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Implementing Technology that Benefits Consumers in the Clean Energy for All Europeans Package

Selected Case Studies

CEER Report

Innovation and Retail Markets WS
of
Customers and Retail Markets WG

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INFORMATION PAGE

Abstract

This document, C19-IRM-16-04, seeks to contribute to a heightened awareness and understanding of the new provisions adopted in the recast Electricity Directive, with a view to facilitating their implementation and application by NRAs, policy-makers, market actors and consumers. The report focuses on three topics in the Directive: lessons learnt relating to on-demand smart meter roll-outs, dynamic prices and data exchange and interoperability.

Target Audience

NRAs, European Commission, Member States, energy suppliers, traders, gas/electricity customers, other gas/electricity industry players, consumer representative groups, Network Operators, Member States, academics and other interested parties.

Keywords

Recast Electricity Directive, National Regulatory Authority (NRA), Package on Clean Energy for all Europeans (CEP), smart meter roll-out, on request smart meter roll-out, dynamic price, dynamic price contract, data exchange, interoperability, smart meters, metering, Data Hub, privacy, national transposition.

If you have any queries relating to this paper, please contact:
CEER Secretariat
Tel. +32 (0)2 788 73 30
Email: brussels@ceer.eu

Related Documents

CEER documents

- CEER Regulatory White Papers on Clean Energy: CEER White Paper no. II – Technology that Benefits Consumers, CEER Advice on Customer Data Management for Better Retail Market Functioning, CEER Review of Current and Future Data Management Models: https://www.ceer.eu/white-papers

- "Conclusions Paper on Incentives Schemes for Regulating Distribution System Operators (DSOs), including for innovation", CEER Consultation Paper, January 2017, C16-DS-28-03

- "CEER Review of Current and Future Data Management Models", CEER, December 2016, C16-RMF-89-03

- "CEER Benchmarking report on removing barriers to entry for energy suppliers in EU retail energy markets", CEER, April 2016, C15-RMF-70-03

- "CEER Position paper on well-functioning retail energy markets", CEER, October 2015, C15-SC-36-03

- "CEER Advice on Customer Data Management for Better Retail Market Functioning", CEER, March 2015, C14-RMF-68-03

External documents

- Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019L0944

- "Dynamic pricing in electricity supply, A EURELECTRIC position paper, February 2017"http://www.eemg-mediators.eu/downloads/dynamic_pricing_in_electricity_supply-2017-2520-0003-01-e.pdf

- "Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation", European Commission, September 2015, COM(2015) 6317 final https://ec.europa.eu/energy/sites/ener/files/documents/1_EN_ACT_part1_v8_0.pdf

- "Energy Efficiency and its contribution to energy security and the 2030 Framework for climate and energy policy", European Commission, July 2014, COM(2014) 520 final https://ec.europa.eu/energy/sites/ener/files/documents/2014_eec_communication_adopted_0.pdf

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EXECUTIVE SUMMARY

On 30 November 2016, the European Commission (EC) published a package of legislative proposals to facilitate the EU's clean energy transition and competitiveness in global energy markets. The Clean Energy for All Europeans package (CEP) included eight legislative texts, one of which was the proposal for a recast of the Directive on common rules for the internal market in electricity (hereafter recast Electricity Directive). The recast Electricity Directive addresses, amongst other issues, the use of technology for new processes and business models and their benefit to consumers.

After two years of legislative negotiations, most articles of the final recast Electricity Directive will need to be transposed into national legislation by 31 December 2020, having entered into force 4 July 2019.

Taking into account the next steps needed to prepare national transposition and a clear understanding of new concepts and obligations in the Directive, this CEER report describes case studies from different Member States (MS) on implementing technology that benefits consumers. The report focuses on three topics in the recast Electricity Directive:

- Lessons learnt relating to on-demand smart meter roll-outs (Articles 19-21; Annex II)
- Dynamic price contracts (Article 11)
- Data exchange and interoperability (Articles 23 and 24)

With reference to on-demand smart meter roll-outs, CEER found that there are currently no known cases among MS of smart meters being installed upon request. However, the two case studies presented in the report, whilst not directly addressing the issue of smart meters upon request, do reveal some of the challenges inherent in the implementation of this specific provision. The Irish case study describes a form of global roll-out where customers can be prioritised in the roll-out if they request a smart meter. The Norwegian case study describes the collective benefits that cannot be achieved with a demand-led roll-out. The latter study also outlines the costs of maintaining two parallel systems, one for traditional meter data and one for smart meter data. The additional cost of maintaining the data management processes for traditional meters is paid for by the small percentage of Norwegian customers who refuse smart meters. CEER also found that a similar, although somewhat different provision currently exists in Sweden. Since 2009, all customers have smart meters. From 2012, all customers were entitled to opt for a meter upgrade in order to get hourly metering, however, very few customers have done so. By 2025 all meters will be upgraded to support hourly settlement, and thus enable customers to opt for dynamic price contracts. In this specific situation, customers who already want such contracts may request an upgrade of their smart meters ahead of the deadline.

With regard to dynamic price contracts, the Spanish case study describes the many characteristics of the default tariff in the Spanish electricity market, called Voluntary Price for the Small Consumer (PVPC), a tariff based on dynamic pricing. The second Swedish case study illustrates how Swedish customers are accustomed to variable price contracts and how suppliers are more and more offering hourly contracts to consumers, resulting in a competitive market where consumers can choose between a large number of different suppliers. The second Norwegian case study explains how suppliers can offer a form of dynamic contract without access to hourly metering data (consumption is instead profiled).

Concerning data exchange and interoperability, the Austrian case study highlights how the "Energy Economic Data Exchange" (EDA), a voluntary industry-led initiative which enables all market players to exchange data and electronic documents in a common format supported by a common communication protocol, is used by all market participants. With regard to the flow of data between market participants in the Czech Republic, it is necessary to distinguish between streams of technical data (data on the operation of the system, data for the preparation of network operation and management, data on connected entities, etc.) and business data flows (data on traders, consumption points data and transfer points data, data for billing purposes and electricity billing data). While in the former case the data is focused on the TSO/DSO, the latter is focused on OTE (the Czech electricity and gas market operator). Both systems are interconnected and the technical data is an input for the business. The Danish case study describes how the Danish electricity TSO Energinet is required by law to establish and operate the datahub in Denmark, which is an IT-platform that handles data communication and business processes between market participants in the Danish electricity market. All metered data and necessary information for settlement purposes, including balance and wholesale settlement, are collected in the datahub. Furthermore, the process of things such as address changes and supplier switching are also handled in the datahub.

While this present report addresses technology aspects, other two (separate) CEER reports address: (1) consumer empowerment (upcoming)[1] and (2) self-consumption and energy communities[2], respectively.

CEER hopes that this series of case studies will contribute to a heightened awareness and understanding of the new provisions adopted in the recast Electricity Directive, with a view to facilitating their implementation and application by NRAs, policy-makers, market actors and consumers.

Regarding subsequent CEER work on CEP implementation, CEER has begun working on the following deliverable in 2019: "Recommendations on Dynamic Price Implementation". This CEER paper will investigate potential implementation barriers, outline good practices and make recommendations on regulation. It may also make recommendations on how individual NRAs should monitor the effect of dynamic prices in the market to consumers benefit, in line with the provisions in the recast Electricity Directive.

[1] Upcoming CEER Report "Case Studies on Implementing Consumer rights of the Clean Energy for All Europeans Package"
[2] CEER Report on "Regulatory Aspects of Self-Consumption and Energy Communities" (2019) https://www.ceer.eu/documents/104400/-/-/8ee38e61-a802-bd6f-db27-4fb61aa6eb6a

1 Introduction

1.1 Background

On 30 November 2016, the European Commission (EC) published a package of legislative proposals to facilitate the EU's clean energy transition and competitiveness in global energy markets. The Clean Energy for all Europeans package (CEP) included eight legislative texts, one of which was the proposal for a recast of the Directive on common rules for the internal market in electricity (hereafter recast Electricity Directive). Following publication, CEER provided extensive regulatory analysis and input on the suite of proposals, outlining our views on the implications of the proposed changes in a series of regulatory White Papers[3]. Many of the issues identified by regulators in these papers were recognised by the European Parliament and Council of Ministers during the legislative process.

Following two years of legislative negotiations, a provisional agreement on the recast Electricity Directive was reached by EU legislators on 18 December 2018, and the final version entered into force on 4 July 2019, 20 days after its publication in the Official Journal of the European Union. This means, the recast Electricity Directive will need to be transposed into national legislation by 31 December 2020.

1.2 Scope and objective of this report

Among other issues, the recast Electricity Directive addresses the use of technology for new processes and business models and their benefit to consumers. Taking into account the next steps needed to prepare national transposition and a clear understanding of new concepts and obligations in the Directive, this CEER report describes case studies from different Member States (MS) on implementing technology that will benefit consumers. The report focuses on three topics in the recast Electricity Directive:

- Lessons learnt relating to on demand smart meter roll-outs (Articles 19-21; Annex II)
- Dynamic price contracts (Article 11)
- Data exchange and interoperability (Articles 23 and 24)

Recognising that the implementation of the CEP at national level will be one of the main priorities for National Regulatory Authorities (NRAs) in the coming years, CEER has gathered a number of national case studies from across the EU covering customer-related elements of the recast Electricity Directive. This report addresses technology aspects, while other two (separate) reports address: (1) consumer empowerment (upcoming) and (2) self-consumption and energy communities.[4]

CEER hopes that this series of reports will contribute to a heightened awareness and understanding of the new provisions adopted in the recast Electricity Directive, with a view to facilitating their implementation and application by NRAs, policy-makers, market actors and consumers.

[3] CEER's series of regulatory White Papers are available online: https://www.ceer.eu/white-papers. These papers covered not only the recast Electricity Directive, but other proposed texts of the CEP as well.
[4] CEER Report on "Regulatory Aspects of Self-Consumption and Energy Communities" (2019) https://www.ceer.eu/documents/104400/-/-/8ee38e61-a802-bd6f-db27-4fb61aa6eb6a

1.3 Structure of the report

As explained above, the objective of this paper is to share a variety of practical experiences regarding the implementation of technologies addressed in the CEP (in the recast Electricity Directive in particular).This report presents eight case studies from seven MS covering the following topics:

1. ***Lessons learnt relating to on-demand smart meter roll-outs:***

- Demand-led component to the first phase of the full smart meter roll-out in Ireland
- The costs of having two parallel metering systems in Norway

2. ***Dynamic price contracts:***

- Voluntary prices for household consumers in Spain
- Dynamic prices in Norway
- Hourly contracts in Sweden

3. ***Data exchange and system interoperability:***

- EDA (*Energiewitschaftlicher Datenaustausch*) – Data exchange and interoperability in Austria
- Data exchange and interoperability in the Czech Republic
- Data exchange and interoperability in Denmark

For each case study, the following pictograms are used to provide a simplified classification.

				
Electricity sector	**Gas sector**	**Consumer affected**	**Time frame**	**Relevant Legislation**

2 Lessons learnt relating to on demand smart meter roll-outs

Articles 19 to 21 of the recast Electricity Directive reinforce and clarify the provisions regarding the roll-out of smart meters, seeking to encourage their widespread deployment across the EU. Among other things, the revisions address:

- Interoperability and common functionalities for smart meters;
- Compliance with data privacy and security rules;
- Consumers' access to historical data and data on their electricity input and off-take; and
- A periodic review of the economic assessment on the possible deployment of smart metering systems.

The recast Electricity Directive also entitles customers to request a smart meter to be installed in MS where the cost-benefit assessment is negative, as long as the customer bears the associated costs. Owing to the above, CEER recalls that smart meters cannot be considered as standalone devices. Their roll-out instead relies on the deployment of IT and communication infrastructure that represent a significant share of the cost. Much of this cost is fixed and is subject to significant economies of scale, such that a limited smart meter roll-out only to customers "on request" would prove disproportionately expensive on a unit basis. Hence, the associated costs could be considerable.

CEER notes the importance of establishing the meaning of the specific provisions regarding these requested smart meters in Article 21: *"…shall ensure that every final customer is entitled on request, while bearing the associated costs, to have installed or, where applicable, to have upgraded, under fair, reasonable and cost-effective conditions…"*

When preparing this report, CEER found that there are currently no known cases among MS of smart meters being installed upon request. However, the two case studies presented in this section, whilst not directly addressing the issue of smart meters upon request, do reveal some of the challenges inherent in the implementation of this specific provision. The Irish case study describes a form of global roll-out where customers can be prioritised in the roll-out if they request a smart meter. The Norwegian case study describes the collective benefits that cannot be achieved with a demand-led roll-out. The latter study also outlines the costs of maintaining two parallel systems, one for traditional meter data and one for smart meter data. The additional cost of maintaining the data management processes for traditional meters is paid for by Norwegian customers who oppose smart meters.

CEER also found that a similar, although somewhat different provision currently exists in Sweden. Since 2009, all customers have smart meters. From 2012, all customers were entitled to opt for a meter upgrade in order to get hourly metering[5], however, very few customers have done so. By 2025 all meters will be upgraded to support hourly settlement, and thus enable customers to opt for dynamic price contracts. In this specific situation, customers who already want such contracts may request an upgrade of their smart meters ahead of the deadline.

[5] For more details, please see the Swedish case study in chapter 3.2 "Hourly contracts on the Swedish electricity market".

2.1 Demand-led component to the first phase of the full smart meter roll-out in Ireland (IE)

				
✓	✓	All metering points	2019 - 2024	S.I. No. 426, Statutory Instrument national, secondary legislation

In the Republic of Ireland, there is a project underway to upgrade both electricity and gas customers to smart meters. Currently, the project is focusing on the upgrade in electricity while delivering the capability for a gas smart metering solution to use its communication channels (standalone gas solutions are rare due to technology and cost restrictions). The upgrade of electricity smart meters is to be completed by 2024 and is to be network-led rather than supplier-led. ESB Networks (the sole electricity DSO in the Republic of Ireland) is leading the implementation of the upgrades and will be responsible for the actual installation of the smart meters. Customers with a demand of less than 100 KiloVoltAmps (kVA) and who currently have meters which are required to be manually read four times a year will be upgraded. This will predominantly encompass domestic and smaller business customers. The cost of the upgrade is to be socialised across all electricity customers. Larger customers are not part of the upgrade programme as their meters can already be read remotely.

2.1.1 Policy for and design of the smart metering upgrade

The Commission for Regulation of Utilities (CRU – the Irish NRA) has conducted significant policy work to ensure that this upgrade to smart meters is beneficial to the customers, not only in terms of both added functionality and cost. This is reflective of the CRU's legislative duties outlined in Part 4 Section 18 of S.I. No. 426 of 2014:

The CER[6] shall ensure that, in so far as it is technically possible, financially reasonable and proportionate in relation to the potential energy savings, final customers for electricity and natural gas are provided with a competitively priced smart metering system that accurately reflects the final customer's actual energy consumption and that provides information on actual time of use.

The policy work carried out by the CRU was conducted with input from industry stakeholders and, importantly, consumer groups. The CRU publicly consulted on its policy proposals and extensive customer trials were carried out in 2009.[7]

[6] The Commission for Energy Regulation (CER) changed its name in 2017 to the Commission for Regulation of Utilities (CRU) to fully reflect its broadened remit and mission to regulate water, energy and energy safety in the public interest.
[7] Trial results are available on the CRU's website – https://www.cru.ie/wp-content/uploads/2011/07/cer11080ai.pdf

In 2014, the CRU set the high-level functionalities that the smart metering upgrade would have to deliver.[8] It stated that the meter would be a so-called 'thin solution', whereby minimum functionality would be performed on the smart meter and the back-office systems would perform the majority of data processing. Key functionality requirements include:

- the daily collection and provision of half hourly consumption data by the network company to suppliers
- the provision of consumption data to third parties upon customer request
- the seamless switching between credit and prepayment modes
- the provision of real-time consumption data over a home area network

In addition, the CRU set out that suppliers must be able to offer customers Time of Use (ToU) tariffs and assist them in understanding their options. It also introduced the concept of a standard smart tariff, which all suppliers must offer. The standard smart tariff is a simple form of ToU tariff, which should be easy to compare across suppliers. The aim is that these relatively simple tariffs (three time phases - day 8am to 11pm / night 11pm to 8am / peak (within day) 5pm to 7pm) would help customers become more familiar with ToU offerings and, in doing so, pave the way for future developments . The CRU recently published a decision that set out the time bands for these standard smart tariffs. That decision also stipulated that price differences between the time bands must be meaningful and cost reflective[9]

2.1.1 The Phased Electricity Upgrade

In 2017, ESB Networks submitted a proposal to the CRU recommending a phased approach to the upgrade of smart meters in the electricity market. The proposal put forward by ESB Networks sought to limit the technical complexity associated with the smart meter upgrade and build in more flexibility to the overall delivery of smart meters to consumers. It also aligned with recent proposals from the EC, contained in the CEP, by introducing the ability for consumers to request the installation of a smart meter.

The proposal recommended that the upgrade to electricity meters will be conducted over a six-year period and that added functionality could be switched on sequentially. Previously, a national upgrade, where all functionality would be switched on at the same time, was recommended. Details of the phased upgrade can be found in Table 1. The additional functionality detailed in the table is to be turned on at the end of each phase. Once the upgrade is complete, a gas smart metering solution will be able to use its communication channels.

	Phase 1	Phase 2	Phase 3
Timeline	2019-2020	2020-2022	2022-2024
Meters upgraded	250,000	1,000,000	1,000,000
Enabled functionality	Half hourly consumption data for settlement	Smart prepayment	The provision of a Home Area Network

Table 1 - Details of the phased upgrade to smart meters, including timelines and added functionality being delivered

[8] See CER National Smart Metering Programme, Smart Metering High Level Design, Decision Paper, CER/14/046
[9] See Smart Meter Upgrade, Standard Smart Tariff decision paper, CRU/18/164

By 2024, there will be over 2 million smart electricity meters installed, all compatible with one another and all with the same level of functionality. This will mean that 96% of all Irish electricity customers will have a smart meter.[10] The availability of half-hourly consumption data within phase one of the upgrade will allow customers to access many of the primary benefits associated with smart meters as early as possible. Amongst other things, this will enable the offering of ToU tariffs and the provision of smart bills.

During phase one of the upgrade programme customers will be able to request a smart meter. Further detailed rules around the allocation of meters to customers during the upgrade are still being developed. Phase one of the project will be predominantly a meter replacement programme for customers whose current meter has reached the latter stages of its technical life and now requires replacement. However, there will also be a demand-led component to phase one of the project, whereby customer requests for a smart meter will be prioritised in the smart meter roll-out.The first phase offers upgrades to customers who have 24-hour meters (one register) rather than meters that have two registers that record day and night usage separately. This approach has been adopted as 24-hour meters make up the vast majority of meters (80%) and focusing on them in phase one allows for a more efficient roll-out. The upgrade is to be extended to all meter types from phase two onwards.

The CRU conducted a CBA to determine whether the phased upgrade is cost reflective. To determine the upgrade's real value for the Irish consumer, the CBA encompassed direct monetary in addition to wider societal costs and benefits. The results of the CBA were published by the CRU in CRU/17/324[11]which announced the adoption of the phased approach. The results showed that the phased approach to the smart meter upgrade represented better value than previous alternatives. It showed that the overall net present value (NPV) of the upgrade was broadly neutral on this €1 billion project[12], with some benefits perceived as unquantifiable. Where European proposals to provide customers with a right to request an electricity smart meter are adopted in the CBA, then the NPV increased to approximately €106 million. This benefit was seen as the IT system costs were treated as sunk, i.e., they would be incurred irrespective of the extent of the roll-out of smart meters.

Having established the value of the upgrade programme, the CRU published its decision to proceed with the smart metering upgrade in September 2017.[13] With this, the upgrade programme moved away from the preparatory stages (led by the CRU) to implementation. Implementation is being led by ESB Networks (and later Gas Networks Ireland), with the CRU's role focused on coordination. Since the publication of the decision to proceed with the smart metering upgrade, the CRU has also published a decision on the incentives around the delivery of the upgrade by ESB Networks[14]. The incentives (awards and penalties) are focused not only on the installation of smart meters but also on delivering smart functionality to the customer. Further policy work is also underway, covering for example the use of actual consumption data rather than estimates in wholesale settlement. This additional policy work will continue to be supported by engagement with stakeholders. The CRU is also co-funding behavioural economics research[15].

10 In total there are 2,057,314 customer in Ireland (see CRU Energy Retail Markets Annual Report 2017). By the end of the upgrade project 96% of all customers will have a smart meter.
11 Update on the Smart Meter Upgrade CER/17/324
12 The upgrade for electricity meters spans three phases. Once completed in 2024, this upgrade would support the delivery of a smart metering upgrade for gas.
13 Update on the Smart Meter Upgrade, Information Paper CER/17/279
14 Reporting and Incentives under Price Review 4, Decision CRU/18/087
15Price Lab report, https://www.esri.ie/publications/price-transparency-in-residential-electricity-experiments-for-regulatory-policy-2

2.2 The costs of having two parallel metering systems in Norway (NO)





✓	All metering points	2011 – 2019	Avregningsforskriften, secondary legislation

The Norwegian regulatory authority for energy (NVE) initiated a mandatory roll-out of smart meters in 2011. The NVE has also been supervising the installation process. Approximately 2.9 million meters in Norway were to be fully installed by 1 January 2019, and from 2019 all consumption will be metered hourly.

2.2.1 The benefit from mandatory smart meter roll-out

The smart meter roll-out is expected to bring several benefits to customers. For example, the benefits from local access to real-time consumption data through a standardised plug-in and the possibility to react to price signals from the wholesale market that do not rely on a critical mass of smart meters being installed. However, more products and services are likely to be offered in a market with a higher share of customers with smart meters.

The smart meter roll-out is also expected to bring efficiency benefits to DSOs[16] since customers pay for the grid through grid tariffs and lower costs for the DSO result in lower tariffs for the customer. More efficient DSOs may also lead to a higher security of supply. These indirect benefits are enjoyed by all customers, regardless of whether or not they have a smart meter. The extent of the total benefits, however, depends on smart meters being installed in as many metering points as possible.

Hourly consumption data, alongside possibilities for alarms (automatic messages to the DSO) in case of voltage problems, ground faults or a power outage will provide the DSO with enhanced possibilities for optimising the management of and the investment in the grid. All other things being equal, the DSO will be able to ensure the same level of security of supply and investment for less than with a traditional metering system. The NVE already sees that some DSOs have been able to postpone or cancel grid investments because the smart meters give them better and more detailed information on grid use. The benefits realised from optimising the management of and the investment in the grid increases with the share of smart meters installed.

Hourly registration of consumption data also allows for the differentiation of grid tariffs depending on the total grid load. This incentivises customers to shift their consumption from hours of high loads and high tariffs to low-load hours with lower tariffs. Overall, this may increase the capacity utilisation of the transmission grid and provide lower costs over time, as new investments are postponed or even avoided. In order to maximise the effect of the price signal in the grid-tariff, and due to non-differential treatment of customers, all customers should have smart meters installed before the introduction of the new network tariff. The fact that the yearly consumption of a typical Norwegian household is about 16,000 kWh/year adds to the necessity of a smart metering roll-out for all.

[16] Unlike the Republic of Ireland, Norway has many electricity DSOs.

Finally, correct meter data will give the DSO more information about grid losses to ensure that all consumption is paid for. Without this, the costs of unregistered consumption are covered through losses and socialised among all customers.

2.2.2 Costs of parallel systems

Smart meters have been installed in approximately 98% of Norwegian metering points at time of writing. The only exceptions are about 2% of metering points where the DSO has not been able to install the smart meter (half of these are due to technical reasons). In a very small amount of cases (approx. 0.25 %), the client has obtained a medical certificate from a medical doctor or psychologist to allow them not to have a smart meter installed. Only in these cases is the individual legally exempt from having a smart meter installed.

When smart meters are not installed in some metering points, the DSO has to have two different systems for metering data collection and settlement. Operating and maintaining two different systems will bring additional costs for the DSO. The DSOs may charge for the cost of reading the metering points. They may also charge customers to deactivate the automatic communication unit in the smart meter after a smart meter has been installed. The cost reflects the additional cost to the DSO; this additional cost is the same for all exempted customers in the DSO-area and likely to be between €50 and €200/yr.

3 Dynamic price contracts

According to Article 2 of the recast Electricity Directive, a dynamic electricity price contract is defined as *"an electricity supply contract between a supplier and a final customer that reflects the price variation at the spot markets including day ahead and intraday markets, at intervals at least equal to the market settlement frequency"*.

Dynamic price contracts create price-driven incentives for customers to react flexibly to wholesale market conditions. They provide greater transparency regarding the price of electricity and incentivise consumers to actively adapt their electricity consumption (e.g. reduce or shift consumption to hours when the system is less congested). For example, several reports and research pieces have concluded that increased flexibility in consumption can be beneficial for the electricity market as a whole (given correct price signals stemming from supply and demand, and potential capacity improvements on the distribution network). Therefore, CEER firmly believes it is important to ensure that there are no market barriers for suppliers to offer such contracts.

Article 11 requires Member States to ensure that national regulatory frameworks enable suppliers to offer dynamic contracts. Member States must also ensure that final customers with smart meters can request a dynamic electricity price contract from at least one supplier and/or from every supplier that has more than 200,000 final customers. The specific details on how such obligations can be implemented in practice will be of particular interest to NRAs.

In this report we describe the use of dynamic price contracts in Spain, Sweden and Norway.

3.1 Voluntary prices for household consumers in Spain (ES)

✓		Consumers up to 10 kW capacity and not under a free market contract	Since 2014	Law 24/2013 of the Power Sector, Royal Decree 216/2014

The purpose of this case study is to analyse the main characteristics of the default tariff in the Spanish electricity market, called Voluntary Price for the Small Consumer (PVPC) – a tariff based on dynamic pricing. PVPC is the electricity price-setting system that is applied to the electricity bill of those consumers whose contracted power does not exceed 10 kW and who do not have a free market supply contract in force.

By the end of 2017 there were 28 million electricity customers in Spain, of which 26.4 million (94%) had a contracted power equal to or below 10 kW. The number of consumers supplied under the PVPC regime by reference suppliers (defined below in 3.1.2)[17] has steadily decreased from 14 million at the end of 2014 (nearly 50% of the consumers entitled) to 11.1 million in August 2018.

[17] Royal Decree 216/2014 (article 3) establishes the requirements that reference suppliers must comply with.

In 2008, the Spanish Government approved a roll-out plan for smart metering devices for household supply points (up to 15 kW of contracted power) until the end of 2018.

3.1.1 Implementation

Act 24/2013 of the Power Sector and Royal Decree 216/2014 modified the regime of the supplier of last resort and introduced PVPC for consumers up to 10 kW.

As a result, the previous last resort regulated tariff for small consumers (TUR) disappeared and, on 1 April 2014, the new system (PVPC) came into force for determining the cost of energy on the electricity bill of small consumers who do not have a contract with a supplier in the liberalised market.

Royal Decree 216/2014 establishes the rules and provisions for implementing PVPC, as well as the methodology used to calculate it. In addition, the Resolution of 2 June 2015 of the Secretary of State for Energy approved the operational procedures necessary to start issuing bills to customers equipped with smart meters based on both hourly consumption and prices.

Following this, the Spanish National Commission for Markets and Competition (CNMC – the Spanish regulator) was mandated to prepare a report with a methodology to determine the regulated margin for reference suppliers (those providing PVPC) - approved in May 2016. In November 2016, Royal Decree 469/2016 was approved, amending Royal Decree 216/2014 which established the new methodology for calculating PVPC. This new methodology recognises the costs incurred to carry out the supply activity made by an efficient and well-managed company. Finally, the values for the new regulated margin for the period 2014-2018 were established in the Ministerial Order ETU/1948/2016.

3.1.2 Legal framework

Small electricity customers (up to 10 kW) have the right to be supplied by reference suppliers under a PVPC regime, as a public service obligation. Alternatively, this customer segment can also choose a regular supplier in the market.

Royal Decree 216/2014 establishes the methodology for calculating PVPC, which includes the energy cost, the applicable network charges and any other charges, such as the margin of the reference suppliers.

Reference suppliers, those entitled by regulation to offer PVPC tariff to domestic consumers, have the obligation to apply these prices to the small consumers that wish to be supplied with a variable price. Additionally, reference suppliers must offer a (non-regulated) fixed price for one year. The idea is that some consumers may wish to have an ex-ante fixed price instead of an ex-post variable price. There are eight reference suppliers in Spain[18].

[18] 6 of them (Endesa Energía XXI, Iberdrola Comercialización de Último Recurso, Gas Natural SUR, EDP Comercializadora de Último Recurso, Viesgo Comercializadora de Referencia and CHC Comercializador de Referencia) operate at national level, while the other 2 (Comercializadora de Ceuta and Teramelcor) operate at local level.

3.1.3 Consumption profiles and settlement

Those consumers who have a smart meter installed that is capable of hourly metering have PVPC applied to their bill in accordance with their hourly consumption throughout the day. This gives them greater access to information regarding hourly pricing schedules and will allow those consumers to adapt their electricity consumption, thereby reducing their bill.

On the contrary, the hourly price tariff is applied via a consumption profile that the Spanish TSO (Red Eléctrica) updates constantly, according to the behaviour patterns of consumers for those consumers who do not have a smart meter installed.[19](The consumption profiles are published on Red Eléctrica's corporate site[20]).

As foreseen in Royal Decree 216/2014, the electricity bill for consumers under the PVPC regime is comprised of the cost of generating electricity, the applicable network charges, and the corresponding retail costs. The cost of energy is calculated on the basis of the hourly price of the day-ahead and intraday markets managed by the Market Operator (OMIE) during the invoicing period, as well as the hourly price of the ancillary services, managed by the System Operator (Red Eléctrica). The formulas for the calculation of PVPC are established in Royal Decree 216/2014 (articles 5 to 12).

3.1.4 Information to customers

The Red Eléctrica has implemented an IT communication service through which PVPC consumers can be fully informed of the price of electricity that will be applied in accordance with Royal Decree 216/2014. This system, which can be accessed through Red Eléctrica's website, allows end users to modify their consumption patterns and improve the management of their electricity consumption. This way, Red Eléctrica offers consumers who have opted for PVPC the ability to see the financial impact of their electricity consumption depending on the selected tariff (general tariff, night tariff or electric vehicle tariff). Prices for the next day are published at 20:15[21].

In addition, as established in Royal Decree 216/2014, CNMC has developed a tool, accessible through its website, with which all PVPC consumers, with or without smart meters, can check their electricity bill[22].

3.1.5 Customer protection

Although there is no applicable floor or ceiling to PVPC's energy component, the general electricity market rules in Spain establish that purchase bids in the day-ahead and intraday markets cannot exceed 180.3 €/MWh (6th Rule of the Resolution of 23 December 2015 of the Secretary of State for Energy).

[19] According to the Ministerial Orden ETU/1282/2017, from 1st January 2019, every distribution company is allowed to have a maximum of 2% of its old metering devices, as long as the failure to replace them is due to reasons beyond their control.
[20] https://www.ree.es/en
[21] https://www.esios.ree.es/es/pvpc
[22] https://facturaluz2.cnmc.es/

Furthermore, reference suppliers must also offer a (not-regulated) fixed price for one year for those consumers who may wish to have an ex-ante fixed price instead of an ex-post variable price. However, these fixed-price offers are usually found to be amongst the most expensive offers in the Price Comparison Tool (PCT) managed by the CNMC. In December 2017, only around 3,500 consumers had contracted this type of ex-ante offer (0.03% of all consumers supplied under the PVPC regime).

3.1.6 Current situation

The introduction of the PVPC regime by Royal Decree 216/2014, together with the roll-out of smart meters, led to a change in the strategy of suppliers in the free market regarding their definition of commercial offers. More specifically, since then, many suppliers started making offers that were indexed to the spot market. For its next monitoring report on the electricity retail market, CNMC has already asked suppliers for information about the number of consumers with dynamic price contracts.

As PVPC is based on dynamic pricing, there is no way in which consumers can calculate their savings ex-ante despite being able to calculate them ex-post. In CNMC's last monitoring report it calculated that consumers under a PVPC regime could have saved €31-70 per year had they chosen the best offer in the free market instead.

Dynamic price offers, however, are still not included in the PCT, given the hourly price change. This is the case for both dynamic price offers in the free market and PVPC. However, CNMC is currently working on improving its PCT, so that in the future all offers will be included. Dynamic price offers will be valued taking into account an estimated evolution of market prices.

3.2 Hourly contracts on the Swedish electricity market (SE)

✓		Household customers	2012	Electricity Act (1997:857)

The smart meter roll-out in Sweden was completed in 2009 when a law requiring monthly metering/settlement came into force. Hourly contracts have been available on the Swedish electricity market since late 2012 after a change in the Electricity Act[23] that enabled consumers to opt for hourly metering. However, not all customers have meters that can register and transmit hourly values. From 2025, all meters will measure at least hourly, and be capable of measuring every 15 minutes if requested[24].

[23] Electricity Act (1997:857) 3 kap. 11 §
[24] Per a new law approved by parliament in 2018

According to estimates from 2013[25], approximately 0.2% of household customers had signed an hourly contract in the year following the regulation change. It is still, therefore, a rarely chosen product[26]. At the same time, by the end of 2016 approximately one third of all suppliers[27] offered these contracts to consumers, resulting in a competitive market where consumers can choose between a large number of different suppliers.

In Sweden, suppliers can independently decide on the contracts they offer. Nonetheless, this will change once the CEP is implemented. It will then be mandatory for suppliers with more than 200,000 customers to offer dynamic contracts. In Sweden, this represents six suppliers, all of whom already offer hourly contracts.

Swedish customers are accustomed to variable price contracts. Monthly variable price contracts are the most common contract type[28] that follow the spot market. Their prices change monthly. The price per kWh is based on the average monthly spot price adjusted for consumption profiles. This can be calculated in a number of ways that must be described in the contract.

As for hourly contracts, the customer's electricity price directly follows the hourly day-ahead price[29]. The hourly spot price for the coming day is published[30] at noon each day. Except for the technical maximum and minimum prices set according to the Guideline on capacity allocation and congestion management (CACM GL) for European day-ahead market coupling, there are no additional limits (i.e. neither a floor nor ceiling) for the spot price.

On top of the cost for the consumed energy (for customers on both monthly variable and hourly contracts) is the supplier's mark-up, which is communicated in the price mechanism described in the terms of the contract. In addition, a customer's bill will typically include a yearly fixed fee, taxes, the price for green certificates plus other governmental costs.

[25] Follow-up of the hourly metering reform, Ei R2013:05
[26] Statistics Sweden conduct a monthly survey about what type of contract customers have. Hourly contract falls under the category "Other contracts" which in December 2017 registered 8%. However, a number of popular mixed products (fixed price in winter, monthly variable price in summer) also fall into this category.
[27] 40 out of 120
[28] 47% of all customers in December 2017
[29] Nord Pool spot market that currently is the only NEMO offering trading services in the Day Ahead market in Sweden. In the future, it may be more accurate to refer to the Day Ahead price of the European market coupling.
[30] https://www.nordpoolgroup.com/Market-data1/Dayahead/Area-Prices/ALL1/Hourly/?view=table

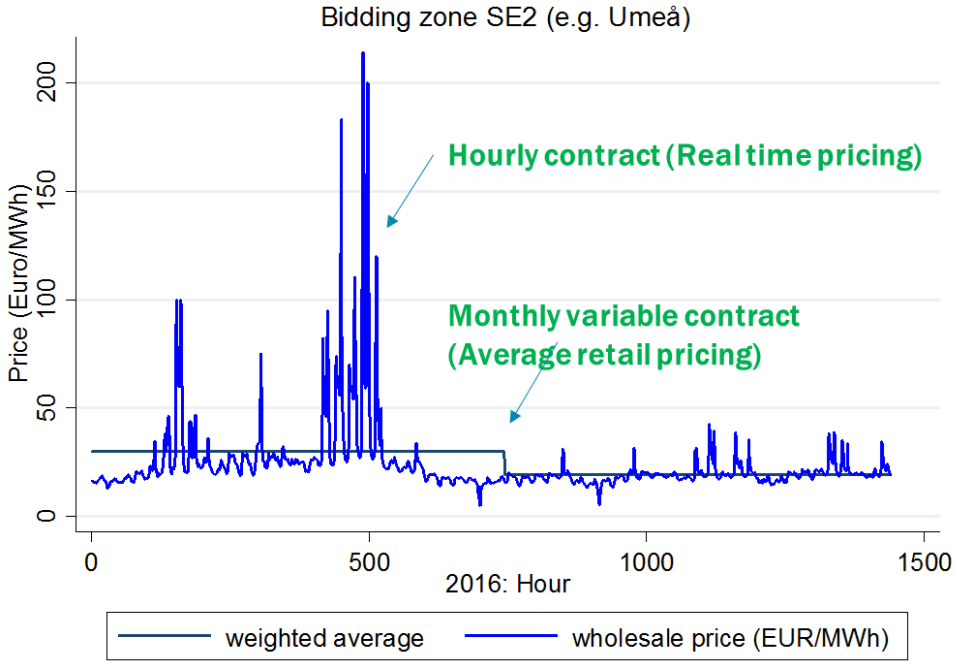


Figure1 - Hourly contract compared to Monthly variable contract in January and February 2016 (EUR/MWh)

Since the price for hourly contracts is directly connected to the hourly price in the spot market, the total risk for the supplier when offering this kind of contract is lower, compared to both monthly variable contracts and differing fixed price contracts. Hence, given the suppliers' lower level of risk the mark-up may sometimes (but not always) be lower for hourly contracts than for other contracts. This means that there is potential for customers on hourly contracts to have a lower annual cost over time compared to customers with the same consumption pattern on other contract types. Nonetheless, if the customer is more active, for instance by moving load from peak hours to non-peak hours (preferably by some form of automation)[31], costs could be reduced even further.

Hourly consumption data is collected by the DSO. For settlement of hourly metered residential customers[32], DSOs can currently choose daily or monthly settlement. In the latter case, standardised consumption profiles are used for the purpose of daily settlement. From 2020 this option will be removed and hourly metered customers will need to be settled daily[33]. Standardised consumption profiles will from then on only be used when the DSO cannot, due to technical problems, read consumption data from the meter.

[31] For example, a device/service offered by an energy service corporation that connects the heat pump to the spot price.
[32] Defined as customers with a maximum fuse of 63 Ampere.
[33] Per a new law approved by parliament in 2018

Contract format is important for price awareness. Monthly variable price contracts dilute the price signal that the end-consumers receive from the wholesale market. Hourly contracts are more transparent and thus incentivise consumers to actively reduce or shift their electricity consumption to hours when the system is less congested). Several reports and research pieces have also concluded that increased flexibility in consumption is also beneficial for the electricity market as a whole (correct price signals stemming from supply and demand, potential capacity improvements on the distribution network, etc.) despite the limited availability of information on the benefits and potential risks with hourly contracts. Suppliers are not currently obliged by legislation to inform customers about the opportunities and risks with hourly contracts, however, according to the Electricity Act, all suppliers offering electricity contracts to consumers are obliged to inform consumers where information about the supplier's prices can be found and how the price is set (the price mechanism in the terms of the contract).

In most cases, customers must contact the supplier or visit the Nord Pool website in order to receive information about hourly prices. Some suppliers offer a service free of charge where the customer can follow its consumption in an app. The customer will hence be better equipped to react on price fluctuations on Nord Pool spot and potentially alter their total electricity cost. Where these services are not available, consumers are advised to conduct their own calculations as there is no official or well-known tool for customers to use to calculate their actual savings.

However, from 2019 onwards, the web-based independent comparison tool run by the NRA[34] includes hourly contracts. This will make it easier for consumers to evaluate the potential monetary savings associated with different electricity contracts. Today, the NRA-run comparison tool shows the most common contract formats in the market. These are monthly variable price contracts and a number of fixed price contracts. For all contracts, an effective unit price is displayed based on the annual consumption the consumer inserts in the tool. The effective unit price for monthly variable products is based on the previous month's prices.

The effective unit price for variable and fixed price contracts is not directly comparable. The NRA advises customers to choose their contract type (variable or fixed price) based on the risk they are prepared to take. A customer on a variable price should be prepared to handle periods of higher prices (usually in winter time) but can also benefit from lower prices (usually in summer time). With a fixed price, the customer knows the price per kWh beforehand, which can be attractive for customers with tight economic budgets or other customers that want to avoid risk. In the past six years, customers on monthly variable contracts have had lower annual costs for their electricity than customers on one or three year fixed price contract.

If it is difficult for a consumer to compare monthly variable contracts with fixed price contracts, it is even more difficult to compare these two contract types with hourly contracts. Here, a large part of the consumer's potential monetary gain is associated with how the electricity is consumed. To get a more realistic cost savings estimate, it is important to control the consumer's consumption profile and their potential for shifting consumption in time. This may be possible once the Swedish data hub is in place in 2021.

With an increased number of prosumers, "smart" heating pumps and electric vehicles, the demand for hourly contracts is likely to rise in the future. This will also make it more interesting for suppliers to offer and market these contracts.

[34] www.elpriskollen.se run by Swedish Energy Markets Inspectorate, Ei

3.3 Dynamic prices in Norway (NO)





✓		Household customers	1998 – present	Avregningsforskriften, secondary legislation

The Norwegian roll-out of smart meters was finalised by 1 January 2019 and provided DSOs and suppliers with hourly consumption data that enabled consumers to react to hourly price changes. Despite hourly metering being unavailable in previous years, dynamic pricing of electricity to customers was already widespread in the Norwegian retail market.

Since the liberalisation of the Norwegian electricity market in 1991, the number of household customers with a spot-based contract has steadily increased. By 2000, 2.4% of household consumers had a spot-based contract.[35] In 2012, this number had increased to 60%, and by 2017 as many as 70% of household customers had a spot-based contract.

This case study explains how suppliers can offer a form of dynamic contract without access to hourly metering data. Since this is not a contract using actual hourly consumption (it is instead profiled), this approach should not be presented as a dynamic price using hourly consumption data.

3.3.1 Market shares – electricity contracts

There are three main categories of electricity contracts offered to customers in the Norwegian market: spot, variable and fixed price. Spot-based contracts follow the day-ahead prices in Norway's five bidding zones at Nord Pool Spot.[36] The price of variable price contracts can be changed with two weeks' notice, while the price in a fixed-price contract cannot be changed during the contract period. The variable price contract has a market share of 25%, while the market share of the fixed price contract is 2%.[37]

[35] Q1 2000: https://www.ssb.no/statbank/table/05103/tableViewLayout1/
[36] Except spot-based contracts based on a monthly average spot price without any use of load profiles.
[37] See footnote 20.

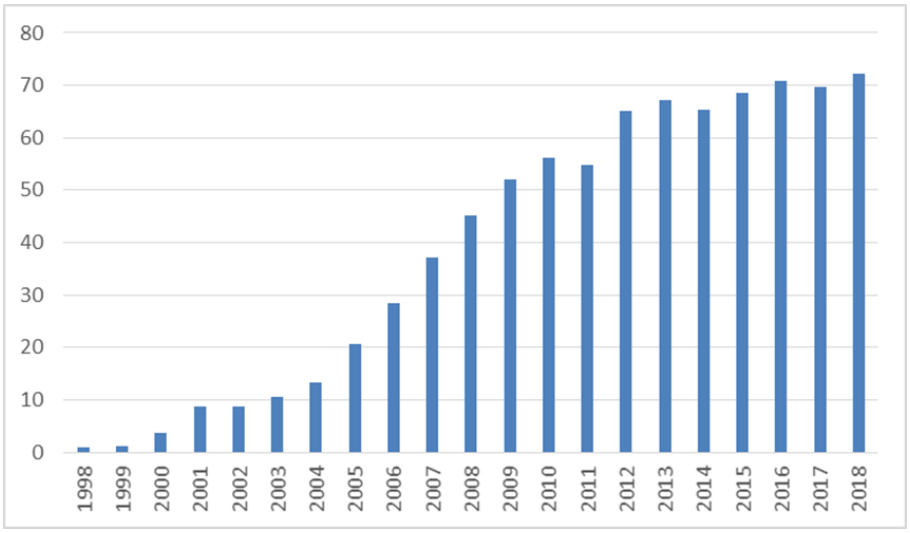


Figure 2 Percentage of electricity volume with a spot-based contract per year 1998 - 2018[38]

3.3.2 The calculation of the "spot price"

The price of a spot-based contract consists of the "spot price" and a predefined mark-up (which includes a RES-charge and can either be a fixed charge or depend on consumption), in addition to VAT. The "spot price" is the hourly wholesale price from the customer's bidding zone on the Nordic physical power exchange (Nord Pool).

Customers on hourly spot-based contracts that have hourly metering are settled by multiplying the spot price with their actual hourly consumption and then adding the mark-up and VAT.

Suppliers without access to their customers' actual hourly consumption have to invoice their customers based on their monthly consumption instead. They therefore have to calculate a monthly spot price. § 22 in the Norwegian secondary legislation on price information for goods and services (FOR-2012-11-14-1066) states that suppliers have to inform their customers about the calculation method.

There are different ways for suppliers to calculate a monthly spot price:

- Suppliers can use the average monthly price calculated by Nord Pool Spot multiplied by the monthly consumption of the customer. [39]
- A weighted average monthly price is calculated by multiplying a load profile with the corresponding hourly prices from Nord Pool Spot. [40] A load profile gives the share of total consumption for every hour.
- The actual hourly consumption is multiplied with the corresponding spot price given by Nord Pool Spot. [41]

[38] No data on the number of households.

[39] $x_m = \frac{\sum_{t=1}^{n_m} x_t}{n_m}$, where x_m is the montly spot price in month m, x_t is the hourly price from NordPool Spot in hour t and n_m is the number of hours in month m.

[40] $x_m = \sum_{t=1}^{n_m}(x_t\, \beta_t)$, where x_m i the monthly spot price in month m, x_t is the hourly price from Nord Pool Spot in hour t, β_t is the load profile for hour t, and n_m is the number of hours in month m.

[41] $x_m = \sum_{t=1}^{n_m}(x_t\, , f_m)$, where x_t is the hourly price from Nord Pool Spot in hour t, f_m is the consumption in hour t and n_m is the number of hours in month m.

All DSOs calculate a standard load profile (SLP) for the customers in their grid area, to be used in the balance settlement. The standard load profile is an hourly average consumption profile for customers without hourly metering. The standard load profile is the distribution of the total non-metered hourly consumption in the grid area as a whole minus the total network losses in the same area. [42]

Suppliers without access to the hourly consumption data of their customers prefer to use a load profile to accurately settle customers. Since the supplier buys electricity hourly on the day-ahead market, and the average customer has higher consumption in peak hours than low peak hours, the average monthly spot price from Nord Pool will generally not cover the supplier's actual electricity expenses. The supplier can either use the standard load profile from the customer's DSO or develop a load profile themselves. The standard load profile of the DSO is based on the general grid status and typography of the area. Suppliers offering contracts in many DSO areas may find it more useful to develop their own custom load profile – this may be a more convenient way to settle their portfolio of customers as opposed to using several different SLPs.[43]

However, a load profile can give an erroneous representation of a specific customer's actual consumption, e.g. it could weight hours with high prices higher than the actual consumption would call for. The complexity in load profiles makes it difficult to calculate and compare the actual prices paid by the consumer on the bill and in the national PCT[44]. The breakdown of prices in the PCT is the spot price plus the mark up. Suppliers therefore have a theoretical opportunity to hide an additional mark up in their customised load profile. This is especially problematic if the supplier does not provide clear and understandable information enabling customers to fully compare the offer with other options.

Furthermore, contracts based on monthly average spot price and contracts based on load profiles are based on the average consumption of a large group of customers so that a single customer cannot change consumption patterns in order to avoid high prices in peak hours.

With access to hourly metering through the new smart meters, all customers will be able to choose an hourly spot-based contract and thereby benefit by shifting their consumption.

3.3.3 Increased benefit of hourly metering

Despite a complicated calculation of the final price in spot-based contracts and thus difficulty in explaining all price elements to customers in the PCT, a spot-based contract without hourly data has a clear advantage over variable and fixed price contracts. The price follows the day ahead market, bringing customers closer to the actual spot price than variable or fixed price contracts, exposing the customers to the price volatility in the market. The risk premium that the supplier will need to calculate into variable and fixed price contracts does not exist in these contracts.

[42] $SLP_h = X_h - \sum_i k_{h,i}^t - N_h, SLP_h$ is the standard load profile for hour h, X_h is the total feed in to the grid hour $h, k_{h,i}^t$ is the consumption in hour h in the hourly metered point i and N_h is the network losses in hour h.

[43] There are 123 DSOs in Norway.

[44] www.strømpris.no developed in close cooperation with the Norwegian Water Resources and Energy Directorate (NVE).

The Norwegian roll-out of smart meters will ensure actual hourly consumption data and the standard load profiles will no longer be needed in the balance settlement. DSOs will therefore no longer develop standard load profiles. The roll-out was completed on 1 January 2019, which means the datahub handling all the data is now in place to give suppliers access to hourly data from all customers. The change sparks the following question: What will happen with customers on a spot-based contract? Do suppliers automatically transfer all customers to an hourly contract or do they stay with a contract that uses the monthly consumption and continue to calculate the price with a load profile as defined in the contract?

In a competitive retail market, there should be no regulation on which offers suppliers have to offer, or how the price is set in an offer. Following this principle, it must be analysed to which extent suppliers may continue, despite access to hourly data, to calculate price based on load profiles in existing contracts.[45] It is important to ensure that all customers are fully informed on how their electricity price is calculated, so they can make an informed choice and switch to better offers if they wish to do so.

There are already several hourly spot-based contracts offered to customers that already have a smart meter installed in the Norwegian retail market, and the NVE expects more offers will be made available as more and more customers have hourly metering. Hourly contracts are easier to compare, more transparent and enable Norwegian customers to change their consumption based on hourly price signals. The regulator expects that hourly contracts will gain popularity as Norwegian customers realise the potential gains from an hourly contract in comparison with a spot-based contract with a load profile.

[45] NVE has not reached a conclusion on this issue.

4 Data exchange and interoperability

The initial European Commission proposal introduced a common European data format. CEER agrees on the importance of retail competition and, where beneficial, of a common EU data format for market players, including suppliers. However, it also welcomes the pragmatic solution adopted in the recast Electricity Directive, which provides for high standards of data interoperability. Indeed, while EU-wide standards may bring long-term benefits, in a transitional period, interoperability is a more cost-effective approach to facilitating retail competition between suppliers from different Member States.

With regards to data management, Article 23 of the recast Electricity Directive provides:

- Rules on the access to data of the final customer by eligible parties
- Not only data access and exchange, but also data protection and data security
- Respect of the General Data Protection Regulation (GDPR) provisions
- Designated competent authorities that shall authorise and certify or, where applicable, supervise the parties which are managing data (compliance officer)
- No additional costs to be charged to final customers for access to their data, or for a request to make their data available (it shall be ensured that any charges imposed by regulated entities that provide data services are reasonable and duly justified)

Meanwhile, Article 24 on "Interoperability requirements and procedures for access to data" requires that:

- Member States shall facilitate the full interoperability of energy services within the EU
- According to Article 68 in the Directive, the NRA shall determine interoperability requirements, non-discriminatory and transparent procedures for accessing the data

This section presents three case studies showing different types of data exchange and interoperability approaches:

- Austria: initiative from the industry; voluntary, but used by all actors; decentralised (only exchange of data); no formal monitoring but the NRA takes part in the process
- Czech Republic: energy market operator in place (business data)
- Denmark: TSO (DataHub), "privacy by design"

4.1 EDA (Energiewirtschaftlicher Datenaustausch, AT)

✓	✓	Market players	2012	Voluntary, decentralised

EDA (*Energiewirtschaftlicher Datenaustausch* – "Energy Economic Data Exchange") enables all market players to exchange data and electronic documents in a common format supported by a common communication protocol. It is part of a joint endeavour by the Association of Austrian Electricity Companies (Österreichs Energie), the Association of Gas- and District Heating Supply Companies (FGW) and the Association of Austrian Electricity Power Plants (VÖEW) to ensure secure and efficient market functioning. Its governance and cost principles are defined in the market rules issued by the NRA.

EDA supports data transmission, distribution and reception regardless of its original format. The standardised data exchange for all participants is a fundamental design characteristic regardless of where the data is stored and with no central data base – not all elements that are usually included in a central data hub are present. Data is generally administered by the market players and only exchanged via the EDA client. However, if one set of data is changed all other participants are informed. Since all the processes are highly standardised and a single communication technology is used, support services and operation in general are kept at a minimum effort level. Implementation is not limited to a certain company size. The relevant benefits of central data exchange are implemented while maintaining the advantages of a lean and decentralised architecture.

Smaller DSOs and suppliers can easily be connected in a cost-efficient way. Third-party intermediaries, such as energy services providers, will be able to use EDA for the exchange of data. Which data is shared with whom will be shown on a web portal hosted by the DSO. The exchange of data with market players other than the DSO or supplier has to be authorised by the customer.

The current communication software is provided by Ponton Consulting (Ponton X/P) and the data exchange protocol is based on ebXML. eBXML-integration, XML-validation, encryption and signature are provided. A Single Internet Access (SIA) enables certification and routing.

Information about the processes, data formats and modalities for standardised data exchange that are used in Austria are published on www.ebutilities.at (in German). The website runs under Chapter 5 of Austria's Electricity Market Code, which enables market player associations to jointly agree upon technical documentation. If all market partners were involved and all deadlines were kept, the documents published on ebUtilities would become binding. There is no formal monitoring, but the NRA takes part in discussions on the processes and signs off the results.

The data exchange that is part of processes which are published on www.ebutilities.at is captured under the name "EDA" (Elektronischer Datenaustausch). Market players must be given at least three options to implement it:

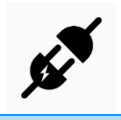
1. **By using their own EDA client**: market players can install an EDA client and execute the entire process in their **in-house IT landscape**. Larger companies with a bigger customer base are most likely to choose this option.

2. **By contracting an external provider:** market players may want to use an **IT service provider** whose services include automated execution of the business processes (e.g. sending replies within the applicable deadlines). If manual execution of the processes is not feasible, this becomes the most efficient solution for medium-to-large market players. Companies do not implement their own EDA client but instead this is taken care of by the service provider.

3. **Manual transmission**: market players, in particular suppliers, can also use the **self-storage option** on www.energylink.at (the platform that hosts different customer related processes) for manual data transmission. Those using this option are likely to be companies with few customers that have few messages to be exchanged. This is because the processes must be executed manually through an online interface. Installation of their own EDA client is not necessary for this option.

The data exchange is generally free of charge for all market players (with the exception of distribution system operators).

4.2 Data exchange and interoperability in the Czech Republic (CZ)

				
		Registered electricity and/or gas market participants	2015	Electricity/Gas Market Rules

With regard to the flow of data between market participants in the Czech Republic, it is necessary to distinguish between streams of technical data (data on the operation of the system, data for the preparation of network operation and management, data on connected entities, etc.) and business data flows (data on traders, consumption points data and transfer points data, data for billing purposes and electricity billing data).

While in the former case the data is focused on the TSO/DSO, the latter is focused on OTE (the Czech electricity and gas market operator). Both systems are interconnected; the technical data is an input for the business data (for the purpose of imbalances' settlement, for example).

The Market Operator (OTE, a.s.), established in accordance with the Energy Act[46] is responsible for business data exchange for both commodities, electricity and gas, in both wholesale and retail markets; which allows many synergies in the procedure, together with a common data format for data exchange being in place.

According to Decree No. 408/2015 Coll., on the Electricity Market Rules, the market operator information system (Sec. 2) is "*a system to which regulated market participants have access and through which communication with a market operator is in progress".* Similar to this, is Decree No. 349/2015 Coll., on Gas Market Rules. The Decrees are issued by the NRA. The NRA approves them and the business terms of market operators.

The Central System of the Market Operator on the Czech market is called CS OTE. The system enables mutual communication and automatic business data exchange between the OTE and registered electricity and/or gas market participants (among these participants, TSOs, DSOs, manufacturers, merchants and balance responsible parties can be found.) and partly, between registered market participants themselves. Customers are an exception here, they are registered with CS OTE through their metering point (identifiable according to European Article Number - EAN). This is an indirect relationship with OTE, which means they do not receive any data from CS OTE.

Only registered market participants[47], who have concluded the respective contract with the Market Operator, have access to CS OTE. Secured access to CS OTE is ensured by using an access certificate (for authenticity) and a signature certificate (for the electronic signing of

[46] Energy Act: No. 458/2000 Sb.: https://www.zakonyprolidi.cz/cs/2000-458)
[47] According to the Energy Act all market participants has to be registered until 2021.

transactions), which allows secure messages to be sent between CS OTE and the Market Operator. This means the content of the messages cannot be changed without notice; cannot be read by an unauthorised person; the identity of both communicating parties is guaranteed; and the sender cannot deny sending and authoring the message.

For customers directly registered on the system relevant information must be provided with the required information free of charge and without undue delay, according to the terms of Article 12 of GDPR. The personal data may be processed by controllers based on agreements on personal data processing, which are concluded in compliance with GDPR requirements.

Discussions on a possible data hub that would merge technical and business data in the future and how it could be structured and used are now underway as part of the National Action Plan for Smart Grids (NAP SG) preparations.

4.3 Data exchange and interoperability in Denmark (DK)

The Danish electricity TSO Energinet is required by law to establish and operate the datahub in Denmark. The datahub is an IT-platform that handles data communication and business processes between market participants in the Danish electricity market. All metered data and necessary information[48] for settlement purposes, including balance and wholesale settlement, are collected in the datahub. Furthermore, the process of things such as address changes and supplier switching are handled in the datahub.

The detailed requirements, rights and obligations of the relevant market participants in terms of the datahub, and thereby also the functionalities of the datahub, are set in regulations issued by Energinet within the framework of the Danish Electricity Supply Act. The Danish Utility Regulator's (DUR) approval of the methods contained in Energinet's datahub regulations is a prerequisite for their commencement and application.

4.3.1 Data collection

There are three types of data collected in the datahub, all of which directly relate to customers:

- Customer-related master data
- Metering point-related master data
- Metered data

Customer-related master data:
The customer-related master data includes all data related to the individual customer and which are required for the correct handling of the customer for the relevant metering point in

[48] E.g. electricity taxes and grid tariffs.

relation to the market. The customer-related master data is inter alia the customer name(s), CPR[49] or CVR[50] number and address. The customer's supplier is responsible for collecting and reporting of all customer-related master data to the datahub, as well as updating the data.

Metering point-related master data:
This type of data relates to the individual metering point and is required for the correct handling of the customer for the relevant metering point in relation to the market. Metering point-related master data includes the address of the metering point, meter reading characteristic, meter reading frequency, settlement type and metering point ID.[51] The distribution system operator (DSO) is responsible for collecting and reporting metering point-related master data to the datahub, as well as updating the data.[52]

Metered data:
The DSO collects and sends metered data per metering point on (for example) the customer's consumption to the datahub. DSOs are by law obliged to install smart meters in the homes, premises etc. of customers in Denmark no later than the end of 2020. The legal requirements of smart meter functionalities are, inter alia registration of metered data every 15 minutes.

Collection of personal data by supplier and DSO:
Overall, customer-related master data, metering point-related master data and metered data constitute personal data under the GDPR.[53] The supplier's and DSO's collection of personal data entails that they have a duty of disclosure to the customer pursuant to GDPR.[54] Furthermore, the customer has a right of rectification and erasure of personal data in accordance with GDPR.[55]

4.3.2 Routing metered data among market actors

In terms of routing metered data among market actors, Energinet is responsible for:

- Receiving metered data per metering point from the DSOs. This applies to both settlement metering and other metered data which are not necessarily included in the balance settlement, but may be included in the wholesale settlement between the grid operator and balance supplier.
- Sending metered data electronically[56] to the suppliers, balance responsible parties (BRPs) DSOs and other legitimate recipients.
- Making all metered data available on the DataHub market portal for all legitimate recipients.
- Guaranteeing confidentiality and discretion in respect of the data.

[49] CPR no. is the civil registration number in Denmark.
[50] CVR no. is the company registration number in Denmark.
[51] Also known as Global Service Relation Number (GSRN)
[52] The supplier and Energinet are separately responsible for only a few of the metering point-related master data.
[53] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons 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)
[54] GDPR article 13 and 14.
[55] GDPR article 16 and 17.
[56] Via Electronic Data Interchange (EDI), i.e. structured electronic transfer of data.

4.3.3 Privacy

From its inception, the datahub was designed according to the *"privacy by design"* principle. Privacy is ensured by Energinet being responsible for establishing and operating the datahub in accordance with applicable legislation, including the GDPR. Energinet is obliged to take necessary and sufficient technical (including IT) and organisational security measures to prevent unauthorised access to data in the datahub.

By signing Energinet's *"Terms of access and use of the DataHub,"* market participants guarantee they will be compliant with the applicable legislation e.g. the Danish Act on Processing of Personal Data and the GDPR. Market participants also warrant that the necessary and sufficient technical (including IT) and organisational security measures are taken to prevent accidental or unlawful loss, as well as deterioration or unauthorised access to data.

Personal data in a form which reveals identification of data subjects must not be stored in the datahub for longer than is necessary for the purposes for which the personal data is processed.[57] Customers can access their data (i.e. customer-related master data, metering point-related master data and metered data) in the datahub free of charge using either the NemID[58] log-in function on the supplier's website or on the public website Eloverblik.dk, operated by Energinet. The data can then be downloaded from *Eloverblik.dk* in an Excel file.

When a customer enters into a supply contract, the supplier obtains access to the customer's data in the datahub, i.e. only the data relevant to the supplier. A supplier with whom the customer does not have a contractual relationship with (i.e. a potential supplier) or a third party[59] can be authorised to have access to the customer's data. The authorisation is part of the customer-controlled access to data in the datahub, whereby a customer can give data authorisation by using the NemID function on the website *Eloverblik.dk*. The customer can withdraw this authorisation at any time.

[57] GDPR article 5 (1) (e).
[58] NemID is the common secure log-in solution in Denmark.
[59] According to Energinet's DataHub regulations, a third party is defined as natural and legal persons operating in the electricity market on behalf of market participants or customers, who are not market participants or customers themselves. E.g. meter data responsibles, brokers and energy consultants.

5 Conclusions

On 14 June 2019, the Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast Electricity Directive) was published in the Official Journal of the European Union. The recast Electricity Directive addresses, among other things, the use of technology for new processes and business models and their benefit to consumers. After two years of legislative negotiations, most articles of the recast Electricity Directive will need to be transposed into national legislation by 31 December 2020, having entered into force 4 July 2019.

Recognising that the implementation of the CEP at a national level will be one of the main priorities for National Regulatory Authorities (NRAs) in the coming years, CEER has gathered a number of national experiences across the EU on various customer-related elements of the recast Electricity Directive and has drafted them into a series of case study reports.

The objective of this CEER Report was to share practical experiences regarding the implementation of technologies addressed in the recast Electricity Directive. The report presented eight case studies from seven MS covering the following three topics:

- Lessons learnt relating to on demand smart meter roll-outs (Articles 19-21; Annex II);
- Dynamic price contracts (Article 11);
- Data exchange and interoperability (Articles 23 and 24).

These case studies illustrated regulatory and national actions that go beyond the current obligations in the Third Energy Package and provide insights into the three topics without giving guidance on implementation.

5.1 Lessons learnt relating to on demand smart meter roll-outs

The recast Electricity Directive reinforces and clarifies the provisions regarding the roll-out of electricity smart meters in the EU. CEER has collected two case studies to illustrate the lessons learnt regarding the implementation of a system for smart meter installations on a customer request basis. While there are no examples of a true framework for smart meters “on request” existing in any MS, both Ireland and Norway have prior experience of such demand-led roll-out. The Irish case study describes a universal smart meter roll-out, with a demand-led component in phase one, during which customers have the right to demand a smart meter and thereby be prioritised in the roll-out. The Norwegian case study summarises the collective benefits of a global roll-out and points out that these benefits would not be realised otherwise (i.e. if the roll-out was not universal). The cost of two parallel systems for data collection is addressed in the Norwegian case study and gives an idea of the costs when customers demand a smart meter.

5.1.1 Demand-led component to the first phase of the full smart meter roll-out in Ireland

- The upgrade of electricity smart meters is to be completed by 2024 and is network-led as opposed to being supplier-led.
- The cost of the upgrade is to be socialised across all electricity customers. Larger customers are not part of the upgrade programme as their meters can already be read remotely .

- Key functionalities include: the daily collection of data with a half hourly granularity; the provision of consumption data to third parties upon customer request; seamless switching between credit and prepayment modes; and consumer access to real time consumption data over a home area network.
- All suppliers must offer a standard smart tariff; these tariffs are 'non-dynamic' tariffs in the sense that they have different defined unit rates for the three time periods (day, night and peak).
- The roll-out is divided into phases based on recommendations informed by a cost benefit analysis (CBA). Phase one is a demand-led roll-out where customers are able to request a smart meter.

5.1.2 The costs of having two parallel metering systems in Norway

- Advantages of the first experience of the Norwegian smart meter roll-out and the use of smart meters that includes a large share of customer base include:
  - Increased DSO efficiency that is dependent on smart meters being rolled out to a large enough share of the metering points. This increased efficiency benefits consumers through lower grid tariffs, as well as increased security and quality of supply.
  - Increased offers of smart meter services due to a bigger market.
  - Parallel metering systems may increase total metering costs substantially compared to a unique single system.
- It is important to note the above advantages occur at a collective level and are unlikely to incentivise an individual to request a smart meter for individual use.

5.2 Dynamic price contracts

Three case studies are presented in this report that describe the introduction of dynamic price contracts in Spain, Sweden and Norway. In Spain, close to 12 million customers benefit from this type of contract in order to better manage their bills. However, in Sweden, customers have been able to choose dynamic contracts since 2012. Nevertheless, few customers have done so. The Swedish NRA hopes that the number of customers will rise once these contracts become introduced in the NRA's comparison tool. Meanwhile, many customers in Norway have so-called spot-based contracts. The Norwegian case study described how this has still been possible without smart meters given they are only now being introduced there.

5.2.1 Voluntary prices for household consumers in Spain

- The Spanish case study analyses the main characteristics of the default electricity tariff that is based on dynamic pricing.
- The default tariff is applied to the electricity bill of consumers whose contracted power does not exceed 10 kW and who do not have a free market supply contract.
- In August 2018, 11.1 million customers had this contract, which equated to 42% of all electricity customers with contracted power equal to or below 10 kW.
- Those customers have access to information regarding hourly pricing schedules allowing them to adjust their consumption and manage their bills, assuming they adapt their electricity consumption to the time slots during the day when electricity is cheaper.
- As the "Precio Voluntario para el Pequeño Consumidor" (PVPC) regime is based on dynamic pricing, there is no way in which consumers can calculate their savings ex-ante, however, they can calculate them ex-post.

- The Spanish NRA has calculated that consumers under a PVPC regime could have saved €31-70 per year had they selected the best offer in the free market instead.

5.2.2 Swedish dynamic price contracts

- Hourly contracts have been available on the Swedish electricity market since late 2012, following a change in the Electricity Act that enabled consumers to opt for hourly metering.
- Today, not all customers have meters that register and transmit hourly values (most only provide monthly values). However, from 2025 all meters will measure consumption hourly as a minimum, and will be capable of measuring at 15 minute intervals if requested.
- The CEP requires that all suppliers with more than 200,000 customers offer dynamic contracts. In practice, this does not change anything in Sweden since all six suppliers with more than 200,000 customers already offer this type of contract.
- According to estimates, only 0.2% of household customers currently have hourly contracts.
- By the end of 2016, approximately one third of all ~120 suppliers offered these hourly contracts to consumers, resulting in a competitive market where consumers can choose between a large number of different suppliers.
- With an hourly contract, the customers' electricity price directly follows the hourly day-ahead prices at the Nord Pool spot market. Around noon each day, the hourly spot price for the coming day is published on the Nord Pool website. Except for the technical maximum and minimum prices set according to the Guideline on capacity allocation and congestion management (CACM GL) for European day-ahead market coupling, there are no additional limits (i.e. neither a floor nor ceiling) for the spot price.
- Suppliers are not obliged by legislation to inform customers about the opportunities and risks associated with hourly contracts. However, according to the Electricity Act, all suppliers offering electricity contracts are obliged to inform consumers where information about the supplier's prices can be found and how the price is set (i.e. the price mechanism in the contract terms).

5.2.3 Norwegian dynamic price contracts

- Although hourly (smart) meters have been available for the vast majority of Norwegian customers until 2019, dynamic pricing of electricity is widespread in the Norwegian retail market.
- Since the liberalisation of the Norwegian electricity market in 1991, the number of household customers with a spot-based contract has steadily increased. By 2000, 2.4% of household consumers had a spot-based contract. In 2012, this number had increased to 60%, and by 2017 it stood at 70%.
- Spot-based contracts follow the day-ahead prices in Norway's five bidding zones at Nord Pool Spot.
- Suppliers without access to their customers' actual hourly consumption have to invoice their customers based on their monthly consumption instead, and in doing so calculate a monthly spot price.
- There are different ways for suppliers to calculate a monthly spot price:
  1. Suppliers can use the average monthly price, calculated by Nord Pool Spot, multiplied by the monthly consumption of the customer.

2. A weighted average monthly price is calculated by multiplying the load profile with the corresponding hourly prices from Nord Pool Spot (A load profile gives the share of total consumption for every hour of the period in question).
3. The actual hourly consumption is multiplied with the corresponding spot price given by Nord Pool Spot.

- However, the new smart meters that were rolled out by early 2019, which allow customers to access hourly metering and to choose an hourly spot-based contract, enable customers to benefit by shifting their consumption away from high prices in peak hours.

5.3 Data exchange and interoperability

These three case studies illustrate different types of data management approaches in different MS. The Austrian case study describes the process of running a joint endeavour run by the Austrian electricity industry association; the Czech Republic has a central system run by a separate market operator; whilst in Denmark the TSO is in charge of operating the DataHub. All listed case studies are in line with the goals of the recast Electricity Directive.

5.3.1 Data exchange and interoperability in Austria

- The system (EDA) enables all market players to exchange data and electronic documents in a common format supported by a common communication protocol. The system is a joint endeavour by the Austrian electricity industry association.
- The EDA system supports data transmission, distribution and reception, but is not a central data hub.
- Smaller DSOs and suppliers can also be connected easily and cost-efficiently.
- There is no formal monitoring in place, however, the NRA takes part in discussions on the processes and will sign off the results.

5.3.2 Data exchange and interoperability in the Czech Republic

- The stream of technical data is focused on the TSO, whilst business data flows are focused on the market operator (OTE). The systems are interconnected (the technical data is an input for business data).
- The central system of the market operator (CS OTE) enables data exchange between the market operator and the registered market participants.
- Discussions on a possible data hub that would merge technical and business data in the future and how it could be structured and used are now underway within the NAP SG (National Action Plan for Smart Grids) preparations.

5.3.3 Data exchange and interoperability in Denmark

- The Danish TSO is by law required to establish and operate the DataHub.
- The DataHub platform handles data communication and business processes between market participants and the electricity market.
- There are three types of data collected in the DataHub:
    - Customer-related master data
    - Metering point-related master data
    - Metered data

From the beginning, the DataHub has been designed according to the “privacy by design” principle.

Regarding the next steps in regard to CEP implementation on customer/retail issues, CEER has begun working on the following deliverable in 2019: "**Recommendations on Dynamic Price Implementation**". This CEER paper will investigate potential implementation barriers, outline good practices and make recommendations on regulation. It may also make recommendations on how individual NRAs could monitor the effect of dynamic prices in the market on consumer benefits, in line with the provisions in the recast Electricity Directive.

Annex 1 – List of abbreviations

Term	Definition
BRP	balance responsible party
CBA	Cost benefit analysis
CEER	Council of European Energy Regulators
CEP	Clean Energy for All Europeans package
CNMC	Comisión Nacional de los Mercados y la Competencia / National Commission for Energy and Prices (NRA Spain)
CPR, CVR	Civil registration number, company registration number (in Denmark)
CRU	Commission for Regulation of Utilities (NRA Ireland)
DSO	Distribution system operator
DUR	Forsyningstilsynet / Danish Utility Regulator (NRA Denmark)
E-Control	Energie-Control Austria (NRA Austria)
Ei	Energimarknadsinpektionen / Energy Markets Inspectorate (NRA Sweden)
ERÚ	Energetický regulační úřad / Energy Regulatory Office (NRA Czech Republic)
GDPR	General Data Protection Regulation
GGP	Guidelines of Good Practice
NRA	National regulatory authority
NVE	Norges vassdrags- og energidirektorat / Norwegian Water Resources and Energy Directorate (NRA Norway)
OTE	Market operator (in the Czech Republic)
PCT	Price comparison tool
PVPC	Voluntary Price for small consumers (in Spain)
SLP	Standard load profile
TSO	Transmission system operator
TUR	Regulated Tariff for small consumers (in Spain)

About CEER

The Council of European Energy Regulators (CEER) is the voice of Europe's national energy regulators. CEER's members and observers comprise 39 national energy regulatory authorities (NRAs) from across Europe.

CEER is legally established as a not-for-profit association under Belgian law, with a Secretariat based in Brussels to assist the organisation.

CEER supports its NRA members/observers in their responsibilities, sharing experience and developing regulatory capacity and best practices. It does so by facilitating expert working group meetings, hosting workshops and events, supporting the development and publication of regulatory papers, and through an in-house Training Academy. Through CEER, European NRAs cooperate and develop common position papers, advice and forward-thinking recommendations to improve the electricity and gas markets for the benefit of consumers and businesses.

In terms of policy, CEER actively promotes an investment friendly, harmonised regulatory environment and the consistent application of existing EU legislation. A key objective of CEER is to facilitate the creation of a single, competitive, efficient and sustainable Internal Energy Market in Europe that works in the consumer interest.

Specifically, CEER deals with a range of energy regulatory issues including wholesale and retail markets; consumer issues; distribution networks; smart grids; flexibility; sustainability; and international cooperation.

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More information at www.ceer.eu.