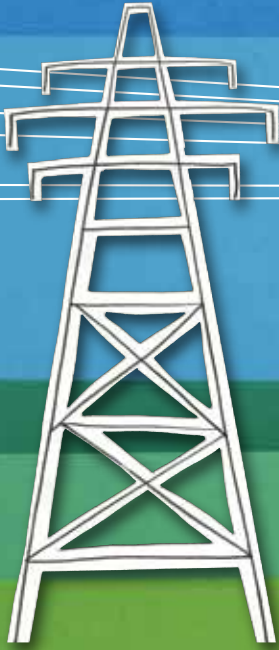
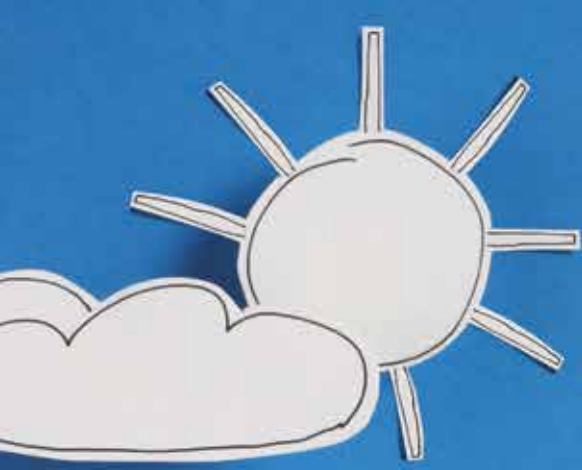


# ANNUAL REPORT 2012



## EUROPE'S LOW-CARBON CHALLENGE AND THE ELECTRICITY NETWORK



European Network of  
Transmission System Operators  
for Electricity

entsoe



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# ENTSO-E'S MISSION

ENTSO-E's role is to enhance cooperation between 41 national electricity TSOs from 34 countries across Europe in order to assist in the development of a pan-European electricity transmission network in line with European Union energy goals. Its specific aims are to:

- ensure the secure and reliable operation of the increasingly complex network;
- facilitate cross-border network development and the integration of new renewable sources of energy;
- enhance the creation of the Internal Electricity Market (IEM) through standardized market integration and transparency procedures.

ENTSO-E is responsible for creating common network operational tools (network codes), a Ten-Year Network Development Plan, recommendations for the coordination of technical cooperation between TSOs within the EU, and annual outlooks for summer and winter electricity generation.

## NETWORK CODES

ENTSO-E network codes follow framework guidelines defined by ACER, the Agency for the Cooperation of Energy Regulators. They set out the rules for European network operation and development, as well as market integration.

The codes are subject to transparent public consultation, followed by input from EU Member States and the EU Parliament via the Comitology process, before becoming legally binding on all market participants.

## NETWORK DEVELOPMENT PLAN

A Community-wide Ten-Year Network Development Plan (TYNDP) is developed every two years. The plan covers models of the integrated network, scenario development, a European generation adequacy outlook and an assessment of the resilience of the network. Regional investment plans (RIPs) complement the TYNDP.

## ADEQUACY FORECASTS

Summer and winter generation outlooks are prepared each year, as well as a long-term system adequacy forecast that looks 15 years into the future.

## OPERATIONAL TOOLS

Development of common pan-European operational tools ensures network coordination under both normal and emergency conditions.

# EXECUTIVE SUMMARY

**D. DOBBENI**

President  
ENTSO-E

**G. STEELE**

Chairman of the  
ENTSO-E Board

**K. STASCHUS**

Secretary General  
ENTSO-E



# MEETING EUROPE'S LOW-CARBON CHALLENGE



DANIEL DOBBENI



GRAEME STEELE



KONSTANTIN STASCHUS

**Daniel Dobbeni:** The development of Europe's low-carbon energy sector affects almost every aspect of the electricity system. In addition to ensuring a reliable transmission network for the future and moving towards the internal market (IEM), one of ENTSO-E TSOs' most important challenges has become managing the rapidly increasing amount of intermittent energy from renewable sources (RES).

Although the industry is well on its way to meet the EU's 2020 targets, there are indications that there will be even more ambitious ones for 2030 and beyond.

**Graeme Steele:** Integrating large amounts of RES certainly constitutes a significant challenge for TSOs across Europe. The rapid growth in wind and solar generation has had a major impact on network operations. The inherent unpredictability of RES makes market integration, especially for the intraday and balancing markets, particularly important.

“The only way Europe will meet its RES targets is through a fully functioning IEM backed by a strong transmission network.”

Mind you, the Third Package gives us the tools to address the challenge. Both the network codes and the Ten-Year Network Development Plan play a vital role in achieving the IEM.

**Konstantin Staschus:** ENTSO-E has worked on nine priority network codes during 2012. Two were submitted to ACER in 2012 and a total of five before April 2013.

Progress on code development has been significant. Our staff and members' experts have worked hard on improving the engagement of stakeholders in the process. For each code, our approach has been tailored to match the activities it addresses and the people affected by it. Besides public consultations, we have also established expert and stakeholder support groups.

**Daniel Dobbeni:** Stakeholder engagement is essential and has been a cornerstone of ENTSO-E since the beginning, not only for the network codes. A significant focus during 2012 has been to ensure that we provide relevant stakeholders with adequate information and take their feedback into

“Stakeholder contributions play an essential part in all ENTSO-E outputs.”

account in the most transparent and appropriate way. We have continued to invest substantial resources in improving our approach.

**Konstantin Staschus:** The TYNDP 2012 package has also benefited from more stakeholder involvement, with better methodology and data, and the multi-criteria evaluation of European projects. The TYNDP 2014, which we have already started working on, will also include cost-benefit analysis of projects of common interest (PCIs), in line with the requirements of the new Energy Infrastructure Regulation.

“The TYNDP 2014 package will have a 2030 planning perspective, rather than be limited to the initial 10-year study horizon.”

Last year's Scenario Outlook and Adequacy Forecast, released as part of the TYNDP 2012 package, has already provided a good basis for a longer planning perspective in the 2014 release. Its 2030 “visions” are now being refined with stakeholders for inclusion in the TYNDP 2014.

**Graeme Steele:** One of the most important points in this year's TYNDP is that roughly one third of the infrastructure projects planned in 2010 are already delayed. The Energy Infrastructure Regulation is essential for TSOs in this respect, as it aims to streamline permitting processes. With the Regulation now being adopted, TSOs need to focus their attention on its appropriate implementation. Among other things, ENTSO-E has to develop the TYNDP further by working out a cost-benefit analysis for future PCI projects and improving the plan's third-party procedures.



“Besides slow permitting, public opposition to the construction of new lines is the other main reason for delays in project implementation.”

Together with the European Commission, we are now looking at ways to make the public more aware of the need to invest in the European grid. The first steps were taken this year, but much more will be done in 2013 and subsequent years.

**Daniel Dobbeni:** Within the 2030 timeframe, the development of a North Seas Offshore Grid is an important project for TSOs. ENTSO-E supports the North Seas Countries Offshore Grid Initiative (NSCOGI) and experts from TSOs in the region are looking at how best to exploit future offshore resources.



With a longer perspective, ENTSO-E is also part of the e-Highways2050 project which is being run by a consortium of TSOs, equipment manufacturers, universities and other research organisations. It will propose the strategic architecture for large-scale electricity highways across Europe. The three-year project, which is co-funded by the EC, kicked off in late 2012.

**Graeme Steele:** Achieving the EU's 2020 renewables objective is also very closely tied to the design and operation of Europe's energy markets. In integrating an increasing share of RES into the grid, careful consideration is also required on how to integrate it into the IEM. We need to reflect on the adequacy of the market design. ENTSO-E has been actively participating in this debate, not least through its contributions on generation adequacy.

“The EC's communication on the IEM is disconcerting, with its findings that its 2014 deadline will be missed.”

We have been able to make good progress on regional market development through voluntary initiatives in both the day-ahead and the intraday timeframes. Important preparatory steps have been taken across Europe in 2012 and the North-West European day-ahead market coupling project is due to be launched in 2013.

**Konstantin Staschus:** More good news for the IEM is the implementation of the European Market Fundamental Information Platform (EMFIP). While the EC's Transparency Regulation is being adopted, TSOs are making good progress on the central platform. A proposal for its operation will be put to ACER within four months of the Regulation entering into force, probably in mid-2013.

There has also been quite a bit of activity in enhancing cooperation between ENTSO-E members and neighbouring TSOs such as TEIAS in Turkey and OST in Albania. ENTSO-E's Project Group Turkey has been cooperating with TEIAS to address a number of technical issues concerning the trial parallel interconnection. Likewise, OST has made progress in its compliance with the ENTSO-E Operations Handbook.





**Daniel Dobbeni:** The value of coordinated action by TSOs was certainly demonstrated in January and February 2012 when the severe cold spell hit large parts of Europe, causing stress throughout the entire network.

“The importance of TSOs working together was brought into sharp relief early in 2012.”

Close day-to-day TSO cooperation was a key factor in maintaining network security. Regional cooperation initiatives such as Coreso, TSO Security Cooperation and the Security Service Centre, have shown their added value and I expect such models to be developed in all parts of Europe. The system operation and market network codes will further enhance data exchange between TSOs and the observation of network conditions at all levels.

**Konstantin Staschus:** We have also made progress on other related initiatives, such as the ENTSO-E electronic highway and the central awareness system (EAS), as well as the ENTSO-E Academy.

34 TSOs were connected to the electronic highway in 2012 and are now using the system to exchange data. The EAS, which will provide real-time data to TSOs on the state of the whole European network, has also started with eight pilot TSOs. Training is being provided to TSO staff on the system operation. And the ENTSO-E Academy has successfully kicked off with a number of workshops. Many more are to follow this year.

**Graeme Steele:** Although it has been a very busy year, we must not forget about the longer-term development of the network. During 2012, our youngest committee, R&D, released its fully updated five-year R&D Roadmap and its first annual Implementation Plan.



“The R&D Roadmap shows that TSO cooperation in R&D is just as important as in other areas.”

Through the Implementation Plans, the Roadmap will pave the way for advances in grid architecture, power technologies and market designs for initiatives such as the e-Highways2050 and Smart Grids projects.

**Daniel Dobbeni:** It's clear that ENTSO-E TSOs are operating in an increasingly dynamic environment that is creating new challenges and opportunities to which they need to respond. What is certain is that this dynamic environment will accelerate in the years to come. Luckily our member TSOs are fully dedicated to this process, as is the staff of ENTSO-E!





# REVIEW OF ACTIVITIES

- OVERVIEW
- THE NETWORK  
CODES
- INFRASTRUCTURE  
DEVELOPMENT
- MARKET  
INTEGRATION
- TSO  
COOPERATION
- RESEARCH &  
DEVELOPMENT



# OVERVIEW

## KONSTANTIN STASCHUS

A major factor in meeting Europe's low-carbon challenge is the use of energy generated from renewable energy sources. Wind and solar generation has grown very rapidly in recent years. Seamlessly integrating this variable output into Europe's increasingly interconnected network, while ensuring its secure and reliable operation and its progress towards a unified internal market, is one of ENTSO-E's most important tasks.

The last few years have seen an explosion in the connection of renewable energy sources (RES) to the network, primarily led by wind and solar generation. The development of national frameworks for investment in RES in Europe was initially prompted by the EU's 2001 Directive on the promotion of Electricity from Renewable Energy Sources (2001/77/EC) and, to further encourage its deployment across Europe, the Renewable Energy Directive (2009/28/EC) in 2009 included a Europe-wide RES target of 20% by 2020.

The Directive's National Renewable Energy Action Plans, which EU Member States submitted to the European Commission (EC) in 2010, show that some 33-35% of EU electricity consumption will be based on renewable energy by 2020.

Equally important for maintaining investment in energy infrastructure, Europe's policymakers have now begun focusing on RES policy frameworks for the decade up to 2030. In July 2012, the EC released its Communication "Renewable Energy: a major player in the European energy market" to provide guidance on the current energy framework up to 2030 and on possible options beyond this date. Its Energy Roadmap 2050 is looking even further into the future with scenarios that aim to achieve emissions reductions of 80-95% below 1990 levels within the next four decades.

### RES-RELATED CHALLENGES

The steep growth generation from RES has already affected almost every aspect of TSO operations, whether they relate to the development of the internal market, current network operation or future system development.

Increasing amounts of fluctuating generation, primarily derived from wind and solar sources, make market integration, especially in the intraday and balancing markets, particularly important.

It requires a robust and fully functioning IEM to successfully integrate the amounts of RES energy foreseen in the 2009 Directive. The IEM will allow regional surpluses to be used all over Europe, with areas without strong conventional generation able to import this energy to maintain their energy supply.

At the same time, the integration of such large amounts of inherently volatile generation makes maintaining the day-to-day reliability of the energy system and the security of supply more challenging. It increases the need to jointly forecast, on a day-ahead and intraday basis, the renewable generation and resulting power flows over regions that include several TSOs and to decide on joint measures to handle any operational risks identified by these joint forecasts.

### INFRASTRUCTURE INVESTMENT

The growth of RES generation has also significantly affected system development and investment in infrastructure. The energy is often produced further away from major centres of consumption than that from conventional sources and, because of its comparatively low load factor, new transmission lines need to be built or existing lines reinforced. ENTSO-E's TYNDP 2012 identified that 80% of all existing and expected bottlenecks in the network are related to renewables integration.

Although RES integration has kept ENTSO-E and its member TSOs very busy over the past year, it is by no means the only focus of our activities. This report also provides a full account of ENTSO-E's operations in 2012 with regards to our progress on the network codes, system development, market integration, Research & Development and further TSO co-operation, as outlined in the ENTSO-E 2012 annual work programme.

# STAKEHOLDER ENGAGEMENT

DANIEL DOBBENI

Stakeholder contributions play an essential part in the development of all main ENTSO-E deliverables, including our network codes, the Ten-Year Network Development Plan, annual work programme and Research & Development Roadmap. Consultation with stakeholders is far more than a mandatory requirement of the Third Energy Package - stakeholders' expertise is indispensable in drafting sound, well critiqued and acceptable proposals.

A significant focus of ENTSO-E's work over the past year has been on ensuring that we provide ample and adequate information for stakeholders and take their views into account. ENTSO-E has continued to invest in resources to improve its approach and to ensure that it clearly explains its actions (and the rationale for them), as well as to provide information to stakeholders in a transparent and accessible manner. Also, to ensure that its consultations, workshops and meetings are well structured and relevant.

The approach reflects our awareness that ENTSO-E's work has a significant impact on stakeholders from across the value chain and that the credibility and quality of our outputs are significantly enhanced by their systematic engagement. Work in this area during 2012 has focused on:

→ **Ensuring ENTSO-E meetings engage**

The rental of additional space within ENTSO-E premises has provided more flexible options for meetings. ENTSO-E has used the opportunity to ensure that meetings are structured to allow for two-way discussion whenever possible.

→ **Communicating clearly**

ENTSO-E understands that it is not possible for every stakeholder to attend events in Brussels. It therefore aims to produce minutes of meetings and make relevant documents and presentations available to those unable to attend. All information is provided on the ENTSO-E website. To ensure the transparency of such information, ENTSO-E has started restructuring and re-organising its website. Further improvements will be implemented throughout 2013.



→ **Explaining links and dependencies**

ENTSO-E events often necessarily focus on one particular area of activity but we are aware that in most cases they have links to or are dependent on others. ENTSO-E therefore aims to make clear any areas of overlap so that the full complexities of issues can be understood by stakeholders.

During the year, ENTSO-E appointed a Consultation Manager whose task is to continue to improve our stakeholder interaction and who will act as a single point of contact for stakeholder questions or general feedback.

ENTSO-E recognises the need to continue to build on the steps it has already taken to inform and consult stakeholders. We will continue to invest in this area in 2013 by improving the ENTSO-E website and our external communications and by reviewing our complete range of consultation tools.



# THE NETWORK CODES

CHANGING  
SECTOR  
CONDITIONS

BENEFITS  
OF THE CODES

INDIVIDUAL  
NETWORK  
CODES

PROGRESS  
IN 2012



# CHANGING SECTOR CONDITIONS

One area of work which has dominated the ENTSO-E workload over the past year has been the continuing development of the package of network codes, which address the challenges involved in delivering Europe's energy policy objectives.

Each network code will be a legally binding instrument that sets out the common rules and requirements that all TSOs and users of the European electricity network - such as generators, large industrial customers, and distribution system operators (DSOs) - must follow. The codes' successful development is based on a joint effort between the EC, ACER, ENTSO-E and stakeholder from across Europe and the value chain.

The Third Energy Package introduced the concept of the network codes because of the broadly shared view that a greater collaborative effort was required to create a secure, competitive and low-carbon energy sector in Europe, given the changing conditions it faces. The three most significant changes that directly influence the focus of the individual codes are:

→ **Fundamental changes in new generation patterns**

The way electricity is generated across Europe is changing, largely due to the rapid increase in the use of renewable energy (RES). The European network needs to integrate a greater number of primarily smaller generating plants connected at lower distribution voltages and at longer distances from customers. It also needs the ability to control and predict the output from these more volatile sources of generation.

→ **An active demand-side**

The development of 'Smart Grids' has opened up the potential for an active demand-side response. By feeding back consumption patterns in real time, smart grids will allow customers to respond to changing price or system conditions. This will empower them to make more informed choices about their energy use, make it easier to manage the system, and will boost competition in the energy market.

→ **More interconnected networks**

The European transmission network is becoming increasingly interconnected. This provides greater opportunities for generators to sell into different markets and gives customers wider choice over where they buy their energy. But it also requires individual systems to be operated in a much more coordinated and interconnected way.

The process of developing the network codes sequentially is intended to separate each code into a self-contained unit that can be independently approved and subsequently amended as future technical or market developments dictate. Each code will become an annex to Regulation (EC) 714/2009 and together they will form a coherent package with the ability to grow and adjust over time.



# BENEFITS OF THE CODES

The network codes are vital tools for achieving Europe's low-carbon targets and promoting cost-effective integration of RES into the transmission network and electricity markets. Standardised operating requirements will facilitate more effective collaboration between TSOs, ensuring that grids remain stable as more intermittent generation connects to the European network.

Security of the energy supply is crucial to European industry and to almost every aspect of our daily life. Each network code plays a role in enhancing this. The grid connection codes ensure that both generators and customers provide the services the system needs and make planning easier, the system operation codes ensure TSOs work together in the most effective ways so that the network is run efficiently, and the market-related codes ensure that the markets work to deliver enhanced competition.

The market-related codes translate the vision of the European Target Model, the widely agreed single market design, into clear rules for implementation across Europe. They will enable energy to be traded in markets ranging from real time (balancing markets) to several years ahead (forward markets) and allow network operators and users to make efficient trading decisions in more liquid markets.

This should increase network stability, reduce risk and provide greater levels of competition, ensuring better value for energy consumers.

## NETWORK CODE DEVELOPMENT

The obligation to develop the network codes arises from Regulation (EC) 714/2009, which defines formal roles for the EC, ACER and ENTSO-E. Article 6 of the Regulation outlines the process that needs to be followed to develop the individual codes.

The process starts with the EC-ACER-ENTSO-E Three-Year Plan which structures individual framework guidelines and network codes over the medium term. Each year, the EC then undertakes a consultation process to establish the priority areas for network code development and requests ACER to develop a framework guideline in a particular area. This framework guideline provides the "terms of reference" to be used by ENTSO-E to develop

## DURING 2012, ENTSO-E HAS WORKED ON NINE NETWORK CODES WHICH IMPACT STAKEHOLDERS AT EACH STAGE OF THE VALUE CHAIN

### Network Connection

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

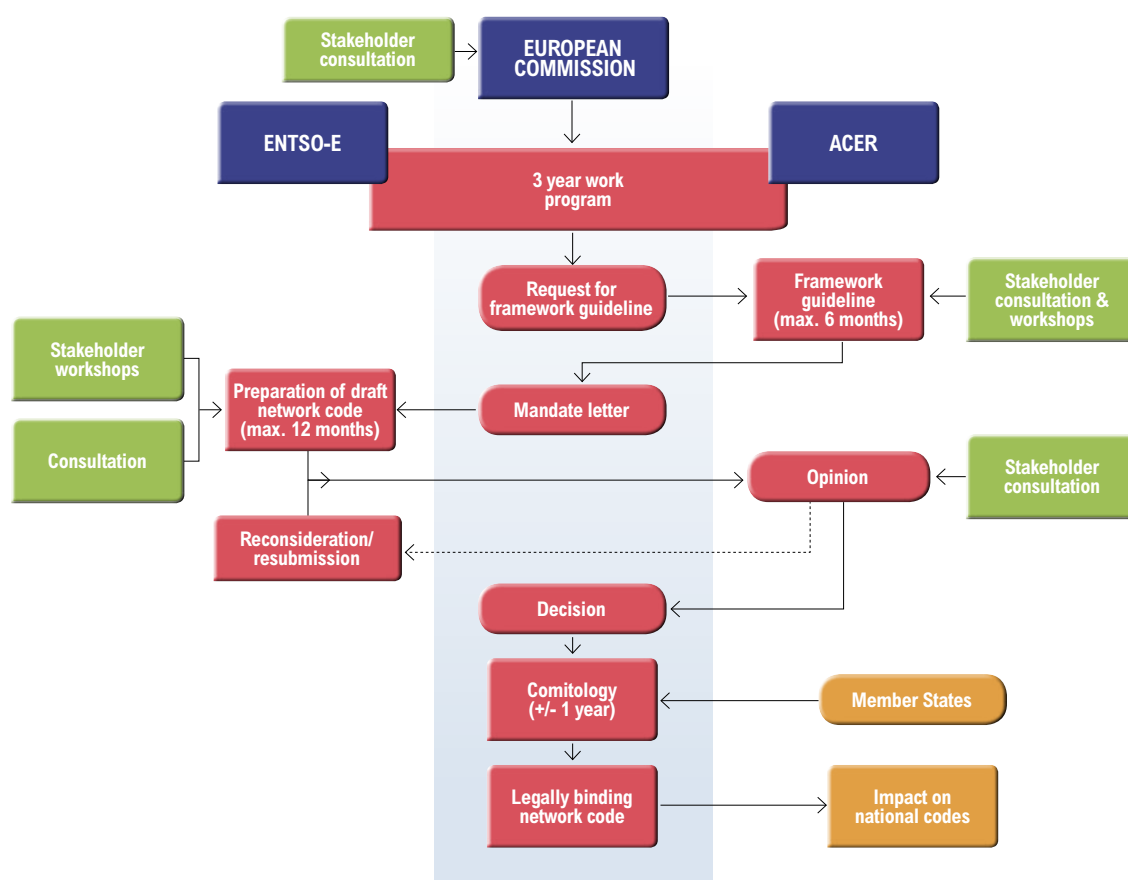
### System Operation

- Operational Security (OS)
- Operational Planning & Scheduling (OPS)
- Load Frequency Control & Reserves (LFCR)

### Electricity Markets

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

## Network code development process



the corresponding network code, or codes, and serves as the basis against which the code(s) will be subsequently assessed.

ACER has a period of six months to develop the framework guideline and is expected to consult widely during this time. Once the EC is satisfied with ACER's guideline, it formally invites ENTSO-E to develop the corresponding network code(s). ENTSO-E has a period of 12 months to develop a code for submission to ACER, which then has up to three months to provide ENTSO-E with a reasoned opinion on it.

If ACER judges the code to be in line with the framework guideline, it can recommend that the EC approve it. If it does not, it is also entitled to recommend that ENTSO-E modify the code. The EC is not bound to accept ACER's recommendation and can also modify the code. It may also undertake further assessment. Once the EC is satisfied, it will initiate the Comitology process<sup>1</sup>, which translates

the network code into European legislation, making it legally binding in all EU Member States.

### STAKEHOLDER INVOLVEMENT

ENTSO-E's role is to produce network codes that represent a balance of views. Every code involves generators, large industrial users, traders, power exchanges, regulators, customers and TSOs. The different views of all these parties need to be understood, analysed and explored in order to create a robust, consensus-based draft.

As such, it is vitally important that stakeholders are involved at every stage. ENTSO-E seeks to consult them throughout the development process, sharing early drafts of codes as soon as possible, holding workshops and putting together expert groups of industry parties and DSOs. The specific approach ENTSO-E takes is tailored to match both the issues being addressed in the codes and the needs of all those affected by them, while maintaining consistency and lack of bias.

1. With the coming into force of the Lisbon Treaty, the Comitology process for the adoption of the network codes will be replaced through the Delegated Acts process. The precise timing for this change is not yet known.



# INDIVIDUAL NETWORK CODES

The areas of development of the network codes - network connection, system operation and electricity markets - follow the requirements of Regulation (EC) 714/2009 and are designed to provide a coherent package.

## NETWORK CONNECTION CODES

The connection codes include the Requirements for Generators (RfG), Demand Connection (DCC) and High Voltage Direct Current (HVDC) codes, as well as the Connection Procedures (CP) code, for which the mandate is forthcoming.

The investment decisions made today will affect the development of the European network over the next few decades - the 2020 network is currently being built and the foundations of the 2050 system being conceived. The connection-related codes define the technical requirements for all parties connected to the network and the capabilities they must have for secure system operation.

### Requirements for Generators (RfG)

The RfG code was the first to be delivered by ENTSO-E, being submitted to ACER at the end of June 2012. Generators provide an indispensable input into the network and rapid implementation of the code will ensure that TSOs are able to successfully handle increasing volumes of RES generation and the progressive replacement of old

large centralised power units based on fossil fuels. The code creates a level playing field for generators throughout the EU by progressively requiring smaller units to adapt to system needs and DSOs to prepare for new supply opportunities.

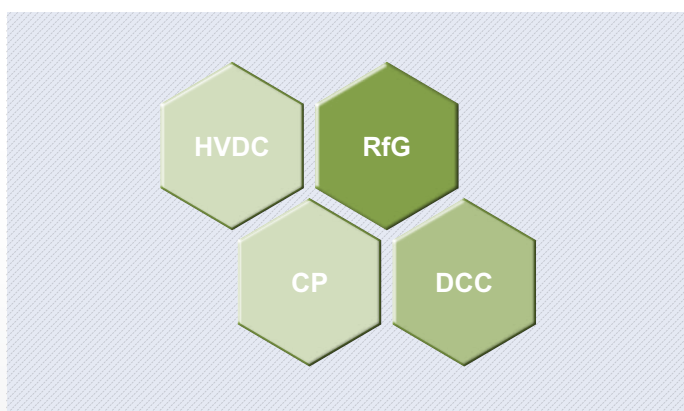
During 2012, ENTSO-E ran an intense stakeholder consultation programme for the code. This included bilateral meetings, workshops, the creation of a stakeholder user group and a DSO technical expert group, and an eight-week web-based consultation. Interest was high and numerous stakeholder comments helped ENTSO-E improve the code's contents. During the final months of 2012 and the first part of 2013, ENTSO-E has worked closely with ACER and the EC to promote a common understanding of the RfG code's qualities among stakeholders and especially the Comitology committee.

### Demand Connection (DCC)

The DCC code complements the RfG code and sets out the connection requirements for DSOs and other users of the network at European level. Although most European countries already have various connection requirements for demand users, there has never before been the need for a common set of rules for users across Europe. The increasing use of RES, future smart grid implementation and the IEM now require a code to define these. Some requirements in the code are either completely new to meet the different challenges faced by the sector or may not have been widely used before in Europe.

Building on the RfG code experience, ENTSO-E ran bilateral discussions with stakeholders throughout the first half of 2012 and formed a stakeholder user group to accompany the DCC code development. In April it launched an open call for information, which attracted a positive stakeholder response. Web-based consultation took place between June and September and included a public workshop in August.

## Network connection codes



The connection codes define the technical requirements and capabilities needed for all parties connected to the European network.

The DCC code was submitted to ACER in January 2013. ACER is expected to deliver its opinion by the end of March 2013, with the EC subsequently launching the Comitology process. During these phases, ENTSO-E is assisting ACER and the EC with the preparations for the code's implementation.

#### High Voltage Direct Current (HVDC) Connection Procedures (CP)

The rapid development of offshore connections and onshore DC tie-lines mean that a particular network code on HVDC connections can provide additional clarity. A formal request to begin work is expected in the first half of 2013, with stakeholder consultation on a draft code anticipated later in the year. The mandate for the CP code is also anticipated later in 2013.

### THE SYSTEM OPERATION CODES

The purpose of the four Operational Security (OS), Operational Planning & Scheduling (OPS), Load Frequency Control & Reserves (LFCR) and Emergency Requirements & Procedures (ERP) codes is to define pan-European operational standards and to put in place common procedures, for example for coordinating outages and sourcing back up generation, in order to continue operation of the European power system in a robust and secure way.

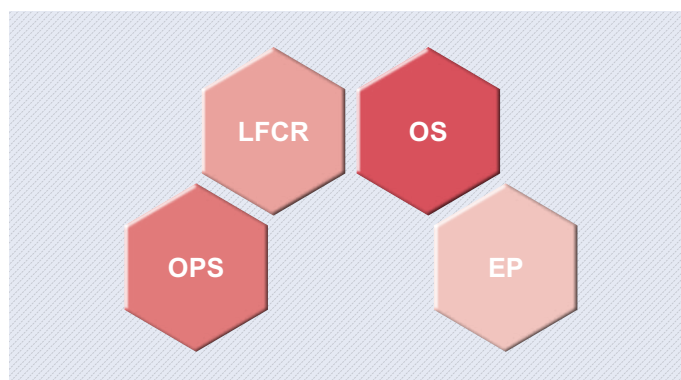
The practices and processes set out in these codes reflect the capabilities provided by generators and the demand side in accordance with the network connection codes and reflect the way the dynamics

of the network are changing as a result of the new generation mix and the impact of larger markets. Scoping work on the ERP network code may begin during 2013 but does not have the same priority.

#### Operational Security (OS)

The OS code is designed to harmonise and improve, where possible, the quality of system operation, as well as to promote TSO coordination of operational activities. This is particularly important with respect to the challenges for TSOs posed by increasing large continental-scale power transfers due to RES. The code is due to be submitted to ACER at the end of February 2013, with ACER's assessment expected by the end of May.

### System operation codes



The system operation codes define pan-European operating standards.





#### Operational Planning & Scheduling (OPS) Load Frequency Control & Reserves (LFCR)

Work on the OPS code started one month after the OS code and it will be submitted to ACER by the end of March 2013. The LFCR code was started three months later and work to assess responses to the public consultation and to refine the code will take place during the first half of 2013, with a view to delivering the code to ACER at the end of June 2013.

The two codes will complement the OS code, for example by setting out rules for TSO coordination on network security calculations for operational planning, and for defining and calculating reserve requirements in the future power system. The LFCR code will require particularly close interaction with the market-related Electricity Balancing code, which will be developed in parallel with it.

Stakeholder consultations have comprised bilateral meetings, workshops, a DSO Technical Expert Group, and a two-month web-based consultation.

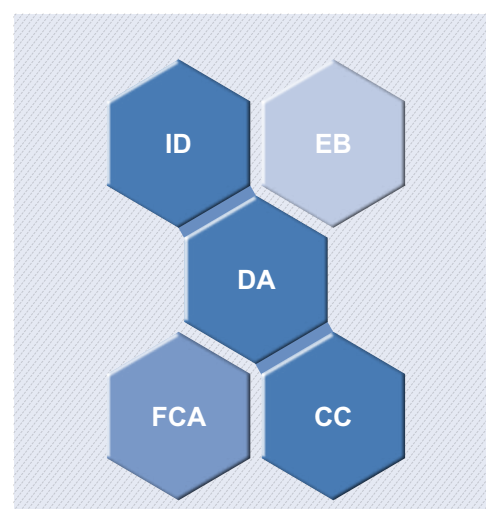
#### MARKET NETWORK CODES

The market-related Capacity Allocation & Congestion Management (CACM), Forward Capacity Allocation (FCA) and Electricity Balancing (EB) codes cover the intraday, day-ahead and forward markets and the balancing timeframe, as well as rules for calculating cross-border capacity and defining bidding zones. They will introduce a standardised set of market practices across Europe and promote the implementation of a competitive pan-European IEM.

Market code development needs to be coherent with the requirements of the connection-related codes (for example, connection requirements need to influence balancing market products) and take into account operational constraints.

Fluctuating wind and solar generation make market integration and especially the codes for the intraday and balancing markets particularly important. Only a fully functioning European IEM will allow any regional energy surpluses to be used elsewhere in the network. Market integration itself presents a significant challenge and the three network codes will also contribute to facilitating regional projects.

#### Market codes



The three market-related codes promote IEM implementation. The CACM code contains the ID, DA and CC subsections.

#### Capacity Allocation & Congestion Management (CACM) Forward Capacity Allocation (FCA)

The CACM code covers the intraday (ID) and day-ahead (DA) markets and the coordinated calculation of network capacity (CC). The code was submitted to ACER in September 2012 and is expected to enter Comitology in early 2013. This will coincide with a Governance Guideline developed by the EC that will identify roles and responsibilities for the European market. Consistency between the two documents is vital and ENTSO-E will have a key role in explaining the rationale for the code's contents and assisting the EC and Member States in this process.

ACER's framework guideline on the CACM code also covers forward markets and ENTSO-E received the official EC request to develop the FCA code in September 2012. Extensive consultation and discussion of the code will take place in 2013 before it is finalised and submitted to ACER before the end of September 2013.



### Electricity Balancing (EB)

The EB code will be developed to meet a separate framework guideline, with a view to ACER delivery by November 2013. In light of the limited experience of the harmonisation of balancing markets across Europe, this will be a challenging task, demanding significant resources and extensive interaction with stakeholders via the stakeholder user group and various workshops, as well as with the EC and ACER.

### LINKS BETWEEN CODES

Developing a number of network codes in parallel means there are inevitably links and dependencies between them which need to be managed and explained. The most significant of these links are:

→ Connection codes to system operation codes (where the capabilities in the connection codes influence the way the system will be operated);

→ Connection codes to electricity balancing (where the connection code requirements will need to be reflected in balancing market products);

→ Load frequency control & reserves to electricity balancing (where the LFCR code defines the volume of reserves to be procured and the EB code defines the market mechanisms by which these reserves are procured);

→ the OS/OPS codes to capacity calculation (where a common grid model is the cornerstone of the analysis required in all codes).

These links and interactions are captured in the diagram below. It does not cover areas such as incentives and tariffs, where there is a prospect of future network codes being developed.

### Network code overview



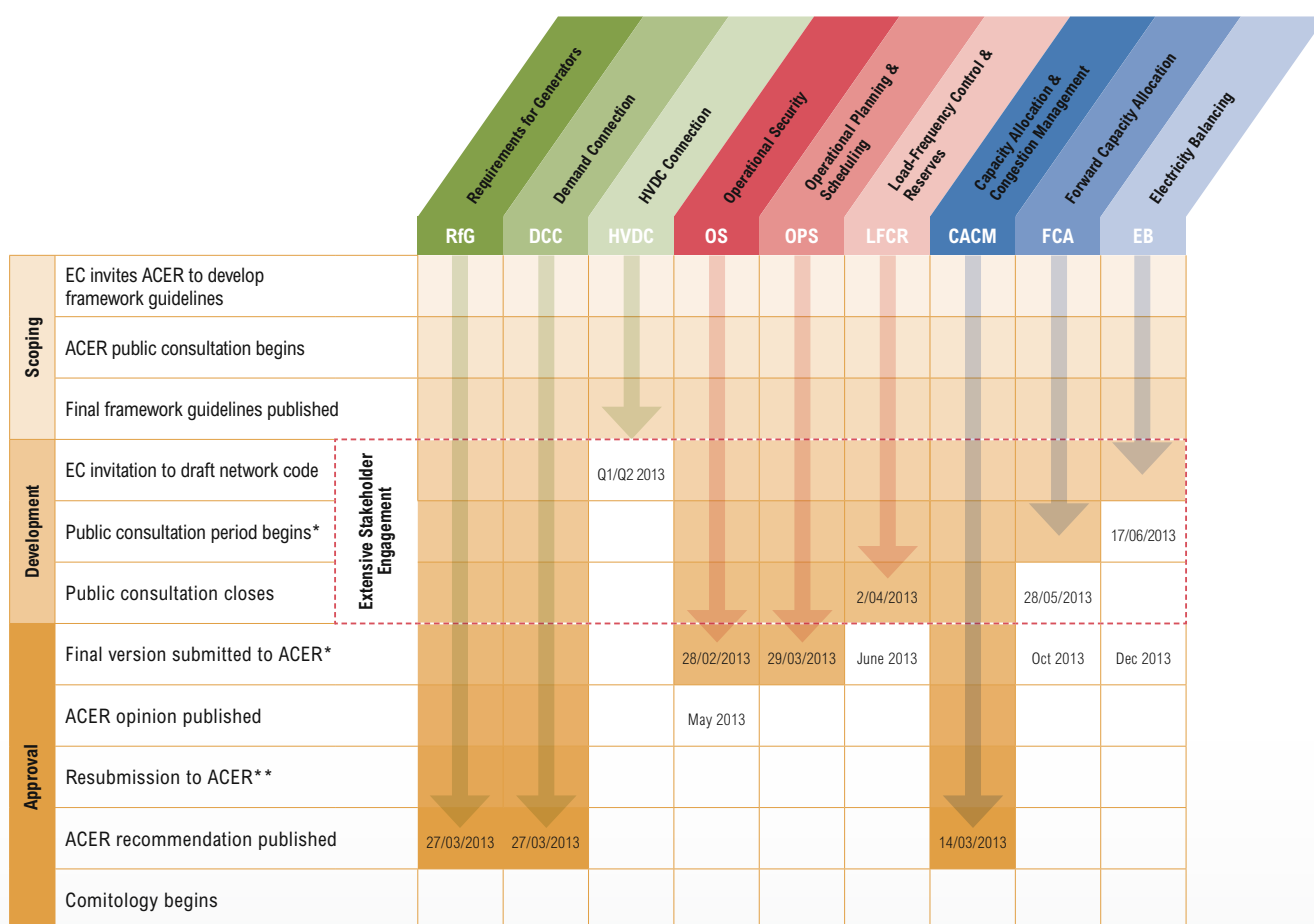
# PROGRESS IN 2012

The chart shows the detailed progress of the nine network codes which ENTSO-E has worked on over the past year. Their continuing development will also represent a very significant part of ENTSO-E's work in 2013.

ENTSO-E's network code development is the first part of a lengthy process that will see each code assessed by Member States and then become law. As the codes are modified in response to future developments in the energy

sector, they will ultimately become an established part of the sector landscape. The network codes are, therefore, an on-going project for ENTSO-E and other stakeholders that will require a significant continued effort.

## ENTSO-E network code status



The purpose of this chart is to provide overall transparency in ENTSO-E's network code development. All forward-looking dates are provisional until confirmed. Stakeholders will be informed and invited to all confirmed events by means of official communication.

\* In accordance with ENTSO-E's Network Code Development Process, internal re/drafting and approval is carried out before public consultation and submission of the code to ACER.

\*\* In cases where ACER does not attach a recommendation to its opinion, ENTSO-E has the opportunity to resubmit the code.

# INFRASTRUCTURE DEVELOPMENT

**STRENGTHENING  
THE NETWORK**

**THE TYNDP  
2012 PACKAGE**

**LOOKING  
TOWARDS 2030**

**TYNDP AND ENERGY  
INFRASTRUCTURE  
REGULATION**

**NORTH SEAS  
OFFSHORE GRID**

**ACCEPTANCE OF  
PROJECTS**

**COLLABORATION  
WITH ENTSOG**

**STANDARDISATION OF  
MODELLING DATA**



# STRENGTHENING THE NETWORK

The decarbonisation of Europe's energy system requires the transmission network to be expanded and strengthened. Areas within the EU and neighbouring countries with large sources of renewable energy, either onshore or offshore, need to be connected to the major demand centres where most Europeans live and work. Variable generation and storage facilities must be successfully integrated into the existing network to ensure a reliable supply of cleaner energy across Europe.

Substantial transmission system upgrading and new power lines are indispensable to meet the requirements of the internal electricity market (IEM) and to integrate ever larger quantities of renewable energy (RES).

The Third Energy Package mandates ENTSO-E to prepare a biennial Ten-year Network Development Plan (TYNDP), which builds on national investment plans to identify gaps in infrastructure from a European perspective and to inform individual

Member States and stakeholders about projects that have a network-wide impact.

The TYNDP constitutes one of ENTSO-E's most important deliverables and, together with the ENTSO-E Scenario Outlook and Adequacy Forecast (SOAF), gives the most comprehensive view of pan-European system development. The SOAF forecasts and assesses long-term generating adequacy and provides the base scenarios for market and network studies within the TYNDP framework.



# THE TYNDP 2012 PACKAGE

ENTSO-E released its first formal Ten-Year Network Development Plan in June 2012, having pro-actively published a pilot plan in 2010. Both the development and contents of the TYNDP 2012 were improved as a result of experience from the pilot project. The TYNDP 2012 consists of a package of six Regional Investment Plans, a Scenario Outlook & Adequacy Forecast and the TYNDP 2012 Synthesis Report.

Since producing the pilot TYNDP in 2010, ENTSO-E's objective has been to improve its methodology, enhance stakeholder interaction and present studies based on both bottom-up and top-down scenarios. The TYNDP 2012 represents a significant step along this path and offers a structure that provides a pan-European overview of transmission planning, as well as a detailed view of transmission investments at regional level.

In addition, the accompanying Scenario Outlook and Adequacy Forecast 2012-2030 gives an update of the TYNDP 2010 scenarios and "visions" of network requirements up to 2030.

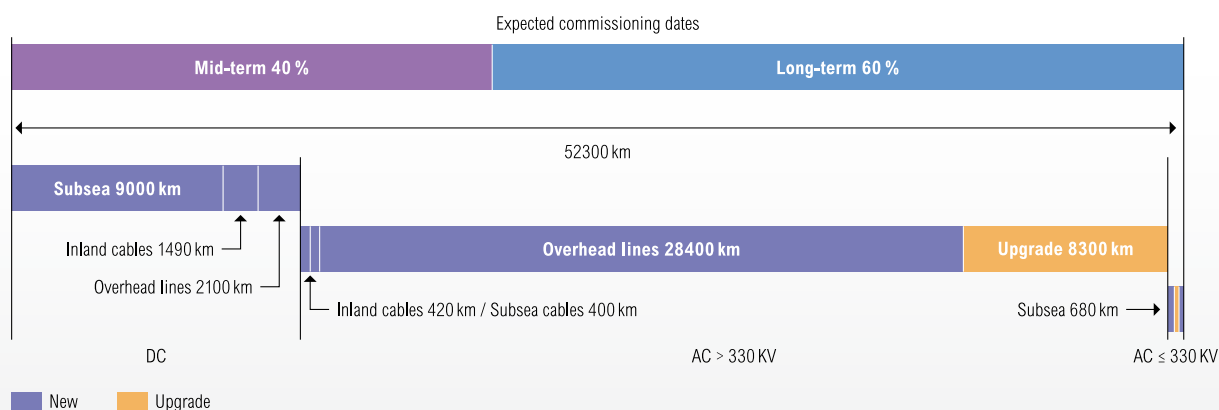
From a RES perspective, the report's findings are particularly interesting. Projects of pan-European significance could result in savings of 170 Mt of CO<sub>2</sub>, of which 150 Mt is due to the connection of RES generation technology and 20 Mt due to further market integration.

Almost 80% of the 100 bottlenecks identified by the report are related, directly or indirectly, to the integration of RES and the rapid increase in its development is the main driver of larger, more volatile long-distance power flows across Europe. These are primarily along a North-South corridor from the Scandinavian countries to Italy; between mainland Europe and the Iberian peninsula, Ireland and the UK; and eastwards to the southern and western Balkan states.

The TYNDP 2012 concludes that, in order for the European network to accommodate increasing amounts of RES generation and reduce cross-market congestion, it needs 52,300 km of new and refurbished high voltage infrastructure by 2020.

In this context, the permitting process becomes very relevant. When comparing the results of the TYNDP 2012 with the 2010 pilot, it is remarkable to see that one in three projects of European significance are already delayed. This is mainly due to social resistance and longer-than-expected procedures to grant project permits.

## Projects of pan-European significance



## NEW IN THE TYNDP 2012

**After discussions with stakeholders, ENTSO-E has implemented several major improvements in the organisation and content of the latest TYNDP, compared to the 2012 pilot.**

### Better organisational framework:

- New study procedures including common top-down scenarios (see SOAF 2012), generic planning standards and specific protocols for joint studies.
- Streamlined procedures that ensure consistency by building up regional and pan-European perspectives in an integrated process and by considering six regions in addressing pan-European grid development (the regions are overlapping to ensure the overall consistency of Regional Investment Plans).
- The possibility for third parties (non-ENTSO-E members) to submit candidate projects by complying with a public procedure.

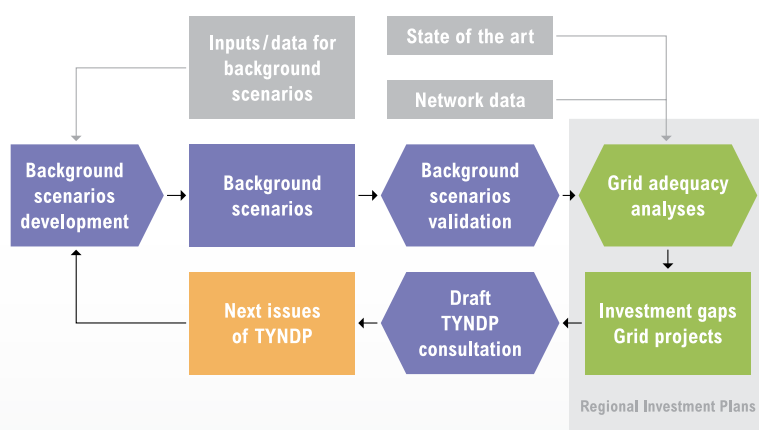
### Improved content (directly answering stakeholder requests):

- Identification of future major grid congestion points and assessment of the bulk power flows across these.
- Higher level project presentation showing connections between investments to develop additional grid transfer capability.
- Valuation of the benefits of every project to enable cost-benefit analysis.
- Synthetic assessment of the transmission adequacy expected with the planned investments.

In terms of cost, projects identified as being of European significance will require a total TSO investment of €104 bn. It is important to realise that this infrastructure does not include the additional national and regional investments set out in each Member State's National Development Plan.

Speeding up project implementation needs improvement in three key areas - permitting (including better public acceptance of new infrastructure), project finance, and the regulatory framework for cross-border schemes. ENTSO-E therefore welcomes recent legislative initiatives such as the EU's Regulation on guidelines for the implementation of trans-European energy infrastructure.

## TYNDP build-up process



## TYNDP 2012 PREPARATION & IMPROVEMENTS

In the preparation of the TYNDP 2012, ENTSO-E organised two public consultations over the past two years (in Spring 2010 on the pilot TYNDP release and in winter 2011 on the proposed TYNDP 2012 scenarios), as well as nine Brussels-based and regional workshops on the TYNDP scenarios, methodologies, study process, project evaluation and initial results.

Several Florence Forums, public conferences and a programme of dedicated meetings with DG Energy, ACER and major market players have also enabled the open discussion of shared concerns, the joint development of more harmonised methodologies, and agreement on what is expected of the TYNDP process.

The chart opposite shows the TYNDP development process, which is open to all stakeholders and promotes efficient integration of the pan-European and regional exercises.



# LOOKING TOWARDS 2030

The aim of ENTSO-E's Scenario Outlook and Adequacy Forecast (SOAF) is to assess Europe's power generation adequacy. The SOAF is part of the TYNDP 2012 package and the 2012-2030 release updates the scenarios presented in the SOAF 2011-2025. The scenarios are used as the background assumptions for the market and network studies within the TYNDP. The SOAF 2012-2030 also includes ENTSO-E visions of the power system up to 2030.

This year's SOAF provides an overview of generation adequacy for the ENTSO-E area as a whole and for each of its six regional groups. It also provides a generation adequacy assessment for each country. An important enhancement is the presentation of "Visions towards 2030", ENTSO-E's longer term view of the power system, which aims to bridge the gap between European 2050 energy targets and the horizon addressed by the EC's 2050 Energy Roadmap.

## EU 2020 SCENARIO

For the pilot TYNDP 2010, ENTSO-E used a classic bottom-up approach in constructing the demand and generation scenarios used to identify grid investment needs. The approach was primarily based on extrapolating the investment forecasts of individual market players.

To add the EU 2020 Scenario to the TYNDP 2012, ENTSO-E introduced a new methodology. The scenario was constructed using a top-down approach with evolution of load and generation for individual countries based on EU National Renewable Energy Action Plans (NREAPs) and forecasts for conventional generation based on national documents focusing on the EU targets.

Initial preparations for the next SOAF 2013 report began prior to the SOAF 2012-2030 release. The pan-European calculations were undertaken at the end of 2012, taking into account the changes and improvements in the data and report structure. The SOAF 2013 will include two additional RES indicators in response to stakeholder feedback at the second "Visions towards 2030" workshop in November 2012. Publication of the report is foreseen for the first quarter of 2013.

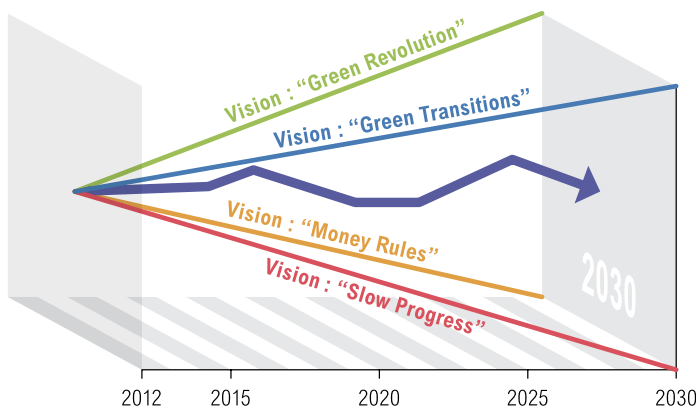
## VISIONS TOWARDS 2030

ENTSO-E has also started further development of its view of power system needs up to 2030 to be used in the next TYNDP 2014. These will bridge the current gap between the 10-year framework of the TYNDP and the 2050 Energy Roadmap and the e-Highways2050 project.

Predicting this far into the future is difficult, so ENTSO-E's aim is to construct contrasting visions that capture a realistic range of pathways showing different requirements for grid development up to 2030. In order to keep the number of visions realistic, ENTSO-E has so far limited them to four.



## ENTSO-E 2030 visions



ENTSO-E's visions for 2030 (Slow Progress and Green Transitions are bottom-up; Money Rules and Green Revolution are top-down).

The pathways are designed along two axes. The first defines the scope for reaching the EU commitment to reduce GHG emissions to 80-95% of 1990 levels by 2050, as stipulated by the 2050 Energy Roadmap. The aim is not to question the commitment but to demonstrate the impact of a delay in its realisation on the requirements for the grid. Two extremes result in very different flow paths: in the first (Money Rules), Europe is assumed to be on track to realise the 2050 objectives; in the second (Slow Progress), Europe faces a serious delay in the realisation of its 2050 goals and likely delays on the way to 2050.

The second axis defines the degree of European integration in achieving the EU objective. This can be within a strong European framework with a high degree of integration (national policies become

more effective but do not prevent Member States developing options that are most appropriate to their circumstances), or within a loose European framework with a low degree of integration (national policies lack a common European vision of the future energy system and result in parallel schemes).

The strong European framework (Green Revolution) assumes a fully functioning IEM, where market competition ensures efficient energy dispatch at the lowest possible cost at a European level. The loose European framework (Green Transitions) has less market integration and poor cross-border competition.

The long-term visions allow the identification of new, flexible infrastructure development needs that can cope with a range of future challenges. Once they are quantified and turned into scenarios, they will enable common input data sets with a 2030 horizon to be established, in line with the n+20 planning perspective of the Energy Infrastructure Regulation. The TYNDP 2014 scenario construction based on the four visions is subject to extensive coherency checks, an often time-consuming and laborious exercise, but an absolute necessity in order to ensure the quality of the Plan.

ENTSO-E implemented a very tight action plan during 2012 to develop the four visions. Workshops in April and November consulted stakeholders on their likely expectations for 2030 and on the methodology to be used. These were followed in December by a call for stakeholder input to refine the visions and the methodology.



# TYNDP AND ENERGY INFRASTRUCTURE REGULATION

The TYNDP 2014 includes a new approach for integrating non-ENTSO-E and non-TSO projects adapted to the requirements of the forthcoming Regulation on trans-European energy infrastructure, as well as a review of the cost-benefit analysis, multi-criteria approach to project selection and other improvements resulting from stakeholder, ACER and EC feedback.

The EC's proposed creation of the Connecting Europe Facility to promote the completion of priority energy, transport and digital infrastructure has dedicated part of the EU budget to energy projects. At the same time, the Regulation on guidelines for trans-European energy infrastructure is being adopted by the EU institutions.

The Energy Infrastructure Regulation gives priority status to 12 strategic trans-European energy corridors and sets out the rules to identify the projects of European interest to support these. Under the established projects of common interest (PCI) regime, a competent authority in each Member State has the responsibility for overseeing the permitting process, setting standards for transparency and public participation, and for fixing the maximum duration of the permitting process. The appropriate implementation of these provisions is now the main challenge in order to make accelerated infrastructure building a reality.

ENTSO-E defined a list of projects of European significance in the TYNDP 2012. The objective of these projects is to increase grid transfer capability across a network boundary, contributing to at least one of Europe's energy goals (the internal market, sustainability, or security of supply). Picking up on this approach, the EC will now adopt a list of EU-wide projects as an annex to its Infrastructure Regulation every two years. The projects will be selected based on an assessment in line with ENTSO-E's TYNDP methodology, thus preserving the system nature of each individual selection.

## COST-BENEFIT ANALYSIS

During the past year, ENTSO-E significantly advanced development of the cost-benefit analysis (CBA) methodology based on the first draft proposed in the TYNDP 2012. This methodology has been updated throughout 2012 to incorporate feedback from stakeholders in a public consultation and bilateral meetings and from ACER in their formal opinion on the TYNDP.

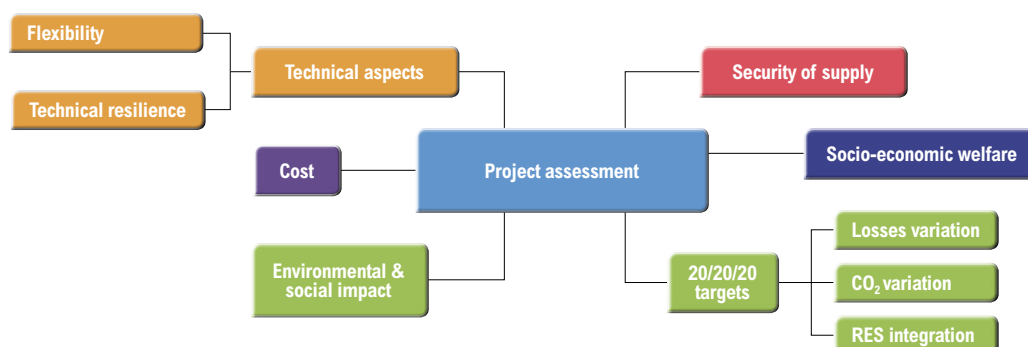


The forthcoming Energy Infrastructure Regulation entrusts ENTSO-E with establishing suitable CBA methodology to assess European and other TYNDP projects, in order to support cost-allocation, investment incentives and grant decisions, as well as to increase the transparency of the process.

For the TYNDP 2014, ENTSO-E is developing this CBA based on a multi-criteria assessment of projects of European interest. This will help highlight robust, efficient projects that provide value under a wide range of scenarios.



## PCI project assessment



An extensive consultation process on the CBA methodology is foreseen in 2013 (subject to the actual date of the Regulation entering into force).

The ENTSO-E approach provides the best available information for both the public (via the TYNDP) and PCI decision-makers on the full range of indicators required by the Regulation. It also allows ENTSO-E to quantify and monetise the benefits in a reliable way and avoid double accounting.

### THIRD PARTY PROJECTS

In light of the Energy Infrastructure Regulation, ENTSO-E has also been working on a new procedure for the inclusion of third-party projects in the TYNDP. Article 3(7) of the Regulation defines the TYNDP as the basis for selection of projects receiving EC support for permitting and/or finance.

The procedure is the second of its kind - the first, released in February 2011 and applied in the TYNDP 2012, imposed legal requirements considered as rather burdensome by third-party promoters.

The new procedure, valid for the inclusion of third-party projects in the TYNDP 2014, is the result of consultation and feedback from third-party promoters. It takes account of stakeholder comments received before the release of the TYNDP 2012, as well as additional suggestions from stakeholders, ACER and the EC during workshops and bilateral meetings in the last quarter of 2012 and in discussions with ENTSO-E's Long-Term Development Stakeholder Group.

## THIRD-PARTY PROJECT PROCEDURE MILESTONES

- **21 January - 1 March 2013:** developers submit third-party projects to ENTSO-E.
- **1 March - 30 April 2013:** finalisation of data (where data submitted is not complete, ENTSO-E contacts developers no later than two weeks after the submission deadline requesting further documentation and clarification).
- **By 30 April 2013:** ENTSO-E notifies all developers of the results of their applications.

- **November 2013:** ENTSO-E informs developers of accepted projects and of the corresponding multi-criteria CBA results.
- **March 2014:** TYNDP 2014 package opens for an eight-week public consultation.

In order to comply with the EU requirement for equal treatment of TSO and third-party projects, all projects providing similar grid and market studies to TSO-backed projects will be included in future TYNDPs.



# NORTH SEAS OFFSHORE GRID

The EU's Energy Infrastructure Regulation recognises the seas of Northern Europe as a priority area to supply a significant amount of wind-based energy up to 2030 and beyond. The launch of the North Seas Countries Offshore Grid Initiative (NSCOGI) supports the development of the North Seas corridor and formed the backdrop for ENTSO-E's Regional Group North Sea's work during 2012.

Recognising the important contribution the Northern Seas of Europe can make in achieving Europe's renewable energy targets, NSCOGI's objective is to evaluate and facilitate the coordinated development of an offshore grid that maximises the efficient use of the renewable resources and infrastructure investments in the region. Ten countries bordering the region signed a corresponding Memorandum of Understanding in December 2010, supported by TSOs, regulators and the EC.

Offshore grid development has a major impact on grid expansion elsewhere. The cost of the additional assets must always be balanced against their expected socio-economic benefits for Europe's consumers. Studies with a broader perspective than that of the simple integration of offshore capacity are therefore needed.

During 2012, ENTSO-E's Regional Group North Sea led a study evaluating the long-term development of an efficient and economic grid structure and looking at how best to exploit future offshore generation resources. The work will offer a view of how a meshed offshore grid might evolve from 2020 to 2030, as the countries in the region move towards a low-carbon energy future.

The grid study was based on a previous report outlining the likely development of new grid technology and setting out when technology is expected to be available to the market and at what price. Stakeholders commented on the comprehensive study through the 'Adamowitsch group', which includes industry and research representatives and guides ENTSO-E's work in support of the NSCOGI.

The NSCOGI study forms the basis for multi-lateral studies that will underpin the exploratory phase of the TYNDP 2014. In addition, ENTSO-E's Regional Group North Sea has contributed to the PCI assessment process by coordinating the input for projects promoted by local TSOs. The NSCOGI reports can be found at: [www.benelux.int/NSCOGI](http://www.benelux.int/NSCOGI).



# ACCEPTANCE OF INFRASTRUCTURE PROJECTS

Public opposition has been identified as one of the major hurdles to the construction of new energy infrastructure, most notably of high-voltage overhead electricity lines. The general public is not widely aware that the development of the pan-European transmission system is a prerequisite for Europe to achieve its energy objectives and a sustainable and efficient European economy.

European energy consumers do not generally understand the benefits that improvements in the grid will bring to their daily lives and to the European economy. In addition to the overall lack of awareness of the future benefits, and the fact that the availability of electricity is widely taken for granted, there is a strong underlying antipathy towards the construction of new power lines.

ENTSO-E and the EC have identified a need to inform the public in a more consistent way about the urgency of future grid development in order to foster wider appreciation and support for infrastructure projects. This includes dialogue with opinion-leaders and opponents of such projects. The ultimate goal is to speed up the implementation of new infrastructure necessary to meet Europe's low-carbon objectives and maintain the network's security of supply.

## MAKING IT HAPPEN

ENTSO-E's vision is to raise long-term awareness and understanding of the need for investment in the European network by reminding the general public of where their power comes from and the vital role it plays in their daily lives, and by explaining the continued need to provide the necessary infrastructure to make this happen.

Following the decision by the ENTSO-E Board in May 2012 to investigate a possible role for ENTSO-E in an awareness campaign, ENTSO-E has been developing a proposal to strategically communicate the need for new power lines via European, regional and Member State institutions. It has held extensive discussions with the EC on the scope of such a campaign.

A stakeholder workshop to discuss the proposal was held in Brussels in July 2012, which was supported by ENTSO-E TSOs and included a wider group of stakeholders to provide input on the key features of this type of campaign. So far, 15 ENTSO-E TSOs have expressed interest in participating in the elaboration of a suitable strategy.

ENTSO-E and the EC will now formally request nominations to become directly involved in the project and communicate a draft work plan to interested TSOs, NGOs and other stakeholders. Campaign development is expected to start in the first quarter of 2013 with implementation, at the earliest, in late summer 2013.





# COLLABORATION WITH ENTSOG

In accordance with Regulation (EC) 715/2009, ENTSOG, the ENTSO for gas, also needs to prepare a Ten-Year Network Development Plan every two years. In a similar fashion to ENTSO-E, ENTSOG develops an outlook for European gas generation and adequacy of supply, assesses the resilience of the European gas network and, on this basis, identifies potential future bottlenecks, particularly with respect to cross-border capacities.

A key element in the TYNDP process is the creation of the base scenarios that reflect the estimated development of generation and demand over the specific timeframe. The scenarios are used in the context of infrastructure identification and assessment.

As the gas and electricity sectors are interdependent, it is important to increase the consistency of the scenarios used in the TYNDP for electricity and in the TYNDP for gas. Although the scenarios may gravitate around different targets (e.g. assessment of the 20/20/20 targets in the electricity report and supply flexibility under different demand scenarios in that for gas), their consistency is especially important in the case where gas is used as a fuel for the generation of electricity.

For the development of the ENTSOG TYNDP 2013-2022, ENTSO-E and ENTSOG have shared data on

the development of electricity load and generation. As a result, the ENTSOG scenario of gas demand for power generation has been compared with the results of the market studies in the ENTSO-E TYNDP 2012.

The future aim is to further refine the assumptions made in the various scenarios on gas used for the generation of electricity. This becomes even more relevant in an environment where the new intermittent sources of generation may require significant back-up capacity in which gas can play a key role.

Besides collaboration on the network plans, ENTSO-E and ENTSOG have also exchanged experience and information on the development of project cost-benefit analysis (CBA) methodology.



# STANDARDISATION OF MODELLING DATA

To assess required European grid reinforcements on a consistent basis, ENTSO-E TSOs prepare network models that take into account different scenarios. The models are used as the basis for studies to improve long-term planning within the TYNDP. Network modelling will eventually provide a vital tool for all coordinated TSO studies to ensure the security of supply and suitable long-term planning, and the validation of investments to meet changing demands on the network.

Network modelling requires regular data exchange between TSOs across different platforms. ENTSO-E has chosen the International Electrotechnical Committee's Common Information Model (CIM) to ensure consistency between such exchanges and to optimise data flows. The CIM standards are continuously evolving to meet the changing requirements for data exchange, which are growing both in frequency and type with increasing RES integration and the introduction of smart grids.

To ensure that the CIM standards are suitable for ENTSO-E use, a specific ENTSO-E CIM Profile has been defined. This, in fact, is a set of profiles that reflect the complexity of TSO data exchanges. ENTSO-E runs tests on a yearly basis to demonstrate the interoperability of its CIM-based exchange format with the IEC standard and to ensure that it supports the ENTSO-E CIM Profile.

The experience gained from developing and implementing the standard directly contributes to future network code development, as data exchange processes form part of several codes. The last large ENTSO-E interoperability test was held in July 2012. TSOs also decided in 2012 to continue using the first edition of the ENTSO-E CIM Profile (CIM 14 v02, May 2009) for data exchanges of studies related to the TYNDP 2014.

Development of the second edition of the ENTSO-E CIM profile (currently based on CIM 16) is in progress, with the next interoperability test planned for July 2013. ENTSO-E is confident that the draft version of the profile tested in July 2012 is in line with the development of future TSO data exchanges but will perform additional testing on it in 2013. ENTSO-E will decide whether to implement the second edition of the CIM Profile in autumn 2013.

## NETWORK MODELLING DATABASE

Data exchange for studies such as the TYNDP and Regional Investment Plans needs a high degree of coordination and, in order to facilitate these at a pan-European, regional or even bilateral level, ENTSO-E members have defined the requirements for a network modelling database (NMD). A corresponding NMD development project was launched in 2012 and the database was successfully commissioned in the first half of the year.

The NMD is improving the coordination and standardisation of TSOs' long term planning of the European network. It helps TSOs to handle the complexity of network model management and facilitates the exchange of any necessary supplementary documentation. Having the NMD as the blueprint and a central store for the network models helps the delivery of more efficiently consolidated modelling information. Data is correctly formatted and addressed to the recipient at the right time to match the exact needs of ENTSO-E, TSOs and third parties.

The NMD now provides member TSOs with a solid foundation for the collection, consolidation, analysis and communication of all internal and externally available network modelling data.



# MARKET INTEGRATION

LONG-TERM  
MARKET DESIGN

REGIONAL  
MARKET  
DEVELOPMENT

MARKET  
TRANSPARENCY

STANDARDISATION  
OF DATA EXCHANGE



# LONG-TERM MARKET DESIGN

While balancing generation and consumption at times of peak demand, or during sudden outages, remains a challenge for TSOs, the integration of large volumes of RES substantially affects the operation of the energy markets. The availability of sufficiently flexible sources of generation is of crucial importance to accommodate a growing share of RES, but current market designs based on “energy only” models puts such capacity at risk and no longer adequately provides the incentives needed to unlock investments in incremental flexibility.

**F**lexible generation units, such as combined cycle gas turbine (CCGT) power plants, are experiencing declining demand with the growing market share of RES and, over time, these units may no longer receive adequate revenues to stay in the market. As this flexible capacity is valuable for system security, governments and regulators in many Member States are concerned about their potential scarcity and considering the introduction of capacity mechanisms (CMs) as a means of providing these units with additional revenue streams.

Within the context of a EC public consultation, ENTSO-E adopted a position on capacity mechanisms, generation adequacy and the IEM<sup>1</sup>, and has continued to engage proactively in the debate on long-term system design. In addition, ENTSO-E members will be working on projects based on the ENTSO-E R&D Roadmap 2013-2022 which defines the necessary activities related to the long-term market design.

## GENERATION ADEQUACY

The growing disparity between Europe's existing generation assets and the needs of power systems using large amounts of variable, non-synchronous generation is a matter of concern. Current market designs, even when the IEM Target Model is fully implemented, may not be equipped for a generation mix that is expected to be made up to 64-97% RES after 2020, according to the various scenarios developed by the EC (Impact Assessment accompanying the document “Renewable energy: a major player in the European energy market”, 06/06/2012).

When discussing how to marry the integration of significant volumes of RES with system security, ENTSO-E believes that the needs of the transmission network rather than those of individual market players should occupy a central place in market design. The only way to facilitate RES integration is to ensure that TSOs have the tools necessary to control the grid at any point in time. To cope with rapidly changing market dynamics, they need access to various generation services in a range of timeframes.

CMs often fail to recognise that the ability to deliver required services is not equal for all types of generation capacity and, as such, do not guarantee incentives for investment in the type of capacity the power system needs most. The market design must reflect the value of a particular type of generation to system security. Capacity cannot be regarded as a single product and market mechanisms should seek to incentivise delivery of capabilities that are particularly scarce, such as flexible generation.

ENTSO-E's SOAF 2012-2030 found that, in most situations, generation adequacy within the European network is assured up to 2020.

In a way, this implicitly demonstrates that current market price mechanisms are sufficient to attract the necessary investment in suitable generation facilities. On the other hand, in order to guarantee system security beyond 2020, there are some key factors that need to be considered. These include the need for a level playing field for all types of generation and a market price mechanism that rewards not only a unit's nameplate capacity but also the type of service it delivers.

1. ENTSO-E Response to the EC Public Consultation on Generation Adequacy and Capacity Mechanisms and the Internal Market in Electricity, 7 February 2013, available from ENTSO-E's website at: [www.entsoe.eu/publications/position-papers](http://www.entsoe.eu/publications/position-papers)

# REGIONAL MARKET DEVELOPMENT

In combination with the network codes, regional market development is essential to achieving an IEM that allows the integration of a variety of energy sources. Regional projects complement the top-down approach provided by the codes and streamline bottom-up cooperation, bringing regional and national reality to the European context.

Throughout 2012, ENTSO-E has encouraged regional coordination, working in close co-operation with all TSOs involved in different implementation projects. Its approach is aimed at achieving pan-European solutions, facilitating exchange of information and expertise among TSOs from different regions, and ensuring consistency between regional implementation projects and the corresponding network codes.

## DAY-AHEAD MARKETS

Market coupling is the process by which cross-border transmission capacities are allocated and day-ahead trades matched in one single step. It is a major step towards market harmonisation, eliminating distortions and giving all market participants an equal chance. It also ensures the most efficient use of available transmission capacity, so maximising social benefit. TSOs and power exchanges are working together at regional level

to implement several day-ahead market coupling projects in order to achieve the European day-ahead market.

## REGIONAL IMPLEMENTATION PROJECTS

At the end of 2010, with the support of the Florence Forum, ENTSO-E chose the North-West Europe Project as the pilot for implementing day-ahead market coupling throughout Europe. Its aim is to implement a full price coupling market across the NWE region in cooperation with the relevant power exchanges.

The project covers eleven European countries and includes the Central-West Europe (CWE) region (Belgium, France, Germany, Luxembourg and The Netherlands), the Nordic region (Denmark, Sweden, Finland, Norway and Estonia) and Great Britain. It will also integrate the Baltic States and the Swepol link with Poland.

## MARKET COUPLING

### Price coupling

- Price coupling enables the creation of an exchange zone between different countries where a single market price is created when interconnection capacities do not limit cross-border exchanges. Price coupling was first implemented by the Nordic countries. France, Belgium and The Netherlands adopted price coupling in 2006 (trilateral coupling) but in 2010 this model was replaced with day-ahead (available transmission capacity-based) market coupling across the whole CWE region.

### Volume coupling

- Volume coupling involves a coordinated day-ahead auction among two or more power markets. Cross-border volumes are computed by an auction office and transferred to the power exchanges, which view them as price-inelastic bids in their local system. The calculated flows are based on anonymous order books and available transmission capacities, while pricing remains in the hands of the relevant power exchanges. Volume coupling was introduced at the Nordic-German border in November 2009 and had been running as Interim Tight Volume Coupling (ITVC) between the CWE and Nordic regions since 2010.

Due to go live in November 2013, the price-coupling pilot will replace the Interim Tight Volume Coupling (ITVC) model, currently used by the CWE and Nordic regions.

In the South-West Europe (SWE) region (France, Spain and Portugal), three TSOs (RTE, REE, and REN) and two power exchanges (OMIE and EPEX SPOT SE) have signed a cooperation agreement establishing a project to couple the Iberian Electricity Market (MIBEL) to the NWE market in the course of 2013.

The Central East Europe (CEE) region (Germany, Poland, Czech Republic, Slovak Republic, Austria Hungary and Slovenia) is currently also working on the implementation of the flow-based price coupling target model. The model takes all electrical flow paths into account, rather than just the contract paths and maximises the use of inter-regional transmission capacity and market efficiency through implicit auctions. The aim of the project is to couple the CEE region with the NWE region and introduce flow-based price coupling in a single step.

Nine parties are involved in the Central West Europe (CWE) region's flow-based project, which is being studied and developed in parallel. They include seven TSOs (Amprion, Creos, Elia, RTE, TenneT TSO, Tennet BV and Transnet BW) and two power exchanges (APX-Endex-Belpex and EPEX Spot). The Czech and Slovak Republics and Hungary are already coupled using the CWE algorithm.

The Italian Round Table encompasses TSOs and power exchanges from countries bordering Italy (including France, Switzerland, Austria, Slovenia and Greece). This project brings the various organisations together to develop a regional approach in designing pre- and post-coupling processes. These cover cross-border capacity assessment and publication, information exchange, settlement management and the distribution of congestion charges. They are prerequisites for market coupling with the NWE region.

## COORDINATION OF MARKET COUPLING

In September 2012, ENTSO-E created a new taskforce for the Coordination of EU Market Coupling (CEMC). This involves both NWE and non-NWE TSOs in order to achieve efficient coordination of individual and regional projects and to ensure that they are consistent, as well as to coherently facilitate the evolution of European-wide price-coupling in line with the CACM network code.

The new CEMC taskforce builds on the experience of the former monitoring group of the Day-Ahead North West Europe project. It assists in the integration of the regions into the single European market-coupling solution, coordinating the exchange of information, activities and expertise between TSOs from each region.

## INTRADAY MARKET

Coupling national intraday markets will increase intraday liquidity, benefiting market players, as well as make the network more secure, especially with regards to RES integration.

The CACM network code defines the rules for a continuous intraday market that allows market participants to trade up to at least one hour before real time. The market will be composed of a shared order book function that will pool the bids of all European bidding zones together and a capacity management module that will contain all cross-zonal capacities to be allocated. Although cross-zonal intraday markets already exist in a number of European areas, such as the Nordic countries and between France and Germany, the goal is eventually to have a pan-EU Intraday market.

The power exchanges launched a tender procedure in 2012 for selecting a single pan-European platform for intraday cross-border trading using continuous auctions. ENTSO-E is playing a key role in the process through its NWE TSOs and the Intraday Monitoring Group. The Intraday Monitoring Group, which also



## FLOW-BASED MARKET COUPLING

Flow-based market coupling is being advocated as the target market model for highly meshed grids (such as that of the Central West Europe region). It allocates capacity by optimising the overall order book surplus of the different spot markets, while ensuring that the physical limits of the grid are respected. The consequence, when sufficient capacity is available, is price harmonisation across the region. By using a more detailed grid description, the flow-based method increases price convergence while ensuring that security of supply is maintained.





includes non-NWE region TSOs, aims at enhancing cooperation between regions and guarantees the exchange of information and expertise. In October, ENTSO-E approved the functional requirements for the platform, covering all TSOs. The common requirements will be part of the tender documentation and will ensure that the needs of every region are met by the selected platform.

### **PILOT STUDY ON BIDDING ZONES**

The target market model for the IEM is based on a zonal approach with several bidding zones.

A bidding zone is the largest geographical area within which market participants can exchange energy without the need for capacity allocation. This implies that, within a bidding zone, energy exchanges are possible without constraint. Exchanges may be constrained between zones, however, where cross-zonal capacities are insufficient to facilitate them. This poses the question of where and how the geographical boundaries of bidding zones should be determined.

The CACM network code describes the review process, which is divided into four activities: the

TSO's technical report, the NRA's market evaluation, the NRA decision on the launch of the bidding zone review, and the review itself.

In October 2012, ENTSO-E decided to pilot the bidding zone review process described in the CACM code in several regions (CWE, Denmark-West, CEE, Switzerland and Italy) and presented the terms of reference of the study at the Florence Forum in November. ENTSO-E and ACER are now working together to establish the pilot project in 2013. Stakeholders will be involved throughout the different stages of the process.

All the regional implementation initiatives above are essential to achieve the IEM. ENTSO-E is working to enhance the coordination of the different projects, so that the solutions can be eventually implemented on a pan-European basis. Follow-up initiatives, such as cross-regional roadmaps, the convergence of regional implementation projects with ACER framework guidelines and ENTSO-E network codes, and adequate transparency for stakeholders, are priorities. ENTSO-E has created different working groups to make further progress on these.

# MARKET TRANSPARENCY

Transparency is essential for the creation of efficient, liquid and competitive wholesale energy markets across Europe and the implementation of the IEM. It is critical to creating a level playing field for market participants and for avoiding scope for market abuse.

ENTSO-E and its predecessor associations have been deeply committed to increasing market transparency. The *entso.net* central information platform, which has been operational since 2007, publishes fundamental transparency data of interest to electricity traders.

Throughout 2012, ENTSO-E has also been actively involved in technical discussions with the EC in relation to its transparency Regulation: "Regulation on submission and publication of data in electricity markets".

The Regulation, based on guidelines issued by ERGEG in 2010, mandates ENTSO-E to develop and operate a new central information transparency platform and to publish an accompanying manual of procedures. The platform will replace *entsoe.net* and make substantially more information available.

After selection from a shortlist of IT vendors, ENTSO-E signed a contract with Unicorn for the development of the new platform in September 2012. A proposal concerning the operation of the platform will be submitted to ACER within four months of the Regulation entering into force.

In December, ENTSO-E invited stakeholders to form an expert group which will consult on the content of the platform's procedures manual, including the details and format of data submitted, standardised ways and formats of data communication, and the technical and operational criteria which data providers need to fulfil when providing data.

After its first formal meeting in January 2013, the group will continue to consult and assist ENTSO-E with a public workshop and consultation before submitting a draft of the manual to ACER.







# STANDARDISATION OF DATA EXCHANGE

Balancing the fluctuations that the integration of renewables brings to the network requires grids that operate smartly and cost-efficiently. Seamless and efficient information exchange among an increasing number of parties, including TSOs, DSOs and generators, is needed.

Efficient exchange of information is necessary for network planning (e.g. in the development of HVDC networks, congestion interconnections, etc.), for system operation (real-time information on generation output, balancing control, etc.) and for market data (generation schedules, trades, balancing resource management, etc.).

Efficiency of data exchanges needs to be based on common business process descriptions and 'role models'. To this end, in cooperation with other associations and forums (particularly EFET and ebIX) and international standardisation organisations such as the IEC, ENTSO-E's Electronic Data Interchange (EDI) Working Group develops and maintains numerous detailed business process descriptions and standards in formats which are easily understood and implemented by the software industry.

Common business process descriptions include those of fundamental TSO practices such as scheduling, settlement, capacity allocation and nomination, acknowledgement, status request and reserve resources' planning. They have been developed over many years, alongside core components, code lists and coding schemes for identification purposes, as a standard for a market data exchange platform and a harmonised electricity model. They constitute ENTSO-E standards for data exchange harmonisation at European level.

## COMMON INFORMATION MODEL

In parallel, ENTSO-E contributes to standardisation activities on the common information model (CIM) within the IEC's Technical Committee 57 and its Working Group 16. Its contribution relates to bringing European electricity market information requirements within the international standards by updating the CIM to include the basic core



components and, subsequently, the definition of a European market profile that includes all contextual document UML models. ENTSO-E also carries out the necessary interoperability (IOP) tests to ensure that the UML models conform to the European industry's business requirements.

The objective of ENTSO-E's first interoperability test on the extension of the CIM to the electricity market in July 2012 was to demonstrate that the IEC 62325-451-1 standard satisfies the requirements for the Acknowledgement business process in the European market profile and that the IEC 62325-301 (CIM market extensions) and IEC 62325-351 (CIM European market profile) standards are consistent.

The test demonstrated that the standards are in line with TSOs business requirements and included all the capabilities needed to support the data exchange procedures already implemented by ENTSO-E.

Following the successful first test, a second test was carried out on the IEC 62325-451-2 standard in December to assess its compliance with ENTSO-E's business requirements for Scheduling. Its main objective was to determine whether current ENTSO-E-compliant XML Scheduling, Anomaly and Confirmation reports can be processed using the XML schema definition generated by the CIM.

The results of the second test are also in line with expectations and are summarised in the corresponding IOP report released in January 2013.

# TSO COOPERATION

ENHANCING TSO  
COOPERATION

THIRD-PARTY  
INTERCONNECTIONS

ELECTRONIC  
HIGHWAY

CRITICAL SYSTEM  
PROTECTION

DETERMINISTIC  
FREQUENCY  
DEVIATIONS

THE ENTSO-E  
ACADEMY

ENTSO-E  
AWARENESS  
SYSTEM



# ENHANCING TSO COOPERATION

TSO cooperation has been a reality for many years and is at the core of everything ENTSO-E does. ENTSO-E is active in a very broad range of activities and, in all cases, it seeks to support its member TSOs in coordinating their efforts more effectively and in developing networks that can help facilitate Europe's energy policy objectives. The changing environment in which TSOs operate is an important driver for adapting and enhancing cooperation.

The challenges facing European TSOs require improved information exchange, closer and broader cooperation, joint training and the exchange of best practice and common studies. The operational environment is not only being shaped by Europe's decarbonisation of the energy system. Further market integration, advances in technology, energy policy, changing demographics, and cyber security all contribute to a dynamic environment to which TSOs need to adjust.

This section of the report highlights a number of areas that demonstrate particular TSO cooperation over and above their work on the network codes and network development.

## WINTER 2011/2012

The extreme weather throughout Europe in January and February 2012 was a great challenge for the entire European electricity system and the wide range of coordinated measures to maintain system security taken by TSOs illustrates the effectiveness of existing cooperation procedures.

The severe conditions, with exceptionally heavy snowfalls and extremely low temperatures had not been seen in many countries for decades. They meant that many experienced extreme demand - France, Poland, Austria, Croatia and Macedonia (FYROM) reported the highest-ever peak loads on their networks, with Bulgaria reporting its highest peak in 20 years.

At the same time, favourable wind conditions along the coasts of the North and Baltic seas resulted in extreme, unplanned power flows from wind generation facilities there. These brought networks in the Central Eastern Europe region close to, and even temporarily beyond, the limits of secure grid operation.

In Germany, particularly in the south of the country, limitations in the supply of gas to power stations posed network balancing problems and TSOs were required to seek coordinated solutions with gas operators to ensure sufficient fuel was available. In the unfavourable conditions, local wind and solar facilities were unable to contribute significantly to the generation-load balance and the effect of the nuclear phase-out on network adequacy was also significant, not only in the German market, but also at regional and even European level.

Generation was also severely restricted in many South Eastern European countries. Some TSOs limited exports but all electricity transits were maintained. Market curtailment was agreed only with the consent of national governments.





TSOs worked closely with each other over the critical period to manage the European network's security of supply, which faced highly loaded cross-border capacities and internal system constraints. All available control reserves were used to maintain customer supplies and import possibilities were maximised. Generally, markets held up well, with generators responding to higher prices.

### **FUTURE OPERATIONAL DEVELOPMENTS**

The cold spell demonstrated that existing regional coordination initiatives such as Coreso, TSO Security Cooperation (TSC) and Security Service Centre (SSC) worked well and these will be further developed across Europe.

ENTSO-E's Winter and Summer Outlooks already contribute significantly to the identification of potentially difficult network situations and suitable short-term precautionary measures to complement TSO cooperation. The Winter Outlook 2012-2013 uses enhanced methodology to provide a European

overview of both upstream and downstream adequacy issues. Downstream issues appear when an excess of inflexible generation exceeds minimum demand levels overnight, highlighting the need for more interconnection capacity.

The forthcoming market and system operation network codes will enable enhanced data exchange among TSOs and the observation of system conditions at all levels, from pan-European to bilateral relationships. TSO access to a common grid model and common methodology to evaluate operational security, capacity allocation, sizing of operational reserves and joint cross-border action are key aspects of the codes.

The development of demand response services that can rapidly reduce load on the network will also enhance network security. The ability of commercial services to bid into EU-wide Intraday and Balancing markets will further assist their performance in extreme conditions.

## **THIRD-PARTY INTERCONNECTIONS**

System extensions connect previously unconnected external grids to one of ENTSO-E's synchronous areas. They are designed to bring benefits in terms of increased trading possibilities and lower costs for consumers due to increased efficiencies in transmission, reserve power and system balancing.

Reserve power and system balancing are particularly important when it comes to more volatile forms of generation. As the overall European synchronous area becomes larger, more reserve power is available to it and system reliability is enhanced. In this context, ENTSO-E's work on the interconnection of the Turkish and Albanian power systems (respectively with the Turkish Electricity Transmission Company TEIAS and the Albanian TSO OST deserve comment.

### **TURKEY**

After rigorous stand-alone operational tests, the Turkish system was synchronously connected to the Continental European system in September 2010. The date marked the beginning of the parallel trial interconnection, originally foreseen for a one-year period. By June 2011, limited commercial exchanges had been successfully progressed on the

interconnection but a number of problems had been observed in the Turkish network which required the trial to be extended. It is currently foreseen to terminate in September 2013.

### **Low frequency inter-area oscillations**

The synchronous interconnection of the Turkish network with the Continental European system generates low frequency inter-area oscillations across the combined network. Sufficient damping of the oscillations is of crucial importance for the security of the overall network and is a challenging task.

Up to now, the oscillations have not had a serious impact on the Continental European system as TEIAS has made a great effort to achieve a positive damping performance. However, it must be ensured that such measures will be further developed and enhanced, particularly in the light of the future

growth of generation capacity and the development of generation technology within the Turkish system.

#### **Secondary control performance**

Secondary control plays a central role in maintaining the quality of the power balance of the different control areas and controlling cross-border power flows. Control performance is continuously monitored through the different indices of the Area Control Error (ACE), which have been predominantly recorded as close to, or even above, the set limits.

Corresponding power flow variations across the interface are disturbing operations in neighbouring power systems in Bulgaria and Greece. Despite this, a continuous improvement in secondary control performance has been observed since the start of

the trial operation and, from February 2012, the ACE indices have mostly been within acceptable limits.

Further measures are being taken to smooth out the load variations that cannot be adequately resolved through automatic generation control. Once such measures are in place (target deadline: summer 2013), the ACE variations are expected to remain within the required limits. Typically, the magnitude of the variations depends on the load demand of the control area concerned. As load demand in Turkey is growing very rapidly, adequate measures are needed in the near future to keep the adverse influence of unintended power flow variations on the neighbouring system within acceptable limits.

#### **Incidents resulting in temporary disconnection**

Transmission capacities at the interface area are rather low and therefore not sufficient to withstand certain incidents within the Turkish system. This structural condition has been recognised as a matter of operational importance, especially as the system has had to be disconnected several times at the interface through the Special Protection Scheme in order to protect the entire Continental European network against severe disruption due to cascading effects.

The number of disconnections has been higher than expected. The root cause has been the insufficient development of the Turkish transmission network in some regions so that it cannot keep pace with generation growth. Electrical faults in the network are often followed by loss of generation or load and the resulting power imbalances cause highly unpredictable power exchanges with the Continental European region. Automatic separation of the Turkish system is needed when admissible power flow limits are exceeded, as incidents of this type have adverse effects on neighbouring systems.

In January 2012, the most serious system disturbance occurred due to severe weather conditions (snow and storm) in the north-west region. A few cities in the western part of Turkey were blacked out. Immediately after the first event, the Turkish system was disconnected from the Continental European system and therefore was in island operation for about three hours.

So far, the integrity of adjacent networks or the Continental European synchronous area has not been affected by disturbances in the Turkish system due to the smooth operation of the protection schemes.



ISTANBUL

However, the experiences raise concerns as far as the ongoing rapid development of the Turkish system is concerned. Its generation capacity is growing without sufficient adaptation of the interface structure with the European region.

#### Monitoring & energy management

Some difficulties relating to the monitoring and emergency management of the Turkish system were already identified in the early stages of the project. This is carried out using SCADA and emergency management (EMS) systems. Since the latter part of 2012, there has been improvement in this area, with stable network operation. Any remaining problems should be addressed by improvements in TEIAS's system observation and modelling through upgrades of its current SCADA and EMS systems in the first quarter of 2013.

#### ALBANIA

The Albanian power system has been synchronously interconnected with the Continental European synchronous area since 1986 and is currently operated and maintained by the TSO "Operatori i Sistemit te Transmetimit - OST". OST's insufficient compliance with ENTSO-E's Operation Handbook means, however, that it is not a member of ENTSO-E (and was not a member of UCTE), but has observer status in ENTSO-E's Market Committee.

#### Compliance with the ENTSO-E Handbook

The evaluation process for OST compliance with the Operation Handbook was initiated by UCTE and while the process continues, the Albanian system remains interconnected with the Continental European synchronous area.

A corresponding project group, established first under UCTE and later under ENTSO-E, has defined the compliance standards and set out the measures that OST has to implement to meet them. It is currently monitoring progress and will recommend membership of ENTSO-E once OST has achieved full compliance.

The agreement between UCTE and OST initially aimed at full compliance within two years of May 2009 but delays in project implementation beyond OST's direct control meant that the compliance period was extended to May 2013 and the measures updated accordingly. On the formation of ENTSO-E, the measures were adjusted a second time with some additional requirements added to meet ENTSO-E standards.



OST has made steady progress over the period in implementing a variety of organisational and infrastructure projects (new lines and upgrades) aimed at restructuring the sector and liberalising its electricity market. Most of the measures foreseen in the compliance agreement are now in place but there are still considerable delays in setting up a new SCADA/EMS system and in the adoption of the Third Energy Package. Advances are being made in these areas, however, and it is expected that all the measures will have been implemented within the agreed timing.

Furthermore, in order to meet power demand in dry years, OST needs to enhance the security of the network with alternative sources of energy and to build a suitable environment for attracting new investments in RES technology.



# ELECTRONIC HIGHWAY

The ENTSO-E electronic highway is a dedicated router network connecting European TSOs, designed for operational data exchange both in real time and over longer timeframes. For network security reasons, such as cyber attack, it is an isolated intranet between TSOs and there is no direct connection to other networks, such as the internet or commercial data networks.

The electronic highway platform plays an increasingly important role in ensuring the security of TSOs' daily operations and of the European transmission system as a whole. The information exchanged via the platform is part of the dataset used for real-time analysis of the state of the network. Knowledge of network risks in real-time allows TSOs to optimise their resources and facilitate the integration of different sources of energy.

Without the real-time interchange of data between neighbouring TSOs, a full analysis of system security is not possible as most operate in a highly meshed network. With the growing share of RES, the highway is therefore set to play an increasingly important role in ensuring system reliability. New operational

tools such as the ENTSO-E Awareness Platform will increasingly depend on it.

## CURRENT STATUS

To date, 34 ENTSO-E TSOs are connected to the electronic highway through 12 dedicated lines. As a consequence of its increasing use for the exchange of operational data and other information, such as schedules, market data, etc., it was agreed to enhance the platform by increasing its line capacity from 2 to 10 Mbps. The majority of the lines are to be upgraded by the end of 2013.

In parallel with this activity, the ENTSO-E's Electronic Highway Working Group is continuing to improve the availability and the security of information on the platform.



# CRITICAL SYSTEM PROTECTION

The EU's EPCIP (European Programme for Critical Infrastructure Protection) Directive 2008/114/EC is aimed at increasing awareness of the need to protect critical infrastructure such as the European electricity transmission network and to define good practice related to its management and protection against all types of incident, including terrorism.

ENTSO-E's Critical System Protection Working Group is tasked with developing a suitable strategy for critical infrastructure protection (CIP) at European level. Its main areas of activity encompass the exchange of best practice in dealing with high impact, low frequency (HILF) events and issues related to cyber security.

The Working Group actively contributes to CIP dialogue with the EC and key stakeholders and encourages the exchange of best practice among TSOs through site visits. In early 2011, it evaluated the progress and implementation of the EPCIP Directive by ENTSO-E TSOs.

## HILF EVENTS

A major focus of ENTSO-E activities is the exchange of information and the coordination of TSO actions to cope with HILF events such as pandemic flu, geomagnetic storms, floods and strikes. The ENTSO-E paper "Current practices for implementation of EPCIP and consideration of HILF events" outlines the main findings of a survey on TSO management of HILF events in 2010, focusing on risk assessment strategies and measures to help improve the common protection of the interconnected grid.

The survey found that financing the implementation of EPCIP measures is not approved by regulators in many countries and TSOs face substantial costs in implementing the Directive. These include costs for additional human resources, additional protective measures and reconstruction work. Secondly, HILF threats need to be considered in each TSO's risk analysis and contingency planning, as they can cause massive disruption to the network and the supply of power to end users.

## CYBER SECURITY

In recent years, cyber attacks have become more frequent, complex and professional. In response, ENTSO-E has established a Cyber Security (CSP)



Expert Group. The group has been instrumental in developing an internal strategy on cyber security for ENTSO-E. This recommends that TSOs focus on the three areas of data availability, integrity, and confidentiality, to ensure the security of the electricity supply. The priority should be on the common information model.

Furthermore, common security standards among ENTSO-E TSOs need to be established to enable their secure interoperation. The strategy suggests a risk-based approach focusing on identified risks and a set of commonly identified threats. Finally, TSOs will need to adopt a holistic approach to security, ensuring that physical and cyber security strategies are aligned.

## CIP WORKSHOP

Through its CSP Working Group, ENTSO-E organises a bi-annual CIP workshop in conjunction with the EC. The next workshop, hosted by REE, will take place in Madrid on 11-12 June 2013. The scope of the workshop will include a review of the EPCIP and cyber security.

# DETERMINISTIC FREQUENCY DEVIATIONS

For several years, European TSOs have observed increasingly important frequency deviations from the network's 50 Hz standard. The deviations are directly related to the generation-load ratio, which needs to be in balance for the system frequency to remain at 50 Hz. They are "deterministic" in nature, being observed at specific hours every day, rather than "stochastic" caused by unpredictable system events such as forced plant or load outages.

**D**eterministic frequency deviations (DFDs) have implications both for TSOs and generators. In addition to reducing TSOs' ability to ensure system security and reliability, they can have a negative effect on their ability to balance the system and lead to higher operating costs for generators, due to the increased use of equipment. Ultimately, this results in higher energy costs for consumers.

A joint ad-hoc working group, comprising experts from ENTSO-E's System Operations and Market Committees and EURELECTRIC, was set up in 2009 to analyse the origin of the DFDs, evaluate their impact and propose solutions for their mitigation. In its first report on the root causes of the phenomenon, published in February 2012, the group found that the deviations result from a regular, short time mismatch between generation and load, which occurs because generation schedules follow market rules rather than real-time demand.

## RESULTS AND RECOMMENDATIONS

The group's subsequent focus has been on identifying remedies for the deviations. The work is ongoing, but a corresponding impact analysis report has been released which notes that DFDs decrease the security of the energy supply and negatively affect all market participants. Continuous and transparent monitoring of the generation-load imbalances within each control block at the time DFDs occur is required.

From a long-term perspective, the report stresses the importance of a suitable regulatory framework and the relevant network codes to address the issue. The system operation network codes being developed by ENTSO-E need to be sufficiently precise to define a clear framework and limits to trigger the measures urgently required to mitigate DFDs.

The report identifies a set of short- and long-term measures. Short-term measures include the implementation of a forecasting process based on the DFD monitoring and reporting system which can significantly increase overall operational efficiency. The forecasting process would also support the identification of critical situations.

Complementary long-term measures are based on related market developments within individual synchronous areas. To accompany and facilitate implementation of the measures, the study also recommends a dedicated monitoring process - a monitoring team, possibly from the existing working group, delivering frequency quality monitoring reports and resulting recommendations on a yearly basis.

## COSTS AND RISKS

It is important to note that only some of the counter-measures can be fully introduced across every market system. Cost-benefit analysis is therefore needed at TSO level, as each TSO's required implementation will vary.

In order to maintain DFD risk at its 2002 level, it is estimated that a 120 MW increase in control reserves is required, resulting in an increase in costs of approximately €31 million a year. However, this amount only covers one element of cost - additional costs are incurred with the increasing use of the control energy.

A number of the proposed DFD mitigation measures are already scheduled to be applied by various TSOs and a continuous monitoring system is under development.



# THE ENTSO-E ACADEMY

The ENTSO-E Academy was created in April 2012 as a educational institution aimed at helping TSOs expand their knowledge management and training support. Its activities include workshops, seminars and the organisation and supply of training materials on specific topics related to the operation of the interconnected grid. The Academy is a working group within ENTSO-E and run by its System Operations Committee and member TSOs.

The Academy supports the initial training of TSO operators and continuous training initiatives to maintain operational knowledge and skills. As such, it has to react to the constantly changing nature of grid operation, market developments and future expectations concerning the security of supply.

Its activities are intended to facilitate shared experience and best practice among TSO operators and other system operations professionals by promoting mutual support for training and technical solutions, the exchange of information about disturbances and critical grid situations, and networking opportunities for system operation trainers.

## PROGRESS IN 2012

During the last quarter of 2012, the Academy organised three workshops - on renewable energy integration, system protection and dynamics, and blackout restoration. The subjects were selected by the participants (mainly system operation trainers) in a pilot workshop held in Madrid in December 2011.

The first workshop focusing on RES integration was organised by Spanish TSO REE in September 2012 and attended by 50 participants from 20 different companies. Experts presented their experience of the impact of RES on operational planning, management of operational reserves, and the assessment of operational control and security. Also discussed were network operation in an emergency, forecasting tools, offshore wind farm connection and trends in technology.

In October, the System Protection and Dynamics Working Group organised a workshop in Brussels to share experience of system stability phenomena and dynamic security assessment, as well as defence plans against extreme contingencies and the restoration and protection of equipment.



Pilot Academy workshop, Madrid, December 2011.

ENTSO-E TSOs APG and CEPS organised the third workshop in Vienna on blackout restoration in November. Twelve experts from across Europe shared their knowledge of the basics of network restoration and special restoration plans, with practical examples and training initiatives.

The Academy also organises common training courses for new tools developed by ENTSO-E, such as the EAS (ENTSO-E Awareness System). Working with the EAS project group, the Academy designed and organised two training sessions in December 2012 and in the first quarter of 2013.

The Academy's 2013 program currently envisages four events focusing on congestion management, the use of various training simulators, the network codes, and their influence on grid operation.

# ENTSO-E AWARENESS SYSTEM

Market liberalisation and the changing generation mix are making network operations increasingly dependent on synchronously connected TSOs. This adds to the need to further improve Europe-wide co-operation and exchange of information to provide system operators with a consistent understanding of the real-time situation within the European network.

Although TSOs supervise their particular transmission networks with their own supervisory control and data acquisition (SCADA) systems, a common view of the network becomes increasingly essential with increased trading activities and the significant increase of power flows between regions.

Given the extent of the European transmission system, with its decentralised frequency control and high interconnectivity through HVDC links, a critical situation taking place inside one network may well negatively affect neighbouring systems. Increasing long-distance load flows add to the risk of critical situations such as tie-line overloads, network splits and even blackouts. In the worst-case scenario, information about a network split or other critical conditions that may impact many TSOs is not available to them without significant delay.

The ENTSO-E awareness system (EAS) focuses on cooperation and real-time data exchange between TSOs using status and measurement information available from individual TSO SCADA systems.

The EAS resembles an online operational information platform that allows operators to observe the current status of the entire European network. Individual TSOs exchange a selection of data, such as network frequency, area control errors, cross-border power exchanges, system balance and generation input. This is fed into the EAS and synchronised with data from other TSOs to provide a synthetic view of the network and enable TSOs to identify critical operational conditions, regional alerts and cross-regional disturbances in real-time.

## SYSTEM OPERATION

The real-time input data is provided by TSOs via the EAS communication infrastructure to a central point within ENTSO-E where it is processed to ensure that the completeness and quality of the information is identical for all TSOs. EAS presenters installed in individual TSOs control rooms then provide common visualisation capabilities for on-screen presentation.

Being based on standard SCADA functionalities, the EAS can easily be extended and further developed according to future needs for TSO coordination and cooperation.

## PROJECT PROGRESS

In 2012, the development, implementation and receipt of the system was achieved, in collaboration with Siemens. The system has successfully been installed and is hosted by Amprion and RTE.

Currently, the EAS is being run by eight TSOs within the EAS pilot project group and the deployment to other TSOs has started.





# RESEARCH & DEVELOPMENT

ADDRESSING  
ENERGY TARGETS  
THROUGH R&D

R&D ROADMAP  
& IMPLEMENTATION  
PLAN

COOPERATION  
ACROSS THE  
VALUE CHAIN

E-HIGHWAYS2050  
PROJECT

STANDARDISATION



# ADDRESSING ENERGY TARGETS THROUGH R&D

Despite the uncertainties about Europe's energy future, everything indicates that it will be "green". By 2020 the share of renewable energy in the electricity system is expected to be somewhere between 34-36% and by 2030 it will greatly surpass this level. The EC's Energy Roadmap 2050 contemplates a reduction in greenhouse gas emissions of 80-95% below 1990 levels over the 2050 timeframe.

To achieve these energy and climate change objectives requires tremendous structural changes in both transmission and power generation. As a result, a critical need has emerged for investment in new expertise and innovation in transmission technology.

New operating technology and improvements in existing practice, such as demand response management, energy storage or market simulation, are needed. Variable generation also requires a market design that enhances cross-border exchanges of electricity close to real time and monitors reserve capacities at a pan-European level. These significant challenges and lack of infrastructure investment are driving transmission grids closer to their physical limits, presenting potential problems in their operation and control.

TSOs are already developing transmission infrastructure for the next decade but investment in R&D is urgently needed to develop solutions with a perspective beyond this timeframe.

A coordinated R&D effort by European TSOs will facilitate the deployment of new technology while keeping network capital and operating expenditures under control. Once the technology becomes more effectively integrated into the energy system, it will be possible to assess its actual costs and move towards market-based deployment.

R&D promotes the scaling-up and replication of best practice (in system planning, markets and network operation) and a more efficient energy market will maximise social welfare in Europe.



# R&D ROADMAP & IMPLEMENTATION PLAN

Research & Development plays an important part in the effort to achieve Europe's sustainable energy objectives and EU Regulation (EC) 714/2009 and Directive EC/72/09 charge ENTSO-E with promoting and coordinating TSOs' R&D activities in this respect. ENTSO-E's R&D Roadmap 2013-2022 & Implementation Plan 2014-2016 provide a vision of the R&D that needs to be carried out by ENTSO-E and its member TSOs to meet the EU's low-carbon objectives. The first ENTSO-E R&D Roadmap was published in late 2012, following R&D Plans in 2010 and 2011.

The Roadmap focuses on R&D strategy and evaluates Europe's energy policy goals. It describes the challenges and opportunities they represent for TSOs, and outlines a methodology to achieve them. It lays the groundwork for the technologies that Europe's transmission systems will need, such as electricity highways, smart grids, offshore networks, etc., in order to meet Europe's sustainable energy objectives.

The Roadmap will be issued every five years and is complementary to the ENTSO-E network codes and Ten-Year Network Development Plan. It sets out priority R&D activities required over the next ten years to meet 20-year transmission system targets. It is complemented by yearly releases of the ENTSO-E R&D Implementation Plan, which prioritises the Roadmap's functional objectives and outlines specific R&D topics over the next three years in line with the Roadmap.

The Roadmap 2013-2022 focuses on six distinct yet highly interdependent R&D clusters, which serve to differentiate the tasks required to address the challenges facing Europe's rapidly changing energy sector. Each cluster helps facilitate cost-effective collaboration between TSOs, the industry and research institutes. Collectively, they provide a shared repository of ideas that enable inherent synergies in Europe to be exploited, the exchange of best practice and the prevention of R&D duplication.

## HIGH-RETURN INVESTMENT

The Roadmap shows that the investment required for effective TSO R&D is relatively modest compared to its potential long-term benefits for grid users. The total TSO R&D budget is estimated at €1,005 million between 2013 and 2022, while TSOs need to invest more than €100 billion in infrastructure projects of European interest over the same time frame.



### TSO R&D CLUSTERS

**The six R&D clusters encompass the full scope of TSO business:**

- Grid architecture
- Power technologies
- Network operation
- Market designs
- Asset management
- Joint TSO/DSO activities.

R&D also provides a means of mitigating the potential risks of failing energy policy and infrastructure investment. But the lack of explicit R&D regulation means that it is often treated by TSOs as another operating cost. In the drive towards increasing cost-effectiveness, R&D allocations therefore tend to be reduced on a yearly basis.

It is essential that European regulators and policy-makers establish a suitable regulatory framework to reverse this trend and create a stable environment for funding TSO's R&D projects.



### IMPLEMENTATION PLAN 2014-2016

In late 2012, ENTSO-E also released its R&D Implementation Plan 2014-2016. Since this covers short-term R&D activities, it serves as a background for developing calls for proposals within the European Energy Research and Innovation Programme. It also provides initial input for the EC, the European Electricity Grid Initiative (EEGI), technology providers and other stakeholders.

The plan covers the monitoring of R&D achievements, tracking Roadmap progress, resources and priorities for 2014-2016, including:

- the demonstration of new technologies to foster network flexibility and enhance observation and control;
- the development of the IEM through new tools and research on alternative market designs (including addressing the long-term perspective of the target market model in light of the rapidly growing share of RES);
- demand-side management at DSO level and ancillary services provided through DSOs.

### ENTSO-E R&D AND THE EEGI

In parallel to the ENTSO-E R&D Roadmap, the European Electricity Grid Initiative (EEGI) has also adopted a Roadmap which covers both transmission and distribution R&D. ENTSO-E actively contributes to this and ensures that the core TSO R&D cluster activities and functional objectives are defined in a consistent manner in both publications. The EEGI Roadmap complements ENTSO-E's R&D Roadmap through a detailed account of R&D at DSO level.

## COOPERATION ACROSS THE VALUE CHAIN

Stakeholder involvement across the industry's value chain is essential to develop the R&D Roadmap and Implementation Plan and to successfully implement TSO R&D projects. No single TSO is able to conquer the many challenges facing the industry. In order to succeed, TSOs must work together and collaborate with universities, research institutes, DSOs, generation companies, equipment manufacturers and consumers.

Close cooperation will enable European TSOs to achieve their R&D goals, as well as to maximise the impact of their results. Knowledge can be quickly disseminated and shared among stakeholders and other interested parties. In 2012 such multi-disciplinary cooperation was manifest through a number joint initiatives and events.

### 2012 R&D SEMINAR

InnoGrid2020+, a joint ENTSO-E, EDSO for Smart Grids, and GRID+ seminar on R&D dissemination, discussed the technology required to effectively

contribute to Europe's future energy system, as envisaged by EU targets for 2020 and beyond. The two-day event, held in February 2012, attracted more than 140 experts from nearly 100 companies, institutions and other organisations, representatives of EU Member States, and distinguished speakers and panellists.

The event focused on the major challenges for transmission and distribution grids resulting from increasing variable, decentralised generation and the integration of energy markets. New technologies, equipment and ICT tools must be



urgently developed to balance large amounts of wind and solar generation with demand in real time. Cost-effective, smart grid solutions also need to be deployed to empower customers through demand-response networks and to enable efficient charging systems for electric vehicles and other services.

The seminar concluded that more R&D collaboration, large-scale demonstrations under real working conditions and the greater involvement of consumers and regulators are required. In this context, the role of the EEGI is significant and 13 large transmission and distribution projects have contributed to its Roadmap (the TWENTIES, OPTIMATE, Umbrella, iTESLA, REALISEGRID, PEGASE, After, EcoGrid EU, Safewind, GRID4EU, Green eMotion, Inovgrid and ADDRESS initiatives).

With the success achieved in 2012, the Inno-Grid2020+ seminar is to become an annual R&D event for network operators.

### JOINT ENTSO-E AND EDSO FOR SMART GRIDS CONSULTATION

In June, ENTSO-E and EDSO for Smart Grids organised joint workshops and consultations with key stakeholders to define R&D priorities for the European networks of the future. Feedback from relevant stakeholders was used in drafting both the ENTSO-E and EEGI R&D Roadmaps.

As network operators, TSOs are aware of the central role the grids play in supporting energy transfer and are committed to developing a system to meet the needs of grid users. Strong stakeholder involvement in R&D and network innovation is highly welcomed.

Contributions and feedback has been received from a variety of energy-related businesses and organisations, including solar, wind, storage, manufacturing and ICT, in the effort to identify the most cost-efficient research programs to pave the way for a more efficient and sustainable energy infrastructure.

## E-HIGHWAYS2050 PROJECT

From a transmission system planning perspective, 2020 is almost upon us. TSOs and stakeholders have therefore started the “e-Highways2050” project to look beyond 2020 to the 2030, 2040 and 2050 time horizons. The project’s main goal is to develop top-down methodology to provide a modular and robust plan that includes the concept of electricity highways in the future pan-European transmission network.

The ENTSO-E TYNDP is one of the main inputs into the e-Highway2050 project, providing the current view of the European network up to 2020. The new e-Highways2050 methodology aims to ensure that Europe’s network development between 2020 and 2050 is in line with its energy policy pillars of sustainability, competitiveness and security of supply.

The e-Highways2050 project is essentially a study roadmap, which contains work packages within a modular development plan. Based on the roadmap, a consortium consisting of ENTSO-E and its member TSOs, and relevant associations, research institutes and universities from all over Europe is preparing the modular development plan.





The e-Highways2050 project's objectives are to:

- develop forward-looking, novel planning approaches to electricity highways;
- analyse and justify bulk power transmission needs;
- propose specific implementation, operation and governance principles for grid investments needed to link neighbouring areas throughout Europe;
- consider the whole energy supply chain in light of security, efficiency, feasibility and sustainability issues;
- follow a modular approach: 2030, 2040, 2050;
- propose general strategic e-Highways architectures, including technology options.

The consortium launched the project in September 2012 and in November the EC signed the grant agreement, officially confirming its support and financial contribution to the study. The consortium's first tasks include defining the boundary conditions for the study, grid architectures for 2050, technology assessment, operation and implementation, governance, and socio-economic analysis. The project also includes innovative enhanced planning methodology, as well as wide stakeholder consultation and dissemination of results.

## PROJECT PROGRESS AND DELIVERABLES

Since the kick-off of the project, the different work packages have made good progress. The report on its boundary conditions "Review of useful studies, policies and codes" was finalised for a stakeholder workshop on 23 January 2013. The consortium also finalised its communication master plan and launched the project website: [www.e-highway2050.eu](http://www.e-highway2050.eu).

ENTSO-E's Working Group 2050 Electricity Highways is actively monitoring project progress and screening its outputs, especially the first report on boundary conditions.

## FUTURE OUTLOOK

In order to be able to deliver the electricity highways system after the three-year study period, ENTSO-E has proposed setting up a master plan for system implementation to accelerate its design, planning and construction.

This master plan would build on the main inputs delivered by the e-Highways2050 project and further prioritise the required electricity corridors identified in the modular development plan and, over the medium-term horizon, in the TYNDP.

# STANDARDISATION

ENTSO-E has an active role in different standardisation activities supporting stable network operation and reliable processes in the smart grid environment. In addition to the common information model (CIM) for network modelling and market data exchange, these include the IEC's 61850 standard and related interoperability protocols, and the EC's M/490 smart grid standardisation mandate.

The report has already described ENTSO-E's efforts related to the network modelling database and market data exchanges on pages 34 and 41. The following section focuses on the IEC 61850 standard covering the design of electrical substation automation and the EC M/490 mandate to support European smart grid deployment.

## SUBSTATION AUTOMATION - IEC 61850

The IEC standard for the design of electrical substation automation is of large potential benefit to TSOs, as it addresses many crucial aspects of TSO communications with the promise of seamless interoperability of different vendors' subsystems within an overall TSO system management architecture. Multiple protocols currently exist in this area, including many proprietary ones with customised communication links that are not always compatible with each other.

IEC 61850 was created in 1995 to respond to these concerns. One of its aims was to develop a single protocol for modelling data. Today, however, nearly ten years after the publication of the first edition of the standard, the deployment of IEC 61850 multi-vendor solutions is still scarce compared to the application of single-vendor solutions. In April 2012, ENTSO-E published a statement calling for all IEC 61850 stakeholders to take appropriate action in order to ensure the success of the standard and ensure that it, and its related technologies, remain sustainable.

ENTSO-E also created an IEC 61850 taskforce to enhance cooperation with Working Group 10 of the IEC, in charge of the standard. Documents describing the interoperability scheme from ENTSO-E's perspective and proposing specific measures to support ENTSO-E's position were prepared for the Working Group. ENTSO-E will continue to actively work on the issue in 2013 by organising technical workshops fostering dialogue with stakeholders on the technical issues related to the standard.

## SMART GRIDS-M/490

In March 2011, the EC released its mandate M/490 to European standardisation organisations to support the deployment of smart grids in Europe. The mandate aims to create a set of consistent standards within a common European framework that will facilitate the implementation of different high-level smart grid services and functionalities in Europe.

Smart grids play an essential role in transforming the functionality of the present electricity supply system so it can provide a user-oriented service that supports the achievement of EU 20/20/20 targets and guarantee the security, quality and economic efficiency of the electricity supply in an open market environment.

Today, the development of smart grids is one the major drivers of standardisation, as it is innovation-intensive and requires systems across the supply-chain to remain compatible. As a member of the EC Task Force on Smart Grids and CEN/CENELEC/ETSI structures, ENTSO-E is providing input to standardisation activities related to the mandate.

ENTSO-E has established a Standardisation Working Group under its Research & Development Committee to facilitate this. In 2013 the working group will develop a process and appropriate structure to streamline ENTSO-E's input into the various smart grid standardisation activities of interest to TSOs.



# CONCLUSION

**G. STEELE**

Chairman of the  
ENTSO-E Board

# CONTINUITY IN 2013

The Review of Activities has described many of the challenges facing ENTSO-E and its member TSOs in meeting EU energy policy goals, highlighting some of the particular aspects related to meeting the EU's climate change and carbon reduction objectives. Much of this work will continue in 2013.

ENTSO-E's 2011 annual report underlined the importance of the Third Package coming into force in helping TSOs achieve the EU's three main energy policy goals. Since then, ENTSO-E has made significant progress on a broad range of initiatives.

ENTSO-E's first formal TYNDP, released in July 2012, contains important improvements compared to the pilot published in 2010, and five of the nine network codes ENTSO-E worked on in 2012 have now been submitted to ACER for its formal opinion. These are only two examples of the full scope of ENTSO-E projects during 2012, but clearly highlight the progress it has made in its annual work programme.

## IMPLEMENTING INFRASTRUCTURE PRIORITIES

The TYNDP 2012 demonstrates that approvals for one third of the projects planned in 2010 to meet the objectives of the Third Package are already delayed and that there are big obstacles to putting in place the necessary infrastructure fast enough.

Specific reasons for the delays are complex but they boil down to a lack of public acceptance for new power lines and lengthy permitting procedures. In addition, to attract the necessary investment for cross-border projects, financial incentives are required that fully reflect any higher risks involved. In this perspective, the EC's proposal for an Energy Infrastructure Regulation and the conclusion of the draft's negotiation in late 2012 were important steps forward and were welcomed by TSOs.

Looking to 2013, legislators, regulators and TSOs now need to focus on implementing the Regulation. Its provisions on PCIs, cost-benefit analyses and the creation of single competent authorities for PCI implementation are most relevant to TSOs. To meet the increasing expectations, the TYNDP and its methodology need to evolve. The 2014 plan will include a 2030 perspective based on Europe-wide visions covering a range of possible outcomes, while matching the EU 20/20/20 targets.

## FUTURE PLANNING

Preparation for the TYNDP 2014 started during 2012 and its market and network modelling will continue intensively throughout 2013. ENTSO-E's four 2030 visions will be translated to planning scenarios for stakeholder consultation. In addition, a new database will be used as the basis for more efficient handling of the market and network data underlying the scenarios. A stakeholder group to support the TYNDP process has been put in place and the group has already met twice. Information sessions at regional level will complement the Europe-wide communications.

The Energy Infrastructure Regulation is expected to have a major impact on future TYNDPs. ENTSO-E has been asked to deliver a cost-benefit analysis methodology to support identification of suitable PCIs. This methodology is being built on the current multi-criteria approach in the TYNDP and will be incorporated fully in the TYNDP 2016. It confirms the role of the TYNDP as the reference tool to drive policy and investment decisions in electricity infrastructure.

## OUTLOOK FOR THE NETWORK CODES

2012 has also been a pivotal year for ENTSO-E with regards to its efforts to improve stakeholder engagement in its key deliverables and to better explain the TYNDP and the network codes.

The network codes developed by ENTSO-E will become legally binding following the Comitology process and will apply to all participants in the electricity market in Europe. ENTSO-E will therefore continue to devote considerable effort in 2013 to seek out and listen to the views of stakeholders. This will take place in workshops, stakeholder groups, presentations, bilateral meetings and web-based public consultations on each individual code, and by making available significant information on each code, and the package as a whole, early in each process.





ENTSO-E will publish detailed timetables for consultations on its website in order to facilitate stakeholder preparation and participation. The ENTSO-E website itself has already seen some improvements and we will continue to reorganise its content, further complete the information we provide, and enhance its user-friendliness.

During 2013 ENTSO-E will continue working on the network codes for balancing and forward markets, HVDC connections, operational security, operational planning and scheduling, and load-frequency control and reserves. Related work will be undertaken on transparency and governance, which have major interactions with the network codes. Significant efforts will be made at regional level to continue to develop market integration projects. 2013 will also see the first network codes moving to become EU law, with ENTSO-E assisting the Comitology process.

#### **MONITORING CODE IMPLEMENTATION**

With the first network codes becoming legally binding, ENTSO-E's mandate under Regulation 714/2009 to monitor network code implementation also becomes relevant.

ENTSO-E has been preparing for this task during 2012 through an Implementation and Compliance Monitoring Expert Group. It is planning for an IT-based implementation monitoring tool to be operational by autumn 2013. The implementation monitoring system and processes should be fully operative by the end of 2013.

It is now well understood by decision-makers and stakeholders that the majority of ENTSO-E's activities either implement or relate to legal mandates under the Third Package. In addition, policy-makers, stakeholders and the general public are increasingly realising that the key objectives of European energy policy depend on a stronger transmission network.

The focus of ENTSO-E's work in 2013, therefore, will be on delivering the key network codes and encouraging the regional initiatives that are essential for the completion of the IEM, on planning Europe's future energy networks and improving the conditions to build new infrastructure on time, and on pursuing R&D initiatives to create stronger and smarter grids.

#### **A DYNAMIC ENVIRONMENT**

The past year has shown that the environment in which ENTSO-E and its member TSOs operate is highly dynamic, creating new challenges and opportunities to which TSOs need to respond quickly and efficiently. The Energy Infrastructure Regulation provides a good example in 2012, but it is certain that the political environment at both national and European level will keep changing rapidly in the run up to 2020.

The EC's Communication on the role of renewables in the Internal Energy Market in mid-2012, as well as its Communication on the state of the IEM, demonstrate that ENTSO-E and its members need to continue to react to this dynamic environment.

The remaining pages of the report show the status of ENTSO-E activities against its 2012 Annual Work Programme, in line with the requirements of Regulation (EC) 714/2009. They also set out our communication with stakeholders and provide an overview of ENTSO-E members, structure and organisation.



# APPENDICES

ENTSO-E WORK  
PROGRAM STATUS

REPORTS, PUBLICATIONS  
& POSITION PAPERS

WORKSHOPS  
& CONSULTATIONS

ANNOUNCEMENTS  
& PUBLIC RELEASES

MEMBER TSOS

ORGANISATION  
& GOVERNANCE

SECRETARIAT  
& MANAGEMENT

SYNCHRONOUS AREAS  
& GRID MAPS

ABBREVIATIONS

# ENTSO-E WORK PROGRAM STATUS - END 2012

Activity	Goal	Deliverable & AWP 2012 completion (quarter/year)	Internal & external consultation (quarter/year)
<b>Network code preparatory work - System Development</b>			
Requirements for Generators (RfG)	Delivery of the final draft RfG network code.	Final draft RfG code: Q2/2012.	Consultation with user group and stakeholders throughout 2012. Public web-based consultation between January and March 2012.
Demand Connection (DCC)	Scoping, preparation and delivery of the DCC network code.	Final draft DCC code: Q4/2012.	Consultation with user group and stakeholders throughout 2012. Public consultation between June and September 2012.
<b>Network code preparatory work - Market</b>			
Capacity Allocation & Congestion Management (CACM)	Preparation of the CACM network code (rules for allocating capacity in the day-ahead and intraday timeframes, calculating levels of available cross-border capacity, and allocating and recovering costs).	Final draft CACM code: Q3/2012.	Consultation with a stakeholder advisory group and interested parties throughout 2012. Public consultation between March and May 2012.
Forward Capacity Allocation (FCA)	Preparation of the FCA network code.	Final draft FCA code: Q3/2013.	ENTSO-E stakeholder advisory group met twice in 2012. Public consultation scheduled for Q1/2013.
Electricity Balancing (EB)	Development of the EB network code (rules for cross-border exchange of reserves and balancing energy consistent with operational standards).	Final draft EB code: Q4/2013.	ENTSO-E stakeholder advisory group met twice in 2012. Public consultation expected in early Q2/2013.
<b>Network code preparatory work - System Operation</b>			
Operational Security (OS)	Delivery of the final draft OS network code.	Final draft OS code: Q4/2012	Workshops with DSOs and stakeholders throughout the drafting period. Public consultation between 03/10/2012 and 03/11/2012.
Operational Planning & Scheduling (OPS)	Delivery of the final draft OPS network code.	Final draft OPS code: Q1/2013	Workshops with a DSO technical expert group and stakeholders throughout the development of the code. Public consultation from 7/11/2012 to 7/01/2013.
Load Frequency Control & Reserves (LFCR)	Delivery of the final draft LRCR network code.	Final draft LRCR code: Q2/2013	Workshops with a DSO technical expert group and stakeholders throughout the development of the code. Public consultation planned for Q1 2013.
<b>Ten-Year Network Development Plan</b>			
Ten-Year Network Development Plan (TYNDP) 2012	Development of the TYNDP 2012 (determination of the trends, needs and future development of the transmission network at pan-European level based on common market and network models).	Draft TYNDP 2012: Q1/2012	Public consultations on the draft TYNDP 2012: Q2/2012
	Publication of the TYNDP 2012.	Final TYNDP 2012: Q2/2012.	
Scenario Outlook & Adequacy Forecast (SOAF)	Delivery of the SOAF 2012 report.	SOAF 2012: Q1/2012	N/A
	Preparation of the SOAF 2013 report.	SOAF 2013: Q1/2013	N/A

## Status - end 2012

### Comments/explanations

The network code was submitted to ACER on 26/06/2012 and its opinion on the code received by ENTSO-E on 13/10/2012. ENTSO-E has worked with interested parties and user group members to explore and address the issues highlighted in the ACER opinion. The amended RfG code was submitted to ACER on 07/03/2013.

The final version of the code was submitted to ACER on 04/01/2013. ACER has been considering the code against the requirements of the framework guideline.

ENTSO-E submitted the code to ACER on 27/09/2012 and received its reasoned opinion on 19/12/2012. Having considered the opinion, ENTSO-E concluded that resubmitting the code would cause an avoidable delay to the 2014 target date for creating the internal market. ENTSO-E then worked with ACER to identify and formulate improvements so that ACER could describe these to the EC in its recommendation to adopt the code dated 14/03/2013.

In line with the EC letter received on 21/09/2012, ENTSO-E initiated the drafting process for the code. A stakeholder advisory group has been established with a first meeting on 01/10/2012, and a draft code was presented at the second group meeting on 26/11/2012. The group will continue to meet throughout 2013. Public web-based consultation is scheduled for 01/04/2013 for a duration of two months. During this period, public workshop(s) are foreseen.

The EC invitation to start drafting the code was received on 21/12/2012. A stakeholder advisory group has been established and two group meetings held prior to the official start of drafting. The second group meeting on 10/12/2012 reviewed the first parts of the code in draft form for initial comments. ENTSO-E circulated the first complete draft code to stakeholders before the third meeting on 26/02/13. The public consultation is expected to start in late May or early June 2013 for a period of two months.

The EC invitation to start drafting the code was received on 24/02/2012 and requested delivery to ACER by 01/03/2013. During the web-based consultation period, circa 1220 comments were received. These were reflected in an updated version of the code made available ahead of a workshop on 20/12/2012. The code was delivered to ACER 28/02/2013.

The EC invitation to start drafting the code was received on 24/02/2012 and requested delivery to ACER by 01/04/2013. Circa 850 comments were received during the two month long web based public consultation. The drafting team assessed stakeholders' comments in time to publish an updated version of the code for a workshop with stakeholders on 14/02/2013. Submission to ACER is foreseen for 29/03/2013.

The EC invitation to start drafting the code was received on 24/02/2012 and requested delivery to ACER by 01/07/2013. The web-based public consultation started on 01/02/2013 for a duration of two months. In addition to a DSO Technical Expert Group web-meeting, which was organised on 13/02/13, one further public workshop was held on 12/03/2013.

During 2011, ENTSO-E organised 10 workshops at European and regional level in the development of the TYNDP 2012 and held a consultation on the 2020 scenarios in January 2011. The TYNDP 2012 Package, comprising 6 Regional investment Plans, a pan-European synthesis report and the Scenario Outlook & Adequacy Forecast 2012, was subject to web-based public consultation between 01/03/2012 and 26/04/2012.

The final TYNDP 2102 Package was released on 05/07/2012; ACER provided its opinion on 23/01/2013.

After consultation, the SOAF 2012 was released on 05/07/2013 as part of the TYNDP 2012 package.

The SOAF 2013 is on track for publication at the end of Q1/2013.



# ENTSO-E WORK PROGRAM STATUS - END 2012

Activity	Goal	Deliverable & AWP 2012 completion (quarter/year)	Internal & external consultation (quarter/year)
TYNDP 2014	Delivery of the SOAF 2013-2027.		Consultation on TYNDP 2014 scenarios: Q4/2012
<b>Research &amp; Development Plan</b>			
ENTSO-E R&D Plan	Coordination of TSO research activities.	2nd edition of the ENTSO-E R&D Plan: Q4/2012  Support for the EC during EIP Calls for Proposals: 2012	Public consultations on the R&D Plan: Q4/2012
Implementation of the ENTSO-E R&D Plan	ENTSO-E monitoring and management of the implementation of the R&D Plan.	Communication of R&D Plan progress in the technical stakeholder community: 2011-2012	N/A
<b>Modular Development Plan on Pan-European Electricity Highways System</b>			
Modular Development Plan on Pan-European Electricity Highways System (ModPEHS)	Preparation of a 3-year in-depth study project on a pan-European highways system.	Study project completion: end 2014.	
<b>Further key areas of TSO cooperation/1</b>			
ENTSO-E Awareness System (EAS)	Effective implementation of a pan-European Awareness System for instantaneous exchange of operational information among TSOs.	Full implementation of the EAS: Q1/2012  Analysis/survey of TSO experience with the EAS: Q3/2012  Plan for possible further EAS functionalities: Q4/2012	N/A
Operational communication standards for TSOs	Transfer of Operation Handbook Policy 6 into ENTSO-E wide standards for operational communication among TSOs.	Transfer into ENTSO-E standards: 2012	N/A
Critical system protection	Preparation of an ENTSO-E position paper on High Impact Low Frequency (HILF) events.	Issuing a "HILF events" position paper: Q2/2012	N/A
Investigation on system frequency deviation with EURELECTRIC	Follow-up on the findings of the investigation on frequency deviation	Follow-up on investigation findings: Q1/2012	N/A
Synchronous operation with Turkey	Evaluation of the trial synchronous operation of the Turkish transmission grid with the Continental Europe system.	Evaluation of the trial operation: Q2/2012	N/A

## Status - end 2012

### Comments/explanations

ENTSO-E established a Long Term Network Development Stakeholder Group in Q4/2012 to comment on all issues related to long term network development (TYNDP, SOAF etc.). The group, comprising customer representatives, NGOs, trade associations etc., met once in 2012 and once in January 2013. It will continue to meet throughout 2013. It combines projects in several areas of system development and provides an open forum for discussion on the long term evolution of the network.

All activities have been performed within the set target deadlines with a dissemination seminar, InnoGrid2020+, held in February 2012. ENTSO-E has restructured the R&D Plan into a R&D Roadmap with a validity of five years. The first R&D Roadmap and Implementation Plan were released on 17/12/2012. Public consultation on the R&D Roadmap was organised during September-October 2012.

ENTSO-E has contributed to the descriptions of the FP7 calls announced in July 2012. EC support was provided through the EEGI or directly by ENTSO-E.

The R&D Plan monitoring report was published on 07/06/2012 and the new Implementation plan 2014-2016 published on 17/12/2012.

The MoDPHES consortium kicked off the project on 01/09/2012 and in November the EC signed the grant agreement project, officially confirming its support and financial contribution to the study. The consortium's first tasks include defining project boundary conditions for the study, grid architectures for 2050, technology assessment, operation and implementation, governance and socio-economic analyses. The project also includes an innovative enhanced planning methodology, wide stakeholder consultation and dissemination of the results.

Some technical delays occurred due to differing IT systems and platforms across TSOs. Nevertheless, the development of the EAS, its installation in hosting entities (Amprion and RTE) and the deployment to six pilot TSOs had been successfully achieved by the end of October 2012. Contracts between ENTSO-E and TSOs and ENTSO-E and hosting entities have been finalised. The deployment of the system to all TSOs has started and should be finalised in 2013.

A coordinated system analysis was completed in Q1/2012.

In addition to the pilot TSOs, six further TSOs have joined the EAS in Q4/2012.

The transfer started at the end of 2012. The work is to be finalised in the first half of 2013

The report for internal use was approved in November 2012 and the paper was finalised on target in Q2/2012.

The joint ENTSO-E/EURELECTRIC working group has finished the follow-up study and prepared recommendations to reduce deterministic frequency deviations. Letter from Eurelectric supports the results and asks for cost-benefit analysis of the proposed measures. ENTSO-E report approval is foreseen in early 2013.

ENTSO-E Regional Group Continental Europe has evaluated regular status reports from the Turkey Project Group TEIAS, assessed progress and made further recommendations. The trial synchronous operation has now been extended until September 2013.

# ENTSO-E WORK PROGRAM STATUS - END 2012

Activity	Goal	Deliverable & AWP 2012 completion (quarter/year)	Internal & external consultation (quarter/year)
<b>Further key areas of TSO cooperation/2</b>			
ENTSO-E Academy	Deployment of the activities of the ENTSO-E Academy. Offering services and undertaking Academy activities based on exchange of experience (focusing on voltage stability at the end of 2012).	Continuation throughout 2012	N/A
System development issues	Methods to increase the social acceptance of transmission infrastructure.	Continuation in 2012 on the basis of the Energy Infrastructure Package/ Regulations	N/A
Transparency	Implementation of EC Guidelines on fundamental data transparency.	Finishing the Comitology procedure on the Guidelines: 2012  Implementation: adapting and developing ENTSO-E transparency platform entsoe.net according to the requirements of the Guidelines: 2012	Public consultation on the manual of procedures: c. Q2/2013 (after publication of the Regulation)
<b>Further key areas of TSO cooperation/3</b>			
ENTSO-E support for regional market development	To ensure that regional developments continue and develop in a manner consistent with the overall EU Target Model and establish a coherent vision for market integration.	Continued support: throughout 2012	N/A
Shaping discussions around the optimal design for the European electricity market	Proactive consideration of issues related to market design and the creation and promotion of an effectively and competitive market. This will include issues such as remunerating capacity.	Consideration of the issues: throughout 2012.	N/A
TSO economic and regulatory frameworks	Ongoing monitoring and influencing the conclusions and consequences of the Energy Infrastructure Package.	Shaping and responding to EC Guidelines on investment incentive schemes and on cross-border trade: 2012  Potential development of a guideline on investment incentive schemes and on cross-border trade: 2012	N/A



## Status - end 2012

### Comments/explanations

The terms of reference of the ENTSO-E Academy were approved in April 2012 and the Academy concept and strategy finalized and adopted on target. A corresponding implementation plan was also finalized with the first training events for TSO staff:

- Sep/12: Workshop on Renewable Energy Integration
- Oct/12: Workshop on System Protection & Dynamics
- Nov/12: Workshop on Blackout Restoration
- Dec/12: EAS common training (1st edition)

The EAS training has been developed in conjunction with the EAS project group to coincide with the anticipated system delivery in December. The first training sessions were held on 13/12/2012 with further sessions organised in Q1/2013.

Following ENTSO-E Board assessment of its role in acceptance of transmission infrastructure, ENTSO-E has held regular exchanges with the EC on the scope of an awareness campaign and proposed the development of a campaign strategy. On 24/07/2012, ENTSO-E held a workshop with stakeholders to discuss this proposal. The workshop was supported by member TSOs and other stakeholders to provide input on the style and key features of a campaign. 15 TSOs expressed interest in elaborating a campaign strategy. A draft of terms of reference for the Campaign is now awaiting EC approval. The campaign development kick-off is expected to be in Q1/2013, with implementation possibly starting in late Summer 2013.

The draft Transparency Regulation was approved by Member States at the electricity cross-border committee meeting on 17/12/2012 and the Regulation was presented to the European Parliament on 18/01/2013. The length of the Comitology process is still to be confirmed but the Regulation will most likely enter into force in mid 2013. The draft Regulation gives ENTSO-E four months after its entry into force to make proposals to ACER on the operation of the transparency platform and the manual of procedures.

The ENTSO-E platform is currently being developed with the IT vendor contract confirmed. Engagement with stakeholders has begun, with an expert group holding a kick-off meeting and public workshop with 75 stakeholders on 31/01/2013. Public consultation on the manual of procedures will be held after publication of the final Regulation.

Partial achievement of the design and implementation of an interim implicit continuous intraday solution in close consultation with non-NWE TSOs and other stakeholders. Design of the common market model/shared order book (CMM/SOB) has been successfully achieved and coordinated with non-NWE TSOs and other stakeholders. TSOs' requirements were validated by ENTSO-E in October 2012 and the tender to select a service provider was launched in Q4/2012. The design of pre- and post-trading was also completed before the end of the year. Implementation of the implicit solution has not yet been achieved as it relies on the smooth functioning of the tender. A lack of agreement among power exchanges (PXs) has created a significant delay in TSO activities.

Work on the inclusion of losses on DC cables in the market coupling algorithm and on firmness (in relation to all time frames, with a view to the network codes) has been accomplished. An educational paper on FTRs has been released.

Accomplished. Input to the drafting of the Energy infrastructure Regulation was provided on a continuous basis on a wide range of topics, including the CBA.

Discussions are still ongoing with EC/ACER on incentives for investment, introducing the concept of "priority premiums". Discussions are to continue in 2013.

# ENTSO-E REPORTS & PUBLICATIONS 2012

December	ENTSO-E Research & Development Roadmap 2013-2022 and Implementation Plan 2014-2016 ENTSO-E Annual Work Programme 2012-2013
November	Winter Outlook Report 2012-2013/Summer Review 2012 Statistical Yearbook 2011
October	Survey on Ancillary Services Procurement and Electricity Balancing Market Design Test report on the 1st ENTSO-E CIM for Market interoperability test Interoperability Scheme and Punch List on the IEC61850 standard
September	Test report on ENTSO-E's 3rd large-scale CIM interoperability test
July	System Adequacy Retrospect 2011 ENTSO-E overview of transmission tariffs in Europe 2012 ENTSO-E Ten-Year Network Development Plan 2012 Package
June	ENTSO-E views on the European Commission's Energy Roadmap 2050 ENTSO-E Memo 2011 Summer Outlook Report 2012/Winter Review 2011-2012 Assessment Report of the system security with respect to disconnection rules for photovoltaic panels
April	ENTSO-E Incidents Classification Scale
March	ENTSO-E annual report 2011 "Completing the Internal Electricity Market by 2014: The Challenges for Europe's Transmission System"
February	Report on "Deterministic Frequency Deviations – Root Causes and Proposals for Potential Solutions" ENTSO-E Articles of Association and Rules of Procedure

# ENTSO-E POSITION PAPERS 2012

December 21	ENTSO-E Expresses its concerns related to the Draft EC Regulation Implementing Directive 2009/125/EC in regard to small, medium and large power transformers
December 6	ENTSO-E responds to ACER's opinion on Summer Outlook 2012
November 15	ENTSO-E says the Commission's Internal Energy Market (IEM) Communication gives much needed direction towards realising the IEM's full potential
November 14	ENTSO-E responds to ACER's opinion on TYNDP 2012
November 2	ENTSO-E responds to ACER's public consultation on forward risk hedging products and harmonisation of long term capacity allocation
October 22	Survey on Ancillary Services Procurement and Electricity Balancing Market Design
October 10	ENTSO-E Position on the draft Regulation on guidelines for trans-European energy infrastructure
September 25	ENTSO-E Position on Draft Regulation on Guidelines for the Implementation of European Energy Infrastructure Priorities of October 2011
June 22	ENTSO-E response to ACER public consultation on the draft Framework Guidelines on Electricity Balancing
June 21	Views on Energy Roadmap 2050
April 16	Public exposure to extremely low frequency (ELF) electric and magnetic fields (EMF)
April 13	ENTSO-E statement on the IEC61850 standard
March 13	Interconnected System Operation Conditions in Continental Central Europe - A Briefing Paper to the European Commission
March 1	How a mid-term target model for balancing energy can deliver efficiency benefits and stimulate future integration?
March 1	Cross-border Capacity Allocation for the Exchange of Ancillary Services
March 1	Key messages on cross-border balancing
March 1	ENTSO-E Position on Draft Regulation on Guidelines for the Implementation of European Energy Infrastructure Priorities and Connecting Europe Facility of October 2011
February 24	ENTSO-E response to EC consultation on Governance of Day-Ahead Market Coupling
February 7	ENTSO-E response to EC public consultation on Renewable Energy Strategy
January 18	ENTSO-E response to the CEER Public Consultation Document on Implications of Non-harmonised Renewable Support Schemes



# ENTSO-E WORKSHOPS 2012

December 20	Fourth stakeholder workshop on Operational Security Network Code
November 22	Second vision workshop on Visions for the Ten-Year Development Plan 2014
November 21	Third public stakeholder workshop on the Operational Planning & Scheduling Network Code
November 20	Stakeholder workshop on Inclusions of Third Party Projects in the Ten-Year Development Plan 2014.
November 19	ENTSO-E Cost and Benefit Analysis methodology workshop on Assessing the Future Projects of European Interest
September 25	Stakeholder workshop on Load Frequency Control & Reserves Network Code
August 9	Public stakeholder workshop on Demand Connection Code
July 25	Second stakeholder workshop on Operational Planning & Scheduling Network Code
July 12	Stakeholder workshop on Load Frequency Control & Reserves Network Code
July 3	Stakeholder workshop on Capacity Allocation and Congestion Management Network Code
July 2	Stakeholder workshop on Operational Security Network Code
June 21	Umbrella and iTesla workshop on “Innovative tools needed for the future and stable system operation”
May 23	First stakeholder workshop on Operational Planning & Scheduling Network Code
May 7	Consultation workshop on Capacity Allocation and Congestion Management Network Code
April 20	Stakeholder workshop on Operational Security Network Code
April 18	Public workshop on Demand Connection Code
April 17	ENTSO-E 2030 Visions workshop
March 28	Public consultation workshop on ENTSO-E’s Ten-Year Development Plan 2012 Package
March 19	Stakeholder workshop on System Operation
February 23-24	European Research and Development Seminar
February 15	Consultation workshop on the draft of the “Requirements for Generators” Network Code

# ENTSO-E CONSULTATIONS 2012

November 7 2012 - January 7 2013	Operational Planning & Scheduling Network Code
September 17 - October 15	Research & Development Roadmap 2013-2022
September 3 - November 3	Operational Security Network Code
July 6 - September 3	Annual Work Programme
June 27 - September 12	Demand Connection Code
March 23 - May 23	Capacity Allocation and Congestion Management Network Code
March 1 - 26 April	TYNDP 2012 Package - TYNDP 2012 report
March 1 - 26 April	TYNDP 2012 Package - RegIP Baltic Sea
March 1 - 26 April	TYNDP 2012 Package - RegIP Continental South East
March 1 - 26 April	TYNDP 2012 Package - RegIP Continental Central East
March 1 - 26 April	TYNDP 2012 Package - RegIP Continental South West
March 1 - 26 April	TYNDP 2012 Package - RegIP Continental Central South
March 1 - 26 April	TYNDP 2012 Package - RegIP Continental North Sea
March 1 - 26 April	TYNDP 2012 Package - Scenario Outlook & Adequacy Forecast
January 24 - March 20	Requirements for Generators Network Code

# ENTSO-E ANNOUNCEMENTS & PUBLIC RELEASES 2012

December 21	ENTSO-E expresses its concerns related to the draft EC Regulation Implementing Directive 2009/125/EC in regard to small, medium and large power transformers
December 19	Second ENTSO-E CIM for market interoperability test
December 17	ENTSO-E Research & Development Roadmap 2013-2022 and Implementation Plan 2014-2016
December 14	ENTSO-E publishes the draft of the Operational Security Network Code after public consultation
December 13	Second edition of the ENTSO-E CIM Profile; registration for the interoperability test "CIM for System Development and Operations" 2013
December 07	ENTSO-E publishes the Annual Work Programme 2012-2013
December 06	ENTSO-E responds to ACER's opinion on Summer Outlook 2012
December 05	Finalisation of the Demand Connection Code and information session on 12 December 2012
December 05	The e-Highway2050 project receives approval from the European Commission
December 04	Call for nominations to the ad-hoc expert group on the manual of procedures for the new ENTSO-E Central Information Transparency Platform
December 03	TYNDP2014 – 2030 Visions – Request for stakeholder input
November 30	ENTSO-E publishes its Winter Outlook Report 2012-2013
November 29	Information session on the final Demand Connection Code on 12 December in Brussels
November 22	Registration open for 4th Operational Security Network Code public stakeholder workshop
November 20	ENTSO-E releases its Statistical Yearbook 2011
November 15	ENTSO-E says the Commission's Internal Energy Market (IEM) Communication gives much needed direction towards realising the IEM's full potential
November 14	ENTSO-E responds to ACER's opinion on TYNDP 2012
November 13	Next steps in the development of the Network Code on "Requirements for Generators" announced by ENTSO-E
November 07	ENTSO-E launches a web-based public consultation on the Operational Planning and Scheduling Network Code
November 06	Last days to register for TYNDP workshops in Brussels
November 02	ENTSO-E responds to ACER's public consultation on forward risk hedging products and harmonisation of long term capacity allocation
October 22	ENTSO-E publishes its 2012 Survey on Ancillary Services Procurement and Electricity Balancing Market Design
October 19	ENTSO-E receives ACER's opinion Network Code on "Requirements for Generators"
October 19	Test report on the 1st ENTSO-E CIM for Market interoperability test is now available, registration opened for the 2nd test
October 18	ENTSO-E releases its Interoperability Scheme and Punch List on the IEC61850 standard
October 17	Second ENTSO-E 2030 Vision workshop on Visions for the Ten Year Network Development Plan 2014
October 16	ENTSO-E stakeholder workshop on Inclusion of 3rd Party Projects in the TYNDP 2014 Procedure
October 15	ENTSO-E CBA methodology workshop on Assessing the Future Projects of European Interest
October 11	Reminder: ENTSO-E R&D Roadmap Public Consultation ends on 15 October 2012
October 10	ENTSO-E position on the draft Regulation on guidelines for trans-European energy infrastructure
September 27	ENTSO-E submits Capacity Allocation & Congestion Management Network Code to ACER
September 21	ENTSO-E receives official request to start drafting a Network Code on Forward Capacity Allocation
September 17	ENTSO-E R&D Roadmap public consultation launched
September 14	ENTSO-E welcomes feedback received in the consultation of the draft Demand Connection Code
September 14	ENTSO-E releases draft Load Frequency Control & Reserves Network Code
September 12	Third phase of the trial parallel operation of TEIAS prolonged until autumn 2013
September 10	ENTSO-E stakeholder workshop on Load Frequency Control & Reserves Network Code on 25 September 2012



September 06	Test report on ENTSO-E's 3rd large-scale CIM interoperability test is now available
September 03	ENTSO-E announces public consultation on the Operational Security Network code
August 30	Reminder ENTSO-E public consultation on the ENTSO-E Work Programme 2012-2013
July 26	ENTSO-E publishes the System Adequacy Retrospect 2011
July 20	ENTSO-E invites expressions of interest to participate in Forward Markets and Balancing Network Code advisory groups
July 19	ENTSO-E publishes its overview of transmission tariffs in Europe 2012
July 18	ENTSO-E releases draft Operational Planning and Scheduling Network Code
July 17	ENTSO-E large-scale CIM interoperability tests
July 13	Network Code on "Requirements for Generators" submitted to ACER
July 11	ENTSO-E opens registration for Demand Connection Code workshop on 9 August
July 06	ENTSO-E opens public consultation on the ENTSO-E Work Programme 2012-2013
July 05	ENTSO-E releases the Ten-Year Network Development Plan 2012
July 04	ENTSO-E releases draft Load-Frequency Control and Reserves Network Code
July 04	ENTSO-E response to ACER public consultation on the draft Framework Guidelines on Electricity Balancing
July 03	Network Code on "Requirements for Generators" to be submitted to ACER on 14 July
June 27	ENTSO-E launches public consultation on the Demand Connection Code
June 26	Second ENTSO-E stakeholder workshop on Operational Planning & Scheduling Network Code on 25 July
June 26	ENTSO-E stakeholder workshop on Load Frequency Control & Reserves Network Code to take place on 12 July
June 26	ENTSO-E releases Operational Security Network Code update
June 21	ENTSO-E publishes its views on the European Commission's Energy Roadmap 2050
June 18	ENTSO-E Memo 2011 published and available for order
June 18	e-Highway2050 Project selected for co-financing by the European Commission
June 15	EDSO for Smart Grids and ENTSO-E define with stakeholders R&D priorities for the European networks
June 15	Finalisation of Network Code on "Requirements for Generators"
June 11	ENTSO-E publishes "Summer Outlook and Winter Review"
June 06	Assessment report of the system security with respect to disconnection rules for photovoltaic panels published
June 01	ENTSO-E publishes minutes from the first stakeholder workshop on OS NC and announces second workshop
May 24	ENTSO-E welcomes the extensive & constructive responses to the consultation on the CACM Network Code
May 15	"Innovative tools needed for the future and stable system operation"
May 11	Stakeholder feedback on Demand Connection Code published
May 07	ENTSO-E stakeholder workshop on Operational Planning and Scheduling Network Code
April 25	ENTSO-E briefing paper to European Commission regarding risks to interconnected system operations in Central Europe
April 16	ENTSO-E publishes its position paper on public exposure to extremely low frequency (ELF) electric and magnetic fields (EMF)
April 13	ENTSO-E statement on the IEC61850 standard
April 12	ENTSO-E releases first draft Network Code for Operational Security and schedules stakeholder workshop
April 05	Call for stakeholder input in the development of the Demand Connection Code
April 03	ENTSO-E publishes its Incidents Classification Scale
April 02	ENTSO-E's initial review of the Winter Cold Spell 2012

# ENTSO-E ANNOUNCEMENTS & PUBLIC RELEASES 2012

March 30	ENTSO-E 2030 Visions workshop
March 26	ENTSO-E releases its Annual Report 2011 “Completing the Internal Electricity Market by 2014: The Challenges for Europe’s Transmission System”
March 23	ENTSO-E launches public consultation on the Capacity Allocation and Congestion Management Network Code
March 22	ENTSO-E 2030 Visions workshop
March 22	ENTSO-E announces Operational Security Network Code development plan and stakeholder workshop
March 21	ENTSO-E welcomes the extensive response to the web-based consultation on the Network Code on “Requirements for Generators”
March 14	ENTSO-E announces Demand Connection Code 2012 work programme and publishes user group invitation
March 06	Demand Connection Code public workshop on 18 April 2012
March 06	ENTSO-E welcomes steps to stimulate the development of pan-European network investment
March 01	ENTSO-E releases Ten-Year Network Development 2012 package for public consultation.
February 29	Stakeholder Advisory: tomorrow, 1 March, ENTSO-E launches a public consultation on its ten-year network development plan 2012 package
February 28	European grid operators getting ready for the new power system challenges
February 24	ENTSO-E publishes Articles of Association and Rules of Procedure
February 23	The report on “Deterministic Frequency Deviations – Root Causes and Proposals for Potential Solutions”
February 22	ENTSO-E holds stakeholder workshop on System Operation on 19 March
February 22	Demand Connection Code Preliminary Scope
February 22	Media Advisory: TYNDP 2012 press briefing on 29 February, prior to ENTSO-E’s release of TYNDP 2012 package
February 22	InnoGrid2020+: The European Research and Development Dissemination Seminar
February 20	ENTSO-E preparing to release TYNDP 2012 Package for public consultation on 1 March, and to hold a TYNDP workshop on 28 March
February 10	Update on the effects of the current cold weather on the European electricity system with reference to the ENTSO-E Winter Outlook of December 2011; information as of 8-9 February 2012
February 08	InnoGrid2020+: The European Research and Development Dissemination Seminar: reminder Registration open until 15 February
January 31	Updated ENTSO-E grid map 2011 now available
January 30	ENTSO-E publishes Network Code on “Requirement for Generators” stakeholder meeting minutes and open invitation to stakeholder user group
January 24	ENTSO-E launches public consultation on the Network Code on “Requirements for Generators”
January 17	Technical issue with ENTSO-E’s Transparency Platform entsoe.net

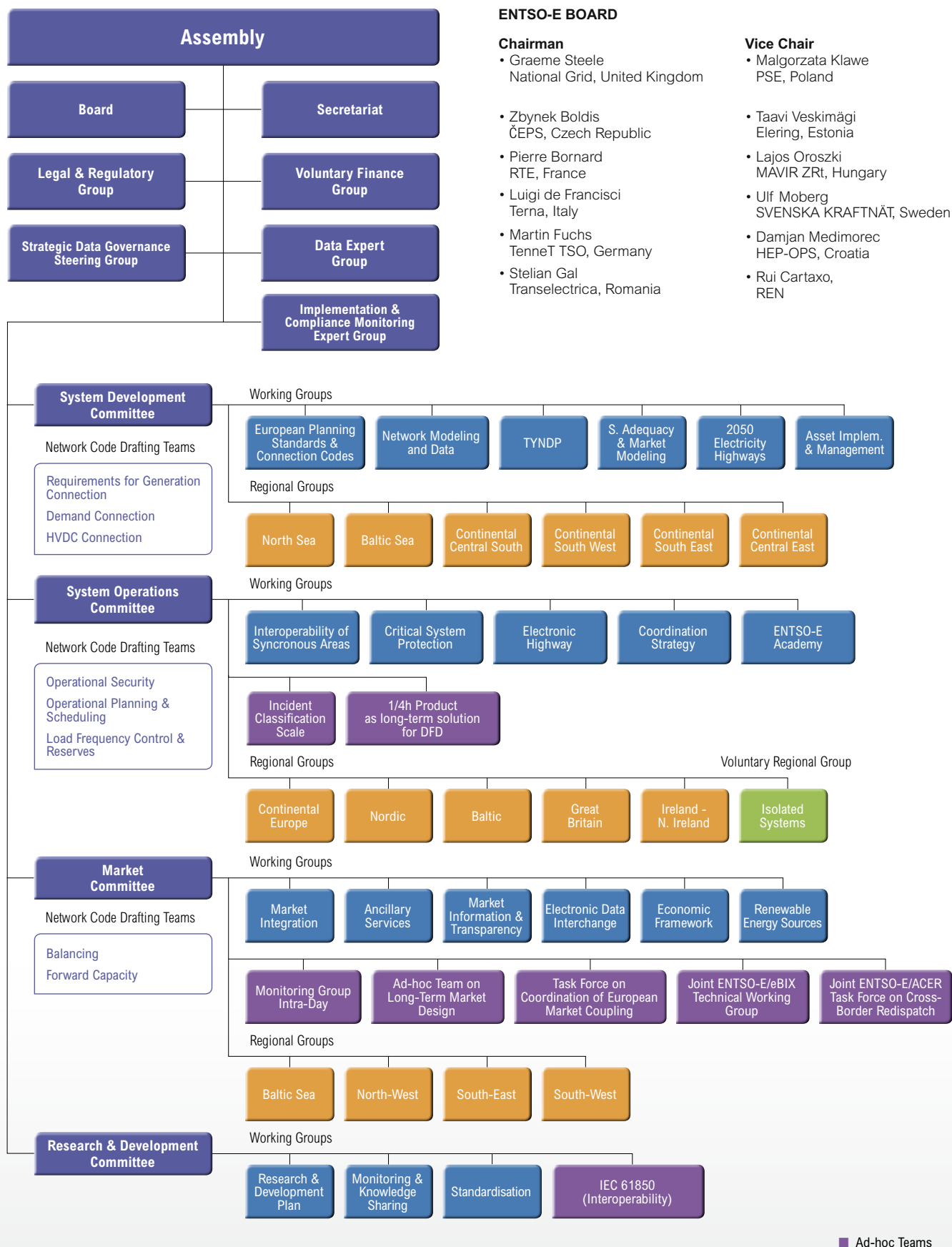
# ENTSO-E MEMBER TSOs

COUNTRY	COMPANY	ABBREVIATION
AT   Austria	Austrian Power Grid AG Vorarlberger Übertragungsnetz GmbH	APG 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 TenneT TSO GmbH Amprion GmbH 50Hertz Transmission GmbH	TransnetBW TenneT TSO Amprion 50Hertz
DK   Denmark	Energinet.dk	Energinet.dk
EE   Estonia	Elering AS	Elering AS
ES   Spain	Red Eléctrica de España S.A.	REE
FI   Finland	Fingrid Oyj	Fingrid
FR   France	Réseau de transport d'électricité	RTE
GB   United Kingdom	National Grid Electricity Transmission plc System Operation Northern Ireland Ltd Scottish Hydro Electric Transmission Limited Scottish Power Transmission plc	National Grid SONI SHETL SPTransmission
GR   Greece	Independent Power Transmission Operator S.A.	IPTO
HR   Croatia	HEP-Operator prijenosnog sustava d.o.o.	HEP-OPS
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	Crnogorski elektroprenosni sistem
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	Affärsverket Svenska Kraftnät	SVENSKA KRAFTNÄT
SI   Slovenia	Elektro Slovenija d.o.o.	ELES
SK   Slovak Republic	Slovenska elektrizačna prenosova sustava, a.s.	SEPS



# ENTSO-E ORGANISATION & GOVERNANCE



ENTSO-E is governed by an Assembly and structured along the lines of four committees: System Development, System Operations, Market, and Research & Development. These committees are organised in a number of working groups, as well as regional and voluntary regional groups.

- The System Development Committee coordinates at pan-European level the network development and prepares the Ten-Year Network Development Plan.
- The System Operations Committee is in charge of technical and operational standards as well as the power system quality. It ensures compliance monitoring and develops tools for data exchange, network models and forecasts.
- The Market Committee works towards an integrated and seamless European electricity market and is in charge of cross-border congestion management, integration of balancing markets, ancillary services, and the inter-TSO compensation mechanism.
- The Research & Development Committee ensures the effective implementation of ENTSO-E's mandate in the area of R&D and to correspond to the EU's greater emphasis on electric grids.

The ENTSO-E Board coordinates the committees' work and implements Assembly decisions. A Legal & Regulatory Group advises all ENTSO-E bodies on legal and regulatory issues and Expert Groups on Data, Implementation & Compliance Monitoring, and External Relations provide expertise to the association and ensure cooperation between all member TSOs in their fields of expertise. The Brussels-based Secretariat is the association's representation to EU institutions, regulators and stakeholders.

## ENTSO-E OFFICE HOLDERS



**President**  
Daniel Dobbeni  
Elia System  
Operator (BE)



**Vice President**  
Jukka Ruusunen  
Fingrid (FI)



**Chairman  
of the Board**  
Graeme Steele  
National Grid (GB)



**Vice Chair  
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Malgorzata Klawe  
PSE (PL)



**Chairman  
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Committee**  
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**Chairman  
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Committee**  
Klaus Kleinekorte  
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**Chairman  
Market Committee**  
Juha Kekkonen  
Fingrid (FI)

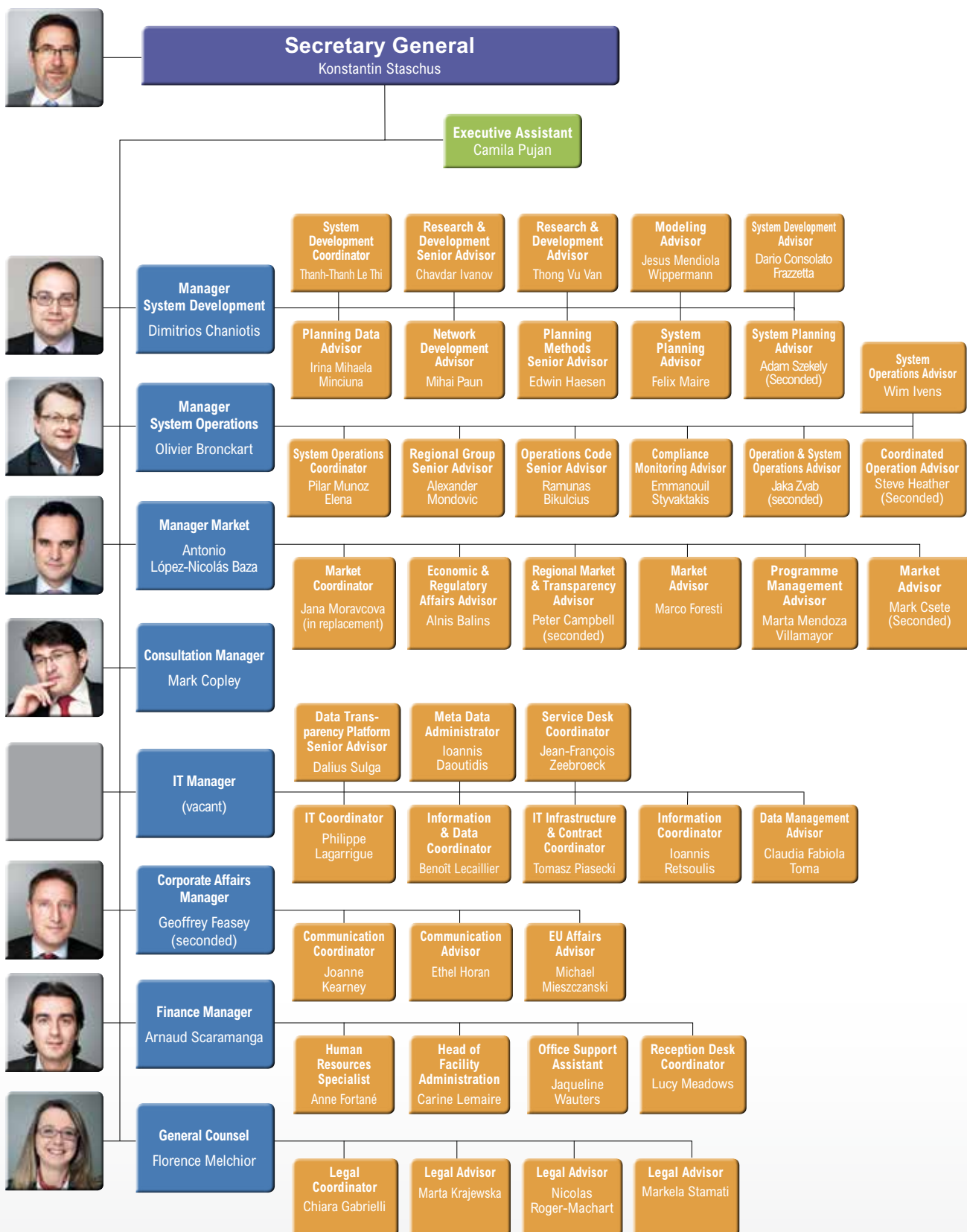


**Chairman  
Research &  
Development  
Committee**  
Hubert Lemmens  
Elia System  
Operator (BE)



**Chair Legal  
& Regulatory  
Group**  
Jacqueline van  
Overbeek de Meyer  
TenneT TSO (NL)

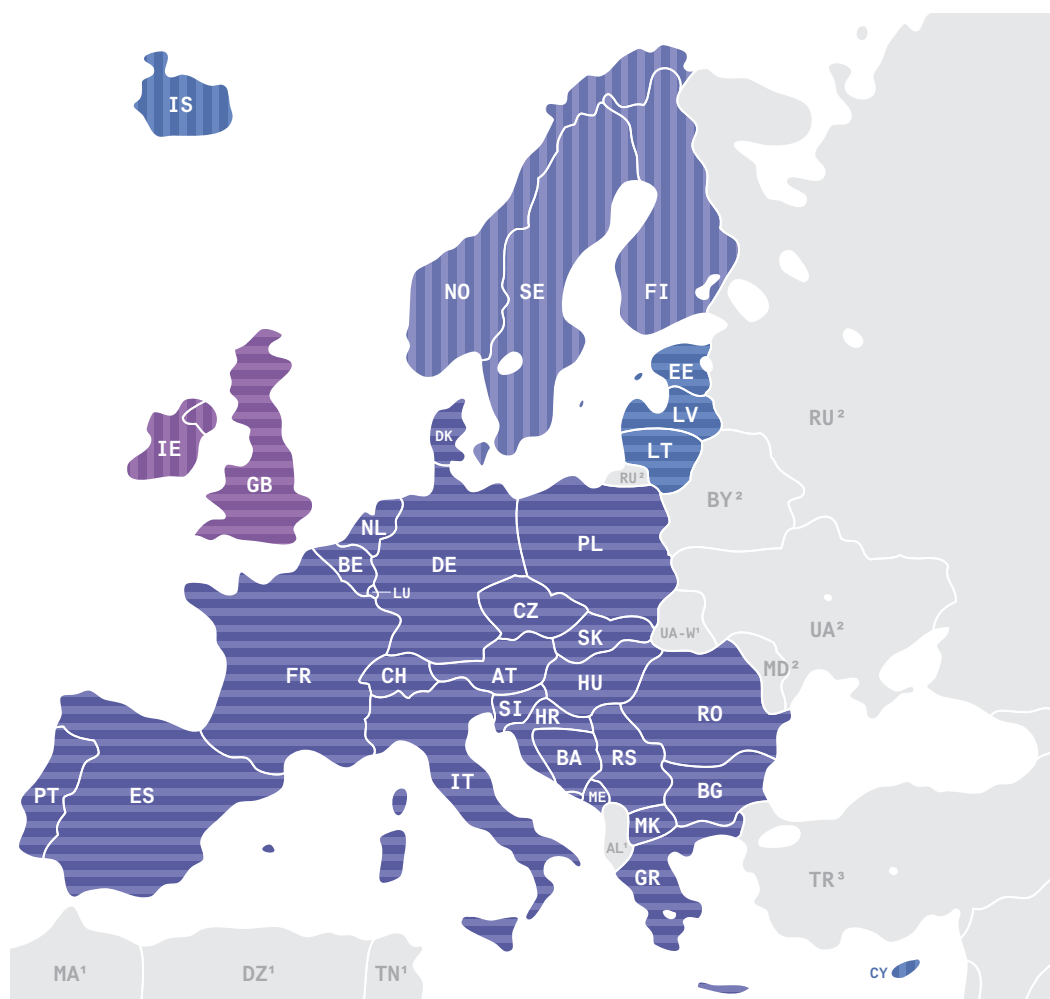
# ENTSO-E SECRETARIAT & MANAGEMENT\*



\*As of 15/05/2013



# ENTSO-E SYNCHRONOUS AREAS & GRID MAPS



- Continental European synchronous area
- British synchronous area
- Baltic synchronous area
- Irish synchronous area
- Nordic synchronous area
- Isolated systems of Cyprus and Iceland

<sup>1</sup> synchronous with the continental European system

<sup>2</sup> synchronous with the Baltic system

<sup>3</sup> Since September 2010 in trial parallel interconnection with the continental European system



## 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 sub-stations, 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.entsoe.eu/resources/gridmap/order-gridmap](http://www.entsoe.eu/resources/gridmap/order-gridmap). Hard copies can also be ordered at: [www.entsoe.eu/resources/publications/order](http://www.entsoe.eu/resources/publications/order).

# ABBREVIATIONS

ACE	Area control error
ACER	Agency for the Cooperation of Energy Regulators
CACM	Capacity allocation & congestion management
CBA	Cost-benefit analysis
CCGT	Combined cycle gas turbine
CEMC	Coordination of EU market coupling
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
CGM	Common grid model
CIM	Common information model
CIP	Critical infrastructure protection
DCC	Demand connection code
DFD	Deterministic frequency deviation
DSO	Distribution system operator
EAS	ENTSO-E awareness system
EB	Electricity balancing
ebIX	European Forum for Energy Business Information Exchange
EC	European Commission
EDI	Electronic data interchange
EDSO	European Network of Distribution System Operators
EEGI	European Electricity Grid Initiative
EFET	European Federation of Energy Traders
EIP	European Infrastructure Package
EMFIP	Electricity Market Fundamental data Information Platform
EMS	Energy management system
ENTSOG	European Network of Transmission Operators for Gas
EP	European Parliament
EPCIP	European Program for Critical Infrastructure Protection
ERGEG	European Regulator's Group for Electricity & Gas
ETSI	European Telecommunications Standards Institute
EURELECTRIC	Union of the Electricity Industry in Europe
FCA	Forward capacity allocation
HILF	High impact, low frequency
HVDC	High voltage direct current
ICT	Information and computer technology
IEC	International Electrotechnical Commission
IEM	Internal electricity market
IOP	Interoperability
ITVC	Interim tight volume coupling
LFQR	Load frequency control and reserves
MiFID	Market in Financial Instruments Directive
NCDP	Network code development process
NMD	Network modelling database
NRA	National regulatory authority



NREAP	National renewable energy action plan
NSCOGI	North Seas Countries Offshore Grid Initiative
OS	Operational security
OPS	Operational planning & scheduling
PCI	Project of common interest
RES	Renewable energy source
RIP	Regional investment plan
RfG	Connection requirements for generators
SCADA	Supervisory control and data acquisition
SOAF	Scenario outlook & adequacy forecast
SSC	Security Service Centre
TSC	TSO Security Cooperation
TSO	Transmission system operator
TYNDP	Ten-year network development plan
UCTE	Union for the Co-ordination of Transmission of Electricity
UML	Unified modelling language
XML	Extensible markup language

## Imprint

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