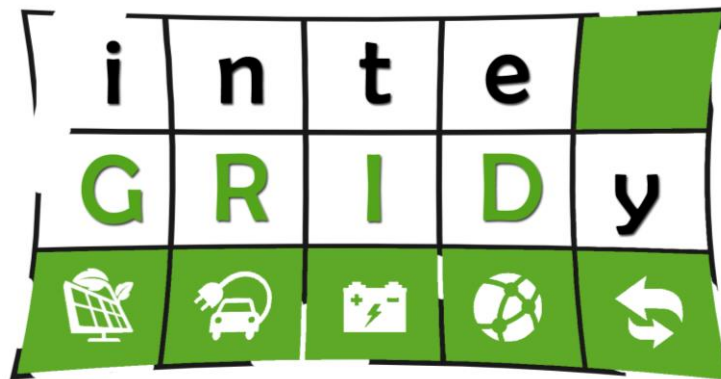


## Innovation Action



# inteGRIDy

integrated Smart GRID Cross-Functional Solutions for  
Optimized Synergetic Energy Distribution, Utilization  
& Storage Technologies

**H2020 Grant Agreement Number: 731268**

**WP2.Standardization Analysis, Regulations &  
Privacy Policy**

**D2.5 Smart Grid Deployment,  
Infrastructures & Industrial Policy  
applicable to the inteGRIDy pilot cases**

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## Executive Summary

The European Commission (EC) monitors EU Member States progress on smart metering roll out. Recommendation 2012/148/EU provides step-by-step guidelines for Member States on how to conduct cost-benefit analysis, sets common minimum functionalities of smart metering systems, addresses data protection and security issues and recommends an 80% target for smart meter diffusion before 2020. EC expects a 72% diffusion rate of smart metering by 2020.

The document is structured in two main parts one considering the smart meter roll-out across EU-28 and the other one detailing the smart meter architecture considering component, communication, information, function and the commercial viewpoint.

The analytical framework consists of a multi-perspective approach including the following: desktop research, pilot country survey, literature review, traffic light method, Smart Grid Architecture Model layers and Computer integrated manufacturing architecture levels.

The perspective of this report is broad and draws attention to the lack of consistent information and transparency considering smart meter devices installed across EU-28.

The document provides an EU-28 overview of the smart meter roll-out implementation progress, a list of deployed smart meters and their most relevant characteristics, communication standards, applicable industrial policies, degree of interoperability, functionalities and consumer benefits.

The results of the research on EU-28 smart metering progress in 2017 are consolidated using the traffic light method. The following parameters have been used to categorize smart meter roll-out in member states:

- Percentage coverage with smart meters in mid-2017;
- Prognosis for 2020;
- Assumed targets;
- Reported results of each EU member states to EC;
- Outcome of PESTLE analysis performed for pilot countries in a previous deliverable of inteGRIDy project.

An in-depth analysis of smart meter functionalities, standards and interfaces to infrastructure and other network platforms identifies consumer benefits that could encourage interest in energy saving and demand flexibility actions.

The report describes smart metering configurations and implementation progress in EU Member States and maps their level of compliance in terms of interoperability, functionalities and consumer benefits.

The assessment of deployed smart metering solutions across EU-28 supports the development of an inteGRIDy-like platform and defines a suitable framework in terms of technical constraints and market service demand.

Information gathered from different pilots suggests the possibility of increasing the level of interoperability across Internal European Market (IEM). The outcome collected mainly from pilot countries creates a relevant basis for the design of inteGRIDy solution and supports its interoperability with other components / operation of the energy system. The degree of interoperability influenced mainly by the communication standards/protocols, data formats, interfaces and parameter semantics. It is worth mentioning that at physical level all smart meters should be interoperable with the rest of the grid components and the rest of the factors may be covered by software updates (application layer).

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## List of Acronyms and Abbreviations

| Term      | Description   |
|-----------|---|
| ACER      | Agency for the Cooperation of Energy Regulators   |
| AEEG      | Autorità per l'Energia Elettrica e il Gas, Italy, <a href="http://www.autorita.energia.it">www.autorita.energia.it</a>  |
| AGEN-RS   | Javna Agencija Republike Slovenije za energijo / Energy Agency of the Republic of Slovenia, <a href="http://www.agen-rs.si">www.agen-rs.si</a>  |
| AMI       | Advanced Metering Infrastructure  |
| AMR       | Automated Meter Reading   |
| ANRE      | Autoritatea Nationala de Reglementare in Domeniul Energiei, Romania, <a href="http://www.anre.ro">www.anre.ro</a>   |
| ANSI      | American National Standard Institute  |
| APDU      | Application Protocol Data Unit  |
| AT        | Austria   |
| BE        | Belgium   |
| BG        | Bulgaria  |
| BNetzA    | Bundesnetzagentur - Federal Network Agency for Electricity, Gas, Telecommunications, Posts and Railway, Germany, <a href="http://www.bundesnetzagentur.de">www.bundesnetzagentur.de</a> |
| BPL       | Broadband over Power Lines  |
| CBA       | Cost Benefit Analysis   |
| CCAPI     | Control Centre Application Programming Interface  |
| CEN       | Comité Européen de Normalisation.   |
| CENELEC   | Comité Européen de Normalisation Electrotechnique   |
| CER       | Commission for Energy Regulation, Ireland, <a href="http://www.cer.ie">www.cer.ie</a>   |
| CERA      | Cyprus Energy Regulatory Authority, <a href="http://www.cera.org.cy">www.cera.org.cy</a>  |
| CIM       | Common Information Model  |
| CNE       | La Comisión Nacional de Energía / National Energy Commission, Spain, <a href="http://www.cne.es">www.cne.es</a>   |
| CRE       | Commission de Régulation de l'Energie, France, <a href="http://www.cre.fr">www.cre.fr</a>   |
| CY        | Cyprus  |
| CZ        | Czech Republic  |
| CREG      | Commission pour la Régulation de l'Electricité et du Gaz Belgium, <a href="http://www.creg.be">www.creg.be</a>  |
| DE        | Germany   |
| DERA      | Energitilsynet - Danish Energy Regulatory Authority, <a href="http://www.dera.dk">www.dera.dk</a>   |
| DK        | Denmark   |
| EE        | Estonia   |
| DMS       | Distribution Management System  |
| DSL       | Digital subscriber line   |
| DSO       | Distribution System Operator  |
| ECA       | Konkurentsiamet - Estonian Competition Authority - Energy Regulatory Dept., <a href="http://www.konkurentsiamet.ee">www.konkurentsiamet.ee</a>  |
| E-Control | Energie-Control Austria, <a href="http://www.e-control.at">www.e-control.at</a>   |
| EI        | Energimarknadsinspektionen / Energy Markets Inspectorate, Sweden, <a href="http://www.ei.se">www.ei.se</a>  |
| EMV       | Energiamarkkinavirasto - The Energy Market Authority, Finland, <a href="http://www.energiamarkkinavirasto.fi">www.energiamarkkinavirasto.fi</a>   |
| ENTSO     | European Networks for Transmission System Operators (ENTSO)   |
| EPRI      | Electric Power Research Institute   |

|           |   |
|-----------|---|
| ERÚ - ERO | Energetický Regulační Úřad - Energy Regulatory Office, Czech Republic, <a href="http://www.eru.cz">www.eru.cz</a>   |
| ERSE      | Entidade Reguladora dos Serviços Energéticos / Energy Services Regulatory Authority, Portugal, <a href="http://www.erse.pt">www.erse.pt</a>                         |
| EC        | European Commission   |
| ES        | Spain   |
| ESMIG     | European Smart Metering Industry Group (ESMIG)  |
| ETSI      | European Telecommunications Standard Institute  |
| EU        | European Union  |
| EVN       | Energieversorgung Niederösterreich)   |
| FI        | Finland   |
| FR        | France  |
| GPRS      | General Packet Radio Service  |
| GR        | Greece  |
| GSM       | Global System for Mobile  |
| HERA      | Croatian Energy Regulatory Agency, <a href="http://www.hera.hr">www.hera.hr</a>   |
| HR        | Croatia   |
| HU        | Hungary   |
| IE        | Ireland   |
| IEDs.     | Intelligent Electronic Devices  |
| IEM       | Internal European Market  |
| IETF      | Internet Engineering Task Force   |
| ILR       | Institut Luxembourgeois de Régulation, <a href="http://www.ilr.lu">www.ilr.lu</a>   |
| LT        | Lithuania   |
| LTE       | Long-Term Evolution   |
| LU        | Luxembourg  |
| LV        | Latvia  |
| MAC       | Medium Access Control   |
| MEH / HEO | Magyar Energia Hivatal / Hungarian Energy Office, <a href="http://www.eh.gov.hu">www.eh.gov.hu</a>  |
| M&M       | Meters & More   |
| MRA       | Malta Resources Authority, <a href="http://www.mra.org.mt">www.mra.org.mt</a>   |
| MT        | Malta   |
| NCC       | Valstybinė kainų ir energetikos kontrolės komisija / National Control Commission for Prices and Energy, Lithuania, <a href="http://www.regula.lt">www.regula.lt</a> |
| NL        | The Netherlands   |
| NMa       | Dutch Office of Energy Regulation / Nederlandse Mededingingsautoriteit, <a href="http://www.dte.nl">www.dte.nl</a>  |
| NSMP      | National Smart Metering Programme   |
| NVE       | Norges vassdrags- og energidirektorat / Norwegian Water Resources and Energy Directorate, <a href="http://www.nve.no">www.nve.no</a>                                |
| Ofgem     | Office of Gas and Electricity Markets, UK, <a href="http://www.ofgem.gov.uk">www.ofgem.gov.uk</a>   |
| OFDM      | Orthogonal Frequency-Division Multiplexing  |
| OBIS      | Object Identification System  |
| OSGP      | Open Smart Grid Protocol  |
| PAE / RAE | Ρυθμιστική Αρχή Ενέργειας / Regulatory Authority for Energy, Greece, <a href="http://www.rae.gr">www.rae.gr</a>   |
| PHY       | Physical  |





|             |   |
|-------------|---|
| PL          | Poland  |
| PLC         | Power Line Communication  |
| PRIME       | PRIME stands for Power line Related Intelligent Metering Evolution  |
| PT          | Portugal  |
| PUC         | Sabiedrisko pakalpojumu regulēšanas komisija/Public Utilities Commission, Latvia, <a href="http://www.sprk.gov.lv">www.sprk.gov.lv</a>          |
| RO          | Romania   |
| RF          | Radio Frequency   |
| SCADA       | Supervisory Control and Data Acquisition  |
| SDO         | Standards Developing Organizations (SDO)  |
| SEWRC       | State Energy & Water Regulatory Commission Bulgaria, <a href="http://www.dker.bg">www.dker.bg</a>   |
| SGAM        | Smart Grid Architecture Model   |
| SE          | Sweden  |
| SI          | Slovenia  |
| SK          | Slovakia  |
| SMCG        | Smart Meter Coordination Group  |
| UK          | United Kingdom  |
| URE / ERO   | Urząd Regulacji Energetyki / The Energy Regulatory Office of Poland, <a href="http://www.ure.gov.pl">www.ure.gov.pl</a>                         |
| URSO - RONI | Úrad pre reguláciu sieťových odvetví / Regulatory Office for Network Industries, Slovakia, <a href="http://www.urso.gov.sk">www.urso.gov.sk</a> |

## 1.Introduction

### 1.1 Scope and objectives of the deliverable

The scope of this deliverable is to assess the interoperability of smart meters that are being rolled out across the EU to comply with the European Commission Recommendation 2012/148/EU [EUC12] on applicable industrial policies and the European Commission (EC) requirement for consumers benefiting from smart metering. An in-depth analysis of smart meter functionalities, standards and interfaces to infrastructure and other network platforms is performed to identify consumer benefits that could encourage interest in energy saving and demand flexibility actions. In the energy sector achieving the EU's internal market requires: the removal of obstacles and trade barriers; the leveling of tax and pricing policies and the adoption of a set of norms and standards; and environmental and safety regulations. [DAG17]. The document provides an EU-28 overview of the smart meter roll-out implementation progress, a list of deployed smart meters and their most relevant characteristics, communication standards, applicable industrial policies, degree of interoperability, functionalities and consumer benefits.

### 1.2 Structure of the deliverable

The document is structured in two main parts one considering the smart meter roll-out across EU-28 and the other one detailing the smart meter architectures considering component, communication, information, function and commercial perspectives.

The analytical framework is described in **Chapter 2** and consists of a desktop research on the progress of EU-28 smart meter deployment and a pilot survey to assess the smart metering technical solutions installed across EU-28. **Chapter 3** uses the traffic light approach to illustrate the **progress and / or existence** of a smart meter national deployment strategy in. **Chapter 4** provides an in-depth analysis of the smart meters that are being rolled-out across Europe. Using the Smart Grid Architecture Model (SGAM) five (5) layers (component, communication, information, function and business) are analysed in order to identify the degree of interoperability between the components included EU-28 smart-meter pilots.

The last chapter provides the conclusions of this report and formulates recommendations for a smooth deployment of ongoing smart-meter roll-outs.

### 1.3 Relation to Other Tasks and Deliverables

Figure 1, below, outlines the relations between this deliverable and other deliverables within Standardization Analysis, Regulations & Privacy Policy activities.



**Figure 1. Relation between deliverables in Standardization Analysis, Regulations & Privacy Policy activities.**

The inteGRIDy Cross Modular Platform interfaces are approached in D 4.1, while, D2.5 only approaches available interfaces and their role in smart metering solutions. The outcomes of this deliverable will be used as a basis for D4.1. inteGRIDy Integration & interconnection Plan and Report.

## 2. Analytical framework

The analytical framework uses the following methods and perspectives:

- Desktop research
- Pilot country survey
- Literature review
- Traffic light method
- SGAM interoperability perspectives including smart meter compatibility level based on TC65/290/DC [IEC02]

Progress on EU-28 smart meter deployment, legal and regulatory status, deployment strategy, communication technologies and smart meter solutions is assessed. The data on each EU member state are consolidated in **Annex 1. EU-28 smart metering systems roll-out status**.

A **visual traffic light map shows** the national progress on smart meter deployment across Europe:

- Red: small or no progress with roll-out
- Yellow – ongoing, good progress,
- Green – full roll-out, Priority road
- *\*Exceptions*

Exploring the SGAM architectural perspective [CEN14], the report uses its 5 specific layers to identify the degree of interoperability of the smart meter devices installed across EU-28 with a particular focus on inteGRIDy pilot countries.

- **Component Layer.** Smart meters deployment and their relevant characteristics are analyzed to identify their degree of compatibility according to TC65/290/DC and their role/place among the other network components of a smart grid. The consolidated data (**Annex 2 - List of identified smart meters deployed across EU-28**) is used to define typologies of smart meters compatible with interoperability levels.
- **Communication Layer** – interfaces (H1, H2, H3) according to Mandate 441 [EUC09], communication standards. H1 is a simple uni-directional interface on the meter at customer premises for interconnection of for example a home display with a high refreshment rate. H2 and H3 are bi-directional, more intelligent interfaces with the meter or NNAP. Might be included as an internal function of the meter or data concentrator, or in a modem, communication hub or gateway separate from the meter. [TSK15]
- **Information Layer** – data type, type of measurements
- **Function Layer** - Functionalities based on EC Recommendation on the roll-out of smart metering systems (2012/148/EU) [EUC12] and optional functionalities based on Mandate 441 [EUC09]. The consolidated data (**Annex 3 - Smart meter functionalities assessment based on COMMISSION RECOMMENDATION of 9 March 2012 on preparations for the roll-out of smart metering systems (2012/148/EU)** [EUC12] is used to identify those countries/functionalities rejected or not implemented.
- **Business Layer** – assess potential incentives and existence of legal framework for incentives, awareness and advocacy actions / initiatives to support energy efficiency and guide consumer behavior)

### 3. Smart metering systems roll-out status across the EU

With the increased number of EU member states and the emergence of new technologies for energy generation and storage, the European Commission had to set up a legal framework for the harmonization and liberalization of the internal energy markets (inclusive of electricity and gas). Thus, through on Article 194<sup>1</sup> of the TFEU [TEU09], the EU initiated Energy Packages to develop a resilient and integrated energy market across the EU. The First Energy Package (1996) proposed common rules for the internal market in electricity and gas. It was updated in 2003 by the Second Energy Package, which enabled new gas and electricity suppliers to enter the market and enabled consumers to choose their own suppliers. The Third Energy Package (2009) further opens up the electricity and gas markets through a secure, competitive and sustainable energy supply. [DAG17].

The legal framework of the Third Energy Package consists of:

- Common Rules for the Internal Market in Electricity (Directive 2009/72/EC) [DEC09]
- Common Rules for the Internal Market for Natural Gas (Directive 2009/73/EC) [DEG09]
- Regulation Establishing an Agency for the Cooperation of Energy Regulators (713/2009/EC) [REC09]
- Regulation on Conditions for Access to the Network for Cross-Border Exchanges in Electricity (714/2009/EC) [REX09]
- Regulation on Conditions for Access to the Natural Gas Transmission Networks (715/2009/EC) [ECD09]

The last Energy Package improves the functioning of the internal energy market, resolving structural problems and covers 5 areas:

- unbundling energy suppliers from network operators
- strengthening regulator independence,
- establishing the Agency for the Cooperation of Energy Regulators (ACER),
- cross-border cooperation between transmission system operators and the creation of European Networks for Transmission System Operators (ENTSO),
- increased transparency in retail markets to benefit consumers.

#### 3.1 Overview of smart meter deployments in EU Member States

Directive 72 [DEC09] adopted in 2009 with the Third energy package presents common rules for the internal market in electricity and all EU member states should have transposed this Directive into national law by 3<sup>rd</sup> of March 2011. Article 2 from Annex 1 of Directive 72 states:

*“Member States shall ensure the implementation of intelligent metering systems that shall assist the active participation of consumers in the electricity supply market. The implementation of those metering systems may be subject to an economic assessment of all the long-term costs and benefits to the market and the individual consumer or which form of intelligent metering is economically reasonable and cost-effective and which timeframe is feasible for their distribution.*

*Such assessment shall take place by 3 September 2012.*

<sup>1</sup> In the context of the establishment and functioning of the internal market and with regard for the need to preserve and improve the environment, Union policy on energy shall aim, in a spirit of solidarity between Member States, to:

- (a) ensure the functioning of the energy market;
- (b) ensure security of energy supply in the Union;
- (c) promote energy efficiency and energy saving and the development of new and renewable forms of energy; and
- (d) promote the interconnection of energy networks.

*Subject to that assessment, Member States or any competent authority they designate shall prepare a timetable with a target of up to 10 years for the implementation of intelligent metering systems. Where roll-out of smart meters is assessed positively, at least 80 % of consumers shall be equipped with intelligent metering systems by 2020.*

*The Member States, or any competent authority they designate, shall ensure the interoperability of those metering systems to be implemented within their territories and shall have due regard to the use of appropriate standards and best practice and the importance of the development of the internal market in electricity” [DEC09]*

The adoption of Directive 2009/72/EC [DEC09] drove commercial and technical initiatives. A Cost Benefit Analysis CBA was commissioned in most EU countries. Based on the results of the CBA each country has to provide a smart metering deployment strategy to achieve a minimum 80% EU recommended penetration rate by 2020. The currently expected EU-28 penetration rate is 72% by 2020. [DAG17]. Large projects like OpenMeter (2009 - partners CEN-CENELEC-ETSI, the main European energy utilities, meter manufacturers, research institutes and universities) assessed the technologies available and provided input for a potential roll-out of smart meters throughout Europe and issued recommendations for standards which are now incorporated in Mandate 441 [EUC09].

Following these initiatives, the EC issued Recommendation 148/2012 [EUC12] which includes a CBA methodology and the minimum requirements for electricity smart meters.

The Recommendations 148/2012 [EUC12] and Mandate 441 [EUC09] are discussed in Chapter 4 of this document.

The inteGRIDy pilot countries were reviewed (Annex 4 Pilot country template) to determine the progress of the smart metering deployment accompanied further research on the countries not involved in the inteGRIDy project (Annex 1, Annex 5 and Annex 6 show the consolidated results of this work)

The research used the following online references:

- European Commission Report (2014) - Benchmarking smart metering deployment in the EU-27 with a focus on electricity [EBR14];
- European Commission Staff Working Document (2014) - Country fiches for electricity smart metering accompanying the document Report from the Commission Benchmarking smart metering deployment in the EU-27 with a focus on electricity [EBA14];
- Commission Staff Working Document Cost-benefit analyses & state of play of smart metering deployment in the EU-27 accompanying the document Report from the Commission Benchmarking smart metering deployment in the EU-27 with a focus on electricity;
- My Smart Energy Website [MSM17];
- Joint Research Center – Smart Electricity Systems and Interoperability, Smart Metering deployment in the European Union [JRC17];
- Institute of Communication & Computer Systems of the National Technical Study on cost benefit analysis of Smart Metering Systems in EU Member States FINAL REPORT / ANNEX: Review of Member State Cost Benefit Analyses (additional material) [NTU15];
- European Smart Grids Task Force Expert Group 1 – Standards and Interoperability (2016) - “My Energy Data” [TSK16];
- European Smart Metering Landscape Report “Utilities and Consumers” [USC16].

The information consolidated is available in Annex 1.

A template was provided for each pilot (Annex 4) to collect specific information about the countries involved in the inteGRIDy project.

- The mandatory CBA results;
- Roll-out strategy decision and roll-out plans;
- Pilot projects deploying smart meters;
- 2017 progress update focusing on the number of SM already installed;
- Electricity market actors (Prosumers, DSOs, pilot).

### Active consumers (prosumers)

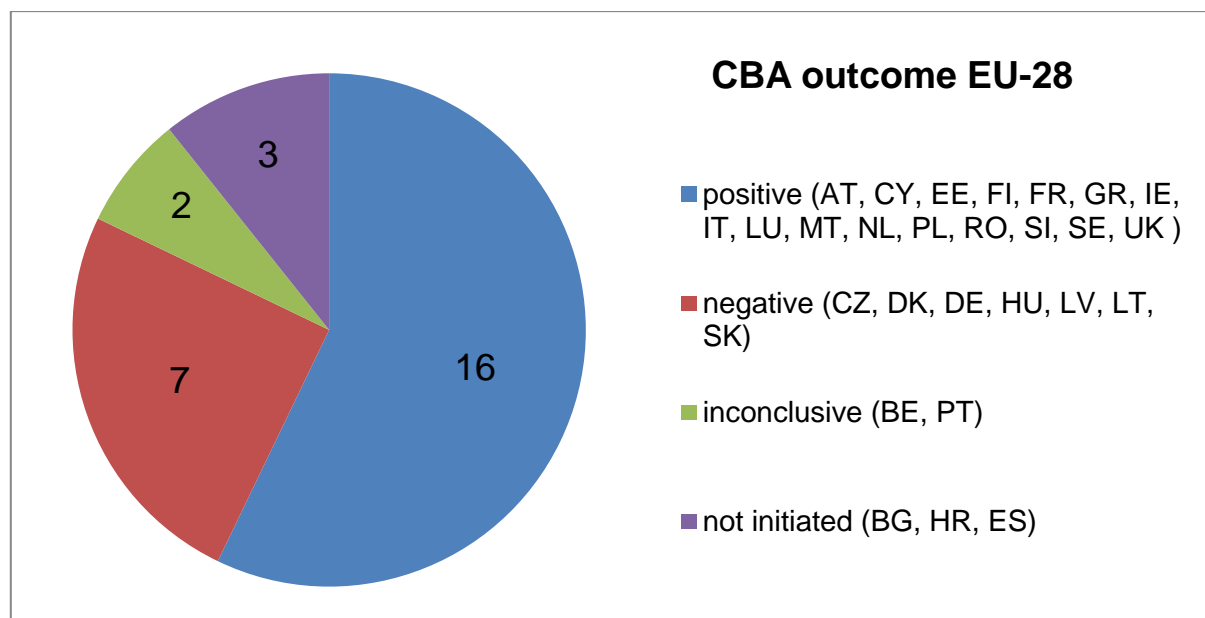
Prosumers are the emerging electricity market actors. Due to their role as both producers and consumers, active consumers may change the electricity system.

Various types of prosumers exist: residential prosumers who produce electricity at home – mainly through solar photovoltaic panels on their rooftops, citizen-led energy cooperatives or housing associations, commercial prosumers whose main business activity is not electricity production, and public institutions like schools or hospitals.

The EU has no specific legislation on prosumers, self-generation or self-consumption, nor a common definition of prosumers. But the Energy Efficiency Directive, the Renewable Energy Directive and Guidelines on State Aid include provisions which relate to small-scale electricity producers. The European Parliament has called for a common operational EU definition of prosumers and for new energy legislation to provide measures for encouraging investment into self-generation capacity. [BRI16]

### 3.2 Progress update per each EU member state

National environment (laws, rules and regulations) caused the EU smart meter roll-out across Europe to accelerate towards the 2020 targets. The first step that EU member states have to take according to Directive 72 / 2009 (in force) [DEC09] is to commission a CBA to assess the feasibility of a smart meter national wide scale roll-out by 2020. Most of the EU-28 countries issued a cost benefit analysis.



**Figure 2. EU - 28 smart meter wide scale roll-out feasibility assessment**

Figure 2, shows that only 3 countries did not undertake a CBA: Bulgaria, Croatia and Spain each for very different reasons:

**Croatia** is a new member of the European Union (joined in July 2013) and plans a CBA shortly. Despite an unclear legal framework, the sole distributor (HEP Group) has initiated some projects to deploy smart meters. Note that the HEP Group is Croatia's single utility



and produces of 89% of domestic electricity and 84.6% of all electricity sold in Croatia. [HEP16]. The Croatian power system is one of the smallest in Europe. Starting June 2013, two new power retailers entered the market offering electricity to customers connected to the distribution network. [EHR14]

**Bulgaria** did not undertake a CBA, has no plans for a nationwide rollout of intelligent metering systems and no legislative or regulatory initiatives. This is not a priority given that in 2013, all three DSOs faced bankruptcy. EVN Bulgaria has signed a deal with ADD Bulgaria in 2016 to deployed around 109,000 smart meters and plans to invest 68 million levs (€34.8 million) over a period of three years to deploy 373,000 smart meters in its service area. [SME17]. In Bulgaria the political factor prevails and all decisions (economic strategy, market trends) are directly affected. EC reported 2014 that Bulgaria requires regulated electricity prices, an independent national regulatory authority and a competitive retail market. [EBG14]

Even though **Spain** did not commission a CBA, the deployment strategy for smart meters is mandatory. The country is proceeding with a full roll-out of electricity metering in compliance with a Royal Decree 1634/2006 [RDE06] stating that by July 1st 2007 the Spanish regulator had to plan for the replacement of all Spanish domestic meters with contracted power lower than 15 kW [ISG17], [EES14]. Spain started the deployment of smart meters (via DSO) in 2011 and aims at a full coverage in 2018. By mid 2017, 77% of the metering points are equipped with smart meters.

#### The outcome of the CBA was inconclusive in Portugal and Belgium.

**Portugal** has no legal framework for a mandatory roll-out, but the largest DSO EDP Distribuição (privatized in 2013 [EPT14] with 99% of market share) decided to deploy smart meters through large pilot projects. Starting in 2007 with InovGrid project, Portugal has 17% coverage of smart metering points by August 2017. Portugal has not committed to the 80% target suggested by EC the ultimate penetration rate achievable by 2020 is unclear.

**Belgium** commissioned region-specific CBAs and the outcome was inconclusive for Flanders, negative for Brussels and had mixed results for Wallonia. Belgium is not legally bound to have 80% smart meters installed in all households and decided not to proceed with the wide-scale roll-out of smart meters in the electricity and gas markets until 2020. [EBE14]

**Sweden and Malta had a positive CBA outcome and opted for a voluntary deployment strategy** (Figure 3, below).

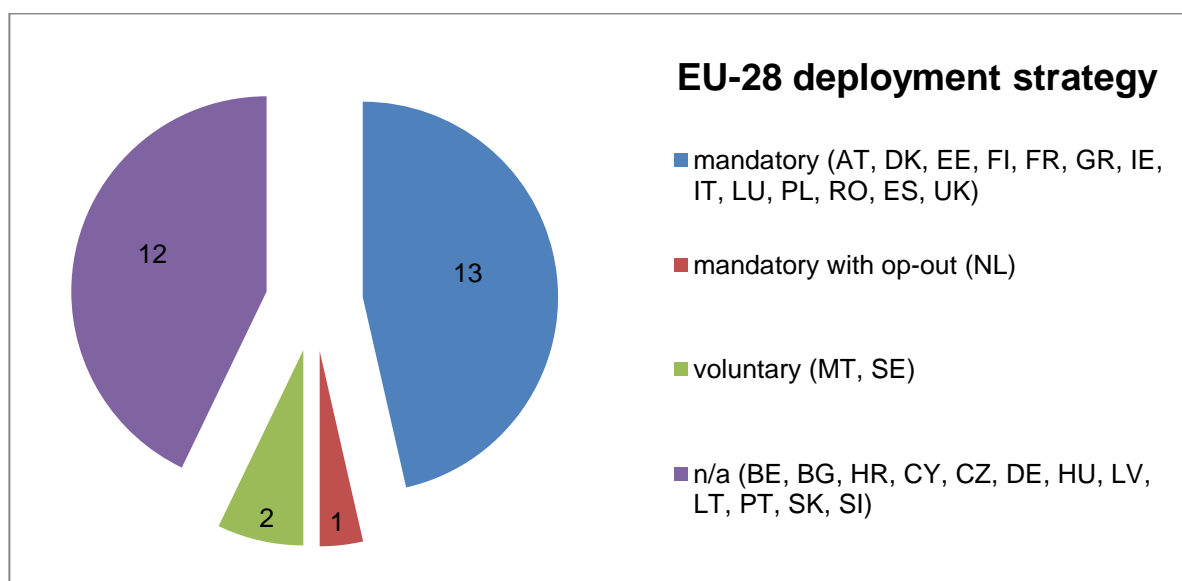
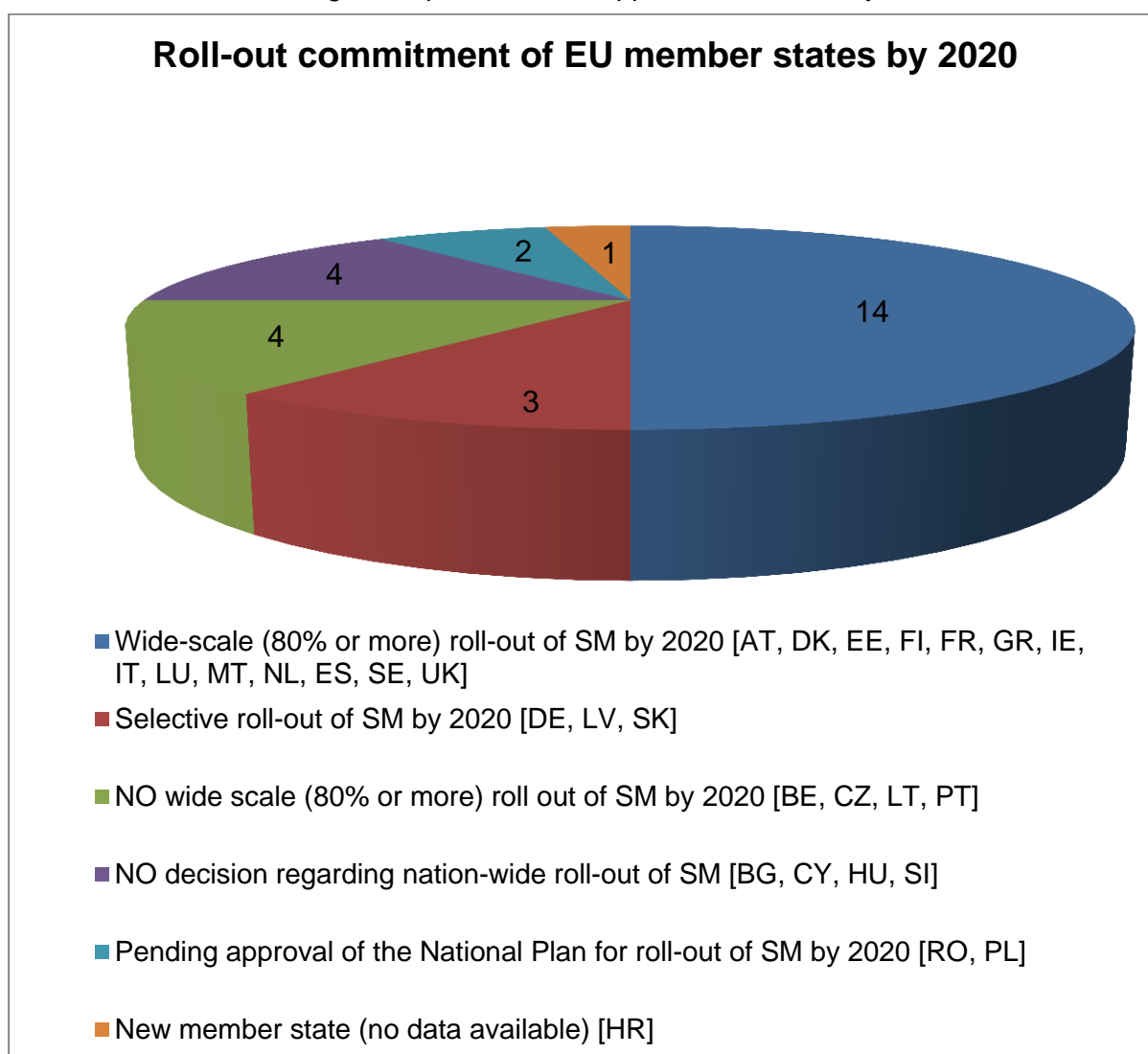


Figure 3. Deployment strategy decision

**Sweden** is the first EU member states to complete a full roll-out of smart meters in 2009 with enabling remote readings. By 2009, Swedish DSOs were obliged to provide monthly meter readings to each household and hourly reading to commercial and industrial customers. [ESE14]. Sweden is also the first country to report customer benefits:

- the Swedish parliament requires all electrical meters to be read at midnight on the first day of each month;
- 90% of all installed smart meters have hourly metering capabilities;
- 30% of installed meters are equipped with Home Area Network port;
- DSOs are switching to hourly priced tariffs.

**Sweden's** current challenge is to persuade all suppliers to offer hourly tariffs.



**Figure 4. 2020 targets EU member states have committed to**

**Malta** deployed smart meters throughout the country between 2009 and 2014. Enemalta is the sole Distribution System Operator (DSO) and energy supplier in Malta. With only one active power station at Delimara, Malta is an exceptional case of an EU member state with no energy competitive market. In 2015 Malta installed a 200MW interconnection with Sicily allowing Malta to integrate with the Italian power market [EUR17]. Malta has now achieved the 10% interconnectivity target set by the EC via COM/2015/082 [COM15]. In 2014, Malta had 90% coverage of smart meters and the missing 10%, (30.000 metering points) only in



closed premises or locations with technical difficulties. It is expected that most of those location is by now equipped with smart meters. [BUT15]

Considering the 2020 target for smart meter deployment (Figure 4), only one country has not started - Croatia as a new EU member state -, 2 countries (Poland and Romania) are pending approval of National Plans for Smart Meter roll-out, 3 countries (Germany, Latvia and Slovakia) opted for a selective roll-out, 4 countries (Bulgaria, Cyprus, Hungary and Slovenia) have not yet decided, 4 countries (Belgium, Czech Republic, Lithuania and Portugal) have not committed to a wide scale roll-out by 2020 due to negative or inconclusive CBAs, while the remaining 14 countries have implemented wide scale roll-outs and with differing rates of progress.

Romania and Poland are waiting on approvals for National Plans for SM wide-scale deployment:

**Romania** has started the deployment of smart meters and has installed 468.410 smart meters by mid-2017 and will attain the 80% target by 2020. Delays are likely as the National Plan of Smart Meter Implementation is awaiting approval from National Regulator. No date for approval has been set. Full market liberalization is due to start on 1<sup>st</sup> of January 2018 and will affect the DSOs plans for the coming months. [ERO14]

Following a positive CBA outcome, **Poland** started working on the Meter Act in 2010 and then dropped it in 2014. A new version was expected in 2016, but no decision has been made. In 2014 the government drafted a schedule for smart meter deployment – with at least 5% penetration achieved in 2015, with final target set for 80% in 2020. It is envisaged that the new Meter Act will introduce a new schedule for meeting the smart meter deployment targets. Since the plans for reaching the 80% target in 2020 are unrealistic it is expected that the target year will be shifted to 2024. [USC16], [EPL14].

Latvia, Slovakia and Germany opted for selective roll-out as the CBAs only yielded positive results for a specific group of consumers.

**Latvia** decided to selectively install smart meters and set a 23% installation achievement by 2020. *"At present smart meters have already been installed at more than 180,000 locations that belong to corporate customers and households. It is planned that altogether 110,000 smart meters will be installed across Latvia this year,"* said Tatjana Smirnova, a spokeswoman for Sadales Tikls. [BCR17]. Latvia was granted derogation from the Third Energy Package as an emergent gas market and it liberalised the electricity market in April 2014. [ELV14]

**Slovakia** set a 23% installation target by 2020 and has made some progress having installed almost 14.000 SM. Slovakia undertook its smart metering CBA in 2013 and decided on a selective smart metering deployment based on the outcome. The project includes supply points with annual consumption of over 4MWh accounting for approximately 23% of the forecast Low Voltage supply points in 2020. In 2015 the government approved a national roll-out plan for selected groups of consumers. [ESK14]

With a negative CBA outcome [EYG13], **Germany** did not committed to a national roll-out strategy and has remained silent in front of the targets assumed by other European Member states. In July 2016 legislation considering kick-start smart meter activity within the country was adopted. The countries' approach is unique and attention must be paid to the details of the deployment strategy selective with a tiered installation schedule. Germany started the roll-out of smart meters in the beginning of 2017. With a competitive market and independent regions, the German Government restrained from a wide scale roll-out plan and let the metering market self regulate, and roll-out progresses naturally. On 8th of July 2016, the new "Digitization of the Energy Turnaround Act" cleared its final legislative hurdle in the German Federal Council (Bundesrat). The new law finally starts the formal roll-out of 'smart meters'

and connected infrastructure in Germany and defines future roles and tasks for all market participants. [EDE14]

### **Belgium, Lithuania, Czech Republic and Portugal decided not to have a wide scale roll-out**

**Lithuania** commissioned a CBA in 2009 and the outcome was negative. The government has decided against widespread deployment. Low electricity prices and low consumption reduces the need for smart meters.

**Czech Republic** commissioned the first CBA in 2012 and planned for a second one in 2017. The outcome of the first CBA was negative and assumed a 26 years period for the roll-out. The Czech Republic has decided not to proceed with a nation-wide roll-out and reported a 1% coverage with smart meters by 2020.

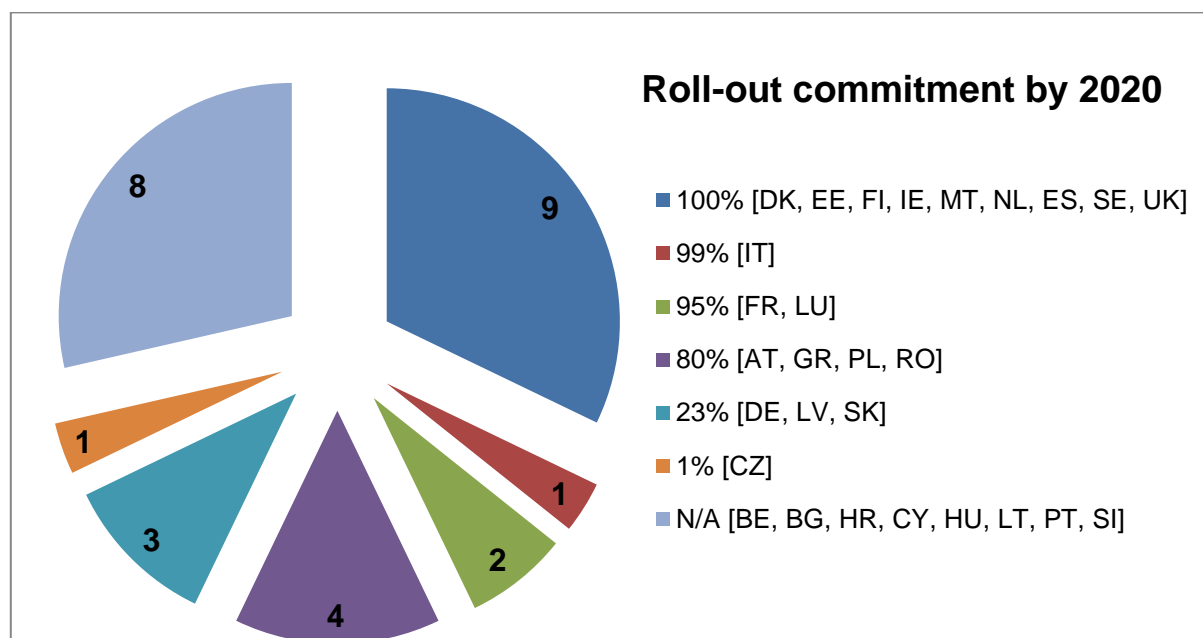
While **Portugal** initiated small roll-outs and reported some progress, **Belgium** remains silent though considering all EU recommendations.

### **Bulgaria, Cyprus, Hungary and Slovenia took no decision regarding nation-wide roll-out of smart meters.**

**Hungary** received a negative outcome of the CBA commissioned in 2010 and did not undertake a wide-scale roll-out.

**Cyprus** commissioned a CBA in 2013 and the outcome was positive. Cyprus has tendered for an MDMS (Metering and Data Management System) capable of handling all the smart meters of the country. Instructions have been given by CERA (the Regulator of Cyprus) to the DSO to draft the tender documents by 31st December 2017. The preliminary decision is for a mass rollout to follow with the target of completing the smart meter installations by 2025.

**Slovenia** has a positive CBA outcome but the government did not put in place legislation for the roll-out of smart meters. Still, the existing legal framework does not exclude the possibility of voluntary roll-outs by distribution network operators (DSOs).



**Figure 5. EU Member States assumed targets of coverage with smart meters until 2020**

The political situation in **Bulgaria** delayed a decision on nation-wide roll-out but they progress towards a 18% smart meter penetration rate in mid-2017.

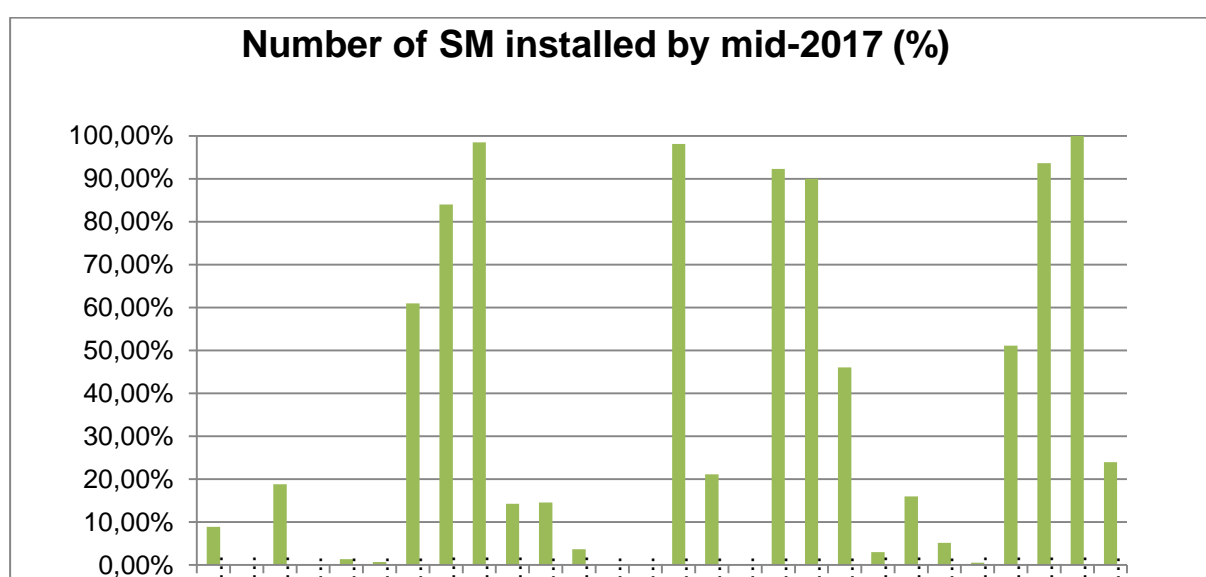
Most of the EU Member States committed to wide-scale roll-out.

As shown in Figure 5, most of the countries committed for a wide-scale roll-out by 2020 and assumed targets, the percentage they intend to cover with smart meters by 2020.

More than half of the EU member states (16) have committed for a large scale roll-out of smart meters and intend to cover at least 80% of the entire number of metering points in their own countries.

By mid-2017, 7 countries have completed the nation-wide roll-out, i.e. they have a minimum of 80% coverage with smart meters: Estonia, Finland, Italy, Sweden, Malta, Spain and Luxembourg.

As shown in Figure 6, below, by mid-2017 the percentage of smart meter installation across EU member states is approximately 45%. The overall EC expected diffusion rate is 72% in 2020.



**Figure 6. EU-28 diffusion of smart meters by mid-2017**

**Finland, Estonia, Sweden, Malta, Spain, Italy and Luxembourg have already performed full roll-outs**

In 2016, **Estonian** DSO Elektrilevi OÜ successfully completed a four-year project. Altogether, in the course of the project 596.000 new SMs were installed (84%).

In **Luxembourg**, two Laws in August 2012 drove the mass roll-out of smart meters. It is expected to reach 95% of electricity consumers by 2018, and 95% of natural gas consumers by 2020. Provisions for the public charging infrastructure of electric vehicles were made to promote their use. Luxmetering G.I.E is the Economic group of interest (G.I.E.) of the 7 luxembourgish gas and electricity DSO's created in 2015.

**Finland** started a wide-scale roll-out in 2013. In January 2016 about 99% of all electricity customers had smart meter installed and the aim of the DSOs is to reach 100% shortly. [EAU17]

**Italy** completed a full roll-out in 2011 and is now working on replacing the smart meters with new generation ones. By the end of 2017, the plan to replace of 1g SMs with 2g devices by e-distribution (PMS2 plan) is envisaged. The target is to install about 35.9 million of new SMs by 2031.

**Sweden, Spain and Malta** are now looking towards consumer benefits as they have completed large scale roll-outs.

## Denmark, Slovenia, France, England and The Netherlands registered consistent progress towards EU2020 smart metering targets

**Denmark** commissioned an update of the CBA in 2013 to evaluate the implementation of 1.38 million metering points. The outcome was positive; Denmark introduced a law in June 2013 and to mandate the full roll-out of smart meters. Denmark started with a voluntary approach (managed by the DSO) switching to a mandatory roll-out through the law [CBA14]. By mid-2017, Denmark has covered over 50% of the metering points and is ahead of the target on reaching 100% diffusion rate by 2020 [EDK14].

**Slovenia** has made a good progress through voluntary roll-outs and by mid-2017 has reached 50% coverage of metering points.

In **France**, Decree number 2010-1022 from 31 August 2010 relating to metering devices on public electricity networks pursuant to the IV of Article 4 of Law No 2000 - 108 of 10 February 2000 on the modernization and development of the public electricity service makes mandatory the implementation of communicating meters by DSOs. By mid-2017 ENEDIS has installed smart meters to 5 million clients (14%) targeting 8 million by the end of 2017 with a speed of 20.000 meters installed each day. As France intends to maintain the same deployment speed and reach over 20% coverage by the end of 2017, their progress may be considered consistent

**The Netherlands** 2013 two year small-scale roll-out programme for smart meters were completed. This programme installed 458,182 smart meters. Following a positive cost-benefit analysis, the Netherlands are proceeding with the large deployment of smart metering and an expected diffusion rate of 100% of consumers by 2020. The Netherlands launched pilot programmes in 2012 and mandated a large-scale roll-out in 2015. Relevant legislation for smart metering is pending Parliamentary approval. [ENL14] A unique situation has arisen in which, following a public debate on data privacy and security, it was decided to allow consumers to refuse a smart meter. The DSO is committed to offering smart meters to all consumers, the consumer can refuse or turn it 'administratively off' (opt-out).[CBA14]

**United Kingdom** is one of the three EU member states alongside Germany and Finland with a competitive metering market (as opposed to a regulated metering market elsewhere). The current expectation in UK is that by the end of 2020, around 53 million smart meters will be fitted in more than 30 million premises (households and businesses) across Wales, Scotland and England. In mid-2017 England had a 24% penetration rate.

The plan is to have different installation phases after the main one started in 2016. The majority of smart meters installed during the main installation phase were supposed to use the second version of the technical specifications SMETS 2, which have technical differences to SMETS 1. The plans stated that the SMETS 1 meters will continue to be installed until 1 August 2016". Then it is expected that the SMETS 2 meters will be installed from February 2017 until the roll-out is complete but it's not sure this is happening yet since it was changed to July 2018. The main advantage of SMETS 2 meters is that they do not lock in a particular supplier; they can be used in 'smart mode' if suppliers are switched. The SMETS 1 meters revert to dumb meters if suppliers are changed. The rollout SMETS 2 meters is dependent on the Data Communications Company (DCC) which supplies the relevant IT infrastructure which was launched at the end of 2016. Significant progress was made during the year of 2017. [DCC17]

Continued regulatory support, and consumer uptake will drive suppliers to integrate updates in technology. It is likely that smart meter deployment will grow after 2020 until the market is saturated in 2022.

There are now over 7.68 million smart and advanced meters (24%) operating across homes and businesses in Great Britain, by both large and small energy suppliers. [GOV17]

## Austria, Greece and Ireland have registered only small progress in deploying smart meters.

According to European Commission reports, **Greece** assumed to replace 80% of meters with smart meters by 2020. This is confirmed by Ministerial Decision published on ΦΕΚ Β' 297/2013 in February of 2013, which stated:

- HEDNO SA to take over the meters replacements
- begin the replacement by July 2014
- complete 40% of meters replacement by June 2017
- complete 80% of meters replacement by December 2020

The pilot project of DEDDIE SA has installed 200,000 smart meters in homes and stores (170,000 mandatory and 30,000 optional). The pilot is now complete. The complete replacement of 7.5 million low - voltage meters will be based on the outcomes from the pilot and is going to cost more than 1 billion Euros.

The **Austrian** electricity market was liberalized in 2001 and the regulator favours smart metering [USC16]. The CBA was positive for smart meters for both electricity and gas. A Ministerial Decree mandated the roll-out of smart meters for electricity customers by the end of 2019 with a specific timetable for implementation. Modification (in 2013) to the Elektrizitätswirtschafts-und-organisationsgesetzes of 2010 makes provision for up to 5% of consumers to decline to have a smart meter installed. [EAT14], [ECO16]

Following a positive CBA outcome, **Ireland** is now in phase 3 of a smart meter implementation program. Ireland completed a thorough process of analysis, engagement and consultation on issues regarding smart meters and updated the 2020 penetration target to 87% (13% of properties are inaccessible and 2% will refuse installation).

Energy suppliers are marketing “smart-pay-as-you-go” as a way of attracting new customers. [USC16]. A small number of smart meters have been installed to date due to delays in procurement and consumer engagement. The Department of Communications Energy and Natural Resources, established Ireland's National Smart Metering Programme (NSMP) in 2007. The aim of the NSMP is to roll out smart meters to all residential customers and the vast majority of SMEs, with the aim of beginning the roll-out in 2018 [CER14].

Some of the circumstances that control smart meter roll-out are as follows:

- Those countries with de-regulated electricity markets plus regulatory support are making the most progress and are likely to achieve the expected 80% penetration rate for smart meters;
- Countries with heavily regulated markets, but with a single utility provider are also making good progress as the utility is under state control and has been ‘ordered’ to do it;
- Lack of government stability and focus in some countries has led to minimal progress.

The results of the Cost Benefit Analysis have been insightful. It is interesting to note that the combination of electricity pricing and demand means that smart meters do not add value.

Consumer support for the process is essential. However note that allowing consumers ‘choice’ does not necessarily result in rapid deployment.

Given the migration towards de-regulated markets, switching electricity suppliers is likely to become increasingly important to consumers. The UK is alone in installing meters with this capability built in. This might cause problems in other countries as consumer choice becomes more important.



### 3.3 EU-28 map (Traffic light method)

The results of the research on EU-28 smart metering progress in 2017 are consolidated using the traffic light method. The following parameters have been used to categorize smart meter roll-out in member states:

- Percentage coverage with smart meters in mid 2017 (**Note:** information sources from National Regulators are incomplete);
- Prognosis for 2020 (EU expected diffusion);
- Assumed targets (EU member states reporting on the smart metering progress in own countries);
- Reported results of each EU member states to EC;
- Outcome of PESTLE analysis performed for pilot countries in the previous deliverable D1.1 - Report on Obstacles & Barriers related to inteGRIDy Framework.

These parameters are consolidated in a 3+1 distribution of the EU member states:

#### Green category

- Presents the EU member states that have fulfilled roll-out of smart meters or are close to complete it;
- Shows those countries with a coherent approach in terms of legislation, political will, stakeholders' involvement, energy market and technological aspects.

#### Yellow category

- Presents the EU member states with consistent progress in smart metering;
- Shows countries where smart meter deployment had a slow start as macro factors such as legislation, political will, market strategies and technological aspects hindered progress; some are still pending approval.

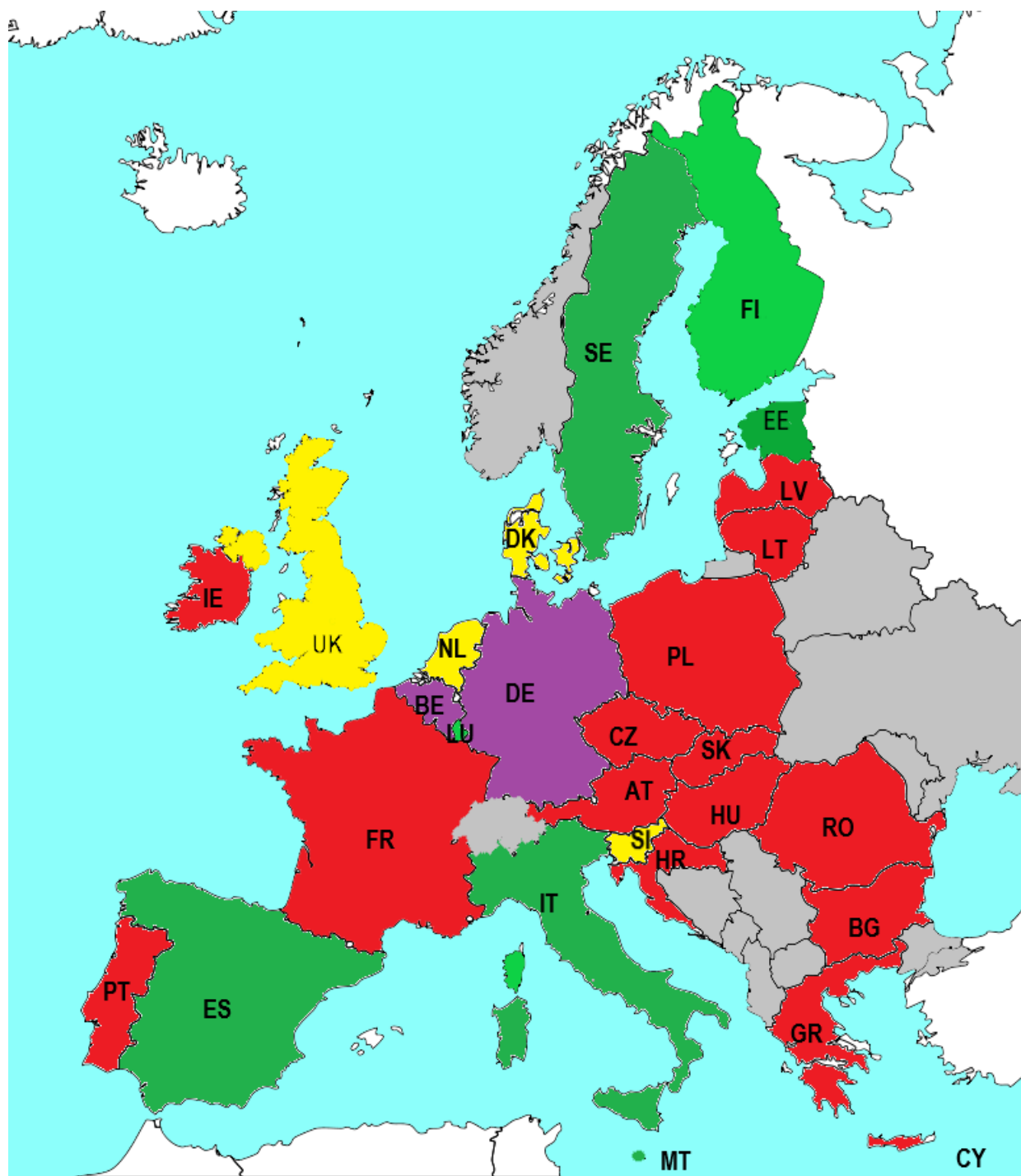
#### Red category

- Presents the EU member states with small or no progress in smart metering;
- Shows countries in which non alignment of political and legislative approach is blocking progress. Consumer resistance (previous political/social experiences opposing measure and monitoring systems) is considerable.

#### +1 category (purple)

- Presents the EU member states with an unpredictable progress and approach of smart metering;
- Shows those countries in which the government took a 'hands-off' position.

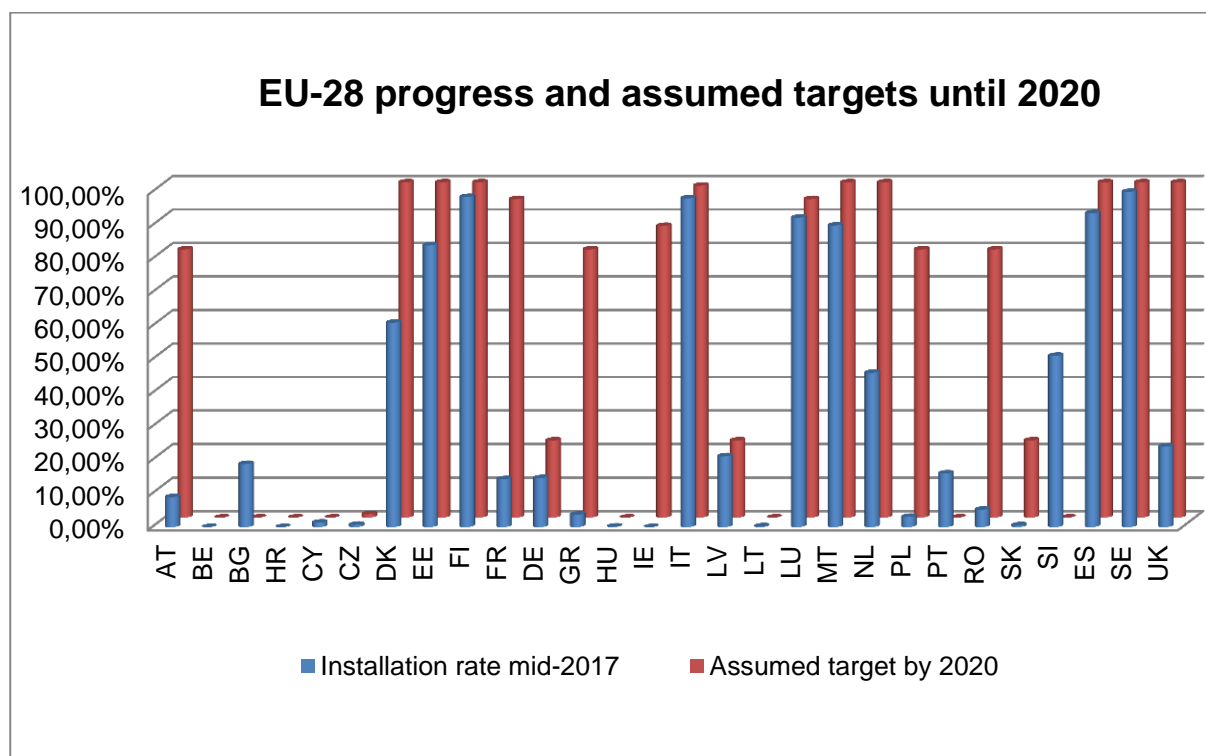
In Figure 7, below, a graphical representation is of SM progress across EU-28 is available.



|  |                      |   |
|--|----------------------|---|
|  | Small or no progress | AT, BG, CY, CZ, FR, GR, HR, HU, IE, LT, LV, PL, PT, RO, SK, |
|  | Consistent progress  | DK, NL, SI, UK  |
|  | Full roll-out        | EE, ES, FI, IT, LU, MT, SE                                  |
|  | Exceptional cases    | BE, DE  |

**Figure 7. EU-28 Smart meter deployment progress**

Considering overall progress, Figure 8, below, most of the countries assuming 100% installation rate of smart meters are most likely to achieve their target except for The Netherlands and UK. The Netherlands has achieved little progress to date and is most likely to miss the target. The process is slowing through lack of consumer engagement and those choosing 'opt-out'. United Kingdom is also facing challenges to replace the old smart meters to meet technical requirements. UK is the first EU member state to consider the ability to change suppliers without changing meters.



**Figure 8. Assumed targets versus actual progress of implementing smart meters**

For countries that have set the 80% target, insufficient progress has been made in most countries. Austria, France, Greece, Ireland, Romania and Poland have deployed in less than 10% of the total metering points and will most likely not meet the target. They are struggling with regulations, political will and social commitment. Of these France is accelerating progress installing 20.000 meters each day and targeting 8 million installations by the end of 2017 (a penetration rate of 14%).

12 out of 28 EU member states committed for smart meters diffusion rate under the EU expected rate (72%) or have not committed at all. Germany, Latvia, Portugal, Slovenia, Belgium and Bulgaria are making good progress considering that these countries have assumed small or no target until 2020.

Slovenia and Belgium are still trying to clarify the legal framework for smart metering but DSOs have started deploying smart meters.

Germany, Portugal and Latvia are approaching 20% installation rate. Germany's competitive market requires stakeholder alignment but has the potential to be the EU leader in smart meter roll-out.

Portugal might surprise the EU smart metering map. They have implemented a number of innovative projects with quantifiable results.

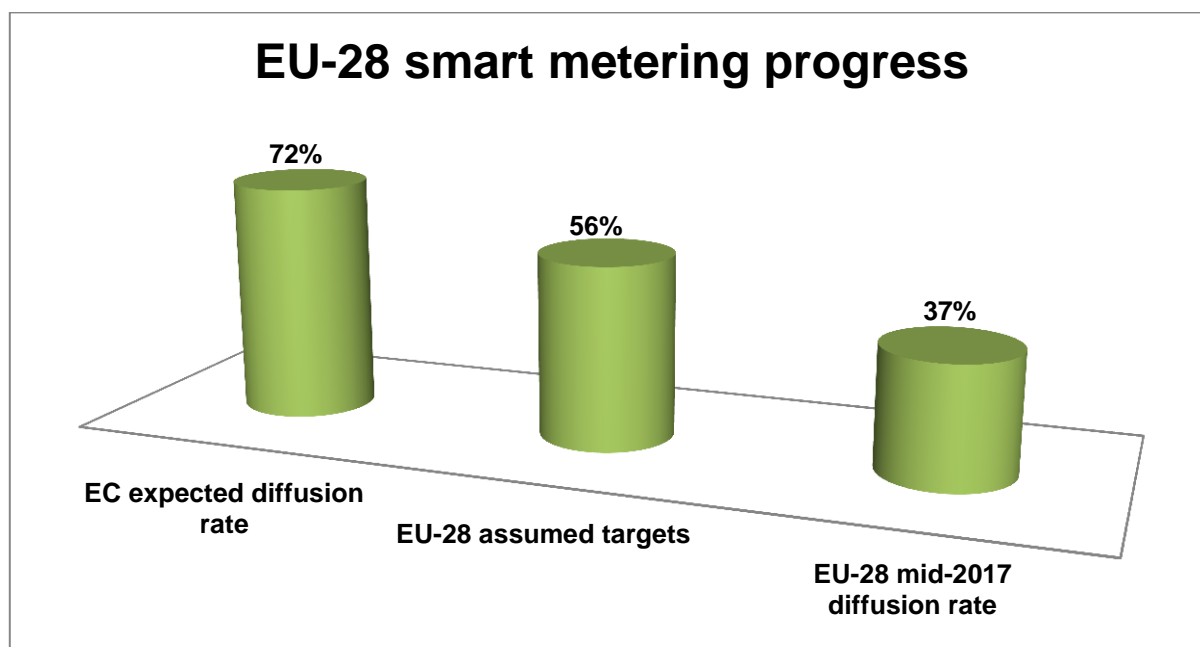
Belgium had an inconclusive CBA is unlikely to speed up smart meter installation.

Bulgaria and Latvia may catch up by 2020.



There is a gap between the EU-28 72% smart meter penetration rate expected by the European Commission and the consolidated target across all EU Member States - 56% (based on assumed targets by EU member states).

EU-28 diffusion of smart meters at mid-2017 is under 40% (Figure 9) and expectations are that the process will speed up with national installation programmes.



**Figure 9. EU-28 smart metering progress, targets and expectations**

Some of the possible causes for this gap are to be found in:

- Late approval of roll-out plans;
- Lack of legal framework in countries that decided to assume the 80% target: Romania and Poland;
- Delays in starting the deployment (latest case Ireland);
- Non-technical setbacks in France (the roll-out strategy was agreed in 2010, but the current roll-out status is one third of the 95% target assumed);
- Political and/or financial instability in Greece and Bulgaria;
- Low targets in a country with large number of metering points - Germany;
- Countries with legal framework and assumed targets but with no significant roll-out: Austria, The Netherlands, Slovakia;
- Countries with different opt-outs regulated options like the Netherlands and Austria.

In conclusion it is likely that the 72% target will not be achieved by 2020. Progress is accelerating in countries with large numbers of metering points (e.g. France and United Kingdom) which have the potential to lift the overall EC penetration rate.

## 4. Smart metering architectural approach based on SGAM interoperability levels

Interoperability is defined as the ease and ability with which different components of a networked system can communicate effectively with each other. Interoperability refers to the ability of two or more devices from the same or different vendors, to exchange information and use that information for correct co-operation [IEC10].

To address the interoperability problem there are multiple on-going initiatives under various Standards Developing Organizations (SDO's) and other Industry user groups. One of the main tasks of these initiatives is to integrate multiple standards from different SDO's and Industry user groups: for example, the work of Internet Engineering Task Force (IETF) on IPv6 for Low Power Personal Area networks, the adaptation layer for IPv6 between RF and PLC networks. Further, the work by IEEE on the 802.15.4 standard [IEE15] has helped this effort greatly, making it the 802.15.4 standard interoperable at the PHY (physical) and MAC (Medium Access Control) layer and expanding adaptation to various country regulations on the spectrum availability.

The European Commission ordered standard organizations to develop a reference architecture to facilitate creating rules for design and analysis of Smart grid solutions. The Smart Grid Architecture Model (SGAM) is a representation of Smart Grid solutions and is popular among Smart Grid stakeholder (utilities and research institutes [CEN12]). SGAM has been developed as part of the reference architecture framework specified in EU Mandate M/490 [CEN14] to European standardization organizations to support the Smart Grid deployment.

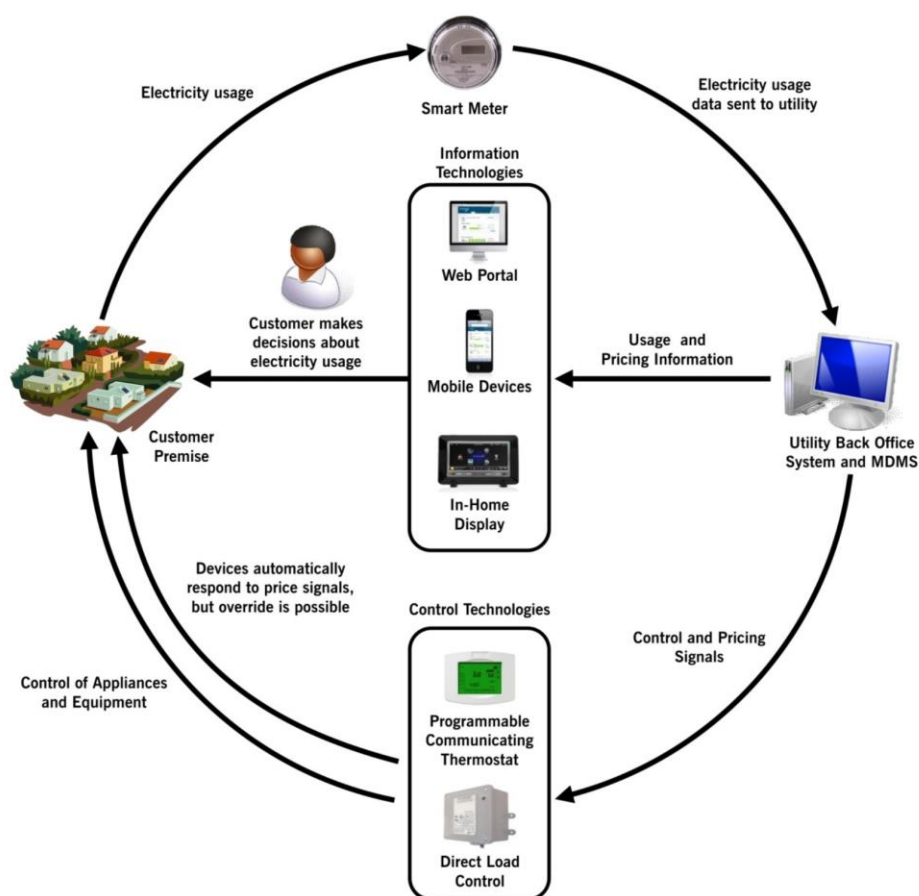


Figure 10. AMI and Customer Technologies and Functions [USE16]

The SGAM defines a set of architecture viewpoints, informal concepts, and a method to map use case information to architectural elements. It provides a structured approach for Smart Grid architecture development. The five interrelated architecture viewpoints, addressing business, functional, information, communication, and component layers are core of the SGAM (see Figure 12).

Extending the scope of the interoperability layers proposed by SGAM we have applied this to interoperability issues related to smart meters. According to a strict layer definition smart meters are only relevant to the Component layer of SGAM. But, taking a broader view, within a Smart grid, all the layers of interoperability are affected by meters. This is the only device sending data to the utility/DSO in an Advanced Metering Infrastructure (AMI) or in a customer system.

Figure 10, above, shows the role of smart metering in improving and supporting the utility and customer technologies and functions. AMI applied to electricity distribution networks exploit smart control and communication technologies to automate metering functions that are typically done manually. These include electricity meter readings, service connection and disconnection, tamper and theft detection, fault and outage identification, and voltage monitoring. AMI also enables utilities to offer new rate options that incentivize customers to reduce peak demand and energy consumption. [USE16]

The European Smart Metering Industry Group (ESMIG) has adopted a set of open standards (originating in the European Commission) to which members' products must comply to ensure interoperability. The Smart Meter Coordination Group (SMCG) that acts on the M/441 mandate [EUC09], defines interoperability as the ability of a system to exchange data with other systems of different types [EUC17].

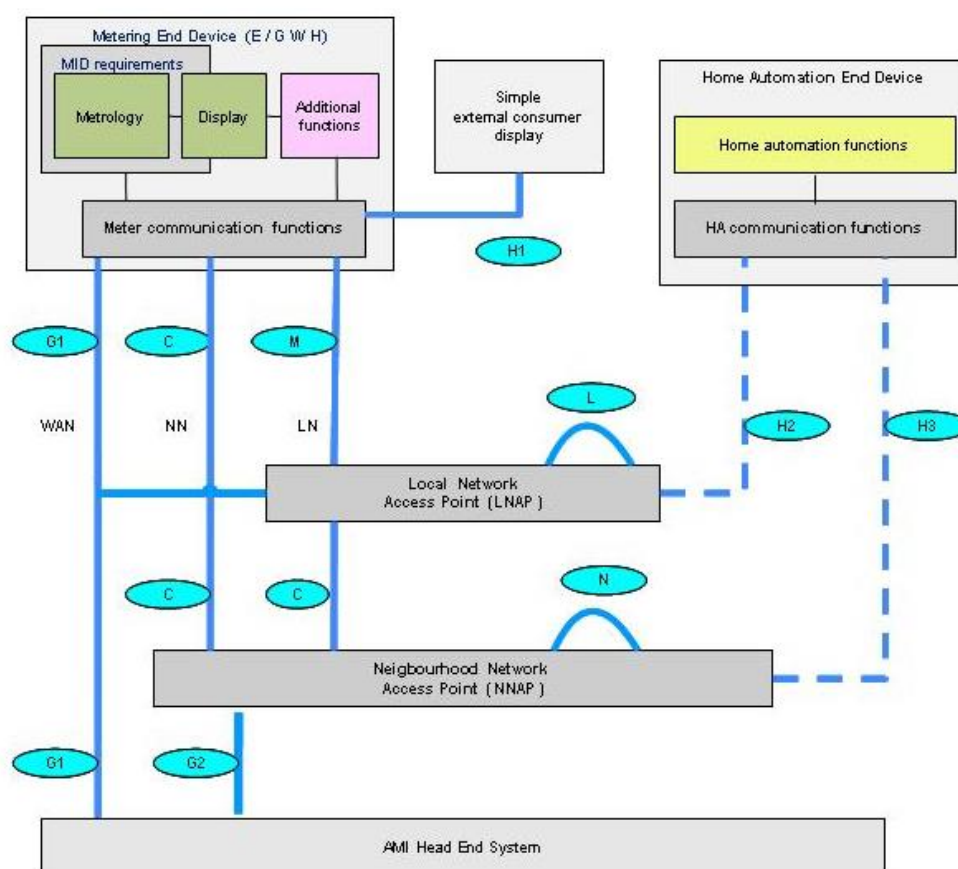


Figure 11 Smart Meter reference architecture [STR17]

In all smart grid topics beyond interoperability aspects, **interchangeability** is the new goal of technical and commercial arrangements and defines the ability to exchange one device with another without reducing the original functionality. To achieve interchangeability, several additional conditions must be met beyond the conditions for interoperability. Interchangeability requires devices to support the same functional behaviour on their communication interfaces or allow changes in functionality to be supported by the relevant communication protocol [STR17]. Thus interchangeability deals with several additional conditions concerning the functional behaviour of devices at their communication interfaces (see Figure 11)

The GWAC (GridWise Architecture Council) [GRD08] has looked at, interoperability between components of the same system, or between different systems and suggests the following required conditions:

- the exchange of meaningful information between devices;
- a shared understanding of the exchanged information;
- a consistent behavior complying with system rules;
- the existence of requisite on the quality of service (reliability, time performance, privacy, and security). These require data consistency, coherence, standardization and quality.

Because the set of standards is a path towards seamless interoperability [CEN12], standardization is required between all layers of interoperability within Smart Grids – communication, information, function and business.

To achieve Smart Grid interoperability requires the use of standards in data acquisition, data exchange, data storage, data model and data behaviour (profiles). One of the reference models which address interoperability based on the architectural approach in Smart Grids is the Smart Grid Reference Architecture (SGAM) [CEN12].

Considering the above-mentioned aspects SGAM model fits better our approach of inteGRIDy interoperability.

Applying the architectural principles and concepts of SGAM [CEN12], the set of standards to be considered for each layer of the inteGRIDy platform as follows:

- Business layer (addressing architectural design compliant with the business model);
- Function layer (addressing data behaviour);
- Information layer (addressing data storage, data model);
- Communication layer (addressing data acquisition, data exchange, data access);
- Component layer (addressing devices, components of the Smart Grid).

The objective of Task 2.4 is to assess *Smart Metering infrastructure* interoperability. A technological approach was used based on specific standards and protocols for interfacing objects within the system.

For *Smart Metering solutions*, the study focussed on the communication layer and information layer of interoperability, addressing, for example, data formats (e.g. XML) for energy usage information and data exchange protocols to facilitate automated data transfer (e.g. PLC).

Communication interoperability uses standards and protocols for data acquisition and data exchange. These are presented in Table 2, below. Most of the analyzed smart meters are compliant with the standards required for interoperability at communications layer.

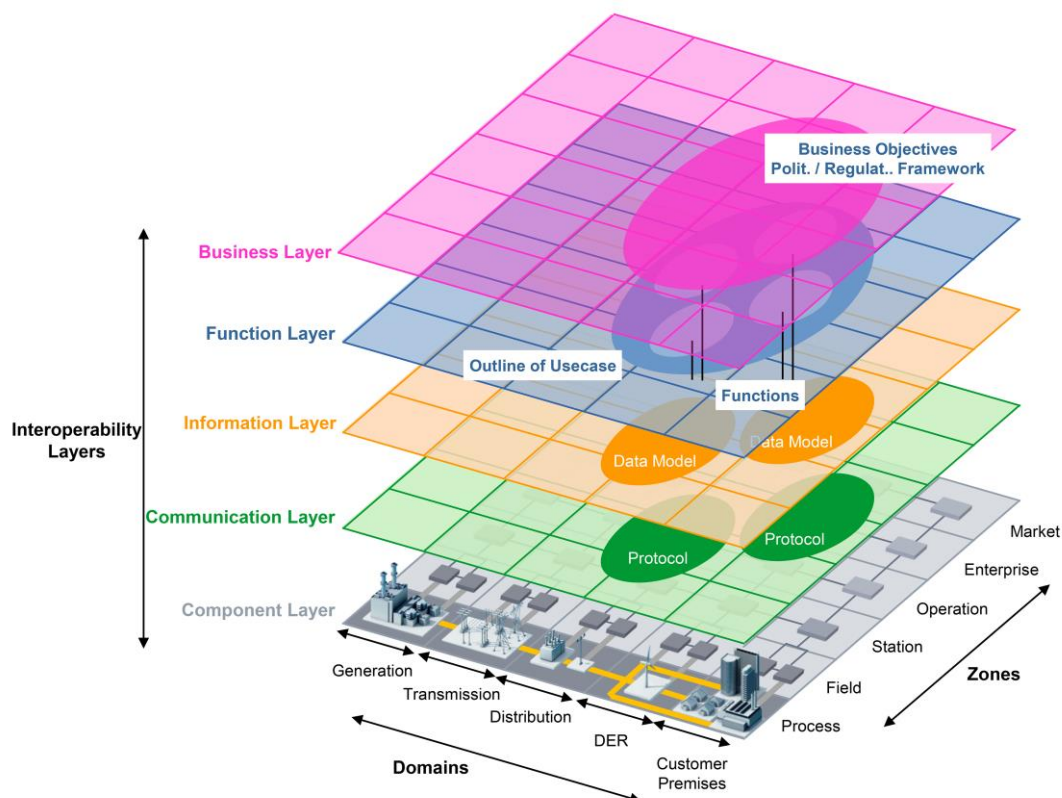
The architectures and functionalities adopted in EU in smart metering applications are briefly summarised briefly in Section 4.1.

This is followed by sections describing each layer of the SGAM interoperability framework [CEN12]: Sections 4.2 and 4.3 present the component and communication layer. The

information, the function and business layers are discussed Section 4.4, 4.5, and respectively 4.6. Finally, in Section 4.7, a qualitative assessment of smart meters and interoperability findings is presented based on the communication protocols and standards of the devices.

#### 4.1 EU Smart metering reference architectures and functionalities

In this section, the interoperability standards and functions applied in EU member states on smart meter architecture are introduced. To ensure interoperability and interchangeability it is important to understand the communication interfaces used by different components. To this purpose, the Smart Grid Reference Architecture framework proposed by CEN-CENELEC-ETSI Smart Grid Coordination Group is presented.



**Figure 12. SGAM Framework – Component reference architecture [CEN12]**

Different Core IEC Standards [IEC17] are applicable to inteGRIDy platform, such as:

- IEC 61970: Common Information Model (CIM)/Energy Management
- IEC 61850: Power Utility Automation
- IEC 61968: Common Information Model (CIM) / Distribution Management
- IEC 62351: Security
- IEC 62056: Data exchange for meter reading, tariff and load control.

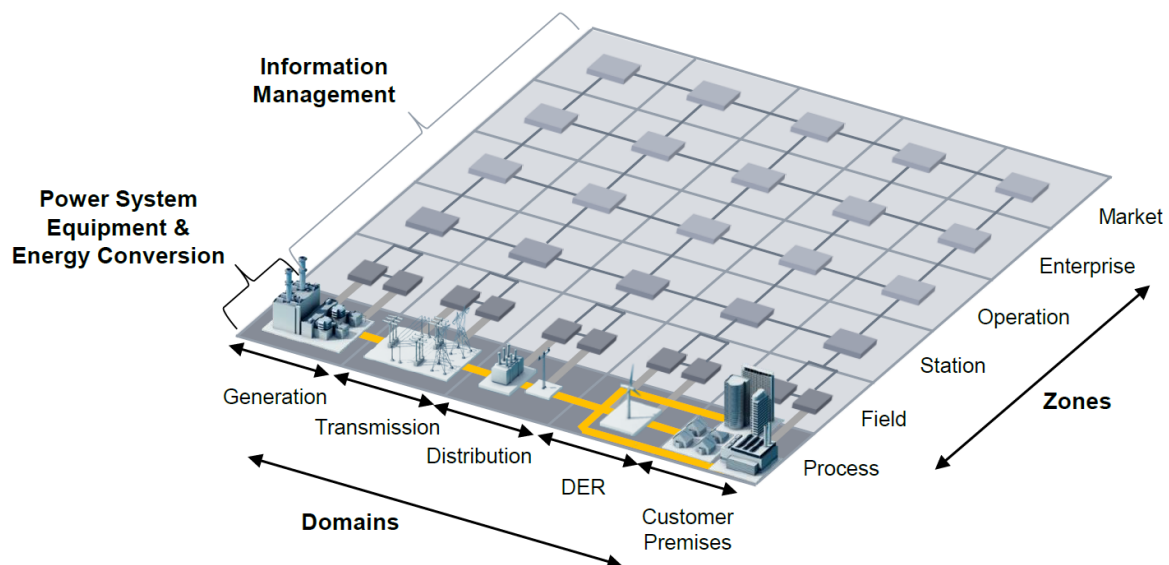
Achieving interoperability requires more than compliance with EU communication standards. ESMIG proposes 2 additional interoperability degrees:

- 1<sup>st</sup> degree interoperability addressing communication;
- 2<sup>nd</sup> degree interoperability addressing application part; specifying what behaviour is expected in both normal and under error conditions;
- CIM - provides a Semantic Layer in an Enterprise Architecture - Smart Grid Standard Maps [IEM17].



A framework to enable standard organisations to continually enhance standards in Smart Grids is developed by CEN-CENELEC-ETSI (a smart grid coordination group) in 2012 [CEN12]. This framework can be used to document smart grid use cases from a technical, business, standards and security point-of-view and identify standards gap.

This framework has three axes as shown in Figure above. The power system equipment and energy conversion axis covers generation, transmission, distribution, distributed energy resources and customer premises. This axis is physically connected through electrical power systems to the second axis. The information management zones which is the corresponding axis to the power system equipment and energy conversion one, includes process, field, station, operation, enterprise and market. The information management zones are a conceptual representation of the groups of actors in Smart Grids. The plan created by the domains and the zones represents the level of power system management interactions.



**Figure 13 Smart Grid plane - domains and hierarchical zones [CEN12]**

The interoperability layers are integrated into a complete framework. As shown in Figure , above, the interoperability layers include a component layer, a communication layer, an information layer, a function layer and a business layer. The component layer includes the physical distribution of all relevant components. The communication layer describes protocols and mechanisms for the exchange of information between components. The information exchanged between functions, services and components is described by the information layer. The function layer describes functions and services including their relationships from an architectural viewpoint. The business layer represents the business perspective on the information exchange related to smart grids.

## 4.2 Component layer

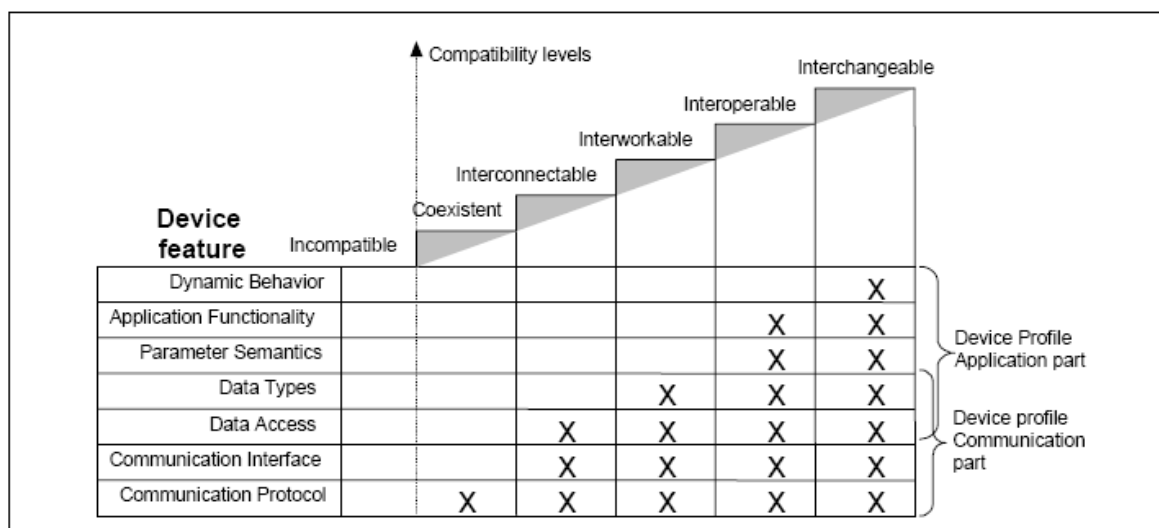
The component layer concerns the physical distribution of components in the smart grid (system actors, applications, power system equipment, protection and remote control devices, network infrastructure and any kind of computers) [CEN12].

Electronic meters can transfer readings remotely and the function is called Automated Meter Reading (AMR). The evolution of AMR is Advanced Metering Infrastructure (AMI) which supports bidirectional communication and is able to implement the management of consumption creating user awareness. The AMI is also known as the Smart Metering System (SMS). In Table 1, below, there is a comparison of AMR and AMI. [GAR17]

**Table 1. Automated Meter Reading and Advanced Metering Infrastructure comparison**

| Technologies            |   |                           |   |
|-------------------------|---|---------------------------|---|
|                         | Manual / AMR                              |                           | AMI/SMS   |
| Power Meter             | Electro-mechanical                        | Electronic                | Electronic/Solid State  |
| Data Collection         | Manual                                    | Drive-by Systems          | Fixed Network Systems   |
| Data Recording          | Monthly                                   | Hourly or more frequently | Hourly or more frequently   |
| Data Transfer           | None                                      | Single way                | Bi-directional  |
| Customer feedback       | Monthly energy consumption                |                           | In-home display, detailed feedback on energy use                                    |
| Bills                   | Monthly bill                              |                           | Pricing Programs  |
| Fault Detection         | Customer contact                          |                           | Automatic   |
| Demand Management       | None                                      |                           | Power, peaks, rebate, load control  |
| Security / Threats      | Meter tampering only                      |                           | Meter tampering, false data injection, cyber security threat, personal data privacy |
| Problems and Challenges | Lack of control and monitoring operations |                           | Transition to new technology and systems, disposal of the old meters                |

In 2002 the International Electrotechnical Commission (IEC) provided a device profile guideline (IEC TC 65/290/DC Figure 14, below) in which smart meters are included. In this guideline, six compatibility levels are defined in Table 2, below, considering the device application and communication features listed in Table 3.

**Figure 14. Levels of compatibility according to TC65/920/DC [IEC02]**

The global providers of smart meters are Landis & Gyr, Itron, Elster and Iskraemeco. All of these companies have backgrounds in electronics. These providers are members of the Interoperable Device Interface Specifications (IDIS). The IDIS association develops, maintains and promotes publicly available technical interoperability specifications, known as 'IDIS specifications', based on open standards and supports their implementation. The association manages, administers and protects the IDIS quality label and supports rigorous interoperability testing to ensure high quality standards. [ID114]

**Table 2. Compatibility levels as defined in IEC TC 65/290/DC**

| Compatibility level | Description   |
|---------------------|---|
| Incompatibility     | Incompatibility is the inability of two or more devices to work together in the same distributed application.   |
| Coexistence         | Coexistence is the ability of two or more devices, regardless of manufacturer, to operate independently of one another at the same communications network, or to operate together using some or all of the same communications protocols, without interfering with the functioning of other devices on the network.   |
| Interconnectability | Interconnectability is the ability of two or more devices, regardless of manufacturer, to operate with one another using the same communication protocols, communication interface.   |
| Interworkability    | Interworkability is the ability of two or more devices, regardless of manufacturer, to support transfer of device parameters between devices having the same communication interface and data types of the application data.  |
| Interoperability    | Interoperability is the ability of two or more devices, regardless of manufacturer, to work together in one or more distributed applications. The application data, their semantic and application related functionality of each device is so defined that, should any device be replaced with a similar one of different manufacture, all distributed applications involving the replaced device will continue to operate as before 65/290A/DC- 14 - the replacement, but with possible different dynamic responses. Interoperability is achieved when both a field device and a system support the same combination of mandatory and optional parts of the same standard. |
| Interchangeability  | Interchangeability is the ability of two or more devices, regardless of manufacturer, to work together in one or more distributed applications using the same communications protocol and interface, with the data and functionality of each device so defined that, if any device is replaced, any distributed applications involving the replaced device will continue to operate as before the replacement, including identical dynamic responses of the distributed applications.   |

#### 4.3 Communication layer (interfaces H1, H2, H3, communication standards)

The communication layer describes protocols for the exchange of information between components from the underlying use case, function or service and related information objects or data models [CEN12].

Communication standards are rules adopted at national or international level that regulate functions in order to allow the communication between devices. (Table 2)

**Table 3. Device application and communication features as defined in IEC TC 65/290/DC**

| Feature                                  | Description  | Examples  |
|--|--|---|
| <b>Device profile Communication part</b> |  |   |
| Communication Protocol                   | This feature is defined by all protocols of layer 1 to 7 of the OSI reference model, i.e. from the physical medium access to the application layer protocol. | <ul style="list-style-type: none"> <li>• DLMS</li> <li>• PLC</li> <li>• RF</li> </ul> |



|  |   |  |
|--|---|--|
| Communication Interface                | This feature is defined by the communication service definition of application layer including the services and the service parameters. Additional mapping mechanisms can be necessary. The dynamic performance of the communication system is part of this feature.  | <ul style="list-style-type: none"> <li>• RS232</li> <li>• RS485</li> </ul>   |
| Data access                            | This feature is defined by the object operation definition or the access parameter attributes of the block data input, data output and parameters   | <ul style="list-style-type: none"> <li>• Data concentrator</li> <li>• storage</li> </ul>   |
| <b>Device profile Application part</b> |   |  |
| Data types                             | The data type of the object attributes or block data input, data output or parameter defines this feature.  | <ul style="list-style-type: none"> <li>• XML</li> <li>• HTML</li> </ul>  |
| Data semantics                         | This feature is defined by the characteristic features (parameter attributes) of the application data this can be data name, data descriptions, the data range, Substitute value of the data, default value, persistence of the data after power loss and deployment. | <ul style="list-style-type: none"> <li>• Application syntax</li> <li>• rules</li> </ul>  |
| Application functionality              | This feature is defined by specifying the dependencies and consistency rules within the Functional Elements. This is done in the data description part or in a separate behaviour section.  | <ul style="list-style-type: none"> <li>• Demand response capability</li> <li>• Application interfaces</li> <li>• Human Machine Interfaces</li> </ul> |
| Dynamic performance                    | This feature is defined by time constraints that influence the data or the general device behaviour. For example, the update rate of a process value can influence block algorithms.  | <ul style="list-style-type: none"> <li>• Demand interval</li> <li>• Fault notification time</li> <li>• Advance tariffs</li> </ul>                    |

With reference to the ISO/OSI, standards can be related to a single layer, as PRIME PLC, or to more layers, as the EN 13757/M-Bus.

Some of the main communication standards for smart metering are described below.

### Power Line Communication (PLC)

Power Line Communication refers to technology that allows the data transmission on existing electric supply cables. The main benefit of PLC technology is the possible use of the existing the electricity distribution grid for all types of generated electricity , reducing costs. More generally, almost all the devices fed by the grid can be controlled and/or monitored.

For the transmission of a small data set over long distances, with the possibility of data corruption “narrow band” power line communication is used. For shorter distances, other transmission systems can be used allowing higher bit rates.

The European body that establishes the frequency range for communication systems on power lines is CENELEC (Committee European de Normalisation Electrotechnique). In case of narrowband PLC the admitted frequency range is 3 - 148,5kHz, divided in four sub-bands depending by the kind of use:

- CENELEC-A 3÷95 kHz: limited to licensed electricity suppliers;

- CENELEC-B 95÷125 kHz: free use, without specific access protocol;
- CENELEC-C 125÷140 kHz: free use, with CSMA/CA access protocol;
- CENELEC-D 140÷148.5 kHz: free use, without specific access protocol, generally used for alarm or security systems.

The main PLC standards are:

#### **Power Line Communication (PLC) IEC 61334**

- IEC 61334 part 5 defines many PLC communication standard. The most common standard is described in the IEC 61334-5-1:2001 Lower layer profiles - The spread frequency shift keying (S-FSK) profile. The S-FSK (Spread Frequency Shift Keying) is used for low speed PLC applications, and represents an expansion of the normal FSK, adding robustness in narrow-band on the usual interferences of the spread spectrum approach.
- The standard IEC 61334-5-1 exploits the S-FSK modulation and uses the frequency range CENELEC-A 3÷95 kHz, with Bit Rate (kbps) 2.4. This standard is suitable for Control and Command applications.

#### **Power Line Communication (PLC) PRIME**

- PRIME stands for Power line Related Intelligent Metering Evolution and defines the lower layers of an Orthogonal Frequency-Division Multiplexing (OFDM) based PLC narrowband system that operates within the CENELEC A-band.
- Raw data rates of up to 130 kbps are possible and an IPv4 convergence layer should allow efficient transfer of TCP/IP traffic. PRIME includes the application profile DLMS/COSEM. This standard is also suitable for Control and Command applications.

#### **Power Line Communication (PLC) G3-PLC**

- G3-PLC is based on the OFDM modulation (Orthogonal Frequency Division Multiplexing) modulation scheme used as a digital multi-carrier modulation method. A large number of closely spaced orthogonal sub-carrier signals are used to carry data on several parallel data streams or channels. G3-PLC has an embedded routing protocol, with a robust mode: priority is given to the security of data transmission. G3-PLC works in the frequency band CENELEC-A. As a result of its embedded IPV6 addressing infrastructure, the G3-PLC standard is compliant with future IoT (Internet of Things) applications. Furthermore, any routing protocol from the Internet Engineering Task Force (IETF) or standardised application layer can be used with G3-PLC. This includes Echonet Lite for home energy management systems (HEMS) in Japan as well as DLMS/COSEM for metering, prepayment standards, and so forth. The G3-PLC allows a data transmission speed of 45 kbps. Also this standard is suitable for Control and Command applications.

#### **Power Line Communication (PLC) Meters and More**

- The open communication protocol Meters and More supports bidirectional data exchange and can be used in Power Line Communication. It uses the B-PSK modulation and includes the DLMS application profile. Meters and More is a specific European technique approved by CENELEC and implemented in Italy by the Italian electrotechnical Committee (CEI). The Meters and More standard is an easy protocol that works in the CENELEC-A band and allows a transmission speed of 4,8 kbit/s. This standard is suitable for Control and Command applications.

Forthcoming PLC communication standards are OSGP and CX1

## Power Line Communication (PLC) OSGP (Open Smart Grid Protocol)

- OSGP (Open Smart Grid Protocol) is proposed by Finland and promoted by ESNA4, a companion specification to EN 14908 PLC using B-PSK PLC and a table oriented data representation similar to ANSI C12.19 (it has been published by ETSI as GS OSG 001, an Industry Group Specification); The Open Smart Grid Protocol (OSGP) is currently deployed in various countries in large-scale Smart Metering projects. The protocol was developed by the OSGP Alliance and published as a standard by the European Telecommunications Standards Institute (ETSI). [GYO11]
- OSGP is targeted at utilities that want a multi-application smart grid infrastructure instead of a basic single function AML. OSGP is not just for meters, it can be applied to a variety of smart grid devices. OSGP was designed to meet present and future advanced networking layer needs. [ETS12]

## Power Line Communication (PLC) CX1

- PLC CX1 is a further standard proposed by Austria. It uses a fast frequency-hopping spread spectrum technique combined with Differential Phase Shift Keying (DPSK) and error-correcting block coding, an adaptive cellular network layer with DLMS/COSEM on top. [GYO11]

The main RF standard is:

## WI-SUN

- Wi-SUN Alliance provides wireless mesh solutions for Field Area Networks for applications such as Advanced Metering Infrastructure and Distribution Automation, and for Home Energy Management. Field Area Network (FAN) specification, aimed at linking smart meters and smart city tech to cloud deployments. [WIS16]

The main radio service (2G up to 5G) is:

## GSM/GPRS

- The GSM (Global System for Mobile communications) is a digital mobile phone standard. In Europe this standard uses frequency bands at 900 MHz and 1800 MHz, with a maximum capacity band of 9.6 kbps which allows the transmission of voice and low size numeric data.
- The GPRS (General Packet Radio Service) standard is an evolution of GSM and sometimes it is called GSM++ or GSM 2+. [ETS17]
- GPRS extends the GSM architecture to allow the transmission of data packets, with possible band capacity of 171.2 kbit/s (in practice up to 114 kbit/s). Thanks to packet-based standard the data transmission uses the network only when it is strongly needed. The GPRS standard allows also charging policies based on the actual size of data exchanged, in addition to the time of connection.
- Evolution of the GSM/GPRS standards is the UMTS (Universal Mobile Telecommunications System) and the more recent LTE, Long Term Evolution.

Other interfaces and protocols are:

## Meter-Bus

- EN 13757 / M-Bus [ENS14]
- EN 13757 (Meter-Bus) is an European standard and uses a reduced OSI layer stack. The EN 13757-3 is about the application layer. The architecture is Master-Slave, with a single Master that controls 250 Slave maximum. The protocol defines first of all the format of the exchanged frames. The first field is called Control Information (CI) and includes, in a defined list, all the possible kind of messages and exchange modes. [MBS97]

The next frame structure and the data typology is defined by the CI. They are messages for data request or answers by the slave devices. Information about typology of meters (power, water, gas, etc.) are codified as well as information about the typology of data, with length and units of measure, information about tariffs etc.

The physical layer is implemented in two ways: serial cable (EN 13757-2) and wireless (EN 13757-4). The transmission system is normally the cable for serial communication e.g. RS232; the transmission speed is codified at 300, 2400 and 9600 bps (different speed can be used on the same network). The bus length must not exceed 4km; however, the combination of relays and amplifiers allows the transmission to reach longer distances. The wireless version WM-Bus specified in EN 13757-4 allows the transmission on a distance until hundreds meters in the frequency band 868 MHz or until hundreds 1-2 km at 169 MHz, with low power consumption (battery endurance declared until 20 years).

## IEC 61850

IEC 61850 is placed at the application layer. [IEC13] All services and models are designed in an abstract form called ACSI (Abstract Communication Service Interface) and thus independent of the underlying medium. ACSI is then mapped to protocols such as MMS2 and TCP/IP over Ethernet. In addition to ACSI, IEC 61850 provides the multicast based GSE (Generic Substation Events), in a way that event data can be transferred quickly over an entire network. Furthermore, part 9-1 and -2 specify a process bus for use with Intelligent Electronic Devices (IEDs). The basic concept of IEC 61850 consists of a hierarchical and object-oriented information model with devices, nodes and classes that can hold different attributes and data. These are self-describing and every vendor is required to publish their extensions. Since January 2009, part 7-420 has been added to IEC 61850 and covers distributed energy sources and storage. It could even be used for V2G (Vehicle to grid) activities. Also of interest is IEC 61400-25, an adaptation of 61850 for wind-turbines.[ABB11]

## 4.4 Information layer (data type and measurements)

As stated in [CEN12], the information layer describes the information that is being used and exchanged between functions, services and components. It contains information objects and the underlying canonical data models (e.g. XML, html). These information objects and canonical data models represent the common semantics for functions and services in order to allow an interoperable information exchange via communication means.

Regarding *Smart Metering solutions*, the actual study was led mainly on communication layer and information layer of interoperability, addressing for instance usual data formats (e.g. XML) for energy usage information and data exchange protocols to facilitate automated data transfer (e.g. PLC).

Two broad categories of data formats/models which may be taken into consideration for the provision of data within the “My Energy Data” [TSK16] initiative are:

- A **human-friendly** format (like CSV/XLS/PDF), that the end user can access to view or download his smart metering data and use with common IT tools (Download My Data service).
- A **machine-friendly** format (like XML/JSON/CSV) that is used to exchange energy data with other 3rd parties (Share My Data service).

The standards that are already used in the Member States for the energy data exchange are:

- CSV format – easy readable by any type of equipment
- JSON - preferred for data transfer to external parties, when more frequent data exchange is required.
- XML - *allowing compatibility of data coming from different network operators (DSOs).*

According to European Smart Grids Task Force Expert Group 1 – Standards and Interoperability [TSK16] stakeholders prefer specific information models:

### **DLMS/COSEM (IEC-62056)**

The DLMS/COSEM format is developed for direct information access from the metering device. DLMS (integrated in IEC 62056) stands for Device Language Message Specification and is an application layer protocol, specifying general concepts for the modelling of object-related services, communication entities and protocols. COSEM is the Companion Specification for Energy Metering. It comprises metering specific objects based on OBIS (Object Identification System) codes for use with (x)DLMS. xDLMS is an extension to DLMS and describes how to access attributes and methods of COSEM objects. COSEM defines a number of standard interface classes, called objects when instantiated, containing attributes and methods to describe some required functionality. An attribute is used to describe the aspects of some data, while methods are used to read or modify it. There are four groups of COSEM interface classes, relating to storage, access control, time and scheduling and communication. Standardized building blocks can be combined to model a metering device in a hierarchical structure, thus allowing the construction of complex metering systems. Two mandatory objects per device regulate access control and identification. When a meter is read, the necessary attributes of certain objects are accessed using a DLMS service and transformed into a series of bytes, called APDUs (Application Protocol Data Units). OBIS naming is used to identify COSEM objects to make them self-describing. A full list of standard OBIS codes and valid combinations of standard values in each group is maintained by the DLMS User Association. To support future functionalities and enable innovation and competition, specific elements such as new OBIS codes, attributes, methods and interface classes are allowed. However, the information on such elements has to be made available by the manufacturer. DLMS/COSEM is based on a client/server structure in which the data collection system acts as a client requesting data from the servers (pull operation), in this case the meters. The communication protocol stack (called a profile) is completely independent of the application layer so servers and clients may independently support one or more communication profiles to communicate over various media. The COSEM model - modelling the application process - and the application layer - making use of this model - remain the same. Future additions will provide push operation (client to server) and more efficient data exchanges by using compression techniques. DLMS/COSEM is positioning itself as the all round contender for smart grid communication.

In the Netherlands the P1 format is derived from the standard, therefore it is easy to understand and to implement, requiring low processing power and memory (minimized number of bytes).

### **CIM (IEC-61968, -61970, -62325)**

CIM is an open standard for representing power system components developed by the Electric Power Research Institute (EPRI) in North America. The standard was developed as part of the IEC TC57 WG13 on developing a Control Centre Application Programming Interface (CCAPI) to provide a common model for describing the components in power systems for use in a common Energy Management System (EMS) Application Programming Interface (API). The format has been adopted by the major EMS vendors to allow the exchange of data between their applications, independent of their internal software architecture or operating platform. The data model itself is language-independent, defining the components of a power system as classes along with the relationships between these classes: inheritance, association and aggregation; and the parameters within each class are also defined. [USG07]

IEC 61970-301:2016 lays down the common information model (CIM), which is an abstract model that represents all the major objects in an electric utility enterprise typically involved in utility operations. By providing a standard way of representing power system resources as



object classes and attributes, along with their relationships, the CIM facilitates the integration of network applications developed independently by different vendors, between entire systems running network applications developed independently, or between a system running network applications and other systems concerned with different aspects of power system operations, such as generation or distribution management.

- This information model is being used for describing electricity systems (generation, transmission, distribution, DER).
- SCADA is modeled to the extent necessary to support power system simulation and inter-control centre communication
- CIM facilitates integration by defining a common language (i.e. semantics) based on the CIM to enable these applications or systems to access public data and exchange information independent of how such information is represented internally.
- The US Green Button standard is basing on CIM descriptions and tags, but is not yet fully compatible with the CIM hierarchical information standard. [IEC16]

#### 4.5 Function layer (functionalities)

The function layer describes functions and services including their relationships from an architectural viewpoint. As defined in [CEN12], functions are represented independent from actors and physical implementations in applications, systems and components. The functions are derived by extracting the use case functionality which is independent from actors.

Within Mandate M/441 [EUC09], CEN, CENELEC and ETSI produced a European standard for communications: the technical report CEN-CLC-ETSI TR 50572:2011 "Functional reference architecture for communications in smart metering systems". The report identifies the functional entities and interfaces that the communications standards should address and it is intended to support the development of software and hardware architectures and related standards. In a second phase, the mandate focused on the development of European Standards containing harmonized solutions for additional functionalities within interoperable frameworks. In 2012, European Commission, through Recommendation of 9 March 2012 (2012/148/EU) [EUC12], provided guidance to Member States on preparations for the roll-out of smart metering systems. The document is organized in four thematic sections, taking into consideration the aspects regarding the customer, the metering operator, the commercial aspects of the energy supply, the security and data protection and distributed generation.

More in detail, the third section of Recommendation provides guidance on measures to be taken to ensure appropriate interoperability and the use of proper standards for smart metering systems currently being developed under Mandates M/441 [EUC09], M/468 [EUC10] and M/490 [CEN14]. To this purpose, a set of common minimum functional requirements for smart metering systems is recommended.

For the customer:

- a) Provide readings directly to the customer and any third party designated by the consumer, possibly in real time and with standardised interfaces which provides accurate, user-friendly and timely readings, in order to running demand response services, taking online energy-saving decisions and effective integration of distributed energy resources.
- b) Update the readings referred to in point (a) frequently enough to allow the information to be used to achieve energy savings (15 minutes at least). If consumers are to rely on the information provided by the system, they need to see the information responding to their action.

For the metering operator:

- c) Allow remote reading of meters by the operator, in order to adapt the network operation to the users' behaviour.

- d) Provide two-way communication between the smart metering system and external networks for maintenance and control of the metering system.
- e) Allow readings to be taken frequently enough for the information to be used for network planning.

For commercial aspects of energy supply:

- f) Support advanced tariff systems, in order to help consumers and network operators to achieve energy efficiencies and save costs by reducing the peaks in energy demand.
- g) Allow remote on/off control of the supply and/or flow or power limitation, aimed to provide additional protection for the consumer by allowing grading in the limitations.

For security and data protection:

- h) Provide secure data communications, concerning both direct communications with the meter and any messages passed via the meter to or from any appliances or controls on the consumer's premises. For local communications within the consumer's premises, both privacy and data protection are required.
- i) Fraud prevention and detection, also with aim to protect the consumer from hacking access.

For distributed generation:

- j) Provide import/export and reactive metering. Most countries are providing the functionalities necessary to allow renewable and local micro-generation, thus future-proofing meter installation. It is recommended that this function should be installed by default and activated/disabled in accordance with the wishes and needs of the consumer.

#### 4.6 Business layer (Consumer benefits)

The business layer represents the business view on the information exchange related to smart grids. SGAM can be used to map regulatory and economic (market) structures and policies, business models, business portfolios (products & services) of market parties involved. Also business capabilities and business processes can be represented in this layer. In this way it supports business executives in decision making related to (new) business models and specific business projects (business case) as well as regulators in defining new market models [CEN12].

Modernization of energy infrastructure (smart grid) is part of the way of life technology is offering to us. Installation of smart meters puts an end to estimation billing providing a real perspective on electricity consumption in "real-time" (most of the deployed smart meters offer reading at 15 minutes interval). Precise consumption measurements, real-time meter data access and anti-fraud detection allow utilities to avoid unnecessary technical losses.

- **Engagement of end-users**

As the consumer has access to detailed own consumption data and to price rates, it becomes aware of the available options to use electrical energy efficiently and maybe to reduce the cost of own invoice. Providing the user with data that create direct connection between own consumption and billing may encourage behavioral change and increase energy efficiency.

End-consumers with access to usage data are able to actively participate in conservation activities. This leads to greater environmental awareness and improves utilities' customer service.

Smart meters equipped with demand response features provide consumer with the possibility to save energy during peak demand events.

- **Policy design for specific consumers**

System monitoring, timely collection of data and understanding consumer patterns makes demand forecasting an easy and transparent step in energy management processes.

- **Sustainability**

State-of-the-art technologies enable reliable and efficient delivery of electrical energy

- **Consumer behaviour**

Forecasting based on consumer behaviour. Accurate and constant data availability leads to environmentally friendly consumer behaviour

#### 4.7 Qualitative assessment based on technical specification of smart meters and interoperability findings

Since 2015, an expert group was set up by the steering committee of the European Smart Grids Task Force to investigate the functionalities, standards and interfaces of the smart meter infrastructures. The investigation is carried out based on a survey among the 17 Member States and concentrates on three aspects: functionalities, interfaces and communication standards [TSK15].

##### Functionalities

The following functionalities are included in this survey

- (a) Direct display of readings to the customers and third party designated by the consumer
- (b) Readings in (a) are updated frequent enough to enable energy savings
- (f) Support advanced tariff systems to enable demand side response

##### Interfaces

The following Interfaces at user level are:

- H1: unidirectional interface on the meter
- H2: bidirectional interfaces between energy management gateway and the smart metering gateway
- H3: bidirectional interfaces between energy management gateway and Neighborhood Network Access Point

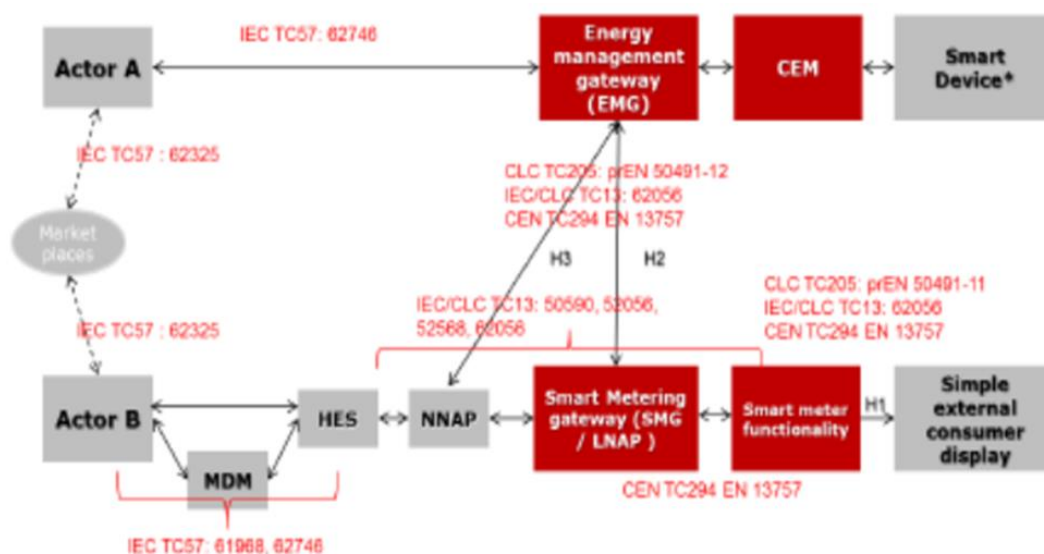


Figure 15. Standardization of the Demand Side Flexibility communications architecture (M/441 and M/490) [TSK15]



H1, H2, H3 interfaces have initially assessed by most EU member states and decisions on implementing them upon customer request were taken, massive roll-out intentions were only for H1 as large scale deployment of all interfaces raised the concern that more interfaces might increase the price of the meter. To overcome this and following economic assessments countries like LV, EE, RO, IT, DK, ES and MT promote a more flexible approach. Some of them indicated to make information available through a website instead of using one of the H interfaces. Moreover, current trend is to substitute H interfaces with dedicated mobile applications [MAR09] (e.g. myENEL, Click Iren, E.ON Energy). Currently running pilot projects validate this approach (e.g. FLEXMETER, eMeter).

EU-28 survey on minimum functionalities approach reveals that most of EU member states comply with the minimum functionalities recommended by the EC. EU member states that reported partial compliance or non-compliance with some of the functionalities have either pending a deployment decision, installed older generation smart meters or face regulatory limitations. The overall status across EU-28 is positive with some particularities detailed below:

- 27 member states (Croatia as a new member state did not provide information until now about smart metering functionalities plans/compliance) have considered implementing function (a). Hungary and Malta partially comply while in Luxembourg the smart meters already installed cannot provide readings directly with the customer. To comply with function (a) Malta considers providing readings through a webpage.
- Frequently enough update readings to implement energy saving algorithms – function (b) – is not implemented in Spain and Bulgaria, while Belgium, Denmark, Estonia, Finland, Italy, Slovenia and Sweden only partially comply as they (except Belgium) have either completed wide scale roll-outs with older generation smart meters, either face low level of energy consumption/prices or they have regulated prices.
- Remote readings by DSO/Supplier (c) and two way communication for maintenance and control purpose (d) are available in all 27 states.
- Frequently readings for network planning (e) are available in 26 member states; only Slovakia reports partial compliance.
- Even though 26 member states (except for Luxemburg) have reported intention or compliance with advance tariffs, some of them do not use function (f) due to the specific tariff systems.
- Remote ON/OFF and/or power limitation – function (g) is available in 23 EU member states. Germany and Luxemburg have no decision while Malta and Sweden reported partial compliance.
- (h) function – secure data communication – is available in 26 member states. Sweden has reported only partial compliance due to the old generation operational smart meters.
- Fraud prevention / detection (i) is partially available in Malta and there is no information available for Luxemburg.
- (j) – import / export and reactive metering function is not available in Hungary, is partially available in Bulgaria, Slovakia and Slovenia, while Luxemburg provided no data.

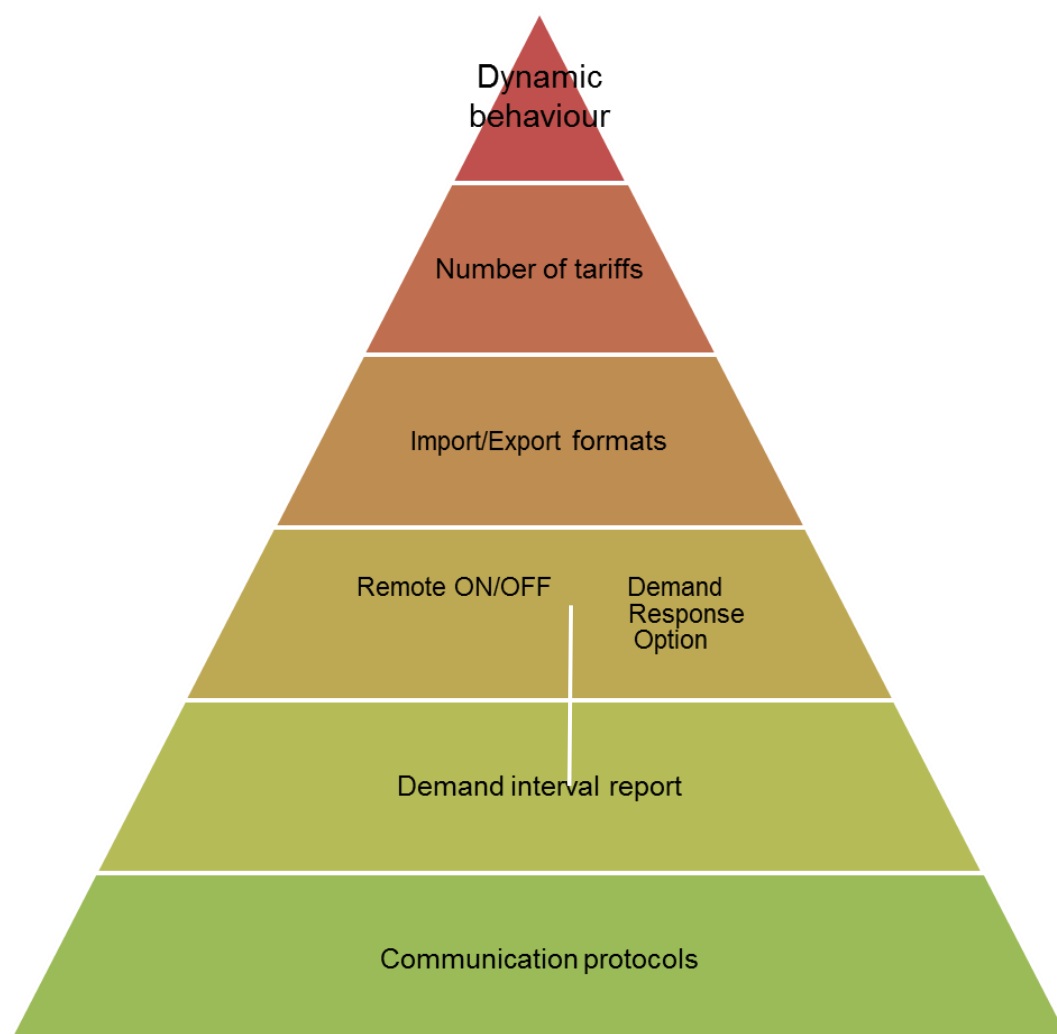
The survey on inteGRIDy pilot countries (details in Annex 5) identified the following suppliers of smart meters were identified as deployed:

- Janz Contactores de Energia SA
- Elster
- Linky
- STAER
- DPEE
- Iskraemeko

- Itron
- Landis+Gyr
- Echelon
- AEM
- ADD
- Sagemcom
- SMETS2
- Ningbosanxing

Following the review of the datasheets and main features of each device (details Annex 2 – List of identified smart meters deployed across EU-28) they are classified in compatibility levels.

Figure 16, below, presents a conceptual approach to assessing smart meters. Thus, from bottom to top, the main features of smart meters depict the level of compatibility, top layer representing the highest degree of compatibility (assuming also compliance with all the features beneath).



**Figure 16. Conceptual assessment of identified smart meters across EU-28**

The findings are based on information provided by smart meter producers from their product data sheets and the information gathered by inteGRIDy partners. Thus, the results detailed

below can be considered as the starting point for further investigations. For instance, the list of smart meters is not a complete list of all EU-28 deployed smart meters, but a representative list with most common meters installed in inteGRIDy pilot countries: Romania, France, Italy, Spain, UK, Greece, Cyprus and Portugal.

In order to decide upon a compatibility level, the following parameters of the identified smart meters were considered:

- Dynamic behaviour
- Semantic interoperability
- Number of tariffs
- Import/export formats
- Remote ON/OFF
- Demand response
- Demand interval report
- Communication protocols

As seen in Annex 2, consistent information is available for communication and standard protocols. This is why smart meters are classified in a matrix considering their compatibility with associated communication and protocols (Table 4, below).

Table 4. Compatibility level of identified EU-28 smart meter devices

| #  | Solution            | Meter types              | Optical port - IEC 62056-21 | FLAG - Mode C | Pulse output according to IEC 62053-31 | DLM S | COSE M | ANS I | RS48 5 | RS - 23 2 | PL C | GSM/GPRS | PST N | ISD N | TCP-IP Ethernet | Modbus | Radio frequency | PAKNET | OSGP | USB | ZigBee | Level of device compatibility TC65/920/DC |
|----|---------------------|--------------------------|-----------------------------|---------------|--|-------|--------|-------|--------|-----------|------|----------|-------|-------|-----------------|--------|-----------------|--------|------|-----|--------|---|
| 1  | Janz (PTI)          | B140                     | x                           | x             | x                                      |       |        |       |        | x         | x    | x        |       |       |                 |        | x               |        |      |     |        | INTEROPERABLE                             |
| 2  | Elster (Romania)    | Alpha A1800              | x                           |               |  | x     | x      | x     | x      | x         |      |          |       |       |                 |        |                 |        |      |     |        | INTERCHANGEABLE                           |
| 3  | Linky (France)      |                          |                             |               |  |       |        |       |        |           | x    | x        |       |       |                 |        |                 |        |      |     |        | INTEROPERABLE                             |
| 4  | STAER (IT)          | EWEPrometer-W            | x                           |               |  | x     | x      |       |        | x         |      | x        | x     | x     | x               | x      |                 |        |      |     |        | INTERCHANGEABLE                           |
| 5  | STAER (IT)          | CEWEPrometer-R           | x                           |               |  | x     | x      |       |        | x         |      | x        | x     | x     | x               | x      |                 |        |      |     |        | INTEROPERABLE                             |
| 6  | DPEE (IT)           | TH40C                    |                             |               |  |       |        |       | x      | x         |      | x        |       |       | x               | x      |                 |        |      |     |        | INTERCHANGEABLE                           |
| 7  | Elster (IT, RO)     | A1700                    |                             |               |  | x     | x      |       | x      | x         |      | x        | x     |       | x               |        |                 | x      |      |     |        | INTERCHANGEABLE                           |
| 8  | Iskraemeko (IT, RO) | TE/DE 851 MT851 / MD851  | x                           |               |  |       |        |       | X      | X         |      | X        | X     | X     |                 | X      |                 |        |      |     |        | INTERCONNECTABLE                          |
| 9  | Iskraemeko (IT)     | CSEMIDMT830 - SEMIDMT831 | x                           |               |  |       |        |       | X      | X         |      | X        | X     | X     | x               |        |                 |        |      | x   |        | INTERCONNECTABLE                          |
| 10 | Iskraemeko (IT)     | MT880                    | x                           |               |  | x     | x      |       | x      | x         |      |          |       |       |                 | x      |                 |        |      |     |        | INTERCHANGEABLE                           |
| 11 | Itron (RO)          | SL7000                   |                             |               |  | x     | x      |       | x      | x         |      | x        | x     |       | x               |        |                 |        |      |     |        | INTERCONNECTABLE                          |
| 12 | ITRON (IT)          | ITRON ACE6000            |                             |               |  | x     | x      |       | x      | x         |      | x        | x     |       |                 |        |                 |        |      |     |        | INTEROPERABLE                             |
| 13 | Landis+Gyr          | ZMD402,405,410           | x                           |               |  | x     |        |       |        |           |      |          |       |       |                 |        |                 |        |      |     |        | INTERCHANGEABLE                           |
| 14 | Elster (CY)         | AS230                    | x                           |               |  |       |        |       |        |           | x    | x        |       |       |                 |        | x               |        |      |     |        | INTERCONNECTABLE                          |
| 15 | Elster (CY)         | Alfa A 1700              |                             |               |  |       |        | x     | x      | x         |      |          | x     |       | x               |        |                 | x      |      |     |        | INTERCONNECTABLE                          |
| 16 | Echelon (RO)        | MTR 3500 CT              | x                           |               |  |       |        | x     |        |           |      |          |       |       |                 |        | x               |        | x    |     | x      | INTERCHANGEABLE                           |
| 17 | AEM (RO)            | CST 0420                 | x                           |               |  |       |        |       |        |           | x    | x        |       |       |                 | x      |                 |        |      |     | x      | INTEROPERABLE                             |
| 18 | ADD (PL, BG)        | Type 5 PRIME             | x                           |               |  | x     | x      |       | x      |           |      |          |       |       |                 |        |                 |        |      |     |        | INTERCHANGEABLE                           |
| 19 | Sagemcom (LU)       | OFDM CX1000-6S           |                             |               |  |       |        |       | x      | x         |      | x        |       |       | x               | x      |                 |        |      |     | x      | INTEROPERABLE                             |
| 20 | SMETS2 (UK)         | SMETS 2                  |                             |               |  | x     | x      |       |        |           |      |          |       |       |                 |        |                 |        |      |     | x      | INTERCHANGEABLE                           |
| 21 | AEM (RO)            | CST0410                  | x                           |               |  | x     | x      |       | x      | x         |      |          |       |       |                 |        |                 |        |      |     |        | INTERCHANGEABLE                           |
| 22 | Elster (RO)         | AS1440                   | x                           |               |  | x     | x      |       | x      | x         |      |          |       |       |                 |        |                 |        |      |     |        | INTERCHANGEABLE                           |
| 23 | Ningbosanxing (RO)  | P34S02-DC                | x                           |               |  | x     | x      |       | x      | x         |      |          |       |       |                 |        |                 |        |      |     |        | INTERCHANGEABLE                           |

Based on this information provided by smart meter producers in their products data sheet and the information gathered by partners (consolidated in Annex 2) and on the levels of compatibility as defined in TC65/920/DC [IEC02] and applying the conceptual assessment presented in Figure 16, above, the smart meters may be grouped in three major categories:

- Level 1 - Interchangeable
  - This is based on the fact that PRIME PLC, G3 PLC and CX1 use DLMS/COSEM. Therefore, they can be readily integrated to the DLMS/COSEM suite to achieve semantic interoperability [GYO11]
  - DLMS/COSEM capable, thus interchangeable from communication perspective are the following meters as quoted in Table 4, above: 2, 4, 5, 7, 10, 11, 13, 16, 18, 20, 21, 22 and 23
- Level 2 - Interoperable
  - Assuming that when working in a platform that integrates information from various device, the format data provided will be translated in a preferred one, all smart meters that do not have the same dynamic behavior are interoperable;
  - In this category are included the meter able to transmit data using wireless communication (e.g. GSM, RF etc): 1, 3, 6, 12, 14, 15, 17, 19
- Level 3 - Interworkable and interconnectable,
  - the smart meters included in this category are only able to transmit information by wired communication (e.g. PLC, PSTN etc) – (8, 9);
  - Coexistent level is not applicable in the present assessment as all the devices considered have similar typologies and functionalities; they are all smart meters.

Considering the second layer of the pyramid presented in Figure 16, above, all the presented meters can be considered interoperable since they all have available the standard 15 min reporting rate. If it is necessary, when demand interval is lower, the information can be aggregated.

For the 3<sup>rd</sup> layer (demand response), there is not enough public information as there is no large-scale demand response service implemented by DSO in EU-28.

For the layer 4 (import/export data) and 6 (dynamic behaviour), there is not enough information to draw a conclusion. This is mainly due to this type of information being usually use case specific and not necessary for most applications (billing, typical curves).

Most of the listed meters have varying tariff procedures ranging from 2 tariffs (day/night) to complex or comprehensive structures with multiple parameters (working days, week-end, holidays, seasons etc.) and the limitations are more based on the specifications of the countries in which the meters were deployed than the technology itself.

## 5. Conclusions

By mid-2017 EU-28 diffusion of smart meters was under 40% with expectations from EU Member States that installation will speed with nation-wide installations. Based on the traffic light map described in **Chapter 3**, 7 EU member states (EE, ES, FI, IT, LU, MT, SE) have completed the smart metering roll-out and are looking towards improving consumer experience, awareness and benefits, increasing energy efficiency and lowering the CO<sub>2</sub> emission level. Moreover, another 4 states (DK, NL, SI, UK) have a good progress towards smart metering deployment and reaching the EC target. Belgium and Germany are exceptional cases if looking closely to their approach on smart meter installations – one is facing a highly competitive market (Germany) and the other one (Belgium) states that all EU regulations and recommendations are being considered, but makes no information available on an actual smart meter deployment. The remaining half of EU member states registers small or no progress with smart meter installations.

The technical solutions proposed and implemented across EU-28 comply with most of the functionalities described in EC Recommendation on preparations for the roll-out of smart metering systems, (2012/148/EU) [EUC12].

EU-28 survey on minimum functionalities approach reveals that most of EU member states comply with the minimum functionalities recommended by the EC. EU member states that reported partial compliance or non-compliance with some of the functionalities have either pending a deployment decision, installed older generation smart meters or face regulatory limitations.

H1, H2, H3 interfaces have initially assessed by most EU member states and decisions on implementing them upon customer request were taken, massive roll-out intentions were only for H1 as large scale deployment of all interfaces raised the concern that more interfaces might increase the price of the meter. To overcome this and following economic assessments decisions to promote a more flexible approach were taken. Some countries make information available through a website instead of using one of the H interfaces. Moreover, current trend is to substitute H interfaces with dedicated mobile applications. Currently running pilot projects validate this approach.

As observed in the assessment on EU-28 smart metering systems roll-out status (**Chapter 3**) a series of factors and circumstances may impact the smart meter installation progress. A strong regulatory framework and a fully liberalized electricity market support the roll-out, but a lack of government stability and low electricity consumptions and prices lead to minimal progress.

A particular factor that may influence the progress of smart metering installation is the consumer itself. As in some cases the political factor cannot enforce a deployment strategy, the engagement of the consumer is critical. However, consumers 'choice' does not necessarily result in rapid deployment. Thus, DSOs and suppliers are challenged to look for new and appealing strategies and design business models in order to meet the market needs and expectations.

Given the migration towards de-regulated markets, switching electricity suppliers is likely to become increasingly important to consumers. As a consequence, the technology readiness level of smart meter devices and application services become one of the aspects to be immediately considered when taking large scale deployment decisions.

The maturity level of smart meter solutions can be assessed based on the compatibility level of the devices/components. Availability of latest communication standards and protocols, canonical data models, semantics and formats and a clearly defined dynamic behaviour facilitates interchangeability. The interchangeability of SMs supports scalability and long term sustainability of the deployed smart metering solution as part of Smart Grid.





This report challenges only a part of the smart meter devices installed through-out EU-28 and opens new perspectives on the reliability of reported figures, compliance and consumer benefits availability.

Beyond a reliable and scalable technical solution for smart metering, external factor influence the progress of large scale deployment. Successful deployments are reported in countries where the political will is synchronized with stakeholder needs thus creating a favourable environment for the development of new business models. However, the presence of clear regulatory framework and deployment strategy are mandatory requirements.

Moreover, consumer engagement and awareness may also influence the progress of deployment and without quantitative incentives and benefits may become a challenge/barrier.

Along the above-mentioned external factors, a successful story is likely to be based on the scalability, flexibility and openness of the proposed / implemented technical solution, the consideration of technological trends, correct market analysis.

In the EU-28 context developing an inteGRIDy-like platform able to gather and operate information (measurement, aggregation, mining and forecasting of data) from different pilots that propose suitable architectural solutions to meet their respective goals is a step towards increasing the level of interoperability across Internal European Market (IEM). Moreover, all inteGRIDy-like solutions are designed to be fully interoperable with the electricity grid.

The findings on this report are limited to information provided by smart meter producers in their product data sheets, public information on smart meter deployment and to the information gathered by inteGRIDy partners.

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## Annex 1 – EU-28 smart metering systems roll-out status

| Member state | Smart meter legal and regulatory status  | Smart meters deployment strategy  | Communication technologies   | Smart meter solution / product   | Consumer benefits   | Progress update/ percentage of roll-out   |
|--------------|--|---|--|--|---|---|
| Austria      | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2010</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity:</b> Regulated</li> <li>- <b>Energy Regulator:</b> E-Control</li> </ul>  | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> Mandatory</li> <li>- <b>Responsible party:</b> implementation and ownership: DSO</li> <li>- <b>Responsible party:</b> access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> Network Tariffs + Metering</li> <li>- <b>Implementation speed:</b> 2012-2020</li> </ul> <b>Penetration rate by 2020:</b> 80% | <ul style="list-style-type: none"> <li>- <b>From the smart meter to the data concentrator</b> – 70% PLC and 30% GPRS</li> <li>- From the data concentrator to the Data Management System – 100% Fibre Optics</li> <li>- UMTS</li> <li>- LTE</li> </ul>   | <ul style="list-style-type: none"> <li>- Landis Gyr (over half a million SM by 2016)</li> <li>- Iskraemeko</li> <li>- AEM</li> </ul> | <ul style="list-style-type: none"> <li>- Opt-out</li> </ul> | <ul style="list-style-type: none"> <li>- Small progress (under 10%)</li> </ul>  |
| Belgium      | Each of the three Belgian regions (Flanders, Wallonia and Brussels-Capital) has been in charge of their region-specific cost-benefit analysis (CBA) for the smart metering roll-out.<br>Metering activity Regulated  | <i>*No decision on whether smart meters will be rolled out.</i><br><i>Belgium is not legally bound to have smart meters installed in 80% of all households in 2020 as is prescribed in the 3rd Energy Package.</i>  | <ul style="list-style-type: none"> <li>- EDIEL - XML in preparation</li> </ul>   |  |   | <ul style="list-style-type: none"> <li>- Exception, no data available on the number of the smart meters installed, still trying to clarify the legal framework of smart meter deployment</li> </ul> |
|              | <b>Flanders</b> <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2008 and 2011</li> <li>- <b>CBA outcome:</b> Inconclusive</li> <li>- <b>Metering activity:</b> Regulated</li> <li>- <b>Energy Regulator:</b> Flemish Energy Regulator (VREG)</li> </ul> | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> N/A</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> N/A</li> <li>- <b>Implementation speed:</b> N/A</li> <li>- <b>Penetration rate by 2020:</b> N/A</li> </ul>                       | <ul style="list-style-type: none"> <li>- From the smart meter to the data concentrator: 80% PLC – with internet gateway (Eandis customers). The remaining 20% (Infrax customers) are equipped by MUC cable (60%) and MUC GPRS (40%)</li> <li>- From the data concentrator to the DMS: Cable or GPRS</li> </ul> |  |   |   |
|              | <b>Brussels</b> <ul style="list-style-type: none"> <li>- <b>CBA</b> 2008 and 2011</li> <li>- <b>CBA outcome:</b> Negative</li> <li>- <b>Metering activity:</b> Regulated</li> <li>- <b>Energy Regulator:</b> Brugel</li> </ul>                               | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> N/A</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> N/A</li> <li>- <b>Implementation speed:</b> N/A</li> <li>- <b>Penetration rate by 2020:</b> N/A</li> </ul>                       | <ul style="list-style-type: none"> <li>- PLC (Basic)</li> <li>- UMTS (Moderate, Advanced)</li> <li>- WiMAX (Full)</li> </ul>   |  |   |   |
|              | <b>Wallonia</b>  | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> N/A</li> <li>- <b>Responsible party</b> – implementation and</li> </ul>  | <ul style="list-style-type: none"> <li>- From the smart meter to the data concentrator:</li> </ul>   |  |   |   |

|                            |   |  |  |  |   |  |
|----------------------------|---|--|--|--|---|--|
|                            | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2012</li> <li>- <b>CBA outcome:</b> Full Roll-out scenario Negative, Smart Meter Friendly scenario - Positive</li> <li>- <b>Metering activity:</b> Regulated</li> <li>- <b>Energy Regulator:</b> Commission Wallonne pour l'Energie – CWAPE</li> </ul> | <ul style="list-style-type: none"> <li>ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> N/A</li> <li>- <b>Implementation speed</b> N/A</li> <li>- <b>Penetration rate by 2020:</b> N/A</li> </ul>  | <ul style="list-style-type: none"> <li>80% PLC and 20% MUC+GPRS</li> <li>- From the data concentrator to the DMS: GPRS</li> </ul>  |  |   |  |
| Bulgaria                   | <ul style="list-style-type: none"> <li>- <b>CBA:</b> not initiated</li> <li>- <b>Metering activity:</b> not regulated</li> <li>- <b>Energy Regulator:</b> State Energy &amp; Water Regulatory Commission (SEWRC)</li> </ul>   | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> N/A</li> <li>- <b>Responsible party</b> – implementation and ownership: N/A</li> <li>- <b>Responsible party</b> – access to metering data: N/A</li> <li>- <b>Financing of roll-out:</b> N/A</li> <li>- <b>Implementation speed</b> N/A</li> <li>- <b>Penetration rate by 2020:</b> N/A</li> </ul>                 | <ul style="list-style-type: none"> <li>- PRIME</li> <li>- DLMS/COSEM</li> </ul>  | <ul style="list-style-type: none"> <li>- AEM</li> <li>- ADD Group</li> <li>- ADDAX IMS</li> </ul>  |   | <ul style="list-style-type: none"> <li>- Small progress (under 20%) but most of it was done in the last 2 years</li> <li>- Bulgaria has the premises for registering a good progress until 2020</li> </ul>   |
| Croatia                    | <ul style="list-style-type: none"> <li>- <b>CBA:</b> not initiated</li> <li>- <b>Metering activity:</b> N/A</li> <li>- <b>Energy Regulator:</b> Hrvatska energetska regulatorna agencija (HERA)</li> </ul>  | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> N/A</li> <li>- <b>Responsible party</b> – implementation and ownership: N/A</li> <li>- <b>Responsible party</b> – access to metering data: N/A</li> <li>- <b>Financing of roll-out:</b> N/A</li> <li>- <b>Implementation speed</b> N/A</li> <li>- <b>Penetration rate by 2020:</b> N/A</li> </ul>                 | <ul style="list-style-type: none"> <li>- DLMS/COSEM,</li> <li>- IEC 62056-21, mode E,</li> <li>- MODBUS</li> </ul>   | <ul style="list-style-type: none"> <li>- Iskraemeko</li> </ul>   | -   | <ul style="list-style-type: none"> <li>- No progress</li> <li>- New EU member state</li> <li>- Croatia has not yet decided to go for a full roll-out of smart metering. However, Croatia has already invested €3 million since 2013 in the introduction of smart meter.</li> </ul> |
| Cyprus<br>(Details - 10.8) | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2013</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity:</b> Regulated*</li> <li>- <b>Energy Regulator:</b> Cyprus Energy Regulatory Authority (CERA)</li> </ul>  | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> N/A</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> N/A</li> <li>- <b>Implementation speed</b> N/A</li> <li>- <b>Penetration rate by 2020:</b> N/A</li> </ul>                 | <ul style="list-style-type: none"> <li>- Optical bidirectional IEC 62056-21 port</li> <li>- GSM/GPRS;</li> <li>- PLC;</li> <li>- Low Power</li> <li>- Radio</li> <li>- Modbus</li> <li>- DLMS/COSEM</li> </ul>   | <ul style="list-style-type: none"> <li>- Iskraemeko</li> <li>- Elster Metering Ltd</li> <li>- AS230 single-phase meter</li> <li>- A1700 three-phase meter</li> </ul> | -   | <ul style="list-style-type: none"> <li>- Small progress (under 5%)</li> <li>- opted for selective roll-outs via DSO as they have no decision on nation-wide roll-out</li> </ul>  |
| Czech Republic             | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2012 negative, planned for 2017</li> <li>- <b>CBA outcome:</b> negative</li> <li>- <b>Metering activity:</b> regulated</li> <li>- <b>Energy Regulator:</b> Energetický Regulační Úřad (ERÚ)</li> </ul>   | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> N/A</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: Central Hub</li> <li>- <b>Financing of roll-out:</b> N/A</li> <li>- <b>Implementation speed:</b> 2020 – 2026</li> <li>- <b>Penetration rate by 2020:</b> 1%</li> </ul> | <ul style="list-style-type: none"> <li>- PLC communication infrastructure from the smart meter to the data concentrator; GPRS (or any other applicable wireless technology) only where it is not possible to use PLC</li> <li>- GPRS+fibres optics from the Data Concentrator</li> </ul> | <ul style="list-style-type: none"> <li>- No data</li> </ul>  | <ul style="list-style-type: none"> <li>- No data</li> </ul> | <ul style="list-style-type: none"> <li>- Small progress (under 5% coverage with smart meters)</li> <li>- Projects and demonstrations underway</li> <li>- Czech Republic decided not to proceed with a mandatory nation-wide roll-out.</li> </ul>                                   |

|  |   |   | to the Data Management System  |  |   |  |
|--|---|---|--|--|---|--|
| Denmark                                      | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2009 (negative), 2013</li> <li>- <b>CBA outcome:</b> Positive</li> <li>- <b>Metering activity:</b> regulated</li> <li>- <b>Energy Regulator:</b> Danish Energy Regulatory Authority (DERA)</li> </ul>  | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> Mandatory</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: Central Hub</li> <li>- <b>Financing of roll-out:</b> Network Tariffs</li> <li>- <b>Implementation speed:</b> 2014-2020</li> <li>- <b>Penetration rate by 2020:</b> 100%</li> </ul>                    | <ul style="list-style-type: none"> <li>- PLC</li> <li>- GPRS/GSM,</li> <li>- WiFi</li> <li>- RF</li> <li>- ebIX</li> </ul>   | - No data  | - | <ul style="list-style-type: none"> <li>- Good progress - by mid-2017, Denmark has covered over 50% of the metering points</li> <li>- started with a voluntary approach (driven by the DSO initiative) then turned into mandatory roll-out through the law</li> </ul>     |
| Estonia<br>(Details - <a href="#">11.1</a> ) | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2012</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity:</b> Regulated</li> <li>- <b>Energy Regulator:</b> ECA - Konkurentiamet (Estonian Competition Authority)</li> </ul>   | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> Mandatory, roll-out complete</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: Central Hub</li> <li>- <b>Financing of roll-out:</b> Network Tariffs</li> <li>- <b>Implementation speed:</b> 2013-2017</li> <li>- <b>Penetration rate by 2020:</b> 100%</li> </ul> | <ul style="list-style-type: none"> <li>- PLC – 90%</li> <li>- GPRS – 10%</li> <li>- XML (W3C)</li> </ul>   | - No data  | - | <ul style="list-style-type: none"> <li>- Full roll-out, Estonia has an over 80% coverage</li> </ul>  |
| Finland                                      | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2008</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity:</b> Regulated</li> <li>- <b>Energy Regulator:</b> EMV (Energiamarkkinavirasto - The Energy Market Authority)</li> </ul>  | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> Mandatory, roll-out complete</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> Network Tariffs</li> <li>- <b>Implementation speed:</b> 2009-2013</li> <li>- <b>Penetration rate by 2020:</b> 100 %</li> </ul>        | <ul style="list-style-type: none"> <li>- PLC – 30 %</li> <li>- GPRS – 60 %</li> <li>- RF – 10 %</li> </ul>   | - Landis Gyr   | - | <ul style="list-style-type: none"> <li>- Full roll-out, Finland has an over 90% coverage</li> </ul>  |
| France<br>(Details - <a href="#">10.5</a> )  | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2007</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity:</b> regulated</li> <li>- <b>Energy Regulator:</b> CRE (Commission de Régulation de l'Energie)</li> </ul>   | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> Mandatory</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> DSO</li> <li>- <b>Implementation speed:</b> 2014-2020</li> <li>- <b>Penetration rate by 2020:</b> 95%</li> </ul>   | <ul style="list-style-type: none"> <li>- PLC</li> <li>- DLMS/COSEM</li> <li>- MODbus</li> <li>- GSM</li> <li>- Fiber optics</li> <li>- CSV (RFC 4180)</li> </ul>                                     | <ul style="list-style-type: none"> <li>- Sagemcom</li> <li>- Itron</li> <li>- Landis+Gyr</li> <li>- Ziv</li> <li>- Elster</li> </ul> | - | <ul style="list-style-type: none"> <li>- Small progress (15%coverage) but the situation may improve as they are installing with a speed of 20.00 meters a day and targets 8 million by the end of the year.</li> </ul>   |
| Germany                                      | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2013</li> <li>- <b>CBA outcome:</b> positive (for the Roll-out Scenario Plus) negative for the EU scenario</li> <li>- <b>Metering activity:</b> Competitive</li> <li>- <b>Energy Regulator:</b> Bundesnetzagentur – BnetzA (Federal Network Agency for Electricity, Gas, Telecommunications, Posts and Railway)</li> </ul> | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> N/A</li> <li>- <b>Responsible party</b> – implementation and ownership: Meter operator / DSO</li> <li>- <b>Responsible party</b> – access to metering data: Meter operator / DSO</li> <li>- <b>Financing of roll-out:</b> No data available</li> <li>- <b>Implementation speed:</b> N/A</li> <li>- <b>Penetration rate by 2020:</b> 23%</li> </ul>     | <ul style="list-style-type: none"> <li>- GPRS/UMTS/LTE – 80 %</li> <li>- PLC/BPL – 20 %</li> <li>- DSL – 5 %</li> <li>- Fibre-optics – 5 %</li> <li>- JSON (RFC 7159, ECMA 404 &amp; 262)</li> </ul> | <ul style="list-style-type: none"> <li>- Landis Gyr</li> <li>- AEM</li> <li>- Itron</li> </ul>                                       | - | <ul style="list-style-type: none"> <li>- Small progress as Germany proceeds with selective roll-outs</li> <li>- The roll-out progresses naturally as the German market is competitive and independent regions, the government let the market to self regulate</li> </ul> |

|                           |   |   |  |  |           |   |
|---------------------------|---|---|--|--|-----------|---|
| Greece<br>(Details– 10.6) | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2010, 2012</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity:</b> Regulated</li> <li>- <b>Energy Regulator:</b> PAE/RAE (Ρυθμιστική Αρχή Ενέργειας / Regulatory Authority for Energy)</li> </ul>     | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> mandatory</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> No data available</li> <li>- <b>Implementation speed:</b> 2015-2018</li> <li>- <b>Penetration rate by 2020:</b> 80%</li> </ul>                           | - No data  | - No data  | - No data | <ul style="list-style-type: none"> <li>- Small progress (under 1% coverage)</li> <li>- Pending a decision with the nation-wide roll-out plan</li> </ul>   |
| Hungary                   | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2010</li> <li>- <b>CBA outcome:</b> negative</li> <li>- <b>Metering activity:</b> N/A</li> <li>- <b>Energy Regulator:</b> MEH/HEO (Magyar Energia Hivatal / Hungarian Energy Office)</li> </ul>                            | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> N/A</li> <li>- <b>Responsible party</b> – implementation and ownership: N/A</li> <li>- <b>Responsible party</b> – access to metering data: N/A</li> <li>- <b>Financing of roll-out:</b> N/A</li> <li>- <b>Implementation speed:</b> N/A</li> <li>- <b>Penetration rate by 2020:</b> N/A</li> </ul>   | - N/A  | - - AEM  | - No data | <ul style="list-style-type: none"> <li>- Small progress reflected in small demonstrations projects (under 5% coverage)</li> </ul>   |
| Ireland                   | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2011</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity:</b> Regulated</li> <li>- <b>Energy Regulator:</b> CER (Commission for Energy Regulation)</li> </ul>  | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> Mandatory</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> Network Tariffs</li> <li>- <b>Implementation speed:</b> 2014-2019</li> <li>- <b>Penetration rate by 2020:</b> 87%%</li> </ul>                            | - PLC/RF   | - No data  | - No data | <ul style="list-style-type: none"> <li>- Small progress (under 1% coverage)</li> <li>- Beginning the roll-out scheduled for 2018.</li> </ul>  |
| Italy<br>(Details – 10.4) | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2001</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity:</b> regulated</li> <li>- <b>Energy Regulator:</b> AEEG (Autorità per l'Energia Elettrica e il Gas)</li> </ul>                                | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> Voluntary + Mandatory</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> Network Tariffs + DSO resources</li> <li>- <b>Implementation speed:</b> 2001-2011</li> <li>- <b>Penetration rate by 2020:</b> 99%</li> </ul> | <ul style="list-style-type: none"> <li>- PLC</li> <li>- DLMS/COSEM</li> <li>- MODbus</li> <li>- GSM</li> <li>- Fiber optics</li> <li>- Zigbee</li> </ul> | <ul style="list-style-type: none"> <li>- Iskraemeko</li> <li>- Staer</li> <li>- DPEE</li> <li>- Itron</li> <li>- Landys-Gir AEM</li> </ul> | -         | <ul style="list-style-type: none"> <li>- Full roll-out (over 95% coverage)</li> <li>- By the end of 2017, the beginning of a plan for the substitution of 1g SMs with 2g devices by e-distribution (PMS2 plan) is envisaged.</li> <li>- The target is to install about 35.9 million of new SMs by 2031</li> </ul> |
| Latvia                    | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2012</li> <li>- <b>CBA outcome:</b> negative</li> <li>- <b>Metering activity:</b> Regulated</li> <li>- <b>Energy Regulator:</b> PUC (Sabiedrisko pakalpojumu regulēšanas komisija/ Public Utilities Commission)</li> </ul> | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> Selective roll-out</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> Network Tariffs</li> <li>- <b>Implementation speed:</b> 2015 to 2017</li> <li>- <b>Penetration rate by 2020:</b> 23%</li> </ul>                 | <ul style="list-style-type: none"> <li>- PLC</li> <li>- GSM</li> </ul>   | - No data  | - No data | <ul style="list-style-type: none"> <li>- Small progress (around 20% coverage)</li> <li>- No legal framework for deployment and/or regulating specific matters such as timeline of the roll-out, or setting technical specifications for the meters etc.</li> </ul>  |
| Lithuania                 | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2009</li> <li>- <b>CBA outcome:</b> negative</li> </ul>  | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> N/A</li> <li>- <b>Responsible party</b> – implementation and</li> </ul>  | <ul style="list-style-type: none"> <li>- PLC</li> <li>- GPRS</li> </ul>  | - No data  | - No data | <ul style="list-style-type: none"> <li>- Small progress (under 1% coverage)</li> </ul>  |



|                            |   |  |  |   |  |  |
|----------------------------|---|--|--|---|--|--|
|                            | <ul style="list-style-type: none"> <li>- <b>Metering activity</b> Regulated</li> <li>- <b>Energy Regulator:</b> NCC (Valstybinė kainų ir energetikos kontrolės komisija / National Control Commission for Prices and Energy)</li> </ul>                                       | <ul style="list-style-type: none"> <li>ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> Network Tariffs</li> <li>- <b>Implementation speed:</b> 2014 to 2020</li> <li>- <b>Penetration rate by 2020:</b> N/A</li> </ul>  |  |   |  | <ul style="list-style-type: none"> <li>- no legal framework for deployment and/or regulating specific matters such as timeline of the roll-out, or setting technical specifications for the meters etc</li> <li>- no decision for roll-out as the electricity bill is small</li> </ul> |
| Luxembourg                 | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2015</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity:</b> Regulated</li> <li>- <b>Energy Regulator:</b> ILR (Institut Luxembourgeois de Régulation)</li> </ul>                                   | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> Mandatory</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> Network Tariffs</li> <li>- <b>Implementation speed:</b> 2015-2018</li> <li>- <b>Penetration rate by 2020:</b> 95%</li> </ul>                                | <ul style="list-style-type: none"> <li>- OFDM G3 / PRIME</li> <li>- GSM/GPRS</li> <li>- Ethernet</li> <li>- RS485/RS232</li> <li>- MBUS</li> <li>- Wireless technology (RF, Zigbee,...)</li> </ul> | <ul style="list-style-type: none"> <li>- Sagemcom (OFDM Single-Phase Meter CX1000-6S, OFDM Single-Phase Meter CX1000-6S)</li> </ul> | <ul style="list-style-type: none"> <li>- Crisis handbook and collaboration with external staff for forensics and disaster recovery</li> <li>- Cyber Risk insurance</li> </ul>  | <ul style="list-style-type: none"> <li>- Full roll-out (over 90% coverage)</li> </ul>  |
| Malta                      | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2009</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity</b> Regulated</li> <li>- <b>Energy Regulator:</b> MRA (Malta Resources Authority)</li> </ul>  | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> voluntary + mandatory (Roll-out complete)</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> Network Tariffs</li> <li>- <b>Implementation speed</b> 2009-2014</li> <li>- <b>Penetration rate by 2020</b> 100%</li> </ul> | <ul style="list-style-type: none"> <li>- PLC</li> <li>- GPRS</li> </ul>  | <ul style="list-style-type: none"> <li>- Enemalta</li> </ul>  | <ul style="list-style-type: none"> <li>- consumption online to better understand consumption patterns enabling them to reduce their consumption</li> <li>- Circuit Breaker – This is used to switch your electricity supply on or off</li> </ul> | <ul style="list-style-type: none"> <li>- Full roll-out (90% coverage)</li> </ul>   |
| The Netherlands            | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2005</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity</b> Regulated</li> <li>- <b>Energy Regulator:</b> NMa (Dutch Office of Energy Regulation / Nederlandse Mededingingsautoriteit)</li> </ul>   | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> Mandatory with opt-out</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> Network Tariffs</li> <li>- <b>implementation speed:</b> 2012-2020</li> <li>- <b>Penetration rate by 2020:</b> 100%</li> </ul>                  | <ul style="list-style-type: none"> <li>- PLC</li> <li>- GPRS</li> <li>- P4 : XML (W3C)</li> </ul>  | <ul style="list-style-type: none"> <li>- Iskraemeko</li> </ul>  | <ul style="list-style-type: none"> <li>- Opt-out</li> </ul>  | <ul style="list-style-type: none"> <li>- Good progress (under 50% coverage)</li> <li>- Dutch Parliament adopted legal framework for voluntary installation of smart metering in November 2010.</li> <li>- The roll-out is lasting for many years</li> </ul>                            |
| Poland                     | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2009</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity</b> Regulated.</li> <li>- <b>Energy Regulator:</b> URE/ERO (Urząd Regulacji Energetyki / The Energy Regulatory Office of Poland)</li> </ul> | <ul style="list-style-type: none"> <li>- <b>Deployment strategy</b> Mandatory</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: Central Hub</li> <li>- <b>Financing of roll-out:</b> Network Tariffs</li> <li>- <b>Implementation speed</b> 2012-2022</li> <li>- <b>Penetration rate by 2020</b> 80%</li> </ul>                           | <ul style="list-style-type: none"> <li>- PLC</li> </ul>  | <ul style="list-style-type: none"> <li>- AEM</li> </ul>   | <ul style="list-style-type: none"> <li>- No data</li> </ul>  | <ul style="list-style-type: none"> <li>- Small progress (under 5% coverage)</li> <li>- <i>The Meter Act initiated in 2010 is pending approval</i></li> </ul>   |
| Portugal<br>(Details 10.2) | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2012</li> <li>- <b>CBA outcome:</b> INCONCLUSIVE</li> <li>- <b>Metering activity</b></li> </ul>  | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> N/A</li> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering</li> </ul>   | <ul style="list-style-type: none"> <li>- PLC-DCSK,</li> <li>- GPRS</li> <li>- <b>RF Mesh</b></li> </ul>  | <ul style="list-style-type: none"> <li>- EDP Box , Janz</li> </ul>  | <ul style="list-style-type: none"> <li>- No data</li> </ul>  | <ul style="list-style-type: none"> <li>- Small progress (under 20% coverage)</li> <li>- Until now Portugal did not commit for the 80%</li> </ul>   |

|  |  |   |  |  |   |   |
|--|--|---|--|--|---|---|
|  | <ul style="list-style-type: none"> <li>Regulated <b>Energy Regulator:</b> ERSE (Entidade Reguladora dos Serviços Energéticos / Energy Services Regulatory Authority)</li> </ul>  | <ul style="list-style-type: none"> <li>data: DSO</li> <li><b>Financing of roll-out:</b> Network Tariffs + DSO</li> <li><b>Implementation speed</b> 2014-2022</li> <li><b>Penetration rate by 2020</b> N/A</li> </ul>  |  |  |   | target suggested by EC and it is not clear what will be the real penetration rate by 2020.  |
| Romania                                  | <ul style="list-style-type: none"> <li><b>CBA:</b> 2012</li> <li><b>CBA outcome:</b> positive</li> <li><b>Metering activity</b></li> <li>Regulated</li> <li><b>Energy Regulator:</b> ANRE (Autoritatea Nationala de Reglementare in Domeniul Energiei)</li> </ul>  | <ul style="list-style-type: none"> <li><b>Deployment strategy:</b> mandatory</li> <li><b>Responsible party</b> – implementation and ownership: DSO</li> <li><b>Responsible party</b> – access to metering data: DSO</li> <li><b>Financing of roll-out:</b> Network Tariffs</li> <li><b>Implementation speed</b> 2013-2022</li> <li><b>Penetration rate by 2020</b> 80%</li> </ul>   | <ul style="list-style-type: none"> <li>PLC;</li> <li>GSM/GPRS</li> <li>WiFi/WiMAX</li> <li>Fibre Optics</li> </ul>                                   | <ul style="list-style-type: none"> <li>Honeywell (Elster)</li> <li>Echelon</li> <li>Landis-Gyr</li> </ul>  | <ul style="list-style-type: none"> <li>Consumption awareness</li> <li>Encourage flexibility consumption</li> </ul>  | <ul style="list-style-type: none"> <li>Small progress (5% coverage)</li> <li>The national Plan for Smart meter implementation is pending approval</li> </ul>  |
| Slovakia                                 | <ul style="list-style-type: none"> <li><b>CBA:</b> 2013</li> <li><b>CBA outcome:</b> negative for a large scale roll-out</li> <li><b>Metering activity</b></li> <li>Regulated</li> <li><b>Energy Regulator:</b> USRO/RONI (Úrad pre reguláciu sieťových odvetví / Regulatory Office for Network Industries)</li> </ul> | <ul style="list-style-type: none"> <li><b>Deployment strategy</b> Mandatory for selective roll-out</li> <li><b>Responsible party</b> – implementation and ownership: N/A</li> <li><b>Responsible party</b> – access to metering data: DSO</li> <li><b>Financing of roll-out:</b> DSO/Central hub</li> <li><b>Implementation speed</b> 2013-2020</li> <li><b>Penetration rate by 2020</b> 23% (considered in the CBA)</li> </ul> | <ul style="list-style-type: none"> <li>GSM/GPRS/</li> <li>ETHN</li> <li>PLC</li> <li>RF</li> <li>WAN</li> </ul>                                      | <ul style="list-style-type: none"> <li>No data</li> </ul>  | <ul style="list-style-type: none"> <li>No data</li> </ul>   | <ul style="list-style-type: none"> <li>Small progress (under 1% coverage)</li> <li>a partial roll-out to about 600,000 is considered</li> <li>In 2015 the government approved a national roll-out plan for selected groups of consumers.</li> </ul>   |
| Slovenia                                 | <ul style="list-style-type: none"> <li><b>CBA:</b> 2014</li> <li><b>CBA outcome:</b> positive</li> <li><b>Metering activity:</b> Not available</li> <li><b>Energy Regulator:</b> AGEN-RS (Javna Agencija Republike Slovenije za energijo / Energy Agency of the Republic of Slovenia)</li> </ul>                       | <ul style="list-style-type: none"> <li><b>Deployment strategy:</b> N/A</li> <li><b>Responsible party</b> – implementation and ownership: N/A</li> <li><b>Responsible party</b> – access to metering data: DSO</li> <li><b>Financing of roll-out:</b> N/A</li> <li><b>Implementation speed:</b> N/A</li> <li><b>Penetration rate by 2020:</b> N/A</li> </ul>   | <ul style="list-style-type: none"> <li>PLC</li> <li>GPRS</li> <li>WiMAX,</li> <li>Ethernet,</li> </ul>   | <ul style="list-style-type: none"> <li>Landis Gyr</li> <li>Iskraemeko</li> </ul>   | <ul style="list-style-type: none"> <li>Equipment interoperability between at least two vendors is required</li> </ul>   | <ul style="list-style-type: none"> <li>Good progress (50% coverage)</li> <li>no government legislation to roll-out of smart meters,</li> <li>the existing legal framework does not exclude the possibility of voluntary roll-out of smart meters by distribution network operators</li> </ul> |
| Spain<br>(Details <a href="#">10.7</a> ) | <ul style="list-style-type: none"> <li><b>CBA:</b> not performed</li> <li><b>Metering activity</b></li> <li>Regulated</li> <li><b>Energy Regulator:</b> CNE (La Comisión Nacional de Energía / National Energy Commission)</li> </ul>  | <ul style="list-style-type: none"> <li><b>Deployment strategy</b> Mandatory</li> <li><b>Responsible party</b> – implementation and ownership: DSO</li> <li><b>Responsible party</b> – access to metering data: DSO</li> <li><b>Financing of roll-out:</b> Network Tariffs + SM rental</li> <li><b>Implementation speed</b> 2011-2018</li> <li><b>Penetration rate by 2020</b> 100%</li> </ul>                                   | <ul style="list-style-type: none"> <li>PLC</li> <li>PRIME</li> <li>GPRS</li> <li>FR</li> <li>Ethernet</li> <li>CSV (RFC 4180), Excel, PDF</li> </ul> | <ul style="list-style-type: none"> <li>ZIV</li> <li>CIRCUTOR</li> <li>ELSTER</li> <li>General Electric</li> <li>ITRON</li> <li>LANDIS+GYR,</li> <li>ORBIS</li> <li>SAGECOM</li> <li>SOGECAM</li> </ul> | <ul style="list-style-type: none"> <li>Transparency in energy billing</li> <li>Hourly tariff selection 9 (the 1<sup>st</sup> country in the world where the default price for households is based on hourly spot prices)</li> </ul> | <ul style="list-style-type: none"> <li>Full roll-out (over 90%)</li> </ul>  |
| Sweden                                   | <ul style="list-style-type: none"> <li><b>CBA:</b> 2003</li> <li><b>CBA outcome:</b> positive</li> </ul>   | <ul style="list-style-type: none"> <li><b>Deployment strategy</b> Voluntary</li> <li><b>Roll-out:</b> complete (in 2009)</li> </ul>   | <ul style="list-style-type: none"> <li>GPRS,</li> <li>PLC</li> </ul>   | <ul style="list-style-type: none"> <li>Landis Gyr</li> <li>AEM</li> </ul>  | <ul style="list-style-type: none"> <li>all electrical meters to be read right after midnight on the first day of each month,</li> </ul>   | <ul style="list-style-type: none"> <li>Full roll-out (100% coverage)</li> <li>Sweden was the first</li> </ul>   |



|                      |  |   |  |  |   |   |
|----------------------|--|---|--|--|---|---|
|                      | <ul style="list-style-type: none"> <li>- <b>Metering activity</b><br/>Regulated</li> <li>- <b>Energy Regulator:</b> EI (Energimarknadsinspektionen / Energy Markets Inspectorate)</li> </ul>   | <ul style="list-style-type: none"> <li>- <b>Responsible party</b> – implementation and ownership: DSO</li> <li>- <b>Responsible party</b> – access to metering data: DSO</li> <li>- <b>Financing of roll-out:</b> Network Tariffs + DSO resources</li> <li>- <b>Implementation speed</b> 2003-2009</li> <li>- <b>Penetration rate by 2020</b> 100%</li> </ul>   | <ul style="list-style-type: none"> <li>- Radio</li> <li>- PLC</li> <li>- IP (fiber, etc.)</li> </ul>   |  | <ul style="list-style-type: none"> <li>- 90% of all installed smart meters have hourly metering capabilities,</li> <li>- 30% of installed meters are equipped with Home Area Network port,</li> <li>- DSOs are switching to hourly priced tariffs,</li> <li>- Currently, the challenge tackled by Sweden is to persuade all suppliers to offer hourly tariffs.</li> </ul>                               | country to (indirectly) mandate a full rollout of smart meters.   |
| UK<br>(Details 10.3) | <ul style="list-style-type: none"> <li>- <b>CBA:</b> 2011</li> <li>- <b>CBA outcome:</b> positive</li> <li>- <b>Metering activity</b><br/>Competitive</li> <li>- <b>Energy Regulator:</b> Ofgem (Office of Gas and Electricity Markets)</li> </ul> | <ul style="list-style-type: none"> <li>- <b>Deployment strategy:</b> Mandatory</li> <li>- <b>Responsible party</b> – implementation and ownership: Supplier</li> <li>- <b>Responsible party</b> – access to metering data: Central Hub</li> <li>- <b>Financing of roll-out:</b> Suppliers</li> <li>- <b>Implementation speed:</b> 2012-2020</li> <li>- <b>Penetration rate by 2020:</b> 100%</li> </ul> | <ul style="list-style-type: none"> <li>- DLMS / COSEM</li> <li>- ZigBee</li> <li>- Zig Bee Smart Energy over the smart meter home area network; XML from DCC (remotely)</li> </ul> | <ul style="list-style-type: none"> <li>- Landis+Gyr,</li> <li>- Itron,</li> <li>- Elster</li> <li>- ZIV</li> <li>- Iskraemeko</li> </ul> | <ul style="list-style-type: none"> <li>- Intechangeability of SM</li> <li>- User engagement</li> <li>- Smart experience to customer</li> <li>- Communication hubs</li> <li>- Messaging services</li> <li>- End-to-end security</li> <li>- Operational support</li> <li>- British Gas Smart Homes included some 500,000 smart meters using Vodafone's sim-cards and network for connectivity.</li> </ul> | <ul style="list-style-type: none"> <li>- Good progress (over 20% coverage)</li> <li>- Changing the devices – SMETS2 roll-out</li> </ul> |

## Annex 2 – List of identified smart meters deployed across EU-28

|    | Solution   | Meter types  | Readings (frequencies, accuracy, remoteness.)  | Advance tariff  | Remote on/off Demand Response – only for direct / connection of SM     | import/export and reactive metering (data type, data format, parameters, storage)   | Communication facilities, protocols / Technologies (   | Device compatibility level (TC65/290/DC) | End user benefits (operational / procedural level)   |
|----|--|--|--|---|--|---|--|--|--|
| 1. | - <b>Janz</b><br>Contactores de Energia SA<br>(Portugal) | - <b>B140</b><br><a href="http://www.janzce.pt/files/Catalogo_B140_SP.pdf">http://www.janzce.pt/files/Catalogo_B140_SP.pdf</a><br>- <a href="http://www.janzce.pt/files/Catalog%20B140_ENG_1.pdf">http://www.janzce.pt/files/Catalog%20B140_ENG_1.pdf</a><br>- <a href="http://www.edpdistribuc%20ao.pt/pt/rede/InovGrid/EDP%20Documents/SGS0044_D_EZ2010.pdf">http://www.edpdistribuc%20ao.pt/pt/rede/InovGrid/EDP%20Documents/SGS0044_D_EZ2010.pdf</a> | - Readings: 15' interval<br>- Class 1 / 2<br>- Direct readings (in kWh)<br>- Records until 999 999 kWh                     | - 5 tariffs   | - DR possible<br>- Latching relay<br>- Available for direct connection | - Non-volatile memory saves records of the last six billing periods as well as metering and safety data (reverse current events and battery alarms).<br>- Burden of the voltage circuit (nominal values): 1,0W (active power) and less than 1,2VA (apparent power) at 230V, 50Hz. | - Optical communication port: in compliance with IEC 62056-21<br>- Communications protocol: FLAG-Mode C<br>- Pulse output according to IEC 62053-31, class A, 100 pulses/kWh<br>- PLC-DCSK,<br>- GPRS<br>- RF Mesh | - interworkable                          | - bi-directional communications with handheld data collecting devices (or PDA and PC, with appropriate software), through the standard optical interface and through a serial RS232 compatible communication port, via RJ12 socket, for access to metering and safety data.<br>- In case of energy failure all the energy records are kept in the non-volatile memory. |
| 2. | - <b>Elster</b><br>(Romania)                             | - <b>Alpha A1800</b><br><a href="https://www.elstersolutions.com/en/product-details-all-regions/61/en/A1800_ALPHA?fid=F032EA0A896F40B486350FF21BE30E5E#sbox0=">https://www.elstersolutions.com/en/product-details-all-regions/61/en/A1800_ALPHA?fid=F032EA0A896F40B486350FF21BE30E5E#sbox0=</a> ;  | - Readings: 5', 15', 30', 60' intervals<br>- Class: 0.2S, 0.5S, A,B,C(MID) active energy<br>- Class: 1,2 - reactive energy | - Comprehensive tariff structure - up to 4 tariffs per day for 4 day types (16) | - DR - No<br>- Available for both direct and indirect connection       | - Non-volatile memory<br>- Optional 1MB extended<br>- 4 quadrant measurements for reactive energy<br>- 2 quadrant measurements for active energy<br>- 60 days storage data for 8 channels on 15 minutes   | - Optical communication port: in compliance with IEC 62056-21<br>- 1-2 Comms, Dlms/Cosem<br>- DLMS and/or ANSI protocol<br>- 2 ports (NIC): RS-232/485\$ and EA_NIC with last gasp                                 | - interchangeable                        | - Multilingual interface: IT, EN, FR, DE, SU<br>- Separate energy and demand tariff switching.<br>- Display of the polar diagram<br>- Graphical and Tabular Data Representation<br>- Instantaneous load curve analysis<br>- Power Quality Measurements data available as instantaneous or average data.  |
| 3. | - <b>Linky</b><br>(France)                               | - Linky (Itron, Landis+Gyr, Iskraemeco, Sagecom)   | - Readings: 30' interval,  | - 10 tariffs<br>- 8 configurable contacts                                       | - No data  | - No data   | - GSM/GPRS;<br>- PLC   | - interworkable                          | - The same device is intended to be deployed in all France<br>- power/supplier change and firmware can be updated  |

|    |                               |   |  |   |  |   |   |                   |   |
|----|-------------------------------|---|--|---|--|---|---|-------------------|---|
| 4. | - <b>STAER</b> (IT)<br>-      | - <b>CEWEPrometer-W</b><br><a href="http://www.staermis.it/ProductAttachments/15_51_0.pdf">http://www.staermis.it/ProductAttachments/15_51_0.pdf</a>                            | - Readings: 15' interval<br>- Class 0.2S 0.5S, 1   | - Two complex tariff systems (8 bands, 16 days, 16 seasons, 30 special days)  | - Available for direct connection<br>- DR – NO                   | - Internal memory: 1 MB   | - PSTN, ISDN, GSM, fiber optic and TCP-IP Ethernet networks (also with Modbus protocol).<br>- Optical Port IEC 1107 - IEC62056-21<br>- IEC62056-21(IEC1107) - DLMS/COSEM.<br>- RS-232,RS-422 - Ethernet (TCP-IP)<br>- The MODBUS protocol is available via an external converter (see CEWEmod Specification)<br>- RS-232 serial communication port      | - interchangeable | - Multilingual interface: IT, EN, FR, DE, SU<br>- Back-up counter clock battery   |
| 5. | - <b>STAER</b> (IT)<br>-      | - <b>Contatore CEWEPrometer-R</b><br><a href="http://www.staermis.it/ProductAttachments/16_54_0.pdf">http://www.staermis.it/ProductAttachments/16_54_0.pdf</a>                  | - Readings:15' interval<br>- Class 0.2S 0.5S, 1  | - Two complex tariff systems (8 bands, 16 days, 16 seasons, 30 special days)  | - Available for direct connection<br>- DR- No                    | - Internal memory: 1 MB   | - PSTN, ISDN, GSM, fiber optic and TCP-IP Ethernet networks (also with Modbus protocol).<br>- Optical Port IEC 1107 - IEC62056-21<br>- IEC62056-21 (IEC1107) the DLMS / COSEM.<br>- RS-232,RS-422 o Ethernet (TCP-IP)<br>- The MODBUS protocol is available via an external converter (see CEWEmod Specification)<br>- RS-232 serial communication port | - interchangeable | - Multilingual interface: IT, EN, FR, DE, SU<br>- Back-up counter clock battery<br>- Mountable on rack  |
| 6. | - <b>DPEE</b> (IT)<br>-       | - <b>TH40C</b><br><a href="http://www.dpee.it/download/contatori/th40c_en.pdf">http://www.dpee.it/download/contatori/th40c_en.pdf</a>   | - Class: 0.2s, 0.5s<br>- Reading intervals – No data   | - 4 tariffs   | - Available for direct connection<br>- DR-No data                | - all legally relevant data are stored in a non-volatile memory                 | - RS232, RS485, GSM/GPRS<br>- Ethernet (RJ45)<br>- IEC62056-21 or MODBUS  | - interworkable   | - NO data   |
| 7. | - <b>Elster</b> (IT, RO)<br>- | - <b>A1700</b><br><a href="http://www.energymis.it/assets/pdf/A1700D_direct_connected_brochure.pdf">http://www.energymis.it/assets/pdf/A1700D_direct_connected_brochure.pdf</a> | - Class 0.2S,0.5S and A,B,C (MID) - active energy<br>- Class: 1,2 - reactive energy<br>- Readings: 5', 15', 30', 60' intervals | - Comprehensive tariff structure<br>- 32 Time of use registers<br>- 8 Maximum demand registers (block or sliding)<br>- 5 Co-incident demands<br>- 2 Sliding demands<br>- 12 Seasons<br>- 24 Season changeover dates<br>- 96 Switching times<br>- 64 Exclusion dates | - DR – No<br>- available for both direct and indirect connection | - Load profile data can be stored for up to 900 days. of 30 minute profile data | - Communications modules can be RS232 or RS485. A range of communications media (PSTN, GSM, Ethernet, PAKNET) plug into a module directly under the meter terminal cover.<br>- Optical Port IEC 1107 - IEC62056-21<br>- DLMS/COSEM  | - interchangeable | - 2 line, multilingual dot matrix display<br>- Voltage imbalance detection<br>- Power Quality Measurements data available as instantaneous or average data. |

|     |   |  |   |  |   |  |  |  |   |
|-----|---|--|---|--|---|--|--|--|---|
| 8.  | <ul style="list-style-type: none"> <li>- Iskraemeko (IT, RO)</li> </ul> | <ul style="list-style-type: none"> <li>- <b>TE/DE 851 (I&amp;C meter) (Iskraemeko)</b></li> <li>- <b>MT851 / MD851</b></li> <li>- <a href="http://www.telematicasistemi.it/it/products/_01.category/old/mt851/TE851_DE851_eng.pdf">http://www.telematicasistemi.it/it/products/_01.category/old/mt851/TE851_DE851_eng.pdf</a></li> </ul> | <ul style="list-style-type: none"> <li>- Class: 0.2, 0.5S,</li> <li>- Readings: from 1 to 60 minutes with 1 minute resolution.</li> <li>- demand period can be set in a range</li> </ul>                                  | <ul style="list-style-type: none"> <li>- Up to 8 different day types (7 days + a holiday) and up to 64 weekly tariff changing-over</li> <li>- Schedule can be programmed.</li> <li>- Up to 64 seasons a year defined by weekly tariff changing-over schedule that is valid in a particular season can be programmed</li> </ul> | <ul style="list-style-type: none"> <li>- The meters can be equipped with auxiliary terminals for a load limiter.</li> <li>- It can be either an ON-OFF switch or a three point controller.</li> <li>- Available only for indirect connection</li> <li>- DR - Not possible</li> </ul>  | <ul style="list-style-type: none"> <li>- stores metering data of previous billing periods (up to 50 last billing periods),</li> </ul>                              | <ul style="list-style-type: none"> <li>- 1-2 comm, IEC61107, Mode C + Modbus</li> <li>- infrared optical port (IEC 61107)</li> <li>- RS 232 and RS 485</li> <li>- PSTN, ISDN or GSM modem</li> </ul>   | <ul style="list-style-type: none"> <li>- interconnectable</li> </ul> | <ul style="list-style-type: none"> <li>- Perpetuum calendar until 2090</li> <li>- Besides the current tariff program up to three so called sleeping tariff programs can be programmed and are activated automatical on programmed dates.</li> </ul>   |
| 9.  | <ul style="list-style-type: none"> <li>- Iskraemeko (IT)</li> </ul>     | <ul style="list-style-type: none"> <li>- <b>CSEMIDMT830 SEMIDMT831</b></li> <li>- Three-phase <a href="http://www.frer.it/public/allegato/CSEMIDMT830_831.pdf">http://www.frer.it/public/allegato/CSEMIDMT830_831.pdf</a></li> </ul>   | <ul style="list-style-type: none"> <li>- Class: 0.2s, 0.5s, 1s</li> <li>- Readings: 15' interval</li> </ul>   | <ul style="list-style-type: none"> <li>- Customizable tariff structure</li> </ul>  | <ul style="list-style-type: none"> <li>- available for both direct and indirect connection</li> <li>- DR possible</li> </ul>  | <ul style="list-style-type: none"> <li>- Reading export at (15 min, 1 hour, 1 day, 1 month)</li> <li>- Data export: XLS, TXT, RTF, MS Office compatible</li> </ul> | <ul style="list-style-type: none"> <li>- Optical interface</li> <li>- Modem (PSTN / ISDN / GSM)</li> <li>- RS232 / RS485 / CS</li> <li>- LAN</li> <li>- Internet</li> <li>- USB port</li> </ul>  | <ul style="list-style-type: none"> <li>- interconnectable</li> </ul> | <ul style="list-style-type: none"> <li>- Display of the polar diagram</li> <li>- Graphical and Tabular Data Representation</li> <li>- Instantaneous load curve analysis</li> </ul>  |
| 10. | <ul style="list-style-type: none"> <li>- Iskraemeko (IT)</li> </ul>     | <ul style="list-style-type: none"> <li>- MT880</li> <li>- Three-phase</li> <li>- four quadrants</li> <li>- <a href="http://www.telematicasistemi.it/en/documents/_01.category/manuali/MT880_UM_V3.00_ENG.pdf">http://www.telematicasistemi.it/en/documents/_01.category/manuali/MT880_UM_V3.00_ENG.pdf</a></li> </ul>                    | <ul style="list-style-type: none"> <li>- <b>Class</b> : 0.5s</li> <li>- Readings: 1', 5', 10', 15', 30', 60'</li> <li>- There are two basic demand period types: fixed demand period and rolling demand period</li> </ul> | <ul style="list-style-type: none"> <li>- Up to 8 tariffs.</li> </ul>   | <ul style="list-style-type: none"> <li>- remote communication channel GPRS or SMS,</li> <li>- load control functionality (three independent channels).</li> <li>- Available for both direct and indirect connection</li> <li>- DR – Not possible – SM missing relay switch</li> </ul> | <ul style="list-style-type: none"> <li>- No data</li> </ul>  | <ul style="list-style-type: none"> <li>- infrared optical port (IEC 62056-21)</li> <li>- optional built-in RS232 communication interface or</li> <li>- optional built-in RS485 communication interface.</li> <li>- DLMS/COSEM,</li> <li>- IEC 62056-21, mode E,</li> <li>- MODBUS OBIS data identification code according to IEC 62056-61 standard.</li> </ul> | <ul style="list-style-type: none"> <li>- Interchangeable</li> </ul>  | <ul style="list-style-type: none"> <li>- Separate energy and demand tariff switching. • Tariff switching driven by internal RTC (by IEC 61038).</li> <li>- Tariff switching via inputs (separately for energy and demand).</li> <li>- Power Quality Measurements data available as instantaneous or average data.</li> <li>- Harmonic components for currents and voltages (up to the 31st), THD factor.</li> <li>- Voltage sags &amp; swells.</li> <li>- Under – over voltage</li> </ul> |

|     |   |  |  |   |  |   |   |   |  |
|-----|---|--|--|---|--|---|---|---|--|
| 11. | <ul style="list-style-type: none"> <li>- Itron (RO)</li> </ul>        | <ul style="list-style-type: none"> <li>- SL7000 (Itron)</li> <li>- <a href="https://www.integra.co.it/attachments/article/58/SL7000%20RT%20Installation%20Guide.pdf">https://www.integra.co.it/attachments/article/58/SL7000%20RT%20Installation%20Guide.pdf</a></li> <li>- <a href="https://www1.itron.com/local/Indonesia%20Portfolio/ACESL7000_brochure_EN.pdf">https://www1.itron.com/local/Indonesia%20Portfolio/ACESL7000_brochure_EN.pdf</a></li> </ul> | <ul style="list-style-type: none"> <li>- Class 0.2S,0.5S and A,B,C (MID) - active energy</li> <li>- Class: 1,2 - reactive energy</li> <li>- Readings: 5', 15', 30', 60' intervals</li> </ul> | <ul style="list-style-type: none"> <li>- Comprehensive tariff structure - 10 tariffs</li> </ul>     | <ul style="list-style-type: none"> <li>- DR-Possible</li> <li>- Available for both direct and indirect connection</li> </ul>   | <ul style="list-style-type: none"> <li>- 4 quadrant measurent for reactive energy</li> <li>- 2 quadrant measurent for active energy</li> <li>- 60 days storage data for 8 channels on 15 minutes</li> </ul>       | <ul style="list-style-type: none"> <li>- 1-2 Comms, DImS/Cosem, Power to an external modem can be supplied from the meter (PSTN / GSM / GPRS / LAN): in IEC7 versions, the meter now provides up to 3W. » DLMS-Cosem conformance</li> <li>- RS232 + RS232 or RS485 DLMS-Cosem compliant PSTN, LAN (TCP/IP), GSM and GPRS media supported</li> </ul> | <ul style="list-style-type: none"> <li>- interchangeable</li> </ul> | <ul style="list-style-type: none"> <li>- Excess Consumption Feature</li> <li>- Power Quality Measurements data available as instantaneous or average data.</li> <li>- Separate energy and demand tariff switching.</li> </ul>  |
| 12. | <ul style="list-style-type: none"> <li>- <b>ITRON</b> (IT)</li> </ul> | <ul style="list-style-type: none"> <li>- <b>ITRON ACE6000</b></li> <li>- <a href="https://www1.itron.com/local/Indonesia%20Portfolio/ace6000_brochure_EN.pdf">https://www1.itron.com/local/Indonesia%20Portfolio/ace6000_brochure_EN.pdf</a></li> </ul>  | <ul style="list-style-type: none"> <li>- Readings: 15'</li> <li>- Class: 0.5s</li> <li>- Measurement period: 15'</li> </ul>  | <ul style="list-style-type: none"> <li>- 10 Basic quantities can be submitted to billing</li> </ul> | <ul style="list-style-type: none"> <li>- Remote/Local connect/disconnect meter installation through external contactor</li> <li>- Meter communication lock after wrong passwords sessions » EN50160 compliancy</li> <li>- Deliver modem information on demand</li> <li>- Available for both direct and indirect connection</li> <li>- DR-possible</li> </ul> | <ul style="list-style-type: none"> <li>- Read cycles are kept to a minimum by internal storage of all billing data, and powerful communications capabilities permit low-cost remote meter reading</li> </ul>      | <ul style="list-style-type: none"> <li>- PSTN, GSM, GPRS and IP communications are supported thanks to DLMS-Cosem Protocol.</li> <li>- Basic version without outputs with 1 serial port</li> <li>- Flexible version with 4 outputs and 1 serial port</li> <li>- Serial port can either be RS232 or RS485</li> </ul>                                 | <ul style="list-style-type: none"> <li>- interworkable</li> </ul>   | <ul style="list-style-type: none"> <li>- Excess Consumption Feature ACE6000 meters can monitor consumption against configurable thresholds and can activate contacts if consumption exceeds limits. » Instantaneous values such as Power Factor, Demand, Volts and Amps are made available for the end-user to help monitor personal consumption.</li> </ul> |
| 13. | <ul style="list-style-type: none"> <li>- Landis+Gyr (RO)</li> </ul>   | <ul style="list-style-type: none"> <li>- ZMD402,405,410 (Landis+Gyr)</li> <li>- <a href="http://www.metsys.hu/villamosenergia/files/7102000134_%20k%20en%20-%20Technical%20Data%20(Z.x.D300).pdf">http://www.metsys.hu/villamosenergia/files/7102000134_%20k%20en%20-%20Technical%20Data%20(Z.x.D300).pdf</a></li> </ul>   | <ul style="list-style-type: none"> <li>- 0.2S, 0.5S, Measurement period: 1'</li> <li>- Three-phase</li> </ul>  | <ul style="list-style-type: none"> <li>- Advance tariff system</li> </ul>                           | <ul style="list-style-type: none"> <li>- Available for both direct and indirect connection</li> <li>- DR-possible</li> </ul>   | <ul style="list-style-type: none"> <li>- 4 quadrant measurements for reactive energy</li> <li>- 2 quadrant measurements for active energy</li> <li>- 60 days storage data for 8 channels on 15 minutes</li> </ul> | <ul style="list-style-type: none"> <li>- serial, bidirectional, half duplex</li> <li>- optical interface according to IEC 62056-21</li> <li>- protocols IEC 62056-21 and DLMS</li> <li>- Other Connections type screwless spring-type terminal</li> </ul>   | <ul style="list-style-type: none"> <li>- interchangeable</li> </ul> | <ul style="list-style-type: none"> <li>- Calendar Type Gregorian or Persian (Jalaali)</li> <li>- Separate energy and demand tariff switching.</li> </ul>   |

|     |                     |   |   |   |  |   |  |                   |  |
|-----|---------------------|---|---|---|--|---|--|-------------------|--|
| 14. | - Elster (CY)       | - <b>AS230</b><br>- <a href="https://www.elstersolutions.com/assets/products/products_elster_files/AS230_Brocure_A1_11042012.pdf">https://www.elstersolutions.com/assets/products/products_elster_files/AS230_Brocure_A1_11042012.pdf</a>                               | - 0.2s, 0.5s<br>- Measurement period: 15'<br>- Single-phase   | - Tariff Structure<br>- 8 Time-of-Use Registers<br>- 1 Maximum Demand Register<br>- 12 Seasons<br>- 24 Change of Season Dates<br>- 48 Switching Times<br>- 32 Exclusion Dates<br>- 13 End of Billing Dates<br>- 10 Daily Billing Registers<br>- Daylight Savings<br>- Deferred Tariff | - Available for direct connection<br>- DR- yes                         | - import/Export   | - Optical bidirectional IEC 62056-21 port<br>- HAN interface will be available to match market requirements<br>- Modules will be available for: GSM/GPRS; PLC; Low Power<br>- Radio  | - interworkable   | - Load limiting  |
| 15. | - Elster (CY)       | - Alfa A 1700<br>- <a href="https://www.elstersolutions.com/assets/products/products_elster_files/A1700_31052012.pdf">https://www.elstersolutions.com/assets/products/products_elster_files/A1700_31052012.pdf</a>  | - Class 0.2S or 0.5S<br>- Reading intervals   | - •Comprehensive tariff structure<br>- 32 Time of use registers<br>- 8 Maximum demand registers (block or sliding)<br>- 5 Co-incident demands<br>- 2 Sliding demands<br>- 12 Seasons<br>- 24 Season changeover dates<br>- 96 Switching times<br>- 64 Exclusion dates                  | - Available for both direct and indirect connection<br>- DR – possible | - No data   | - Communications modules can be RS232 or RS485.<br>- PSTN, GSM, Ethernet, PAKNET<br>- 2 line, multilingual display<br>- ANSI communications port   | - interworkable   | - Instantaneous instrumentation values<br>- Instrumentation monitoring<br>- Data stream mode<br>- communications allows up to 90 days of 30 minute profile data to be collected in less than 30 seconds.                                   |
| 16. | - Echelon (RO)<br>- | - MTR 3500 CT Series Poly Phase Smart Meters<br>- <a href="http://www.echelon.com/assets/bltc7179d27178ed4c7/Smart-Meter-MTR-3500-IEC-Poly-Phase-datasheet.pdf">http://www.echelon.com/assets/bltc7179d27178ed4c7/Smart-Meter-MTR-3500-IEC-Poly-Phase-datasheet.pdf</a> | - +/-0.5 seconds per day.<br>- Logging intervals user-selected at 5, 10, 15, 20, 30, 60 minutes, or 1 day | - Comprehensive tariff structure  | - DR - yes   | - 2 quadrant measurement for reactive energy<br>- 2 quadrant measurement for active energy<br>- 60 days storage data for 8 channels on 15 minutes | - fully capable of securely connecting to ZigBee radio frequency (RF) or LonWorks® PL, M-bus, Multipurpose Expansion Port (MEP) or Open Smart Grid Protocol (OSGP) devices for Home Area Network (HAN) integration<br>- Optical Port: Certified to IEC 62056- 21 [2002] (physical and electrical requirements); ANSI C12.18 [2006] (communications protocol); ANSI C12.19 [1997] (data structure) Channel Type: CENELEC A-band power line communication channel. | - Interchangeable | - Dynamic behaviour (operational / procedural level)<br>- Connect to auxiliary meters (gas, water, heat) and grid devices<br>- Excess Consumption Feature<br>- Power Quality Measurements data available as instantaneous or average data. |



|     |              |  |   |   |   |                           |  |   |   |
|-----|--------------|--|---|---|---|---------------------------|--|---|---|
| 17. | - AEM (RO)   | <ul style="list-style-type: none"> <li>- CST 0420</li> <li>- <a href="http://aem.ro/wp-content/PDF/AEM_CST_0420.pdf">http://aem.ro/wp-content/PDF/AEM_CST_0420.pdf</a></li> </ul>  | <ul style="list-style-type: none"> <li>- class B (MID)</li> <li>- Logging intervals user-selected at 5, 10, 15, 20, 30, 60 minutes, or 1 day</li> </ul> | <ul style="list-style-type: none"> <li>- Comprehensive tariff structure</li> <li>- No of tariffs supported: 6</li> <li>- 4 quadrant measurement for reactive energy, 2 quadrant for active energy</li> <li>- 60 days storage data for 8 channels on 15 minutes</li> </ul> | <ul style="list-style-type: none"> <li>- DR- yes (switch relay optional for on/off and load limiting)</li> </ul>  | -                         | <ul style="list-style-type: none"> <li>- Optical Port: Certified to IEC 62056- 21 [2002] (physical and electrical requirements)</li> <li>- Remote communication like GSM/GPRS, PLC, RF; Local communication like M-bus, M-bus wireless, Zigbee;</li> </ul> | <ul style="list-style-type: none"> <li>- interworkable</li> </ul>   | <ul style="list-style-type: none"> <li>- Load limiting</li> <li>- The meter can be customised, i.e. specific parameters can be set with software according to the specific requirements of each customer. The parameters can be set during manufacturing or later by parametrization software through the optical port or remotely through the AMR module. The parameters stored in the meter are protected against unauthorized overwriting</li> <li>- Excess Consumption Feature</li> <li>- Separate energy and demand tariff switching.</li> </ul>               |
| 18. | ADD (PL, BG) | full range of Type 5 PRIME smart meter single phase, three phase direct and three phase with a current transformer (indirect)<br><a href="http://add-bg.com/en/products/9/electricity/66/meters">http://add-bg.com/en/products/9/electricity/66/meters</a> | Class: No data<br>Readings: No data   | - Multi tariffs   | <ul style="list-style-type: none"> <li>- Load control</li> <li>- Remote status control</li> <li>- Remote software update</li> <li>- DR- yes (disconnection through latching relay)</li> </ul> | - Import or Import/Export | <ul style="list-style-type: none"> <li>- DLMS/COSEM and OBIS</li> <li>- Integrated PL modem with OFDM</li> <li>- Optical port IEC 62056-21</li> <li>- RS485 port</li> <li>- Multi-communication platform</li> <li>- Open communication protocol</li> </ul> | <ul style="list-style-type: none"> <li>- interchangeable</li> </ul> | <ul style="list-style-type: none"> <li>- Max load for a period</li> <li>- Load profile</li> <li>- Events log</li> <li>- Alarms for unauthorized manipulation</li> <li>- Phase and Neutral</li> <li>- Energy quality monitoring</li> <li>- LCD display &amp; Battery</li> <li>- Built-in relays</li> <li>- Built-in quartz stabilized RTC</li> <li>- Tariff management</li> <li>- Programmable load profile</li> <li>- Load management via built-in relay</li> <li>- Local and remote Reading &amp; programming</li> <li>- Enhanced anti-tampering system</li> </ul> |

|     |                    |  |   |   |  |   |   |   |  |
|-----|--------------------|--|---|---|--|---|---|---|--|
| 19. | Sagemcom (LU)      | <p>OFDM Single-Phase Meter CX1000-6S<br/> <a href="http://www.sagemcom.com/fileadmin/user_upload/CP/pdf/2015/CP_Sagemcom_LuxMetering_220715_EN.pdf">http://www.sagemcom.com/fileadmin/user_upload/CP/pdf/2015/CP_Sagemcom_LuxMetering_220715_EN.pdf</a><br/> <a href="http://www.sagemcom.com/smart-city/smart-meter/electricity/advanced-metering/smart-metering/ofdm-single-phase-meter-cx1000-6s/">http://www.sagemcom.com/smart-city/smart-meter/electricity/advanced-metering/smart-metering/ofdm-single-phase-meter-cx1000-6s/</a></p> | <ul style="list-style-type: none"> <li>- Class 1 or 2 for active Energy</li> <li>- Class 2 or 3 for reactive energy</li> <li>- Readings: No data</li> </ul> | <ul style="list-style-type: none"> <li>- Tariff management</li> <li>- Programmable load profile</li> <li>- Local and remote Reading &amp; programming</li> <li>- Remote software upgrade</li> </ul>   | <ul style="list-style-type: none"> <li>- Load management via built-in relay</li> <li>- Disconnection through latching relay</li> </ul> | <ul style="list-style-type: none"> <li>- Import/Export Energy</li> <li>- DIN/BS connection</li> </ul>   | <ul style="list-style-type: none"> <li>- OFDM G3 / PRIME</li> <li>- GSM/GPRS</li> <li>- Ethernet</li> <li>- RS485/RS232</li> <li>- MBUS</li> <li>- Wireless technology (RF, Zigbee,...)</li> <li>- Multi-communication platform</li> <li>- Open communication protocol</li> </ul> | <ul style="list-style-type: none"> <li>- interoperable</li> </ul>   | <ul style="list-style-type: none"> <li>- Enhanced anti-tampering system</li> <li>- Multi-communication platform</li> <li>- Open communication protocol</li> <li>- Remote software upgrade</li> <li>- Enhanced anti-tampering system</li> <li>- Metrological locked software</li> <li>- Download capability on field</li> <li>- Remote Configuration</li> </ul> |
| 20. | SMETS2 (UK)        | <p>SMETS 2<br/> <a href="https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/381535/SMIP_E2E_SMETS2.pdf">https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/381535/SMIP_E2E_SMETS2.pdf</a></p>  | <p>Class: No data<br/> Readings: 30' intervals</p>  | <ul style="list-style-type: none"> <li>- the Payment Mode (currently in operation, being Prepayment Mode or Credit Mode [PIN];</li> <li>- the Tariff TOU Register Matrix(4.6.5.20) and the Tariff Block Counter</li> <li>- Matrix</li> <li>- the Consumption Register;</li> <li>- the Meter Balance [PIN];</li> </ul> | <ul style="list-style-type: none"> <li>- optional Load Control Switch</li> <li>- DR-possible</li> </ul>                                |   | <ul style="list-style-type: none"> <li>- DLMS/COSEM</li> <li>- Zigbee</li> <li>- HAN interface</li> </ul>   | <ul style="list-style-type: none"> <li>- Interchangeable</li> </ul> | <ul style="list-style-type: none"> <li>- Credit card prepayment</li> </ul>   |
| 21. | AEM (RO)           | <ul style="list-style-type: none"> <li>- CST0410</li> <li>- <a href="http://aem.ro/wp-content/PDF/AEM_CST_0410.pdf">http://aem.ro/wp-content/PDF/AEM_CST_0410.pdf</a></li> </ul>   | <ul style="list-style-type: none"> <li>- class B,C (MID)</li> <li>- Logging intervals user-selected at 5, 10, 15, 20, 30, 60 minutes, or 1 day</li> </ul>   | <ul style="list-style-type: none"> <li>- Comprehensive tariff structure</li> </ul>  | <ul style="list-style-type: none"> <li>- no</li> </ul>   | <ul style="list-style-type: none"> <li>- 4 quadrant measurement for reactive energy, 2 quadrant for active energy</li> <li>- 60 days storage data for 8 channels on 15 minutes</li> </ul> | <ul style="list-style-type: none"> <li>- Optical Port: Certified to IEC 62056- 21 [2002] (physical and electrical requirements)</li> <li>- 2 comm.ports (RS232/485) DLMS/COSEM</li> </ul>   | <ul style="list-style-type: none"> <li>- Interchangeable</li> </ul> | <ul style="list-style-type: none"> <li>- Excess Consumption Feature</li> <li>- Separate energy and demand tariff switching.</li> </ul>   |
| 22. | Elster (RO)        | <ul style="list-style-type: none"> <li>- AS1440</li> <li>- <a href="https://www.elstersolutions.com/en/product-details-sa/130/en/ALPHA_SMART_AS1440#sbox0=">https://www.elstersolutions.com/en/product-details-sa/130/en/ALPHA_SMART_AS1440#sbox0=</a></li> </ul>  | <ul style="list-style-type: none"> <li>- class B,C (MID)</li> <li>- Logging intervals user-selected at 5, 10, 15, 20, 30, 60 minutes, or 1 day</li> </ul>   | <ul style="list-style-type: none"> <li>- Comprehensive tariff structure</li> </ul>  | <ul style="list-style-type: none"> <li>- YES</li> </ul>  | <ul style="list-style-type: none"> <li>- 4 quadrant measurement for reactive energy, 2 quadrant for active energy</li> <li>- 60 days storage data for 8 channels on 15 minutes</li> </ul> | <ul style="list-style-type: none"> <li>- Optical Port: Certified to IEC 62056- 21 [2002] (physical and electrical requirements)</li> <li>- 2 comm.ports (RS232/485) DLMS/COSEM</li> </ul>   | <ul style="list-style-type: none"> <li>- Interchangeable</li> </ul> | <ul style="list-style-type: none"> <li>- Excess Consumption Feature</li> <li>- Separate energy and demand tariff switching.</li> </ul>   |
| 23. | Ningbosanxing (RO) | <ul style="list-style-type: none"> <li>- P34S02-DC</li> <li>- <a href="http://www.sanxingelectric.com/prodeta.php?id=5bmy5ra4ezkxfXRoaXNfaXNfYV9lbmNyeXB0KiUIJCQsO14seGJsP2lkPTYxNi8%3D">http://www.sanxingelectric.com/prodeta.php?id=5bmy5ra4ezkxfXRoaXNfaXNfYV9lbmNyeXB0KiUIJCQsO14seGJsP2lkPTYxNi8%3D</a></li> </ul>   | <ul style="list-style-type: none"> <li>- class B,C (MID)</li> <li>- Logging intervals user-selected at 5, 10, 15, 20, 30, 60 minutes, or 1 day</li> </ul>   | <ul style="list-style-type: none"> <li>- Comprehensive tariff structure</li> </ul>  | <ul style="list-style-type: none"> <li>- YES</li> </ul>  | <ul style="list-style-type: none"> <li>- 4 quadrant measurement for reactive energy, 2 quadrant for active energy</li> <li>- 60 days storage data for 8 channels on 15 minutes</li> </ul> | <ul style="list-style-type: none"> <li>- Optical Port: Certified to IEC 62056- 21 [2002] (physical and electrical requirements)</li> <li>- 2 comm.ports (RS232/485) DLMS/COSEM</li> </ul>   | <ul style="list-style-type: none"> <li>- Interchangeable</li> </ul> | <ul style="list-style-type: none"> <li>- Excess Consumption Feature</li> <li>- Separate energy and demand tariff switching.</li> </ul>   |

## Annex 3 - Smart meter functionalities assessment based on COMMISSION RECOMMENDATION of 9 March 2012 on preparations for the roll-out of smart metering systems (2012/148/EU)

|  | Austria | Belgium | Bulgaria | Croatia | Cyprus | Czech Republic | Denmark            | Estonia            | Finland            | France | Germany | Greece | Hungary | Ireland | Italy              | Latvia | Lithuania | Luxembourg | Malta | The Netherlands | Poland | Portugal | Romania | Slovakia | Slovenia | Spain | Sweden | United Kingdom   |     |
|--|---------|---------|----------|---------|--------|----------------|--------------------|--------------------|--------------------|--------|---------|--------|---------|---------|--------------------|--------|-----------|------------|-------|-----------------|--------|----------|---------|----------|----------|-------|--------|------------------|-----|
| Common minimum functional requirements   |         |         |          |         |        |                |                    |                    |                    |        |         |        |         |         |                    |        |           |            |       |                 |        |          |         |          |          |       |        |                  |     |
| Every smart metering system for electricity should offer at least all the functionalities listed below. <i>Please check each applying functionality under corresponding pilot case</i> |         |         |          |         |        |                |                    |                    |                    |        |         |        |         |         |                    |        |           |            |       |                 |        |          |         |          |          |       |        |                  |     |
| For the customer:  |         |         |          |         |        |                |                    |                    |                    |        |         |        |         |         |                    |        |           |            |       |                 |        |          |         |          |          |       |        |                  |     |
| (a) Provide readings <sup>2</sup> .  | [+]     | [+]     | [+]      | [?]     | [+]    | [+]            | [+]                | [+]                | [+] <sup>3</sup>   | [+]    | [+]     | [+]    | [+/-]   | [+]     | [+]                | [+]    | [+]       | [?]        | [+/-] | [+]             | [+]    | [+]      | [+]     | [+]      | [+]      | [+]   | [+]    | [+] <sup>4</sup> |     |
| (b) Update the readings <sup>5</sup> .   | [+]     | [+/-]   | [-]      | [?]     | [+]    | [+]            | [+/-] <sup>6</sup> | [+/-] <sup>7</sup> | [+/-] <sup>8</sup> | [+]    | [+]     | [+]    | [+]     | [+]     | [+/-] <sup>9</sup> | [+]    | [+]       | [?]        | [+]   | [+]             | [+]    | [+]      | [+]     | [+]      | [+]      | [+/-] | [-]    | [+/-]            | [+] |
| For the metering operator:   |         |         |          |         |        |                |                    |                    |                    |        |         |        |         |         |                    |        |           |            |       |                 |        |          |         |          |          |       |        |                  |     |
| (c) remote reading <sup>10</sup>   | [+]     | [+]     | [+]      | [?]     | [+]    | [+]            | [+]                | [+]                | [+]                | [+]    | [+]     | [+]    | [+]     | [+]     | [+]                | [+]    | [+]       | [+]        | [+]   | [+]             | [+]    | [+]      | [+]     | [+]      | [+]      | [+]   | [+]    | [+]              |     |
| (d) two-way communication <sup>11</sup>  | [+]     | [+]     | [+]      | [?]     | [+]    | [+]            | [+]                | [+]                | [+]                | [+]    | [+]     | [+]    | [+]     | [+]     | [+]                | [+]    | [+]       | [+]        | [+]   | [+]             | [+]    | [+]      | [+]     | [+]      | [+]      | [+]   | [+]    | [+]              |     |
| e) readings with frequency. <sup>12</sup>  | [+]     | [+]     | [+]      | [?]     | [+]    | [+]            | [+]                | [+]                | [+]                | [+]    | [+]     | [+]    | [+]     | [+]     | [+]                | [+]    | [+]       | [+]        | [+]   | [+]             | [+]    | [+]      | [+]     | [+/-]    | [+]      | [+]   | [+]    | [+]              |     |
| For commercial aspects of energy supply:   |         |         |          |         |        |                |                    |                    |                    |        |         |        |         |         |                    |        |           |            |       |                 |        |          |         |          |          |       |        |                  |     |
| (f) Support advanced tariff systems. <sup>13</sup>   | [+]     | [+]     | [+]      | [?]     | [+]    | [+]            | [+]                | [+]                | [+]                | [+]    | [+]     | [+]    | [+]     | [+]     | [+]                | [+]    | [+]       | [?]        | [+]   | [+]             | [+]    | [+]      | [+]     | [+]      | [+]      | [+]   | [+]    | [+]              |     |
| (g) remote on/off control <sup>14</sup> .  | [+]     | [+]     | [+]      | [?]     | [+]    | [+]            | [+]                | [+]                | [+]                | [+]    | [?]     | [+]    | [+]     | [+]     | [+]                | [+]    | [+]       | [?]        | [+/-] | [+]             | [+]    | [+]      | [+]     | [+]      | [+]      | [+]   | [+/-]  | [+]              |     |

<sup>2</sup> Provide readings directly to the customer and any third party designated by the consumer. This functionality is essential in a smart metering system, as direct consumer feedback is essential to ensure energy savings on the demand side. There is a significant consensus on provision of standardised interfaces which would enable energy management solutions in 'real time', such as home automation, and different demand response schemes and facilitate secure delivery of data directly to the customer. Accurate, user-friendly and timely readings provided directly from the interface of customer's choice to the customer and any third party designated by the consumer are strongly recommended since they are the key to running demand response services, taking 'online' energy-saving decisions and effective integration of distributed energy resources. In order to stimulate energy saving, Member States are strongly recommended to ensure that final customers using smart metering systems are equipped with a standardised interface which provides visualised individual consumption data to the consumer.

<sup>3</sup> customers have the possibility to order (at an extra cost) metering equipment with separate output installation for real time readings.

<sup>4</sup> Smart Metering Equipment Technical Specifications (SMETS) document describes, amongst other, the minimum functional requirements for electricity and gas smart meters

<sup>5</sup> Update the readings referred to in point (a) frequently enough to allow the information to be used to achieve energy savings.. The general consensus is that an update rate of every 15 minutes is needed at least. Further developments and new energy services are likely to lead to faster communications. It is also recommended that the smart metering system should be able to store customer consumption data for a reasonable time in order to allow the customer and any third party designated by the consumer to consult and retrieve data on past consumption. This should make it possible to calculate costs related to consumption

<sup>6</sup> previously installed meters still reflect electricity consumption readings, available to the consumers, on an hourly base

<sup>7</sup> Partly complying with the second functionality (functionality (b)): Meter readings are on an hourly base (instead of 15min)

<sup>8</sup> electricity consumption data are communicated on an hourly base.

<sup>9</sup> The metering data can be accessed through local interface (Enel smart info®) that can be connected by the customer in every domestic socket. This interface is already available and it is currently being provided in large pilot projects. With the Enel smart info® final customers can monitor their consumption data collected every 10 min and achieved in real time 20 upon customer request.

<sup>10</sup> Allow remote reading of meters by the operator. This functionality relates to the supply side (metering operators). There is a broad consensus that this is a key functionality.

<sup>11</sup> Provide two-way communication between the smart metering system and external networks for maintenance and control of the metering system. This functionality relates to metering. There is a broad consensus that this is a key functionality

<sup>12</sup> Allow readings to be taken frequently enough for the information to be used for network planning. This functionality relates to both the demand side and the supply side.

<sup>13</sup> Support advanced tariff systems. This functionality relates to both the demand side and the supply side. Smart metering systems should include advance tariff structures, time-of-use registers and remote tariff control. This should help consumers and network operators to achieve energy efficiencies and save costs by reducing the peaks in energy demand. This functionality, together with functionalities referred to in points (a) and (b), is a key driving force for empowering the consumer and for improving the energy efficiency of the supply system. It is strongly recommended that the smart metering system allows automatic transfer of information about advanced tariffs options to the final customers, e.g. via standardised interface mentioned under (a).

| For security and data protection:   |  |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |       |       |       |     |  |
|---|--|-----|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----|-----|-----|-----|-------|-------|-------|-----|--|
| (h) secure data communications. <sup>15</sup>   | [+]  | [+] | [+]   | [?] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+]   | [+] | [+] | [+] | [+] | [+]   | [+]   | [+/-] | [+] |  |
| (i) Fraud prevention and detection. <sup>16</sup>   | [+]  | [+] | [+]   | [?] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [?] | [+/-] | [+] | [+] | [+] | [+] | [+]   | [+]   | [+]   | [+] |  |
| For distributed generation:   |  |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |       |       |       |     |  |
| (j) import/export and reactive metering. <sup>17</sup>  | [+]  | [+] | [+/-] | [?] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [+] | [-] | [+] | [+] | [+] | [+] | [?] | [+]   | [+] | [+] | [+] | [+] | [+/-] | [+/-] | [+]   | [+] |  |
| Industrial Policy <sup>18</sup> (sustainability, efficiency, services, security, support for EU IEM, coordinated grid development, market mechanisms for new services, adequate grid connection and access, consumer awareness and engagement, national strategies) |  |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |       |       |       |     |  |
| Finland   | Customers have the possibility to order (at an extra cost) metering equipment with separate output installation for real time readings.  |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |       |       |       |     |  |
| Italy   | <p>The Italian Regulatory Authority for Electricity Gas and Water (AEEGSI), according to the Legislative decree 4th July 2014, n. 102, has started consultations about the definition of requirements and framework that have led to the issuance of the resolutions 87/2016/R/eel “<i>Functional requirements enabling intelligent low voltage smart meters and performance of the second generation (2G) smart metering systems in the electric sector, according to the Legislative decree 4th July 2014, n. 102</i>” and 646/2016/R/eel “<i>Second generation (2G) smart metering systems: identification of costs for the measurement of the low voltage electrical power and provisions about the commissioning. TIME changes</i>”. The operations that have to be assured by the second generation (2G) smart metering systems have the following targets:</p> <ul style="list-style-type: none"><li>- increasing efficiency of remote reading and management;</li><li>- increasing the granularity of the energy measurements remotely detected;</li><li>- making validated measurements available to the sellers within 24h;</li><li>- delivering data in real time to the customers;</li><li>- allowing the meters to send messages spontaneously.</li></ul> <p>The faster validated data availability for the sellers and other eventual chain actors and the instant not validated data availability for customers, create the conditions to develop new services.</p> <p>For the 2G systems, the Italian Authority has overtaken the criterion of the identification of cost at closure; following the international best practices, the Authority sets a standard cost that is used to define the spending forecast for the investment, year by year, for fifteen years. The standard cost considers also the forecast of the distribution companies. These companies are encouraged to make accurate forecast through penalties for wrong forecast. Furthermore, if the company succeeds in lowering costs than expected, it can hold part of the benefit till 25%.</p> |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |       |       |       |     |  |
| Malta   | In Malta, Smart metering encapsulates the concept of managing new metering devices for both water and electricity services. Smart meters bring an end to estimated bills and door-to-door meter readings, and provide customers, Utilities, and the Regulator with accurate information on the amount of electricity being used.<br>Consumer engagement through better consumption information   |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |       |       |       |     |  |
| Netherlands   | Opt-out functionality  |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |       |       |       |     |  |
| Portugal  | EDP ready product (the main energy consuming equipment identification; possibility of the electricity bill estimation; the remote control of the equipment; programming the equipment use; warning in case of anomaly or unexpected consumption; identification of savings opportunities) <ul style="list-style-type: none"><li>• In Lisbon pilot in Parque das Nações there are implemented NB-IoT meters that play an active role in helping to improve the energy consumption efficiency.</li><li>• NB-IoT supports online measurements of consumption, supporting various values per hour, in addition to this, the DR functionality is improving, enabling the installed capacity to be managed almost in real time. This function will go a long way in supporting the increase of EV and renewable energy.</li></ul>  |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |       |       |       |     |  |
| Romania   | Smart meter implementation Plan – expected to be approved by ANRE by the end of 2017   |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |       |       |       |     |  |
| Spain   | Iberdola: The company has already modernised 76% of all of its meters with subscribed power equal to or less than 15 kilowatts, totalling 10.5 million meters.   |     |       |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |     |     |     |     |       |       |       |     |  |

<sup>14</sup> Allow remote on/off control of the supply and/or flow or power limitation. This functionality relates to both the demand side and the supply side. It provides additional protection for the consumer by allowing grading in the limitations. It speeds up processes such as when moving home — the old supply can be disconnected and the new supply connected quickly and simply. It is needed for handling technical grid emergencies. It may, however, introduce additional security risks which need to be minimised.

<sup>15</sup> Provide secure data communications. This functionality relates to both the demand side and the supply side. High levels of security are essential for all communications between the meter and the operator. This applies both to direct communications with the meter and to any messages passed via the meter to or from any appliances or controls on the consumer's premises. For local communications within the consumer's premises, both privacy and data protection are required.

<sup>16</sup> Fraud prevention and detection. This functionality relates to the supply side: security and safety in the case of access. The strong consensus shows the importance attached to this functionality. This is necessary to protect the consumer, for example from hacking access, and not just for fraud prevention.

<sup>17</sup> Provide import/export and reactive metering. This functionality relates to both the demand side and the supply side. Most countries are providing the functionalities necessary to allow renewable and local micro-generation, thus future-proofing meter installation. It is recommended that this function should be installed by default and activated/disabled in accordance with the wishes and needs of the consumer.

<sup>18</sup> <http://ec.europa.eu/energy/en/topics/markets-and-consumers/smart-grids-and-meters/smart-grids-task-force>



|        |  |
|--------|--|
|        | <p>The smart meters are equipped with a remote management system allowing the customers to access the website and see their daily, weekly and monthly consumption curves, their maximum power demand and many other details.</p> <ul style="list-style-type: none"><li>• <b>In terms of security:</b> Iberdola uses the highest international standards and robust, maximum security encryption algorithms that guarantee the authentication, confidentiality and privacy of every one of its digital devices by means of unique user name and password identification.</li><li>• Digital meters use high-security cryptographic keys, in accordance with internationally established standards in the sector, ensuring data package leave encrypted and authenticated</li><li>• The digitalization of the grid facilitates the integration of the renewable energy distributed, the management of a grid is going to be increasingly active, and the future mass integration of EV</li><li>• The information received about the state of operation of the grid enables the necessary investments to be optimized, maintenance work to be improved, increasing operating efficiency</li><li>• The gradual roll-out of smart grids in Spain once again demonstrates IBERDOLA's strong pull effect on the domestic business sector and its positive impact on job creation and maintenance</li></ul> |
| Sweden | Vendor lock risk. Grid operators can become too dependent on a single supplier, because in Sweden the metering infrastructure does not have to comply with a certain standard  |
| UK     | Smart Metering Equipment Technical Specifications (SMETS) document describes, amongst other, the minimum functional requirements for electricity and gas smart meters  |

- [+] – full compliance
- [-] – no compliance
- [+/-] – partial compliance
- [?] - no data available/no decision

## Annex 4 - Pilot country template

| <b>Objectives</b> | <ul style="list-style-type: none"> <li>Eliciting information from each pilot country considering the real status of smart meter roll-out at the level of mid-2017</li> <li>Please try to add specific info considering the questions above regardless of the information already published in EU reports like: <ul style="list-style-type: none"> <li><a href="http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0356&amp;from=EN">http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0356&amp;from=EN</a></li> <li><a href="http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014SC0188&amp;from=EN">http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014SC0188&amp;from=EN</a></li> <li><a href="http://my-smart-energy.eu">http://my-smart-energy.eu</a></li> <li><a href="http://ses.jrc.ec.europa.eu/smart-metering-deployment-european-union">http://ses.jrc.ec.europa.eu/smart-metering-deployment-european-union</a></li> </ul> </li> </ul> <p>*the information from this reports is already consolidated in the tables proposed in D2.5 (attached)</p> |                |
|-------------------|---|----------------|
| RQ                | Pilot Country:  | [Country Name] |
| RQ1               | <p>Following the CBA (in what year) which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extend your country will be able to achieve the 2020 target?</p>   |                |
| RQ2               | Number of DSOs and their influence on the market  |                |
| RQ3               | Number of projects deploying smart meters in your country? Who leads those projects?  |                |
| RQ4               | No of smart meters installed in your country by June 2017 (info from National Regulator)  |                |
| RQ5               | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the approach in your country?   |                |
| RQ6               | SM infrastructure is dependent on DSO /Energy Supplier  |                |
| RQ7               | Producer / Supplier of SMs implemented in your country  |                |
| RQ8               | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi , Zigbee, other   |                |



|      |   |  |
|------|---|--|
| RQ9  | <p>Rules in force in each pilot country (technical standards &amp; national authorities regulations) referring specifically to the SM (e.g. <i>ANRE Decree no 145/2016 in Romania or standards CEI 0-16/CEI o-21 and TIME in Italy</i>). Indeed, the functionalities supported by each device strictly depend on the existing regulatory framework; therefore, a better knowledge of the rules will probably allow us to better understand the motivations of given choices of SM manufacturers.</p>  |  |
| RQ10 | <p>Type of smart meters installed in your country. Please provide the link to the installation manual, if available.</p> <p>Please provide the following information if possible:</p> <ol style="list-style-type: none"> <li>1. name of product OR family of products OR series of the product OR suite of products:</li> <li>2. Technical specifications / distinctive features for the type of smart meters described above:</li> </ol> <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, if applicable in your country, focus more on the categories of users. Metering performances (reading frequency, etc.) mainly depend on the rules in force, as already mentioned, and on the characteristics of the user involved. For example, in Italy, different metering strategies are adopted according to the user's voltage level, contractual power (e.g., LV ≤55 kW, LV &gt;55 kW, MV) and behavior (passive user, prosumer, etc.).</i></p> <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <ol style="list-style-type: none"> <li>a) Readings (frequencies, accuracy, remoteness</li> <li>b) Advance tariff/ /number/configurable tariffs</li> <li>c) Remote on/off (DR)</li> <li>d) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>e) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>f) End-user benefits (could the consumer change the energy provider without changing the device already installed?<br/>Does the smart meter installed need a firmware update?</li> </ol> |  |
| RQ11 | <p>Please provide info on whether the legal framework in your country provides clear definitions of technical and organizational requirements to ensure data protection and data security. (cyber-security aspects of the smart meter infrastructure)</p>   |  |

## Annex 5 – Pilot countries fiches

### Romania

|     | Pilot Country:  | Romania  |
|-----|---|--|
| RQ1 | <p>Following the CBA (in what year) which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extend your country will be able to achieve the 2020 target?</p> | <ul style="list-style-type: none"> <li>Romanian government commissioned a CBA to AT Kearney in 2012.</li> <li>Outcome: positive</li> <li>Smart meter deployment strategy: Mandatory</li> <li>Responsible party for implementation of SM: DSO</li> </ul> <p><b>Current situation:</b></p> <ul style="list-style-type: none"> <li>All 8 Romanian DSOs initiated implementations plans that were referred to ANRE (<i>details on RQ4</i>)</li> <li>Now they are pending advice notes from ANRE to initiate investments;</li> <li>until receiving the advice note from Regulator, DSOs may allocate to smart meters 10% of the investment budget</li> <li>2020 target: 80%</li> <li>Possible delays because the National Plan of Smart Grid Implementation is pending approval from National Regulator, the deadline is pushed since April 2017</li> </ul> |
| RQ2 | Number of DSOs and their influence on the market  | <ul style="list-style-type: none"> <li>8 concessionary DSOs (<b>Electrica</b> (Muntenia Nord, Transilvania Sud și Transilvania Nord), <b>Enel</b> (Muntenia Sud, Banat și Dobrogea), <b>E.ON</b> (Moldova) și <b>CEZ</b> (Oltenia).</li> <li>The Government leased the infrastructure to these 8 DSOs for 48 years in 2007 when the liberalization process started.</li> <li>Natural monopoly as the DSO are regional distribution operators with no real competition</li> <li>The liberalization of energy market will end in 31<sup>st</sup> of December 2017, starting 1<sup>st</sup> of January 2018 all the energy will come from the free market</li> </ul>  |

|     |   |   |
|-----|---|---|
| RQ3 | Number of projects deploying smart meters in your country? Who leads those projects?  | <ul style="list-style-type: none"> <li>All 8 DSOs have submitted to the National Regulator implementation plans for smart meter roll-out yearly</li> <li>CEZ pending approval for 2017</li> </ul>   |
| RQ4 | No of smart meters installed in your country by June 2017 (info from National Regulator)  | <p><b>Total: 468.410</b></p> <p><b>ENEL – 2.8 million clients</b></p> <ul style="list-style-type: none"> <li>ENEL (via 3 pilot projects)– installed 140.000</li> <li>- 2017 Target - 150.000</li> </ul> <p><b>E.ON – 1.4 million clients</b></p> <ul style="list-style-type: none"> <li>E.ON installed– 150.000 smart meters</li> <li>- 2017 Target - 150.000</li> </ul> <p><b>CEZ – 1.3 million clients</b></p> <ul style="list-style-type: none"> <li>CEZ installed starting from 2012 - 33.410 (SM from local producer AEM)</li> </ul> <p><b>ELECTRICA – 3.5 million clients</b></p> <ul style="list-style-type: none"> <li>ELECTRICA – installed 145.00</li> <li>2017 Target - 200.000</li> </ul> |
| RQ5 | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the approach in your country? | <ul style="list-style-type: none"> <li>at the moment, there is no legislative solution to inject the electricity into the grid</li> <li>Feed-in tariff accepted based on a regulation framework (ANRE and Government initiatives to support renewables and Smart Grids infrastructure)</li> <li>The biggest obstacle for the country to have more prosumers is the lack of the smart grids since the infrastructure is rather old.</li> <li>A Decree from ANRE could clarify the role of prosumer on Romanian market-</li> </ul>  |
| RQ6 | SM infrastructure is dependent on DSO /Energy Supplier  | <ul style="list-style-type: none"> <li>the smart meter infrastructure is depended on DSO</li> </ul>   |
| RQ7 | Producer / Supplier of SMs implemented in your country  | <ul style="list-style-type: none"> <li>Honeywell (Elster)</li> <li>Echelon</li> <li>Landis-Gyr</li> <li>Iskraemeco (IDIS smart meter)</li> <li>AEM</li> </ul>   |
| RQ8 | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM,  | <p>Data collection: From sensors to smart meters: WiFi, Zigbee, WIMAX</p> <p>Data communication: From smart</p>   |

|      |   |   |
|------|---|---|
|      | WiFi , Zigbee, other  | meter to Data Concentrator: PLC (G3, Prime, M&M, OSGP)<br>Data communication/ data analysis: from Data Concentrator to ICT infrastructure: GPRS, GSM, 3G, 4G, RF 868 MHz,   |
| RQ9  | Rules in force in each pilot country (technical standards & national authorities regulations) referring specifically to the SM (e.g. <i>ANRE Decree no 145/2016 in Romania or standards CEI 0-16/CEI 0-21 and TIME in Italy</i> ). Indeed, the functionalities supported by each device strictly depend on the existing regulatory framework; therefore, a better knowledge of the rules will probably allow us to better understand the motivations of given choices of SM manufacturers.  | <ul style="list-style-type: none"> <li>Decree no 145/2016, issued by ANRE sets the minimum requirements for the smart meters implementation projects</li> </ul>   |
| RQ10 | <p>Type of smart meters installed in your country. Please provide the link to the installation manual, if available.</p> <p>Please provide the following information if possible:</p> <ol style="list-style-type: none"> <li>name of product OR family of products OR series of the product OR suite of products:</li> <li>Technical specifications / distinctive features for the type of smart meters described above:</li> </ol> <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, if applicable in your country, focus more on the categories of users. Metering performances (reading frequency, etc.) mainly depend on the rules in force, as already mentioned, and on the characteristics of the user involved. For example, in Italy, different metering strategies are adopted according to the user's voltage level, contractual power (e.g., LV ≤55 kW, LV &gt;55 kW, MV) and behavior (passive user, prosumer, etc.).</i></p> | <p>ENERLUX family (from AEM) – triphase, installed in CEZ , ENEL projects</p> <p><a href="https://www.cez.ro/ckfinder/userfiles/files/cez/cariere-in-cez/bibliografie/enerlux-m.pdf">https://www.cez.ro/ckfinder/userfiles/files/cez/cariere-in-cez/bibliografie/enerlux-m.pdf</a></p> <ul style="list-style-type: none"> <li>A) yes, 15',</li> <li>B) yes, 12 tariffs</li> <li>C) no</li> <li>D) yes</li> <li>E) GSM/GPRS; PLC; RF</li> <li>F) NO</li> </ul> <p>ELECTRICA – installed a series of smart meters in the pilot projects:</p> <p><a href="http://www.edtn.ro/wp-content/uploads/2017/06/Instruc%C5%A3iune-pentru-citirea-indexurilor-aferente-energiei-electrice-%C3%AEnregistrate-de-contoare-V6-Iunie-2017.pdf">http://www.edtn.ro/wp-content/uploads/2017/06/Instruc%C5%A3iune-pentru-citirea-indexurilor-aferente-energiei-electrice-%C3%AEnregistrate-de-contoare-V6-Iunie-2017.pdf</a></p> <ul style="list-style-type: none"> <li>- ENERLUX M</li> <li>- AEM CST 0410</li> <li>- AEM CST 0420</li> <li>- MTR 1000</li> <li>- MTR 3000</li> <li>- ITRON ITE 411 PRIME</li> <li>- ZIV 5CTD</li> <li>- ELSTER A1800</li> <li>- ITRON ACE 6000</li> <li>- ITRON SL 7000</li> </ul> |

|      |   |   |
|------|---|---|
|      | <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <ul style="list-style-type: none"> <li>g) Readings (frequencies, accuracy, remoteness)</li> <li>h) Advance tariff/ /number/configurable tariffs</li> <li>i) Remote on/off (DR)</li> <li>j) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>k) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>l) End-user benefits (could the consumer change the energy provider without changing the device already installed? Does the smart meter installed need a firmware update?)</li> </ul> | <p>ENEL – installed (SMART METER CERM1) SM and for 2017 will use SM produced by AEM Romania</p> <p><a href="https://www.e-distributie.com/ro-RO/Documents/enel_smart%20meter_pliant_148x210.pdf">https://www.e-distributie.com/ro-RO/Documents/enel_smart%20meter_pliant_148x210.pdf</a></p> <p><a href="https://www.e-distributie.com/_catalogs/masterpage/pdf/flyer_smart_meter.pdf">https://www.e-distributie.com/_catalogs/masterpage/pdf/flyer_smart_meter.pdf</a></p> |
| RQ11 | <p>Please provide info on whether the legal framework in your country provides clear definitions of technical and organizational requirements to ensure data protection and data security. (cyber-security aspects of the smart meter infrastructure)</p>   | <ul style="list-style-type: none"> <li>• Decree no 145/2016, issued by ANRE sets the minimum requirements for security and data protection to ensure data security, data privacy and secured communication.</li> </ul>  |

## Portugal

|     | Pilot Country:  | Portugal  |
|-----|---|---|
| RQ1 | <p>Following the CBA (in what year) which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extent your country will be able to achieve the 2020 target?</p> | <ul style="list-style-type: none"> <li>• In Portugal there <b>is no legal framework</b> for a mandatory <b>SM rollout</b>, but the DSO (EDP Distribuição) has decided to start the installation of the SM through the pilot projects</li> <li>• The first economic evaluation of long-term costs and benefits associated with SM rollout has been <b>completed in 2012</b></li> <li>• There is a decision process for a <b>Cost-Benefit analysis (CBA)</b> which</li> </ul> |

|     |  |   |
|-----|--|---|
|     |  | <p><b>has not been finished</b> yet. The massive <b>installation</b> of <b>SMs</b> has <b>not started yet</b>.</p> <ul style="list-style-type: none"> <li>The number of SMs that must be installed by 2020: 6 500 000</li> </ul>  |
| RQ2 | Number of DSOs and their influence on the market   | <ol style="list-style-type: none"> <li><b>EDP Distribuição (the largest, 99%)</b></li> <li>Cooperativa Eléctrica de Vale D'Este´</li> <li>Cooperativa Eléctrica de Vilarinho, C.R.L.</li> <li>Cooperativa Eléctrica de Loureiro, C.R.L.</li> <li>Cooprорiz - Cooperativa de Abastecimento de Energia Eléctrica, CRL.</li> <li>A Eléctrica Moreira de Cónegos, CRL</li> <li>A Celer - Cooperativa Electrificação de Rebordosa, CRL</li> <li>Casa do Povo de Valongo do Vouga</li> <li>Junta de Freguesia de Cortes do Meio</li> <li>Cooperativa Electrificação A Lord, CRL</li> <li>Cooperativa Eléctrica S. Simão de Novais</li> <li>Electricidade dos Açores</li> <li>Empresa de Electricidade da Madeira</li> </ol> |
| RQ3 | Number of projects deploying smart meters in your country? Who leads those projects?     | <p><b>Project Inovgrid</b></p> <p><b>Start:</b> 2007</p> <p><b>Project coordinator:</b> Portuguese DSO (EDP Distribuição)</p> <ul style="list-style-type: none"> <li>There have been realized a SMs rollout in in the Portuguese municipality of <b>Évora</b>, installing <b>35,000</b> SMs at client's homes</li> <li>In <b>2012-2013 more 100,000</b> meters were installed in other 6 Portuguese regions as part of the <b>Inovgrid</b> project: Guimarães, S. João Madeira, Lamego, Marinha Grande, Batalha, Alcochete</li> </ul> <p><b>Other smaller EU-funded projects</b> are slowly implementing smaller scale Smart Grid solutions (as inteGRIDy)</p>  |
| RQ4 | No of smart meters installed in your country by June 2017 (info from National Regulator) | <ul style="list-style-type: none"> <li>In Portugal there are 6 500 000 metering points</li> </ul> <p><b>ALREADY INSTALLED:</b></p> <p>The most <b>recent</b> figures available indicate that <b>1,040,000</b> SMs have been installed at <b>LV till mid-August of 2017</b>, which</p>   |



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|     |   | corresponds to around <b>17%</b> of <b>LV's</b> total customers   |
| RQ5 | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the approach in your country? | <ul style="list-style-type: none"> <li>In October 2014 the <b>Decree-Law No. 153/2014</b> was published, which introduced a new regime for self-consumption units. So, the consumer evolved to a <b>PROSUMER</b>, being able to produce, consume and sell the excess energy to the grid. This new Decree-Law was intended to be a new measure of <b>energy efficiency</b>. Self-consumption power systems were created <b>to avoid the injection of energy in the grid</b>, having as the main objective to fulfil the energy demands just with own produced energy.</li> </ul>   |
| RQ6 | SM infrastructure is dependent on DSO /Energy Supplier  | <ul style="list-style-type: none"> <li>The metering activity in Portugal is regulated and the Portuguese <b>DSO (EDP Distribuição)</b> is the entity <b>responsible</b> for SMs implementation and financing of the rollout</li> </ul>  |
| RQ7 | Producer / Supplier of SMs implemented in your country  | <ul style="list-style-type: none"> <li><b>In Inovgrid project</b> there is used <b>EDP Box</b> – device certified according to the European standard EC Directive 2004/22/EC, referring to the instruments of energy counting</li> <li>The <b>EDP Box</b> replaces the current meters. It has numerous advantages, since it allows to access the detailed information on the consumption profile, enabling the consumers to know the hours of the day when they consume the most and which hours they can use the electricity at the most favorable price</li> </ul> <p><b>Manufacturer of EDP Box:</b> Janz-contadores de energia SA<br/><b>Siemens Portugal</b></p> |
| RQ8 | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi , Zigbee, other                           | In the framework of <b>Inovgrid</b> , EDP-D used <b>PLC-DCSK, GPRS and RF Mesh</b> for the remote access to the SMs   |

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| RQ9  | <p>Rules in force in each pilot country (technical standards &amp; national authorities regulations) referring specifically to the SM (e.g. <i>ANRE Decree no 145/2016 in Romania or standards CEI 0-16/CEI 0-21 and TIME in Italy</i>). Indeed, the functionalities supported by each device strictly depend on the existing regulatory framework; therefore, a better knowledge of the rules will probably allow us to better understand the motivations of given choices of SM manufacturers.</p>  | <ul style="list-style-type: none"> <li>• “Guide for Metering, Reading and Availability of Data of the electricity sector in Portugal” by ERSE (Energy Service Regulating Entity)</li> <li>• The measuring equipment to be installed must possess <b>minimum</b> characteristics that allow the fulfilment of the obligations foreseen in the Guide of Measurement.</li> </ul>   |
| RQ10 | <p>Type of smart meters installed in your country. Please provide the link to the installation manual, if available.</p> <p>Please provide the following information if possible:</p> <ol style="list-style-type: none"> <li>1. name of product OR family of products OR series of the product OR suite of products:</li> <li>2. Technical specifications / distinctive features for the type of smart meters described above:</li> </ol> <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, if applicable in your country, focus more on the categories of users. Metering performances (reading frequency, etc.) mainly depend on the rules in force, as already mentioned, and on the characteristics of the user involved. For example, in Italy, different metering strategies are adopted according to the user's voltage level, contractual power (e.g., LV ≤55 kW, LV &gt;55 kW, MV) and behavior (passive user, prosumer, etc.).</i></p> <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <ol style="list-style-type: none"> <li>a) Readings (frequencies, accuracy, remoteness</li> <li>b) Advance tariff/ /number/configurable tariffs</li> </ol> | <p><b>In Inovgrid project there are used the following 2 SMs:</b></p> <ul style="list-style-type: none"> <li>• Type of meter: C2801*****</li> </ul> <p><b>Description of Meter:</b> Single Phase, Credit, Active Import/Export, Multi-rate, Indoor, Electricity Meter</p> <p><b>Accuracy Class:</b> A or B (kWh)</p> <p><b>Sealing type:</b> 1 X Wire &amp; Crimp or tamper proof sealing rate</p> <p><b>Type of circuit:</b> 1p2w</p> <p>LINK:<br/> <a href="http://www.edpdistribuicao.pt/pt/rede/InovGrid/EDP%20Documents/SGS0043.pdf">http://www.edpdistribuicao.pt/pt/rede/InovGrid/EDP%20Documents/SGS0043.pdf</a></p> <ul style="list-style-type: none"> <li>• Type of meter: B1801*****</li> </ul> <p><b>Description of Meter:</b> Poly Phase, Credit, Active Import/Export, Multi-rate, Indoor, Electricity Meter</p> <p><b>Accuracy class:</b> A or B (kWh)</p> <p><b>Sealing type:</b> 2 X Wire &amp; Crimp or 2 X Tamper Proof Sealing Tape</p> <p><b>Type of circuit:</b> 3p4w</p> <p>LINK:<br/> <a href="http://www.edpdistribuicao.pt/pt/rede/InovGrid/EDP%20Documents/SGS0044_DEZ2010.pdf">http://www.edpdistribuicao.pt/pt/rede/InovGrid/EDP%20Documents/SGS0044_DEZ2010.pdf</a></p> <ol style="list-style-type: none"> <li>a) Yes, each 15 minutes</li> <li>b) Yes</li> <li>c) ???</li> <li>d) Yes</li> <li>e) PLC, GPRS</li> <li>f)</li> </ol> |

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|      | <ul style="list-style-type: none"> <li>c) Remote on/off (DR)</li> <li>d) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>e) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>f) End-user benefits (could the consumer change the energy provider without changing the device already installed? Does the smart meter installed need a firmware update?</li> </ul> |  |
| RQ11 | Please provide info on whether the legal framework in your country provides clear definitions of technical and organizational requirements to ensure data protection and data security. (cyber-security aspects of the smart meter infrastructure)   | <p>[Few information found]</p> <ul style="list-style-type: none"> <li>In Portugal there is a Decree-Law Nr 69/2014 that regulates Cybersecurity in Portugal [Concerning the Cybersecurity and SMs no information]</li> </ul> |

## France

|     | Pilot Country:  | France  |
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| RQ1 | <p>Following the CBA (in what year) which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extend your country will be able to achieve the 2020 target?</p> | <ul style="list-style-type: none"> <li>CBA has been carried out based on the outcome of the pilot project Linky</li> <li>• Scenario 1: Annual average tariffs increase of 2.3% from 2010 to 2020 and 1.8% after 2020; and • Scenario 2: Annual average tariffs increase of 5.75% from 2010 to 2020 and 1.8% after 2020</li> <li>Outcome: neutral for scenario 1</li> <li>Outcome: positive for scenario 2</li> <li>Regulator recommendation to proceed with a national roll-out</li> <li>Responsible party for implementation of SM: DSO</li> </ul> <p><b>Current situation:</b></p> <ul style="list-style-type: none"> <li>Installation of 35 million meters by 2020</li> <li>Deployment : 7 million meters per</li> </ul> |

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|     |   | year <ul style="list-style-type: none"> <li>2020 target: 90%</li> </ul>  |
| RQ2 | Number of DSOs and their influence on the market  | <ul style="list-style-type: none"> <li>ENEDIS is the DSO for 95% of the territory</li> <li>160 DSOs representing 5% of the national territory</li> <li>Natural monopoly of the main national DSO. No real competition with the 160 regional DSOs</li> </ul>  |
| RQ3 | Number of projects deploying smart meters in your country? Who leads those projects?  | <ul style="list-style-type: none"> <li>Linky project roll out for 35 million SM</li> <li>90% DSOs regional will install Linky</li> </ul>   |
| RQ4 | No of smart meters installed in your country by June 2017 (info from National Regulator)  | <ul style="list-style-type: none"> <li><b>ENEDIS – 35 million clients</b> <ul style="list-style-type: none"> <li><b>5 million SM installed at June 2017</b></li> <li><b>End 2017 Target : 8 millions</b></li> <li><b>20 000 SM installed each day</b></li> </ul> </li> <li><b>Regional DSOs pilot projects only</b></li> </ul>   |
| RQ5 | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the approach in your country? | <ul style="list-style-type: none"> <li>Feed-in tariffs regulated for PV plants depending on the power installed.</li> <li>Self-Consumption : Order of 9 May 2017 fixing the conditions for the purchase of electricity generated by installations installed on buildings using photovoltaic solar energy with a peak installed power not exceeding 100 kilowatts</li> <li>Feed-in tariffs regulated for Hydroelectric powerplants</li> </ul> |
| RQ6 | SM infrastructure is dependent on DSO /Energy Supplier  | <ul style="list-style-type: none"> <li>the smart meter infrastructure is dependent on DSO</li> </ul>   |
| RQ7 | Producer / Supplier of SMs implemented in your country  | <ul style="list-style-type: none"> <li>Sagemcom</li> <li>Itron</li> <li>Landis+Gyr</li> <li>Ziv</li> <li>Elster</li> </ul>   |
| RQ8 | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi , Zigbee, other                           | <ul style="list-style-type: none"> <li>Data communication: From smart meter to Data Concentrator: PLC G3</li> <li>Data communication/ data analysis: from Data Concentrator to ICT infrastructure: GPRS, GSM</li> </ul>  |

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| RQ9  | <p>Rules in force in each pilot country (technical standards &amp; national authorities regulations) referring specifically to the SM (e.g. <i>ANRE Decree no 145/2016 in Romania or standards CEI 0-16/CEI 0-21 and TIME in Italy</i>). Indeed, the functionalities supported by each device strictly depend on the existing regulatory framework; therefore, a better knowledge of the rules will probably allow us to better understand the motivations of given choices of SM manufacturers.</p>  | <ul style="list-style-type: none"> <li>• Decree n° 2010-1022 from 31 August 2010 relating to metering devices on public electricity networks pursuant to the IV of Article 4 of Law No 2000-108 of 10 February 2000 on the modernization and development of the public electricity service → it makes mandatory the implementation of communicating meters by DSOs</li> <li>• Deliberation of the CRE of 8 December 2016 announcing the progress of the roadmaps of the network operators and proposing new recommendations on the development of smart grids of electricity and natural gas</li> </ul>   |
| RQ10 | <p>Type of smart meters installed in your country. Please provide the link to the installation manual, if available.</p> <p>Please provide the following information if possible:</p> <ol style="list-style-type: none"> <li>1. name of product OR family of products OR series of the product OR suite of products:</li> <li>2. Technical specifications / distinctive features for the type of smart meters described above:</li> </ol> <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, if applicable in your country, focus more on the categories of users. Metering performances (reading frequency, etc.) mainly depend on the rules in force, as already mentioned, and on the characteristics of the user involved. For example, in Italy, different metering strategies are adopted according to the user's voltage level, contractual power (e.g., LV ≤55 kW, LV &gt;55 kW, MV) and behavior (passive user, prosumer, etc.).</i></p> <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <p>a) Readings (frequencies, accuracy, remoteness</p> | <ul style="list-style-type: none"> <li>• “Linky” smart meters will communicate with data concentrators through PLC powerline carrier technology. Data will then transfer to a central information system using telecommunications network such as GPRS.<br/><a href="http://www.enedis.fr/sites/default/files/Notice_Compteur_Linky_Monophasique.pdf">http://www.enedis.fr/sites/default/files/Notice_Compteur_Linky_Monophasique.pdf</a></li> <li>• a) yes, by default 30',</li> <li>• b) yes, 10 tariffs</li> <li>• c) yes : 8 configurable contacts</li> <li>• d) yes</li> <li>• e) GSM/GPRS; PLC;</li> <li>• f) yes, power/supplier change and firmware can be updated</li> </ul> |

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|      | <ul style="list-style-type: none"> <li>b) Advance tariff/<br/>/number/configurable tariffs</li> <li>c) Remote on/off (DR)</li> <li>d) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>e) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>f) End-user benefits (could the consumer change the energy provider without changing the device already installed? Does the smart meter installed need a firmware update?</li> </ul> |   |
| RQ11 | <p>Please provide info on whether the legal framework in your country provides clear definitions of technical and organizational requirements to ensure data protection and data security. (cyber-security aspects of the smart meter infrastructure)</p>   | <ul style="list-style-type: none"> <li>• Deliberation No. 2012-404 of 15 November 2012 on the treatment of detailed consumption data collected by communicating meters</li> <li>• REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, of 27 April 2016, on the protection of individuals with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46 / EC (General Data Protection Regulation)</li> </ul> |

### Italy

|     | Pilot Country:   | Italy  |
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| RQ1 | <p>Following the CBA (in what year) which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extent your country will be</p> | <ul style="list-style-type: none"> <li>• CBA commissioned in in 2001.</li> <li>• Outcome: positive</li> <li>• Smart meter deployment strategy: Mandatory+Voluntary</li> <li>• Responsible party for implementation of SM: DSO</li> </ul> <p><b>Current situation:</b></p> <ul style="list-style-type: none"> <li>• A first phase of the deployment started in 2001 with the voluntary SM installation by Enel Distribuzione</li> </ul> |



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|     | able to achieve the 2020 target?   | <p>S.p.A. and later ACEA Distribuzione S.p.A. and A2A Reti Elettriche S.p.A.</p> <ul style="list-style-type: none"> <li>• A second phase has been driven by AEEGSI Resolution 292/06, which obliged DSOs to install SG devices according to the following roadmap:           <ul style="list-style-type: none"> <li>○ Passive users with contractual power equal to or lower than 55 kW: 25% of users by 31 December 2008, 65% by 31 December 2009, 90% by 31 December 2010 and 95% by 31 December 2011.</li> <li>○ Passive users with contractual power greater than 55 kW: 100% of users by 31 December 2008.</li> </ul> </li> </ul> <p>By the end of 2017, the beginning of a plan for the substitution of 1g SMs with 2g devices by e-distribution (PMS2 plan) is envisaged. The target is to install about 35.9 million of new SMs by 2031.</p> |
| RQ2 | Number of DSOs and their influence on the market                                     | <p>There are 135 DSOs in Italy. Of these, 29 are DSOs with at least a point of interconnection with the HV system, while the others are minor operators. Below the main DSOs in Italy (source: AEEGSI 2016), with the relevant number of points of withdrawal, are listed:</p> <ul style="list-style-type: none"> <li>• E-distribuzione: 31,433,028</li> <li>• Arete: 1,625,358</li> <li>• Unarete: 1,131,514</li> <li>• IReti: 688,735</li> <li>• Inrete: 424,252</li> <li>• SET Distribuzione: 309,786</li> <li>• Edyna: 232,978</li> <li>• Megarete: 166,839</li> <li>• DEVAL: 133,948</li> <li>• Servizi a rete: 71,522</li> </ul> <p>Roll-out finalization: 31 December 2013</p>  |
| RQ3 | Number of projects deploying smart meters in your country? Who leads those projects? | <p>In 2014, AEEGSI approved the incentivization of 7 projects aiming at experimenting multi-service smart meters (electricity, gas, water). The projects are deployed in Torino, Reggio Emilia, Parma, Modena, Genova, Verona, Bari, Salerno, Catania and other minor municipalities and involve 60,000 users.</p>   |

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|     |   | The deployment of 2g SMs (PMS2 plan) will start by the end of 2017.   |
| RQ4 | No of smart meters installed in your country by June 2017 (info from National Regulator)  | Over 35 million of 1g SMs (e-distribuzione about 31.9 millions).  |
| RQ5 | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the approach in your country? | <p>The prosumer concept is regulated in Italy. Four different mechanisms of remuneration of the production are provided:</p> <ul style="list-style-type: none"> <li>• Direct access to the Electricity Market</li> <li>• Simplified purchase &amp; resale arrangements (applying to power plants from RES with a nominal power of less than 10 MVA and power plants from wind, solar, geothermal, waves, tides, run-of-river hydro RES power plants of any capacity);</li> <li>• All-inclusive feed-in tariff (admitted for RES power plants, excluding solar ones, with nominal power of less than 1 MW and 200 MW for on-shore wind plants);</li> <li>• Net metering (applying to RES plants and high-efficiency CHP plants with a capacity of up to 200 kW).</li> </ul> <p>The connection of energy storage systems (coupled with the local generation or installed standalone) is admitted since 2014. In some connection schemes, the installation of a further SM device (M3) is required to measure the energy exchanged by the storage.</p> |
| RQ6 | SM infrastructure is dependent on DSO /Energy Supplier  | The SM infrastructure is dependent on the DSO.  |
| RQ7 | Producer / Supplier of SMs implemented in your country  | Main SM suppliers: CEWE, DPEE, Elster, EMH, ISKRAEMECO, ITRON, LANDIS + GYR   |
| RQ8 | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK, RF868MHz, GPRS/GSM, WiFi, Zigbee, other)                             | <ul style="list-style-type: none"> <li>• From smart meter to data concentrator: PLC BPS-K (+RF 169 MHz for 2g SMs)</li> <li>• From Data Concentrator to DSO control center: GSM (3G/4G for 2g SMs)</li> </ul>   |

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| RQ9  | <p>Rules in force in each pilot country (technical standards &amp; national authorities regulations) referring specifically to the SM (e.g. <i>ANRE Decree no 145/2016 in Romania or standards CEI 0-16/CEI 0-21 and TIME in Italy</i>). Indeed, the functionalities supported by each device strictly depend on the existing regulatory framework; therefore, a better knowledge of the rules will probably allow us to better understand the motivations of given choices of SM manufacturers.</p>   | <ul style="list-style-type: none"> <li>• AEEGSI Resolution 23 December 2015 654/2015/R/eel (Testo integrato delle disposizioni per l'erogazione dei servizi di trasmissione e distribuzione dell'energia elettrica - disposizioni per il periodo 2016-2019, TIME) defines the national regulatory framework related to SM (metering responsibility, metering fees, procedures, etc.).</li> <li>• The technical aspects related to SM (points of measurement needed, scheme of installation of SM, etc.) are provided, respectively, for Low Voltage and Medium Voltage users by technical standards CEI 0-21 and CEI 0-16.</li> </ul>   |
| RQ10 | <p>Type of smart meters installed in your country. Please provide the link to the installation manual, if available.</p> <p>Please provide the following information if possible:</p> <ol style="list-style-type: none"> <li>1. name of product OR family of products OR series of the product OR suite of products:</li> <li>2. Technical specifications / distinctive features for the type of smart meters described above:</li> </ol> <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, if applicable in your country, focus more on the categories of users. Metering performances (reading frequency, etc.) mainly depend on the rules in force, as already mentioned, and on the characteristics of the user involved. For example, in Italy, different metering strategies are adopted according to the user's voltage level, contractual power (e.g., LV ≤55 kW, LV &gt;55 kW, MV) and behavior (passive user, prosumer, etc.).</i></p> <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <ol style="list-style-type: none"> <li>a) Readings (frequencies, accuracy, remoteness</li> <li>b) Advance tariff/</li> </ol> | <ul style="list-style-type: none"> <li>• CEWE Prometer W <ul style="list-style-type: none"> <li>• <a href="http://www.staermisure.it/ProdutAttachments/15_51_0.pdf">http://www.staermisure.it/ProdutAttachments/15_51_0.pdf</a></li> </ul> </li> <li>• CEWE Prometer R <ul style="list-style-type: none"> <li>• <a href="http://www.staermisure.it/ProdutAttachments/16_54_0.pdf">http://www.staermisure.it/ProdutAttachments/16_54_0.pdf</a></li> </ul> </li> <li>• DPEE TH40/TH40C <ul style="list-style-type: none"> <li>• <a href="http://www.dpee.it/download/contatori/th40c_en.pdf">http://www.dpee.it/download/contatori/th40c_en.pdf</a></li> </ul> </li> <li>• Elster A1700/A1700i <ul style="list-style-type: none"> <li>• <a href="http://www.energymis.it/assets/pdf/A1700D_direct_connected_brochure.pdf">http://www.energymis.it/assets/pdf/A1700D_direct_connected_brochure.pdf</a></li> </ul> </li> <li>• ISKRAEMECO MT851 <ul style="list-style-type: none"> <li>• <a href="http://www.telematicasistemi.it/it/products/_01.category/old/mt851/brochure_Mx851.pdf">http://www.telematicasistemi.it/it/products/_01.category/old/mt851/brochure_Mx851.pdf</a></li> </ul> </li> <li>• ISKRAEMECO TE851 <ul style="list-style-type: none"> <li>• <a href="http://www.telematicasistemi.it/it/products/_01.category/old/mt851/TE851_DE851_eng.pdf">http://www.telematicasistemi.it/it/products/_01.category/old/mt851/TE851_DE851_eng.pdf</a></li> </ul> </li> <li>• ISKRAEMECO MT830/MT831 <ul style="list-style-type: none"> <li>• <a href="http://www.frer.it/public/allegato/CSEMIDMT830_831.pdf">http://www.frer.it/public/allegato/CSEMIDMT830_831.pdf</a></li> </ul> </li> <li>• ISKRAEMECO MT860 <ul style="list-style-type: none"> <li>• <a href="http://www.telematicasistemi.it/en/documents/_01.category/manuali/MT860-Technical_description_MID_version_1.pdf">http://www.telematicasistemi.it/en/documents/_01.category/manuali/MT860-Technical_description_MID_version_1.pdf</a></li> </ul> </li> <li>• ISKRAEMECO MT880 <ul style="list-style-type: none"> <li>• <a href="http://www.telematicasistemi.it/en/documents/_01.category/manuali/MT880_UM_V3.00_ENG.pdf">http://www.telematicasistemi.it/en/documents/_01.category/manuali/MT880_UM_V3.00_ENG.pdf</a></li> </ul> </li> </ul> |

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|      | <p>/number/configurable tariffs</p> <ul style="list-style-type: none"> <li>c) Remote on/off (DR)</li> <li>d) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>e) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>f) End-user benefits (could the consumer change the energy provider without changing the device already installed? Does the smart meter installed need a firmware update?</li> </ul> | <ul style="list-style-type: none"> <li>• ITRON SL7000</li> <li>• <a href="https://www1.itron.com/local/Indonesia%20Portfolio/ACESL7000_brochure_EN.pdf">https://www1.itron.com/local/Indonesia%20Portfolio/ACESL7000_brochure_EN.pdf</a> ITRON ACE6000 <ul style="list-style-type: none"> <li>• <a href="https://www1.itron.com/local/Indonesia%20Portfolio/ace6000_brochure_EN.pdf">https://www1.itron.com/local/Indonesia%20Portfolio/ace6000_brochure_EN.pdf</a></li> </ul> </li> <li>• LANDIS + GYR ZMD 310 <ul style="list-style-type: none"> <li>• <a href="http://www.metsys.hu/villamosenergia/files/7102000134_%20k%20en%20-%20Technical%20Data%20(Z.x.D300).pdf">http://www.metsys.hu/villamosenergia/files/7102000134_%20k%20en%20-%20Technical%20Data%20(Z.x.D300).pdf</a></li> </ul> </li> <li>• LANDIS + GYR ZMD 405/410 <ul style="list-style-type: none"> <li>• <a href="https://www.prodemel.es/manual/es/LANDIS_GYR_ZMD_INTERNACIONAL-datos_tecnicos.pdf">https://www.prodemel.es/manual/es/LANDIS_GYR_ZMD_INTERNACIONAL-datos_tecnicos.pdf</a></li> </ul> </li> <li>• A) <ul style="list-style-type: none"> <li>○ LV ≤55 kW users, TOU metering</li> <li>○ LV &gt;55 kW users, hourly metering</li> <li>○ MV users, hourly metering</li> </ul> </li> <li>• B) not required</li> <li>• C) no</li> <li>• D) yes</li> <li>• E) GSM; PLC</li> <li>• F) The consumer can change the energy provider without changing the device already installed and without firmware updates.</li> </ul> |
| RQ11 | <p>Please provide info on whether the legal framework in your country provides clear definitions of technical and organizational requirements to ensure data protection and data security. (cyber-security aspects of the smart meter infrastructure)</p>  | <p>The legal framework in Italy does not provide definitions of technical and organizational requirements to ensure data protection and data security in smart metering applications.</p> <p>In Italy, the data protection Directive 95/46/EC integrated with Opinion 12/2011 of the Working Party on the Smart Metering apply.</p>  |

## UK

|     | Pilot Country:  | United Kingdom   |
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| RQ1 | <p>Following the CBA (in what year) which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extent your country will be able to achieve the 2020 target?</p> | <p>Without Government intervention to ensure technical and commercial interoperability, meter owners in competitive markets face greater risks of losing the value of the meter when customers switch energy suppliers. Because the receiving supplier might be unable or unwilling to use the smart technology, they might also be unwilling to cover its full cost. Because of this potential loss of asset value and the resulting investment uncertainty, the lack of interoperability is a considerable hurdle to a universal roll-out of smart metering in the absence of a Government mandate</p> <p>The CBA considered for Great Britain is that issued by DECC in January 2014. The key roll out scenario considered in this report refers to the domestic sector IA</p>  |
| RQ2 | Number of DSOs and their influence on the market  | <ul style="list-style-type: none"> <li>• British Gas: British Gas is the largest supplier in the UK, servicing more than 11 million homes with gas and 6 million with electricity. It is a subsidiary of the UK-based Centrica group which also owns Scottish Gas.</li> <li>• EDF Energy: EDF energy supplies gas and electricity to 6 million homes. It's wholly owned by the French national provider EDF SA and is also the largest electricity producer in the UK.</li> <li>• E.ON: E.ON provides energy to around 7 million homes and is owned by German E.ON AG. Prior to its 2002 acquisition it was known as Powergen.</li> <li>• npower: npower provides energy to around 5 million homes. Having begun life as Innogy, it was purchased by German RWE in 2002.</li> <li>• Scottish Power: Scottish Power also has around 5 million residential customers. It was acquired by Spanish-based Iberdrola in 2006.</li> </ul> <p>SSE: SSE is the second-largest energy supplier with almost 9</p> |

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|     |   | <p>million customers. It's a Scottish-registered company trading on the London Stock Exchange and a major hydro and wind energy producer.</p> <ul style="list-style-type: none"> <li>• Another strand is focused on what is regarded as the essential transition of UK distribution network operators (DNOs) into distribution system operators (DSOs) – a subtle but far-reaching change, which is envisaged to take place over the period to 2030.</li> <li>• Currently the DNOs control and maintain the transmission and distribution networks. Under the DSO model, the operator will take a more active role in managing local electricity generation and use.</li> <li>• The map above should give you a good idea as to who your Distribution Network Operator is. If you'd like to contact them check out the details below from the ENA:               <ol style="list-style-type: none"> <li>1. SSE Power Distribution</li> <li>2. SP Energy Networks</li> <li>3. Northern Powergrid</li> <li>4. Electricity North West</li> <li>5. Northern Powergrid</li> <li>6. SP Energy Networks</li> <li>7. Western Power Distribution</li> <li>8. UK Power Networks</li> <li>9. SSE Power Distribution</li> <li>10. UK Power Networks</li> <li>11. UK Power Networks</li> <li>12. Northern Ireland Electricity</li> </ol> </li> </ul> |
| RQ3 | Number of projects deploying smart meters in your country? Who leads those projects?                      | <p>British Gas Smart Homes</p> <p>British Gas Smart Homes included some 500,000 smart meters using Vodafone's sim-cards and network for connectivity.</p>   |
| RQ4 | No of smart meters installed in your country by June 2017 (info from National Regulator)                  | <b><u>7.68 milion SM</u></b>  |
| RQ5 | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the | no  |



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|      | approach in your country?  |  |
| RQ6  | SM infrastructure is dependent on DSO /Energy Supplier   | <p>Yes</p> <ul style="list-style-type: none"> <li>Another strand is focused on what is regarded as the essential transition of UK distribution network operators (DNOs) into distribution system operators (DSOs) – a subtle but far-reaching change, which is envisaged to take place over the period to 2030.</li> </ul> |
| RQ7  | Producer / Supplier of SMs implemented in your country   | Landis+Gyr<br>Elster   |
| RQ8  | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi , Zigbee, other  |  |
| RQ9  | Rules in force in each pilot country (technical standards & national authorities regulations) referring specifically to the SM (e.g. <i>ANRE Decree no 145/2016 in Romania or standards CEI 0-16/CEI 0-21 and TIME in Italy</i> ). Indeed, the functionalities supported by each device strictly depend on the existing regulatory framework; therefore, a better knowledge of the rules will probably allow us to better understand the motivations of given choices of SM manufacturers. |  |
| RQ10 | <p>Type of smart meters installed in your country. Please provide the link to the installation manual, if available.</p> <p>Please provide the following information if possible:</p> <ol style="list-style-type: none"> <li>1. name of product OR family of products OR series of the product OR suite of products:</li> <li>2. Technical specifications / distinctive features for the type of smart meters described above:</li> </ol>  |  |

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|      | <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, if applicable in your country, focus more on the categories of users. Metering performances (reading frequency, etc.) mainly depend on the rules in force, as already mentioned, and on the characteristics of the user involved. For example, in Italy, different metering strategies are adopted according to the user's voltage level, contractual power (e.g., LV ≤55 kW, LV &gt;55 kW, MV) and behavior (passive user, prosumer, etc.).</i></p> <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <ul style="list-style-type: none"> <li>m) Readings (frequencies, accuracy, remoteness</li> <li>n) Advance tariff/<br/>/number/configurable tariffs</li> <li>o) Remote on/off (DR)</li> <li>p) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>q) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>r) End-user benefits (could the consumer change the energy provider without changing the device already installed? Does the smart meter installed need a firmware update?</li> </ul> |  |
| RQ11 | <p>Please provide info on whether the legal framework in your country provides clear definitions of technical and organizational requirements to ensure data protection and data security. (cyber-security aspects of the smart meter infrastructure)</p>   |  |

## Greece

|     | Pilot Country:  | Greece  |
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| RQ1 | <p>Following the CBA (in what year) which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extent your country will be able to achieve the 2020 target?</p> | <p>According to European Commission requirements, Greece has to replace 80% of meters with smart meters by 2020. By a Ministerial Decision published on ΦΕΚ Β' 297/2013 in February of 2013, decided to:</p> <p>.</p>   |
| RQ2 | Number of DSOs and their influence on the market  | <ul style="list-style-type: none"> <li>• HEDNO SA</li> </ul>  |
| RQ3 | Number of projects deploying smart meters in your country? Who leads those projects?  | <ul style="list-style-type: none"> <li>• HEDNO SA to take over the meters replacements</li> <li>• begin the replacement by July 2014</li> <li>• complete 40% of meters replacement by June 2017</li> <li>• complete 80% of meters replacement by December 2020</li> </ul> <p>Now, the pilot is at the phase of competition for the smart meters. The total budget of the pilot project is €86.5 million euros. The study of the complete replacement of 7.5 million low-voltage meters will be based on the pilot and is going to cost more than 1 billion Euros. Until now, smart meters have been installed only to a small number of companies.</p> <p>Two different DSOs: HEDNO SA (DEDDIE SA) (with individual department for not interconnected islands and DSO for National Athens Airport region).</p> <p>HEDNO SA leads the project of deploying smart meters,</p> |
| RQ4 | No of smart meters installed in your country by June 2017 (info from National Regulator)  | <ul style="list-style-type: none"> <li>• The pilot project of DEDDIE SA includes the installation of 200,000 smart meters in homes and stores (170,000 mandatory and 30,000</li> </ul>  |

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|      |   | optional).   |
| RQ5  | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the approach in your country?   | No prosumer project yet.   |
| RQ6  | SM infrastructure is dependent on DSO /Energy Supplier  | yes  |
| RQ7  | Producer / Supplier of SMs implemented in your country  |  |
| RQ8  | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi , Zigbee, other   |  |
| RQ9  | Rules in force in each pilot country (technical standards & national authorities regulations) referring specifically to the SM (e.g. <i>ANRE Decree no 145/2016 in Romania or standards CEI 0-16/CEI 0-21 and TIME in Italy</i> ). Indeed, the functionalities supported by each device strictly depend on the existing regulatory framework; therefore, a better knowledge of the rules will probably allow us to better understand the motivations of given choices of SM manufacturers.  |  |
| RQ10 | <p>Type of smart meters installed in your country. Please provide the link to the installation manual, if available.</p> <p>Please provide the following information if possible:</p> <ol style="list-style-type: none"> <li>1. name of product OR family of products OR series of the product OR suite of products:</li> <li>2. Technical specifications / distinctive features for the type of smart meters described above:</li> </ol> <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, if applicable in your country,</i></p> | <p>Smart meter infrastructure is depended on DSO.</p> <p><b>MV meters currently used</b></p> <p><b>Basic characteristics</b></p> <ul style="list-style-type: none"> <li>• Three-phase electronic meters, with 2 elements - 3 conductors active (kWh) and reactive (kVarrh) energy asymmetric charging.</li> <li>• The accuracy class 1 for active and 2 for reactive consumption.</li> <li>• Meters measure and store energy in two directions and in four quadrants (<math>\pm A</math>, <math>\pm R_i</math>, <math>\pm R_c</math>), voltage and intensity per phase, number of</li> </ul> |

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|      | <p><i>focus more on the categories of users. Metering performances (reading frequency, etc.) mainly depend on the rules in force, as already mentioned, and on the characteristics of the user involved. For example, in Italy, different metering strategies are adopted according to the user's voltage level, contractual power (e.g., LV ≤55 kW, LV &gt;55 kW, MV) and behavior (passive user, prosumer, etc.).</i></p> <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <ul style="list-style-type: none"> <li>a) Readings (frequencies, accuracy, remoteness</li> <li>b) Advance tariff/ /number/configurable tariffs</li> <li>c) Remote on/off (DR)</li> <li>d) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>e) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>f) End-user benefits (could the consumer change the energy provider without changing the device already installed? Does the smart meter installed need a firmware update?</li> </ul> | <p>voltage sinks with the associated time duration; and power factor. All values are stored in corresponding load curves.</p> <ul style="list-style-type: none"> <li>• The completion period can be 1, 5, 10, 15, 30 and 60 minutes.</li> <li>• Meters have a digital liquid crystal mobitor for the display of measurement values (kWh, kVArh) with 8 digits and for the 6-digit identifier code of the measured sizes.</li> <li>• Meters are capable of communicating with a Central Station Telemetry, using the DLMS communication protocol.</li> <li>• They have a measuring capacity of 96 periods per day for at least 60 days and for all recorded sizes.</li> </ul> <p>All the specifications are provided by Meters &amp; Measurements manual of HTSO</p> |
| RQ11 | <p>Please provide info on whether the legal framework in your country provides clear definitions of technical and organizational requirements to ensure data protection and data security. (cyber-security aspects of the smart meter infrastructure)</p>   |   |

## Spain

|     | Pilot Country:  | Spain  |
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| RQ1 | <p>Following the CBA (in what year) which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extent your country will be able to achieve the 2020 target?</p> | <ul style="list-style-type: none"> <li>• CBA; not initiated</li> <li>• Deployment strategy: mandatory</li> <li>• [the country has decided to proceed with a full roll-out in the case of electricity in compliance with a Royal Decree 1634/2006 stating that by July 1st 2007 the Spanish regulator had to elaborate a replacement plan for all Spanish domestic meters with contracted power lower than 15 kW]</li> <li>• The Spanish regulation obliges to substitute old meters to smart meters before the end of 2018 for clients with a contracted power below 15kW.</li> <li>• It depends on the company if this deployment has finished or not yet.</li> <li>• We (as GNF) are around 94%</li> </ul>                   |
| RQ2 | Number of DSOs and their influence on the market  | <ul style="list-style-type: none"> <li>• There is 5 big energy distributors in Spain: <b>Gas Natural Fenosa</b> (Galicia, Castilla-la Mancha, Madrid and Castilla y León), <b>Iberdrola</b> (País Vasco, Navarra, La Rioja, Castilla y León, Castilla-la Mancha, Valencia, Madrid, Murcia and Extremadura) , <b>Endesa</b> (Cataluña, Aragón, Andalucía, Islas Baleares and Islas Canarias), <b>Edp</b> (Asturias) and <b>E-on</b> (Cantabria and Galicia).</li> <li>• The distribution of electricity is a natural monopoly and the authorization of DSO is regulated and follows a minimum cost criteria.</li> <li>• The liberalization of energy market establishes a legal and accounting unbundling of the DSO</li> </ul> |
| RQ3 | Number of projects deploying smart meters in your country? Who leads those projects?  | <ul style="list-style-type: none"> <li>• All DSO are managing the installation of SM to obey the regulation.</li> </ul>  |
| RQ4 | No of smart meters installed in your country by June 2017 (info from National Regulator)  | <ul style="list-style-type: none"> <li>• <b><u>Number of metering points is aprox 33.5 millions</u></b></li> <li>• Approximately, there is around 26 Million SM installed in Spain</li> <li>• From GNF we have already 3,4 million SM installed (out of 3.7</li> </ul>   |



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|      |  | customers)   |
| RQ5  | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the approach in your country?  | It is possible to self-consume produced electricity but injected electricity to the grid does not have a retribution   |
| RQ6  | SM infrastructure is dependent on DSO /Energy Supplier   | The regulation enables the client to buy its own SM, but generally the one in charge is the DSO  |
| RQ7  | Producer / Supplier of SMs implemented in your country   | ZIV, CIRCUTOR, ELSTER, General Electric, ITRON, LANDIS+GYR, ORBIS, SAGECOM, SOGECAM  |
| RQ8  | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi, Zigbee, other   | All companies use PLC to communicate with the SM, there is two technologies:<br>Enel Technology (50% of the market)<br>PRIME (the other 50%)<br>Data communication to ICT infrastructure: GPRS, FR, Ethernet   |
| RQ9  | Rules in force in each pilot country (technical standards & national authorities regulations) referring specifically to the SM (e.g. <i>ANRE Decree no 145/2016 in Romania or standards CEI 0-16/CEI 0-21 and TIME in Italy</i> ). Indeed, the functionalities supported by each device strictly depend on the existing regulatory framework; therefore, a better knowledge of the rules will probably allow us to better understand the motivations of given choices of SM manufacturers. | Order ITC/3022/2007<br>First additional provision "Substitution plan of measurement equipment" of the Order ITC/3860/23007<br>RD 889/2006<br>Twenty-second additional Provision "Installation plan of measurement equipment" of RD 1634/2006<br>Second final Provision of RD 413/2014  |
| RQ10 | Type of smart meters installed in your country. Please provide the link to the installation manual, if available.<br>Please provide the following information if possible:<br>1. name of product OR family of products OR series of the product OR suite of products:<br>2. Technical specifications / distinctive features for the type of smart meters described above:  | ZIV ( they ae the ones GNF has deployed)<br>ZIV / 5CTM<br><a href="https://www.ziv.es/wp-content/uploads/2015/04/4_ziv_5ctm-5ctd_data_sheet_english_rev_2.1.pdf">https://www.ziv.es/wp-content/uploads/2015/04/4_ziv_5ctm-5ctd_data_sheet_english_rev_2.1.pdf</a><br><br><a href="http://www.cem.es/sites/default/files/cem-09-em-082247002-77.2-090729-1407261.pdf">http://www.cem.es/sites/default/files/cem-09-em-082247002-77.2-090729-1407261.pdf</a> |

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|      | <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, if applicable in your country, focus more on the categories of users. Metering performances (reading frequency, etc.) mainly depend on the rules in force, as already mentioned, and on the characteristics of the user involved. For example, in Italy, different metering strategies are adopted according to the user's voltage level, contractual power (e.g., LV ≤55 kW, LV &gt;55 kW, MV) and behavior (passive user, prosumer, etc.).</i></p> <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <ul style="list-style-type: none"> <li>g) Readings (frequencies, accuracy, remoteness</li> <li>h) Advance tariff/<br/>/number/configurable tariffs</li> <li>i) Remote on/off (DR)</li> <li>j) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>k) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>l) End-user benefits (could the consumer change the energy provider without changing the device already installed? Does the smart meter installed need a firmware update?</li> </ul> | <ul style="list-style-type: none"> <li>a) yes, every 15' or 1h</li> <li>b) yes, there are 4 possible tariffs</li> <li>c) yes</li> <li>d) yes</li> <li>e) Protocol : UNE-EN 606870-5-102</li> <li>f) Two options of technology:               <ul style="list-style-type: none"> <li>• modem PLC ZIV</li> <li>• PRIME</li> <li>• No</li> </ul> </li> </ul> |
| RQ11 | <p>Please provide info on whether the legal framework in your country provides clear definitions of technical and organizational requirements to ensure data protection and data security. (cyber-security aspects of the smart meter infrastructure)</p>   | <p>Ley Orgánica 15/1999, 13 December</p> <p>The article 81.2 f) of the regulation of development of Ley Orgánica 15/1999 establishes that the data received by the companies from meters needs minimum a medium level of security measures to be implemented.</p>   |

## Cyprus

|     | Pilot Country:  | Cyprus   |
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| RQ1 | <p>Following the CBA (in what year) which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extent your country will be able to achieve the 2020 target?</p> | <ul style="list-style-type: none"> <li>• CBA 2013</li> <li>• Outcome; positive</li> </ul> <p>No smart meter roll-out implemented as yet but a decision has been taken for tendering for an MDMS (Metering and Data Management System) system capable of handling all the smart meters of the country. Instructions have been given by CERA (the Regulator of Cyprus) to the DSO to draft the tender documents by 31st December 2017. Preliminary decision is for mass rollout to follow with the target of completing the smart meter installations by 2025.</p> <p>A tender has been awarded by the DSO for the installation of 3000 smart meters in two distinct areas for testing the various technologies. The project is to be operational within 2018.</p> |
| RQ2 | Number of DSOs and their influence on the market  | <ul style="list-style-type: none"> <li>• 1 DSO</li> <li>• Dominant Participant in the Market</li> <li>• Natural monopoly as the DSO faces no competition</li> </ul>  |
| RQ3 | Number of projects deploying smart meters in your country? Who leads those projects?  | <p>«Smart net metering for promotion and cost-efficient grid-integration of PV technology in Cyprus (LIFE+ SmartPV)»</p> <ul style="list-style-type: none"> <li>• Investigates pilot net metering schemes for cost-effective PV implementation</li> <li>• FOSS Research Center of UCY leads the project</li> </ul>   |
|     | No of smart meters installed in your country by June 2017 (info from National Regulator)  | ELECTRICITY AUTHORITY OF CYPRUS<br>3000 installed smart meters   |
| RQ5 | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the approach in your country?   | No, the prosumer concept is not regulated. However, there are net metering schemes that have been introduced by the Government   |
| RQ6 | SM infrastructure is dependent on DSO /Energy Supplier  | <ul style="list-style-type: none"> <li>• Yes, SM infrastructure is dependent on DSO</li> </ul>   |
| RQ7 | Producer / Supplier of SMs implemented in your country  | <p>Elster Metering Ltd</p> <ul style="list-style-type: none"> <li>• AS230 single-phase meter</li> </ul>  |

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|      |  | <ul style="list-style-type: none"> <li>A1700 three-phase meter</li> </ul>   |
| RQ8  | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi , Zigbee, other  | GPRS/GSM  |
| RQ9  | Rules in force in each pilot country (technical standards & national authorities regulations) referring specifically to the SM (e.g. <i>ANRE Decree no 145/2016 in Romania or standards CEI 0-16/CEI 0-21 and TIME in Italy</i> ). Indeed, the functionalities supported by each device strictly depend on the existing regulatory framework; therefore, a better knowledge of the rules will probably allow us to better understand the motivations of given choices of SM manufacturers.   | <p>No rules implemented yet</p> <p>Law N.149 (I)/2015 provides for the development of a national energy efficiency program and includes measures for the deployment of a “smart metering” initiative</p>  |
| RQ10 | <p>Type of smart meters installed in your country. Please provide the link to the installation manual, if available.</p> <p>Please provide the following information if possible:</p> <ol style="list-style-type: none"> <li>name of product OR family of products OR series of the product OR suite of products:</li> <li>Technical specifications / distinctive features for the type of smart meters described above:</li> </ol> <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, if applicable in your country, focus more on the categories of users. Metering performances (reading frequency, etc.) mainly depend on the rules in force, as already mentioned, and on the characteristics of the user involved. For example, in Italy, different metering strategies are adopted according to the user's voltage level, contractual power (e.g., LV ≤55 kW, LV &gt;55 kW, MV) and behavior (passive user, prosumer,</i></p> | <ul style="list-style-type: none"> <li>ELSTER AS230 single-phase meter<br/><a href="http://www.camax.co.uk/downloads/Elster-AS230-MANUAL-FOR-WEBSITE.pdf">http://www.camax.co.uk/downloads/Elster-AS230-MANUAL-FOR-WEBSITE.pdf</a></li> <li>ELSTER A1700 three-phase meter<br/><a href="http://www.camax.co.uk/downloads/A1700camax-metermarket-datasheet.pdf">http://www.camax.co.uk/downloads/A1700camax-metermarket-datasheet.pdf</a></li> </ul> <ol style="list-style-type: none"> <li>30 min intervals</li> <li>yes, 32 tariff registers</li> <li>no</li> <li>yes</li> <li>GPRS/GSM</li> <li>No</li> </ol> |

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|          | <p>etc.).</p> <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <ul style="list-style-type: none"> <li>a) Readings (frequencies, accuracy, remoteness)</li> <li>b) Advance tariff/<br/>/number/configurable tariffs</li> <li>c) Remote on/off (DR)</li> <li>d) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>e) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>f) End-user benefits (could the consumer change the energy provider without changing the device already installed? Does the smart meter installed need a firmware update?</li> </ul> |   |
| RQ1<br>1 | <p>Please provide info on whether the legal framework in your country provides clear definitions of technical and organizational requirements to ensure data protection and data security. (cyber-security aspects of the smart meter infrastructure)</p>  | <p>Principal Data Protection Legislation:</p> <ul style="list-style-type: none"> <li>• The Processing of Personal Data (Protection of Individuals) Law, 2001 (No. 138(I) of 2001). The Law was amended in 2003 so that to harmonise the Cyprus legislation with the EU Directive 95/46</li> </ul> <p>Other General Legislation that impacts Data Protection</p> |

## Annex 6. Additional information on countries not involved in the inteGRIDy project

### Estonia

|     | Pilot Country:  | Estonia  |
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| RQ1 | <p>Following the CBA (in what year) which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extent your country will be able to achieve the 2020 target?</p> | <ul style="list-style-type: none"> <li>In Estonia <b>CBA</b> outcome was <b>Positive</b>, with the total investment of 110 mn EUR, and total benefit of 191 mn. EUR</li> <li>In Estonia metering activity is regulated, and the SMs rollout is mandatory</li> <li>The implementation speed of the SMs in Estonia is 2013-2017 and the penetration rate by 2020 is 100%</li> <li>The average daily installation volume was over 800 SMs</li> <li>Elektrilevi OÜ completed a far-reaching and unique project (Remotely read meters project): the SMs rollout started with a pilot of installing 5 700 SMs in 2012 and was completed by January 2017</li> <li>There were replaced the customer's previous-generation electricity meters with new hourly SMs that can be read remotely</li> <li>This has made Estonia a country with one of the world's smartest distribution networks.</li> </ul> |
| RQ2 | Number of DSOs and their influence on the market  | <p><b>In Estonia there are 36 DSOs</b></p> <ul style="list-style-type: none"> <li>The largest DSO is Elektrilevi OÜ, whose sales volume was 6491 GWh in 2013, the number of customers was 475 000; with the market share of 87.5%</li> <li>The following 2 distribution network companies (cover 2,8%) were VKG Elektrivõrgud OÜ (sales volume of 212,5 GWh and nr of customers 33 898) and Imatra Elekter AS (sales volume of 199 GWh and nr of customers 24 689).</li> <li>The remaining 33 distribution networks' total sales volume is below 500 GWh per year</li> </ul>   |



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| RQ3 | Number of projects deploying smart meters in your country? Who leads those projects?  | <ul style="list-style-type: none"> <li>There was deployed one four-year project of the substitution of the traditional generation meters by new SMs</li> <li>The project's leader was Estonian dominant DSO -Eletrilevi OÜ</li> </ul>   |
| RQ4 | No of smart meters installed in your country by June 2017 (info from National Regulator)  | <ul style="list-style-type: none"> <li>In 2016, Estonian DSO Elektrilevi OÜ successfully completed a four-year project</li> <li>Altogether, in the course of the project 596 000 new SMs were installed</li> </ul>  |
| RQ5 | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the approach in your country? | <ul style="list-style-type: none"> <li>Prosumer concept is not regulated</li> <li>However, in Estonia there are paid subsidies for electricity that is generated from renewable energy sources, from biomass in CHP mode or in efficient CHP mode: 53.7 EUR/MWh</li> <li>In Estonian, just the terms "consumer" and "producer" are used. It is possible to connect a power generating unit up to 200 kW to the electricity transmission network.</li> <li>With electricity self-generation there is a "two-way traffic"- the electricity is taken from the network if the self-produced electricity is not enough to cover consumption, and when there is excess of the produced energy, it is delivered to the network. The energy supply from the grid and the excess delivery to the grid is measured by the network operator, with whom the manufacturer's network agreement has been concluded.</li> </ul> |
| RQ6 | SM infrastructure is dependent on DSO /Energy Supplier  | <ul style="list-style-type: none"> <li>The responsible party for the SMs implementation and ownership is DSO</li> </ul>   |
| RQ7 | Producer / Supplier of SMs implemented in your country  | <ul style="list-style-type: none"> <li>In Estonia, during the four-year project of DSO Elering AS, the supplier and the installer of the SMs was Ericsson Estonia and product partner Landis+Gyr</li> </ul>   |

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| RQ8  | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK, RF868MHz, GPRS/GSM, WiFi, Zigbee, other)  | <ul style="list-style-type: none"> <li>• <b>Communication Technology</b> <ul style="list-style-type: none"> <li>- Protocol based on DLMS/COSEM</li> <li>- Power Line Communication: PLAN+</li> <li>- Wireless communication: GPRS/UMTS</li> </ul> </li> <li>• <b>Technology highlights</b> <ul style="list-style-type: none"> <li>- Interoperability (IDIS)</li> <li>- Pushed messaging from Meters to System</li> <li>- Head-end system with standard interfaces (IEC)</li> <li>- Proven and customer tested technology</li> <li>- High level security</li> </ul> </li> <li>• <b>PLC Concentrators</b> <ul style="list-style-type: none"> <li>- 10 500 – 44% of all substations</li> </ul> </li> </ul>  |
| RQ9  | Rules in force in each pilot country (technical standards & national authorities regulations) referring specifically to the SM (e.g. <i>ANRE Decree no 145/2016 in Romania or standards CEI 0-16/CEI 0-21 and TIME in Italy</i> ). Indeed, the functionalities supported by each device strictly depend on the existing regulatory framework; therefore, a better knowledge of the rules will probably allow us to better understand the motivations of given choices of SM manufacturers.   | <p>[Unfortunately did not find]</p> <ul style="list-style-type: none"> <li>• The supplied SMs and their central system must meet the technical standards <b>IDIS</b></li> </ul>  |
| RQ10 | <p>Type of smart meters installed in your country. Please provide the link to the installation manual, if available.</p> <p>Please provide the following information if possible:</p> <ol style="list-style-type: none"> <li>1. name of product OR family of products OR series of the product OR suite of products:</li> <li>2. Technical specifications / distinctive features for the type of smart meters described above:</li> </ol> <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, if applicable in your country, focus more on the categories of users. Metering performances (reading frequency, etc.) mainly depend on the rules in force, as already mentioned, and on the characteristics of the user</i></p> | <p>The following 5 SMs types :</p> <ol style="list-style-type: none"> <li>1. TY120is 10(65)A</li> <li>2. TK420iNNs 5(100)A</li> <li>3. ML 3df6 0,5-40</li> <li>4. GH46TF 10(60)A</li> <li>5. ACE1000</li> </ol> <p><b>MANUAL :</b></p> <p><a href="https://www.elektrilevi.ee/en/kuidas-kaugloetav-arvesti-tootab">https://www.elektrilevi.ee/en/kuidas-kaugloetav-arvesti-tootab</a> (how it works)</p> <p><a href="https://www.elektrilevi.ee/en/kauglugemine-paigaldamine">https://www.elektrilevi.ee/en/kauglugemine-paigaldamine</a> (installation of SMs)</p> <ol style="list-style-type: none"> <li>a) Yes. Frequency of information provision is 60 minutes (online, via data hub)</li> <li>b) Yes. For the financing of the SMs rollout there are « <b>Network tariffs</b> »</li> <li>c) The functionalities include <b>two-</b></li> </ol> |

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|      | <p><i>involved. For example, in Italy, different metering strategies are adopted according to the user's voltage level, contractual power (e.g., LV ≤55 kW, LV &gt;55 kW, MV) and behavior (passive user, prosumer, etc.).</i></p> <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <ul style="list-style-type: none"> <li>m) Readings (frequencies, accuracy, remoteness</li> <li>n) Advance tariff/<br/>/number/configurable tariffs</li> <li>o) Remote on/off (DR)</li> <li>p) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>q) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK, ), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>r) End-user benefits (could the consumer change the energy provider without changing the device already installed? Does the smart meter installed need a firmware update?</li> </ul> | <p><b>way communication</b>, as well as <b>remote activation or de-activation</b> by the customer or DSO</p> <p>d)</p> <p>e) PLC, GPRS</p> <p>f) YES</p> <ul style="list-style-type: none"> <li>The <b>SMs</b> have an <b>open port</b> through which the consumers can have <b>access to their data</b>. Consumers can receive their hourly electricity <b>consumption</b> data and <b>costs</b> on the following day</li> <li>Market processes such as supplier switching and availability of different tariffs are being improved as SM are rolled out</li> <li>The consumers with SMs can view their hourly consumption their DSO's and supplier's online service and from the Estonian Data Hub website.</li> <li>Other consumer benefits of SMs include automatic reading, accurate bills, smarter supplier comparisons and easier switch of supplier. Hourly electricity tariffs are available for smart metered consumers</li> </ul> |
| RQ11 | <p>Please provide info on whether the legal framework in your country provides clear definitions of technical and organizational requirements to ensure data protection and data security. (cyber-security aspects of the smart meter infrastructure)</p>   | <p>[Few information]</p> <ul style="list-style-type: none"> <li>The introduction of SMs in Estonia <b>motivated</b> to direct more resources into ensuring the security of the <b>ICS/SCADA systems</b> necessary for providing vital services.</li> <li>In 2012, RIA (Estonian Information System Authority) <b>organized</b> several <b>penetration tests</b> in cooperation with the providers of vital services during which the security of the information systems of vital services was tested</li> </ul>   |

## Sweden

|     | Pilot Country:   | Sweden  |
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| RQ1 | <p>Following the CBA which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extend your country will be able to achieve the 2020 target?</p> | <ul style="list-style-type: none"> <li>Sweden was the first country to fully rollout smart meters</li> <li>CBA finalized in 2003</li> <li>In 2003 new regulation was adopted requiring monthly energy consumption for consumers and hourly energy consumption for larger consumers to be implemented by 2009</li> <li>Outcome: positive</li> <li>Smart meter deployment strategy: Voluntary</li> <li>Roll-out finalisation: 1 July 2009</li> <li>Sweden has an estimated penetration rate of 100% until 2020.</li> </ul> <p><b>Current situation:</b></p> <ul style="list-style-type: none"> <li>Sweden is the only country with full rollout that has reported any achieved customer benefits</li> <li>Swedish parliament decision requires all electrical meters to be read right after midnight on the first day of each month</li> <li>90% of all installed smart meters have hourly metering capabilities</li> <li>30% of installed meters are equipped with Home Area Network port</li> <li>DSOs are switching to hourly priced tariffs</li> <li>Hourly tariffs are not offered by all suppliers</li> <li>2020 target:100%</li> </ul> |
| RQ2 | Number of DSOs and their influence on the market   | <ul style="list-style-type: none"> <li>The Swedish regulator, Energy Market Inspectorate (Ei), has been in operation since 2008</li> <li>Svenska Kraftnät is the Transmission System Operator (TSO) for electricity</li> <li>4 Regional Network operators</li> <li>171 Distribution System Operators (DSO) are functionally unbundled in electricity, 3 companies have 50% of customers</li> </ul>  |
| RQ3 | Number of projects deploying smart meters in your country? Who leads those projects?   | <ul style="list-style-type: none"> <li>Vattenfall AMR project in Sweden 2002 – 2008</li> <li>Large research projects: <ul style="list-style-type: none"> <li>EIT KIC InnoEnergy Sweden</li> </ul> </li> </ul>   |

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|     |   | <p>European Node for Innovation on Smart Grids and energy storage</p> <ul style="list-style-type: none"> <li>○ ELEKTRA Research program in electrical power engineering in close cooperation with industry</li> <li>○ SweGRIDS Swedish research program in Smart Grids and energy storage (<a href="http://swedishsmartgrid.se/wp-content/uploads/2016/04/swe-day-smart-city-week-23-okt-k-widegren.pdf">http://swedishsmartgrid.se/wp-content/uploads/2016/04/swe-day-smart-city-week-23-okt-k-widegren.pdf</a>)</li> </ul> |
| RQ4 | No of smart meters installed in your country by June 2017 (info from National Regulator)  | <ul style="list-style-type: none"> <li>• Sweden has 5200000 meters in the country (<a href="http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52014SC0189">http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52014SC0189</a>)</li> </ul>   |
| RQ5 | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the approach in your country? | <ul style="list-style-type: none"> <li>• Yes, all companies are required to connect to the grid consumers with renewable energy</li> <li>• Sweden has installed Solar photovoltaic (PV) on rooftops of housing cooperatives (22% of all housing in Sweden) (<a href="http://www.diva-portal.org/smash/get/diva2:917873/FULLTEXT01.pdf">http://www.diva-portal.org/smash/get/diva2:917873/FULLTEXT01.pdf</a>)</li> </ul>  |
| RQ6 | SM infrastructure is dependent on DSO /Energy Supplier  | <ul style="list-style-type: none"> <li>• the smart meter infrastructure is depended on DSO</li> </ul>  |
| RQ7 | Producer / Supplier of SMs implemented in your country  | <ul style="list-style-type: none"> <li>• AMR 3- Telvent (from Vattenfall Group)</li> <li>• AMR 2 – Iskraemeco (from Vattenfall Group)</li> <li>• AMR 1- Actaris (from Vattenfall Group) (<a href="https://www.e-control.at/documents/20903/-/f93fa131-fd7c-4388-8397-5217a60b9f6e">https://www.e-control.at/documents/20903/-/f93fa131-fd7c-4388-8397-5217a60b9f6e</a>)</li> </ul>   |
| RQ8 | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi , Zigbee, other                           | <ul style="list-style-type: none"> <li>• cell phone modem included in the meter which is used to download the reading to the utility company's computers, using the existing cell phone services</li> <li>• via the existing electrical distribution lines, using high frequency signals</li> </ul>  |

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|     |  | <p>that are received by equipment mounted on utility poles throughout the neighborhood</p> <ul style="list-style-type: none"> <li>• PLC systems turned out to be a problem as well as the wireless type. The problem with PLC communication is that the electrical wiring inside the house radiate the transmitted signals from every wall</li> </ul> |
| RQ9 | <p>Type of smart meters installed in your country. Please provide the link to the installation manual, if available.</p> <p>Please provide the following information if possible:</p> <ol style="list-style-type: none"> <li>1. name of product OR family of products OR series of the product OR suite of products:</li> <li>2. Technical specifications / distinctive features for the type of smart meters described above:</li> </ol> <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <ol style="list-style-type: none"> <li>a) Readings (frequencies, accuracy, remoteness</li> <li>b) Advance tariff/ /number/configurable tariffs</li> <li>c) Remote on/off (DR)</li> <li>d) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>e) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>f) End-user benefits (could the consumer change the energy provider without changing the device already installed? Does the smart meter installed need a firmware update?</li> </ol> | <ul style="list-style-type: none"> <li>• National law: Electricity act (1997:857), Government Decree (1999:716)</li> <li>• Administrative decrees: EIFS 2011:3, EIFS 2012:2</li> <li>• Recommendations and guidelines by industry organizations or TSO: Svensk Energi: Elmarknads handboken Svenska Kraftnät: Teknisk Riktlinje TR3-01</li> </ul>     |



## The Netherlands

|     | Pilot Country:  | Netherlands   |
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| RQ1 | <p>Following the CBA () which was the deployment strategy smart meter roll-out? (Mandatory/voluntary?)</p> <p>If the decision was not mandatory, please provide details about the way SM deployment carries out now – considering the targets assumed by 2020</p> <p>To what extent your country will be able to achieve the 2020 target?</p> | <ul style="list-style-type: none"> <li>• CBA of smart metering produced by KEMA in 2010, supplemented by earlier analysis summarised in a report issued in 2005 by SenterNovem</li> <li>• Bi-monthly readings are provided to customers, with this supplemented by additional information on usage</li> <li>• Outcome: positive</li> <li>• Smart meter deployment strategy: Mandatory</li> <li>• Netherlands has an estimated penetration rate of 80% until 2020.</li> </ul> <p><b>Current situation:</b></p> <ul style="list-style-type: none"> <li>• Smart metering is not mandatory</li> <li>• 2008 original smart meter proposal with mandated roll out in 2009 -2010</li> <li>• 2020 target:80%</li> </ul> |
| RQ2 | Number of DSOs and their influence on the market  | <ul style="list-style-type: none"> <li>• The Dutch Office of Energy Regulation is part of the Netherlands Authority for Consumers &amp; Markets (ACM).</li> <li>• TenneT is the national TSO for the transmission of electricity</li> <li>• Since the end of 2010, all but two DSOs are fully ownership unbundled from the integrated company and are mostly owned by Dutch municipalities and provinces. There are eight DSOs that distribute both gas and electricity</li> <li>• 4 grid operators: Alliander, Stedin, DELTA Netwerkbedrijf and Westland Infra</li> </ul>  |
| RQ3 | Number of projects deploying smart meters in your country? Who leads those projects?  | <ul style="list-style-type: none"> <li>• Middle of 2015, Iskraemeco concluded a strategic partnership with four utilities from the Netherlands, Liander, Stedin, Enduris and Westland Infra. Within the smart metering project Iskraemeco will deploy up to 2, 5</li> </ul>   |

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|     |  | <p>million smart electricity meters during the next five years. Liander, Stedin, Enduris and Westland Infra manage a network consisting of more than 5 million electricity metering points.</p>  |
| RQ4 | No of smart meters installed in your country by June 2017 (info from National Regulator)   | <ul style="list-style-type: none"> <li>1.5 million Dutch households have smart meters so far</li> </ul> <p>(<a href="http://www.engerati.com/article/netherlands-smart-meter-rollout-goes-large-scale">http://www.engerati.com/article/netherlands-smart-meter-rollout-goes-large-scale</a>)</p>   |
| RQ5 | Is the prosumer concept regulated in your country? Please add details about the initiatives; which is the approach in your country?  | In 2013 40 social organisations have endorsed the Energy Agreement for Sustainable Growth  |
| RQ6 | SM infrastructure is dependent on DSO /Energy Supplier   | <ul style="list-style-type: none"> <li>the smart meter infrastructure is depended on DSO</li> </ul>  |
| RQ7 | Producer / Supplier of SMs implemented in your country   | <p>Iskraemeco AM550</p> <p>(<a href="http://www.iskraemeco.com/en/portfolio/electricity-meters/residential-smart-meters/am550/">http://www.iskraemeco.com/en/portfolio/electricity-meters/residential-smart-meters/am550/</a>)</p>   |
| RQ8 | Technologies (PLC G3, PLC PRIME, PLC M&M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi, Zigbee, other   | <p>Communication will be via Alliander and Stedin's CDMA network for the majority of smart meters and GPRS for the remainder</p> <ul style="list-style-type: none"> <li>By end of 2016, around 160.000 smart meters based on GSM/GPRS and CDMA communication were already sent to the Netherlands.</li> </ul> <p>(<a href="http://www.engerati.com/on-demand/alliander-and-stedin-our-dedicated-private-wireless-telecom-network-and-smart-grid-becoming-reality/7176">http://www.engerati.com/on-demand/alliander-and-stedin-our-dedicated-private-wireless-telecom-network-and-smart-grid-becoming-reality/7176</a>)</p> |
| RQ9 | <p>Type of smart meters installed in your country. Please provide the link to the installation manual, if available.</p> <p>Please provide the following information if possible:</p> <p>1. name of product OR family of products OR series of the product OR suite of products:</p> | <p>Around 160.000 smart meters based on GSM/GPRS and CDMA communication were already sent to the Netherlands.</p> <p>The modular smart meter, AM550 is an essential part of this smart metering transition.</p> <p>Installation manual and docs here: <a href="http://www.iskraemeco.com/en/portfolio/electricity-">http://www.iskraemeco.com/en/portfolio/electricity-</a></p>  |

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|  | <p>2. Technical specifications / distinctive features for the type of smart meters described above:</p> <p><i>Please include details about all the pilot projects rolled-out in your country</i></p> <p><i>Also, add details about the SM that qualifies for the inteGRIDy pilot</i></p> <ul style="list-style-type: none"> <li>g) Readings (frequencies, accuracy, remoteness</li> <li>h) Advance tariff/<br/>/number/configurable tariffs</li> <li>i) Remote on/off (DR)</li> <li>j) import/export and reactive metering (data type, data format, parameters, storage)</li> <li>k) Communication facilities, protocols / Technologies (PLC G3, PLC PRIME, PLC M&amp;M, PLC OSGP, PLC S-FSK,), RF868MHz, GPRS/GSM, WiFi – Zigbee, other</li> <li>l) End-user benefits (could the consumer change the energy provider without changing the device already installed? Does the smart meter installed need a firmware update?</li> </ul> | <p><a href="https://www.instrumart.com/assets/meters/residential-smart-meters/am550/mprobe-AM540-AM550-Manual.pdf">meters/residential-smart-meters/am550/<br/>https://www.instrumart.com/assets/A<br/>mprobe-AM540-AM550-<br/>Manual.pdf</a></p> <p>(<a href="http://www.iskraemeco.com/en/news/netherlands-largest-smart-metering-deployment-utility-perspective/">http://www.iskraemeco.com/en/news/netherlands-largest-smart-metering-deployment-utility-perspective/</a>)</p> |
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<http://www.integrity.eu>