# ANNUAL REPORT 2014

# SECURITY OF SUPPLY IN 2015: LOOKING AHEAD

European Network of
Transmission System Operators
for Electricity

entsoe

# ABOUT ENTSO-E

ENTSO-E, the European Network of Transmission System Operators, represents 41 electricity transmission system operators (TSOs) from 34 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.

The role of Transmission System Operators has considerably evolved with the Third Energy Package. Due to unbundling and the liberalisation of the energy market, the transmission system has become the meeting place where the various players interact. The importance of the work of TSOs and of ENTSO-E's work products to a well-functioning energy market, a reliable energy system and the success of EU energy policy keeps growing.

## ENTSO-E OBJECTIVES

ENTSO-E members share the objective of completing the Internal Energy Market and ensuring its optimal functioning, and of supporting the ambitious European energy and climate agenda. One of the important issues on today's agenda is the integration of a high degree of renewables in Europe's energy system, the development of the correspondingly needed system flexibility, and a much more customer centric approach than in the past.

ENTSO-E is committed to develop the most suitable responses to the challenge of a changing power system while maintaining security of supply. Innovation, a market-based approach, customer focus, stakeholder focus, security of supply, flexibility, and regional cooperation are key to ENTSO-E's agenda. ENTSO-E contributes to the achievement of these objectives through:

- policy proposals based on the European system viewpoint;
- the drafting of network codes and contributing to their implementation;
- strengthened and focused regional cooperation through the Regional Security Coordination Initiatives (RSCIs);
- technical cooperation between TSOs;
- the publication of Summer and Winter Outlook reports for short term system adequacy;
- the development of long term pan-European network development plans (TYNDPs);
- the coordination of Research and Development plans, innovation activities and the participation in research programmes like Horizon 2020 or formerly FP7.

Through these deliverables, ENTSO-E is contributing to build the world's largest integrated electricity market, the benefits of which will be felt not only by all those in the energy sector but also by Europe's overall economy, today and into the future.

ENTSO-E is aware that such important tasks go hand in hand with a strong interaction with European institutions, ACER, and crucially with market participants and stakeholders. Transparency is therefore a key principle for ENTSO-E, and requires constant listening, learning and improvement, in the interest of society at large.

# CONTENTS

# KEY MESSAGES

- With the energy transition, the customer moves to centre stage. Customers have to be able to actively participate in all markets.
- The network codes support a “fit for purpose” regulatory framework for the Internal Energy Market (IEM). Their implementation gets on top of the agenda and requires cooperation and focus among all national and European players.
- Security of supply is one of the objectives underlying the completion of the IEM and, as such, is at the core of ENTSO-E’s main deliverables.
- Information exchange and transparency are key components of the IEM and of ENTSO-E’s commitments. Ever increasing transparency with stakeholders includes the newly established ENTSO-E Transparency Platform.
- ENTSO-E is committed to a regional approach as a step towards the IEM. That is why Regional Security Coordination Initiatives have been set up proactively by TSOs and will gain further importance while covering the full ENTSO-E membership.
- ENTSO-E endorses the Energy Union. It responds with its Vision package, which sets out its views on the key dimensions of EU energy policy such as the regulatory framework, regional cooperation, security of supply, market design and innovation.

# A RELIABLE AND COMPETITIVE EUROPEAN NETWORK

## EXECUTIVE SUMMARY

NICK WINSER
ENTSO-E PRESIDENT

PIERRE BORNARD
CHAIRMAN OF THE BOARD

KONSTANTIN STASCHUS
SECRETARY-GENERAL

"Security of supply is one of the objectives underlying completion of the Internal Energy Market and is at the core of ENTSO-E's main deliverables."

Ensuring a secure electricity supply is often overlooked as a key function of TSO cooperation, but it happens every day and is part of their enduring activities, as well as new functions resulting from the codification of these activities into the network codes.

**Pierre Bornard:** Indeed, the network codes are the building blocks of the IEM and essential components to ensure energy security. They support a fit-for-purpose energy network that

NICK WINSER

**Nick Winser:** 2014 has been marked by increasing concerns about energy security in Europe following political events in Ukraine and the related gas crisis. In addition, the European Commission's proposed target of 27% energy from renewable sources (RES) in its 2030 energy framework communication means that further steps are needed in the market integration of RES and demand-side response to maintain the security of the electricity supply.

The topic is high on the agenda, especially as the European Commission is expected to propose a review of the Electricity Security of Supply Directive in 2015. Security of supply means many things to stakeholders but for ENTSO-E it has a very immediate focus.

is able to cope with any evolution in Europe's climate and energy policies. They implement the world's most advanced cooperation schemes between system operators to ensure the best possible security in normal operation, as well as in emergencies. They provide fair, transparent and efficient market rules for operating from a few seconds before real time to years ahead.

"December 5, 2014 was a significant day for ENTSO-E as the first network code - Capacity Allocation and Congestion Management - passed through the Comitology process between the Commission and Member States."

The event has significance for all stakeholders in the power sector as it paves the way for the first network code to become binding European law and move towards implementation. ENTSO-E has now delivered nine network codes, of which eight have been recommended for adoption by ACER.

On 26 June 2015 the Requirements for Generators network code became the second network code to be adopted in Comitology.

of the EU energy mix, research and innovation. Grid development is one example of how TSOs already participate.

"The work conducted on the Ten-Year Network Development Plans (TYNDPs) is vital to achieving the policy objectives of a secure electricity supply,

PIERRE BORNARD

These are huge achievements for all involved, including the very important contributions of many stakeholders who continue to commit time and energy to the code development process.

"The network code progress is good news for 2015 as we head into the decisive months for approval of the remaining codes."

Significant advances have been made in agreeing the policies that will determine the commercial characteristics of the IEM and work has started with early implementation of several features of various codes being the focus for 2015.

**Konstantin Staschus:** TSOs play a key role in all five dimensions defined by the Commission - security of supply, a competitive and complete IEM, moderation of demand, decarbonisation

sustainable development of the network, and affordable energy for European consumers through market integration."

**Nick Winser:** In fact, the TYNDP 2014, delivered in December, was our most complex and thorough plan to date. Key innovations have included adjustments in its content from the adoption of stakeholder suggestions and the changing dynamics created by Energy Infrastructure Regulation 347/2012.

What has not changed is the importance of the TYNDP to all stakeholders interested in the development of European power infrastructure.

The pace of change and improvements in the transparency of modelling and data sources meant that the scoping stage of TYNDP 2016 started before work on the TYNDP 2014 ended.

"The TYNDP shows that projects continue to face delays due to the permitting difficulties which partly stem from sections of the public not accepting new transmission infrastructure."

This publication strives to set up effective actions and priorities for achieving the policy objectives while taking into account the needs of the TSOs and looking forward to reflect those of power system customers.

**Konstantin Staschus:** In addition to the activities above, our Winter and Summer Supply Outlooks remain an important tool for assessing the short and medium-term state of the European network by focusing attention on generation-demand reserve margins.

KONSTANTIN STASCHUS

Photo: TenneT

The TYNDP 2014 assesses delays on 30% of the projects identified in the 2012 plan - a situation little changed from the figure reported in 2012.

ENTSO-E regularly raises these delays with stakeholders as a matter requiring urgent attention and this year ENTSO-E and TSOs contributed to the Commission's project to develop a best practice tool kit for engaging stakeholders in the need for and the routing of transmission infrastructure.

**Pierre Bornard:** Talking about achieving Europe's policy objectives, the TSO-led R&D activities coordinated by ENTSO-E represent a significant contribution. ENTSO-E released its R&D Roadmap and R&D Implementation Plan 2015-2017 in 2014 and began work on the ENTSO-E Implementation Plan 2016-2018, published in the first quarter of 2015.

"Working with ENTSOG, in the Winter Outlook 2014/15 ENTSO-E has looked at the impact in each EU country of potential gas disruptions due to delivery issues between Russia and Ukraine. This is the first time ENTSO-E has undertaken such detailed assessments."

Europe's interconnected European power system and its progress to achieving its 20-20-20 objectives require increasingly convergent national energy policies. With greater interconnectivity and trading, decisions on national energy mixes have greater cross-border impact.

The growing share of renewable energy sources, secure network operation, trading and consumer choice motivated ENTSO-E to publish policy papers on design of the IEM and demand-side response. These proposed forward-looking solutions for the evolution of the market.

**Pierre Bornard:** Information exchange and transparency are also key components of the IEM. In 2014, data provision has been further enhanced for stakeholders, customers and traders by the new ENTSO-E transparency platform. This large project was delivered in early 2015 and represents the combined efforts of TSOs and other data providers to make key information available so that the IEM functions efficiently.

"Market integration implies exchanges of data among an increasing number of parties, including TSOs, DSOs, generators, suppliers and consumers."

These need to be handled securely, smartly and cost-efficiently, taking into account operational constraints, current and future market rules, and EU policy targets.

**Nick Winser:** In addition to increased interconnectivity within the EU, the TSOs of the Continental Europe synchronous area and the Albanian TSO OST have signed a long-term agreement contractually integrating the Albanian power system into the Continental European network, based on many years of studies and tests.

"Let's not forget that 2014 has also seen important developments in interconnections with non-EU countries."

Photo: ENTSO-E

Progress has also been made on interconnections with the Turkish and Kosovan power systems, leading to the signature of a long-term agreement with Turkish TSO TEIAS in April 2015.

The feasibility of synchronously connecting the Ukrainian and Moldovan systems with Continental Europe is also being analysed and ENTSO-E has continued discussions with the Russian grid operator on important synchronous operation issues with EU TSOs.

**Konstantin Staschus:** TSO cooperation took a significant step forward in 2014 with the November announcement of ENTSO-E's TSO cooperation policy. This sets out how future regional TSO cooperation will develop and establishes a road map for agreement on regional groupings and tasks.

"The preferred tool to enhance cooperation among TSOs are the Regional Security Coordination Initiatives."

Pioneered and developed proactively by TSOs, the Regional Security Initiatives (RSCIs) are already recognised as important contributors to the security of the European network.

The document was published on ENTSO-E's website and is now widely used when engaging with stakeholders.

"ENTSO-E learns from stakeholder consultation activities, which continues to play a key role in the preparation of ENTSO-E deliverables and

Photo: ENTSO-E

ENTSO-E has adopted a new approach to European network policy preparation and governance.

Its strategy is to more actively promote ENTSO-E's views on the key evolutionary requirements of the European power system with policy-makers and interested stakeholders. In 2014, ENTSO-E published 11 policy documents resulting from this new approach.

**Nick Winser:** 2014 was also the time for ENTSO-E to review its first five years of operations since its inception in 2009. As a result, and coupled with initial stakeholder feedback, ENTSO-E has adopted Principles of Conduct covering the way its member TSOs conduct themselves when setting out ENTSO-E positions.

is essential to the delivery of pertinent and well-argued documents."

ENTSO-E's work is also conducted in collaboration with ENTSOG, the European Network of Transmission System Operators for Gas. Both ENTSOs work together on a wide range of projects, particularly in infrastructure development.

Finally, we would like to thank our member TSOs for their essential input during 2014 and look forward to our continued collaboration with stakeholders and TSOs in the completion of the IEM.

# REVIEW OF ACTIVITIES

# ENTSO-E IN 2014

# OVERVIEW

Completion of the Internal Energy Market (IEM) advanced significantly in 2014. The approval by the European Commission and EU Member States of the Capacity Allocation and Congestion Management (CACM) guideline (formally a draft network code) was a major step forward. Approval of the key principles for the formulation of rules governing cross-border power flows is one of the key tenets of the IEM.

Other ENTSO-E network codes, however, did not progress as hoped and the delays have forced re-planning of their implementation beyond intended time frames. Elsewhere, the impressive progress made by industry participants in interconnecting Europe's power markets can be seen as 19 countries are now linked, allowing buyers and sellers to operate freely within and across former boundaries.

In 2014, ENTSO-E released its third Ten Year Network Development Plan (TYNDP). The plan presents the development needs of the network in more detail and with greater comprehensiveness than previous editions. It offers a more robust assessment of system needs and a better policy tool for regulators and governments. Work on the next TYNDP 2016 has started with scoping activities to define better ways of working in order to provide enhanced analysis and reporting for stakeholders.

## STAKEHOLDER CONSULTATION IS KEY

ENTSO-E has conducted various consultations during the year, ranging in content from the network codes and the TYNDP to the consultation process itself. These enable ENTSO-E to accurately capture feedback on proposals and stakeholders to share their views with the industry, regulators and officials. In addition to responding online, stakeholders are encouraged to participate in workshops and briefing sessions to better understand ENTSO-E 's work.

ENTSO-E receives considerable input from stakeholders on improvements to its products and the consultation process. Feedback from consultations and other channels of communication suggests that further improvements in the process are needed for ENTSO-E to be recognised as a listening organisation.

## CHANGING NETWORK ENVIRONMENT

ENTSO-E's activities respond to its mandated deliverables, political and regulatory requests, and dynamic changes within the power system. The most obvious change is in generation patterns with the shift from fossil fuel-based systems to RES. Total generation and consumption levels remain reasonably flat [see graphs below].

### CHANGING EUROPEAN GENERATION PATTERNS

TSOs have to manage the impact of this shift in generation within their own countries and increasingly across borders. They have alerted national regulators and governments to the general increase in system risk and have made specific alerts (such as the large number of solar units being installed and unplanned power flows across system boundaries and borders) in several countries.

ENTSO-E TSOs have observed a continuing trend in changing generation patterns across Europe. While national generation and consumption are primarily matters for Member States and local TSOs to manage over the short term, ENTSO-E's seasonal outlooks describe the expected balance between consumption and generation, likely power transfers and the anticipated margin (generation held in reserve) across Europe.

In 2012, there was considerable interest in the winter outlook and, again in 2014, political and public concern was apparent over tight generation margins or unusually high dependency on imports in some countries.

A recent trend is the increasing media interest in energy security. Traditionally focused on winter preparations, this is now more widely related to geo-political concerns or the impact of renewable energy sources within the generation mix.

## RESEARCH & DEVELOPMENT

ENTSO-E continues to review and assess R&D needs for the European transmission system. In 2014, ENTSO-E has sought to leverage TSO expertise and technical knowledge through a wider range of R&D activities funded mainly through European grants. ENTSO-E and TSO experts continue to share research knowledge and expertise through a wide communication and information exchange programme where plans and progress are regularly updated with the wider research community.

## WORKING WITH ENTSOG

Security of supply and joint development work on TYNDP methodologies are two examples of close cooperation between ENTSO-E and ENTSOG, the ENTSO for gas. In addition, the two organisations have developed additional cooperation activities outside the routine exchange of information and shared approaches to mandated tasks. Two examples are an evening session introducing the two ENTSOs to new EU officials and parliamentary assistants and an evening event, hosted by the TSO Elia, where the ENTSOs discussed industry preparations for winter.

# STAKEHOLDER ENGAGEMENT

Stakeholder contributions play an essential role in the development of all ENTSO-E deliverables including the TYNDP, the network codes and the ENTSO-E annual work programme. ENTSO-E is committed to taking into account the broadest range of views from stakeholders at an early stage in projects and to engage actively with them in delivering acceptable, well critiqued proposals.

ENTSO-E has further stepped up its engagement in 2014 with the wider stakeholder community with the aim of fostering a more transparent, effective and collaborative process for developing its work products and for driving forward energy market integration.

Over the year, ENTSO-E sought stakeholder views in six public consultations and also organised 24 public stakeholder workshops, both in the context of the consultation processes and outside of them. The workshops triggered stakeholder participation on technical issues such as adequacy methodology, the TYNDP 2014, the eHighway2050 Project and the financing of investments in infrastructure.

March 2014 also saw the organisation of six regional workshops in member states addressed at local stakeholders. These discussed the TYNDP 2014 and Regional Investment Plans (RIPs) and were successful in collecting stakeholder opinions and generating debate on region-specific issues.

## ENTSO-E PRINCIPLES OF CONDUCT

ENTSO-E's principles of conduct, adopted in July 2014, frame its interaction with European and national institutions, stakeholders and society at large, and define ENTSO-E's duties in discharging its formal responsibilities.

In particular, ENTSO-E is committed to listen to the concerns of customers, stakeholders and other relevant parties, to strive to understand their needs, and to use stakeholder feedback as an important contribution for improving the quality of ENTSO-E work products. In discharging its responsibilities, ENTSO-E's focus is always on the public interest.

## REGULATORS

ENTSO-E is committed to working closely and productively with ACER in order to deliver the benefits of the IEM to EU citizens. ENTSO-E and ACER have collaborated with the EC throughout 2014 in the network code development process. The next big step to completing the IEM is directly linked to the timely implementation of the codes once they have been adopted.

ENTSO-E's close cooperation with ACER, National Regulatory Associations (NRAs), Member States, the EC and all stakeholders would be key to ensure that the network codes are well understood and

Photo: ENTSO-E


Photo: ENTSO-E

that all parties have the capacity to implement them successfully. The European Stakeholder Committees for network code implementation, which are jointly set up with ACER, will also help to address this challenge.

## DISTRIBUTION SYSTEM OPERATORS

The DSOs are crucial partners for TSOs in the transition to clean energy. Both face a number of common challenges to maintain system adequacy and security of supply in light of the increasing share of intermittent RES generation, growing grid interconnections, EU decarbonisation and climate objectives, and the integration of modern energy services such as demand-side response.

ENTSO-E and the four DSO associations cooperated in 2014 through joint workshops on topics of common interest. A Memorandum of Understanding between the TSO and the DSO communities was signed in January 2015 to strengthen this cooperation and ensure that they fulfil their missions in a way that maximises the competitiveness, sustainability and security of the EU power system to the benefit of society at large.

Throughout 2015, TSOs and DSOs will undertake a number of thematic workshops to develop solutions for new challenges in the areas of data management, regulatory policies, tariffs, R&D and standardisation, as well as collaborate closely in the network code implementation process.

## THE ENERGY COMMUNITY

The Energy Community is another key partner for ENTSO-E in promoting further market integration and implementing the principles of the IEM in the wider European area. In February 2014, ENTSO-E and the Energy Community jointly organized a workshop on establishing a regional balancing initiative in southeast Europe.

Throughout 2015, ENTSO-E will further enhance its cooperation with the Energy Community through a number of joint workshops, conferences, training and capacity-building initiatives. This closer collaboration will enable TSOs from various parts of Europe to exchange best practice and will foster cross-border cooperation and faster implementation of the Third Energy Package and the network codes. Overcoming obstacles to interconnectivity, harmonising legal frameworks and promoting regional security coordination are some of the key challenges ahead for ENTSO-E and the Energy Community.

## ANNUAL CONFERENCE: SECURING EUROPE'S COMPETITIVE ENERGY FUTURE

The annual ENTSO-E conference 'Securing Europe's competitive energy future' in November brought together members of the European Commission, European and national regulators, Member State government representatives and other European energy stakeholders. The conference, designed to present ENTSO-E's activities and the role played by TSOs in Europe's energy future and to trigger debate on current energy challenges, was attended by 450 participants from 39 countries representing a wide range of organisations.

The feedback received by ENTSO-E reveals the interest in this kind of event, which presents ENTSO-E's work to a wider audience of stakeholders than those regularly involved in the consultation processes and workshops. ENTSO-E would like to build on this success and will organise a similar event in November 2015..

# STANDARDISATION

Standardisation brings simplicity and cost-efficiency to the harmonisation of TSO operations, increasing the robustness of the pan-European network. Interoperability of TSO communications procedures, equipment and services are required at all levels. ENTSO-E's standardisation activities support TSO operation and planning processes, as well as European market integration and demand-side participation.

Standardisation creates economies of scale and bridges the gaps between existing standards and the requirements of the network codes, network planning and the common grid model, and facilitates the creation of the European IEM and the deployment of smart grids.

ENTSO-E's standardisation activities are carried forward by its Standardisation Working Group. This group ensures that TSOs benefit from collective participation in the activities of international and European standardisation bodies, such as the IEC (International Electrotechnical Commission) and CEN/CENELEC, when developing standards of importance to TSOs.

Activities include liaison with these organisations, as well as others such as the EC, and participation in working groups chaired by them. ENTSO-E also plays an important role in monitoring all standardisation activities affecting TSOs, in identifying gaps in standards supporting ENTSO-E products, and in recommending standards that TSOs should support and adopt.

## OPERATIONAL DATA EXCHANGE

In 2014, ENTSO-E has continued its focus on implementation of the Common Grid Model Exchange Standard (CGMES) for TSO data exchange in the areas of network operation and development, particularly with regard to the network codes and the TYNDP.

The CGMES is the baseline standard for the methodologies required to implement several network codes. It is used in tools supporting network data management as well as network analysis. These include dynamic network security assessment, load flow and contingency analysis, market information and transparency, and calculations for capacity allocation and congestion management.

The interoperability of the applications used by TSOs for data exchange is crucial and ENTSO-E's objective has been to ensure this through compliance with CGMES requirements. In 2014, it has therefore approved the CGMES conformity assessment framework. This establishes the services to facilitate elaboration of the CGMES, implementation of the network codes, system development studies and software for specific system analysis, as well as IT systems to ensure smooth TSO data exchange.

## SUBSTATION MANAGEMENT

Multiple protocols exist in the area of electricity substation automation but are often incompatible. The IEC 61850 standard for electrical substation automation addresses many important aspects of TSO communication, data modelling and engineering in order for different vendors' subsystems to interoperate seamlessly with TSO system management architecture.

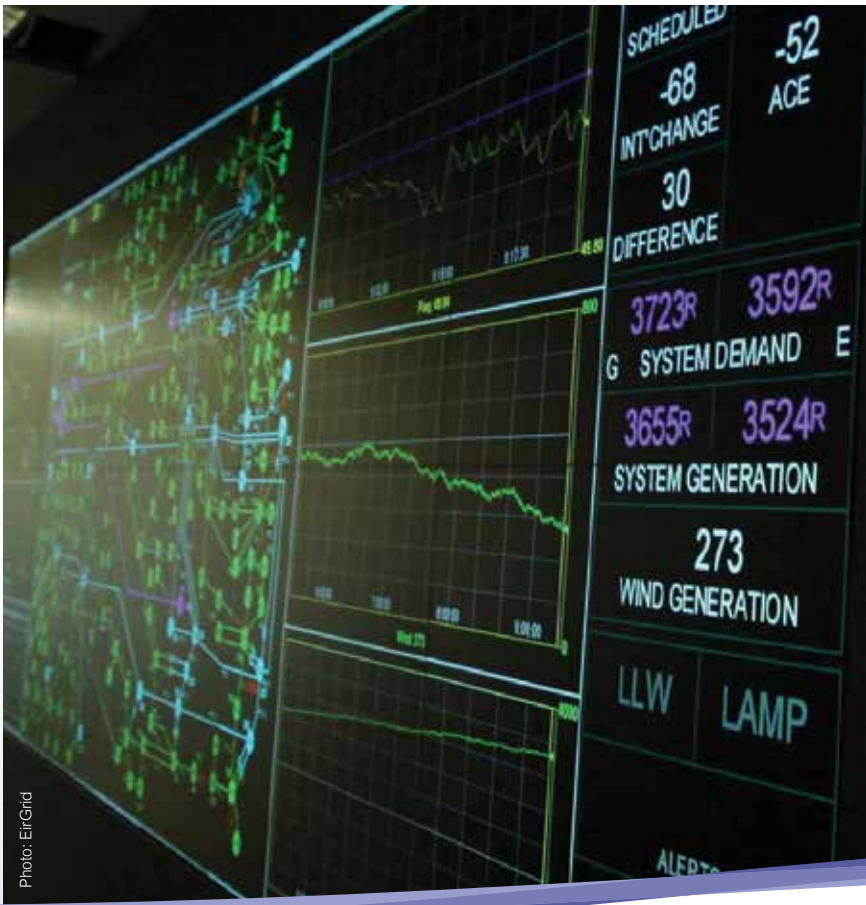


Photo: EirGrid


ENTSO-E is currently developing an Interoperability Specification Tool (ISTool) which will support the interoperability aspects of the IEC 61850 standard.

## MARKET INFORMATION EXCHANGE

European market integration and a smarter grid require information to be exchanged between an increasing number of parties including TSOs, DSOs, generators, suppliers and consumers. These exchanges need to be reliable, secure and cost-efficient, taking into account operational constraints, market rules and EU policy. Standardisation as a means of harmonisation is therefore essential.

ENTSO-E's Electronic Data Interchange (EDI) working group collaborates with other ENTSO-E groups, and organisations such as ENTSOG, EFET (European Federation of Energy Traders), ebIX (European Forum for Energy Business Information Exchange) and the IEC to develop common descriptions and standards for market-related TSO business processes in order to facilitate their implementation by software suppliers. These cover operations such as scheduling, settlement, capacity allocation and nomination, acknowledgement, status request and reserve resources planning.

Over many years, the EDI group has developed and maintained common descriptions for these processes, as well as for core components, code lists, an identification coding scheme (EIC) for the European IEM covering both electricity and gas, the MADES market data exchange platform standard, and has developed harmonised guides for data submission to the ENTSO-E central transparency platform in 2014.

## COMMON INFORMATION MODEL

The working group has also actively contributed to standardisation activities within the common information model (CIM). The objectives are twofold:

- → to bring the requirements of ENTSO-E TSOs into the IEC's CIM 62325 series of standards covering the exchange of data in deregulated energy markets, in Europe;
- → to conduct the necessary interoperability (IOP) tests to ensure the standards' conformity with TSO requirements. The European style market profile (ESMP) defined in the CIM provides the core components for use in standards covering specific business processes in the European IEM.

Since 2012, ENTSO-E has conducted four IOP tests on the CIM standards in which TSOs and transmission capacity allocators, transmission capacity auction offices and market management system (MMS) software providers have participated. The tests have demonstrated that the standards satisfy ESMP business processes requirements and that the CIM and ESMP include all the capabilities to support information exchanges already implemented within ENTSO-E.

# COLLABORATION WITH ENTSOG

As the two European Networks for Transmission System Operators created under the Third Energy Package, ENTSO-E and ENTSOG, the ENTSO for gas, undertake many similar tasks. These include the development of regular reports on system adequacy, network codes, a ten-year network development plan, and cost-benefit analysis (CBA) methodology.

In view of the close relationship between these tasks and the gas and electricity industries within the European energy system, with gas playing a significant role in electricity generation, the two organisations continuously interact with each other and exchange information and experience on common topics.

Collaboration in 2014 was primarily focused on TYNDP development in terms of the assumptions and data used, as well as on drafting similar CBA methodologies and exploring the adequacy of the overall European energy system under possible gas disruption scenarios.

For this latter activity, ENTSO-E and ENTSOG jointly looked at the impact on each EU Member State of potential disruptions caused by gas delivery issues between Russia and Ukraine. This is the first time that ENTSO-E has undertaken such a detailed assessment, even if risk of disruption may have been reduced by an agreement between the two countries to maintain gas supplies.

In 2015, ENTSO-E and ENTSOG are further expanding their collaboration on the tasks above. In addition, they are concentrating on how to better fulfill the requirements of Regulation (EU) 347/2013 on the development of consistent, interlinked electricity and gas market models.

ENTSO-E and ENTSOG jointly organised an information session in October 2014, explaining their role in the implementation of the Internal Energy Market. Similar workshops, addressed to EU officials from the European Commission and the European Parliament, are foreseen in 2015.

# SECURITY OF SUPPLY

## SYSTEM ADEQUACY FORECASTS

# SYSTEM ADEQUACY FORECASTS

The changing nature of the European network combined with well publicised problems in generating capacity in some Member States have brought the continuing security of the electricity supply into sharper relief. Reporting on the performance of the European system and forecasting its adequacy to meet future demand is one of ENTSO-E's tasks under Regulation (EC) 714/2009.

ENTSO-E meets this obligation through its twice-yearly Summer and Winter Outlook & Review publications and its annual long-term System Adequacy Forecast. In 2014, the ENTSO-E Summer Outlook 2014 and Winter Review 2013/2014 was published in May and its Winter Outlook 2014/2015 and Summer Review 2014 in December.

ENTSO-E published its Scenario Outlook & Adequacy Forecast (SOAF) 2014 in June as part of the TYNDP 2014 package.

## SHORT-TERM SYSTEM OUTLOOK

ENTSO-E's two Adequacy Outlook & Review publications present the combined views of Europe's TSOs on national and regional security of supply for the upcoming six-month period and review network performance over the preceding six months.

The ENTSO-E Summer Outlook 2014 forecast that the European network's generation and transmission capacity would be sufficient to cover consumer demand over the summer season. Perhaps more importantly, its Winter Outlook 2014/2015 also confirmed that the European network would generally be able to meet the higher energy demand over this period, even under severe weather conditions.

The Winter Outlook did state that many Member States would rely on imports to meet peaks in national demand but that the network had enough cross-border transmission capacity available to handle these.

Potential risks to local electricity supplies, due to generation shortages combined with extreme cold spells, were identified in some countries. Other factors affecting network operations, such as possible disruptions in the gas supply and the effects of the March 2015 solar eclipse, were also highlighted.

## LONG-TERM ADEQUACY

ENTSO-E's draft Scenario Outlook & Adequacy forecast (SOAF) 2014-2030 was published for stakeholder consultation in July as part of the ENTSO-E draft Ten-Year Network Development Plan (TYNDP) 2014 package.

The SOAF provides stakeholders with a pan-European overview of the future adequacy of the European system's capacity to meet demand using different scenarios based on power balance, generation margin, consumption indicators and generation mix.

**CASE HISTORY**

TSO: NATIONAL GRID (UNITED KINGDOM)

# SEASONAL BALANCING MEASURES

**In anticipation of the current winter 2014/2015, British TSO National Grid signed contracts for demand-side balancing reserves (DSBR) and supplemental balancing reserves (SBR) that provided the TSO with an additional 319 MW of network capacity.**

Demand-side response measures such as DSBR avoid the need for additional generation to meet peaks in demand. National Grid works with large-scale industrial energy users (e.g. processing plants, factories, steelworks and other businesses) whose operations give them the flexibility to reduce their demand at certain times. In return, they receive contracted payments from the TSO. DSBR also helps to keep energy system costs down for consumers by avoiding the need for generating companies to build additional power stations to meet peaks in demand.

The other side of the balancing equation is SBR, which is a mechanism for returning generating plant to the grid that would otherwise be closed or mothballed. National Grid's SBR contracts are open to all electricity suppliers, generators as well as large users, as long as they can link to the balancing mechanism systems at its national control centre.

National Grid's DSBR and SBR arrangements give the TSO access to a total of 1,100 MW of additional network capacity and involve the participation of a significant cross-section of energy providers or users, including generators, refineries, factories, retail outlets and aggregations of smaller contributors. For many years the TSO has also had other measures to reduce demand during peak periods in place. These include Triad charges levied on licensed electricity suppliers each year to stimulate reductions in demand.

ENTSO-E has developed two bottom-up generation scenarios to help assess the range of uncertainty within the European network and to evaluate risks to the security of supply for the years 2015, 2016, 2020 and 2025. A top-down EU 2020 scenario, compatible with its 20-20-20 objectives has also been created. In addition, the forecast describes the four ENTSO-E "2030 Visions" used as background assumptions for the market and network studies within the TYNDP.

## ASSESSMENT METHODOLOGY

In 2014, ENTSO-E provided regular updates on the ongoing work of its taskforce on short and long-term adequacy assessment and encouraged all interested parties to participate in a public consultation from July to September on its adequacy assessment methodology. Around 30 stakeholders participated in the consultation, providing valuable feedback.

The consultation covered three documents:

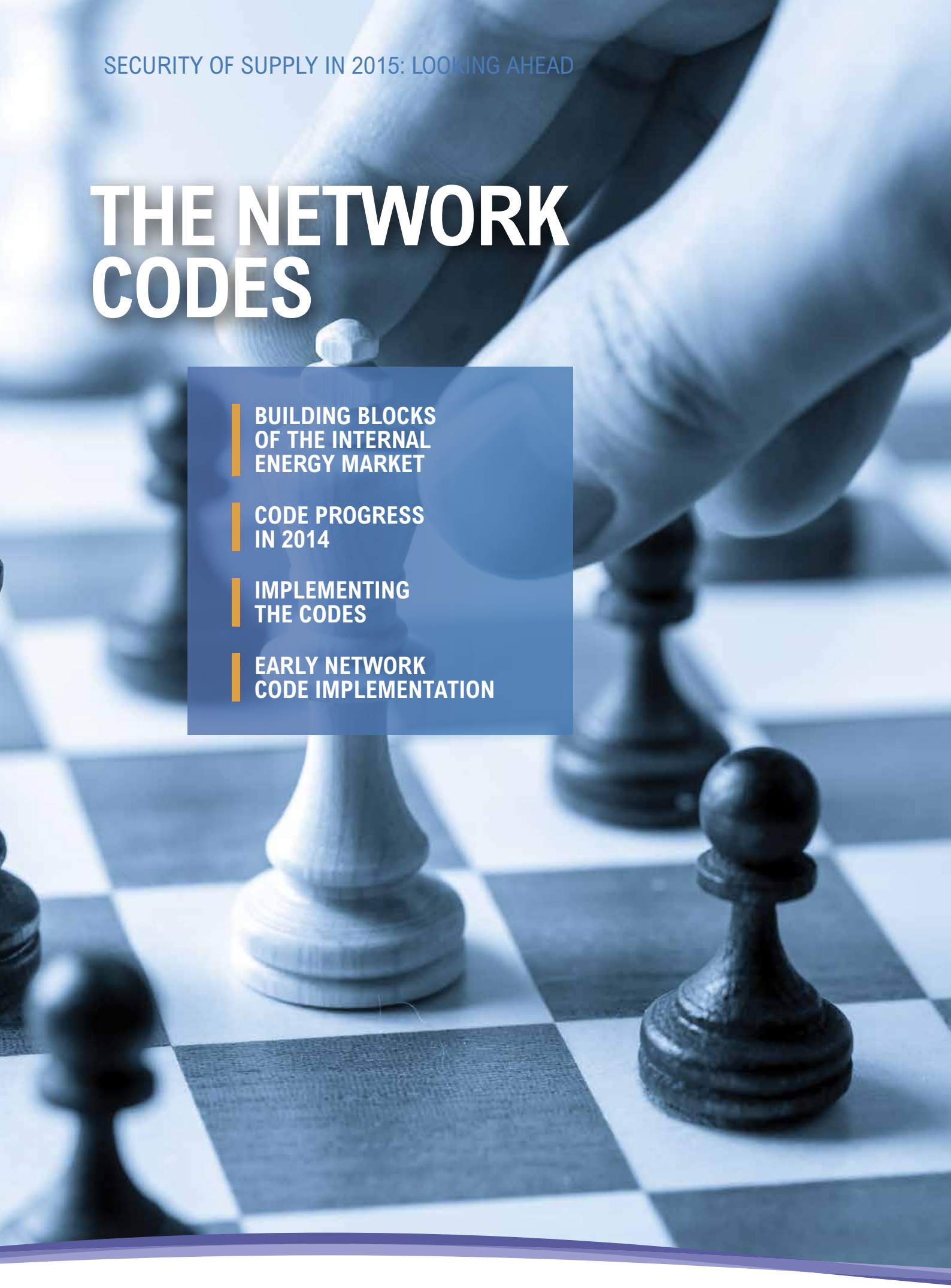
- ENTSO-E Target Methodology for Adequacy Assessment, presenting its overall goal for improvements to the methodology;
- Scenario Outlook and Adequacy Forecast Evolutions, outlining improvements to be implemented in the next SOAF 2015 and introducing objectives for improvement in future SOAF reports for later consultation;
- Seasonal Outlook Report Evolutions, detailing improvements implemented in the Winter Outlook 2014/2015 report and introducing objectives for improvements in future Winter and Summer Outlook/Reviews.

Stakeholders generally acknowledged the value of the proposed methodology. Comments primarily focused on particular aspects of it, on the assumptions and models to be implemented, and on the need for greater transparency so stakeholders can make a more effective contribution. Increased focus was put on the economic feasibility of generation assets in relation to system adequacy assessment.

ENTSO-E's answers to the comments and the updated consultation documents with stakeholders' input are available on the ENTSO-E website: www.entsoe.eu.


Photo: TenneT

# THE NETWORK CODES



- BUILDING BLOCKS OF THE INTERNAL ENERGY MARKET
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# BUILDING BLOCKS OF THE INTERNAL ENERGY MARKET

ENTSO-E sees the pan-European network codes as the foundation for the world's largest and most competitive electricity market. The Internal Energy Market was set for 2014 but more ambition is required.

Since the start of the network code programme, more than 1000 experts from TSOs, national regulatory authorities (NRAs), the European Commission, and all sectors of the power industry have collaborated in the process to develop the set of legally-binding instruments which provide the rules, obligations and rights for all users of the European electricity network.

Creating effective codes to support the European network is a long-term project. Drafting the codes and assisting them through the European legislative process is only the beginning. Once they are adopted by Member States, their effective implementation and monitoring still requires a major collaborative effort by TSOs, NRAs and a large number of stakeholders.

As network codes become a reality in each Member State, their impact on local grid operation, market efficiency and consumers will need to be monitored.

Over the past year, ENTSO-E, ACER, the EC and many stakeholders have made significant progress in delivering and implementing the codes. The first, Capacity Allocation and Congestion Management (NC CACM), has been adopted in Comitology by Member States and is expected to enter into EU law as a new "Binding Guideline" in 2015.

ENTSO-E has also drafted a new code, Emergency and Restoration (NC ER), and submitted it to ACER and most other codes have progressed through the approval process. Furthermore, several early implementation activities have been set in motion and ENTSO-E has started working with ACER and stakeholders to create stakeholder forums on network code implementation.

Code content will also need to be reviewed periodically and the resources required for this will need to be balanced with the objective of keeping the codes flexible. Such reviews will aim to make the codes more efficient and capable of adapting to new technologies, market practices or political orientation.

## BINDING GUIDELINES

The European Commission's legal considerations in the network code adoption process have led to the new Binding Guideline terminology for some of the codes. The EC decided to requalify the CACM network code as guideline without any legal effect as both texts are adopted as binding regulations.

This decision was based on a technical review of the text of the CACM code by the EC's internal legal services - standard practice for all EU legislation.

The unprecedented nature of intercontinental day-ahead and intraday electricity market coupling makes the scope of the CACM code very wide and it includes methodologies and processes that will only be defined by TSOs and power exchanges (NEMOs) subject to regulatory approvals from NRAs, after its entry into force.

The content of the code has not changed and, once adopted as a binding guideline, it will still become an EU regulation that Member States will be obliged to enforce to bring the realisation of the IEM a step closer.

For the sake of simplicity, this report uses the term 'network codes' to refer to the set of common rules on electricity market operation defined in Regulation (EC) 714/2009 and covers both network codes and binding guidelines. The network code programme refers to the code development process.


Photo: Energinet.dk

## DIFFERENCES BETWEEN THE NETWORK CODES AND BINDING GUIDELINES

| | Network code | Binding guideline |
|---|---|---|
| **Definition** | Set of rules that can be directly implemented in each Member States with no need for coordinated decision of several TSOs/ NRAs at cross-border level | Include items which require further implementation by coordinated decision of several TSOs/NRAs at cross-border level |
| **Legal force** | Binding | Binding |
| **Development process** | Defined in the Third Energy Package | The process can be less formal. In practice, the same process as that for the network codes has been used |
| **Adoption process** | Comitology | Comitology |
| **Amendment process** | Defined in the Third Energy Package and ACER guidelines | The process is led by the European Commission and can be less formal |

**THE EXISTING NETWORK CODES FALL INTO THREE CATEGORIES - ELECTRICITY MARKETS, NETWORK CONNECTION AND SYSTEM OPERATIONS - ALTHOUGH THERE ARE SIGNIFICANT LINKS AND OVERLAPS BETWEEN INDIVIDUAL CODES.**

### Electricity Markets

- Capacity Allocation and Congestion Management (NC CACM)
- Forward Capacity Allocation (NC FCA)
- Electricity Balancing (NC EB)

### Network Connection

- Requirements for Generators (NC RfG)
- Demand Connection (DCC)
- High Voltage Direct Current (NC HVDC)

### System Operations

- Operational Security (NC OS)
- Operational Planning and Scheduling (NC OPS)
- Load Frequency Control & Reserves (NC LFCR)
- Emergency and Restoration (NC ER)

# CODE PROGRESS IN 2014

ENTSO-E has collaborated closely with ACER and the EC throughout the year to draft and submit the two outstanding codes and prepare the remainder for the Comitology adoption process. The chart on the next page gives the overall status of the network code programme.

## CAPACITY ALLOCATION AND CONGESTION MANAGEMENT

Member states' adoption of the CACM code as a binding guideline in December 2014 represents a significant milestone in the effort to deliver the integrated European electricity market. The CACM binding guideline is the first in the network code programme to be adopted and it will now be scrutinised by the European Parliament and the Council. ENTSO-E expects a definitive approval of the guideline in its current form in Q3, 2015.

Adoption of the CACM guideline will boost efforts to create well-functioning pan-European day-ahead and intraday markets, but it is only a beginning. TSOs and other stakeholders have already started early CACM implementation projects. The implementation of the guideline across Europe is not straightforward and will require substantial work by TSOs and other parties from the sector.

## HVDC CONNECTION

ENTSO-E delivered the draft code on HVDC Connections and DC-connected Power Park Modules (NC HVDC) to ACER in April 2014.

The code sets out the rules and requirements for connecting high voltage direct current technology to the European network. It covers HVDC connections between different areas of the grid, as well as the connection of generators via HVDC lines.

The NC HVDC represents the results of more than 12 months' work, which has closely involved many stakeholders. DC link owners, equipment manufacturers, generators and other sector organisations have provided extensive and constructive input.

The prevalence of HVDC technology in Europe is of strategic importance. By increasing inter-connections between and within synchronous areas, the technology will facilitate the integration of RES and will expand and reinforce the European market. In addition to benefitting consumers across Europe, ENTSO-E is confident that adoption of the HVDC code will be a significant step in creating a transparent and non-discriminatory business environment for investors in HVDC lines and technology.

## EMERGENCY AND RESTORATION

The Emergency and Restoration code (NC ER) sets out the procedures and remedial action to be taken when the network is in emergency, blackout or restoration states. It is key to ensuring the security and continuity of the electricity supply. It involves the preparation of advance plans for system defence, restoration and re-synchronisation, information exchange, operating procedures, and ad-hoc analysis of incidents. The EC officially asked ENTSO-E to start drafting the code in March 2014. Prior to submitting the code to ACER in December, ENTSO-E focused on interacting with stakeholders via two public consultations, technical expert meetings for Distribution System Operators (DSOs), public stakeholder workshops and ad-hoc meetings with other interested parties.

## ENTSO-E NETWORK CODE STATUS (AS OF 1 JUNE 2015)

| | | | CACM (Capacity Allocation & Congestion Management) | FCA (Forward Capacity Allocation) | EB (Electricity Balancing) | RFG (Requirements for Generators) | DCC (Demand Connection) | HVDC (HVDC Connection) | OS (Operational Security) | OPS (Operational Planning and Scheduling) | LFCR (Load-Frequency Control and Reserves) | ER (Emergency and Restoration) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scoping | EC invites ACER to develop framework guidelines | | | | | | | | | | | |
| | ACER public consultation begins | | | | | | | | | | | |
| | Final framework guidelines published | | | | | | | | | | | |
| Development | Formal invitation to develop network code | Extensive stakeholder engagement | | | | | | | | | | |
| | Public consultation period begins[1] | | | | | | | | | | | |
| | Public consultation closed | | | | | | | | | | | |
| Approval | Final version submitted to ACER[1] | | | | | | | | | | | |
| | ACER opinion published | | | | | | | | | | | |
| | Resubmission to ACER[2] | | | | Sep 2014 | | | | | | | |
| | ACER recommendation published | | | | | | | | Nov 2013 | Nov 2013 | Sep 2013 | Jun 2015 |
| | Operational codes merged into a single operational guideline | | | | | | | | Q3 2015 | | | |
| | Comitology begins | | | Jun 2016 | | | Mar 2014 | Mar 2015 | | | | |
| | Cross-border committee delivers opinion[3] | | | | | Jun 2015 | | | | | | |
| | EC submits code for scrutiny to the Council and EP[3] | | Apr 2015 | | | | | | | | | |
| | Network code is adopted | | Q3 2015 | | | | | | | | | |
| Entry into force | Implementation begins[4] | Extensive stakeholder engagement | Early impl. started | Early impl. started | Early impl. started | | | | Early implementation started | | | |
| | Network code enters into force | | | | | | | | | | | |
| | Network code is monitored and can go through amendment procedure[5] | | | | | | | | | | | |

All forward-looking dates in this chart are provisional. Stakeholders will be informed and invited to all confirmed events by means of official communication.

[1] As part of ENTSO-E's network code development process, internal re/drafting and approval is carried out by ENTSO-E before public consultation and submission of the code to ACER.
[2] In case ACER does not attach a recommendation to its opinion, ENTSO-E has the opportunity to resubmit the code.
[3] Changes in the process may occur if the Regulatory Procedure with Scrutiny is replaced by the Delegated Acts Procedure for network code validation.
[4] Some provisions are being implemented before this stage. Estimated timing for code implementation varies from 18 months for NC OPS to 39 months for NC FCA. A six-year phased introduction period is planned for NC EB.
[5] The final amendment procedure has yet to be determined.

### OTHER NETWORK CODES

In April 2014, ENTSO-E submitted an improved version of the code for Forward Capacity Allocation (NC FCA), which fully complied with ACER's CACM framework guideline. ACER subsequently recommended adoption of the code with some comments and proposals for changes in July.

In September, ENTSO-E submitted a new version of the Electricity Balancing code (NC EB) and explanatory documents to ACER in answer to its comments in March. The code is now generally in line with ACER's framework guideline. The few exceptions, such as the implementation deadline for the European integration model, are motivated by TSOs' experience in grid operation and commitment to deliver realistic codes. ENTSO-E is confident that the enhancements will enable ACER to recommend that the EC proceeds with the adoption of the code.

In September, ACER issued a positive opinion and recommendation to adopt the Load Frequency Control and Reserves code (NC LFCR). The EC is now reviewing the code before Comitology.

Photo: Mavir

# IMPLEMENTING THE CODES

Network code implementation is a tremendous challenge. Each code requires a series of steps to be taken before it can be considered fully implemented. These will include national decisions, the conclusion of regional agreements and the creation of detailed common European methodologies.

All stakeholders, especially TSOs, DSOs and NRAs, will be involved in the code implementation work and there will need to be extensive consultation. Although the codes are expected to evolve as they are finalised and adopted by EU member states, TSOs have already started work on a number of projects agreed with by the EC and ACER to speed up their subsequent implementation.

### STAKEHOLDER ENGAGEMENT

A high level of coordination and effective stakeholder engagement are a priority for successful code implementation and ACER and ENTSO-E are looking for substantial input from stakeholders about how this should take place.

In practice, a successful process involves continuous sharing of information and opinions among interested parties. Stakeholders will need to be efficiently kept abreast of any new developments and be able to submit their views and feedback as appropriate. Both ACER and ENTSO-E, and in some cases nominated electricity market operators (NEMOs), will play an important role.

For the CACM guideline, the EC has tasked ACER, in close collaboration with ENTSO-E, to establish a stakeholder committee to facilitate discussions during the implementation phase. ACER and ENTSO-E subsequently launched their first joint public consultation in December 2014 to explore the best way of involving stakeholders in the implementation process.

# EARLY NETWORK CODE IMPLEMENTATION

During 2014, ENTSO-E has undertaken a number of activities associated with the early implementation of the market-based CACM binding guideline, Forwards Capacity Allocation guidelines and Electricity Balancing network code (NC EB). These include a review of the CACM bidding zones, harmonisation of allocation rules (HAR) and several balancing product development and pilot harmonisation projects.

## BIDDING ZONES REVIEW

Bidding zones are network areas within which market participants can offer energy without having to acquire transmission capacity to conclude their trades. TSOs manage the transmission network to ensure that there is no congestion within each bidding zone, so that market participants can trade with each other without constraints.

Bidding zones are important because they provide transparency to market participants on network congestion and associated costs. Depending on the size and configuration of the bidding zones, grid operation by TSOs can be more or less complex and costly, while electricity markets' efficiency, liquidity and concentration can also be affected.

The European electricity market currently has several bidding zones, many of which historically correspond to Member State boundaries. For completion of the IEM, it is important to analyze the robustness of this structure and whether it is appropriate for future market needs.

As a first step in the review process, ENTSO-E published a technical evaluation of the bidding zones in January 2014. The report contains data from the CWE region, Denmark-West, the CEE region, Switzerland and Italy. It highlights current areas of congestion, power flows not resulting from capacity allocation, congestion incomes and firmness costs. It was complemented by a corresponding market report published by ACER in March 2014.

ENTSO-E has now started its review of the bidding zones, the results of which are expected in 2016.

## HARMONISATION OF ALLOCATION RULES

Currently there is no single set of harmonised rules for long-term trading across European bidding zone borders. A number of regional allocation platforms are in place in different regions, each one with specific allocation rules.

The network code on Forward Capacity Allocation (FCA) tasks TSOs with drafting harmonised auction rules (HAR), at the latest 12 months after the code's entry into force.

ENTSO-E has decided to start the early implementation of the harmonised allocation rules in 2014, including clear milestones and plans for extensive stakeholder engagement (dedicated stakeholder group, public consultation and public workshop). The new HAR are expected to be available by the end of 2015.

## REDISPATCHING FRAMEWORK

Throughout the year, the joint ACER and ENTSO-E Cross-border Redispatching taskforce has continued its work. The taskforce has proposed the first steps towards defining a framework for sharing redispatching costs and identifying challenges to the implementation of coordinated remedial action. It delivered its results on cost-sharing keys to the Florence Forum in May 2014, and continued working to define power flows and as a platform for bilateral discussions on different implementation projects between ACER and ENTSO-E throughout the year.

## ELECTRICITY BALANCING

Electricity balancing is the process by which the TSOs ensure, in real time, sufficient energy to balance inevitable differences between supply and demand.

The NC EB aims to move Europe from the current situation in which most balancing is carried out at a national level to a situation in which larger markets allow the resources which Europe has available to be used in a more effective way ( for example hydro power from Switzerland allowing greater levels of solar power to be connected in Italy or Germany).

This project is a very ambitious one, which will require significant changes in all European countries, and is planned to last six years after the code enters into force.

Work on implementation of the NC EB in 2014 has involved development of a CBA methodology for harmonisation of the imbalance settlement period, application of the TSO-BSP (Balancing Service Provider) model and modification of the European market integration framework. Stakeholder consultation on these topics took place in March 2015.

ENTSO-E also started development of standard balancing products in 2013 and completed a draft proposal for restoration reserves (RR) and manual frequency restoration reserves (FRR-M) in 2014. Work on the pricing methodologies and algorithms for standard balancing products naturally depends on the development of the products so work on this is foreseen for 2015.

Development of proposals for Coordinated Balancing Areas (CoBAs) for the implementation of regional targets is also foreseen for 2015. Once the initial set of CoBAs has been agreed, recommendations can be prepared on how to expand existing pilot projects or which new projects need to be created. These can then form the foundations for regional integration models.

## BALANCING PILOT PROJECTS

Good progress has been made on existing balancing pilot projects in 2014 and the number of projects is increasing. ENTSO-E is gaining valuable experience through monitoring the results. These include:

- Complete market harmonisation for automatic and manual Frequency Restoration Reserves (FRR-A & FRR-M) has been achieved in Germany;
- The project on "Imbalance netting" to avoid counter-activation of balancing energy has been expanded from Germany to Denmark, The Netherlands, Belgium, Switzerland, Austria and the Czech Republic;
- Feasibility studies for future extension of the Nordic balancing market to the Baltic States, Poland and Germany have been completed;
- The project on XB FRR-A and FRR-M product harmonization between Belgium and The Netherlands has been achieved and feasibility studies completed.

# INFRASTRUCTURE DEVELOPMENT

# FUTURE-PROOF POWER NETWORK

Decarbonisation and system integration are driving Europe's energy agenda. The infrastructure challenge to make ambitions meet reality is enormous. ENTSO-E and its members are meeting the challenge everyday!

Transmission networks are the backbone of Europe's power system and market. The upgrading and strengthening of Europe's power grids is needed for it to fulfil its market integration and decarbonisation objectives. In the next decades no less than 45% of the electricity we consume will be generated from RES.

## ADVANCING EUROPE'S CLIMATE AGENDA

RES generation is often very dispersed and located in remote areas ( for example in offshore wind parks). More grid infrastructure is needed to connect this new capacity and smotthly transport large flows of renewable energy over long distance to the main demand centres (cities).

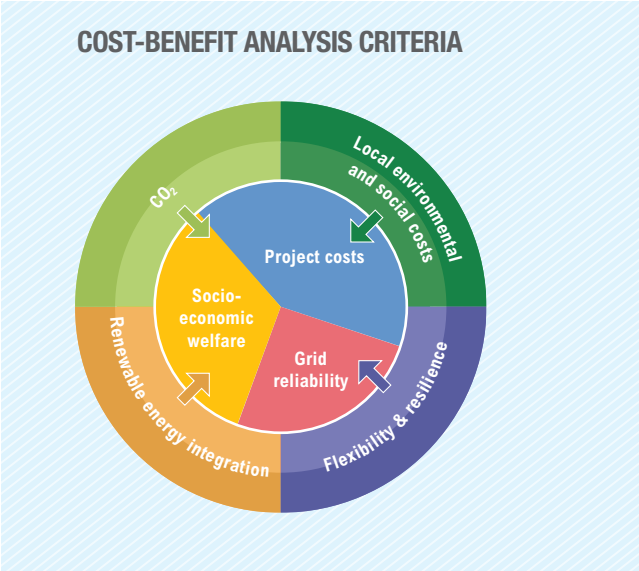
Other developments such as the growth of electric vehicles, energy storage, and pressure for higher enegy efficiency impact the European grid.

## MEASURING GRID BENEFITS FOR EUROPEANS

As per EU Regulation (EC) 347/2013 ENTSO-E has developed cost-benefit analysis (CBA) methodology to assess transmission and storage infrastructure projects of European significance. The methodology helps determine the main socio-economic benefits of grid: how they benefit Europe from an environmental, competitiveness, market integration, security of supply point of view.

After intensive consultation with interested stakeholders, including Member States, and taking into account the opinions of ACER and the EC. ENTSO-E submitted the final CBA methodology for approval by the EC in October 2014.

The first Europe-wide methodology for analysing electricity infrastructure projects was adopted in February 2015. It will be mandatory for use in future ENTSO-E Ten-Year Network Development Plans (TYNDPs). At the same time, work continues on further improvements to the methodology.



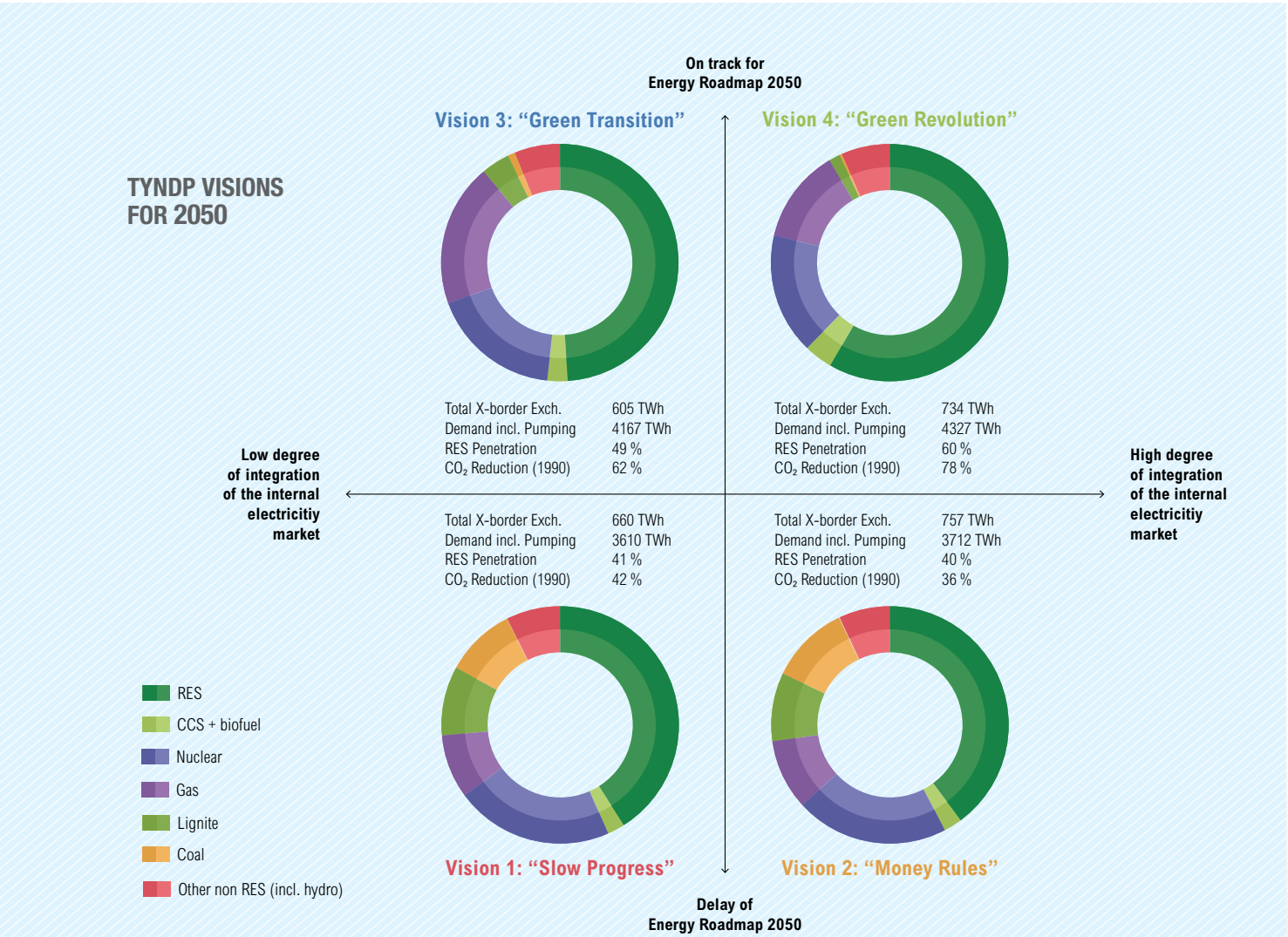

Following Regulation (EC) 347/2013, and starting from 2014 onwards, only projects included in ENTSO-E's 10-year network development plan (TYNDP) can be considered for selection as an EU project of common interest (PCI). These projects qualify for European support in the permitting process and/or financial incentives.

# TYNDP 2014: GREENING THE GRID

The TYNDP 2014 shows that all grid infrastructure projects benefit citizens twice as much as they cost. Grid expansion greatly contributes to solving the energy trilemma of security, affordability and sustainability.

The TYNDP is a key instrument of Europe's power policy. It is the only existing centralised reference for transmission and storage development projects of pan-European significance. Combining the expertise of TSOs and feedback from the entire electricity sector, the plan ranks network and storage development projects against common criteria (i.e. through common cost-benefit analysis and visions of the future of Europe's power system.)

Six Regional Investment Plans (RIPs) and the ENTSO-E Scenario Outlook and Adequacy Forecast (SOAF) 2014-2030, - a long-term assessment of Europe's system adequacy - complement the TYNDP report 2014. The TYNDP gives an objective analysis of what would be needed in terms of transmission infrastructure to achieve Europe's climate and integration objectives.



**CASE HISTORY**

TSOs: LITGRID (LITHUANIA), SVENSKA KRAFTNÄT (SWEDEN)

# THE NORDBALT INTERCONNECTOR

**In April 2014 a special ship off the coast of Lithuania began laying a cable under the Baltic Sea, one of the major stages in constructing the NordBalt interconnector - a 450 km HVDC link between Lithuania and Sweden.**

The project is being jointly implemented by the TSOs Litgrid and Svenska Kraftnät. The 700 MW link will ultimately be connected to DC converters at Klaipeda in Lithuania and Nybro in Sweden. The first 25 km metres of cable were laid on the sea bed in Lithuanian territorial waters, about 600 metres off the Curonian Spit near Alksnyne during the summer of 2014. Work resumed in April 2015 and the cable laying process is now finished.

The estimated cost of the NordBalt project is €552 million, funded by Lithuania, Sweden and the European Union.

The TYNDP 2014 looks at the time horizon of 2030. It thus bridges between the 2020 objectives and the 2050 roadmap for the decarbonisation of Europe's power system. This 2030 time horizon answers stakeholders' wish for longer-term contrasting scenarios of grid development.

As the TYNDP was being finalised, EU Member States committed to the EU's binding 2030 energy targets. Future editions of the TYNDP will continue thus to focus on this time scale.

All the scenarios used in the TYNDP 2014 assume the development of significant RES generation (supplying between 40% to 60% of total annual demand, depending on the vision) combined with a major reduction in $CO_2$ emissions (-40% to -80% compared to 1990). Following a favourable opinion by ACER in January 2015, the TYNDP 2014 was finalised with €150 billion of grid expansion.

Enhanced market integration will lower bulk power prices by some €2 to €5/MWh and enable a 20% mitigation in the sector's CO2 emissions by 2030. It will also ensure the change in the generation pattern with the increasing integration of RES. Less than 10% of the proposed project corridors cross protected or urbanised areas.

The TYNDP 2014 also highlights some 100 areas within the European grid where bottlenecks exist or may develop in the future if reinforcements are not implemented.

With the improved guidelines for including "third party" projects in the TYNDP 2014, ENTSO-E received 33 applications for transmission and storage projects, of which 21 were accepted.

# FINANCING TRANSMISSION INVESTMENTS

A stable regulatory framework is one of the prerequisite for European grid projects to be completed on time. Although these projects benefit the network as a whole by providing a net reduction in power supply costs, they represent large investments for individual TSOs which are more and more faced by an investment challenge.

TSOs are increasingly confronted with difficulties in securing investment plans to finance grid projects. Securing suitable investment plans is therefore key to their successful implementation.

In most EU countries, current regulatory frameworks largely focus on cost-efficiency. But without serious consideration of the long-term infrastructure investment finance issue, Europe may find itself unable to meet EU policy goals.

The challenge is not only limited to PCI projects, as TSOs are also required to deliver other investments as part of the TYNDP and national development plans. Policy and regulatory focus should therefore consider the entire investment portfolio.

In December, ENTSO-E's Economic Framework and Voluntary Finance Group addressed the issue through a policy brief entitled "Fostering Electricity Transmission Investments to achieve Europe´s Energy Goals - Towards a Future-looking Regulation".

The paper informs EU and national policy-makers, as well as NRAs, about the investment challenges faced by TSOs in financing network development projects. The paper goes on setting out a number of "ready-to-use" solutions that can be integrated into existing regulatory frameworks.


Photo: TenneT

To foster the necessary investments and make the associated tariff evolution sustainable, the regulatory framework should focus on creating a stable and predictable long-term risk-reward balance to offer more certainty to capital markets. It should also ensure that the solution is adequate to meet the size and pace of the investment challenge faced by TSOs. The paper is available: www.entsoe.eu.

# LOOKING AHEAD: THE TYNDP 2016

Initial development work for the next pan-European Ten-Year Network Development Plan (TYNDP 2016) started before the official release of the final TYNDP 2014 report.

Learning from the experience of the TYNDP 2014, ENTSO-E's development process for the TYNDP 2016 will include a number of improvements. Greater direct interaction with stakeholders will permit a more fluent exchange of information and internal reorganisation of project management at ENTSO-E will provide greater harmonisation and coordination of the activities and output of the more than 200 experts contributing to the plan.

The TYNDP 2016 package will also have a different focus between the Regional Investment Plans (RIPs) and the TYNDP report. The RIPs will be published during summer 2015 and concentrate on the regional planning studies and the identification of pan-European project candidates. The TYNDP report will be finalized at the end of the year and focus on assessment of the projects using the common CBA methodology and common scenarios and data sources.

In the same way as for the 2014 release, the TYNDP 2016 will focus on the 2030 timeframe, with four contrasting visions of the network defined in collaboration with stakeholders. To answer stakeholder request, ENTSO-E has also prepared a 2020 scenario representing an intermediate stage.

Collaboration with stakeholders has already started with several workshops in September 2014 and early 2015.

**CASE HISTORY**

TSO: NATIONAL GRID, (UNITED KINGDOM)

The 'T-pylon' is the winner of an international design competition to look for a 21st century design to carry high voltage overhead lines.

# REDUCING THE VISUAL IMPACT OF POWER LINES

**A study commissioned by British TSO National Grid has assessed 571 km of electricity transmission lines crossing some of the most treasured landscapes in England and Wales. The study is part of the Visual Impact Provision project, an initiative by National Grid that uses an allowance of £500 million from the regulator Ofgem to reduce the visual impact of high voltage power lines in protected areas.**

The study has shortlisted 12 areas in eight national parks or "areas of outstanding natural beauty" (AONBs) where existing overhead lines have the most visual impact. National Grid is currently carrying out feasibility work into potential major capital schemes to mitigate the visual impact of the lines at some of these locations. A variety of measures are being considered including replacement by underground cables, re-routing, and screening the lines from key public viewpoints.

The TSO also plans to use a part of the allowance for smaller localised projects which can be carried out in all national parks or AONBs with existing National Grid infrastructure.

Decisions about which of the shortlisted areas are to be taken forward will be made in Autumn 2015, following engagement with local stakeholders and further investigation of the technical feasibility and socio-economic, environmental, archaeological and heritage issues.

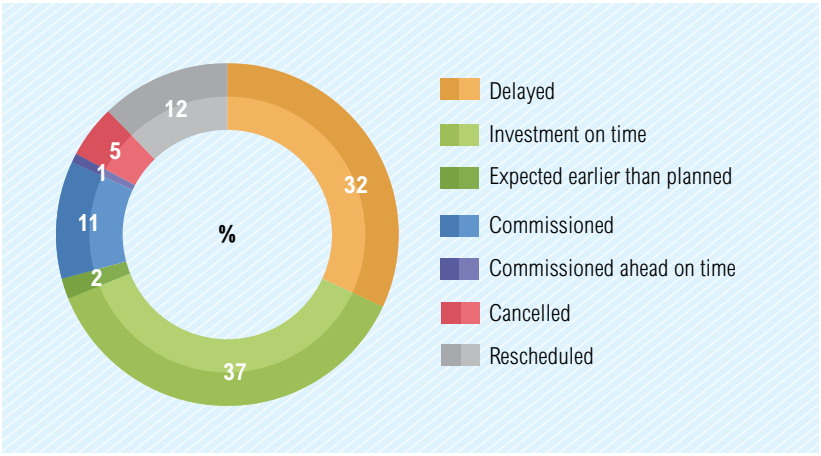
# TIME TO FAST-TRACK INFRASTRUCTURE

A major risk to grid development is the delayed completion of infrastructure projects. Connection of renewables needed to meet the 2020 targets and the realisation of the internal energy market are at risk. Time for an infrastructure push!

Although most stakeholders and consumers generally support grid developments that facilitate the changes needed within Europe's energy system, those directly impacted by the proximity of new power lines or by new generation facilities show a lower level of acceptance. Conflicts in project acceptance combined with lengthy permitting procedures regularly result in delays in commissioning new infrastructure.

Most of the projects in the TYNDP 2014 that have entered the permitting process have experienced some sort of delay (similar to the findings of the TYNDP 2012). ENTSO-E and member TSOs are therefore making a significant effort to inform local communities of the potential impact of new grid infrastructure and to collaborate with them in ensuring its smooth integration into the local environment.

If Europe's energy objectives are to be achieved, it is of the utmost importance to streamline current authorisation processes for transmission infrastructure and to gain active political support at all levels for its implementation. ENTSO-E welcomes Regulation 347/2013, which includes many positive elements regarding the permitting process, including proposals on one-stop-shops and defined timelines, is a step forward. ENTSO-E is calling for its full implementation in all Member States.




**CASE HISTORIES**

TSOs: LITGRID (LITHUANIA); MAVIR (HUNGARY)

# PROTECTING WILDLIFE

Moving protected species from under the path of power lines in Lithuania.

**A project by Lithuanian TSO Litgrid is safeguarding protected flora and fauna along the cross-border interconnector currently being constructed between the Lithuanian and Polish networks. Construction of the LitPol Link started in mid-2014 is scheduled for completion by December 2015.**

The TSO's Wildlife Protection project has three objectives: to ensure a ecologically viable way of safeguarding any protected species affected by construction of the link, to minimise its overall environmental impact, and to collaborate with environmental consultants and the local community to improve the monitoring of wildlife habitats.

Prior to construction, scientists from the TSO's Environmental Research Centre and the Lithuanian Fund for Nature conducted a detailed field study to identify the flora and fauna along the route and analyse any risk zones. The requirement to safeguard any protected species was subsequently included in the project's environmental impact assessment and technical specifications.

The study found that most of the construction corridor consisted of ploughed fields or pasture but identified some areas that needed special protection measures. For example, the early marsh orchid (dactylorhiza incarnata), which is on the Red List of threatened plant species in Lithuania, was found in the planned construction area. With the collaboration of a regional environmental protection department, this plant was therefore relocated to other areas that can provide its preferred wet, non-acidic soil.

Local monitoring of all the wildlife in the area is taking place during each phase of the power line's construction and will continue for the remainder of the construction period.


Installing diverters and nesting structures for local wildlife in Hungary.

**The objective of Hungarian TSO MAVIR's bird protection programme is to reduce the risks of power line infrastructure to vulnerable and rare bird species and to encourage an increase in their numbers.**

The core of the programme consists of using diverters to reduce the risk of local birds, such as great bustards and waders, colliding with power lines or pylons and the construction of special man-made nesting structures to discourage birds of prey, particularly saker falcons, from using pylons for this purpose.

The TSO has achieved significant results with both activities and regularly exchanges its experience with other conservation bodies. New diverter devices are in constant development and the nesting infrastructure has been shown to provide a safe, appropriate habitat for the falcons.

MAVIR cooperates with a number of national parks and NGOs in the programme. In addition to offering professional wildlife management, these organisations recommend further action to be taken in the area of protection.

# MARKET INTEGRATION

- LONG-TERM MARKET DESIGN
- DEMAND-SIDE RESPONSE
- REGIONAL MARKET DEVELOPMENT
- MARKET TRANSPARENCY

# LONG-TERM MARKET DESIGN

Meeting Europe's 2030 energy goals and the integration of 45% RES-generated electricity require new market thinking and operating methods. Market and network procedures, as well as energy consumers, need greater flexibility to maximise the benefits of the IEM. The challenge calls for substantial cooperation between policy-makers and stakeholders.

Investment in the network and new market dynamics need to be driven not only by physical network constraints but also by customer needs. Markets should signal the true value of electricity to consumers, reflecting features such as network capacity, resilience and security.

It is essential that this value is then translated into appropriate prices and incentives so that markets charge for supply according to its contribution (positive or negative) to overall system adequacy. Infrastructure development, including smart meters and smart grids, and continuous technological innovation will play an increasingly important part in this process.

## MARKET EFFICIENCY

The general principle behind an efficient market design is that its participants are adequately incentivised to solve network capacity and flexibility issues. RES should be fully integrated into the energy mix with its pricing fully reflecting network balancing costs. By setting the appropriate incentives for market participants to be in balance in real-time operation, demand for flexibility will occur naturally and traders, generators and end-users will all be able to contribute to system needs at lower cost.

Balancing mechanisms also need to be complemented by appropriate risk-hedging instruments. Allowing energy consumers to react to electricity prices, will allow them to save money, while also implicitly contributing to making the overall system more stable.

## ENTSO-E'S VIEWS

In the short term, ENTSO-E's policy paper on market design recommends that the target model be implemented as soon as possible. The current market model, however, needs to be modified to integrate renewables and demand-side response (DSR) into the markets.. TSOs also need to be able to assess technical network constraints in a coordinated way, complemented by ENTSO-E's overall adequacy assessment.

Over the medium term, the paper proposes that market incentives should encourage participants to take greater responsibility for system adequacy, particularly capacity and flexibility. In both cases, the market design needs to enable market participants to hedge their risks. These risk-hedging products need to be compatible across national borders.

By 2020, TSOs and ENTSO-E should be able to identify technical scarcities in the network at regional and European level via enhanced adequacy assessment. In parallel, national and regional capability hedging products (spontaneous or regulated) need to be incorporated into a consistent European model. Although the Electricity Balancing Network Code (NC EB) addresses imbalance pricing, its general settlement principles need to be modified accordingly.

# DEMAND-SIDE RESPONSE

Demand-side response (DSR) will play a major role in the market and all stakeholders, particularly policy-makers, DSOs and TSOs, need to cooperate closely to define clear market rules and responsibilities. By contributing to network balancing and congestion management, DSR benefits market security and flexibility. It also empowers consumers to more actively manage their electricity consumption.

Demand-side participation in electricity markets will enhance competition and liquidity at the same time as optimising utilisation of the network. In the long run, it will enable the reduction of system scarcities more cost-efficiently than alternative regulatory initiatives which may lead to over-investment in generation capacity.

However, implementation of DSR requires a concerted effort to develop and deploy sound data management and DSR-friendly products, market planning and operational standards. It will be a growing focus of DSOs' and TSOs' activities over the next few years.

## ENTSO-E'S VIEWS

ENTSO-E's developed a DSR policy paper in close consultation with stakeholders, including a bilateral meeting with Eurelectric (Union of the Electricity Industry in Europe) and a workshop with SEDC (Smart Energy Demand Coalition) and the Norwegian Energy company ENFO.

ENTSO-E's recommendations are:

- Setting out clear roles and responsibilities to facilitate the delivery of DSR and customer engagement;
- Development of a framework that optimises the use of DSR across multiple parties (i.e. DSR sharing), facilitated via a data-handling body (or bodies);
- Agreement on European network needs, security of supply and the development of network planning and operation standards to reflect the new network;
- Integration of DSR as a market participant on transparent terms, equitable with generation and storage;
- Adoption of a common European framework for DSR with regional and national settings.

**CASE HISTORY**

TSOs: STATNETT (NORWAY), ENERGINET.DK (DENMARK)

Laying the 500 kV interconnector cable.

# NEW SKAGGERAK 4 INTERCONNECTOR

**Skagerrak 4, the fourth HVDC interconnector between Norway and Denmark, started operation in December 2014. The 500 kV interconnector, built and operated by TSOs Statnett and Energinet.dk, increases energy exchange capacity between the two countries by 70% to 1700 MW.**

Skagerrak 4 has a capacity of 700 MW and VSC (Voltage Source Converter) stations at either end linking to the respective national grids. The converter stations are the first in the world to use VSC technology at this high voltage.

In addition to handling energy trade between the two countries in the day ahead and intraday markets, 100 MW of the interconnection capacity is allocated to the exchange of automatic restoration reserves. It is the first time in Europe that such capacity has been prioritized for this type of exchange.

The trade is based on an agreement between the Norwegian and Danish TSOs and Norwegian generators, who deliver their services to Denmark via the cable. The agreement ensures that the two countries' balancing resources are used in an efficient way, minimizing costs.

The interconnector will further strengthen the security of supply in Norway and Denmark as well as facilitate the increased production of renewable energy, contributing to a more climate-friendly energy system.

# REGIONAL MARKET DEVELOPMENT

In combination with the network codes, regional market development projects are essential to achieving the IEM. They complement the network code programme's top-down approach, encourage TSO cooperation, and bring a national and regional perspective to the European context.

As the representative of TSOs in Europe, ENTSO-E works closely with all the organisations involved in regional market development in order to achieve pan-European solutions and ensure consistency between regional projects and the corresponding network codes and guidelines.

The Capacity Allocation and Congestion Management guideline and the Forward Capacity Allocation network code establish a legal obligation to integrate the intraday (ID) and day-ahead (DA) markets in Europe and harmonise long-term, cross-border capacity allocation. The CACM guideline makes implementation of ID and DA market coupling mandatory for European TSOs and power exchanges (PXs).

Major regional market coupling projects in 2014 include the successful go-live in February of the North-Western Europe (NWE) DA price coupling project, implementing European PXs' price coupling of regions (PCR) model. The project covers TSOs and PXs in Belgium, France, Germany, Luxembourg, The Netherlands, Denmark, Sweden, Finland, Norway, Latvia, Lithuania, Estonia and Great Britain, as well as the Swepol link between Sweden and Poland. The NWE project is the pilot for implementing DA market coupling throughout Europe.

In May, the South Western Europe (SWE) project involving TSOs and PXs in France, Spain and Portugal joined the NWE project, which was renamed the Multi-Regional Coupling (MRC) project. The MRC activities represent an important step towards realisation of the IEM.

The Italian Borders Working Table (IBWT) and Swiss Northern Borders (SNB) projects, including TSOs and PXs from Italy, France, Switzerland, Germany, Austria, Slovenia and Greece, successfully carried out integration and simulation tests and were technically ready to also join the MRC project in December. The IBWT joined the project in February 2015, while SNB is subject to an agreement between the EC and the Swiss authorities.

The 4M project went live in November 2014. The day-ahead, price coupling project based on available transmission capacity (ATC) covers the Czech, Slovak, Hungarian and Romanian markets and follows the PCR model.

The Central-West Europe (CWE) project to introduce flow-based (FB) capacity calculation into the highly meshed region successfully performed the parallel run. The nine parties involved include TSOs from France, Belgium, Luxembourg, Germany and the Netherlands, and two PXs. Although implementation was postponed due to specific supply risks in Belgium over the winter, the flow-based methodology went live on 20 May 2015.

The NWE-CEE (Central East Europe) flow-based project is currently working on implementation of the FB model into the CEE region (Austria, Czech Republic, Germany, Hungary, Poland, Slovakia and Slovenia) and then couple with the NWE region to introduce FB price coupling in a single step. The memorandum of understanding between all the parties involved was signed by eight TSOs, seven PXs, seven NRAs and ACER in February 2014 and a common project structure set up by the TSOs and PXs.

The I-SEM Region (Ireland-Northern and Ireland-GB borders) started the design phase of the MRC project in 2014 with a target of joining the project at the end of 2016.

TSOs and PXs continued their joint work on developing the Cross-Border (XB) European Intraday platform. In 2014, TSOs increased their participation in the project and, although there have been several delays in the contract with

the provider of the Europe-wide platform, the project is now in its final stage with delivery of the platform expected in 2015. ENTSO-E has created the Advancing Towards Market Integration Coordination Group (DICOG) to follow the various DA, ID and capacity calculation projects across Europe and facilitate their coordination and the exchange of information between regions. In addition, the group will assume the coordination role required by the CACM guideline, as many of its activities will be elaborated at a regional level.

# MARKET TRANSPARENCY

A significant step in the construction of the IEM was achieved in January 2015 with the go-live of ENTSO-E's Transparency Platform. The platform is central to achieving market transparency. The requirements for the platform are set out in Regulation (EC) 543/2013 on the submission and publication of data in electricity markets.

A level playing field, where all market participants - big and small, incumbents and new entrants, businesses and individuals - have free and equal access to fundamental data and information on pan-European wholesale energy generation, transmission and consumption, has now become a reality: the new ENTSO-E Transparency Platform provides this access.

The work on the platform, which started more than a year ago, intensified in 2014. Alongside the technical implementation of the platform, ENTSO-E finalised the corresponding manual of procedures in early 2014. This gives data providers, TSOs and end-users technical guidance on the platform and allowed initial migration to the new web interface in 2015.

At the time of the launch, the platform was already receiving 80,000 data files per day from data providers and data owners, including generation companies, power exchanges, capacity allocation offices, TSOs, market balancing operators, DSOs and large consumers. Since then, new data has continuously come on-line and the great majority of data is now being reported as required.

Data providers and ENTSO-E are working constantly to improve the processes and systems to ensure timely and consistent publication of data, with regular maintenance fixes implemented as required. A second release of the platform takes place in June 2015, including technical requirements for the REMIT reporting which will begin in October.

# TSO REGIONAL AND EUROPEAN COOPERATION

- TSO COOPERATION: THE ENERGY UNION AHEAD
- REAL-TINE DATA EXCHANGE
- COMMON GRID MODEL
- THIRD-PARTY SYNCHRONOUS OPERATION
- INTEROPERABILITY OF SYNCHRONOUS AREAS
- RESTORATION RESERVES IN THE NORDIC AREA
- ENTSO-E ACADEMY
- INCIDENT CLASSIFICATION SCALE

# TSO COOPERATION: THE ENERGY UNION AHEAD

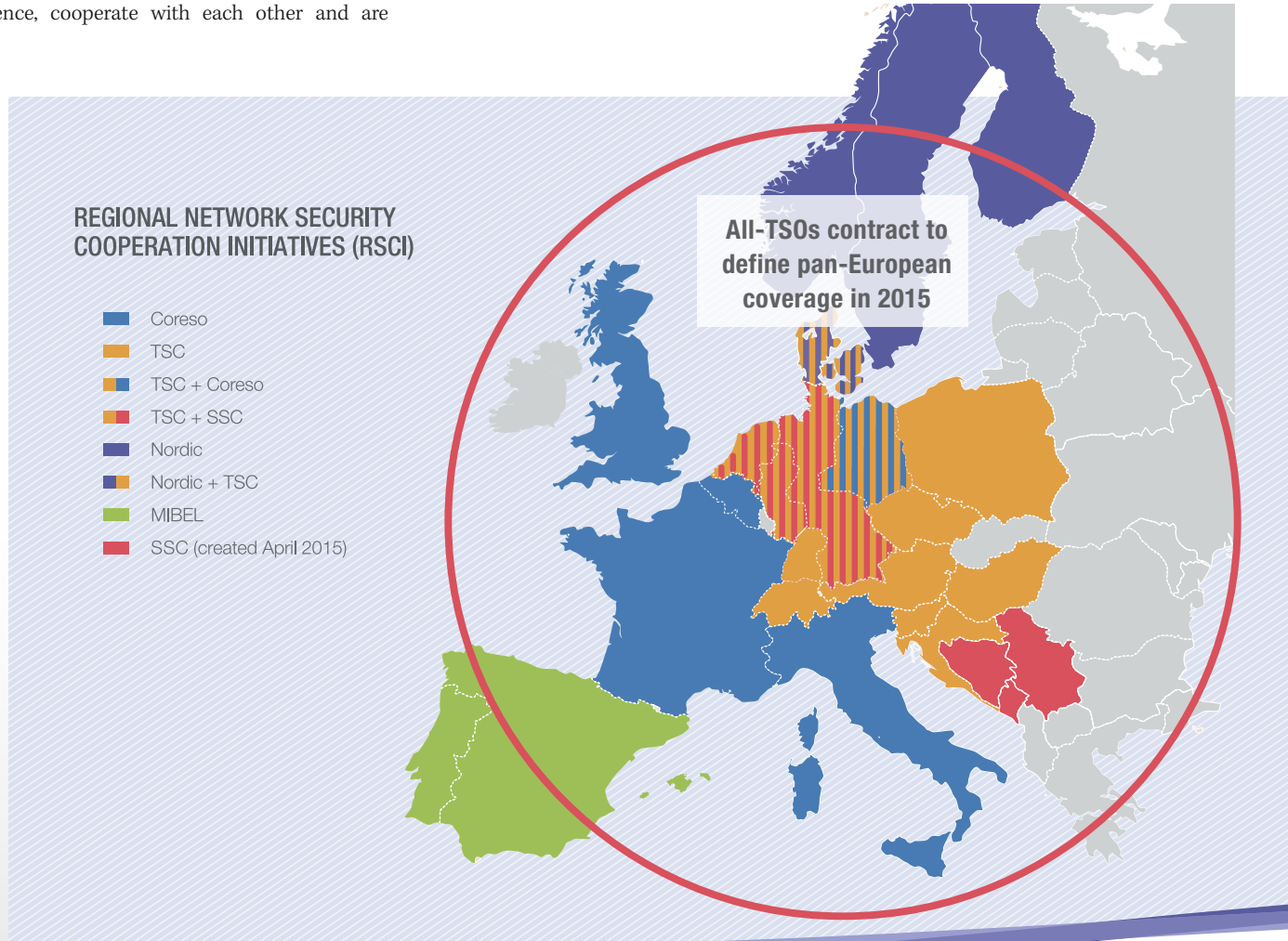
Changes in technical energy demand have resulted in significant modifications to established network operational practices and in the need for even greater cooperation among TSOs to maintain the security and quality of the network supply that consumers expect. ENTSO-E is helping TSOs to meet this challenge.

ENTSO-E has analysed the coordination of TSO operation across Europe and developed a strategy for further cooperation based on the experience of the network's Regional Security Coordination Initiatives. The strategy is described in the policy paper released by ENTSO-E in November 2014.

Regional Security Coordination Initiatives (RSCIs), such as Coreso (Coordination of Electricity System Operators), SSC (Security Service Centre), TSC (Transmission System Operator Security Cooperation), MIBEL (Mercado Ibérico de Energia Eléctrica) and Nordic, already play a key role in the harmonisation of TSO practices in many parts of Europe. These initiatives have several years' experience, cooperate with each other and are recognised as important contributors to the overall security of the network.

ENTSO-E TSOs have therefore decided to ensure the increased coordination of their activities by making TSO participation in a RSCI mandatory. Essential coordination functions will be organised through existing or new RSCIs, from which TSOs will procure common services. Typical services include:

- → analysis of network security (including remedial action-related analysis);
- → short and medium-term adequacy forecasts;



- coordinated capacity calculation;
- outage planning coordination;
- improved individual/common grid model delivery.

A TSO multilateral agreement will be the basis for deploying the ENTSO-E strategy, which will enable rapid implementation of cross-border practices and guarantee geographical coverage and consistency. ENTSO-E is currently working on the development of the multilateral agreement with the aim of finalising it in 2015.

### ENTSO-E AWARENESS SYSTEM

The ENTSO-E Awareness System (EAS) has now been operational for more than a year. It allows TSOs to monitor real-time information on the state of the European network and provide rapid assistance or take other measures if a particular area appears to be under stress.

All five European synchronous areas are now displayed on the EAS and it has been successfully used to display "alert" states in several TSOs due to weather-related events and indicate possible issues with the generation margin.

After its initial operation, the EAS's processes and procedures are now being analysed for their further development and harmonisation and to ensure they meet the final requirements of the network codes. During the year, the EAS was demonstrated to the EC, ACER and other stakeholders as the successful completion of one of the original projects required by Regulation 714/2009 and the network codes.

# REAL-TIME DATA EXCHANGE

The security and availability of information on ENTSO-E's electronic highway (EH) real-time data exchange network has continued to improve in 2014 through the joint efforts of its EH and Cyber Security working groups.

The backbone of the EH has been upgraded to 10 Mbps and the lines encrypted throughout the whole ENTSO-E area except for the Baltic and parts of South-East Europe.

The Albanian TSO OST has been successfully connected to the highway and a dedicated team is currently working with Turkish TSO TEIAS to verify its compliance with the EH's technical requirements. The EH working group is also in contact with the RSCI organisations Coreso and TSC in order to identify their current interchanges over the highway and future needs.

After analysis of different alternatives to the EH for market-related business processes, ENTSO-E has decided to suspend this project.

**CASE HISTORY**

TSOs: ELIA (BELGIUM), RTE (FRANCE)

# PROJECT LIFE

**Project Life, launched in 2011 by Belgian and French TSOs Elia and RTE, combines safety with biodiversity in a multi-partner approach. The five-year project to create green corridors under overhead electricity lines in wooded areas of Belgium and France is partly financed and monitored by the European Commission.**

The project encourages innovative land management techniques and wherever possible relies on local partnerships to reach its objectives. Environment-friendly techniques include restoring forest edges and planting orchards, managing vegetation growth by mowing or grazing with farm animals, sowing wildflower meadows, and restoring peat bogs and moorland. Digging ponds provide natural habitats for rare species such as dragonflies and amphibians, directly enriching biodiversity.

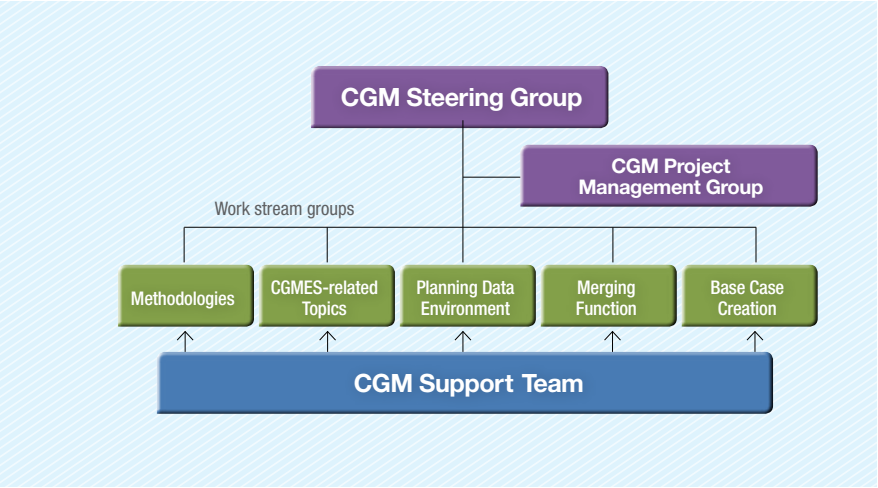
The project team uses a variety of communication tools such as conferences, meetings, displays, leaflets and newsletters to promote a better understanding of their conservation efforts with all those interested in the electricity network and the environment. These cover public and private land owners, administrators, governmental bodies, hunters, farmers and environmental NGOs, as well as the general public. The team has also built partnerships with 16 other European TSOs.

The Project Life team released in June 2015 a financial cost-benefit analysis on the project in June 2015, clearly comparing the value of its activities with conventional network vegetation management practices, as well as a report documenting European best practice.

# COMMON GRID MODEL

ENTSO-E is preparing guidelines for the creation of a pan-European Common Grid Model (CGM) to support operational planning, scheduling and capacity allocation. This includes the definition of scenarios, the collection of data from TSOs and other grid users, and TSO preparation of individual grid models. This information will be finally collected and merged to create the CGM.

ENTSO-E's CGM project team is currently developing methodologies for the exchange of grid model and associated information to support TSO implementation of the common processes defined in the four system operation network codes.




The team has focused its activities on developing the exchange of "steady state" grid models using the CGMES to support coordinated outage planning, operational security assessment and capacity calculation processes. During 2014, five main work streams - Methodologies, CGMES-related Topics, Operational Planning Data Environment, European Merging Function, and Base Case Creation - have been identified and incorporated into the organisation of the project.

Because of the many interdependencies between the different work streams, dedicated CGM steering and management groups, backed by an ENTSO-E CGM support team, have been set up. These have defined the scope, deliverables and timeline of each work stream package and work started on their realisation.

# THIRD PARTY SYNCHRONOUS OPERATION

System extensions enable the connection of external networks to one of ENTSO-E's synchronous areas. The benefits are increased network security and lower costs for energy consumers resulting from efficiencies in transmission, reserve power and system balancing.

Reserve power and system balancing are particularly important when it comes to intermittent RES generation. As the synchronous area becomes larger, it gains access to more reserve power so the network can be operated with the same level of security at a reduced cost. It is therefore worth commenting on the progress of the Continental Europe synchronous area's interconnections with the Turkish and Albanian networks (operated respectively by TSOs TEIAS and OST), as well as work on integrating the Kosovo* system (operated by KOSTT) and analysing the feasibility of synchronous connections with the networks of Ukraine and Moldova.

## TURKEY

The Turkish network has been connected to the Continental Europe synchronous area since September 2010, the beginning of a trial parallel interconnection originally foreseen for a one-year period. However, due to technical problems within the Turkish system, the trial operation needed to be extended. The system's satisfactory compliance with the ENTSO-E Continental Europe regional group's operational standards was reached in autumn 2013.

This group and the ENTSO-E System Development Committee's Continental South East group jointly decided on the Turkish system's permanent synchronous operation with the Continental Europe area in April 2014.

In April 2015 TEIAS signed a long term agreement (LTA) with the Continental Europe TSOs, in which it agrees to adhere to their operational standards and ensure that its market transactions are carried out in line with the requirements of the Third Energy Package.

## ALBANIA

The Albanian power system has been synchronously connected to Continental Europe since 1986. The TSO OST was created in 2004 to manage the system and committed to upgrade it in order to join UCTE (the predecessor of ENTSO-E in Europe). This required OST's compliance with the Continental Europe synchronous area's operational standards.

In 2009, a catalogue of technical and system performance operational standards was defined and agreed with OST. The agreement initially aimed at OST's full compliance within two years but, due to delays in project implementation beyond OST's direct control, this period was extended to May 2014 with an updated catalogue of measures. OST reached satisfactory compliance with these at the beginning of 2014.

In April, the ENTSO-E Continental Europe and Continental South East regional groups agreed the system's permanent synchronous operation with the Continental Europe area. This was followed in December by an LTA between the TSOs and OST.

## KOSOVO*

In September 2013, the political representatives of Belgrade and Pristina agreed an arrangement whereby the KOSTT (Kosovo*) energy network was separated from that controlled by Serbian TSO EMS. This was followed in February 2014 by a framework agreement between KOSTT and EMS to implement the arrangement through a number of separate arrangements including an operating agreement based on the operational standards and requirements of the ENTSO-E Continental Europe regional group's "Operation Handbook".

NB: Kosovo is not recognised by every EU member state and has no seat at the United Nations. Use of the name Kosovo* is based on the 2012 "Asterisk agreement" between Belgrade and Pristina, which allows the state to represent itself as such at all regional meetings.


TIRANA

Photo: © Drilon BIÇOKU

This agreement, signed in September 2014, allowed ENTSO-E to approach KOSTT and officially start the process leading to its compliance with the operational standards of the Continental Europe synchronous area.

As a first step, in autumn 2014 KOSTT was asked to carry out a self-assessment of its compliance with the standards, with any areas of non-compliance becoming the basis of a connection agreement with the TSO. This agreement, which will list the areas of non-compliance and task KOSTT to implement appropriate corrective measures, is expected to be signed in 2015. ENTSO-E has set up a project group to monitor KOSTT's activities and provide the necessary technical support and advice.

## UKRAINE AND MOLDOVA

The idea of synchronously connecting the Ukrainian and Moldovan networks with the Continental European area dates from the early 2000's, with UCTE approving analysis on the possibility of synchronous interconnection in 2006. The terms of reference for a feasibility study to assess the technical, regulatory and operational requirements for full integration of the two power systems were approved by UCTE in 2008.

In September 2009, a group of ENTSO-E TSOs, coordinated by Romanian TSO Transelectrica, created a consortium to elaborate the feasibility study. The following year, however, Ukraine and Moldova declared that they did not have the necessary funds for the study, so activities were put on hold until a new source of funding was found.

After exploring various solutions, the governments of Romania, Ukraine and Moldova took the decision to seek finance under one of the EU's new ENPI (European Neighbourhood and Partnership Instrument) initiatives - the Joint Operational Program Romania/Ukraine/Moldova 2013-2017. Following EC funding approval in autumn 2013, the Moldovan Ministry of the Economy started negotiations with members of the consortium on a service contract to undertake the feasibility study. This contract was signed in November 2014.

The results of the feasibility study are expected at the end of 2015. ENTSO-E's Continental Europe regional group will then take the decision on whether, how and when to start the interconnection process.

# INTEROPERABILITY OF SYNCHRONOUS AREAS

To help counter instances of system frequency deviations, ENTSO-E's Interoperability between Synchronous Areas (ISA) working group continued its activities on the network control opportunities provided by HVDC interconnectors between different ENTSO-E synchronous areas.

During 2014, the working group updated its guidance on the operation of HVDC interconnectors. It also ensured that information from studies such as Continuous Ramping (CR) was made available to TSOs. This included an interactive workshop in September on how advanced control opportunities via HVDC links can improve network operation, as well as offer market-related benefits.

## CONTINUOUS RAMPING

In 2013 the group established a task force to investigate the feasibility of using continuous flow change (ramping) on HVDC interconnections between synchronous areas.

The current ramping restriction on each HVDC interconnector between ENTSO-E's Nordic and Continental Europe (CE) areas is 600 MW/hour, with a ramping time of 10 minutes either side of the hour shift. With CR this timeframe is extended to 30 minutes before and after the hour shift, with a maximum ramping rate of 20 MW/min and a flow change of 1200 MW.

The aim of relaxing the restrictions is to improve the quality of the system frequency in both areas, as well as to increase capacity in the day-ahead market. Faster network flows from the low to the high price area on the interconnectors make better use of price differences.

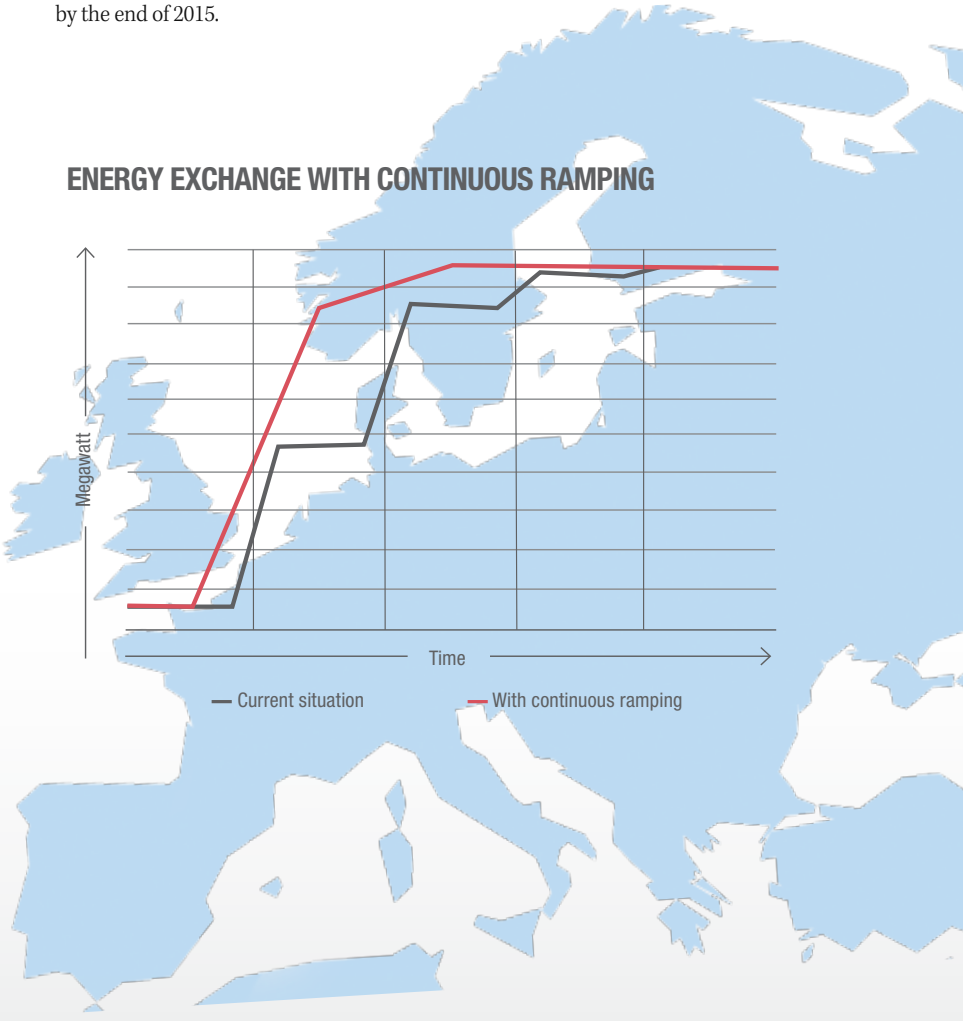
In February 2014, the taskforce released its technical report on controlling network imbalances with CR and proposals for further studies on its impact on the day-ahead, intraday and balancing markets.

It recommended that 15 minute generation scheduling should be developed in the Nordic area and the effects of ±5 minute and ±30 minute ramping further investigated in Continental Europe. The aim is to find a global technical and market solution for existing and planned Nordic-CE and Nordic-Baltics HVDC connections.

Because of the complexity of these studies it was decided to launch a pilot project on the Skagerrak link between Norway and Denmark and the AC border connection between Denmark and Germany to analyse the impact of CR on TSO power exchange transactions and balancing processes.

The project also allows analysis of CR's impact on network operation in terms of frequency deviation and localised phenomena such as voltage profiles and congestion management.

Completion of the pilot project is foreseen for 2015, with the full CR study expected to provide technical and market solutions for all Nordic HVDC connections by the end of 2015.

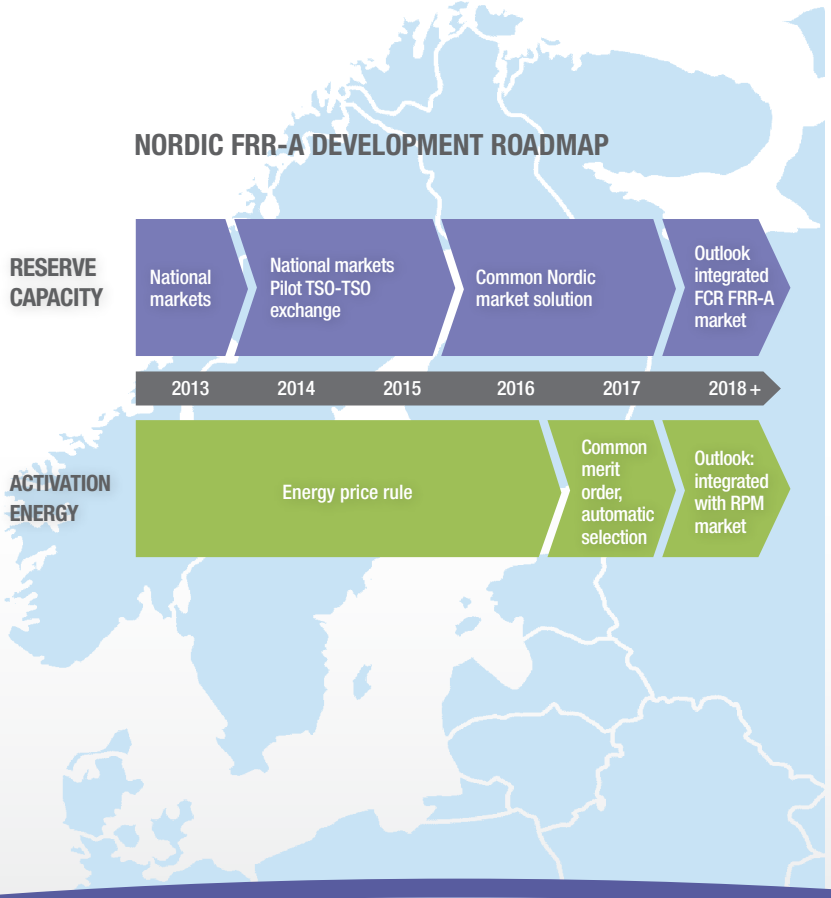


# RESTORATION RESERVES IN THE NORDIC AREA

TSOs in the Nordic synchronous area first identified the use of restoration reserves as a way to improve its decreasing frequency quality in the area in 2011. After an initial technical investigation, they decided to adopt the use of automatic frequency restoration reserves (FRR-A) rather than the usual frequency containment reserves (FCR-N) to make the required frequency improvements.

The Nordic TSOs set about procuring 250-400 MW of FRR-A within the area to create a common restoration reserves market that would deliver greater restoration capability at a lower cost. Their objective is to implement a Nordic FRR-A capacity market by 2016 and a Nordic FRR-A energy activation market by 2017.

FRR-A capacity in the region is currently procured on a national basis, so their goal is to establish common procurement backed by sufficient cross-border transmission capacity between the different countries. Four work streams were set up: market design and implementation, congestion management, cost sharing (cost distribution for the energy activation market) and FRR-A capability.




After finalising the target model in 2012, the TSOs started joint FRR-A procurement the following year. Several tests were carried out during 2013 but for most of the time only 100 MW was procured, which was distributed according to FCR-N sharing keys. 250 MW was procured in a test in 2014, but only for the hours when the FRR-A gain was estimated to be the highest.

## CONGESTION MANAGEMENT

One of the main challenges for cross-border (XB) FRR-A exchange is to handle network congestion. As FRR-A capacity is procured prior to real time, XB capacity must also be acquired in this time frame.

One option is to reserve capacity on XB transmission lines. This method is permitted by the network codes, provided that it demonstrates socio-economic efficiency, and is currently being tested in the Hassle pilot project between Sweden and Norway which started in October 2014.

Another option is the probabilistic solution also mentioned in the network codes, although it is not suitable for highly congested XB transmission lines. According to this method, the required capacity is estimated based on past experience. Real-time counter-trade is then used to guarantee it.

The Nordic Market (MSG) steering group and System Operation Nordic (RGN) regional group decided in autumn 2014 that further development of FRR-A within the area should be handled through a formal project structure, with a programme manager answering to a combined FRR-A steering group. This structure is now in place.

# ENTSO-E ACADEMY

The ENTSO-E Academy has continued its activities to assist member TSOs in developing their knowledge sharing, education and training support activities.

The Academy's activities enable system operation technicians such as operators, trainers and experts to share experience; promote mutual support for training, technical solutions and Europe-wide concepts and tools; facilitate the exchange of lessons learnt; and offer system operation networking opportunities. Two workshops were held in 2014 with high TSO participation and excellent feedback.

British TSOs National Grid and Scottish Power organised a two-day workshop on Wide Area Monitoring Systems (WAMs) and Use of Phasor Measuring Units (PMUs) in Edinburg in June. The event provided a good opportunity for sharing existing and future operating practices between different synchronous areas and isolated systems.

The workshop on Forecasting Real Time Renewables and the Management of Imbalances organised by Danish TSO Energinet.dk took place in Copenhagen on September 16 and 17. Topics ranged from forecasting solar power to its impact on balancing and ancillary services.

Throughout the year the Academy has also been involved in the collection and selection of common training materials to be translated into English and then turned into templates. Materials reviewed and consolidated have been made available in May 2015 to ENTSO-E Member TSOs.

# INCIDENT CLASSIFICATION SCALE

In addition to producing its annual Incident Classification Scale (ICS) report on the network incidents that took place in 2013, in 2014 ENTSO-E's ICS working group updated its methodology for the classification of incidents. The new methodology is used for classifying incidents in 2015.

ENTSO-E's development of the ICS methodology is mandated EU Regulation (EC) 714/2009. Its aim is to define the severity of network incidents as well as the scope and content of the annual ICS report.

The group submitted its Incident Classification Scale Methodology (ICSM) 2014 to ACER in June 2014. According to ACER, the methodology meets the objectives of non-discrimination, effective competition, and the secure functioning of the internal market. The Agency also stated that, in addition to network performance, the ICSM ensures effective monitoring of the efficiency and appropriateness of the majority of the provisions of the system operation network codes.

The objective of the methodology is to achieve full harmonisation between the ICS and the ENTSO-E Awareness System's reporting of the state of the European network and take into account key performance indicators (KPIs) from the network codes. This last feature will be available after full implementation of the codes.

The ENTSO-E annual ICS report is a collation of the reports prepared by each TSO, classified according to the ISCM and appraised at synchronous area level. The 2013 Report covers all 41 ENTSO-E member TSOs, across 34 countries. It was approved by the System Operation Committee in September 2014 and submitted to ACER at the end of the year.

# RESEARCH DEVELOPMENT & INNOVATION

- RD&D COORDINATION
- SET PLAN INTEGRATED R&D ROADMAP
- EUROPEAN ELECTRICITY GRID INITIATIVE ROADMAP
- TSO R&D PROGRESS
- ENTSO-E R&D IMPLEMENTATION PLAN
- SHARING R&D KNOWLEDGE
- REGULATORY FRAMEWORK FOR INNOVATION YET TO COME

# RD&D COORDINATION

Coordinated TSO Research & Development facilitates the deployment of new technology and is playing a major role in the ability of the European network to meet its low carbon objectives. Regulation (EC) 714/2009 and Directive EC/72/09 charge ENTSO-E with promoting and coordinating these activities.

While TSOs propose and undertake their own research, development and demonstration (RD&D) projects in collaboration with partners such as universities, consultants and other research organisations, ENTSO-E does not conduct any R&D of its own. ENTS-E's role is to facilitate collaboration and interaction between TSO projects and promotes the implementation of R&D advances in TSOs' daily operations.

ENTSO-E's R&D Roadmap 2012-2023 provides its vision of the network R&D projects that need to be addressed over the next ten years to meet the EU's energy and environmental objectives. It is supported by the annual ENTSO-E R&D Implementation Plan, which provides the basis for project proposals within the European Energy Research and Innovation (EERI) programme.

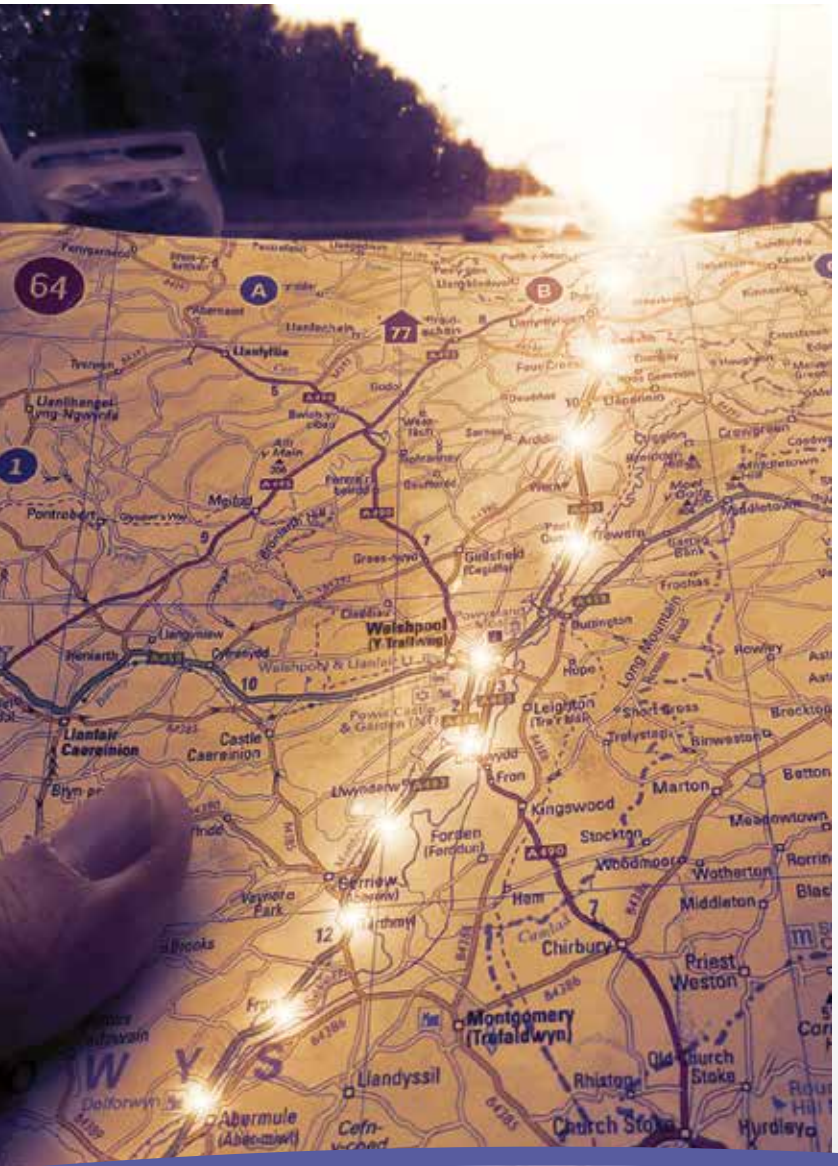
The ENTSO-E Roadmap and Implementation Plan also provides ongoing input into other research, development and innovation initiatives affecting TSO operations, such as the EC's Strategic Energy Technology (SET) Plan Integrated R&D Roadmap and the European Electricity Grid Initiative's (EEGI) R&D Roadmap, as well as other R&D projects undertaken by technology providers and stakeholders.

Photo: National Grid

# SET PLAN INTEGRATED R&D ROADMAP

Fifteen months after launching the development process for the SET Plan Integrated R&D Roadmap, the European Commission presented its summary document "Towards an Integrated Roadmap: Research & Innovation Challenges and Needs of the EU Energy System" at the SET Plan conference in Rome in December 2014. The roadmap reflects input from more than 100 stakeholders from across the energy sector.

ENTSO-E actively contributed to the SET Plan Integrated Roadmap through its own R&D Roadmap and R&D Implementation Plan 2015-2017 in order to ensure that TSOs' R&D priorities were aligned with those of the integrated roadmap.




The Roadmap prepared by the European Commission puts customers at the centre of the system and its first priority looks at how their needs may be met through market transformation, the adoption of new technology, and new products and services. The second priority focuses on enhancing Europe's energy-use efficiency: in buildings, heating and cooling systems, industry, etc.

The third priority is energy system optimization. This is crucial for ENTSO-E as it covers modernisation of the network and includes the development of a framework for R&D activities enabling synergies between the electricity network and other energy networks, alternative energy carriers (such as hydrogen) and energy storage systems. The focus is placed on flexibility, security and cost-effectiveness. While the EC's Smart Cities and Communities initiative will ensure the development of holistic systems at a local level, energy system optimisation will be based on regional and pan-European R&D.

The document's fourth priority relates to securing a cost-effective, clean and competitive energy supply and covers renewable electricity, heating and cooling systems, nuclear energy, carbon capture and storage (CCS), and the development of biofuels, fuel cells, hydrogen and alternative fuels. The final priority relates to cross-sector activities such as education and socio-economic data to support policy-making and innovative financing schemes.

The roadmap development process continues in 2015. The Energy Union provides the broad framework for this activity through its research and innovation (R&I) pillar to which ENTSO-E has also provided input. The SET Plan Integrated R&D Roadmap will now form the basis for future biennial work programmes under the EC's Horizon 2020 R&I framework programme.

**CASE HISTORY**

TSO: ELERING AS, ESTONIA

# EMERGENCY RESERVE POWER IN ESTONIA

**An innovative 250 MW emergency reserve power plant has been commissioned in Estonia by local TSO Elering. Inaugurated in October, the plant is the first of its kind in the region, increasing the security of supply of the Estonian network in case of an emergency.**

Situated at Kiisa near the outskirts of the capital Tallinn, the plant does not generate electricity on a daily basis. However, it is on constant standby for the Estonian market and ready to start up in case of a failure in the country's interconnections or in other power plants serving the grid. It reaches full capacity in less than 10 minutes. It consists of two independent 110 MW and 140 MW generating units based on piston engines, which are connected to the grid via 110 kV and 330 kV overhead lines respectively. Both units run on natural gas or light fuel oil.

According to Elering's estimates, Estonia will need emergency power reserves generated by the units for about 200 hours a year. Since they were taken over from the constructor Wärtsilä Finland in early July, they have already proved their worth. According to the TSO, they have been used repeatedly during local system failures, as well as in neighbouring countries, and have helped considerably in ensuring the security of supply in Estonia.

At €135 million, the project is Elering's biggest investment so far. The project is partly sponsored by the European Investment Bank. More information about the Kiisa plant and its technical features can be found on the Elering website: http://elering.ee.

# TSO R&D PROGRESS

R&D is still relatively new for many TSOs and their R&D resources are often limited, but steady advances have been made in 2014 in reaching the objectives of the ENTSO-E R&D Roadmap. Identification of R&D gaps has allowed research priorities to be assigned in the ENTSO-E R&D Implementation Plan 2015-2017.

ENTSO-E's R&D monitoring report provides a summary of the 38 R&D projects related to TSO operations. These are split between European and national projects that are funded either by the EU, Member States or individual TSOs. Specific details on each of the projects can be found in the latest ENTSO-E R&D monitoring report on the ENTSO-E website: www.entsoe.eu.

Many of the technologies and operational techniques proven by completed projects are now being integrated into TSOs' daily operations, where they are improving system operation and capacity, reinforcing network forecasting and control, and improving operating competencies across Europe. Some highlights are given below.

## DYNAMIC LINE RATING

Thanks to the Ewis project, British TSO National Grid adopted dynamic line rating (DLR) technology to provide extra capacity on selected transmission lines. The TSO has now expanded its use of DLR throughout its network. At the same time, TenneT TSO B.V. in the Netherlands has started using the technology to reduce dispatching costs on some of its 150 kV lines. Several Ewis-based recommendations were also included in Polish TSO PSE's national development plan.

The Twenties project demonstrated that Europe's existing network could handle larger amounts of wind infeed by combining DLR with power flow controllers to alleviate local congestion. Almost all the technologies demonstrated by Twenties are now being used in normal control centre operation (e.g. Belgian TSO Elia uses DLR and DLR-based forecasting and Spanish TSO REE employs overhead line controllers and real-time thermal rating).

## HVDC GRIDS

Results from Twenties on HVDC grids are being used in interconnector projects between France and Spain (INELFE) and between France and Italy (Piémond-Savoie). The Twenties project also demonstrated that additional R&D was required to overcome interoperability issues in multi-vendor,

multi-terminal grids where particular technical specifications are required to ensure HVDC grid performance in transient regimes and to prevent adverse interactions between terminals and devices. The Best Paths project is now tackling some of these issues.

## TSO OPERATING COMPETENCIES

Many R&D project results have been adopted in national control centres. The forecasting tool and mobilisation of reserves procedure from Anemos Plus has enabled Portuguese TSO REN to increase operating transparency and quantify the additional reserves needed with wind generation. REN has also used the results of Windgrid to link its national control centre with its renewables centre to control output from individual wind farms.

Both REN and REE have applied the results of Merge to enhance their reserve power planning. The software tool simulates demand scenarios with different levels of development of electric vehicles, providing information about their impact on the Iberian network. Analysis of demand in 2020 and 2030 has shown that the networks in both countries are robust enough to integrate the number of vehicles expected.

In Italy, TSO Terna plans to apply the results of Icoeur in the development of new automatic procedures for its Energy Management System (EMS) tools for analysing network stability and security. In France, results from Pegase have been already applied by TSO RTE. Most notably, many of the advances in the algorithms for time-domain simulation were implemented in the Eurostag simulation software and are now used in operational studies.

As a result, studies on the complete Continental European network are more common, removing the limits and uncertainties associated with dynamic network equivalents.

## BROADER INDUSTRY BENEFITS

TSOs' R&D projects have also benefited other stakeholders, regulators, industry and society at large. For example, EWIS has enabled both stakeholders and the general public to benefit from a reduction in CO2 emissions and more environmentally-friendly products.

In addition, the EWIS results improved NRAs' understanding of the need to harmonize the network codes and encouraged to use more transparent and effective development processes including cost-benefit and system needs analyses (CBA).

Twenties has enabled cost-benefit analysis of the electrical power system as a whole, rather than from a particular TSO's business perspective. The project has also ensured that the application of the new technology does not undermine current network reliability and security standards.

Interest in Realisegrid's multi-criteria CBAs is expanding and, depending on further European development of grid methodologies, its implementation is possible. Project participation has increased knowledge within the electricity sector and allowed stakeholder comparisons, as well as fostering communication among TSOs and other partners.

## NEW R&D DIRECTIONS

Completed R&D projects have also opened up new direction for research. Pegase led to projects such as Umbrella and iTesla, which aims to integrate many of its modules into a single prototype suite. RTE also continues to exploit the results of Pegase to improve its simulation tools and some of the ideas demonstrated by the project have been used in research on digital substations.

The Market4RES project which investigates evolution of the Target Model to integrate European markets into the IEM is a follow-up of Optimate. The IEE-funded project will identify steps to implement policy, legislation and regulation across the different market timeframes.

# ENTSO-E R&D IMPLEMENTATION PLAN

ENTSO-E developed its R&D Implementation Plan 2016-2018 after assessing the Horizon 2020 Work Programme 2015-2016 and the development of the SET Plan Integrated Roadmap. A stakeholder consultation was held in Q1 2015 and the plan published shortly thereafter. ENTSO-E will align the plan with the SET Plan smart grids and energy storage initiative at a later date.

Since the launch of ENTSO-E's previous R&D Implementation Plan 2015-2017, the political environment has changed significantly. The EU set new 2030 targets for RES, emissions reduction and energy efficiency in October 2014 and the European Council has agreed that Member States should ensure 10% interconnector capacity by 2020, arriving at the EC target of 15% by 2030.

The new Horizon 2020 R&D Work Programme defines calls for proposals that are very broad in scope so their alignment with specific TSO R&D objectives is harder to achieve. However, both the Horizon 2020 programme and the SET Roadmap focus on a cross-sectorial approach which ENTSO-E welcomes as a necessary step towards fully integrated markets based on all types of generation.

The ENTSO-E R&D Implementation Plan 2016-2018 describes in detail the projects planned for 2016 and outlines suggested topics for 2017 and 2018. They take into account the ENTSO-E Roadmap, gaps in projects versus Roadmap targets, the SET Plan Roadmap, TSO expectations, national and individual R&D programmes and resource limitations.

R&D topics for 2016 focus on increasing network integration of storage, demand-side response and balancing and ancillary services:

- **Topic 1** (Fast Storage) stems from the rapid technological advances in this area; it is important that TSOs follow these closely in terms of performance and time-to-market to maximise the possibilities for their application;
- **Topic 2** (Innovative Control Systems) aims at the development of more advanced control tools that enhance network security by allowing risk-free operation closer to operational limits;
- **Topic 3** (Monitoring Tools) targets improved knowledge of component life in order to improve network performance in terms of quality and security of supply;
- **Topic 4** (Demand-Side Response) is the combination and updating of two previous projects on market inputs and increased collaboration between TSOs and DSOs.

The R&D Implementation Plan 2016-2018 also features the regulatory options envisaged by ENTSO-E and TSOs in cooperation with ACER and National Regulatory Authorities.

By considering the top-down guidance provided by the SET Plan Roadmap and the Horizon 2020 framework and the bottom-up needs of TSOs, ENTSO-E has sought to determine the R&D priorities to achieve European energy policy targets for the benefit of TSOs and system users alike.

# EEGI R&D ROADMAP

The European Electricity Grid Initiative (EEGI) R&D Roadmap covers both transmission and distribution networks, providing a detailed account of DSO R&D. ENTSO-E is a member of the EEGI and has actively contributed to discussions with DSOs, Member States and the EC on smart grids to ensure that core TSO R&D priorities and objectives are defined in a consistent way.

Future EEGI activities are being financed by DG Energy via a tender process defined in its document "Support to R&D strategy in the area of SET Plan activities in smart grids and energy storage".

Following the call for tenders in August 2014, ENTSO-E and three TSOs (REE, RTE and REN) acting as subcontractors are part of the winning consortium formed by Technofi (project coordinator), EDSO for Smart Grids, (EDSO-SG) EASE (European Association for Storage of Electricity) and energy companies RSE and Vito. The consortium started the work in December 2014 within the Grid + Storage project.

ENTSO-E's involvement in the project is strategic, as it will provide a framework for adapting the ENTSO-E R&D Roadmap and Implementation Plans over the next two years to the new EC Horizon 2020 Roadmap. Deliverables will cover both TSO and DSO networks and electricity storage. The aim is to move from a sectorial approach to one with more integrated solutions.

The project will prioritise transmission, distribution and storage R&I needs, ensure knowledge-sharing, and review energy system R&D projects at European and global levels.

# SHARING R&D KNOWLEDGE

In 2014, ENTSO-E has participated in several R&D knowledge sharing and dissemination activities targeted at a wide range of stakeholders. These activities aim at ensuring the European network's continued technological advancement.

The Gridinnovation knowledge-sharing platform (www.gridinnovation-on-line.eu) is an online database featuring a virtual library of R&D articles structured in a systematic way to allow advanced search and optimal navigation.

Three types of article are available on the platform:

- State-of-the-art: very latest project information within a roadmap cluster or functional objective;
- Project: general project descriptions linked to related articles;
- Knowledge: devoted to one specific result, describing the new knowledge gained.

The platform focuses on packaging R&D project results under advances in knowledge, rather than providing an interactive map of existing projects. It is intended to be efficient and simple to navigate.

Appropriate processes are being implemented to operate and maintain the platform as a pivotal tool for replicating promising technological advances across Europe.

In 2014, ENTSO-E also published a number of papers in the Institute of Electrical and Electronics Engineers (IEEE) "Power and Energy" magazine.

### INNOGRID2020+ CONFERENCE

After the success of the 2014 edition, ENTSO-E partnered with EDSO for Smart Grids to organise the Innogrid2020+ Conference in March 2015. The conference focused on smart grid research, development, demonstration and innovation. Presentations, panel sessions and debates on project funding, regulatory frameworks, deployment solutions, market design, system resilience and flexibility enable participants to share knowledge and best practice.

# REGULATORY FRAMEWORK FOR INNOVATION YET TO COME

Although the need to test new technical solutions to optimise system development and operational procedures are well recognised by TSOs and DSOs, the R&D roadmaps and implementation plans will not be realised without appropriate regulatory incentives to support R&D expenditure.

Based on a survey at the end of 2013 and earlier studies on the regulatory framework for TSO R&D, ENTSO-E has worked on an advocacy paper that covers development of the European R&D landscape.

TSO and DSO R&D relates to system development, optimisation of assets, network operation, market facilitation and system technology. The next step for the R&D roadmaps, starting in 2015, is the integration of R&D on storage technology, which can provide an important input to network flexibility.

However, R&D carried out by network operators has often not been considered a necessity by many European and national legislators and regulatory authorities. Often, the methodology applied to calculate their remuneration does not take into account R&D expenses. In addition, as a regulated industry, they have limited access to the commercial benefits of implementing innovations.

When there is no explicit mechanism to cover R&D expenses, these are usually considered to be operational costs, recoverable through the normal tariff. Although the Third Energy Package requires NRAs to ensure that TSOs and DSOs are given the incentives they need to support R&D expenditure, five years after its adoption only five EU countries explicitly consider transmission system R&D expenses in their tariff structures.

This creates a disconnection between the EU's ambitions for Europe's electricity grid and the R&D required to prepare the network for the future. Intensive discussions at all levels, from the EC and ACER to member state NRAs, are necessary to examine the issues and create a significant improvement in the financial support mechanisms for TSO and DSO R&D.

Placing consumers at the core of European power system is paramount. Transmission and distribution network R&D activities that are financed through a combination of suitable tariff mechanisms, national or European R&D funds, and TSOs and DSOs own financial resources will ensure the development of a future energy system in Europe to meet their needs.

# APPENDICES

# ENTSO-E WORK PROGRAM STATUS - END 2014

| Deliverable | Goal | Status - end 2013 |
|---|---|---|
| **Progressing and delivering network codes - Connection** | | |
| Network code on Requirements for Generators (NC RfG) | Deliver to ACER draft binding EU legislation for generation connection to underpin system development fit for the future<br><br>Support ACER Opinion and Comitology phases | Network code prepared by EC for formal Comitology |
| Network code on DSO and Industrial Load Connection (NC DCC) | Deliver to ACER draft binding EU legislation for demand connection to underpin system development fit for the future<br><br>Support ACER Opinion and Comitology phases | Network code prepared by EC for formal Comitology |
| Network code on HVDC Connections (NC HVDC) | Deliver to ACER draft binding EU legislation for HVDC connections to underpin system development fit for the future | Draft network code in written consultation |
| **Progressing and delivering network codes - Market** | | |
| Network code on Capacity Allocation and Congestion Management (NC CACM) | Deliver to ACER draft binding EU legislation for market integration, especially allocating capacity in the day-ahead and intra-day timeframe, for calculating the levels of available cross border capacity, and for allocating and recovering costs<br><br>Support ACER Opinion and Comitology phases | |
| Network code on Forward Markets (NC FCA) | Deliver to ACER draft binding EU legislation for forward market integration | ACER opinion received in Q4 2013 |
| 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 | |
| **Progressing and delivering network codes - System Operations** | | |
| Network code on Operational Security (NC OS) | Deliver to ACER draft binding EU legislation for operational security based on TSO coordination<br><br>Support ACER Opinion and Comitology phases | Submitted to ACER end of Q3/2013. ACER reasoned opinion for adoption by EC issued in Q4 2013.<br><br>Awaiting Comitology |
| Network code on Operational Planning and Scheduling (NC OPS) | Deliver to ACER draft binding EU legislation for operational planning and scheduling based on TSO coordination<br><br>Support ACER Opinion and Comitology phases | Submitted to ACER end of Q3/2013. ACER reasoned opinion for adoption by EC issued in Q4 2013.<br><br>Awaiting Comitology |
| Network code on Load-Frequency Control and Reserves (NC LFCR) | Deliver to ACER draft binding EU legislation for the definition and dimensioning of reserves and for load- frequency control, based on TSO coordination and the requirements for generators<br><br>Support ACER Opinion and Comitology phases | Submitted to ACER Q3/2013. ACER reasoned opinion for adoption by EC issued in Q4/2013<br><br>Awaiting Comitology |

| Deliverable & AWP 2014 completion (quarter/year) | Internal & external consultation | Status - end 2014 Comments/explanations |
|---|---|---|
| Comitology expected to conclude in 2014 | Written consultation in Q1/2012 - continuous consultation mainly via User Group | Network code in Comitology |
| Comitology expected to conclude in 2014 | Written consultation in Q3/2012 - continuous consultation mainly via User Group and DSO Expert Group | Network code in Comitology |
| Submission to ACER for Opinion Q2/2014 | Written consultation in Q4/2013 - continuous consultation mainly via User Group | Code submitted to ACER for opinion and ACER recommendations published in Q2/2014<br>Network code prepared by EC for formal Comitology |
| End Q3/2012<br>Comitology expected to conclude in Q1/2014 | Q1-Q2/2012 | NC CACM adopted in Comitology in Q4 2014 |
| Comitology expected to conclude in Q1/2015 | Written public consultation in Q1-Q2/2013<br>Additional consultation via Stakeholder Advisory Group Q1-Q3/2013 | ACER recommendations published in May 2014 |
| Submission to ACER for opinion in Q1/2014<br>Comitology expected to conclude in Q1/2015 | Q2/2013 | Submitted to ACER for Opinion Q1/2014, re-submitted in Q3/2014 |
| Comitology expected to begin Q2/2014 | Q3-Q4/2012 | Awaiting Comitology |
| Comitology expected to begin Q2/2014 | Q4/2012 | Awaiting Comitology |
| Comitology expected to begin Q2/2014 | Q1/2013 | Awaiting Comitology |

# ENTSO-E WORK PROGRAM STATUS - END 2014

| Deliverable | Goal | Status - end 2013 |
|---|---|---|
| Network code on Emergency & Restoration (NC ER) | Deliver to ACER draft binding EU legislation on procedures and remedial actions to be applied in the Emergency, Blackout and Restoration states. | n/a |
| **Planning & delivering Europe's future energy networks - Ten-Year Network Development Plan (TYNDP), system adequacy reports** | | |
| Adequacy reports | Build scenarios for the TYNDP 2014 and deliver the Scenario Outlook & System Adequacy Forecast 2013 | Published 4 April 2013 |
| | Summer Outlook 2013/Winter Review | Published 30 May 2013 |
| | Winter Outlook 2013/2014/Summer Review | Published 28 November 2013 |
| TYNDP 2014 | Prepare the 2014 TYNDP with common market and network models to derive the trends, needs and future development of the transmission network at pan-European level | Process ongoing towards the delivery of the TYNDP 2014 for consultation during the summer 2014 |
| 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 | n/a |
| Cost-benefit analysis in the context of energy infrastructure legislation | Deliver methodologies for cost-benefit analyses of transmission infrastructure (TYNDP; Projects of Common Interest) for a pragmatic and comprehensive approach to drive policy, incentives and investment decisions | Methodology submitted to ACER and EC for opinion in Q4/2013 |
| **Planning & delivering Europe's future energy networks - public acceptance for power infrastructure, financing** | | |
| Public awareness campaigncoordinated between EC, ENTSO-E and TSOs | Definition, proposal and launch of a campaign, aimed at EU citizens, that reconnects people with electricity and how it is delivered to their community, so they recognise the need for power infrastructure to maintain or enhance living standards | In April 2013 the EC released a tender for a pilot project on public acceptance of grid infrastructure. Successful tenderer appointed and project commenced in Q3 2013<br>Expected completion Q2 2014 |
| Permitting and public acceptance of best practice | Collection and consolidation of best practices on activities related to permitting and public acceptance processes. This work will be informed by other activities undertaken by TSOs in various external relationships as well as stakeholder input within the Long-Term Network Development Stakeholder Group | Report on main environmental issues associated with electricity transmission projects finalised in Q1 2014 |
| 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 | |

| Deliverable & AWP 2014 completion (quarter/year) | Internal & external consultation | Status - end 2014 Comments/explanations |
|---|---|---|
| | | Mandate delivered by the EC on 1 April 2014 |
| | Four stakeholder workshops held in Q2-Q3/2014 and Q1/2015.<br>Two public consultations in Q4/2014 - Q1/2015. | Preliminary working draft completed in June 2014, followed by consultation phase<br>New draft of the code prepared on the basis of the input received during the consultation process, submitted to ACER Q2/2015 |
| | | Scenario Outlook & Adequacy Forecast (SO&AF) 2014-2030 published on 3 June 2014 |
| Q2/2014 | | Summer Outlook Report 2014 and Winter Review 2013/14 published on 21 May 2014 |
| Q4/2014 | | Winter Outlook 2014/15 and Summer Review 2014 published on 1 December 2014 |
| Q4/2014 | Consultation on TYNDP 2014 scenarios: Q4/2012 Long-Term Network Development Stakeholder Group: 2012-2014<br>TYNDP 2014 report submitted to web-based public consultation in Q3/2014 | TYNDP 2014 submitted to ACER for Opinion on 31 October 2014 |
| Preparation to begin in 2014 | Stakeholder engagement though workshops in 2014-2015 | Scenario and identification of investment needs/common planning studies has started and will continue in 2015 |
| Q3/2014 | ACER opinion received in Q1/2014, EC opinion in Q3/2014 | CBA methodology submitted to EC for approval in Q3/2014 |
| 2013 | | ENTSO-E will review the EC report and work on recommendations for future related work |
| | | |
| Follow-up of the EC study on possible guidelines on investment incentives, so that appropriate Europe-wide rules on incentives can be made binding | Seminar with stakeholders organized in Q4/2014 | Publication of a position paper and a policy Brief on "Fostering electricity transmission investments to achieve Europe's goals: towards a future-looking"- published in Q4/2014 |

# ENTSO-E WORK PROGRAM STATUS - END 2014

| Deliverable | Goal | Status - end 2013 |
|---|---|---|
| **Implementing and enhancing the internal electricity market** | | |
| Electricity Market Fundamental Information Platform (EMFIP) | Implementing the EC Guidelines on Fundamental Data Transparency in an integrated IT system for all of Europe | First draft of manual of procedures was published at the end of 2013. Preparation for first release of the new platform launched in early 2014 |
| Support and pan-European guidance to regional market integration developments | Ensure that regional developments continue to develop in a manner consistent with the overall EU Target Model. Establish a coherent vision for market integration | Creation of a new ENTSO-E Working Group to deal with regional projects on capacity calculation, day-ahead and intraday markets is ongoing. The group will facilitate the exchange of information and monitoring of different regional projects in these three areas. |
| Shaping discussions around the optimal design for the European electricity market | Proactively considering issues around market design and the creation and promotion of an effectively competitive market.<br><br>Propose solutions on RES support and design & implementation of capacity mechanisms | The Ad-hoc team on Long-Term Market Design is continuing its work to identify concrete market design options. The results of the work to be discussed with stakeholders starting in Q2 2014. |
| **Research and Development towards stronger and smarter grids including the e-Highway2050 project** | | |
| R&D Roadmap, R&D Implementation Plans | Foster TSO coordination on R&D, with strong links to the SET Plan and EEGI, by publishing and disseminating the R&D Implementation Plan 2016-2018 (yearly publication) | Preparation to begin in 2014 |
| Implementation of the R&D Plan/ R&D Roadmap | Monitoring and managing implementation of the R&D Roadmap 2013-2022: R&D Monitoring report (yearly publication)<br><br>Contributing in the Grid+ project activities | |
| Modular Development Plan on Pan-European Electricity Highways System - e-Highway2050 | Contribute to the e-Highway2050 R&D consortium, e.g. through the dissemination work package, so that the study becomes the definitive study on the methodologies and architecture (e.g. voltage levels) of the long-term future grid fit for 2050 goals | On schedule |
| **Enhancing TSO cooperation - coordination of network operation** | | |
| Electronic highway | Implement bandwidth upgrades to meet the increased challenges and coordination needs of the future, including the EAS | Upgrades in progress; further planned to be completed by Q2/2014 |
| Incident Classification Scale (ICS) | Implementation with ICS software and software upgrades | IDS methodology draft still under development (to be aligned with NC OS, NC OPS & NC LCFR) Expected Q2/2014 |

| Deliverable & AWP 2014 completion (quarter/year) | Internal & external consultation | Status - end 2014 Comments/explanations |
|---|---|---|
| 2014 | Regular stakeholder meetings in 2013 and 2014 with a public consultation on the manual of procedures before submission of the draft to ACER | The Transparency Platform went live on 5 January 2015<br><br>EMFIP data exchange implementation guide complete, maintenance to continue in 2015 |
| 2014 | | Go-live in Q2/2014 of the North-Western Europe and South-Western Europe day-ahead electricity markets.<br>4M MC go-live in Q4/2014.<br><br>Integration to continue in 2015 |
| Q3/2013 - Q1/2014 | Continuous dialogue with stakeholders and policy makers and consultation. | Market design policy paper published in Q3/2014.<br>Follow-up activities to be taken forward in 2015<br><br>Work to continue in 2015 |
| Q1/2015 | Q2-Q3/2014 | Publication in Q1/2015 |
| Q1/2015 (yearly Q1) | | Publication of R&D Monitoring Report 2014 in Q1/2015 |
| 2014, 2015 | 2014, 2015 | Several deliverables to be published throughout 2015 |
| Q2/2014<br>Consideration of alternative Electronic Highway for Market Business Processes in Q4/2014 | | Further upgrades planned for 2015 |
| ICS annual report 2013 Q2/2014<br><br>ICS update Q4/2014 | | ICS Annual report sent to ACER in Q4/2014<br><br>Updated ICS submitted to ACER in Q2/2014 |

# REPORTS & PUBLICATIONS

| | |
|---|---|
| December | ENTSO-E Yearly Statistics & Adequacy Retrospect 2013<br>Winter Outlook Report 2014/2015 and Summer Review 2014 |
| November | ENTSO-E Annual Work Programme 2014-2015 |
| September | ENTSO-E at a Glance - Who We Are and What We Do<br>ITC Transit Losses Data Report 2013<br>Report on Transparency of Electricity Market Data in the South-East Europe Region |
| July | ENTSO-E Overview of Transmission tariffs 2014 |
| June | Scenario Outlook & Adequacy Forecast (SOAF) 2014-2030 |
| May | Summer Outlook 2014 and Winter Review 2013/14 Report<br>Electricity in Europe 2013 |
| April | ENTSO-E Statistical Factsheet 2013<br>Annual Report 2013: TSO Cooperation and the Internal Energy Market |
| March | R&D Implementation Plan 2015-2017 |
| February | Report on European Style Market Interoperability Test 2013 |
| January | R&D Monitoring Report 2013<br>ENTSO-E Technical Report - Bidding Zone Review Process |

Further statistics and data are provided and updated regularly throughout the year on ENTSO-E's website: *www.entsoe.eu*

# POSITION PAPERS

| | |
|---|---|
| December 2 | Fostering electricity transmission investments to achieve Europe's energy goals: Toward a future looking regulation |
| November 27 | ENTSO-E Memorandum to the Juncker Commission |
| November 18 | ENTSO-E Policy Paper on Future TSO Coordination for Europe |
| October 08 | ENTSO-E Policy Recommendations to help achieve Europe's energy and climate policy objectives |
| September 15 | ENTSO-E Policy Paper on Market Design |
| September 15 | ENTSO-E Policy Paper on Demand-Side Response |
| August 22 | ENTSO-E Power System Vision and Action Paper |
| June 16 | ENTSO-E Response to ACER Consultation 'European Energy Regulation: A Bridge to 2025' |
| May 16 | ENTSO-E position on European Union policy framework for climate and energy in the period from 2020 to 2030 |
| April 1 | ENTSO-E Position on ACER Opinion about guideline for cost-benefit analysis of grid development projects |
| February 13 | ENTSO-E Response to the European Commission Consultation on the Draft Guidelines on Environmental and Energy Aid for 2014-2020 |

# WORKSHOPS

| | |
|---|---|
| December 4 | Discussion Seminar on Financing transmission investments |
| November 12 | Second Public Stakeholder Workshop on the Network Code on Emergency & Restoration |
| October 23 | Umbrella Workshop on System State Modelling and Toolbox Design |
| October 13 | ENTSO-E & ENTSOG Joint Information Session on the Completion of the IEM |
| September 16 | Public Workshop on Scenario Methodology for TYNDP 2016 |
| September 4 | Stakeholder Workshop on the TYNDP 2014 |
| July 9 | Public Stakeholder Workshop on the Network Code on Emergency & Restoration |
| June 18 | Stakeholder Workshop on Innovation and technologies for the deployment of meshed offshore grid (Horizon 2020 WP 2015- LCE5) |
| June 17 | Second Public Stakeholder Consultation Workshop on Adequacy Methodology |
| April 16 | Public Stakeholder Consultation Workshop on Adequacy Methodology |
| April 15 | Fouth Stakeholder Workshop on the eHighway2050 Project |
| March 31 | North Sea Regional Stakeholder Workshop on TYNDP 2014 and RIPs |
| March 27 | Continental South East Regional Stakeholder Workshop on TYNDP 2014 and RIPs |
| March 26 | Continental Central East Regional Stakeholder Workshop on TYNDP 2014 and RIPs |
| March 25 | Continental South West Regional Stakeholder Workshop on TYNDP 2014 and RIPs |
| March 21 | Public Stakeholder Workshop on Bidding Zones Review and Technical & Market Reports |
| March 20 | Public Stakeholder Explanatory Session on the Technical Report of the Bidding Zones Review |
| March 20 | Third Stakeholder Workshop on the eHighway2050 Project |
| March 20 | Continental Central South Regional Stakeholders Workshop on TYNDP 2014 and RIPs |
| March 18 | Baltic Sea Regional Workshop with Stakeholders on TYNDP 2014 and RIPs |
| March 7 | eHighway2050 Project - Stakeholder & TSO Workshop |
| February 26 | CBA methodology and tendering process workshop |
| February 6 | Joint Energy Community-ENTSO-E Workshop on Establishing a Regional Balancing Initiative in Southeast Europe |
| January 14 | Third iTesla/Umbrella Open Workshop - Innovative Tools for the Future Coordinated Operation of the Pan-European Electricity Transmission System |

# CONSULTATIONS

| | |
|---|---|
| December 15 - January 14 2015 | Network Code on Emergency & Restoration: market interactions and automatic low frequency control scheme |
| December 12 - January 23 2015 | Joint consultation with ACER on role of stakeholders in the implementation of network codes & related guidelines and the establishment of European Network Code Stakeholder Committees |
| October 13 - December 8 | Network Code on Emergency and Restoration |
| July 14 - September 19 | System Adequacy Methodology |
| July 10 - September 20 | Ten-Year Network Development Plan 2014 |
| July 4 - August 29 | ENTSO-E Draft Annual Work Programme 2014-2015 |

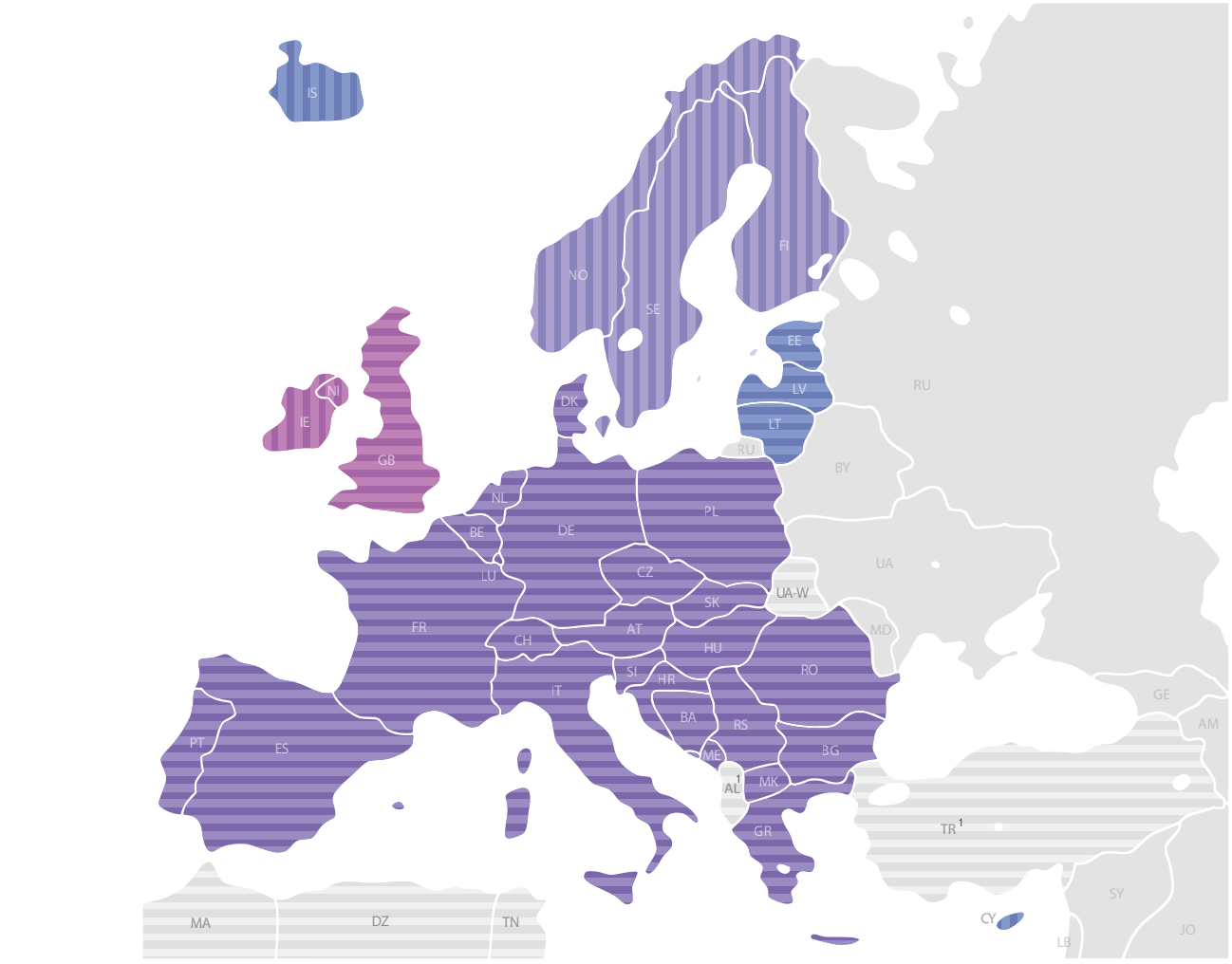
# ANNOUNCEMENTS & PUBLIC RELEASES

| | |
|---|---|
| December 15 | Yearly Statistics & Adequacy Retrospect 2013 is Released |
| | Public Consultation on Emergency and Restoration is Open |
| December 12 | Network Codes: Joint ACER/ENTSO-E Consultation on the Role of Stakeholders |
| December 9 | EU Energy Council: Network Codes Are Indispensable for Europe's Internal Electricity Market |
| December 5 | EU Member States Adopt Major Building Block of the Internal Energy Market |
| December 2 | How to Foster Investments in the Electricity Transmission System to Achieve EU Energy Goals |
| December 1 | ENTSO-E Winter Outlook 2014/15 Released |
| November 28 | SEE CAO Successfully Started its Operations for the Yearly Allocation of Cross-Border Capacity |
| November 27 | Czech, Slovak, Hungarian Power Market Coupling Extends to Romania |
| | ENTSO-E Memorandum to the Juncker Commission |
| November 26 | Ten European Gas and Electricity Associations Call for a Comprehensive Implementation of the EU Anti-VAT-Fraud Package by All 28 Member States |
| November 21 | ENTSO-E Work Enables the Low-Carbon and Competitive Energy Future - Conference Speakers Call for Consistent Political Support |
| November 17 | ENTSO-E Delivers Draft Annual Work Programme 2014-2015 to ACER |
| November 14 | ENTSO-E Assessment of the Adequacy Methodology Consultation is Released |
| November 7 | Request for Proposal on Test Configurations Maintenance and Review |
| November 3 | ENTSO-E Delivers Final Draft TYNDP 2014 Package to ACER |
| October 24 | 2030 Energy and Climate Goals only Possible with Sufficient Power Lines |
| October 22 | TYNDP 2014 Consultation Summary and Next Steps |
| October 20 | ENTSO-E Vision and Action Paper on Power System |
| October 15 | 2030 Interconnection Targets to Reflect Real System Needs |
| October 13 | Network Code on Emergency and Restoration: Public Consultation is Open |
| September 26 | ENTSO-E at a Glance – Who We Are and What We Do |
| September 25 | ENTSO-E Is Establishing the Harmonised Allocation Rules Stakeholder Advisory Group |
| September 23 | ENTSO-E Recommendations on Market Design and Demand Side Response |
| September 16 | ITC Transit Losses Data Report 2013 is Now Available |
| | ENTSO-E Delivers Improved Network Code on Electricity Balancing |
| September 8 | Transparency: 60% of South-East Europe Energy Market Data Published |
| August 20 | Have your Say: Contribute to ENTSO-E Public Consultations |
| August 4 | ENTSO-E Conducts Fifth CIM Interoperability Test |
| July 14 | Public Consultation on the Adequacy Methodology is Open |
| July 10 | Consultation Open on the Ten-Year Network Development Plan 2014 |
| July 8 | ENTSO-E Publishes 'Overview of Transmission Tariffs 2014' |
| July 4 | Public Consultation on the Draft Annual Work Programme 2014-2015 is Launched |

| | |
|---|---|
| June 24 | European Commission Launch Grid Infrastructure Communication Toolkit |
| June 16 | ENTSO-E Responds to ACER's 'European Energy Regulation: A Bridge to 2025' |
| June 13 | ENTSO-E Comments on 13 June Energy Council Conclusions |
| June 6 | Network Code on Emergency and Restoration Development is Underway |
| June 5 | ENTSO-E Launches a Tender on Cost Benefit Analysis for Electricity Balancing |
| June 3 | Scenario Outlook & Adequacy Forecast (SO&AF) 2014-2030 Published |
| May 22 | Join the ENTSO-E Bidding Zones Stakeholder Group<br>ENTSO-E Position on EU 2020-2030 Climate and Energy Policy Framework |
| May 21 | ENTSO-E Summer Outlook 2014 and Winter Review 2013/14 |
| May 15 | ENTSO-E Presents Work on Electricity Market Cost-Sharing Principles |
| May 13 | South-Western and North-Western Europe Market Coupling Project Go-Live |
| May 7 | New ENTSO-E Publication: Electricity in Europe 2013 |
| May 5 | Network Code on HVDC Connections Delivered to ACER<br>Turkey and Albania Electricity Transmission Systems in Permanent Synchronous Operation with Continental Europe |
| April 30 | Download the ENTSO-E Statistical Factsheet 2013 |
| April 15 | ENTSO-E Publishes Annual Report 2013 |
| April 11 | Contribute to the ENTSO-E Online Adequacy Methodology Survey |
| April 3 | ENTSO-E Resubmits Network Code on Forward Capacity Allocation |
| March 27 | ENTSO-E Market Committee Approves ITC Audit Results and 2013 Perimeter Fee |
| March 25 | InnoGrid2020+ Highlights Importance of R&D to Achieving EU Energy & Climate Policy Goals |
| March 24 | ACER Provides Reasoned Opinion on the Network Code on Electricity Balancing |
| March 21 | ENTSO-E Statement on the EC Framework on Climate and Energy 2030 |
| March 12 | ENTSO-E Survey on Ancillary Services Procurement and Electricity Balancing Market Design 2013 Released |
| March 4 | ENTSO-E Releases the R&D Implementation Plan 2015-2017 |
| February 19 | Regional Public Stakeholder Workshops on 2014 Ten-Year Network Development Plan |
| February 13 | ENTSO-E Welcomes EC Proposals on Environment and Energy Aid |
| February 11 | Report on Fourth ENTSO-E CIM for Market Interoperability Test is Available |
| February 4 | Go-live of NWE Project a Major Step towards an Integrated European Electricity Market |
| January 31 | ENTSO-E Publishes R&D Monitoring Report 2013 |
| January 29 | ENTSO-E Publishes Bidding Zone Review Technical Report |
| January 22 | ENTSO-E to Review Network Code on Forward Capacity Allocation |
| January 15 | The New ENTSO-E Transparency Platform (Release 1) is Launched |
| January 6 | ENTSO-E President Awarded CBE in UK's New Year Honours List |

# SYNCHRONOUS AREAS & GRID MAPS

## ENTSO-E SYNCHRONOUS AREAS




Continental Europe (CE) area

Baltic area

Nordic area

British area

Irish area

Isolated systems area

Synchronous with CE area

[1] Permanently connected to the Continental Europe area since April 2015.


## ENTSO-E GRID MAPS

ENTSO-E produces three grid maps - the interconnected network of ENTSO-E, the interconnected network of Continental Europe and the interconnected network of Northern Europe. The grid maps show power plants, power stations and substations, existing high voltage lines and lines under construction of voltages of 220 kV and more (and of 110 kV to 150 kV if they cross national borders).

Electronic versions of the maps can be downloaded from ENTSO-E's website at: **www.enstsoe.eu/publications/order-maps-and-publications/electronic-grid-maps**. Hard copies can also be ordered at: **www.enstsoe.eu/publications/order-maps-and-publications/printed-publications-and-maps**.

# ENTSO-E MEMBER TSOs

| COUNTRY | COMPANY | ABBREVIATION |
|---|---|---|
| AT \| Austria | Austrian Power Grid AG | APG |
| | Vorarlberger Übertragungsnetz GmbH | VÜN |
| 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 | TransnetBW |
| | TenneT TSO GmbH | TenneT GER |
| | Amprion GmbH | Amprion |
| | 50hertz Transmission GmbH | 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'électricité | RTE |
| GB \| United Kingdom | National Grid Electricity Transmission plc | National Grid |
| | System Operation Northern Ireland Ltd | SONI |
| | Scottish Hydro Electric Transmission Limited | SHETL |
| | Scottish Power Transmission plc | 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. |
| IE \| Ireland | EirGrid plc | EirGrid |
| IS \| Iceland | Landsnet hf | Landsnet |

| COUNTRY | COMPANY | ABBREVIATION |
|---|---|---|
| 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 | CGES AD |
| MK \| FYROM | Macedonian Transmission System Operator AD | MEPSO |
| NL \| Netherlands | TenneT TSO B.V. | TenneT NL |
| NO \| Norway | Statnett SF | Statnett |
| PL \| Poland | PSE S.A. | PSE |
| PT \| Portugal | Rede Eléctrica Nacional, S.A. | REN |
| RO \| Romania | C.N. Transelectrica S.A. | Transelectrica |
| RS \| Serbia | JP Elektromreža Srbije | EMS |
| 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 |

# 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. 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 (LRG) 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 managers 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 drafts 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 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 (LRG) advises all bodies across ENTSO-E on legal and regulatory issues. In addition, Expert Groups on Data, Network Codes Implementation and EU Affairs provide specific expertise and work products.

## ENTSO-E SECRETARIAT

The ENTSO-E Secretariat is based in Brussels and employs 69 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 well based on its Brussels location and communications expertise.

As the Organisation chart on page 84 shows, the Secretariat's structure mirrors the ENTSO-E Committee structure, with thematic and horizontal sections. Each section is headed by managers, supported by advisers and co-ordinators.

The overall ENTSO-E annual budget is detailed on page 83. ENTSO-E member TSOs contribute to the budget according to the number of countries and population served.

## ENTSO-E BOARD

Incoming Board as from 28/06/2015. ENTSO-E Board members in 2014 until 25/06/2015: Chairman, Pierre Bornard, RTE, France; Vice-Chair, Bente Hagen, Statnett SF, Norway; Peder Andreasen, Energinet.dk, Denmark; Varis Boks, AS Augstsprieguma tïkls, Latvia; Klaus Kleinekorte, Amprion, Germany; Thomas Karall, APG, Austria; Milos Mladenovic, JP EMS, Serbia; Piotr Rak, PSE, Poland; Ann Scully, EirGrid, Ireland; Andrés Seco, REE, Spain; Thomas Tillwicks, Swissgrid, Switzerland; Ben Voorhorst, Tennet TSO BV, The Netherlands

**Chair**

Bente Hagem
Statnett SF, Norway

**Vice-Chair**

Ben Voorhorst, TenneT
TSO B.V., The Netherlands

**Member**

Zbynek Boldis
CEPS, Czech Republik

**Member**

Kamilla Csomai
MAVIR, Hungary

**Member**

Matt Golding
National Grid, UK

**Member**

Thomas Karall
APG, Austria

**Member**

Klaus Kleinekorte
Amprion, Germany

**Member**

Piotr Rak
PSE, Poland

**Member**

Jukka Ruusunen
Fingrid, Finland

**Member**

Andres Seco
REE, Spain

**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 System
Operator, Belgium

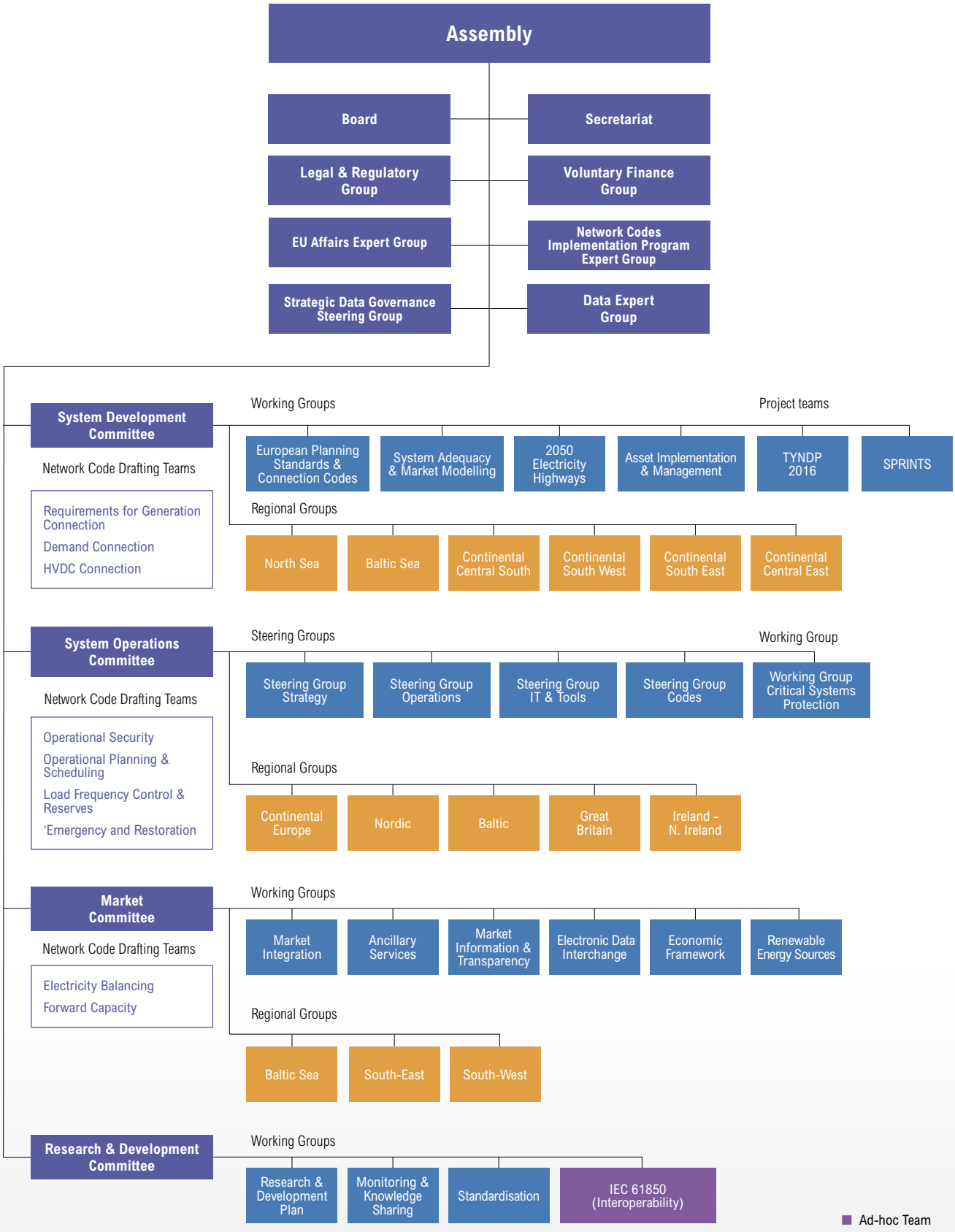
**Chair Research & Development Committee**

Carlo Sabelli
Terna, Italy

**Chair Legal & Regulatory Group**

Milan Roman
SEPS, Slovakia

# ENTSO-E STRUCTURE



# ENTSO-E BUDGET 2014

ENTSO-E is entirely funded through membership fees paid to the association by its member TSOs.
Its annual budget for 2014 was €17.7 million.

**PROFIT & LOSS OVERVIEW**

| December, 2014 | YTD Actual | YTD Budget | |
|---|---|---|---|
| All amounts expressed in €1,000 | 2014 | 2014 | |
| | A | B | A - B |
| **REVENUES** | | | |
| Member fees | 17,700 | 17,700 | 0 |
| Other incomes | 142 | 190 | -48 |
| **Total revenues** | **17,842** | **17,890** | **-48** |
| | | | |
| **EXPENSES** | | | |
| Events | -143 | -181 | 38 |
| Communication consultancies | -17 | -12 | -5 |
| Communication structure | -195 | -219 | 24 |
| Project & research | -2,171 | -2,774 | 602 |
| EMFIP project | -2,172 | -1,500 | -672 |
| Awareness System (EAS) project | -467 | -506 | 39 |
| Sub-total communications & project | -5,166 | -5,192 | 26 |
| Remunerations | -5,878 | -5,958 | 80 |
| Other staff costs | -771 | -721 | -50 |
| Administration & legal fees | -185 | -158 | -27 |
| Travel & accommodation | -101 | -106 | 5 |
| Renting & building charges | -685 | -679 | -6 |
| IT | -2,266 | -1,926 | -340 |
| Depreciations | -198 | -306 | 108 |
| Sub-total staff & infrastructure | -10,084 | -9,854 | -230 |
| Assembly & Board | -27 | -18 | -10 |
| Committee | -87 | -38 | -49 |
| Group | -348 | -379 | 32 |
| Sub-total meetings | -480 | -435 | -45 |
| **Total expenses** | **-15,731** | **-15,481** | **-250** |
| Financial & other results | 169 | 20 | 149 |
| **NET RESULT** (before contigency fund) | **2,280** | **2,429** | **-149** |
| Contingency fund* | -566 | -973 | 407 |
| **NET RESULT** (build up of reserve if positive) | **1,715** | **1,456** | **258** |

*Budget agreed by the Board on Nov 13, 2014 (€ 973,000 authorisation from € 2.2 million)

# ENTSO-E SECRETARIAT 2015

**Secretary General**
Konstantin Staschus

**Executive Assistant**
Kamila Pujan

**Manager System Development**
Robert Schroeder

**Manager Market**
Zoltan Gyulay

**Manager System Operations**
Steve Heather (seconded)

**IT Manager**
Kees de Jong

**Corporate Affairs Manager**
Susanne Nies

**Finance Manager**
Arnaud Scaramanga

**General Counsel**
Florence Melchior

**Resource Planing Manager**
Nick Frydas

**Research & Development Assistant**
Ioana Nedelcu

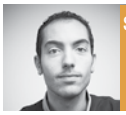
**Strategy & Research Senior Advisor**
Chavdar Ivanov

**DSO/DSR Senior Advisor**
Thong Vu Van

**System Development Coordinator**
Thanh-Thanh Le Thi

**Grid Development Senior Advisor**
Edwin Haesen

**System Planning Advisor**
Alban Joyeau (seconded)



**System Development Advisor**
Dario Consolato Frazzetta

**System Development Advisor**
Simone Biondi (seconded)

**System Development Advisor**
Alasdair Muntz

**Market Coordinator**
Valentina Siddi

**Market Senior Advisor**
Marco Foresti

**Programme Man. Advisor**
Marta Mendoza Villamayor

**System Operations Coordinator**
Pilar Munoz-Elena

**Regional Group Senior Advisor**
Alexander Mondovic

**Coordinated Operations Advisor**
Emmanouil Styvaktakis

**IT Assistant**
Cristina Danilov

**Data & Publication Coordinator**
Philippe Lagarrigue

**Data Management Advisor**
Eric Devillers

**Senior Application Lead**
Martin Kuijs

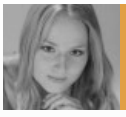
**Application Lead**
Christophe Montoisy

**Application Lead**
Ewelina Cupryn

**Communication Coordinator**
Léa Dehaudt

**Communication Advisor**
Claire Camus

**EU Affairs Advisor**
Michael Mieszczanski



**Reception Desk Coordinator**
Gwenaelle Ballesteros

**Human Resources Specialist**
Anne Fortané

**Office Support Assistant**
Jaqueline Wauters

**Legal Coordinator**
Chiara Gabrielli

**Legal Advisor**
Anne de Geeter

**Legal Advisor**
Nicolas Roger-Machart



**Resource Planning Advisor**
Bertrand Macabéo


As of 1/06/2015

# ABBREVIATIONS

| | |
|---|---|
| ACE | Area control error |
| ACER | Agency for the Cooperation of Energy Regulators |
| ATC | Available transmission capacity |
| CACM | Capacity allocation & congestion management |
| CBA | Cost-benefit analysis |
| CC | Coordinated calculation of capacity |
| CEER | Council of European Energy Regulators |
| CEMC | Coordination of EU market coupling |
| CEN | European Committee for Standardisation |
| CENELEC | European Committee for Electrotechnical Standardisation |
| CGM | Common grid model |
| CGMES | Common grid model exchange standard |
| CIM | Common information model |
| CORESO | Coordination of Electricity System Operators |
| DA | Day-ahead |
| DCC | Demand connection code |
| DSM | Demand-side management |
| DSO | Distribution system operator |
| DSR | Demand-side response |
| EAS | ENTSO-E awareness system |
| ebIX | European Forum for Energy Business Information Exchange |
| EC | European Commission |
| EDI | Electronic data interchange |
| EEGI | European Electricity Grid Initiative |
| EERI | European Energy Research & Innovation |
| EFET | European Federation of Energy Traders |
| EH | Electronic highway |
| EIP | European Infrastructure Package |
| EMS | Energy management system |
| ENTSOG | European Network of Transmission Operators for Gas |
| EP | European Parliament |
| ER | Emergency & restoration |
| ESMP | European-style market profile |
| EURELECTRIC | Union of the Electricity Industry in Europe |
| FCA | Forward capacity allocation |
| HVDC | High voltage direct current |
| ID | Intraday |
| IEC | International Electrotechnical Commission |
| IEM | Internal energy market |
| IOP | Interoperability |
| KPI | Key performance indicator |
| LFCR | Load-frequency control and reserves |
| NRA | National regulatory authority |
| OS | Operational security |
| OPS | Operational planning & scheduling |
| PCI | Project of common interest |
| PCR | Price coupling of regions |
| RES | Renewable energy source |
| RIP | Regional investment plan |
| RfG | Connection requirements for generators |
| SET | Strategic energy technology |
| SOAF | Scenario Outlook & Adequacy Forecast |
| SPS | Special protection scheme |
| SSC | Security Service Centre |
| TCA | Transmission capacity allocators |
| TSC | TSO Security Cooperation |
| TSO | Transmission system operator |
| TYNDP | Ten-Year Network Development Plan |

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