ANNUAL REPORT 2016

entsoe

43
electricity transmission system operators (TSOs)

36
countries across Europe

Over **500**
million citizens served

Contents

2016 IN NUMBERS

5 *major conferences*

Including for the first time, **3** *regional conferences*

Over **1,600** *attendees, all events combined*

20 *public consultations*

Over **20** *new publications*

Over **14 million** *visits to entsoe.eu*


Over 7,500
social followers
A EUROPEAN NETWORK

ABOUT ENTSO-E

ENTSO-E, the European Network of Transmission System Operators, **represents 43 electricity transmission system operators** (TSOs) (42 members* and one observer member) from 36 countries across Europe. ENTSO-E was established and given **legal mandates** by the EU's Third Legislative Package for the Internal Energy Market in 2009, which aims at further liberalising the gas and electricity markets in the EU. In addition to its legal mandates, ENTSO-E is Europe at work and aims to ensure efficient cooperation of its members, supportive of the overall vision of a reliable, sustainable, and competitive European power market.

The role of TSOs has considerably evolved with the Third Energy Package, the energy transition, and the 20-20-20 targets. The TSOs are neutral facilitators in a liberalised energy market, as networks become the interface of various players.

OUR OBJECTIVES

ENTSO-E members share a common vision of a reliable, sustainable, and competitive European power market. One of the important issues on today's agenda is the integration of a high degree of renewables in Europe's energy system and the development of flexibility with a much more customer-centric approach than in the past. These issues naturally lead to a much closer interaction with distribution system operators (DSOs) because a large part of the decentralised generation reaches the system through the distribution grid.

ENTSO-E is committed to developing the most suitable responses to the challenge of a changing power system while maintaining the security of supply. Security of the supply, innovation, a market-based approach, customer focus, stakeholder focus, flexibility and regional cooperation are key to ENTSO-E's agenda.

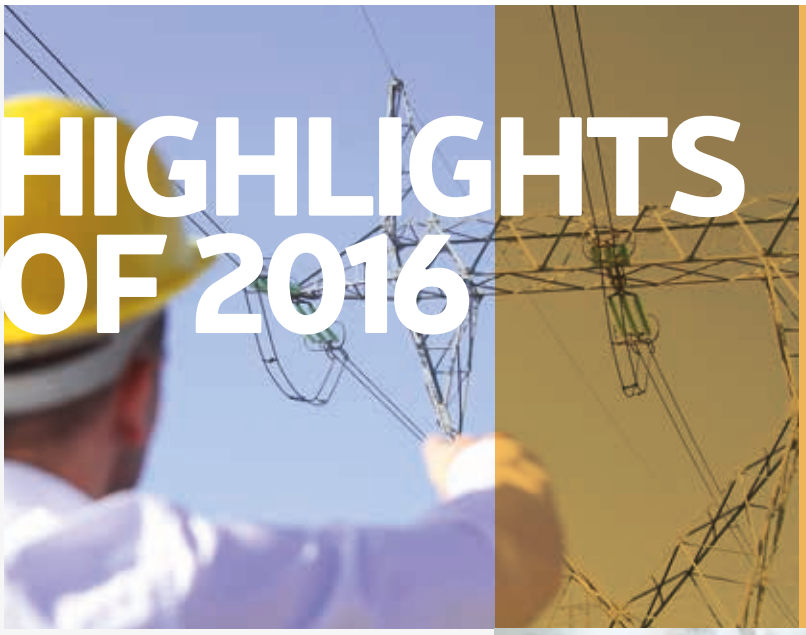
ENTSO-E contributes to the achievement of these objectives through:

- drafting network codes – the rules of the game of the internal energy market and their implementation in close interaction with the Agency for the Cooperation of Energy Regulators (ACER), the European Commission, and all stakeholders;
- developing pan-European 10-year network development plans (TYNDPs), on which the list of projects of common interest is based;
- developing policy proposals based on the European system viewpoint;
- strengthening and focusing regional cooperation in markets, planning, and operation, most recently through the Regional Security Coordinators (RSC);
- ensuring technical cooperation between TSOs;
- publishing Summer and Winter Outlook reports for short-term system adequacy, along with annual Scenario Outlook & Adequacy Forecast reports, providing a pan-EU overview on longer term system adequacy;
- coordinating research and development (R&D) plans, innovation activities, and the participation in research programmes such as Horizon 2020;
- providing events, studies, and training.

Through these deliverables, ENTSO-E is helping to get the world's largest integrated electricity market from promise to practice.

ENTSO-E is aware that such important tasks require a strong interaction with European institutions as well as market participants and stakeholders. Transparency is therefore a key principle for ENTSO-E and requires constant listening, learning, and improvement in the interests of society.

** OST (Albania) joined ENTSO-E in March 2017.*



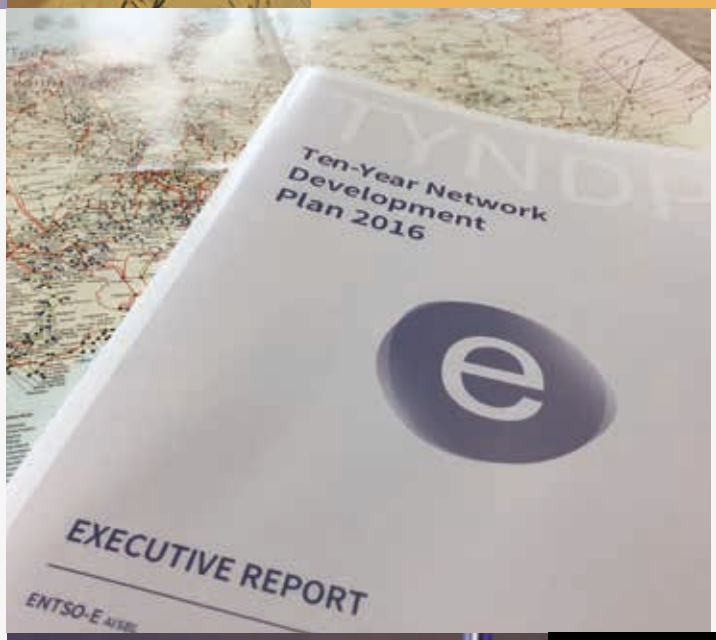
HIGHLIGHTS OF 2016

THE YEAR 2016 WAS THE START OF THE NETWORK CODE IMPLEMENTATION

The year 2016 was the start of the network code implementation with all network codes and guidelines now adopted. Putting the codes into practice is now the priority of ENTSO-E and will remain so for the years to come.

ENTSO-E RELEASED ITS TYNDP 2016

ENTSO-E released its 10-year network development plan (TYNDP) 2016, foreseeing up to 150 billion euros of investments in grid infrastructure and 200 projects in transmission and storage.



ENTSO-E BIDS GOODBYE TO KONSTANTIN STASCHUS AND WELCOMES LAURENT SCHMITT AS NEW SECRETARY-GENERAL

Finally, 2016 was the last year in office of ENTSO-E's Secretary-General Konstantin Staschus, who founded ENTSO-E eight years ago, with our dedicated members and staff.

2016: A YEAR OF REGIONAL COOPERATION

Our three regional conferences provided the opportunity for diving deep into regional concerns and increasing regional engagement. Also during the year, all ENTSO-E members signed up to RSCs, and new RSCs opened in the Nordic and Baltic regions as well as in South-East Europe.

CLEAN ENERGY FOR ALL EUROPEANS

In 2016, the European Commission published its 'Clean Energy for all Europeans' package, addressing the policy framework for the next decade. ENTSO-E will work with EU institutions and stakeholders to further improve the package to the benefit of all Europeans.

EXECUTIVE SUMMARY – A YEAR OF TRANSITION

Our President, Chair of the Board and Secretary-General take you through the main developments of 2016.

Peder Andreasen
PRESIDENT
Energinet.dk, Denmark

> *With all network codes approved by EU member states, ENTSO-E with the entire electricity community is turning its attention to their implementation.*

Peder Andreasen: The year 2016 was a year of transition. First, there was transition from the development of the network codes to their implementation. Five codes have become binding EU law, while three more are awaiting their entry into force. The development phase is over, and the focus is now on implementation.

Making the codes reality will be central to ENTSO-E's work for the years to come. Far from being alone in the implementation tasks allocated to us, we rely on our collaboration with ACER and all national regulatory authorities (NRAs), with EU member states, and with all involved stakeholders.

Bente Hagem: Indeed, none of our legally mandated deliverables would have existed if it were not for constant engagement with EU institutions and power market participants. ENTSO-E's legal mandates come with great responsibilities. We must ensure that all parties affected by our deliverables – be it the TYNDPs, the network codes, or others – are involved and their opinion is considered throughout the whole process.

Moreover, 2016 saw ENTSO-E taking one step further in opening to stakeholders with the creation of our independent Advisory Council. The first two meetings saw lively discussions on ENTSO-E's work programme and output, and I am confident that the council will trigger a new dynamic of transparency in the coming years.

Laurent Schmitt: In addition, 2016 saw the publication of the 'Clean Energy for all Europeans' package of proposals by the European Commission. There could not be a more exciting time for me to join ENTSO-E, as Europe takes the leading role in placing customers at the heart of the power system. Ahead of us are ground-breaking changes. It is up to us to facilitate the radical transformation in the way that electricity is consumed and produced – from the development of digital grids to connecting record-high levels of renewables to the system.

ENTSO-E's joint work with distribution system operators (DSOs) on data management and active power management is one small step towards that digital revolution. There will be more in years to come, and ENTSO-E will help by identifying how to best build the adequate IT infrastructure, starting with the publication of an IT roadmap in 2017.

Peder Andreasen: The TSOs' R&D and innovation efforts will be instrumental in transforming the power system. ENTSO-E's new research & innovation roadmap, covering the period 2017 to 2026, looks ahead at the areas where innovation is needed to bring about the EU's climate objectives and deploy smart grids. Our R&D monitoring exercise found steady progress in the completion of R&D objectives.

Also released in the past year, our 10-year network development plan 2016 ensures the grid infrastructure is fit to achieve Europe's climate objectives by 2030, foreseeing up to 150 billion euros of investments in grid infrastructure supporting 200 projects in transmission and storage.

Bente Hagem
CHAIR OF THE BOARD
Statnett SF, Norway

The TSOs are adapting fast and developing regional cooperation to ensure customers see the benefits in security of supply, market and renewables integration.

Bente Hagem: Action at regional level is key to security of supply, renewable integration and more efficient markets. In 2016 ENTSO-E went to Vilnius, Bratislava and Thessaloniki, to meet local stakeholders and discuss local issues in three regional conferences. These were a success and we'll organise similar events in 2017.

Regional security coordinators are another example of action at regional level. Initially an initiative of TSOs who wanted to coordinate their task of maintaining the operational security of the electricity system, they have now become mandatory and will cover the whole of Europe by end of 2017.

Laurent Schmitt: RSCs are indeed a major step towards increased system security. ENTSO-E also innovates in that area, with the publication in 2016 of the first pan-European probabilistic assessment of adequacy, the midterm adequacy forecast (MAF) 2016, looking at risks to the security of the supply and the need for flexibility over the coming decade.

We will continue innovating in 2017 and the following years to support the transition towards a cleaner, safer, digital energy system. I would like to thank the stakeholders and TSOs for their essential input and support and look forward to our continued collaboration.

Laurent Schmitt
SECRETARY-GENERAL

We are at the beginning of the digital transformation. Europe is very advanced in the amount of renewables already connected to the system and has more experience than any other region in the world when it comes to managing variable flows of electricity using digital technology.


ENTSO-E IN FIGURES
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↑ *Konstantin Staschus and the ENTSO-E secretariat staff.*

PROUDLY LOOKING BACK AND FORWARD

by Dr. Konstantin Staschus,
SECRETARY-GENERAL OF ENTSO-E
FROM ITS FOUNDATION TO JANUARY 2017

Hardly anyone in Brussels or those working in electricity in any European country knew of ENTSO-E in 2009. The European Commission, Council and Parliament had defined us in the 3rd Internal Energy Market Package, and the TSOs' top managers had agonized over the merger of ETSO, UCTE, Nordel and other regional voluntary associations into ENTSO-E.

However, not one of them knew how long ENTSO-E would live, whether we would fulfil our legal mandates, whether we would always argue for TSO bottom line interests or for the public good, or how many different work products, working groups, projects and employees we would have. Now we know and many in Brussels and in the electricity industry know, and so we can be proud of the answers.

ENTSO-E is alive and well, every legal mandate has been fulfilled on time and with high and ever-improving quality, and the public good guides our decisions, yet we nonetheless speak up when key TSO interests are endangered. The 100 or so work products every year continue to get the necessary input and support from 2000+ experts from all TSOs because they help us all keep the lights on and the energy transition affordable. Failure was not an option, you might say, and that made my job easy. Well... easier than it might be otherwise, just as the TSOs' work products in terms of network plans and codes, R&D, transparency, operational coordination, and market coupling make the energy transition more affordable than it could have been. The energy transition is not cheap, and being the ENTSO-E Secretary-General is not an easy job, but the importance of the former going well is such a huge motivator for me and the ENTSO-E staff and members that we happily invest the hard work.

But eight years away from home seemed enough; the expat life is exciting, though for us, not sustainable into retirement, and I hope to support the energy transition from Berlin with a focus on European, and even global, energy R&D and innovation.

Please give your support to my successor, Laurent Schmitt, who is especially well-prepared for the smart grid and empowered customer developments, which are one of the key drivers of change in energy today.

Please keep the system view on the energy transition, and please keep building trust and a more perfect market design with an investable price of CO2. Finally, please keep being guided by the knowledge that the energy transition cannot succeed with lights on and affordability in each nation alone, but only in Europe together, just like freedom, democracy, and honest business all need a united Europe.

ENTSO-E IN CONTEXT

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↑ *European Commission Vice-President for the Energy Union Maroš Šefčovič, ITRE Committee Chair Jerzy Buzek and ENTSO-E President Peder Andreasen.*

ENTSO-E does not work in isolation but strives to co-create and to be a 'learning' organisation; each of our work products benefits from the input and ideas of market participants, regulators, European institutions, and other stakeholders.

Be it the 10-year network development plans (TYNDPs), network codes or research and development (R&D) work, they all build on stakeholders' expertise. Important input is regularly provided, in particular by SolarPower Europe, Wind Europe, the SEDC, distribution system operators (DSOs) (with associations CEDEC, EDSO for Smart Grids, and GEODE), generators (EURELECTRIC), traders (EFET), and consumers (IFIEC and BEUC), to name only a few, as well as the European Commission and ACER.

Twenty public consultations, five major conferences, and 20 smaller events, workshops, and webinars were organised in 2016, along with many bilateral meetings. Our annual conference organised in December 2016 gathered close to 400 attendees, representing a wide range of market participants, stakeholders, and policymakers.

Additionally, and for the first time, ENTSO-E organised a series of three regional conferences, addressing specific issues of the Baltic region (Vilnius, 1 June), Central-East Europe (Bratislava, 23 September) and South-East Europe (Thessaloniki, 3 November).

IMPROVED INTERACTIONS WITH STAKEHOLDERS

As a progressive organisation, we are eager to learn and improve, and stakeholder feedback on the development of our products is essential. Our annual stakeholder satisfaction survey of early 2016 gathered comments on ENTSO-E's mandated deliverables, corporate identity, external communication, and outreach from 46 stakeholders representing various institutions, industry associations, and civil society. The results revealed an overall improvement of 5% in the satisfaction of stakeholders with ENTSO-E's work compared to 2014. In particular, ENTSO-E is perceived as increasingly available and open-minded and as serving the public interest more than in the past and showing more leadership in implementing EU energy policy decisions. In addition, ENTSO-E is perceived as being more transparent (increase of nearly 5%), better at communication (increase of 5%), and as improving its follow-up on actions and changes.

However, we recognise that further improvements are needed and are pursuing our efforts in 2017 in response to stakeholders' expectations and suggestions. One of the actions taken towards more transparency is the creation of an independent Advisory Council.

↑ *ENTSO-E's 2016 Annual Conference gathered about 400 participants from the whole electricity sector.*

LAUNCH OF ENTSO-E'S INDEPENDENT ADVISORY COUNCIL

ENTSO-E has set up, on its own initiative, an Advisory Council that will deliver its views to ENTSO E's Board and Assembly on ENTSO-E's work programme and achievements, and will give opinions on whether our key products actually contribute to the energy transition and the innovation push linked to it. It is composed of nine members representing DSOs, electricity generators, consumers, traders, wind and solar renewable energy producers, non-governmental organisations (NGOs), and the European Commission (with observer status). Its findings and recommendations will be made public. It met twice already, in September 2016 and February 2017.

THE ADVISORY COUNCIL PROVIDES US WITH STRATEGIC, FORWARD-LOOKING AND HOLISTIC ADVICE ON OUR WORK AND ON KEY POWER SYSTEM ISSUES IN EUROPE. HAVING A FORMAL CHANNEL OF EXCHANGE AT A VERY HIGH LEVEL WITH OUR PARTNERS IS A REAL PLUS.

COOPERATION WITH EU INSTITUTIONS, ACER, AND EU MEMBER STATES

Because it has been tasked with several legal mandates, ENTSO-E collaborates closely with the European Commission and with the ACER. Legal mandates include the preparation of the TYNDPs, the development and implementation of the network codes, and the delivery of adequacy forecasts, to name but a few. Furthermore, ACER oversees all these deliverables, which are further shaped with the input of EU member states and of the European Parliament.

The year 2016 was the European Commission's 'year of delivery' of the Energy Union. The Commission delivered its most substantial proposals in years with the release of its Clean Energy for All Europeans package. The increasing role of TSOs and ENTSO-E is recognised here (e.g., with the European-wide system adequacy assessment). Exchange with the European Parliament played a key role for ENTSO E, as the institution is central in deciding on the regulatory framework for the next decade. Upfront to the release of the package at the end of 2016, manifold discussions and debates have taken place with the European Parliament, including a meeting between ENTSO-E's president and MEPs in Strasbourg in February or at the European Parliament's ITRE Committee in June for a public hearing on energy market design.

Additionally, as the single voice of Europe's TSOs, ENTSO-E continued being consulted actively by the European Commission, the European Parliament, and the Presidency of the Council on current work related to network codes, transmission planning, and system adequacy. ENTSO-E's three regional conferences and annual conference in December were respectively organised under the auspices of the Dutch and Slovak Presidencies of the Council of the EU.

↑ *ENTSO-E President Peder Andreasen speaking to MEPs at a dinner organised by the European Energy Forum, European Parliament, Strasbourg.*

↑ *RGI's Good practice of the year award recognises exceptional practices in grid development.*

RENEWABLES GRID INITIATIVE

ENTSO-E and the Renewables Grid Initiative (RGI) signed a memorandum of understanding in May 2016. The RGI brings together NGOs and TSOs from across Europe to promote transparent, environmentally sensitive grid development to enable the further steady growth of renewable energy and the energy transition. ENTSO-E and the RGI are committed to exploring joint activities in the fields of best practice exchange and promotion, regulatory and political aspects of grid infrastructure, and its development, the TYNDP process, and the projects of common interest (PCI) selection process. The RGI contributed to ENTSO-E's annual conference, and other joint projects are ongoing.

COOPERATION WITH ENTSOG

Although gas and electricity are very different commodities, and the energy transition affects the gas and electricity systems in different ways, both are network bound, and it is not by chance that 2009 saw the creation of both ENTSOG and ENTSO-E. Both organisations share similar challenges on their mandates, roles, and institutional issues. Moreover, one should not forget that one-sixth of the electricity in Europe is generated from gas (the figure is much higher in some member states) and that innovative technologies, such as power to gas, even suggest a 'network of networks' type of interaction in the future, at least as one scenario.

ENTSO-E and ENTSOG are working closely together. They cooperate on joint work on outlook reports, adequacy assessments, and TYNDPs and on interlinked electricity and gas market and network models. These insights were particularly relevant when the European Commission released proposals on the security of the gas supply in early 2016. Moreover, representatives from both ENTSOs meet regularly across different business areas to exchange best practices, for instance, on network code development and implementation.

CUSTOMERS AT THE CENTRE

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In the last decade, the European power system has gone through important changes resulting from successful European energy, climate, and environmental policies as well as digitalisation and technological progress. The role of consumers in electricity markets is growing, as they take on the role of producer-consumer ('prosumer') and as they engage in demand response. This, along with developments such as the increasing amount of renewable energy sources, calls for a revision of the interaction between transmission and distribution and, beyond, for a new market design.

TOWARDS MORE SYNERGIES BETWEEN WHOLESALE AND RETAIL MARKETS

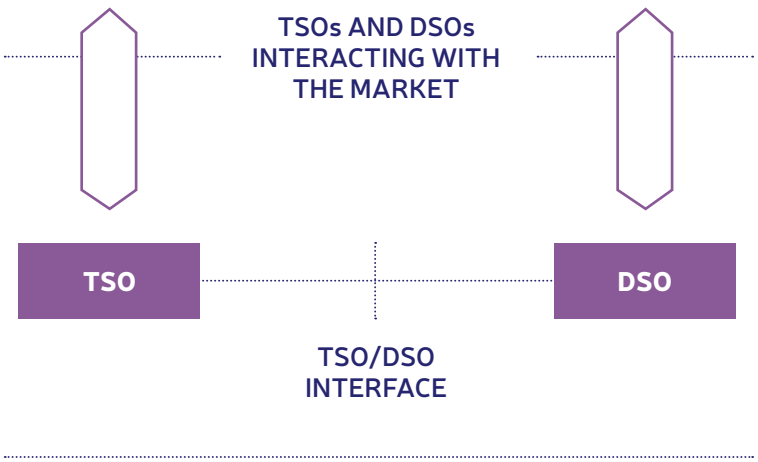
When striving for an integrated European electricity market allowing enhanced exchanges between countries and an optimal use of resources, it is necessary to work on a smarter interface between the wholesale and retail markets. Variable distributed generation and baseload centralised generation must complement each other to meet a fluctuant demand, targeting cleaner and cheaper energy across Europe.

In an integrated electricity market, flexibility, coming from consumption or generation, is necessary to enhance the development of new services and support an efficient use of energy sources and a secure operation of the system at both distribution and transmission levels. For this purpose, data is becoming a key asset that should be extensively and speedily exchanged, while ensuring security and confidentiality for the consumers. This is the basis for a smarter grid.

To meet these challenges, TSOs and DSOs cooperate closely to build the rules of the game for today and tomorrow. This is, of course, not a sole TSO-DSO business and requires dialogue with customers, electricity retailers, smart grid technology providers, data hubs, etc. The first objective of the TSO-DSO work is to build a common understanding of the challenges and needs from the perspectives of a system operator and neutral market facilitator and to share it more widely with the market parties, regulators, and European Commission.

ENERGY STORAGE AND STORAGE SERVICES

Storage is one of the promising options to provide more flexibility to the system. ENTSO-E published in October 2016 a position paper on storage and storage services, assessing the services that storage could provide and proposing general principles that should guide the future policy and investments framework for storage to be taken up at European level.



↑ *Interaction between TSO, DSO and the market*

TSO-DSO COOPERATION: HOW AND WHICH PRIORITIES?

Based on the memorandum of understanding signed in 2015 between the four DSO associations (EDSO for Smart Grids, CEDEC, EURELECTRIC, and GEODE) and ENTSO-E and the creation of a TSO-DSO platform supervised by the European Commission, TSOs and DSOs have intensified their work together in 2016.

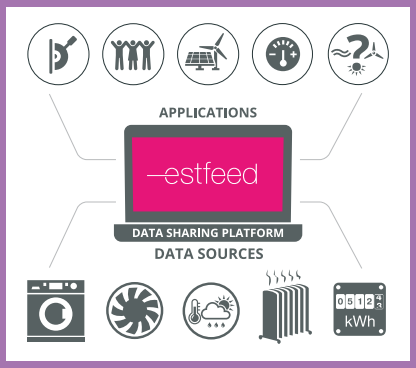
They delivered a common report on **data management**, outlining needs, roles, and responsibilities in data exchanges. Further work is being carried out on more concrete models for data management: which kind of data needs to be exchanged? For which business processes? How to deliver it in the best way to consumers, market players, and new service providers?

EMPOWERING CUSTOMERS: TSO CASE STUDY

ELERING/ESTONIA –
Estfeed, the Smart Energy System Platform

Estfeed is a **data sharing platform** that allows network companies, energy producers, and consumers to interact more efficiently and make the data collected during energy consumption understandable and usable for end users. The objective of the Estfeed project is to **create a smart grid** that allows market players to obtain energy consumption information securely and transparently, to understand the needs related to the metering point, and to change their behaviour accordingly. The Estfeed platform and applications turn the data into valuable information for consumers, energy producers, network companies, and other participants in the energy market.

Estfeed brings together data sources and applications. **Data sources** range from electricity, gas, and district heating smart meter readings to weather forecasts and energy day-ahead prices. It can also be consumption information from individual devices in industry, offices, and households.



Estfeed is a portal that gives developers a chance to access this information flow. By interpreting and combining data, they can create useful **applications** for themselves or their customers (end consumers). The aim of the applications is to **create efficiency**, either for cost optimisation or for end consumers.

Estfeed is an integrated part of the Estonian public information exchange platform called X-Road. This means the highest **security** standards. The X-Road enables access to all kinds of public data sources, which may be of relevance for the developers of Estfeed applications.

The Estonian electricity and gas TSO, Elering, as a neutral party, is well placed to provide this data sharing service to the public in a reliable and independent way. The growing importance of information and communication technologies is becoming central in running the energy system. It transforms the role of the TSO; Elering is the smart energy system operator and Estfeed is the tool for realising the smart grid.

DATA IS BECOMING A KEY ASSET THAT SHOULD BE EXTENSIVELY AND SPEEDILY EXCHANGED, WHILE ENSURING SECURITY AND CONFIDENTIALITY FOR THE CONSUMERS. THIS IS THE BASIS FOR A SMARTER GRID.

A second area of collaboration addresses **active power management**. Distributed generation and customer participation through demand-side response create a wide potential of new services for the grid and the system, called 'distributed flexibilities'. These flexibilities will be key to managing the electrical system in the best possible way and to developing new products on the market (such as aggregator activities). Rules of the game are needed to ensure a fair and efficient market, to avoid the multiplication of non-coordinated local marketplaces, and to get the most out of these services.

The TSOs and DSOs work together on this issue to understand their respective challenges and work towards an integrated market. One of the core issues is the interaction between balancing the electrical system, managing congestion on the grid, and tackling both global and local issues at the same time. The TSOs and DSOs plan to work on voltage control, storage, and network planning as further steps.

EMPOWERING CUSTOMERS: TSO CASE STUDY

EIRGRID/IRELAND – Power Off & Save

Launched in June 2016, Power Off & Save, developed by EirGrid in partnership with Electric Ireland, is a pilot project in demand-side management (DSM), empowering and rewarding residential customers to reduce their energy use when electricity demand is high.

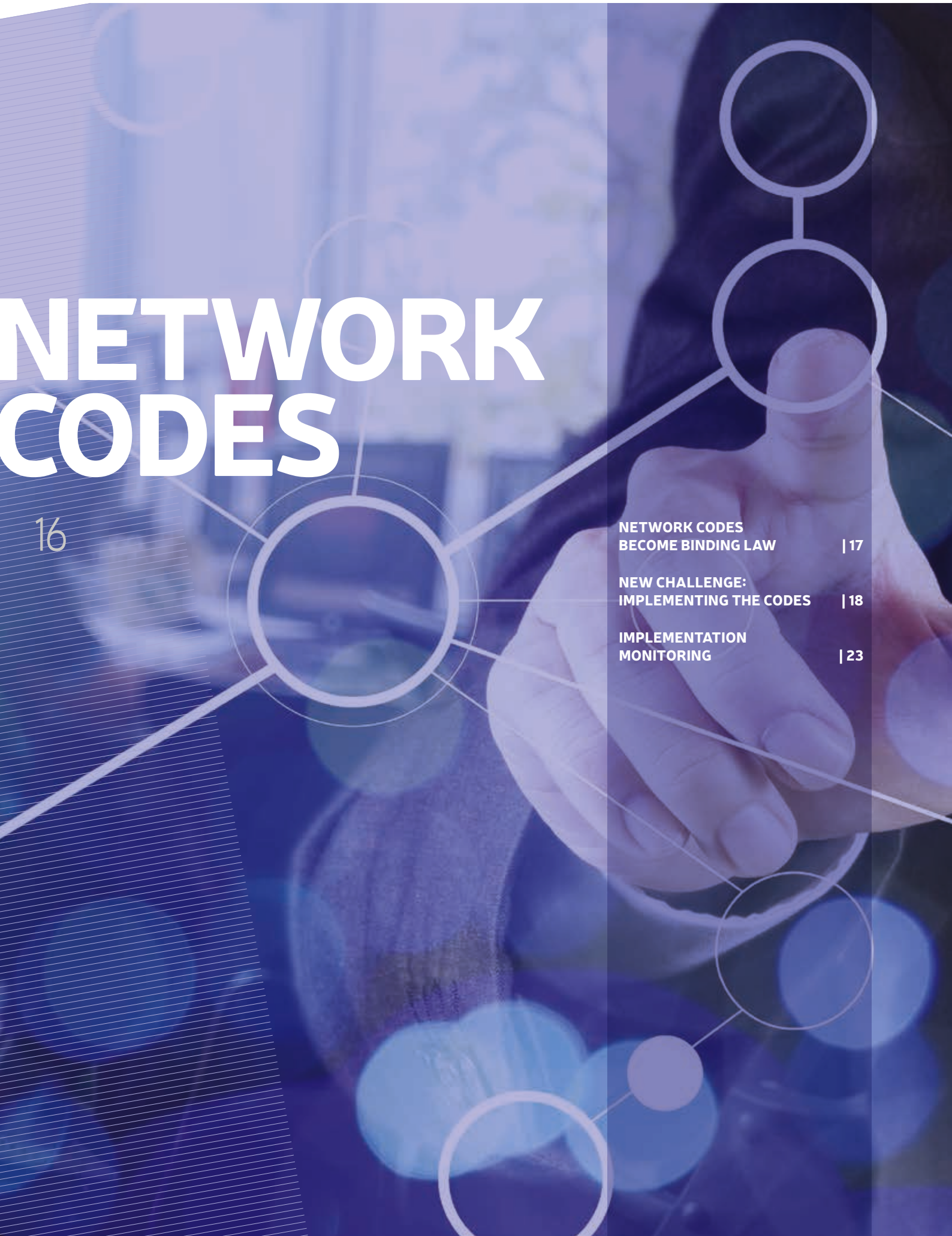
The integration of DSM is an important component of Ireland and the EU's transition towards a low carbon economy. The DSM is expected to feature as a key part of the energy system on the road to 2030, and the Irish government has also recognised its potential and is committed to exploring opportunities in the sector.

The growth of DSM in Ireland is undergoing rapid change; however, this recent growth has focused on commercial and industrial loads only. Given the scale of residential demand in Ireland, EirGrid was keen to engage residential customers and harness their power to contribute to a stable electricity system through a project such as Power Off & Save.

The project has already engaged almost 1,000 residential customers. Those participating have been asked via SMS text message directly to their mobile phones or via a notification to their smartphone to switch off appliances for approximately 30 minutes. These 'demand events' will take place on 10 occasions, over the 18-month project duration. Those who participate in the scheme will be rewarded with up to €100 off their electricity bill.

To date there have been two Power Off & Save 'demand events', and as a result behaviour patterns and learning can only be inferred; however, preliminary effects have been identified:

- **Independent control is of value to participants.** The enhanced agency offered by the smart energy controllers (SEC) installed for the project provides a real benefit to the customer in terms of control and comfort.
- **Response rates have been high.** A minimum of 70% of project participants responded to the notification and reduced their load; however, both 'demand events' took place in the evening (after 6 pm).
- **Participant reaction times can vary.** Approximately 40% of participants reacted within the first five minutes of receiving the notification. Response times vary in accordance with the technology deployed in the home.



NETWORK CODES

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NETWORK CODES BECOME BINDING LAW

Building a secure, competitive, and low carbon European electricity sector and the internal energy market are ambitious targets that need a clear legal ground to become reality. The network codes complement existing legislation by defining a common 'code of conduct' for the different players in the sector, harmonising practices and business processes.

The codes are divided into three families:

> Market codes are moving market integration forward for more competition and resource optimisation.

They define rules on forward or long-term capacity allocation so that market players can hedge the risks associated with cross-border trading. They set how capacity on interconnections is calculated and how congestion is managed to boost cross-border exchanges in the day-ahead (the day before real-time dispatch) and intraday timeframes. Finally, the codes address electricity balancing, that is, the procedures to apply after intraday/market closure and real-time dispatch. The idea is to maximise the exchange of balancing resources as well as to integrate new providers, such as demand response.

> Connection codes set the EU-wide conditions for linking all actors in all safety to the grid, including renewables and smart consumption.

They include requirements for generation and demand facilities, DSOs, and high voltage direct current (HVDC) technologies. The codes will improve security and foster new entrants, new technologies, and smarter grids. It will also help attract investors by creating a common European level playing field.

> Operational codes reinforce security of supply through state-of-the-art, harmonised, and coordinated rules for operating the grid.

Regional cooperation of grid operators is enshrined in EU law.
Operational codes also establish common procedures and remedial actions to be applied in the emergency, blackout and restoration states.

WHERE DO WE STAND AT THE BEGINNING OF 2017?

3 CONNECTION CODES	3 MARKET CODES	2 OPERATIONAL CODES
Requirements for Generators	Capacity Allocation & Congestion Management	System Operation Guideline
Demand Connection	Forward Capacity Allocation	Emergency & Restoration
HVDC	Balancing	
> Published in the EU Official Journal and/or in force	> Validated by member states' representatives, awaiting validation by EU Council & Parliament	

The year 2016 saw the entry into force of four codes (following capacity calculation and congestion management – CACM, in 2015). The three grid connection codes (requirements for generators, demand connection, and HVDC) and the code on forward capacity allocation (FCA). The two operational codes, the System Operation Guideline, and the Emergency & Restoration Code, are awaiting their entry into force after positive votes from EU member states in comitology.

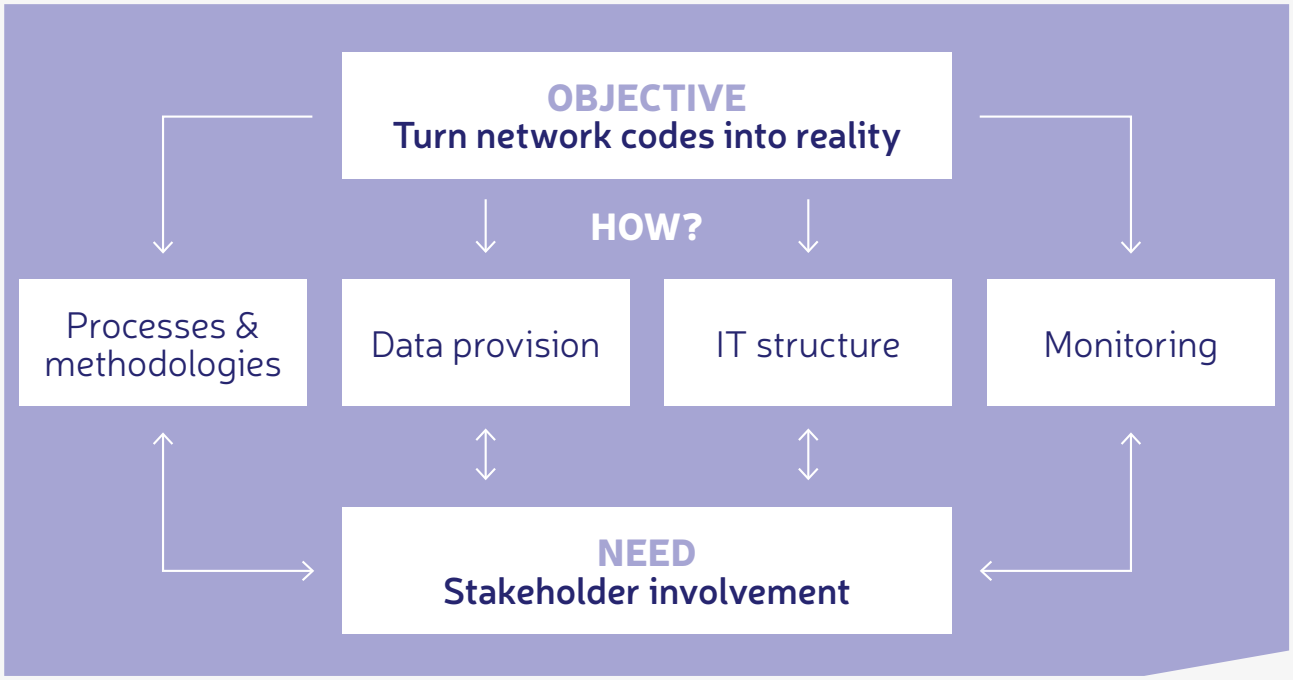
The remaining market network code, the Electricity Balancing Guideline, was in the comitology process in 2016 and was adopted by EU member states in March 2017.

↑ *ENTSO-E organises regular workshops and consultations with stakeholders, to discuss the network codes and their implementation.*

NEW CHALLENGE: IMPLEMENTING THE CODES

The period of development of the codes is over; ENTSO-E's resources are now fully devoted to their implementation. Entry into force of the codes mean they become binding EU law, to be applied by all European and national players. Implementation often requires a combination of national decisions, regional agreements, and pan-European methodologies and tools. Stakeholder consultation and regulatory approval is as central in the implementation phase of the codes as it is in their development phase. Implementing the codes thus requires the involvement of the whole electricity community, at the EU and national levels.

STAKEHOLDER CONSULTATION AND REGULATORY APPROVAL IS AS CENTRAL IN THE IMPLEMENTATION PHASE OF THE CODES AS IT IS IN THEIR DEVELOPMENT PHASE.



TASK	RESPONSIBILITY	APPROVAL
ENTSO-E	ENTSO-E	ACER
Pan-European 'All TSOs'	All TSOs	All NRAs
Regional 'All TSOs'	TSOs of the regions	NRAs of the region
National	Depending on national legislation (TSO, DSO,...)	National NRAs

Stakeholders involvement from European and regional groups to national bodies

Monitoring by ACER, EC, ENTSO-E

The codes define which entity is responsible for each implementation task.

> ENTSO-E oversees part of the implementation tasks.

> Additionally, ENTSO-E facilitates the tasks attributed to 'all TSOs'. 'All TSOs' refers to the TSOs of all EU countries (pan-European 'all TSOs'), or to the TSOs of a specific EU region (regional 'all TSOs'). The TSOs whose countries are not member of the EU are also involved in the development phase. Because TSOs have decided that ENTSO-E's structures are the most efficient vehicle to facilitate the delivery of pan-European tasks and of some regional tasks, ENTSO-E coordinates and supports the decision-making process. However, the validation of the deliverables to be submitted to NRAs is made by 'all TSOs', not by ENTSO-E.

Once submitted to all EU NRAs (or to those of the region), all NRAs must similarly reach a decision to formally adopt the deliverable and make it legally binding. In case they cannot reach a consensus, a safety net process involving ACER is foreseen. The codes set deadlines for implementation, and these can be ambitious. Therefore, ENTSO-E and the TSO community started early implementation projects before the official entry into force of the codes.

IMPLEMENTING THE CODES: A COLLECTIVE EXERCISE

To involve stakeholders in the implementation of the codes, ACER and ENTSO-E have set up European Stakeholders Committees with three main missions:

> monitoring progress in the implementation;

> serving as a platform to share general views on implementation;

> contributing to a more informed decision-making process for the methodologies and rules still to be developed.

The Market Stakeholders Committee launched in 2015 and gathered four times in 2016. The Grid Connection Stakeholders Committee was launched in 2016 and gathered four times. The System Operations Stakeholders Committee will be launched in 2017.

CAPACITY ALLOCATION AND CONGESTION MANAGEMENT (CACM) REGULATION

The rules set by the CACM Regulation provide the basis for the implementation of a single energy market across Europe.
The CACM Regulation sets out the methods for allocating capacity in day-ahead and intraday timescales and outlines the way in which capacity will be calculated across the different zones.

Putting in place harmonised cross-border markets in all timeframes will lead to a more efficient European market and will benefit customers.

The first code to enter into force, the implementation of the CACM Regulation is well under way. Here is the status of the different implementation tasks, performed by 'all TSOs' and by nominated electricity market operators (NEMOs).

'ALL TSOs' TASKS

CAPACITY CALCULATION REGIONS

Capacity calculation regions (CCRs) are geographical areas in which TSOs apply a coordinated capacity calculation method. Defining the regions is the first step towards more efficient electricity markets and 'all TSOs' submitted a proposal on CCRs to all NRAs in November 2015.

The NRAs did not reach a unanimous agreement on the proposal and the task was then referred to ACER. In November 2016, ACER approved the CCRs as proposed by 'all TSOs' with one amendment; it merged the Central-West Europe and the Central-East Europe regions in a 'CORE CCR'.

ENTSO-E will monitor the implementation of this decision through its biennial report on capacity calculation and allocation constraints. The first edition is due by August 2017. The decision and implementation on CCRs is the basis for a series of other regional deliverables to couple day-ahead and intraday markets in Europe, e.g., the common capacity calculation methodologies in each CCR.

The TSOs of the Central-West and Central-East Europe regions have taken a first step towards merging by signing a memorandum of understanding in March 2016, to develop a common day-ahead flow-based capacity calculation methodology.

CONGESTION INCOME DISTRIBUTION

Congestion income – defined as the revenues received as a result of capacity allocation – needs to be distributed to the involved TSOs or third-party asset owners. The sharing of the congestion income between the TSOs is typically based on joint agreements among them. 'All TSOs' were tasked to deliver a proposal for a pan-European methodology to share congestion income.

The proposal was submitted in August 2016 by all TSOs to all NRAs for approval. Following the reception of a request for amendment by all NRAs in February 2017, all TSOs will submit an amended proposal for the congestion income distribution methodology by April 2017.

BIDDING ZONE REVIEW

A bidding zone is the largest geographical area within which market participants can exchange energy without capacity allocation. As part of the implementation of the CACM Regulation, a reporting on the efficiency of existing bidding zones, and possibly a review, are foreseen.

In 2016, ENTSO-E and involved TSOs have continued to progress on the bidding zone review of Central-West Europe, Central-East Europe, Switzerland, and Italy north, closely involving NRAs, ACER, and other stakeholders. In December 2016, ACER sent a letter to all involved TSOs, formalising the current bidding zone review as a formal CACM process. The work will continue in 2017.

DAY-AHEAD FIRMNESS DEADLINE

The day-ahead firmness deadline is the point in time after which cross-zonal capacity becomes firm. To coordinate and harmonise capacity calculation and allocation in the day-ahead cross-border markets, all TSOs have been asked to develop a single pan-European day-ahead firmness deadline. 'All TSOs' proposal was submitted to all NRAs on 14 December 2016.

INTRADAY CROSS-ZONAL GATE OPENING AND GATE CLOSURE TIMES

For a given bidding zone border and a given time unit, capacity can only be allocated within a specific timeframe. The intraday cross-zonal gate opening time is the point in time when cross-zonal capacity between bidding zones is released, while the gate closure time is the point in time where cross-zonal capacity allocation is no longer permitted for a given market time unit. On 14 December 2016, 'all TSOs' submitted their proposal to all NRAs for approval.

CALCULATION OF SCHEDULED EXCHANGES RESULTING FROM SINGLE INTRADAY AND DAY-AHEAD COUPLING

On 14 December 2016, all relevant TSOs submitted the proposals for calculating scheduled exchanges resulting from single day-ahead and intraday coupling, developed under the ENTSO-E framework, to their NRAs for approval.

TSOs-NEMOs' TASKS

PLAN FOR THE MARKET COUPLING OPERATOR FUNCTION

Developing, operating, and governing market coupling is a highly complex task at the heart of cross-border trade and capacity allocation. In April 2016, all NEMOs – defined as the entities designated to perform tasks related to single day-ahead or single intraday coupling – submitted their proposal for the setting-up and performance of the market coupling operator function to all NRAs for approval.

The NRAs asked all NEMOs to review and amend their proposal, thus delaying the approval process, which would formally make the multi-regional coupling project and the cross-border intraday project the pan-European solutions for day-ahead and intraday market coupling. On 14 December, all NEMOs submitted their amended proposal to the NRAs. (On this topic, see also ENTSO-E's policy paper of July 2016 'Governance of the market coupling operation functions – TSOs' perspective').

DAY-AHEAD AND INTRADAY ALGORITHMS

The CACM Regulation requires all NEMOs to develop price coupling and continuous trading matching algorithms for the day-ahead and intraday markets. 'All TSOs' under the ENTSO-E framework provided all NEMOs with a proposal for a common set of requirements for efficient capacity allocation to enable the development of the price coupling algorithm and of the continuous trading matching algorithm.

MAXIMUM AND MINIMUM PRICES

All NEMOs are developing a proposal on harmonised maximum and minimum clearing prices to be applied in all bidding zones that participate in single day-ahead and intraday coupling. ENTSO-E is cooperating with all NEMOS and all relevant TSOs in the preparation of this deliverable.

BACK-UP METHODOLOGY

All NEMOs are preparing, in collaboration with ENTSO-E and all TSOs, a back-up methodology.

PRODUCTS ACCOMMODATED

All NEMOs are developing a proposal on products that can be considered in the single day-ahead and single intraday couplings.

The above proposals by all NEMOs, except for the plan of the market coupling operator function, have been submitted for public consultation on 3 November 2016. The final proposals were submitted by all NEMOs to all NRAs in early 2017 for approval.

ELECTRICITY BALANCING GUIDELINE

Electricity balancing is the process by which TSOs ensure, in real time, sufficient energy to balance inevitable differences between supply and demand. The Electricity Balancing Guideline aims to move Europe from the current situation in which balancing energy is procured at a national level to a situation in which larger markets allow the resources available in Europe to be used in a more effective way. The Electricity Balancing Guideline was approved by EU member states in comitology in March 2017 and early implementation activities are already ongoing.

In 2015 and 2016, ENTSO-E conducted a cost-benefit analysis (CBA) of a change to the imbalance settlement period, over which the imbalance of balance responsible parties is calculated. The study was based on a detailed survey in which stakeholders (mainly generators but also DSOs, imbalance settlement service providers, TSOs, and regulators) expressed their expectations on the consequences of a change of the imbalance settlement period. Four different planning cases were analysed (all regions go to 15 minutes ISP, countries with ISP longer than 30 minutes change to 15 minutes, countries with ISP longer than 30 minutes change to the ISP of their neighbouring country, and all regions go to 5 minutes ISP; for further details see the CBA analysis). The analysis yielded positive results for the third approach and an additional sensitivity analysis, in which Great Britain, Northern Ireland, and Ireland remain at 30 minutes, while all other countries change to 15 minutes.

Furthermore, ENTSO-E conducted a study on the effect of merit-order activation of automatic frequency restoration reserves (aFRR) and harmonised full activation time. The study concluded that, with a merit-order activation scheme, the provider of a selected bid needs to activate more aFRRs per selected bid, which will take more time. The aFRR activation price may decrease since only the cheapest bids are activated, and the aFRR activation price will be higher with larger imbalances and thus could contribute, giving the right signals to market participants for being balanced. For large aFRR activations caused by a power plant trip (for example), the differences between pro-rata schemes and merit-order schemes are smaller. The results of the study will help in defining standard products.

Finally, ENTSO-E created project teams for preparing the 'all TSOs' deliverables for imbalance netting, aFRR, frequency restoration reserves with manual activation (mFRR), and replacement reserves. It also approved the International Grid Control Cooperation project as implementation project for imbalance netting and the Trans European Replacement Reserves Exchange - 'TERRE' - project as an implementation project for replacement reserves. Work on creating project teams for all TSO deliverables and identifying implementation projects for aFRR and mFRR has been started.

FORWARD CAPACITY ALLOCATION (FCA) REGULATION

Forward markets allow parties to secure transmission capacity before the day-ahead timeframe, while hedging the risks. The FCA Regulation aims at establishing and promoting forward markets in a coordinated way across Europe.

HARMONISED ALLOCATION RULES

An important component of the FCA, harmonised allocation rules (HARs) deal with the procedures for auctioning transmission rights, the terms on which market participants may participate in explicit auctions and the terms for use of cross-zonal capacity. Their early implementation started as early as 2014 with the first version being delivered in 2015.

In 2016, following requests from stakeholders, ENTSO-E delivered a second version of the HARs for FCA. The maximum possible compliance with the (then) draft FCA was the main target when updating the HARs. In addition, the number of border/regional

specific annexes was reduced compared to the previous version. The proposal was put to public consultation and comments from all concerned stakeholders were evaluated before the submission of the HAR to all NRAs in July 2016. Once approved by the NRAs, these HARs will be applied in the long-term auctions for 2017.

Following the entry into force of the FCA Regulation in October 2016, ENTSO-E will deliver the HARs as part of the official FCA implementation, including a public consultation in early 2017, with the official submission set at mid-April 2017.

PROPOSAL FOR THE ESTABLISHMENT OF A SINGLE ALLOCATION PLATFORM

ENTSO-E has been working on a proposal to establish the Single Allocation Platform, the European platform to be established by all TSOs for FCA. The proposal will encompass several aspects related to the establishment and operation of the platform, namely, the functional requirements, governance points, and cost sharing issues. The timing for delivering this proposal is set to mid-April 2017.

NEXT STEPS

Deliverables in 2017 include FCA-specific topics (e.g., nomination rules for physical transmission rights), complementing the CACM methodologies to accommodate FCA requirements (e.g., common grid model/generation and load data provision methodology) and a list of monitoring tasks.

SPECIFIC CASE OF SOUTH-EAST EUROPE

South-East Europe covers a wide range of countries, some of which are not members of the EU and are therefore not subject to the same legislation. For large parts of the region, the Energy Community ensures that the EU internal energy market, including network codes and guidelines, is extended to the countries of this region. ENTSO-E also supports the TSOs of South-East Europe in aligning their legal and regulatory framework with that of the EU. This will ensure the consistent development of their national and regional electricity markets in line with the requirements of the internal electricity market.

In particular, ENTSO-E supports the TSOs of the six Western Balkans countries (WB6) – Albania, Bosnia and Herzegovina, Kosovo[1], former Yugoslav Republic of Macedonia, Montenegro, and Serbia – which are not members of the EU. In April 2016, WB6's TSOs, regulators, and ministries of energy and power exchanges entered into a memorandum of understanding setting obligations to integrate day-ahead markets, and cross-border balancing cooperation. ENTSO-E will support the implementation of the memorandum of understanding and ensure its coherence with market coupling plans at the European level, including by participating as a key external stakeholder in the Day Ahead Market Integration Programme Steering Committee, which met for the first time in September 2016.

SYSTEM OPERATION GUIDELINE

The System Operation Guideline sets out harmonised rules on how to operate the grid to ensure the security of supply with increasing renewables. It also enshrines in EU law the regional security coordinators (RSCs) that will cover the whole of Europe by the end of 2017. It entails several challenging implementation tasks for TSOs at pan-European, regional, and national levels.

The implementation of the System Operation Guideline involves ENTSO-E and TSOs; ACER and NRAs are monitoring progress. From early 2017, the European Stakeholder Committee on Network Codes Implementation dealing with system operations ensures that all electricity stakeholders are involved in the process. The implementation of the System Operation Guideline started in 2016, with the following main tasks:

- The common grid model (see in 'IT Tools & Strategy').
- Data exchange: ENTSO-E kicked off a project in April 2016 to develop key organisational requirements, roles, and responsibilities in relation to data exchange in between TSOs, DSOs, and significant grid users. This work is expected to be completed in 2017/by six months after the entry into force of the System Operation Guideline.
- Coordinated security analysis: In February 2016, ENTSO-E began the development of the methodology for coordinating operational security analysis, including methods for assessing the influence of transmission system elements, the principles for common risk assessment and for dealing with uncertainties of generation and load, requirements on coordination between RSCs and the definition of the role of ENTSO-E in the governance of common tools, data quality rules improvement, and the monitoring of the methodology.
- Year-ahead scenarios: In September 2016, ENTSO-E kicked off the work on a common list of scenarios, against which TSOs assess the operation of the interconnected transmission system for the following year. The list will be published every year by mid-July, with the description of the scenarios and the period for which these scenarios are to be used. Work has begun on the process description and the workflow chart.
- Regional security coordinators (RSCs; see in 'Where Europe Starts: Regions').

Additionally, there is a long list of methodologies, terms, and conditions that need to be developed at synchronous area level and included in the synchronous area operational agreements. By 12 months after entry into force of the System Operation Guideline, all TSOs of a synchronous area must develop and agree on the principles governing the operation of the synchronous area. This includes the load-frequency control structure, frequency quality defining parameters,

1. This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence.

IMPLEMENTING THE CODES REQUIRES THE INVOLVEMENT OF THE WHOLE ELECTRICITY COMMUNITY, AT THE EU AND NATIONAL LEVELS.

frequency quality target parameters, dimensioning rules for frequency containment reserves (FCR), operational rules in case of exhausted FCR as well as the risk assessment methodology for these cases, roles and responsibilities for exchanging and sharing the frequency restoration reserves and replacement reserves, and requirements concerning the availability, reliability, and redundancy of the technical infrastructure, to mention but a few. The work on the content of these agreements is ongoing.

Some implementation tasks have also started at the national level, ENTSO-E is not involved but will monitor their implementation.

CONNECTION CODES

Electricity transmission infrastructure has developed differently throughout Europe due to several national factors, including scale, topography, and economic factors. Furthermore, the levels of interconnection between countries vary greatly. Therefore, the implementation of the three connection network codes – Requirements for Generators (RfG), Demand Connection (DC), and High Voltage Direct Current (HVDC) – relies on parameters set in part at the national level and in part at the pan-European level.

To support the implementation at the national level, ENTSO-E has drafted an initial set of 18 non-binding implementation guidance documents. They highlight the effect on specific technologies, the link with local network characteristics, and the need for coordination between network operators and grid users.

ENTSO-E collected stakeholders' feedback on the implementation guidance documents from the perspective of the RfG code, and published an updated version in November 2016. The documents were then submitted to a second round of public consultation, this time looking at the DC and the HVDC codes, and were further updated and published in March 2017.

IMPLEMENTATION MONITORING

Along the progressive entry into force of the network codes since August 2015 and in addition to the implementation tasks detailed above, ENTSO-E is tasked with monitoring the implementation of the codes and their effects on the harmonisation of applicable rules aimed at facilitating market integration. Most ENTSO-E monitoring activities in 2016 were dedicated to the CACM Regulation, as it is already in the second year of its implementation. ENTSO-E submitted a monitoring plan to ACER in February 2016, explaining the scope, frequency, and method used for the monitoring of the implementation.

In August 2016, ENTSO-E submitted and published its first monitoring report to ACER. The report was dedicated to the progress and potential problems in the implementation of single day-ahead and intraday coupling. This report takes stock of the progress achieved so far in the coupling of electricity markets through the different projects in place before the entry into force of the CACM, which became leading projects following the entry into force of the CACM. These are the day-ahead market coupling project (namely, the multi-regional coupling project) and the intraday market coupling project (namely, the cross-border intraday project). The report shows progresses in these projects and their progressive extension to European TSOs and NEMOs as well as the foundations for open cooperation between European TSOs and NEMOs. Discussions also took place throughout 2016 with ACER to identify the list of information that ENTSO-E, TSOs, and other market entities should submit to ACER for its own monitoring of the CACM implementation.

Following the entry into force of the FCA Regulation in October 2016, a similar approach will be followed towards fulfilling the monitoring tasks of this regulation.

ENTSO-E has also been paving the way for the monitoring of the implementation of the connection codes (RfG, DCC, and HVDC). The connection codes implementation library, initiated in 2015, went live in December 2016. It aims at making all documents on the implementation of connection codes available to stakeholders in an easy and practical way. It will contain all available European and national documents and timelines on the implementation of the connection codes in all European countries and regions and will be populated as documents become available.

IT TOOLS & STRATEGY

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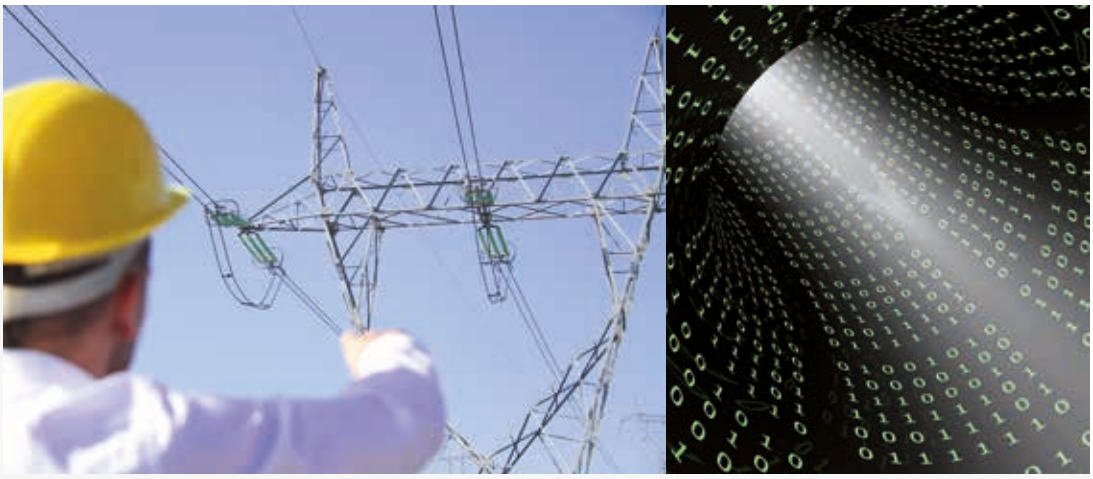

TSOs and ENTSO-E work in an increasingly interlinked and digital environment. The implementation of the network codes, for example, is resulting in closer collaboration between TSOs and other actors of the energy sector. To stay fast and efficient, business models and related IT infrastructures must be adapted across regional dimensions and physical- and market-related issues. Therefore, ENTSO-E is in the process of developing an IT strategy spanning the period from 2017 to 2020.

The new strategy will cover legally mandated products: the common grid model, and the ENTSO-E Transparency Platform described below. It will also extend to IT, data architecture, or data exchange standard settings for the entire industry to which ENTSO-E contributes and aims at addressing the increasingly interlinked IT needs of TSOs and other players, such as regional security coordinators, the Joint Allocation Office, capacity calculation regions or power exchanges.

COMMON GRID MODEL

Grid operators use computer models of their network to simulate its behaviour to make decisions. Up to now, each TSO has been using its own grid model. As networks become more interconnected and as European electricity markets are getting increasingly integrated, there is a need to develop a common grid model that will ease the cooperation between TSOs and will result in an even more secure and cost-efficient European grid.

The common grid model is a prerequisite for any joint regional security evaluation and capacity calculation among several TSOs and is specified in the CACM Regulation and in the System Operations Guideline. Methodologies for the common grid model and the generation and load data provision are developed by all TSOs and submitted for approval to the competent regulatory authorities. For more information on the common grid model, watch our explanatory video on ENTSO-E's YouTube channel (see in *https://www.youtube.com/user/ENTSOE*).

COMMON GRID MODEL METHODOLOGIES

The common grid model methodology was submitted to ACER in June 2016, following a public stakeholder consultation and approval by all TSOs. The NRAs requested in January 2017 that three modifications be made to the methodology as a condition of its approval. The TSOs are expected to agree on an amended version of the methodology before resubmission to ACER in 2017.

The generator and load data provision methodology was also submitted to ACER in June 2016, and approved by all NRAs. Following the entry into force of the FCA Regulation in October 2016, both methodologies will be amended in 2017, with respect notably to capacity calculation for long-term timeframes. The revised draft versions were published for public consultation in March 2017.

OPERATIONAL PLANNING DATA ENVIRONMENT (OPDE)

An information platform will support the common grid model: the Operational Planning Data Environment (OPDE). One software component of the OPDE, the Electricity Communication Platform, which implements the private and secure communication layer of the OPDE, was fully developed and delivered in 2016. The development of two other software components, including the Operational Planning Data Management, is ongoing.

ALL TSO NETWORKS FOR NON-REAL-TIME OPERATIONAL AND MARKET-RELATED DATA COMMUNICATION NETWORK (ATOM)

The common grid model will run on a brand-new communication network called ATOM. This data exchange tool will support the performance of long- and short-term capacity calculation, operational security analysis, outage planning, and grid planning and adequacy forecast. In 2016, ENTSO-E prepared the setup of the core of the ATOM communication network. Four TSOs – RTE, Amprion, APG, and Swissgrid – have been appointed to realise the fully meshed core of ATOM.

ENTSO-E'S TRANSPARENCY PLATFORM

ENTSO-E's Transparency Platform centralises data on energy generation, transmission, and consumption, collected from data providers including TSOs, power exchanges, and other third parties. By making information available freely to all, it allows for a level playing field where market participants can make better analyses and decisions. It is also instrumental for the monitoring and regulation of power markets.

The quality of the data and the access to the data must be constantly improved, and ENTSO-E has launched extensive work in that direction in 2016. Developing additional download possibilities on the platform was identified as the top priority request by users, who are involved in the constant improvement of the platform via ENTSO-E's Transparency User Group. Several options have been discussed, and the two solutions chosen serve different purposes and were confirmed by users as very useful.

APPROX.
6,700
REGISTERED USERS

2,000-2,500
ACTIVE USERS PER DAY

10 million
FILES RECEIVED EACH YEAR

50
DATA PROVIDERS

To increase data quality, the review of the Manual of Procedure was also carried out in close cooperation with ACER and with users via the Transparency User Group. The opinion of ACER on this reviewed set of documents was received in early 2017; the implementation work has now started both on the Transparency Platform and on the data providers' side.

↑ *ENTSO-E's interactive map of the transmission grid.*

STANDARDISATION ACTIVITIES

ENTSO-E engages in various standardisation activities in support of reliable and stable system operation and processes for the smart grid environment. Standards facilitate cross-border exchanges and allow efficient and reliable identification of different objects and parties relating to the internal energy market and its operations and support network code implementation in various ways.

ELECTRONIC DATA INTERCHANGE LIBRARY

ENTSO-E's Electronic Data Interchange library regroups all documents and definitions for the harmonisation and implementation of standardised electronic data interchanges. This includes the transformation of business requirements into implementation guides and Unified Modelling Language (UML) model documents. These documents allow the definition of processes and electronic documents for interchange between actors in the electrical industry in Europe.

ENERGY IDENTIFICATION CODING

ENTSO-E supports the Energy Identification Coding (EIC) scheme, which provides a unique identification of market participants and other entities active with the European electricity and gas markets. The EIC scheme is widely used in relation to electronic document interchange. The EIC codes are necessary for ENTSO-E and all actors of the energy market to fulfil their obligations relating to the Transparency Regulation and the REMIT Regulation. In 2016, ENTSO-E continued to support the maintenance and development of ENTSO-E profiles under the Common Information Model (IEC 62325, IEC 61970, and IEC 61968) and IEC 61850 standards. The European Style Market Profile, relating to Market Data Communications under IEC 62325, saw several approved corrigenda and enhancements to the series of standards.

Part of supporting the implementation of the CACM Regulation and of the System Operations Guideline, the common grid model exchange specification, based on IEC 61970, was submitted as a technical specification to the IEC for approval. In addition, the development of an interoperability specification tool has progressed, with the aim of creating an ENTSO-E profile under the IEC 61850 standard, supporting multi-vendor interoperability over systems' life cycles. Moreover, ENTSO-E successfully submitted a document for comment to national committees to significantly enhance the IEC 61850 engineering process.

A workshop, jointly organised with the European Committee for electro technical standardisation, CENELEC, addressed cooperation on the HVDC code between the two entities. ENTSO-E also participated in the European level Smart Energy Grid Coordination Group. To cap off the year, ENTSO-E hosted a workshop on standardisation, highlighting the importance of standardisation activities in many different areas of the TSO business to promote interoperability and cost savings at both European and international levels.

POWER STATISTICS

ENTSO-E collects and publishes statistics on the production, consumption, and exchanges of electricity, aggregated by country. The datasets of historical data cover hourly, monthly, and yearly data, and go back (for part of the data) to 1991. In 2016, ENTSO-E launched a new user interface, 'Power statistics', covering the data from 2016 onwards. Older data will remain available in an archive.

ONLINE MAP OF THE TRANSMISSION GRID

In April 2016, ENTSO-E launched an interactive online version of its European transmission grid map. All map data has been provided by TSOs through the national data correspondents. It shows all transmission lines designed for 220 kV voltage and higher and generation stations with net generation capacity of more than 100 MW. Since launch, the map has received over 850,000 views.

WHERE EUROPE STARTS: REGIONS

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↑ *ENTSO-E visit to SCC.*

How can we integrate at least 45% renewables, maintain the security of the supply, and develop efficient markets in Europe? Action at the regional level is key to each of these three objectives of the Energy Union. How we can best organise cooperation within regions has been a main area of focus for TSOs and ENTSO-E in 2016 and over the past few years.

ENTSO-E'S VISION FOR REGIONS

REGIONAL COOPERATION AND GOVERNANCE

ENTSO-E's vision is that of policy regions bringing political, regulatory, technical, and commercial competences together. As detailed in our policy paper released in April 2016, energy policy regions are based on historical, geographical, and market cooperation. Successful examples of policy regions include the Pentalateral Energy Forum and the Nordics.

These are not to be mixed-up with the functional areas needed to ensure optimal and fit-for-purpose TSO cooperation. The perimeters of functional areas are determined on physical and operational aspects and could differ between functions. Regional security coordinators (RSCs) are functional areas for system operations.

REGIONAL SECURITY COORDINATORS

Started off in a voluntary manner, RSCs are mandatory today. Initially, TSOs voluntarily committed to intensify regional cooperation to increase the value to customers in reliability, cost efficiency, and sustainability. The RSCs are service providers to TSOs, contributing to the operational security of the electricity system. They deliver five core services to the TSOs. In 2015 and 2016 ENTSO-E members have all signed a multilateral agreement, which states each TSO must contract the following five services.

FIVE SERVICES	BENEFIT FOR TSOS & MARKET PARTICIPANTS
Regional operational security coordination	Identify risks of operational security in areas close to national borders. Identify the most efficient remedial actions in these areas and make recommendations to the concerned TSOs without being constrained by national borders.
Regional outage coordination	Single register for all planned outages of grid assets (overhead lines, generators, etc.). Enhanced governance of asset maintenance.
Coordinated capacity calculation from CACM	Calculate available electricity transfer capacity across borders (using flow-based or net transfer capacity methodologies). Maximise the capacity offered to the market.
Regional adequacy assessment	Provide market participants with consumption, production, and grid status forecasts up to several weeks ahead.
Building of common grid model	Provide a regional dynamic view of all major grid assets (generation, consumption, and transmission), updated every hour.

Today, RSCs are already playing a key role in regional TSO cooperation implementing these five services. Decision on system operation remains the responsibility of TSOs, but TSOs will perform their tasks by relying increasingly on the information and services provided by the RSCs.

The TSO coordination through the RSCs increases efficiency in system operation, minimises risks of wide area events, such as brownouts or blackouts, and lowers costs through maximised availability of transmission capacity to market participants.

The System Operation Guideline formalises the name, existence, and role of the RSCs and makes it mandatory for all TSOs to contract the five services. In that sense, the voluntary character of the proactive TSO cooperation has turned into a legal framework, which leaves room for future amendment and for taking stock of dynamic developments and learning from experience. By 2019, all five services must be implemented across Europe. The number of services may evolve over time, once the five initial services are successfully implemented.

MEET THE REGIONAL SECURITY COORDINATORS

BY THE END OF 2016 THERE WERE FIVE RSCs ESTABLISHED AND ONE IN THE MAKING.

CORESO

ESTABLISHED: 2008

SEVEN TSOS: REE (Spain), Elia (Belgium), RTE (France), National Grid (UK), Terna (Italy), 50Hertz (Germany), and REN (Portugal)

POPULATION COVERED: 279,088,515

SERVICES PROVIDED: capacity calculation and operational security analysis

SERVICES IN DEVELOPMENT: outage planning coordination and short- and medium-term adequacy assessment

The tasks performed by security and coordination engineers include monitoring and assessing the security of the electrical system at the regional level and initiating and coordinating appropriate initiatives with the relevant TSOs to ensure the security of the supply on a European scale. Other services relate to operational security in regional market initiatives (market coupling activities, capacity assessment, and capacity calculation).

TRANSMISSION SYSTEM OPERATOR SECURITY COOPERATION (TSC)

ESTABLISHED: 2008

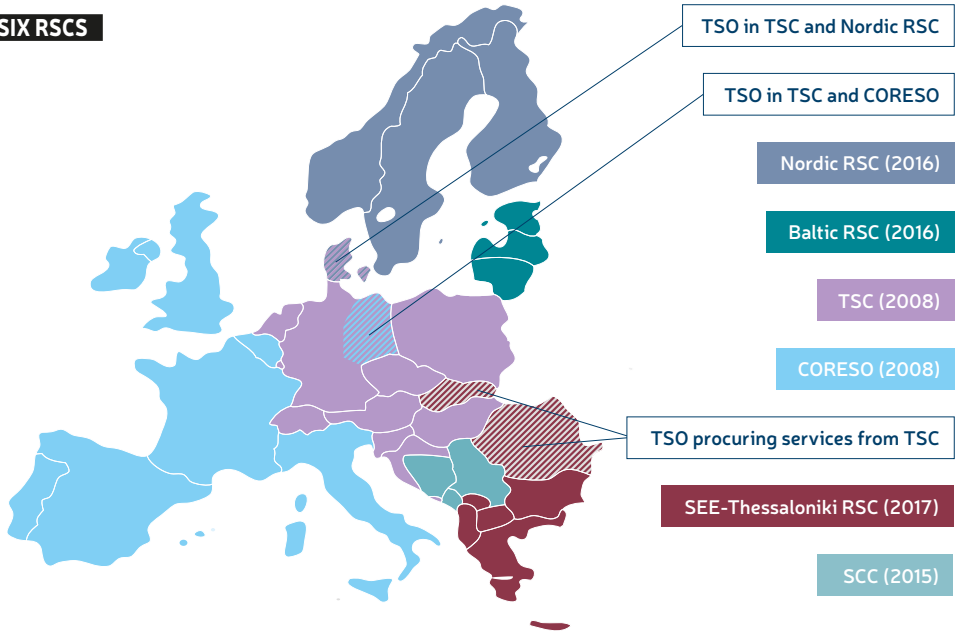
THIRTEEN TSOS: 50Hertz (Germany), Amprion (Germany), APG (Austria), CEPS (Czech Republic), ELES (Slovenia), energinet.dk (Denmark), HOPS (Croatia), MAVIR (Hungary), PSE (Poland), Swissgrid (Switzerland), TenneT TSO (the Netherlands), TenneT TSO GmbH (Germany), and TransnetBW GmbH (Germany)

POPULATION COVERED: 185,270,801

TSCNET Services, the service company of the TSC TSOs, coordinates most of TSC's activities and renders all the tailor-made coordination services for operational planning, forecast data merging, congestion assessment, and capacity calculation for TSOs' control centres:

- Merging of common grid models
- Capacity calculation
- Security assessment
- Outage planning (extended pilot phase)
- System adequacy (under development)

EXPECTED STRUCTURE OF THE SIX RSCS BY END OF 2017



Source: FTI-CL report for ENTSO-E

↑ *Coreso's operational room.*

The IT infrastructure of TSC is ready to be imbedded into ENTSO-E's future Operational Planning Data Environment (OPDE) and the processing of the Common Grid Model Exchange Standard (CGMES).

SECURITY COORDINATION CENTRE (SCC)

ESTABLISHED: 2015

THREE TSOS: NOS BiH (Bosnia Herzegovina), CGES (Montenegro), and EMS (Serbia)

POPULATION COVERED: 12,183,900

CURRENT SERVICES PROVIDED BY SCC:

- Validation and quality improvement of individual grid models
- Merging of individual grid models into the common grid model
- Validation of the common grid model and its delivery
- N-1 security analysis

Starting from 1 July 2016, SCC began to perform the validation of individual grid models, merging and delivering of common grid models at reference time 8:00 and 16:00 CET for the next eight hours of the day.

NORDIC RSC

ESTABLISHED: 2016

FOUR TSOS: Fingrid (Finland), Svenska Kraftnät (Sweden), Statnett (Norway), and energinet.dk (Denmark)

POPULATION COVERED: 26,144,225

Nordic RSC's joint office in Copenhagen has been operational since 1 November 2016. The implementation of business processes and IT applications will take place during the first half of 2017. The final go-live for the five services is planned for 1 December 2017.

BALTIC RSC

ESTABLISHED: 2016

THREE TSOS: Elering (Estonia), AST (Latvia), and Litgrid (Lithuania)

POPULATION COVERED: 6,173,459

The initial description of the services has been finalised by the end of 2016. The Baltic RSC will perform all five mandatory services with dedicated staff within the offices of each TSO in Tallinn, Riga, and Vilnius.

NEW RSC IN SOUTH-EAST EUROPE

EXPECTED TO BE ESTABLISHED: 2017

ESO-EAD (Bulgaria), KOSTT (Kosovo*) and IPTO (Greece) are in the process of establishing a new RSC in South-East Europe.

** This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.*

↑ *The team of Nordic RSC, including staff from Energinet, Fingrid, Statnett and Svenska kraftnät.*

FUTURE OF POWER SYSTEM REGIONAL COORDINATION

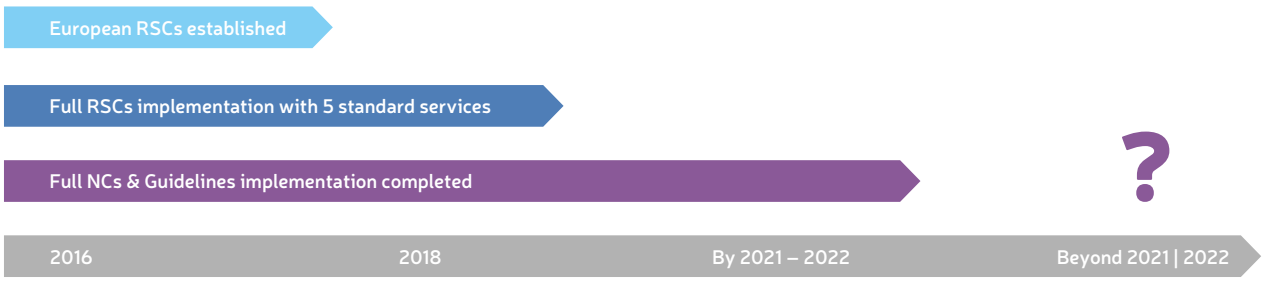
To analyse options for the future of the coordination of system operations at the regional level in the next decade, ENTSO-E has commissioned an independent study from FTI-CL Energy. The objective was to look beyond the System Operations Guideline and identify several practical recommendations.

The study identified five pillars for an enhanced regional coordination framework:

- a stronger regional cooperation for policy and regulation: Divergence and gaps in policies and regulations are hurdles for further integration and/or causes of inefficiencies in operations or market functioning;
- the RSCs as regional coordinators for system operation: The RSCs are the natural entities to perform coordinated tasks at the regional level for the TSOs, and they are gradually increasing their skills and expertise;
- a governance and decision-making process allowing RSCs to efficiently support TSO tasks pursuing system security and social welfare optimisation at the regional or European level;
- the RSCs as natural bodies to coordinate additional services as needed;
- a geographical modularity focused on efficiency gains to account for regional specificities.

The role of policy regions would be to build the convergence of policies and regulations and to coordinate necessary decisions at the national and regional levels to allow and facilitate the improvements of the regional cooperation of TSOs.

EVOLUTION OF REGIONAL COORDINATION FROM 2016 OVER 2021/2022 AND BEYOND



Source: FTI-CL report for ENTSO-E

↑ *South-East Europe regional conference in Thessaloniki, November 2016.*

REGIONALLY COORDINATED SYSTEM OPERATIONS

In addition to the coordination services rendered by RSCs, ENTSO-E publishes studies and develops tools to support TSO coordination at the European and regional levels. In 2016, notable projects included the development of new operational procedures for a more secure system. In the last decade, the penetration of distributed energy sources has increased significantly. In the case of high frequency deviations, there is a risk of uncoordinated disconnection of a high amount of distributed generation. To avoid serious system disturbances, ENTSO-E developed an extraordinary procedure for frequency monitoring and countermeasures in the case of large steady-state frequency deviations. This coordinated procedure between TSOs is intended as a guideline for real-time operators in control rooms and will further guarantee the safety of the grid by:

- sharing information concerning frequency deviations, which otherwise could potentially initiate cascading events on the interconnected grid (load shedding, generation disconnection, separate network, etc.);
- reducing significant frequency deviations with predefined/prepared remedial actions proposed and implemented by TSOs.

Other projects in 2016 include the publication of a report on frequency stability evaluation criteria for the synchronous zone of Continental Europe, analysing the effect of reduced system inertia caused by an increased amount of non-synchronous generation.

REGIONAL AGENDA: ENTSO-E'S REGIONAL CONFERENCES 2016

How do we best discuss the specific issues faced by each region? In 2016, ENTSO-E went to meet regional actors on the ground. To promote regional cooperation and complete its European outreach, ENTSO-E organised three regional conferences, in the Baltics, in the Central-East European region, and in South-East Europe.

The conferences took stock of the progress that has already been achieved across the different regions on regional cooperation, market integration challenges, network code implementation, infrastructure development, and operational planning. They provided a discussion forum by bringing together EU institution representatives closer to the regional context, by reaching out to national governments, stakeholders, and regulators in the respective regions, by connecting the European dimension with the regional and the national ones. All three conferences were organised in cooperation between ENTSO-E and the members of the respective regions and in partnership with the Florence School of Regulation, targeting current issues specific to each region.

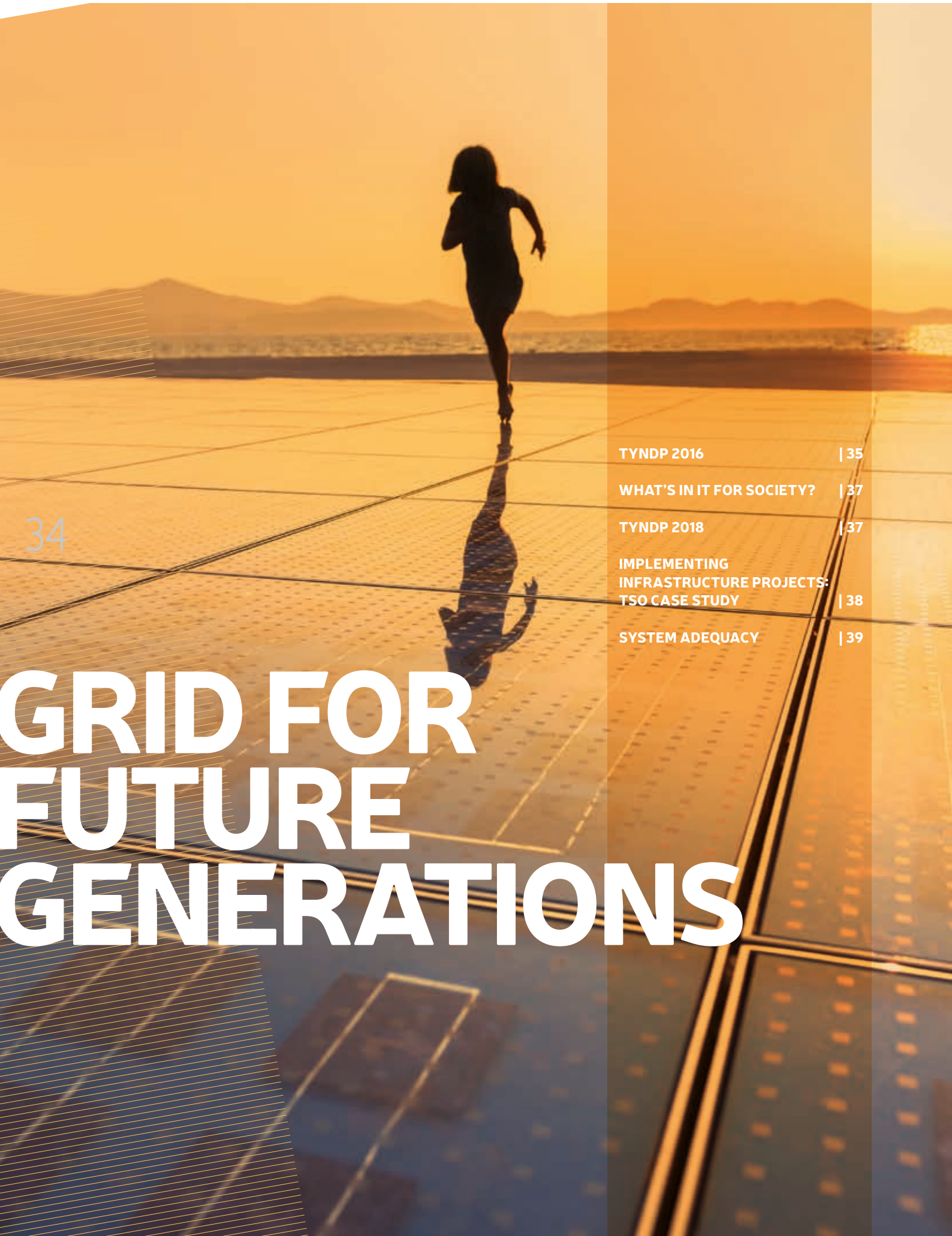
The Baltic regional conference (1st–2nd June, Vilnius) welcomed more than 270 attendees from the three Baltic states and from the Nordics.

The CEE regional conference (22nd–23rd September, Bratislava) welcomed over 150 participants from CEE and its neighbourhood. The conference clarified the progress of market integration between Central-East and Central-West Europe, the developments of the CWE-CEE market coupling, the bidding zone study, regional system adequacy, and infrastructure needs considering the security of the supply and loop flow-related challenges, the RSCs and the need to strengthen TSO-DSO cooperation in the region.

The SEE regional conference (2nd–3rd November, Thessaloniki) welcomed about 200 participants from over 20 countries and focused on the steps needed to overcome market fragmentation in SEE, on exploiting opportunities to foster liquid cross-border markets through strengthened regional cooperation and synergies with solutions and models, such as the well-established CESEC Initiative, as well as on the need to cooperate further with the Energy Community to support the Western Balkan 6 initiative.

Next to each conference, ENTSO-E teamed up with the Florence School of Regulation to offer executive training, targeting senior-level representatives from TSOs, NRAs, and ministries to address the specific needs and market challenges of each region.

Despite the very complex and diverse contexts at the national level and within regions, regions will allow us to move faster and to test and spread innovative solutions towards achieving the common objective of a single energy market. ENTSO-E plans to continue with this regional approach and outreach in the coming years through similar regional events in other parts of Europe.



GRID FOR FUTURE GENERATIONS

What grid do we need to achieve Europe's climate objectives by 2030? In 2016, ENTSO-E released a new version of the pan-European long-term grid plan, the 10-year network development plan, or TYNDP.

TYNDP 2016

Updated every two years, the TYNDP analyses possible ways the next decades will unfold in terms of economic progress, technological developments, and electricity generation and demand. It shows what they could imply for future electricity network needs. The TYNDP 2016 explores four scenarios, including the possibility of a power system where 80% of the emissions will be cut by 2030.

The TYNDP also assesses all future projects for cross-border electricity transmission infrastructure in Europe, as well as large-scale electricity storage projects. It does so through a cost benefit analysis (CBA) methodology recognised by the European Commission. The TYNDP 2016 foresees around 150 billion euros of investments in grid infrastructure supporting 200 projects in transmission and storage.

The TYNDP builds on complex market and network data analysis, involving experts from the entire European electricity sector as well as consumers and environmental organisations. An international benchmark showed that the TYNDP stands unique world-wide in terms of the number of TSOs collaborating, total number of customers served, methodologies to tackle long-term challenges, and transparency of the data and process.

WHERE WE NEED TO BE HEADING: KEY FINDINGS OF THE TYNDP 2016

The TYNDP 2016 identifies 10 main boundaries, which are many main barriers to power exchanges in Europe. They obey a globally radial pattern; tensions on the grid occur between regions of Europe where potential for renewable energy sources is high (hydro and wind in Scandinavia; wind in Scotland, Ireland, Spain, and Italy; solar in Mediterranean countries) and densely populated, power consuming areas in between. These barriers appear mostly where geography has set natural barriers, such as seas and mountain ranges, which are more difficult to cross.

The TYNDP project proposals address these 10 boundaries and barriers as well as many more regional ones. Interconnection capacities should double by 2030 in Europe, on average (though discrepancies are high between the different countries and scenarios).

The TYNDP therefore provides a resilient picture of reinforcements on transmission grids, mostly confirming the TYNDP 2014 project portfolio in 2016 and introducing new projects responding to system needs identified in the previous TYNDP. The list of projects and in-depth analysis of system needs were published (in 2015) in six Regional Investment Plans covering all of Europe, while the final project assessment and TYNDP reports were published in December 2016.

To come to the TYNDP conclusions, thousands of market situations were simulated and processed for every scenario. Practically all hazards that may affect the power system were considered, including frequent situations or rare ones resulting in particularly extreme flow patterns, such as peak loads in winter or summer, with extreme low or high wind/solar generation. A complete grid modelling also enabled an accurate appraisal of every physical bottleneck, allowing the most appropriate solution to be designated (upgrade of existing lines or new infrastructure need).

TRANSPARENCY OF TYNDP DATA

ENTSO-E makes the following available to all on the TYNDP page of its website:

- data used to prepare the TYNDP – grid and market modelling datasets;
- full set of intermediary results – output of market modelling tools (hourly series for cross-border exchanges and marginal costs and yearly overview of production types per country);
- all project data including TYNDP CBA results in user-friendly Excel format, allowing further analysis of the TYNDP results.

PROJECTS OF COMMON INTEREST (PCI) SUBMISSION PLATFORM

ENTSO-E has provided an online platform for the European Commission to allow the submission of TYNDP projects for consideration as PCIs in the third list of PCIs. The platform was launched on 21 December, with the submission period running until 22 January 2017.

REVIEWED COST-BENEFIT ANALYSIS METHODOLOGY

A CBA is realised to evaluate the benefits and costs of TYNDP projects from a pan-European perspective. The feedback received from stakeholders and ENTSO-E's experience with the CBA methodology 1.0 (used for the TYNDP 2014 and 2016), showed a need for improvement. In 2016, ENTSO-E has drafted and put to public consultation a new methodology. After discussion with ACER and the European Commission, the proposed CBA 2.0 was submitted to ACER in December. The new methodology will be used to assess projects starting with the TYNDP 2018.

↑ *Attendees of ENTSO-E's annual conference 2016 believe better communication is needed on the benefits of infrastructure development.*

TYNDP PROJECTS WOULD PREVENT WASTING THE EQUIVALENT ANNUAL GENERATION OF UP TO 10 NUCLEAR PLANTS IN RENEWABLE ENERGY.

THE TYNDP 2016 COMPILES

€150

BILLION IN INVESTMENTS OF PAN-EUROPEAN SIGNIFICANCE

THE PROJECT PORTFOLIO DIRECTLY CONTRIBUTES TO UP TO

8%

OF THE CO_2 DECREASE BY 2030

WHAT'S IN IT FOR SOCIETY?

The TYNDP 2016 compiles €150 billion in investments of pan-European significance, of which €80 billion are for projects already endorsed in national plans and/or intergovernmental agreements by 2030. This effort is significant. Still, it only represents about 2% of the bulk power prices or less than 1% of the total electricity bill.

Furthermore, this investment scheme has a significant positive effect on European social welfare. The ensuing progress in market integration will reduce bulk power prices by 1.5 to 5€/MWh (depending on fuel and carbon dioxide (CO_2) cost assumptions per scenario).

The project portfolio has **a positive environmental impact**. The grid has an indirect but important positive effect on CO_2 emissions, as it is a prerequisite to the implementation of clean generation technologies. By either directly connecting renewable energy sources, avoiding spillage (TYNDP projects would prevent wasting the equivalent annual generation of up to 10 nuclear plants in renewable energy) or enabling more-climate-friendly units to run, the project portfolio directly contributes to up to 8% of the CO_2 decrease by 2030 and indirectly drives decarbonisation by facilitating connection of renewables in an integrated European market.

TYNDP 2018

For the first time, ENTSO-E initiated the next TYNDP process almost three years before its release in early 2016. The TYNDP continuously evolves to meet stakeholders' rising expectations. For example, the TYNDP 2018 must answer the still-open questions about power system operation and profitability issues that are today answered in an overly simplified manner; market modelling will also evolve consistently with rising concerns about the security of the supply or the increasing demand-side response.

The focus was on the development of an entirely new set of scenarios for 2030 and 2040, co-constructed with stakeholders, and common to the gas and electricity TYNDPs 2018 (the gas TYNDP is developed by ENTSOG). Through several collaborative workshops, consultations with stakeholders, national regulators, and EU member states in 2016, ENTSO-E and ENTSOG have started drafting three new scenario storylines, which will form the basis of the next TYNDP analysis. The Scenario Report will be published in June 2017.

IMPLEMENTING INFRASTRUCTURE PROJECTS: TSO CASE STUDY

TENNET, TRANSNETBW/GERMANY –

Breaking the Mould Before Breaking Ground: SuedLink's Early Public Participation

SuedLink – a power line project that will connect the north with the south of Germany – plays a decisive role in realising the expansion of Germany's electricity grid for the 'Energiewende' – Germany's energy transition. Resulting from a legal amendment in late 2015 for HVDC projects, such as SuedLink, HVDC power lines are now required to be implemented as underground cables.

When presenting possible route options for underground cable corridors, project developers TenneT and TransnetBW have, as a rule, worked to involve the public at an early stage – even prior to the start of the federal planning procedure. Since late September 2016, in support of early participation, proposals for SuedLink cable corridors have been presented to local authorities, rural districts, and municipalities as well as to the public at locally held public events ('Info Forums'). To date, TenneT and TransnetBW have visited 41 rural districts in six federal states and held 36 Info Forums with about 5,000 visitors in attendance.

TenneT and TransnetBW have worked together with key stakeholders during the preparation of this communication phase, including mayors and those from rural districts and citizens' initiatives. Together with these stakeholder groups, project developers have discussed how the planning should be communicated and how public participation should be implemented. Such cooperation has a positive effect, as it defuses matters of potential conflict. For instance, in the case of Germany's rural districts, which are one of the most important stakeholder groups, some of the district administrators cooperated when organising public events, partially taking over invitations and participating actively during the events.

One of the key goals of enabling early participation was to activate regional knowledge to assist project developers in determining potential route options for the underground cable corridors. Within the eight weeks of participation, from September to November 2016, all interested parties were invited to submit suggestions for optimising the corridor proposals. An online platform based on a geographical information system ('WebGIS') was installed in which comments could be pinpointed directly on a map. In addition to allowing full transparency of the planning input and decisions, the WebGIS platform also acted as a participation platform by logging and displaying user comments and suggestions. The WebGIS platform was also a popular tool at the Info Forums, where attendees used it to incorporate their comments directly. In total, around 6,600 comments were inputted, and the maps available on the platform were accessed approximately 900,000 times. The feedback is now being evaluated by ARGE SuedLink – the working group of consulting engineers. The comments and suggestions that could potentially reduce the effect on humans and nature are being included in the route planning and into the application to commence the federal planning procedure.

Rarely has there ever been such early and comprehensive public participation in a power grid or comparable infrastructure project. Even sceptical stakeholders have praised the information policy, as echoed in media headlines such as: 'You can't get more transparency than that'. TenneT and TransnetBW have thus set standards by which they will be – and will be pleased to be – judged during the next project phases.

SYSTEM ADEQUACY

System adequacy is the possibility for a power system to meet demand at all times and thus guarantee the security of the supply. The ENTSO-E system adequacy forecasts not only present the views of the TSOs on risks to the security of the supply but also the countermeasures they plan, either individually or in cooperation. They also give input regarding the establishment of countermeasures by relevant stakeholders (e.g., EU member state authorities, policy makers, regulatory agencies, and energy producers) to ensure the desired adequacy levels.

ENTSO-E analyses in its forecasts the effect on system adequacy of climate conditions, planned outages, evolution of demand, demand management, evolution of generation capacities, and system stability issues.

The geographical perimeter of the adequacy analyses comprises the whole ENTSO-E area, which covers 35 countries including Turkey[2]. The reports also cover Kosovo[3], Albania, Malta, and the Burshtyn Island in Ukraine, as they are synchronously connected with the electrical system of continental Europe.

These analyses are performed at different time horizons from 10 years to six months ahead. ENTSO-E publishes an annual mid-term adequacy forecast (MAF) that examines system adequacy for the next 10 years.

Additionally, ENTSO-E issues its Summer Outlook every year before 1 June and its Winter Outlook before 1 December.

The MAF 2016 presented the first pan-European probabilistic assessment of adequacy. While market-based probabilistic modelling approaches have already been adopted in some national generation adequacy studies and in the Pentalateral Energy Forum's regional adequacy assessment, this is the first time such studies have been conducted at the pan-European level. This represents a significant analytical achievement.

SEASONAL OUTLOOKS

The Seasonal Outlooks raise awareness and incentivise stakeholders to review, for instance, the maintenance schedules of power plants, the postponement in decommissioning, and other risk preparedness actions. Each outlook is accompanied by a review of what happened during the previous season. This is used as lessons learnt for a continuous improvement of the methodology.

THE MAF 2016 PRESENTS THE FIRST PAN-EUROPEAN PROBABILISTIC ASSESSMENT OF ADEQUACY.

2. TEIAS, the Turkish transmission system operator is an ENTSO-E Observer member.
3. The designation Kosovo is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.

RESEARCH & INNOVATION: WHAT DOES THE FUTURE HOLD?

40

↑ *Innovative projects in electricity networks gather at the InnoGrid2020+ conference, June 2016.*

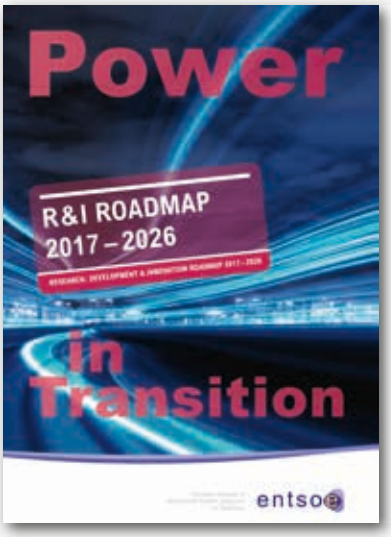
Research and innovation (R&I) is the enabler for moving the energy transition forward. Sound research, development, and innovation policies must bring new technologies to a point at which markets will decide on their uptake. Grid operators are the integrators of technologies and solutions, as such they are at the core of the transformative change of the power system. The TSOs should be prepared to face game-changing environments, such as new actors entering the electricity market (e.g., storage, ICT, prosumers, and active customers).

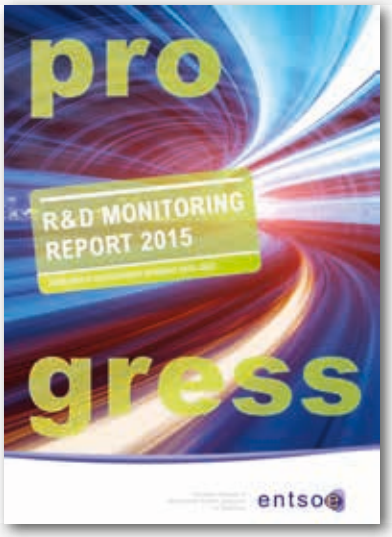
ENTSO-E supports and coordinates TSOs' innovation activities, so that the transmission network is up to facing societal challenges. We publish roadmaps looking ahead at the R&I needed for the future and monitor their implementation and the real-life application of R&D results.

RESEARCH AND INNOVATION ROADMAP 2017–2026

In June 2016, ENTSO-E released its R&I Roadmap 2017–2026, a legally mandated deliverable providing the medium- and long-term vision for R&I activities coordinated by ENTSO-E and performed by TSOs. Owing to fast technological and policy changes, a midway update/revision of the previous roadmap (spanning the decade 2013–2022) was needed.

The roadmap separates R&I activities in five interdependent clusters, addressing Power System Modernisation, Security and System Stability, Power System Flexibility, Power System Economics & Efficiency, and ICT & Digitalisation of Power System.





KEEPING TRACK: ENTSO-E'S R&D MONITORING REPORT 2015

ENTSO-E's R&I Monitoring Report keeps track of the progress achieved towards the objectives set in the R&I Roadmap. The Monitoring Report 2015 looked at 71 R&D projects, both European and national, and found that the completion of the R&D objectives set by the R&D Roadmap 2013–2022 had considerably progressed from an estimated 11% of completion in 2013 to 38% in 2016 (see graph). The results were used to perform a gap analysis to better inform the preparation of the R&D Roadmap 2017–2026.

DISSEMINATING R&D RESULTS: INNOGRID2020+

Every year, ENTSO-E organises the InnoGrid2020+ conference, jointly with EDSO for Smart Grids. The conference provides a platform to allow R&D projects led by DSOs and TSOs to showcase the results of their research, interact with policymakers and stakeholders, and share best practices. The fifth edition in 2016 focused on 'digital energy' and TSO-DSO synergies, and it showcased 25 R&D projects to over 300 attendees.

COMING UP NEXT

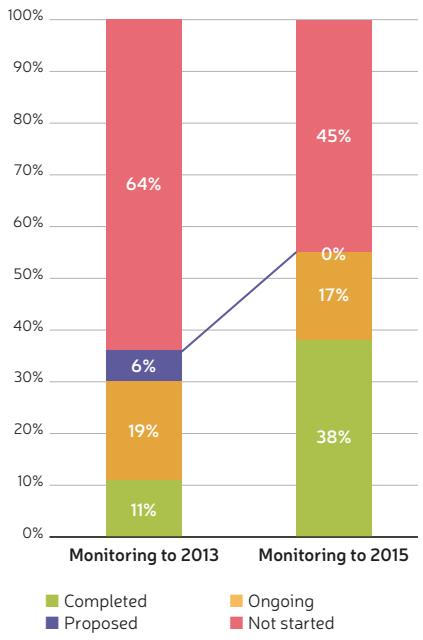
By mid 2017, ENTSO-E will release an R&I application report, looking at 19 European Commission-funded projects now finalised, assessed from the perspective of the application of the R&I results in the daily TSO business. The Implementation Plan 2017–2019 will focus on more flexibility means for TSOs, more digitalisation, use of data hubs and data exchanges, modernisation of the power system, and market design related issues.

CREATION OF THE ETIP FOR SMART NETWORKS FOR THE ENERGY TRANSITION

Launched in June 2016, the European Technology and Innovation Platform (ETIP) for Smart Networks for the Energy Transition (SNET) gathers actors from electricity, storage, ICT, heating, transport, and gas and EU member states, academia, research institutes, and the European Commission. It supports the new integrated Strategic Energy Technology Plan.

The mission of the ETIP SNET is to set out a vision for research and innovation towards smart networks, storage, and integrated systems and to engage stakeholders in this vision. It will also identify innovation barriers, notably related to regulation and financing. It is chaired by ENTSO-E's former Secretary-General Konstantin Staschus.

PROGRESS OF THE R&D ROADMAP 2013-2022, COMPARED TO 2013



The year 2016 saw the start of four TSO-driven R&D projects:

FutureFlow:
proposes R&I activities to validate that consumers and distributed generators, which fulfil technical preconditions, can be put in a position to provide balancing and redispatching services in addition to conventional units, within an attractive business environment.

Promotion:
will develop and demonstrate three missing key HVDC technologies, a regulatory and financial framework, and an offshore grid deployment plan for 2020 and beyond.

Migrate:
will provide requirements for future measures, methods, and tools for secure operation of the upcoming converter-dominated power system.

SmartNet:
aims at proposing architectures for optimised interaction between TSOs and DSOs in managing the exchange of information for the monitoring and acquisition of ancillary services (reserve and balancing, voltage regulation, and congestion management).

TSOS HAVE A KEY ROLE IN INNOVATION AS SYSTEM INTEGRATORS OF DIFFERENT COMPONENTS, E.G., ICT, STORAGE AND POWER ELECTRONICS.

APPENDICES

ENTSO-E MEMBER TSOs

COUNTRY	COMPANY	ABBREVIATION
AL Albania	OST a.s. *(member since March 2017)*	OST
AT Austria	Austrian Power Grid AG Vorarlberger Übertragungsnetz GmbH	APG VUEN
BA Bosnia and Herzegovina	Nezavisni operator sustava u Bosni i Hercegovini	NOS BiH
BE Belgium	Elia System Operator SA	Elia
BG Bulgaria	Electroenergien Sistemen Operator EAD	ESO
CH Switzerland	Swissgrid ag	Swissgrid
CY Cyprus	Cyprus Transmission System Operator	Cyprus TSO
CZ Czech Republic	ČEPS a.s.	ČEPS
DE Germany	TransnetBW GmbH TenneT TSO GmbH Amprion GmbH 50Hertz Transmission GmbH	TransnetBW TenneT DE Amprion 50Hertz
DK Denmark	Energinet.dk	Energinet.dk
EE Estonia	Elering AS	Elering AS
ES Spain	Red Eléctrica de España S.A.	REE
FI Finland	Fingrid Oyj	Fingrid
FR France	Réseau de Transport d'Electricité	RTE
GB United Kingdom	National Grid Electricity Transmission plc System Operator for Northern Ireland Ltd Scottish Hydro Electric Transmission plc Scottish Power Transmission plc	National Grid SONI SHE Transmission SPTransmission
GR Greece	Independent Power Transmission Operator S.A.	IPTO
HR Croatia	Croatian Transmission System Operator Ltd	HOPS
HU Hungary	MAVIR - Magyar Villamosenergia-ipari Átviteli Rendszerirányító Zártkörűen Működő Részvénytársaság	MAVIR ZRt.

COUNTRY	COMPANY	ABBREVIATION
IE Ireland	EirGrid plc	EirGrid
IS Iceland	Landsnet hf	Landsnet
IT Italy	Terna - Rete Elettrica Nazionale SpA	Terna
LT Lithuania	Litgrid AB	Litgrid
LU Luxembourg	Creos Luxembourg S.A.	Creos Luxembourg
LV Latvia	AS Augstsprieguma tĪkls	Augstsprieguma tĪkls
ME Montenegro	Crnogorski elektroprenosni sistem AD	Crnogorski elektroprenosni sistem
MK FYR of Macedonia	Macedonian Transmission System Operator AD	MEPSO
NL Netherlands	TenneT TSO B.V.	TenneT NL
NO Norway	Statnett SF	Statnett
PL Poland	Polskie Sieci Elektroenergetyczne S.A.	PSE
PT Portugal	Rede Eléctrica Nacional, S.A.	REN
RO Romania	C.N. Transelectrica S.A.	Transelectrica
RS Serbia	Akcionarsko društvo Elektromreža Srbije Beograd	EMS AD Beograd
SE Sweden	Svenska Kraftnät	Svenska kraftnät
SI Slovenia	ELES, Ltd., Electricity Transmission System Operator	ELES
SK Slovak Republic	Slovenská elektrizačná prenosová sústava, a.s.	SEPS

OBSERVER MEMBER

COUNTRY	COMPANY	ABBREVIATION
TR Turkey	TEIAŞ	TEIAŞ

ENTSO-E'S WORK PROGRAM STATUS | 2015-2016*

DELIVERABLE	GOAL	STATUS - END 2015
NETWORK CODES DEVELOPMENT AND IMPLEMENTATION		
Network Code on Requirements for Generators (NC RfG)	Draft and implement binding EU legislation for generation connection to underpin system development fit for the future.	Approved in comitology in June 2015.
Network Code on DSO and Industrial Load Connection (NC DCC)	Draft and implement binding EU legislation for demand connection to underpin system development fit for the future.	Approved in comitology in October 2015.
Network Code on HVDC Connections (NC HVDC)	Draft and implement binding EU legislation for HVDC connections to underpin system development fit for the future.	Approved in comitology in September 2015.
Network Code on Capacity Allocation and Congestion Management (NC CACM)	Prepare the implementation of CACM guideline, allocating capacity in the day-ahead and intra-day timeframe, calculating the levels of available cross border capacity, and allocating and recovering costs.	Entry into force in August 2015. Implementation: Proposal on capacity calculation regions published in October 2015. Ongoing work on the bidding zone study, alternative BZ configurations proposed. Ongoing work on draft methodology for congestion income distribution. CGM methodology and Generator and Load Data provision methodology drafted in 2015, publication of drafts for consultation foreseen Q1 2016.

** status on 31/12/2016*

	DELIVERABLE & AWP 2016 COMPLETION (QUARTER/YEAR)*	INTERNAL & EXTERNAL CONSULTATION IN 2016	STATUS - END 2016: COMMENTS/EXPLANATIONS
	Publication of the implementation guidance document (at the latest 6 months after entry into force). Development over 2015 and early 2016 of the Active Library, to support the implementation of the 3 connection codes by EU Member States.	Public consultation on priority issues for connection codes implementation guidance in Dec 2015 - Jan 2016. A public workshop on the implementation of connection codes in South-East Europe was held on 25 February in Vienna, with the Energy Community. Public consultation on the draft implementation guidance documents, from RfG perspective only, in July-August 2016. Workshop with stakeholders on 13 September. Public consultation on the draft implementation guidance documents from the DC and HVDC perspective in Dec 2016 - Jan 2017.	The regulation establishing the RfG code entered into force in May 2016. Publication of 18 RfG implementation guidance documents in November 2016. The regulation establishing the DC code entered into force in September 2016. The regulation establishig the HVDC code entered into force in September 2016. Work ongoing on the DC and HVDC implementation guidance document, for publication by March 2017. An online library dedicated to collecting all three connection codes implementation documents at national level has been launched in 2016 and will be populated as documents become available.
	Development over 2015 and early 2016 of the Active Library, to support the implementation of the 3 connection codes by EU Member States. Depending on date of entry into force, publication of implementation guidance document.		
	Development over 2015 and early 2016 of the Active Library, to support the implementation of the 3 connection codes by EU Member States. Depending on date of entry into force, publication of implementation guidance document.		
	Monitoring report.		CACM monitoring plan was submitted to ACER on 12 Feb 2016. Following ACER opinion received in June, first monitoring report submitted to ACER in August 2016.
	Generation and load data provision methodology, May 2016.	(see Common Grid Model below)	(see Common Grid Model below)
	CGM methodology, May 2016.		
	Start work on the Intraday capacity pricing.		Work ongoing. Completion expected August 2017.
	Congestion income distribution arrangements, July 2016.		All TSOs' proposal for a Congestion Income Distribution Methodology was submitted to national regulatory authorities and to ACER on 12 Aug 2016.
	Day ahead firmness deadline, Nov 2016.	A public consultation was held from 18 Apr to 18 May 2016. Webinar with stakeholders on 9 May 2016.	All TSOs' proposal for the day-ahead firmness deadline was submitted to all NRAs on 14 Dec 2016.
	Intraday cross zonal gate opening and closure time, Nov 2016.	A public consultation was held from 18 Apr to 18 May 2016. Webinar with stakeholders on 9 May 2016.	All TSOs' proposal for intraday cross-zonal gate opening and gate closure times was submitted to all NRAs on 14 Dec 2016.
	Methodology scheduled exchanges.	Two public consultations run from 4 Oct to 6 Nov. Workshop with stakeholders on 26 Oct.	All relevant TSOs submitted to NRAs for approval the proposals for calculating scheduled exchanges resulting from single day-ahead and intraday coupling on 14 Dec 2016.

DELIVERABLE	GOAL	STATUS - END 2015
Network Code on Forward Markets (NC FCA)	Deliver to ACER draft binding EU legislation for forward market integration.	Approved in comitology in October 2015. Early implementation: Final version of the harmonised allocation rules (HAR) submitted and approved by national authorities (Q3). Ongoing update of the HAR based on final version of FCA Regulation.
Network Code on Balancing (NC EB)	Deliver to ACER draft binding EU legislation for market integration and system security, especially the cross border exchange of reserves and balancing energy.	ACER recommendation published Q3 2015, comitology expected to begin in 2016. Early implementation: General CBA methodology and specific CBA methodology on the imbalance settlement period finalised. Proposal for Imbalance Netting Coordinated Balancing Area. Study on the automatic Frequency Restoration Reserves process conducted. Proposal for a list of activation purposes developed Ongoing coordination of cross border pilot projects Ongoing preparation of document defining the rules and procedures for the future financial settlement of inadvertent interchange.
System Operations Guideline (SO GL)		Operational codes merged into a single operational guideline in Q3 2015. Implementation: Work on Implementation guidelines started in Q4 2015. Ongoing work on proposal on how to aggregate data from generators (see SO-System frequency). Draft Operational Planning Data Environment specifications are expected to be finalised early 2016.
Network Code on Emergency & Restoration (NC ER)	Binding EU legislation on procedures and remedial actions to be applied in the Emergency, Blackout and Restoration states.	ACER recommendation published in June 2015, comitology expected to begin in 2016.

	DELIVERABLE & AWP 2016 COMPLETION (QUARTER/YEAR)*	INTERNAL & EXTERNAL CONSULTATION IN 2016	STATUS - END 2016: COMMENTS/EXPLANATIONS
	Common set of requirements for price coupling & continuous matching.		All TSOs provided all NEMOs with a proposal for a common set of requirements for efficient capacity allocation.
	Bidding zones review.		Work ongoing, to continue in 2017.
	Communication of list of information to ACER, Jan 2016.		Discussions with ACER during 2016 on the request for data and agreeing on counter-proposals.
			The regulation establishing the FCA Guideline entered into force in October 2016.
	Functional requirements for establishment of the single allocation platform - Dec 2016.		Work ongoing, proposal expected to be delivered in April 2017.
	Development of the HAR for long-term transmission rights - Nov 2016.	Public consultation on the HAR was held in April-May 2016. Public webinar on 6 May.	As part of the early implementation process, all TSOs' approved the HAR main body and explanatory document in June 2016. Submission by TSOs to their respective national regulatory authority in July 2016. In terms of official implementation, the proposal was put to public consultation in January 2017 and will be submitted to NRAs in April 2017.
			End of comitology process expected in Q1 2017.
	CBA of imbalance settlement period - Mar 2016.	A webinar took place on 8 Mar and a workshop with stakeholders on 15 Apr.	The draft CBA report was submitted to the European Commission on 29 Apr 2016.
	Proposals for standard aFRR products, pricing methodology, algorithms and optimisation process.		Work ongoing. Study on the impact of merit order activation of aFRR and harmonized full activation time released in Feb 2016.
	Early implementation projects for the European Platforms for Imbalance Netting, aFRR, mFRR and replacement reserves.	A public consultation for the design of the TERRE project (Trans European Replacement Reserves Exchange) ran from 7 Mar 8 Apr 2016. Over 2015 and 2016 ENTSO-E conducted a CBA on a change to the imbalance settlement period, based on a stakeholder survey.	Early implementation has been started in 2016 with project teams on IN, aFRR and mFRR, and implementation projects for IN and RR. Work will be continued.
			On 4 May 2016 EU Member States approved the SO Guideline. Expected entry into force early 2017.
	Key organisational requirements, roles and responsibilities in relation to data exchange.		Work started in 2016, completion expected in 2017/6 months after entry into force of SO GL.
	Methodology for coordinating operational security analysis.		Work started in 2016, completion expected Q4 2017.
	Year-ahead scenarios (yearly task).		Publication expected in July 2017.
	Synchronous area operational agreements.		Working ongoing, completion expected Q4 2017/by 12 months after entry into force of the SO GL.
	CGM implementation - See 'Common Grid Model' below.		
			The NCER was approved in comitology in October 2016. Implementation work has started for the over-frequency control schemes.

DELIVERABLE	GOAL	STATUS - END 2015
Common Grid Model	Allow for the implementation of network codes with TSO coordination.	CGM methodology and the Generator and Load Data provision methodology drafted in 2015, publication of drafts for consultation foreseen Q1 2016. Final drafting of Operational Planning Data Environment specifications expected Q1 2016. Timeline delayed due to intense discussion and investigation regarding the network layer (OPDE/internet/ATOM concept).
RESEARCH, DEVELOPMENT AND INNOVATION ACTIVITIES		
RD&I		R&D Implementation Plan 2016-2018 published in March 2015. R&D Application 2014 report published in March 2015. R&D Monitoring Report 2015 scheduled for publication in Q1 2016.
RD&I dissemination activities	Communicating R&D activities, via the Innogrid 2020+ conference organised jointly with EDSO for Smart Grids.	Innogrid2020+ conference took place on 31 March - 1 April 2015.
Standardisation	Improve interoperability and cooperation with standardisation bodies.	Cooperation with CENELEC on connection network codes.
SYSTEM DEVELOPMENT ACTIVITIES		
TYNDP 2016	Prepare the 2016 TYNDP with common market and network models to derive the trends, needs and future development of the transmission network at pan-European level.	Released Q4 2015: the six regional investment plans, the list of projects to be assessed in the TYNDP 2016 main report, the TYNDP 2016 scenario development report and associated market data.
TYNDP 2018	Prepare the 2018 TYNDP.	n/a
CBA 2.0	Review the methodology used to assess TYNDP project, providing a common and uniform basis with regard to their value for European society.	Work ongoing in 2015.

	DELIVERABLE & AWP 2016 COMPLETION (QUARTER/YEAR)*	INTERNAL & EXTERNAL CONSULTATION IN 2016	STATUS - END 2016: COMMENTS/EXPLANATIONS
	CGM methodology.	A public consultation on the draft methodologies was held from 4 Feb to 4 Mar 2016, and a workshop with stakeholders took place on 18 Feb.	All TSOs' proposals for a Common Grid Model Methodology and a Generation and Load Data Provision Methodology were submitted to national regulatory authorities on 14 June 2016. The GLDP methodology was approved in Jan 2017, the CGM methodology is subject to amendments.
	Generator and Load Data provision methodology.		
	Operational Planning Data Environment (OPDE) and All TSO network for non-real time Operational and Market related data communication network (ATOM).		Work ongoing, OPDE and ATOM are expected to be commissioned in 2017.
	R&D Implementation Plan 2017-2019 - Q1 2016.	A public consultation ran in Feb-March 2017.	The R&I Implementation Plan is foreseen to be published in early 2017.
	R&I Roadmap 2017-2026 - Q4 2016.	A public consultation on the R&I Roadmap 2017-2026 was held from 3 to 24 May 2016.	The R&I Roadmap 2017-2026 was published on 26 June 2016.
	Position paper on regulatory framework on R&D.		
	Monitoring report 2015.		The R&D Monitoring Report 2015 was released on 22 March 2016.
	R&D Application Report 2016.		Work ongoing, planned for publication Q2 2017.
			The 5th edition of the InnoGrid2020+ conference took place on 26-27 June 2016.
	Interoperability test related to the CGMES incl. conformity assessment.	A webinar on the IEC61850 interoperability specification tool took place in May 2016. Joint workshop with CENELEC on the HVDC code. Workshop on standardisation.	The 6th interoperability test related to the CGMES took place from 11 to 15 Juy 2016.
	Interoperability test - IEC 61850.		
	Standardisation cooperation.		
	Assessment of TYNDP 2016 projects (CBA).	A public consultation on the TYNDP 2016 report and the 12 insight reports run from 23 June to 9 Sept 2016.	The final version of the TYNDP 2016 was released in Dec 2016.
	TYNDP drafting.		
	Scoping, project description and scenario development.	A public consultation on the TYNDP 2018 scenarios run from 12 May to 12 June 2016, organised jointly with ENTSOG. A workshop took place on 2 June. A 2nd public consultation run from 20 Sept to 10 October, to collect further feedback on the 3 scenarii considered.	Ongoing.
	Methology development and submission to ACER, European and Member States - Q4 2016.	A public consultation run from 25 April to 31 May 2016.	The proposed CBA 2.0 was submitted to ACER in July, modified and re-submitted in Dec 2016 after discussion with ACER and the European Commission.

DELIVERABLE	GOAL	STATUS - END 2015
System adequacy reports	Deliver the Scenario Outlook & System Adequacy Forecast. Summer Outlook, Winter Review. Winter Outlook, Summer Review.	Summer Outlook 2015 and Winter Review 2014/15 published in May 2015. SO&AF 2015-2030 released in July 2015. Winter Outlook 2015/16 released in December 2015.
Adequacy methodology implementation	Review the system adequacy assessment methodology, to better account for the risks to security of supply and the need for flexibility as the Pan-European power system moves towards higher levels of renewable energy sources.	Test phase for adequacy methodology improvements near completion, for application in next report Q2/2016.
SYSTEM OPERATIONS ACTIVITIES		
Incident classification scale	Requirement under Regulation (EC) 714/2009 where transmission system operators (TSOs) are asked to develop a common incidents classification scale.	ICS Annual report 2014 published in December 2015.
Optimal use of assets		
ENTSO-E awareness system	Increase security of supply.	EAS is in full operational use.
Critical systems protection	Assessing and enhancing the protection of critical infrastructure.	Continuous activity throughout 2015.
Electronic Highway	Implement bandwidth upgrades to meet the increased challenges and coordination needs of the future, including the EAS and RSCIs.	Activity completed to 95%, will be finalised in 2016.
Implementation of new operational procedures	Develop operational procedures to meet regional needs and ensure cross-regional coordination.	
Interoperability of synchronous areas	Promote cooperation between TSOs to ensure reliable operation, optimal management and technical development of the HVDC links between synchronous systems. Study on Increase hourly ramping on HVDC links between Nordic and CE.	Two projects started in 2015: "Frequency coupling" (expected completion end 2016) and "Mutual frequency assistance between synchronous areas" (expected completion mid-2016). Study completed in 2015. A pilot test on one HVDC link planned for early 2016.
System frequency	Develop measures to improve frequency quality. Preparation of a document defining the rules and procedures for the future financial settlement of inadvertent interchange envisaged by the NC EB.	Project ongoing (in 2015 a questionnaire on the onservability of generators sent to TSOs and answers evaluated; in 2016 a process for implementation will be prepared). Ongoing, adoption by ENTSO-E Market Committee foreseen by end 2016.
Compliance monitoring	Assess whether the RGCE member TSOs are compliant with the standards of the RGCE Operations Handbook. Evaluation of compliance for TSO KOSTT.	To be completed early 2016. Completed Q1 2015.

	DELIVERABLE & AWP 2016 COMPLETION (QUARTER/YEAR)*	INTERNAL & EXTERNAL CONSULTATION IN 2016	STATUS - END 2016: COMMENTS/EXPLANATIONS
	Publication of the Summer Outlook 2016 (Q2), Scenario Outlook and Adequacy Forecast 2016 (Q4) and Winter Outlook 2016/17 (Q4 2016).	The draft Mid-Term Adequacy Forecast 2016 (MAF 2016, replacing the SOAF under the new methodology) was submitted to public consultation from 29 Jul to 29 Sept 2016.	The final MAF 2016 was published early 2017. The Winter Outlook report 2016-17 was released on 29 Nov. 2016. The Summer Outlook report 2016 was released on 31 May 2016.
	Implementation of pan-EU target methodology. Harmonised database for market modelling studies. Stable group of TSO market modellers for adequacy.		The new methodology was implemented in the preparation of the MAF 2016.
			The ICS annual report 2015 was published in Dec 2016. The implementation of EDICT is delayed.
	Develop strategies for weather and conductor related operations, probabilistic approaches for system operation, dynamic studies, and smart operation.		Work on Dynamic Line Rating for Overhead Lines, Initial Dynamic Model of Continental Europe and Wide Area Monitoring was completed before start of 2016. GARPUR project on probabilistic approaches for system operation is ongoing until Q3 2017.
	Development of additional information such as operational mix and voltage displays.		
			Continuous activity.
			Electronic Highway is operational, further development is ongoing. A bandwith upgrade was carried on with success rate of 98%, an optimisation activity was carried on for improved operational use and more secure monitoring.
	Ongoing activities, e.g. develop process leading to full TSO observability of all relevant generators; revision and harmonization of the Nordic frequency containment process; development of basic concepts for the coordination of phase-shifting transformers.		An extraordinary procedure for frequency monitoring and countermeasures in case of large steady-state frequency deviations has been developed.
	Develop concepts for the operation of inter- and intra-synchronous areas HVDC links - 2016-2017.		Work started on development of concepts for the operation of inter- and intra-synchronous area HVDC links.
	Adapt the quarterly load frequency control reports with the parameters requested in the network code Load frequency control & reserves (now SO Guideline).		Project ongoing.
	Assess whether ENTSO-E RGCE members TSOs are compliant with the standards of the RGCE Operation Handbook.		Completed, to be approved in Q1 2017.

DELIVERABLE	GOAL	STATUS - END 2015
TSO cooperation/Regional security coordinators	Implementation of the roadmap described in the policy paper for TSO coordination.	Multi-lateral agreement signed by TSOs in December 2015, setting the framework for TSO cooperation via the RSCIs.
MARKET ACTIVITIES		
European day-ahead and intraday market	Develop the European day-ahead and intraday coupling.	
The Central Information Transparency Platform	Implementing the EC Guidelines on Fundamental Data Transparency in an integrated IT system for all of Europe.	Data population grew substantially in the course of the year. Data reporting to ACER (under REMIT) started in October 2015.
Market design 2030 framework and RES integration	Proactively considering issues around market design and the creation and promotion of an effectively competitive market. Propose solutions on RES support and design & implementation and capacity mechanisms. Investigate how the market can promote tools and technologies facilitating large scale integration of RES such as storage and demand side participation, including TSO-DSO interaction, ancillary services.	Policy Paper "Markets and Innovation deliver the Energy Union" Q4 2015. Contribution to ongoing discussion on demand-side response by participation in Smart Grid Task Force EG3, and policy paper 'Market design for Demand-Side Response' Q4 2015.
The challenges of financing infrastructure – investment incentives	To work with the EC and ACER to encourage national regulatory authorities and member states to improve the regulatory certainty for investors in transmission projects to encourage vital investment.	Study commissioned by the EC analysed the financial situation of 14 member states, ENTSO-E part of steering committee. Date of publication tbc.
Inter TSO Compensation (ITC)	Coordination of the ITC settlement process, annual ITC audit process and preparation and delivery of the ITC data for annual monitoring report developed by ACER.	ITC data delivered. Launch of process for inclusion of KOSTT as separatate ITC party to the ITC agreement.
Delivery of the Annual Tariffs Report and Congestion Revenue Management Report	Publication of ENTSO-E Overview of Transmission Tariffs in Europe, providing a comparative overview of transmission tariffs for 32 European countries. Delivery of annual Congestion Revenue Management report to regulators.	Overview of transmission tariffs in Europe published in June 2015. Congestion revenue management report 2014 delivered in July 2015.
Tariffs structure harmonisation	Harmonised transmission tariff structures is one area defined for framework guidelines and network codes in Regulation (EC) No. 714/2009, Article 8(6).	Based on pre-scoping study, ACER concluded on preparatory work to start in 2016.
Electronic Data Interchange (EDI)	Harmonisation and implementation of standardised electronic data interchange.	Preparation of Weather Data Exchange Process began, publication expected in 2016.
TSO-DSO cooperation	Follow up on the EC recommendation to enhance cooperation between DSOs and TSOs.	Signature of a MOU with European DSO associations, publication of joint guidelines November 2015. Second joint paper on data management foreseen for 2016.

	DELIVERABLE & AWP 2016 COMPLETION (QUARTER/YEAR)*	INTERNAL & EXTERNAL CONSULTATION IN 2016	STATUS - END 2016: COMMENTS/EXPLANATIONS
			At end 2016, 5 RSCs have been established and one is in the making.
	Continue the development of day-ahead and intraday projects.		Methodology developed, consulted and submitted in accordance with Article 69 of CACM.
	Enhance download facility (expected Q2 2016); revise the technical documentation; introduce improved governance structure.	Involvement of users via the Transparency User Group.	Addition to the platform of two download possibilities. Review of the manual of procedures to increase data quality, submitted to ACER.
	Continuous work on how the market can promote tools and technologies facilitating large-scale integration of RES.		Contribution to debate on market design via meetings and conferences. Publication of policy paper RES Directive review - ENTSO-E views on RES support schemes in Oct 2016.
	Continuous work with the European Commission and ACER to encourage NRAs and member states to improve the regulatory certainty for investors in transmission projects to encourage vital investments.		EC study results published early 2016. Further discussion / presentation of EE advocacy at EC workshop 4/02/2016 and at infrastructure forum 23-24 June 2016 in Copenhagen. Follow-up in 2017 EE participation in EC Connecting Europe Facilities public consultation and new study launched by EC on financial framework.
			ITC Audit Results and 2016 Perimeter Fee published in Apr 2016. ITC Transit Losses Data Report 2015 published in Sept 2016. KOSTT successfully join the ITC Agreement by 1st January 2016.
			Overview of Transmission Tariffs in Europe (2016 and updated 2015) published in July 2016. Congestion revenue management report 2015 delivered in July 2016 to the EC and ACER.
			Internal ENTSO-E position on tariff structure harmonisation approved by the Board in November 2016.
	Standardisation work on IEC 62325 series; finalisation of Weather Data Exchange Process document; development of data exchanges to support the publication of information related to flow-based market coupling and CGMES-related net positions.		Continous maintenance of EIC code list. Weather Process Energy Prognosis Implementation Guide released in July 2016.
	Publication of joint paper on data management (Q1 2016); work on identified main challenges, network planning and active and reactive power management.		Publication of Data management report jointly with DSOs in Sept 2016. Collaborative work ongoing on active power management.

ENTSO-E GOVERNANCE

ENTSO-E is an international non-profit association (AISBL) established according to Belgian law. The highest body within ENTSO-E is its Assembly, which comprises representatives at CEO level of all the current 41 members. ENTSO-E also has one observer member, which is not represented in the Assembly but is invited to appoint representatives in certain working groups. The Assembly meets four times a year.

The ENTSO-E Board is elected from the overall ENTSO-E membership via the Assembly every two years. The Board comprises 12 representatives. The ENTSO-E President, Vice President, and Committee Chairs are also invited to Board meetings. The Board coordinates the work of ENTSO-E's committees and its Legal & Regulatory Group and implements Assembly decisions. It adopts position papers within the framework of the general ENTSO-E strategy adopted by the Assembly. The Board meets approximately six times a year.

ENTSO-E's four specialised committees comprise representatives from member TSOs. They lead a number of regional groups and working groups. The committees deal, from different angles, with TSO cooperation on a European basis, as well as with overall energy system and energy policy issues.

The ENTSO-E committee structure reflects its contributions to the four main EU energy policy goals:

1. Contributing to the development of a strong and adequate grid

   The System Development Committee coordinates network development at European and regional level and prepares the Ten-Year Network Development Plans, the Regional Investment Plans and adequacy forecasts. It also drafted the connection network codes.

2. Guaranteeing secure and reliable power system operations

   The System Operations Committee is in charge of technical and operational standards, including operational network codes, as well as of power system quality. It ensures compliance monitoring and develops tools for data exchange, network models and forecasts.

3. Promoting a fully developed internal electricity market

   The Market Committee works towards an integrated and seamless European electricity market and is in charge of methods for cross-border congestion management, integration of balancing markets, ancillary services, and the inter-TSO compensation mechanism, including market network codes.

4. Ensuring the ambitious use of innovation

The Research, Development and Innovation Committee ensures the effective implementation of ENTSO-E's mandate in the area of innovation and R&D, largely focusing on strong and smart grids and the empowerment of customers and consumers.

At the same level as the four committees, the Legal & Regulatory Group advises all bodies across ENTSO-E on legal and regulatory issues. In addition, expert groups provide specific expertise and work products.

ENTSO-E SECRETARIAT

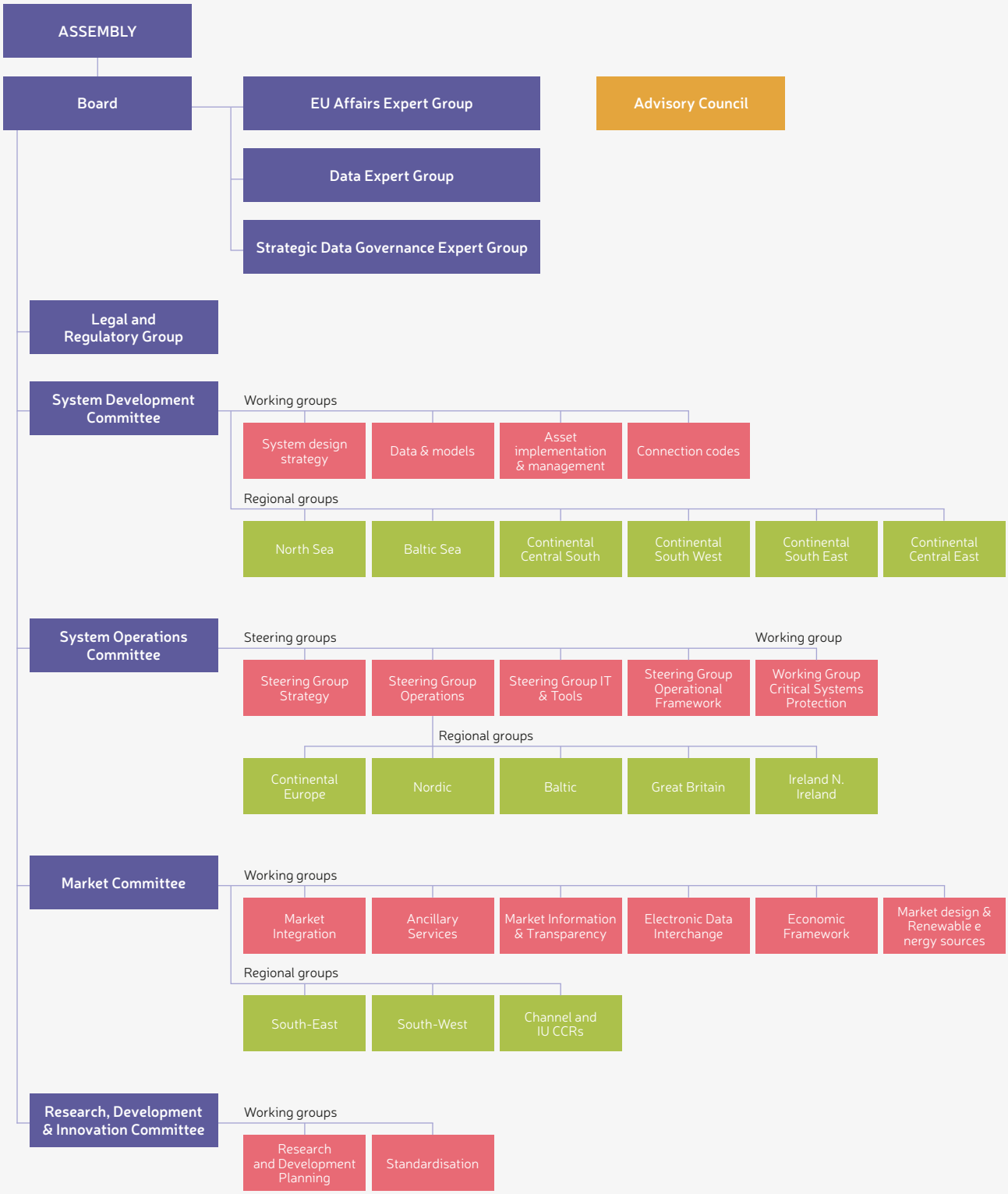
The ENTSO-E Secretariat is based in Brussels and employs 70 permanent staff. It is headed by the Secretary-General and represents ENTSO-E with the European institutions, regulators and stakeholders.

Together with the Board, Assembly, Committees and the LRG, the Secretariat develops ENTSO-E deliverables. Through its support for the various bodies and groups, it ensures the smooth and effective management of the association's work. An important task is to ensure that ENTSO-E work products reflect European policy directions and stakeholder concerns, which the Secretariat is well placed to understand based on its Brussels location and communications expertise.

As the organisation chart on page 62 shows, the Secretariat's structure mirrors the ENTSO-E Committee structure, with thematic and horizontal sections. Each section is headed by a manager, supported by advisors and coordinators.

The overall ENTSO-E annual budget is detailed on page 60. ENTSO-E member TSOs contribute to the budget according to the number of countries and population served.

ENTSO-E STRUCTURE



FINANCIAL STATEMENT

PRO FORMAT PROFIT & LOSS OVERVIEW (NON AUDITED SUBJECT TO CHANGES)
December, 2016

ALL AMOUNTS EXPRESSED IN KEUR	YTD ACTUAL 2016 A	YTD BUDGET 2016 B	A - B
REVENUES			
Member fees	18.048	18.200	-152
Other incomes	-17	93	-111
Total revenues	18.030	18.293	-263
EXPENSES			
Communication	-557	-558	1
Project & research*	-2.473	-4.471	1.998
Sub-total communications & project	*-3.031*	*-5.029*	*1.998*
Remunerations	-6.944	-7.011	67
Other staff costs	-862	-906	44
Administration & legal fees	-254	-181	-73
Travel & accommodation	-130	-95	-34
Renting & building charges	-889	-959	70
IT	-3.760	-3.328	-433
Depreciations	-395	-655	260
Sub-total staff & infrastructure	*-13.234*	*-13.135*	*-99*
Assembly & Board	-53	-27	-26
Committee	-103	-78	-24
Group	-365	-368	3
Sub-total meetings	*-543*	*-473*	*-70*
Total expenses	-16.808	-18.637	1.830
Financial & other results	-8	16	-24
NET RESULT	**1.214**	**-328**	**1.542**

ENTSO-E BOARD*

Chair

Bente Hagem
Statnett SF, Norway

Vice-Chair

Ben Voorhorst
TenneT TSO B.V., The Netherlands

Member

Zbynek Boldis
ČEPS, Czech Republic

Member

Kamilla Csomai
MAVIR, Hungary

Member

Matt Golding
National Grid, UK

Member

Thomas Karall
APG, Austria

Member

Klaus Kleinekorte
Amprion, Germany

Member

Santiago Marin
Red Eléctrica de España, Spain

Member

Jukka Ruusunen
Fingrid, Finland

Member

Tomasz Sikorski
PSE, Poland

Member

Thomas Tillwicks
Swissgrid, Switzerland

Member

Jean Verseille
RTE, France

ENTSO-E OFFICE HOLDERS*

President

Peder Andreasen
Energinet.dk, Denmark

Vice-President

Matteo del Fante
Terna, Italy

Chair System Development Committee

Sébastien Lepy
RTE, France

Chair System Operations Committee

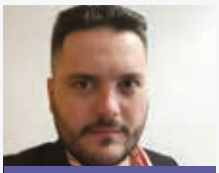
Joachim Vanzetta
Amprion, Germany

Chair Market Committee

Pascale Fonck
Elia, Belgium

Chair Research, Development and Innovation Committee

Carlo Sabelli
Terna, Italy



Chair Legal & Regulatory Group

Milan Roman
SEPS, Slovakia

ENTSO-E ADVISORY COUNCIL

Chair

Juan Alba Rios	EURELECTRIC
Jean-Yves Blanc	SEDC
Christian Buchel	EDSO for Smart Grids
Peter Claes	IFIEC
Paul Giesbertz	EFET
Stew Horne	BEUC
Alfredo Parres	ABB
Wendel Trio	Can Europe

** until 28 June 2017*

ENTSO-E SECRETARIAT

Secretary General
Laurent Schmitt

Executive Assistant
Kamila Pujan

Corporate Affairs & Secretary-General Office Coordinator
Sylvie Numuhire

Manager System Development
Robert Schroeder

System Development Advisor
Simone Biondi (sec.)

System Development Project Management Advisor
Omar Picone Chiodo

Senior Advisor R&D Team Lead
Norela Constantinescu

System Development Advisor
Dario Consolatto Frazzetta

Senior Advisor Adequacy Team Lead
Alban Joyeau

System Development Co-ordinator
Thanh-Thanh Le Thi

System Planning Advisor
Irina Mihaela Minciuna

Data quality & Modelling Advisor
Marcos Olmos

Senior Advisor – TYNDP Team Lead
Jean-Baptiste Paquel

R&D Advisor
Cristina Gómez Simón (seconded)

TYNDP PMO Advisor
Andriy Vovk

Standardisation & Interoperability Advisor
Olivier Aine (seconded)

R&D Advisor
Ioannis Theologitis

Manager Market
Zoltan Gyulay

Market Advisor
Martin Clark (seconded)

Market Advisor
Mark Csete

Market Advisor
Alexander Dusolt

Senior Market Advisor – Policy Team Lead
Marco Foresti

Market Advisor
Petra Kopýtková (seconded)

Economic & Regulatory Affairs Advisor
Adeline Lassource

Market Advisor
Ludivine Marcenac

Senior Advisor – Market NCs Impl. Team Lead
Marta Mendoza-Villamayor

Market Advisor
Athanasios Troupakis

Market Advisor
Mariola Juszczuk (seconded)

Market Coordinator
Volha Veramyeva

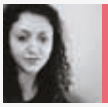
Manager System Operations
Sonya Twohig

System Operations Advisor
Carlos Castel Conesa

System Operations Co-ordinator
Pilar Munoz Elena

System Operations Advisor
Wim Ivens

System Operations Senior Advisor
Alexander Mondovic



System Operations Advisor
Alina Neagu

System Operations Advisor
Kristel Romeo

Network Code Implementation Programme Advisor
Alan Whitaker

IT Manager
Vacant position

Data Management Advisor
Adam Abramowicz

IT Assistant
Cristina Danilov

Application Lead
Martin Kuijs

Senior Advisor Data & Transparency Platform Team Lead
Dalius Sulga

Information Security Officer
Keith Buzzard

Data Management Advisor
Ioannis Daoutidis

Data & Publication Co-ordinator
Philippe Lagarrigue

Application Lead
Glykeria Zapanti

Application Lead
Ewelina Cupryn

Data Management Advisor
Eric Devillers

Application Lead
Christophe Montoisy

Service Desk Supervisor
Jean-Francois Zeebroeck

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Corporate Affairs Advisor
David Villadsen (seconded)

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Corporate Affairs Senior Advisor
Michael Mieszczanski

Corporate Affairs Advisor
Léa Dehaudt

Corporate Affairs Advisor
Stela Nenova

Manager Finance
Arnaud Scaramanga

Reception Desk & HR Coordinator
Corina Cojocaru

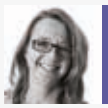
Event and Facility Officer
Carine Lemaire

Human Resources Specialist
Anne Fortané

Resources Planning Advisor
Bertrand Macabeo

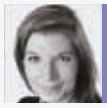
Human Resources Team Lead
Marie-Laure Hespel

Office Support Assistant
Jacqueline Wauters



General Counsel
Florence Melchior

Legal Advisor
Anne de Geeter



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