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Regulatory Issues and Recommendations

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Abstract:

This deliverable D1.7 reports on aspects of the European regulatory environment, in both telecommunications and energy, which are relevant to the use of Future Internet technologies for Smart Energy in Europe, and assesses the implications for the FINSENY use cases. This work provides analysis and commentary; it is not intended to explicitly influence or define European regulations. The report includes an assessment of how regulation in energy and telecommunications is moving in Europe as a whole and in selected countries, and how the FINSENY scenarios might be impeded or encouraged by existing, or changes to, regulation in energy and telecommunications.

Keyword list:

Regulation, Future Internet, Smart Energy, FINSENY, User-Centricity, Innovation, Investment, Activity Structure, Activity Model, Whole System Regulation, Distributed Control, Stability, Agility, Smart Grid, Infrastructure Sharing, Open Access, Spectrum, Privacy, Critical Infrastructure Security, Interworking, Standardisation, Collaboration, Competitiveness, Energy Security, Sustainability

Executive Summary

This FINSENY deliverable D1.7 is the documented output from task T1.4 "Regulation Recommendations", which has investigated regulatory issues related to the Future Internet for Smart Energy. The aim is to understand how regulation in both energy and telecommunications is moving in Europe as a whole and in selected countries, and how the FINSENY use cases might be impeded or encouraged by regulatory developments.

The focus of this document is the activities and impacts of Regulatory Authorities who employ regulations as instruments for implementing European and national policy. It is an underlying assumption of this document, however, that such regulatory frameworks need to be consistent with allowing real-time controls within the governed energy systems to maintain the dynamic stability of those systems (a process which engineers would also refer to as "regulation").

Energy regulation in Europe is designed to deliver energy security in a low carbon future, whilst ensuring competitiveness and protecting consumers, to underpin sustainable economic prosperity and social cohesion. Regulation in telecommunications has a particular focus on ensuring effective competition and consumer protection. Although the primary focus for Future Internet Public Private Partnership (FI-PPP) projects such as FINSENY is the Future Internet, many of the significant themes which emerged from the regulatory research by the FINSENY consortium, leading to this deliverable, were actually associated with energy regulation rather than explicitly to do with the regulation of telecommunications and the Future Internet. This is because the energy industry is built around monopolistic network businesses, the regulation of which has a fundamental impact on the potential to realise synergies between the Future Internet and the energy industry.

Chapter 1 of the document briefly sets out the objectives and motivation for this work, describes the scope and approach taken to the research, and summarises the structure of the document.

Chapter 2 introduces the bodies involved in regulation, gives an overview of relevant legislation and regulation in Europe, and provides profiles of four selected countries: the UK, Germany, Spain and Poland. It finishes with a summary of key themes and trends in energy and communication regulation.

Chapter 3 provides the view from FINSENY, taking key issues in turn, and describing each (where relevant) in relation to the five scenario work packages of the project: Distribution Networks (WP2), Microgrids (WP3), Smart Buildings (WP4), Electric Mobility (WP5), and the Electronic Marketplace for Energy (WP6).

Chapter 4 draws together the findings of chapters 2 and 3 to understand the suitability of existing regulatory frameworks, and observed regulatory trends, to address the issues identified by the FINSENY project.

Chapter 5 summarises recommendations by taking a crosscutting perspective of the whole project, arriving at the following actions with respect to regulating the Smart Energy future in Europe, recognising the part to be played by the Future Internet:

- **Investment and Innovation**: Encourage and accelerate the current shift in regulation of Distribution System Operators from cost-effectiveness regulation to performance-based regulation, designed to incentivise investment and innovation, in order to maximise development and deployment of smart grids across Europe. Explore the feasibility of allowing alternative regulatory frameworks to be tested in live trials in order to better understand the interplay between regulation and technology in the innovation process.
- **User-Centricity**: Encourage the regulatory trend in both energy and telecommunications to enable consumers to become active participants, developing regulatory strategies to ensure that consumers are not only well-informed but are also engaged in learning loops with suppliers and governments.
- **Whole System Regulation**: Initiate research to develop models of the "activity structure" of the energy system as a whole that transcends, but maps to, existing organisational boundaries, in order to guide the evolution of frameworks for energy policy and regulation that could enable the stable transition from the current system of centralised control to a system of distributed control which is able to capitalise on the full capabilities and promise of the smart energy future.
- **Interworking**: Encourage and extend the current focus on data sharing, which is particularly evident in supply chain process innovation, to encourage interworking between different organisations, industries (including energy and ICT), and across national borders, recognising the value of a

reference model of the whole energy system (above) which links activities to common purposes such as energy security, affordability, competitiveness, economic prosperity, social cohesion and environmental sustainability.

- **Standardisation**: Continue to encourage the development and adoption of open standards in ICT across the European Union (EU) as an effective strategy for maximising interoperability, competitiveness, innovation, and delivery of value to all stakeholders, with a general principle of technology-neutral regulation but retaining the option for mandating standards if essential. Details of relevant standardisation activities are provided in FINSENY deliverable D1.6.
- **Privacy**: Continue with the strong development of data protection and privacy legislation and regulation, with an increasing focus on the specific requirements of smart energy.
- **Regulatory Collaboration**: Formalise and strengthen dialogue between policy-makers and regulators in communications and energy to address the likely tensions that exist between the highly regulated energy industry and the more lightly regulated communications industry, in order to ensure that Europe is able to lead, rather than lag, the development of opportunities at the nexus between the Future Internet and Smart Energy.
- **ICT Infrastructure Sharing**: Align energy regulation with the EU open access agenda for public telecommunications infrastructure by removing any barriers to sharing ICT infrastructure created by energy regulation, in countries where this is the case, both by ensuring that commercial ICT services are not discouraged with respect to self-build, and removing inconsistencies from country to country in the extent to which utilities are allowed to use assets to sell telecoms services to third parties.
- **Spectrum**: Consider the allocation, by 2020 at the latest, of harmonised spectrum for smart grid use across Europe, including frequencies below 1 GHz for resilience and geographic coverage, supplemented by additional spectrum in the range 1-3 GHz for capacity, recognising the existence of conflicting interests in such spectrum between utilities and telecoms operators, in particular.
- **Security of Critical National Infrastructure**: Encourage, and continue to focus on ensuring, appropriate security controls, for the enabling ICT in particular, to protect the energy systems of member states, strengthening an understanding of potential vulnerabilities arising from the current lack of a whole system regulation model.

Glossary

This document uses the terms included in the general FINSENY Glossary and Terms. Additional terms are referenced in the following list:

ACER	Agency for the Cooperation of Energy Regulators
AMI	Advanced Metering Infrastructures
CCA	Climate Change Agreement
CHP	Combined Heat and Power
DCC	Data and Communications Company
DER	Distributed Energy Resources
DG	Directorate General
DNO	Distribution Network Operator
DSO	Distribution System Operator
EC	European Commission
EEAP	Energy Efficiency Action Plan
EED	Energy Efficiency Directive
EG	Expert Group
eMarket4E	Electronic Marketplace for Energy
EMSP	E-Mobility Service Provider
ESD	Energy Services Directive
EU	European Union
EU ETS	European Union Emissions Trading System
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
FI	Future Internet
FI-PPP	Future Internet Public Private Partnership
GDP	Gross Domestic Product
GHG	Green House Gas
HAN	Home Area Network
HV	High Voltage
ICT	Information and Communication Technology
IPv6	Internet Protocol version 6
IT	Information Technology
IoT	Internet of Things
Ktoe	Kilotonne of oil equivalent
LV	Low Voltage
M2M	Machine to Machine
Mtoe	Million tonnes of oil equivalent
MV	Medium Voltage

NEEAP	National Energy Efficiency Action Plan
NRA	National Regulatory Authority
NRP	National Reform Programme
PCI	Project of Common Interest
PRG	Policy, Regulation and Governance
QoS	Quality of Service
R&D	Research and Development
RES	Renewable Energy Sources
RF	Radio Frequency
RFID	Radio Frequency IDentification
RIIO	Revenue = Incentives + Innovation + Outputs (UK regulation model)
SCADA	Supervisory Control and Data Acquisition
SGTF	Smart Grids Task Force
SIM	Subscriber Identity Module
SME	Small and Medium Enterprise
TSO	Transmission System Operator
V2G	Vehicle to Grid
UHF	Ultra High Frequency
VHF	Very High Frequency
WEP	Wholesale Energy Products
WG	Working Group
WLAN	Wireless Local Area Network
WP	Work Package

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1. Introduction

This FINSENY deliverable D1.7 is the documented output from task T1.4 "Regulation Recommendations", which has investigated regulatory issues related to the Future Internet for Smart Energy.

Chapter 1 briefly sets out the objectives and motivation for this work, describes the scope and approach taken to the research, and summarises the structure of the document.

1.1 Objectives

The aim of the task reported in this deliverable is to understand how regulation in both energy and telecommunications is moving in Europe as a whole and in selected countries, and how the FINSENY use cases might be impeded or encouraged by regulatory developments.

1.2 Motivation

FINSENY is fundamentally a technical research project, investigating the information and communication technology (ICT) enablers required for the future energy system. Technology exists in an economic, social, political and ecological context, and should be developed in dialogue with this wider environment. The regulatory environment, and the policy drivers that shape this, have an influence on the evolution and adoption of technologies. FINSENY task T1.4 is motivated by the recognition of a need to be aware of the influence of regulation on market and technology development, and, conversely, by the conviction that policy makers and regulators need to understand the industry perspective in order to develop effective regulatory frameworks.

1.3 Scope

The primary focus of the Future Internet Public Private Partnership (FI-PPP) Programme, from a technical perspective, is on the development of the Future Internet. This report therefore includes analysis of the regulatory issues related to telecommunications and ICT. There is recognition in the FINSENY consortium, however, that there is a wide range of critical regulatory issues in the energy domain that are intimately bound up with the use of Future Internet enablers for Smart Energy. Consequently, there is a significant focus on energy related regulation in this study.

This work is intended to identify issues, and not to design or explicitly influence policy or regulatory development.

1.4 Approach

A research approach was designed which combined some hypothesis-led investigation with more open-ended exploration. This was done in order to capture the very wide range of issues anticipated.

Research sources included:

- Secondary research using publicly available information
- Involvement from all FINSENY scenario work packages through a structured questionnaire and discussions
- Primary research with EUTC members (utility companies) and other contacts
- Participation in the FI-PPP Working Group on Policy, Regulation and Governance (WG-PRG).

1.5 Structure of the Document

This document is structured into the following chapters:

1. Introduction
2. Regulatory Overview
3. The View from FINSENY
4. Regulatory Outlook for FINSENY Scenarios
5. Recommendations

2. Regulatory Overview

2.1 Introduction

2.1.1 Purpose

The purpose of this chapter is to provide an overview of the regulatory situation in Europe in telecommunications and energy, including four selected country profiles, and commentary on trends, issues and current debates.

2.1.2 Approach

This chapter is based on desk research and analysis by a number of FINSENY partners.

2.1.3 Structure of Chapter 2

Chapter 2 is structured as follows:

- Regulation: Why, What, How
- Who is Involved? providing an overview of bodies involved, or with an interest, in regulation
- Legislation and Regulations
- Country Profiles for the UK, Germany, Spain and Poland
- Regulatory Trends, Issues and Debates

2.2 Regulation: Why, What, How

This section 2.2 provides a summary of why regulation is important, what it aims to achieve, and how.

2.2.1 Definition of Regulation

To regulate, in the sense intended in the task leading to this FINSENY deliverable D1.7, is "to control by rule", or "to subject to restrictions". Regulations can be seen as instruments for implementing policy.

There is a related, although somewhat different, sense of the word regulation which is about the ability of a system to adapt to changing circumstances in order to maintain a state of (dynamic) stability. This second sense is more familiar to engineers than to policy makers and regulatory authorities.

It is an underlying assumption of this document that the regulatory framework (in the first sense) needs to allow regulatory mechanisms (in the second sense) to maintain the dynamic stability of the energy system.

2.2.2 Why: Motivations for Regulation

The ultimate motivation for regulation should be to ensure that the regulated system remains able to fulfil its purposes, in changing circumstances, over the short and long term.

Energy regulation is designed to deliver energy security in a low carbon future, whilst protecting consumers and ensuring competitiveness, to underpin sustainable economic prosperity, and social cohesion and stability. Regulation in telecommunications also focuses on ensuring effective competition and consumer protection.

2.2.3 What: Regulatory Issues

There is a very wide range of issues that regulators deal with. Key issues are:

- Promoting competitive markets
- Regulating monopolies (e.g. TSOs, DSOs)
- Protecting consumers
- Maintaining service quality standards
- Ensuring provision of information
- Preventing environmental degradation
- Guaranteeing wide access to services.

2.2.4 How: Regulatory Interventions

Regulatory interventions are often characterised in terms of ex-ante ("before the event") regulation and ex-post ("after the event") regulation. The visible instruments of ex-ante regulation are, in general, a

framework of incentives and constraints. The key issue of ex-ante regulatory controls on electricity network businesses is discussed in section 2.2.4.2 below.

Regulatory interventions operate in the context of a defined market structure, which is, in itself, a fundamental aspect of the regulatory framework. This issue is addressed first, in section 2.2.4.1.

2.2.4.1 Market Structure

The structure of the market is a critical part of the regulatory framework. Although structure might not normally be seen as a regulatory *intervention*, it is a fundamental determining factor behind the behaviour of the system as a whole. In this sense, any decisions about market structure are, indeed, interventions. It is typically defined by policy directives, which are then implemented via the regulatory regime. Once a structure is established, it has a tendency to become relatively "invisible".

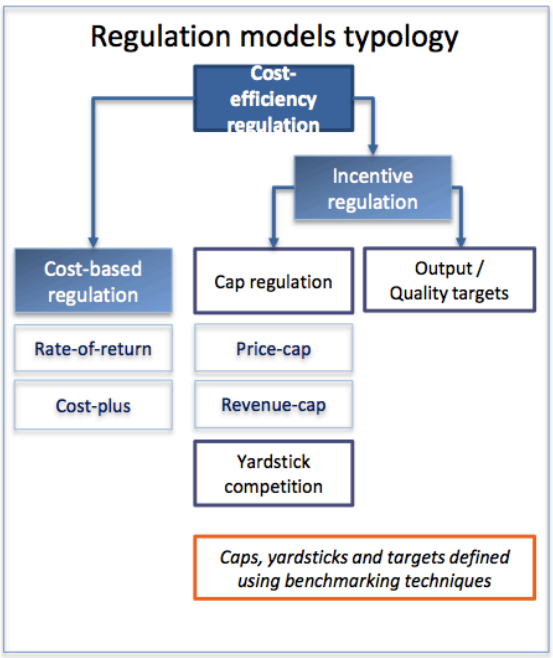
In the case of the electricity value chain, the principal activities are generation, transmission, distribution, wholesale and retail. After the Second World War, vertically integrated monopolies at national or regional level, delivering all aspects of this value chain, rapidly became the dominant business model in the electricity industry. To this day, the European electricity system remains highly centralised with mostly unidirectional power flows, and essentially no consumer participation, but the transition to the Smart Energy future is set to radically change this landscape.

Following market liberalisation in a number of industries initiated in Scandinavia, the UK and the US in the 1980s and 1990s, European electricity markets have been progressively liberalised. The European Commission has encouraged a process of unbundling through a series of Directives, most recently the Third Energy Package that came into effect in March 2011 (section 2.4.6). As a result, power generation, wholesale supply and retail supply, have become (in principle, at least) competitive segments of the value chain across the EU with a single energy market by 2014, while transmission and distribution have remained as regulated businesses since it is impracticable to introduce competition at the power infrastructure level.

2.2.4.2 Incentives and Constraints

The regulation of telecommunications in Europe uses predominantly an ex-ante approach, with a principal tool being price regulation. The focus is those telecommunications companies that have significant market power, and which have created barriers to effective competition.

In the energy domain, a key focus is the regulation of the monopoly grid businesses (Transmission System Operators, TSOs, and Distribution System Operators, DSOs). DSOs lie at the heat of the smart grid, and are therefore key for FINSENY. Their regulation is discussed below.



Source: Enerdata

Figure 1: Typology of Regulation Models for Electricity Networks, as developed by Enerdata for the European Parliament (Science and Technology Options Appraisal, STOA, 2012)

A project to review the regulatory issues relating to smart grids was conducted in 2012 as part of the Science and Technology Options Appraisal (STOA) for the European Parliament by a partnership made up of Enerdata, ISIS, IZT and Tecnalia. Enerdata presented a summary of the regulatory implications of smart grid deployment [19] arising from this project in a public webinar fronted by Clean Energy Solutions [18] on 22/01/13.

Enerdata's work includes a helpful typology of traditional regulatory models used for energy networks (transmission and distribution) in Europe. The typology, developed for the European Parliament, is shown in Figure 1 above.

The revenues of TSOs and DSOs, as regulated monopolies, are derived primarily from a regulatory formula.

Grid regulation has traditionally focused on cost-efficiency by minimising operating expenditure (opex) and rationalising investments (to avoid over-provisioning). Such regulation also embraces the need to meet a number of non-economic objectives including security of supply, power quality, grid stability and non-discriminatory access for third parties.

Early regulation of DSOs and TSOs focused on cost-based regulation, shown on the left of Figure 1, by which capital expenditure (capex) and opex profiles are fully defined, and costs are passed through to customers. Profits are capped in relative terms. Such regulation provides a means of controlling costs, but without providing any incentive to increase cost-efficiency beyond the mandated level.

Cap regulation means that prices or revenues (plus Consumer Price Index, CPI) are capped for a regulatory period (of typically 3 to 5 years), and a minimum efficiency target is set. Extra profit is retained if the company is more efficient than the target, and efficiency gains are passed through to customers at the start of the next regulatory period. This model, which provides direct financial incentives to be as efficient as possible, tends to deliver efficiency gains in the first few years in most countries, but with decreasing gains possible as time goes on. Importantly, it has the downside of risking lower quality of service, under-investment and minimal innovation.

Yardstick regulation is a variation of cap regulation by which revenues are set by benchmarking costs or productivity improvements against a peer group of similar companies.

Output-based regulation is designed to incentivise electricity network operators to ensure that non-financial objectives are not neglected. Thus it provides targets for parameters such as quality of service and security of supply, with associated financial rewards and penalties.

In general, European electricity grid regulation has moved away from cost-based regulation towards incentive-based regulation over time (that is, cap, yardstick, or output-based regulation). Most EU countries now use models that include a mix of cost-based, efficiency incentive, and output-based regulation. Fine tuning the regulatory model can take years, and is specific to each country.

All of the regulatory approaches discussed above focus on cost-efficiency. Beyond this traditional picture, Italy has allowed a research and development (R&D) component to be included in the network tariff but, in general, output-based regulation is difficult to apply to R&D and innovation.

In response to these difficulties, some countries, notably the UK, Germany, the Netherlands and the Nordic countries, are now making moves to rebalance the regulatory focus from cost-efficiency towards investment and innovation. More information is provided on the UK's new RIIO regulation model in section 2.5.2.4.2.

2.3 Who is Involved?

This section provides a factual overview of the main bodies involved in regulatory activities that have a bearing on Future Internet enablement of Smart Energy, providing an overview of their role. Details of key legislation and regulatory frameworks arising from these organisations are presented in section 2.4 which follows.

2.3.1 Global and Other Bodies beyond the European Union

The EU operates within a global context, as well as a wider European context, which has an influence on its policy making. This section summarises relevant bodies relating to international cooperation and coordination in telecommunications and energy.

2.3.1.1 ITU, International Telecommunication Union

The ITU (www.itu.int) is the United Nations specialised agency for information and communication technologies. The ITU allocates radio spectrum and satellite orbits, develops the technical standards that ensure networks and technologies seamlessly interconnect, and strives to improve access to ICTs for underserved communities worldwide.

2.3.1.2 CEPT, European Conference of Postal and Telecommunications Administrations

CEPT (www.cept.org) enables 48 European countries to cooperate to regulate posts, radio spectrum, and communications networks. CEPT includes:

- ECO, Electronic Communications Office (www.cept.org/eco)
- ECC, the Electronic Communications Committee (www.cept.org/ecc)
- The Committee for ITU Policy in Europe (www.cept.org/com-itu).

2.3.1.3 IEA, International Energy Agency

The IEA (www.iea.org) is an autonomous organisation that works to ensure reliable, affordable and clean energy for its 28 member countries and beyond. The European Commission also participates in the work of the IEA.

The IEA produces regulation reviews, and publications, which are free, or books. Examples are:

- Policy Pathways: Energy Performance Certification of Buildings, 2010
- Policy Pathways: Energy Management Programmes for Industry - Gaining through saving, 2012
- Policy Pathways: Joint Public-Private Approaches for Energy Efficiency Finance, 2012
- Policy Pathways: Monitoring, Verification and Enforcement, Improving compliance within equipment energy efficiency programmes, 2010
- Policy Pathways: Q&A Fact Sheet, 2010

The IEA also has Policies and Measures Databases that offer access to information on energy-related policies and measures taken or planned to reduce greenhouse gas emissions, improve energy efficiency and support renewable energy development and deployment. The IEA states that the databases are not exhaustive; for example, information on actions taken by provincial or regional government is not systematically included. Delegates from IEA member countries are given the opportunity to review information in the databases twice a year. Analysis of the information available, conducted by FINSENY partners, revealed that some information needs to be updated. As a specific example, information was missing on EC internal markets, and enforcement/punishment to those Member States not following pricing policies. In that sense, and relating to European countries, more reliable and updated information can be found at the Commission's webpage.

2.3.1.4 IRENA, International Renewable Energy Agency

IRENA (www.irena.org) is an intergovernmental organisation dedicated to renewable energy. As of September 2012, IRENA participants include 158 States and the European Union (EU).

Governments, public and private organisations, academics and the media can draw on IRENA's extensive knowledge base and wide-reaching expertise for a one-stop service that facilitates increased interest in, and adoption of, renewable energy technology and policies.

2.3.1.4.1 IRENA´s Policy Advice and Capacity Building

The Policy Advice and Capacity Building (PACB) Directorate supports countries' capacity to design long-term enabling renewable energy policy frameworks and promote a better understanding of economic and financial conditions to leverage renewable energy investments.

2.3.1.4.2 IEA/IRENA Global Renewable Energy Policies and Measures Database

The joint IEA/IRENA database provides an overview of global status on renewable energy policies as well as country specific policy profiles, which will meet the increasing demand from policy makers, researchers, and general public for accurate, timely, easily accessible information on renewable energy policies and measures.

2.3.1.5 UN-Energy, the United Nations' Interagency Mechanism on Energy

UN-Energy (www.un-energy.org) is a mechanism to promote coherence within the United Nations family of organisations in the energy field and to develop increased collective engagement between the United Nations and other key external stakeholders. Its envisaged role was to increase the sharing of information,

encourage and facilitate joint programming and develop action-oriented approaches to coordination. It was hoped that it would develop into a system-wide network, open to all, and a mechanism by which a range of organisational actors could work with the United Nations to ensure a more coherent approach to addressing energy issues.

2.3.1.6 ICER, International Confederation of Energy Regulators

ICER (www.icer-regulators.net) is a voluntary framework for cooperation between energy regulators from around the globe, with a participation of over 200 regulatory authorities and spanning six continents. The aim is to improve public and policy-maker awareness and understanding of energy regulation and its role. The focus is around four key areas: reliability and security of supply; the role of regulators in responding to climate change; competitiveness and affordability; and the independence, powers, responsibilities, best practices and training of regulators.

ICER includes the following bodies:

- CEER (www.energy-regulators.eu), the Council of European Energy Regulators (section 2.3.2.9)
- ARIAE (www.ariae.org), la Asociación Iberoamericana de Entidades Reguladoras de la Energía
- MEDREG (www.medreg-regulators.org), the Institution of Mediterranean Energy Regulators
- AFUR (www.afurnet.org), the African Forum for Utility Regulators
- CAMPUT (www.camput.org), Canada's Energy and Utility Regulators
- EAPIRF (www.eapirf.org), the East Asia and Pacific Infrastructure Regulatory Forum
- ERRA (www.erranet.org), the Energy Regulators Regional Association (with members primarily from the Central European and Eurasian region)
- NARUC (www.naruc.org), the US-based National Association of Regulatory Utility Commissioners
- OOCUR (www.oocur.org), the Organisation of Caribbean Utility Regulators
- RERA (www.rerasadc.com), the Regional Electricity Regulators Association of Southern Africa
- SAFIR (www.safirasia.org), the South Asia Forum for Infrastructure Regulation
- AEMC (www.aemc.gov.au), the Australian Energy Market Commission

2.3.2 European Union Bodies

This section outlines the role of European bodies that influence policy-making and/or regulation in communications and/or energy.

2.3.2.1 European Parliament and Council

The European Parliament (www.europarl.europa.eu) is one of the EU's main law-making institutions, along with the Council of the European Union (the Council).

One of the roles of The European Parliament is debating and passing European laws, with the Council. In many areas, such as consumer protection and the environment, Parliament works together with the Council (representing national governments) to decide on the content of EU laws and officially adopt them. Under the Lisbon Treaty, the range of policies covered by the new ordinary legislative procedure has increased, giving Parliament more power to influence the content of laws in areas including energy policy and budgets for energy.

2.3.2.2 European Commission: DG Connect

DG Connect (ec.europa.eu/dgs/connect) is the European Commission's Directorate-General for Communications Networks.

DG Connect coordinates a better regulatory framework over the entire range of issues in the communications field: economic analysis, impact assessment, policy development and regulatory compliance. These responsibilities correspond to Unit B1: Regulatory Coordination and Business.

As part of the team regulating electronic communications within the EU, they ensure Member States implement the rules to which they have agreed. Amongst other tasks, they:

- Initiate infringement proceedings in the event that legal action needs to be taken against Member States for failure to transpose and / or subsequently to implement the EU regulatory framework, or to uphold the independence and effectiveness of the Regulatory Agencies.
- Promote pan-European standards as a way to deliver pan-European services.

2.3.2.3 BEREC, the Communications "Super-Regulator"

The Body of European Regulators for Electronic Communications, BEREC (berec.europa.eu), which replaced the European Regulators Group (ERG) in January 2010, is the EU's telecoms super-regulator. Its board comprises the heads of the 27 National Regulatory Authorities (NRAs).

BEREC advises the Commission and the NRAs, and assists the European Parliament and Council, on issues related to the application of the EU regulatory framework for electronic communications. It is tasked with contributing to the development and better functioning of the internal market for electronic communications networks and services.

2.3.2.4 ETNO, the European Telecoms Network Operators' Association

ETNO (www.etno.eu) has become the principal policy group for European electronic communications network operators, with 50 members and observers in 35 countries.

2.3.2.5 EUTC, the European Utilities Telecom Council

EUTC (www.eutc.org), a trade association based in Brussels, is the premier source of ICT advocacy, information and services for Europe's critical infrastructure industries.

EUTC is a FINSENY partner.

2.3.2.6 European Commission: DG Energy

DG Energy (ec.europa.eu/energy) is the European Commission's Directorate-General for Energy.

DG Energy is responsible for developing and implementing a European energy policy, aiming to:

- Contribute to setting up an energy market providing citizens and business with affordable energy, competitive prices and technologically advanced energy services.
- Promote sustainable energy production, transport and consumption in line with the EU 2020 targets and with a view to the 2050 decarbonisation objective.
- Enhance the conditions for secure energy supply in a spirit of solidarity between Member States.

2.3.2.7 ACER, the "Energy Super-Regulator"

ACER, the Agency for the Cooperation of Energy Regulators (www.acer.europa.eu) is the EU's energy super-regulator. ACER was created in March 2011 by the Third Energy Package (section 2.4.6). Its mission is to complement and coordinate the work of national energy regulators at EU level and work towards the completion of the single EU energy market for electricity and natural gas.

ACER's main activities are to:

- Play a central role in the development of EU-wide network and market rules, with a view to enhancing competition;
- Coordinate regional and cross-regional initiatives which favour market integration;
- Monitor the functioning of electricity (and gas) markets in general, and of wholesale energy trading in particular; and
- Monitor the work of European Networks of TSOs (ENTSOs) for electricity (and gas).

2.3.2.8 ENTSO-E, the European Network of Transmission System Operators for Electricity

ENTSO-E (www.entsoe.eu) represents 41 Transmission System Operators (TSOs) from across Europe. It was established as an association (AISBL) according to Belgian law on 19 December 2008 and became fully operational on 1 July 2009.

ENTSO-E's legal raison d'être is Regulation (EC) 714 / 2009 on conditions for access to the network for cross-border ex-changes in electricity. The Regulation is part of the Third Energy Package on the Internal Energy Market, which was adopted on 3 September 2009 and came fully into force on 3 March 2011.

Regulation (EC) 714 / 2009 mandates ENTSO-E to:

- Draft network codes, ranging from network security and reliability, transparency, and capacity-allocation and congestion-management, through to energy efficiency. The codes have to be in line with the corresponding framework guidelines, defined by ACER (section 2.3.2.7).
- Adopt a non-binding Community-wide ten-year network development plan (TYNDP) every two years. The TYNDP includes the modelling of the integrated network, scenario development, a European generation adequacy outlook and an assessment of the resilience of the system.

- Adopt an annual work programme. The programme contains a list and description of the network codes to be prepared, a plan on coordination of operation of the network, research and development activities, and an indicative calendar.
- Adopt common network operation tools to ensure coordination of network operation in normal and emergency conditions, including a common incidents classification scale, and research plans.
- Provide annual summer and winter generation adequacy outlooks.

2.3.2.9 CEER, the Council of European Energy Regulators

CEER (www.energy-regulators.eu) is the voice of Europe's national regulators of electricity and gas at EU and international level. Through CEER, a non-for-profit association, the national regulators cooperate and exchange best practice. A key objective of the CEER is to facilitate the creation of a single, competitive, efficient and sustainable EU internal energy market that works in the public interest.

CEER works closely with and supports the work of ACER, and deals with issues "such as smart grids" that are seen as complementary to ACER's work.

CEER produces reports as the outcome of observatory work relating to policy activities, and also publishes national reports [2].

2.3.2.10 eceee, the European Council for an Energy Efficient Economy

The European Council for an Energy Efficient Economy, eceee (www.eceee.org) is a non-profit, independent organisation. It offers governments, industry, research institutes and citizen organisations a unique resource of evidence-based knowledge and information.

The Council promotes the understanding and application of energy efficiency in society and assists its target groups, from policy makers to programme designers to practitioners, with making energy efficiency happen. It participates actively in the European policy making process through a number of EU policy-making and advisory fora, and frequently comments on European energy policy through position papers and responses to public consultations.

2.3.2.11 EDSO, the European DSOs' Association for Smart Grids

EDSO for Smart Grids (www.edsoforsmartgrids.eu) is a not for profit organisation that works as a key interface between DSOs and European institutions to promote reliability, management and technical development of electricity distribution grids while reaching the European 20-20-20 targets. It comprises 30 DSOs from 17 EU countries.

2.3.2.12 Eurelectric

The Union of the Electricity Industry, Eurelectric (www.eurelectric.org) is the sector association representing the common interests of the electricity industry at pan-European level, plus its affiliates and associates on several other continents.

In line with its mission, Eurelectric seeks to contribute to the competitiveness of the electricity industry, to provide effective representation for the industry in public affairs, and to promote the role of electricity both in the advancement of society and in helping provide solutions to the challenges of sustainable development.

Eurelectric have published "ten steps to smart grids", and promote the role of DSOs as information hubs and key facilitators of competitive retail markets [1].

2.3.2.13 FI-PPP and the WG-PRG

2.3.2.13.1 Future Internet Public Private Partnership (FI-PPP) Programme

The global, integrated communications infrastructures and service platforms of the Internet underpin the fabric of the European economy and society. Yet today's Internet was designed in the 1970s, for purposes that bear little resemblance to current and future usage scenarios. Mismatches between the original design goals and how the Internet is being used are beginning to hamper its potential. Many challenges in the areas of technology, business, society and governance will have to be overcome if the future development of the Internet is to sustain the networked society of tomorrow.

The Future Internet Public Private Partnership (FI-PPP) programme, of which FINSENY is a constituent project, was established to address these challenges (www.fi-ppp.eu). Its main goal is to advance a shared vision for harmonised European-scale technology platforms and their implementation, as well as the integration and harmonisation of the relevant policy, legal, political and regulatory frameworks. As set

forth in the Digital Agenda for Europe (section 2.4.4), these are considered to be prerequisites for realising a European online Digital Single Market and, more broadly, an inclusive knowledge society. It runs from April 2011 to March 2016.

The aims of the FI-PPP programme are to:

- Increase the effectiveness of business processes and infrastructures supporting applications in areas such as transport, health and energy.
- Derive innovative business models that strengthen the competitive position of European industry in sectors such as telecommunications, mobile devices, software and services, and content provision and media.

2.3.2.13.2 FI-PPP Working Group on Policy, Regulation and Governance (WG-PRG)

In the area of policy, regulation and governance, FI-PPP is expected to deliver studies and proposals regarding necessary regulatory evolution to enable the operation of a distributed Future Internet platform across Europe, with a perspective of an internal market for trusted and secure e-services (related, for example, to public sector priorities). Identified regulatory and policy issues include interoperability, openness, standards, data security and privacy within the context of the Future Internet usage scenarios. The FI-PPP agenda also seeks to address the required methodologies, procedures and best practices needed to address transnational aspects where a high degree of public-private co-operation is needed.

Important focus areas for FI-PPP's policy work are:

- Highlighting SME-oriented measures including actions aimed at local and regional innovation ecosystems;
- Supporting and joining the European Web Entrepreneurship Strategy as part of the Digital Agenda and Horizon 2020 priorities.

To progress this work on issues of policy, regulation and governance across FI-PPP as a whole, CONCORD coordinates the Institutional Agenda Design (IAD) Working Group on Policy, Regulation and Governance (WG-PRG). The working group held its first meeting, by telephone conference, on 22 June 2012, and is set to continue work beyond phase 1 of the FI-PPP programme.

Key issues concerning the role of FI-PPP and the WG on Policy, Regulation and Governance are:

- Raising awareness of issues, rather than designing policy;
- Identifying common issues across all FI-PPP projects related to the Future Internet;
- Identifying areas in which interaction and collaboration is required between communications policy makers (DG Connect) and regulators with other policy makers and regulators, and thus, in the case of FINSENY, exploring the need for collaboration and understanding between DG-Connect and DG-Energy, and between energy and communications regulators.
- Highlighting and understanding variations in policy and regulation from country to country, which for FINSENY includes issues such as varying levels of retail market competition, and differences in the extent to which energy regulators allow utility companies to be involved in the provision of commercial telecom services to third parties;
- Defining a timeline of necessary interventions to enable the development of the Future Internet market, including a focus on local and regional innovation ecosystems, as noted above.

FINSENY actively participated in all meetings of the WG-PRG during FI-PPP phase 1, as follows:

- Three telephone conferences with representatives of CONCORD and most FI-PPP projects on 22 June 2012, 13 November 2012 and 14 February 2013;
- Depth interview with Ilkka Lakaniemi of CONCORD concerning regulatory issues arising in FINSENY, on 3 January 2013;
- First face-to-face meeting of the WG in Brussels, 13 March 2013.

2.3.2.14 SGTF, Smart Grids Task Force

The European Commission's SGTF [5] is a collaboration between DG-Energy and DG-Connect which advises the Commission on policy and regulatory direction in smart grids.

- SGTF initial work 2009-2011
- New SGTF Expert Groups (EG) launched February 2012
- EG1: Reference Group for Smart Grid Standards
    - Approve and follow the work programme for M/490 mandated standardisation work

  - Ensure coordination of M/490 work with M/441 (for smart meters) and M/468 (for EVs)
- EG2: Regulatory Recommendations for Data Privacy and Data Protection
  - Data Protection Impact Assessment (DPIA) template for smart grid and smart metering
  - Cyber-security assessment, vulnerabilities and threats, collection of best practices
- EG3: Regulatory Recommendations for Smart Grids Deployment
  - Largest SGTF expert group, combines energy and telecoms sectors and regulators
  - Reference market model, and business model options
  - Potential implications for regulatory frameworks to efficiently facilitate roll out
- EG4: Smart Grid Infrastructure Deployment
  - Trans-European energy infrastructure projects (consultation closed 30 September 2012)
  - Exploring how utilities and telecoms operators can work together in the deployment of infrastructure to support the EU broadband agenda (consultation closed).

2.3.2.15 European Standardisation Organisations (ESOs)

The standardisation bodies in Europe, which collaborate in response to European standardisation mandates including M/490 for Smart Grids, M/441 for Smart Meters, and M/468 for Electrical Vehicles, are:

- CEN, the European Committee for Standardisation (www.cenorm.be)
- CENELEC, the European Committee for Electrotechnical Standardisation (www.cenelec.eu)
- ETSI, the European Telecommunications Standards Institute (www.etsi.org).

Relevant standardisation mandates are addressed in section 2.4.15.

2.3.3 Country-Specific Regulatory Authorities

Each EU country has a body responsible for regulating telecommunications, and a body responsible for regulating energy. These are usually separate, although not always: for example, in Germany, the Federal Network Agency, BNetzA, is responsible for regulation of both energy and telecommunications (section 2.5.3.1). The EU lays down certain requirements that must apply to regulators, such as independence and transparency.

2.4 Legislation and Regulations

2.4.1 Introduction

The evolution of the Future Internet for Smart Energy will be influenced by policy and regulation in both energy and telecommunications. The figure below sets the key packages of directives side by side.

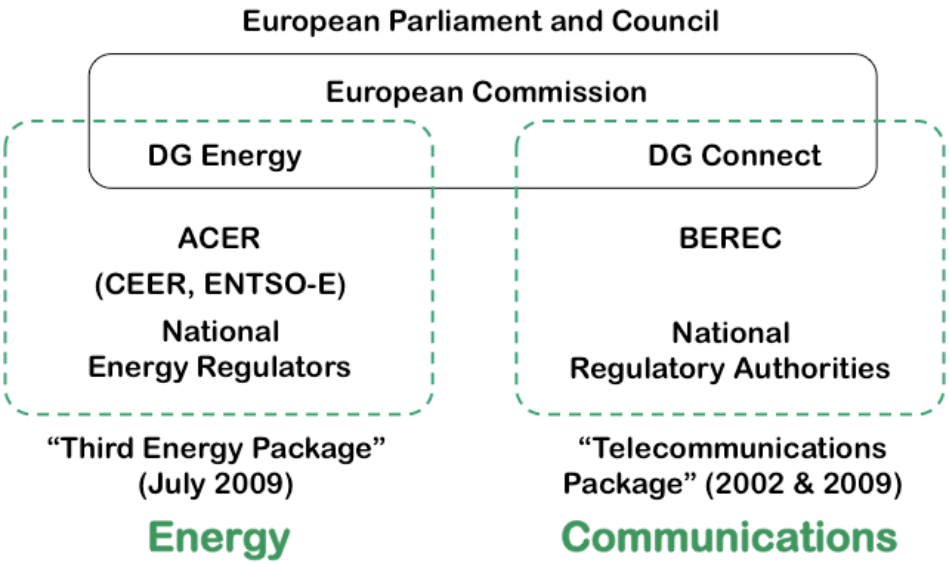


Figure 2: European Directives in Energy and Communications

2.4.2 Legislation Relating to Energy

A summary of EU legislation relating to energy is provided by the European Commission [4].

- A strategy for competitive, sustainable and secure energy
- European Energy Programme for Recovery
- Energy Security and Solidarity Action Plan
- An Energy Policy for Europe
- Green Paper: A European strategy for sustainable, competitive and secure energy

Major efforts are needed to modernise and expand Europe's energy infrastructure and to interconnect networks across borders to meet the Union's core energy policy objectives of competitiveness, sustainability and security of supply.

The Commission's Communication on energy infrastructure priorities for 2020 and beyond, adopted on 17 November 2010, therefore called for a new EU energy infrastructure policy to coordinate and optimise network development on a continental scale. It confirmed in particular the necessity to overhaul the existing Trans-European Networks for Energy (TEN-E) policy and financing framework

The EU Emissions Trading System, EU ETS [7] is a cornerstone of the EU's policy to combat climate change and its key tool for reducing industrial greenhouse gas emissions cost-effectively. The first - and still by far the biggest - international system for trading greenhouse gas emission allowances, the EU ETS covers more than 11,000 power stations and industrial plants in 31 countries, as well as airlines

2.4.3 Legislation Relating to Communications

A summary of EU legislation relating to communications is provided by the European Commission [43].

2.4.4 Digital Agenda and Horizon 2020

The Digital Agenda for Europe entrusts the following tasks to the Member States:

- Developing operational strategies for high-speed Internet and directing public funds, particularly structural funds, to areas not fully served by private investments.
- Creating a legal framework for the coordination of public actions to reduce the costs of the Internet development process. It is noted that due to the budget cuts of the EU Multi-Annual Financial Framework, the intended €9 billion programme has been reduced to €1 billion.
- Promoting the use of modern on-line services (such as e-government, e-health, smart home, IT skills, security).

The Digital Agenda sets the context for much of FI-PPP's work.

Horizon 2020, running from 2014 to 2020 with an €80 billion budget, is the EU's new programme for research and innovation, which is part of the drive to create new growth and jobs in Europe [40].

2.4.5 EU Climate and Energy Package, 20:20:20

The EU climate and energy package is a set of binding legislation which aims to ensure the European Union meets its climate and energy targets for 2020.

These targets, known as the "20-20-20" targets, set three key objectives for 2020:

- A 20% reduction in EU greenhouse gas emissions from 1990 levels;
- Raising the share of EU energy consumption produced from renewable resources to 20%;
- A 20% improvement in the EU's energy efficiency.

2.4.6 Third Energy Package

The Third Energy Package consists of Directives and Regulations of the European Parliament and Council (July 2009) related to Electricity:

- Establish ACER (Regulation (EC) No 713/2009)
- Common rules for the internal market in electricity (Directive 2009/72/EC, replacing Directive 2003/54/EC)
- Conditions for access to the network for cross-border exchanges in electricity (Regulation (EC) No 714/2009, replacing Regulation (EC) No 1228/2003)
- Wholesale energy market integrity and transparency (REMIT) (Regulation (EU) No 1227/2011)

2.4.7 Common Rules for an Internal Market

The EU has set a clear deadline of 2014 for the completion of the internal energy market. By this date, existing legislation needs to be implemented fully, including putting in place the essential technical rules at EU level, and providing regulators with necessary tools and resources to enforce legislation effectively.

Cross-border markets for gas and electricity must be up and running in all parts of the EU and the implementation of plans to complete, modernise and smarten EU grids must be well under way.

In November 2012, the European Commission presented a communication assessing the state of play of the internal energy market [8]. This review concludes that, today, "the EU is not on track to meet this deadline". Not only are Member States slow in adjusting their national legislation and creating fully competitive markets with consumers' involvement, they also need to move away from, and resist the calls for, inward-looking or nationally inspired policies. These tendencies are preventing the internal market from working.

2.4.8 REMIT, Regulation on wholesale Energy Market Integrity and Transparency

REMIT [6], which came into force on 28 December 2011, regulates wholesale energy markets at an EU level, and is part of the third energy package. REMIT seeks to detect and prevent market abuse (or more specifically, market manipulation and insider trading) in the wholesale energy sector. This is in contrast to the existing European market abuse legislation which applied, almost exclusively, to financial instruments admitted to trade on regulated markets.

REMIT applies to wholesale energy products (WEPs):

- Contracts for the supply of electricity (or natural gas) delivered in the EU;
- Contracts relating to the transport of electricity (or natural gas) within the EU; and
- Derivatives of those contracts;

irrespective of where or how they are traded, but does not apply if the consumption capacity of the gas or electricity is less than 600 GWh per year.

REMIT prohibits the manipulation of WEP transactions, and requires energy market participants to publish inside information relating to WEPs and submit details of energy transactions to the European energy regulatory authority, ACER. REMIT also requires ACER, working with National Regulatory Authorities (NRAs), to monitor wholesale energy markets and requires energy market participants to register with the NRAs. Member States, in turn, are charged with ensuring that NRAs have the necessary investigatory powers, which shall be exercised in a proportionate manner.

REMIT extends securities market concepts to the energy sector by prohibiting manipulative transactions and the dissemination of misleading information, and preventing insiders from benefiting from access to information relating to power, natural gas and commodity derivatives markets. Compliance with REMIT will require market participants to introduce or review information barriers between operational and trading activities and ensure timely public disclosure of relevant information.

Rules are to be promulgated requiring energy traders to report transactions to ACER. ACER, in turn, will be responsible for monitoring and analysing all trades to verify that the rules are followed, and will instruct NRAs to investigate any incidents of market abuse.

Each NRA must establish a register of market participants. This is central to the goal of increased market transparency. Participants will be required to register with one authority only: in the Member State in which it was established or is resident (if neither applies to the participant, then it must register in a Member State where it is active). The European Commission will adopt implementing acts defining the scope of trade reporting and registration obligations. Member States must establish registries of electricity and natural gas traders three months after the adoption of the implementing acts, with transaction reporting requirements coming into force three months later.

2.4.9 Network Codes from ENTSO-E

The Third Energy Package aims to deepen market integration by regulatory harmonisation through European network codes, developed by ENTSO-E, reporting to ACER. The status of each of the network codes, as at the end of March 2013, is shown below.

- Codes for Grid Connection
    - RfG (Requirements for Generators): amended and submitted to ACER, March 2013
    - DCC (Demand Connection Code): awaiting opinion from ACER
    - HVDC (High-Voltage, Direct Current): awaiting formal mandate from EC
- Codes for Developing the Internal Energy Market
    - CACM (Capacity Allocation & Congestion Management): recommendation submitted by ACER to the EC, March 2013, with 4 areas of concern from raised by ENTSO-E
    - FCA (Forward Capacity Allocation): internal approval process underway

  - BAL (Balancing): preliminary draft completed
- Codes related to System Operation
  - OS (Operational Security): approved and submitted to ACER, February 2013
  - OPS (Operational Planning & Scheduling): submitted to ACER, March 2013
  - LFCR (Load Frequency Control & Reserves): consultation in progress

2.4.10 Energy Efficiency Directive

The Energy Efficiency Directive (EED) was published in the Official Journal of the EU on 14 November 2012 [3].

The Directive brings forward legally binding measures to step up Member States' efforts to use energy more efficiently at all stages of the energy chain – from the transformation of energy and its distribution to its final consumption. Measures include the legal obligation to establish energy efficiency obligations schemes or policy measures in all Member States. These will drive energy efficiency improvements in households, industries and transport sectors. Other measures include an exemplary role to be played by the public sector and a right for consumers to know how much energy they consume.

The Concerted Action for the Energy Efficiency Directive (CA EED) was launched order to support the effective implementation of the Directive on Energy Efficiency (2012/27/EU) in all EU Member States as well as Norway and Croatia.

There are two sister Concerted Actions that support the transposition and implementation of the Renewables Directive and Energy Performance of Building Directive.

2.4.11 Energy Services Directive (ESD)

On 5 April 2006, the EU adopted the Directive 2006/32/EC on energy end-use efficiency and energy services [41]. It includes an indicative energy savings target for the Member States, obligations on national public authorities as regards energy savings and energy efficient procurement, and measures to promote energy efficiency and energy services.

2.4.12 CHP Directive

Combined Heat and Power (CHP) is a highly efficient process that captures and utilises the heat that is a by-product of the electricity generation process. By generating heat and power simultaneously, CHP can reduce carbon emissions by up to 30% compared to the separate means of conventional generation via a boiler and power station.

The EC Directive on promotion of CHP in the internal energy market, developed by the European Commission in 2004 [42], aims to promote high-efficiency cogeneration given the potential benefits with regard to saving primary energy, avoiding network losses and reducing emissions, in particular of greenhouse gases. In addition, efficient use of energy by CHP can also contribute positively to the security of energy supply.

Member States are obliged to produce reports covering their analysis of the state of CHP in their own countries.

2.4.13 Telecommunications Package

The following regulation summary is related to the obligations imposed on telecommunication operators with significant market power (typically the incumbent telecoms operators such as British Telecom in the UK, Deutsche Telekom in Germany and Telefonica in Spain) to share their telecommunication infrastructures with third parties on a non-discriminatory basis with regulated prices (copper loop, ducts for introducing fibre, space in telephone exchanges, ADSL access, etc).

At European level, the regulation in the telecommunication sector contains a list of directives:

- Directive (2002/21/EC) on a common regulatory framework as amended by Directive 2009/140/EC ("Better Regulation Directive")
- Directive (2002/19/EC) on access and interconnection as amended by Directive 2009/140/EC ("Better Regulation Directive")
- Directive (2002/20/EC) on the authorization of electronic communications networks and services as amended by Directive 2009/140/EC ("Better Regulation Directive")
- Directive (2002/22/EC) on universal service and users' rights relating to electronic communications networks and services as amended by Directive 2009/136/EC ("Citizens' Rights Directive")

- Directive (2002/58/EC) on privacy and electronic communications as amended by Directive 2009/136/EC ("Citizens' Rights Directive")
- Regulation (EC) No 1211/2009 of the European Parliament and of the Council of 25 November 2009 establishing the Body of European Regulators for Electronic Communications (BEREC) and the Office
- Directive 2009/140/EC ("Better Regulation Directive")
- Directive 2009/136/EC ("Citizens' Rights Directive")

2.4.14 Data Privacy Legislation

Adopted in 1995, the European Directive 95/46/EC on Protection of Personal Data was designed to unify national laws on data protection within the European Community and came into force in 1998. It regulates the handling of personal data relating to a natural person processed by automated means or in non-automated filing systems.

Data privacy regulations are described in some detail in FINSENY deliverable D1.11 on Security Elements for the FINSENY Functional Architecture and are, therefore, not repeated here.

2.4.15 European Standardisation Mandates

Standardisation is crucial to ensure the openness and interoperability required to enable competitive technology markets to thrive.

Mandate M/490 (DG-Energy, March 2011) is the standardisation mandate to European Standardisation Organisations (CEN, CENELEC and ETSI) to support European smart grid deployment. M/490 must coordinate with other standardisation mandates:

- M/441, on open architectures for utility meters (March 2009)
- M/468, on charging of electric vehicles (June 2010)

The Smart Grid Coordination Group (SGCG) is doing this work, with FINSENY involvement, as reported in FINSENY deliverable D1.6.

2.4.16 National Regulatory Authorities (NRAs) for Communications

The EU seeks to achieve harmonisation of regulatory frameworks for telecommunications through defined obligations on National Regulatory Authorities set out in the Telecommunications Package.

NRAs for Communications are obliged by Directive to:

- Promote competition, in particular by
    - Ensuring that users derive maximum benefit in terms of choice, price and quality
    - Encouraging efficient use and management of radio frequencies and numbering resources
- Contribute to development of the internal market, in particular, by:
    - Encouraging trans-European networks and interoperability of pan-European services
    - Cooperating with each other and the EC to ensure consistent regulatory practice and application of the regulatory framework for the telecommunications sector
- Promote European public interests by:
    - Ensuring that all citizens have access to a universal service
    - Ensuring the availability of simple and inexpensive dispute resolution procedures
    - Contributing to ensuring a high level of protection of personal data and privacy

Other obligations and tasks include:

- Ensuring that rights of way are granted using transparent procedures, within six months
- Imposing, in certain cases, sharing of facilities or property
- Protecting network security by issuing binding instructions to communication network providers, and informing other NRAs of any breach of security or loss of integrity
- Imposing regulatory obligations on undertakings with significant market power where markets are deemed to be not effectively competitive.

Member States are obliged to encourage the use of EC standards, some of which may be compulsory, and also to lay down rules on penalties for infringements of the Directive.

2.4.17 National Energy Regulators for Electricity

The EU seeks to achieve harmonisation of regulatory frameworks for energy through defined network codes (section 2.4.9), as set out in the Third Energy Package.

Each country has its own authority responsible for energy regulation (a list of EU energy regulators is available from CEER at www.energy-regulators.eu).

2.5 Country Profiles

2.5.1 Introduction

This section contains profiles of the regulatory situation in four selected European countries: the United Kingdom, Germany, Spain and Poland. These were chosen to span a range of different regulatory and market conditions in order to give a flavour for the variety of conditions and industry structures in different EU countries.

Each EU country translates EU directives into their own context, taking specific national issues into consideration.

Each country profile in this section follows the same pattern:

- Regulatory Bodies in communications and electricity, defining the relevant national authorities
- Communications Regulation
- Utility use of Telecoms Assets for Third Party Services, highlighting an issue of particular interest with respect to the interaction between energy and telecoms regulation
- Energy Policy Context
- Electricity Networks, focusing on the regulated structure of, and regulatory controls over, the TSOs and DSOs; this is particularly relevant for FINSENY WP2 (Distribution Networks) and WP3 (Regional- / Microgrids)
- Wholesale and Retail Electricity Markets, particularly relevant for WP6 (Electronic Marketplace for Energy)
- Energy Efficiency, particularly relevant for WP4 (Smart Buildings)
- Electric Vehicles, directly relevant for WP5 (Electric Mobility)

2.5.2 United Kingdom

This section provides an overview of regulation in communications and energy in the UK.

2.5.2.1 UK Regulatory Bodies: Ofcom and Ofgem

2.5.2.1.1 Ofcom

Ofcom, the Office of Communications (www.ofcom.org.uk) is the independent regulator and competition authority for the UK communications industries. Ofcom regulates fixed and mobile telecommunications sectors, television and radio, use of the radio frequency spectrum, as well as postal services. Ofcom was established by the Office of Communications Act 2002 [9].

Ofcom operates under the UK Communications Act 2003 [10]. This UK Act of Parliament sets out Ofcom's duties in detail. Under the Act, Ofcom is required to further the interests of citizens and of consumers:

> "It shall be the principal duty of Ofcom, in carrying out their functions; (a) to further the interests of citizens in relation to communications matters; and (b) to further the interests of consumers in relevant markets, where appropriate by promoting competition."

Accountable to Parliament, Ofcom is involved in advising and setting some of the more technical aspects of regulation, implementing and enforcing the law.

Ofcom is funded by fees from industry for regulating broadcasting and communications networks, and grant-in-aid from the Government.

2.5.2.1.2 Ofgem

Ofgem, the Office of Gas and Electricity Regulation (www.ofgem.gov.uk) is the energy regulator for Great Britain. The electricity industry in Northern Ireland is regulated separately by the Utility Regulator (www.uregni.gov.uk), which is responsible for regulating the electricity, gas, water and sewerage industries in Northern Ireland.

Ofgem's first priority is protecting consumers, which it does by promoting competition, wherever appropriate, and regulating the monopoly energy network operators.

Consumers' interests are taken to include the whole spectrum of concern, including affordability as well as reduction of greenhouse gases and security of supply of gas and electricity. Ofgem also explicitly recognises other priorities and influences, including:

- Helping to secure Britain's energy supplies by promoting competitive gas and electricity markets, and regulating them so that there is adequate investment in the networks, and
- Contributing to the drive to curb climate change and other work aimed at sustainable development.

Ofgem is governed by the Gas and Electricity Markets Authority (GEMA), whose powers are provided for under the Gas Act 1986, the Electricity Act 1989, the Utilities Act 2000, the Competition Act 1998 and the Enterprise Act 2002. The Electricity Act 1989 provided for the privatisation of the electricity supply industry in Great Britain.

Aspects of Ofgem regulatory model have subsequently been adopted by the European Union.

Ofgem recovers its costs from the licensed companies it regulates through annual licence fees.

2.5.2.2 Utility use of Telecoms Assets for Third Party Services in the UK

The regulated network businesses in the UK are allowed and encouraged to use spare capacity on any telecom assets to generate revenue in the competitive telecoms market. Ofgem, mindful that the regulated business may have made the investment in these assets looks to ensure a proportion of external revenue generated in this way is returned to the regulated business. There are many examples of the regulated energy businesses creating significant value through the creation of external telecom businesses.

2.5.2.3 UK Energy Policy Context

The ministries and authorities with energy-related responsibilities in the UK are:

- Department of Energy and Climate Change (www.decc.gov.uk)
- Competition Authority (www.competition-commission.gov.uk)

In July 2009 the Government published 'The UK Low Carbon Transition Plan – National Strategy for Climate and Energy'. This white paper outlines the broad set of policy measures, targets and principles that will allow the UK to deliver its five- point-plan to tackle climate change. It also provides the framework against which the role of the smart grid can be identified, and offers a benchmark against which the smart grid vision must be tailored. The Plan aims at 30% of renewable and of 40% of low CO_2-content fuels in electricity generation by 2020.

The UK has signed up to the EU Renewable Energy Directive, which includes a UK target of 15% of energy (as opposed to 30% of electricity, as above) from renewables by 2020. This target is equivalent to a seven-fold increase in UK renewable energy consumption from 2008 levels: the most challenging of any EU Member State. The Renewable Energy Strategy sets out how everyone has a role to play in promoting renewable energy, from individuals to communities to businesses. [15]

Furthermore, there are binding targets to reduce greenhouse gas emissions by at least 80% by 2050 (on 1990 levels). This is likely to involve an increased electrification of heat and transport as well as a greater reliance on renewable and local sources of generation.

2.5.2.4 UK Electricity Networks

2.5.2.4.1 DNOs and TNOs

There are 14 licensed and regulated Distribution Network Operators (DNOs) in Great Britain, owned by seven companies, plus Northern Ireland Electricity, as shown in Figure 3 and Table 1 below. The separate DNOs retain separate distribution licences and they have to report to the regulator as separate operations, but they can merge aspects of their physical operations. Smaller independent network operators also exist who own and run smaller networks embedded within the DNO areas.

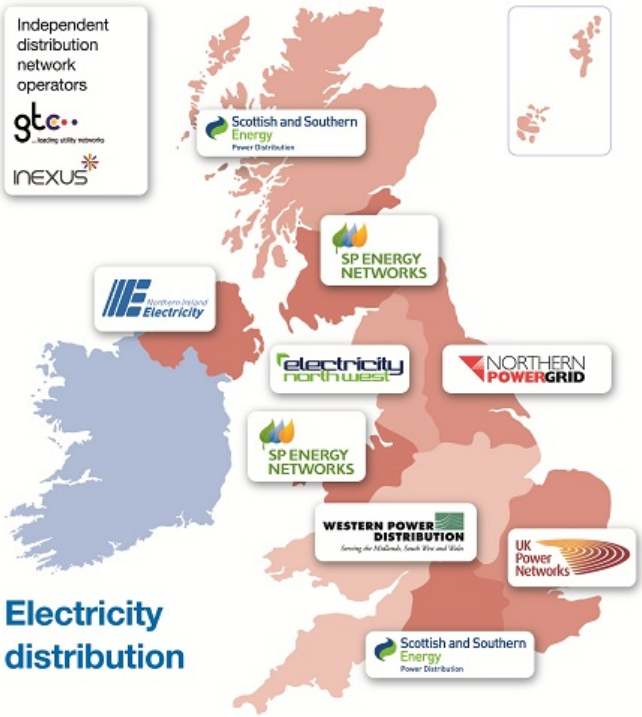


Figure 3: UK Distribution Network Operator Companies (source: Energy Networks Association, ENA [11])

Area of the UK	DNO Company
North Scotland	Scottish & Southern Energy
South Scotland	Scottish Power
North East England	Northern Powergrid
North West	Electricity North West Ltd
Yorkshire	Northern Powergrid
East Midlands	Western Power Distribution
West Midlands	Western Power Distribution
Eastern England	UK Power Networks
South Wales	Western Power Distribution
Southern England	Scottish & Southern Energy
London	UK Power Networks
South East England	UK Power Networks
South West England	Western Power Distribution
North Wales, Merseyside and Cheshire	Scottish Power
Northern Ireland	Northern Ireland Electricity

Table 1: Distribution Network Areas and Operators in the UK

The UK is served by four Transmission Network Operators (TNOs): National Grid in England and Wales, Scottish Power in South Scotland, Scottish and Southern Energy in North Scotland, plus Northern Ireland Electricity.

2.5.2.4.2 Electricity Network Regulation

The UK is arguably the most advanced, of a small number of EU countries, in starting to reform network regulation in a direction away from the traditional cost-based and incentive regulation models, towards performance-based regulation (discussed in section 2.2.4.2). Traditional models are widely recognised to fail in providing adequate incentives for innovative grid investment.

Ever since the privatisation of the electricity industry, regulatory controls in Great Britain have used the Retail Price Index (RPI-X) formula. This encourages efficiency by taking the retail price index (i.e. the rate of inflation) as its benchmark for the allowed changes in network prices and then subtracting an efficiency factor (X) from it.

Great Britain is now moving to a new approach to network regulation, called RIIO (Revenue = Incentives + Innovation + Outputs) [12]. The RIIO regulatory framework will be implemented first for electricity transmission starting in 2013, and for electricity distribution in 2015. RIIO represents a shift away from a price-based model that focuses on efficiency, towards a performance-based model that also encourages investment and innovation.

RIIO seeks to ensure that consumers get the necessary investment in Great Britain's energy networks (gas as well as electricity) whilst containing network costs to ensure the improvements are delivered at a fair price for customers. It is designed to promote long term planning and the ability to cope with increasing uncertainty by rewarding innovation and setting a long-term framework to encourage a more flexible and forward-looking approach from network companies. RIIO will ensure that network costs do not rise any more than they need to by financially punishing inefficient companies that fail to deliver for consumers. Companies will have to meet performance targets, set in consultation with consumers and network users: failure to do so brings automatic penalties.

Key features of the RIIO regulatory framework are:

- Rewards for companies that innovate and run their networks to better meet the needs of consumers and network users;
- Longer price control periods, up from five years to eight years;
- Incentives focused on delivering results;
- Expansion of the £500 million Low Carbon Network Fund (LCNF) to encourage the growth of smart grids to support the move to a low carbon economy;
- Retention of key features of the previous regime, including an upfront price control so companies know the revenue they are allowed to earn, adjustments for inflation, and a return on the regulatory asset value.

It is notable that the drivers for smart grid investment which are generally stated by Ofgem tend to focus on supply side factors such as: the need to connect more (home-based) micro-generation, and smaller scale renewables and Combined Heat and Power (CHP), to the Low Voltage (LV) distribution network; extending the HV transmission network to connect new renewable generation offshore and in remote locations; balancing the network to manage the intermittent nature of renewables; coping with a predicted increase in overall generating capacity due to the rise of electric mobility and the electrification of heat. Demand side management by players in the value chain for the control of peak load, for example, tends not to be part of the presentation of RIIO.

2.5.2.4.3 Smart Meters

The European SmartRegions Project classifies the UK as a Dynamic Mover with respect to smart meter implementation and regulation [32].

The responsibility for the electricity meter lies with the retailer in Great Britain, and not the DNO. This situation is almost unique in the world. This came about due to liberalisation of the meter market, driven by cost-efficiency arguments. This market structure will remain unchanged following the deployment of smart meters.

The strategic aim of Great Britain's Smart Metering Implementation Programme is to roll out 53 million smart electricity (and gas) meters to all domestic properties and smart or advanced meters to small and medium non-domestic sites by 2019. This will affect approximately 30 million premises.

The Government is currently in the process of procuring a national Data and Communications Company (DCC), to be regulated by Ofgem, which will facilitate access to data held on smart meters for retailers, DNOs and other specified parties, based on fully defined rights of access to different types of data (such

as consumption and quality of service data). These access rights are defined in the Smart Energy Code. The DCC will also provide data network connectivity to the smart meters through subcontracts in three areas: North including Scotland, Central including Wales, and South.

Most households will have smart meters installed between 2014 and 2019, although some retailers have started installation already.

The regulatory framework for the DCC includes the Electricity and Gas (Smart Meters Licensable Activity) Order 2012, which amends the Gas Act 1986 and the Electricity Act 1989 to create the licensable activity of the DCC; the DCC Licence; and the Smart Energy Code, which will be a new industry code defining the contractual relationships between the DCC and its users.

2.5.2.5 UK Wholesale and Retail Electricity Markets

The UK market was opened to full retail competition in 1999.

Electricity retailers' market shares in 2011 based on the number of customers were approximately [30]:

- 25% Centrica
- 20% SSE
- 18% E.ON UK
- 14% RWE npower
- 12% EDF Energy
- 11% Scottish Power

In a comparison of 24 European countries, the UK has the seventh lowest market concentration, with Finland having the lowest (Cap Gemini analysis, [30]).

2.5.2.6 Energy Efficiency in the UK

This section is provided from a report by the European Council for an Energy Efficient Economy, eceee [21].

In its National Energy Efficiency Action Plan the UK adopts a nine per cent target for 2016, but indicates that it expects savings from key policies and measures to be equivalent to 18% by 2016 without formally committing to this higher target.

The UK has historically set itself binding targets for energy efficiency. The Home Energy Conservation target required Local Authorities to improve energy efficiency in the housing stock by 30% over the period 1996 to 2011. In addition, approximately 10 years ago the Government set a target to double CHP installed capacity to 10 GWe by 2010 but the failure to obligate a party meant the target was not met. Recent activity is driven by the legally binding carbon targets the UK has set itself under the Kyoto protocol and has focused on public sector buildings.

The UK has three different schemes placing requirements on businesses to deliver energy savings (measured in Carbon) in the commercial and domestic sectors.

The first is a target of 293MtCO_2 of lifetime savings over the programme is placed on all energy suppliers over a threshold size. The primary aim of the target is to make a contribution to the UK's legally binding target under the Kyoto protocol but secondary drivers also include reducing energy demand, energy security, household energy bill reduction, alleviation of fuel poverty and green jobs. Fines are payable to the government if the target is not reached: as a consequence, all historic targets have been met by suppliers, individually and collectively. The targets have been increased over the years, responding to the known deliverables in the previous scheme, meaning that the targets are considered to be ambitious.

The second scheme is another mandatory scheme, the CRC Energy Efficiency Scheme (commenced in 2010), placing responsibilities on all large public and private sector organisations (measured through annual electricity consumption). Individual targets are set on qualifying companies and cover all CO_2 emissions (energy use converted to CO_2) except those from domestic accommodation, transport, those included under a Climate Change Agreement (CCA) or the EU Emissions Trading System (ETS) or consumption outside the UK. The savings are self-certified by the participating companies with audits carried out by the Environment Agency (a Government Agency) and penalties for companies failing to meet the reporting requirements. The overall target for the scheme is consistent with the aim of meeting the five-yearly carbon budgets.

The third scheme is a long running scheme introduced in 2001, which focuses on energy intensive industry. Sector associations or facility operators can negotiate a voluntary CCA with government

(Department of Energy and Climate Change) on a challenging energy efficiency target using a business as usual baseline and based on technical potential and individual assessment. The targets are revised every two years. Through this agreement participants can benefit from an 80% reduction in the energy tax (Levy).

The UK's National Reform Programme, 2011 [44] makes no mention of the 2020 target, although a selection of programmes and actions are described.

Quarterly updates on the supplier obligation are provided by Ofgem [45], and the Department of Energy and Climate Change publishes analysis for the Climate Change Agreements [46].

2.5.2.7 Electric Vehicles in the UK

The UK's Carbon Plan makes a commitment to install up to 8,500 charge points across the UK. The UK expects tens of thousands of plug-in vehicles on the roads by 2015, and quote independent forecasts that suggest the possibility of hundreds of thousands by 2020 [13]. To the end of December 2012, a total of just 4,415 electric cars have been registered in the UK [31].

The Office for Low Emission Vehicles (OLEV) is a team working across government to support the early market for ultra-low emission vehicles (ULEV). It is providing over £400 million with the intention of positioning the UK at the global forefront of ULEV development, manufacture and use, with funding from the Department for Transport, the Department for Business, Innovation and Skills, and the Department of Energy and Climate Change. The desired outcomes are to contribute to economic growth and help reduce greenhouse gas emissions and air pollution.

OLEV's responsibilities include:

- A nationwide recharging infrastructure strategy, including funding to eight pilot areas under the Plugged-in Places programme to install electric vehicle charging points
- Grants to reduce the upfront cost of new ULEVs
- A programme of research through the Technology Strategy Board and supporting wider green growth opportunities.

The Plug-In Vehicle Infrastructure Strategy from OLEV, published in June 2011 [13], sets out the framework for the development of recharging infrastructure to support plug-in vehicles in the UK to encourage recharging both at home and at work. The strategy includes the following elements:

- **Removing regulatory barriers**: Ofgem consulted on an exemption that makes it clear that charge point owners and operators can sell electricity via charge points at the market rate;
- **Charge points**: facilitating the initial installation of charge points in domestic, workplace and public locations through Plugged-In Places projects (with a view to stimulating commercial roll out in due course);
- **Smart grids**: supporting smart grid projects linked to the Plugged-In Places projects in London and the North East through Ofgem's Low Carbon Network Fund (LCNF), examining the management of plug-in vehicles and domestic recharging;
- **Smart metering**: ensuring that smart metering in Great Britain includes the functionality to support smart charging of plug-in vehicles, allowing recharging to react to price signals, ensuring that it can happen when it is cheapest for consumers and the energy system, subject to appropriate technology in the charge point or plug-in vehicle;
- **Planning**: proposing policy on plug-in vehicle infrastructure in the National Planning Policy Framework
- **Exemptions**: enabling businesses whose emissions are caught under the Carbon Reduction Commitment to not count electricity used to charge plug-in vehicles as part of their total electricity consumption, meaning that businesses with workplace charge points will not face additional costs;
- **Standards**: supporting a common standard for plug-in vehicle smartcards issued by the Plugged-In Places to access their infrastructure, making it easier for users to access more than one scheme;
- **Registry**: establishing a National Chargepoint Registry that will allow charge point manufacturers and operators to make information on their infrastructure, including location, available in one place;
- **Information sharing**: making data freely available on how public recharging infrastructure installed through the Plugged-In Places is used, to help inform commercially viable business models.

2.5.3 Germany

2.5.3.1 German Regulatory Body: BNetzA (Federal Network Agency)

The Federal Network Agency, BNetzA (Bundesnetzagentur), for Electricity, Gas, Telecommunications, Post and Railway (www.bundesnetzagentur.de), is responsible for regulating both the communications market and the electricity market in Germany. It is a separate higher federal authority within the German Federal Ministry of Economics and Technology.

The central task of the Federal Network Agency, of relevance here, is to provide for compliance with the Telecommunications Act, the Energy Act. The Agency ensures liberalisation and deregulation of the telecommunications and energy markets through non-discriminatory access and efficient use-of-system charges. For the purpose of implementing the aims of regulation, the Agency has instruments at its disposal including rights of information and investigation and the right to impose graded sanctions.

2.5.3.1.1 Communications

The central task of regulation in communications is to keep a check on the market power of the former monopoly telecoms provider, Deutsche Telekom, and to help new competitors enjoy the same opportunities.

In the field of telecommunications BNetzA is responsible for:

- Securing fair and working competition, including in rural areas;
- Ensuring provision throughout the Federal Republic of Germany of basic telecommunications services (universal services) at affordable prices;
- Promoting telecommunications services in public institutions;
- Securing efficient and interference-free use of frequencies, account also being taken of broadcasting interests; and
- Protecting public safety interests.

2.5.3.1.2 Energy

The Energy Act assigned the task of regulating Germany's electricity and gas markets to BNetzA.

The purpose of regulation is to establish fair and effective competition in the supply of electricity and gas. The responsibilities of BNetzA therefore include ensuring non-discriminatory third-party access to networks and policing the use-of-system charges levied by market players.

In the field of energy BNetzA secures:

- As far as possible, a secure, cost-efficient, consumer-friendly, efficient and environmentally compatible provision of electricity to the general public;
- Working and undistorted competition in the provision of electricity and ensures the efficient operation of energy supply networks on a long-term basis;
- The implementation and enforcement of Community law in the field of wired energy supply.

2.5.3.2 Utility use of Telecoms Assets for Third Party Services in Germany

The regulated network businesses in Germany are allowed and encouraged to use spare capacity on any telecom assets to generate revenue in the competitive telecoms market. Some utility companies have progressed beyond the usual dark fibre and/or provision of wholesale telecoms services and are entering the fibre to the home market providing media bundled services, although this seems to be limited to municipal or city-based DSOs.

2.5.3.3 German Energy Policy Context

The ministries and authorities with energy-related responsibilities in Germany are:

- Federal Environment Ministry (www.bmu.de)
- Energy Agency (www.dena.de)
- Competition Authority (www.bundeskartellamt.de)

On 15 March 2011, the German government announced that it would shut down, *with immediate effect*, all those nuclear reactors that went online before 1981, amounting to eight of its 17 reactors [22].

Government energy policy is for the share of electricity produced by renewables (wind, sun and biomass) to rise to 35% by 2020, and to 80% by 2050.

A series of legislative measures (new laws or amendments to existing laws) was adopted in July 2011 in order to implement German Energy Policy (the Energiewende):

- Atomic Energy Act: phase-out of all German nuclear power stations by 2022
- Act to Accelerate the Expansion of the Grid: including acceleration of spatial planning (NABEG) and ensuring integration of renewables
- Energy Industry Act: transposition of 3rd Internal Market Directives
- Renewable Energies Act: cost-efficient expansion of renewables to enable government targets to be met
- Energy and Climate Fund Act: from 2013 all revenues from auctioning emission allowances will be a contribution to this fund
- Energy efficiency: tax concessions for renovation of buildings; climate-friendly development of cities and municipalities; public procurement.

Thus, the German Energy Package of 2011 is driving rapid expansion of renewables, nuclear phase out by 2022, reduced electricity consumption as a result of increased efficiency, and increased cross-border electricity trading. These are driving network development as a priority, particularly as a result of increasing volatility of production and consumption, and *increasing* average distance between production and consumption (for example, there is a need to expand transmission capacity to enable future renewable power generated predominantly in the north to meet the needs of the south that will suffer most from the loss of nuclear generation) [22].

2.5.3.4 German Electricity Networks

2.5.3.4.1 DSOs and TSOs

In Germany energy supply companies are classified as either “network energy supply companies”, “regional energy supply companies” or “municipal utilities” [23].

By 2004, after the process of liberalisation, there were four companies (down from eight in 1997 when the market was liberalised) acting as TSOs (RWE, E.ON, Vattenfall and EnBW). These four dominant companies also control a majority of the country’s generating capacity, as well as having a relatively large share of the retail market.

At the distribution level, there were 50 regional DSOs by 2004 (down from 80 in 1997) and 700 municipal utilities (down from 900 in 1997) supplying electricity, gas, water and district heat.

In 1996 and in 2003 the EU gave impulses for national revisions of the respective Energy Acts, which aimed at fostering competition and the unbundling of energy transmission and distribution from production and supply. Germany went beyond the EU directive 96/92/EC, with the National Energy Act of 1998, by implementing an *immediate* and *complete* liberalisation for industry *and* households. Despite the impetus provided by the EU for unbundling, the EU did not hinder market concentration due to mergers and acquisitions in Europe. In Germany, the large electricity network companies reacted in the early stages of liberalisation with a massive wave of mergers, such that the German process of liberalisation is “primarily characterised as a privatisation process, which strengthened the market power of the large network energy supply companies” [23].

2.5.3.4.2 Smart Meters

The European SmartRegions Project classifies Germany as a Market Driver with respect to smart meter implementation and regulation [32]. This means that it is relatively advanced in its smart meter implementation, yet lacks clarity in its legal framework. Germany has yet to finally decide as to whether they will open meter provision/reading to a competitive market as in the UK.

2.5.3.5 German Wholesale and Retail Electricity Markets

The German market was opened to full retail competition in 1998.

Electricity retailers’ market shares in 2011 based on the number of customers were approximately [30]:

- 15% RWE
- 13% E.ON
- 12% EnBW
- 6% Vattenfall
- 2% EWE
- 52% Other

In a comparison of 24 European countries, Germany has the second lowest market concentration behind Finland (Cap Gemini analysis, [30]).

2.5.3.6 Energy Efficiency in Germany

This section is provided from a report by the European Council for an Energy Efficient Economy, eceee [21].

Targets pertaining to energy efficiency and energy saving in Germany are driven by multiple factors. Economy-wide, there are three indicative and relevant targets:

- The climate protection target (for a 40% greenhouse gas, GHG, cut by 2020 and an 80% cut by 2050 on 2008 levels), which embodies a package of programmes;
- The competitiveness-driven energy intensity target (for a reduction in primary energy use per unit of GDP of 20% by 2020 and 50% by 2050 on 2008 levels) which embodies a series of sectoral objectives; and
- The nine per cent 2016 target, driven by compliance with the Energy Service Directive (ESD).

By 2050 compared to 2008:

- Electricity consumption is to fall by 25%;
- The retrofit rate of buildings is to double to two per cent and their primary energy use to fall by 80%; and
- Final energy use in transport is to fall by 40% compared to 2005.

The climate and *Energiekonzept* targets are generally deemed to be ambitious, although their achievability is unclear, given that policy detail is still missing. The 2016 target on the other hand is deemed to be unambitious compared to energy saving potential and to have had barely any impact on the German market. Overall, Germany's emerging energy efficiency and energy saving objectives appear promising, but there are serious concerns about monitoring and evaluation of progress to date; the relative lack of efforts to tackle industry; and the absence of a more systemic and integrated approach to energy savings.

Germany's National Reform Programme [47] refers to the *Energiekonzept's* target of reducing absolute primary energy consumption by 20% by 2020 and 50% by 2050 compared to 2008, and reiterates the other targets which support this. The German National Energy Efficiency Action Plan NEEAP [48] makes reference on page 37 to energy saving potentials.

2.5.3.7 Electric Vehicles in Germany

The German government said in 2011 that it wanted to see 1 million electric cars on the road by 2020 as part of its decarbonisation agenda, but has since conceded that this goal is very unlikely to be met [25]. A total of just 7,500 electric cars sold in Germany between January 2010 and September 2012 [31].

€500 million in research funding was invested through 2012 to promote the desired transition to electric mobility.

2.5.4 Spain

2.5.4.1 Spanish Regulatory Bodies: CMT and CNE

2.5.4.1.1 CMT, Communications

CMT, Comisión del Mercado de las Telecomunicaciones, the Commission for the Telecommunications Market (www.cmt.es), is the Spanish national telecommunications regulator.

2.5.4.1.2 CNE, the National Energy Commission

CNE (Comisión Nacional de Energía), the National Energy Commission (www.cne.es) is the national regulatory body for energy in Spain. It is a legally independent, public authority, created by law in 1998.

CNE's objectives are to benefit individuals who work in the energy systems, and consumers, by promoting the principles of open competition.

2.5.4.2 Spanish Communications Regulation

In Spain, the most relevant regulation is "Law 32/2003, 3rd November, General of Telecommunications" developed by different regulations:

- Real Decreto 346/2011, 11th March 2011: regulation of common telecommunication infrastructure for the access to telecommunication services in buildings.

- Real Decreto 863/2008, 23rd May 2008: regulation concerning the use of public radio electric domain.
- Real Decreto 424/2005, 15th April 2005: regulation about the conditions for the operation of electronic communication services, the universal service and final user protection.
- Real Decreto 2296/2004, 10th December 2004: regulation about electronic communication market and access to the networks and numbering.

Every operator has to share their fibre networks deployed into buildings.

2.5.4.3 Utility use of Telecoms Assets for Third Party Services in Spain

The regulated network businesses in Spain have for many years participated in the competitive telecoms market and have developed profitable telecoms businesses in the wholesale and business-to-business telecoms market. Such developments have not been limited to the electricity sector, as telecom networks have also been constructed by gas distribution businesses.

As in the United Kingdom, some of the successful utelco (utility telecoms) businesses were sold, which in turn meant the utility takes some of its services through a managed service or outsource agreement with a player in the telecoms market.

2.5.4.4 Spanish Energy Policy Context

The ministries and authorities with energy-related responsibilities in Spain are:

- Ministry of Industry, Energy and Tourism (www.minetur.gob.es)
- Ministry of Agriculture, Feeding and Environment (www.magrama.gob.es)
- Competition Authority (www.cncompetencia.es)

2.5.4.5 Spanish Electricity Networks

2.5.4.5.1 DSOs and TSOs

Spain has a single TSO, Red Electrica de España SA. There are several main DSOs in Spain (including Endesa, Iberdrola, Union Fenosa, E.ON) and many small ones (343 registered DSOs in total).

2.5.4.5.2 Electricity Network Regulation

Spain uses a reference grid model which not only considers cost efficiency but also the built in system efficiency in the grid. The model tries to estimate if the DSO is constructing the grid in an efficient manner to handle the task at hand, which is delivery of energy to customers. [24]

2.5.4.5.3 Smart Meters

The European SmartRegions Project classifies Spain as a Dynamic Mover with respect to smart meter implementation and regulation [32].

Spain's smart metering obligations were established by Royal Decree (RD 1634/2006: Order to the Regulator, CNE) in December 2007 which defined the national meter substitution plan. This mandates the installation of smart meters for all consumers under 15 kW by 31 December 2018, with a binding target of 30% of all customers set for 2010.

DSOs are responsible for the installation of the meters. The initial 2010 target was not reached by any DSO [29].

2.5.4.6 Spanish Wholesale and Retail Electricity Markets

The Spanish market was opened to full retail competition in 2003.

Electricity retailers' market shares in 2011 based on the number of customers were approximately [30]:

- 40% Endesa (Enel)
- 37% Iberdrola
- 13% Gas Natural Fenosa
- 4% EDP
- 2% E.ON
- 4% Other

In a comparison of 24 European countries, Spain has the thirteenth lowest market concentration, with Finland having the lowest (Cap Gemini analysis, [30]).

2.5.4.7 Energy Efficiency in Spain

This section is provided from a report by the European Council for an Energy Efficient Economy, eceee [21].

In Spain, the content of the NEEAP is derived from a pre-existing Saving and Energy Efficiency Strategy covering the period 2004-12. Within this strategy a savings target of 13.7% is set for 2012 measured in primary energy against a reference scenario. This target is translated in the NEEAP into an ESD target of 11%. The EU targets, including the 20% reduction in primary energy use by 2020 will be included in a new Law on Sustainable Economy. The driver for energy efficiency is Spain is compliance with Directives and the Spanish greenhouse gas reduction target with co-benefits of energy independence and employment and economic benefit.

Within the 2004-12 Strategy, the 2008-12 Action Plan outlines national indicative (non-binding) targets for seven sectors and a goal for installed co-generation of 8400 MW. A number of legally binding targets sit below these sectoral savings covering for example share of biofuels in the transport energy mix and energy savings from public buildings. Two Ministries are jointly responsible for all of the sectoral targets.

The targets for all sectors apart from Industry have been increased in the 2008-12 Action Plan from the levels initially set in the 2004-12 Strategy, with the need to reduce greenhouse gas emissions named as the driver. The savings expected from Industry have not been increased due to the fact that energy intensity in the sector increased between 2000 and 2005. Industry has the second most ambitious target and there is uncertainty if this target is achievable, although higher savings are available with better defined objectives and instruments (similar for buildings sector). The transport target is the most ambitious and similar concerns exist about its achievement with the diffuse nature of the sector and the low quality and low level of competition in the freight services named as barriers.

Spain's National Reform Programme reports a target reduction of two percentage points in energy intensity in terms of final energy. This represents a 20% decline by 2020 with respect to 2009; in terms of primary energy consumption, it is a reduction of close to 25.2 Mtoe with respect to the baseline projection for 2020. Energy efficiency and renewable energy bulletins are available from the Institute for the Diversification and Saving of Energy (IDEA) [49].

2.5.4.8 Electric Vehicles in Spain

In May 2011 the Spanish government approved a €72 million fund for year 2011 to promote electric vehicles. The incentives include direct subsidies for the acquisition of new electric cars for up to 25% of the purchase price, before tax, to a maximum of €6,000 per vehicle, and 25% of the gross purchase price of other electric vehicles such as buses and vans, with a maximum of €15,000 or €30,000, depending on the range and type of vehicle. Several regional government grant incentives for the purchase of alternative fuel vehicles including electric and hybrid vehicles. In 9 Spanish regions, electric vehicles are eligible to a €6,000 tax incentive and hybrids to €2,000. [31]

Just 401 electric cars and utility vehicles were sold in Spain during 2011, and 209 during the first half of 2012, representing a market share of 0.05% of new car sales. [31]

2.5.5 Poland

2.5.5.1 Polish Regulatory Bodies: UKE and URE

2.5.5.1.1 UKE, the Office of Electronic Communications

UKE (Urząd Komunikacji Elektronicznej), the Office of Electronic Communications (www.en.uke.gov.pl) is Poland's national regulator for telecommunications and post.

The mission of the President of the Office of Electronic Communications is to provide Polish society with access to modern telecommunications and postal services while ensuring transparency and effective communication of UKE actions.

2.5.5.1.2 URE, the Energy Regulatory Office

URE (Urząd Regulacji Energetyki), the Energy Regulatory Office (www.ure.gov.pl) is Poland's national regulator for electricity and gas.

2.5.5.2 Polish Communications Regulation

In 2012, the President of UKE published Poland's Regulatory Strategy until 2015 relating to Telecommunications and Post [27].

Priority objectives to 2015 relating to telecommunications are as follows:

- Introducing tools to stimulate telecommunications undertakings to invest in infrastructure based on modern technologies;
- Stimulating growth of competition in the telecommunications market;
- Strengthening the position of consumers and providing the required level of quality of service;
- Increasing access to services through efficient management of spectrum.

2.5.5.3 Utility use of Telecoms Assets for Third Party Services in Poland

In Poland, regulated network businesses are not allowed to generate any additional revenue from telecommunications assets and therefore there are no utility telecom businesses. This stance restricts the future opportunity for utility and telecoms to share infrastructure, and contradicts the stance being developed by the European Commission in promoting an open access policy in the sharing of ducts, electricity poles and radio masts and the wider telecoms infrastructure such as utility optical fibre.

2.5.5.4 Polish Energy Policy Context

The ministry with energy-related responsibilities in Poland is:

- Ministry of Economy (www.mg.gov.pl)

The National Report of the URE for 2012 [28] makes reference to recent amendments to Polish energy regulation and the Energy Law, through which the President of the URE has new responsibilities. Regulatory activity has also been strongly driven by EU energy policy, in particular the European Council decision of 4 February 2011 to complete the EU single market by 2014, and the Third Energy Package of March 2011 extending the deregulation and integration of the European energy market, increasing the powers and duties of national energy regulators, and making the independence of regulators obligatory.

The Energy Law is currently being amended to account for the regulation of distributed generation (section 2.5.5.5.2).

2.5.5.5 Polish Electricity Networks

2.5.5.5.1 DSOs and TSOs

Poland has a single, independent state-owned TSO (PSE Operator SA) and six large unbundled DSOs who also remain the dominant retail suppliers (section 2.5.5.6). In addition, there are 78 smaller DSOs (those serving fewer than 100,000 customers) who are not legally obliged to become independent in terms of legal structure, organization and decision-making (by Article 9d of the Energy Law).

The six unbundled DSOs are Energa in the North, PGE in the East, TAURON in the South and Enea in the West, plus RWE Stoen Operator and PKP Energetyka.

2.5.5.5.2 Electricity Network Regulation

Market liberalisation began in 1989. The first version of the Energy Act came into force in 1997, and full implementation of Third party Access (TPA), by which the TSO and the six major DSOs became legally unbundled, was introduced on 1 July 2007.

Regulatory discussion concerning smart grids in Poland has tended to focus on smart meters, concentrating on the use of smart metering data for off-line optimisation of the network configuration. Discussion about the future need for active management of distributed generation and loads is very limited in this context.

Thus, Poland does not currently have specific regulation related to the development and control of smart grids. However, new regulations related to smart grids are currently under discussion: new revisions to the Energy Law (first introduced by the Act of 10 April 1997), and a new law concerning Renewable Energy Sources (RES).

The new regulation will, for the first time, introduce a definition of micro and small electrical installations, and specific regulations for their grid connection and operation (including financial support schemes for LV distributed generation based on feed-in tariffs). The micro installation is defined as a low voltage grid, up to the connection point to the utility grid, with embedded generating sources up to 40kW. A small installation contains generating capacity of between 40kW and 200kW.

It remains to be seen the extent to which the new laws, once finalised, will actually pave the way to smart grid developments by forcing utilities to change the way they plan and operate LV networks by introducing the need for active management.

2.5.5.5.3 Smart Meters

The European SmartRegions Project classifies Poland as an Ambiguous Mover with respect to smart meter implementation and regulation [32], meaning that the legal framework is relatively clear yet the implementation to date has been relatively slow.

The Polish energy strategy "Energy Policy for Poland till 2030" makes reference to the "gradual introduction of obligatory usage of smart meters enabling providing price signals to the end users, starting from 2011". Other legislative acts do not establish barriers to smart meter development [33].

2.5.5.6 Polish Wholesale and Retail Electricity Markets

The Polish market was not opened to full retail competition until the European deadline of 1 July 2007. Consumers are still generally tied to their current retail suppliers, with only minimal switching taking place. To the end of 2011, only 21,000 industrial and commercial consumers, and 14,000 household consumers, had changed suppliers, although these numbers are very significantly up on the previous year (7,611 and 1,340 respectively) [28].

Electricity retailers' market shares in 2011 based on the number of customers were approximately [30]:

- 30% PGE Energia
- 24% TAURON
- 18% Energa
- 15% Enea
- 6% Vattenfall
- 7% Other

In a comparison of 24 European countries, Poland has the tenth lowest market concentration, with Finland having the lowest (Cap Gemini analysis, [30]).

2011 saw a significant reorganisation of the wholesale power market because of the obligation imposed on electricity generators on 9 August 2010 under Article 49a of the Energy Law to sell generated electricity via the Polish Power Exchange (POLPX) rather than via bilateral contracts.

2.5.5.7 Energy Efficiency in Poland

In 2011 the Energy Efficiency Act was adopted. The new law set forth new regulations concerning the national targets for energy efficiency improvement.

This section is provided from a report by the European Council for an Energy Efficient Economy, eceee [21].

The indicative NEEAP target to achieve final energy consumption savings of nine per cent by 2016 compared with 2001-5 is the main energy efficiency target in Poland. The savings are calculated in terms of final energy used without counting the energy used in installations covered by the EU ETS.

Savings are calculated through a combination of 'top-down' and 'bottom-up' approaches to identify overall savings and individual contributions. The main drivers behind the policy are compliance with the ESD, and a desire to increase productivity.

There is a longer term ambition to reduce the energy intensity of the Polish economy to the 2005 EU-15 average by 2030.

The ambition is for all heat generated in Poland to be from co-generation by 2030.

Poland's National Reform Programme indicates that cumulative primary energy savings from programmes and actions will amount to 13.6 Mtoe by 2020, or 14.2% below the business as usual projection for 2020. Further information on Polish energy efficiency is available in references [51] and [52].

2.5.5.8 Electric Vehicles in Poland

According to Wikipedia, Poland is developing charging station infrastructure in Gdańsk, Katowice, Kraków, Mielec, and Warsaw. Funds for the project come from the European Union [31].

2.6 Regulatory Trends, Issues and Debates

This section provides a brief summary of how the regulatory environment seems to be moving in energy and telecommunications in Europe, in terms of trends, key issues, and primary points of debate.

2.6.1 Energy Efficiency and Renewables

European objectives, to drive the transition to a low carbon economy, have given rise to a strong legislative and regulatory focus on energy efficiency and the use of renewables. Such regulation is a primary driver for the Smart Energy future.

2.6.2 Single Market and Country-Specific Variations

A primary objective at European level is to ensure the operation of a single market across Europe, which, in general terms, requires harmonised rules and regulations across all member states. The issue of the extent to which individual countries should be permitted to develop their own approaches to any particular aspect of legislation or regulation is a theme that will continue to affect regulatory development across Europe.

2.6.3 Encouraging Investment (Energy and Telecoms)

In the energy domain, there is recognition of the need for substantial investment in smart grid infrastructure across Europe to support the achievement of energy policy objectives, and a widespread acceptance that traditional approaches to electricity network regulation fail to provide adequately for such investment. In response, a number of countries, notably the UK, Germany, the Netherlands and the Scandinavian countries, are seeking to rebalance their TSO/DSO regulatory frameworks away from pure cost-efficiency to performance-based regulation which explicitly incentivises investment (and innovation) without compromising energy quality and security.

Telecommunications policy-makers and regulators also face a significant challenge in how to ensure that market players (telecoms operators) invest in network infrastructure in pursuit of Digital Agenda broadband coverage targets for all EU citizens, often in geographic areas that are currently commercially unviable.

2.6.4 Encouraging Innovation (Energy)

The move that is starting towards performance-based regulation for TSOs and DSOs in Europe is also designed to ensure incentives for the regulated businesses to innovate.

2.6.5 User-Centricity (Energy and Telecoms)

Regulators in both telecoms and energy are moving to encourage users to become more active participants rather than simply passive consumers of service.

2.6.6 Cyber-Security (Telecoms and Energy)

Countering cyber threats to business, government and critical national infrastructure, including energy systems, is and will remain high on the agenda for policy makers and regulators.

2.6.7 Privacy and Data Protection (Telecoms)

The development of data protection and privacy legislation and regulation is a high profile issue across all sectors, with specific work focused on smart grids being undertaken by the Smart Grids Task Force, for example.

2.6.8 Open Access Infrastructure (Telecoms)

The European Commission is developing a stance to promote an open access policy for telecommunications infrastructure to ensure non-discriminatory access for all service providers not only to wholesale services, but also to passive infrastructure such as ducts, poles and fibre optic cables.

2.6.9 Cross-Industry Collaboration (Energy and Telecoms)

There is a general awareness of the need for coordination and collaboration between industries, particularly at the business level but also for policy and regulatory development, although much of this is achieved in practice through trade associations etc., rather than formal structures.

2.6.10 Energy Industry Structure

Work is progressing to understand the evolving structure of the energy industry, particularly in terms of market models arising from the emergence of new types of market actor (for example, the work of SGTF Expert Group 3, and FINSENY's deliverable D1.8, Report on Business Models and Market Trends).

There is also some speculation, and increasing debate, about the long-term need for structural change at a more profound level in the energy industry, because of the trend inherent in smart energy towards more distributed control in energy systems, which is at odds with the traditional centralised control structure and associated regulatory frameworks.

The European Commission has published an Energy Roadmap to 2050 [38], which sets out possible scenarios for the energy industry, highlighting the need for radical change across the industry in order to meet long-term European targets for energy efficiency and renewables. Other work on long-term scenario planning in the energy industry has been published, for example, by Ofgem in the UK [39].

2.6.11 Standardisation

The EU is generally strong on encouraging the development and adoption of open standards in ICT across the EU as an effective strategy for maximising interoperability, competitiveness, innovation, and delivery of value to all stakeholders. This is no less the case for smart energy developments, with European standardisation mandates having been issued to the standards development organisations, with significant work completed, and continuing.

3. The View from FINSENY

3.1 Introduction

3.1.1 Purpose

Chapter 3 discusses regulatory issues and requirements from the perspective of FINSENY.

In contrast to chapter 2, which gave a viewpoint of the way in which regulation is developing across Europe, this section provides an industry perspective of the issues that regulatory frameworks need to address in order to support the developments envisaged by FINSENY relating to the Future Internet as an enabler for Smart Energy.

Chapter 4 of this report then presents an analysis of the suitability of existing regulatory frameworks (discussed in chapter 2 above) for addressing the issues identified in this chapter 3.

3.1.2 Approach

The content of this chapter is based on the perspectives of partners and third parties in the FINSENY consortium, gathered primarily through a structured questionnaire and subsequent discussions. The questionnaire included a number of open-ended questions in the following areas:

- Barriers to FINSENY use cases from current regulation in Energy, Communications, or other
- Enablers and incentives for FINSENY use cases from current regulation in Energy, Communications, or other
- The need for new regulations, or changes to existing regulation, to support the development of the FINSENY use cases, the Future Internet, and smart energy in general
- The relationship between regulation and standardisation.

The full questionnaire is included as an appendix to this report.

The following consortium partners provided written responses to the questionnaire:

- ABB
- ATOS
- EUTC
- Iberdrola
- Orange
- RWTH Aachen
- Scottish Power (EUTC third party)
- Siemens
- Telecom Italia
- Telefonica, TID
- Teletrans (EUTC third party).

Representatives from other FINSENY partners provided verbal input during teleconference discussions with each scenario work package to address regulatory issues, and there were also various written contributions at points throughout the project.

3.1.3 Structure of Chapter 3

Following an introduction and a summary, chapter 3 is structured around the key issues that are perceived to require regulatory intervention:

- Enabling New Activities and Behaviours
- Enabling Participation of Relevant Actors
- Enabling Efficient use of ICT Infrastructure
- Promoting Data Sharing and Interworking
- Protecting Personal Data and Privacy
- Keeping the Lights On: Affordability, Quality, Security and Universality
- Keeping the Lights On Tomorrow: Innovation and Investment
- Ensuring Consumers are Informed and Engaged
- Reducing Consumption via Energy Efficiency
- Sustaining the Natural Environment
- Controlling Access to the Radio Frequency Spectrum

- Other Issues with Regulatory Implications
  - Protecting Health and Safety
  - Preventing Fraud
  - Resolving Disputes
  - Developing Skills and Education
  - Enabling Machine to Machine Communications.

For each issue, an explanation is provided of why intervention is believed to be necessary, and what kinds of intervention are likely to be appropriate. Specific reference is made throughout to FINSENY scenario work packages wherever appropriate.

The chapter ends with the issue of Visioning and Development of Regulatory Frameworks:

- Testing New Regulatory Frameworks in Trials
- Modelling the Activity Structure of the Whole Smart Energy System.

3.2 Summary

3.2.1 Overall Trend to a More Distributed System of Control

The top level view from FINSENY is that there is an overall trend from centralised control to distributed control in energy systems, ultimately creating pressure for the regulatory framework over the long term to transition from one that supports centralised control to one that supports more distributed control in a way that ensures the ongoing (dynamic) stability of the system, as well as embedding a sufficient degree of agility and ability to change.

The trend from centralisation to decentralisation is illustrated in Figure 4 which shows evolutionary paths for the energy system in Europe in terms of three dimensions: its information system, provision system and market system.

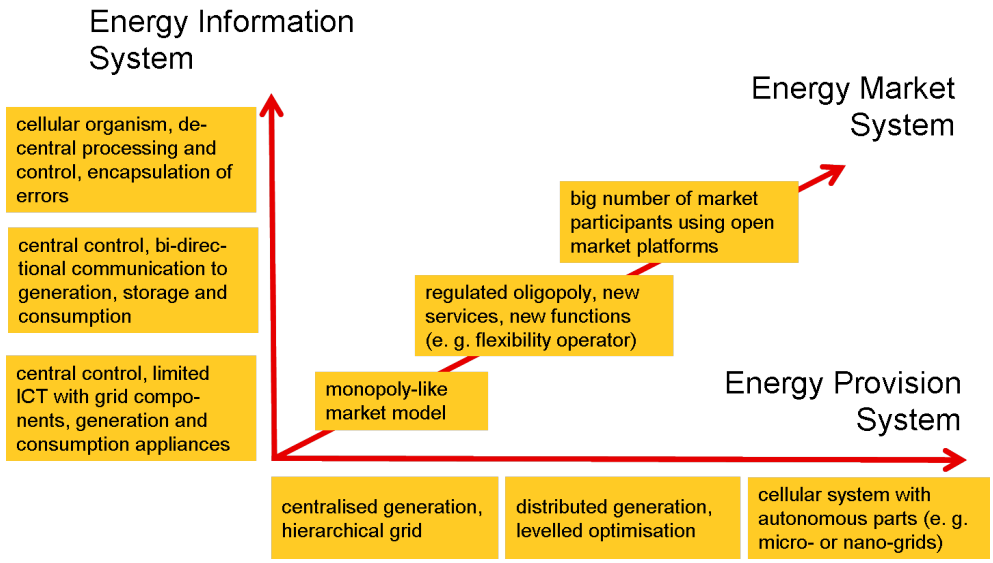


Figure 4: Evolution of the Information, Market and Provision Systems for Energy in Europe (from the FINSENY Vision Paper [53])

This shift is inherent in the definition of FINSENY's scenario work packages. Figure 5 hints at the layered nature of the system by showing Smart Buildings (WP4) and Electric Mobility (WP5) existing within distribution networks or microgrids, and Microgrids (WP3) existing within distribution network areas. Distribution Networks are becoming increasingly equipped with control mechanisms and automation through smart grid technologies (as detailed by WP2), and the electronic marketplace for energy (WP6) provides services to facilitate contracts, commercial transactions and consumer choice across the whole system.

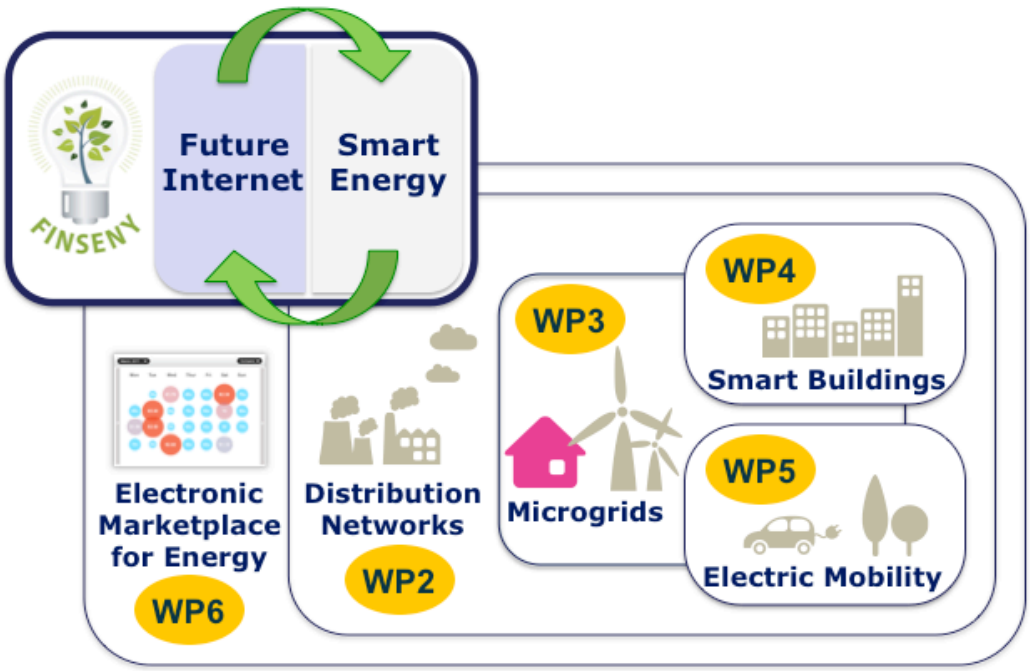


Figure 5: FINSENY Scenario Work Packages

From the perspective of the broader FI-PPP agenda, the key objectives of relevance are to ensure stable regulatory frameworks that enable and encourage:

- Competitive markets, including support for SMEs and local markets
- Innovation, including the development of regional innovation ecosystems
- Security
- Data protection
- Interoperability, openness and standards.

3.2.2 Key Regulatory Issues Overall

It is perceived that regulatory interventions are likely to be necessary in the following areas:

- Enabling new activities and behaviours, in particular active management of both distributed generation and of loads, balancing of supply and demand at multiple geographic scales, supporting local energy communities, and shaping local energy markets
- Enabling participation of relevant actors, in particular consumers, as well as new types of market actor
- Enabling efficient use of ICT infrastructure across domains and industries
- Promoting data sharing and interworking, and associated responsibilities for creating data and making it available
- Protecting privacy

Regulation is also perceived to have an ongoing part to play in the following areas:

- Ensuring affordability and investment through promoting competition and appropriate regulation of monopolies
- Ensuring security and system stability of the critical national energy infrastructure (CNI) in order to ensure continuity of service
- Ensuring access to (electrical power) services for all consumers
- Ensuring consumers are protected and informed
- Reducing consumption via energy efficiency measures
- Protecting the natural environment
- Ensuring health and safety
- Ensuring efficient use of natural resources, including controlling access to the radio frequency spectrum.

These are discussed in sections 3.3 to 3.14.

3.2.3 Relevance of Regulatory Action in General

The reasons that these issues require policy or regulatory action vary from issue to issue. The main motivations identified for regulatory action can be summarised as:

- Increasing delivery of value to customers and society;
- Increasing market and business opportunities, value and growth;
- Compensating for market failure;
- Ensuring competitiveness of European markets, both internally and internationally;
- Countering market dominance by large actors;
- Stimulating innovation.

3.2.4 Regulatory Interventions in General

In broad terms, the proposed regulatory interventions required to deal with the issues outlined in section 3.2.2 are to:

- Enable the consumer to become a full participant in the energy system;
- Recognise the need for structural change in the electricity system and markets as a whole, if the full opportunities for the growth of local markets and innovation ecosystems are to be realised (see section 3.2.5 below);
- Accelerate the development of experience with regulatory models that explicitly incentivise innovation and investment in smart grid infrastructure and processes, whilst maintaining appropriate price, cost and quality controls, such as Great Britain's pioneering RIIO model: such regulation should be informed by the potential for long term structural change alluded to in the bullet point above;
- Continue to encourage both the telecoms and the energy industry to develop and adopt open standards to maximise interoperability and affordability of the supporting ICT systems and technologies;
- Continue to develop policy and regulatory approaches to data protection and privacy as applied to smart grids and smart energy systems;
- Ensure appropriate focus on data sharing requirements amongst market actors for cohesion and optimal operation and management of the system as a whole;
- Encourage constructive interaction between regulators (and policy makers) in telecoms and energy, in order to position Europe to take a global lead in enabling the smart energy future through maximum use of Future Internet technologies and services;
- Encourage further collaboration and understanding between different actors in the energy value chain, and between the telecoms and energy industries in particular.

3.2.5 Visioning and Development of Regulatory Frameworks

It is suggested, furthermore, that in order to maximise the opportunity for regulatory interventions to deliver favourable outcomes from the FINSENY use cases over the long term, the following measures should be considered (discussed further in section 3.15):

- Enable proposed regulatory frameworks to be tested in trials.
- Conduct research to develop models and scenarios for long-term structural change in the electricity system as a whole, which could enable the growth of local markets and innovation ecosystems based on a layered architecture of distributed control capable of maintaining stability, security and quality of supply at all levels in the system. Such innovative models are a potential response to meeting European and national policy and targets relating to economic development, renewable energy and energy efficiency, and should be used to inform decisions about the design of policy and regulatory frameworks appropriate for long term evolution towards a fully resilient and sustainable smart energy system.

3.3 Enabling New Activities and Behaviours

3.3.1 Summary of Issues Related to Enabling New Activities

3.3.1.1 Key Issues

A range of new activities is necessary in order to enable the smart energy future envisaged by FINSENY. These are either entirely new, or they are existing activities which need to be carried out in new contexts or new locations. The regulatory environment needs to be appropriate for these new activities.

The key issues are:

- Active management of distributed generation, required because generation is becoming more distributed and more variable because it is largely based on renewable sources: such distributed generation needs to be actively managed.
- Active management of loads, required because generating capacity is becoming more variable and unpredictable, and because of the introduction of large numbers of mobile loads (electric vehicles).
- Balancing supply and demand at multiple geographic scales, from national level (as is done traditionally by TSOs) to regional level (placing new requirements on DSOs) as well as local level (through the emergence of innovations such as microgrids) and even building level.
- Supporting the emergence and evolution of localised energy communities, creating conditions for shaping local energy markets.
- Provision and support for appropriate charging points for electric vehicles in the home, workplaces and public locations.

The associated issues of enabling participation of market actors is addressed in section 3.4.

3.3.1.2 Relevance of Regulatory Action for Enabling New Activities

In the broadest sense of national policy, the evolution towards a smart energy future supports critical national imperatives including energy security and low carbon economic prosperity, as well as broader concerns of social and political stability. The regulatory environment needs to ensure an appropriate framework to support developments that deliver wider economic, social and/or environmental benefits.

Regulatory action is required to address the new activities and behaviours for the full range of reasons outlined in section 3.2.3: that is, to maximise value for customers and society, increase business opportunities and competitiveness, and stimulate innovation.

3.3.1.3 Regulatory Interventions for Enabling New Activities

Designing an appropriate regulatory framework to enable the full range of new activities and behaviours envisaged by smart energy developments in general, and FINSENY in particular, lies at the heart of the significant regulatory challenge posed by the smart energy future.

Distribution networks lie at the centre of the future smart energy system, and current regulatory arrangements for DSOs, which are based on price and cost control, do not support the level of investment required in smart grids. This much is widely accepted, and national energy regulators (in particular in Great Britain) are moving to design and implement new performance-oriented regulatory frameworks which incentivise innovation and investment in smart grids whilst maintaining affordability, stability and quality of service. Such investment in ICT and other infrastructure in distribution networks is required to maximise the opportunity for smart technologies to address the considerable challenges of future energy provision and control in Europe. The FINSENY use cases for WP2 are central to the functionality required in these networks, and smart grid investment is a fundamental enabler of the use cases in all of the other scenario work packages, WP3, 4, 5 and 6.

Over and above the issue of smart grid investment and innovation, however, lies the challenge and opportunity of structural change in the electricity system as a whole. The concept of regional grids and microgrids, examined in WP3, focuses attention on the technical feasibility of growing “islands” of semi-autonomous smartness within the energy system. At the next level “up”, there is a need and opportunity for DSOs to undertake balancing activities at their level in the system. These issues are indicative of the general shift from centralised control to increasingly distributed control, which is inherent in the FINSENY use cases. For the benefits and opportunities of such a shift to be maximised, and the risks associated with grid stability (in particular) to be managed, the status and role of such semi-autonomous cells (of whatever scale) need to be recognised in models of the dynamic structure of the electricity industry, and in the associated regulatory framework. This will require regulatory reform over the long term. This issue is important because the details of the smart technological enablers required in the traditional distribution networks will in some respects depend on requirements for interworking with different levels in the system, including microgrids and smart buildings, and such investment is accelerating at this moment. It would be better to invest in smart grids with an eye on the potential shape of the future system, rather than necessarily to assume the ongoing suitability of historic organisational structures, which were established to implement a centralised system of unidirectional power flows.

3.3.2 Enabling New Activities in Distribution Networks (WP2)

New activities and behaviours related to WP2 include:

- Active management of increasing numbers of Distributed Energy Resources (DERs) connected directly to the Medium Voltage (MV) and Low Voltage (LV) distribution network.
- Balancing at the distribution network level, taking into account relevant connected DERs, as above, and connected loads. This would be a departure from the current situation in which the balancing activity is carried out at the transmission network level, mostly taking into account centralised generation (which still dominates the overall generating capacity today).

Regulatory solutions to these issues include:

- Incentivising investment and innovation by DSOs in smart grids, whilst maintaining focus on quality and service delivery for electricity consumers.
- Introducing regulatory measures to enable DSOs to take full advantage of smart grid automation capabilities in terms of active management of distributed generation, active Demand Response (DR), and balancing at the DSO level.
- Recognising that the point above about enabling more control and autonomy at DSO level is the first step in a move away from the existing centralised system of control and regulation, to an architecture of distributed control which is extended further by the microgrid concept (section 3.3.3).
- Ensuring a level of clarity over the commercial case for smart grid investments, from the perspective of the DSOs, to ensure consistency between the regulatory framework, DSO decision-making processes at a business level, and DSO technology strategy.
- Ensuring that regulatory allowances can be used for investment in external provision of ICT services where this fulfils requirements (see also section 3.5.2).
- As a corollary to the point above, recognising the role of regulation in ensuring specific quality standards for defined investment in telecoms: this has potential implications for the suitability of services available from external communications providers which, for mission critical control applications for example, may not provide the required reliability and performance.

3.3.3 Enabling New Activities in Microgrids (WP3)

Regional-/microgrids represent a fundamental departure from the structure of the electricity system as it is currently organised and regulated because the concept introduces high levels of autonomy and control in restricted elements of the electricity system that contain not only loads and a power distribution network, but also generating capacity and, in general, storage.

The microgrid concept offers a range of opportunities, in terms of stimulating new markets and innovation, offering the potential for enabling a much high level of choice and active involvement from consumers, and contributing to the stability and resilience of the overall system through a layered architecture of distributed control.

New activities and behaviours arising from WP3 include:

- Creating the functionality required for the operation and management of a semi-autonomous element of the grid, interconnected to an overlay grid, that is able to actively manage both its connected energy resources and demand profiles, balance supply versus demand on various timescales (including long term planning), manage disconnection (islanding) and reconnection events, and conduct a blackstart if necessary.
- Provision by the microgrid of ancillary services to its overlay grid to assist the overlay grid in its own balancing activities.
- Enabling the emergence of “energy communities” in which members of the community are able to trade electricity, which they have generated, with one another.

Regulatory solutions to these issues, for consideration, include:

- Reconsidering the centralised industry structure that underpins the current regulatory assumptions and framework. Such a radical structural rethink, pointed to by the microgrid concept, would be required in order to fully exploit the opportunities of microgrids, including local market development, innovation, consumer involvement, and the potential for building a layered architecture of distributed control through the whole of the electricity system for resilience and stability.
- Following the point above, recognising that smart grid development in distribution networks is already about the distribution of control “outwards” from the transmission system to the distribution

systems, which is itself a step on the way to structural change in the industry which needs to be recognised and accounted for in the regulatory framework (section 3.3.2 above).

- Establishing an appropriate regulatory approach to enable the operation of microgrids, including active management of energy resources, demand response, and balancing. For maximum effectiveness, this will require a new structural approach to the industry, as above, and a careful appraisal of the extent to which microgrids are or are not allowed to operate outside the standard regulatory controls applied to DSOs.
- Incentivising active participation of demand in some way to enable effective demand response.
- Enabling the emergence of market mechanisms that support local trading and energy communities (see section 3.3.6).
- Recognising the dependency on appropriate smart grid investment in distribution networks to enable the full potential of microgrids to be realised in terms of interaction with the overlay grid (for provision of ancillary services to the overlay grid and playing an active part in the stabilisation and operation of the overall energy system).

3.3.4 Enabling New Activities in Smart Buildings (WP4)

In many respects, the development of smart building functionality, defined by the WP4 use cases, is *driven by* regulatory requirements, in particular energy efficiency regulations.

New activities and behaviours arising from WP4 include:

- Increasing flexibility and controllability of power consumption both by consumers, retailers and other providers in the energy value chain for demand side management.
- Ability to support innovative electricity pricing models at the point of consumption, such as time of use (i.e. continuously variable) pricing, via the building energy management system.
- The smart building functioning as a microgrid.
- The need for contractual arrangements to govern the active participation of consumers and prosumers (see WP6).

Some possible regulatory interventions relevant to the new activities enabled by WP4 are:

- Encouraging the development of open standards supporting Future Internet technologies and Smart Energy solutions in order to ensure cost-effective development and deployment of solutions in the Smart Building scenarios.
- Tax exemptions for broadband connection when used to enable a Home Energy Management System.
- Recognising the dependency on appropriate smart grid investment in distribution networks (section 3.3.2).

3.3.5 Enabling New Activities for Electric Mobility (WP5)

New activities and behaviours arising from WP5 include:

- Electric vehicle (EV) charging at charge points, requiring the development of appropriate infrastructure and control processes.
- Use of electric vehicle batteries as intermittently connected, distributed storage for the grid (Vehicle to Grid, V2G, scenarios).
- The desire by EV users to be able to travel from country to country and still be able to charge their vehicles.
- The need for contractual arrangements to govern the consumption of electricity by EVs and the provision of storage services back to the grid (see WP6).

Regulatory interventions relevant to WP5 activities are:

- Investment to kick-start the roll out of EV charging infrastructure (this is more a matter of policy than regulation), generally underway in most countries.
- Regulations governing the use of, and pricing for, vehicle-to-grid (V2G) scenarios, for example regulating who pays for battery wasting when providing V2G, and the arrangements by which EV users might choose to, or be forced to, accept flexibility in the rate of charging in the interests of system stability.
- Ensuring guaranteed non-discriminatory access to public EV charging infrastructure.
- Establishing standards, processes and protocols for EV roaming from country to country.
- Providing subsidies, incentives and tax breaks for electric vehicle purchase and use.
- Encouraging the development of open standards.

- Recognising the dependency on appropriate smart grid investment in distribution networks (section 3.3.2) for the control of charge points, and the active use of EV storage as a service to the grid.

3.3.6 Enabling New Activities in the Electronic Marketplace for Energy (WP6)

New activities and behaviours arising from WP6 include:

- Provision of detailed information about energy use in final user contracts, including ability to choose type of energy, and ability to configure electricity contract on line.
- Contractual arrangements for demand side management governing the agreement by which consumers allow a level of control over their electricity usage by retailers and other grid users.
- Energy trading, enabling in particular the involvement of the consumer and prosumer via contractual arrangements.
- Dependencies on smart building (WP4) functionality to support innovative service pricing models and consumer involvement, as well as on smart grid enablement to facilitate market activity.

A wide range of possible regulatory interventions might be considered with respect to the complex web of options set out by the WP6 use cases, including:

- Creating the conditions for shaping local energy markets and "energy communities" including, for example
    - The ability for prosumers to sell energy that they have generated to one another
    - Incentives for micro-generation, for example feed in tariffs
    - Incentives, such as the one imposed by the Italian Energy Authority, for energy generated from renewables to be locally consumed rather than injected back into the grid
- Recognising dependencies on microgrids and their regulation for the enablement of local energy communities (section 3.3.3).
- Potential for tax differentiation based upon the type of usage of electrical energy: e.g. energy used for electric vehicle batteries versus energy used for air conditioning.
- Incentives to consumers who allow active demand of their electrical loads as part of demand side management scenarios.
- Incentives to consumers who provide an ICT interface to allow the DSO to control his or her micro-generation (as part of required regulatory changes to the role of DSOs, section 3.3.2).
- Incentivising energy saving, such as the approach taken by the Italian Energy Authority which imposes price controls to ensure that the unitary price (€/kWh) of electricity to the consumer *increases*, rather than decreases, with an increase in annual energy consumption.
- Incentivising consumers with lower contractual peak power in order to help manage overall peak loading. For example, as a result of such incentives in Italy, as few as 5% of Italian residential contracts have a contractual peak power higher than the minimum of 3 kW.
- Setting the duration of the local concessions for DSOs, and rules for how – at the end of the concession – the change over between outgoing and incoming DSOs should be done, in particular with respect to whether service platforms, smart meters and the like should be considered as part of the capitalisation or not.
- Recognising the dependency on appropriate smart grid investment in distribution networks to support the development of the electronic marketplace for energy (section 3.3.2).

3.4 Enabling Participation of Relevant Actors

3.4.1 Summary of Issues Related to Enabling Participation

3.4.1.1 Key Issues

Having established the new activities that are implied by the FINSENY use cases above, there is then the recognition that such activities will lead to changing roles for existing actors in the energy value chain, as well as the emergence of entirely new actors.

Key issues to be considered from the regulatory perspective include:

- Enabling increasing participation of consumers, including EV users, such that consumers become active players in the market for demand management purposes, as well as providers of temporary storage (in the case of EVs) and micro-generation (i.e. acting as prosumers).
- Supporting the emergence of new types of market actor including, for example:
    - (WP2) Metering operator; DER operator
    - (WP3) Microgrid operator; aggregator

  - (WP4) Cloud services provider, facilities manager; energy service provider
  - (WP5) EV Supply Equipment (EVSE) operator; aggregators such as E-Mobility Service Provider (EMSP), fleet operator, and EV users as above
  - (WP6) Demand side manager, and balance responsible party, who may potentially be new independent market actors.
- Ensuring clarity of responsibility for each type of actor to enable the effective functioning of the system as a whole.

FINSENY's view of emergent market actors and their interactions are discussed in deliverable D1.8, Report on Business Models and Market Trends, which also provides a definition of these actors.

In addition, actors in the existing supply chain, including TSOs, DSOs, generators, retail suppliers, wholesale suppliers, ICT service and equipment providers, etc., are expected to remain, albeit with changing roles and interactions.

3.4.1.2 Relevance of Regulatory Action for Enabling Participation

An understanding of the likely market structures, in terms of market actors and their interactions, is crucial for regulation. Indeed, the European Commission's Smart Grids Task Force (section 2.3.2.14) has an expert group (EG3) focusing on regulatory issues, which is dealing primarily with the definition of emergent market models, detailing the types of actor and their relationships.

Creating appropriate regulatory frameworks to govern the behaviour of emergent market actors is essential for maximising market and business opportunities and growth, stimulating innovation, and guarding against market dominance to ensure competitiveness.

Enabling the active participation of consumers in the smart energy system is a critically important development to position users' needs and choices at the centre of system.

3.4.1.3 Regulatory Interventions for Enabling Participation

Regulators need to maintain a clear understanding of evolving market models in order to encourage the development of competitive markets in the interests of consumers. Regulatory interventions will be achieved through the application of appropriate incentives and constraints for different actors.

It should be noted that the structural considerations discussed through section 3.3 relate to the *activity structure* of the system. This is of course related to the identities and relationships of the market actors, but should not be mistaken for being the same thing. This deliverable makes the assumption that establishing the underlying activity structure of the socio-technological system of interest is the first responsibility of policy makers, from which the market structures, and associated regulatory frameworks, will flow.

3.4.2 Enabling Participation in Distribution Networks (WP2)

The key issue with respect to WP2 is to provide a regulatory framework that enables DSOs to undertake the new activities outlined in section 3.3.2.

In addition, it needs to be clear which actor is to be responsible for advanced metering infrastructure (AMI), although the most critical issue in this regard is rights of access to data (see section 3.6).

There is a case to be made for incentivising the active involvement of consumers and micro-producers. Their interaction with the DSO will in general be mediated through contractual arrangements with market actors considered by WP6.

3.4.3 Enabling Participation in Microgrids (WP3)

The concept of a microgrid operator is built on assumptions about their ability to exercise a level of self-sufficiency and autonomy within the overall electricity system, on behalf of the consumers, with involvement of grid users (retailers etc.) within their domain of control. Such "autarkic" behaviour might be possible in microgrids that are only loosely coupled to the overlay grid, but for the full opportunities of microgrids to be realised, the structural considerations discussed in, for example, section 3.3.1.3 (and later in 3.15.2) are essential. A model of truly autarkic energy cells should include the opportunity for microgrid operators to influence price incentives.

The ability or otherwise of micro-generators to have flexibility of choice over whom to sell excess power to, will be a strong determinant of the development of local energy communities underpinned by microgrid functionality.

3.4.4 Enabling Participation in Smart Buildings (WP4)

Issues related to enabling the participation of consumers and micro producers in the smart energy system are also key to unlocking the full opportunities of smart buildings.

Encouraging the development and adoption of open standards is a key issue for ensuring competitiveness and affordability, and constructive involvement of the ICT sector in supporting the provision of energy services.

3.4.5 Enabling Participation in Electric Mobility (WP5)

Regulatory understanding of appropriate market roles, such as EVSE operators and EMSPs, is necessary to ensure a supportive regulatory environment for the development of electric mobility.

3.4.6 Enabling Participation in the Electronic Marketplace for Energy (WP6)

A fundamental concern for regulators with respect to the marketplace is to ensure its competitiveness. A focus on competitiveness in the context of the range of possible use cases considered by WP6 is likely to encourage the creation of new actors in the energy marketplace such as Demand Side Managers.

There are currently limited incentives for retailers to offer flexible tariffs to customers. The electric marketplace for energy presents a wide range of opportunity, subject to smart grid enablement, to introduce more choice and flexibility for consumers.

3.5 Enabling Efficient Use of ICT Infrastructure

3.5.1 Summary of Issues Related to Efficient Use of ICT Infrastructure

3.5.1.1 Key Issues

From the perspective of the European Commission, there is an imperative to ensure that deployed ICT infrastructure, whether publicly or privately owned, is appropriate to meet the needs of stakeholders, and is effectively used. This implies encouraging the development and deployment of open infrastructures that are suitable, and accessible, for use by multiple parties and multiple industries.

Seeking to establish generic enablers for the Future Internet is, of course, one of the fundamental concepts behind the FI-PPP programme, and efficient shared use of ICT infrastructures is indeed very important for enabling the effective realisation of FINSENY scenarios.

The key issue is to enable and encourage increasing levels of mutual understanding and collaboration between communications providers and utilities, by ensuring that utilities are able to make full use of commercially available services on public infrastructure (telecoms networks, servers in the cloud, etc.) where these fulfil needs and requirements, and, conversely, to enable utilities to sell telecoms services to third parties using their own telecoms networks.

3.5.1.2 Relevance of Regulatory Action for Enabling Efficient Use of ICT Infrastructure

Success in enabling efficient use of ICT infrastructure, both across organisational domains, and across industries, would reduce wastage arising from duplication of infrastructure, while maximising opportunities for innovation and competitive activity in telecoms and IT.

Increasing collaboration between communications providers and utilities also has the potential to contribute to the European Digital Agenda. The potential for utilities' own networks to be used for commercial broadband service deployment is being explored by the EC as part of the Smart Grids Task Force EG4 (section 2.3.2.14).

3.5.1.3 Regulatory Interventions for Enabling Efficient Use of ICT Infrastructure

Solutions include:

- Encouraging the development and adoption of open standards to enable interoperability.
- Strengthening regulatory requirements for ICT infrastructure owners to provide open access on non-discretionary terms to multiple service providers.
- Ensuring that energy regulation does not limit the ability of utilities to use commercially available services delivered over public networks, where these services are appropriate to fulfil the utilities' needs.
- Removing regulatory barriers in those countries where the energy regulator prevents utilities from providing communications services to third parties using their own telecoms networks.

3.5.2 Enabling Efficient Use of ICT Infrastructure in Distribution Networks (WP2)

The key issues relating to distribution networks are:

- Ensuring that providers of telecoms and ICT services do not encounter regulatory barriers to the provision of services to the regulated DSOs, where such services can fulfil requirements.
- Ensuring that DSOs are allowed to open up their own telecoms networks to provide services to third parties.

Potential solutions are:

- Noting that a focus on capital expenditure (capex) over operating expenditure (opex) helps to drive particular choices of private networks over public by DSOs in some countries. In Poland for example, DSOs are reimbursed only for capex investments, which can lead to self-build choices for telecoms even in cases where external service provision could meet the requirement. Similar arguments apply to many other countries in which DSOs have a strong tendency to favour private networks over public due to concerns for the performance and resilience of services delivered over public networks, especially for operational telecoms applications, but who are then effectively discouraged or prevented from exploring other more opex-intensive options.
- Re-examining the way that public institutions refinance utility investments to ensure that there is not a bias towards capex investments (which favour self-build of new networks) over opex (which is more associated with using existing ICT infrastructures from commercial communications providers).
- Regulatory allowance should facilitate joined up thinking between smart grids (WP2) and smart metering, driving economies of scale and financial efficiency: this may be a particular challenge in the UK in which smart meters are not the responsibility of the DSO.
- Encouraging the development and adoption of standards for advanced metering infrastructures (AMI) in accordance with the EU mandate on standardisation for AMI which refers not only to the electricity sector but also to gas and water, to ensure that standardised interfaces are adopted between meters and data centres, for example, in order to avoid the need for separate ICT infrastructures for each utility, and to maximise the use of public infrastructure.

3.5.3 Enabling Efficient Use of ICT Infrastructure in Microgrids (WP3)

Encouraging the development and adoption of open standards to enable competitive technology-based market development, and interoperability, is the key issue for microgrids with respect to efficient use of ICT infrastructure. The extent to which microgrids might fall inside or outside the kind of regulatory controls currently applied to DSOs will affect the extent to which the other issues raised in section 3.5.2 above are relevant to microgrids.

3.5.4 Enabling Efficient Use of ICT Infrastructure in Smart Buildings (WP4)

Issues relating to the efficient use of ICT infrastructure in the smart building domain include:

- Regulatory barriers that currently prevent or discourage sharing of infrastructure for smart building services between vertical domains (e.g. between electricity and water or gas distribution).
- Possibility that smart building infrastructure is deployed for use by one service provider, with one set of services, only, restricting the scope of competition and innovation.

Solutions to these issues could be:

- Encouraging the development of cross-domain standards, rather than industry-specific standards, in cases where there are no industry-specific requirements that would preclude the use of these, for issues including Machine to Machine (M2M) and Internet of Things (IoT) applications.
- Creating regulatory models to encourage both competitiveness, and innovation, at the service level, whereby multiple service providers could offer a variety of smart building services on common, shared infrastructure.

3.5.5 Enabling Efficient Use of ICT Infrastructure for Electric Mobility (WP5)

In order to ensure efficient and effective use of new and existing ICT for electric mobility, it is important that:

- The regulatory environment for electric vehicles actively encourages the development, and then probably mandates the adoption, of relevant standards across the industry relating to ICT (and, indeed, to power: charging schemes, plug design, battery specifications, etc.).

- The telecoms services required for the control of charge points can be provided by public communications providers.
- The regulatory environments for DSOs and electric mobility should facilitate joined up thinking between smart grids (WP2) and EVs (WP5), driving economies of scale and financial efficiency.

3.5.6 Enabling Efficient Use of ICT Infrastructure in the eMarket4E (WP6)

The electronic marketplace for energy (eMarket4E) exists to facilitate commercial transactions and consumer choice across the energy industry, underpinned and facilitated by electricity networks and energy sources. Service providers in the electronic marketplace for energy should be enabled, and even encouraged, to adopt cloud-based services for their service provision to ensure, from a holistic perspective, most efficient use of deployed ICT infrastructure.

The definition of standards supporting Future Internet technologies and Smart Energy solutions is key for the cost-effective development and deployment of solutions in the marketplace for energy, both from the perspective of shared infrastructure as above, and for maximising economies of scale and service innovation. There is a regulatory role to encourage the development and adoption of such standards.

3.6 Promoting Data Sharing and Interworking

3.6.1 Summary of Issues Related to Promoting Data Sharing and Interworking

3.6.1.1 Key Issues

The key issue is that information flows, enabled by ICT, are playing an increasingly prominent part throughout the energy industry value chain, including:

- Enabling commercial transactions amongst actors and consumers in the electronic marketplace for energy;
- Providing information about services to customers, including not only information about choice of providers but also about energy generation mix, delivery path congestion and cost of energy;
- Enabling interactions between consumers and suppliers on line;
- At a power network level, supporting the real-time operational management of energy flows and energy system stability and integrity in distribution networks and microgrids, which really is the essence of the smart grid.

All of these issues are leading to the need for increased sharing of data, especially between organisational domains.

3.6.1.2 Relevance of Regulatory Action for Promoting Data Sharing and Interworking

Promoting data sharing and interworking is critical for the effective functioning of the whole electricity system and supply chain, with both economic and social implications. Regulatory intervention is likely to be essential to ensure effective cooperation across organisational boundaries.

3.6.1.3 Regulatory Interventions for Promoting Data Sharing and Interworking

Possible solutions include:

- Encouraging openness and standards to enable interoperability;
- Encouraging or enforcing standards for data exchange and interfaces between domains;
- Defining roles and responsibilities of different types of actor;
- Considering the potential need for new supra-organisations to observe and manage the whole energy picture as an integrated system.

In assessing types of interactions that might be required between which actors and subsystems, an holistic model of the electricity system would guide decision-making, especially with respect to considerations of the possible need for management functions that span existing organisational domains. The development of such a model, to guide the evolution of the structure of the energy industry into the future, and associated regulatory frameworks, is discussed in section 3.15.2.

3.6.2 Promoting Data Sharing and Interworking for Distribution Networks (WP2)

Data sharing and interworking issues related to distribution networks include:

- The need for increasing collaboration between TSOs and DSOs, between DSOs, and between TSOs for more effective and efficient management and control of the whole energy system: practical

proposals for trials in this area are included in three Projects of Common Interest (PCI) from EG4 of the Smart Grids Task Force, SGTF (section 2.3.2.14).

- Standardised methods for sharing data from the increasing numbers of distributed energy resources to enable DSOs to effectively engage and manage around these assets (or indeed actively manage them), and the need for associated new regulation to support data transfer. The SGTF is providing some recommendations in this regard also.
- Ensuring that smart grid developments are fully aligned with smart metering developments. This should be eased in the majority of European countries in which smart meters are the responsibility of the DSO, but in the UK, for example, there are specific commercial and organisational challenges in this regard because, unusually, the regulatory framework does not assign responsibility for the smart meter to the distribution network operators in the UK (section 2.5.2.4.3). The key issue here is access to relevant data by different parties.
- Standards and protocols for access to smart meter data by multiple parties (DSOs, retailers, etc.).

There is a regulatory role to be played in encouraging standards, and in prescribing data interchange protocols and responsibilities.

3.6.3 Promoting Data Sharing and Interworking for Microgrids (WP3)

The key for microgrids, with respect to data sharing and interworking, is to ensure standardised interfaces between the microgrid and the overlay grid (typically a distribution network).

There may be a role for regulation to play in enforcing minimal requirements.

3.6.4 Promoting Data Sharing and Interworking for Smart Buildings (WP4)

Standardising the interface between the smart building and the outside world (both the smart grid and grid users) is absolutely key to the future of the smart building use cases in FINSENY. There are many possible standards for this, but no clearly preferred candidates as yet. Standardised interfaces are particularly important to enable demand-response scenarios.

Within the Home Area Network (HAN), it is essential to ensure that all devices can seamlessly connect and interwork as required, given that such devices are sourced from several types of industries, including utility smart meters, broadband gateways and ICT in general, white goods, and household appliances.

3.6.5 Promoting Data Sharing and Interworking for Electric Mobility (WP5)

Standardised interfaces will be required to enable controlled interaction between smart grids and electric vehicles to actively manage load profiles and to enable vehicle to grid scenarios.

3.6.6 Promoting Data Sharing and Interworking for the eMarket4E (WP6)

Key issues for the energy marketplace with respect to data interchange are:

- Potential for multiple data models for tariff structures, leading to potential market inflexibility.
- Provision of real time consumption and energy cost data for consumers. In particular for Italy, the decision on the deployment policy of the Enel Smart Info device is relevant in this regard: will the Italian energy authority mandate that the Smart Info is provided to all users or will users have to take the initiative to ask for this new device?

Potential solutions include:

- Definition of a common data model for the tariff structure.
- Regulators should foster collaboration between the several types of industries involved in home area networks.
- Create an obligation on all DSOs to provide an in-house real-time visualisation of consumption data and energy cost data.
- Encouragement or enforcement of a defined ICT control interface to all the micro-generation plants to enable the DSO to proactively and in real-time control some energy-related parameters.
- Creation of an ICT infrastructure to resolve the user meter ID into the energy retailer name and into the machine-readable active user energy tariff.
- Ensuring the selection of common data models.

3.7 Protecting Personal Data and Privacy

3.7.1 Key Issues Related to Protecting Personal Data and Privacy

Protecting privacy is a key aspect of the legislation and regulatory framework around ICT and the Future Internet.

Data privacy regulations are described in some detail in FINSENY deliverable D1.11 on Security.

Drivers for concerns about privacy include general changes to technological enablers, in particular increasing use of cloud based services, and the Internet of Things. In the smart energy arena, work has been particularly driven by smart metering developments. Privacy will become an increasingly important consideration in marketplace developments (WP6).

A huge amount of personal data could be linked to the use of M2M devices. The EC has adopted a recommendation on RFID identification that provides guidelines on privacy and protection of personal data for M2M devices using RFID tags. However, this covers just a part of the M2M applications because most current M2M do not use RFID. The general legislation would be applicable in these applications.

In general, FINSENY believes that more emphasis should be placed on protecting data privacy as it is an essential issue for smart grids. Indeed, the EC's SGTF has included this subject as the topic for one of its expert groups (EG2, section 2.3.2.14).

Policies that promote customer privacy may be a source of competitive advantage for companies in the energy industry.

3.7.2 Regulatory Interventions for Protecting Personal Data and Privacy

The solution is data protection legislation and regulation. The EU has already a directive in place, which all EU member states had to implement in the form of national laws to ensure a minimal level of data protection.

Dedicated policies may still be needed for smart grids, recognising that being too specific may inhibit business.

A key aspect of privacy regulation for smart meters is the opt-in versus opt-out decision:

- Harmonisation of the approaches should be enforced among all EU countries and, as much as possible, be consistent with the approaches selected by the rest of the world in order not to create competitive disadvantages for the EU companies.

3.8 Keeping the Lights On: Affordability, Quality, Security and Universality

3.8.1 Ensuring Affordability

Affordability of electricity for the end consumer, whether residential, commercial or industrial, is a continuous and critically important element for energy regulation, which is taken very seriously by regulators.

In regulatory moves to encouraging innovation and investment (section 3.9), it is essential to ensure that price and cost control mechanisms remain in force, as planned in the UK's new regulatory model RIIO.

The basic mechanism adopted across the European Union as a lever to drive affordability is promoting competitive markets, and applying appropriate regulatory controls for any organisations that have an unavoidable monopoly position (in particular, TSOs and DSOs).

Encouraging the development of open standards to maximise openness and interoperability is an important element of ensuing affordability that is strongly favoured in the EU.

Encouraging sharing of ICT infrastructure, for example through the open access agenda, is another contributing factor to ensuring affordability of services supported by ICT.

3.8.2 Ensuring Quality of Electricity Service

Ensuring the quality of power service delivered to consumers is a key concern of DSOs, and regulatory frameworks tend to include provisions to ensure that such quality is delivered and maintained, even while pressure is applied to improve cost-efficiencies (as has been the traditional focus in DSO regulation).

3.8.3 Ensuring Security and Stability of CNI for Service Continuity

Cyber security concerns are increasingly on the agenda at national and EU level, and the protection of critical national infrastructure including electrical power networks is a fundamental area of focus. This aspect is particularly important for WP2 and WP3, but security is an essential concern for all FINSENY scenarios and is addressed in detail in the FINSENY deliverable D1.11.

The area of concern of relevance here is to ensure the security of the communications networks and IT systems on which the smart energy functionality depends.

In the case of M2M communications, due to their inherent un-guarded, low cost and mass-deployed nature, M2M devices, and wireless communication architectures and solutions for such devices, would pose new threats in security. These threats may not be fully addressed by use of security technologies and methods adopted in existing wireless devices, cellular networks or WLANs.

The EC has indicated that they will take actions to provide a policy framework, following the European Network and Information Security Agency (ENISA), to meet the challenges related to trust, acceptance and security.

3.8.4 Ensuring Access of Electricity Service for all Consumers

National governments need to ensure, through regulatory controls of DSOs, that all citizens (as far as is reasonably possible) can get access to electrical power.

3.9 Keeping the Lights On Tomorrow: Innovation and Investment

Traditional cost-efficiency regulation of TSOs and DSOs is widely acknowledged to act as a disincentive to investment and innovation. Energy regulators need to move to a regulatory framework which encourages investment and innovation, without which European energy policy objectives are unlikely to be met, and the market for smart ICT, whether Future Internet technologies or not, will be suppressed below its potential.

Allowing R&D spending to be included in the regulatory tariff has been used as mechanism in Italy to introduce an element of research and innovation within the regulatory framework [19], and in the UK for example the regulator has provided £500m funding for smart grid research under the Low Carbon Network Fund (LCNF).

More significantly, however, the required regulatory shift to formally incentivising innovation and investment is beginning to happen, led by the UK's RIIO model (section 2.5.2.4.2), with Germany, the Netherlands, and the Scandinavian countries also seeking to rebalance away from pure cost-efficiency towards regulatory frameworks that incentivise investment and innovation in electricity grids.

To maximise the economic, energy security, environmental and social impacts enabled by FI technologies in Smart Energy, this regulatory change needs to be encouraged and accelerated across Europe.

3.10 Ensuring Consumers are Informed and Engaged

The need to ensure that consumers are informed is a primary concern for regulators.

Furthermore, there is a general trend towards a more user-centric approach in both telecommunications and energy. As consumers become more active participants in the systems that serve them, regulators will increasingly need to be concerned not only with informing the consumer, but ensuring that they are actively engaged as well. For full effect, such engagement will need to go well beyond periodic public consultations, to involving consumers in learning loops with suppliers and governments to improve the content and presentation of information, and to help consumers to become responsible partners in energy management.

In the smart energy future, information and engagement is particularly important for the Marketplace for Energy (WP6) because of the potential for hugely increasing the range and complexity of tariffs and choice available to customers, as well as the increasing involvement of consumers as actors in the smart grid in demand side management scenarios, becoming producers themselves through micro-generation, and potentially having options in the future to become part of local "energy communities" which may be based on microgrids.

In competitive retail energy markets such as the UK, the complexity of tariffs that can result even for basic energy provision can be bewildering for the average consumer. Indeed, the UK energy regulator is

currently taking steps to ensure that tariff structures are simplified to enable consumers to make more informed choices and receive a better deal. This experience suggests that there will be a need for an increasingly strong regulatory hand, to ensure the provision of clear information about services in an increasingly complex future with greater involvement of, and responsibilities borne by, consumers.

The crucial role that government has to play in informing and engaging consumers about changes in the energy landscape has been demonstrated in the roll out of smart meters in a number of places across the world. Where consumer understanding of benefits is unclear or absent, US experience has shown that consumer action can block smart meter deployment, placing the future of smart energy in some areas in jeopardy.

3.11 Reducing Consumption via Energy Efficiency

A drive to increasing levels of energy efficiency is a high profile trend in Europe.

Smart building scenarios (WP4) can, in many respects, be seen *as a response to* energy efficiency legislation and regulation. Thus, energy efficiency is the primary driver for the development of smart buildings, despite the fact that current regulations are largely attained through physical rather than ICT-based measures. Typical energy efficiency regulations for residential and office buildings provide mandates for maximal energy consumption of all new buildings, and objectives for renovation of existing buildings.

When setting energy reduction targets, if the objective is to stimulate energy efficiency for economic or social reasons then an efficiency target is likely to be most appropriate. If the objective is environmental or for energy security then a consumption-based target is more suitable: for this purpose, whether the reduction is made by efficiency improvement or energy service demand reduction does not matter.

Rising energy prices tend to drive the adoption of energy efficiency measures in buildings. There is an argument to be made that electricity pricing is artificially low because it does not take into account an economic assessment of negative externalities. On the basis of this argument, current pricing could be seen as hampering the adoption of energy efficiency measures. Any changes to the mechanisms for electricity pricing to account for externalities would be a radical step, however, and one whose time has yet to come.

3.12 Sustaining the Natural Environment

Ultimately, all human activity takes place within, and is an integral aspect of, the natural world. Both the average citizen, and policy makers, are increasingly recognising that human beings can no longer afford to separate different domains of concern from one another, and in particular can no longer ignore the critical interdependencies between economic considerations and the sustainability of natural ecosystems of which we are a part and on which we depend for our long term survival as a species.

Modern European energy policy can be seen as playing a pivotal role in the integration of economic and environmental concerns, demonstrated in the existence of the EU Climate and Energy Package, and the increasing integration between energy and climate policy in government ministries in Europe (for example, the UK's Department of Energy and Climate Change, DECC).

The fundamental drivers of energy policy in Europe, and the associated regulatory frameworks required for its implementation, are to do with the desired transition to a low carbon economy, which is taken to represent a lower risk (from the global perspective) than continuing with carbon intensive fossil fuel use.

It is therefore fair to say that smart energy regulation is directly driven by, and supports, an integrated environmental and economic sustainability agenda.

3.13 Controlling Access to the Radio Frequency Spectrum

3.13.1 Key Issues for Controlling Access to Spectrum

Aggressive target dates for the achievement of specific energy policy is likely to require much of smart grid telecoms to be delivered by wireless technologies. The role of radio spectrum in facilitating the introduction of smart utility networks is recognised in Article 7 of the European Spectrum Policy Programme.

The characteristics of utility communications networks differ in a number of ways from current public communications networks, specifically in terms of resilience, latency, security, longevity and geographic

coverage. A Commission consultation on spectrum for smart grids, which closed in April 2012, indicated that views diverge widely from those who consider it imperative that utilities be allocated more spectrum to manage their networks for operational and security reasons, to those who think utilities should have no spectrum allocated to them as commercial networks can meet their needs more cost-effectively.

On balance, although commercial communications networks can meet many utility telecommunications requirements, there is likely to remain a core requirement that will be self-provided by the utilities, and for which dedicated radio spectrum will be needed.

In general, utilities require a mix of spectrum to meet their needs, reflecting the wide diversity of requirements, geography, market structures and current communications facilities across member states. In order to obtain the required resilience and geographic coverage, many utilities maintain that they will require radio spectrum below 1 GHz, supplemented by additional spectrum in the range 1-3 GHz for capacity. It should be noted that any decisions about allocation of spectrum will need to take into account potentially conflicting interests from, in particular, utilities and telecoms operators.

This is an issue for the control of the grids themselves, so primarily for WP2 and WP3.

3.13.2 Relevance of Regulatory Action for Controlling Access to Spectrum

Harmonisation of spectrum allocated to utilities on a European basis would bring benefits in terms of support from industry, reduction in cross-border interference and lower costs to energy consumers.

This is a regulatory issue because access to the radio frequency spectrum is subject to licensing and regulatory control since it is a finite, shared resource.

In order to achieve the EU 20:20:20 targets, EUTC assesses that wireless network provision will be essential and that progress towards accessing relevant spectrum will be required by 2015, with access to the full amount identified by 2020.

3.13.3 Regulatory Interventions for Controlling Access to Spectrum

There are multiple small allocations within harmonised bands in Europe to support secure smart grid applications [34]:

- VHF spectrum (50-200 MHz) for resilient voice communications and distribution automation for rural and remote areas [2 x 1 MHz]
- UHF spectrum (450-470 MHz) for SCADA and automation [2 x 2.5 MHz]
- Lightly regulated or deregulated shared spectrum (870-876 MHz) for smart meters and smart grid
- L-band region (1500 MHz) for more data intensive smart grid, security and point-to-multipoint applications [10 MHz]
- Public microwave and satellite bands (1.5-58 GHz) for access to utilities' core fibre network or strategic resilient backhaul.

Recent activities in seeking harmonised spectrum for utility and smart grid use include:

- The recent Radio Spectrum Policy Programme (RSPP) report concluded there appears to be no spare spectrum, followed up with a spectrum requirements analysis study currently underway
- 1.5 GHz: CEPT FM50 is examining future use of the 1.5 GHz band in Europe, which has not produced a harmonised block of spectrum but utilities would not be excluded from use of this spectrum and would be able to make a case for access on a country-by-country basis
- 1.3 GHz: French proposal to use the 1.3 GHz band for IMT2000 technologies is likely to be blocked by NATO
- 700 MHz: ITU WRC 2012 decision on future use of 700 MHz band
    - US 20 MHz public safety mobile broadband spectrum may be shared with utilities
    - Vodafone European plan gives M2M 2x3 MHz of dedicated spectrum for utilities.

EUTC continues to:

- Support calls for harmonised spectrum in L-Band (1.3 GHz–1.5 GHz) for applications such as WiMAX-enabled substation automation.
- Support access to 870-876MHz lightly licensed spectrum for mesh networks for smart meters and smart grid.
- Monitor the possibility of harmonised spectrum within the 700MHz band becoming available across Europe over the longer term (since it is looking unlikely in the short term).

- Showcase and support Dutch and German developments towards using the 450-470 MHz band for smart grid and smart metering purposes, in the light of proposals by the Spanish administration to allocate 2x5MHz for public safety.
- Monitor the availability of VHF spectrum for emergency voice and SCADA communications, although since demands for VHF spectrum are decreasing, this should not be a major issue.

3.14 Other Issues with Regulatory Implications

3.14.1 Protecting Health and Safety

Health and safety is a key issue in the electricity industry, both for employees in the power industry, and for consumers. The proliferation of new types of equipment associated with the development of the smart energy future therefore has inevitable implications for the detail of health and safety legislation in member countries. In particular:

- Definition of the conditions under which installation and operation of equipment shall be allowed, especially power equipment such as micro-generators and storage, particularly in private homes or facilities.

3.14.2 Preventing Fraud

The electronic marketplace for energy will need anti-fraud regulation. Whenever new transaction mechanisms appear, and when money or goods are implied, new fraud strategies are developed, which will need to be analysed and avoided.

The scope of the regulation in this field would affect software, hardware, processes, citizens and organisations.

3.14.3 Resolving Disputes

The increasing complexity of services, tariff plans, choice, market actors and consumer involvement is likely to lead to a new range of potential sources of dispute. Regulators will need to ensure that their dispute resolution procedures are robust enough to cope with the range of possibilities as the smart energy future evolves.

3.14.4 Developing Skills and Education

There is a major impending challenge throughout Europe to ensure the skilled workforce required to develop, implement, operate and support the new technologies and systems required to achieve the energy goals established by the EU.

This issue does not fall under the responsibilities of regulatory bodies *per se*, but it is a critical issue that regulators should be strongly concerned with because of the impact that skills deficits have on the functioning of the complex systems that they seek to regulate. Regulation in its broadest sense is about the ability to adapt to changing circumstances in order to maintain a level of (dynamic) stability.

Solving the issue of qualifications and skills requires a complex interplay of national policy across multiple domains (education, innovation, energy, telecommunications and others) with companies throughout the energy and ICT supply chains.

3.14.5 Enabling Machine to Machine Communications

3.14.5.1 Enabling Mobile Operator Flexibility: White SIMs

The SIM cards used for mobile terminals are not adequate for M2M applications because the card connections lack the specifications required in M2M devices (the SIM should be smaller and the connections should be bonded) and also it should be possible to change mobile operator without manually changing the SIM card.

Thus, M2M devices should use embedded SIM cards that enable the mobile operator subscription to be set up by software (typically over the air) and for the operator to be switched without manually changing the SIM card.

The GSMA is promoting the standardisation of these new embedded SIMs in ETSI.

Brazil has regulated a specific embedded SIM, and the associated system for operator switching, for automotive applications.

3.14.5.2 Numbering

M2M communications may require specific E.164 numbering, with large addressing capabilities, which is not available in all European countries.

Spain has modified the numbering regulation to assign a very large range of numbers (13 digits, 10,000 million different numbers) to M2M applications. This should allow Spanish numbers to be used abroad, if required.

The possibility of creating an international single numbering space could be also considered to simplify numbering management. An International M2M numbering range managed by ITU-T could be a possible long-term solution.

The possibility of not using E.164 numbering in the future for M2M applications could also be an option to be analysed for the future. In particular, addressing based on IPv6 seems to be the natural evolution for mobile networks. For the moment, however, E.164 numbers are required.

3.14.5.3 Roaming

An important part of M2M services will use roaming services, so roaming regulation should be compatible with the business models used in M2M.

Current European regulation on the issue does not pose a problem to M2M businesses:

- Data tariffs are applicable to M2M services, except when the customer is in a tariff demonstrably below the Euro-data tariff, or the customer has deliberately chosen an alternative roaming tariff.
- Transparency measures for data do not apply: welcome message with tariff information, the €50 data cap and warning message when 80% of the €50 data cap is reached.
- Some transparency measures for voice and SMS do not apply to devices that do not support SMS functionality: welcome message and special number for tariff information.

3.15 Visioning and Development of Regulatory Frameworks

The behaviour and evolution of industries and markets are linked in complex ways to the regulatory frameworks by which they are governed. In the energy industry, fine-tuning regulatory models can take years, is country-specific, and is typically carried out through a process of "learning by doing" in the live commercial environment [19]. This argument applies equally to telecoms, and other regulated industries.

The following two proposals, discussed in this section, are made as possible approaches to help optimise the design and impact of new regulatory frameworks without unnecessarily disrupting business as usual:

- Testing proposed regulatory frameworks in R&D, trial and demonstration projects.
- Modelling the *activity* structure and regulatory controls for the whole system, prior to making assumptions about *market* structure.

3.15.1 Testing New Regulatory Frameworks in Trials

Research and development, including trials and large-scale demonstrations, is a normal part of the development cycle for new technologies and processes. Large-scale demonstrators, involving live customers, generally have to operate under existing regulatory conditions. This issue has been identified, for example, by Projects of Common Interest (PCIs) in the SGTF's Expert Group 4 (section 2.3.2.14) in which a number of regulatory barriers exist in the countries of interest, which prevent the proposed projects from testing all aspects of the proposed smart grid functionality in the PCIs.

The result is that existing regulatory frameworks typically restrict the scope for innovation in trials.

It is proposed that it would be of mutual benefit, both for the development of regulatory frameworks, and for accelerated innovation, if it were possible to test new regulatory frameworks in R&D projects and trials.

3.15.2 Modelling the Activity Structure of the Whole Smart Energy System

The European Commission's Smart Grids Task Force (section 2.3.2.14) Expert Group 3 is developing regulatory recommendations for smart grid deployment. The focus of the work of EG3 is to develop market models, on the understanding that market structure is a critical starting point for regulatory activity (see section 2.2.4.1).

This report from the FINSENY consortium fully accepts that regulatory intervention needs to relate to specific types of market actor and, therefore, to likely future market structure. It also asserts, however, that "behind" the *market* structure lies the more fundamental *activity* structure. The distinction between the two types of structure only becomes apparent in times of transition or disruption, in which the organisational identities that have developed historically, to conduct required activities, are challenged by the evolving nature of those activities.

The transition to the smart energy future represents a huge shift in the activity structure of the energy system. Policy makers, regulators, and the industry itself, must recognise that such a radical change in *what is done* could entail a similarly radical shift in what kinds of organisation are best placed to do it, and the kinds of relationships that need to exist between them. For all existing actors in the system, be they the regulated TSOs or DSOs, large energy producers, wholesalers, retailers, or any of the equipment or service providers in the supply chain, not to mention the consumers for whose benefit the entire system exists, this change offers both significant opportunities and significant threats. The potential risk of developing future market models by iterating from existing market models, is that non-optimal assumptions can be made about the roles, or even the necessity, of particular types of market player.

Of course, any "idealised" future state only has any relevance in reality if there is a workable transition path from the present to the future.

It is an assertion of this report, however, that there is immense value for policy makers, regulators and indeed all actors and stakeholders in the energy industry, to develop a reference model of the activity of the whole system that transcends existing organisational boundaries.

The objective of such a model would be to provide a reference against which existing and planned developments in smart energy could be tested to see the extent to which they are aligned with the shared purposes of the system as a whole. Being able to see the activities that are required to enable the functioning of the whole system, and the part that any one organisation needs to play in contributing to this, is likely to be a powerful way of motivating new interactions that are aligned with shared purposes and are of mutual benefit. Furthermore, by visioning an effective "smart" future, regulatory frameworks can be designed to enable market structures to evolve in a direction compatible with this future position.

The principal trend, introduced in section 3.2.1, which will need to be accommodated by the activity model, is the shift from a centralised, to a more distributed, system of control. A possible model is of an architecture of nested, semi-autonomous interacting cells, building up from smart buildings, through areas of smartness which could be identified with microgrids, to regional level, national level, and beyond for inter-country collaboration. In such a model, a clear regulatory framework would endow every level in the system with sufficient autonomy to innovate while managing its own dynamic stability, whilst also cohering as an element of a larger evolving system.

Such a model may share some characteristics with the cellular approach being discussed, somewhat controversially, in Germany [35].

Going further, some authors have speculated about the future advent of an "Internet-type" of regulation in Energy, subject to distributed control placed under a global protocol [20]. Perhaps the greatest impact of the Future Internet on Smart Energy will end up being as much to do with drawing on its organisational philosophy as its technological enablers.

Thus, we think, with visionary policy-making, there is an opportunity to take a more radical approach than just a focus on investment and innovation within existing network organisations, such as that encouraged by the UK's RIIO model for TSOs and DSOs (which, admittedly, is ground-breaking in itself). This could stimulate the growth of local markets, with active involvement from SMEs, communities and other small scale players, but only if the energy policy and regulatory frameworks are overhauled with a view to moving towards a more agile system, and away from the historic blueprint of a centralised top down control structure which suited the needs of the past but which is in danger of outliving its usefulness.

EUTC is currently developing a proof of concept to demonstrate the feasibility and value of building such an activity model of the smart energy system. Further development of this model could form a valuable contribution to ongoing research in smart energy policy and regulation, for example through phases II and III of the FI-PPP programme.

4. Regulatory Outlook for FINSENY Scenarios

4.1 Introduction

4.1.1 Purpose

The purpose of this chapter 4 is to bring together the overview of European regulation presented in chapter 2 with the view from FINSENY presented in chapter 3 to understand the suitability of existing regulatory frameworks, and observed regulatory trends, to address the issues identified. It also looks at areas of existing legislation and regulation for which FINSENY use cases can provide an effective market response.

4.1.2 Approach

The approach taken to the analysis presented in this chapter was to compare material from chapters 2 and 3 with the following questions in mind:

- What issues and regulatory interventions are specific to each work package?
- What issues are common to all work packages?
- What aspects of current regulation, and trends, are likely to be enablers for FINSENY use cases?
- What aspects of current regulation, and trends, are likely to be barriers?
- What regulatory issues, that need to be addressed to support FINSENY use cases, do not appear to be part of current regulatory debates?

4.1.3 Structure of Chapter 4

Chapter 4 is structured as follows:

- 4.2 FINSENY as a Market Enabler for Regulatory Response
- 4.3 Regulatory Issues and Interventions for each FINSENY Scenario
- 4.4 Regulatory Outlook for FINSENY as a Whole

These three sections tell three different aspects of the regulatory story.

4.2 FINSENY as a Market Enabler for Regulatory Response

This section links selected aspects of existing legislation and regulation to ways in which the FINSENY use cases can provide solutions for a market response.

4.2.1 Energy Efficiency Directive

Europe's Energy Efficiency Directive (EED), approved during the lifetime of FINSENY project, enforces stakeholders to adopt particular behaviours and take particular actions with respect to the use of energy.

Europe's current Energy Efficiency Plan (EEP), which grew out of the Energy Efficiency Action Plan (EEAP) of 2006, was an important first step towards reaching the EU's policy objective of 20% primary energy savings in 2020 compared to a baseline. However, the official Impact Assessment, which informed the development of the Energy Efficiency Directive, concludes that the EU's 20% policy objective for energy savings will not be met with present policies, and thus that the related environmental, social, security of supply and economic benefits will not be realised [36]. The EED is the response to this challenge.

Energy efficiency is an inherent aspect of all FINSENY scenario work packages. This applies most transparently to the Smart Building (WP4, section 4.3.3) and Electronic Marketplace (WP6, section 4.3.5) scenarios, but the achievement of energy efficiency targets is also underpinned by smart grid developments in Distribution Networks (WP2) and Microgrids (WP3), and by the controls required for Electric Mobility (WP5). FINSENY provides the means, therefore, for practical market responses to a major pan-European challenge, which is enshrined in legislation and associated regulations, that affects every member state in the EU.

In conclusion, the Energy Efficiency Directive is a principal driver for the practical development of all FINSENY scenarios, and presents a major opportunity for exploiting the results of FINSENY research in the marketplace.

4.2.2 Europe's Recovery Plan

In response to the ongoing economic crisis, Europe has approved a considerable budget to support the implementation of energy projects. This provides an incentive for companies, SMEs, and entrepreneurs to get involved in energy-related projects [37]. The plan is oriented towards projects that are currently non-profitable, which is always an issue at the early adoption stage of new technologies, faced by, for example, many renewable energy schemes. This source of funding could provide an impetus for the commercialisation of the ICT enablers developed by FINSENY.

4.3 Regulatory Issues and Interventions for each FINSENY Scenario

This section takes each FINSENY scenario work package, selecting the most significant regulatory issues for each in turn, and sets out the issues, the need for regulatory intervention, and recommended actions. The aim is to clarify the main regulatory developments that would be required to maximise the impacts (economic, social, environmental) of each FINSENY scenario. This is different from section 4.2 above, which accepts current legislation and regulation as it is, and simply discusses FINSENY as a response to that.

4.3.1 Regulation to Support Distribution Network Use Cases (WP2)

Distribution networks need investment and innovation to provide the smart grid functionality that underpins all FINSENY use cases across all scenario work packages.

Traditional cost-efficiency regulation of TSOs and DSOs is widely acknowledged to act as a disincentive to investment and innovation. Energy regulators need to move to a regulatory framework which encourages investment and innovation, without which European energy policy objectives are unlikely to be met, and the market for smart ICT, whether Future Internet technologies or not, will be suppressed below its potential.

This regulatory shift is beginning to happen, led by the UK's RIIO model, with Germany, the Netherlands, and the Scandinavian countries also seeking to rebalance away from pure cost-efficiency towards regulatory frameworks that incentivise investment and innovation in electricity grids.

To maximise the economic, energy security, environmental and social impacts enabled by FI technologies in Smart Energy, this regulatory change needs to be encouraged and accelerated across Europe.

In parallel with investment incentives, however, additional regulatory changes will be required if the full promise of smart grids is to be realised by allowing active management of distributed generation and loads by DSOs, and the ability to balance supply and demand at DSO level. Such a change would be non-trivial because it would be the start of a shift in the "activity structure" of the energy industry, which would mark a fundamental departure from the current model of centralised control. The split of responsibilities, and the relationship, between TSOs and DSOs would have to be redefined. This is, however, likely to be important – or perhaps essential – in order to ensure effective control of a future smart system containing widespread distributed and variable generation, actively managed loads, and greater participation of consumers.

4.3.2 Regulation to Support Microgrid Use Cases (WP3)

The Microgrid concept presents a significant challenge for energy regulation. Microgrids, as largely self-sufficient customer-oriented cells within the wider energy system, are effectively excluded from existing regulatory frameworks.

The fundamental reason for this is that energy regulators are operating within an existing highly centralised market structure (with respect to the regulated network businesses) that is not at all aligned with the microgrid concept. To make progress, specific regulatory arrangements will need to be established for microgrid operation.

In thinking about possible regulatory scenarios for microgrids, it is tempting to get drawn into a debate in which a centralised, regulated environment is set against a decentralised, deregulated environment, with no middle ground. Following the comments at the end of section 4.3.1, however, an architecture of distributed control could be envisaged in which semi-autonomous microgrid "cells" operate within a wider regional system which again has a level of autonomous control, which in turn operates within a larger (national) system and, indeed within a yet larger trans-national system. The roles and responsibilities of each level, the interactions between them, and the necessary integrative management functions, would need to be defined as part of the regulatory framework. Such nested logical levels of

control share features with the organisation of biological systems, which are, undoubtedly, dynamically stable and viable systems.

Alternatively, there may well be options to allow self-sufficient microgrids to be loosely coupled to the rest of the grid, creating market opportunities for providers of technologies and services, and sites for local and regional innovation and local market development. This would not, however, represent the full realisation of the potential of microgrid control scenarios to contribute to the operation and stabilisation of the energy system as a whole.

4.3.3 Regulation to Support Smart Building Use Cases (WP4)

In contrast to the grid scenarios of WP2 and WP3, which require changes to energy regulation for their full implementation, the Smart Building scenario is largely *driven by* energy regulation, specifically Energy Efficiency regulations.

In addition, the full realisation of the benefits from smart buildings is dependent on the deployment of smart meters (which is subject to regulatory requirements, although formally outside the scope of the FINSENY use cases) and, furthermore, on the deployment of smart grid functionality in distribution networks (WP2).

FINSENY has developed specific proposals for a regulation framework strategy to boost the introduction of renewable energy sources (RES) in smart buildings (see also FINSENY deliverable D1.9 Exploitation Strategies):

- Local empowerment: building regulations, efficiency standards and mandatory renewable energy provisions for new buildings. Examples are mandates for solar hot water and solar photovoltaic (PV) installations, and zero-net-energy homes.
- Effective and reasonable obligations: Local regulator must assess which energy efficiency and renewable energy obligations are effective and reasonable in the respective environment. It must be ensured that an obligation is necessary and that the same goal cannot be achieved by less intrusive instruments (i.e. an obligation to incorporate solar thermal systems in newly built homes is a good policy in Spain or in Italy, but would not be effective in Scandinavia and financially unviable in African countries). Finally, the so-called, “twin rate price”, already in use in Italy: a price policy, in order to shift the energy consumption in a given time zone.
- Compensation: The local regulator should think of appropriate compensation schemes, if necessary, either for all affected addressees or for financially disadvantaged parts of the population. These could take the form of grants or free-loans for mandatory efficiency measures or renewable installations.

4.3.4 Regulation to Support Electric Mobility Use Cases (WP5)

A critical “big picture” regulatory issue for the support of electric mobility is incentivising appropriate investment in the smart grid, as discussed in section 4.3.4.

Beyond this, a key issue is providing sufficient public investment for charging infrastructure, and individual incentives for electric vehicle ownership and use, in order to kick start this entirely new industry.

Finally, critical enablers that require regulatory intervention are associated with ensuring standardisation of technology and processes: for technical interfaces, for non-discriminatory access to charging infrastructure, and for enabling seamless roaming from country to country.

4.3.5 Regulation to Support Electronic Marketplace for Energy Use Cases (WP6)

The Electronic Marketplace for Energy (eMarket4E) can only exist because of the deregulation of retail and wholesale energy markets. It owes its existence, therefore, to the particular structure of the energy industry that is established in EU legislation, i.e. one in which the process of buying and selling electricity is unbundled from the energy networks, and is open to market competition.

Beyond this relatively “invisible” structural driver, there are more tangible regulatory issues that drive the eMarket4E use cases, in particular energy efficiency regulation, and the general trend towards greater “user-centricity” which will increase the engagement of users as active participants in the energy system over time. To date, energy markets have not changed the basic principle of energy provisioning, despite legislated unbundling. Even in competitive energy markets, energy is still being delivered as a commodity service. With the exception of having information on choice of providers, consumers still do not have access to significant information on the energy generation mix, potential delivery path congestion or cost of energy. Increasing user-centricity, however, is likely to drive a growing desire by consumers to

exercise more complex choices over the trade-offs between source, price and quality of electricity. Such a scenario, in which information flows play a much greater role in the energy industry value chain, is fundamental to the FINSENY use cases (see, for example, FINSENY deliverable D1.9 Exploitation Strategies).

As for all other FINSENY scenarios, the eMarket4E is underpinned and enabled by smart grid investment, and the regulatory changes discussed in section 4.3.1.

The FINSENY vision for the eMarket4E is ultimately focused on the energy customer as an active player in the market, and on creating the conditions for the shaping of local energy markets. Such conditions will require appropriate regulatory support, both in energy and in communications, and will be linked in complex ways to potential future structural changes discussed in sections 4.3.1 and 4.3.2. The scope for creating opportunities for market innovation and growth, by enabling integrated developments across the whole energy value chain, is potentially enormous.

4.4 Regulatory Issues and Outlook for FINSENY as a Whole

Finally, this section takes a top-down view of FINSENY as a whole, identifying issues that are relevant to all scenarios. This section is likely to be of particular interest in the broader perspective being taken by FI-PPP in the area of policy, regulation and governance (PRG). FINSENY representatives have played an active part in the WG-PRG (section 2.3.2.13.2), which is undertaking this work in FI-PPP.

Table 2 summarises the major crosscutting issues from this report that have regulatory implications for all FINSENY scenarios (column 1), with a brief description of the proposed regulatory intervention (column 2), the desired impact of each intervention (column 3), and the extent to which the intervention appears to be supported by current regulations and visible regulatory trends (column 4).

FINSENY Issues	**Proposed Regulatory Intervention**	**Impact of Proposed Intervention**	**Support from Current Regulatory Trends**
1) Innovation and investment	Incentivising innovation and investment in the energy industry, particularly in regulated energy networks, and in electric mobility Allowing alternative regulatory frameworks to be tested in live trials	Without smart grid investment at DSO level, EU energy policy targets would not be achieved and the benefits of all FINSENY use cases would be compromised	Moderate support, increasing. Regulatory frameworks for DSOs (and TSOs) are beginning to move from cost-effectiveness to performance-based regulation (e.g. in the UK) to incentivise innovation and investment in smart grids. But this is driven country by country, progress is uneven, and it focuses on organisational domains, not the whole system.
2) User centricity	Enabling consumers to actively participate in energy markets. Ensuring active engagement of consumers, beyond just provision of information, to involve them in learning loops with suppliers and governments.	Enabling consumers to become responsible participants in energy management. Stimulating market innovation leading to business opportunity. Maximising user and societal value.	Moderate support, increasing. General regulatory trend towards a desire for a more user-centric approach in both telecommunications and energy, with a general aim in energy to transform consumers from passive to responsive users (via smart meter roll out, enabling a level of demand response). But regulatory engagement strategies still tend to focus on information provision rather than full engagement in two-way learning loops.

FINSENY Issues	Proposed Regulatory Intervention	Impact of Proposed Intervention	Support from Current Regulatory Trends
3) Whole system regulation to enable new activities, and participation of existing and new actors	Designing a regulatory framework to enable the full range of activities and behaviours envisaged for the smart energy future, informed by a model of the "activity structure" of the whole system.	Maximising value for consumers and society, business opportunities, competitiveness, innovation and environmental benefit. Ensuring the ongoing dynamic stability and adaptability of the whole system in the face of predictable and unknowable future uncertainties Could lead to e.g. supra-organisational management structures, and/or holistic innovation strategies, to ensure the integrity of the whole into the future	Poor support. Very limited evidence that regulatory debate extends to considerations of how to regulate *the energy system as a whole*, as opposed to considerations of how to separately optimise the performance of each market-defined element of the existing structure (i.e. retailers, wholesalers, producers, TSOs, DSOs, consumers/prosumers, suppliers and service providers)
4) Interworking between different organisations, industries, and across borders	Encouraging or requiring data sharing and constructive collaboration through standards and protocols Defining roles and responsibilities of different types of actor	Essential for the effective functioning of the whole electricity system and supply chain across Europe as information flows play an increasing part in control and market activity, and cross-border interactions rise Risk of critical failure of the whole if the parts are not integrated into an holistically coordinated system.	Moderate support, but lacks holistic planning. There is an increasing focus on data sharing, particularly in supply chains. Network code development for coordination and regulation in the energy system. However, no obvious focus on developing a system-wide activity model to define the roles and relationships and management functions needed to manage the energy system as an integrated whole: see (3)
5) Standardisation for interoperability	Encouraging the development and adoption of open standards	Maximising competitiveness, innovation, delivery of value to stakeholders	Good support. EU mandates M/490, M/441 and M/468 have led to detailed standardisation work in smart grids, smart meters and electric vehicles. Regulators need to be clear on their approach to mandating versus encouraging standards in different circumstances, remaining technology neutral as a rule except where absolutely essential

FINSENY Issues	Proposed Regulatory Intervention	Impact of Proposed Intervention	Support from Current Regulatory Trends
6) Privacy	Data protection legislation and regulations	Consumer protection	Good support. Strong focus on data protection and privacy legislation in general. Likely to need more specific focus on smart energy requirements as smart energy systems and markets develop.
7) Ensuring that potential synergies are maximised between energy and telecoms markets through regulatory collaboration	Ensuring collaboration between energy and communications regulators to address, head on, likely tensions that arise between highly regulated industries (energy in this case) and lightly regulated industries (communications)	Ensuring that Europe is able to lead, rather than lag, in developing opportunities at the nexus between the Future Internet and Smart Energy, to avoid the "catch up" scenario experienced, for example, in mobile banking (which arose in part due to regulatory tensions between banking and communications)	Poor support. Limited regulatory interaction: currently via the EC's SGTF and other time-bound initiatives. Collaborative regulatory development should be encouraged. (Interactive activity tends to be at an industry, not regulatory, level, for example through EU funded research such as FINSENY, or trade associations such as EUTC)
8) ICT infrastructure sharing	Enforcing open access ICT infrastructures Encouraging use of public ICT infrastructures by electricity network operators Enabling utilities to become telecoms businesses in all countries Encouraging industry collaboration between energy and ICT players in all countries	Maximising opportunities for innovation and competitive activity in telecoms and IT Reducing wastage from infrastructure duplication Potentially contributing to European digital agenda	Mixed support. Encouraging interaction and understanding between the energy and telecoms industries is enabled in collaborative research projects such as FINSENY, and encouraged by trade associations such as EUTC, and others. There is a strong focus on the open access agenda for public telecoms infrastructure at EU level. However, energy regulations vary from country to country in the extent to which they result in encouraging self-build over purchase of commercial services Also inconsistencies from country to country in the extent to which utilities are allowed to use assets to sell telecoms services to third parties.

FINSENY Issues	Proposed Regulatory Intervention	Impact of Proposed Intervention	Support from Current Regulatory Trends
9) Spectrum	Allocating harmonised spectrum for smart grids across Europe, especially for use in private utility networks	Reducing smart grid costs; reducing cross-border RF interference.	Mixed support. Divergent views on the need for utility spectrum. Need for sustained, coordinated lobbying over long periods to secure harmonised spectrum across Europe.
10) Security of critical national infrastructure for energy	Ensuring appropriate security controls, for the enabling ICT in particular, are in place to protect the energy system	Minimising the chance of accidental or malicious disruption to energy services, which could have potentially enormous impact on economic and societal stability of member states	Moderate support. Strong and increasing focus on cyber-security. DSO/TSO regulation accounts for the need to deliver a secure service. Potential vulnerabilities due to the lack of focus on the whole system: see (3)

Table 2: Summary of Crosscutting Regulatory Issues for FINSENY Scenarios

5. Recommendations

In summary, taking a crosscutting perspective of the whole project, FINSENY recommends the following actions with respect to regulating the Smart Energy future in Europe, recognising the part to be played by the Future Internet:

- **Investment and Innovation**: Encourage and accelerate the current shift in regulation of Distribution System Operators from cost-effectiveness regulation to performance-based regulation, designed to incentivise investment and innovation, in order to maximise development and deployment of smart grids across Europe. Explore the feasibility of allowing alternative regulatory frameworks to be tested in live trials in order to better understand the interplay between regulation and technology in the innovation process.
- **User-Centricity**: Encourage the regulatory trend in both energy and telecommunications to enable consumers to become active participants, developing regulatory strategies to ensure that consumers are not only well-informed but are also engaged in learning loops with suppliers and governments.
- **Whole System Regulation**: Initiate research to develop models of the "activity structure" of the energy system as a whole that transcends, but maps to, existing organisational boundaries, in order to guide the evolution of frameworks for energy policy and regulation that could enable the stable transition from the current system of centralised control to a system of distributed control which is able to capitalise on the full capabilities and promise of the smart energy future.
- **Interworking**: Encourage and extend the current focus on data sharing, which is particularly evident in supply chain process innovation, to encourage interworking between different organisations, industries (including energy and ICT), and across national borders, recognising the value of a reference model of the whole energy system (above) which links activities to common purposes such as energy security, affordability, competitiveness, economic prosperity, social cohesion and environmental sustainability.
- **Standardisation**: Continue to encourage the development and adoption of open standards in ICT across the European Union (EU) as an effective strategy for maximising interoperability, competitiveness, innovation, and delivery of value to all stakeholders, with a general principle of technology-neutral regulation but retaining the option for mandating standards if essential. Details of relevant standardisation activities are provided in FINSENY deliverable D1.6.
- **Privacy**: Continue with the strong development of data protection and privacy legislation and regulation, with an increasing focus on the specific requirements of smart energy.
- **Regulatory Collaboration**: Formalise and strengthen dialogue between policy-makers and regulators in communications and energy to address the likely tensions that exist between the highly regulated energy industry and the more lightly regulated communications industry, in order to ensure that Europe is able to lead, rather than lag, the development of opportunities at the nexus between the Future Internet and Smart Energy.
- **ICT Infrastructure Sharing**: Align energy regulation with the EU open access agenda for public telecommunications infrastructure by removing any barriers to sharing ICT infrastructure created by energy regulation, in countries where this is the case, both by ensuring that commercial ICT services are not discouraged with respect to self-build, and removing inconsistencies from country to country in the extent to which utilities are allowed to use assets to sell telecoms services to third parties.
- **Spectrum**: Consider the allocation, by 2020 at the latest, of harmonised spectrum for smart grid use across Europe, including frequencies below 1 GHz for resilience and geographic coverage, supplemented by additional spectrum in the range 1-3 GHz for capacity, recognising the existence of conflicting interests in such spectrum between utilities and telecoms operators, in particular.
- **Security of Critical National Infrastructure**: Encourage, and continue to focus on ensuring, appropriate security controls, for the enabling ICT in particular, to protect the energy systems of member states, strengthening an understanding of potential vulnerabilities arising from the current lack of a whole system regulation model.

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7. Appendix: Regulatory Questionnaire for FINSENY Partners

Introduction

Purpose and Deadline

This document contains a number of questions for partners in each of the FINSENY scenario work packages (WP2, 3, 4, 5 and 6). The questions concern regulatory issues related to the use cases in each work package.

Each partner in each scenario work package is kindly requested to answer the questions below, and return to Roger Duck, roger.duck@utc.org, by **Friday 16 November 2012**. Roger intends to join a telco for each WP before this date to discuss the task and answer any questions you may have.

It would also be useful if each scenario work package could discuss the issues raised in order to develop a consolidated view from the work package, in addition to the individual responses.

Context and Further Information

The objective of FINSENY task 1.4, which concerns smart grid regulation, is to assess how regulation in Energy and Communications is moving in Europe as a whole and in selected countries, and how the FINSENY use cases might be impeded or encouraged by this. Findings will be published in D1.7. We are aiming to circulate a draft of this deliverable in January 2013, and the final report is due at the end of March 2013.

Please see the accompanying presentation, **FINSENY_T1.4_Regulation_Overview_Dublin_GM.pptx**, which provides an overview of regulation related to smart energy in Europe, a list of issues that are typically subject to regulation, and an outline of the deliverable D1.7.

Please direct all questions and comments to Roger Duck, EUTC, contact details above.

Questionnaire

Each Partner is requested to answer the questions below, with respect to the scenario work package(s) in which you are involved. There are two pages of questions. The deadline is Friday 16 November 2012.

1) Your Details

Name:

Partner Organisation:

Work Package about which you are answering this questionnaire:

2) Initial Ideas

What regulatory issues come to mind when you consider the FINSENY Use Cases in your work package?

Answer:

3) Use Case Barriers

In what ways do you think that current regulation, in Energy, Communications, or other, may present barriers to the Use Cases in your scenario work package?

Answer:

4) Use Case Enablers and Incentives

In what ways do you think that current regulation, in Energy, Communications, or other, is helpful for the Use Cases in your scenario work package?

Answer:

5) Regulatory Changes to Support Use Cases

What new regulations, or changes to existing regulation, do you think are needed to support the development of the Use Cases in your scenario work package?

Answer:

6) Regulatory Changes to Support the Future Internet

What new regulations, or changes to existing regulation, do you think are needed to support the development of the Future Internet in general?

Answer:

7) Regulatory Changes to Support Smart Energy

What new regulations, or changes to existing regulation, do you think are needed to support the development of Smart Energy in general?

Answer:

8) Policy versus Regulation

Which of the issues that you have identified above might be issues of Policy rather than Regulation? (In general, regulations can be seen as instruments for implementing policy.)

Answer:

9) Standardisation

Standardisation can play an important part in the take-up of new technologies and the development of new markets. What thoughts do you have on the relationship between standardisation and regulation in the context of the Future Internet for Smart Energy?

Answer:

10) Regulatory Issues

Initial research suggests that the following "big picture" regulatory issues are important for the development of the Future Internet for Smart Energy. You are invited to comment on these issues.

10.1) A stable regulatory environment, within a stable policy environment, is likely to be critical for attracting investment for Future Internet and Smart Energy developments. This raises questions of how to balance the tensions between certainty and innovation (in technology and business models, for example).

Agree/Disagree/Comments:

10.2) Responsibilities for developing smart energy/smart grid regulation need to be fully defined, and are in potential danger of falling between the Energy and Communications regulatory environments.

Agree/Disagree/Comments:

10.3) There is a tension between maintaining grid stability and ensuring market openness, which is being particularly debated in Germany.

Agree/Disagree/Comments:

10.4) Policy and regulation can have particular impacts on the following issues:

- Maintaining the balance of energy supply and demand into the future
- New types of market player, and market roles
- Supply chain impacts (Power and ICT supply chains)

Agree/Disagree/Comments:

10.5) The way in which European regulatory rules are applied across Europe varies from country to country. Examples include: the competitiveness of energy retail markets in different countries; and the way different in-country utility regulators view use of utility telecoms assets for generating revenue.

Agree/Disagree/Comments:

11) FINSENY Regulation Presentation

What comments do you have on the content of the overview presentation circulated with this questionnaire? It includes a list of issues that are typically subject to regulation.

Answer:

12) Other Key Issues

What other regulatory issues do you think are important and need to be considered by FINSENY?

Answer:

13) Contacts in your Organisation

Please give the name and contact details of people in your organisation, if any, who would be willing and able to provide further input to the FINSENY task on regulation, if required, in the following areas:

13.1) EU regulatory frameworks for Energy

Name and Contact:

13.2) EU regulatory frameworks for Communications (including Future Internet)

Name and Contact:

13.3) Germany energy regulation

Name and Contact:

13.4) Germany communications regulation

Name and Contact:

13.5) Spain energy regulation

Name and Contact:

13.6) Spain communications regulation

Name and Contact:

13.7) UK energy regulation

Name and Contact:

13.8) UK communications regulation

Name and Contact:

13.9) Romania[1] energy regulation

Name and Contact:

13.10) Romania communications regulation

Name and Contact:

14) Recent Developments

What news have you heard recently that you think could be relevant for this study?

Answer:

15) Final Report

What do you hope to learn from the final report D1.7, and what would you like to see included as part of that report?

Answer:

16) Any Other Comments?

Answer:

Thank you very much for your time.

[1] On the basis of feedback from FINSENY partners to this questionnaire, it was decided to develop a country profile for Poland instead of Romania.