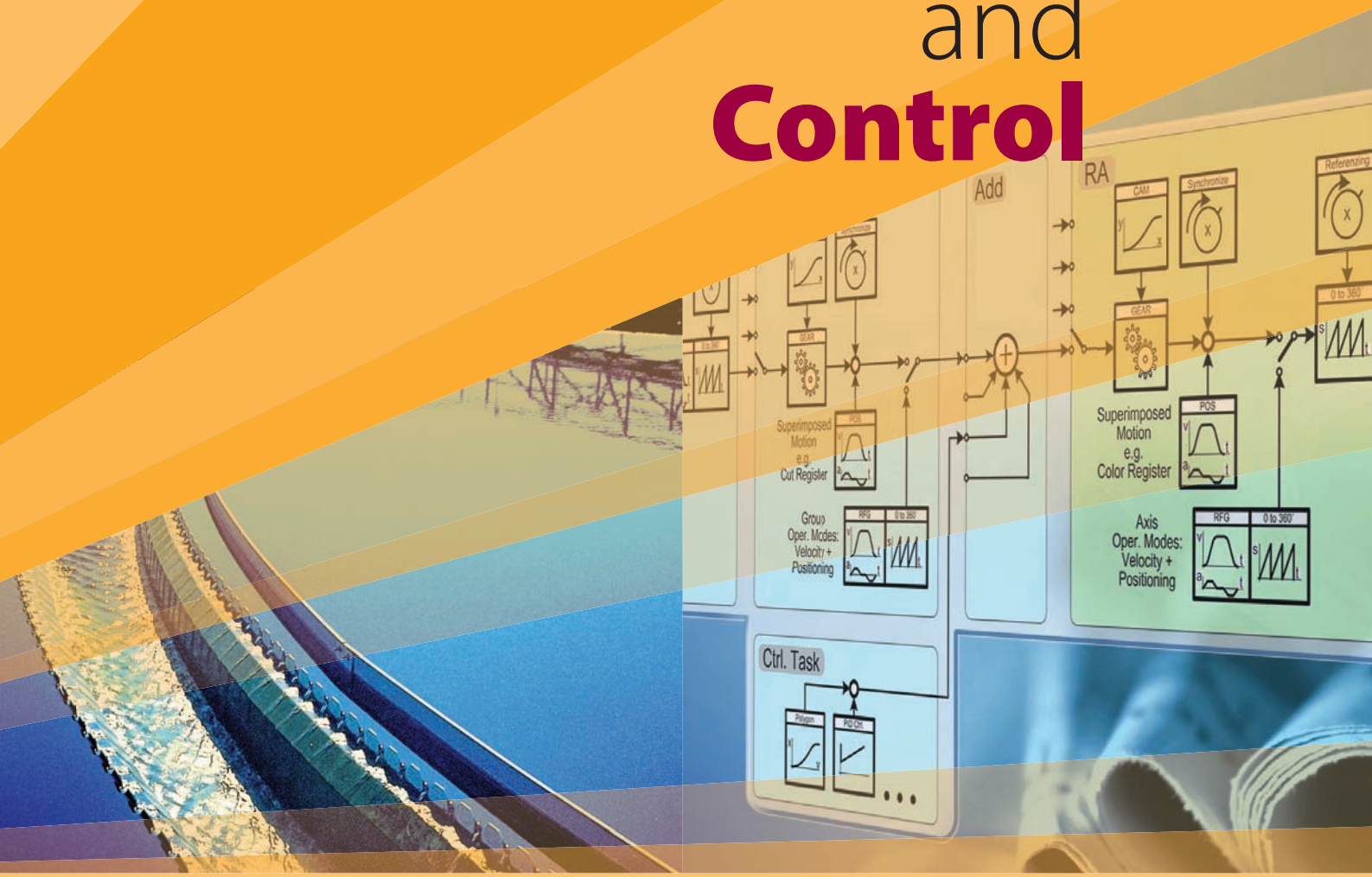
Monitoring and Control



Today's market and its evolution till 2020

Final Report of the Study
SMART 2007/047

European Commission
Information Society and Media

Monitoring & Control

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Edited by:
Jorge Pereira, EC

European Commission
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Luxembourg: Office for Official Publications of the European Communities, 2009

ISBN 978-92-79-12045-9
DOI 10.2759/11437

Cover illustration: © Siemens AG

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Report prepared by

DECISION Etudes & Conseil

RPA

Printed in Luxembourg

Printed on white chlorine-free paper

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http://cordis.europa.eu/fp7/ict/necs/home_en.html

FOREWORD

The growing importance of the Monitoring and Control sector in Europe has called for an assessment of the size of the market, of the positioning of Europe and its major players and of the potential for growth. In the context of the Lead Market Initiatives, it was also necessary to identify barriers to growth and come up with recommendations to address them. A Call for Tenders was issued to address the Monitoring and Control (M&C) market in Europe, from 2007 and until 2020, in a global context.

This report is the result of the ensuing study, SMART 2007/047, performed by DECISION Etudes & Conseil and RPA Ltd. and based upon ample consultation with Industry and other interested parties. The presentations from the Final Workshop where the main results were presented and discussed can be found on the Networked Embedded and Control website[♣].

The first important conclusion is that Europe has captured roughly 1/3 of the global market, on a par with the US and Asia, to the amount of **62B€ in 2007**. Moreover, major European players are seen to be well placed to compete in this market. Secondly, in spite of the crisis, the M&C sector is expected to continue to **grow at 7% per year** at a much higher rate than the economy overall, pointing towards a figure of **143B€ in 2020**.

In comparative terms, the M&C market is substantial: it is similar to the total revenues of the semiconductor industry and twice the revenues of the mobile phone industry. It represents also twice the revenues of the TV set producers and 10 times the revenues of the music industry. Furthermore, it represents **750.000 jobs** in terms of total employment in the EU-27.

The study identifies the level of maturity and criticality of the different areas of M&C, discusses trends and drivers, analyses a number of scenarios (cf. business-as-usual), including the impact of the crisis plus disinvestment, and comes up with a number of recommendations to address barriers to growth, in particular in a few sectors at early stages of deployment (namely Smart Home, Distributed Generation and Pervasive Networking).

[♣] http://cordis.europa.eu/fp7/ict/necs/events-20081009_en.html

In the Appendix, results of a complementary study conducted by DECISION focusing on the Sensor Market in Europe – explicitly excluded from the Tender formulation – are also reported. The Sensor market in Europe amounts to 10B€ in 2007, representing 28% of the world sensor market. The expected growth of the sector is estimated at 6% per year until 2011. The clear dependency between the two sectors makes it very likely that the recommendations for the M&C sector will have considerable repercussion as well in the Sensing sector.

We are therefore looking at an overall Sensing, Monitoring & Control market in Europe worth 72B€ in 2007, expected to grow to 166B€ in 2020, provided the right measures are taken to foster the take up of the technologies and reduce the barriers to deployment, regulatory and other.

This report is essential to establish M&C as a major ICT market and promote a discussion on trends, drivers, barriers and recommendations.

Thierry VAN DER PYL
Director, Components and Systems
DG INFSO

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A - EXECUTIVE SUMMARY

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1 Scope and Definitions of Monitoring & Control

The scope of Monitoring & Control (M&C) is defined here as *the control of any system, device or network through automated procedures, managed by a control unit with or without the capability to display information*. In this study, we surveyed the equipment, software and services markets to assess the costs of using such applications, i.e. the automation equipment required for a machine, not the machine itself.

The M&C industry is not a sector that can be isolated in statistics; as it is not a homogeneous business. By combining various statistics, reports and information, we defined M&C activities with 13 products and services solutions and eleven application markets.

Monitoring & Control Product and services:

Hardware
1. Control layer: Programmable Logic Controllers (PLCs), NCs, power switches, …
2. Interfaces layer: PCs, Human-Machine interfaces, displays, etc.
3. Network: switches/hubs, LAN CAN LIN cards and controllers, RF receivers/transmitters, networked smart sensors, etc.
4. Computing systems
5. OS and drivers: bundle OS, drivers

Software
6. Communication software
7. Application and visualisation: Human Interface, SCADA …
8. Development, simulating and modelling: compiler, debugger, simulation …
9. Decision support systems and ERP: AI, expert systems, reporting, data storage, data warehousing, data mining, ERP …

Services
10. Application design
11. Integration, installation and training
12. Communication and networking
13. Maintenance, repair and overall

Monitoring & Control application markets:

1. Environment (agriculture, air, water, soil, waste)
2. Critical infrastructure (network, hubs)
3. Manufacturing Industries (factory and business automation)
4. Process Industries (factory and business automation)
5. Building (construction, services automation, facility management)
6. Home (automation, safety, energy management)
7. Electric Power and Grid (power plants, transport and distribution, renewable sources, co-/micro-generation)
8. Vehicle (car, aircraft, etc.)
9. Logistics and Transport (fleet, freight, parcel/mail, passenger)
10. Household Appliances
11. Healthcare (health and home care)

2 The Monitoring & Control Market and its Potential

In 2007, the worldwide Monitoring & Control (M&C) market represented just below 200 billions euros in revenue, including all its products, solutions and services. Further analysis shows that:

- The European revenue stood at 61 B€, or one third of the world market; and
- The largest 3 application markets, process industries, manufacturing industries and embedded systems for vehicles account for two thirds of the total.

Table 1, World M&C Market by Market Application (2007 in M€)

Market application	World total	Total Europe
Environment	**9 467**	2 700
Critical Infrastructures	**14 370**	3 317
Manufacturing Industries	**31 493**	13 585
Process Industries	**26 295**	9 976
Building	**7 160**	2 573
Logistics and Transport	**10 875**	3 524
Electric Power and grid	**8 601**	3 779
Vehicles	**56 407**	17 141
Household appliance	**4 344**	999
Healthcare	**18 279**	3 656
Home	**667**	240
Total	**187 957**	**61 490**

Source: DECISION/RPA, SMART 2007, October 2008

Size comparisons

In the field of ICT, the M&C market is comparable in scale to:
- the total global revenues of the semiconductor industry; and
- twice the global revenues of the mobile phone manufacturer industry.

In the media, communication and entertainment industries, this is comparable to
- twice the global revenues of the TV set producers;
- 10 times the revenues of the global music industry; and
- the total revenues of the US publishing and printing industry.

The European M&C market corresponds to:

- more than 1 day of the total EU-27 yearly Gross Domestic Product (GDP); and
- 750 000 jobs in terms of total employment inside EU-27 and a value added share of 70%.

The European M&C market relative to ICT, services, media, communication and entertainment:

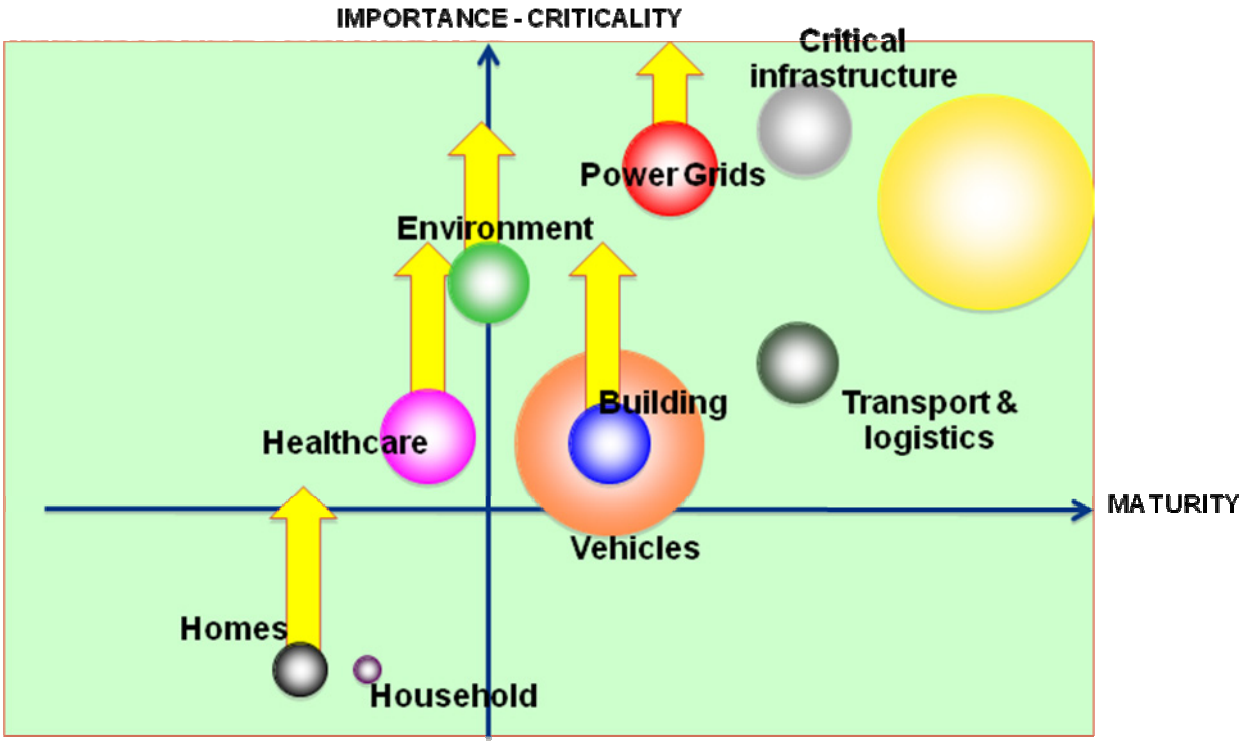
- represents 8% of the EU-27 telecoms and transport sector gross value-added; and
- is equivalent to two thirds of the total EU-27 printing market.

Overview and outlooks

In all market applications, the leading European suppliers appear to be amongst the world leaders.

A comparative analysis of market size, importance of M&C tools and maturity stages of the eleven application markets studied in detail, showed that the different profiles of each market impacts on the market potential of each solution.

Figure 1, Importance of M&C tools and maturity stages of M&C solutions



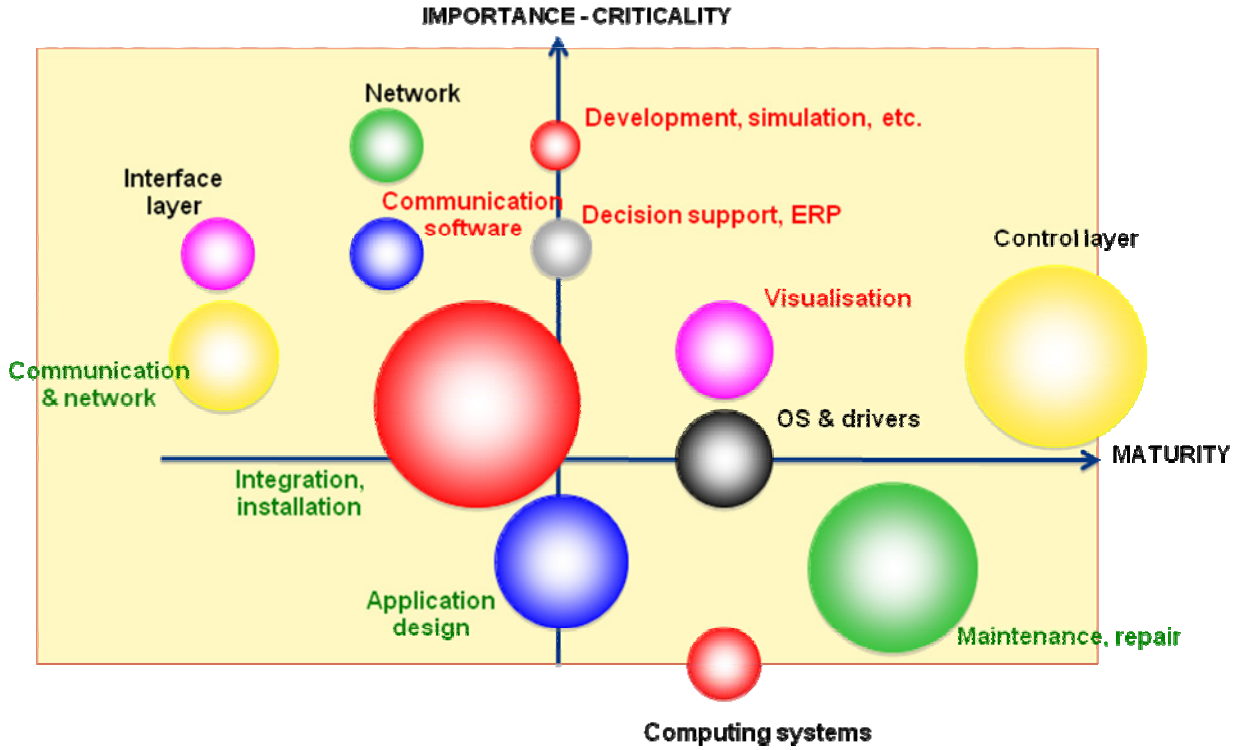
Source: DECISION/RPA, SMART 2007, October 2008

Market profiles are influenced by the emphasis given to M&C, which varies amongst sectors: in industrial automation, power grids and critical infrastructure, M&C is vital and its absence or failure could threaten the functioning of entire operations and the infrastructure on which society depends. On the other hand, M&C is not as important in homes and household equipment.

In addition, the maturity of M&C solutions in different market application varies. For example, it is highly mature in industrial control and critical infrastructure applications. However, in healthcare, buildings and homes, M&C solutions are only beginning to evolve and are predicted to grow in the future.

Figure 2 shows that some products and services such as computing systems, maintenance and repair have mature M&C solutions which are widely available, while others (such as networking, communication and simulation) still require the development of more strategic solutions.

Figure 2, Importance and maturity stages of M&C solutions



Source: DECISION/RPA, SMART 2007, October 2008

Figures 1 and 2 show that some fields are already well equipped with M&C systems and are unlikely to require external support to continue to develop while others might need further assistance and support to develop.

With regards to global issues, the longer term evolution of M&C systems may be affected by the impacts from changing underlying drivers, including:

- energy efficiency;
- cost of oil/gas;
- safety;
- security;
- developments of services;
- reliability;
- easy to use;
- environment concerns;
- regulation;
- flexibility;
- cost of labour;
- social security reforms; and
- ageing population.

Trends and drivers impacts

M&C is a fast growing business: the world market is projected to grow from 188 to 499 B€ between 2007 and 2020, a growth trend of 8% per year on average. During the same period, European demand is expected to grow at a slightly lower rate of 7% per year from 61 to 143 B€, reflecting a more mature situation for some important European markets.

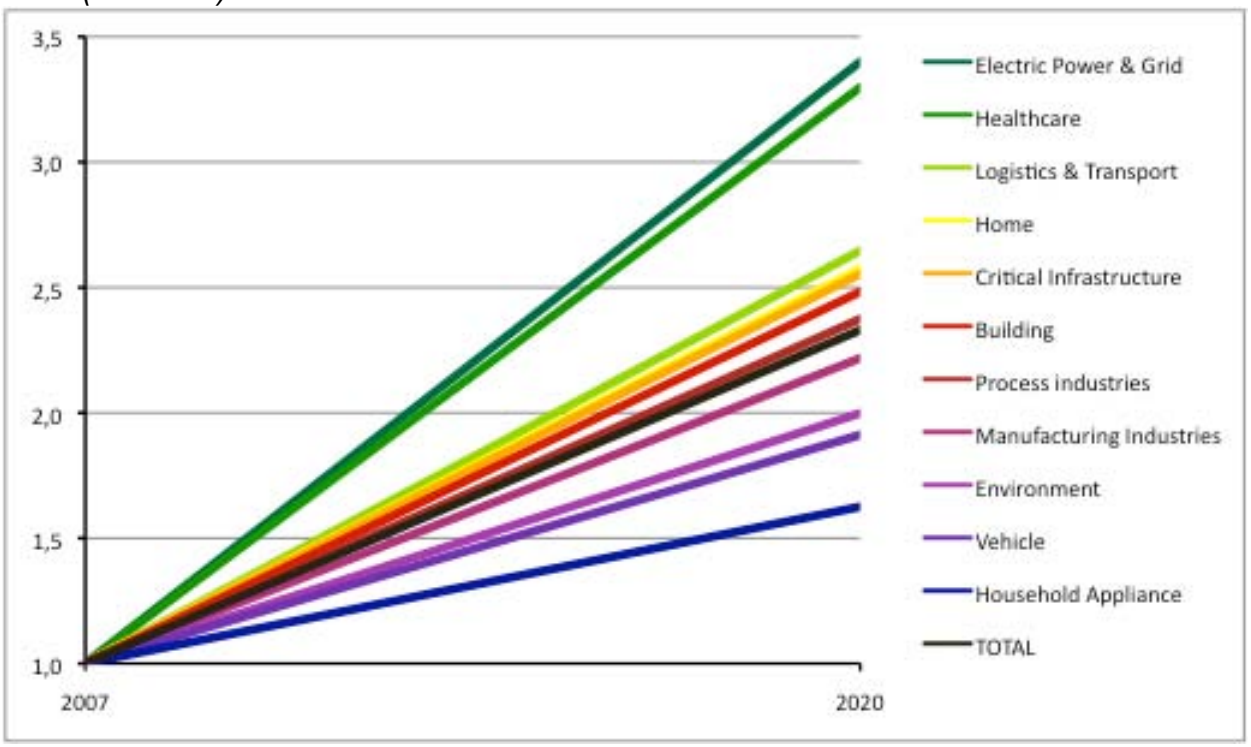
Services are growing much faster than demand for equipment. This is driven both by price pressures and technological improvements, as well as by increasing demand from individuals, companies and governments related to increased safety, security, energy or environment concerns. These issues are regarded as global drivers which serve to maintain, renew and extend M&C uses and expenditure.

As can be seen in Figure 3, the two market applications with the highest growth potentials are the Electric Power and Grid and Healthcare sectors

In most cases, M&C actors are expecting and preparing themselves for new business conditions. Consequently, large or fast growing markets such as healthcare, environment, power grid, industries or building have already been influenced by major changes and are responding to new policy challenges.

In order to better prepare for new challenges, and ensure higher and sustainable long-term growth, improvements need to be made in the field of network interconnection and in the weakest markets, such as home solutions.

Figure 3, Trends: European M&C market growth index by market applications – 2007-2020 (2007 = 1)



Source: DECISION/RPA, SMART 2007, October 2008

These potential opportunities and threats are presented in four of our growth scenario options:

- Smart Home;
- Distributed Generation;
- Pervasive Networking; and
- Industrial Divestment.

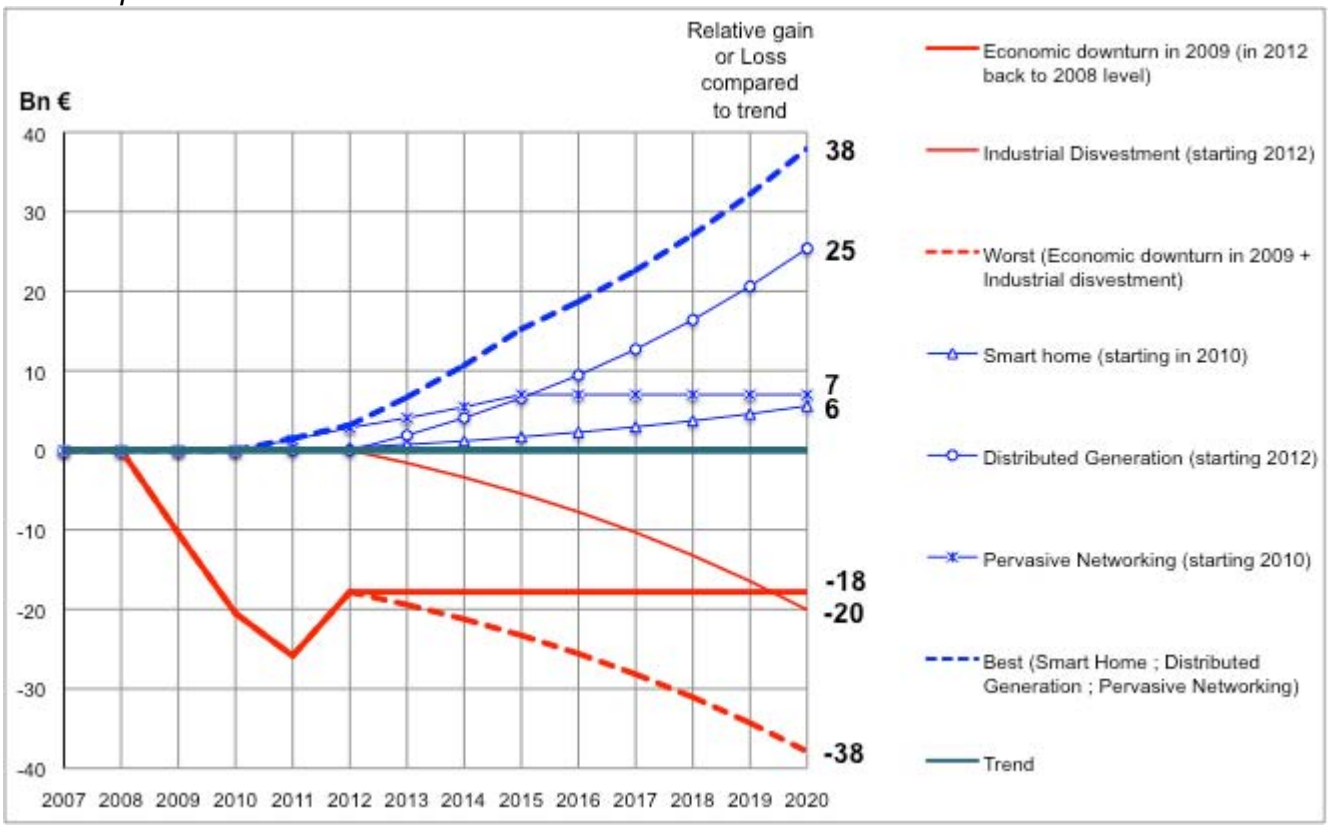
At that level, difference in growth from our best case / worst case scenario represents a loss or a gain of 40 B€ revenue for the European M&C market in 2020. In terms of employment figures, this accounts for hundreds of thousands of potential employment opportunities.

Scenario impact

Networking, electrical power and home sectors offer a high growth potential. Our model also identifies decreasing expenditure factors for M&C activities in general. By quantifying these positive and negative options we define the best and worst case scenarios.

Best case	+8,7% per year
Trend (business as usual)	+6,7% "
Worst case	+4,2% "

Figure 4, Scenario details: Global European M&C Market – 2007-2020 worst and best cases' options in B€



Source: DECISION/RPA, SMART 2007, October 2008

Growth in perspective

A strong dynamic is expected: future smart systems require a networking capability, the access to existing one plus demand specific potential needs to be activated and better address by suppliers.

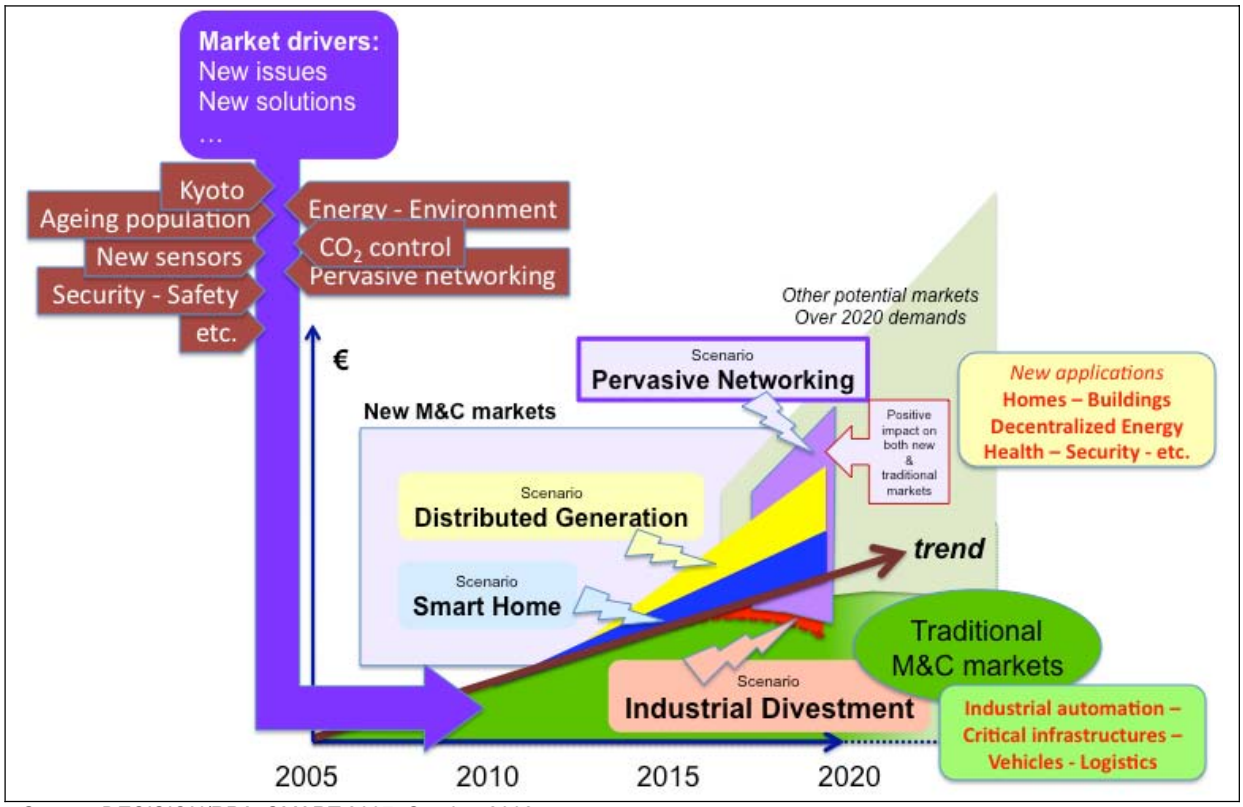
Then a global approach to the scenarios should be considered:

For example

- Smart Home requires smart metering infrastructure and is a step toward
- Pervasive Networking is a vertical requirement for new smart devices, systems and services in many of the application markets.
- Industrial Divestment will create a demand for new efficient and precision industrial tools.

The overall issue is to activate several markets and corresponding needs that would lead European people to a faster growing and more sustainable economy. In the end, the main goal is to create favourable market conditions and regulatory environment that could change our standard of living in accordance to new environmental, energy and economic concerns, in particular those included in various European and national Member State policy.

Figure 5, Scenarios and growth dynamic



Source: DECISION/RPA, SMART 2007, October 2008

3 Scenario Snapshots

Table 2, Smart Home scenario snapshot

Scenario	Smart Home
Brief description	The Smart Home scenario option focuses on the speed of adoption of automation systems by households in Europe to control space heating/cooling, water heating, lighting, security equipment and domestic appliances. These M&C systems for on/off functions, standby periods, temperature settings, the time and duration of appliance's use, and so on are also expected to be capable of controlling 'smart' appliances, so that the operation of each appliance can be synchronised to operate only when energy is cheapest or its use is likely to be the most efficient.
Main drivers	Energy efficiency; Cost of oil/gas; Environmental concerns
Application markets involved and impacted	Homes and Buildings Electric Power and grid Household Appliances
Barriers to be tackled	"Home automation" is not a priority for households: products are still very expensive (no mass market yet), no real plug-n-play solutions until now.
Expected growth impact on European M&C market 2007-2020 baseline growth	**For both "Home" and "Household appliances" application markets:** Baseline trend : +4,7% per year. Scenario 1 average growth : +17,6% per year. **Global expected effects on overall M&C market:** Baseline global trend : +6,7% per year. Scenario 1 average growth : +7,2% per year **=> 8 B€ above trend in 2020**
Cost-Benefit analysis	The Smart Home scenario is expected to generate an additional market worth over €10 B€ during the period of 2007-2020. **Benefit-Cost balance is negative** The take up of home automation technology is low and is likely to continue to be low without some kind of subsidy to encourage consumption by households. The sensitivity analysis shows that even with 15% energy savings associated with home automation, the costs still substantially exceed the benefits.

Scenario	Smart Home
Conclusion	Once individuals are informed about personal energy use (i.e. energy consumption, carbon signature etc.) they may respond by changing their behaviour by: monitoring energy use to collect and share information; installing new integrated control systems to prevent energy wastage; and responding to tariffs and incentives. It is important to note that changing people's behaviour is not a short term activity. The achievement of this scenario is likely to increase householders' familiarity with new technology and make them more aware of future technology trends, in particular in the field of Monitoring & Control. Similarly, the uptake of automation systems for the home is also likely to generate markets for add-on software, communications, system upgrade and accessory products leading to a market value above that estimated in this scenario.

Source: DECISION/RPA, SMART 2007, October 2008

Table 3, Distributed Generation scenario snapshot

Scenario	**Distributed Generation**
Brief description	Driven by green concerns and increasing energy prices, the adoption of micro generation and local distribution/transmission of energy technology is expected to enter a fast growing period. It is assumed that Monitoring & Control devices will be required extensively under this scenario, to connect micro generating devices to local or national grids and for homes and businesses to receive a safe and consistent supply of energy.
Main drivers	Energy efficiency Cost of oil/gas Environment concerns Regulation
Application markets involved and impacted	Environment Homes and Buildings Electric Power and Grid Household Appliances
Barriers to be tackled	Standard product availability Financing solutions
Expected growth impact on European M&C market 2007-2020 baseline growth	**For both "Home" and "Electric Power and Grid" application markets:** Baseline trend : +9,7% per year. Scenario 2 average growth : +19,0% per year. **Global expected effects on overall M&C market:** Baseline global trend : +6,7% per year. Scenario 1 average growth : +8,1% per year **=> 25 B€ above trend in 2020**
Cost-Benefit analysis	The introduction of the European Electricity and Gas Directive and other initiatives by the European Commission are important in relation to the establishment of a competitive market with expected benefits of nearly 1.9 B€ in the baseline scenario. Although many Member States are considering the compulsory introduction of smart meters, the model results indicate an expected **net negative balance of over 8.5 B€.**
Conclusion	This scenario assumes that users of electricity and gas will adopt smart meters (using radio frequency technology) to automatically read and display current consumption of gas and electricity, communicating this information back to utility companies and to users in order to encourage energy-saving behaviour amongst consumers. By reducing future energy demand and therefore energy generation capacity, this scenario could assist the EU and its Member States to achieve their greenhouse gas emission targets by 2020. The impacts of distributed power on the energy mix and energy dependency could be significant if shortages of energy in the EU economy are considered. The benefits of improved security must therefore be substantial in this example (if risks are also considered).

Source: DECISION/RPA, SMART 2007, October 2008

Table 4, Pervasive Networking scenario snapshot

Scenario	**Pervasive Networking**
Brief description	Transparent networking over all sectors, data acquisition from a large number of sensors and data sources, information storage and retrieval, powerful monitoring capabilities and associated services.
Main drivers involved	Safety Security Developments of services Environment concerns
Application markets involved and impacted	Environment Critical Infrastructures Logistics and Transport Vehicles
Barriers to be tackled	Large number of actors to convince Legacy system providers could resist for economy reasons
Expected growth impact on European M&C market 2007-2020 baseline growth	**Global expected effects on overall M&C market:** Baseline global trend : +6,7% per year. Scenario 3 average growth : +7,2% per year **=> 8 B€ above trend in 2020**
Cost-Benefit analysis	The simultaneous introduction of the previous scenarios and an assumed compatibility between technologies should generate a positive externality (i.e. additional benefits). Therefore, increased benefits should be achievable with a relatively small increase in costs (compared to scenarios 1 or 2). **The net benefits could be of nearly 20 B€.**
Conclusion	A voluntary scenario with probably the best return in many fields and many positive side effects for the economy. This scenario demonstrates that through networking, the benefits of M&C technology can be increased disproportionately to costs as new opportunities or capabilities emerge from two or more technologies being integrated or networked together. Although this study has focused on the example of energy saving technology, a brief impact assessment of Pervasive Networking in other segments of the M&C market can be identified (see Table 5).

Source: DECISION/RPA, SMART 2007, October 2008

Table 5, Networking – Manufacturing and Logistics Technology Impact Assessment

Impact Category	Potential Impacts Expected
Operating Costs of Business	Networking of supply chains to improve efficiency and quality of manufacturing and logistics activities should help reduce costs for those businesses applying such systems and those relying on reliable and efficient supplies of goods and services (e.g. SME craft industries reliant on next-day delivery to customers).
Competitiveness and Trade	The resulting more efficiently functioning supply chains and lower costs should increase the competitiveness of many EU industries, as well as generate more export opportunities for M&C providers and associated businesses. It is important to realise the knock on impacts of this technology, as once one business gains a competitive advantage through these measures, others will need to follow to remain competitive.
Competition and Internal Market	Competition might be expected to intensify in terms of reliability, quality and price as the first businesses to adopt the technology gain competitive advantages in costs, etc.
Innovation and Research	Once the benefits of networking have been achieved, users are likely to demand further innovations in the technology to generate further benefits , in order to gain a competitive advantage over rivals in terms of cost, quality, reputation, reliability, etc.
Employment and Macro-economy	Increased automation could result in the loss of employment in labour intensive sectors; however, the networking of existing automation technology should increase the efficiency of existing systems and may generate new employment opportunities stemming from improved business performance.
Environment and Energy	By improving resource efficiency through the networking of two existing technologies, energy savings and knock on reductions in carbon emissions should be expected.
Social	No significant impacts expected EU wide, although regional impacts could be significant if automation increases unemployment in labour intensive sectors
Sustainability	Intensive competition within the EU and globally is likely to driver further developments in manufacturing and logistics automation, thus sustainability should be high.

Table 6, Industrial Divestment scenario snapshot

Scenario	**Industrial divestment**
Brief description	This scenario represents a loss of around a third of the entire European M&C market, affecting all sectors of the M&C industry to differing degrees. This could manifest itself in a shift in demand for M&C solutions from EU suppliers to non-EU alternatives or the movement of EU companies outside the EU, or a combination of both possibilities. This industrial divestment would concern all industrial activities.
Main drivers	The continuously evolving competitive position of Europe The willingness to keep part of the industry in Europe
Application markets involved and impacted	Critical Infrastructures Manufacturing Industries Process Industries Logistics and Transport
Barriers to be tackled	The inertia of the existing industrial infrastructure
Expected growth impact on European M&C market 2007-2020 baseline growth	**For "Process", "Manufacturing Industries", "Vehicle" and "Household Appliances" application markets:** • Baseline trend : +5,9% per year • Scenario 4 average growth : +3,8% per year **Global expected effect on overall M&C market** including positive impact pulled by consumption of similar Monitoring & Control product, solutions or services in other application markets: Baseline global trend : +6,7% per year Scenario 4 average growth : +5,5% per year => 20 B€ below trend in 2020
Comments and Conclusion	Detailed analysis of this scenario was considered beyond the scope of the cost and benefit assessment. However, a qualitative analysis of the impacts is presented in Appendix 3. This scenario represents a loss of around a third of the entire European M&C market, affecting all sectors of the M&C industry to differing degrees. This could manifest itself in a shift in demand for M&C solutions from EU suppliers to non-EU alternatives or the movement of EU companies outside the EU, or a combination of both possibilities. M&C is an important component of smart manufacturing, transport and distribution and should be supported independently of the speed of industrial divestment

Source: DECISION/RPA, SMART 2007, October 2008

4 Conclusions

Our main conclusions presented during the Workshop held in Brussels on 9th October 2008 were as follows:

- the **Monitoring & Control** field covers heterogeneous technologies, application markets and issues

- **Monitoring & Control is a growing and service-oriented market**

- **Application Markets: Where could we do better?**
  There is potential for higher growth in this market. Scenarios were developed by the team to illustrate this situation, as follows:
  - Application Markets for Home, Electric Power and Grid, Healthcare and the Environment.
  - There are barriers that limit the development of **Distributed Generation, Smart Home** and **Pervasive Networking.**

- **By analysing each application's growth potential, costs and benefits and synergies, we found that**
  - the costs (i.e. market value) could be high: several tens of billions of euros by 2020;
  - potential for jobs creation: higher growth represents a few hundred thousand more jobs in 2020;
  - possible cross-market fertilisation: e.g., joint developments in Smart Home and healthcare would bring benefits to both sectors; and
  - better development of networking, monitoring and analysis in one field may bring major benefit for all markets.

- **Main issues**
  - There are barriers to the development of home markets
  - There is a significant lack of networking solutions standards

- **Future possible actions?**
  - Coordination programme to cover vertical and horizontal aspects, to assess and engage all possible linkages between existing policies, stakeholders R&D and strategies
  - Dedicated actions in the field of home and networking applications

In our scenarios, we clearly identify the importance of synergic effects and consequently, the ultimate recommendation focuses on fostering synergy.

- **How to benefit from the synergies?**
  - The last recommendation is to properly coordinate actions via a Lead Market Initiative

Table 7, The Road Map for synergies: the diversity of actions and stakeholders

	Smart Home	Distributed Generation	Pervasive Networking
Drivers	•Energy Prices •Environment •Health •Security	•Energy Efficiency • Energy Prices •Renewable Energies •CO_2 Reduction •Regulation	•Synergies between applications •Safety and Security •Development of services •Green Concern
Policies (DG involved)	•Information Society and Media •Environment •Health •Energy	•Information Society and Media •Enterprise and Industry •Environment •Energy	•Information Society and Media •Enterprise and Industry •Transport •Environment •Health •Energy
Major Players	•Equipment Manufacturers •Energy operators •Service operators •Construction	•Equipment Manufacturers •Energy operators •Service operators	•Equipment Manufacturers •Energy operators •Service operators •R&D labs
Recommendations	•Grants for technology adoption •Evolutionary systems •Energy market liberalization •Funded studies •Awareness campaign •Standardization	•Grants for technology adoption •Regulation on energy losses •Energy market liberalization •Simplify Procedures •Awareness campaign •Standardization	•Grants for technology adoption •Energy market liberalization •Funded studies •Awareness campaign •Standardization
Stakeholders	•M&C Providers, •EU Industry, Non-EU Industry, •Professional Users, •Consumers, •Government Authorities	•M&C Providers, •EU Industry, Non-EU Industry, •Professional Users, •Consumers, •Government Authorities	•M&C Providers, •EU Industry, Non-EU Industry, •Professional Users, •Consumers, •Government Authorities

Source: DECISION/RPA, SMART 2007, October 2008

5 Recommendations

The results of this study indicate that the high infrastructure costs (equipment and installation) represent a significant barrier to the adoption of technology by the mass-market, a result consistent with the conclusions of other studies.

This is particularly pronounced in the home automation segment of the M&C market, as the costs are an order of magnitude greater than the energy and environmental benefits, representing a significant barrier to take-up.

Our 14 recommendations are summarised in the Tables 8 and 9 below, and focus on five key issues;

- costs of infrastructure;
- regulation;
- the technology and its Impacts;
- interconnectivity and compatibility; and
- roles and responsibilities of stakeholders.

Table 8, Summary of Policy Recommendations by Sector Affected

Recommendation	Sectors Significantly Affected
1. Grant Schemes	Homes and Buildings and Electric Power Grid
2. Evolutionary Systems	Homes and Buildings and Household Appliances
3. Liberalisation of Energy Market	Electric Power Grid
4. Simplified Planning Procedures	Home, Building and Electric Power Grid
5. Accelerated Energy Market Liberalisation	Electric Power Grid
6. Regulation on Transmission Losses	Electric Power Grid and Critical Infrastructures
7. Regulation for Smart Meters	Electric Power Grid
8. Energy Efficiency in Buildings Directive	Homes and Buildings and Household Appliances
9. EU Funded Studies	All Sectors (i.e. Manufacturing, Process, Environment, Healthcare, Home, Building, Transport, Logistics, Vehicles, etc.)
10. 1st Class Meetings	All Sectors (i.e. Manufacturing, Process, Environment, Healthcare, Homes and Buildings and Household Appliances, Transport, Logistics, Vehicles, etc.)
11. Awareness Campaigns	Homes and Buildings and Household Appliances
12. Energy Labelling	Homes and Buildings and Household Appliances
13. Global Standards	Manufacturing, Process, Environment, Homes and Buildings and Household Appliances
14. European Standards	All Sectors (e.g. Manufacturing, Process, Environment, Healthcare, Homes and Buildings, Transport, Logistics, Vehicles)

Table 9, Summary of Policy Recommendations by and Stakeholder Action

Recommendation	Stakeholder Action Potentially Required By…				
	Industry	Industry Associations and Similar Bodies	European Standards Bodies	European Commission	Member States
1. Grant Schemes	✓	✓		✓	✓
2. Evolutionary Systems	✓				
3. Liberalisation of Energy Market				✓	✓
4. Simplified Planning Procedures				✓	✓
5. Accelerated Energy Market Liberalisation				✓	✓
6. Regulation on Transmission Losses				✓	✓
7. Regulation for Smart Meters				✓	✓
8. Energy Efficiency in Buildings Directive	✓	✓	✓	✓	
9. EU Funded Studies	✓	✓	✓	✓	
10. 1st Class Meetings	✓	✓		✓	
11. Awareness Campaigns	✓	✓		✓	
12. Energy Labelling	✓	✓	✓	✓	
13. Global Standards	✓	✓	✓	✓	
14. European Standards	✓	✓	✓	✓	✓

6 Putting it all in context

Timeline and background

The analytical framework for this study and accompanying assumptions were developed in the Spring of 2008. The assumptions made and scenarios developed are therefore intended to reflect the expectations of the future, based on the best information available at the time of writing. Market projections, take-up rates and other such assumptions were therefore based on those values reported in the literature and in consultation responses gathered by the consultants in preliminary research.

These assumed expectations and values over the assessed period formed the basis of the **business-as-usual** or baseline scenario. As a result, where an individual technology was found to achieve relatively low market uptake at present and is expected to maintain low growth in the foreseeable future, the baseline is consequently conservative in its outlook.

Other scenarios were then developed, building on this baseline to reflect more optimistic and pessimistic views and expectations. This involved the development of three positive scenarios (smart home, distributed generation and pervasive networking) to demonstrate the potential of these individual technologies in a best-case environment, representative of the optimal market potential of each technology. Similarly, two negative scenarios were developed to reflect the risk of a global recession or a divestment of manufacturing to outside Europe.

Changing economic climate

Since then, it is clear that the global economic environment and future expectations have changed significantly in many industry sectors. In addition, discussions with stakeholders and experts, namely at the time of the Final Workshop[1] organized in Brussels, provided contradictory views on the market uptake of the technology assessed in this study (particularly in relation to smart home). These two views can be summarised as follows:

[1] http://cordis.europa.eu/fp7/ict/necs/events-20081009_en.html

- Some found our assumptions and expectations too optimistic, predicting rapid growth and market introduction to occur around 2015 rather than during the 2010-2012 period as assumed in our analysis.

- Others found our projections to be too pessimistic, resulting in lower than expected benefits emerging from technology introduction. Our projections could therefore appear “conservative”.

In response to these comments and changing economic circumstances it is possible to interpret our analysis and results in a different light. Firstly, by adopting the global recession scenario as the new baseline, the uptake benefits of each technology in terms of employment and market potential should be increased by an order of magnitude. Thus, the lost potential opportunity from not introducing the various technologies is increased.

Secondly, although some assumptions may appear overly conservative, this should strengthen the case for action, as if the technology is economically viable (i.e. achieves a positive benefit cost ratio) under conservative assumptions, the certainty of positive outcomes being achieved should increase.

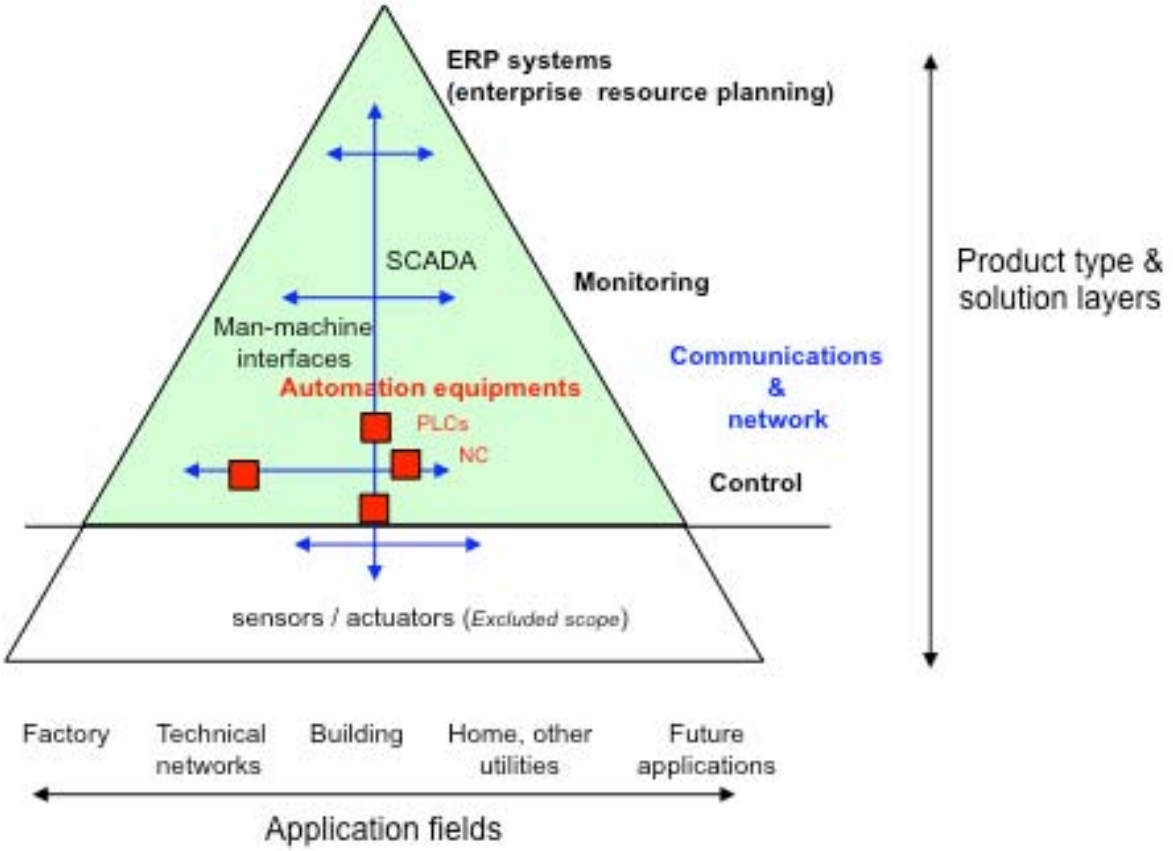
Furthermore, the appendix of this study presents some of the different views on the assumptions used in the analysis and presents a sensitivity analysis on key assumptions in order to evaluate the robustness of the results generated in this study.

B - DETAILED REPORT

1 Context

The Monitoring & Control (M&C) industry is defined as a part of the ICT sector, providing solutions for sensing/monitoring, supervising, controlling and automating everything from objects/systems, to industrial processes/systems and (critical) infrastructures. These systems can be found at the upper levels of enterprise organisation, for example in IT systems performing supervisory and interfacing roles. At the lower levels of enterprise organisation, Monitoring & Control can be found in machines and processes through the application of sensors and actuators.

Figure 6, Classical view of the fully range of M&C solutions illustrated by product layer



Source: DECISION/RPA, SMART 2007, October 2008

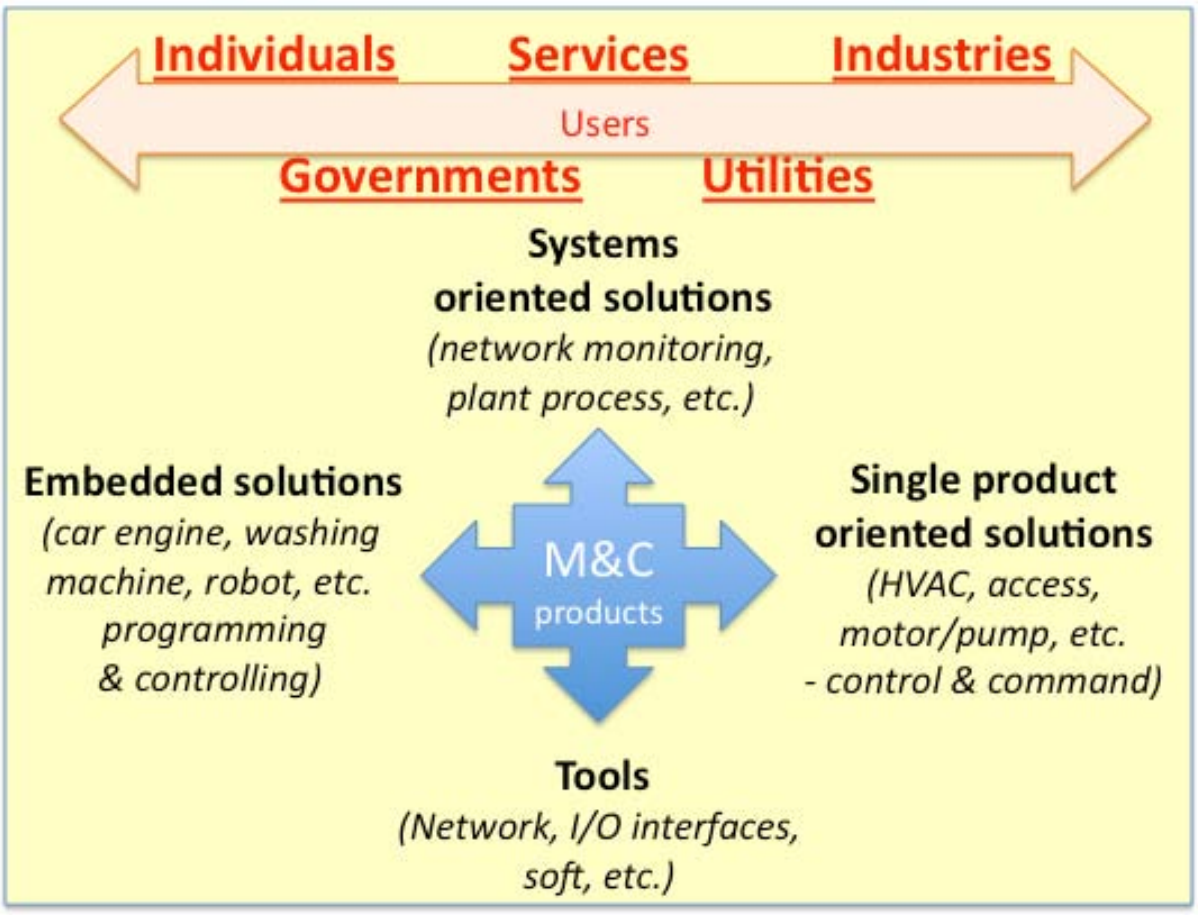
This industry supplies electronic products and/or solutions, such as:
- Dedicated hardware: industrial network, DCS, PLCs, SCADA, …
- Solutions for: workshops, resources and flow management, labs, …
- All the associated software or services.

Parts of these products and solutions associate the end users for the definition the design and the implementation at various shares.

At this stage it is important to define global issues that may affect a variety of applications and the European market as a whole, from individual issues that affect specific markets and users.

From a user point of view, the global area of Monitoring & Control is made of hidden black boxes (i.e. embedded solutions - often single products dedicated to the control of a single device), systems dedicated to a local application (a workshop, a factory, etc.), as well as more sophisticated and integrated solutions (ERP, infrastructures, etc.):

Figure 7, The user point of view of M&C solutions



Source: DECISION/RPA, SMART 2007, October 2008

Global objective of the survey

One of the purposes of this study is to assess if the Monitoring & Control sector could achieve a «Lead Market» status for innovation and competitiveness, as defined by the European Commission. This assessment is based on 5 major elements:

- The existence of EU industrial strengths;
- The potential for the creation of world-class markets;
- The interest of the industrial and service sectors;
- The need for market regulations;
- The innovation in public procurement.

Lead markets are about creating frameworks for innovation in specific areas of the economy where European firms could have a global leading role, but where this potential remains unrealised due to current regulatory or systemic failures in policy and legislation, or market a fragmentation /lack of a pan-European market.

Monitoring & Control should therefore be evaluated, in terms of:

- The current market;
- The potential market (in the short, medium and long term);
- The possible economic and societal impacts of the industry;
- Concluding with recommendations of a public policy, where appropriate.

2 Objectives

In order to determine opportunities for a Lead Market Initiative in the field of Monitoring & Control, the main goals of this study are summarised as follows:

1. To provide a comprehensive view of the M&C sector, markets, trends and barriers;
2. To see how M&C could answer today's political priorities and tomorrow's challenges (energy efficiency, climate change, safety, security, …);
3. To determine how European companies could benefit from these challenges and become leaders in those new fields;
4. To present to the European Commission, a number of alternatives in terms of actions to be taken to address identified barriers.

This is a large scope spanning legal, social, technical and economical aspects of the M&C and associated sectors.

In order to meet these aims, the call for tender SMART 2007/047 asked for four main objectives, all of which are addressed in this final report.

Objective 1: Description of the today's market.

Objective 2: Quantitative and qualitative analysis of the Monitoring & Control market potential for 2007, 2012 and 2020.

Objective 3: Assessment of the economic and societal impacts of the future Monitoring & Control market.

Objective 4: Proposition of policy recommendations, based on the identified market potential of Monitoring & Control in 2007, 2012, and 2020.

3 Scope and definition of the Monitoring & Control

3.1 Products and services

We also provided a detailed nomenclature in terms of M&C products and services.

In order to have a **comprehensive view of this business** we adopted a classification designed to cover all types of products and solutions, including services that are supplied by actor.

We isolated **13 types of products and solutions** for all Monitoring & Control markets.

- *Hardware*
  - **Control layer**: Programmable Logic Controllers (PLCs), NCs, power switches, …
  - **Interfaces layer**: PCs, Human-Machine interfaces, displays …
  - **Network**: switches/hubs, LAN CAN LIN cards/controllers, RF receivers/transmitters, networked smart sensors …
  - **Computing systems**
  - **OS and drivers**: bundle OS, drivers
- *Software*
  - **Communication software**
  - **Application** and **visualisation**: Human Interface, SCADA …
  - **Development, simulating and modelling**: compilers, debuggers, simulation, …
  - **Decision support systems and ERP**: Artificial Intelligence (AI), expert systems, reporting, data storage, data warehousing, data mining, ERP, …

- *Services*

    - **Application design.**
    - **Integration, installation and training.**
    - **Communication and networking.**
    - **Maintenance, repair and overall.**

3.2 Application Markets

According to M&C solutions suppliers, at least 3 main groups of markets have been identified, which do not fully correspond to technical domains explained in previous definitions of the markets. In order to clarify this point, the definitions applied in this study are presented below.

The three technical domains are:
- Embedded systems
- Simple products
- Systems

In terms of application markets identified by the end users, the three major segments can be defined as:

- Embedded

    - Embedded M&C systems that are incorporated inside an equipment or a machinery and are viewed by the end user as black boxes that provide defined functionalities e.g., automotive electronics, home appliances, vehicle control.

- Professional

    - Industrial, business, environment, building and infrastructure process M&C systems: these are products and services that are used in manufacturing, buildings, services, administrations, hospitals, energy, transport and distribution, pollution and traffic control ....

- Individual

    - M&C devices for personal use such as energy management, security, personal care, heating, ventilation and air conditioning (HVAC) applications, etc.

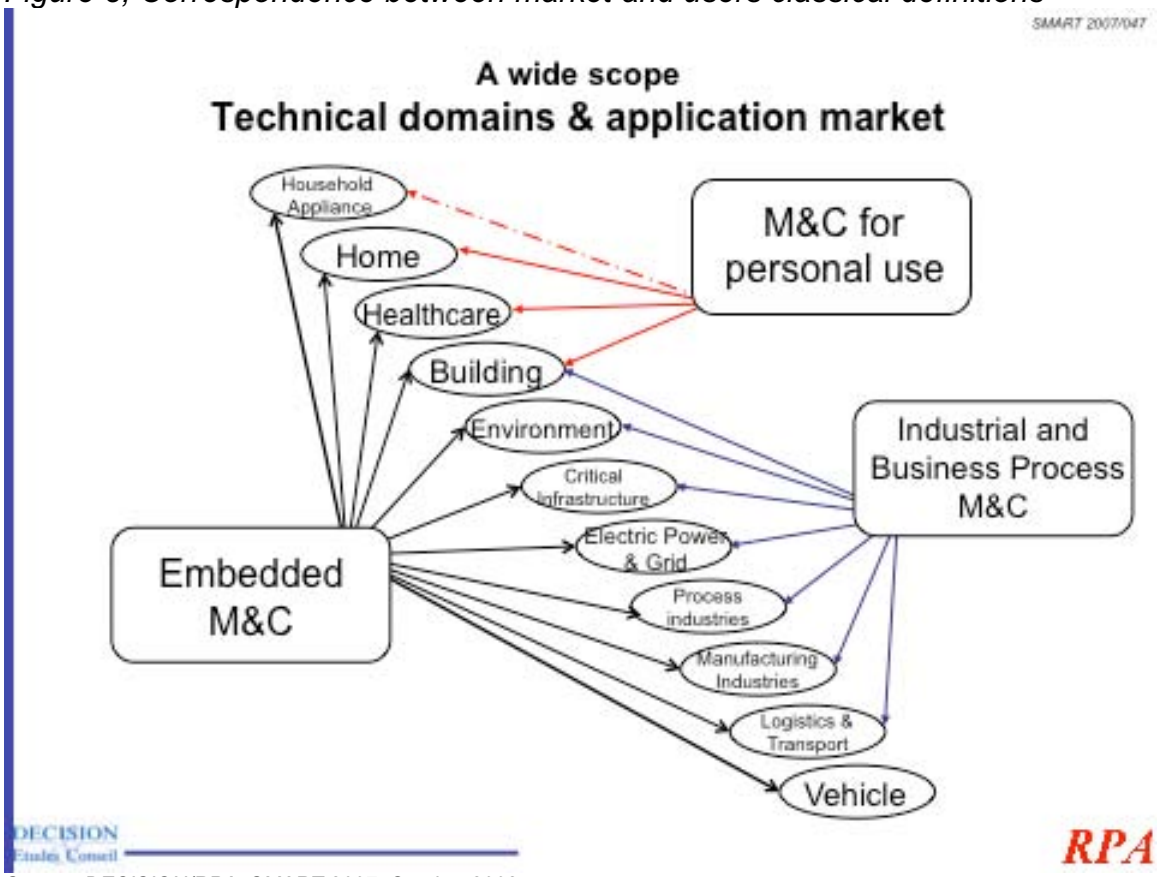
After several iterations of the market definitions with the European Commission, a detailed nomenclature has been adopted in order to describe the global field of M&C applications according to global issues that are analysed in this report.

By considering various definitions in relation with market typologies by technology, by use or by actor's portfolio, we adopted a market segmentation that reflected the major distinctions between embedded, professional and personal application markets and covered the global market per application field. We selected 11 main application fields, covering one or several of the types of applications.

The 11 application markets:

- Environment (agriculture, air, water, soil, waste).
- Critical Infrastructures (network, hubs).
- Manufacturing Industries (factory and business automation).
- Process Industries (factory and business automation)
- Building (construction, services automation, facility management).
- Home (automation, safety, energy management).
- Electric Power and Grid (power plants, transport and distribution, renewable sources, co-/micro-generation).
- Logistics and Transport (fleet, freight, parcel/mail, passenger).
- Household Appliances.
- Healthcare (health and homecare).
- Vehicle (car, aircraft, etc.).

Figure 8, Correspondence between market and users classical definitions



Source: DECISION/RPA, SMART 2007, October 2008

3.3 List and definitions

A detailed summary of the application markets, covering all the economic categories and specific technology issues (i.e. types of system involved), is presented below.

Table 10, Economy and M&C application fields

Group of economic sectors or branches	***Main activities***	***Application markets***	***Main application fields***
Agriculture, Utilities and Energy	Mining, energy, farms and agriculture, wastes, etc.	Environment	Technical infrastructures Monitoring & Control
		Electric Power and Grid	Power plants, power grids and associated process Monitoring & Control
Industry	Fabrication of goods and all intermediate products for professional and personal use	Manufacturing Industries	Machines, process, factories Monitoring & Control
		Process Industries	
Services and Home	Education, banking, retail, social services, travel, transport, etc.	Critical Infrastructures	Security and technical infrastructure Monitoring & Control
		Logistics and Transport	Flow Monitoring & Control
		Building	Technical infrastructures Monitoring & Control
		Healthcare	From hospital to home applications Monitoring & Control
Embedded	Dedicated solutions integrated by the product manufacturer	Home	
		Vehicle	
		Household appliances	

Embedded systems are evaluated as a single application field as they clearly warrant a separate analysis, due to the linkages that exist between so many applications and markets, which would make an inclusion in other fields rather complex.

M&C application fields and markets can also be defined by the nature of the solution offered, either horizontal or specialised in nature:

- A horizontal application market is a large cohesive group of economic activities with major similarities. They are defined according to an usual economic sector classification (European NACE) and grouped according to major similarities, at a global level.

- A specialised application market is a narrow field with more specific M&C characteristics.

Complete list	*type*	*comments*
1. Environment	Horizontal	see Appendix 2 for NACE.
2. Critical Infrastructures	Horizontal	see appendix 2 for NACE.
3. Manufacturing Industries	Horizontal	see appendix 2 for NACE.
4. Process Industries	Horizontal	see appendix 2 for NACE.
5. Building	specialised	see appendix 2 for NACE.
6. Home	specialised	All M&C solutions dedicated to homes (includes home automation; home security; energy management).
7. Household Appliances	specialised	M&C embedded solutions for house hold appliances.
8. Healthcare	specialised	All activities related to personal care (health, elderly people, etc.).
9. Vehicle	specialised	M&C embedded solutions for vehicles (of any type).
10. Logistics and Transport	Horizontal	see appendix 2for NACE.
11. Electric Power and Grid	specialised	All activities related to electrical grids (generation, transport, distribution + co-/micro-generation)

See detailed definitions and scope in Appendix 2.

4 Describing today's Monitoring & Control market

4.1 Objectives

- To describe today's current M&C capabilities and markets, with a breakdown provided by product and by application.
- To assess the relative position of the European market, its industry and suppliers.

4.2 Methodological approach

This task has been conducted in parallel to the task on market potential. Existing data was collected and analyzed; 39 interviews were conducted at a European level.

4.2.1 Interviews

Interviews were conducted during the first half of 2008 with representatives of organisations or companies involved in the M&C sector, from R&D labs to large users, half by phone and half face-to-face. All these organisations and companies are based in Europe with a wide diversity of interests and business models. Interviewees ranged from R&D managers to general, sales or marketing managers, professors, etc.

An actor's one day-meeting was also organised in Germany with R&D programmes stakeholders.

Relevant trade fairs (Hannover, Automation, etc.) were visited to establish further contacts and get additional input.

Table 11, Interviews list

1. ABB
2. ADEME
3. Arcelor Mittal
4. AutomationML
5. Baumüller
6. BSC Embedded Intelligence
7. Cap Gemini
8. Casino
9. CECED
10. Coventry City Council
11. CSC
12. CSL Behring
13. Delta Dore
14. Deutsche Telekom
15. Domergie
16. Dunkirk Harbor
17. Echelon
18. ELPRO
19. Emerson
20. Endesa
21. Fraunhofer
22. Gimelec
23. Hirschmann - Lumberg
24. Home Automation Europe
25. Invensys
26. Johnson Controls
27. Lafarge
28. OMI
29. OnBase – Hyland
30. OSADL
31. RTE
32. SAP
33. Schneider Electric
34. Siemens Building Technologie
35. Trialog
36. University of Grenoble
37. University of Sevilla
38. University of Verona
39. Yokogawa

4.2.2 Data collection and analysis

Main reports or sources for market valuations, growths, trends and a breakdown by product, solution or market application were

DECISION

- World electronic industries 2006-2011.

  Main coverage: embedded solutions, infrastructures markets, security and government markets, medical solutions.

ARC Advisory group

- Enterprise Resource Planning Worldwide Outlook.
- Automation Systems for Discrete Industries Worldwide Outlook.
- Automation Systems for Process Industries Worldwide Outlook.

  Main coverage: factory automation products and an end users breakdown including power and environment and software expenses including ERP.

Press, Internet

Complementary research in order to help performing the axis breakdown.

All market data were then analysed and expertised in order to adjust them with requested details for this report.

In order to detail market values per application market crossed with solution we examined the situation of a set of 30 separate single markets in the scope of M&C. This compilation was necessary in order to validate a coherent and exhaustive view of all M&C businesses with no overlap (as far as it is possible).

For each market we used available documentation and expertise to split it into 11 applications crossed with 13 solution groups. The result was as follows:

30 single markets surveyed:

- AC Drives.
- Access control.
- All solutions dedicated to logistic.
- Collaborative production management.
- Computer Numerical Control.
- Distributed Control Systems.
- Embedded solutions: airborne systems.
- Embedded solutions: automotive.
- Embedded solutions: home appliances.
- Embedded solutions: vehicle systems.
- Enterprise Resource Planning.
- General motion controller.
- Handling hard and soft dedicated solutions.
- Human machine interfaces.
- Industrial ethernet equipment.
- Integration services.
- Lab information management systems.
- Machine safeguarding solutions.
- Plant asset management.
- POS/ATM.
- Process engineering tools.
- Programmable logic controllers.
- Real time process optimisation and training.
- RF devices for industrial applications.
- Solutions for health, hospital and patients: monitoring equipment.
- Solutions for Health, hospital and patient, hospital IT.
- Solutions for home automation.
- Supervisory control and data acquisition.
- Telecom services.
- Vending machines.

4.2.3 Monitoring & Control detailed sub-market evaluation

An important work of data analysis and refining was then conducted:

DECISION and ARC sources were selected mainly because of the interest of their global coverage data in terms of products, end-users or geographical zones breakdowns. In many cases sources were combined or refined in order to get more details for the 30 isolated products markets. Each market was split into 11 applications crossed with 13 product and solution groups.

Figure 9, The bottom up approach for market evaluation

Source: DECISION/RPA, SMART 2007, October 2008

Bottom-up analysis: no overlap between markets

The results of our analysis is a global and exhaustive estimate of the M&C market situation with a cohesive 2 axis breakdown by product and solution, and by application market showing current values and trend potential.

In conclusion, our approach was designed to evaluate the global market value with appropriate scales to avoid all major sources of overlapping:

- First level: a bottom up analysis of 30 separate markets.
- Second level: application market definitions linked to the hypothesis of the existence of:
  - A dedicated specific market such as Embedded solutions;
  - Vertical application specific markets such as Factory automation;
  - A horizontal product layer oriented to the market such as ERP.

4.3 Today's market: 2007 overview

4.3.1 The global market

The total world automation expenditure represented 5% of the industrial CAPEX and was, with the addition of consumer and embedded markets, total M&C world market, just below 190 B€ in 2007. The global growth level, at current price, has remained at a high level of 8% per year, over the period 2007-2020.

This represents 8% of total ICT expenditures worldwide.

In the field of ICT, this is comparable to:
- The whole semiconductor industry world revenues.
- Twice the world mobile phone manufacturers' revenues.

In the media, communication and entertainment area, this is comparable to
- Twice the global revenues of the TV sets manufacturers.
- 10 times the revenues of the global music industry.
- Equal to the US publishing and printing industry total revenues.

Table 12, World M&C Market by product / solution (2007 in M€)

Type of product	Product / solution	2007 in million Euros
Hardware	Control layer	36 180
	Interfaces Layer	5 653
	Network	5 671
	Computing systems	6 172
	OS and drivers	11 615
	Total	65 291
Software	Communication software	5 212
	Application and visualization	10 353
	Development, simulating and modelling	2 610
	Decision support systems and ERP	4 031
	Total	22 205
Services	Application design	17 364
	Integration, installation and training	38 370
	Communication and networking	14 098
	Maintenance, repair and overall	30 629
	Total	100 461
Total [2]		**187 957**

Source: DECISION/RPA, SMART 2007, October 2008

[2] Remark: for all tables, due to rounding, total may differ from sum of entries.

Services, with more than 50% of the market value, have the biggest share.

With 100 B€, total services represent half of the Monitoring & Control market. In comparison, the OS driver and hardware segments still represent around one third of the market. Software represents 12% of the market covering the licence expenditures by user. If software is bundled with OS and drivers (including in hardware) plus application design services its combined share exceeds a quarter of the market with a 27% share.

The 3 largest solution segments add up more than half of the market:

- Hardware: control layer with 36 B€.
- Services: integration, installation and training with 38 B€.
- Services: maintenance, repair and overall with 31 B€.

Table 13, World M&C Market by market application (2007 in M€)

Market application	Equipment	Software	Services	**Total**
Environment	1 765	1 498	6 204	**9 467**
Critical Infrastructures	4 521	3 525	6 323	**14 370**
Manufacturing Industries	6 786	3 918	20 790	**31 493**
Process Industries	4 928	3 977	17 391	**26 295**
Building	556	1 458	5 147	**7 160**
Logistics and Transport	1 826	2 415	6 634	**10 875**
Electric Power and Grid	1 555	1 371	5 674	**8 601**
Vehicle	32 489	2 076	21 842	**56 407**
Household Appliances	2 536	157	1 651	**4 344**
Healthcare	7 967	1 761	8 551	**18 279**
Home	362	50	255	**667**
Total	**65 291**	**22 205**	**100 461**	**187 957**

Source: DECISION/RPA, SMART 2007, October 2008

Table 14, World M&C Market by market application and solution – hardware (2007 in M€)

Market application	Equipment					
	Control layer	Interfaces layer	Network	Computing systems	OS and drivers	**Total**
Environment	637	161	226	262	479	**1 765**
Critical Infrastructures	2 134	245	257	628	1 257	**4 521**
Manufacturing Industries	3 562	591	639	572	1 421	**6 786**
Process Industries	2 236	398	515	508	1 269	**4 928**
Building	303	39	53	37	124	**556**
Logistics and Transport	703	163	234	327	399	**1 826**
Electric Power and Grid	534	153	213	256	400	**1 555**
Vehicle	19 534	2 515	2 515	2 648	5 277	**32 489**
Household Appliances	1 756	195	195	0	390	**2 536**
Healthcare	4 572	1 143	750	929	573	**7 967**
Home	208	50	74	5	25	**362**
Total	**36 180**	**5 653**	**5 671**	**6 172**	**11 530**	**65 291**

Source: DECISION/RPA, SMART 2007, October 2008

Table 15, World M&C Market by market application and solution – Software (2007 in M€)

Market application	Software				
	Communication software	Application and visualisation	Development, simulation and modelling	Decision support systems and ERP	**Total**
Environment	171	934	149	245	**1 498**
Critical Infrastructures	928	1 975	284	339	**3 525**
Manufacturing Industries	761	1 953	461	742	**3 918**
Process Industries	566	2 220	402	788	**3 977**
Building	261	315	232	650	**1 458**
Logistics and Transport	436	698	725	556	**2 415**
Electric Power and Grid	151	855	135	230	**1 371**
Vehicle	1 017	1 060	0	0	**2 076**
Household Appliances	78	78	0	0	**157**
Healthcare	808	250	221	482	**1 761**
Home	35	15	0	0	**50**
Total	**5 212**	**10 353**	**2 610**	**4 031**	**22 205**

Source: DECISION/RPA, SMART 2007, October 2008

Table 16, World M&C Market by market application and solution – Services (2007 in M€)

Market application	Services				
	Application design	Integration, installation and training	Communi-cation and networking	Mainte-nance, repair and overall	**Total**
Environment	968	2 805	537	1 894	**6 204**
Critical Infrastructures	1 185	1 544	1 299	2 296	**6 323**
Manufacturing Industries	2 826	10 567	1 532	5 866	**20 790**
Process Industries	2 634	8 105	1 235	5 416	**17 391**
Building	830	2 089	126	2 102	**5 147**
Logistics and Transport	1 345	2 043	732	2 515	**6 634**
Electric Power and Grid	890	2 535	510	1 740	**5 674**
Vehicle	5 148	5 745	5 720	5 229	**21 842**
Household Appliances	392	627	436	196	**1 651**
Healthcare	1 138	2 260	1 793	3 361	**8 551**
Home	10	51	179	15	**255**
Total	**17 364**	**38 370**	**14 098**	**30 629**	**100 461**

Source: DECISION/RPA, SMART 2007, October 2008

4.3.2 The European market

We will then present separately the European market in order to better understand the relative position of Europe within the global market.

With a total market value of 62 B€ the European market represents a third of the global Monitoring & Control market and is comparable in terms of size to the US market. With a more mature profile than the world market, the European Monitoring & Control market remains also dynamic by its strong position in embedded and factory automation solutions. At current prices, its annual average growth trend is around 6.5% per year over the period 2007-2020.

It is comparable to:

- In relative terms, compared to the European economy, this is more than 1 day of the total EU-27 yearly Gross Domestic Product.
- Compared to the total employment inside EU-27 and with a value added share of 70%, it is worth 750 000 jobs.

ICT, services, media, communication and entertainment comparisons:

- Compared to services businesses, it represents 8% of the EU-27 Telecoms and Transport sector gross value-added.
- The European Monitoring & Control market is 2/3 of the total EU-27 printing market.

Table 17, European M&C Market by product / solution (2007 in M€)

Type of products	Product / solution	2007 in million Euros
Hardware	Control layer	10 918
	Interfaces Layer	1 697
	Network	1 771
	Computing systems	1 876
	OS and drivers	3 662
	Total	19 925
Software	Communication software	1 596
	Application and visualisation	3 481
	Development, simulating and modelling	905
	Decision support systems and ERP	1 392
	Total	7 374
Services	Application design	5 799
	Integration, installation and training	13 716
	Communication and networking	4 339
	Maintenance, repair and overall	10 337
	Total	34 191
Total		**61 490**

Source: DECISION/RPA, SMART 2007, October 2008

Structural European details are quite comparable to Worldwide ones:

- More than 50% of services.
- 3 same major application markets.
- 3 same majors product and solution sub segments.

4.3.3 The European market by application

Table 18, European M&C Market by market application (2007 in M€)

Market application	Equipment	Software	Services	Total
Environment	503	427	1 770	2 700
Critical Infrastructures	1 044	814	1 460	3 317
Manufacturing Industries	2 927	1 690	8 968	13 585
Process Industries	1 870	1 509	6 597	9 976
Building	200	524	1 850	2 573
Logistics and Transport	518	771	2 235	3 524
Electric Power and Grid	683	602	2 493	3 779
Vehicle	9 873	631	6 637	17 141
Household appliance	583	36	380	999
Healthcare	1 593	352	1 710	3 656
Home	130	18	92	240
Total	**19 925**	**7 374**	**34 191**	**61 490**

Source: DECISION/RPA, SMART 2007, October 2008

Table 19, European M&C Market by market application and solution – hardware (2007 in M€)

Market application	Equipment					
	Control layer	Interfaces layer	Network	Computing systems	OS and drivers	Total
Environment	182	46	64	75	137	503
Critical Infrastructures	493	57	59	145	290	1 044
Manufacturing Industries	1 537	255	276	247	613	2 927
Process Industries	848	151	195	193	482	1 870
Building	109	14	19	13	44	200
Logistics and Transport	186	52	78	99	104	518
Electric Power and Grid	234	67	94	112	176	683
Vehicle	5 936	764	764	805	1 604	9 873
Household Appliances	404	45	45	0	90	583
Healthcare	914	229	150	186	115	1 593
Home	75	18	27	2	9	130
Total	**10 918**	**1 697**	**1 771**	**1 876**	**3 631**	**19 925**

Source: DECISION/RPA, SMART 2007, October 2008

Table 20, European M&C Market by market application and solution – Software (2007 in M€)

Market application	Software				
	Communication software	Application and visualisation	Development, simulation and modelling	Decision support systems and ERP	**Total**
Environment	49	266	42	70	427
Critical Infrastructures	214	456	66	78	814
Manufacturing Industries	328	843	199	320	1 690
Process Industries	215	842	153	299	1 509
Building	94	113	83	233	524
Logistics and Transport	129	190	258	194	771
Electric Power and Grid	66	376	59	101	602
Vehicle	309	322	0	0	631
Household Appliances	18	18	0	0	36
Healthcare	162	50	44	96	352
Home	13	5	0	0	18
Total	**1 596**	**3 481**	**905**	**1 392**	**7 374**

Source: DECISION/RPA, SMART 2007, October 2008

Table 21, European M&C Market by market application and solution – Services (2007 in M€)

Market application	Services				
	Application design	Integration, installation and training	Communi-cation and networking	Mainte-nance, repair and overall	**Total**
Environment	276	800	153	540	1 770
Critical Infrastructures	274	356	300	530	1 460
Manufacturing Industries	1 219	4 558	661	2 530	8 968
Process Industries	999	3 075	469	2 055	6 597
Building	298	751	45	755	1 850
Logistics and Transport	456	702	226	851	2 235
Electric Power and Grid	391	1 114	224	765	2 493
Vehicle	1 564	1 746	1 738	1 589	6 637
Household Appliances	90	144	100	45	380
Healthcare	228	452	359	672	1 710
Home	4	18	64	5	92
Total	**5 799**	**13 716**	**4 339**	**10 337**	**34 191**

Source: DECISION/RPA, SMART 2007, October 2008

4.3.4 Suppliers by main product and service

The M&C market is served by a large number of suppliers of many types. One of the main characteristics of this market is the tight links between layers of suppliers and the final equipment suppliers or users.

In classical M&C areas such as Process Control, Discrete Piece Manufacturing, Electric Power and Grid and Critical Infrastructures, the landscape is relatively stable, dominated at the centre, by well known market leaders such as ABB, Siemens, Schneider Electric, Honeywell and Yokogawa. These suppliers have decades of development experience behind them in standard or more specific technologies. Major suppliers such as these provide the sensors, the control layers with distributed control systems or PLCs, and all the programming software, development tools and operating systems to complete an automation system. Computing systems and displays may come from these companies for special purposes or hardened products, but present trends suggest that many systems are standardized enough to be supplied by classical manufacturers such as HP, IBM, Intel and others. Supplies of network equipment and some sensors can also be outsourced to companies such as Cisco, Intel or Motorola.

Table 22, Suppliers by product / solution

Type	Product / solution	Main suppliers
Hardware	Control layer	ABB Bosch Delphi Honeywell Invensys Rockwell Automation Schneider Electric Siemens Yokogawa …
	Interfaces Layer	
	Network	
	Computing systems	
	OS and drivers	
Software	Communication software	Cap Gemini IBM SAP Syseca
	Application and visualisation	
	Development, simulation and modelling	
	Decision support systems and ERP	
Services	Application design	*All*
	Integration, installation and training	
	Maintenance, repair and overall	
	Communication and networking	

Source: DECISION/RPA, SMART 2007, October 2008

The M&C systems also need to be designed, integrated, installed and maintained. The suppliers of these services may be engineering companies, system integrators, software

providers or the users themselves. For machine control, the services are usually provided by the machine manufacturer.

For more specific areas such as transportation systems, health systems or building, the industry structure is generally a two-tier structure with hardware manufacturers working with automation suppliers, system integrators that design and assemble hardware, software and other equipments. In the case of transport equipment, the manufacturers of transport vehicles or infrastructures establish the specifications of the M&C solution and often design it in-house. They then have their subcontractors (such as Bosch, Delphi, Johnson Controls or Denso), assemble and deliver the systems to the manufacturer at the production stage for inclusion in the car, truck or plane.

The European position is generally strong with leaders such as Siemens, ABB, Bosch and Schneider Electric. These companies are more or less European based with headquarters in Europe but R&D centres and manufacturing facilities all over the world. The services are generally more localised in the user neighbourhood, with some software giants such as SAP, Cap Gemini and smaller and more specialised companies locating close to markets.

Specialisation is important inside the European leaders. Then we may take into account that the main markets positions are:

- ABB, Schneider Electric and Siemens are specialised in the automation field and also in the power systems' one. Siemens is present in the health, transportation and home fields.
- Bosch is involved in the automotive, industrial and home equipment markets
- Continental in the automotive systems' market.
- Cap Gemini and IBM are specialised in the systems integration and software design markets.
- Electrolux and Legrand are specialised in the consumer goods, home and building automation markets.
- SAP in the ERP systems market.
- Orange in the telecom services market.

4.3.5 Market leaders

Most of the leaders are global players, historically coming from one product or solution layer and then diversifying their portfolios through acquisitions. Now they are positioned from catalogue control products to turnkey plant solutions. They are also integrators for solution based on products/services developed by others.

The main specialization in the field of M&C is then more visible by user and by application rather than by solution.

Table 23, M&C and embedded solutions European and Global Players

With a global portfolio (from hardware to services)	European global players	Others European players	Non European leaders with strong bases in Europe	Other leaders
Critical Infrastructures (IT and defence)	Alcatel-Lucent (FR/US) Nokia (FI) Ericsson (SE) Thales (FR) EADS (FR/DE) BAE Systems (UK) Rhode & Schwarz (DE)	Sagem (FR) Finmeccanica (IT)	Nortel (CN) Motorola, Agilent (US)	Huawei (CH) Raytheon (US) LM (US) Boeing (US) NEC (JP) Fujitsu (JP)
Manufacturing Industry	ABB (SE/CH) Siemens (DE) Schneider Electric (FR)	Danfoss (DK)	Rockwell (US)	Mitsubishi, FANUC (JP)
Process Industry Environment Building Logistics and Transport	ABB (SE/CH) Siemens (DE) Invensys (UK)	Endesa (IT) Schneider (FR)	Honeywell, Emerson, Johnson Control (US)	Yokogawa, Mitsubishi (JP)
Electric Power and Grid	ABB (SE/CH) Siemens (DE) Schneider Electric (FR)	Areva (FR) Endesa (IT)	GE (US)	Mitsubishi (JP)
Vehicle	Robert Bosch, Continental (DE) Thales, Alstom (FR) BAE Systems (UK) EADS (FR/DE)	Valeo (FR) Magnetti Marelli (IT) Autoliv (SE)	Delphi (US)	Boeing (US) Denso (JP)
Household Appliances	Bosch-Siemens (DE) Electrolux (SE)	Miele (DE) Indesit (IT) Fagor (ES) Gorenje (SI) Beko (TU)	Whirlpool, Maytag (US)	Haier (CH) Panasonic (JP) Samsung, LG (SK)
Healthcare	Philips (NL) Siemens (DE)		GE (US)	Toshiba (JP) Medtronic, Boston Sc. (US)
Home	Legrand, Schneider Electric (FR) Siemens (DE)	Hager (FR)	GE (US)	Home Automation (US)

Source: DECISION/RPA, SMART 2007, October 2008

Table 24, European M&C and embedded solutions suppliers – market shares

With a global portfolio (from hardware to services)	European market shares	World market shares
Critical Infrastructures (IT and defence)	60%	35%s
Manufacturing Industry	60%	30% - 35%
Process Industry; Environment; Building; Logistics and Transport	50%	35% - 40%
Electric Power and Grid	80%	>50%
Vehicle	50% – 70%	40% - 50%
Household appliances	30% - 40%	25%
Healthcare	25%	10% - 15%
Home	50% - 60%	20% - 30%

Source: DECISION/RPA, SMART 2007, October 2008

4.4 Description of the European Monitoring & Control market by application market

4.4.1 Environment

Figure 10, Environment M&C Market: Growth perspectives (2007-2020 annual rate)

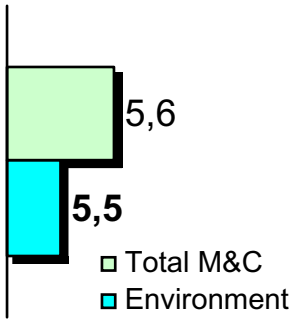


Figure 11, Environment M&C Market: % of total M&C (2007)

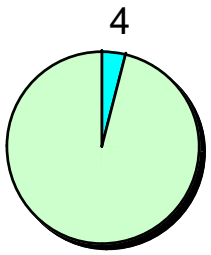
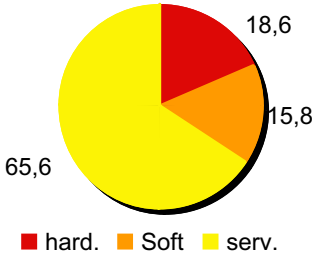
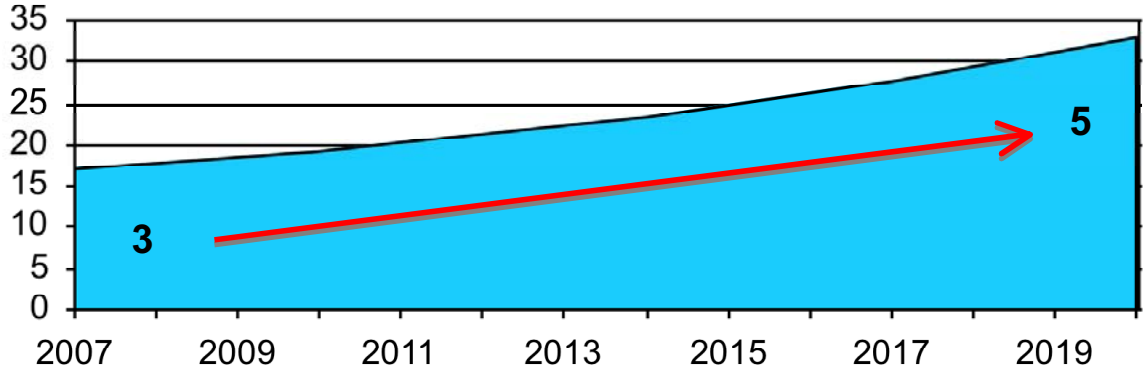


Figure 12, Environment M&C Market: % of hardware – soft – services (2007)



Source: DECISION/RPA, SMART 2007, October 2008

Figure 13, Environment M&C Market Value (B€)



Source: DECISION/RPA, SMART 2007, October 2008

The **Monitoring & Control market for Environment** includes various solutions dedicated to primary sectors of the economy such as agriculture, air, water and soil pollution, aquaculture, CO_2 sequestration, fishing, forestry, mining, oil and gas extraction and waste treatment.

This is a sector impacted by many new concerns and global drivers such as:

- Global consciousness of pollution and global heating problems.
- Oil and gas extraction is pushed to the limits.
- Food problems bring the need for more observation of soils and crops.
- Water strategic resource and water treatment have to be improved.

Market situation

This is a relatively young market with increasing scope for Monitoring & Control. It can be related to air, water, pollution, mining, gas extraction, greenhouse effect and many other applications. The awareness of environmental issues is not new but the recent pessimistic projections have pushed many governments and regulation authorities to issue new constraints.

Furthermore, growing economies such as China and India have urgent needs for energy, food and raw materials. To satisfy these needs, market suppliers have to go to more and more extreme conditions with increased risks of danger and pollution. Cleaning up and purification (water, air, wastes) are also increasing markets especially for fast growing economies.

The forecasts for this market give a 12% annual increase rate (one of the biggest rates) from 2006 to 2012 and 8% from 2012 to 2020.

Remarks

The relatively low market value can be explained by :

- The localization outside Europe of extraction industries.
- The exclusion of sensors of the scope of the study.

Market drivers:

- More severe regulations and policies.
- Global heating and Greenhouse effect.
- Scarcity of natural resources: water, oil and gas, raw materials, food...
- Consumer and government pressure for environmental friendly industries.

Market barriers:

- Emerging economies have less environmental regulations. It is also true for the USA but the situation should be improved.
- High cost of solutions.
- Pressure on production costs.

With new solutions, demand is oriented toward:

- Early warning and critical situation control.
- Large scale supervision systems.

Scenario options

The main option is the ability of environment conscious countries and organizations to induce a real change in local regulations in emerging economies.

4.4.2 Critical Infrastructures

Figure 14, Critical infrastructure M&C Market: Growth perspectives (2007-2020 annual rate)

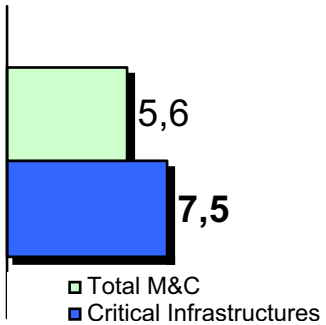


Figure 15, Critical infrastructure M&C Market: % of total M&C (2007)

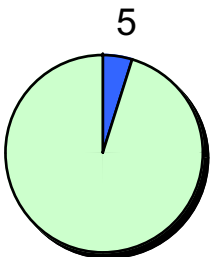
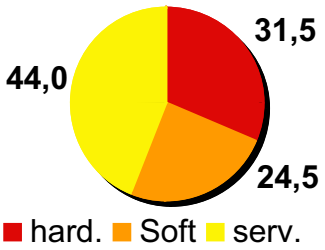
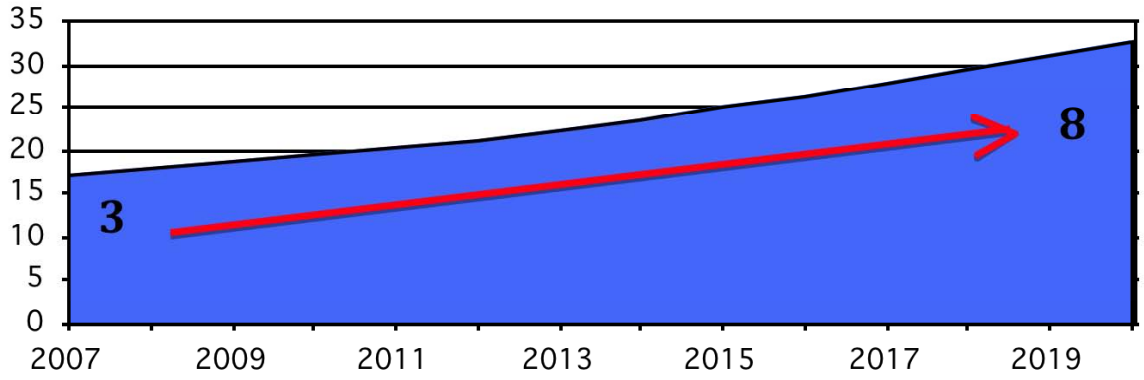


Figure 16, Critical infrastructure M&C Market: % of hardware – soft – services (2007)



Source: DECISION/RPA, SMART 2007, October 2008

Figure 17, Critical Infrastructures M&C Market Value (B€)



Source: DECISION/RPA, SMART 2007, October 2008

The <u>Monitoring & Control market for Critical Infrastructures</u> includes 2 main fields:

- The infrastructure workflow management.
- The protection and safety of the infrastructure itself.

There are many types of infrastructures: railways, roads, rivers, airports, harbours, telecommunication networks, oil and gas transportation (pipelines), storage and distribution, heat and steam (CHP), etc.

<u>Market situation</u>

The market for Monitoring & Control for critical infrastructure should have a 6% increase rate but with different forecasts in the different geographic regions.

The main developed regions - USA, Western Europe, Russia, Japan and China - represent 85% of the world market and 95% of the world production.

China will have a higher increase rate (9.5%) and its share in the world market will increase from 6 to 8%, while the USA will decrease from 43% to 41%. China's share in the world market increases from 6 to 8%, while the USA's one will decrease from 43% to 41%.

There will be important renews of demand with new requirements for more integrated systems and new functions including:

- Smart and precision workflow management.
- Upper integration.
- Protection against terrorism attacks
- Multimodal control systems.
- Large scale interoperable systems.
- Weather condition large scale and real time alert.

The USA dominates the world market with 14 companies in the top 20 leaving 6 places to European companies. Top American companies are Raytheon, Honeywell and GE and top European companies are Thales, Alcatel-Lucent, Safran and BAE.

Market drivers:

- Globalization of many infrastructures.
- Safety and environment concerns.
- Rapid evolution of civil and military transportation systems.
- Launch of the European Positioning Satellites.
- Strategic and regional alliances.

Market barriers

- Large domination of the USA.
- Long term investments and increasing costs.
- Increasing complexity of critical infrastructures.

Scenario options

The main option is the speed of globalization and its depth. If the speed is high, it should give large-sized and high performance systems in which Europe is well positioned. If markets remain mainly regional with specific regulations and standards, there will be many solutions coming from the classical suppliers.

4.4.3 Process Industries

Figure 18, Process Industries M&C Market: Growth perspectives (2007-2020 annual rate)

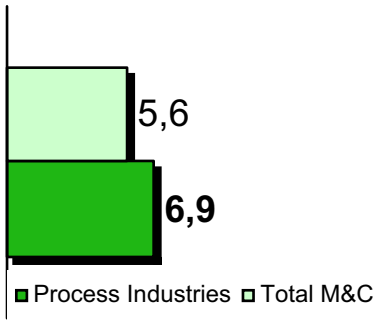


Figure 19, Process Industries M&C Market: % of total M&C (2007)

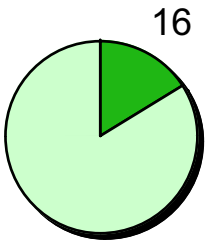
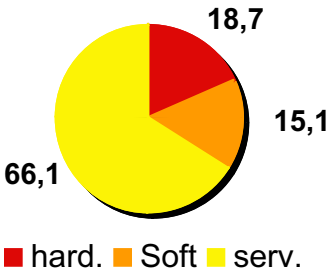
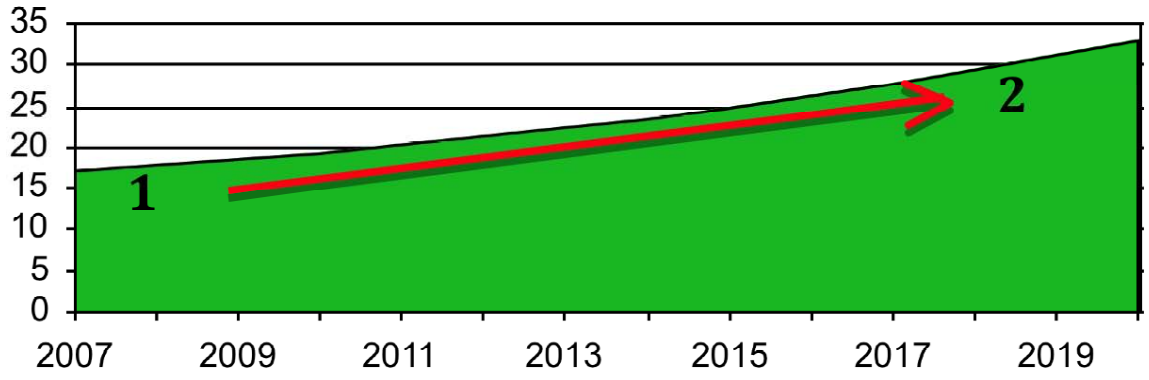


Figure 20, Process Industries M&C Market: % of hardware – soft – services (2007)



Source: DECISION/RPA, SMART 2007, October 2008

Figure 21, Process Industries M&C Market Value (B€)



Source: DECISION/RPA, SMART 2007, October 2008

The <u>Monitoring & Control market for Industry process control</u> refers to those products monitoring the inputs and outputs of a process conducted predominately by industry in the extraction or production of oil, gas, chemicals, food, and aggregates.

Control of these inputs and outputs can then be regulated by a device located at source or through a network of sensors and devices controlled by a central computer and its associated IT network.

Such controls can be applied to ensure worker safety, maximise efficiency in order to create lower costs, and introduce flexibility to each process. The process control was the first application to experiment a large use of automation systems starting from simple regulation and reaching very complex systems.

Market situation

The market is estimated at 30 billion dollars with an expected growth rate of almost 10% in the next decade. This increase rate would be even higher if the hardware cost and performance improvements were not so important.

Globalization and cost pressure will renew localization strategies.

A small number of suppliers from emerging economies propose new solutions on the process control market.

Cost and quality pressures resulting from market globalization induce a higher use of M&C to achieve:

- Better plant utilization.
- Higher yields.
- Product quality.
- Safety and respect of environment.
- Flexibility.

Main challenges on the process industries market are similar to those from the industries manufacturing ones with a higher sensibility to environmental concerns, energy saving questions, and CO_2 issues.

The growth is much higher in emerging economies and developing countries such as China, India, Latin America, Eastern Europe and the Middle East. The leading growth sectors will remain the petrochemical, refining, chemical, mining and metals and oil and gas industries.

The EMEA market should remain the first market with about 40% of the world total. The North American market should retrograde from the second place with 28% in 2006 to the third place with 26% in 2011. Asia will go from the third to the second place with more than 30% of the world market in 2011.

Table 25, M&C Process Industries market, by region

World Region	Share in 2006	Share in 2011	CAGR
Asia	26.6%	30.5%	12.9%
EMEA	40.9%	39.8%	9.2%
Latin America	4.1%	4.0%	9.4%
North America	28.4%	25.6%	7.3%
Total	100.0%	100.0%	9.6%

Source: DECISION/RPA, SMART 2007, October 2008

Market leaders are ABB, Siemens, Honeywell, Invensys, Emerson Process Management, Rockwell Automation, Yokogawa and Mitsubishi. ABB has been leading the world market for years followed by Siemens at a short distance. Europe has a strong position, followed by the USA and Japan.

Remarks

Market drivers:

Economic and regulation drivers are:

- Demand and high prices for energy and raw materials.
- Increasing regulatory requirements for safety and environment.
- Growth in infrastructure industries.
- Higher performances and better quality requirements.

Technical drivers are:

- Increased use of Fieldbus and Ethernet based communication.
- New automation strategies.
- Better supervision and maintenance tools.

Market barriers

- Complexity of systems.
- High installation costs.
- Many old installations with legacy equipment.

Scenario options

Globalization and cost pressure will continue to lead to global mergers and acquisitions with renewed localization strategies more and more closed to customer markets. A few suppliers from emerging economies begin to show on the process control market. One scenario is the acquisition of a world leader by a Chinese or an Indian company and a higher penetration of newcomers. The other scenario is strong resistance by the present market leaders by ensuring dominance on technology development and innovation.

4.4.4 Manufacturing Industries

Figure 22, Manufacturing Industries M&C market: Growth perspectives (2007-2020 annual rate)

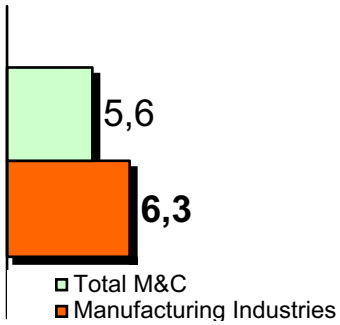
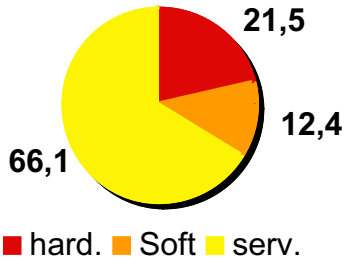


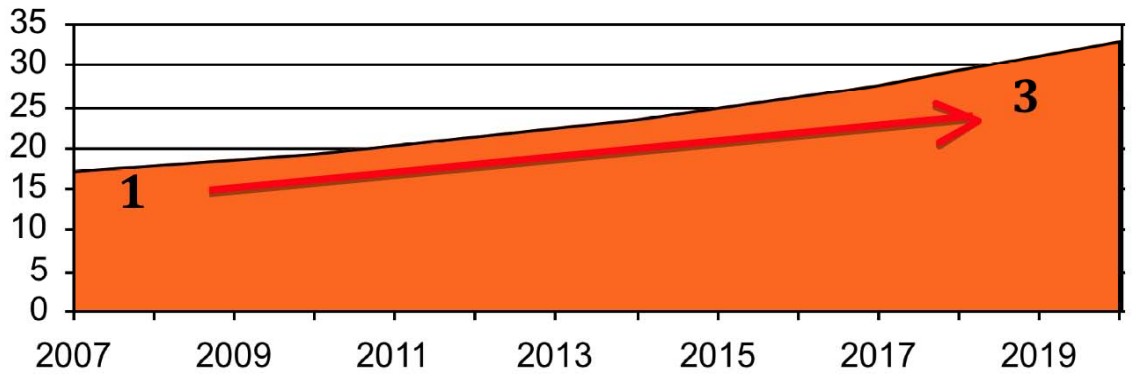
Figure 23, Manufacturing Industries M&C Market: % of total M&C (2007)

Figure 24, Manufacturing Industries M&C Market: % of hardware – soft – services (2007)



Source: DECISION/RPA, SMART 2007, October 2008

Figure 25, Manufacturing Industries M&C Market Value (B€)



Source: DECISION/RPA, SMART 2007, October 2008

The Monitoring & Control market for Manufacturing Industries represents investments plus ownership expenses from the manufacturing industries for their production and enterprise controls and monitoring needs.

Namely they belong to the following sectors: computers, electronic and optical products, electrical equipment, furniture, machinery and equipment, motor vehicles and other transport equipment, leather and wearing, other manufacturing.

The main challenges are in particular:
- All IP and SOA architectures.
- Complex systems optimization and control.
- Flexibility, availability and maintenance control.

Market situation

The market of automation for Discrete Piece Manufacturing is also increasing but in a different way than for Process Industries. From a technical point of view, there is no global view and modelling of a continuous process but a set of “islands of automation” such as an NC machine, a transfer line, an assembly line, a robot or a storage system. Flexibility and efficiency are the goals of automation but the tools used are more sophisticated than for continuous systems: we talk about simulation, capacity management, optimization, scheduling and real time rescheduling. The tools are either attached to the equipment or related to workflow organization. The life cycle of manufacturing systems is much shorter for Discrete Piece manufacturing than for Process Industries. The progress in automation can be much faster too.

The overall market growth from 2006 to 2011 should be around 7% but with Asia increasing faster than the other regions with the transfer of many manufacturing activities to this area. Eastern Europe and Latin America will also experience high growth rate as compared to North America or Western Europe.

Table 26, M&C Manufacturing Industries market, by region

World Region	Share in 2006	Share in 2011	CAGR
Asia	34.9%	37.8%	9.2%
EMEA	43.1%	40.1%	5.8%
Latin America	1.8%	2.2%	10.6%
North America	20.2%	19.9%	7.1%
Total	100.0%	100.0%	6.8%

Source: DECISION/RPA, SMART 2007, October 2008

The strongest industrial sectors for automation expenditure are:

- Automotive industry (22% of the total).
- Machinery (20%).
- Electronics and semiconductors (16%).
- Fabricated metals (8%).
- Building automation (8%).

The world market leaders are: Siemens (22% of market share), Mitsubishi, Fanuc, Rockwell and Schneider. In Europe, Siemens leads the way with around 40% of the market shares followed by Schneider (6%), Bosch (5%) and Rockwell (4%). Mitsubishi and FANUC largely dominate the Asian market and Rockwell is the number one in North America.

Remarks

Market drivers:

- Adaptation to the rapid design changes.
- Flexibility in manufacturing.
- Cost and efficiency improvement.
- Work organization and conditions.
- Just-in-Time capabilities.
- The ease of shift between geographical regions.
- Scarcity and price of energy and raw materials.
- Use of networks such as Fieldbus and Ethernet.

Market barriers

- Complexity of simulation, modelling and optimization.
- Some emerging economies need less automation as wages are very low (less and less true).

Scenario options

The concentration of suppliers amongst Germany, Japan and the USA will probably last for many years although some Chinese companies are starting to emerge.

Furthermore, there is a direct relation between machine and equipment manufacturing and the mastering of automation technologies and it is unlikely that this situation will vary.

4.4.5 Building

Figure 26, Building M&C Market: Growth perspectives (2007-2020 annual rate)

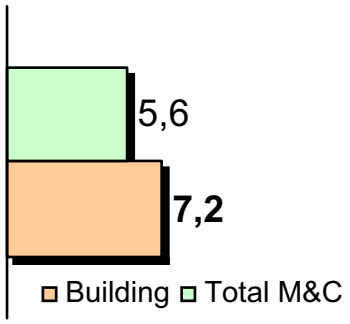


Figure 27, Building M&C Market: % of total M&C (2007)

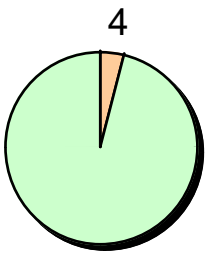
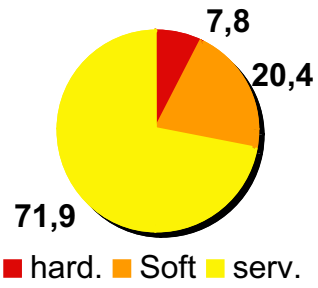
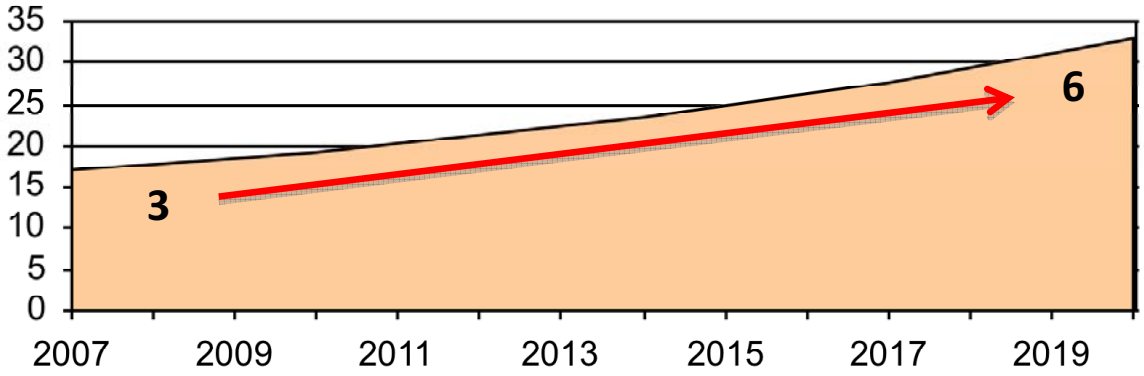


Figure 28, Building M&C Market: % of hardware – soft – services (2007)



Source: DECISION/RPA, SMART 2007, October 2008

Figure 29, Building M&C Market Value (B€)



Source: DECISION/RPA, SMART 2007, October 2008

Building relates to M&C products incorporated in a building to achieve certain performance characteristics from a multitude of technologies installed within the construction. Consulters divided this market into two different segments.

The first one focuses on new construction in which M&C technology can be limited by changes that an architect and a designer can make to the building.

The second one includes products implemented in existing buildings where it is difficult to introduce new systems.

This field includes namely: all M&C related activities from construction to Facility management services, and main users include:

- Construction.
- Renting and operating of estate.
- Tertiary sector.

Main drivers:

- Lighter supervision systems for smaller buildings.
- Facility Management.
- Energy management.
- Security and hazard control.

Table 27, M &C Building Construction, Automation and Facility management solutions main suppliers

	Main suppliers
Global Solutions	Siemens Building Technology, Schneider Electric (TAC), Johnson Controls, Dynalite,
Standards	BacNet, LonWork (Echelon), Konnex, Zigbee[3], …

Source: DECISION/RPA, SMART 2007, October 2008

One of the exciting new trends in Building Automation today is the growing popularity of Direct Digital Control (DDC) as a measure incorporated with Performance Contracts. This is definitely driven by Energy Efficiency demand, because of both environmental and financial concerns.

The performance based method of combining multiple energy measures into a turnkey package, including financing and a performance guarantees, has developed into a mature market and drives hundreds of millions in energy projects per year. For the controls industry it is exciting that these projects are starting to entail more complex systems, such as:

- Central plant upgrades.
- Distribution loop modifications including plate and frame heat exchanges.
- Combined heat and power technology.

Performance contracts target existing buildings, ideally with high-energy costs and ageing equipment. This means that the size of the market is much larger that focusing on new construction and renovation, plus owners of existing buildings who have real problems that Building Automation can solve.

Another factor is that the target customers for performance contracts have traditionally been public entities, but in the present economic climate this concept is starting to appeal to business owners as well. With this opportunity however comes a challenge and that is, learning to sell systems directly to an owner rather than submitting a bid. This is certainly not new to most controls contractors, so the key challenge is more centred on learning how to offer these services and finance them, which is simply a different sales approach.

[3] http://www.zigbee.org/en/index.asp

Another key issue that seems to have been resolved is the development of standards in order to enable different solutions from different providers, to be used and monitored on one single system. BacNet, Echelon and Konnex are still competing against each other, but at least equipment suppliers do not develop their own proprietary solutions for Building Automation (which is not the case for Home Automation).

Security is still a driver, but most of the modern buildings are already equipped. The next step will be to properly equip older buildings, hospitals and education buildings.

4.4.6 Logistics and Transport

Figure 30, Logistics and Transport M&C Market: Growth perspectives (2007-2020 annual rate)

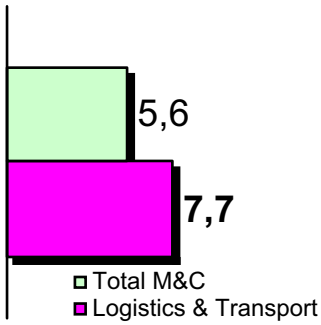


Figure 31, Logistics and Transport M&C Market: % of total M&C (2007)

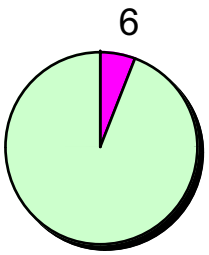
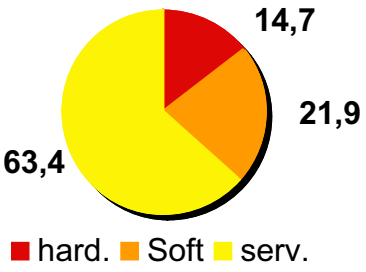
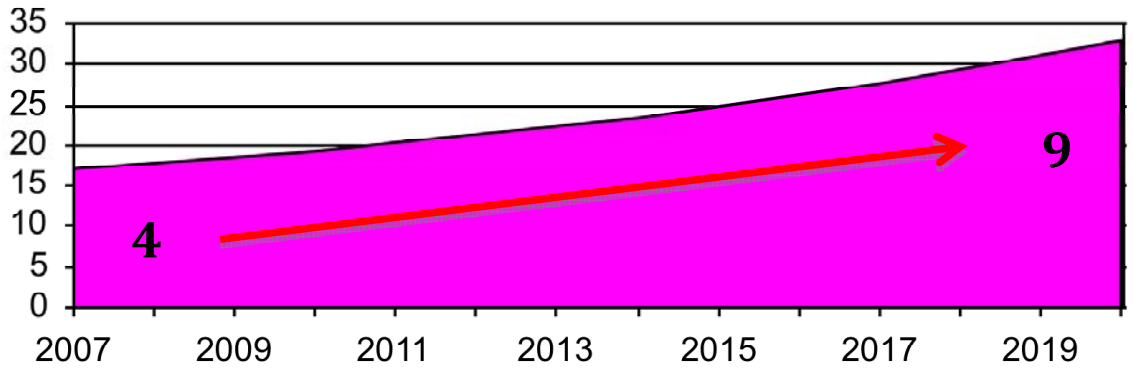


Figure 32, Logistics and Transport M&C Market: % of hardware – soft – services (2007)



Source: DECISION/RPA, SMART 2007, October 2008

Figure 33, Logistics and Transport M&C Market Value (B€)



Source: DECISION/RPA, SMART 2007, October 2008

The Logistics and Transport sector encompasses the distribution of goods, transport ticketing Monitoring & Control solutions such as:

- Supply chain.
- Warehousing.
- Fare collection.
- Parcel tracking.
- Mail.
- Handling.

It has evolutions closed to infrastructures:

- Large scale and multimodal systems.
- Mixed application platforms management.

Market situation

This market consists in four main applications:

- Warehouse management.
- Parcel tracking and delivering applications.
- Management of Logistic service providers and operators especially for Just-In-Time applications.
- Transport.

The global M&C market for logistics is around 7.2 B€ in 2007 and should increase to 11.3 billion in 2012 and 16.6 billion in 2020 giving increase rates of 9.5% in the next five years and 5% after. Logistic platforms and operators are mainly located near customer premises or markets. This explains why the market is concentrated in Europe and North America. It is also the case for suppliers of solutions for this market.

Market drivers:

- Overall efficiency (speed and reliability).
- Traceability.
- Real time stock monitoring.
- Pressure on costs.
- Globalization of commerce and industrial manufacturing.
- Multimodality and heterogeneity of systems.

Market barriers:

- Full solution prices that limit user size in terms of activity.
- Multi-modal systems are difficult to control.
- Legacy systems in transportation services.

Scenario options

Logistics systems are today specialized and regional based. The Automotive industry for instance does not have the same requirement than retail stores and the logistics system are very specific for each case. One scenario is the merger of logistics for many applications and different regions. The other is the development of railway based logistics at much higher levels than today.

4.4.7 Electric Power and Grid

Figure 34, Electric Power and Grid M&C Market: Growth perspectives (2007-2020 annual rate)

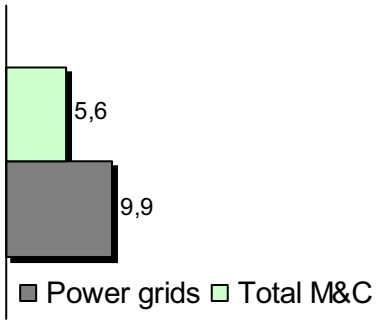


Figure 35, Electric Power and Grid M&C Market: % of total M&C (2007)

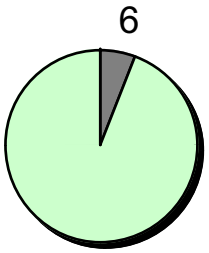
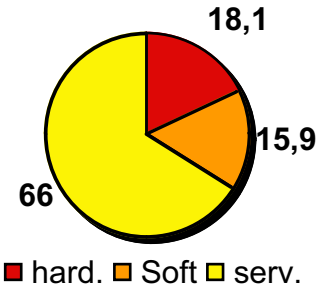
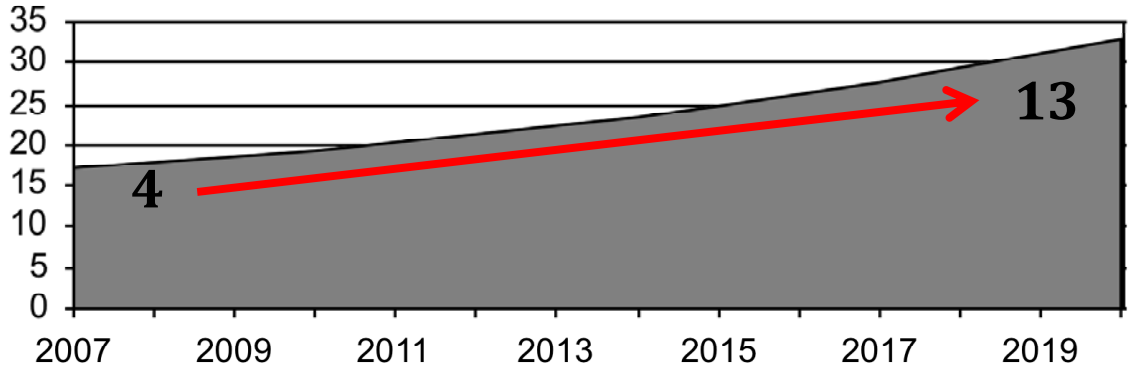


Figure 36, Electric Power and Grid M&C Market: % of hardware – soft – services (2007)



Source: DECISION/RPA, SMART 2007, October 2008

Figure 37, Electric Power and Grid M&C Market Value (B€)



Source: DECISION/RPA, SMART 2007, October 2008

The Monitoring & Control market for Electric Power and Grid includes all expenses from the electricity sector in Monitoring & Control equipment and solutions ranging from power plants to micro- generation and co-generation including transport and distribution grids, metering, etc.

Due to important investments in grids and production, this market is entering a high growth area driven both by highly energy prices, renewal of power plant base, improvement of grids and grid interconnections.

Similar to infrastructure needs, it will be engaged in better integration of:

- Large scale multiregional systems.
- Multimodal control systems.
- Multi-energy sources.

Electric energy can be transported, compared with heat, which has to be produced on the use location. Power grids are the core systems for electric energy delivery from the production to the use locations.

Problems have changed over the past ten years with the emergence of renewable energy systems (windmill farms, photo electricity, small dams, waves energy, etc.), which can feed the power net either by the transport or the distribution nets. Furthermore, the multiplication of power sources changes the way to manage the balance between production and distribution.

Transport grids (over 64 000 Volts) are controlled by SCADA systems. Similar but more decentralized systems are used for distribution nets.

Distribution systems have also to manage smart meters and accounting. The meter reading activity will be fully changed in Europe in the next ten years with smart meters, which will include power management functions, directly usable by the consumers.

SCADA hardware systems are generally old. The software has also taken a long time to be secured and, thus, because of their long life cycle, most of them are older than 10, sometimes 20 years. Changes are therefore slow on the SCADA systems.

Market drivers are mainly the fast evolution of decentralized production and the quick change of meters, including hardware, software, installation and service changes.

A key challenge is to secure production, transport and distribution without wasting too much energy, which is always to be produced in greater quantities than the consumption needs.

4.4.8 Vehicle

Figure 38, Vehicle M&C Market: Growth perspectives (2007-2020 annual rate)

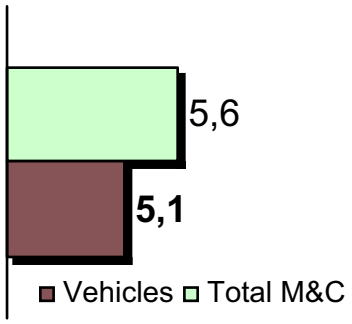


Figure 39, Vehicle M&C Market: % of total M&C (2007)

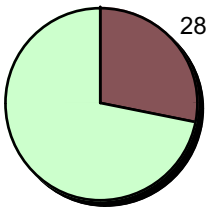
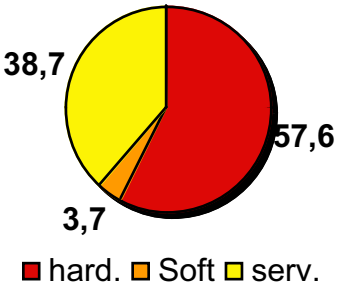
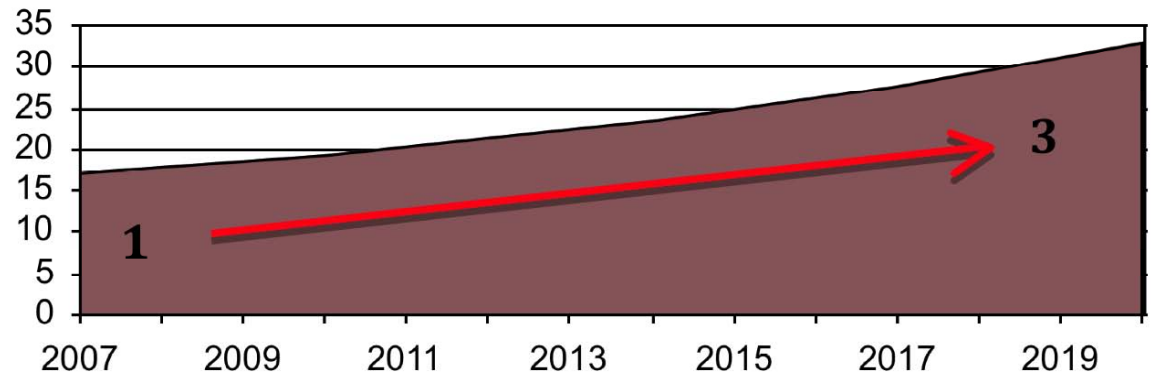


Figure 40, Vehicle M&C Market: % of hardware – soft – services (2007)



Source: DECISION/RPA, SMART 2007, October 2008

Figure 41, Vehicle systems M&C Market Value (B€)



Source: DECISION/RPA, SMART 2007, October 2008

The Monitoring & Control market for Vehicle represents expenses by vehicle manufacturers for inside produced vehicle embedded solutions. It represents their yearly expenses for components such as: ABS braking, air conditioning, airbags, automatic transmissions, adaptive suspension, engine control, etc.

World leaders are Bosch, Continental AG, Delphi, Denso, etc.

This application market is facing numerous challenges from various natures:

Technology area:
- Technological integration
- Mechatronics
- Multiservice architecture
- Systems safety
- Remote control and diagnosis
- Etc.

Global issues:
- CO_2 emissions reduction
- Hybrid motorisation
- Electrical vehicles
- Smart vehicles
- Traffic management
- Etc.

NB:

- The main market for vehicle is represented by **in-car systems**, but we also include the other vehicles such as agriculture engines, aircrafts, buses, trucks, off-road vehicles, railways, ships, etc.

- Monitoring & Control investments and expenses for vehicles manufacturing plants and production lines are counted in the Manufacturing Industries Applications Markets segments.

Market situation

In terms of size the largest market in this field is Automotive that accounts for 95%, and includes almost all in-car systems.

After the extensive development of the engine management systems and new functions (ABS, ESP, Airbags, etc.) the next challenges for Monitoring & Control are:
- A better integration and optimisation of existing functions.
- The development of standard control functions for electric power (hybrid, or electrical motorisation).
- Active security: to have a system capable of stopping unsafe driver behaviours.
- Future communication and environment control systems (cruise radar, RF warning, interaction with traffic and smart road) are the long term evolutions issues.

Remarks
- The real frontier of automotive (or vehicle) Monitoring & Control solutions is the capability of systems to drive cars (or to let another system, road-traffic management for example to do it). It requires many improvements before being acceptable on a large scale.
- Share of software: in provided figures, shares of software (less than 5%) could appear as very low, this is because we considered OS value included with hardware and development as a service 4. Then, total software expenses, including the share in hardware plus the one in services, reach then 25%.

[4] This restriction clearly indicate the difference that exist inside each application market while regarding product definitions, for an ERP solution, software cost represents licences.

Market drivers:

- Hybrid vehicles that require more electronic control with higher value.
- Environment regulation that targets to optimise energy efficiency and to limit air pollution. Previous levels were reachable only with the assistance of control devices.
- Oil prices that modify driving behaves and new model types.
- Other legislation on road safety.

Market barriers

- Network security.
- Drivers and buyers expectation or behaves: there are supposed to dislike any devices that could take the hand and drive for them. They are more interested by driving helping devices …

Scenario options

- Rapid growth of active security concerns and car-to-car and car-to-infrastructure communication.

4.4.9 Household Appliances

Figure 42, Household Appliances M&C Market: Growth perspectives (2007-2020 annual rate)

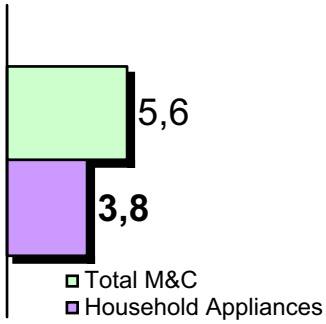


Figure 43, Household Appliances M&C Market: % of total M&C (2007)

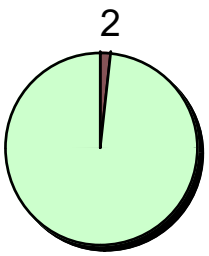
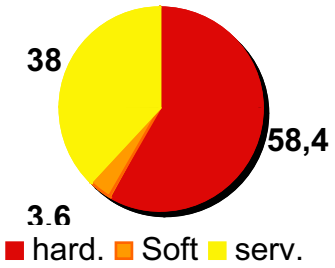
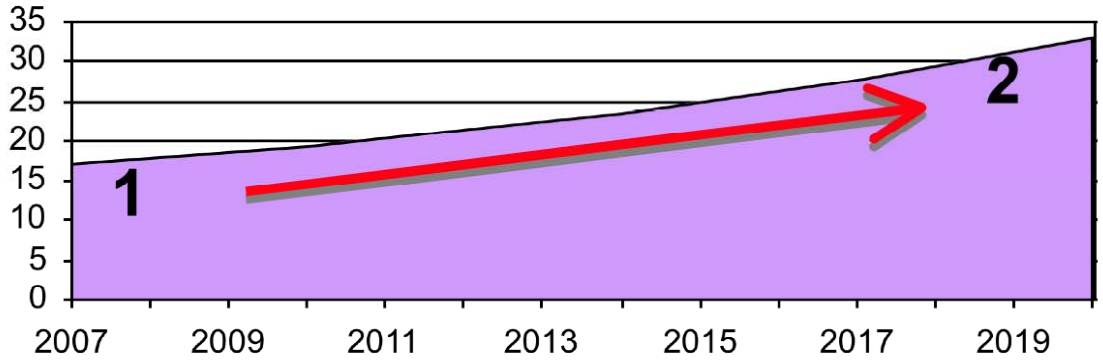


Figure 44, Household Appliances M&C Market: % of hardware – soft – services (2007)



Source: DECISION/RPA, SMART 2007, October 2008

Figure 45, Household Appliances M&C Market Value (B€)



Source: DECISION/RPA, SMART 2007, October 2008

The Monitoring & Control market for Home Appliances represents expenses by consumer device manufacturers for inside produced embedded solutions (I/O, programmers, etc.).

Main sub segments include:

- TVs and other audio video products.
- White goods (washing machines, fridges, …).

The market is very low due to the lack of integration in home systems and the coordination of the different stakeholders:

- Confidential market for smart applications.
- Expensive options.
- Withdrawal of products.

Market situation:

Three types of Monitoring & Control applications for home appliances equipment:

- Embedded: programming and control devices to manage the appliance itself such as the temperature level for refrigerators, the washing machine programmer, the oven time programmer, etc. A simple On/Off without variable control became rare and dedicated to small home appliances (boilers, toaster, etc.). A recent innovation is for example the self programming coffee machine with an integrated optical barcode reader that allowed to identify the quantity and the duration of hot water for the introduced capsule;
- Home network: Communicating devices that allow collecting information on an equipment current situation. Such functions exist in numerous very high-end labels in Europe, but the market remains weak: a few hundred of functions appear per year. Communication between devices is made through Power Line Communication (PLC). All major suppliers used the same communication standard, distributed by their European association. It is almost a plug and play in that the washing machine from one supplier can communicate with the oven from another supplier. The most common application is to display on a single screen the status of various appliances being used in the same house. It is not used for control operations.
- External communication: the only authorised remote control is an emergency stop function.

Remarks:

In general several manufacturers developed a future vision based on science-fiction systems - not because the technology is not available but just because the market is not ready. Some of the most famous examples are the pay-per-use washing machine and the self-shopping fridge.

Main issues:

- Centralised control with all the safety consequences.
- Energy consumption optimisation.
- Maintenance and services.

Market drivers:

- Standardisation.
- Home network (RF, PLC, TP, etc.) interconnections.
- Global home automation.
- Efficiency and energy management.

Market barriers:

- Many markets remain national: no global communication on high-end smart products, cultural difference remains, etc.

Scenario options:

- Higher sensibility to energy issues.
- Need for smart interface/monitoring applications.

4.4.10 Healthcare

Figure 46, Healthcare M&C Market: Growth perspectives (2007-2020 annual rate)

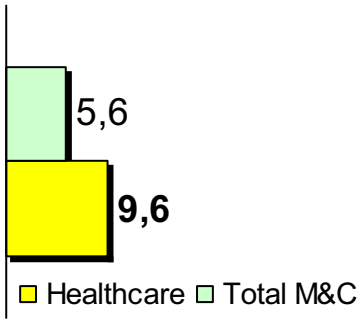


Figure 47, Healthcare M&C Market: % of total M&C (2007)

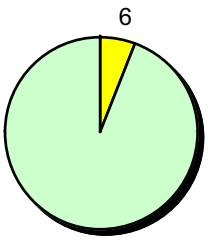
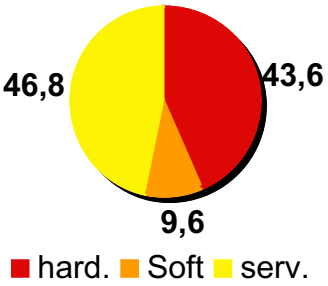
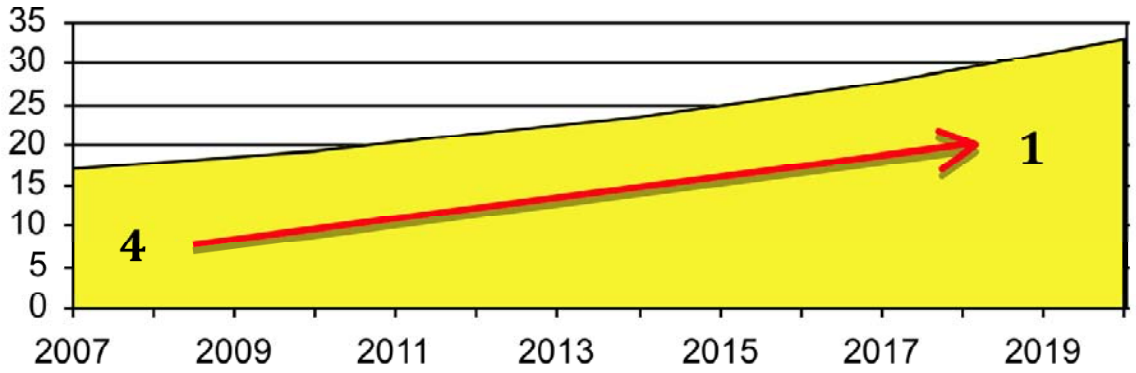


Figure 48, Healthcare M&C Market: % of hardware – soft – services (2007)



Source: DECISION/RPA, SMART 2007, October 2008

Figure 49, Healthcare M&C Market Value (B€)



Source: DECISION/RPA, SMART 2007, October 2008

The <u>Monitoring & Control market for Healthcare</u> includes:

- Human health activities – including monitoring equipment and other materials, used by health professionals in public and private hospitals.
- Residential care activities.
- Nomadic medical equipments are principally used by individuals to alert health authorities on the difficulties an individual may experience at home and to track vulnerable patients.
- Personal medical equipments are mainly designed for individuals. This sub-sector covers personal equipments such as blood pressure measurers and self medication devices that allow individuals to independently monitor and control their healthcare.

The healthcare sector is strongly influenced by M&C. It could grow a lot, primarily through ICT developments, enabling telemedicine, remote assistance for senior/disabled people, etc.

Table 28, *M &C Healthcare solutions main users*

	Main users
Human and animal health activities (hospitals and doctors' material, …)	Hospitals Private Clinic Consulting rooms
Residential care activities	Retirement homes, homes for disabled people
Nomadic medical equipment	…
Personal medical equipment	

Source: DECISION/RPA, SMART 2007, October 2008

This application market is entering a high-growth area pulled by various challenges such as:

- Distance medicine and healthcare.
- Nomadic equipments systems.
- Large scale networks.
- Preventive medicine systems.
- Adapted home for ageing population.
- Advanced diagnosis and monitoring.

Human health activities can be divided in two categories:

- Materials, such as surgery monitoring.
- Building automation in the dedicated fields of hospitals and private clinics.

Residential care activities are also made of building automation technology, with some adaptations coming from the « Home Automation » field, such as detectors of falls, presence detectors, etc.

Nomadic Medical equipments are developing rapidly, especially for ageing people and more especially people suffering from neurodegenerative diseases such as the syndrome of Alzheimer. For example, patients may wander away from their home: so there is a strong need for an alert system.

Personal Medical Equipment is also developing with cheaper self-medication appliances like blood pressure indicators, sugar monitors, etc.

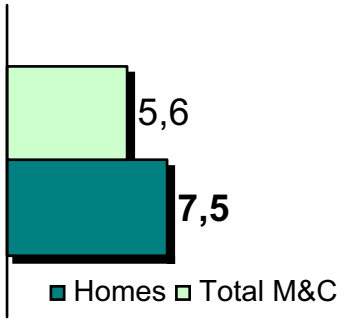
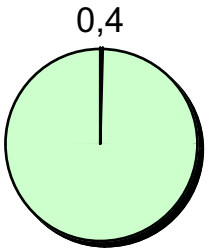
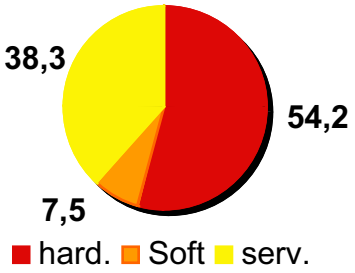
The market drivers are definitely an ageing population, wishing to spend their last days at home. It could also relieve some of the stresses on the social security systems: it is indeed much cheaper for the medical insurances to keep as long as possible older people in their homes, than to reimburse the costs of an hospitalization. However, the recognition of those appliances by social security systems remains difficult (how to reimburse them? what should be paid back and what should not?). New roles will probably appear on the market of services (new kind of residential care activities, new insurance products, safety services, etc.) in order to answer the needs of a European population, ageing but still willing to live independently.

Table 29, M &C Healthcare solutions main suppliers

	Main suppliers
Human and animal health activities (hospitals and doctors' material, …)	Philips, GE Healthcare, Siemens, Toshiba, Medtronic, Boston Scientific, St Jude, Hologic, HBOC, Elektra, Instrumentarium, Prosurgics, Mindray
Residential care activities	Alpha surveillance, Artys, Tunstall
Nomadic medical equipment	Resound, Widex,
Personal medical equipment	Tunstall, Omron, Nissei, Spengler, A&D, Colson, Accu Chek Go

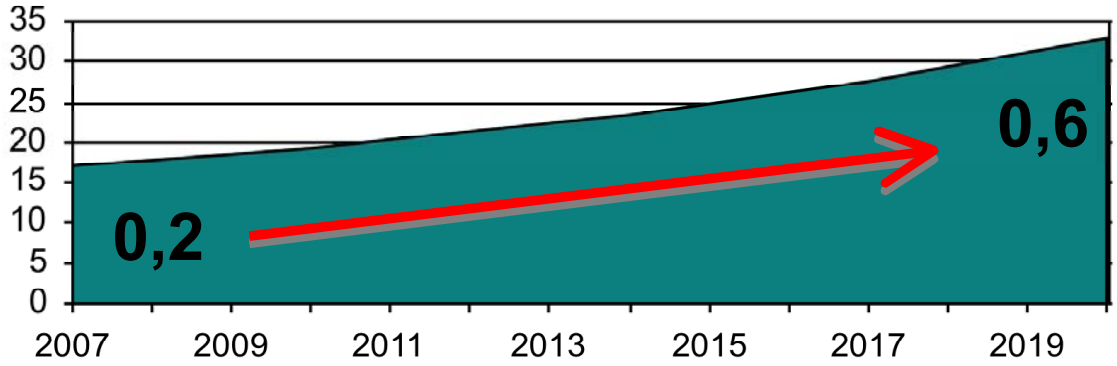
Source: DECISION/RPA, SMART 2007, October 2008

4.4.11 Home

Figure 50, Home M&C Market: Growth perspectives (2007-2020 annual rate)	Figure 51, Home M&C Market: % of total M&C (2007)	Figure 52, Home M&C Market: % of hardware – soft – services (2007)
		

Source: DECISION/RPA, SMART 2007, October 2008

Figure 53, Home M&C Market Value (B€)



Source: DECISION/RPA, SMART 2007, October 2008

Home Automation is a dedicated segment that included all M&C solutions designed for home uses. It is different from the Building Automation segment, as its customers are mainly individuals or providers of services for individuals. It also has to adapt a lot to the market, especially by developing its plug and play capacities and becoming accessible to no techno-fans. Moreover, it has to deal with other distribution markets, either through installers or providers of services, mainly security solutions or utilities.

Main sub segments or activities include:

- HVAC.
- Lighting.
- Alarms.
- Access Control.
- Motorisation.
- Entertainment automation.

Some products and systems were being highly developed (e.g. thermostat for central heating and alarms), while others are just emerging (entertainment).

The complexity of the technologies and the lack of strong incentives explain the low market value.

Table 30, M &C Home Security and Energy management solutions main suppliers

	Main suppliers	
HVAC	Delta Dore …	***Echelon (LonWorks), Schneider, Siemens, Hager, ENEL, EDF, Fifthplay, Home Automation***
Alarms	Alert Service, Alice, EPS, Securitas	
Lighting	Legrand	
Access control	Safeware	
Motorisation	Somfy, Bobbendorf	
Entertainment Automation	LG Homenet, Samsung (Homevita), Apple	

Source: DECISION/RPA, SMART 2007, October 2008

The different sub-segments show very different trends, for example:

- The alarms and control access sectors are relatively flat, as most of the existing demand has already been met.
- Thermostats are so much used and have become so basic for households (at least in Western European countries) that many providers do not consider these simple solutions as being parts of “Home automation” anymore.
- The motorisation segment is rather dynamic, with new remote solutions.
- The entertainment automation is still very low, reduced to consumers who may be considered as techno-addicts.

The development of ICT is definitely what could activate the different markets:

- People are willing to change their alarm system if they can be informed by SMS or call phone that something strange is happening.
- Motorisation is all the systems developed when the solution is completely automated, to make as if someone is living in the house (when inhabitants are out for work or for holidays) for example.
- The entertainment automation is considered as interesting only when connected to the Internet, the mobile phone and all different entertainment appliances (TV, HiFi, etc.) in the house.

The drivers are multiple:

- Comfort: Make life simpler and automate repetitive tasks.
- Demand for security: presence detection, presence simulation, …
- Energy efficiency: automatic lighting, hanging lighting atmosphere, turn off all the lights in the house with only one button, warming management, optimize energy costs, power cut, …
- Support to ageing people: remote controls to help when mobility problems, detection of presence to turn on the light (and avoid falls).

Brakes are however still considerable:

- "Home automation" is not a priority for households: products are still very expensive (no mass market yet).
- Designers tend to focus too much on what technology is capable to do rather than on customers' demand and their capacity to use the devices;
- Electricity installers are not educated for complicated solutions, often having to deal with computer sciences issues.
- No real plug and play solutions until now.
- Difficulty to have evolutionary systems (needs to cable everything from the beginning).
- Difficulty to mix different suppliers' products (many suppliers prefer to continue to use proprietary protocols, rather than Konnex).
- Etc.

"Home automation" should develop in the next years, but it is difficult to predict when it will boom. A regulation (on standardisation) could be very helpful in stimulating demand amongst equipment suppliers and installers. However, this can also have side effects such as the development of new players from non-European countries, which might explain why European market leaders are sometimes reluctant to welcome change.

5 Quantitative and qualitative analysis of the market potential

Objectives:

To have a precise view of Monitoring & Control market potential:

- Expected impacts of new needs and new solutions to be appearing on the short- (3 years), mid- (5 years) and long-term (13 years).
- Results will be used to draw a market growth scenario that will be applied to year 2007 situation, in order to a present future market value for years 2010, 2012 and 2020.

Description of the methodological approach:

Global or specific expectation presented here are the result from interviews plus available information related to existing trends in terms of demand behaviours new needs, new products, future possible impacts of existing actions or policies.

We also analysed how the supplier would adapt a portfolio and would provide new solutions.

Those analyses are presented in 4 axis

- Market drivers' identification: Mega trends and their declination in terms of global driver expected impacts on Monitoring & Control markets.
- Development of demand: driver impacts and main trends on demand behaviours for each of the application market.
- Impact of existing policies and regulations.
- Development of the offer.

Results:

- A growth trend: a baseline scenario with detailed figures presented by product and by market for the years 2010, 2012, 2020.
- Growth options: scenarios.

5.1 Market drivers' identification

This research primarily focused on energy efficiency, safety and security issues, together with other major trends that concern global outlooks:

- **Environment.**
- **Climate changes.**
- **Food security.**
- **Health and ageing population.**

Those global megatrends are presented through their expected impacts in terms of possible impacts and drivers for the M&C market.

They are key issues for the market future growth.

Table 31, M&C Market drivers' identification

Drivers	Expected development
Energy efficiency	Intelligent metering is a great driver in many countries. It is complete in Italy and Scandinavia, it has already started in Spain and France, and developments will take longer in other countries like Germany. Other forms of energy efficiencies are being sought in all kinds of industries. More precise M&C solutions always brings energy cost reductions, it also saves raw materials.
Cost of oil/gas	Because oil and gas are very costly, industries need to optimize their use, and to control their consumption.
Safety	Still an important factor (especially in oil and gas), but a lot of improvements have already been made.
Security	Security in the communication is a big issue, and may negatively impact the development of wireless solutions (fear of hackers).
Developments of services	Machine vendors want to keep in touch with their customers: M&C makes them able to sell services in addition to their typical machines, so that they can follow the needs of their customers.
Reliability	People/Industries want more reliable devices: it should not "bip" at any time, it should work when needed, etc. People/industries are willing to pay if it is proved to them that it will always function.

Source: DECISION/RPA, SMART 2007, October 2008

Drivers	Expected development
Easy to use	Plug-and-play is the solution to make automation a "must" for individuals: it answers the problem of the training of installers and the social acceptability. Plug-and-play is also an answer for the industrial purposes, as it allow adaptivity/flexibility (more needed in Europe than anywhere else in the world)
Environment concerns	Avoiding pollution because of today's regulation or of future regulations (directives to be taken applied soon, protection against possible future evolutions, etc.)
Environmental concerns (global society concern)	Answering a new marketing driver: people want to "save the world" or at least to avoid polluting it too much. In order to make their consumers feel better, suppliers tend to offer environmental-friendly solutions. This is especially true for industries having individuals as end-users (home, Household Appliances, etc.).
Regulation	A key issue: it forces a lot of conservative industries. The European Commission is seen as the main regulator and its directives are either feared or greatly expected.
Flexibility	People/Industries want the control and monitoring to be flexible, to adapt their needs: it should match their wills with only few modifications.
Cost of labour	A great driver for automation in Europe.
Social security reforms	Costs should be decreased in order to keep the current model of European Welfare States. This leads to: - Automation of administrative tasks. - Automation of medical tasks (lack of doctors and nurses). - Less hospitalization (rather having people staying at home, tele-medicine, tele-healthcare, etc.).
Ageing population	Older people have new needs: - Staying at home as long as possible. - Being ill but still being independent.

Source: DECISION/RPA, SMART 2007, October 2008

5.2 Development of demand

The resulting effects of the preceding drivers can be either qualitative, with a better solution integration, or quantitative, with an increasing demand of M&C solutions. These effects vary from one market application to another.

Table 32, Demand for M&C solutions, by markets' application

Markets	Expected development
Environment	Development of controls for pollution. Oil and gas continue to expand.
Critical Infrastructures	More security, more safety.
Manufacturing Industries	More flexibility, more reliability. Energy and raw material saving. Maintenance cost reduction.
Process Industries	More flexibility, more reliability. Improved energy efficiency, security and respect of environment and working conditions.
Building	Refurbishment (few new constructions), needs for energy efficiency.
Logistics and Transport	Precise localisation and transport monitoring are still lacking efficiency. Multimodality is also a concern for Monitoring & Control for heterogeneity reasons.
Electric Power and Grid	Smart metering, enhanced control systems, remote and wireless control.
Vehicle	Air pollution control. Road safety.
Household Appliances	Connexion with the rest of the homes.
Healthcare	Ageing population needs: - Better hospitals/clinics. - Adapted housing. - Nomadic equipments.
Home	5 main market drivers: - Fear (I want to feel safe). - Fun (I want to play with everything). - Green (I want to save the world). - Money (I want to show I have money). - Praising (I want to show I am the best).

Source: DECISION/RPA, SMART 2007, October 2008

5.3 Impact of existing policies or regulations

Several European existing policies and regulations impact on the different application markets. They can lead to the creation of new standards, new technologies or also new markets.

We have listed the most important ones that already have direct impacts sorted by main application domain:

Table 33, Main policy actions that impact M&C

Domain	Main policies actions
Environment (air, soil, water)	Policies and regulations in this sector aim to reduce air, soil and water pollution such as : - The Water Framework Directive dealing with groundwater covers a number of different steps for achieving quantitative and chemical good status by 2015. - The new Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe entered into force on 11 June 2008. - The framework for worldwide actions is the United Nations Convention on Biological Diversity of 1992. At the UN World Summit on Sustainable Development, at Johannesburg in 2002, governments committed themselves to significantly reducing the rate of biodiversity loss by 2010. The European Union has been legislating and taking action since the 1970s to safeguard biodiversity, and has also taken an active role on the international scene.
Environment and security	GMES is a joint initiative of the European Commission and ESA. Its objectives are to provide relevant information to policy-makers and other users, particularly in relation to environment and security.
Chemical products use	**REACH** is a new European Community Regulation on chemicals and their safe use (EC 1907/2006). The new law entered into force on 1 June 2007. The aim of REACH is to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. The benefits of the REACH system will come gradually, as more and more substances are phased into REACH.

Source: DECISION/RPA, SMART 2007, October 2008

Domain	Main policies actions
Security and civil protection	The policies and regulations on this sector have as main purpose to be in response to rising anxieties about crime and terrorism : - The Treaty of Lisbon and Euratom for example introduce several mechanisms regarding civil protection. - Seveso is more on the prevention of major-accident hazards involving dangerous substances. - The new laws on CCT Access control and alarms systems such as UrbanEye aim at the prevention of crime.
Energy efficiency and security	The possible principles of **Energy Policy for Europe** were elaborated at the Commission's green paper on 8 March 2006. The main key proposals were the following : - A cut of at least 20% in greenhouse gas emissions from all primary energy sources by 2020 compared to 1990 levels. In the same time Kyoto Protocol aims at achieving a 30% cut by all developed nations by 2020. - A cut of up to 50% in carbon emissions from primary energy sources by 2050, compared to 1990 levels. - A minimum target of 10% for the use of biofuels by 2020. - The European Commission White Paper on Renewable Energy Sources sets out a strategy and action plan to achieve the goal of doubling the renewables' share of the European Union's total energy supply, from 6% to 12%, by 2010.
Manufacturing and Process Industries	The policies and regulations in this sector deal with R&D, productivity, energy savings and environmental concerns. We can mention : - **IRIM** for Industrial Research Investment Monitoring - **Ecolabel** and **ETAP** for Environmental Technologies Action Plans. - **IPP** for Integrated Product Policy.

Source: DECISION/RPA, SMART 2007, October 2008

Domain	Main policies actions
Transport and Vehicles	- Some of the European policies and regulations on transport and vehicles aim to provide safe and secure transport systems and networks. They also encourage interconnections between the different national authorities and actors. - Some of them such as the program **"Clean Air for All'** aim to encourage local authorities to organise initiatives highlighting the link between mobility and air quality. It also seeks to mark the launch of permanent measures to cut harmful emissions, such as introducing London-style low-emission zones or parking and bus shuttle services to city centres.
Healthcare sector	The policies and regulations have a lot of impacts on the healthcare sector : - By **reducing costs.** - By improving the **quality of treatments** and the efficiency of equipment and procedures. - By permitting to develop **new solutions of care** such as home care, telemedicine … - By improving European medical **networks** and **mobility** throughout Europe. The main directives that affect the healthcare sector are the following: - A directive on **medical devices** throughout the internal market - A directive on the **mobility of the patient** which is in the Annual Policy Strategy of the European Commission for 2007
Information and Communication Technologies (ICT)	Numerous policy actions and research programs for communication and information improvement such as **i2020** promote the positive contribution that information and communication technologies (ICT) can make to the economy, society and personal quality of life. Among the FP7 ICT work programs, many topics have direct impacts on the Monitoring & Control evolution: pervasive and trusted networking, sustainable and personalized healthcare, independent living and inclusion.

Source: DECISION/RPA, SMART 2007, October 2008

5.4 Development of offer

5.4.1 Introduction

How will the offer of products and solutions adapt their portfolio to new challenges, create new demand or follow the global technical trends of ICT innovation?
Crossing interviews, dedicated searches and expertises we choose to underline three main aspects:

- Expectation per market applications
- Main drivers impacts
- The global impact of innovation

In this section, we will identify for each market the new products and solutions, which are likely to appear. Through the knowledge of our experts, after iterations with the task 3, researches and interviews, we will be able to describe new needs and new products.

For each product or solution, we quantified the expected timeline of start, acceptance and maturity or common uses by giving one to four stars. Of course, technologies may evolve differently than expected, new technologies could also appear and bring new concepts. But the following analysis represents a synthesis of the interviewed experts' findings.

5.4.2 Per Monitoring & Control type

Many of the trends deal with networking cross integration, unification of concepts, developments tools and architecture which are partly the result of IP and web expanded acceptance along with new communication channels. For many aspects, the simplification of developments tools and platforms should lead to an improved design cycle and lower implementation costs. The acceptance should also be improved by more efficient and user friendly application interfaces.

Table 34, Offer for M&C solutions

Product / solution	Expected development	Expected impact		
		2010	2012	2020
Hardware	- Ethernet based and SOA (Service Oriented) architectures in all applications and at all levels.	*	**	****
	- RF solution: more interconnections, more sensors, better global view of a system situation.	**		
	- Scalability.	**	***	****
Software	- More real time capabilities with a higher speed and exponential quantities and a rate of data to collect and analyze.	**	***	****
	- Complexity management tools.	**	****	****
	- Global management tools.	*	**	***
	- Multi-Tier and open architecture.	*	**	****
Services	- Reliability and availability.	*	**	***
	- TCO efficiency.	*	**	****
	- Facility management.	**	***	****
	- Energy on environment impact management and optimization.	**	***	****

Source: DECISION/RPA, SMART 2007, October 2008

*:	Starting
**	Average acceptance
***	High acceptance
****	Commonly used

Except for home and healthcare market the majority of the suppliers and users see a future made of optimisation of current solutions bases.

5.4.3 Per Monitoring & Control application market

We find the declination of the preceding evolutions for each market and application with earlier adoption for the more mature and strong markets. The higher optimization, reliability and scalability both for large and small systems are also expected.

Table 35, M&C new needs and products development, by markets' application

Markets	Likely to appear: description	Expected introduction cycle		
		2010	2012	2020
Environment	Large scale supervision systems. Early warning and critical situation control.	* *	** ***	*** ****
Critical Infrastructures	Large scale interoperable systems. Multimodal control systems.	* *	** **	*** ***
Electric Power and Grid	Large scale multiregional systems. Optimized reliable network control.	** **	*** ***	**** ****
Manufacturing Industries	All IP and SOA architectures. Complex systems optimization and control. Flexibility, availability and maintenance control.	* ** **	** *** ***	**** **** ****
Process Industries	All IP and SOA architectures. Complex systems optimization and control. Energy and CO2 efficient systems.	* ** *	*** *** ***	**** **** ****
Building	Energy efficient systems. Security and hazard control. Lighter supervision systems for smaller building.	** * **	*** *** ***	**** **** ****
Home	Supervision platforms. Adapted HMI (dedicated to specific public like bigger displays for older people, mobile phones or PC for younger people, etc.). Energy consumption real time controller. Communication between homes.	* *	** ** * *	*** **** *** **

Source: DECISION/RPA, SMART 2007, October 2008

*	Starting
**	Average acceptance
***	High acceptance
****	Commonly used

Table 36, M&C new needs and products development, by markets' application

Markets	Likely to appear: description	Expected introduction cycle	Markets	Likely to appear: description
Logistics and Transport	Large scale and multimodal systems. Mixed application platforms management.	* **	** **	*** ***
Vehicles	Multiservice architecture. Remote control and diagnosis. Fleet management and optimization.	* * **	** *** ***	*** **** ****
Household Appliances	Global home automation. Efficiency and energy management.	* **	** ***	*** ****
Healthcare	Large scale networks. Advanced diagnosis and monitoring. Distance medicine and healthcare. Preventive medicine systems. Nomadic equipments connected. Adapted home for ageing population.	* ** * * * *	** *** ** ** ** **	**** **** *** *** **** ****

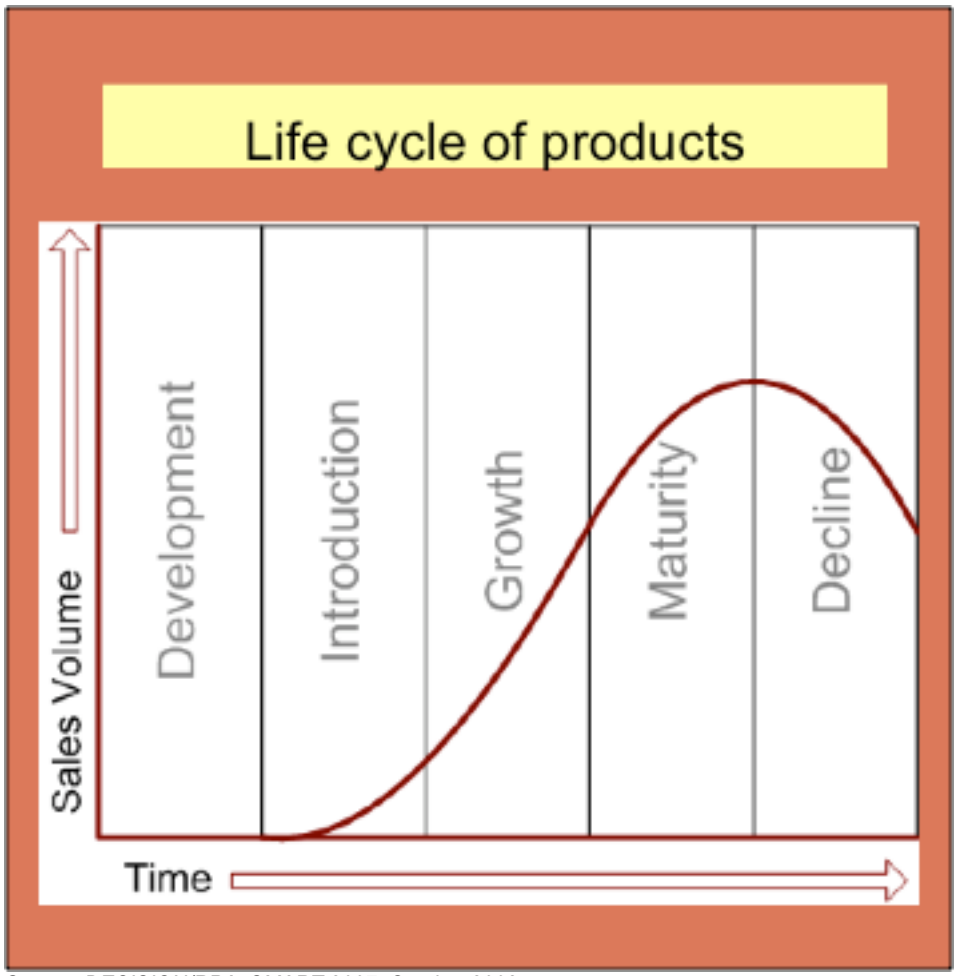
Source: DECISION/RPA, SMART 2007, October 2008

*	Starting
**	Average acceptance
***	High acceptance
****	Commonly used

5.4.4 Innovation and maturity

The speed of evolution depends on many factors from which we selected two important ones: Maturity and importance of M&C for each application and for each product and solution.

Maturity in products and services:
The maturity of M&C solutions in each market application also varies following the classical five life cycle periods.



Source: DECISION/RPA, SMART 2007, October 2008

It is important in Industrial Controls and Critical Infrastructures while in Healthcare, Building and Home, there will be strong evolutions in the future.

Importance and maturity of Monitoring & Control in the applications sectors:

- M&C is more or less important in the different application sectors.
- In some of them (Critical Infrastructures, Industrial Automation) M&C is absolutely vital.
- In others it is important but not vital.

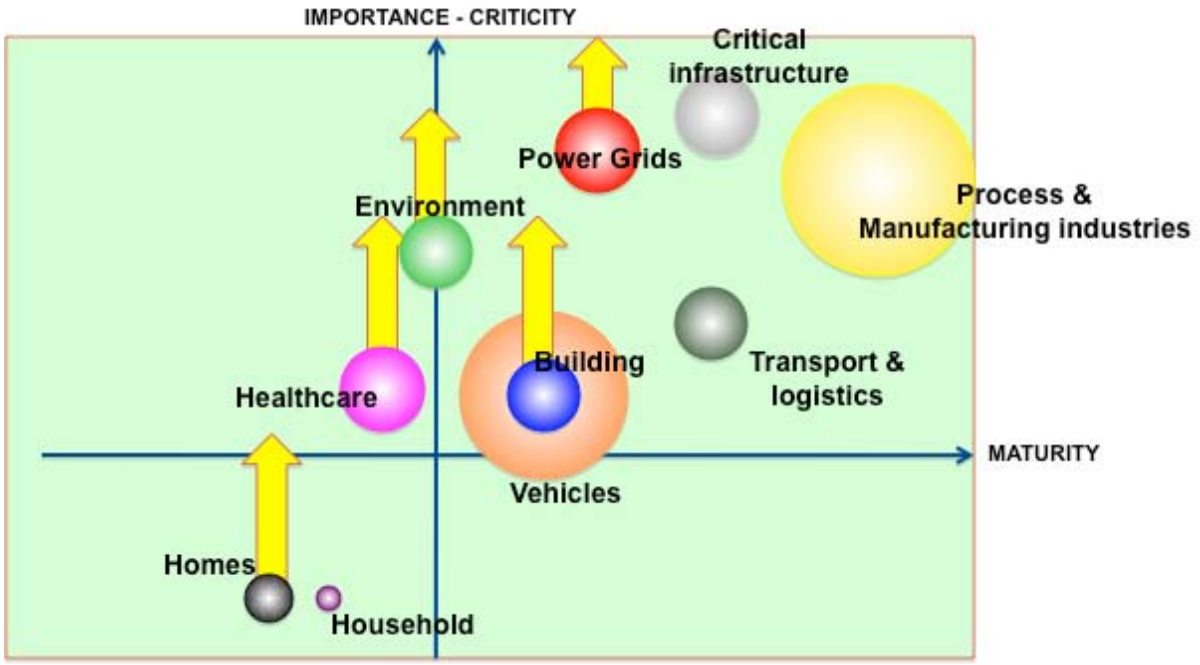
Monitoring & Control applications are more or less mature:
In some areas, decades of development make the changes more difficult.
In others, the youth of application allow them to take advantages on all the new technologies and concepts.

The high maturity of M&C doesn't mean that progresses and improvements are not expected to happen. For instance in industrial automation, new concepts often come from "rich" or large size users that are able to pay for the development of new concepts. These concepts are then adapted to smaller and less "rich" users in scaled down systems with simplified features. The high maturity results in less flexible and less willingness to radically change development methods and concepts.

By crossing market size, importance of M&C tools and maturity stages, the application markets included in our study appeared to have different profiles.

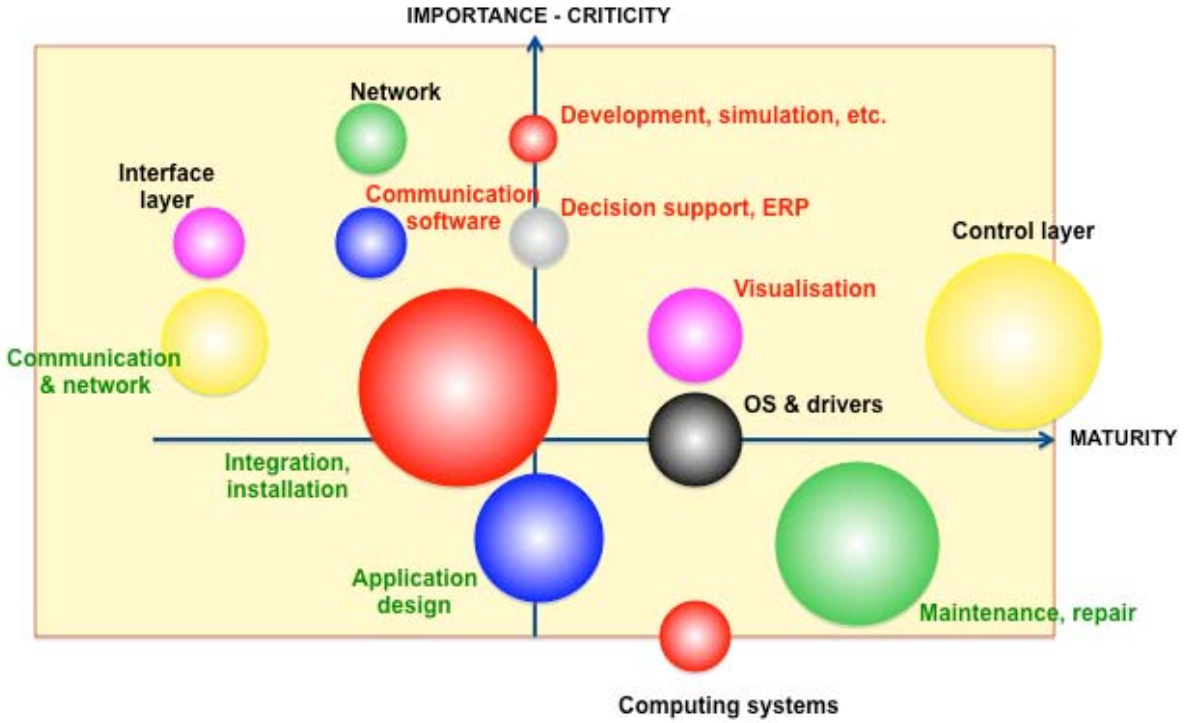
In the following graph, the bubble sizes are proportional to M&C markets and the positions show the importance and maturity of M&C applications.

Figure 54, Importance and maturity of M&C in the applications sectors



Source: DECISION/RPA, SMART 2007, October 2008

Figure 55, Importance and maturity of M&C products and services



Source: DECISION/RPA, SMART 2007, October 2008

The importance and criticality for products and solutions are more related to the strategic importance and the scarcity of resources and know-how. For instance, computing systems are commonly available while simulation is more critical to develop.

5.5 Conclusion about Monitoring & Control market trends

The main impacts of innovation may be summarized as follows:

For components:

- Increasing computing power and integration.
- Intelligent communicating local components.
- Standardization.
- Lower prices.

For Networks:

- IP everywhere.
- Transparent networks across application sectors.
- Service Oriented Architecture.

For Services:

- A higher industrialization and reduction of development costs and cycles.

We do not expect a major change on the market in the case of technological progress.

A few comments coming from interviews:

- No one is waiting for a new solution in particular.
- “Everything is almost possible, the real question is the price.”
- Development is an issue.
- Industrialisation is an issue. “Progressive improvement, no revolution.”
- “The major introduction is already there: it is wireless communication.”
- Indeed, 2/3 of the market is made of services.

As a consequence: the evolution of the sector won’t be directly linked to technology progress but to different business models, which are connected to it. That is why the impact of drivers can sometimes be significant or critical.

New needs are characterized by a bigger proportion of networking because networking needs more services, more development and may bring new stakeholders on M&C markets. New needs lead also to more interface. This type of services is more related to software development.

We also expect fluctuations not linked to market’s characteristics and evolutions but more to economic cycles.

Global drivers like new policies and regulations can have a major impact on markets:

- By creating new markets and sub-markets.
- By creating new standards.
- By creating opportunities or threats.

Besides the crucial Factory and Process Automation markets and the Automotive market which constitute the kernel of the sector, a number of new areas have been identified as emerging, where considerable growth is expected:

- Smart Homes and Buildings (Automation, Facility Management, Energy Management, Ambient Assisted Living, Energy Efficiency).
- Distributed Generation (Insertion of RES, insertion of Micro- and Co-generation, Smart Metering, Energy Efficiency).
- Environmental Monitoring and Sensing (including Water, Air, Soil quality).
- Critical Infrastructures (Power Grid; Gas; Water; Telecoms; roads, bridges, tunnels).

5.6 European Monitoring & Control market trend

The European market growth is expected to follow different levels. Some markets are expected to emerge but the larger part is expected to benefit from a continuing growth, comparable to existing ones (legacy and install based effect).

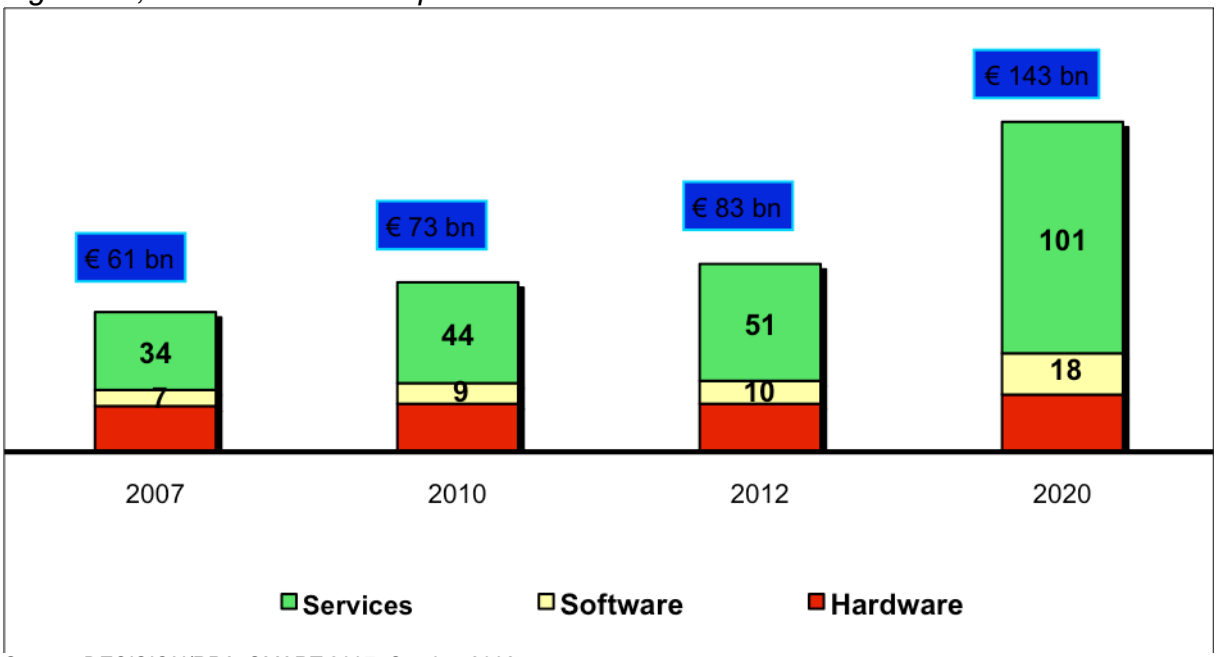
The two consequences in terms of forecasts are:

- Comparable growth levels between analysed periods

  - 2007 to 2010: 6,1% per year
  - 2010 to 2012: 6,4% "
  - 2012 to 2020: 7,1% "
  - 2007 to 2020 +6,7% per year

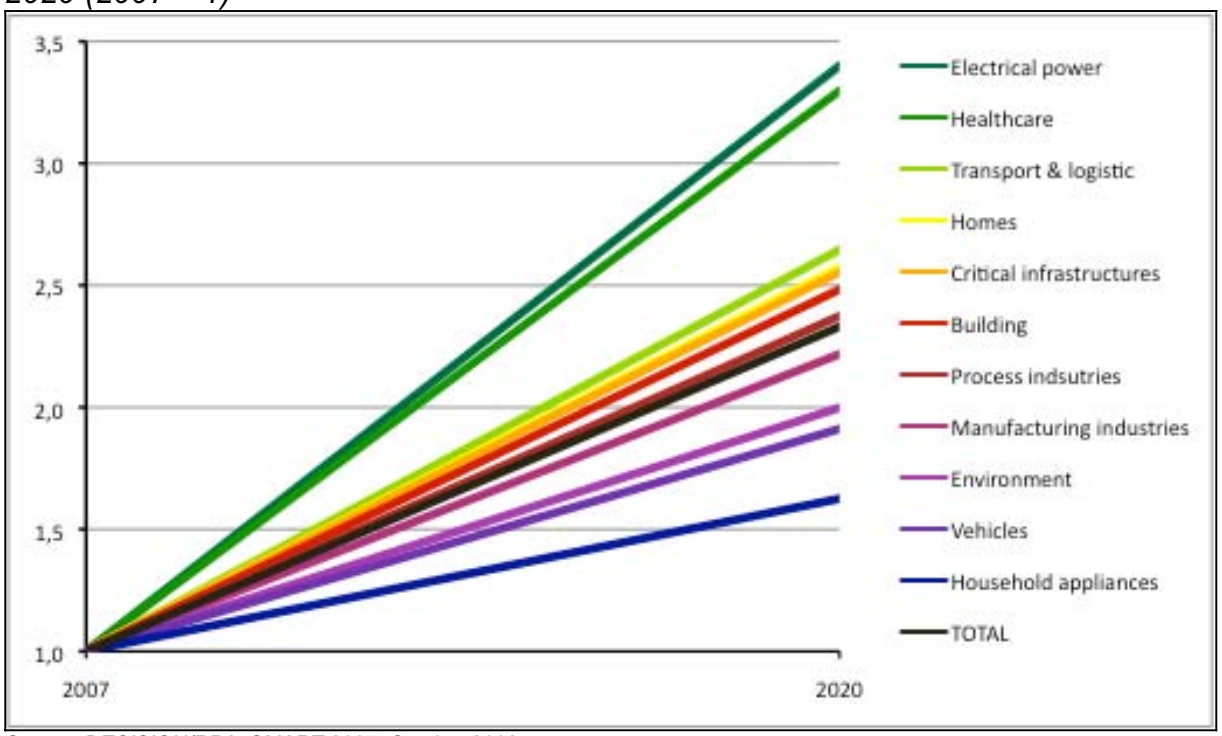
- Our global average trend scenario is therefore not a *do nothing* picture but a business as usual situation.

Figure 56, Global value: European market – 2007-2020 in B€



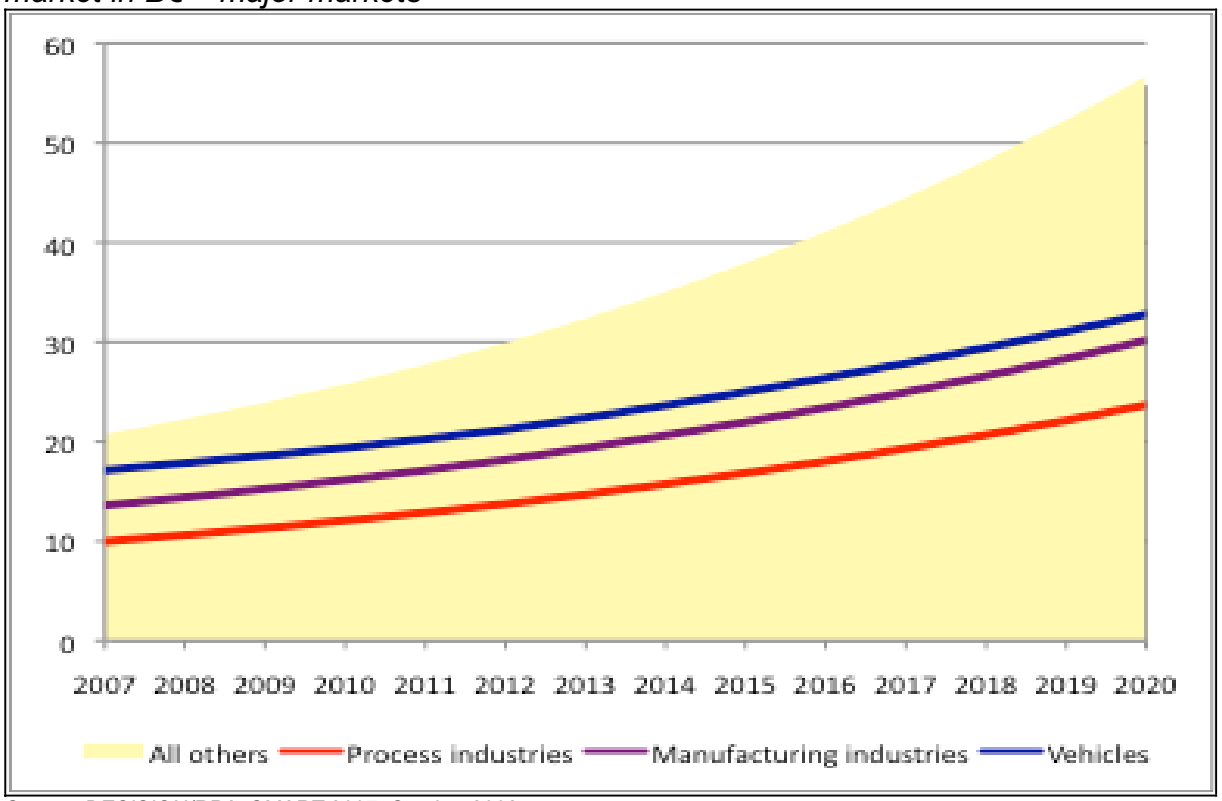
Source: DECISION/RPA, SMART 2007, October 2008

Figure 57, Trends: European M&C Market growth index by market applications – 2007-2020 (2007 = 1)



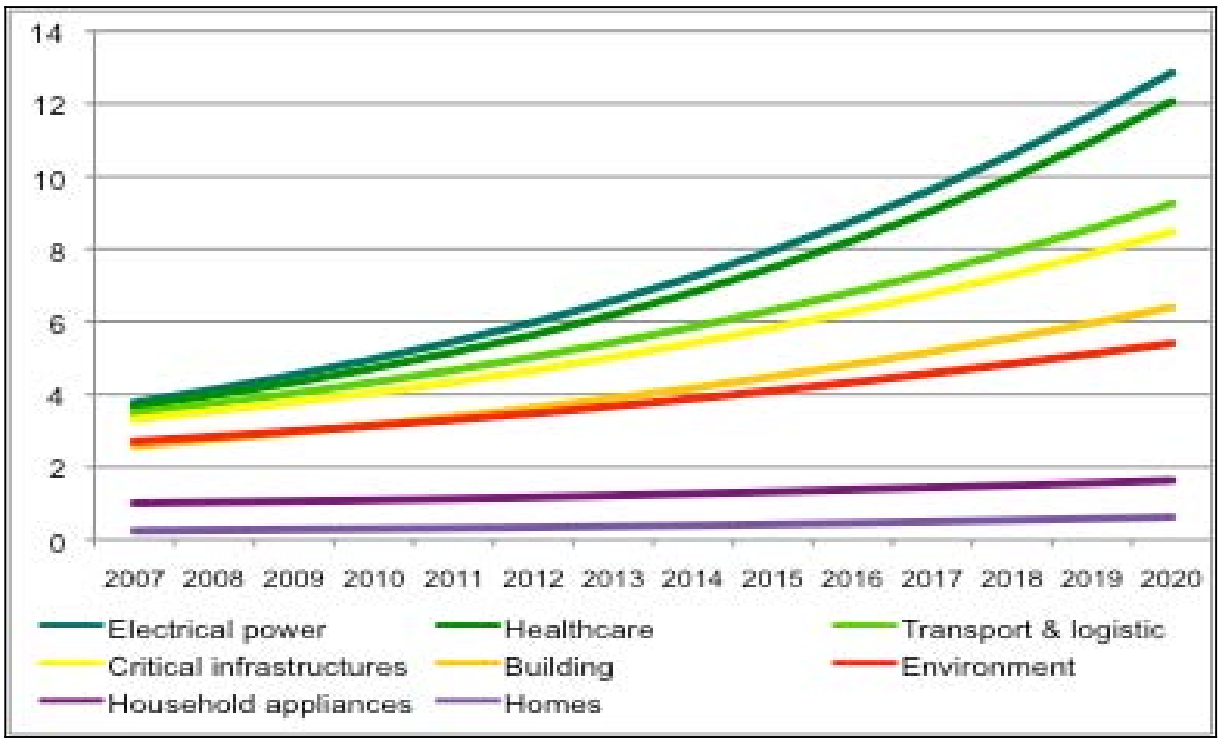
Source: DECISION/RPA, SMART 2007, October 2008

Figure 58, Application details: European M&C Market – 2007-2020 by application market in B€ – major markets



Source: DECISION/RPA, SMART 2007, October 2008

Figure 59, Application details: European M&C Market – 2007-2020 by application market in B€ – other markets



Source: DECISION/RPA, SMART 2007, October 2008

5.7 Dynamics and scenarios

5.7.1 Approach and objectives

Our approach is, by screening various expectations or assumptions, to define how and why the future growth could differ from the one defined in our trend.

How to do better? The objective is to clearly identify growth potential that still needs to be activated, markets where barriers still exist and prevent the market to develop as it could.

5.7.2 Trend's variations vs Scenarios

The trend is an average value; of course we expect some variations to exist due to a mix of:

- Macro economic short-term up/down phases.
- More abrupt impacts from demand needs.
- More or less reactivity from offer to demand's variations.
- Etc.

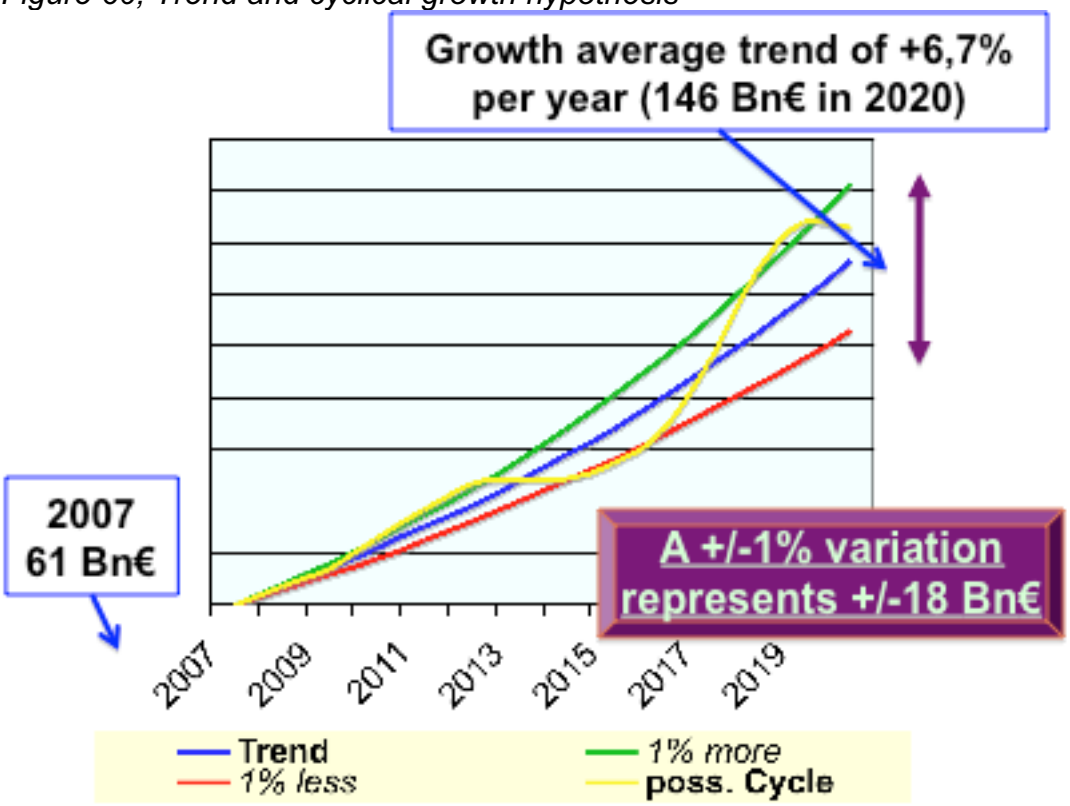
The main impact of such variations is usually synthesized into a cyclical effect: a n% variation from trend. For example, a low medium impact would be therefore a +/-1% variation.

We could find many dynamics that could bring such variations, but we did not assess it as an interesting situation to define scenarios because we also assess the fact that the trends better define the main impacts of market situations and potentials.

Variations better reflect the potential for one of the application market to diverge from its initial potential.

Main causes for important variations are exogenous to the M&C market, trends better show its real potential.

Figure 60, Trend and cyclical growth hypothesis



Source: DECISION/RPA, SMART 2007, October 2008

An average growth also better takes into account the Monitoring & Control market specific structure and dynamics:

- 70% of the European M&C market is made of services.
- They are not related to a unique type of expenses: development, investment, ownership, etc.
- It could be also disseminated: no centralised M&C budget as for advertising for example.
- M&C could be some kind of hidden expenses while occurs in technical or dedicated levels: you may monitor your plant with an ERP system, but you may not compare that expenses with the ones of the control unit of your elevator of your climate system.
- Services vs embedded devices.
- Balance between investments and ownership costs: thus weaken impacts from medium variations, e.g. investment expenses cycles.
- The trend depends on the global economic outlook, and even at that level a slow investment level could positively affect maintenance or other ownership cost developments.

We expect an average growth to be closed to the trend level:

- With variations while looking at single markets levels.
- At a global level with negative variations partly compensated by positive ones: e.g. a weaker growth in Automotive but with a stronger one in Building.
- It already includes market with a high growth level.
- Cycle effects are not enough to define scenarios. It is just a probable pattern: a global +/-1% variation is more likely to happen than +/-2%, etc.

5.7.3 Trend as a baseline scenario

With the inclusion of a high growth market we clearly indicated the potential of the Monitoring & Control market and the fact that **our 2007-2020 growth trend of +6.7% per year for European Monitoring & Control market is a baseline "business as usual" scenario:**

- That means new products. Pull by new technology successive waves, M&C products and services will continue to be improved and competed with new products. The market will continue to grow.
- For Europe, it already includes fast growing M&C markets such as Healthcare with a +9.6% average growth per year or Electric Power and Grid with a +9.9% average growth per year.
- The consequence is a global growth level for the European M&C market that is already on high growth trends: between 2 and 3 times GDP growth outlooks.

This is not a "do nothing scenario": effects of existing Policies are already implicitly included, some market specific issues as well:

- Financing is a global issue for Healthcare services also with direct effects on the M&C market.
- Environmental and Safety issues will continue to modify Automotive M&C solutions.
- Also in balance short/medium term compensation for a growth level (difference between market investment cycles).
- E.g. a long duration project in Power Industry may cause delay vs. increasing energy price may accelerate investment both with direct effects on M&C market.
- Etc…

5.8 The Four scenarios

The evolution of M&C markets may be affected in many ways that could be underlined in a specific scenario.

The first concern was to define priorities:

- What is the major risk that we could isolate?
- Which market(s) could be activated to reach a higher growth potential?
- Some of the drivers may have higher or other impacts than expected?
- Today's macro economic environment is depressed, could the European M&C market enter a depressed phase? A down phase that would create a 3 years delay in terms of growth would have an impact of less than 38 B€ on the 2020 market value.
- What are drivers that could create new risks and opportunities for M&C markets?
- Environmental concerns could create higher needs for smarter monitoring of living conditions (air, water, etc.) as well as less tolerance regarding big industrial plants: a massive "not in my garden" phenomena could affect negatively the largest M&C market in the field of Industries.
- On the contrary increasing higher energy prices will create needs for personal generation solutions that will create totally new M&C solutions for houses and home appliances.
- The application market that looks the less prepared to face such new challenges is in fact the home.

Growth Opportunities

Based on these assumptions we defined four corresponding scenarios:

The 3 positive scenarios for the European Monitoring & Control Market:

Scenario 1: **Smart Home** with higher Monitoring & Control contents especially in the newly built houses and apartments.

Scenario 2: **Distributed Generation** large development including renewable energy sources, small generators and a local production.

Scenario 3: **Pervasive Networking** in all sorts of fields and applications should enhance the field of Monitoring & Control.

One other negative scenario for the European Monitoring & Control Market:

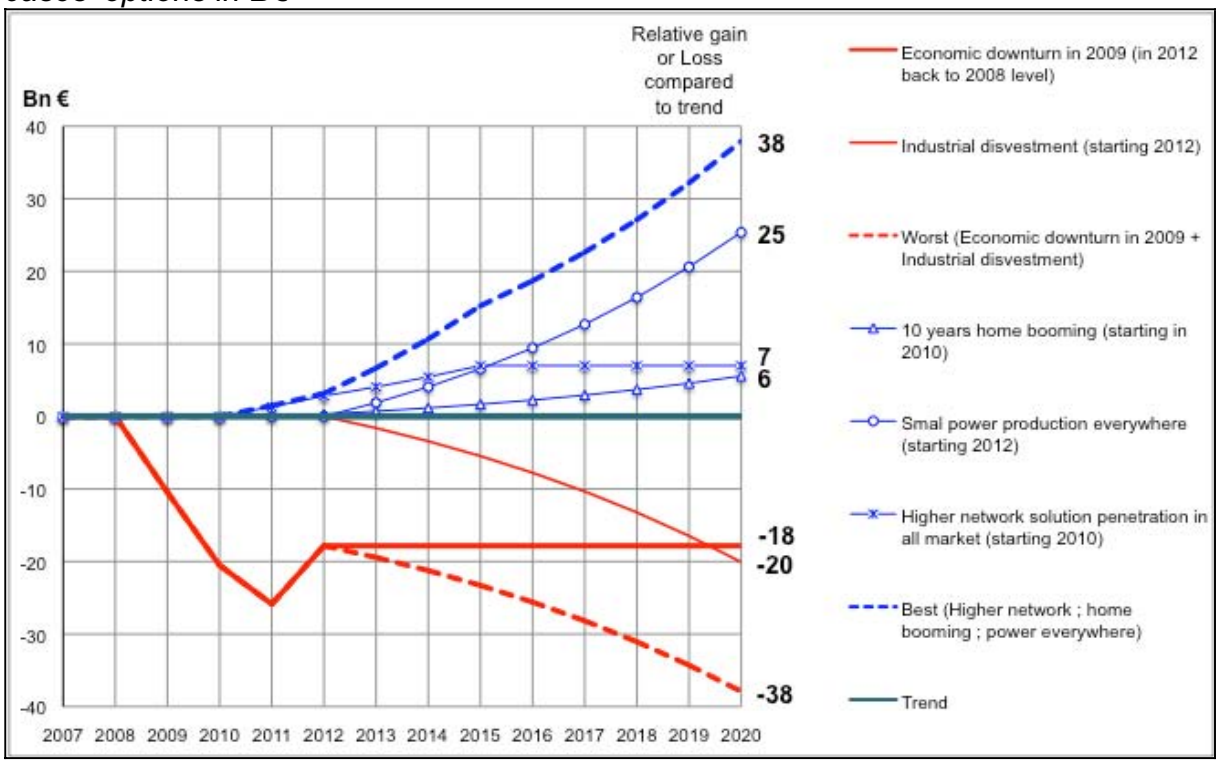
Scenario 4: **Industrial Divestment** in the European Union following a large delocalisation of manufacturing activities to low cost areas with lower investments and a higher unemployment.

Best case / worst case

A best case based upon the combination of the 3 positives scenario (1 to 3).
A worst case based upon a combination of scenario 4 with an economic downturn.

Variation between positive and negative options		
Gain:	best case	+8,7% per year
Average:	trend (business as usual)	+6,7% "
Loss:	Scenario 3: worst case	+4,2% "

Figure 61, Scenario details: Global European M&C Market – 2007-2020 worth and best cases' options in B€



Source: DECISION/RPA, SMART 2007, October 2008

Questions and assumptions

Why 2 scenarios for the European Monitoring & Control market focus on Home and Personal Equipment?

- Because this market is still looking for take-off opportunities.
- It is the less prepared to face new challenges from global drivers. Furthermore, it is not much engaged yet in current ones…
- Nevertheless many barriers have to be addressed:
  - Lake of standards.
  - No integrated solution: more single applications such as door control, heating, alarm, etc.
  - Poor demand for Home M&C integration and smarter solutions.
- But there is an opportunity: it could help reaching some global goals of major policies actions in energy or environment (Kyoto, Energy Package, etc.).
- Energy prices + environment concerns are important drivers that will impact personal behaviour.
- Healthcare and home patients are already in a booming situation (this has been included in the trend).

More details about the scenario scope:

- **Smart Home**

Solutions dedicated to the home market already exist. The market remains underdeveloped for decades now. It seems reasonable to think that incentives and interest could be higher (more security, a better energy consumption, etc.). It also needs more opened solutions (plug and play, higher interoperability, etc.). New construction and renovation are a more likely path for a higher implementation.

Impact is limited to home applications.

- **Distributed Generation**

Directly linked to the new energy trends this option concerns all application sectors. Driven by increasing energy prices and environmental concerns, everyone will try to produce a part of their need with remote or local *green/renewable* solutions.

All users will need new tools to better monitor their consumption and the capacity of their installation and network. This is also a major issue in terms of electricity quality for operators. A major positive impact is also expected in the power grid application market.

- **Pervasive Networking**

The concept of pervasive, transparent, ubiquitous, converged networks will be the results of decades of progress both in infrastructure and services delivery. In businesses, the all IP networks allow companies to have a single converged network that carries all data, voice, video and business applications. The absorption of voice by data networks (VoIP) resulted in a major disruption of the telecom business and Telcos which were forced to reinvent their business models. New networks architectures have been introduced such as Next Generation Networks (NGN) that are an intermediary step to IP Multimedia Subsystems (IMS) that should be opened, vendors and operators are independent and associate all forms of communications.

Networks have been extended with mobility applications and with the increase of the networks reach: Logistics, Inventory Control, Security Energy and environment are more and more included in the data systems.

Mobile and wireless technologies have also much improved in interoperability and convergence with wired IP networks with 3G, WiMAX and the most promising LTE (Long Term Evolution) 4G network.

Beside the Core communication networks, new architectures are developed to reach new places and new users. As the Internet is becoming present everywhere with sufficient bandwidths, edge networks such as Mesh Networks, RFID, Powerline and others should be connected at different horizons.

The evolution toward pervasive networks depends on new technology and services developments but brings numerous challenges as stated in the ICT Work Program 2007-2008:

> The future infrastructures envisaged will need to:
>
> - Be pervasive, ubiquitous and highly dynamic. They have to offer almost unlimited capacities to users, by supporting a wide variety of nomadic interoperable devices and services, a variety of content formats and a multiplicity of delivery modes. They also have to support context awareness and the dynamic behaviour needed for applications with requirements that vary with time and context.
>
> - Guarantee robustness, resilience, trust and security compatible with networks and software service platforms reaching a complexity and scale that are an order of magnitude greater than those of today's infrastructures.
>
> - Support networked and managed business and service convergence across a multiplicity of environments such as the home, businesses, or nomadic situations.

In the telecommunication sector, the landscape and the scope of the stakeholders presence has deeply changed:

- Telecom operators (Telcos) are moving from the business model of owning and operating a delimited network to service and content providing using large

virtual networks. Many of them are externalizing network ownership and operations to third parties such equipment vendors.

- Before the liberalization of the telecom services, the Telcos used integrate all services related to its business: marketing, customer support, network management and operation, and a number of back office and jobs. Today, these services are made by a number of specialized service operators including virtual network operation.

- Equipment vendors are digesting the convergence between telecommunications and computing with large restructuration, mergers and acquisitions and the aggressive arrival of Chinese companies such as Huawei and ZTE. These vendors are more and more asked by the Telcos to build the network, operate it and manage its performance.

- A number of new actors are coming in the field among them:

    - Companies coming from the internet business such as Google, Skype, Microsoft ...
    - Local authorities that build local networking infrastructure based on Wifi, WiMAX, Mesh Networks or even fibre optics

The networking infrastructure is just the lower layer of the new communication system. Above it are data collection, data storage and integrity, applications layers to make the services possible and interoperability between sectors and services to have unified and understandable concepts. As stated earlier, service infrastructure has to be built and it should be more expensive than the network itself.

The arrival of pervasive networks is not only a question of technology. It should lead to a complete redistribution of playing cards, the involvement of new stakeholders and deep transformation of the business models and a strong need for overall coordination and governance.

The place of M&C is important in the development of pervasive networks. The great majority of applications can benefit from these converged networks. Some of them such as industrial or business processes can work without these networks but their integration into new concepts of smart manufacturing, smart buildings, smart energy and others would be easier if they participate in the definition and operation of the future networks.

The development of pervasive networks would need three parallel approaches:

- Technical horizontal platforms and frameworks that would be common for all applications: physical networking, logical networking, data management, application developments, service infrastructure.
- Vertical development of applications such as smart homes, decentralized energy, healthcare using as early as possible, the new platforms defined earlier. They must participate in the development of these platforms.
- Cross fertilization of applications : smart homes and decentralized energy, smart homes and healthcare, smart energy and environment ...

- **Positive best case option**

The coincidence of positive factors could lead to an even higher growth.

This is not so unexpected since it combines the concerns of individuals and the emergence of new perspectives concerning environment, security and energy. Such concerns are of course already included in the trend scenario but not targeted as priority tools to be developed.

- **Economy Crisis**

Although today's demand for Monitoring & Control is high, in parallel the cumulative effects of various shortages (oil, food, etc.), major financial downturns (inflation, interest rates, etc.) in developed economies (real estate crisis, sub-prime consequences, etc.) and troubles elsewhere (hunger riots, etc.) could cause the world economy to crash (GPD and world trade falls).

Here we just try to evaluate the possible direct impact for the Monitoring & Control European market of such a situation. We suggest that it could reduce the market during 3 consecutive years followed by 2 years of recovery. Then the growth slope could come back to the trend scenario.

The result is a 5 year loss in terms of growth representing a 18 B€ difference with the trend scenario (this is one third of present 2007 market value)

- **Divestment in the European Union**

We are talking about an industrial divestment that would concern any industrial activities.

Reasons could be diverse from financial concerns (better ROI in emerging countries) to environmental (offensive actions from people, a massive *not in my back yard (NIMBY)* phenomenon).

The consequence for Monitoring & Control markets in 2020 could represent a third market value (a loss of euros 20 billion compare to trend value for year 2020).

In this option we anticipate a reduction of all Monitoring & Control expenses for all embedded market (Monitoring & Control products that are used inside others, for example cars, fridges for which production is moving abroad) and also a reduction of all application markets with industrial activities (in particular the manufacturing and process industries ones). Embedded plus industrial are the current largest market and the negative impact would therefore be very deep, affecting products, software and services as well.

- **Negative worst case option**

This scenario combines short and long term effects of a possible economic crisis (negative option 1). In this scenario the divestment of negative option 2 would have

been caused first by the crisis and driven by financial factors rather than the public opinion or behaviour.

Other global outlooks and expectations

- Employment

According to today's average labour costs it is not negligible: 10 B€ could represent more than 100,000 jobs.

- R&D

Considering that numerous research projects are running addressing major issues in Monitoring & Control, we are definitively not in a "do-nothing" situation.

Examples of such projects include:

- FP6

HYCON – Energy Management + Industrial Process Control + Automotive Control.
RUNES – Factory Automation + Emergency Services + Homecare.
WASP – Homecare/Healthcare; Traffic; Agriculture.
EMMA – Automotive and Traffic.
AWARE – Civil Security/Disaster management.

- FP7

POBICOS – Home Automation; Energy Efficient Building.
SM4ALL – Smart Homes for All; Home Automation.
GINSENG – Plant Automation; Industrial Environments.
IPAC – manufacturing plant control, traffic management, crisis management.
LocON – Monitoring & Control of Critical Infrastructures.
SENSE - civil security monitoring system.
µSWN – Surveillance, tracking and real-time monitoring.
PECES – Automotive.
CHOsen – Automotive and Aerospace.

- Importance and nature of interventions:

The positive options already take into account a possible intervention with positive impacts. It does not define the nature of the interventions and whether they are the indirect consequences of other interventions.

For example: Increasing energy price plus higher restriction on CO2 emissions already have an impact that is included in the trend scenario. The positive show the fact that it could have higher impact if Monitoring & Control solutions are included in incentives policy or better identified as helpful tools by public opinion,

5.9 Market forecast – 2010 and 2012

5.9.1 World market by product / solution

After 5 years of growth at 8% per year the world Monitoring & Control market will reach 275 billion euro in 2012. The services share will increase by 10 point and will represent 60% of total.

Table 37, World M&C Market by product / solution (2010 in M€)

Product group	Product / solution	M€
Hardware	Control layer	38 245
	Interfaces Layer	6 705
	Network	6 921
	Computing systems	6 717
	OS and drivers	13 389
	Total	71 978
Software	Communication software	6 911
	Application and visualisation	12 639
	Development, simulating and modelling	3 461
	Decision support systems and ERP	5 345
	Total	28 356
Services	Application design	23 033
	Integration, installation and training	50 890
	Communication and networking	21 368
	Maintenance, repair and overall	39 517
	Total	134 807
Total		**235 141**

Source: DECISION/RPA, SMART 2007, October 2008

Table 38, World M&C Market by product / solution (2012 in M€)

Product group	Product / solution	M€
Hardware	Control layer	39 757
	Interfaces Layer	7 530
	Network	7 919
	Computing systems	7 121
	OS and drivers	14 737
	Total	77 065
Software	Communication software	8 357
	Application and visualisation	14 455
	Development, simulating and modelling	4 184
	Decision support systems and ERP	6 463
	Total	33 460
Services	Application design	27 843
	Integration, installation and training	61 524
	Communication and networking	28 237
	Maintenance, repair and overall	46 919
	Total	164 523
Total		**275 113**

Source: DECISION/RPA, SMART 2007, October 2008

Table 39, World M&C Market by market application (2010 in M€)

Market application	Equipment	Software	Services	**Total**
Environment	2 166	2 067	9 041	**13 274**
Critical Infrastructures	4 996	4 475	8 571	**18 041**
Manufacturing Industries	7 159	4 773	26 556	**38 487**
Process Industries	5 215	4 811	22 120	**32 146**
Building	630	1 939	6 952	**9 521**
Logistics and Transport	1 997	3 052	8 606	**13 654**
Electric Power and Grid	1 804	1 789	7 832	**11 425**
Vehicle	35 058	2 602	29 553	**67 213**
Household Appliances	2 636	190	2 174	**5 001**
Healthcare	9 933	2 596	13 048	**25 578**
Home	384	62	355	**800**
Total	**71 978**	**28 356**	**134 807**	**235 141**

Source: DECISION/RPA, SMART 2007, October 2008

Table 40, World M&C Market by market application and solutions – hardware (2010 in M€)

Market application	Equipment					
	Control layer	Interfaces layer	Network	Computing systems	OS and drivers	**Total**
Environment	740	206	301	310	610	**2 166**
Critical Infrastructures	2 257	287	313	677	1 462	**4 996**
Manufacturing Industries	3 591	661	742	588	1 577	**7 159**
Process Industries	2 248	444	597	521	1 405	**5 215**
Building	329	47	65	41	147	**630**
Logistics and Transport	736	186	276	345	453	**1 997**
Electric Power and Grid	584	185	268	286	481	**1 804**
Vehicle	20 295	2 901	3 014	2 807	6 040	**35 058**
Household Appliances	1 761	218	226	-	432	**2 636**
Healthcare	5 494	1 515	1 032	1 137	755	**9 933**
Home	210	55	86	5	28	**384**
Total	**38 245**	**6 705**	**6 921**	**6 717**	**13 389**	**71 978**

Source: DECISION/RPA, SMART 2007, October 2008

Table 41, World M&C Market by market application and solutions – Software (2010 in M€)

Market application	Software				
	Communi-cation software	Application and visualisation	Develop-ment, simulating and modelling	Decision support systems and ERP	**Total**
Environment	245	1 254	216	352	**2 067**
Critical Infrastructures	1 221	2 427	379	447	**4 475**
Manufacturing Industries	957	2 292	588	936	**4 773**
Process Industries	710	2 597	511	992	**4 811**
Building	351	395	316	877	**1 939**
Logistics and Transport	562	848	932	709	**3 052**
Electric Power and Grid	204	1 086	186	313	**1 789**
Vehicle	1 320	1 283	-	-	**2 602**
Household Appliances	99	92	-	-	**190**
Healthcare	1 198	348	333	718	**2 596**
Home	44	18	-	-	**62**
Total	**245**	**1 254**	**216**	**352**	**28 356**

Source: DECISION/RPA, SMART 2007, October 2008

Table 42, World M&C Market by market application and solutions – Services (2010 in M€)

Market application	Services				
	Application design	Integration, installation and training	Communi-cation and networking	Mainte-nance, repair and overall	**Total**
Environment	1 406	4 092	880	2 663	**9 041**
Critical Infrastructures	1 582	2 067	1 962	2 960	**8 571**
Manufacturing Industries	3 602	13 518	2 213	7 223	**26 556**
Process Industries	3 349	10 340	1 780	6 651	**22 120**
Building	1 131	2 858	194	2 769	**6 952**
Logistics and Transport	1 738	2 646	1 081	3 141	**8 606**
Electric Power and Grid	1 225	3 501	792	2 315	**7 832**
Vehicle	6 776	7 589	8 541	6 647	**29 553**
Household Appliances	500	802	631	241	**2 174**
Healthcare	1 711	3 411	3 037	4 889	**13 048**
Home	13	65	258	19	**355**
Total	**23 033**	**50 890**	**21 368**	**39 517**	**134 807**

Source: DECISION/RPA, SMART 2007, October 2008

Table 43, World M&C Market by market application (2012 in M€)

Market application	Equipment	Software	Services	**Total**
Environment	2 487	2 563	11 634	**16 684**
Critical Infrastructures	5 347	5 249	10 520	**21 116**
Manufacturing Industries	7 431	5 448	31 294	**44 174**
Process Industries	5 425	5 664	25 994	**36 885**
Building	685	2 348	8 503	**11 536**
Logistics and Transport	2 123	3 569	10 258	**15 950**
Electric Power and Grid	1 994	2 138	9 726	**13 858**
Vehicle	36 938	3 027	36 241	**76 207**
Household Appliances	2 710	217	2 626	**5 553**
Healthcare	11 523	3 364	17 338	**32 225**
Home	400	71	454	**925**
Total	**77 065**	**33 460**	**164 523**	**275 113**

Source: DECISION/RPA, SMART 2007, October 2008

Table 44, World M&C Market by market application and solutions – hardware (2012 in M€)

Market application	Equipment					
	Control layer	Interfaces layer	Network	Computing systems	OS and drivers	**Total**
Environment	817	243	363	346	717	**2 487**
Critical Infrastructures	2 343	319	357	712	1 617	**5 347**
Manufacturing Industries	3 610	712	820	599	1 690	**7 431**
Process Industries	2 256	478	658	530	1 503	**5 425**
Building	347	53	76	44	166	**685**
Logistics and Transport	759	203	309	357	494	**2 123**
Electric Power and Grid	621	211	312	307	543	**1 994**
Vehicle	20 819	3 190	3 402	2 919	6 609	**36 938**
Household Appliances	1 765	234	250	0	462	**2 710**
Healthcare	6 210	1 828	1 276	1 301	908	**11 523**
Home	211	60	95	5	29	**400**
Total	**39 757**	**7 530**	**7 919**	**7 121**	**14 737**	**77 065**

Source: DECISION/RPA, SMART 2007, October 2008

Table 45, World M&C Market by market application and solutions – Software (2012 in M€)

Market application	Software				
	Communi-cation software	Application and visualisation	Develop-ment, simulating and modelling	Decision support systems and ERP	**Total**
Environment	311	1 526	277	449	**2 563**
Critical Infrastructures	1 467	2 785	459	539	**5 249**
Manufacturing Industries	1 115	2 549	691	1 093	**5 448**
Process Industries	826	2 884	600	1 157	**5 466**
Building	428	461	388	1 071	**2 348**
Logistics and Transport	667	965	1 102	835	**3 569**
Electric Power and Grid	250	1 273	230	385	**2 138**
Vehicle	1 570	1 457	0	0	**3 027**
Household Appliances	115	102	0	0	**217**
Healthcare	1 558	433	437	936	**3 364**
Home	51	20	0	0	**71**
Total	**8 357**	**14 455**	**4 184**	**6 463**	**33 460**

Source: DECISION/RPA, SMART 2007, October 2008

Table 46, World M&C Market by market application and solutions – Services (2012 in M€)

Market application	Services				
	Application design	Integration, installation and training	Communi-cation and networking	Mainte-nance, repair and overall	**Total**
Environment	1 805	5 264	1 222	3 342	**11 634**
Critical Infrastructures	1 917	2 512	2 583	3 507	**10 520**
Manufacturing Industries	4 235	15 931	2 827	8 297	**31 294**
Process Industries	3 930	12 164	2 270	7 626	**25 994**
Building	1 390	3 521	259	3 328	**8 503**
Logistics and Transport	2 063	3 144	1 401	3 644	**10 258**
Electric Power and Grid	1 515	4 342	1 062	2 800	**9 726**
Vehicle	8 139	9 137	11 158	7 800	**36 241**
Household Appliances	587	945	807	277	**2 626**
Healthcare	2 246	4 488	4 317	6 276	**17 338**
Home	15	76	330	21	**454**
Total	**27 843**	**61 524**	**28 237**	**46 919**	**164 523**

Source: DECISION/RPA, SMART 2007, October 2008

5.9.2 European market by product / solution

Table 47, European M&C Market by product / solution (2010 in M€)

Product group	Product / solution	M€
Hardware	Control layer	10 875
	Interfaces Layer	1 892
	Network	2 044
	Computing systems	1 924
	OS and drivers	4 012
	Total	20 747
Software	Communication software	2 008
	Application and visualisation	4 062
	Development, simulating and modelling	1 150
	Decision support systems and ERP	1 753
	Total	8 973
Services	Application design	7 331
	Integration, installation and training	17 372
	Communication and networking	6 249
	Maintenance, repair and overall	12 669
	Total	43 620
Total		**73 340**

Source: DECISION/RPA, SMART 2007, October 2008

Table 48, European M&C Market by market application (2010 in M€)

Market application	Equipment	Software	Services	**Total**
Environment	507	488	2 141	**3 136**
Critical Infrastructures	1 120	1 005	1 925	**4 050**
Manufacturing Industries	2 998	2 002	11 142	**16 141**
Process Industries	1 955	1 805	8 299	**12 059**
Building	208	644	2 308	**3 160**
Logistics and Transport	554	960	2 853	**4 367**
Electric Power and Grid	784	777	3 404	**4 965**
Vehicle	10 085	751	8 536	**19 372**
Household Appliances	571	41	473	**1 086**
Healthcare	1 825	479	2 411	**4 715**
Home	139	22	128	**289**
Total	**20 747**	**8 973**	**43 620**	**73 340**

Source: DECISION/RPA, SMART 2007, October 2008

Table 49, European M&C Market by market application and solutions – hardware (2010 in M€)

Market application	Equipment					
	Control layer	Interfaces layer	Network	Computing systems	OS and drivers	**Total**
Environment	173	48	71	72	143	**507**
Critical Infrastructures	506	64	70	152	328	**1 120**
Manufacturing Industries	1 503	277	311	246	661	**2 998**
Process Industries	843	167	224	195	527	**1 955**
Building	109	15	22	14	49	**208**
Logistics and Transport	190	58	90	102	114	**554**
Electric Power and Grid	254	81	116	124	209	**784**
Vehicle	5 834	835	869	807	1 739	**10 085**
Household Appliances	381	47	49	-	94	**571**
Healthcare	1 008	279	190	209	139	**1 825**
Home	76	20	31	2	10	**139**
Total	**10 875**	**1 892**	**2 044**	**1 924**	**4 012**	**20 747**

Source: DECISION/RPA, SMART 2007, October 2008

Table 50, European M&C Market by market application and solutions – Software (2010 in M€)

Market application	Software				
	Communi-cation software	Application and visualisation	Develop-ment, simulating and modelling	Decision support systems and ERP	**Total**
Environment	58	295	51	83	**488**
Critical Infrastructures	274	545	85	100	**1 005**
Manufacturing Industries	402	961	247	393	**2 002**
Process Industries	266	974	192	372	**1 805**
Building	117	131	105	291	**644**
Logistics and Transport	163	225	329	244	**960**
Electric Power and Grid	89	472	81	136	**777**
Vehicle	381	370	-	-	**751**
Household Appliances	21	20	-	-	**41**
Healthcare	221	64	61	133	**479**
Home	16	6	-	-	**22**
Total	**2 008**	**4 062**	**1 150**	**1 753**	**8 973**

Source: DECISION/RPA, SMART 2007, October 2008

Table 51, European M&C Market by market application and solutions – Services (2010 in M€)

Market application	Services				
	Application design	Integration, installation and training	Communi-cation and networking	Mainte-nance, repair and overall	**Total**
Environment	333	969	210	629	**2 141**
Critical Infrastructures	355	464	441	665	**1 925**
Manufacturing Industries	1 511	5 672	929	3 029	**11 142**
Process Industries	1 257	3 880	668	2 495	**8 299**
Building	376	949	65	919	**2 308**
Logistics and Transport	581	897	327	1 047	**2 853**
Electric Power and Grid	532	1 522	344	1 006	**3 404**
Vehicle	1 956	2 191	2 471	1 918	**8 536**
Household Appliances	109	175	138	52	**473**
Healthcare	316	630	563	902	**2 411**
Home	5	23	93	7	**128**
Total	**7 331**	**17 372**	**6 249**	**12 669**	**43 620**

Source: DECISION/RPA, SMART 2007, October 2008

Table 52, European M&C Market by product / solution (2012 in M€)

Type of products	Product / solution	2012 in million Euros
Hardware	Control layer	10 856
	Interfaces Layer	2 036
	Network	2 250
	Computing systems	1 958
	OS and drivers	4 266
	Total	21 366
Software	Communication software	2 341
	Application and visualisation	4 506
	Development, simulating and modelling	1 351
	Decision support systems and ERP	2 045
	Total	10 244
Services	Application design	8 576
	Integration, installation and training	20 348
	Communication and networking	7 975
	Maintenance, repair and overall	14 519
	Total	51 418
Total		**83 027**

Source: DECISION/RPA, SMART 2007, October 2008

Table 53, European M&C Market by market application (2012 in M€)

Market application	Equipment	Software	Services	**Total**
Environment	511	533	2 433	3 477
Critical Infrastructures	1 176	1 157	2 320	4 653
Manufacturing Industries	3 051	2 242	12 888	18 182
Process Industries	2 018	2 035	9 679	13 732
Building	214	739	2 676	3 629
Logistics and Transport	581	1 113	3 362	5 055
Electric Power and Grid	860	922	4 194	5 976
Vehicle	10 246	843	10 118	21 207
Household Appliances	564	45	549	1 159
Healthcare	2 001	589	3 037	5 627
Home	145	26	160	331
Total	**21 366**	**10 244**	**51 418**	**83 027**

Source: DECISION/RPA, SMART 2007, October 2008

Table 54, European M&C Market by market application and solutions – hardware (2012 in M€)

Market application	Equipment					
	Control layer	Interfaces layer	Network	Computing systems	OS and drivers	**Total**
Environment	167	50	75	71	148	**511**
Critical Infrastructures	515	70	79	156	356	**1 176**
Manufacturing Industries	1 481	293	337	246	694	**3 051**
Process Industries	839	178	245	197	559	**2 018**
Building	108	17	24	14	52	**214**
Logistics and Transport	192	63	100	105	122	**581**
Electric Power and Grid	267	91	135	132	234	**860**
Vehicle	5 767	887	946	809	1 836	**10 246**
Household Appliances	367	49	52	0	96	**564**
Healthcare	1 076	318	223	226	158	**2 001**
Home	76	22	35	2	11	**145**
Total	**10 856**	**2 036**	**2 250**	**1 958**	**4 266**	**21 366**

Source: DECISION/RPA, SMART 2007, October 2008

Table 55, European M&C Market by market application and solutions – Software (2012 in M€)

Market application	Software				
	Communi-cation software	Application and visualisation	Develop-ment, simulating and modelling	Decision support systems and ERP	**Total**
Environment	65	316	58	94	**533**
Critical Infrastructures	323	613	101	119	**1 157**
Manufacturing Industries	459	1 048	285	450	**2 242**
Process Industries	307	1 073	223	431	**2 035**
Building	135	145	122	337	**739**
Logistics and Transport	190	252	386	285	**1 113**
Electric Power and Grid	108	549	99	166	**922**
Vehicle	438	406	0	0	**843**
Household Appliances	24	21	0	0	**45**
Healthcare	273	76	77	164	**589**
Home	19	7	0	0	**26**
Total	**2 341**	**4 506**	**1 351**	**2 045**	**10 244**

Source: DECISION/RPA, SMART 2007, October 2008

Table 56, European M&C Market by market application and solutions – Services (2012 in M€

Market application	Services				
	Application design	Integration, installation and training	Communi-cation and networking	Mainte-nance, repair and overall	**Total**
Environment	377	1 101	259	696	**2 433**
Critical Infrastructures	423	554	571	773	**2 320**
Manufacturing Industries	1 744	6 561	1 167	3 415	**12 888**
Process Industries	1 464	4 530	846	2 840	**9 679**
Building	438	1 109	82	1 047	**2 676**
Logistics and Transport	683	1 057	419	1 203	**3 362**
Electric Power and Grid	654	1 874	459	1 208	**4 194**
Vehicle	2 271	2 549	3 124	2 174	**10 118**
Household Appliances	123	198	170	58	**549**
Healthcare	393	786	760	1 098	**3 037**
Home	5	28	119	8	**160**
Total	**8 576**	**20 348**	**7 975**	**14 519**	**51 418**

Source: DECISION/RPA, SMART 2007, October 2008

5.10 Market forecast - 2020

This market forecast is based on continuation of trends of evolution in the base scenario with constant economy structure. Global transformation of some major sectors such as transportation or energy may deeply change the trends for some products and services.

5.10.1 World market by product / solution

Table 57, World M&C Market by product / solution (2020 in M€)

Type of products	Product / solution	2020 in million Euros
Hardware	Control layer	48 165
	Interfaces Layer	11 539
	Network	15 399
	Computing systems	10 669
	OS and drivers	19 958
	Total	105 727
Software	Communication software	15 510
	Application and visualisation	24 678
	Development, simulating and modelling	11 213
	Decision support systems and ERP	18 322
	Total	69 723
Services	Application design	52 697
	Integration, installation and training	101 726
	Communication and networking	51 735
	Maintenance, repair and overall	117 960
	Total	324 118
Total		**499 567**

Source: DECISION/RPA, SMART 2007, October 2008

Table 58, World M&C Market by market application (2020 in M€)

Market application	Equipment	Software	Services	Total
Environment	3 419	5 017	22 444	**30 880**
Critical Infrastructures	8 503	11 754	25 003	**45 260**
Manufacturing Industries	8 562	9 546	52 294	**70 401**
Process Industries	6 230	9 375	43 178	**58 782**
Building	965	5 693	18 060	**24 719**
Logistics and Transport	2 884	6 601	16 385	**25 870**
Electric Power and Grid	3 200	4 839	21 653	**29 692**
Vehicle	40 693	4 302	59 290	**104 284**
Household Appliances	3 690	385	5 101	**9 176**
Healthcare	26 834	12 054	59 657	**98 545**
Home	748	159	1 053	**1 959**
Total	**105 727**	**69 723**	**324 118**	**499 567**

Source: DECISION/RPA, SMART 2007, October 2008

Table 59, World M&C Market by market application and solutions – hardware (2020 in M€)

Market application	Equipment					
	Control layer	Interfaces layer	Network	Computing systems	OS and drivers	**Total**
Environment	949	333	673	479	984	3 419
Critical Infrastructures	3 301	529	796	1 192	2 685	8 503
Manufacturing Industries	3 639	850	1 331	722	2 020	8 562
Process Industries	2 232	560	1 049	627	1 763	6 230
Building	431	77	149	65	242	965
Logistics and Transport	957	244	469	461	753	2 884
Electric Power and Grid	839	335	667	493	866	3 200
Vehicle	20 416	3 718	5 419	3 432	7 707	40 693
Household Appliances	2 178	342	495	0	675	3 690
Healthcare	12 890	4 440	4 111	3 187	2 206	26 834
Home	333	111	239	10	55	748
Total	**48 165**	**11 539**	**15 399**	**10 669**	**19 956**	**105 727**

Source: DECISION/RPA, SMART 2007, October 2008

Table 60, World M&C Market by market application and solutions – Software (2020 in M€)

Market application	Software				
	Communi-cation software	Application and visualisation	Develop-ment, simulating and modelling	Decision support systems and ERP	**Total**
Environment	512	2 560	744	1 200	**5 017**
Critical Infrastructures	2 916	5 639	1 477	1 723	**11 754**
Manufacturing Industries	1 604	3 736	1 634	2 572	**9 546**
Process Industries	1 166	4 148	1 391	2 670	**9 375**
Building	750	822	1 101	3 019	**5 693**
Logistics and Transport	1 056	1 708	2 150	1 687	**6 601**
Electric Power and Grid	478	2 472	710	1 180	**4 839**
Vehicle	2 211	2 090	0	0	**4 302**
Household Appliances	202	183	0	0	**385**
Healthcare	4 501	1 275	2 005	4 272	**12 054**
Home	114	44	0	0	**159**
Total	**15 510**	**24 678**	**11 213**	**18 322**	**69 723**

Source: DECISION/RPA, SMART 2007, October 2008

Table 61, World M&C Market by market application and solutions – Services (2020 in M€)

Market application	Services				
	Application design	Integration, installation and training	Mainte-nance, repair and overall	Communi-cation and networking	**Total**
Environment	3 445	8 832	2 111	8 056	**22 444**
Critical Infrastructures	4 405	5 086	5 376	10 136	**25 003**
Manufacturing Industries	7 081	23 348	4 272	17 593	**52 294**
Process Industries	6 449	17 495	3 365	15 868	**43 178**
Building	2 816	6 287	475	8 483	**18 060**
Logistics and Transport	3 110	4 062	2 209	7 004	**16 385**
Electric Power and Grid	3 338	8 432	2 121	7 762	**21 653**
Vehicle	13 359	13 107	16 523	16 301	**59 290**
Household Appliances	1 200	1 694	1 490	717	**5 101**
Healthcare	7 454	13 211	13 022	25 970	**59 657**
Home	39	173	771	70	**1 053**
Total	**52 697**	**101 726**	**51 735**	**117 960**	**324 118**

Source: DECISION/RPA, SMART 2007, October 2008

5.10.2 European market by product / solution

Table 62, European M&C Market by product / solution (2020 in M€)

Type of products	Product / solution	2020 in million Euros
Hardware	Control layer	10 854
	Interfaces Layer	2 756
	Network	3 331
	Computing systems	2 118
	OS and drivers	5 482
	Total	24 540
Software	Communication software	4 358
	Application and visualisation	6 862
	Development, simulating and modelling	2 581
	Decision support systems and ERP	3 818
	Total	17 618
Services	Application design	16 145
	Integration, installation and training	38 505
	Communication and networking	21 280
	Maintenance, repair and overall	25 209
	Total	101 139
Total		**143 297**

Source: DECISION/RPA, SMART 2007, October 2008

Table 63, European M&C Market by market application (2020 in M€)

Market application	Equipment	Software	Services	**Total**
Environment	532	766	4 100	**5 398**
Critical Infrastructures	1 444	2 046	4 982	**8 473**
Manufacturing Industries	3 319	3 554	23 264	**30 137**
Process Industries	2 320	3 311	18 058	**23 689**
Building	244	1 287	4 860	**6 390**
Logistics and Transport	709	2 011	6 559	**9 279**
Electric Power and Grid	1 261	1 838	9 752	**12 851**
Vehicle	11 061	1 352	20 365	**32 778**
Household Appliances	545	66	1 013	**1 624**
Healthcare	2 929	1 343	7 787	**12 059**
Home	175	45	398	**618**
Total	**24 540**	**17 618**	**101 139**	**143 297**

Source: DECISION/RPA, SMART 2007, October 2008

Table 64, European M&C Market by market application and solutions – hardware (2020 in M€)

Market application	Equipment					
	Control layer	Interfaces layer	Network	Computing systems	OS and drivers	**Total**
Environment	145	58	96	65	167	**532**
Critical Infrastructures	552	99	123	177	493	**1 444**
Manufacturing Industries	1 396	365	466	245	848	**3 319**
Process Industries	824	230	352	204	710	**2 320**
Building	107	22	34	14	66	**244**
Logistics and Transport	202	85	149	114	158	**709**
Electric Power and Grid	330	147	240	172	372	**1 261**
Vehicle	5 507	1 124	1 333	816	2 281	**11 061**
Household Appliances	315	56	66	0	108	**545**
Healthcare	1 397	541	419	308	264	**2 929**
Home	78	29	52	2	14	**175**
Total	**10 854**	**2 756**	**3 331**	**2 118**	**5 447**	**24 540**

Source: DECISION/RPA, SMART 2007, October 2008

Table 65, European M&C Market by market application and solutions – Software (2020 in M€)

Market application	Software				
	Communi-cation software	Application and visualisation	Develop-ment, simulating and modelling	Decision support systems and ERP	**Total**
Environment	103	417	96	150	**766**
Critical Infrastructures	625	986	203	232	**2 046**
Manufacturing Industries	784	1 488	505	777	**3 554**
Process Industries	545	1 583	411	772	**3 311**
Building	240	214	226	607	**1 287**
Logistics and Transport	356	396	731	528	**2 011**
Electric Power and Grid	237	1 007	226	368	**1 838**
Vehicle	765	587	0	0	**1 352**
Household Appliances	38	28	0	0	**66**
Healthcare	630	146	184	383	**1 343**
Home	34	11	0	0	**45**
Total	**4 358**	**6 862**	**2 581**	**3 818**	**17 618**

Source: DECISION/RPA, SMART 2007, October 2008

Table 66, European M&C Market by market application and solutions – Services (2020 in M€)

Market application	Services				
	Application design	Integration, installation and training	Communi-cation and networking	Mainte-nance, repair and overall	**Total**
Environment	623	1 835	599	1 044	**4 100**
Critical Infrastructures	848	1 122	1 598	1 414	**4 982**
Manufacturing Industries	3 095	11 753	2 898	5 519	**23 264**
Process Industries	2 695	8 421	2 177	4 765	**18 058**
Building	810	2 073	211	1 765	**4 860**
Logistics and Transport	1 305	2 034	1 126	2 095	**6 559**
Electric Power and Grid	1 489	4 306	1 446	2 511	**9 752**
Vehicle	4 122	4 672	7 980	3 590	**20 365**
Household Appliances	203	329	395	87	**1 013**
Healthcare	945	1 907	2 530	2 405	**7 787**
Home	11	53	320	14	**398**
Total	**16 145**	**38 505**	**21 280**	**25 209**	**101 139**

Source: DECISION/RPA, SMART 2007, October 2008

6 Economic and societal impact

6.1 Screening and Introduction to Methodology

6.1.1 Introduction

This chapter introduces the methodological framework adopted in this study, to assess the implications of each of these scenarios for different stakeholder groups. They include monetary and non-monetary impacts, in addition to issues of distribution and equity among these stakeholders. Particular attention was given to the identification of obstacles that are having a negative impact on the development of the M&C market.

This chapter also includes a description of the model used to undertake a quantitative assessment of the key positive and negative impacts of each scenario on a range of stakeholder groups.

6.1.2 Assessment Methodology

There are five steps involved in analysing the impacts of each scenario:

1. identifying which impact categories (from those included in the Commission's Impact Assessment Guidelines) and which stakeholder groups are expected to be relevant to the M&C industry;
2. screening the impacts by identifying the types (positive and negative) that may result from each scenario for each stakeholder group(s);
3. describing the impacts in qualitative (words) and quantitative (numbers) terms, applying a structural model where necessary;
4. identifying and assessing the measures and instruments which may be applied to alleviate obstacles or to enforce drivers within the M&C market so that a desired scenario is more likely to be achieved; and
5. identifying the possible suite(s) of measures and instruments at the Commission's disposal in the form of policy actions that could be implemented to result in the 'best' overall result (lowest costs, highest benefits) for all stakeholders. Recommendations will then be provided, highlighting the costs and benefits of each option and how they might complement existing initiatives.

Steps 1 and 2 are included within this chapter, with Step 3 assessed in the following chapter, focussing on the economic and social impact assessment in qualitative and quantitative terms. Steps 4 and 5 relate to potential policy recommendations, presented at the end of this report.

6.1.3 Identification of Appropriate Stakeholders and Impact Categories

Table 67 summarises the stakeholder groups relevant to the M&C market in Europe, including the stakeholder definitions to apply in this study.

Table 67, Summary of Stakeholder Groups

Stakeholder Group	Definition
EU M&C Providers	Private sector enterprises involved in the production and/or provision of M&C solutions, with head offices and/or the majority of production located in the EU-27 (includes hardware, software and service providers)
EU Industrial and Professional Users	Downstream users of M&C solutions in the private sector, either in the provision of services, construction or manufacturing enterprises
EU Consumer Users	Non-professional downstream users of M&C solutions, often embedded in many products and services without the user being aware of the technology
Public Sector Authorities	Member State and European authorities and organisations acting as regulators, investors and customers of the M&C industry
Non-EU M&C Providers	Private sector enterprises involved in the production and/or application of M&C solutions, with head offices and/or the majority of production located outside the EU-27
Non-EU Users	Professional (industrial) and non-professional (consumer) users of M&C solutions outside the EU-27

In line with the European Commission's Impact Assessment Guidelines[5] and the objectives of this study as presented in the tender specifications, Table 68 (overleaf) presents the impact categories that have been identified as relevant to this study as a sub-set of those presented in the Commission's guidance. Table 68 also outlines the type of information that might be required to complete a qualitative and quantitative assessment of the potential impacts in later analytical steps.

In order to simplify the analysis where possible, and to maintain focus on the economic and societal impacts resulting from each scenario, some individual impact categories (such as land use and biodiversity in the case of environmental impacts) are referred to collectively under the title of environmental and energy impacts. Similarly, the analysis of crime, security, and social inclusion are evaluated collectively under social impacts.

5 EC (2005): **Impact Assessment Guidelines with March 2006 Update**, SEC(2005)791, 15/06/2005: http://ec.europa.eu/governance/impact/docs/key_docs/sec_2005_0791_en.pdf

Table 68, Summary of Impacts to be Considered and Information Required for Analysis

Category	Description	Information Required		
		Qualitative	**Quantitative**	**Monetary**
Operating costs and conduct of business	Impacts associated with operation of individual businesses and their creation (incl. business administration)	Impacts on the cost of inputs, capital and finance	Estimates of changes to input prices including labour and capital (as percentage)	Estimates of changes to input prices (as €)
		Impacts on business strategies including, location of production, etc.	Number or proportional estimates of changes in production and products/firms entering the market	Estimates of changes in terms of turnover, value of production (as €)
Competitiveness, trade and investment flows	Impacts on EU stakeholders in relation to non-EU rivals, in terms of efficiency, cross border investment, imports and exports	Impacts on the trade of goods/services between MS and third parties	Estimates of the change in the volume of goods/services traded (as percentage)	Estimates of the change in the value of goods/services traded (as €)
		Impacts on investment decisions and levels	Estimates of change in the level and type of investment (as percentage)	Estimates of the change in the level of investment (as €)
		Relative changes to the costs between EU and non-EU parties	-	-
Competition in the internal market	Impacts to the functioning of the EU market and on the level of competition (price and non-price)	Impacts on market share of EU firms compared to its rivals	Estimates of change in market share (as percentage)	Estimates of change in market share (as €)
		Changes to the markets available to a manufacturer	Estimates in change of turnover (as percentage)	Estimates of change in turnover (as €)
		Impacts to the costs of production and market prices of final goods/services	Savings from changes to production and ability to source lower cost inputs (as percentage)	Estimates of cost savings from lower cost inputs and price changes from competition (as €)
		Impacts on product choice and quality	Estimates of the change in the number and availability of products placed on the market (as percentage)	Estimates of the products lost/gained on the market (as €)
Property rights	Impacts on the protection of innovations, technology and rights	Changes to the level of protection afforded to entrepreneurs and innovators	Estimates of changes to the length or breadth of patents and degree of counterfeiting (as percentage of turnover/products)	Estimates of the value of production protected (as €)
Innovation and research	Impacts on the direction, efficiency, frequency and investment in innovation and R&D.	Impacts on the development or time to market of innovative products	Estimates of the change in time to market (as percentage)	Estimates of the impact of increased/decreased time to market (as €)
		Change in incentives for innovation and research	Estimates of increased expenditure on R&D and successful innovations placed on the market (as percentage)	Estimates of increased expenditure on R&D and successful innovations placed on the market (as €)

Table 68, Summary of Impacts to be Considered and Information Required for Analysis

Category	Description	Information Required		
		Qualitative	**Quantitative**	**Monetary**
Consumers and households	Impacts on choices, prices and quality of the goods and services consumers purchase	Impacts of changes to consumer behaviour, household costs, volume of goods and services demanded, choice, etc.	Estimates of changes in product choice, cost and consumer behaviour (as percentages)	Estimates of 'value' of changes to cost behaviour and choice (as €)
Macroeconomic and Employment	Impacts on growth, regional development, employment and inflation	Impacts of changes in the sector on employment and regional economic growth	Estimate of change in employment (as number of jobs or percentage)	Estimates of the 'value' of employment (as €)
Environmental and Energy	Impacts to the quality of air, water and land, plus the biodiversity and sustainability of a region, with particular reference to energy	Impacts to the local, regional and global environment and energy consumption	Estimates of changes to biodiversity, emissions, standard of living, etc. (as percentage or number of species) or percentage change in energy generation/consumption	Estimates of the 'value' of an environment or energy savings (as €)
Social Impacts	Impacts on the equality, protection of particular groups, health and access to services	Impacts on the protection of individuals and groups under law (e.g. privacy, surveillance and personal information)	-	Estimates of the 'value' of changes to legal protection under the law (as €)
		Impacts on the health and interaction of society	Estimates of changes to the health and interactions of society in terms of changes to crime, life expectancy (as percentages)	Estimates of the 'value' of changes to life expectancy, crime, etc (as €)
Distributive/Equity	The relative impact of measures between different regions of Europe, Member States, industries or individuals	The difference in impacts between different groups affected equally by the same measure in absolute terms	Estimates of proportional differences in impacts between different groups (as percentage)	Estimates of proportional differences in impacts between different groups (as €)
Sustainability	Can impacts be maintained in the long run	Are competitive advantages or cost savings short lived	Estimates of the time impacts are expected to last (in years/months)	Life-Cycle Analysis (LCA) of impacts to derive monetary estimates (as €)

Based on the Commission's Impact Assessment Guidelines, 15/6/05 with March 2006 update, SEC(2005) 791, available at http://ec.europa.eu/governance/impact/docs/key_docs/sec_2005_0791_en.pdf

6.1.4 Screening

6.1.4.1 Overview

At present, the impact analysis of each scenario involves the evaluation of six stakeholder groups, against 11 impact categories in 11 sub-sectors of the M&C industry, defined in previous chapters. In order to make the analysis more manageable and focussed on key sub-sectors or impacts, a screening exercise is undertaken. Screening involves excluding those stakeholders and sectors, which are deemed to face a negligible or insignificant impact under each scenario. Justification for including or excluding stakeholders and/or impacts in a particular sub-sector or scenario is provided in Appendix 4.

6.1.4.2 Screening of Impacts Against Stakeholder Groups

Appendix 4 presents the results of the screening exercise, in the form of an impact matrix of sub-sectors, stakeholders and potential impacts, for each scenario. This matrix provides an initial qualitative description of all potential impacts resulting from each of the scenarios. Table 69 provides a simplified summary of the impacts identified by the screening exercise to be taken through for more detailed assessment.

Taking into account the likely duration (short term versus longer term) and magnitude of the impact, specifically whether the impact is negative or positive in nature, the following scale has been used to summarise the results of this exercise:

- `-` indicates a negative impact has been identified
- `0` indicates no/negligible impact
- `+` indicates a positive impact has been identified
- `+/-` indicates positive and negative impacts have been identified

Table 69, Summary of Impacts Identified through Screening

Impact Categories / Scenario	Stakeholders					
	European M&C Providers	European Industry and Professional Users	European Consumers	Public Sector Authorities	Non-EU M&C Providers	Non-EU Users
Smart Home Scenario						
Operating Costs of Business	+	0	+	0	0	+
Competitiveness and Trade	+	0	0	0	-	0
Competition and Internal Market	+	+	0	0	+	
Innovation and Research	0	0	0	0	0	0
Employment and	+	+	0	0	0	0

Table 69, Summary of Impacts Identified through Screening

Impact Categories / Scenario	Stakeholders					
	European M&C Providers	European Industry and Professional Users	European Consumers	Public Sector Authorities	Non-EU M&C Providers	Non-EU Users
Macroeconomy						
Environment and Energy	0	0	+	+	0	+
Social	0	0	+/-	+	0	+/-
Distributive and Equity	+/-	+/-	+/-	0	0	+/-
Sustainability	-	-	-	0	0	0
Distributed Power Scenario						
Operating Costs of Business	+	+	+	0	0	0
Competitiveness and Trade	+	+	0	0	+/-	0
Competition and Internal Market	+	+	0	0	+	0
Innovation and Research	0	0	0	0	0	0
Employment and Macroeconomy	+	+/-	0	0	0	0
Environment and Energy	0	+	+	+	0	+
Social	0	0	0	0	0	0
Distributive and Equity	0	+/-	0	+/-	0	0
Sustainability	+	+	0	+	0	0
Pervasive Networking Scenario						
Operating Costs of Business	+	+	+	0	0	0
Competitiveness and Trade	+	+	0	0	0	0
Competition and Internal Market	+	+	0	0	+	0
Innovation and Research	0	0	0	0	0	0
Employment and Macroeconomy	+	+/-	0	0	0	0
Environment and Energy	0	+	+	+	0	0
Social	0	0	0	0	0	0
Distributive and Equity	0	0	+/-	0	0	0
Sustainability	+	+	+	0	0	0
Global Economic Recession Scenario						
Operating Costs of Business	-	-	0	0	-	-
Competitiveness and Trade	-	-	0	0	-	-
Competition and Internal Market	-	-	0	0	-	-
Innovation and Research	-	-	0	0	-	-
Employment and	+/-	+/-	0	0	+/-	+/-

Table 69, Summary of Impacts Identified through Screening

Impact Categories / Scenario	Stakeholders					
	European M&C Providers	European Industry and Professional Users	European Consumers	Public Sector Authorities	Non-EU M&C Providers	Non-EU Users
Macroeconomy						
Environment and Energy	0	0	0	0	0	0
Social	0	0	-	-	0	0
Distributive and Equity	+/-	+/-	0	0	+/-	+/-
Sustainability	-	-	0	0	-	-
European Divestment Scenario						
Operating Costs of Business	0	0	0	0	+	+
Competitiveness and Trade	+/-	+/-	0	0	+	+
Competition and Internal Market	-	-	0	0	-	-
Innovation and Research	+/-	+/-	0	0	0	0
Employment and Macroeconomy	-	-	0	0	+	+
Environment and Energy	0	0	0	0	0	0
Social	0	0	-	-	0	0
Distributive and Equity	-	-	0	0	+	+
Sustainability	-	-	0	0	-	-

In addition to this table, Appendix 4 also identifies which segments of the M&C market are most likely to be affected by the above impacts. In the smart home scenario, building, home appliance and home sectors are identified, with power grids and critical infrastructure in the distributed power scenario. As a composite of both smart home and distributed power, the Pervasive Networking scenario identifies both groups of sectors as important. In contrast, the global recession and European divestment scenarios are identified as having a primarily negative impact on manufacturing, process, vehicle, logistics, home, building and household appliance sectors of the market. Healthcare and environment sectors are, however, identified as exhibiting some positive impacts, as they are less responsive to economic factors. Regulation and an aging population were identified in consultation as the key drivers for these sectors.

The qualitative assessment of identified impacts and justification of these impacts is provided in Chapter 6, together with the quantitative results of the modelling exercise.

6.1.4.3 Assessing Quantitative Impacts

There are a number of uncertainties and challenges when estimating quantitative impacts, particularly when the impacts are disaggregated by sector and occur over an extended time-period. In many cases, interviewees find it difficult to break down potential costs and benefits by an individual product range or geographical region. Consequently, estimates of impacts are often given as a percentage change for a particular factor (e.g. turnover, R&D expenditure, number of successful innovations) or as qualitative valuations of expected impacts based on the interviewee's experience and knowledge of the sector. Therefore, for many impacts a qualitative approach has been adopted, based on the views of interviewees and industry experts within the study team. For other impacts, a model has been developed to estimate key monetary impacts resulting from each scenario. For example, it may be possible to estimate the order of magnitude of any energy savings resulting from the introduction of a specific technology. Estimates of the potential impacts on household utility bills and carbon savings may also be quantified using this approach.

Appendix 5 describes the structure of this model and the underlying assumptions necessary to derive such impacts. Past studies, market reviews and European Commission initiatives involving the M&C market provided a basis for the establishment of assumptions and provided indicative estimates of the potential impacts, which were then compared against the opinions, and expectations gathered in interviews with industry stakeholders. Finally, a validation exercise was undertaken, in order to check the calibration and assumptions of this model, focussing on the conclusions.

6.2 Analytical Framework

6.2.1 Scenario Development

6.2.1.1 Introduction

From interviews and consultation with industry stakeholders, the preceding tasks have generated six scenarios depicting the future growth of the M&C sector in Europe, based on various economic and technological developments assumed to occur in the period 2007-2020. Collectively, three scenarios (smart home, distributed power, and networking) represent a best case for the industry, while another two represent a worst case (global economic recession and European divestment) where negative economic conditions are assumed to dominate. A baseline scenario is also included, to reflect a business as usual forecast, based on the best information available today as to the future progression of the M&C industry. This is important as it indicates what degree of technological progress and economic growth is likely to be achieved in the absence of additional action. The focus of this study is on the evaluation of the net impacts of each scenario, compared to this baseline.

The large degree of uncertainty associated with future events and outcomes requires that certain assumptions be made regarding the technologies that are likely to enter the market between 2007 and 2020, including how these technologies are likely to be adopted and by whom. The purpose of this section is to introduce the scenarios in more detail and to set out the assumptions supporting them. These assumptions will also inform the initial structure of the modelling exercise, presented in Appendix 5.

6.2.1.2 Selection of Scenarios

Based on the earlier tasks describing the different M&C markets and applications, future growth potential was deemed greatest in those market segments characterised by low initial uptake (technology still in its infancy) and of potential importance for users, driven in part by regulation. By comparison, more mature segments of the M&C industry were identified as being relatively stable; growing as users chose to upgrade or replace existing M&C systems. Based on this evidence, home, networking and energy based technology appeared to offer the highest growth potential in building, home, household appliance, power grid and critical infrastructure market segments. In addition to identifying the potential within each market sector, threats to future growth were also highlighted. By quantifying these positive and negative options for the future development of the sector, best and worst case scenarios were defined.

6.2.1.3 The Baseline Scenario

Overview

The baseline or business as usual scenario represents a situation where current economic and regulatory conditions are maintained with minor changes, throughout the 2007-2020 period. It includes changes that can reasonably be expected to occur, given the best information currently available. For example, regulatory measures that have been approved for implementation or transposition by 2015 are included, as are any impacts arising from these regulations. However this approach does have some limitations, for example, known or expected uptake levels of a specific technology can be included in the baseline, yet it is difficult in many cases to account for the degree of market liberalisation or standardisation which may occur under the baseline.

6.2.2 The Best Case

The best case is indicative of the total potential future value of the of M&C industry should all positive scenarios be simultaneously realised. It is therefore calculated as the sum of each scenario's value over the assessed period. We set out below the technologies and products assumed to be placed on the market under each individual scenario.

6.2.2.1 Scenario 1: Smart Home

Smart Home focuses exclusively on the adoption of automation systems by households in Europe to control space heating/cooling (incl. air conditioning), water heating, lighting, security equipment (i.e. alarms and building entry systems) and domestic appliances. These automation systems control and monitor on/off functions, standby periods, temperature settings, and the time and duration of each appliance's use by the household. It is assumed that each automation system has the capability to control 'smart' appliances, so that the operation of each appliance can synchronised to operate only when energy is cheapest or its use is likely to be the most efficient. Commercial premises are excluded, as the majority are already assumed to have automation systems to control temperature, building access and security. Consequently, the screening exercise identified the building, home, and household appliance segments of the M&C market, as those segments most likely to be significantly affected by this scenario. All households are assumed to have individual heating and cooling systems, therefore each household controls its own energy consumption and is responsible for its own billing accordingly.

Consultation has indicated that the technology necessary for home automation has been around for over 20 years. There are numerous providers of such systems, ranging from high-end electrical appliance providers to suppliers of home and business lighting and security systems. Therefore few, if any, technical barriers are expected. However, uptake is relatively low in most Member States according to consultation. The main barrier appears to be economic, as prospective customers are unwilling to make large initial investments in home automation systems based just on comfort, convenience and home security benefits alone. Therefore, consumer acceptance and uptake of automation systems is unlikely to change unless significant benefits are acknowledged, perceived as achievable and expected to exceed the initial cost of purchase and installation.

This situation can partly be attributed to the limited capabilities of home automation systems, as current metering, billing, distribution and generation of energy restrict the ability of the household to realise the energy efficiency savings and other benefits they might experience. For example, without dynamic pricing and metering of electricity in peak and off-peak periods, an automated system is unlikely to be able to switch usage patterns for the benefit of the user, as the unit price of energy is constant regardless of when it is consumed and from whom it is consumed. However, in the current situation, if the consumer switches from peak to off-peak consumption, the electricity provider benefits, as automation reduces peak load demand on the network and therefore the amount of energy needed to be generated, yet the household witnesses no benefit as energy bills do not change. Therefore, users are presently assumed to miss out on significant potential benefits from smart home technology.

6.2.2.2 Scenario 2: Distributed Power

6.2.2.2.1 Overview

Distributed Power is a scenario intended to reflect the possibility of increased micro and decentralised power generation in Europe and its implications for the M&C sector. It is assumed that M&C devices will be required extensively under this scenario, to connect new energy generating devices (e.g. local wind-farms, micro-generation units, and solar panels) to a local or national grid in order for homes and businesses to receive safe and consistent supplies of electricity. Secondly, this scenario assumes that users of electricity and gas will adopt smart meters. Smart meters will use radio frequency technology to automatically read and display current consumption of gas and electricity, communicating this information back to utility companies and to users via a visual display in order to encourage energy saving behaviour amongst consumers. In addition, smart meters should also have the ability to meter the export and import of energy, thus enabling households and businesses to generate their own power, to supply the local or national grids. Combined, these two technologies could represent a step towards 'intelligent' or 'smart' power grids. The screening exercise identifies the power grid and critical infrastructure segments of the M&C industry as the most significantly affected by this scenario.

6.2.2.2.2 Smart Metering

The assumed specifications of smart metering are derived from an impact assessment completed by Frontier Economics for Centrica[6], a major gas and electricity supplier in the UK. The specifications of the smart meter are assumed to allow for the following functionality:

- separate visual display;
- remote meter reading;
- storage of half-hourly / daily consumption data;
- capable of recording imported and exported units of electricity separately;
- remote connect /disconnect; and
- remote switch between credit / prepayment functionality.

The product definition used is consistent with that presented by the European Smart Metering Alliance (ESMA)[7], which establishes that smart metering should have the following features:

- automatic processing, transfer, management and utilisation of metering data;
- automatic management of meters;
- two-way data communication with meters;

[6] Frontier (2007): **Smart Metering** – A Report Prepared For Centrica, by Frontier Economics, October 2007

[7] EAMA (2007): **European research experience and needs on smart metering**, Presentation by John Parson, Project Coordinator for the European Smart Metering Alliance

- providing meaningful and timely consumption information to the relevant actors and their systems, including the energy consumer; and
- supports services that improve the energy efficiency of the energy consumption and the energy system (generation, transmission, distribution and especially end use).

6.2.2.2.3 Connection and Transmission of Distributed Power

Energy generating technologies can be differentiated between small 'micro-generation' technologies (e.g. household solar, wind, and biomass) and large energy generating technologies. The latter can include renewable technologies such as wind-farms and hydropower, or conventional fossil fuel powered energy generation.

In this study, attention is given to:

- decentralised energy technologies which have the advantage of generating energy closer to the point of consumption in order to reduce transmission/distribution losses in the grid network; and
- the connection of the generating technologies (of all types) to local and national grids.

The baseline assumes a basic integration of generating technologies to a single grid within a building (i.e. household) or the larger national grid, incorporating local control functions. The distributed power generation scenario assumes that all generating technologies are connected to a national grid and are remotely controlled and optimised.

For example, households and businesses can connect to this 'smart' grid, choosing when to export, consume or store energy depending on the relative costs and benefits at any point in time. Similarly, decentralised technologies can be connected to this grid to supply local consumers with energy, thus reducing losses and improving efficiency. As decentralised technologies generally produce many times the energy produced by micro technologies, the costs and benefits are weighted accordingly with greater savings and costs attributable to larger technologies. The cost of making the required connection between the generating technology and the grid includes all the M&C devices necessary, including power switches, management tools and transponders.

6.2.2.2.4 Summary

This scenario is assumed to commence in 2012, with baseline trends followed prior to this point, for both smart meter and distributed power technologies. A start date of 2012-2015 is consistent the predictions of market maturity for most of the technologies required, presented in a ZVEI study on future automation technology[8].

[8] ZVEI (2008): **Integrated Technology Roadmap – Automation 2015+**, by the Institute for Futures Studies and Technology Assessment (IZT) for the German Electrical and Electronic Manufacturer's Association (ZVEI), June 2008

6.2.2.3 Scenario 3: Pervasive Networking

The networking scenario attempts to simulate the possibility of two or more technologies being connected together, physically (by cable), through communication (radio frequency communication) or functionality (plug-and-play and compatibility). Interconnection of this type is assumed to have the following advantages:

- improves the efficiency of the functions performed by the technology (e.g. through constant monitoring);
- permits technology to respond in real time to changes in inputs entered manually or communicated from the connected technology (e.g. sensors);
- improves comfort and convenience for the user;
- enable synergies in the costs and benefits of the technology to emerge, and
- creates new opportunities as new capabilities can emerge from the connection of technology.

The difficulty of this scenario is that it can apply to virtually all Monitoring & Control application markets, and without a clear definition of each interconnection product or solution in each market segment, a quantitative impact assessment is prohibitively difficult. Consequently, the approach taken in this scenario attempts to evaluate the impacts of networking between smart home and distributed power technologies as representative of a much broader range of impacts and technology that could be connected in other application markets. For example, in the security sector, video surveillance cameras already exist in many towns and cities across the EU. In addition, many households have access to computers or mobile devices, which can display real-time graphical information and communicate with various other technologies. In the case of mobile devices or radio frequency devices, the location of a specific device can be located utilising the surveillance technology. Networking can therefore provide the opportunity for mobile devices and surveillance technology to work together, allowing parents to track the location of their children, provide the latest travel information to travellers approaching a specific location, or allow law and order authorities to locate and track individuals at large scale events such as sporting events.

The Pervasive Networking scenario should therefore be interpreted as indicative of the potential impacts that could result across all M&C application sectors, not just in relation to energy saving technologies evaluated in this study.

Defining this scenario more clearly, it assumes that the simultaneous realisation of both smart home and distributed power technologies working together creates additional benefits for users and reduces the costs of each technology, therefore resulting in greater growth for the M&C sector in terms of hardware, software, and service provision. In other words, this scenario can be referred to as a positive externality of the previous two scenarios, not realised by the independent introduction of each technology with no capability to interconnect.

In a modification to the assumptions applied in the previous scenarios, it is assumed that both smart home and distributed power scenarios commence in

2010, therefore bringing forward the take-up of distributed power technology by two years from that assumed when the technology is independently introduced. The most significant difference is expected to emerge in the benefits realised by households and businesses from the simultaneous and connected introduction of smart appliances, smart meters and building management solutions. For example, smart appliances shall be able to choose when to consume energy (i.e. only when it is cheapest and during off-peak periods), thus benefiting users through smart metering and energy producers due to reduced peak load demand. Intelligent models for distributed energy are also assumed to emerge in order to optimise the generation and distribution of energy based on forecasts of weather conditions, economic activity, and the consumption profiles of specific countries/regions. Thus different power sources can be used at different times to optimise efficiency and energy saving benefits.

6.2.3 The Worst Case

6.2.3.1 Overview

The worst case is composed of two scenarios. The first is a global economic recession, affecting many segments of the M&C market as consumption and investment decreases in the face of rising prices, costs, and unemployment. The second scenario reflects a progressive divestment of industry and related sectors to non-EU countries. This demonstrates the potential for some M&C segments of the market to follow their future customer base to countries such as China in order to remain competitive.

Depending on the drivers of each market segment, each sector of the M&C industry could be affected in different ways and to different extents; therefore, it will be important to highlight those market sectors most vulnerable under these scenarios, as they may indicate where measures taken in the best case scenario are likely to yield the greatest benefit in terms of employment and other economic factors.

6.2.3.2 Global Economic Recession

This scenario assumes that negative global economic conditions with high inflation in prices, increasing unemployment and falling aggregate demand causing a contraction in the world economy for three consecutive years, with a further two years allowed for recovery of the economy back to the baseline. The impacts of this downturn are expected to be greatest in those M&C sectors where downstream uses are more responsive or susceptible to changing economic conditions. For example, reduced investment by businesses and lower consumer confidence within households is likely to result in a greater reduction orders for industrial M&C technology and consumer goods containing M&C embedded technology than in environmental and healthcare sectors, where regulation and an ageing population are often regarded as the key drivers, according to consultation. Consequently, this scenario assumes negative growth followed by a recovery period in the manufacturing, processing, building, vehicle, critical infrastructure, logistics, home, and household appliance sectors of the M&C industry. However, these negative impacts are assumed not to affect the

environment, healthcare, and power grid sectors significantly, as demand for M&C technologies is likely to remain high due to regulatory requirements, planned public sector investments and the demands of an older population in Europe. The screening exercise gives details of the impacts expected under this scenario (see Appendix 4).

6.2.3.3 Divestment of European Industry

This scenario represents a loss of around a third of the entire European M&C market, affecting all sectors of the M&C industry to differing degrees. This could manifest itself in a shift in demand for M&C solutions from EU suppliers to non-EU alternatives or the movement of EU companies outside the EU, or a combination of both possibilities. As in the previous scenario, those sectors more susceptible to economic drivers are assumed more adversely affected than sectors driven by other factors, which are likely to retain a certain level of domestic EU demand. The household appliance and vehicle sectors are the two largest markets for M&C technology at present. M&C technologies are also usually embedded in the final product in both of these markets, therefore it is important to realise in the baseline, that many such products are already manufactured outside the EU due to global supply chains and low cost manufacturing in some developing economies. Therefore, any industry divestment in either of these market segments could have a disproportionate impact in relation to the rest of the M&C sector. Potential impacts identified by stakeholders are presented in Appendix 4 (as part of the screening exercise).

6.2.4 Selection of Scenarios

With the optimum prospects for the M&C industry already identified in the best-case scenario, the focus of the study is on evaluating the wider social and economic impacts arising from this scenario. In addition, that the aim is to identify measures and policy recommendations that increase the possibility of this best case scenario being realised. The worst-case scenario described above is important for assessing the robustness of any recommendations proposed by this study. **However, a detailed quantification of the impacts relating to this worst-case scenario is outside the scope of the study. Thus, it has not been modelled in this study.**

6.2.5 Quantification of Impacts

6.2.5.1 Approach

The process undertaken above has already identified and screened the initial impacts by stakeholder group(s) and industry sector, followed by a detailed development of the scenarios to define their characteristics. The approach taken to perform a detailed quantification of the monetary impacts resulting from all scenarios involves:

- the development of a model to quantify, where possible, the monetary impacts attributable to key stakeholders, such as households and industry, resulting from each scenario;
- the calibration and validation of the assumptions to be applied in the model, using evidence collated by industry experts and consultation responses during the interview process; and
- the comparison of estimated scenario and baseline impacts in order to calculate net impacts, discounted to reflect the value of future impacts at present prices, including the Net Present Value (NPV) of each scenario for the complete period under assessment.

The first two elements of this approach are presented in this section, with the results of the analysis presented in the following chapter.

6.2.5.2 The Assessment Model

We are not aware of any previous assessment of the European M&C industry, let alone of its wider impacts on the European economy and society. Consequently, the amount of information available to conduct this assessment and validate assumptions has been limited in some cases and the analysis has had to rely partly on the expert opinions and 'guestimates' of interviewees and study team experts. The results should therefore not be interpreted as exact measures of specific impacts, but rather as a guide to magnitude of potential impacts resulting from each scenario. Below we summarise the structure of the model, including the key assumptions and data used. A comprehensive description of the model and its assumptions is presented in Appendix 5 to this study.

6.2.5.2.1 Population, Households and Enterprises

The model is constructed from population projections for the EU-27 taken from the Eurostat database for the years 2007, 2010, 2015 and 2020[9]. The average number of persons per household in the EU-27 is assumed to converge on the average household size in the EU-15[10] in order to calculate the number of households in Europe over this period. As a simplifying assumption, the number of enterprises in the EU was assumed equivalent to the number of business premises. The projected number of enterprises/businesses premises over the period 2007-2020 was calculated by applying the population growth rate generated previously.

9 Eurostat (2008): **Europe in Figures – Eurostat Yearbook 2008** and Eurostat Database, available at: http://ec.europa.eu/eurostat

10 EC (2008): **Demographic Trends, Socio-Economic Impacts and Policy Implications in the European Union – 2007**, Monitoring Report prepared by the European Observatory on the Social Situation – Demography Network for the European Commission (DG Employment) dated Feb. 2008.

6.2.5.2.2 *Households and Businesses*

Each scenario is developed from these population projections, using average price and consumption data for households and business to derive potential costs and benefits associated with each scenario. Costs include the expenditure required to purchase, install, and operate the relevant technology over the assessment period. They also represent the approximate value of the M&C sector under each scenario including hardware, software and service elements of the market. Benefits are defined as the impacts resulting from the above expenditure, which have a broadly positive result on stakeholders. In each scenario, the calculated benefits primarily focus on the energy savings possible through technology adoption for average households and businesses and for energy producers, in addition to related savings for users that emerge from the adoption of such technology, such as reduced insurance premiums. Base data and assumptions used to characterise household and business behaviour are presented in Table 70.

Table 70, Assumed Consumption Behaviour of Households and Businesses

Assumption	**Value**
Average Electricity Consumption per Household (kWh)**	4,344
Average Natural Gas Consumption per Household (GJ)*	83.70
Average Electricity Consumption per Business (kWh)*	112,500
Average Natural Gas Consumption per Business (GJ)*	41,680
Average Household Price for Electricity per kWh (€, excluding taxes)***	0.12
Average Household Price for Natural Gas per GJ (€, excluding taxes)***	11.68
Average Business Price for Electricity per kWh (€, excluding taxes)***	0.08
Average Business Price for Natural Gas per GJ (€, excluding taxes)***	8.89

*Sources: * Eurostat (2007): Energy Statistics 2007and JRC/IES (2006): **Electricity Consumption and Efficiency Trends in the Enlarged European Union;** ODYSSEE (2008): **Energy Efficiency Indicators in Europe**, available at: http://www.odyssee-indicators.org/; and *** Eurostat (2007a): **Consumers in Europe – Facts and Figures on Services of Interest**, 2007 Edition*

In order to ensure the robustness of the analysis, all the assumptions used to calibrate the model have been validated by experts on the project team and compared with industry association and European Commission published data where possible. Where significant differences in the values used have been reported, sensitivity analysis has been performed in Appendix 6.

6.2.5.3 Scenario 1: Smart Home

6.2.5.3.1 *Overview*

The scope of Smart Home take-up is assumed limited to energy using applications around the home, in areas of security, water and space heating, in addition to lighting and household and consumer appliances (e.g. fridges, freezers, stereo equipment, televisions, kettles and irons). From 2007 to 2009, the scenario is assumed to follow the baseline, before the uptake of home

automation systems are assumed to rapidly increase in the scenario from 2010 to 2020. Over the assessed period, the market penetration of smart home systems is assumed to increase from 0.02% of households to 2.1% of households in 2020 under the baseline, compared to the 5.5% market penetration achieved under the Smart Home scenario'[11].

6.2.5.3.2 Costs

A 'typical' home automation system is assumed to incorporate a centralised control system plus software, multiple remote controls, displays and terminals to automate an average four-bedroom house or equivalent apartment. A breakdown of individual component costs and the number of appliances assumed to be contained within this 'typical' home are presented in Table C5.5 of Appendix 5. These costs relate to the installation of an automation system in a new home. The installation costs are assumed to double in the case of older properties, in order to reflect the potentially higher costs of installing wiring, wireless communications, etc. A casual observation of current home automation systems placed on the market has identified that the costs are often well above 13,000€. However, experts have identified that many of the systems currently available are essentially composed of several different products sold as a package for a specific project, opposed to a standardised 'kit'. The experts have therefore proposed that present systems should be viewed as 'prototype' technologies. This study therefore assumes a value for a standardised system or 'kit' as the basis for the analysis (around €2,000 plus installation costs), shown in Table 71.

Table 71, Composition and Costs of a 'Typical' Home Automation System

Component (Number)	**Cost (€)**
Home automation system equipment cost	2,060
Installation costs	360
Total Cost	**€2,420**

Maintenance costs are assumed equivalent to 2% of installation costs, and are incurred annually for the entire life of a system. In addition, it is assumed that the 10 appliance connections (not including lighting) which generally require the appliance to be plugged in to a mains electrical supply must contain a smart device, in order to communicate with the automation system and monitor energy consumption during on/off and standby functions. According to consultation, the additional cost to the consumer of purchasing a 'smart' appliance over a standard appliance could be in the region of tens of euro in the future, should a mass market develop. In this analysis, large appliances (fridges, freezers, water heaters, washing machines etc.) are assumed to cost an extra €90 per appliance and small appliances (microwave, stereo, kettle, iron, etc.) €30 in 2007.

For technology still in its infancy in terms of market acceptance, such as home automation, it is common for the price to decrease over time, as the efficiencies of mass manufacture and supply reduce costs. In order to account for this factor in the analysis, a 5% reduction in the average cost of a system is assumed annually.

[11] See Appendix 4 for more details.

6.2.5.3.3 *Benefits*

The potential benefits of home automation, identified in the screening exercise, can be summarised as follows:

- **Insurance:** households with home and motor insurance are assumed to receive a discount of 5% on average premiums as automated homes reduce the risks of crime by improving building access security, controlling indoor and outdoor lighting plus other deterrents when householders may not be in residence. In addition, automation within the home allows greater communication between security products (e.g. alarms and cameras) to alert owners and law enforcement authorities of intruders and vehicle movements.

- **Reduced energy consumption:** significant energy savings are assumed to be possible for autonomous home users, as devices can be automatically switched on and off, avoiding the unintentional operation of appliances when not in use and reducing standby energy consumption. A reduction of 1% in energy consumption is assumed possible with just the introduction of home automation[12], as energy savings for the household must be net of the additional energy used to power motors, remote controls and other devices composing of the automation system. It is important to highlight that this is a household impact affecting only those households adopting the automation technology.

- **Indirect Benefits:** Other benefits associated with home automation could include the capability for devices to shift energy-consuming patterns between peak and off-peak periods of demand, where different tariffs are likely to be charged. This, in turn, could lead to a reduced peak demand giving savings on network capacity. Such savings of electricity (and generation capacity) would also lead to carbon savings. However, these benefits are relatively small - particularly when compared to the benefits associated with smart meters (even under the baseline scenario as discussed below) - and have not been included in the analysis.

- **Other benefits:** consumers are likely to incur a comfort and convenience benefit from home automation. However, such impacts are difficult to quantify and are therefore discussed in the results chapter of this study with other qualitative impacts.

6.2.5.4 *Scenario 2: Distributed Power (and Smart Meters)*

6.2.5.4.1 *Overview*

Distributed Power refers to technologies that enable smaller energy generating systems to be safely connected to a national or local grid network, in addition to smart metering of micro generation supplies and consumption of energy. Thus, two distinct technologies are included in this scenario, distributed energy and smart metering.

[12] It is accepted that there are claims of greater energy savings and these are discussed further in Appendix 5.

At present, the majority of electricity is generated by large facilities, often located a significant distance from users in order to benefit from economies of scale and maintain a clean and safe environment for populous areas. Electricity is then distributed via a national grid network, with associated distribution and transmission losses. Decentralised power provides the possibility of more local generation of energy. This could include relatively large technologies, such as wind or CHP[13], located next to populous regions or industrial sites producing several megawatts of energy. Furthermore, much small energy generating technologies could be adopted by households and small businesses (e.g. solar panels and wind turbines), producing only a few kilowatts of energy (micro-generation). In each case, M&C technology is required to permit the user to import energy from the national or local grid in times of high demand and to export or store surplus energy not immediately consumed. This must be achieved safely and ensure a consistent and reliable supply of energy. The voltage created in generation must therefore be transformed to the same voltage as that used on the grid, requiring Monitoring & Control technology.

In the case of smart metering, known and expected introductions of smart meters, in countries such as Italy[14], Sweden, the Netherlands and France[15], has been taken into account in setting the baseline. It has been assumed that smart meters would be installed for gas and electricity in homes and businesses to save energy and, potentially, to benefit from the micro-generation of energy by users. In order to encompass existing planned roll-out of smart meters, 65% of households and business are assumed to have one installed by 2020 in the baseline, increasing to 88% in the scenario both from an initial starting point of 10% in 2007 (See Appendix 5).

6.2.5.4.2 Costs

The costs associated with the introduction of smart meters across Europe are presented in Table 72 for electricity and gas. The Frontier (2007) study reports that the costs of smart meters have reduced substantially in recent years, a trend which is assumed to continue in the future. In order to maintain consistency with the previous scenario, a 5% decrease in smart meter purchase costs shall be assumed in the first 6 years of assumed roll-out in both the baseline and scenario.

[13] Combined Heat and Power

[14] Leonardo Energy (2006): **Smart Metering**, by Rob van Gerwen, Saskia Jaarsman and Rob Wilhite at KEMa, the Netherlands, for Leonardo-Energy, July 2006. Available at: http://leonardo-energy.org

[15] Metering (2008): **Consortium Appointed for Smart Metering Project in France**, Metering.com article, downloaded from http://www.prepayment.com/node/13046 , last accessed 04/08/2008

Table 72, Cost Assumptions for the Introduction of Smart Metering in Europe		
Costs	**Household (€)**	**Business (€)**
Electricity Meters		
Purchase Cost	90	310
Installation Cost	20	170
Maintenance Cost*	2.25	7.75
Communication Cost**	5	10
Gas Meters		
Purchase Cost	120	310
Installation Cost	20	170
Maintenance Cost*	3	7.75
Communication Cost**	5	10
Note: *Assumes Annual Maintenance Cost equal to 2.5% of meter purchase cost; **Annual costs *Source: Frontier (2007): Smart Metering – A Report Prepared For Centrica, by Frontier Economics, October 2007*		

In addition to the costs indicated above, utility companies would be required to make significant investments in infrastructure, to adapt current systems and modify operations such as billing and meter reading. The magnitude of these costs is difficult to determine, thus the estimates presented in the Frontier study will be applied, based on the assumption that they relate to UK gas and electricity costs (for 60 million inhabitants). These one-off implementation and system costs are presented in Net Present Value terms in Table 73.

Table 73, Assumed One-off Implementation and System Costs	
Net Present Value per 60 million inhabitants	€ 500 million (NPV)
Source: Frontier (2007): Smart Metering – A Report Prepared For Centrica, by Frontier Economics, October 2007	

The costs of connecting decentralised and micro generating power systems using M&C technology are presented in Table 74. In order to differentiate between technologies, the cost estimates differ for small (household and small business micro-generation) and large power technology (decentralised power) requiring connection to a power grid with intelligent capabilities.

Table 74, Assumed Costs of Distributed Power Systems		
Cost	**Small System(€)**	**Large System(€)**
Equipment Costs	2,000	4,000
Installation	500	1,000
Maintenance Cost*	50	100
*Note: * Assumed 2.5% of Equipment Costs per annum*		

The impact of distributed power adoption is assumed to be relative to the density of power generating equipment, as the closer users are to an energy source, the lower the transmission losses. In the analysis, the market penetration is therefore measured in terms of the number of small and large energy generating technologies installed per 100,000 inhabitants. Energy savings from reduced transmission and distribution losses can then be assumed to increase as the density of local energy generating technologies reaches pre-defined thresholds. The market penetration assumed in the baseline and scenario are presented in

Appendix 5, illustrating an increase in uptake from 40 micro-generation and 2 decentralised power generation technologies per 100,000 population to 1,000 micro-generation and 14 large power systems in the scenario compared to 250 and 8 units respectively in the baseline.

6.2.5.4.3 Benefits

The screening exercise (see Appendix 4) identified the benefits attributable to the decentralised power scenario as being similar to those for the smart home scenario, with the exception of insurance related benefits. Specifically, the identified benefits include:

- **Reduced energy consumption:** smart metering is assumed to result in energy savings of around 2% as the display of costs and potential benefits change behaviour. However, independent of home automation and changes to utilities billing, the potential benefits are assumed limited[12]. Again, this is a local impact on households and businesses consuming energy.

- **Reduced losses from transmission and distribution:** the closer energy generation is to consumers, the lower the losses of energy in the national or local grid are likely to be. The density of micro generation in the population is therefore used as an estimate of the proximity of consumers to energy producers. In the analysis, it is assumed that transmission and distribution losses could be reduced from 6.6% to 4.5% with extensive use of decentralised power generation. In order to weight the output of various technologies, and therefore the possibility to supply more users in a local area, large generators such as a wind turbines or hydro generators are assumed to represent the equivalent of 250 smaller energy generating technologies such as photovoltaic panels, CHP and household wind turbines. This impact is therefore largely global as reduced losses affect peak demand and the generating capacity required from producers and distributors.

- **Load shifting from peak to off-peak periods:** as consumers become more informed about the cost of their consumption and respond accordingly, they consequently reduce peak demand consumption with associated knock on impacts for energy producers as generating and network capacity can be reduced. However, as the technology is introduced independent of automation, the benefits for households are limited as consumption patterns will largely be unaffected, although the total consumption may decrease, causing a reduction in the peak load, assumed in this scenario to be equivalent to a 5% shift.

- **Avoided peak network capacity costs:** a reduction in the total quantity of energy consumed by households, or a shift in household consumption from peak to off-peak periods, is assumed to result in a related reduction in peak demand. Given that peak demand generally determines generating and network capacity (as opposed to total energy consumption), this will reduce future capacity requirements and costs. Assuming that existing capacity is a sunk cost, therefore, changes in consuming behaviour of households will not reduce this cost. However, since energy demand is growing over time, any reductions in peak demand in future years will reduce future capacity

expenditure by energy suppliers. Even if this were not the case, demand for new capacity would exist to replace existing capacity that has outlived its life and/or cannot meet new environmental standards. Table 75 presents the assumed savings in avoided system capacity costs per year for storage, transmission and distribution of energy, based on Frontier (2007). Avoided capital costs of generation are not included in the analysis, since these costs are ultimately reflected in energy prices. This simplification of the analysis only works where these reductions are factored into future prices, otherwise the benefits will be over estimated. In this analysis, energy prices are held constant from 2007 onwards despite generally increasing trends. In addition, if real prices are considered, a decrease in prices should be expected if prices are held constant as €1 today is worth less tomorrow, therefore through a combination of the above-mentioned factors, price reductions in energy are included in the model to a limited degree. Both network capacity and carbon saving impacts are assumed global in context as they benefit the energy generating/distribution sector and the environment as a whole.

Table 75, Avoided Peak Network Capacity Costs

Cost	Electricity €/kW/year	Gas €/kW/year
Storage	-	0.1
Transmission	25	0.2
Distribution	65	0.2
Total	**90**	**0.5**

Source: Frontier (2007): Smart Metering – A Report Prepared For Centrica, by Frontier Economics, October 2007

- **Reduced carbon emissions:** society is assumed to benefit further from reduced energy consumption and shifts in energy demand through the carbon savings that result. This is measured by the reduction in energy demand multiplied by the carbon emission factor of the marginal units of consumption, followed by the social cost of carbon which monetises the carbon benefit. Table 76 presents the carbon emission factors and carbon costs assumed in this analysis. At this stage, it is important to note that carbon emissions also affect the price of energy, as climate change levies and carbon trading both represent significant costs to energy generating enterprises. Consequently, calculation of carbon savings in the above manner would double-count some of the benefits. In order to avoid double counting, 50% of the cost of carbon emissions is subtracted from the calculated savings to account for the carbon cost pass-through in energy prices[16].

[16] Numerous studies of the initial stages of the EU ETS have estimated the level of carbon cost "pass-through" at between 40-70%, hence 50% represents a reasonable midpoint. For example, see " **CO_2 dynamics – A follow-up analysis of the implications of EU emissions trading for the price of electricity**" by Sijm, J.P.M.; Donkelaar, M; Hers, J.S.; Scheepers, M.J.; Chen, Y. (2006), ECN Policy Studies, ECN-C-06-015.

Table 76, Conversion Factors for Carbon Assessment		
Conversion Factors	**Electricity**	**Gas**
Emission factor (tCO_2/MWh)*	0.64	0.19
Price of CO_2 (€/tCO_2)**	€32	
* *ODYSSEE (2008): Energy Efficiency Indicators in Europe, available at: http://www.odyssee-indicators.org/*		
** Based upon the Frontier (2007) estimates, converted to 2007 euro prices at £1 = €1.25		

- **Other benefits** include reduced meter reading costs and reduced crime in terms of the quantity of energy consumed illegally from the national grid. With limited availability of data, it has not been possible to quantify these and other benefits identified in the screening exercise.

6.2.5.5 Scenario 3: Pervasive Networking

The networking scenario could have a number of impacts that change the assumptions of the previous two scenarios, enabling the realisation of many more benefits and potentially generating greater market value for the M&C sector. Each impact is assumed to commence in 2010:

- **Energy savings:** with technology interconnection established, information gathered on consumption and costs presented on visual displays or on a computer screen used to control appliances around the home, induced reductions in consumption should be maximised. This is because the technology is working together and offers an improved ease of use to the household, through displays and computer programs that could be connected to mobile devices, etc. Energy savings are therefore assumed to increase from 1% to 3% for home automation and from 2% to 3% for smart meter technologies.

- **Shifts in peak demand:** combining technologies is likely to emerge from shifts in energy consumption from peak to off-peak periods, or between different suppliers of energy at specific points in time. This is only possible through interconnection as the information relayed and collected by smart meters can be used by home automation systems to maximise efficiency and minimise the costs of energy consumed by each household. Therefore, under this scenario the household as well as the energy provider benefits from this development. Reductions in peak demand are therefore assumed to increase from 5% to 15% in this scenario (as of 2010). It is also important to highlight in this scenario, that many households and businesses may choose to only generate energy and supply it to the national/local grid in peak demand periods, therefore maximising the price they receive for the energy generated, while using conventional energy in off-peak periods. Alternatively, conventionally generated power may only be consumed in peak periods for some generators/consumers of energy. In both cases, the shifts in energy consuming patterns and subsequent changes in peak demand are likely to be a magnitude greater than in previous scenarios.

- **Mass-market acceptance:** commencing in 2010 and assuming an increased awareness of the benefits of both technologies, the decentralised energy scenario is assumed to commence two years earlier, bringing forward the uptake of the technology. In response, it is assumed that cost savings are

also increased from 5% per annum in the first scenarios to 7.5% per annum to reflect economies of scale in production, installation and maintenance.

- **New opportunities:** it is possible for new opportunities, in terms of the application of current technology or the development of new technology, to emerge from this scenario. For example, the connection of a mobile device to automation systems so that the user can be alerted to security problems or program heating and other appliances to be switched on prior to the user arriving home. This could generate a plethora of new services and opportunities from the initial interconnection of technology in the home. However, without specification of exact opportunities arising in this example and the qualitative nature of many such impacts, it has not been possible to provide a quantification of these impacts.

- **Administrative and meter reading costs:** without the interconnection of technology, smart meters and other devices are likely to require manual checking and reading, plus paper billing and recording activities to be performed by the household or utilities supplier. Remote reading and paperless billing possible through interconnection could therefore reduce administrative and reading costs for both parties.

6.3 Economic and Social Impacts: results and main findings

6.3.1 Overview

This chapter presents the results of the modelling approach taken in this study to quantify the potential monetised impacts associated with the best-case scenario. All quantifiable impacts generated by the model are presented as discounted Net Present Values (NPV) of the scenario. Discounted figures value future impacts at today's prices, therefore accounting for differences in the value of the Euro at different points in time. A 4% discount rate has been used throughout the analysis, as recommended in the Commission's impact assessment guidelines[17]. The NPV of impacts associated with each scenario values the total impact of that scenario over the entire period being assessed (2007-2020), net of any baseline.

6.3.2 Estimated Impacts

Due to the nature of the analysis, the results are highly dependant on the assumptions made and therefore the uncertainties surrounding them. For example, use of average household consumption figures is likely to overestimate the costs and benefits for some households, while underestimating for many others. This difference is likely to be more striking across different regions of the EU, as consumer behaviour, consumption, prices and access to supporting technology such as information technology are likely to vary considerably.

[17] EC (2005): **Impact Assessment Guidelines with March 2006 Update**, SEC(2005)791, 15/06/2005 available at: http://ec.europa.eu/governance/impact/docs/key_docs/sec_2005_0791_en.pdf

Consequently, any results should be compared in context. The impacts predicted by the model are presented in Table 77.

Table 77, Summary of Net Present Value Costs (€m) and Benefits by Scenario

	Baseline	Scenario 1: Smart Home	Scenario 2: Distributed Power	Scenario 3: Networking, Monitoring and Sensing
Costs (2007-2020, €m)				
Smart home automation	5,557	14,453	5,557	15,950
Appliance costs	1,097	2,861	1,097	3,736
Smart meters	34,207	34,207	46,639	52,266
Distributed energy	2,263	2,263	9,282	13,696
Total Costs	**43,123**	**53,784**	**62,575**	**85,648**
Benefits (2007-2020, €m)				
Insurance savings (automation)	584	1,480	584	1,874
Energy savings (appliances)	170	435	170	1,019
Energy savings (smart meters)	26,971	26,971	33,889	63,580
Capacity cost savings (smart meters)	3,305	3,305	4,151	13,173
Cost savings (distributed energy)	1,984	1,984	3,020	3,814
Associated carbon savings	6,081	6,081	8,165	18,841
Total Benefits	**39,095**	**40,257**	**49,979**	**102,302**
Benefits -Costs	**-€4,028m**	**-€13,527m**	**-€12,596m**	**€16,653m**

In order to access the robustness of these results and therefore to account for uncertainty, sensitivity analysis has been performed in Appendix 6.

Since the baseline accounts for much of the costs and benefits associated with each scenario, Table 78 presents a summary of values relative to those for the baseline.

Table 78, Summary of Net Present Value Costs (€m) and Benefits by Scenario (relative to the Baseline)

	Scenario 1: Smart Home	Scenario 2: Distributed Power	Scenario 3: Networking, Monitoring and Sensing
Costs (2007-2020, €m)			
Smart home automation	8,895	0	10,393
Appliance costs	1,765	0	2,640
Smart meters	0	12,432	18,059
Distributed energy	0	7,019	11,433
Total Costs	**10,660**	**19,451**	**42,230**
Benefits (2007-2020, €m)			
Insurance savings (automation)	897	0	1,291
Energy savings (appliances)	265	0	849
Energy savings (smart meters)	0	6,918	36,608
Capacity cost savings (smart meters)	0	846	9,868
Cost savings (distributed energy)	0	1,036	1,830
Associated carbon savings	0	2,084	12,760
Total Benefits	**1,162**	**10,884**	**63,206**
Benefits -Costs	**-€9,498m**	**-€8,568m**	**20,976**

The implications of the above results and any qualitative impacts are now discussed scenario by scenario.

6.3.3 Scenario 1: Smart Home

6.3.3.1 Monetary Impacts

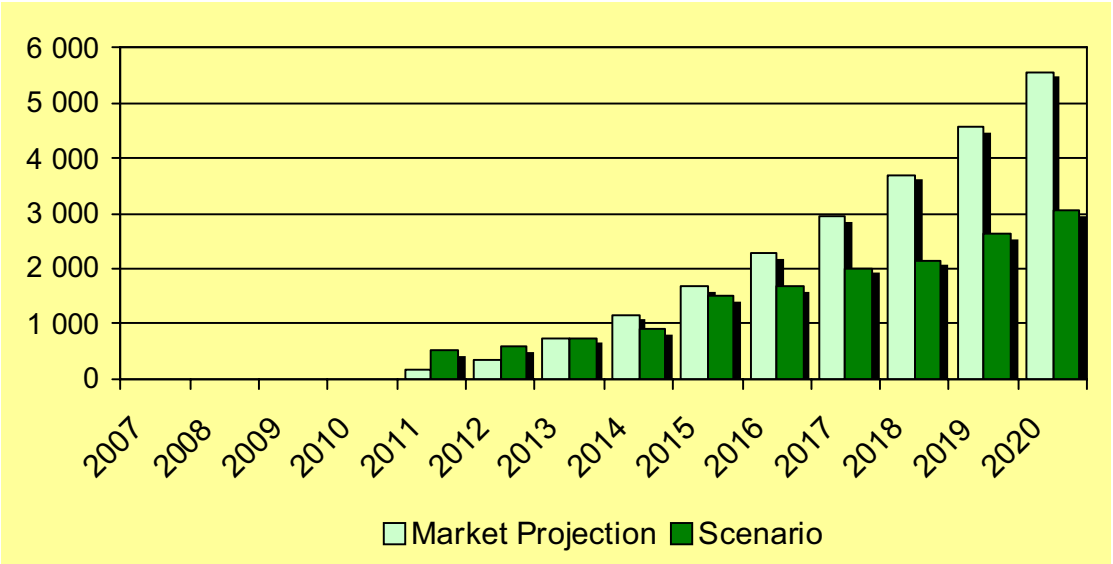
The results in Table 79 indicate that the Smart Home scenario generates an additional market worth over €10 billion above the baseline during the 2007-2020 period. However, as discussed in the previous chapter, home automation technology is unable to achieve its full potential without other technologies, such as smart metering. In this scenario, where the technologies are introduced independently of each other, this results in a net cost to users of nearly €10 billion. Such investment should be regarded as highly inefficient and irrational on the part of the investor. As a result, it is not surprising that the take up of home automation technology is low and is likely to continue to be low without some kind of subsidy to encourage consumption by households. Examples of a subsidy might include grants to households (in the region of half the purchase cost in this example) or public procurement of systems for low socio-economic groups.

Table 79, Net Present Value (NPV) of Smart Home 2007-2020			
	Baseline	**Smart Home**	**Net of Baseline**
Costs (2007-2020, €m)			
Home Automation System	5,557	14,453	8,895
Smart Appliance	1,097	2,861	1,765
Total Cost	**6,654**	**17,314**	**10,660**
Benefits (2007-2020, €m)			
Insurance Saving	584	1,480	897
Energy Saving	170	435	265
Total Benefits	**754**	**1,915**	**1,165**
Benefits-Costs	***-€5,900m***	***-€15,399m***	***-€9,498m***

The sensitivity analysis presented in Appendix 6 illustrates that even with 15% energy savings associated with home automation; the costs still substantially exceed the benefits. This suggests that the cost of such systems must fall substantially for household adoption to accelerate.

The realisation of this scenario is also likely to increase householder's familiarity with new technology and awareness of future technology trends specifically in the field of Monitoring & Control. Similarly, the uptake of automation systems for the home is likely to generate a market for add-on software, communications, system upgrade and accessory products leading to a market value above that estimated in this scenario. However, this associated market is accounted for in the projected market value estimated in earlier tasks, presented with the scenario estimate in Figure 62.

Figure 62, Scenario and Estimated Market Projection for Smart Home



6.3.3.2 Qualitative Impacts

Sustainability

The screening exercise (see Table 79 and Appendix 4) identified the Smart Home scenario as having a negative impact on long-term sustainability of the M&C and related industries. The results indicate that the costs of take up are likely to be higher than the benefits without a subsidy like a grant (itself a short term measure), therefore repeat consumption of the technology is predicted to be low, thus influencing sustainability in a negative manner.

Competition and Competitiveness

Where demand for home automation exists in non-EU countries, the smart home may have a positive impact on trade, competitiveness and inward investment, if the expertise developed in the EU and first-mover advantage generated by the accelerated adoption leads to competitive advantage, which could include the development of a positive reputation for EU providers. Non-EU consumers may then be more inclined to purchase EU equipment and services, in addition to investing in the enterprises involved in M&C related sectors. Hence, a positive impact has been identified in terms of competitiveness. In terms of competition, an expanding market is likely to attract new entrants, therefore intensifying rivalry both inside and outside the EU. This could be a critical driver in reducing system costs and thus increasing take-up in the future.

Operating Costs and Business Conduct

Increased uptake of home automation technology should result in significant economies of scale emerging in production, thus reducing costs as factored into the assessment model. However, as commercial buildings are currently the largest users of home automation systems, it is likely that present business strategies might have to change in order to meet the demands of a new customer base, which would include DIY[18] consumers, professional users and architects. For example, establishing retail distribution and sales channels, including the internet may be important to maximise uptake and awareness. No significant impacts are expected regarding administrative costs for any stakeholders.

Employment

Employment related to the provision of home automation systems (including M&C technology) is likely to increase with the size of the market. However, as many components may be manufactured outside the EU, employment at the manufacturing supply chain is likely to increase less than proportionally with the size of the market. In contrast, employment in services such as home designing, technology consulting, system maintenance and installation would be expected

[18] Do-It-Yourself refers to households who choose to undertake home repairs, maintenance and improvement themselves in preference to employing a professional.

to increase more than proportionally with technology take-up as new opportunities and services emerge, as demonstrated previously in Figure 3.1.

Household

In addition to energy and insurance savings mentioned previously, households are likely to benefit from the comfort and convenience that home automation offers, making everyday tasks less time consuming and more pleasurable. Despite this largely unquantifiable benefit, households may also encounter some disadvantages, such as the health implications of performing fewer manual tasks. Reduced energy consumption assumed in this scenario should also lead to benefits for the environment if fewer resources are utilised in the generation and distribution of energy. Households may therefore also gain unquantifiable benefits in relation to the well-being they may experience when reducing energy consumption and helping the environment.

Social Impacts

The existence of home automation systems connected to security devices such as cameras, lighting and entry controllers could have a positive impact on crime where the concentration of such systems is high in a specific geographical location (e.g. housing estate). However, with the cost of systems so high, the likelihood is that these systems will be heavily distributed in areas populated by high socio-economic groups in new buildings equipped for such systems. The impact on crime and security may therefore be limited in such cases, with crime actually increasing in poorer regions. Similarly, the energy savings of home automation are more likely to affect higher socio-economic groups than poor ones, creating potential technological poverty where advances in electronics and buildings cannot be accessed by poorer groups in society. Added to this, some homeowners of older properties may find automation disproportionately costly, again limiting the benefits to a certain proportion of society. Energy security related benefits are expected to be insignificant in this scenario as the shift in peak demand assumed under this scenario is unlikely to affect the energy mix of the EU.

6.3.4 Scenario 2: Distributed Power

6.3.4.1 Monetary Impacts

The introduction of the European Electricity and Gas Directives[19] and other initiatives by the European Commission[20] are important in relation to the establishment of a competitive market with expected benefits of nearly €1.9 billion in the baseline scenario.

Although many Member States are considering the compulsory introduction of smart meters[21], the model results indicate an expected net disadvantage of over

19 See European Directives **2003/54/EC** and **2003/55/EC** respectively

20 See EC (2007): **COM(2007)001**: Communication from the Commission to the European Council and European Parliament – **An Energy Policy for Europe**, SEC(2007) 12 of 10/1/2007

21 Studies currently ongoing in France, Denmark, Norway and Britain, with many smart meters

€8.5 billion from the introduction of additional smart meters and distributed electricity generation.

Without the possibility to switch between energy providers at low cost, requiring dynamic pricing and billing of energy as well as allowing more renewable energy to be placed on the market, the additional potential benefits of this scenario would be difficult to achieve. A European Industry expert group[22] concluded that the speeding up of energy market liberalisation should be a key objective of the European Commission, as without implementation across all Member States, this represents a key barrier to the growth of decentralised energy.

Table 80, Net Present Value (NPV) of Distributed Power 2007-2020

	Baseline	Distributed Power	Net of Baseline
Costs (2007-2020, €m)			
Smart Meters	34,207	46,639	12,432
Decentralised Energy	2,263	9.282	7,019
Total Cost	**36,469**	**55,920**	**19,451**
Benefits (2007-2020, €m)			
Energy Saving	26,971	33,889	6,918
Capacity Cost Saving	5,289	7,171	1,882
Carbon Saving	6,081	8,165	2,084
Total Benefits	**38,341**	**49,225**	**10,884**
Benefits-Costs	***€1,872m***	***-€6,695m***	***-€8,568m***

The avoided network capital costs in this scenario amount to around €2 billion from smart meters and transmission savings from decentralised power, leading to additional carbon savings of over €2 billion. The benefits result largely from reductions in energy consumption and shifts in peak energy demand, influencing the energy generating and network capacity required in each Member State. By actually reducing future energy demand and therefore energy generation capacity, this scenario could assist the EU and its Member States to achieve their greenhouse gas emission targets by 2020[23]. Achievement of these targets will also help reduce air and water pollution, in addition to improving energy security. The impacts of distributed power on the energy mix and energy dependency could be significant if shortages of energy in the EU economy are considered, which could have an impact valued at many billions of euros if transport infrastructure, industry and households were to experience power shortages for a noticeable period. The benefits of improved security must therefore be substantial in this example. However, energy savings are not maximised in this scenario, increasing the potential that exists if the technology were interconnected. Therefore, it seems unlikely given the number of other

already installed in the Netherlands and Italy (included in model baseline).

22 Cogen(2007): Joint Letter to the European Energy Regulators and the European Commission – **Addressing the Issues of Barriers to Decentralised Generation**, Friday, 29th June 2007

23 See EC(2007a): COM(2007)2: Communication from the Commission to the Council and the European Parliament – **Limiting Climate Change to 2C: Policy for the EU and the World for 2020 and beyond** of 10/01/2007

factors involved in determining energy security that the results of this scenario would have a substantial impact on security if the risks are also considered.

The costs are likely to be borne by the energy utilities, which may pass any costs on to consumers. However, utilities may be able to generate significant economies of scale in rollout where households are highly concentrated (i.e. urban areas). In addition, utilities are likely to have the finance available to make this scenario a reality[24] making them best placed to introduce the technology at the lowest possible cost. A significant market (€2.5 billion) is also anticipated for GSM and other communication providers to develop the network capacity necessary to accommodate smart metering. Impacts on non-energy markets could therefore be significant in terms of energy savings and the provision of services (e.g. maintenance, installation, and communication). Greater acceptance and awareness of technology more generally may also encourage households and business to adopt more technology in other Monitoring & Control market sectors. For example, ESMIG[25] identifies smart metering as a catalyst for technology advances in smart housing and home communication, with associated influences in the technical development of communication infrastructure, communication protocols, and appliance management systems. This partially explains the difference in the market value generated by this scenario and the market projection estimated earlier, presented in Figure 63.

Figure 63, Scenario and Estimated Market Projection for Distributed Power

[24] See the Cost Benefit Assessment of various roll-out scenarios in: Frontier (2007): **Smart Metering** – A Report Prepared For Centrica, by Frontier Economics, October 2007 and in the UK governments own impact assessment at: http://www.defra.gov.uk

[25] ESMIG (2008): **The Potential of Smart Metering**, downloaded from the European Smart Metering Industry Groups (ESMIG) webpage, last accessed 10/10208, available at: http://www.esmig.eu/smart-metering/potential

6.3.4.2 Qualitative Impacts

Sustainability

In contrast to the previous scenario, increasing energy prices and regulations on energy efficiency, generation and distribution are likely to maintain a strong long-term demand for distributed energy technologies. Added to this, the relative long life for many systems (15 years or more) should also maintain a sustainable industry in the maintenance and operation of these technologies.

Competition and Competitiveness

With energy prices increasing worldwide, including a global desire to reduce CO_2 and environmental impacts emerging[26], demand for energy saving technologies such as distributed power and smart metering should increase outside of the EU. Consequently, by introducing the technology early, European industry should gain a first mover advantage in the technology and gain valuable experience, creating significant export potential and increased competitiveness. Consistent with the previous scenario, a growing market with rivals located outside the EU should also increase competition.

Operating Costs and Business Conduct

If energy savings in consumption and shifts in peak demand reduce energy prices, many high-energy using industries are likely to benefit from lower energy and carbon costs, particularly if companies have to purchase carbon credits through the EU Emissions Trading Scheme (ETS). As a result, industry sectors consuming large amounts of energy should become more competitive against non-EU rivals. Other costs such as administrative costs in recording consumption and in the reading of meters should also decrease with smart meters for utilities, leading to estimates of 25-50% reduction in technical and non-technical energy losses as fraud is prevented and faults detected[27]. However, this impact is likely to vary considerably by Member State as OFGEM in the UK estimates a 25% reduction in theft and a 1% reduction technical losses[28].The ability of utilities to identify theft from a network or outages in the system could also reduce maintenance times and costs to users as well as utility companies.

Employment

The impact on employment is difficult to assess in this scenario as many staff involved in the manual checking of meters or who administer the billing of customers may no longer be required in the same numbers as before, due to smart meters. On the other hand, new employment opportunities may exist in

26 For example, see the Kyoto Protocol and G8 commitments on CO_2 reduction

27 DONG Energy (Denmark) reports 25%-50% reduction in non-delivered energy and CRE (France) reports 50% in non-technical losses in EC (2008): **ICT for Smart Distribution Networks – Summary Report**, European Commission Consultation May-September 2008.

28 Ofgem (2006): **Domestic Innovative Metering**, Ofgem's high-level cost benefit analysis – supporting documentation

the servicing of the smart meters and in the maintenance of distributed energy technologies, particularly in the servicing and maintenance of micro-generation in the household and small business market. The net impact on employment is therefore difficult to estimate without better information on the operation of the various technologies to be adopted. In either case, re-training of staff in utility and service companies will be required in order to gain familiarity with the new technology.

Household

Households, like business users of energy are likely to benefit from lower energy prices where peak demand and generating capacity can be reduced. Similarly, micro and decentralised energy provides opportunities for further savings and improves energy security for the household should a failure of a grid network occur. However, significant administrative costs in dealing with planning regulations for micro-generation, and form filling to connect with the grid or comply with environmental, health and safety regulations may exist. Therefore, if households are to adopt micro-generation and connect to decentralised M&C technology, strong incentives and guidance must be provided to minimise additional costs, particularly when planning legislation can delay distributed power adoption for long time periods, involving much administration.

Social

Cheaper energy and better energy security are both positive impacts on society. However, the impacts may create issues of equity as some countries and groups are better positioned to benefit from the technology than other groups. For example, the UK and its coastline benefits from high winds, high precipitation and strong seas, therefore enabling the UK to benefit from wind, wave and hydro generating technologies to a greater extent than some other European countries. Similarly, the average wealth of EU-15 households relative to the rest of the EU-27 as a generalisation also provides an advantage in the affordability of new technologies. Other regions of the EU may be less fortunate, with only solar technologies being technically and economically feasible, increasing energy dependence on a single technology that may only have seasonal efficiency. Consequently, some regions are likely to benefit to a greater extent than others from distributed power.

6.3.5 Scenario 3: Pervasive Networking

The simultaneous introduction of the previous scenarios and an assumed compatibility between technologies should, as discussed in the preceding chapter, generate a positive externality. Therefore, increased benefits should be achievable with a relatively small increase in costs, as these will already have been incurred by stakeholders under the previous scenarios (if market penetration is assumed the same in each scenario). However, this scenario does bring forward the introduction of the distributed energy and smart metering from 2012 to 2010. Therefore, a cost is incurred to introduce the technology ‘earlier’ than anticipated and from increased market penetration as potential users realise the benefits achievable from the technology.

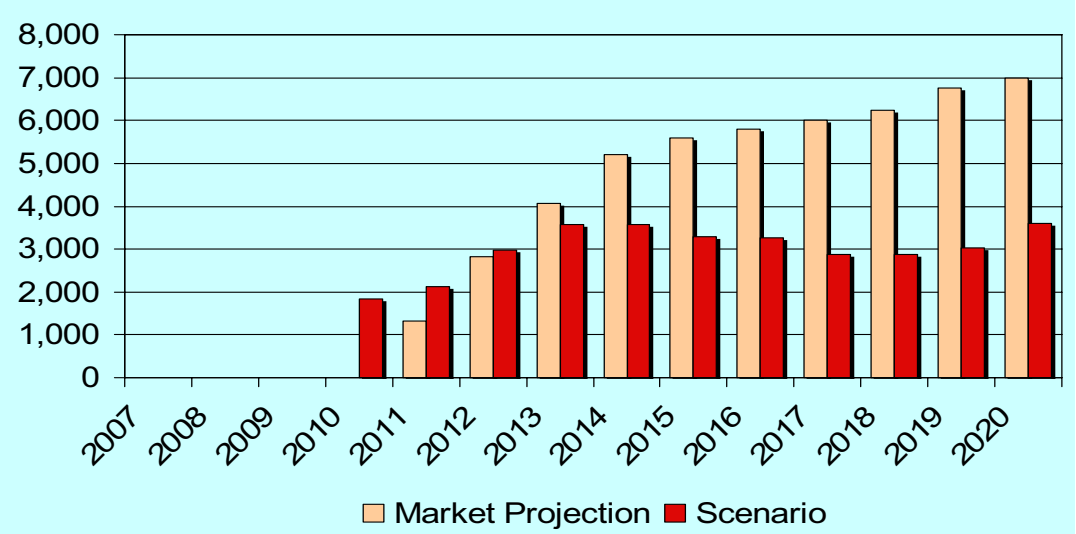
The additional cost of this scenario is estimated at around €10 billion, above the independent introduction of the previous two scenarios (approximately €30 billion) resulting in net benefits of nearly €20 billion, compared to a net cost of around €20 billion without networking of the two technologies. Consequently, the net payback (net benefit) is significantly increased, particularly for home automation, as households now benefit from more significant energy savings and lower purchasing costs, as the mass market for home automation develops.

Table 81, Net Present Value (NPV) of Networking 2007-2020

	Baseline	**Networking**	**Net of Baseline**
Costs (2007-2020, €m)			
Smart Home	6,654	19,686	13,032
Distributed Power	36,469	65,962	29,197
Total Cost	**43,123**	**85,648**	**42,230**
Benefits (2007-2020, €m)			
Insurance	584	1,874	1,290
Energy Saving	27,141	64,599	37,458
Capacity Cost Saving	5,289	16,987	11,698
Carbon Saving	6,081	18,841	12,760
Total Benefits	**39,095**	**102,301**	**63,206**
Benefits-Costs	***-€4,028m***	***€16,653m***	***€20,976m***

This scenario demonstrates that through networking, the benefits of M&C technology can be increased disproportionately to costs as new opportunities or capabilities emerge from the two or more technologies being integrated or networked together. Although this study has focussed on the example of energy saving technology, consultation responses have revealed that interconnection can achieve similar results in other M&C market segments. A brief impact assessment of Pervasive Networking in other segments of the M&C market are summarised below, based on the results and evidence of this cost benefit analysis and the views of stakeholders expressed in consultation. Figure 64 presents the estimated market projection of Pervasive Networking against the networking market associated with just smart home and power technology.

Figure 64, Scenario and Estimated Market Projection for Pervasive Networking



Finally, the qualitative impacts of this scenario are essentially a combination of those set our for the Smart Homes and Decentralised Power scenarios.

6.3.5.1 *Environment and Transport*

The environment represents one field in which the networking of communication devices, sensors, monitoring systems and control technology can work together with potential synergies occurring in costs and benefits. For example, the information gathered on town or city air quality using remote sensors can be relayed to traffic control authorities in real time utilising radio frequency technology. Road pricing and transport systems can then be networked to air or traffic monitoring systems in order to control traffic volumes and limit pollution within urban areas, maintaining air quality, reducing congestion and achieving a more efficient use of transport systems. The networking of environmental and transport systems and devices (e.g. sensors and monitoring equipment) in this example therefore improves the potential of traffic and environmental systems to achieve greater benefits at lower cost, therefore optimising the efficiency of each technology, compared to a situation where each may have been introduced independently.

The potential of smart transport systems applied in this manner has been identified by the Smart 2020 report highlighting the global carbon saving potential of ICT, estimating that transport optimisation through traffic flow, monitoring and planning could result in savings of 0.6 Gigatonnes of carbon equivalent by 2020[29]. The magnitude of potential impacts in the EU can therefore be expected to be significant. A brief impact analysis of is example is provided in Table 82.

29 GeSI (2008): **Smart 2020 – Enabling the Low Carbon Economy in the Informational Age**, report by the Climate Group and Global eSustainability Initiative (GeSI).

Table 82, Networking – Environment and Transport Technology Impact Assessment	
Impact Category	**Potential Impacts Expected**
Operating Costs of Business	For those stakeholders implementing a Monitoring & Control system, a networked system combining the various technologies and formats in one computer system opposed to many independent systems should create significant synergies, reducing implementation and running costs. For businesses involved in the transport of goods and employers travelling to work in from a wide catchment area, improved traffic efficiency and less congestion should reduce journey times and business transport costs. In turn, this could be expected to result in greater productivity if the time saved is used in productive activities and in the improved health of employees (e.g. through less stress).
Competitiveness and Trade	Any first mover advantage or expertise gained by EU Monitoring & Control or application providers should generate more opportunities in emerging overseas markets also suffering from air pollution and congestion problems, increasing trade and the competitiveness of EU industry if reduced transport costs leads to lower cost production.
Competition and Internal Market	As a market such as this grows and new entrants emerge, this can only increase competition both within and outside the EU.
Innovation and Research	Could encourage the development of other smart and environment/transport related technologies such as real-time road pricing or the use of smart cards on transport networks for other uses (e.g. Oyster smart card technology in the UK now used to purchase goods and services through contact less payment systems).
Employment	Employment should be expected to increase as businesses become more productive and technicians are required to maintain, service and operate these systems.
Environment and Energy	Shorter journey times and reduced congestion should generate a significant benefit s in terms of improved air quality, reduced fuel consumption and therefore carbon emissions.
Social	Social impacts on human health from better air quality, less stress in making journeys and employment could be significant.
Sustainability	Expected to be highly sustainable as the global urban population increases and transport costs increase due to congestion and rising fuel prices.

6.3.5.2 Manufacturing and Logistics

The Smart 2020 study, ZVEI study and consultation responses all demonstrate the potential of smart industry automation and logistics as key M&C user applications that could benefit from networking. Greater networking of supply chains and manufacturing processes with the original equipment manufacturer (OEM), so that production can be better synchronised across different countries and regions while maintaining quality is one such application of networking open to manufacturers often part of a complex global supply chain. Networked automated systems or 'advanced process control' could include self configuration, self maintenance and self connectivity[30] technology responding to changes in the production process, the installation of new capital equipment or the current production batch to improve turn around times and efficiency, resulting in lower costs.

30 See Alkis (2007): **R&D Opportunities for ICT 3.4-3.6**, presentation given by Valentijn de Leeuw, 17/12/2007.

Table 83, Networking – Manufacturing and Logistics Technology Impact Assessment	
Impact Category	**Potential Impacts Expected**
Operating Costs of Business	Networking of supply chains to improve efficiency and quality of manufacturing and logistics activities should help reduce costs for those businesses applying such systems and those relying on reliable and efficient supplies of goods and services (e.g. SME craft industries reliant on next-day delivery to customers).
Competitiveness and Trade	More efficiently functioning supply chains and lower costs that result should increase the competitiveness of many EU industries, as well as generate many export opportunities for M&C providers and associated businesses. Important to realise the knock on impacts of this technology, as once one business achieves many of the impacts giving competitive advantages, others will need to follow to remain competitive.
Competition and Internal Market	Competition might be expected to intensify in terms of reliability, quality and price as the first businesses to adopt the technology gain competitive advantages in costs, etc.
Innovation and Research	Once the benefits of networking have been achieved, users are likely to demand further innovations in the technology that generate further benefits to gain a competitive advantage over rivals in terms of cost, quality, reputation, reliability, etc.
Employment and Macroeconomy	Increased automation could result in the loss of employment in labour intensive sectors; however, the networking of existing automation technology should increase the efficiency of existing systems and not the employment levels, considering that new employment opportunities may emerge from improved business performance.
Environment and Energy	By improving resource efficiency through the networking of two existing technologies, energy savings and knock on reductions in carbon emissions should be expected.
Social	No significant impacts expected EU wide, although regional impacts could be significant if automation increases unemployment in labour intensive sectors
Sustainability	Intensive competition within the EU and globally is likely to driver further developments in manufacturing and logistics automation, thus sustainability should be high.

6.3.5.3 Healthcare

Consultation suggests that, in the future, more people may receive medical aftercare at home as opposed to in a dedicated healthcare environment (e.g. hospital). This is assumed possible by integrating heart rate monitors, household cameras, and emergency switches to communication devices. In turn, these devices can alert healthcare professionals of potential difficulties or enable relatives to monitor other family members in case of a fall within the home or other such accident. Pervasive Networking technology is therefore deemed essential in this example, as without it, mobile communication devices (e.g. mobile phones or personal alarms) may not be compatible or providers may not realise the potential opportunities and the costs of establishing a patient or home network would be disproportionate to any benefit. Networking could therefore lead to a number of impacts, otherwise unobtainable through independent technology adoption as summarised in Table 84.

Table 84, Networking – Healthcare Technology Impact Assessment

Impact Category	Potential Impacts Expected
Operating Costs of Business	For healthcare systems adopting the technology against a background of an ever increasing aging population in Europe, the cost savings for Member State and private sector healthcare budgets could be substantial, if less hospital capacity and dedicated healthcare professionals are required in the future, as advice could be dispensed by home visiting healthcare professionals and local or online healthcare centres.
Competitiveness and Trade	With a largest private healthcare system in the US and developing systems in the emerging economies, the opportunities for EU solution providers of this technology and expertise in its application, the trade benefits could highly significant.
Competition and Internal Market	Likely to intensify as the market for such systems expands and new rivals emerge.
Innovation and Research	Innovation of add-on systems such as the services available on the mobile devices of relatives or self monitoring equipment where results can be sent through the internet or other communication networks to healthcare professionals are likely to develop as new opportunities emerge and costs fall.
Employment and Macroeconomy	Employment likely to be generated in the EU, particularly in relation to services, as manufacturing of the necessary equipment likely to be global in scale and scope.
Environment and Energy	No significant impacts expected.
Social	Improved human health, plus the convenience and comfort of being treated at home opposed to a hospital is likely to be a significant benefit. In addition, relatives may also gain from having better communication with family members and healthcare professionals. However, the cost of these systems is likely to ensure that the greatest benefits are experienced by higher income groups and more developed economies with large pubic and/or private healthcare budgets.
Sustainability	Likely to be highly sustainable given the aging population of the EU and the size of non-EU healthcare markets.

6.4 Conclusions

In conclusion, the results of this assessment indicate that in order for the M&C sector to achieve its full potential, it must first be demand driven so that the technology placed on the market satisfies an identifiable need for users. For example, in the past, intelligent fridges have been developed, but they were not demanded by consumers.

Secondly, this study and the intelligent fridge example demonstrates that the technology must be economically viable before a mass market can be expected to develop, as few if any technical barriers could be identified in this study. After all, few users are likely to invest in a technology if the expected benefits are unlikely to exceed the expected costs of purchase, installation, operation and eventual disposal of the technology over its lifecycle.

Thirdly, the introduction of technology in isolation to other technologies and needs can result in different standards and communication protocols emerging, in many cases without solution providers and users realising their common objectives and combined potential of the technology, resulting in less than

optimal benefits. In the case of smart home and distributed power modelled in our analysis, this prevents the economic viability of mass-market adoption. In contrast, a coordinated, interconnected and sometimes standardised technology solution to an identified need is estimated to be economically viable according to the analysis. This is illustrated by the Pervasive Networking scenario, which demonstrates that through the interconnection of devices and the compatibility of systems, each technology is likely to operate interdependently, therefore allowing the optimisation of total benefits for both technologies.

The growth of the M&C industry can therefore be described as deadlocked at present, as without the facilitation of networking and interconnection between two or more technologies by industry or other actors, growth is likely to be sub-optimal compared to what could be achieved should efforts be coordinated.

7 Recommendations and Policy Actions

7.1 Introduction

This chapter presents those policy actions and instruments that have been identified as potentially alleviating obstacles and reinforce drivers to stimulate the emergence of the M&C market in Europe. This chapter will consequently draw on the results of the previous analysis, consultation responses and conclusions from the Final Workshop[31] held in Brussels on 9th October 2008.

Each recommendation is presented in relation to the identified driver/obstacle it is intended to enhance/alleviate. In each case, linkages with current European Commission and industry actions shall be presented, identifying each stakeholder's roles and responsibilities.

7.2 Costs of Infrastructure

7.2.1 Overview

The results of this study indicate that high infrastructure costs (i.e. equipment and installation) of home automation systems represent a significant barrier to the adoption of the technology by the mass-market, a result consistent with the conclusions of other studies[32]. This is particularly pronounced in the home automation segment of the M&C market, as the costs are an order of magnitude greater than the energy and environmental benefits, representing a significant barrier to take-up.

Similarly, if decentralised energy technologies are to witness a 'boom' in uptake, they must become more cost-effective in relation to the energy saving benefits they are expected to generate.

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31 http://cordis.europa.eu/fp7/ict/necs/events-20081009_en.html

32 CECED (2007): **Evaluation of environmental benefits, reduction of CO_2 emissions, added value for new buildings due to application of energy management functions through connected appliances**, September 2007

A recent report evaluating the potential for micro-generation[33] in the UK concluded that both high costs, the level of consumer awareness and legislation are the most commonly perceived barriers in industry to the introduction of this technology, with cost effective introduction predicted from circa 2015 onwards. The obstacle that infrastructure costs represent may be less pronounced in the decentralised sector than in the home automation sector, as other costs may be more important. For example, lengthy planning procedures and innovations in generating technology (making older equipment more difficult to integrate with new power grids) may significantly increase the overall costs of introduction.

The other costs identified in the analysis that may act as a barrier to decentralised energy take-up relate to the revenue that can be gained from supplying the grid network with surplus energy. At present, a fixed price is offered to households wishing to supply surplus energy to a national grid. However, if dynamic pricing were introduced, then energy generated and supplied by households to the grid may fetch a high price during peak demand periods and lower prices in off-peak periods. An opportunity to generate energy in peak periods and consume during off-peak periods may therefore exist, improving the efficiency of decentralised generation and maximising household benefits. In the present situation, regulated prices may represent an additional cost to households investing in the technology where the revenue received by the household is less than the costs of generation (in other words it is more cost effective to purchase energy from the grid than generate it). The price of energy achievable by households is therefore related to the cost effectiveness of the generating technology, as higher prices should result in reduced costs of technology introduction.

7.2.2 Recommendations

1) **Grant Schemes** - could be introduced to support uptake levels of technology until a mass market develops and becomes economically viable in its own right. However, it is recognised that grant schemes are not a long-term solution. For decentralised energy technology, studies have estimated that a capital grant of 25-50% could be sufficient to support uptake levels until commercialisation, circa 2015[33], while a grant of 50% of infrastructure costs appears reasonable in order to induce consumption of home automation systems based on the results of this study. EU initiatives such as RENAISSANCE to demonstrate the social, environmental and economic benefits of integrating renewable energy, energy efficiency, and energy management systems on a community scale already receive grants from CONCERTO II and I[34]. At a national level, similar initiatives and funding programmes exist to promote energy efficiency in buildings, such as the Low Carbon Building Programme (LCBP) in the UK[35]. These mechanisms could all

33 DTI (2005): **Potential for Microgeneration – Study and Analysis**, final report, by Econnect, element energy

34 Find out more about RENAISSANCE implementation in France, the UK and Spain, at: http://www.renaissance-energy.net

35 See the LCBP website at: http://www.lcbp.org.uk

be utilised to distribute home automation grants, often coordinated with other energy saving technologies to maximise the benefits across the EU.

a. **Evolutionary Systems -** could be introduced for specific uses where the benefits exceed the costs (e.g. automated lighting or security systems), allowing the potential to expand or upgrade such systems as individual applications become economically viable or are desired by the household (e.g. entertainment or energy saving systems).

b. **Liberalisation of Energy Market -** enabling the price of energy generated by micro or decentralised technologies to vary according to economic, weather and consumption patterns has been identified in many studies[36] as an incentive for households and enterprises to adopt generating technology. This assumes that the revenue gained from exporting energy to a grid could help pay back the initial infrastructure costs. At present, prices attainable by small generators are fixed and could be set at a level below cost in some Member States. Prices could even be subsidised in order to promote the economic viability of decentralised energy. However, subsidies would likely distort the market, encouraging over-production of local energy, likely to lead to inefficiency in the overall generation and distribution of energy. A market solution involving a degree of market liberalisation is therefore preferable in this example.

7.3 Regulation

7.3.1 Overview

Many interviewees identified regulation as the most significant barrier and driver for most M&C sectors. In the case of home automation, building regulations mandating energy efficiency standards[37] were identified as providing a stimulus for the adoption of automation technology. In this example, home automation may even add value to the property where energy efficiency is desired by homeowners. At the same time, regulation of the energy sector was identified as restricting the potential of home automation where markets are not sufficiently liberalised to enable dynamic pricing of energy and switching between energy distributors to optimise the benefits of demand management and supply functions of smart home technology.

Specially in relation to the energy sector, ZVEI[38] observes that liberalisation of the energy sector can result in "cost pressures and profit maximisation acting as a stimulus for increased levels of automation, but on the other hand they frequently act as a hindrance because the necessary investments are not made

[36] Cogen (2007): Joint Letter to the European Energy Regulators and the European Commission – **Addressing the Issues of Barriers to Decentralised Generation**, Friday, 29th June 2007

[37] EC (2002): **Directive 2002/91/EC** of the European Parliament and of the Council of 16 December 2002 - **on the energy performance of buildings**, for transposition by 04/01/2006

[38] ZVEI (2008): **Integrated Technology Roadmap – Automation 2015+**, by the Institute for Futures Studies and Technology Assessment

due to an emphasis on short-term success". Therefore a paradigm can exist between how and by how much to regulate a specific sector in order to achieve optimal results for the M&C industry and society more generally.

A review of the literature on automation and decentralised energy has identified numerous regulations and targets as having a significant impact on either sector of the M&C market. A summary of the key regulatory drivers and their limitations are presented as follows:

- **European CO_2 reduction commitments** under the Kyoto Protocol, creates important opportunities for energy efficiency and renewable technologies.
- **Lisbon Strategy**[39] - establishes targets for renewable energy, growth and jobs in the EU, including support for economic instruments to promote technology and policy. For example, some Lisbon Strategy initiatives[40] have established economic instruments such as the EU Emissions Trading Scheme (ETS) to provide incentives for renewable energy technologies as well as improving energy efficiency.
- **Energy Market Liberalisation -** numerous European Directives[41] on the competitive functioning of the internal market have been introduced to harmonise infrastructure, transmission networks, and secure access to supplies of energy. Industry stakeholders[42] have concluded that this process must be speeded up if the take up of technology is to increase significantly.
- **Transmission losses -** legislation is imposed to reduce transmission losses from the power grid network[43] in two Member States (Estonia and UK) which penalises network operators for excessive losses. In Estonia, the maximum network loss permitted is reduced every year by 1% of the total load. In the UK, the losses that exceed a certain target rate incur a penalty of £48(€60) per MWh paid by the distribution network operator.
- **Smart meters -** it has been observed that in some Member States[44], legislation has been passed to ensure the mandatory introduction of smart meters or to oblige grid companies to obtain a monthly meter reading for electricity users, stimulating the introduction of smart metering.

39 See **COM (2005) 330/EEC:** Communication from the Commission to the European Parliament and the Council **– Common Actions for Growth and Employment: The Community Lisbon Programme,** July 2005 and **COM (2005) 97:** Communication from the Commission to the European Parliament and the Council **– Better Regulation for Growth and Jobs in the European Union,** March 2005.

40 **COM (2007) 2:** Communication from the Commission to the European Parliament and the Council **– Limiting Climate Change to 2°C: Policy Options for the EU and the world for 2020 and beyond**

41 **Directives 2003/54 and 2003/55** respectively referred to as the Electricity and Gas Directives, summarised in: EC (2006): **COM(2006) 841:** Communication of the Commission to the European Parliament and the Council - **On prospects for the Internal Gas and Electricity Market**

42 Cogen(2007): Joint Letter to the European Energy Regulators and the European Commission – **Addressing the Issues of Barriers to Decentralised Generation**, Friday, 29th June 2007

43 Leonardo Energy (2008): **Reducing electricity network losses**, by R. Targosz, based on a Discussion Webinar, Friday, April 11th 2008, available at: http://www.leonardo-energy.org/drupal/print/2935

44 Leonardo Energy (2006): **Smart Metering**, by Rob van Gerwen, Saskia Jaarsman and Rob Wilhite at KEMa, The Netherlands, for Leonardo-Energy, July 2006. Available at: http://leonardo-energy.org

- **Building energy efficiency -** standards and Directives are emerging to improve the energy efficiency of buildings, therefore encouraging the adoption of new technology and materials by architects, developers and engineers.
- **Local/National planning procedures -** can represent a significant obstacle to both home automation and decentralised energy. The administrative burden placed on developers/customers and the uncertainty surrounding the long time taken to process planning applications have been identified as significant barriers. Similarly, restrictions on what changes and maintenance can be carried out on certain buildings for historical and cultural reasons can increase the cost of energy efficiency materials due a limited number of products and methods, which can be adopted, but also increases the administrative burden.

7.3.2 Recommendations (continued)

The above summary of regulatory actions and comments from stakeholders, suggests that many regulatory measures already exist to promote the uptake of energy saving technology in at least one Member State. These recommendations therefore focus on implementing successful national regulations at a European level, while simplify others in order to reduce uncertain and costs relating to the adoption of energy saving technology. The regulatory recommendations include:

4) **Introduction of simplified local/national planning procedures** for mutually beneficial technologies such as renewable, micro-generation and decentralised energy systems. This could include the harmonisation of procedures and documentation where possible, encouraging the adoption of harmonised product standards and the provision of clear and consistent information to consumers and professional users across the EU. Action should be considered at Member State and EU level.

5) **Accelerated energy market liberalisation** already introduced by the European Commission, but not completely implemented in some Member States. This could include a move from Directives on gas and electricity markets to regulations that are more prescriptive or a Communication from the Commission to Member States, urging action on this issue.

6) **European regulation on transmission losses**, limiting losses of energy in all Member States, based on UK and Estonian experience of such legislation, applying targets, penalties and other incentives where necessary.

7) **Introduce regulatory measure(s)** to require the regular reading of utility meters or require the compulsory introduction of smart meters by households and businesses, thus stimulating smart meter adoption. The costs and benefits of current roll-out schemes in different Member States could be useful in indicating best practice and cost saving measures in roll-out that might be included in any such regulatory measures.

8) **Revision of the Energy Efficiency in Buildings Directive** could encompass further minimum standards on building or management system efficiency. Similarly, labelling and standards could be revised (within the Directive) to better inform consumers and professional users. Thus, it is hoped that the incentives for consumers to adopt smart home systems will increase.

7.4 Awareness of the Technology and its Impacts

7.4.1 Overview

A high degree of uncertainty surrounds many of the potential costs and benefits of each technology for developers, architects and users. Similarly, a low awareness amongst potential customers of the technology and it impact on energy bills and the environment were identified as barriers preventing the uptake of the technology, particularly to a mass market. Other uncertainties, such as reliability, product life, ease of use and applicability of the technology to certain buildings (e.g. older homes) were also highlighted as significant concerns relating to such untested technology, specifically in relation to intelligent grids and home automations systems. This is perceived as less of a barrier for smart meters, as many large-scale trials have been completed in many countries, with wide scale roll-out already underway in Italy, the Netherlands and Sweden[44].

Electricians and other professionals required to maintain and install the different technologies were identified as encountering similar difficulties to consumers and users as they need to re-train and adapt to new technologies, standards, and systems if wider introduction is to occur EU-wide.

Without more information, it is therefore more likely that the energy saving technology presented in this study will not achieve its full potential, with knock-on implications for the M&C industry in Europe.

7.4.2 Recommendations (continued)

9) **EU funded studies** focused on assessing the complete life costs and benefits of the relevant technologies in isolation and when interconnected with other devices.

10) **1 Class meetings** were suggested by at least one interviewee so that more one-topic meetings/workshops could be arranged to bring together all application users, researchers, solution providers, etc. in order to discuss problems and solutions relating to a specific technology or research area.

11) **Awareness campaigns** were identified as helpful for professional users and consumers so that they become more aware of the technology and its capabilities, through information leaflets, websites, workshops and trade fairs.

European Community initiatives such as ManagEnergy[45] supporting actors working in energy efficiency and renewable energies at the local and regional level, in addition to RENNAISANCE test projects (see Recommendation 1), could be used to generate some of the publicity and information required to promote the relevant technology.

12) **Revision of energy labelling legislation** could be introduced to certify the energy efficiency of smart appliances and homes using management systems. Awareness could then be increased amongst consumers, and potential benefits would be easier to value for households.

7.5 Interconnectivity and Compatibility

7.5.1 Overview

The issue of interconnectivity and compatibility between different technologies and different manufacturers/providers of the same technology has been highlighted in the scenario assessment and by interviewees as vital for the mass market uptake of technology. Measures to ensure compatibility between products are centred on standardisation, while those involving coordination of existing standards are often referred to as harmonisation (e.g. the harmonisation of energy transmission networks and infrastructure standards across all EU Member States).

The issue of standardisation is of particular importance regarding home automation and smart appliances as this requires the creation of a home or building 'network', which may incorporate multiple devices from different manufactures and product sectors. In order to ensure compatibility between these devices, provide plug-and-play functionality, and connection of devices to a central network or connection hub. Standards must also encompass software and communication protocols as well as individual technology devices. CENELEC's Smarthouse project, industry KNX[46], CHAIN program[47], Creston I2P partnership scheme[48] and DLNA[49] are examples of this standardisation and harmonisation of standards currently underway to ensure interoperability of technology over extended periods. However, according to consultation, some standards are incomplete and global standards have yet to emerge which are necessary to facilitate greater uptake of each technology. .

45 See the ManagEnergy website for more details, at: http://www.managenergy.net

46 See Official site of KNX at: http://www.knx.org/

47 See CECED (2007): **Evaluation of environmental benefits, reduction of Co2 emissions, added value for new buildings due to application of energy management functions through connected appliances**, September 2007

48 Hiddenwires (2004): **Automation Control – an Overview**, article downloaded 16/07/2008 from industry publication available at: http://www.hiddenwires.co.uk/resourcesarticles2004/articles20040202-01.html

49 Digital Living Network Alliance (DLNA) – industry led alliance of more than 250 companies to ensure compatibility of products

Easy integration of third party systems with that of the automation system is therefore essential in order to make programming and installation faster and more efficient. The attractiveness of systems to potential customers may also be enhanced if they know that in the future new technologies can be connected to the same system or it can be upgraded without a complete replacement of present systems. Industry lead standardisation, such as the Creston I2P partnership scheme[50] for example, establishes strong working relationships with other manufacturers so that the latest communication protocols are speedily implemented into its database, enabling compatibility.

CECED, the European home appliance association, through its CHAIN programme is also developing industry standards to ensure compatibility and interoperability for smart appliances over a product life over around 13 years[51]. This has included developing a platform and appliance interface in order to ensure interoperability. Although standardisation is clearly taking place, consultation with stakeholders suggested that revised energy labelling (to encompass energy saving from smart technology) and the development of global standards would be welcomed, as this would facilitate entry into non-EU markets.

In relation to the energy generating and distribution sector, many standards already exist. Therefore, the focus should be on the harmonisation between Member States in order to create a competitive European energy market[52]. This is the principle objective of the various energy directives mentioned previous in the section on regulation. However, comments from stakeholder and the conclusions of other studies[33] suggest that this harmonisation has not been fully implemented in all Member States therefore limiting the incentives to adopt energy saving technologies, such as micro and decentralised power.

7.5.2 Recommendations (continued)

13) **Global Standards -** EU and standardisation bodies (CEN/CENELEC) to push for the development of global standards where deemed appropriate, in order to simplify compliance with existing standards and allow free competition between providers worldwide.

14) **European Standards -** development of specific European standards where appropriate (i.e. specific to electricity distribution) to establish and improve the functioning of the internal market. It may also be necessary to develop new standards in order to ensure devices can communicate to one another and with user technologies such as PCs, mobile phones, and PDAs, building on existing work (e.g. CENELEC EN 50090 and CEN EN 13321-1).

50 Hiddenwires (2004): **Automation Control – an Overview**, article downloaded 16/07/2008 from http://www.hiddenwires.co.uk/resourcesarticles2004/articles20040202-01.html

51 See CECED (2007): **Evaluation of environmental benefits, reduction of Co2 emissions, added value for new buildings due to application of energy management functions through connected appliances**, September 2007

52 EC (2006a): **COM(2006) 841**: Communication of the Commission to the European Parliament and the Council – **on prospects for the Internal Gas and Electricity Market**

7.6 Roles and Responsibilities of Stakeholders

Having established the actions that could be taken to facilitate the development of the Monitoring & Control industry in Europe, the actors best placed to implement a particular measure should be identified. Table 85 summarises those actors that could undertake this role recommendation by recommendation, numbered 1 to 14 in the above text. This table also highlights those application sectors of the M&C market most likely to be affected by each measure, therefore identifying sector specific measures from global recommendations that broadly apply to the whole industry (e.g. standardisation, feasibility studies and 1st class meetings).

Discussions with stakeholders revealed a clear preference for more globally applicable measures over sector specific actions, such as measures targeted at reducing transmission losses. Priority should therefore be given to standardisation and coordination studies and meetings.

Table 85, Summary of Policy Recommendations by Sector Affected and Stakeholder Action

Recommendation	Sectors Significantly Affected	Stakeholder Action Potentially Required By…				
		Industry	Industry Associations and Similar Bodies	European Standards Bodies	European Commission	Member States
1. Grant Schemes	Home, Building and Electric Power Grid	✓	✓		✓	✓
2. Evolutionary Systems	Home, Building and Household Appliances	✓				
3. Liberalisation of Energy Market	Electric Power Grid				✓	✓
4. Simplified Planning Procedures	Home, Building and Electric Power Grid				✓	✓
5. Accelerated Energy Market Liberalisation	Electric Power Grid				✓	✓
6. Regulation on Transmission Losses	Electric Power Grid and Critical Infrastructures				✓	✓
7. Regulation for Smart Meters	Electric Power Grid				✓	✓
8. Energy Efficiency in Buildings Directive	Home, Building and Household Appliances	✓	✓	✓	✓	
9. EU Funded Studies	All Sectors (i.e. Manufacturing, Process, Environment, Healthcare, Home, Building, Transport, Logistics, Vehicles, etc.)	✓	✓	✓	✓	
10. 1 Class Meetings	All Sectors (i.e. Manufacturing, Process, Environment, Healthcare, Home, Building, Transport, Logistics, Vehicles, etc.)	✓	✓		✓	
11. Awareness Campaigns	Home, Building and Household Appliances	✓	✓		✓	
12. Energy Labelling	Home, Building and Household Appliances	✓	✓	✓	✓	
13. Global Standards	Manufacturing, Process, Environment, Home, Building and Household Appliances	✓	✓	✓	✓	
14. European Standards	All Sectors (i.e. Manufacturing, Process, Environment, Healthcare, Home, Building, Transport, Logistics, Vehicles, etc.)	✓	✓	✓	✓	✓

C - APPENDICES

1 Detailed definition and scope of application markets

1.1 Environment

Main sub segments or activities include:

- Agriculture
- Air, Water and Soil pollution
- Aquaculture
- CO_2 sequestration
- Fishing
- Forestry
- Mining
- Oil and gas extraction
- Waste treatment

Table 86, Main Environment M&C solutions users, by region

Main M&C solution users	European	Other Developed countries	Developing countries
Agriculture			
Air, Water and Soil pollution	Manufacturing facility or process (industry (chemistry, …), agriculture, power generation (coal-fired, …)		
Fishing and aquaculture	Orthongel (FR)	*Japan*	*Chile*
Forestry	UPM Kymmene (FI)	International Paper (US)	
Mining and extraction	Xstrata (SE) Rio Tinto (UK)	BHP Billiton (AU)	
Oil and gas extraction	Total (FR), Shell (UK/NL), BP (UK), Technip (FR), Schlumberger (FR)	ExxonMobil, Chevron, ConocoPhilips, ARCO (US)	CNPC, Sinopec, CNOOC (CN); Indian Oil Cord (IN); PDVSA (VE); Petrobras (BR); Rosneft, Gazprom (RU); Sonangol (AO)
Waste treatment	Veolia (FR), Suez (FR/BE)	Republic Services, Allied Waste (US)	

Source: DECISION/RPA, SMART 2007, October 2008

1.2 Critical infrastructure

Main sub-segments or activities include:
- Railways
- Road transport infrastructure
- River
- Airports
- Harbours
- Telecommunication networks
- Oil and Gas transportation (pipelines), storage and distribution
- Heat and steam (CHP)
- Power Plants and the Power grid (the site itself and the infrastructure grid)

Table 87, Main Critical Infrastructures M&C solutions users, by region

Main M&C solution users	European
Airports	ADP (FR), BAA (UK)
Communication networks	Vodaphone (UK), Deutsch Telekom (DE), Orange-FT (FR), Telefonica (ES)
Gas transportation, storage and distribution	GRTgaz (FR), E.ON Transport Verbund (DE)
Harbours	Port of Rotterdam Authority (NL)
Heat and steam	CCPU (FR)
Pipelines	BP (UK), SHELL(UK/NL)
Railway grids and stations	RFF (FR)
River	VNF (FR)
Road	Vinci (FR), Autostrade (IT), Brisa (PT)
Water supply	

Source: DECISION/RPA, SMART 2007, October 2008

1.3 Manufacturing Industries

Main sub segments or activities include:
- Manufacture of computer, electronic and optical products
- Manufacture of electrical equipment
- Manufacture of furniture
- Manufacture of machinery and equipment n.e.c.
- Manufacture of motor vehicles, trailers and semi-trailers
- Manufacture of other transport equipment
- Manufacture of leather and wearing
- Other manufacturing

Table 88, Main Manufacturing Industries M&C solutions users, by region

Main M&C solution users	European	Developed Countries	Developing Countries
Manufacture of computer, electronic and optical products	Philips (NL), Nokia (FI), Ericsson (SE), Elcoteq (FI)	Apple (US), Nec (JP), Fujitsu (JP) IBM (US), Dell (US), Acer (TW)	Lenovo (CN),
Manufacture of electrical equipment	Osram (DE), Bosch (DE), Nexans (FR)		
Manufacture of furniture	Ikea –Swedwood (SE)		
Manufacture of machinery and equipment n.e.c.	Metso (paper processing, FI)		
Manufacture of tools, clocks, toys etc.	Swatch Group, Breitling (CH)	Mattel, MGA Entertainment (US)	
Manufacture of vehicles	BMW, Daimler, Volkswagen (DE) Renault, PSA (FR) Fiat (IT) Volvo, SAAB (SE) Alstom (FR) Ansaldo (IT) BMW (DE), Ducati, Vespa (IT)	GM, Ford (US) Toyota, Honda, Nissan (JP) Hyundai, Kia (SK) Bombardier (CA) Mitsubishi (JP) Yamaha, Suzuki, Kawasaki (JP) Harley Davidson (US)	Tata (IN) CHERY, Geely Auto (CN)
Manufacture of leather and wearing	Armor-Lux (FR),Benetton (IT)	Phillips Van-Heusen (US)	

Source: DECISION/RPA, SMART 2007, October 2008

1.4 Process Industries

Main sub segments or activities include:
- Chemistry and pharmacy
- Food, beverage and tobacco
- Metal
- Mineral products (Glass, cement, … and other non-metallic mineral products)
- Paper, printing
- Petroleum and cook refining
- Rubber and plastic
- Textile

Table 89, Main Process Industries M&C solutions users, by region

Main M&C solution users	European	Developed Countries	Developing Countries
Chemistry and pharmacy	GlaxoSmithKline (UK), Sanofi-Aventis (FR), BASF (DE), Bayer (DE), Solvay (BE)	Johnson and Johnson (US),	
Food, beverage and tobacco	Danone (FR), Unilever (NL-UK), EVIAN (FR), VITTEL (FR),	Kraft Food (US)	
Metal	Mittal-Arcelor (UK/LU), Riva Group (IT), ThyssenKrupp (DE)	Alcan (CA), Nippon Steel (JP), US Steel Corporation (US)	
Mineral products (Glass, cement, etc.)	Lafarge (FR), Saint-Gobain (FR), Pilkington PLC (UK)	Asahi Glass (JP)	
Paper, printing	UPM (FI)	International Paper (US)	
Petrol and cook refining	Total (FR), Shell (UK/NL), BP (UK)	Exxon (US), Chevron (US), ConocoPhilips (US)	Lukoil (RU), Tupras (TR)
Rubber and plastic	Michelin (FR), Pirelli (IT), Beiersdorf (DE), Schwarzkopf and Henkel (DE)	Dow (US), Bridgestone (US), DuPont (US), Gore (US), 3M (US),R	
Textile	Kindy (FR), Aubade (FR)	International Textile Group (US)	Grasim Industries (IN)

Source: DECISION/RPA, SMART 2007, October 2008

1.5 Building

From Construction to Facility Management

Definition: a horizontal segment that includes three main activities, the construction of buildings, maintenance and operating of estates. It can also concern (according to their involvement) the management of buildings, technical installations, plus any service activities related to that building or development such as retail, professional/business services and public buildings (including education), etc.

Main segments or activities include:
- Construction
- Operating and Managing real estate
- Tertiary services (bank and payment systems, vending machines, etc.)

Table 90, Main Building M&C solutions users, by region

Main M&C solution users	European
Construction	Bouygues (FR), Vinci (FR)
Operating and managing real estate	Unibail-Rodamco (NL-FR), Immofinanz (AT), CORLO (IT), Siemens (DE)
Tertiary sector	Deutsche Bank (DE), AXA (FR), Allianz (DE), BBVA (ES), UBS (CH), Royal Bank of Scotland (UK) ; Universities, schools;public administrations, Carrefour (FR), IKEA (NL), Inditex (ES), Hennes and Mauritz (SE)

Source: DECISION/RPA, SMART 2007, October 2008

1.6 Electric Power and Grid

Electrical power from generation to transport and distribution, including co-/micro-generation and grids

Definition: a dedicated segment that covers the complete electrical power supply chain from production through distribution to retail.

Main sub segments or activities include:
- Power plant (nuclear, oil-fired, coal-fired, …)
- Electricity transport
- Electricity distribution
- Electricity retail
- Metering
- Co-/Micro-generation

Table 91, Main Electric Power and Grid M&C solutions users, by region

Main M&C solution users	European
Power generation	EDF (FR) E.ON, RWE (DE), ENDESA (ES), IBERDROLA (ES),
Electricity transport	Verbund (AT)
Electricity distribution	Stadwerke (DE) ErDF (FR)
Electricity retail	EDF (FR), Actaris (FR)
Microgeneration	Montelec (ES)

Source: DECISION/RPA, SMART 2007, October 2008

1.7 Logistics and Transport

Main sub-segments or activities include:

- Fleet
- Freight
- Mail/Courier services
- Transport of Passengers
- Other transport of Goods
- Warehousing
-

Table 92, Main Logistics and Transports M&C solutions users, by region

Main M&C solution users	European
Mail/Courier services	Deutsche Post (DE), DHL (DE), TNT (NL), Chronos (BE)
Transport of Passengers	Lufthansa (DE), British Airways (UK), AF/KLM (FR); SNCF (FR), DB (DE), RENFE (ES)
Transport of Goods	Inside Green Logistics (FR), CMA CGM (FR), Maersk (DK), Hapag-Lloyd (DE)
Warehousing	Rexel (FR), Radiospares (UK)

Source: DECISION/RPA, SMART 2007, October 2008

1.8 Vehicle

Definition: a dedicated segment that includes all Monitoring & Control solutions used in vehicles. If not isolated, this segment would have been included in the manufacturing industry segment. The scale of this segment warrants separate assessment. Industrial users can include vehicle designers, the manufacturer, but it also refers to end-user products purchased by vehicle dealers or sold through retail routes. In terms of defining the need and specifications, the main sub segments or activities include:

- Agriculture engines
- Aircraft
- Car
- Buses, trucks
- Off-road vehicles
- Rolling stocks
- Ship
- …

Table 93, Main Vehicle M&C solutions users, by region

Main M&C solution users	European	Developed Countries	Developing Countries
Agriculture engines	CNH (IT-NL)	John Reed (US), AGCO(US)	Tata (IN)
Aircraft	Airbus (EUROPE)	Boeing (US)	
Car	BMW (DE), Volvo (SE), Renault (FR), Daimler (DE), Fiat (IT), Volkswagen (DE), PSA (FR), Porsche (DE), Saab (SE),	GM (US), Ford (US), Toyota (JP), Honda (JP), Hyundai (SK), Kia (SK), Delphi (US)	Tata (IN)
Buses, Trucks	Daimler (DE), Volvo (SE), Scania (SE), IVECO (IT)	PACCARD (FR) , Navistar (US), HINO (JP), NISSAN (JP)	
Off-road vehicles	Liebherr (DE), Volvo (SE), JCB (UK)	Caterpillar (US), Case (US), Komatsu (JP)	
Rolling stocks	Alstom (FR), Siemens (DE), Ansaldo (IT)	Bombardier (CA), Mitsubishi (JP),	
Ship	Aker Yards (NO), Damen (NL), BAe Systems (UK), VT Group (UK) Fincantieri (IT) Azimut-Benetti (IT), Codecasa (IT)	Kawasaki Heavy Industry (JP), Mitsui (JP), Mitsubishi (JP), Hyundai Heavy Industry (SK)	

Source: DECISION/RPA, SMART 2007, October 2008

1.9 Household Appliances

Definition: this dedicated segment is composed of all Monitoring & Control solutions employed in household appliances. If not isolated, this industry would have been included in the manufacturing industry segment.
Main sub segments or activities include:

- TVs and other audio video products
- White goods (washing machine, fridge, …)

Table 94, Main Household Appliances M&C solutions users, by region

Main M&C solution users	European	Developed Countries	Developing Countries
TVs and other audio video products	Philips (NL)	Sony (JP), Panasonic (JP), Pionner (JP) ,Samsung (SK), LG (SK),	Haier (CN)
White goods (washing machine, fridge, …)	Electrolux (SE), Gorenje (SL), Seb (FR)	Whirlpool (US), Maytag (US), GE (US)	

Source: DECISION/RPA, SMART 2007, October 2008

1.10 Healthcare

Main sub segments or activities include:

- Human health activities (hospitals and doctors' material, …)
- Residential care activities (retiring residents, residents for disable people, …)
- Portable medical equipment
- Personal medical equipment

Table 95, Main Healthcare/homecare M&C solutions users, by region

Main M&C solution users	European
Human and animal health activities (hospitals and doctors' material, …)	Hospitals Private Clinic Consulting rooms
Residential care activities	Retirement homes, residencies for disable people
Portable medical equipment	homes, families, visiting nurses, patients
Personal medical equipment	

Source: DECISION/RPA, SMART 2007, October 2008

1.11 Home

Definition: a dedicated segment that includes all Monitoring & Control solutions designed for home uses (Automation, Home Safety, Energy management, etc.)

Main sub segments or activities include:
- HVAC
- Alarms
- Intelligent Lighting
- Access control
- Motorisation
- …

Table 96, Main Home Automation, Home Safety, Energy management M&C solutions users, by region

Main M&C solution users	European
Home Automation	End users Installers (Telecom operators & Energy retailers)

Source: DECISION/RPA, SMART 2007, October 2008

2 Reconciliation of NACE with application market

Application market and industry segmentation is made in reconciliation with European statistical classification NACE rev.2 at top level:

- The 21 groups for the total economy
- The 24 groups of industry (detail of top level group C manufacturing)

Table 97, NACE – M&C market reconciliation

Top classification identify 21 economic activities	Application markets for M&C
A Agriculture, forestry and fishing	Environment
B Mining and quarrying	Environment
C Manufacturing	Manufacturing industry Process industry
D Electricity, gas, steam, air conditioning supply	Electric Power and Grid Critical infrastructures
E Water supply; sewerage, waste management and remediation activities	Environment Critical infrastructures
F Construction	Building
G Wholesale and retail trade; repair of motor vehicles and motorcycles	Building Logistics and Transport
H Transportation and storage	Logistics and Transport
I Accommodation and food service activities	Logistics and Transport
J Information and communication	Building Critical Infrastructures
K Financial and insurance activities	Building Critical Infrastructures
L Real estate activities	Building
M Professional, scientific and technical activities	Diverse
N Administrative and support service activities	Building
O Public administration and defence; compulsory social security	Diverse
P Education	Building
Q Human health and social work activities	Healthcare
R Arts, entertainment and recreation	Building
S Other service activities	Building
T Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	Home

U Activities of extraterritorial organisations and bodies	Building

Source:
http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=NACE_REV2&StrLanguageCode=FR&IntPcKey=&StrLayoutCode=&CFID=1570896&CFTOKEN=8d3667204993fe6-D4D4D029-A480-E7DE-5CFAA680B3E2B7F9&jsessionid=ee3055a645a1347134d4

Group C – Manufacturing includes all the following.

Table 98, NACE Manufacturing

Classification	Industry
Process	Food products
	Beverages
	Tobacco products
	Textiles
	Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials
	Paper and paper products
	Printing and reproduction of recorded media
	Coke and refined petroleum products
	Chemicals and chemical products
	Basic pharmaceutical products and pharmaceutical preparations
	Crubber and plastic products
	Other non-metallic mineral products
	Basic metals
	Fabricated metal products, except machinery and equipment
Manufacturing	Computer, electronic and optical products
	Electrical equipment
	Machinery and equipment n.e.c.
	Motor vehicles, trailers and semi-trailers
	Other transport equipment
	Furniture
	Wearing apparel
	Leather and related products
	Other manufacturing
	Repair and installation of machinery and equipment

For the M&C activities we distinguish those which process is mainly non-continuous from those that are continuous.

- Non continuous industries are grouped in the *manufacturing industry* category

Continuous industries are grouped in the *process industry* category

3 Extracts from the interviews conducted

Environnment

There is a lack of European suppliers. Main issues are not on Software, but on Hardware and sensors.
A European certification should be created: today everything is done according to the American EPA certification.
Many projects in Eastern European countries are realized only because of the European Commission's funds.

Critical Infrastructures

A local government was interviewed about its CCTV solutions, used for traffic monitoring. They permit fluidity of the traffic, detection of incidents, development of indicators. A weakness of the solution in that case was that it was not connected to other solutions like weather, police, etc.
A harbor authority mentioned the need for upgrades because of regulation (main driver in the industry). The control of containers is not ready yet: too costly and no good technology so far for it.

Automation (Industrial and Process)

Innovations
For most of the interviewees in the field, the next big step will be the capabilities to do « plug-and-play » solutions.
The data transfers and the format of data should also be improved. The communication has to be standardised. The leitmotiv is "Automation from the automation". Objects should be able to adapt by themselves, to provide their own descriptions, etc.
The development of web services will answer many needs in the automation: some products will already be available in the next two years (rather in Building and Electric Power and Grid).
You do not have to take care of the inferior layers, which will simplify your task
"Wireless is in its infancy, and the industry is very conservative".
When upgrading monitoring systems, one problem is the software portability. ERP-like products, pulled by finance, accounting or purchasing services, became more present. It consists in more regular reporting, for example from monthly to daily reports.
Every leaders want to develop asset management in the future.

Standardization
We met different organizations aiming to work on open systems for automation, but problems remain, because of the certification needs. The industry remains reluctant to work with non-specific solutions. However, it is not because people face specific problems that they have to use specific hardware and software. By doing this way, they are usually less efficient and very expensive.

Ergonomics
For one of the leader of the process automation, a very important issue is the ergonomics for the operator. For a research centre in Germany, Anthropotechnology is really the next step in terms of HMI.

Ideas of figures
For a Pharma industry, the cost for a Monitoring & Control system is 20% HW, 40 % SW, 40% Services.
Machines are designed to work at least 25 years
80% Standard, 20% Specific
To cable a plant = 20 000 euros.
LNG plant: 5 to 6 M€.
Refinery: 15 to 100 M€.
HW: 40%, SW:40%, Services: 20%.

Markets
A market for local smaller suppliers exists.
Local competitors in China represent already 30% of the process market.
Europe will continue to be an important player in Automation, because it knows how to adapt easily to the market.

Drivers
The cost of energy as been mentioned consistently.
Security (in the sense “preventing people to have access to your personal data”) was also mentioned as a great issue for communications.
The cost of labour is a great market driver.

Building

Innovations
RF devices are a real improvement to deploy control devices.
Ethernet is the future of communication. The problem is not the support of the communication, but the language, and only 2 languages are robust enough: BacNet and Konnex.

Ergonomics
An important aspect in Home Automation will be the ergonomics (need to display the right information, to provide benchmarking, etc.). Usually not yet taken into account by suppliers.

Organization
A problem in the Building sector is that it exists a difference between:
- Those buildings where inhabitants buy their energy (and are more efficient).
- Those where the owners buy their energy.

Standardization
Leaders work with different standards: OPC-UA (competitor of DPWS from Schneider), BacNet (very fast, stable, sure, independent from a supplier), Konnex, Echelon, EuBac (for Energy Efficiency).

Ideas of figures
Today the supervision station costs nothing.
In developed countries, it is interesting to see that about 100% of more than 100 000 m2 buildings are equipped with BMS, whereas 0% of less than 3 000 m2 are equipped.

Markets and Drivers
In buildings energy efficiency is the new market driver. A distinguished manager of a French leader company in the field said that he believed that from 2009, the market growth will be decreased from 10 to 15%, because of energy efficiency ! Change will not come from behaviours but from regulations.
Another contact in a German leader company does not planned great revolutions, but improvements and concerns on energy efficiency.

Logistics

Users are usually satisfied with their information systems as it is robust enough. However, they sometimes want new features for the future.

Electric Power and Grid

Innovations
The energy market in Europe is moving very quickly with major opportunities: smart metering, market places, energy efficiency, plus the long term new plants investment programmes, etc.

The interest for security (in the sense “preventing people to have access to your personal data”) was confirmed by different significant and smaller players as a great issue for communications.

Prediction of maintenance would be a great asset.

Standardization
The power industry developed its own standards. This model leads us to use very expensive solutions. Today we try to better use standard solutions from suppliers and to have them adapted to our needs.

Difficulties
A Spanish leader currently faces problem with the upper systems (not the capabilities to do everything).

In energy management, people are more interested by limiting their costs than their consumption per se. A brake is that the possible economies at the level of a household are not sufficient enough (today) to make them change significantly their behavior/uses (even though the change of habits at the global population scale would be very visible!).

Markets and drivers
Considered by many players and many researchers as a major market.
The development of smart meters is very different form one country to the other. In Spain, for example, 30% are already installed, 60% will be installed in 6 years, 100% in 10 years.
Intelligent metering is a great driver for Home Automation in many countries (many start ups we met worked on that topic).

Healthcare

Document Monitoring & Control
Healthcare is a giant market with a 45% growth a year. No real technology developments for DMS

Innovation
A physicist confirmed us that home patient maintaining is emerging as a real demand, everything has to be invented: financing solutions, rules of good practices, medical team commitment, patients real expectation, etc.

Robotics
A Researcher on robotics told us that there is a lack of European suppliers for surgery robots; we need a friendlier ecosystem for star-up business to emerge in Europe.
To have more robots in interaction with human behaves is a real challenge for the future (in particular if used for home or individual care purposes)

Home Automation

Innovations
With Internet and WiFi solutions everywhere, Home and Household Monitoring & Control should explode sooner or later, but they have to be standardised first. The main players have reacted differently in the matter of standardisation; most of them remain on proprietary solutions.
The different parts of Home Automation do not all have the same maturity: whereas heat control is widely offered today, lighting is more difficult and developments are still under work.
Plug-and-play is the solution for Home Automation's development

Difficulties
Social acceptance is an issue: people do not want to be always controlled
Reliability is a great issue

Organization
A great diversity in the people we interviewed. Many start ups work both on the Hardware and the Software.
A great part of the production is sold through OEM or distribution. The Channels for distribution can be very different, depending on the negotiation power of the society: some of them are sold through great shopping centres, others through Internet, and others through installers, etc.

Telecom operators also told us that they started to be interested by Home Automation market, as they could already be active on entertainment, security, etc. In Germany, one of the biggest players was however concerned with the possibility to do the global range of Home Automation, i.e. also smart metering, as it demands great resources.

According to leaders in the field, bigger services companies will not come on the Home Automation market before 10 years

Markets
There is no Chinese brand product made in Europe yet, so far. On the other hand, European players are opening plants in China to serve the China market.

Different French manufacturers have segmented the market drivers in 5 attitudes:
- Fear (I want to feel safe).
- Fun (I want to play with everything).
- Forest (= environment-friendly, I want to save the world).
- Money (I want to show I have money).
- Praising (I want to show I am the best).

Home Automation concerns less than 1% of the households in the NL (similar in the rest of Europe).

European markets from one country to the other can be very different in terms of Internet connexions: this has a great impact on the development of Home Automation.

4 Impacts Summary Tables

4.1 Screening of smart home scenario

BUILDING	SMART HOME SCENARIO
EU M&C Providers (Hardware, Software and Service)	COMPETITIVENESS, TRADE and INVESTMENT
First mover advantage gained by rapid roll out in Europe should increase market potential in non-EU countries. Competitiveness and trade therefore expected to increase in volume and value. Many systems and components likely to be imported into the EU as already manufactured in low cost economies, restricting manufacturing benefits. Software and services therefore likely to incur greatest	COMPETITION and the INTERNAL MARKET
Increases in the range and technical capability of products available on the EU market should intensify competition and create new market opportunities.	OPERATING COSTS AND CONDUCT OF BUSINESS
Greater acceptance of existing technology and increasing demand should bring down costs through economies of scale and competition between providers. Business strategies may change for providers re-focussing on professional user/consumer distribution and retail channels.	ADMINISTRATIVE COSTS
No Impacts Expected	INNOVATION and RESEARCH
Growth in sector is likely to focus a greater proportion of existing R&D expenditure on home management and related products/services.	EU CONSUMERS and HOUSEHOLDS
Acceptance of home management M&C solution should increase consumer acceptance of technology, leading to addition sales of related systems for the workplace or in different high –tech fields.	MACROECONOMIC and EMPLOYMENT
Minimal impact on EU employment expected as the manufacturer of a large proportion of component and systems expected to be produced outside the EU. However, software and service elements (particularly maintenance and installation) likely to generate significant employment	ENVIRONMENTAL and ENERGY
No Impacts Expected	SOCIAL
No Impacts Expected	DISTRIBUTIVE / EQUITY
Expertise and suppliers expected to be located close to customer base, therefore more likely to be concentrated in high income urban areas, where modern building are adapted for M&C solutions and affordable to households SMEs could find it difficult to compete where larger providers team up to offer complete solutions through	SUSTAINABILITY
Medium to high sustainability given that technology rarely moves backwards, but growth and jobs rely on availability of services (maintenance) in regions and affordability of systems in relation to energy costs, etc. If future consumer response is negative towards these systems, sustainability could be low.	

SMART HOME SCENARIO	COMPETITIVENESS, TRADE and INVESTMENT	COMPETITION and the INTERNAL MARKET	OPERATING COSTS AND CONDUCT OF BUSINESS	ADMINISTRATIVE COSTS	INNOVATION and RESEARCH	EU CONSUMERS and HOUSEHOLDS	MACROECONOMIC and EMPLOYMENT	ENVIRONMENTAL and ENERGY	SOCIAL	DISTRIBUTIVE / EQUITY	SUSTAINABILITY
EU Industry and Professional Users	First mover advantage also possible for trained professional users and installers of equipment as they gain greater market opportunities and increase their competitiveness over rivals. Also raises the possibility of selling such products/services outside the EU.	New products, providers and expertise in automation and general building electrics likely to intensify competition for installers/users	With many large commercial buildings already containing automations systems, business strategy of professional users must shift to consumer DIY, property developer and renovation markets	No Impacts Expected	New training schemes and installation/building techniques likely to emerge as market develops to accommodate the technology	Initially consumers and households encounter a shortage of trained installers and advice until market develops and more professional users/architects are trained or become aware of the technology	Employment likely to increase in professional services as demand for maintenance, installation, software and associated technologies grows	No Impacts Expected	No Impacts Expected	Expertise and suppliers expected to be located close to customer base, therefore more likely to be concentrated in high income urban areas, where modern building are adapted for M&C solutions and affordable to households SMEs could find it difficult to compete where larger providers team up to offer complete solutions through large-scale retail channels and professional user networks.	Medium sustainability as growth in the home automation likely to sustain many service/maintenance employment and support industry for life of a typical system (circa. 10 years). However, impact depends on long term consumer acceptance and adoption.

EU Consumer Users	SMART HOME SCENARIO
No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	COMPETITION and the INTERNAL MARKET
Energy and Insurance costs could fall as an automated security and heating systems could reduce risks and consumption of gas/electric.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	INNOVATION and RESEARCH
Security benefits for consumers and small improvements in energy efficiency as lighting and heating can be utilised in a more efficient way. Significant increases in efficiency and reductions in energy bills only likely in combination with changes to energy charging, metering, transmission and generation. Likely to incur costs in terms of installation and maintenance, plus potential health impacts if physical activity is reduced for some households.	EU CONSUMERS and HOUSEHOLDS
No Impacts Expected	MACROECONOMIC and EMPLOYMENT
Consumer use of energy should decrease due to improved energy efficiency, carbon emissions may then also decrease as an indirect benefit. Small shift in peak demand may also occur, although minimal as user/management system cannot differentiate between peak and off peak in this scenario	ENVIRONMENTAL and ENERGY
Information gathered by systems and control of systems raises e-security, privacy, data protection and legal issues over how it is stored/used/controlled by individuals/companies/governments. Systems could help reduce crime and therefore assist police forces/insurers and improve the quality of life in communities. Health implication of increased automation and less exercise should also be considered.	SOCIAL
.Distribution of systems expected to be high in high socio-economic groups, pushing crime to less wealth areas. Similarly, energy savings likely to benefit higher socio-economies groups opposed to poorer households who spend a greater proportion of incomes on energy related costs, due to the initial affordability of home management systems.	DISTRIBUTIVE / EQUITY
Sustainability depends on consumer response to first adoption of automation systems. If expected benefits/costs are not realised or fashions change, then sustainability likely to be low	SUSTAINABILITY

Non-EU Users	Non-EU Hardware and Software Providers	SMART HOME SCENARIO
No Impacts Expected	Hardware and some software providers likely to benefit outside the EU because a large proportion of components and systems are currently manufactured outside the EU.	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Increases in the range and technical capability of products available on the EU market should intensify competition and create new opportunities worldwide	COMPETITION and the INTERNAL MARKET
Benefit from reduce energy costs as efficiency due to efficiency of automation systems. Similarly, insurance costs could fall for some users	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	EU CONSUMERS and HOUSEHOLDS
No Impacts Expected	Employment likely to be generated in the manufacture and development of devices/software, less so services where EU likely to gain competitive advantage.	MACROECONOMIC and EMPLOYMENT
Consumer use of energy should decrease due to improved energy efficiency and operation of electrical devices. Overall CO2 emissions may indirectly decrease.	No Impacts Expected	ENVIRONMENTAL and ENERGY
Information gathered by systems and control of systems raises e-security, privacy, data protection and legal issues over how it is stored/used/controlled by individuals, companies, and governments. Systems could help reduce crime and therefore assist police forces/insurers and improve the quality of life in communities. Health implication of increased automation and less exercise should also be considered.	No Impacts Expected	SOCIAL
Distribution of systems expected to be high in high socio-economic groups, pushing crime into, and increasing relative energy costs for poorer households/regions	Cost of production in emerging economies and affordability of systems by users on the other hand likely to determine geographical distribution of impacts.	DISTRIBUTIVE / EQUITY
Sustainability depends on consumer response to first adoption of automation systems. If expected benefits/costs are not realised or fashions change, then sustainability likely to be low	Sustainability likely to be similar to that expected in the EU, based on consumer response to technology.	SUSTAINABILITY

HOUSEHOLD APPLIANCES		SMART HOME SCENARIO
EU M&C Providers (Hardware, Software and Service)	**Public Sector Bodies**	
First mover advantage gained by rapid roll out in Europe should increase market potential in non-EU countries. Competitiveness and trade therefore expected to increase in volume and value. Many systems and components likely to be imported into the EU as already manufactured in low cost economies, restricting manufacturing benefits.	No Impacts Expected	**COMPETITIVENESS, TRADE and INVESTMENT**
Increases in the range and technical capability of products available on the EU market should intensify competition and create new market opportunities regarding how individual appliances may interact with a management system	No Impacts Expected	**COMPETITION and the INTERNAL MARKET**
Greater acceptance of existing technology and increasing demand should bring down costs through economies of scale and competition between providers. Business strategies may change to develop more appliances compatible with management systems and develop new functionalities	No Impacts Expected	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
Growth in sector is likely to focus a greater proportion of existing R&D expenditure on creating new opportunities for new and existing appliances in home management	No Impacts Expected	**INNOVATION and RESEARCH**
Acceptance of home management M&C solutions should increase consumer acceptance of other technologies. This is particularly relevant in the home appliance sector where new products and solutions are constantly emerging with updated specifications and increased capabilities.	No Impacts Expected	**EU CONSUMERS and HOUSEHOLDS**
Minimal impact on EU employment expected as the manufacturer of a large proportion of component and systems expected outside of the EU.	No Impacts Expected	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	May assist in the achievement of energy efficiency objectives under environmental agreements for individual MS governments.	**ENVIRONMENTAL and ENERGY**
No Impacts Expected	No Impacts Expected	**SOCIAL**
SMEs could find it difficult to compete in the appliance sector due to the research, production, marketing and distribution scale economies enjoyed by multinational groups that dominate the appliance market in Asia, Europe, and the US.	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
More sustainable than the home management product groups as existing demand already exists for many home appliances, however the sustainability of home management functions incorporated in appliances is less certain as it will depend on consumer response to the technology and its opportunities.	No Impacts Expected	**SUSTAINABILITY**

EU Consumer Users	EU Industry and Professional Users	SMART HOME SCENARIO
No Impacts Expected	No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	No Impacts Expected	COMPETITION and the INTERNAL MARKET
Energy and insurance costs could fall as an appliances help reduce energy consumption and increase security around the home.	Service and repair engineers/electricians may need to retrain in order to understand the new technologies. However, this is ongoing for many as the technology and model placed on the market is constantly changing. Impact from baseline therefore expected to be minimal.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	No Impacts Expected	INNOVATION and RESEARCH
In addition to energy savings, households also likely to gain potential comfort and convenience benefits from new appliances that can be programmed or automated.	No Impacts Expected	EU CONSUMERS and HOUSEHOLDS
No Impacts Expected	No Impacts Expected	MACROECONOMIC and EMPLOYMENT
More efficient energy use by home appliances is likely to generate indirect carbon savings.	No Impacts Expected	ENVIRONMENTAL and ENERGY
No Impacts Expected	No Impacts Expected	SOCIAL
.Distribution of appliances expected to be high in high socio-economic groups, opposed to poorer households due to the affordability of appliances and rate at which households are likely to replace/upgrade appliances in response to trends, etc.	No Impacts Expected	DISTRIBUTIVE / EQUITY
Depends on consumer response to the technology and their future demand for 'smart' functions over other product characteristics such as price, quality and ease of use.	No Impacts Expected	SUSTAINABILITY

Public Sector Bodies	Non-EU Users	Non-EU Hardware and Software Providers	SMART HOME SCENARIO
No Impacts Expected	Significant benefits possible as many appliances consumed in the EU are manufacture outside the EU	Significant benefits possible as many M&C systems consumed in the EU are manufacture outside the EU	**COMPETITIVENESS, TRADE and INVESTMENT**
No Impacts Expected	Increases in the range and technical capability of products available should intensify competition.	Increases in the range and technical capability of products available should intensify competition.	**COMPETITION and the INTERNAL MARKET**
No Impacts Expected	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions in appliances	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions in appliances	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
No Impacts Expected	Growth in sector is likely to focus a greater proportion of existing R&D expenditure on creating new opportunities for new and existing appliances in home management	Growth in sector is likely to focus a greater proportion of existing R&D expenditure on creating new opportunities for new and existing appliances in home management	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**EU CONSUMERS and HOUSEHOLDS**
No Impacts Expected	Employment likely to be generated in the manufacture of appliances	Employment likely to be generated in the manufacture and development of embedded M&C solutions	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**ENVIRONMENTAL and ENERGY**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**SOCIAL**
No Impacts Expected	Cost of production in emerging economies and affordability of systems by users on the other hand likely to determine geographical distribution of impacts.	Cost of production in emerging economies and affordability of systems by users on the other hand likely to determine geographical distribution of impacts.	**DISTRIBUTIVE / EQUITY**
No Impacts Expected	Sustainability likely to be similar to that expected in the EU, based on consumer response to technology.	Sustainability likely to be similar to that expected in the EU, based on consumer response to technology.	**SUSTAINABILITY**

HOMES EU M&C Providers (Hardware, Software and Service)	SMART HOME SCENARIO
First mover advantage gained by rapid roll out in Europe should increase market potential in non-EU countries. Competitiveness and trade therefore expected to increase in volume and value. Many systems and components likely to be imported into the EU as already manufactured in low cost economies, restricting manufacturing benefits. Software and services therefore likely to incur greatest benefits in the EU.	**COMPETITIVENESS, TRADE and INVESTMENT**
Increases in the range and technical capability of products available on the EU market should intensify competition and create new market opportunities.	**COMPETITION and the INTERNAL MARKET**
Greater acceptance of existing technology and increasing demand should bring down costs through economies of scale and competition between providers. Business strategies may change for providers re-focussing on professional user/consumer distribution and retail channels.	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	**ADMINISTRATIVE COSTS**
Growth in sector is likely to focus a greater proportion of existing R&D expenditure on home management and related products/services.	**INNOVATION and RESEARCH**
Acceptance of home management M&C solution should increase consumer acceptance of technology, leading to addition sales of related systems for the workplace or in different high –tech fields.	**EU CONSUMERS and HOUSEHOLDS**
Minimal impact on EU employment expected as the manufacturer of a large proportion of component and systems expected to be produced outside the EU. However, software and service elements (particularly maintenance and installation) likely to generate significant employment	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	**ENVIRONMENTAL and ENERGY**
No Impacts Expected	**SOCIAL**
Expertise and suppliers expected to be located close to customer base, therefore more likely to be concentrated in high income urban areas, where modern building are adapted for M&C solutions and affordable to households SMEs could find it difficult to compete where larger providers team up to offer complete solutions through	**DISTRIBUTIVE / EQUITY**
Medium to high sustainability given that technology rarely moves backwards, but growth and jobs rely on availability of services (maintenance) in regions and affordability of systems in relation to energy costs, etc. If future consumer response is negative towards these systems, sustainability could be low.	**SUSTAINABILITY**

EU Industry and Professional Users	SMART HOME SCENARIO
First mover advantage also possible for trained professional users and installers of equipment as they gain greater market opportunities and increase their competitiveness over rivals. Also raises the possibility of selling such products/services outside the EU.	**COMPETITIVENESS, TRADE and INVESTMENT**
New products, providers and expertise in automation and general building electrics likely to intensify competition for installers/users	**COMPETITION and the INTERNAL MARKET**
With many large commercial buildings already containing automations systems, business strategy of professional users must shift to consumer DIY, property developer and renovation markets	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	**ADMINISTRATIVE COSTS**
New training schemes and installation/building techniques likely to emerge as market develops to accommodate the technology	**INNOVATION and RESEARCH**
Initially consumers and households encounter a shortage of trained installers and advice until market develops and more professional users/architects are trained or become aware of the technology	**EU CONSUMERS and HOUSEHOLDS**
Employment likely to increase in professional services as demand for maintenance, installation, software and associated technologies grows	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	**ENVIRONMENTAL and ENERGY**
No Impacts Expected	**SOCIAL**
Expertise and suppliers expected to be located close to customer base, therefore more likely to be concentrated in high income urban areas, where modern building are adapted for M&C solutions and affordable to households	**DISTRIBUTIVE / EQUITY**
Medium sustainability as growth in the home automation likely to sustain many service/maintenance employment and support industry for life of a typical system (circa. 10 years). However, impact depends on long term consumer acceptance and adoption.	**SUSTAINABILITY**

EU Consumer Users	SMART HOME SCENARIO
No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	COMPETITION and the INTERNAL MARKET
Energy and Insurance costs could fall as an automated security and heating systems could reduce risks and consumption of gas/electric.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	INNOVATION and RESEARCH
Security benefits for consumers and small improvements in energy efficiency as lighting and heating can be utilised in a more efficient way. Significant increases in efficiency and reductions in energy bills only likely in combination with changes to energy charging, metering, transmission and generation. Likely to incur costs in terms of installation and maintenance, plus potential health impacts if physical activity is reduced for some households.	EU CONSUMERS and HOUSEHOLDS
No Impacts Expected	MACROECONOMIC and EMPLOYMENT
Consumer use of energy should decrease due to improved energy efficiency, carbon emissions may then also decrease as an indirect benefit. Small shift in peak demand may also occur, although minimal as user/management system cannot differentiate between peak and off peak in this scenario	ENVIRONMENTAL and ENERGY
Information gathered by systems and control of systems raises e-security, privacy, data protection and legal issues over how it is stored/used/controlled by individuals/companies/governments. Systems could help reduce crime and therefore assist police forces/insurers and improve the quality of life in communities. Health implication of increased automation and less exercise should also be considered.	SOCIAL
.Distribution of systems expected to be high in high socio-economic groups, pushing crime to less wealth areas. Similarly, energy savings likely to benefit higher socio-economies groups opposed to poorer households who spend a greater proportion of incomes on energy related costs, due to the initial affordability of home management systems.	DISTRIBUTIVE / EQUITY
Sustainability depends on consumer response to first adoption of automation systems. If expected benefits/costs are not realised or fashions change, then sustainability likely to be low	SUSTAINABILITY

Non-EU Users	Non-EU Hardware and Software Providers	SMART HOME SCENARIO
No Impacts Expected	Hardware and some software providers likely to benefit outside the EU because a large proportion of components and systems are currently manufactured outside the EU.	**COMPETITIVENESS, TRADE and INVESTMENT**
No Impacts Expected	Increases in the range and technical capability of products available on the EU market should intensify competition and create new opportunities worldwide	**COMPETITION and the INTERNAL MARKET**
Benefit from reduce energy costs as efficiency due to efficiency of automation systems. Similarly, insurance costs could fall for some users	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
No Impacts Expected	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	**EU CONSUMERS and HOUSEHOLDS**
No Impacts Expected	Employment likely to be generated in the manufacture and development of devices/software, less so services where EU likely to gain competitive advantage.	**MACROECONOMIC and EMPLOYMENT**
Consumer use of energy should decrease due to improved energy efficiency and operation of electrical devices. Overall CO2 emissions may indirectly decrease.	No Impacts Expected	**ENVIRONMENTAL and ENERGY**
Information gathered by systems and control of systems raises e-security, privacy, data protection and legal issues over how it is stored/used/controlled by individuals, companies, and governments. Systems could help reduce crime and therefore assist police forces/insurers and improve the quality of life in communities. Health implication of increased automation and less exercise should also be considered.	No Impacts Expected	**SOCIAL**
Distribution of systems expected to be high in high socio-economic groups, pushing crime into, and increasing relative energy costs for poorer households/regions	Cost of production in emerging economies and affordability of systems by users on the other hand likely to determine geographical distribution of impacts.	**DISTRIBUTIVE / EQUITY**
Sustainability depends on consumer response to first adoption of automation systems. If expected benefits/costs are not realised or fashions change, then sustainability likely to be low	Sustainability likely to be similar to that expected in the EU, based on consumer response to technology.	**SUSTAINABILITY**

SMART HOME SCENARIO	COMPETITIVENESS, TRADE and INVESTMENT	COMPETITION and the INTERNAL MARKET	OPERATING COSTS AND CONDUCT OF BUSINESS	ADMINISTRATIVE COSTS	INNOVATION and RESEARCH	EU CONSUMERS and HOUSEHOLDS	MACROECONOMIC and EMPLOYMENT	ENVIRONMENTAL and ENERGY	SOCIAL	DISTRIBUTIVE / EQUITY	SUSTAINABILITY
Public Sector Bodies	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	May assist in the achievement of energy efficiency objectives under environmental agreements for individual MS governments.	No Impacts Expected	No Impacts Expected	No Impacts Expected

4.2 Screening of distributed generation scenario

DISTRIBUTED GENERATION SCENARIO	COMPETITIVENESS, TRADE and INVESTMENT	COMPETITION and the INTERNAL MARKET	OPERATING COSTS AND CONDUCT OF BUSINESS	ADMINISTRATIVE COSTS	INNOVATION and RESEARCH	CONSUMERS and HOUSEHOLDS	MACROECONOMIC and EMPLOYMENT	ENVIRONMENTAL and ENERGY	SOCIAL	DISTRIBUTIVE / EQUITY	SUSTAINABILITY
CRITICAL INFRASTRUCTURES **EU M&C Providers (Hardware, Software and Service)**	Skills and expertise developed in applying M&C technology to different energy generating technology and infrastructure likely to increase the competitiveness, volume of trade and investment in EU M&C providers	As market develops and new rivals emerge, competition likely to intensify for M&C solutions in energy grids	Custom solutions to individual power generating facilities likely to limit benefits from economies of scale, compared to the M&C solutions required in more standardised consumer markets.	No Impacts Expected	Innovation focussed on more efficient and cost effective solutions likely to be driven by regulation on emissions, renewables and losses in the network infrastructure	No Impacts Expected	Employment in the manufacture, software development and services associated with the technology is likely to increase in the EU, more so than in some other sectors as M&C and energy expertise of many companies located in the EU	No Impacts Expected	No Impacts Expected	The integrated nature of solutions in this area and the customisation of many systems in large infrastructure likely to require a 'system integrator' approach to M&C provision. SMEs may therefore be disadvantaged.	Likely to be highly sustainable as once technology is rolled out in Europe, it can be applied across the world using EU skills and technology. Global regulatory drivers also likely to maintain demand for the foreseeable future.

EU Industry and Professional Users	DISTRIBUTED GENERATION SCENARIO
Energy generating industry should improve its competitiveness in terms of energy efficiency, cost per unit, flexibility, improved energy security and reduced environmental impact. Expertise developed in the EU can then be exported to other regions of the world, while attracting inward investment in EU energy companies.	**COMPETITIVENESS, TRADE and INVESTMENT**
The energy sector should become more competitive as providers have access to new technology and energy mix options, to provide energy at the lowest price, with the best security, environmental impact, etc.	**COMPETITION and the INTERNAL MARKET**
Operating costs should fall as efficiency of generation and distribution increases in terms of fuel inputs used and the carbon savings through lower CO_2 emissions. Conduct and strategies likely to become European and less national as internal market develops and grids become connected.	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	**ADMINISTRATIVE COSTS**
Innovation in the network and generating infrastructure likely to continue, particularly as existing capacity nears the end of its life and new capacity decisions need to be made (i.e. between nuclear, renewables and conventional energy sources)	**INNOVATION and RESEARCH**
Should benefit from cheaper energy, improved security of supply and the potential to generate their own energy. May also benefit from the comfort of knowing that the environment will benefit from lower carbon emissions.	**CONSUMERS and HOUSEHOLDS**
Employment unlikely to experience any significant impact as industry already automates and employs trained staff to monitor and maintain systems. At consumer level, employment could be increased in the maintenance and installation of home generating technology.	**MACROECONOMIC and EMPLOYMENT**
Efficiency gains in power generation and increases in renewables should reduce CO_2 and other emissions	**ENVIRONMENTAL and ENERGY**
Lower energy bills and cleaner environment, are expected to improve standards of living in the EU.	**SOCIAL**
Energy producing mix likely to differ between regions based on cost and applicability to region, leaving some regions of Europe to benefit to a greater extent than others do.	**DISTRIBUTIVE / EQUITY**
Highly sustainable as demand for energy and efficiency/technology advances always sought by industry and consumers, driven by regulation. EU expertise can also be exported worldwide creating more opportunities for growth	**SUSTAINABILITY**

EU Consumer Users	DISTRIBUTED GENERATION SCENARIO
No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	COMPETITION and the INTERNAL MARKET
Household energy bills should decrease in response to greater energy efficiency, choice, home generation, etc. High initial costs in installation and maintenance must first be earned back through these expected savings.	OPERATING COSTS AND CONDUCT OF BUSINESS
Potentially high administrative costs for households wishing to generate energy due to planning legislation, form filling to connect to national grid network, meter reading and EHS regulations	ADMINISTRATIVE COSTS
Innovations in products and services targeted at consumers likely to emerge as market develops for microgeneration	INNOVATION and RESEARCH
Should benefit from cheaper energy and improved security of supply	CONSUMERS and HOUSEHOLDS
New markets likely to emerge in the consulting, maintenance and installation of home generation, likely to boost employment in consumer/retail sector for microgeneration products	MACROECONOMIC and EMPLOYMENT
Efficiency gains in power generation and distribution should reduce CO_2 and other emissions Noise pollution and localised air pollution could be an issue in some areas where de-centralised/microgeneration takes place in built up areas or in areas of outstanding natural beauty (e.g. windfarms)	ENVIRONMENTAL and ENERGY
Lower energy bills and cleaner environment for all, should improve standards of living in the EU.	SOCIAL
Energy producing mix likely to differ between regions based on cost and applicability to region, leaving some regions of Europe to benefit to a greater extent than others. Wealthier socio-economic groups also more likely to adopt technology with larger homes and gardens in which to generate energy and to invest in the initial technology. Isolated communities should benefit most from decentralised power as transmission losses should decrease the most.	DISTRIBUTIVE / EQUITY
Sustainability dependant on initial cost of systems compared to conventionally produced energy. If large scale generation can achieve lower per unit costs and emissions than a microgeneration unit then highly unsustainable and visa-versa. For larger technology employed by energy providers, sustainability should be high driven by renewable, efficiency and carbon emission targets in the EU and worldwide	SUSTAINABILITY

Non-EU Users	Non-EU M&C Providers	DISTRIBUTED GENERATION SCENARIO
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Negative impact on competitiveness, trade and investment as expertise, skills and innovation in energy production grows within Europe	**COMPETITIVENESS, TRADE and INVESTMENT**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Provider may be able to compete aggressively on price but may find it more difficult in terms of solutions offered, training, efficiency of system, etc, as EU becomes leading market	**COMPETITION and the INTERNAL MARKET**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Same impacts as in the EU sector should apply	**OPERATING COSTS AND CONDUCT OF BUSINESS**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	No Impacts Expected	**ADMINISTRATIVE COSTS**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Same impacts as in the EU sector should apply.	**INNOVATION and RESEARCH**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Some employment generated as some components and devices will be sourced from outside EU, however as Europe is expected to be lead market in this area, it is likely to be the largest beneficiary	**MACROECONOMIC and EMPLOYMENT**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	No Impacts Expected	**ENVIRONMENTAL and ENERGY**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	No Impacts Expected	**SOCIAL**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	The integrated nature of solutions in this area and the customisation of many systems in large infrastructure likely to require a 'system integrator' approach to M&C provision. SMEs may therefore be disadvantaged.	**DISTRIBUTIVE / EQUITY**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Likely to be highly sustainable as once technology is rolled out in Europe, it can be applied across the world using EU skills and technology. Global regulatory drivers also likely to maintain demand for the near future.	**SUSTAINABILITY**

POWER GRIDS		DISTRIBUTED GENERATION SCENARIO
EU M&C Providers (Hardware, Software and Service)	**Public Sector Bodies**	
Volume of trade and investment should increase in smart metering and power grid technology as Europe takes a lead in mass adoption.	No Impacts Expected	**COMPETITIVENESS, TRADE and INVESTMENT**
As the market develops and new rivals emerge, competition is likely to intensify for M&C metering and power grid providers	No Impacts Expected	**COMPETITION and the INTERNAL MARKET**
Significant economies of scale in mass metering role-out should reduce costs for M&C system providers.	No Impacts Expected	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	Increased administrative costs in monitoring and regulating producers, specifically household generators of energy due to planning, health, safety and environmental obligations	**ADMINISTRATIVE COSTS**
Expertise and growing market in EU likely to spur further investment and innovation	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Employment expected to increase in response to demand for metering and power grid technology.	Some increased employment to deal with administrative tasks involved in household generation	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	Policy targets partially achievable (i.e. Lisbon Agreement and Strategy) avoiding EU infraction proceedings for individual Member States by achieving reductions in carbon emissions and renewable energy targets.	**ENVIRONMENTAL and ENERGY**
No Impacts Expected	No Impacts Expected	**SOCIAL**
No Impacts Expected	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
High sustainability given demand for energy saving and efficiency technology	Sustainability of energy supplies to businesses and households should improve, thus enabling MS to partially achieve sustainable growth and development policy objectives.	**SUSTAINABILITY**

DISTRIBUTED GENERATION SCENARIO	COMPETITIVENESS, TRADE and INVESTMENT	COMPETITION and the INTERNAL MARKET	OPERATING COSTS AND CONDUCT OF BUSINESS	ADMINISTRATIVE COSTS	INNOVATION and RESEARCH	CONSUMERS and HOUSEHOLDS	MACROECONOMIC and EMPLOYMENT	ENVIRONMENTAL and ENERGY	SOCIAL	DISTRIBUTIVE / EQUITY	SUSTAINABILITY
EU Industry and Professional Users	Should improve competitiveness of energy sector as metering, billing and associated costs are reduced. Energy savings in distribution, should also increase environmental competitiveness.	No Impacts Expected	Energy sector likely to benefit substantially from smart meters as billing, admin, meter reading and non-technical reduced. Staff may require training in new technology and systems, as well as informing consumers of its application, if benefits to be optimised. Utility companies are likely to be the investor in the technology on	Smart metering should lower administrative costs in terms of recording and reporting consumption of energy for the energy sector and industry users	No Impacts Expected	No Impacts Expected	Service and maintenance employment in the energy sector is less likely to increase a technicians already exist, however, training in new technology likely and some unemployment possible as smart meters require less manual recording.	Energy generating energy should see improvements in the efficiency of the network and reduced consumption by businesses/households, therefore reducing emissions of CO_2	Monitoring of energy use via smart meters should enable the identification of those customers fraudulently consuming energy from network. Society may also become more energy conscious.	No Impacts Expected	High sustainability as demand for greater efficiency and reduced consumption industry as its is a cost should ensure long-term market for metering and power grid uses of the technology
EU Consumer Users	No Impacts Expected	No Impacts Expected	Lower energy bills possible through the improved efficiency of the network and some home/local generation, plus changes to consumer behaviour where smart meters include a visual display. Higher bills possible at first to pay for utility investments.	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	Reduced energy consumption and improved transmission efficiency should reduce environmental impacts (e.g. CO_2 and associated emissions)	The least honest consumers will find it more difficult to fraudulently consume energy from the network and society may become energy conscious.	Role out of technology likely to begin in new properties, therefore disproportionate benefit for some households, as are households able to afford microgeneration technology as they gain the most from smart meter capabilities.	Sustainability of the smart meter and associated technology is high provided the reliability and cost of smart meters is not greater than the benefits for households as energy prices drive consumers to save energy

DISTRIBUTED GENERATION SCENARIO		
	Non-EU Hardware and Software Providers	Non-EU Users
COMPETITIVENESS, TRADE and INVESTMENT	Trade likely to increase as some components and devices sourced from outside the EU. Similarly, EU technology will be exported to other countries.	No Impacts Expected
COMPETITION and the INTERNAL MARKET	As the market for smart technology expands inside and outside Europe, competition is likely to intensify.	No Impacts Expected
OPERATING COSTS AND CONDUCT OF BUSINESS	Similar impacts to those affecting the EU are expected	Similar impacts to those affecting the EU are expected
ADMINISTRATIVE COSTS	No Impacts Expected	Similar impacts to those affecting the EU are expected
INNOVATION and RESEARCH	Similar impacts to those affecting the EU are expected	No Impacts Expected
CONSUMERS and HOUSEHOLDS	No Impacts Expected	Similar impacts to those affecting the EU are expected
MACROECONOMIC and EMPLOYMENT	Similar impacts to those affecting the EU are expected.	Similar impacts to those affecting the EU are expected
ENVIRONMENTAL and ENERGY	No Impacts Expected	Similar impacts to those affecting the EU are expected
SOCIAL	No Impacts Expected	Similar impacts to those affecting the EU are expected
DISTRIBUTIVE / EQUITY	Likely to lose out to EU providers who gain experience in EU market and develop skills/industry base from which future innovations may emerge.	Potentially the same impacts as EU Users
SUSTAINABILITY	Highly sustainable as emerging economies and others likely to follow EU lead over time, thus industry likely to develop with the market for smart metering and power gird technology	Highly sustainable as emerging economies and others likely to follow EU lead over time, thus industry likely to develop over time

DISTRIBUTED GENERATION SCENARIO	COMPETITIVENESS, TRADE and INVESTMENT	COMPETITION and the INTERNAL MARKET	OPERATING COSTS AND CONDUCT OF BUSINESS	ADMINISTRATIVE COSTS	INNOVATION and RESEARCH	CONSUMERS and HOUSEHOLDS	MACROECONOMIC and EMPLOYMENT	ENVIRONMENTAL and ENERGY	SOCIAL	DISTRIBUTIVE / EQUITY	SUSTAINABILITY
Public Sector Bodies	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	Policy targets partially achievable (i.e. Lisbon Agreement and Strategy) avoiding EU infraction proceedings for individual Member States by achieving reductions in carbon emissions and renewable energy targets. As an indirect impact, energy security should be improved if reductions and shifts in consumption reduce the energy dependency of the EU on fuel imports. This could be significant	No Impacts Expected	No Impacts Expected	Sustainability of energy supplies to businesses and households should improve, thus enabling MS to partially achieve sustainable growth and development policy objectives.

4.3 Screening of pervasive network scenario

CRITICAL INFRASTRUCTURES	PERVASIVE NETWORK SCENARIO	COMPETITIVENESS, TRADE and INVESTMENT	COMPETITION and the INTERNAL MARKET	OPERATING COSTS AND CONDUCT OF BUSINESS	ADMINISTRATIVE COSTS	INNOVATION and RESEARCH	CONSUMERS and HOUSEHOLDS	MACROECONOMIC and EMPLOYMENT	ENVIRONMENTAL	SOCIAL	DISTRIBUTIVE / EQUITY	SUSTAINABILITY
	EU M&C Providers (Hardware, Software and Service)	Skills and expertise developed in applying M&C technology to different energy generating technology and infrastructure likely to increase the competitiveness, volume of trade and investment in EU M&C providers	As market develops and new rivals emerge, competition likely to intensify for M&C solutions in energy grids	Custom solutions to individual power generating facilities likely to limit benefits from economies of scale, compared to the M&C solutions required in more standardised consumer markets.	No Impacts Expected	Innovation focussed on more efficient and cost effective solutions likely to be driven by regulation on emissions, renewables and losses in the network infrastructure	No Impacts Expected	Employment in the manufacture, software development and services associated with the technology is likely to increase in the EU, more so than in some other sectors as M&C and energy expertise of many companies located in the EU	No Impacts Expected	No Impacts Expected	The integrated nature of solutions in this area and the customisation of many systems in large infrastructure likely to require a 'system integrator' approach to M&C provision. SMEs may therefore be disadvantaged.	Likely to be highly sustainable as once technology is rolled out in Europe, it can be applied across the world using EU skills and technology. Global regulatory drivers also likely to maintain demand for the foreseeable future.

EU Industry and Professional Users	PERVASIVE NETWORK SCENARIO
Energy generating industry should improve its competitiveness in terms of energy efficiency, cost per unit, flexibility, improved energy security and reduced environmental impact. Expertise developed in the EU can then be exported to other regions of the world, while attracting inward investment in EU energy companies.	**COMPETITIVENESS, TRADE and INVESTMENT**
The energy sector should become more competitive as providers have access to new technology and energy mix options, to provide energy at the lowest price, with the best security, environmental impact, etc.	**COMPETITION and the INTERNAL MARKET**
Operating costs should fall as efficiency of generation and distribution increases in terms of fuel inputs used and the carbon savings through lower CO_2 emissions. Conduct and strategies likely to become European and less national as internal market develops and grids become connected.	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	**ADMINISTRATIVE COSTS**
Innovation in the network and generating infrastructure likely to continue, particularly as existing capacity nears the end of its life and new capacity decisions need to be made (i.e. between nuclear, renewables and conventional energy sources)	**INNOVATION and RESEARCH**
Should benefit from cheaper energy, improved security of supply and the potential to generate their own energy. May also benefit from the comfort of knowing that the environment will benefit from lower carbon emissions.	**CONSUMERS and HOUSEHOLDS**
Employment unlikely to experience any significant impact as industry already automates and employs trained staff to monitor and maintain systems. At consumer level, employment could be increased in the maintenance and installation of home generating technology.	**MACROECONOMIC and EMPLOYMENT**
Efficiency gains in power generation and increases in renewables should reduce CO_2 and other emissions	**ENVIRONMENTAL**
Lower energy bills and cleaner environment, are expected to improve standards of living in the EU.	**SOCIAL**
Energy producing mix likely to differ between regions based on cost and applicability to region, leaving some regions of Europe to benefit to a greater extent than others do.	**DISTRIBUTIVE / EQUITY**
Highly sustainable as demand for energy and efficiency/technology advances always sought by industry and consumers, driven by regulation. EU expertise can also be exported worldwide creating more opportunities for growth	**SUSTAINABILITY**

EU Consumer Users	PERVASIVE NETWORK SCENARIO
No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	COMPETITION and the INTERNAL MARKET
Household energy bills should decrease in response to greater energy efficiency, choice, home generation, etc. High initial costs in installation and maintenance must first be earned back through these expected savings.	OPERATING COSTS AND CONDUCT OF BUSINESS
Potentially high administrative costs for households wishing to generate energy due to planning legislation, form filling to connect to national grid network, meter reading and EHS regulations	ADMINISTRATIVE COSTS
Innovations in products and services targeted at consumers likely to emerge as market develops for microgeneration	INNOVATION and RESEARCH
Should benefit from cheaper energy and improved security of supply	CONSUMERS and HOUSEHOLDS
New markets likely to emerge in the consulting, maintenance and installation of home generation, likely to boost employment in consumer/retail sector for microgeneration products	MACROECONOMIC and EMPLOYMENT
Efficiency gains in power generation and distribution should reduce CO_2 and other emissions Noise pollution and localised air pollution could be an issue in some areas where de-centralised/microgeneration takes place in built up areas or in areas of outstanding natural beauty (e.g. windfarms)	ENVIRONMENTAL
Lower energy bills and cleaner environment for all, should improve standards of living in the EU.	SOCIAL
Energy producing mix likely to differ between regions based on cost and applicability to region, leaving some regions of Europe to benefit to a greater extent than others. Wealthier socio-economic groups also more likely to adopt technology with larger homes and gardens in which to generate energy and to invest in the initial technology. Isolated communities should benefit most from decentralised power as transmission losses should decrease the most.	DISTRIBUTIVE / EQUITY
Sustainability dependant on initial cost of systems compared to conventionally produced energy. If large scale generation can achieve lower per unit costs and emissions than a microgeneration unit then highly unsustainable and visa-versa. For larger technology employed by energy providers, sustainability should be high driven by renewable, efficiency and carbon emission targets in the EU and worldwide	SUSTAINABILITY

Non-EU Users	Non-EU M&C Providers	PERVASIVE NETWORK SCENARIO
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Negative impact on competitiveness, trade and investment as expertise, skills and innovation in energy production grows within Europe	**COMPETITIVENESS, TRADE and INVESTMENT**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Provider may be able to compete aggressively on price but may find it more difficult in terms of solutions offered, training, efficiency of system, etc, as EU becomes leading market	**COMPETITION and the INTERNAL MARKET**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Same impacts as in the EU sector should apply	**OPERATING COSTS AND CONDUCT OF BUSINESS**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	No Impacts Expected	**ADMINISTRATIVE COSTS**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Same impacts as in the EU sector should apply.	**INNOVATION and RESEARCH**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Some employment generated as some components and devices will be sourced from outside EU, however as Europe is expected to be lead market in this area, it is likely to be the largest beneficiary	**MACROECONOMIC and EMPLOYMENT**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	No Impacts Expected	**ENVIRONMENTAL**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	No Impacts Expected	**SOCIAL**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	The integrated nature of solutions in this area and the customisation of many systems in large infrastructure likely to require a 'system integrator' approach to M&C provision. SMEs may therefore be disadvantaged.	**DISTRIBUTIVE / EQUITY**
Non-EU users (households and businesses), specifically the energy sector should be affect to the same extent as EU users.	Likely to be highly sustainable as once technology is rolled out in Europe, it can be applied across the world using EU skills and technology. Global regulatory drivers also likely to maintain demand for the near future.	**SUSTAINABILITY**

POWER GRIDS		PERVASIVE NETWORK SCENARIO
EU M&C Providers (Hardware, Software and Service)	**Public Sector Bodies**	
Volume of trade and investment should increase in smart metering and power grid technology as Europe takes a lead in mass adoption.	No Impacts Expected	**COMPETITIVENESS, TRADE and INVESTMENT**
As the market develops and new rivals emerge, competition is likely to intensify for M&C metering and power grid providers	No Impacts Expected	**COMPETITION and the INTERNAL MARKET**
Significant economies of scale in mass metering role-out should reduce costs for M&C system providers.	No Impacts Expected	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	Increased administrative costs in monitoring and regulating producers, specifically household generators of energy due to planning, health, safety and environmental obligations	**ADMINISTRATIVE COSTS**
Expertise and growing market in EU likely to spur further investment and innovation	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Employment expected to increase in response to demand for metering and power grid technology.	Some increased employment to deal with administrative tasks involved in household generation	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	Policy targets partially achievable (i.e. Lisbon Agreement and Strategy) avoiding EU infraction proceedings for individual Member States by achieving reductions in carbon emissions and renewable energy targets. As an indirect impact, energy security should be improved if reductions and shifts in consumption reduce the energy dependency of the EU on fuel imports. This could be significant	**ENVIRONMENTAL**
No Impacts Expected	No Impacts Expected	**SOCIAL**
No Impacts Expected	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
High sustainability given demand for energy saving and efficiency technology	Sustainability of energy supplies to businesses and households should improve, thus enabling MS to partially achieve sustainable growth and development policy objectives.	**SUSTAINABILITY**

EU Industry and Professional Users	PERVASIVE NETWORK SCENARIO
Should improve competitiveness of energy sector as metering, billing and associated costs are reduced. Energy savings in distribution, should also increase environmental competitiveness.	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	COMPETITION and the INTERNAL MARKET
Energy sector likely to benefit substantially from smart meters as billing, admin, meter reading and non-technical reduced. Staff may require training in new technology and systems, as well as informing consumers of its application, if benefits to be optimised. Utility companies are likely to be the investor in the technology on behalf of industry and consumer users at high cost. Lower energy bills also expected for industry as efficiency improves and consumption decreases	OPERATING COSTS AND CONDUCT OF BUSINESS
Smart metering should lower administrative costs in terms of recording and reporting consumption of energy for the energy sector and industry users	ADMINISTRATIVE COSTS
No Impacts Expected	INNOVATION and RESEARCH
No Impacts Expected	CONSUMERS and HOUSEHOLDS
Service and maintenance employment in the energy sector is less likely to increase a technicians already exist, however, training in new technology likely and some unemployment possible as smart meters require less manual recording. Impact on industry using energy likely to be unchanged	MACROECONOMIC and EMPLOYMENT
Energy generating energy should see improvements in the efficiency of the network and reduced consumption by businesses/households, therefore reducing emissions of CO_2	ENVIRONMENTAL
Monitoring of energy use via smart meters should enable the identification of those customers fraudulently consuming energy from network. Society may also become more energy conscious.	SOCIAL
No Impacts Expected	DISTRIBUTIVE / EQUITY
High sustainability as demand for greater efficiency and reduced consumption industry as its is a cost should ensure long-term market for metering and power grid uses of the technology	SUSTAINABILITY

Non-EU Users	Non-EU Hardware and Software Providers	EU Consumer Users	PERVASIVE NETWORK SCENARIO
No Impacts Expected	Trade likely to increase as some components and devices sourced from outside the EU. Similarly, EU technology will be exported to other countries.	No Impacts Expected	**COMPETITIVENESS, TRADE and INVESTMENT**
No Impacts Expected	As the market for smart technology expands inside and outside Europe, competition is likely to intensify.	No Impacts Expected	**COMPETITION and the INTERNAL MARKET**
Similar impacts to those affecting the EU are expected	Similar impacts to those affecting the EU are expected	Lower energy bills possible through the improved efficiency of the network and some home/local generation, plus changes to consumer behaviour where smart meters include a visual display. Higher bills possible at first to pay for utility investments.	**OPERATING COSTS AND CONDUCT OF BUSINESS**
Similar impacts to those affecting the EU are expected	No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
No Impacts Expected	Similar impacts to those affecting the EU are expected	No Impacts Expected	**INNOVATION and RESEARCH**
Similar impacts to those affecting the EU are expected	No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Similar impacts to those affecting the EU are expected	Similar impacts to those affecting the EU are expected.	No Impacts Expected	**MACROECONOMIC and EMPLOYMENT**
Similar impacts to those affecting the EU are expected	No Impacts Expected	Reduced energy consumption and improved transmission efficiency should reduce environmental impacts (e.g. CO_2 and associated emissions)	**ENVIRONMENTAL**
Similar impacts to those affecting the EU are expected	No Impacts Expected	The least honest consumers will find it more difficult to fraudulently consume energy from the network and society may become energy conscious.	**SOCIAL**
Potentially the same impacts as EU Users	Likely to lose out to EU providers who gain experience in EU market and develop skills/industry base from which future innovations may emerge.	Role out of technology likely to begin in new properties, therefore disproportionate benefit for some households, as are households able to afford microgeneration technology as they gain the most from smart meter capabilities.	**DISTRIBUTIVE / EQUITY**
Highly sustainable as emerging economies and others likely to follow EU lead over time, thus industry likely to develop over time	Highly sustainable as emerging economies and others likely to follow EU lead over time, thus industry likely to develop with the market for smart metering and power gird technology	Sustainability of the smart meter and associated technology is high provided the reliability and cost of smart meters is not greater than the benefits for households as energy prices drive consumers to save energy	**SUSTAINABILITY**

PERVASIVE NETWORK SCENARIO	COMPETITIVENESS, TRADE and INVESTMENT	COMPETITION and the INTERNAL MARKET	OPERATING COSTS AND CONDUCT OF BUSINESS	ADMINISTRATIVE COSTS	INNOVATION and RESEARCH	CONSUMERS and HOUSEHOLDS	MACROECONOMIC and EMPLOYMENT	ENVIRONMENTAL	SOCIAL	DISTRIBUTIVE / EQUITY	SUSTAINABILITY
Public Sector Bodies	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	Policy targets partially achievable (i.e. Lisbon Agreement and Strategy) avoiding EU infraction proceedings for individual Member States by achieving reductions in carbon emissions and renewable energy targets. As an indirect impact, energy security should be improved if reductions and shifts in consumption reduce the energy dependency of the EU on fuel imports. This could be significant	No Impacts Expected	No Impacts Expected	Sustainability of energy supplies to businesses and households should improve, thus enabling MS to partially achieve sustainable growth and development policy objectives.

BUILDING EU M&C Providers (Hardware, Software and Service)	PERVASIVE NETWORK SCENARIO
First mover advantage gained by rapid roll out in Europe should increase market potential in non-EU countries. Competitiveness and trade therefore expected to increase in volume and value. Many systems and components likely to be imported into the EU as already manufactured in low cost economies, restricting manufacturing benefits. Software and services therefore likely to incur greatest benefits in the EU.	COMPETITIVENESS, TRADE and INVESTMENT
Increases in the range and technical capability of products available on the EU market should intensify competition and create new market opportunities.	COMPETITION and the INTERNAL MARKET
Greater acceptance of existing technology and increasing demand should bring down costs through economies of scale and competition between providers. Business strategies may change for providers re-focussing on professional user/consumer distribution and retail channels.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	ADMINISTRATIVE COSTS
Growth in sector is likely to focus a greater proportion of existing R&D expenditure on home management and related products/services.	INNOVATION and RESEARCH
Acceptance of home management M&C solution should increase consumer acceptance of technology, leading to addition sales of related systems for the workplace or in different high –tech fields.	CONSUMERS and HOUSEHOLDS
Minimal impact on EU employment expected as the manufacturer of a large proportion of component and systems expected to be produced outside the EU. However, software and service elements (particularly maintenance and installation) likely to generate significant employment	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	SOCIAL
Expertise and suppliers expected to be located close to customer base, therefore more likely to be concentrated in high income urban areas, where modern building are adapted for M&C solutions and affordable to households SMEs could find it difficult to compete where larger providers team up to offer complete solutions through large-scale retail channels and professional user networks.	DISTRIBUTIVE / EQUITY
Medium to high sustainability given that technology rarely moves backwards, but growth and jobs rely on availability of services (maintenance) in regions and affordability of systems in relation to energy costs, etc. If future consumer response is negative towards these systems, sustainability could be low.	SUSTAINABILITY

EU Industry and Professional Users	PERVASIVE NETWORK SCENARIO
First mover advantage also possible for trained professional users and installers of equipment as they gain greater market opportunities and increase their competitiveness over rivals. Also raises the possibility of selling such products/services outside the EU.	COMPETITIVENESS, TRADE and INVESTMENT
New products, providers and expertise in automation and general building electrics likely to intensify competition for installers/users	COMPETITION and the INTERNAL MARKET
With many large commercial buildings already containing automations systems, business strategy of professional users must shift to consumer DIY, property developer and renovation markets	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	ADMINISTRATIVE COSTS
New training schemes and installation/building techniques likely to emerge as market develops to accommodate the technology	INNOVATION and RESEARCH
Initially consumers and households encounter a shortage of trained installers and advice until market develops and more professional users/architects are trained or become aware of the technology	CONSUMERS and HOUSEHOLDS
Employment likely to increase in professional services as demand for maintenance, installation, software and associated technologies grows	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	SOCIAL
Expertise and suppliers expected to be located close to customer base, therefore more likely to be concentrated in high income urban areas, where modern building are adapted for M&C solutions and affordable to households SMEs could find it difficult to compete where larger providers team up to offer complete solutions through large-scale retail channels and professional user networks.	DISTRIBUTIVE / EQUITY
Medium sustainability as growth in the home automation likely to sustain many service/maintenance employment and support industry for life of a typical system (circa. 10 years). However, impact depends on long term consumer acceptance and adoption.	SUSTAINABILITY

EU Consumer Users	PERVASIVE NETWORK SCENARIO
No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	COMPETITION and the INTERNAL MARKET
Energy and Insurance costs could fall as an automated security and heating systems could reduce risks and consumption of gas/electric.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	INNOVATION and RESEARCH
Security benefits for consumers and small improvements in energy efficiency as lighting and heating can be utilised in a more efficient way. Significant increases in efficiency and reductions in energy bills only likely in combination with changes to energy charging, metering, transmission and generation. Likely to incur costs in terms of installation and maintenance, plus potential health impacts if physical activity is reduced for some households.	CONSUMERS and HOUSEHOLDS
No Impacts Expected	MACROECONOMIC and EMPLOYMENT
Consumer use of energy should decrease due to improved energy efficiency, carbon emissions may then also decrease as an indirect benefit. Small shift in peak demand may also occur, although minimal as user/management system cannot differentiate between peak and off peak in this scenario	ENVIRONMENTAL
Information gathered by systems and control of systems raises e-security, privacy, data protection and legal issues over how it is stored/used/controlled by individuals/companies/governments. Systems could help reduce crime and therefore assist police forces/insurers and improve the quality of life in communities. Health implication of increased automation and less exercise should also be considered.	SOCIAL
.Distribution of systems expected to be high in high socio-economic groups, pushing crime to less wealth areas. Similarly, energy savings likely to benefit higher socio-economies groups opposed to poorer households who spend a greater proportion of incomes on energy related costs, due to the initial affordability of home management systems.	DISTRIBUTIVE / EQUITY
Sustainability depends on consumer response to first adoption of automation systems. If expected benefits/costs are not realised or fashions change, then sustainability likely to be low	SUSTAINABILITY

Non-EU Users	Non-EU Hardware and Software Providers	PERVASIVE NETWORK SCENARIO
No Impacts Expected	Hardware and some software providers likely to benefit outside the EU because a large proportion of components and systems are currently manufactured outside the EU.	**COMPETITIVENESS, TRADE and INVESTMENT**
No Impacts Expected	Increases in the range and technical capability of products available on the EU market should intensify competition and create new opportunities worldwide	**COMPETITION and the INTERNAL MARKET**
Benefit from reduce energy costs as efficiency due to efficiency of automation systems. Similarly, insurance costs could fall for some users	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
No Impacts Expected	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
No Impacts Expected	Employment likely to be generated in the manufacture and development of devices/software, less so services where EU likely to gain competitive advantage.	**MACROECONOMIC and EMPLOYMENT**
Consumer use of energy should decrease due to improved energy efficiency and operation of electrical devices. Overall CO2 emissions may indirectly decrease.	No Impacts Expected	**ENVIRONMENTAL**
Information gathered by systems and control of systems raises e-security, privacy, data protection and legal issues over how it is stored/used/controlled by individuals, companies, and governments. Systems could help reduce crime and therefore assist police forces/insurers and improve the quality of life in communities. Health implication of increased automation and less exercise should also be considered.	No Impacts Expected	**SOCIAL**
Distribution of systems expected to be high in high socio-economic groups, pushing crime into, and increasing relative energy costs for poorer households/regions	Cost of production in emerging economies and affordability of systems by users on the other hand likely to determine geographical distribution of impacts.	**DISTRIBUTIVE / EQUITY**
Sustainability depends on consumer response to first adoption of automation systems. If expected benefits/costs are not realised or fashions change, then sustainability likely to be low	Sustainability likely to be similar to that expected in the EU, based on consumer response to technology.	**SUSTAINABILITY**

HOUSEHOLD APPLIANCES		PERVASIVE NETWORK SCENARIO
EU M&C Providers (Hardware, Software and Service)	**Public Sector Bodies**	
First mover advantage gained by rapid roll out in Europe should increase market potential in non-EU countries. Competitiveness and trade therefore expected to increase in volume and value. Many systems and components likely to be imported into the EU as already manufactured in low cost economies, restricting manufacturing benefits.	No Impacts Expected	**COMPETITIVENESS, TRADE and INVESTMENT**
Increases in the range and technical capability of products available on the EU market should intensify competition and create new market opportunities regarding how individual appliances may interact with a management system	No Impacts Expected	**COMPETITION and the INTERNAL MARKET**
Greater acceptance of existing technology and increasing demand should bring down costs through economies of scale and competition between providers. Business strategies may change to develop more appliances compatible with management systems and develop new functionalities	No Impacts Expected	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
Growth in sector is likely to focus a greater proportion of existing R&D expenditure on creating new opportunities for new and existing appliances in home management	No Impacts Expected	**INNOVATION and RESEARCH**
Acceptance of home management M&C solutions should increase consumer acceptance of other technologies. This is particularly relevant in the home appliance sector where new products and solutions are constantly emerging with updated specifications and increased capabilities.	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Minimal impact on EU employment expected as the manufacturer of a large proportion of component and systems expected outside of the EU.	No Impacts Expected	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	May assist in the achievement of energy efficiency objectives under environmental agreements for individual MS governments.	**ENVIRONMENTAL**
No Impacts Expected	No Impacts Expected	**SOCIAL**
SMEs could find it difficult to compete in the appliance sector due to the research, production, marketing and distribution scale economies enjoyed by multinational groups that dominate the appliance market in Asia, Europe, and the US.	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
More sustainable than the home management product groups as existing demand already exists for many home appliances, however the sustainability of home management functions incorporated in appliances is less certain as it will depend on consumer response to the technology and its opportunities.	No Impacts Expected	**SUSTAINABILITY**

EU Consumer Users	EU Industry and Professional Users	PERVASIVE NETWORK SCENARIO
No Impacts Expected	No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	No Impacts Expected	COMPETITION and the INTERNAL MARKET
Energy and insurance costs could fall as an appliances help reduce energy consumption and increase security around the home.	Service and repair engineers/electricians may need to retrain in order to understand the new technologies. However, this is ongoing for many as the technology and model placed on the market is constantly changing. Impact from baseline therefore expected to be minimal.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	No Impacts Expected	INNOVATION and RESEARCH
In addition to energy savings, households also likely to gain potential comfort and convenience benefits from new appliances that can be programmed or automated.	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	No Impacts Expected	MACROECONOMIC and EMPLOYMENT
More efficient energy use by home appliances is likely to generate indirect carbon savings.	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	SOCIAL
.Distribution of appliances expected to be high in high socio-economic groups, opposed to poorer households due to the affordability of appliances and rate at which households are likely to replace/upgrade appliances in response to trends, etc.	No Impacts Expected	DISTRIBUTIVE / EQUITY
Depends on consumer response to the technology and their future demand for 'smart' functions over other product characteristics such as price, quality and ease of use.	No Impacts Expected	SUSTAINABILITY

Public Sector Bodies	Non-EU Users	Non-EU Hardware and Software Providers	PERVASIVE NETWORK SCENARIO
No Impacts Expected	Significant benefits possible as many appliances consumed in the EU are manufacture outside the EU	Significant benefits possible as many M&C systems consumed in the EU are manufacture outside the EU	**COMPETITIVENESS, TRADE and INVESTMENT**
No Impacts Expected	Increases in the range and technical capability of products available should intensify competition.	Increases in the range and technical capability of products available should intensify competition.	**COMPETITION and the INTERNAL MARKET**
No Impacts Expected	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions in appliances	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions in appliances	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
No Impacts Expected	Growth in sector is likely to focus a greater proportion of existing R&D expenditure on creating new opportunities for new and existing appliances in home management	Growth in sector is likely to focus a greater proportion of existing R&D expenditure on creating new opportunities for new and existing appliances in home management	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
No Impacts Expected	Employment likely to be generated in the manufacture of appliances	Employment likely to be generated in the manufacture and development of embedded M&C solutions	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**ENVIRONMENTAL**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**SOCIAL**
No Impacts Expected	Cost of production in emerging economies and affordability of systems by users on the other hand likely to determine geographical distribution of impacts.	Cost of production in emerging economies and affordability of systems by users on the other hand likely to determine geographical distribution of impacts.	**DISTRIBUTIVE / EQUITY**
No Impacts Expected	Sustainability likely to be similar to that expected in the EU, based on consumer response to technology.	Sustainability likely to be similar to that expected in the EU, based on consumer response to technology.	**SUSTAINABILITY**

HOMES EU M&C Providers (Hardware, Software and Service)	PERVASIVE NETWORK SCENARIO
First mover advantage gained by rapid roll out in Europe should increase market potential in non-EU countries. Competitiveness and trade therefore expected to increase in volume and value. Many systems and components likely to be imported into the EU as already manufactured in low cost economies, restricting manufacturing benefits. Software and services therefore likely to incur greatest benefits in the EU.	**COMPETITIVENESS, TRADE and INVESTMENT**
Increases in the range and technical capability of products available on the EU market should intensify competition and create new market opportunities.	**COMPETITION and the INTERNAL MARKET**
Greater acceptance of existing technology and increasing demand should bring down costs through economies of scale and competition between providers. Business strategies may change for providers re-focussing on professional user/consumer distribution and retail channels.	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	**ADMINISTRATIVE COSTS**
Growth in sector is likely to focus a greater proportion of existing R&D expenditure on home management and related products/services.	**INNOVATION and RESEARCH**
Acceptance of home management M&C solution should increase consumer acceptance of technology, leading to addition sales of related systems for the workplace or in different high –tech fields.	**CONSUMERS and HOUSEHOLDS**
Minimal impact on EU employment expected as the manufacturer of a large proportion of component and systems expected to be produced outside the EU. However, software and service elements (particularly maintenance and installation) likely to generate significant employment	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	**ENVIRONMENTAL**
No Impacts Expected	**SOCIAL**
Expertise and suppliers expected to be located close to customer base, therefore more likely to be concentrated in high income urban areas, where modern building are adapted for M&C solutions and affordable to households SMEs could find it difficult to compete where larger providers team up to offer complete solutions through	**DISTRIBUTIVE / EQUITY**
Medium to high sustainability given that technology rarely moves backwards, but growth and jobs rely on availability of services (maintenance) in regions and affordability of systems in relation to energy costs, etc. If future consumer response is negative towards these systems, sustainability could be low.	**SUSTAINABILITY**

EU Industry and Professional Users	PERVASIVE NETWORK SCENARIO
First mover advantage also possible for trained professional users and installers of equipment as they gain greater market opportunities and increase their competitiveness over rivals. Also raises the possibility of selling such products/services outside the EU.	**COMPETITIVENESS, TRADE and INVESTMENT**
New products, providers and expertise in automation and general building electrics likely to intensify competition for installers/users	**COMPETITION and the INTERNAL MARKET**
With many large commercial buildings already containing automations systems, business strategy of professional users must shift to consumer DIY, property developer and renovation markets	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	**ADMINISTRATIVE COSTS**
New training schemes and installation/building techniques likely to emerge as market develops to accommodate the technology	**INNOVATION and RESEARCH**
Initially consumers and households encounter a shortage of trained installers and advice until market develops and more professional users/architects are trained or become aware of the technology	**CONSUMERS and HOUSEHOLDS**
Employment likely to increase in professional services as demand for maintenance, installation, software and associated technologies grows	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	**ENVIRONMENTAL**
No Impacts Expected	**SOCIAL**
Expertise and suppliers expected to be located close to customer base, therefore more likely to be concentrated in high income urban areas, where modern building are adapted for M&C solutions and affordable to households	**DISTRIBUTIVE / EQUITY**
Medium sustainability as growth in the home automation likely to sustain many service/maintenance employment and support industry for life of a typical system (circa. 10 years). However, impact depends on long term consumer acceptance and adoption.	**SUSTAINABILITY**

EU Consumer Users	PERVASIVE NETWORK SCENARIO
No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	COMPETITION and the INTERNAL MARKET
Energy and Insurance costs could fall as an automated security and heating systems could reduce risks and consumption of gas/electric.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	INNOVATION and RESEARCH
Security benefits for consumers and small improvements in energy efficiency as lighting and heating can be utilised in a more efficient way. Significant increases in efficiency and reductions in energy bills only likely in combination with changes to energy charging, metering, transmission and generation. Likely to incur costs in terms of installation and maintenance, plus potential health impacts if physical activity is reduced for some households.	CONSUMERS and HOUSEHOLDS
No Impacts Expected	MACROECONOMIC and EMPLOYMENT
Consumer use of energy should decrease due to improved energy efficiency, carbon emissions may then also decrease as an indirect benefit. Small shift in peak demand may also occur, although minimal as user/management system cannot differentiate between peak and off peak in this scenario	ENVIRONMENTAL
Information gathered by systems and control of systems raises e-security, privacy, data protection and legal issues over how it is stored/used/controlled by individuals/companies/governments. Systems could help reduce crime and therefore assist police forces/insurers and improve the quality of life in communities. Health implication of increased automation and less exercise should also be considered.	SOCIAL
.Distribution of systems expected to be high in high socio-economic groups, pushing crime to less wealth areas. Similarly, energy savings likely to benefit higher socio-economies groups opposed to poorer households who spend a greater proportion of incomes on energy related costs, due to the initial affordability of home management systems.	DISTRIBUTIVE / EQUITY
Sustainability depends on consumer response to first adoption of automation systems. If expected benefits/costs are not realised or fashions change, then sustainability likely to be low	SUSTAINABILITY

Non-EU Users	Non-EU Hardware and Software Providers	PERVASIVE NETWORK SCENARIO
No Impacts Expected	Hardware and some software providers likely to benefit outside the EU because a large proportion of components and systems are currently manufactured outside the EU.	**COMPETITIVENESS, TRADE and INVESTMENT**
No Impacts Expected	Increases in the range and technical capability of products available on the EU market should intensify competition and create new opportunities worldwide	**COMPETITION and the INTERNAL MARKET**
Benefit from reduce energy costs as efficiency due to efficiency of automation systems. Similarly, insurance costs could fall for some users	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
No Impacts Expected	Same impacts expected worldwide as in the EU as dealing with global markets and suppliers of M&C solutions	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
No Impacts Expected	Employment likely to be generated in the manufacture and development of devices/software, less so services where EU likely to gain competitive advantage.	**MACROECONOMIC and EMPLOYMENT**
Consumer use of energy should decrease due to improved energy efficiency and operation of electrical devices. Overall CO2 emissions may indirectly decrease.	No Impacts Expected	**ENVIRONMENTAL**
Information gathered by systems and control of systems raises e-security, privacy, data protection and legal issues over how it is stored/used/controlled by individuals, companies, and governments. Systems could help reduce crime and therefore assist police forces/insurers and improve the quality of life in communities. Health implication of increased automation and less exercise should also be considered.	No Impacts Expected	**SOCIAL**
Distribution of systems expected to be high in high socio-economic groups, pushing crime into, and increasing relative energy costs for poorer households/regions	Cost of production in emerging economies and affordability of systems by users on the other hand likely to determine geographical distribution of impacts.	**DISTRIBUTIVE / EQUITY**
Sustainability depends on consumer response to first adoption of automation systems. If expected benefits/costs are not realised or fashions change, then sustainability likely to be low	Sustainability likely to be similar to that expected in the EU, based on consumer response to technology.	**SUSTAINABILITY**

ENVIRONMENT			PERVASIVE NETWORK SCENARIO
EU Industry and Professional Users	**EU M&C Providers (Hardware, Software and Services)**	**Public Sector Bodies**	
Competitiveness of industrial users of the technology should increase if the technology meets a need (i.e. efficiency and cost saving objectives of industry)	Competitiveness and trade still likely to improve as technology connections are made and opportunities arise, giving EU providers a first mover advantage	No Impacts Expected	**COMPETITIVENESS, TRADE and INVESTMENT**
Competition intensity to increase as technology enables users to modify or improve areas of their business producing more product and price competition	Intensity of competition should increase as new solutions and products emerge	No Impacts Expected	**COMPETITION and the INTERNAL MARKET**
Potential marginal decrease in operating costs due to automation of monitoring, control, sampling and reporting of emissions, etc.	Could see a change in M&C provider business strategies as move away from independently focussed technology groups towards integrated groups takes place	No Impacts Expected	**OPERATING COSTS AND CONDUCT OF BUSINESS**
Potential for networking to reduce admin cost if the recording of monitoring information is automated, plus RF and other communication technology could reduce the need to complete documents	No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
No Impacts Expected	Greater horizontal solution driven research likely to identify new opportunities for existing technology through interconnection	No Impacts Expected	**INNOVATION and RESEARCH**
Potentially benefit form lower prices and cleaner environment	No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Potential decrease in employment as less manual checking, sampling etc. is required, however, maintenance of such devices likely to increase employment, therefore net impact is inconclusive	Employment likely to increase in relation to growth in new markets, etc.	No Impacts Expected	**MACROECONOMIC and EMPLOYMENT**
Improved capability of devices and real-time monitoring through RF networks should reduce water/air/noise pollution, etc.	No Impacts Expected	May assist in the achievement of energy efficiency objectives under environmental agreements for individual MS governments.	**ENVIRONMENTAL**
Improved environment likely to lead to improve standards of living for society	No Impacts Expected	No Impacts Expected	**SOCIAL**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
Regulatory drivers likely to maintain sustainable demand for cost saving and environmental protection technology	Sustainable provided the interconnection achieves an identifiable need in the market	No Impacts Expected	**SUSTAINABILITY**

Non-EU Users	Non-EU Hardware and Software Providers	EU Consumer Users	PERVASIVE NETWORK SCENARIO
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	**COMPETITIVENESS, TRADE and INVESTMENT**
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	**COMPETITION and the INTERNAL MARKET**
Same cost benefits as those experienced by EU industrial users	Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	Potential for prices to decrease through cost pass through and competition.	**OPERATING COSTS AND CONDUCT OF BUSINESS**
Reduced administrative burden from recording and reporting of emissions as RF automates this process	No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
No Impacts Expected	Some increase in employment outside the EU expected as many drivers the same	No Impacts Expected	**MACROECONOMIC and EMPLOYMENT**
Improved capability of devices and real-time monitoring through RF networks should reduce water/air/noise pollution, etc.	No Impacts Expected	No Impacts Expected	**ENVIRONMENTAL**
Improved environment likely to lead to improve standards of living for society	No Impacts Expected	May gain comfort from a cleaner environment	**SOCIAL**
No Impacts Expected	No Impacts Expected	Likely to affect those living next to a river of industrial site the most as they will gain the most significant environmental benefits	**DISTRIBUTIVE / EQUITY**
Similar sustainability to Europe as same drivers likely to apply in time depending on region	Similar sustainability to Europe as same drivers likely to apply in time depending on region	No Impacts Expected	**SUSTAINABILITY**

MANUFACTURING		PERVASIVE NETWORK SCENARIO
EU M&C Providers (Hardware, Software and Services)	**Public Sector Bodies**	
Competitiveness and trade still likely to improve as technology connections are made and opportunities arise, giving EU providers a first mover advantage	No Impacts Expected	**COMPETITIVENESS, TRADE and INVESTMENT**
Intensity of competition should increase as new solutions and products emerge	No Impacts Expected	**COMPETITION and the INTERNAL MARKET**
Could see a change in M&C provider business strategies as move away from independently focussed technology groups towards integrated groups takes place	Greater automation of regulatory functions in terms of environmental reporting and monitoring should reduce operating and administrative costs of regulation	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	Reduced administrative burden from recording and reporting of emissions as RF automates this process	**ADMINISTRATIVE COSTS**
Greater horizontal solution driven research likely to identify new opportunities for existing technology through interconnection	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Employment likely to increase in relation to growth in new markets, etc.	Some decrease in regulatory employment as site checks, sampling and admin less burdensome	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	No Impacts Expected	**ENVIRONMENTAL**
No Impacts Expected	No Impacts Expected	**SOCIAL**
No Impacts Expected	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
Sustainable provided the interconnection achieves an identifiable need in the market	Reduced burdens on regulator and industry in terms of monitoring and reporting likely to achieve policy objectives such as 'better regulation' , 'reductions in admin burden' and regulatory efficiency	**SUSTAINABILITY**

Non-EU Hardware and Software Providers	EU Consumer Users	EU Industry and Professional Users	PERVASIVE NETWORK SCENARIO
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Competitiveness of industrial users of the technology should increase if the technology meets a need (i.e. efficiency and cost saving objectives of industry)	**COMPETITIVENESS, TRADE and INVESTMENT**
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Competition intensity to increase as technology enables users to modify or improve areas of their business	**COMPETITION and the INTERNAL MARKET**
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	Potential for prices to decrease through cost-pass through of manufacturer efficiency gains	Potential decrease in operating costs due to automation and interconnection of two or more business activities. Strategies and supply chains may also change to maximise any benefit and reduce any costs (i.e. degree of outsourcing, production location)	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	Potential for networking to reduce admin cost if less information and communication is completed manually	**ADMINISTRATIVE COSTS**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	Potentially benefit the improved efficiency, quality, etc achieve by manufacturers	**CONSUMERS and HOUSEHOLDS**
Some increase in employment outside the EU expected as many drivers the same and manufacturing supply chain located globally	No Impacts Expected	Potential decrease in employment as degree of automation is increased	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	No Impacts Expected	Improved capability of devices and real-time monitoring through RF networks should improve productive and resource efficiency therefore energy and material savings possible	**ENVIRONMENTAL**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**SOCIAL**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
Similar sustainability to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Competitive drivers experienced by manufacturers likely to maintain sustainable demand for technology that achieves competitive advantages	**SUSTAINABILITY**

PROCESS INDUSTRIES			PERVASIVE NETWORK SCENARIO
EU M&C Providers (Hardware, Software and Services)	**Public Sector Bodies**	**Non-EU Users**	
Competitiveness and trade still likely to improve as technology connections are made and opportunities arise, giving EU providers a first mover advantage	No Impacts Expected	Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	**COMPETITIVENESS, TRADE and INVESTMENT**
Intensity of competition should increase as new solutions and products emerge	No Impacts Expected	Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	**COMPETITION and the INTERNAL MARKET**
Could see a change in M&C provider business strategies as move away from independently focussed technology groups towards integrated groups takes place	No Impacts Expected	Same cost benefits as those experienced by EU industrial users	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	Potential for networking to reduce admin cost if less information and communication is completed manually	**ADMINISTRATIVE COSTS**
Greater horizontal solution driven research likely to identify new opportunities for existing technology through interconnection	No Impacts Expected	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Employment likely to increase in relation to growth in new markets, etc.	No Impacts Expected	Some increase in employment outside the EU expected as many drivers the same and manufacturing supply chain located globally	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	No Impacts Expected	Improved capability of devices and real-time monitoring through RF networks should improve productive and resource efficiency therefore energy and material savings possible	**ENVIRONMENTAL**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**SOCIAL**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
Sustainable provided the interconnection achieves an identifiable need in the market	No Impacts Expected	Similar sustainability to those expected in the EU as solutions likely to be globally applicable and manufactured	**SUSTAINABILITY**

Non-EU Hardware and Software Providers	EU Consumer Users	EU Industry and Professional Users	PERVASIVE NETWORK SCENARIO
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Competitiveness of industrial users of the technology should increase if the technology meets a need (i.e. efficiency and cost saving objectives of industry)	**COMPETITIVENESS, TRADE and INVESTMENT**
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Competition intensity to increase as technology enables users to modify or improve areas of their business	**COMPETITION and the INTERNAL MARKET**
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Potential decrease in operating costs due to automation and interconnection of two or more business activities. Strategies and supply chains may also change to maximise any benefit and reduce any costs (i.e. degree of outsourcing, production location)	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	Potential for networking to reduce admin cost if less information and communication is completed manually	**ADMINISTRATIVE COSTS**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	No Impact Expected	**CONSUMERS and HOUSEHOLDS**
Some increase in employment outside the EU expected as many drivers the same	No Impacts Expected	Potential decrease in employment as degree of automation is increased	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	Might gain comfort from more efficient use of resources and extraction of materials for environmental conscious consumers (e.g. oil and gas sector)	Improved capability of devices and real-time monitoring through RF networks should improve productive and resource efficiency therefore energy and material savings possible	**ENVIRONMENTAL**
No Impacts Expected	No Impacts Expected	Improving extraction and refining process should extent the life of oil/gas fields and the availability of other minerals for the benefit of society and industry that depends on these finite resources.	**SOCIAL**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
Similar sustainability to that expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Competitive drivers experienced by manufacturers likely to maintain sustainable demand for technology that achieves competitive advantages (e.g. improves mineral extraction efficiency)	**SUSTAINABILITY**

LOGISTICS and TRANSPORT			PERVASIVE NETWORK SCENARIO
EU M&C Providers (Hardware, Software and Services)	**Public Sector Bodies**	**Non-EU Users**	
Competitiveness and trade still likely to improve as technology connections are made and opportunities arise, giving EU providers a first mover advantage	No Impacts Expected	Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	**COMPETITIVENESS, TRADE and INVESTMENT**
Intensity of competition should increase as new solutions and products emerge	No Impacts Expected	Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	**COMPETITION and the INTERNAL MARKET**
Could see a change in M&C provider business strategies as move away from independently focussed technology groups towards integrated groups takes place	No Impacts Expected	Same cost benefits as those experienced by EU industrial users	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	Potential for networking to reduce admin cost if less information and communication is completed manually	**ADMINISTRATIVE COSTS**
Greater horizontal solution driven research likely to identify new opportunities for existing technology through interconnection	No Impacts Expected	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Employment likely to increase in relation to growth in new markets.	No Impacts Expected	Some increase in employment outside the EU expected as many drivers the same and manufacturing supply chain located globally	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	No Impacts Expected	Improved capability of devices and real-time monitoring through RF networks should improve productive and resource efficiency therefore energy and material savings possible	**ENVIRONMENTAL**
No Impacts Expected	No Impacts Expected	Improving extraction and refining process should extent the life of oil/gas fields and the availability of other minerals for the benefit of society and industry that depends on these finite resources.	**SOCIAL**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
Sustainable provided the interconnection achieves an identifiable need in the market	No Impacts Expected	Similar sustainability to that expected in the EU as solutions likely to be globally applicable and manufactured	**SUSTAINABILITY**

Non-EU Hardware and Software Providers	EU Consumer Users	EU Industry and Professional Users	PERVASIVE NETWORK SCENARIO
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Competitiveness of industrial users of the technology should increase if the technology meets a need (i.e. time saving, efficiency, better tracking), plus users may be able to offer new services (e.g. online parcel/delivery tracking)	**COMPETITIVENESS, TRADE and INVESTMENT**
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Competition intensity to increase as technology enables users to modify or improve areas of their business	**COMPETITION and the INTERNAL MARKET**
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	Potential for prices to decrease through cost-pass through of transport efficiency gains	Potential decrease in operating costs due to automation and interconnection of two or more business activities. Strategies and supply chains may also change to maximise any benefit and reduce any costs (i.e. logistic supply chains)	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	Online tracking and ordering at the end of the supply chain should create potential for admin savings	Potential for networking to reduce admin cost if less information and communication is completed manually	**ADMINISTRATIVE COSTS**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	Improved reliability, cost and convenience of logistics should generate benefits	Potentially benefit the improved efficiency, quality, etc achieve by logistics	**CONSUMERS and HOUSEHOLDS**
Some increase in employment outside the EU expected as many drivers the same and manufacturing supply chain located globally	No Impacts Expected	Potential decrease in employment as degree of automation is increased	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	Consumers may opt to use delivery systems more frequently (i.e. home shopping) reducing individual journeys and carbon/congestion impacts	Improved efficiency should reduce the average mileage of a parcel, therefore reducing furl consumption, packaging and carbon impacts	**ENVIRONMENTAL**
No Impacts Expected	Changes to consuming behaviour and social interactions could change through increased logistic use by households opposed to conventional purchasing channels	No Impacts Expected	**SOCIAL**
No Impacts Expected	More applicable to some consumers than others as those not familiar or find it difficult to use online order/tracking of logistic may not encounter the same benefits as more technically savvy consumers	Likely to benefit certain business model and sectors more than others, depending on what is transported.	**DISTRIBUTIVE / EQUITY**
Similar sustainability to that expected in the EU as solutions likely to be globally applicable	No Impacts Expected	Competitive drivers experienced by manufacturers likely to maintain sustainable demand for technology that achieves competitive advantages (i.e. transport cost reductions)	**SUSTAINABILITY**

VEHICLES			PERVASIVE NETWORK SCENARIO
EU M&C Providers(Hardware, Software and Services)	**Public Sector Bodies**	**Non-EU Users**	
Competitiveness and trade still likely to improve as technology connections are made and opportunities arise, giving EU providers a first mover advantage	No Impacts Expected	Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	**COMPETITIVENESS, TRADE and INVESTMENT**
Intensity of competition should increase as new solutions and products emerge	No Impacts Expected	Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	**COMPETITION and the INTERNAL MARKET**
Could see a change in M&C provider business strategies as move away from independently focussed technology groups towards integrated groups takes place	No Impacts Expected	Same cost benefits as those experienced by EU industrial users	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	Potential for networking to reduce admin cost if less information and communication is completed manually	**ADMINISTRATIVE COSTS**
Greater horizontal solution driven research likely to identify new opportunities for existing technology through interconnection	No Impacts Expected	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Employment likely to increase in relation to growth in new markets, etc.	No Impacts Expected	Some increase in employment outside the EU expected as many drivers the same and manufacturing supply chain located globally	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	No Impacts Expected	Improved capability of devices and real-time monitoring through RF networks should improve productive and resource efficiency therefore energy and material savings possible	**ENVIRONMENTAL**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**SOCIAL**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
Sustainable provided the interconnection achieves an identifiable need in the market	No Impacts Expected	Similar sustainability to that expected in the EU as solutions likely to be globally applicable	**SUSTAINABILITY**

Non-EU Hardware and Software Providers	EU Consumer Users	EU Industry and Professional Users	PERVASIVE NETWORK SCENARIO
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Competitiveness of industrial users of the technology should increase if the technology meets a need (i.e. efficiency and cost saving objectives of industry)	**COMPETITIVENESS, TRADE and INVESTMENT**
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Competition intensity to increase as technology enables users to modify or improve areas of their business	**COMPETITION and the INTERNAL MARKET**
Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	No Impacts Expected	Potential decrease in operating costs due to automation and interconnection of two or more business activities. Strategies and supply chains may also change to maximise any benefit and reduce any costs (i.e. degree of outsourcing, production location)	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	Potential for networking to reduce admin cost if less information and communication is completed manually	**ADMINISTRATIVE COSTS**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	Embedded systems in vehicles could provide new functions and opportunities, increasing the comfort of vehicle users	Potentially benefit the improved efficiency, quality, etc achieve by manufacturers	**CONSUMERS and HOUSEHOLDS**
Some increase in employment outside the EU expected as many drivers the same and manufacturing supply chain located globally	No Impacts Expected	Potential decrease in employment as degree of automation is increased	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	Could help improve fuel efficiency and resource efficiency to the benefit of the environment	Improved capability of devices and real-time monitoring through RF networks should improve productive and resource efficiency therefore energy and material savings possible	**ENVIRONMENTAL**
No Impacts Expected	With the use of vehicles potentially changed and increased functionality of in-car systems, safety, congestion and the environment could all improve	No Impacts Expected	**SOCIAL**
No Impacts Expected	Affordability likely to be a significant barrier as innovations likely to emerge first in high-end vehicles or at high initial cost for the user (e.g. dual fuel technology)	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
Similar sustainability to those expected in the EU as solutions likely to be globally applicable and manufactured	Sustainability dependant on consumer trends and demand from vehicle manufacturer	Competitive drivers experienced by manufacturers likely to maintain sustainable demand for technology that achieves competitive advantages	**SUSTAINABILITY**

HEALTHCARE			PERVASIVE NETWORK SCENARIO
EU M&C Providers(Hardware, Software and Services)	**Public Sector Bodies**	**Non-EU Users**	
Ageing population maintaining increases in health spending and consumer demand for health solutions likely to maintain investment and competitiveness of EU providers	No Impacts Expected	Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	**COMPETITIVENESS, TRADE and INVESTMENT**
Competition likely to remain intense as market attracts new entrants	No Impacts Expected	Similar impacts to those expected in the EU as solutions likely to be globally applicable and manufactured	**COMPETITION and the INTERNAL MARKET**
No Impacts Expected	No Impacts Expected	Same cost benefits as those experienced by EU industrial users	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	Potential for networking to reduce admin cost if less information and communication is completed manually	**ADMINISTRATIVE COSTS**
R&D spending should increase in response to aging population and healthcare sector demands (homecare)	No Impacts Expected	No Impacts Expected	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Employment likely to increase in response to growth in the industry filtering down to M&C providers	No Impacts Expected	Some increase in employment outside the EU expected as many drivers the same and manufacturing supply chain located globally	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	Fuel saving and the development of new fuel and engine technology could assist in the achievement of CO_2	Improved capability of devices and real-time monitoring through RF networks should improve productive and resource efficiency therefore energy and material savings possible	**ENVIRONMENTAL**
More efficient and accessible existing technology , plus new innovations likely to improve life expectancy, quality of life and standards of living more generally	Could reduce energy dependence on fossil fuels, improving energy security	No Impacts Expected	**SOCIAL**
Trends in networking and communication likely to result in greater impacts in software and services, opposed to physical equipment.	No Impacts Expected	No Impacts Expected	**DISTRIBUTIVE / EQUITY**
Demographics of population and health expenditure likely to move in a positive direction in the medium to long term, therefore sustainability of sector should be high in and outside Europe	Highly sustainable	Similar sustainability to those expected in the EU as solutions likely to be globally applicable and manufactured	**SUSTAINABILITY**

Non-EU Hardware and Software	EU Consumer Users	EU Industry and Professional Users	PERVASIVE NETWORK SCENARIO
Same impacts as European providers as market expands	No Impacts Expected	Ageing population maintaining increases in health spending and consumer demand for health solutions likely to maintain investment and competitiveness of EU providers	**COMPETITIVENESS, TRADE and INVESTMENT**
Same impacts as European providers as market expands	No Impacts Expected	Competition likely to remain intense as market attracts new entrants	**COMPETITION and the INTERNAL MARKET**
Same impacts as European providers as market expands	May be asked to contribute to cost of new systems through taxation or subsidised payment	The cost of new systems in likely to be higher, with long payback periods. Business strategy of health sector may change to offer more pay to use services through the technology in order to recoup initial high investment costs	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
Same impacts as European providers as market expands	No Impacts Expected	Focus of R&D may change do to changing priorities of users in response to energy and raw material prices. However, overall R&D spending should increase in response to aging population and healthcare sector	**INNOVATION and RESEARCH**
Same impacts as European providers as market expands	Improvements in accessibility, efficiency, comfort, and user-friendliness aspects of M&C related health products/healthcare experiences	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Same impacts as European providers as market expands	No Impacts Expected	Employment in health services could increase or decrease depending on business model applied to technology	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	No Impacts Expected	No Impacts Expected	**ENVIRONMENTAL**
Same impacts as European providers as market expands	Expected impacts include improved life expectancy, quality of life and standards of living more generally	More efficient and accessible existing technology , plus new innovations likely to improve life expectancy, quality of life and standards of living more generally	**SOCIAL**
Same impacts as European providers as market expands	No Impacts Expected	Trends in networking and communication likely to result in greater impacts in software and services, opposed to physical equipment.	**DISTRIBUTIVE / EQUITY**
Same impacts as European providers as market expands	Sustainability dependant on innovation advances in terms of consumer benefits and acceptance of technology by consumers	Demographics of population and health expenditure likely to move in a positive direction in the medium to long term, therefore sustainability of sector should be high in and outside Europe	**SUSTAINABILITY**

Public Sector Bodies	Non-EU Users	PERVASIVE NETWORK SCENARIO
No Impacts Expected	Ageing population maintaining increases in health spending and consumer demand for health solutions likely to maintain investment and competitiveness of EU providers	**COMPETITIVENESS, TRADE and INVESTMENT**
No Impacts Expected	Competition likely to remain intense as market attracts new entrants due to economic conditions in other sectors and growth in healthcare	**COMPETITION and the INTERNAL MARKET**
Costs of increasing health budgets and aging population likely to fall heavily on government through national health insurance/services	Economic conditions likely to increase costs, with potential implications for technology as users may demand better energy saving technologies and greater energy efficiency from medical equipment/M&C components (incl. software, etc)	**OPERATING COSTS AND CONDUCT OF BUSINESS**
No Impacts Expected	No Impacts Expected	**ADMINISTRATIVE COSTS**
No Impacts Expected	Focus of R&D may change do to changing priorities of users in response to energy and raw material prices. However, overall R&D spending should increase in response to aging population and healthcare sector demands	**INNOVATION and RESEARCH**
No Impacts Expected	No Impacts Expected	**CONSUMERS and HOUSEHOLDS**
Employment in health services could increase or decrease depending on business model applied to technology	Employment in health services could increase or decrease depending on business model applied to technology	**MACROECONOMIC and EMPLOYMENT**
No Impacts Expected	No Impacts Expected	**ENVIRONMENTAL**
More efficient and accessible existing technology , plus new innovations likely to improve life expectancy, quality of life and standards of living more generally	More efficient and accessible existing technology , plus new innovations likely to improve life expectancy, quality of life and standards of living more generally	**SOCIAL**
Affordability likely to be important between socio-economic groups, the amount of technology adopted and MS health policy	Affordability likely to be important between socio-economic groups, the amount of technology adopted and health policy	**DISTRIBUTIVE / EQUITY**
Demographics of population and health expenditure likely to move in a positive direction in the medium to long term, therefore sustainability of sector should be high in and outside Europe	Demographics of population and health expenditure likely to move in a positive direction in the medium to long term, therefore sustainability of sector should be high in and outside Europe	**SUSTAINABILITY**

4.4 Screening of Global recession scenario

ENVIRONMENT		GLOBAL RECESSION SCENARIO
EU Consumer Users	EU Industry and Professional Users	EU M&C Providers (Hardware, Software and Services)
No Impacts Expected	Potential marginal improvement in competitiveness as technology should reduce costs of manual Monitoring & Controlling of emissions, sampling, reporting etc.	Competitiveness and trade still likely to improve on baseline due to regulatory drivers requiring M&C of environment
No Impacts Expected	No Impacts Expected	Competition likely to remain intense as market attracts new entrants to a growing market and recession in other market segments
No Impacts Expected	Potential marginal decrease in operating costs due to automation of monitoring, control, sampling and reporting of emissions, etc.	Could see a change in M&C provider business strategies in the short term to make the most of growing sectors in the face of declines in sales in other market segments
No Impacts Expected	Reduced administrative burden from recording and reporting of emissions as RF automates this process	No Impacts Expected
No Impacts Expected	No Impacts Expected	No Impacts Expected
No Impacts Expected	No Impacts Expected	No Impacts Expected
No Impacts Expected	Potential decrease in employment as less manual checking, sampling etc. is required, however, maintenance of such devices likely to increase employment therefore net impact is inconclusive	Increases in employment likely, specifically in the installation and software programming of smart sensoring networks and devices
No Impacts Expected	Improved capability of devices and real-time monitoring through RF networks should reduce water/air/noise pollution, etc.	No Impacts Expected
No Impacts Expected	Improved environment likely to lead to improve standards of living for society	No Impacts Expected
No Impacts Expected	No Impacts Expected	No Impacts Expected
No Impacts Expected	Regulatory drivers likely to maintain sustainability as stringency in environmental standards increase	Regulatory drivers likely to maintain sustainability as stringency in environmental standards increase

COMPETITIVENESS, TRADE and INVESTMENT	COMPETITION IN THE INTERNAL MARKET	OPERATING COSTS AND CONDUCT OF BUSINESS	ADMINISTRATIVE COSTS	INNOVATION and RESEARCH	CONSUMERS and HOUSEHOLDS	MACROECONOMIC and EMPLOYMENT	ENVIRONMENTAL	SOCIAL	DISTRIBUTIVE / EQUITY	SUSTAINABILITY

GLOBAL RECESSION SCENARIO			
	Non-EU Hardware and Software Providers	**Non-EU Users**	**Public Sector Bodies**
COMPETITIVENESS, TRADE and INVESTMENT	Trade imports likely to increase in manufactured M&C components and like wise exports of complete systems and software out of the EU should increase	No Impacts Expected	No Impacts Expected
COMPETITION IN THE INTERNAL MARKET	No Impacts Expected	No Impacts Expected	No Impacts Expected
OPERATING COSTS AND CONDUCT OF BUSINESS	No Impacts Expected	Same cost benefits as those experienced by EU industrial users	Greater automation of regulator functions in terms of the environment should reduce operating and administrative costs of regulation
ADMINISTRATIVE COSTS	No Impacts Expected	Reduced administrative burden from recording and reporting of emissions as RF automates this process	Reduced administrative burden from recording and reporting of emissions as RF automates this process
INNOVATION and RESEARCH	No Impacts Expected	No Impacts Expected	No Impacts Expected
CONSUMERS and HOUSEHOLDS	No Impacts Expected	No Impacts Expected	No Impacts Expected
MACROECONOMIC and EMPLOYMENT	Some increase in employment outside the EU as European demand increases and non-EU countries adopt the technology in response to similar regulations	No Impacts Expected	Some decrease in regulatory employment as site checks, sampling and admin less burdensome
ENVIRONMENTAL	No Impacts Expected	Improved capability of devices and real-time monitoring through RF networks should reduce water/air/noise pollution, etc.	No Impacts Expected
SOCIAL	No Impacts Expected	Improved environment likely to lead to improve standards of living for society	No Impacts Expected
DISTRIBUTIVE / EQUITY	No Impacts Expected	No Impacts Expected	No Impacts Expected
SUSTAINABILITY	Similar sustainability to Europe as same drivers likely to apply in time depending on region	Similar sustainability to Europe as same drivers likely to apply in time depending on region	Reduced burdens on regulator and industry in terms of Monitoring & Controlling emissions likely to achieve policy objectives such as 'better regulation', 'reductions in admin burden' and regulatory efficiency

CRITICAL INFRASTRUCTURES			GLOBAL RECESSION SCENARIO
EU Consumer Users	**EU Industry and Professional Users**	**EU M&C Providers (Hardware, Software and Services)**	
No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Reductions in employment likely for many users of M&C technology	Reductions in employment likely in many providers of M&C solutions	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
No Impacts Expected	The longer and deeper an economic recession, the less sustainable industry is likely to remain in Europe as other parts of the world may become more favourable	The longer and deeper an economic recession, the less sustainable the less sustainable the future of the industry is likely to be in Europe	SUSTAINABILITY

Non-EU Users	Non-EU Hardware and Software Providers	GLOBAL RECESSION SCENARIO
Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	SOCIAL
Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	SUSTAINABILITY

MANUFACTURING				GLOBAL RECESSION SCENARIO
EU Consumer Users	EU Industry and Professional Users	EU M&C Providers (Hardware, Software and Services)	Public Sector Bodies	
No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	No Impacts Expected	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	No Impacts Expected	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	No Impacts Expected	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Reductions in employment likely for many users of M&C technology	Reductions in employment likely in many providers of M&C solutions	No Impacts Expected	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	No Impacts Expected	DISTRIBUTIVE / EQUITY
No Impacts Expected	The longer and deeper an economic recession, the less sustainable industry is likely to remain in Europe as other parts of the world may become more favourable	The longer and deeper an economic recession, the less sustainable the less sustainable the future of the industry is likely to be in Europe	No Impacts Expected	SUSTAINABILITY

Public Sector Bodies	Non-EU Users	Non-EU Hardware and Software Providers	GLOBAL RECESSION SCENARIO
No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
No Impacts Expected	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	SUSTAINABILITY

PROCESS INDUSTRIES			GLOBAL RECESSION SCENARIO
EU Consumer Users	**EU Industry and Professional Users**	**EU M&C Providers (Hardware, Software and Services)**	
No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Reductions in employment likely for many users of M&C technology	Reductions in employment likely in many providers of M&C solutions	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
No Impacts Expected	The longer and deeper an economic recession, the less sustainable industry is likely to remain in Europe as other parts of the world may become more favourable	The longer and deeper an economic recession, the less sustainable the less sustainable the future of the industry is likely to be in Europe	SUSTAINABILITY

Public Sector Bodies	Non-EU Users	Non-EU Hardware and Software Providers	GLOBAL RECESSION SCENARIO
No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
No Impacts Expected	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	SUSTAINABILITY

BUILDING			GLOBAL RECESSION SCENARIO
EU Consumer Users	**EU Industry and Professional Users**	**EU M&C Providers (Hardware, Software and Services)**	
No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Reductions in employment likely for many users of M&C technology	Reductions in employment likely in many providers of M&C solutions	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
No Impacts Expected	The longer and deeper an economic recession, the less sustainable industry is likely to remain in Europe as other parts of the world may become more favourable	The longer and deeper an economic recession, the less sustainable the less sustainable the future of the industry is likely to be in Europe	SUSTAINABILITY

Non-EU Users	Non-EU Hardware and Software Providers	GLOBAL RECESSION SCENARIO
Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	SOCIAL
Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	SUSTAINABILITY

LOGISTICS and TRANSPORT				GLOBAL RECESSION SCENARIO
EU Consumer Users	**EU Industry and Professional Users**	**EU M&C Providers (Hardware, Software and Services)**	**Public Sector Bodies**	
No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	No Impacts Expected	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	No Impacts Expected	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	No Impacts Expected	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Reductions in employment likely for many users of M&C technology	Reductions in employment likely in many providers of M&C solutions	No Impacts Expected	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	No Impacts Expected	DISTRIBUTIVE / EQUITY
No Impacts Expected	The longer and deeper an economic recession, the less sustainable industry is likely to remain in Europe as other parts of the world may become more favourable	The longer and deeper an economic recession, the less sustainable the less sustainable the future of the industry is likely to be in Europe	No Impacts Expected	SUSTAINABILITY

Public Sector Bodies	Non-EU Users	Non-EU Hardware and Software Providers	GLOBAL RECESSION SCENARIO
No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
No Impacts Expected	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	SUSTAINABILITY

POWER GRIDS		GLOBAL RECESSION SCENARIO
EU Industry and Professional Users	**EU M&C Providers (Hardware, Software and Services)**	
No Impacts Expected	Energy efficiency requirements and regulations should maintain investment in more efficient transmission equipment	COMPETITIVENESS, TRADE and INVESTMENT
Internal market for energy should expand as micro generation and more alternative energy sources increase competition	Intense competition likely to remain	COMPETITION IN THE INTERNAL MARKET
Improved efficiency of networks and introduction of alternative energy sources, therefore reducing exposure to oil prices and reducing carbon credit demand should reduce costs	No Impacts Expected	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
R&D expenditure likely to remain high, with focus moving to securing energy sources and developing new ones in light of future concerns.	R&D expenditure likely to remain high, with focus moving to securing energy sources and developing new ones in light of future concerns.	INNOVATION and RESEARCH
Lower bills or lower than baseline increases in energy costs likely as transmission efficacy and increased choice in the energy market emerge	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Some small increases in employment likely as demand for micro generation and new energy sources grow in response to security concerns and inflation in energy prices	MACROECONOMIC and EMPLOYMENT
Potential for reduction in a variety of emissions quantity of energy generation necessary to meet demand falls through efficiency	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	SOCIAL
Member States with access to alternative energy sources and technology likely to benefit the most with costs falling on those Member States and regions dependant on fossil fuels and old transmission technology	Member States with access to alternative energy sources and technology likely to benefit the most with costs falling on those Member States and regions dependant on fossil fuels and old transmission technology	DISTRIBUTIVE / EQUITY
Likely to be highly sustainable as increase in energy prices and desire for lower costs in industry will drive demand for new technologies and alternatives	Likely to be highly sustainable as increase in energy prices and desire for lower costs in industry will drive demand for new technologies and alternatives	SUSTAINABILITY

Non-EU Hardware and Software Providers	EU Consumer Users	GLOBAL RECESSION SCENARIO
Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner. However, economic conditions in EU likely to result in greater competitiveness of non-EU rivals	No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	No Impacts Expected	COMPETITION IN THE INTERNAL MARKET
Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	Lower bills or lower than baseline increases in energy costs likely as transmission efficacy and increased choice in the energy market emerge	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	No Impacts Expected	INNOVATION and RESEARCH
Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	Lower bills or lower than baseline increases in energy costs likely as transmission efficacy and increased choice in the energy market emerge	CONSUMERS and HOUSEHOLDS
Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	No Impacts Expected	MACROECONOMIC and EMPLOYMENT
Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	Potential for reduction in a variety of emissions quantity of energy generation necessary to meet demand falls through efficiency	ENVIRONMENTAL
Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	No Impacts Expected	SOCIAL
Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	Member States with access to alternative energy sources and technology likely to benefit the most with costs falling on those Member States and regions dependant on fossil fuels and old transmission technology	DISTRIBUTIVE / EQUITY
Likely to be highly sustainable as increase in energy prices and desire for lower costs in industry will drive demand for new technologies and alternatives, including non-EU countries as they face similar pressures	Likely to be highly sustainable as increase in energy prices and desire for lower costs in industry will drive demand for new technologies and alternatives	SUSTAINABILITY

VEHICLES			GLOBAL RECESSION SCENARIO
EU M&C Providers(Hardware, Software and Services)	Public Sector Bodies	Non-EU Users	
Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	No Impacts Expected	Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner. However, economic conditions in EU likely to result in greater competitiveness of non-EU rivals	COMPETITIVENESS, TRADE and INVESTMENT
Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	No Impacts Expected	No Impacts Expected	COMPETITION IN THE INTERNAL MARKET
Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	No Impacts Expected	Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	No Impacts Expected	No Impacts Expected	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	CONSUMERS and HOUSEHOLDS
Reductions in employment likely in many providers of M&C solutions	No Impacts Expected	Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	SOCIAL
Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	No Impacts Expected	Potentially, similar impacts as the EU as the world faces similar concerns and responds in a similar manner.	DISTRIBUTIVE / EQUITY
The longer and deeper an economic recession, the less sustainable the less sustainable the future of the industry is likely to be in Europe	No Impacts Expected	Likely to be highly sustainable as increase in energy prices and desire for lower costs in industry will drive demand for new technologies and alternatives, including non-EU countries as they face similar pressures	SUSTAINABILITY

Non-EU Hardware and Software Providers	EU Consumer Users	EU Industry and Professional Users	GLOBAL RECESSION SCENARIO
Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	No Impacts Expected	Reductions in employment likely for many users of M&C technology	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	No Impacts Expected	The longer and deeper an economic recession, the less sustainable industry is likely to remain in Europe as other parts of the world may become more favourable	SUSTAINABILITY

HOUSEHOLD APPLIANCES			GLOBAL RECESSION SCENARIO
EU M&C Providers (Hardware, Software and Services)	**Public Sector Bodies**	**Non-EU Users**	
Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
Reductions in employment likely in many providers of M&C solutions	No Impacts Expected	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
The longer and deeper an economic recession, the less sustainable the less sustainable the future of the industry is likely to be in Europe	No Impacts Expected	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	SUSTAINABILITY

Non-EU Hardware and Software Providers	EU Consumer Users	EU Industry and Professional Users	GLOBAL RECESSION SCENARIO
Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	No Impacts Expected	Reductions in employment likely for many users of M&C technology	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	No Impacts Expected	The longer and deeper an economic recession, the less sustainable industry is likely to remain in Europe as other parts of the world may become more favourable	SUSTAINABILITY

HEALTHCARE			GLOBAL RECESSION SCENARIO
EU M&C Providers(Hardware, Software and Services)	**Public Sector Bodies**	**Non-EU Users**	
Ageing population maintaining increases in health spending and consumer demand for health solutions likely to maintain investment and competitiveness of EU providers	No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
Competition likely to remain intense as market attracts new entrants due to economic conditions in other sectors and growth in healthcare	No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
Economic conditions likely to increase costs, with potential implications for technology as users may demand better energy saving technologies and greater energy efficiency from medical equipment/M&C components (incl. software, etc)	No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
Focus of R&D may change do to changing priorities of users in response to energy and raw material prices. However, overall R&D spending should increase in response to aging population and healthcare sector demands	No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
Employment likely to increase in response to growth in the industry filtering down to M&C providers	No Impacts Expected	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
More efficient and accessible existing technology , plus new innovations likely to improve life expectancy, quality of life and standards of living more generally	No Impacts Expected	No Impacts Expected	SOCIAL
Trends in networking and communication likely to result in greater impacts in software and services, opposed to physical equipment.	No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
Demographics of population and health expenditure likely to move in a positive direction in the medium to long term, therefore sustainability of sector should be high in and outside Europe	No Impacts Expected	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	SUSTAINABILITY

Non-EU Hardware and Software Providers	EU Consumer Users	EU Industry and Professional Users	GLOBAL RECESSION SCENARIO
Same impacts as European providers as market expands	No Impacts Expected	Ageing population maintaining increases in health spending and consumer demand for health solutions likely to maintain investment and competitiveness of EU providers	COMPETITIVENESS, TRADE and INVESTMENT
Same impacts as European providers as market expands	No Impacts Expected	Competition likely to remain intense as market attracts new entrants due to economic conditions in other sectors and growth in healthcare	COMPETITION IN THE INTERNAL MARKET
Same impacts as European providers as market expands	No Impacts Expected	Economic conditions likely to increase costs, with potential implications for technology as users may demand better energy saving technologies and greater energy efficiency from medical equipment/M&C components (incl. software, etc)	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
Same impacts as European providers as market expands	No Impacts Expected	Focus of R&D may change do to changing priorities of users in response to energy and raw material prices. However, overall R&D spending should increase in response to aging population and healthcare sector demands	INNOVATION and RESEARCH
Same impacts as European providers as market expands	Improvements in accessibility, efficiency, comfort, and user-friendliness aspects of M&C related health products/healthcare experiences	No Impacts Expected	CONSUMERS and HOUSEHOLDS
Same impacts as European providers as market expands	No Impacts Expected	Employment likely to increase in response to growth in the industry filtering down to M&C providers	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
Same impacts as European providers as market expands	Expected impacts include improved life expectancy, quality of life and standards of living more generally	More efficient and accessible existing technology , plus new innovations likely to improve life expectancy, quality of life and standards of living more generally	SOCIAL
Same impacts as European providers as market expands	No Impacts Expected	Trends in networking and communication likely to result in greater impacts in software and services, opposed to physical equipment.	DISTRIBUTIVE / EQUITY
Same impacts as European providers as market expands	Sustainability dependant on innovation advances in terms of consumer benefits and acceptance of technology by consumers	Demographics of population and health expenditure likely to move in a positive direction in the medium to long term, therefore sustainability of sector should be high in and outside Europe	SUSTAINABILITY

Public Sector Bodies	Non-EU Users	GLOBAL RECESSION SCENARIO
No Impacts Expected	Ageing population maintaining increases in health spending and consumer demand for health solutions likely to maintain investment and competitiveness of EU providers	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Competition likely to remain intense as market attracts new entrants due to economic conditions in other sectors and growth in healthcare	COMPETITION IN THE INTERNAL MARKET
Costs of increasing health budgets and aging population likely to fall heavily on government through national health insurance/services	Economic conditions likely to increase costs, with potential implications for technology as users may demand better energy saving technologies and greater energy efficiency from medical equipment/M&C components (incl. software, etc)	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Focus of R&D may change do to changing priorities of users in response to energy and raw material prices. However, overall R&D spending should increase in response to aging population and healthcare sector demands	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
Employment likely to increase in response to growth in the industry filtering down to M&C providers	Employment likely to increase in response to growth in the industry filtering down to M&C providers	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
More efficient and accessible existing technology , plus new innovations likely to improve life expectancy, quality of life and standards of living more generally	More efficient and accessible existing technology , plus new innovations likely to improve life expectancy, quality of life and standards of living more generally	SOCIAL
Trends in networking and communication likely to result in greater impacts in software and services, opposed to physical equipment.	Trends in networking and communication likely to result in greater impacts in software and services, opposed to physical equipment.	DISTRIBUTIVE / EQUITY
Demographics of population and health expenditure likely to move in a positive direction in the medium to long term, therefore sustainability of sector should be high in and outside Europe	Demographics of population and health expenditure likely to move in a positive direction in the medium to long term, therefore sustainability of sector should be high in and outside Europe	SUSTAINABILITY

HOMES			GLOBAL RECESSION SCENARIO
EU Consumer Users	**EU Industry and Professional Users**	**EU M&C Providers(Hardware, Software and Services)**	
No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Reductions in employment likely for many users of M&C technology	Reductions in employment likely in many providers of M&C solutions	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
No Impacts Expected	The longer and deeper an economic recession, the less sustainable industry is likely to remain in Europe as other parts of the world may become more favourable	The longer and deeper an economic recession, the less sustainable the less sustainable the future of the industry is likely to be in Europe	SUSTAINABILITY

Public Sector Bodies	Non-EU Users	Non-EU Hardware and Software Providers	GLOBAL RECESSION SCENARIO
No Impacts Expected	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	Competitiveness , investment and trade likely to decrease as economy contracts and business expectations worsen	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	Competition likely to remain intense, unless economic conditions force competitors to leave the market raising future competition issues	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	Inflation, low growth and falling revenues likely to increase operating costs, that may result in changing business strategies in terms of product offering, placement, location etc.	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	Decreases in business R&D likely to result from falling revenues and higher costs in a recession period. Focus of innovation may also switch to efficiency innovations in response to high raw material and energy prices	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	Employment likely to decrease in the short term. However, in the longer term persistent poor economic conditions in the EU could see providers and industry move to non-EU countries, particularly emerging economies where growth and costs are likely to be more favourable	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	Economic and market conditions likely to vary by specific technology and region therefore significant inequality in impacts likely	DISTRIBUTIVE / EQUITY
No Impacts Expected	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	Likely to be more sustainable than EU as potentially lower labour costs in emerging economies and high economic growth likely to encourage relocation of EU enterprises	SUSTAINABILITY

4.5 Screening of industry divestment scenario

MANUFACTURING		DIVESTMENT SCENARIO
EU Industry and Professional Users	**EU M&C Providers (Hardware, Software and Services)**	
Significant loss in competitiveness and investment in EU as industry relocates. Manufactured imports likely to increase	EU investment likely to decrease as is competitiveness relative to non-EU competitors	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	No Impacts Expected	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	Movement of manufacturing and associated supply chains to outside EU likely to result in movement of M&C providers to be close to users. EU businesses likely to become more globally focussed in order to survive, changing investment and sales strategies	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	No impacts expected as innovation and R&D for EU companies likely to remain due to skills base (universities, clusters, highly innovative SMEs and enterprise)	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	Employment likely to fall as activities move outside of the EU	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	ENVIRONMENTAL and ENERGY
No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	Negative impacts expected to be regional as some technology areas/clusters/geographical regions likely to be at greater risk than others. SMEs without a global customer base and do not adapt may be worse off than larger multinational who may already have established sales bases, production facilities, market experience, etc.	DISTRIBUTIVE / EQUITY
No Impacts Expected	Remaining industry likely to be completive and sustainable if industrial base (i.e. users, research facilities, skilled labour force etc), remains in place	SUSTAINABILITY

PROCESS INDUSTRIES					
EU M&C Providers (Hardware, Software and Services)	**Public Sector Bodies**	**Non-EU Users**	**Non-EU Hardware and Software Providers**	**EU Consumer Users**	**DIVESTMENT SCENARIO**
EU investment likely to decrease as is competitiveness relative to non-EU competitors closer to user market	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	COMPETITION IN THE INTERNAL MARKET
Movement of manufacturing and associated supply chains to outside EU likely to result in movement of M&C providers to be close to users. EU businesses likely to become more globally focussed in order to survive, changing investment and sales strategies	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No impacts expected as innovation and R&D for EU companies likely to remain due to skills base (universities, clusters, highly innovative SMEs and enterprise)	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
Employment likely to fall as activities move outside of the EU	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL and ENERGY
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
Negative impacts expected to be regional as some technology areas/clusters/geographical regions likely to be at greater risk than others. SMEs without a global customer base and do not adapt may be worse off than larger multinational who may already have established sales bases, production facilities, market experience, etc.	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	DISTRIBUTIVE / EQUITY
Remaining industry likely to be completive and sustainable if industrial base (i.e. users, research facilities, skilled labour force etc), remains in place	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	SUSTAINABILITY

DIVESTMENT SCENARIO	EU Industry and Professional Users	EU Consumer Users	Non-EU Hardware and Software Providers	Non-EU Users	Public Sector Bodies
COMPETITIVENESS, TRADE and INVESTMENT	Significant loss in competitiveness and investment in EU as industry relocates. Manufactured imports likely to increase	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
COMPETITION IN THE INTERNAL MARKET	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
OPERATING COSTS AND CONDUCT OF BUSINESS	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
ADMINISTRATIVE COSTS	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
INNOVATION and RESEARCH	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
CONSUMERS and HOUSEHOLDS	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
MACROECONOMIC and EMPLOYMENT	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
ENVIRONMENTAL and ENERGY	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
SOCIAL	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
DISTRIBUTIVE / EQUITY	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
SUSTAINABILITY	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected

VEHICLES				DIVESTMENT SCENARIO
Non-EU Hardware and Software Providers	**EU Consumer Users**	**EU Industry and Professional Users**	**EU M&C Providers(Hardware, Software and Services)**	
No Impacts Expected	No Impacts Expected	Significant loss in competitiveness and investment in EU as industry relocates. Manufactured imports likely to increase	EU investment likely to decrease as is competitiveness relative to non-EU competitors closer to user market	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	No Impacts Expected	No Impacts Expected	Movement of manufacturing and associated supply chains to outside EU likely to result in movement of M&C providers to be close to users. EU businesses likely to become more globally focussed in order to survive, changing investment and sales strategies	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	No Impacts Expected	No Impacts Expected	No impacts expected as innovation and R&D for EU companies likely to remain due to skills base (universities, clusters, highly innovative SMEs and enterprise)	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	No Impacts Expected	No Impacts Expected	Employment likely to fall as activities move outside of the EU	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL and ENERGY
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	No Impacts Expected	No Impacts Expected	Negative impacts expected to be regional as some technology areas/clusters/geographical regions likely to be at greater risk than others. SMEs without a global customer base and do not adapt may be worse off than larger multinational who may already have established sales bases, production facilities, market experience, etc.	DISTRIBUTIVE / EQUITY
No Impacts Expected	No Impacts Expected	No Impacts Expected	Remaining industry likely to be completive and sustainable if industrial base (i.e. users, research facilities, skilled labour force etc), remains in place	SUSTAINABILITY

HOUSEHOLD APPLIANCES					
EU Consumer Users	**EU Industry and Professional Users**	**EU M&C Providers (Hardware, Software and Services)**	**Public Sector Bodies**	**Non-EU Users**	**DIVESTMENT SCENARIO**
No Impacts Expected	Significant loss in competitiveness and investment in EU as industry	EU investment likely to decrease as is competitiveness relative to non-EU competitors closer to user market	No Impacts Expected	No Impacts Expected	COMPETITIVENESS, TRADE and INVESTMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	COMPETITION IN THE INTERNAL MARKET
No Impacts Expected	No Impacts Expected	Movement of manufacturing and associated supply chains to outside EU likely to result in movement of M&C providers to be close to users. EU businesses likely to become more globally focussed in order to survive, changing investment and sales strategies	No Impacts Expected	No Impacts Expected	OPERATING COSTS AND CONDUCT OF BUSINESS
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	ADMINISTRATIVE COSTS
No Impacts Expected	No Impacts Expected	No impacts expected as innovation and R&D for EU companies likely to remain due to skills base (universities, clusters, highly innovative SMEs and enterprise)	No Impacts Expected	No Impacts Expected	INNOVATION and RESEARCH
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	CONSUMERS and HOUSEHOLDS
No Impacts Expected	No Impacts Expected	Employment likely to fall as activities move outside of the EU	No Impacts Expected	No Impacts Expected	MACROECONOMIC and EMPLOYMENT
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	ENVIRONMENTAL and ENERGY
No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	SOCIAL
No Impacts Expected	No Impacts Expected	Negative impacts expected to be regional as some technology areas/clusters/geographical regions likely to be at greater risk than others. SMEs without a global customer base and do not adapt may be worse off than larger multinational who may already have established sales bases, production facilities, market experience, etc.	No Impacts Expected	No Impacts Expected	DISTRIBUTIVE / EQUITY
No Impacts Expected	No Impacts Expected	Remaining industry likely to be completive and sustainable if industrial base (i.e. users, research facilities, skilled labour force etc), remains in place	No Impacts Expected	No Impacts Expected	SUSTAINABILITY

DIVESTMENT SCENARIO	COMPETITIVENESS, TRADE and INVESTMENT	COMPETITION IN THE INTERNAL MARKET	OPERATING COSTS AND CONDUCT OF BUSINESS	ADMINISTRATIVE COSTS	INNOVATION and RESEARCH	CONSUMERS and HOUSEHOLDS	MACROECONOMIC and EMPLOYMENT	ENVIRONMENTAL and ENERGY	SOCIAL	DISTRIBUTIVE / EQUITY	SUSTAINABILITY
Non-EU Hardware and Software Providers	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
Non-EU Users	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected
Public Sector Bodies	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected	No Impacts Expected

5 Economic and Social Impact Analysis

5.1 Overview

This appendix describes the analysis and assumptions used to generate the monetary costs and benefits associated with each scenario, as presented in the main body of this report. The appendix is therefore intended to complement Chapter 2 of this report as well as the evaluation of the non-monetary or qualitative impacts summarised in Chapter 3 and the matrix of impacts developed for this purpose (See Appendix 3).

By following this appendix, it is hoped that the reader can be made fully aware of the assumptions and data used in the analysis, and the opportunity to remodel each scenario if so desired with different assumptions.

The three scenarios can be summarised as follows (with these all assessed against a baseline of market adoption and regulatory conditions maintained at current or expected levels, given the best information available):

Scenario 1: Smart home assumes the rapid introduction of automation equipment utilising M&C technology to regulate the on/off and standby functions of electrical appliances in a household, including white goods, space heating/cooling equipment, entertainment devices, and security appliances. The purpose of the automation technology in this scenario is maximising the energy efficiency of the appliances in terms of both the energy consumed and the cost of that energy to the household. It is also intended to improve the comfort and security of those individuals living in that household.

Scenario 2: Distributed power is a scenario developed to reflect the introduction of smart metering to homes and businesses in order to induce reductions in electricity and gas consumption. This scenario also reflects an accelerated introduction of decentralised and micro generating technologies to local and national grids, requiring the utilisation of Monitoring & Control technology to safely operate this equipment. In this scenario, the objective is to make the adoption of renewable energy technology possible, reduce transmission losses in the distribution of energy, and encourage users to reduce consumption of energy.

Scenario 3: Pervasive Network describes a scenario in which technologies are allowed to communicate with one another, therefore enabling each technology to be synchronised in order operate in response to other devices, or simply to allow plug and functionality and compatibility to emerge. As it is impossible to evaluate all potential cases of interconnection occurring in each application sector, this scenario is developed from the previous two scenarios, to illustrate the potential of interconnection.

5.2 Households and Businesses

As discussed in the body of the main report, the modelling exercise is based on household and business population data, plus the average consumption and price paid by these two groups for energy and other services or products relevant to this study (i.e. average insurance premiums). This then establishes a base from which future scenarios can be modelled to determine both costs and benefits. Tables 99 and 100 summarise the consuming and price behaviour of households and businesses respectively in the EU. It is acknowledged that these figures are only approximate as climatic conditions, government policy, regional preferences, cultural and architectural differences (particularly in older buildings) will vary considerably between Member States, with associated impacts on the supply, demand and price of energy affecting businesses and consumers.

Table 99, Key Assumptions Regarding Households

Assumption	**Value**
Annual Average Electricity Consumption per Household (kWh)	4,344
Annual Average Natural Gas Consumption per Household (GJ)	83.70
% of Household Electricity Consumption used in Water and Space Heating	42
% of Household Electricity Consumption used in Large Appliances	27
% of Household Electricity Consumption used in Small Appliances	21
% of Household Electricity Consumption used in Lighting	10
Average Household Price for Electricity per kWh (€ excluding taxes)	0.12
Average Household Price for Natural Gas per GJ (€ excluding taxes)	11.68
Average Insurance Premium per Property (€)	363
Total EU-25 Property Premium (€ billion)	71.785
Average Insurance Premium per Vehicle (€)	424
Number of Vehicles per Household in Europe	1.52
Total Number of Vehicles in Europe (2007)	300 million
*Sources: Eurostat (2007): Energy Statistics 2007and JRC/IES (2006): **Electricity Consumption and Efficiency Trends in the Enlarged European Union;** ODYSSEE (2008): **Energy Efficiency Indicators in Europe**, available at: http://www.odyssee-indicators.org/; and Eurostat (2007a): **Consumers in Europe – Facts and Figures on Services of Interest**, 2007 Edition*	

Table 100, Key Assumptions Regarding Businesses

Assumption	Value
Annual Average Electricity Consumption per Business (kWh)	112,500
Annual Average Natural Gas Consumption per Business (GJ)	41,860
Average Business Price for Electricity per kWh (€ excluding taxes)	0.08
Average Business Price for Natural Gas per GJ (€ excluding taxes)	8.89
*Sources: Eurostat (2007): Energy Statistics 2007and JRC/IES (2006): **Electricity Consumption and Efficiency Trends in the Enlarged European Union;** ODYSSEE (2008): **Energy Efficiency Indicators in Europe**, available at: http://www.odyssee-indicators.org/; and Eurostat (2007a): **Consumers in Europe – Facts and Figures on Services of Interest**, 2007 Edition*	

Population projections of businesses and households over the period 2007-2020 are provided in Table 101 Household numbers were calculated by dividing the estimated population of the EU by the average household size (which was assumed to converge from the EU-27 figure of around 2.5 persons to the EU-15 value of 2.4 persons over the assessed period). Business number are assumed to increase at the same rate as population, measured in terms of enterprise as reported by Eurostat as a proxy for the actual number of business sites.

Table 101, Projected Number of Households and Enterprises in the EU-27

Year	Number of Households (millions)	Number of Enterprises (millions)
2007	198.0	18.9
2010	204.5	19.1
2015	210.2	19.3
2020	215.6	19.3

Population growth derived from Eurostat population projections between 2007 and 2020 have been used throughout the analysis to derive estimates of future values for energy consumption, generation capacity, and vehicle numbers from reported 2007 values.

5.3 The Energy Sector

It is important to emphasis the knock on impacts of energy savings on the energy sector, specifically in relation to energy losses in generation and transmission/distribution, in addition to capacity requirements in the EU. In order to assess these impacts, a number of simplifying assumptions have been made, presented in Table 102

Table 102, Assumptions Characterising the Energy Sector

Assumption	Value
Total EU-27 Electricity Generation in 2007 (TWh)	3,309
Average rate of Transmission/Distribution Losses (%)	6.6%
Source: Eurostat (note 1 TWh = 1,000,000,000 kWh)	

Consideration in the analysis is also given to aspects of the energy sector that are not easily quantifiable in the analysis. In particular, this refers to the energy generating mix between primary sources and renewable sources, as well as security of supply issues. It is realised that these topics have an important influence on the structure and future development of the energy sector in

Europe, therefore a qualitatively assessment of expected impacts is provided in the main body of the report and in Appendix 3.

5.4 Scenario 1: Smart Home

As described, the smart home scenario reflects the potential for automation systems to be installed in homes to monitor and control the functions of household appliances and electrical circuits in order to increase the comfort and convenience experienced by residents, improve security and operate appliances more efficiently in order to save energy, reducing household bills. At present, it is recognised that home automation systems already exist for lighting, entertainment, etc. However, these products are sold as tailored solutions combining many different solutions in order to arrive at the finished solution for the user, currently at a high cost (typically €5-15,000 or higher). This scenario assesses the introduction of a more standardised or 'off-the-shelf' solution. A 5% reduction in the average cost of each system annually is assumed from the date of the scenario commencing to reflect the progression of the technology from its infancy to mass market, benefiting from economies of scale in production, marketing, distribution, etc.

The key assumptions and definitions supporting this scenario are provided in the following Table.

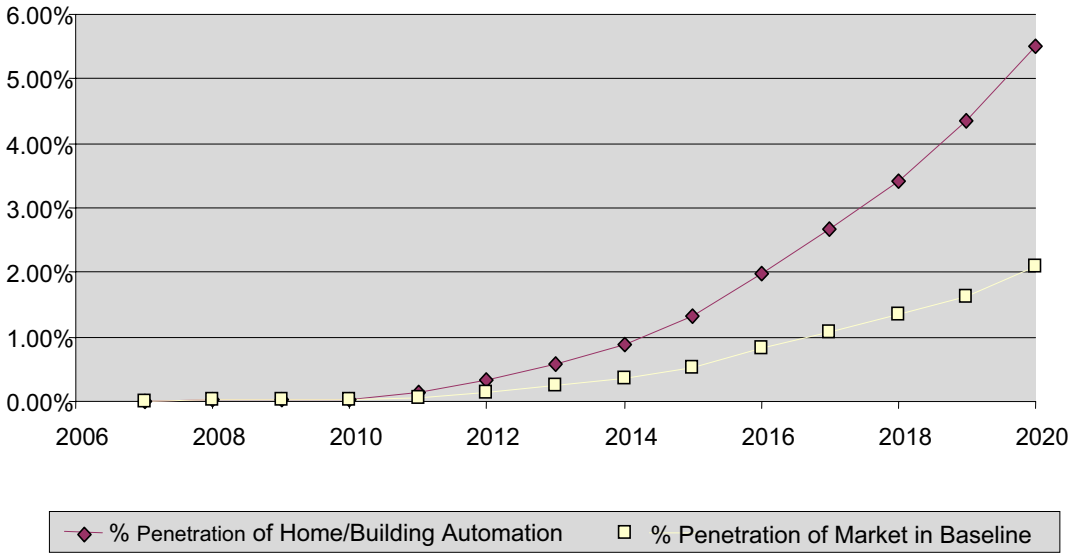
Table 103, Smart Home Assumptions and Definitions

Product Definition: Standardised off the shelf automation system sold through retail and professional user channels to household consumers, enabling the regulation of heat/cooling systems, lighting, entry, security and household appliances, compatible with smart appliances. A complete system is assumed to also require embedded devices in 'smart' appliances in order to provide a connection with the automation system.			
Product Components: Centralised function unit (x2), Network gateways (x5), software (x1), Terminals (x3), Remote controls (x5), Motors (x10), Miscellaneous wiring, components, etc. (x10), Appliance/ Device connections (x18) and 'smart' devices in large (x4) and small (x5) appliances (excluding lighting).			
Costs	**Unit Costs(€)**	**Number**	**Total Assumed Value (€)**
Centralised function unit	250	2	500
Network gateways	20	5	100
Software	50	1	50
Terminals	150	3	450
Remote controls	80	5	400
Motors	5	10	50
Misc	15	10	150
Home appliance connections	20	18	360
Installation costs	360	1	350
		Sub-total	***€2,420***
'Smart' large appliances	90	4	360
'Smart' small appliances	30	5	150
		Sub-total	***€510***
		Total	**€2,930**
Annual maintenance cost	2% of system cost		€48.4
Benefits			
Home and vehicle insurance premium discount			5%
Reduced energy consumption per household			1%
Shift in energy consumption from peak to off-peak periods			5%*

Note: *without smart metering and dynamic pricing it is difficult for the automation system to know which periods of the day are off peak or cheapest in which to operate appliances, therefore indirect benefits are minimal in this analysis compared to the other benefits

The market penetration of smart home technology in the baseline and in the scenario where rapid adoption is assumed is presented in Figure 65 as a percentage of the total number of households in the EU. This scenario commences in 2010.

Figure 65, Assumed market penetration in baseline and scenario



5.5 Scenario 2: Distributed Power

This second scenario, commencing in 2012, incorporates the introduction of two distinct technologies to improve the efficiency of energy generation, distribution and consumption in the EU. Smart metering makes consumers of energy (households and businesses) aware of consumption and its costs, and it enables those households or businesses generating their own energy to regulate its import/export to and from the national or local grid. The second technology proposed by this scenario refers to use of M&C devices to enable the connection of micro-generation and decentralised energy technologies to national or local grids, thus ensuring stable and secure supplies of energy from conventional and renewable sources. In summary, the combination of both technologies is assumed to develop 'smart grids' in this scenario.

The key assumptions underpinning the analysis of smart meters are presented in Table 104.

Table 104, Cost Assumptions for the Introduction of Smart Metering in Europe

Product Definition: 3rd Generation smart meters with the capability for radio frequency (RF) communication, including a visual display of current consumption and costs, plus the ability to meter both imports and export of energy from/to the home or business.		
Costs	**Household (€)**	**Business (€)**
Electricity Meters		
Purchase Cost	90	310
Installation Cost	20	170
Maintenance Cost*	2.25	7.75
Communication Cost**	5	10
Gas Meters		
Purchase Cost	120	310
Installation Cost	20	170
Maintenance Cost*	3	7.75
Communication Cost**	5	10
Note: *Assumes Annual Maintenance Cost equal to 2.5% of meter purchase cost; **Annual costs *Source: Frontier (2007): Smart Metering – A Report Prepared For Centrica, by Frontier Economics, October 2007*		

In addition it is acknowledged that utility companies involved in the distribution, metering and billing of customers will encounter significant costs in order to adapt existing systems and infrastructure so that they are compatible with smart meters. For example, they must invest in infrastructure to ensure that billing systems have the capability and capacity to communicate with smart meters. These costs are difficult to quantify and as such, they have been derived from an impact assessment on smart metering in the UK[53]. The cost is presented as a net present value per 60,000,000 inhabitants in the model, (broadly equivalent to the UK population) and multiplied accordingly to reflect the population of the EU in the final analysis to estimate the final infrastructure system costs.

Table 105, Assumed One-off Implementation and System Costs

Net Present Value per 60 million inhabitants	€ 500 million
Source: Frontier (2007): Smart Metering – A Report Prepared For Centrica, by Frontier Economics, October 2007	

The costs relating to the introduction of distribution technology are assumed to vary between small (micro-generation) and large (decentralised energy generating) technologies which require connection to a grid utilising Monitoring & Control solutions. These assumed costs are presented in Table 106, in addition to installation and annual maintenance required.

Table 106, Assumed Costs of Distributed Power Systems

Cost	**Small Distributed Power (€)**	**Large Distributed Power(€)**
Equipment Costs	2,000	4,000
Installation	500	1,000
Maintenance Cost*	50	100
*Note: *Assumed 2.5% of Equipment Costs per annum*		

53 *Frontier (2007): Smart Metering – A Report Prepared For Centrica, by Frontier Economics, October 2007*

Consistent with the other scenarios, a 5% reduction in equipment costs of the technology is assumed from the commencement date of the scenario to reflect the benefits of mass-market adoption on the costs of production.

In terms of the benefits described in the main body of this report, the assumptions underlying their quantification in relation to distributed energy and smart metering can be summarised in Table 107.

Table 107, Benefit Assumptions for the Introduction of Smart Metering and Distributed Energy in Europe

Assumed Benefit	**Percentage**
Reduced energy consumption per household (from smart metering)	2%
Shift in energy consumption from peak to off-peak periods (from smart metering)	5%*
Reduced losses from the transmission and distribution of energy (from distributed power)	32%**
*Note: * introduced independently of home automation systems, consumption patterns will be largely unaffected, although total consumption may decrease, therefore limiting the overall impact* ***based on a reduction of transmission losses from 6.6% to 4.5% of actual energy production applied at incremental levels based on the density of distributed energy technology in Europe*	

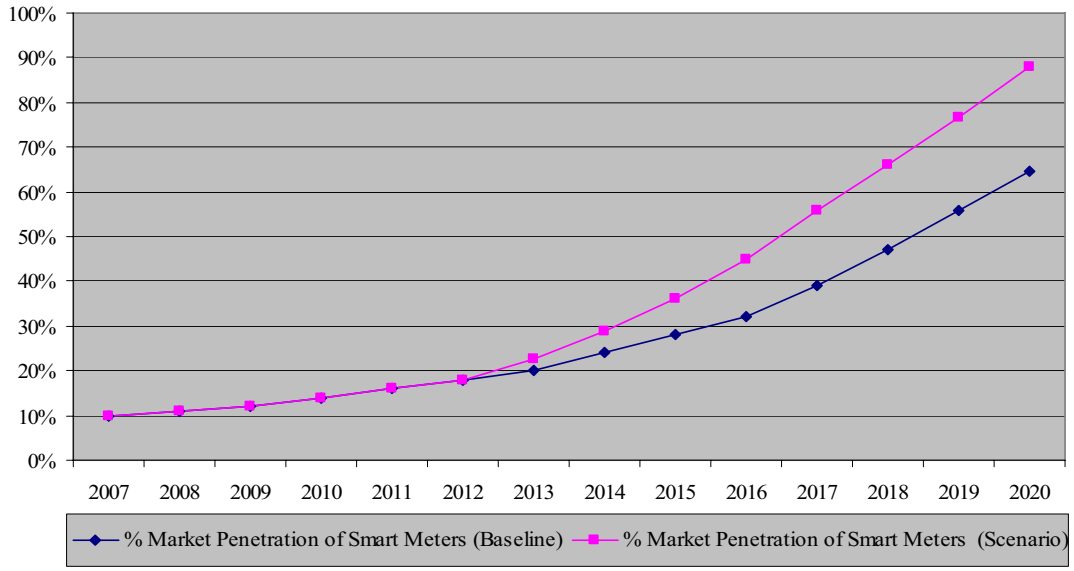
Further benefits are also assumed to exist, indirectly of those stated above, as reductions in energy demand will lead to decreases in the network and production capacity of the energy sector in the future, in addition to reduced carbon emissions (See Section 5.7)

It is recognised that the roll-out of smart metering in Europe is ongoing, thus the baseline analysis must take account of known future adoption rates. A literature summary of smart metering activities in various EU Member States is summarised in Table 108, including an indication of the timeframe for introduction, if known. Accounting for this information, the market penetration rate assumed in the baseline and scenario for smart metering is provided in Figure 66.

Table 108, Summary of Literature Review on Smart Metering Role Out in Europe

Member State	Smart Metering Roll-out	Timescale (by/during…)
EU-25	81.2 million electricity AMM meters	2013
France	300,000	2007-2009
France, Spain, Netherlands	11 million annual unit installation	2013
Italy	27 million smart meters (of which 24 million remotely managed and read)	2005
Netherlands	All residential customers	2008-2013
	50,000 in trial	2006
Norway	All homes by 2013	2013
Portugal	2,300 house trial	2008
Sweden	All homes by 2009 due to legislation requiring all meters to be read monthly	2009
UK	41,000 house trial	2007
Sources: Berg Insight (2008): Smart Metering and Wireless M2M; EAMA (2007): European Research Experience and Needs on Smart Metering, Presentation given by John Parsons, Project Coordinator, European Smart Metering Alliance (ESMA); and, Leonardo Energy (2006): Smart Metering, by Rob van Gerwen, Saskin Jaarsma and Rob Wilhite, KEMA, the Netherlands, for Leonardo Energy		

Figure 66, Assumed market penetration of smart meters in baseline and scenario



In the example of distributed energy generation involving the use of Monitoring & Control devices to connect generating equipment to national or local grids, the benefits have been derived from the density of installations. Thus, a unit measure of the number of small (micro) and large (decentralised) generating technologies in the baseline and scenario has been estimated. Figures 67 and 68 present the number of small/large installations assumed respectively in the analysis.

Figure 67, Assumed market for small distributed energy generating technology

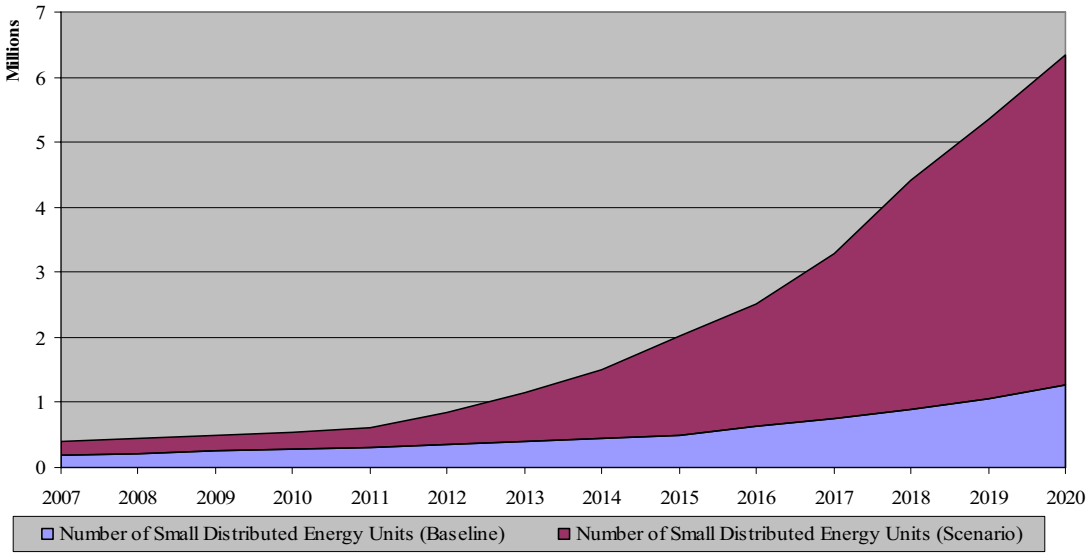
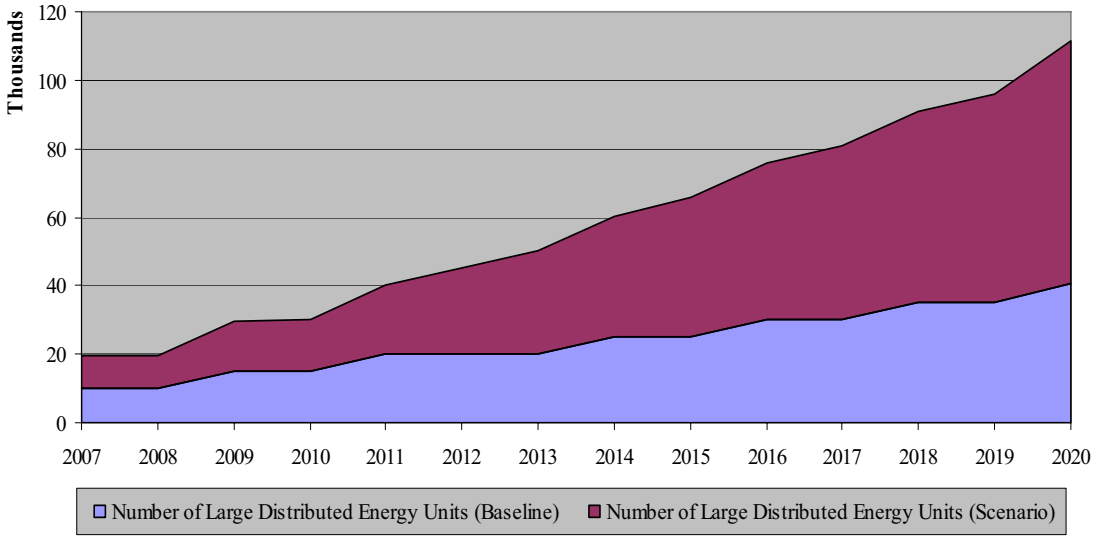


Figure 68, Assumed market for large distributed energy generating technology



5.6 Scenario 3: Pervasive Network

This third scenario, takes a snapshot view of the potential impacts that could emerge should two or more technologies and devices be connected in terms of technology compatibility or a physical connection through a cable. As noted in the main report, this can occur in all sectors of the monitoring can control industry identified. However, to assess the impact across all possible applications requires a much more detailed analysis than that permitted by the scope of this study. In order to provide an indicative example of the magnitude of impacts that could result, this scenario assumes that the technologies introduced in the previous two scenarios can be interconnected, thus sharing information gathered from smart meters in the management of energy

consumption within homes. This includes the intelligent use of distributed power by households and business when it is the most efficient to do so.

In relation to the costs of this scenario, the same assumptions have been applied as in the previous scenario except that an annual 7.5% reduction in equipment costs is assumed from the commencement of the scenario (2010) to reflect the potential for a more rapid growth in technology adoption and therefore mass-market production.

The benefits attributable under this scenario are also revised from the previous smart home and distributed energy scenarios, as follows:

- Energy savings are assumed to increase from 1% to 3% for smart home and from 2% to 3% for smart meter technology as each becomes synchronised with each other's functions.

- Shifts in peak energy demand to off peak periods is assumed to increase from 5% to 15% as through smart metering, smart home technology can identify when demand on the grid is lowest and where individual suppliers of energy (including micro and distributed generation sources) are cheapest, responding accordingly to reduce peak demand and energy bills for the household.

One of the key impacts identified in the networking scenario is a much sharper increase in technology adoption compared to the previous scenarios, driven by the lower prices achieved through mass market production and increases in the realisable benefits achievable by connecting both groups of technology in homes and businesses. An additional factor to consider in this scenario is its commencement in 2010 instead of 2012 for distributed energy technology, bringing forward the increase in uptake. The market penetration of smart home and smart metering applications are depicted in Figure 69 showing both baseline and scenario market penetration rates. Figure 70 presents the net increase in the number of small and large energy generation units installed in this scenario above the baseline.

Figure 69, Smart Home and Smart Metering Market Penetration Rates

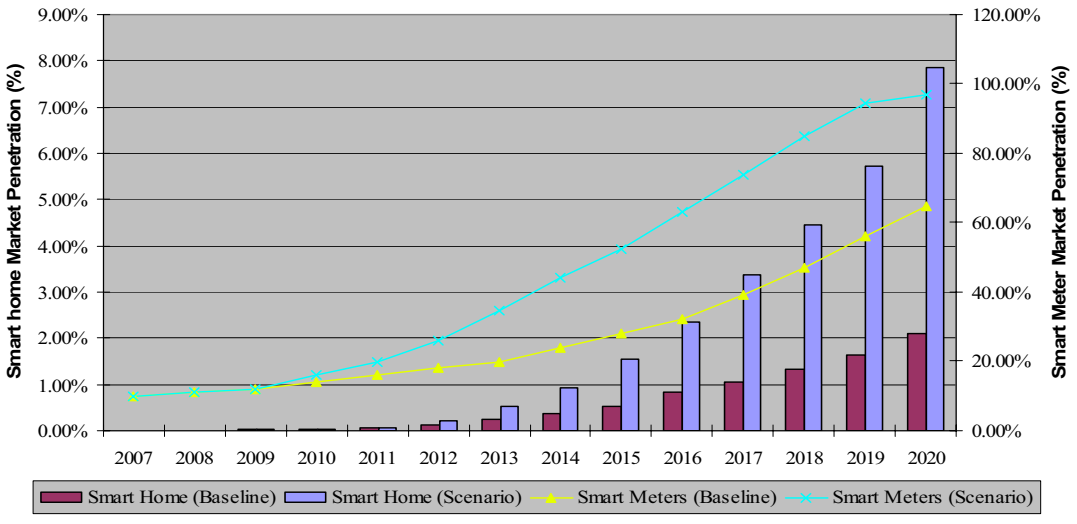
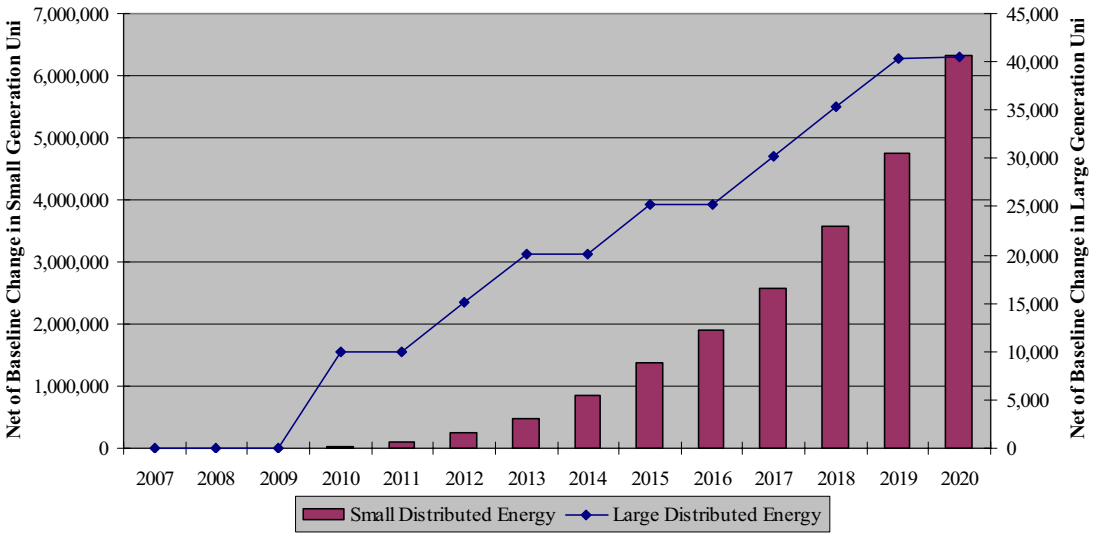


Figure 70, Market for small and large distributed energy generating technology (net of baseline)



5.7 Indirect and Environmental Impacts

Each impact described and quantified in the previous analysis is also assumed to have a knock-on or indirect impact on carbon dioxide emissions and future capacity costs associated with the generation of energy. The same assumptions and calculation methods have been applied in each scenario to quantify these impacts in monetary terms, thus the analysis is described separately below.

Firstly, reductions in energy consumption and shifts in peak demand are assumed to have an associated impact on the energy generating and distribution capacity necessary to satisfy European energy demand. Consequently, peak energy demand partially determines this required capacity. Reductions and shifts in energy consumption by households and businesses can therefore result in future avoided capacity costs. These can be quantified using estimates from the recent Frontier Economics study (as previously referenced). Two sets of avoided cost are possible in these circumstances:

Avoided generation capacity – at present, the price of energy across Europe appears to be following an increasing trend. By holding energy prices constant throughout the period under assessment, the analysis assumes that the developing difference in price reflects the value of avoided generating capacity costs. This is plausible in the short term as generating capacity is largely a sunk costs included in present prices. However, in the long term, these avoided costs could be much higher, but this also applies to energy prices that are expected to increase substantially.

Avoided network capacity - a reduction in peak capacity load reduces the pressure on the network caused by the heat generated by high voltage power lines and the number of power lines necessary in a region. Consequently, a

saving in future network capacity can be calculated based on the assumptions presented in Table 109.

Table 109, Avoided Peak Network Capacity Costs

Table C5.11:		
Benefit	**Electricity €/kW/year**	**Gas €/kW/year**
Storage	-	0.1
Transmission	25	0.2
Distribution	65	0.2
Total	**90**	**0.5**
Source: Frontier (2007): Smart Metering – A Report Prepared For Centrica, by Frontier Economics, October 2007		

Secondly, associated carbon impacts can be calculated based on the energy mix of each individual Member State to derive a carbon emission factor per MWh of energy produced (tCO_2/MWh). However, the complexity of energy generation in different countries (e.g. France produces a high proportion of energy using nuclear technology opposed to mainly fossil fuel produced energy in Italy) makes the calculation a complex issue. For simplification, a common emission factor for electricity and gas has been applied, presented in Table 110. The price of carbon (€/tCO_2) is then applied to monetise the impacts.

Table 110, Conversion Factors for Carbon Assessment

Table C5.12:		
Conversion Factors	**Electricity**	**Gas**
Emission factor (tCO_2/MWh)*	0.64	0.19
Price of CO_2 (€/tCO_2)**	€32	
** ODYSSEE (2008): Energy Efficiency Indicators in Europe, available at: http://www.odyssee-indicators.org/* ** Based upon the Frontier (2007) estimates, converted to 2007 euro prices at £1 = €1.25		

As the impact of reduced energy consumption or carbon savings have already been calculated in the analysis in different ways, there is a possibility that the analysis may double count the benefits. For example, as climate change levies and carbon trading represent significant costs to the energy-generating sector, they are already accounting for a large proportion of the carbon they may be emitting in their costs and revenue, therefore calculating total carbon emissions again would simply over estimate their impact. In order to avoid double counting, 50% of the cost of carbon emissions is subtracted from the calculated savings to account for the carbon cost pass-through in energy prices[54].

54 Numerous studies of the initial stages of the EU ETS have estimated the level of carbon cost "pass-through" at between 40-70%, hence 50% represents a reasonable midpoint. For example, see " **CO_2 dynamics – A follow-up analysis of the implications of EU emissions trading for the price of electricity**" by Sijm, J.P.M.; Donkelaar, M; Hers, J.S.; Scheepers, M.J.; Chen, Y. (2006), ECN Policy Studies, ECN-C-06-015.

6 Sensitivity Analysis

6.1 Overview

The purpose of this exercise is to establish the robustness and, to some degree, the reliability of the conclusions reached by the cost benefit exercise. Specifically, this analysis enables the importance of individual assumptions to be identified and their relative importance to the results to be quantified. Following a workshop held with stakeholders in October 2008, it emerged that many diverging opinions and study results exist regarding the energy saving potential of home automation and distributed power technologies.

This appendix presents the results of an iterative analysis undertaken by applying different energy saving assumptions using information gathered from a range of technology specific studies and trials conducted across the EU, in addition to comments received from stakeholders on the results of the study presented at the October workshop held in Brussels.

6.2 Revision 1: Smart Home

In this study, (see Chapter 3) it was assumed that the introduction of a smart management system for the home, automating the on/off functions of appliances, lighting, and heating/cooling equipment would result in a 1% reduction in energy consumption by households on average. This rather conservative figure was selected for a number of reasons. Firstly, the automation system and its connections to devices around the home consume a certain amount of energy and generate losses through wiring. Radio frequency communication may reduce these losses, but ultimately increase consumption when the complete system is on stand-by. Secondly, the reduced energy consumption of appliances is assumed to lead to a loss in heat emanating from the equipment and consequently, there is likely to be a "heat replacement effect" (HRE). HRE occurs as households use more heating in order to compensate for the loss of heat from the appliance, resulting in a corresponding increase in energy consumption of other appliances (typically space heating or cooling equipment). Applying an average energy saving of 1% across all Member States would

therefore seem reasonable, given the variation in households, ownership of electrical appliances, building characteristics, etc.

However, for the purposes of robustness it is important to evaluate the impacts of much higher energy savings resulting from home automation systems independent of other technologies. Consequently, the smart home scenario has been re-calculated assuming 5%, 7%, 10% and 15% energy savings rates, the results of which are presented in Tables 111 to 114 below.

Table 111, Smart Home Cost Benefit Analysis – 5% Energy Saving

	Baseline	Scenario	Net of Baseline
Costs (2007-2020, €m)			
Home Automation System	5,557	14,453	8,895
Smart Appliance	1,097	2,861	1,765
Total Cost	**6,654**	**17,314**	**10,660**
Benefits (2007-2020, €m)			
Insurance Saving	584	1,480	897
Energy Saving	851	2,176	1,325
Total Benefits	**1,435**	**3,656**	**2,222**
Benefits-Costs	***-€5,219***	***-€13,658***	***-€8,439***

Table 112, Smart Home Cost Benefit Analysis – 7% Energy Saving

	Baseline	Scenario	Net of Baseline
Costs (2007-2020, €m)			
Home Automation System	5,557	14,453	8,895
Smart Appliance	1,097	2,861	1,765
Total Cost	**6,654**	**17,314**	**10,660**
Benefits (2007-2020, €m)			
Insurance Saving	584	1,480	897
Energy Saving	1,192	3,047	1,855
Total Benefits	**1,776**	**4,527**	**2,752**
Benefits-Costs	***-€4,878***	***-€12,787***	***-€7,908***

Table 113, Smart Home Cost Benefit Analysis – 10% Energy Saving

	Baseline	Scenario	Net of Baseline
Costs (2007-2020, €m)			
Home Automation System	5,557	14,453	8,895
Smart Appliance	1,097	2,861	1,765
Total Cost	**6,654**	**17,314**	**10,660**
Benefits (2007-2020, €m)			
Insurance Saving	584	1,480	897
Energy Saving	1,703	4,358	2,655
Total Benefits	**2,287**	**5,838**	**3,552**
Benefits-Costs	***-€4,367m***	***-€11,476m***	***-€7,108m***

Table 114, Smart Home Cost Benefit Analysis – 15% Energy Saving

	Baseline	Scenario	Net of Baseline
Costs (2007-2020, €m)			
Home Automation System	5,557	14,453	8,895
Smart Appliance	1,097	2,861	1,765
Total Cost	**6,654**	**17,314**	**10,660**
Benefits (2007-2020, €m)			
Insurance Saving	584	1,480	897
Energy Saving	2,554	6,529	3,975
Total Benefits	**3,138**	**8,009**	**4,872**
Benefits-Costs	***-€3,516m***	***-€9,305m***	***-€5,788m***

The sensitivity analysis performed above still demonstrates that the costs of smart home introduction are an order of magnitude greater than the expected benefits for households according to our model. However, the model does exclude the beneficial impact of convenience and comfort enjoyed by households when functions of the home are automated. Further iterative analysis shows that energy saving of 37% or above would be needed if in terms of energy and insurance savings, the adoption of smart home technology were to be economically viable.

While it is important to identify and assess all potential benefits of smart home technology, all potential costs should face the same treatment. For example, the more developed and widespread an automation or management system is within a home, the less human interaction and control is necessary, thus the user is required to move around less with knock-on impacts for human health if this results in significantly less exercise for the user. However, regardless of the number and types of impacts identified, this assessment suggests that only a very significant change in the expected costs or benefits of home automation will have a decisive impact on the outcome.

6.3 Revision 2: Smart Meters

The initial analysis assumes a reduction of 2% in energy consumption on average is possible through the introduction of smart metering independent of any other technology. This figure was derived from the conclusions of literature review undertaken by Frontier Economics[55] investigating the impact of smart meters utilising visual display technology on consumer consumption, which concluded that combined savings of between 1% and 3% were plausible in the context of installing smart meters with visual displays, to induce the consumer to observe consumption volumes and costs, responding accordingly. However, it is clear from the literature review that these reductions differ widely between Member States, individuals and to some extent the age and energy efficiency of appliances within each household[56]. Another key factor to consider is the response of consumers to the information provided by smart meters over a long period, as initially the consumer may change behaviour rapidly in response to the new information. However, overtime the consumer may become less responsive to the same information, opting to revert to habitual and seasonal consuming patterns established prior to the installation of the smart meter. Applying an average figure of 2% to account for the above-mentioned factors over time and between households therefore seems plausible in the analysis, if conservative. In addition, no study appears to account for the energy consumption of the meters, their displays and communication equipment when calculating energy savings. For comparison, a summary of other study findings in the literature are presented in Table 115.

55 Frontier (2007): **Smart Metering** – A Report Prepared For Centrica, by Frontier Economics, October 2007

56 See Sustainability First (2007): **Smart meters in Great Britain : the next steps?**, by Gill Owen and Judith Ward, available at: http://www.sustainabilityfirst.org.uk/

Table 115, Summary of Smart Metering Energy Saving Findings

Study	Savings	Details
Energy watch (2007)	3.5-7%	-
Owen, G. and Ward, J. (2006): Smart Meters: Commercial, Policy and Regulatory Drivers, for Sustainability First, March 2006	1-3%	-
Ofgem (2006): UK Guidelines for Smart metering systems in the UK, 2006	1%	Applied to Ofgem's cost-benefit analysis
Darby, S. (2006): The Effectiveness of Feedback on Energy Consumption, April 2006	Over 10% in some cases	Majority of savings the result of real time information
EAMA (2007): European research experience and needs on smart metering, presentation by John Parsons, for the European Smart Metering Alliance (ESMA)	1.5-14% Examples: Finland - 10% target, Netherlands – 2% expected	Dependant on support and differences in customer behaviour across EU
Logica CMG (2006): Energy Efficiency, Public Attitude, Private Action, by the Future Foundation available at: http://www.logicacmg.com	Range 0-34%, average of 15%	Based on survey of consumers, which asked by how much each though they could reduce their energy bill if using a smart meter
EC (2008): ICT for Smart Distribution Networks – Summary Report, provided by DG INFSO, 25/09/2008	7%	Energy efficiency saving in Finland
	24.5%	Demand response in Norway (SINTEF)
	5%	Residential efficiency

Based upon the published results of previous studies and comments received from stakeholders, included in Table C6.4 above, various percentage reductions in energy consumption have been taken forward for sensitivity analysis in an iterative analysis. The results indicate that a 5% reduction in energy consumption by households and businesses would be enough to ensure that the benefits of distributed power exceed the expected costs in the model. Therefore, assumed savings would need to more than double for the outcome to change. The results of a 5% energy saving, all other assumptions held constant, is presented in Table 116 below.

Table 116, Distributed Power Cost Benefit Analysis – 5% Energy Saving

	Baseline	Scenario	Net of Baseline
Costs (2007-2020, €m)			
Smart Meters	34,207	46,639	12,432
Decentralised Energy	2,263	9,282	7,019
Total Cost	**36,469**	**55,920**	**19,451**
Benefits (2007-2020, €m)			
Energy Saving	67,429	84,723	17,294
Capacity Cost Saving	6,649	8,879	2,230
Carbon Saving	8,650	11,393	2,743
Total Benefits	**82,728**	**104,995**	**22,267**
Benefits-Costs	***€46,258m***	***€49,074m***	***€2,816m***

In addition, it is possible to re-run the economic model with changes made to the assumed shifts in peak to off peak load demand. Set at 5% for this scenario in this study, the sensitivity analysis will also consider a shift of 25% based on the results of a survey[57] of 1894 energy-consuming households in Germany, Netherlands, UK, USA, Japan and Australia that found that peak load shifting of between 5.7% and 25.4% are possible. A similar study by Boeing found that a 20-30% reduction in peak load usage was possible through smart metering and dynamic pricing, with other studies estimating savings of up to 50% as possible in this situation. However, as this scenario is assumed to be introduced independent of other technology (smart homes and buildings) and market liberalisation (dynamic pricing), these trial results should be viewed with a degree of caution as without the incentive of lower energy bills possible through dynamic pricing, the demand response of energy users can be expected to be low, thus 5% in the original analysis seems reasonable. Sensitivity analysis is however conducted on this assumption with the shift in consumption increased to 25%. Table 117 showing the results illustrates that the results of the analysis still remain the same (although further analysis indicated that a peak load reduction of 40% or more would be required to give an overall gain net of the baseline).

Table 117, Distributed Power Cost Benefit Analysis – 25% Peak Load Shift

	Baseline	Scenario	Net of Baseline
Costs (2007-2020, €m)			
Smart Meters	34,207	46,639	12,432
Decentralised Energy	2,263	9,282	7,019
Total Cost	**36,469**	**55,920**	**19,451**
Benefits (2007-2020, €m)			
Energy Saving	26,971	33,889	6,918
Capacity Cost Saving	14,881	19,220	4,339
Carbon Saving	15,641	20,174	4,533
Total Benefits	**57,493**	**73,283**	**15,790**
Benefits-Costs	***€21,024m***	***€17,363m***	***-€3,661m***

In relation to energy savings attributable to distributed energy technology including decentralised and microgeneration energy, the methodology assumes that incremental reductions in transmission losses result from increases in the density of generating installations. This approach appears to find support in the literature, which identifies the distance between producer and user of energy as the most significant factor in transmission/distribution losses[58]. Published trial results in the literature make it difficult to isolate the benefits of distributed power from other savings attributable to losses of energy in the network (e.g. energy fraud) as some studies report the saving in total non-technical or non-delivered energy. Overall, 50% reductions in network losses have been reported, significantly higher than the 32% assumed in this model. However, when it is considered that some Member States such as Germany have reduced losses in the network to around 5%, while others in newer Member States have considerably higher losses, typically 10% or higher[59], it appears unlikely that an

57 pers.comm, DG INFSO summary of recent trial results 10/10/2008

58 Leonardo Energy (2008): Reducing electricity Network Losses – Based on a Discussion Webinar, Friday, April 11th 2008, by Roman Targosz, available at: http://www.leonardo-energy.org/drupal/print/2935

59 EC (1999): The scope for energy saving in the EU through the use of energy-efficient electricity

overall decrease in losses of 50% across the board is possible, a view supported by participants of a workshop held in Brussels to discuss the findings of this study in October 2008. The 32% saving assumption is therefore maintained without further analysis.

distribution transformers, produced by the European Copper Institute for the ENERGIE project of DG Energy, 1999

7 Glossary

A glossary of all technical, economic and product related terms used within this study is provided below. This includes the definition of the technologies evaluated and of the key impacts assumed to arise in this study.

Automation	Describes a process whereby devices self regulate their activities by interaction with various inputs from the user or other technologies (e.g. sensors).
Bidirectional meters:	Metering equipment with the functionality to measure both consumption of energy, but also exports of energy to a power grid. This functionality is assumed standard in third generation smart meters.
Decentralised power:	Refers to medium to large energy generating technology such as wind farms and wave power located closer to the point of consumption than traditional power generating technology, often located a large distance away from the point of consumption. Power generation therefore becomes more localised.
Discount rate:	Used to convert a future income (or expenditure) stream to its present value. It shows the annual percentage rate at which the present value of a future Euro, or other unit of account, is assumed to decrease over time (4% in this study).
Discounting:	A method used to convert future costs or benefits to present values using a discount rate.
Distributed energy:	Decentralised power and micro-generation technology employed by energy suppliers, households and businesses. This study focuses on the technology necessary to connect these generating technologies to the home/business and to the power grid, potentially creating 'smart' grids.
Dynamic pricing	Pricing of utilities which is allowed to vary by time of consumption and supplier, thus producing a fully liberalised market from which consumers can purchase energy.

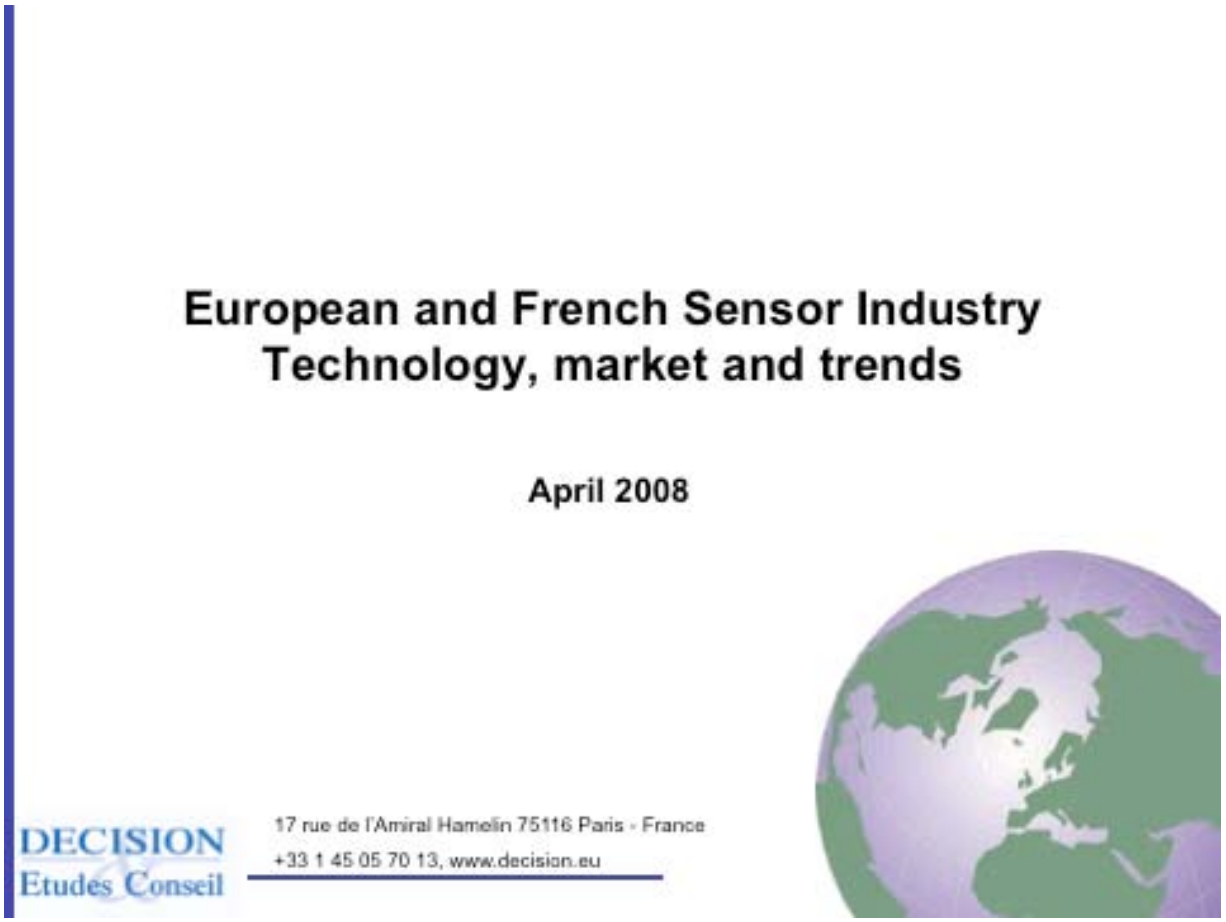
Externalities	The non-market impacts of an activity that is not borne by those who generate them.
Micro-generation:	Refers to small energy generating technologies installed and operated by households and businesses for there own consumption or supplied to a power grid.
Net Present Value (NPV)	Present value is the discounted value of a stream of future costs and/or benefits. Net Present Value (NPV) is the value today of a project, an investment, scenario or policy. It is calculated as the sum of discounted streams of costs and benefits related to the activity in question.
Plug-'n-play functionality	Allows simple connection of devices or modules, without having to install drivers or other parameters to set.
RFID	Radio Frequency Identification (RFID) systems are part of automatic identification systems. These systems are used to store information on a tag and to transmit and readout them wirelessly in the near field. RFIT is used in logistics, on transport palettes, batches and single product packages to enable smart applications, detailed tracking and tracing.
Smart energy grids	Due to different trends (notably higher percentage of renewable energies and electricity market liberalisation) the electricity grids requirements are increasing. The classical structure (distribution from large power plants via the various voltage levels to the end consumer) is replaced by decentralised power generators and bidirectional networks. Consequently, more and more control capabilities have to be transferred to new 'smart' or 'intelligent' networks to ensure the steadiness of energy supplies.
Smart home	Applies automation technology to the functions of the home to optimise energy efficiency, comfort and user convenience.
Smart metering	Meters and metering services capable of interacting with smart energy grids, wireless communication networks and distributed energy technologies. The exact specifications are presented later in this study. For now, it is assumed that this refers to third generation smart meters currently appearing on the market.
Wireless networks	Integration of sensors into automation systems requires sensor networks, which transmit the recorded information wirelessly to appropriate interfaces.

D – European Sensor Market

SENSORS: Overview of Technologies, Markets and Trends

Sensors, together with motors and actuators, are the basic components of any Monitoring & Control systems. The tender for this study excluded sensors themselves (as components) from its scope, but as they are an integral part of any Monitoring & Control solutions, it is important to understand technology and market trends of this sector, in as much as they affect the market under consideration.

We provide here an overview of the European sensor market and its trends, including technological ones, from a study on the "European and French Sensor Industry - Technology, market and trends" performed by DECISION.



>Introduction

An heterogeneous business
European and French sensor markets

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Content

- **Detailed analysis of the sensor industry in Europe and France per product segment (temperature, pressure…) and application sector (automotive, industrial…)**
  - consumption estimates in million euros per product segment and application sector
  - forecasts in value terms from 2007 to 2011
- **Analysis of major technical trends and impact per product segment and application sector**
  - digital and wireless sensors penetration analysis
  - MEMs and thin film technologies penetration, sensors networks, etc.
- **Panel analysis of sensor manufacturers/integrators localized in France**
  - mapping per product segments and application sectors
  - analysis per type of activity in France

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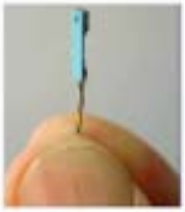
Sensor definition

Discrete element, of reduced size, connected to an electronic system, able to measure physical, chemical, electrical parameters, and whose sensitive element (transducer) represents a significant share of the value added.



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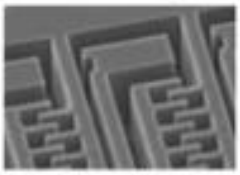

Source Freescale

Source Siemens VDO

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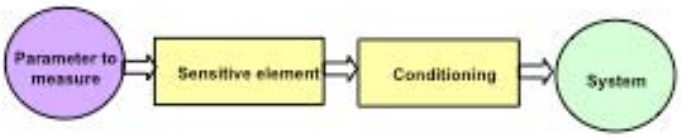
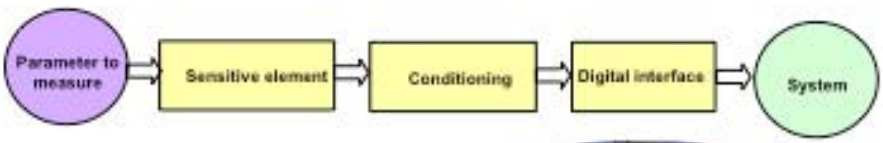
Sensors typologies

Transducer:

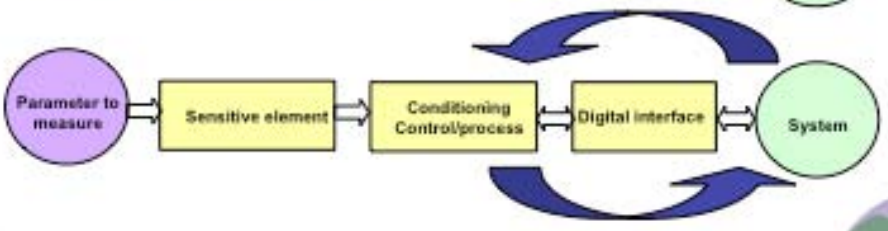
Functional sensor:



Digital sensor:



Smart sensor:



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Sensor role in the system

- Depending on applications, sensors are used to satisfy 4 main functions within a system:
  - monitoring & control : in order to increase the **performances** and **regulate** the system
  - security & warning : in order to increase the **safety** of the system and **anticipate** default
  - diagnosis & analysis : in order to **understand** the system and **improve**
  - interface & navigation : in order to **operate** the system and increase **functionalities**
- Historical sensors functions are in monitoring and control as it brings direct system performances improvement
- The others are developing equal or faster
  - sensors are more and more becoming central elements within the system, bringing either new functionalities or reducing Total Cost of Ownership
  - now sensors are starting to be used to prevent rather than to cure, development of sensors usage in early warning systems and intelligent maintenance schemes
  - sensors are also key pieces of new electronics interfaces (natural motion detection)

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Survey's product segment scope

- Sensors are either used in stand-alone configurations or integrated within end-equipment
- Detectors represent the vast majority of the sensor industry, at least 60 to 70% of the market, providing Boolean information (ON/OFF)
- Sensors are basically used to detect and measure four main categories of parameters: physical, mechanical, chemical and electromagnetic

Physical parameters		Chemical parameters
• acoustic	• pressure	• gas
• flow	• temperature	• liquid(1)
• humidity		• solid(1)
Mechanical parameters		**Electromagnetic**
• absolute position	• level	• current(2)
• force/deformation	• position/displacement	• voltage(2)
• inertial	• proximity/distance	• magnetic field(2)

(1): not isolated in the survey's detailed analysis ('other' category)
(2): grouped within the electromagnetic sensors product segment

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Survey's application scope

• Sensors are used in every kind of markets, from industrial process control/regulation to game consoles remote controls

• The following scope has been adopted to cover the majority of sensors applications and ensure a good market coverage

- sub segments of the "traditional" industrial application sector have been isolated in order to provide a better visibility on the European sensor market outlook

Aerospace & Defense	Industrial process and manufacturing
Automotive	IT Infrastructure
Building and infrastructure	Laboratories and test
Consumer	Medical healthcare
Energy and networks	Security
Environment	Transportation
Home Appliances	

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Introduction

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European and French sensor markets

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Sensors food chain

• The sensors food chain includes:

- **component manufacturers**: focusing on a general basis on the transducer part (generally Tier N suppliers)
- **sensors manufacturers/integrators**: taking care of the packaging and interface, sometimes of the electronics (Tier 1 suppliers)
- **system integrators and OEMs** who are now in demand of complete solutions rather than single components
- **sensors distributors**: playing a key role between manufacturers and system integrators-OEMs

• Depending on the application sector, the decomposition of the sensor added value is very different

- while transducers represent 25% of the full sensor value, other elements like conditioning, packaging, interface, test and qualification, see their relative share varying significantly depending on application
- very few players have kept vertically integrated organizations (e.g. Bosch, Thales)

• Measurement principles are relatively stable but integration technologies are rapidly evolving (stimulating by MEMs penetration)

- this trend has some deep influence on the industrial landscape (consolidation and technology acquisition)

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Consolidation is under way

• The sensor market has experienced over the last decade a significant consolidation process that has eventually led to the creation of large industrial conglomerates through acquisitions

- these conglomerates have both large product and end market coverages (in particular for industrial application sectors)
- most significant are: Ametek, Baumer, Emerson Process, Esterline, GE Sensing, Industrial Scientific Corporation, Measurement Specialties, Meggitt, Schneider, Spectris, etc.

• Some examples of industry consolidation in France:

- Auxitrol (affiliate of the US Group Esterline since 1972, acquisition of Sagem pressure sensors buisiness line and Fluid Regulators Corp. in 1997, acquisition of BVR Aero Precision in 2003)
- Sensorex (affiliate of Vibro-Meter France since 2005, part of Meggitt UK)
- Humirel (created in 1998, acquired by Measurement Specialties in 2004 US)
- Kavlico's (US) acquisition in 2004 and BEI Technologies (US) in 2005 by Schneider Electric

• To increase market coverage, reach critical mass and develop technical and marketing synergies between business lines

- in line with OEMs demand looking for complete measurement and system solutions

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Sensors discrepancy

• Over 100 sensors technologies have been identified during the survey, and many more have not !

- According to Wikipedia, there are at least 50 technologies for pressure sensing alone

• Depending on application markets, required sensors characteristics are very different. Sensors precision, accuracy, stability, repeatability, reliability have considerable impacts on:

- transducer technologies
- integration value added (including test and qualification)
- and company profiles

• Which turns into a tremendous price discrepancy depending on functions and applications

- from 100keuros for spatial applications, same sensor can cost 20 times less in industrial applications
- from 5 to 1000 euros for sensors integrated to an end equipment/platform (as opposed to stand alone configurations)

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Sensors manufacturers geographical mapping

• 212 sensors manufacturers have been integrated into the panel analysis during the course of the survey

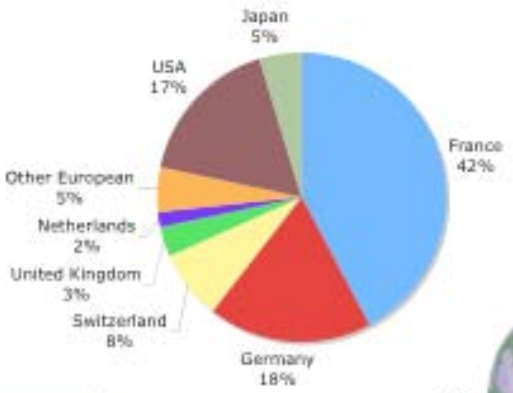
• European companies represent 78% of the panel

• Out of the 212 sensors manufacturers, 183 have a local office in France

• Out of the 183, 113 either have a production or development site in France

• In comparison, the German sensor industry is composed of 420 members (including 70 R&D institutes)

Companies within the panel per country of origin



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Companies localized in France

- The following 183 companies have been identified in the panel as having a representation in France
- In bold are 113 companies with a presence in France other than pure commercial, either in production and/or development
- Within these 113 companies, 30 indicated in red are focusing on sensor integration, the others are developing/manufacturing discrete sensors. Most of them are small and niche players

France suffers from a deficit in sensors development and manufacturers with respect to the end demand of OEMs

ABB	DELPHI	JTEKT	SENSEOR
ADT	DIEPROCOM	KAVLICO	SENSOPART
AHLBORN	DJB Instruments	KELLER	SENSOR TECHNICS
AIRINDEX	DOERLER	KISTLER	SENSOREX
AKOTRONIC	E+E ELEKTRONIK	KLOE	SENTRONIC
ALLEGRO	EZV technologies	KOBOLD	SERCEL
ALLIANCE Instrument	EFE	KROHNE	SETNAG
ALLIANTECH	EFS	KULITE	SICK
AMG microwave	ELECTRICFIL	LaVision	Siegfried & Vester
AMM	Electronique Contrôle Mesure	LEM	Siemens Building Technologies
ANALOG DEVICES	ELMOS	LESCATE	Siemens Automation & Drives
ANDLOG	ELOBAU	LEUZE Electronic	SMARTEC
ASC Instrument	EMERSON	LINOS	SNR
ASCO INSTRUMENTS	ENDRESS + HAUSER	LITTOCLIME	SOFRADIR
ASCO Joucomatic Normalinx	ENERDIS	LOREME	SOFRASER
ASHCROFT Instruments	Environnement SA	MARTEC	SOLARTRON
ATEQ	EPCOS	MCB Industrie	SONOTEC
ATEXIS	ERCIAT	MCC	SOPHYSA
ATMEL	E-T-A	MEGATRON	STEDIM
AUTOCRUISE	ETAMIC-HOMMEL	MEMI	STERELA
AUXITROL	EURO PHYSICAL ACOUSTICS	MELEXIS	STL
AXON	EUROFARAD	MEMSCAP	STMicroelectronics
BALLUFF	FGP sensors	METRAVIB	THALES AVIONICS
BEI IDEACOD	FIRST Technology	MICREL	THERMOCOAX
BERTHOLD	FLINTEC	Micro-contrôle Spectra-Physics	THERMO-EST
BERTIN Technologies	FOGALE nanotech	Micro-Epsilon	TME
BIACORE	FREESCALE	Moving Magnet Technologies	TRAFAG
BOSCH	Fritz Kübler	NaSENS	TRONICS
BOURDON - HAENNI	Fuji Electric	NGK / NTK Technical Ceramics	TRW
BRONKHORST	GARDIS	NIVUS	TUREK BANNER
BURKERT	GEFRAN-CORECI	NKE	TYCO
CADDEN	GEORGIN	Ocean Optics	ULIS
CAPACITEC	gsAMO	OLDHAM	VAISALA
CAPTEC	GRUTER ET MARECHAND	OMRON	VALEO
CAPTELS	Hanamatsu	OMRON	VEGA
Carlo Gavazzi	HBM	OPTEL THEVON	VISHAY
CEDES	HEITO	ORION TMI	WABCO
CHERRY	HUBA Control	PANASONIC Electric Works	Weigtor Sensors
CIMEL Electronique	HUMIREL	PARATRONIC	Yokogawa
CITYSENSORS	IBS Precision Engineering	PCB Piezotronics	
CMR	IDIL	PONSEL	
CODECHAMP	IFM Electronic	PRECILEC	
COFRATHERM	IJINUS	PROSENSOR	
COMPAUT	IMPAC	PYRO CONTRÔLE	
CONTINENTAL	INDUSTECHNIC	SAUTER REGULATION	
CORREGE	ITECA SOCADEI	SCAME	
CRANE Aerospace	IXSEA	SCHLUMBERGER	
CROUZET	JPC	SCHNEIDER ELECTRIC	

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Introduction

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>European and French sensor markets

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European sensor consumption per application sector, 2007

		Europe		
Sensor Type	#	In million euros	Market structure	CAGR 2007-11
Industrial	1.	2 643	26%	7%
Automotive	2.	2 304	23%	3%
Aerospace/Defense	3.	1 684	17%	8%
Laboratories/test	4.	952	9%	4%
Consumer	5.	724	7%	2%
Medical	6.	534	5%	16%
Security	7.	250	2%	5%
Transport	8.	226	2%	5%
Building	9.	204	2%	7%
Energy	10.	199	2%	4%
Home Appliances	11.	183	2%	2%
Environment	12.	160	2%	15%
IT infrastructure	13.	138	1%	4%
TOTAL		**10 198**	**100%**	**6%**

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Sensor market and average growth in Europe

- The European sensor market is estimated at 10 billion euros in 2007
- This represents 28% of the World sensor market (36 billion euros)
- The average sensor market growth is estimated at 6% in value terms between 2007 and 2011

- Average growth trend is similar to the World electronic equipment market during the period
  - at least twice the growth rate of the electronic component market in Europe
  - sensors are generally at the origin of new functionalities and market development in electronic and industrial equipment
- While Europe represents 20% of the World electronic equipment production, its share of the sensor market is significantly larger (28%)
  - this is due to the leadership position of Europe in application sectors that are "sensor intensive" such as industrial, automotive and aerospace & defense

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Sensor market and average growth in France

- The French sensor market is estimated at 1.5 billion euros in 2007, which represents 15% of the European sensor market
  - the French market is also specialized on sensor intensive application sectors such as aerospace&defense, automotive and industrial
- Average growth in France is estimated at 6%, similar to the European market
- However, the growth structure and drivers are different between France and Europe, especially from an application market perspective
  - the dynamic of the French market can be largely explained by the current demand in aerospace&defense applications which remains in France the first end application sector for sensors
  - the French industrial sensor market is also very much specialized in process and food industry rather than industrial equipment manufacturing
- Other important sensor markets in Europe are Germany and Italy
  - with large and dynamic end markets in Automotive and Industrial machinery
  - and a strong sensor manufacturing base compared to France including transducers manufacturers and sensors integrators as well

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Sensor consumption analysis per product segment

Global European and French sensor market overview

- The structure of the sensor consumption per product segment is much more fragmented than per application sector
  - this is due to the large scope of parameters that are being measured in the main application sectors (industrial, aero, auto)
- New applications of inertial sensors and gas sensors are stimulating both product segments (10% average growth over the forecast period)
- More mature sensor products like Temperature, Position, Flow, Force, Electromagnetic, etc. are still growing, though less rapidly due to cost decrease and thin film penetration
- The analysis of the aggregated market structure per product segment category (cf. product segment scope) gives the following

Product segment category	European sensor market structure	French sensor market structure
Physical	37%	35%
Mechanical	37%	40%
Chemical	16%	16%
Electromagnetic	10%	8%

Source DECISION

- Physical and mechanical sensors represent the vast majority of the sensor market in Europe (and France too) with 75% of the global market
- Structure in France shows a larger share of mechanical sensors due to the relative size of aerospace&defense and automotive application sector

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>Conclusion

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Sensor industry overview

- Actors
  - an heterogeneous industry both in terms of end application markets and in terms of added value from the actors (complex value chain)
  - an industry that is under consolidation where France do not have the sensor manufacturing base corresponding to its local end application demand and integration capabilities (with respect to Germany or Switzerland)
- Markets
  - some historical end markets with long industrial cycles (industrial, aerospace & defense, etc.) and slow technology penetration
  - …and others with tremendous potential (consumer, medical, environment, security), relying on new sensor deployment concepts, features, integration know-how and business models (sensors networks, autonomous and abandoned sensors, smart sensors)
- Technology
  - the dynamic development of thin film integration technologies (ICs, MEMS, etc.) is supporting this trend by allowing new integrated solutions along with sharp potential price decrease
  - it is in a position to modify profoundly the technological landscape of the sensor industry, still dominated by mature solutions
  - and introduce new products segments (e.g. bio-sensors, spectrometers), features (e.g. wireless, energy autonomy), which can in turn trigger the development of new applications (in medical, environment, security, consumer, etc.)

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Evolution towards system

- System approach is intimately linked to the sensor market development
  - sensors have a direct impact on users (functionality, interface) and ownership cost (diagnostic, maintenance)
  - representing an opportunity to be in direct contact with final OEM (system level definition)
- From curative to palliative functions
  - structural health monitoring: new concepts of embedded monitoring in order to optimize maintenance schemes in historical markets such as aerospace and defense, industrial manufacturing, etc.
  - early warning (environment, medical, security), smart diagnostic functions as well as energy savings and control (intelligent building, distribution networks, consumer devices) heavily rely on sensors
- These market opportunities rely on new technologies and development in base materials, transducers, electronic processing, packaging and system integration
  - key research fields concern multiple measurements sensors (heterogeneous material integration and nanostructures), smart and interconnected sensors (sensor networks, self-diagnostic and configuration capabilities), energy autonomy (low power consumption and energy harvesting techniques), etc.
- ….at a reasonable cost
  - regulation and standardization are key steps in order to facilitate market development and reach acceptable cost
  - depending on application, collaboration throughout the foodchain (from OEMs to transducer manufacturers) can also help in developing efficient solutions based on available technologies

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>Appendix

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Methodology

- **Application sectors**
  - 13 application sectors, providing a comprehensive coverage of European and French sensor consumption
  - including professional application sectors analysis such as (building, energy, environment, transportation…)
- **Product segments**
  - 13 product segments based on measured parameters rather than transducer technologies
  - e.g. position/displacement, pressure, temperature, humidity sensors etc.
- **Sensors consumption analysis based on**
  - European industrial and electronic production in depth analysis and associated sensor content
  - consumption figures, i.e. market estimates correspond to the place where the sensor is actually being integrated within the equipment or infrastructure
  - more than 50 interviews in Europe and France with sensors manufacturers, integrators, end-users and laboratories in order to cross-check and validate market estimates and forecasts

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Application sectors definition

End application Market	Definition
Aerospace/Defense	Embedded sensors in aerospace and military platforms (civil/military aircraft, weapons, etc.)
Automotive	Embedded sensors in passenger cars (engine, body, chassis)
Building	Embedded sensors in home, office and public buildings as well as real estate infrastructures (civil engineering)
Consumer	Embedded sensors in mass market products (mobile phones, TVs, media players, computers, etc.)
Energy	Sensors used in power plants as well as energy transportation networks
Environment	Sensors used to monitor environmental parameters (meteorological sensors, air/water monitoring, etc.), excluding those integrated to an equipment platform (e.g. gas sensors in cars)
Home Appliances	Embedded sensors in large and small appliances (coffee machine, washer and dryer, etc.)
Industrial	Sensors used in industrial process and manufacturing including petrochemical industries, equipment manufacturing and assembly plant, food industry, etc.
IT infrastructure	Embedded sensors in computer and telecom networks and infrastructure (e.g. data warehouse)
Laboratories/test	Sensors used in R&D, laboratories and for test purposes
Medical	Embedded sensors in medical equipment including medical imagery, drug delivery, implantable devices, homecare devices, etc.
Security	Sensors used for personal, goods, site and homeland security
Transport	Sensors used in railway and marine transportation equipment and networks

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Companies and organization interviewed

Manufacturers & Distributors		OEMs		Labs	Organizations
Ademics	Infineon	Airbus	Sagem	LAAS	Alliance7
Alliantech	Kistler	Bosch	Schlumberger	LETI	ANR
Aragonesas	LWorks	Clemessy	SEB Group	Pole capteur Bourges	Cetiat
Auxitrol	MicroEpsilon	EADS Secure Net.	SPX (for BMW)	Pole mer	Cetim
Bossa Nova	Micronas	EDF	Continental	Technopole Anticipa	Exera
Bronkhorst	Oxford Tech. Solutions	ELA Medical	Technip	Rennes University	Fédération ATMO
City Sensors	Pepperl&Fuchs	GE Healthcare	Tecnotest		Ministère de l'équipement
Corrsys	Prosensor	Kirsten Soldering	Thales		SYMOP
Epcos	Rheinhardt	MBDA	Veolia		
First Sensor Tech.	Senseor	PSA			
Freescale	Sensorex				
Gefran	Tronics				

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Sensors manufacturers panel: purpose and methodology

- The sensors manufacturers panel has been realized in order to get a representative analysis of the sensors industry in France both in terms of product segment and application sectors
- Due to the disparity of the sensors industry in terms of value chain, technologies, applications and the lack of professional representation in France, this panel is not aimed to be exhaustive
- Companies within the panel have been continuously integrated throughout the course of the survey, based on desk researches (press, internet and companies websites, dedicated trade shows exhibitors list, etc.)
- Several structural information have been aggregated at the company level in order to provide some qualitative description of the panel and prove its relevance with the French market structure, including:
  - origin of the company
  - product segment and application sector coverage
  - type of activity and localization in France

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European Commission

Final Report of the Study SMART 2007/047

"Monitoring & Control: Today's market and its evolution till 2020"

Luxembourg: Office for Official Publications of the European Communities

2009 — 330 pp. — 21 x 29.7 cm

ISBN 978-92-79-12045-9
DOI 10.2759/11437

KK-78-09-697-EN-C

Monitoring and **Control:** Today's market and its evolution till 2020

Monitoring and Control

Publications Office

ISBN 978-92-79-12045-9

European Commission
Information Society and Media