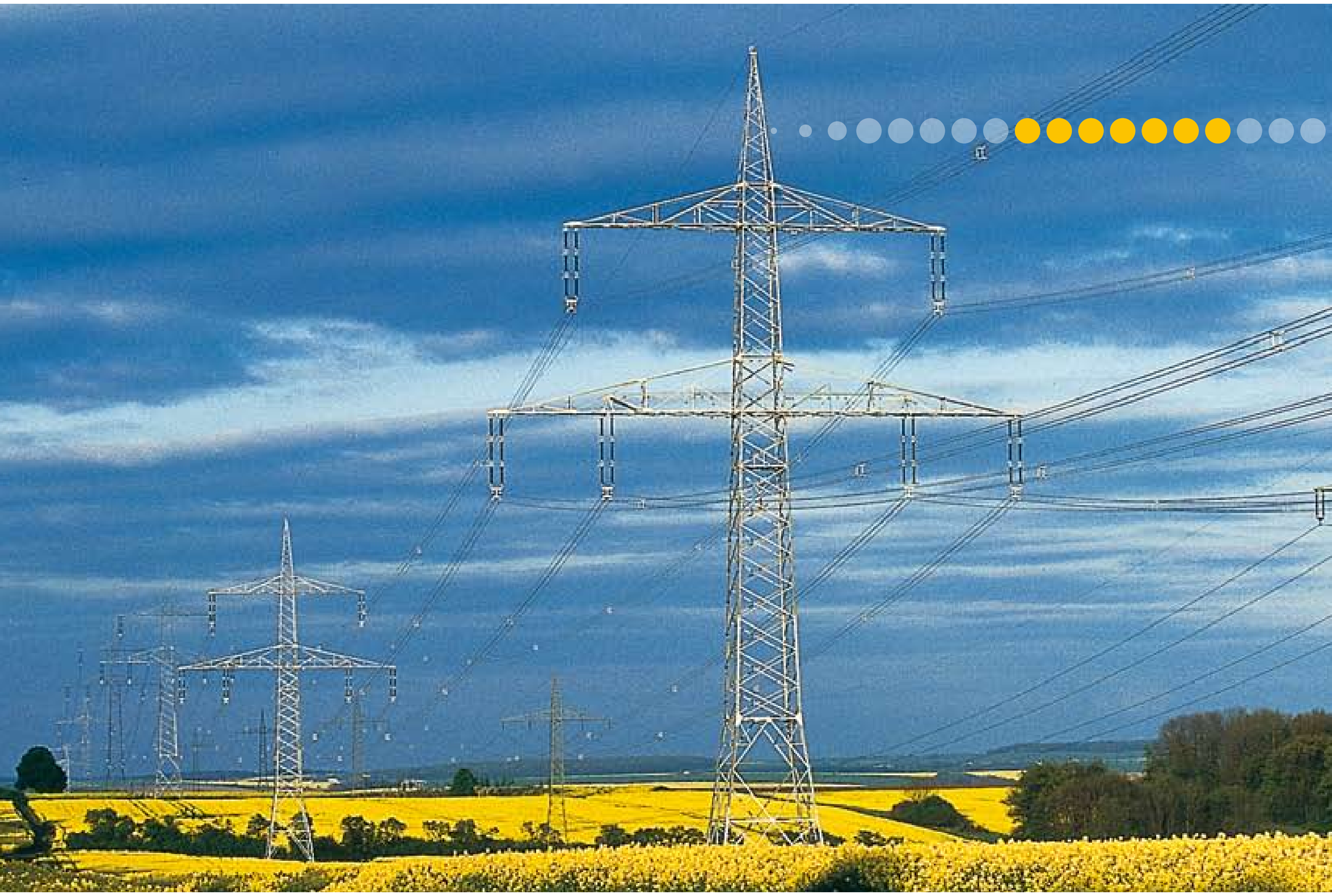


UCTE Transmission Development Plan

Edition 2008

union for the co-ordination of transmission of electricity

UCTE

Table of contents

EXECUTIVE SUMMARY

Executive Summary

In order to meet the objectives of the European energy policy, the transmission grid must be developed while maximizing security and minimizing the total cost (from generation to retail). Grid development is influenced by two interrelated parameters: consumption and generation. If consumption is expected to follow a rather low growth rate as a result of improved energy efficiency, generation is affected by major changes resulting from the development of renewable energy sources and the renewal of the oldest thermal plants.

The UCTE Transmission System Operators (TSOs) therefore have two objectives: maximising the security of supply and integrating the market in order to allow an efficient use of the generation and by this way minimise total costs.

Over the next 10 years, net installed generation capacity in UCTE attributable to both new projects already submitted to the TSOs and expected decommissioning of existing plants or attributable to energy policy objectives amounts be approximately 220 GW (including 80 GW of wind power). At the same time, consumption over the same period is forecasted to increase by approximately 90 GW.

Since rising generation capacity is strongly linked to market conditions, there is almost certain that all generation projects submitted to the TSOs will not be confirmed. This means a great deal of uncertainty regarding the location and the amount of future generation as well as the associated transmission needs.

Nevertheless, due to the time needed to commission new grid equipment (7 to 10 years for overhead lines), all these parameters must be forecasted by the TSOs in order to identify the locations of potential future congestions and determine the most robust and flexible developments. The increasing volatility of these parameters (for example, influenced by energy prices, energy policy decisions on renewables, emission trading schemes or nuclear requirements) makes more difficult to anticipate future congestions.

TSOs' long experience in grid parameters forecasting and assessment has resulted in a very complex investment process. In any case, to further integrate the European market the TSOs have been developing – and are continuing to develop – the transmission grid.

The UCTE Transmission Development Plan is a survey of the investments that UCTE TSOs have either approved or are considering. Most of those investments have already been presented in the TSOs' respective Transmission Development Plans. Cross-border and internal investments are both important to the European market.

On the whole, UCTE TSOs should devote a total investment of around € 17 000 M to the development of the interconnections and their main internal transmission grid in the coming 5 years. It must be noticed that most of these projects refer to overhead lines. If due to external pressure solutions with more extensive use of underground cables would have to be considered the investment costs would be dramatically increased.

Also the dates for commissioning take into account the time necessary for the licencing procedures as they can be anticipated by TSOs provided that the process does not suffer any undue delay. However, it is very important to emphasise the impact that permitting procedures have on the integration of the European market. UCTE fully supports the European Commission in its plans to promote projects leading to the better integration of the European market and to support the TSOs in the permitting procedures. At the same time, this principle should be extended to include internal projects as well.

The present draft of the 3rd Energy Package of the European Commission states that a 10-year investment plan should be provided by TSOs every 2 years. Therefore the present document can be considered as the first issue. The next release of the European Transmission Development Plan is to be provided in 2010 and should benefit from the enlarged cooperation between TSOs in the framework of the future European Network of TSOs (ENTSO-E).

1 INTRODUCTION

1.1 Background

The objectives of European energy policy are to provide a secure, sustainable and competitive energy supply for all European citizens and companies. The electricity system plays a central role in reaching these objectives as electricity offers the possibility of using a large variety of primary sources to generate power and, at the other end, electricity can be used for a very wide range of applications.

Transmission System Operators (TSOs) clearly have specific duties in order to allow the electricity industry to meet these objectives. Besides enabling efficient and competitive energy markets and operating power systems on a daily basis in a reliable way, TSOs must adapt and develop the transmission network in order to create the conditions to develop the European generation mix, especially generation from renewable energy sources and the replacement of the oldest thermal units by more efficient gas-fired units.

In this context, the main drivers for transmission system development in the coming years will be the development of new generation units and the integration of the European market. On the other hand, increase in demand is not expected to play a major role. Increase in demand should be rather smooth, except in the southern section of the European system, as a result of the efforts towards making energy use more efficient.

In more practical terms, most of the transmission projects should meet the following objectives:

- connect new generation capacity, whether from fossil fuels or renewable sources, to the networks; the location of these new units differs substantially from the previous thermal units;
- increase transmission capacity all over Europe to allow the most efficient use of the generating units according to energy policy and economic objectives, not only at national but also at European level; this requires energy exchanges between all member states in order to create a real European playing field.

Over the last ten years, TSOs have already faced the practical implications of the changes which are affecting the European system:

- the current fast changes in huge energy flows observed on a regular basis were unknown 10 years ago;
- large synchronous areas, such as the Scandinavian and the Continental areas, are more interconnected creating new interdependencies that need to be managed securely;
- the penetration of intermittent generation creates new interdependencies throughout existing large synchronous areas for which current assets and procedures were not designed;
- finally, an increasing number of Direct Current interconnections and phase-shifting transformers are being installed in Europe as well as decentralised generation units that require new tools for planning purposes and operation of the power system and the electricity markets.

All these changes require greater coordination between TSOs when it comes to developing the European grid.

In order to facilitate this coordination, UCTE set up the Working Group Coordinated Planning (WG CP) at the end of 2006. Its objectives are:

- to facilitate the exchange of information between TSOs (scenarios, on going studies);
- to harmonise and develop methods and tools for long-term network development studies in order to prioritise the implementation of new investments across Europe and to maximise the economical efficiency of the decisions;
- to make it easier to organise regional studies aimed at reaching shared conclusions about identifying future bottlenecks and joint approval of projects to alleviate these bottlenecks.

It must be stressed that grid development is a difficult task. It clearly refers to building the future: in the case of grids, assumptions must be made on the development of different parameters, such as consumption, generation and also market needs in terms of mechanisms. All those parameters are subject to increasing uncertainties and depend on decisions which are not in the hands of TSOs: energy policy objectives at European and national level (e.g. renewables or emission trading schemes) and their translation in the strategy of the generating companies.

In addition, network development is characterised by two specific issues:

- it takes a very long time to get the appropriate authorisations (7 to 10 years) to build new transmission assets (especially overhead lines), longer than the time required to build new power plants (3 – 4 years for wind farms or combined cycle gas turbines – CCGT); TSOs must anticipate their decisions in a very uncertain environment; figures concerning generation scenarios presented in this report illustrate this difficulty;
- electricity systems are, among other things, characterised by the very long technical and economic life of their assets; the network assets are operated for up to more than 50 years for high-voltage assets compared to usually around 10 years for information technology (IT) systems. Upgrading these assets is therefore a necessity as part of the development strategy and requires time and money.

TSOs therefore currently face a basic paradigm when drawing up their grid development strategy; they must rely on a long-term assessment of the projects (up to 15 years ahead) when, at the same time, more and more uncertainties affect the system and lead the market players to shorter-term decisions (e.g. change in the Brent price, policies for the development of sustainable energy sources, CO_2 certificates, even the future of nuclear energy as well as the increasing difficulties faced to build new power plants due to the NIMBY[1] effect).

Nevertheless, in managing and coordinating the operation of Extra High Voltage (EHV) Transmission System Grids across Europe, TSOs have acquired unique experience, expertise and knowledge of interaction between power systems and the requirements for grid development brought about through changing generation, demand patterns and market mechanisms. TSOs definitely have the leading role in identifying and prioritising strategic development projects, both within and between control areas, and assessing their importance from a European perspective.

This report is one of the first practical contributions by TSOs cooperating within UCTE in this field. Ongoing interconnection projects and LT[2] studies are presented as along with a summary of the national transmission plans. Parallel initiatives have been launched to create shared data bases and facilitate coordinated studies at regional level. The next release of this document should benefit from this progress and improved coordination with other associations in the framework of the future European Network of Transmission System Operators for Electricity (ENTSO-E) which will be set up as part of the 3rd EC package.

Particular attention must be paid to the fact that most of the transmission investments will not be driven by demand, in other words not driven by higher volumes of transmitted electricity; consequently the unit cost of transmitted electricity will increase. This tariff impact needs public and political acceptance before such investments will take place.

---

1 Not in My Back Yard
2 Long Term

1.2 Purpose

As a consequence of the previous statements, the potential congestions of each TSO and the additional infrastructures needed to alleviate them are listed in the UCTE Transmission Development Plan in order to constitute the frame of the future European Transmission Development Plan.

Nevertheless, it is very important to state that the UCTE Transmission Development Plan stems from a survey of the different Transmission Development Plans of TSOs within the UCTE. Furthermore, the preparation of a fully-integrated and coordinated Transmission Development Plan requires additional grid studies executed at the regional level. Such regional grid studies need a specific organisation to collect the data, create scenarios and a substantial amount of time and human resources to perform the analyses. UCTE TSOs are creating the appropriate structure to complete the coordinated grid studies to produce the next versions of the Transmission Development Plan. However most of the interconnection projects presented in the current version of the UCTE Transmission Development Plan are recognised as a result of regional or bilateral studies.

According to the present draft of the European Commission, the 3rd Energy Package, which specifies that TSOs should provide a 10 years investment plan and update it every 2 years, the next issue of the European Transmission Development Plan should be available in 2010. By that time, it should be possible to take full advantage of the measures that are already in progress within TSOs associations towards improved coordination and common view of grid development.

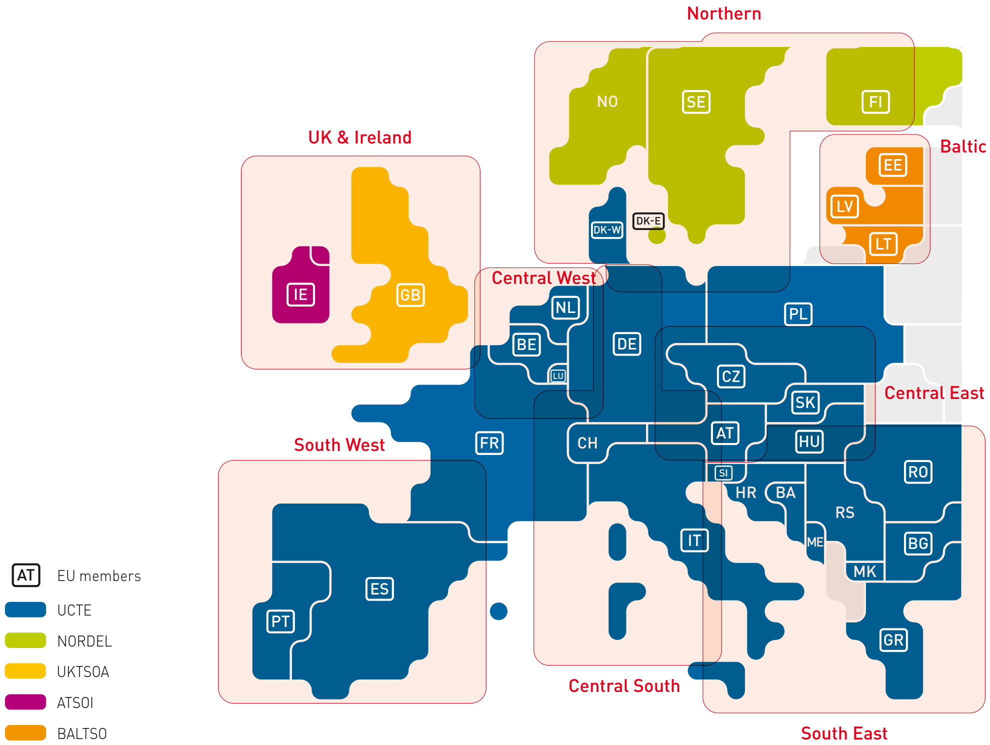
1.3 Acknowledgement

This document contains the result of work carried out by hundreds of individuals who worked on internal studies, bilateral studies and multilateral studies within Europe. Moreover the work presented here implies challenging activities for thousands of people responsible for implementing the new investments detailed later in the document. It is unfortunately not possible to list each of these individuals by name. They include engineers, economists, lawyers, environment specialists, negotiators, communicators, technicians and managers.

The members of the UCTE Working Group »Coordinated Planning« and the members of the UCTE Steering Committee want to congratulate and thank all of them for the great job they have done as part of the grid development.

1.3 Organisation

The following diagram conceptually illustrates how the TSOs organise their cooperation in order to optimise and prioritise investments within and between regions.



The European grid is divided into five synchronous regions and five relevant organizations: NORDEL, BALTSO, UKTSOA, ATSOI and UCTE. Each of these organizations implements some coordination between the involved TSOs, in the operational stage as well as at the planning stage.

The creation of the future ENTSO-E will provide a new framework aimed at facilitating coordination between the different areas.

In the case of UCTE, the general coordination and the common principles for grid development are implemented in the framework of the Working Group »Coordinated Planning«. Nevertheless, for practical reasons due to the size of the system, the actual coordination in the field of LT planning is made through five Regional Fora: Central West, South West, Central South, Central East and South East.

The present Transmission Development Plan is the fruit of reflections and coordination within the five UCTE Regional Fora where 23 countries are involved: Austria (AT), Bosnia & Herzegovina (BA), Belgium (BE), Bulgaria (BG), Switzerland (CH), the Czech Republic (CZ), Germany (DE), Spain (ES), France (FR), Greece (GR), Croatia (HR), Hungary (HU), Italy (IT), Luxembourg (LU), Montenegro (ME), the Former Yougoslav Rebublic of Macedonia (MK), the Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Serbia (RS), Slovenia (SI) and Slovakia (SK).

1.4 Methodology

On the European Extra High Voltage network, power flows basically from the substations where generation units are connected to those where loads are to be fed. As this network is meshed, power flows use every parallel path according to physical laws. As every European country is interconnected with its neighbours, the European grid ensures the European security of supply (SoS), provides the Internal Electricity Market with cross border capacities and allows for taking advantage of Renewable Energy Sources. Thus, it matches the three main criteria of the European Commission regarding Trans European Networks in the field of electricity.

On the other hand, the transmission capacities of the grid elements (lines and transformers) are limited by their physical characteristics and the voltage must be kept within rated limits, in order to guarantee a safe and secure operation of the grid. TSOs' operators permanently monitor electrical parameters for every element in the power system in order to make sure that they remain within their rated limits, even in case of additional contingency (e. g. additional forced outage of a generation or network element). If they detect a risk of exceeding the acceptable limits, i. e. a congestion situation, they take appropriate countermeasures, such as asking some generators to modify their output power; this has a cost for the TSO, which is called a congestion cost.

In the same way, the basic job of TSOs' planning experts consists of activities related to grid development. The basic tasks could be summarized as follows:

- to forecast the load flows on the power grid;
- to check whether or not the acceptable limits might be exceeded (in standard conditions as well as in case of additional loss of a grid or generation element, the so-called N -1 criteria);
- to imagine and evaluate a set of possible strategies and to select the one(s) that have the best cost / benefit performance[3];

In order to fulfil their tasks, TSOs rely on scenarios of forecasted consumption, development of generation projects, and power exchanges evolvement.

For each scenario, they have to take into account the random aspect of the phenomena.

Firstly, forecasted load varies from one moment to another according not only to human activity, but also outdoor temperature. Generating units may generate or not according to their availability, which results either from external factors (e. g. wind or hydro conditions or forced outage) or from generation companies decisions which can be hardly forecasted (place of thermal units in the merit order).

Second, the scenarios should reflect the asset strategy of the generation companies; however these resulting decisions are not known in advance by the TSOs and are even made at the last moment by the asset owners in order to minimise the uncertainties liable to affect their projects.

Last but not least, cross border exchanges may vary greatly depending on the strategies of market players on the European market. The TSOs' task therefore becomes more and more critical as the uncertainty about new projects (particularly new generation projects) increases and expands to the neighbouring systems.

3 The cost of a strategy is the discountes cost of the necessary works; its benefit are the discounted expected increase in SoS as well as reduction of congestion costs and Joule losses in operation

Besides, the global transmission capacity of the network can be increased by several means, such as:

- Adding transformers in existing substations in order to be able generally to feed higher load and in some cases to evacuate higher generated power;
- Upgrading some assets, e. g. operate a line at higher voltage (the line must have been originally designed for that), increasing the transmission capacity of a power line by tightening the conductors and reinforcing the towers;
- Installing new facilities in some grid substations, that will improve the distribution of power flows among the different parallel paths in order to fit better with the capacities of lines, e. g. series reactors or phase shifters, or that will increase voltage support, e. g. shunt reactive devices, static VAR compensators;
- Taking greater advantage of existing assets when possible, e. g. changing the conductors of a line to high temperature ones or adding a second circuit on an existing line, the towers of which have been originally designed to that purpose;
- Replacing existing assets by new ones with higher transmission capacity, e. g. building a 400-kV-double-circuit-line in place of an existing 225-kV one that will be dismantled;
- Adding new infrastructures, e. g. building new transmission lines and/or new substations.

Of course, all these solutions are neither always possible to implement, nor appropriate to provide the suitable transmission capacity increase. Therefore, TSOs conduct a case by case analysis comparing expected future needs and actual possibilities, taking into account the existing network characteristics and environment. In particular, the insertion of new facilities is only proposed if other actions that would have less impact on the environment are not sufficient, or not possible in the specific context. Particular techniques like underground cables may be envisaged where appropriate.

Last, it is worth pointing out that the improvement of transmission grid performance generally implies that some facilities should be taken out of operation for the safety of persons and equipment during some phases of the works. Although operating modes are adapted in order to minimize these planned unavailabilities, some reductions in transmission or interconnection capacities may be experienced by transmission grid users during the works.

1.5 Data Representativeness

The data collected for this common report is based on the current Ttransmission Development Plan of each TSO within the UCTE.

It is also important to note that at the same time UCTE has decided to harmonize data and tools (through the Working Group »Coordinated Planning«) for all UCTE TSOs. Several actions are in progress, some of them being time consuming, such as building a common database representing the whole UCTE system for planning studies and conducting multi-lateral coordinated studies at regional level. Therefore, TSOs will need some time before getting the outcome of their efforts. This is why UCTE has thought highly preferable to give an outlook on on-going projects and studies, based on present practices, rather than waiting until the achievement of the actions currently in progress. On the other hand, the described activities will help to develop future versions of this document.

Since grid reinforcement strategies mainly depend on the generation development hypothesis and on the load forecasts, it is necessary to update this document every two years to include the latest developments of the strategies developed by power generators. This is also a requirement of the present draft of the European Commission's, the 3 rd Energy Package.

2 EVOLUTION OF THE UCTE GENERATION-LOAD BALANCE

2.1 Present Situation

Remarks:

1. All data presented here has been drawn from the »System Adequacy Retrospect (SAR) 2006«, published by the end of July 2007 and available on the UCTE website (www.ucte.org).
2. Due to rounding of figures, slight differences may be observed in the following tables between the sum of individual values and the associated total value of lines or columns.

Consumption

The evolution of energy consumption in UCTE is as follows:

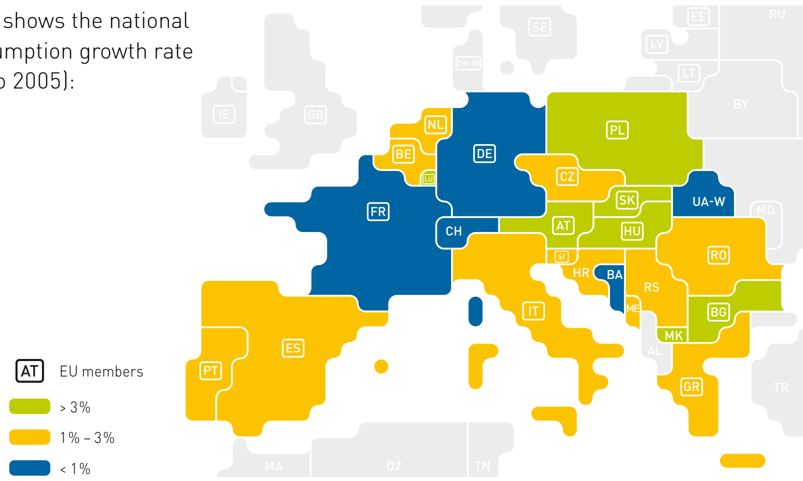
	Yearly load (TWh)			Annual peak load (MW)
Country	2004	2005	2006	2006
AT	56.6	57.1	58.9	9481
BA	10.7	11.1	11.1	2019
BE[4]	87,6	87.9	90.4	13909
BG	35.6	36.6	37.9	6930
CH	60.4	61.7	62.2	10218
CS	39.9	41.7	42.5	7699
CZ	61.5	62.7	64.2	10484
DE	561.2	563.2	567.0	77800
ES	235.4	246.8	253.4	42153
FR	479.2	483.2	478.4	86280
GR	51.2	52.9	54.0	9889
HR	16.0	16.7	17.2	3036
HU	38.3	39.3	40.6	6074
IT	325.3	330.5	337.8	55619
LU	6.3	6.2	6.6	1035
MK	7.4	8.1	8.3	1565
NL	111.1	114.7	116.1	16496
PL	130.6	130.7	136.5	22673
PT	45.5	47.9	49.1	8804
RO	50.7	51.9	53.1	8151
SI	12.6	12.8	13.0	2075
SK	26.3	26.3	27.2	4423
UA-W	4.4	4.4	4.4	1028
UCTE	**2453.8**	**2494.4**	**2529.9**	

NB: CS stands for the aggregate RS & ME

A high degree of volatility can be observed, especially in case of maximum loads. For instance the peak load of France is highly sensitive to weather conditions in winter, mainly due to widespread use of electric heating (the demand for electricity could rise by approximately 1700 MW for every 1°C drop in the outdoor temperature; annual consumption may subsequently vary by as much as a dozen TWh, between very cold and very mild winters).

4 data from present draft of SAR 2007

The following image shows the national annual energy consumption growth rate (2006 with respect to 2005):



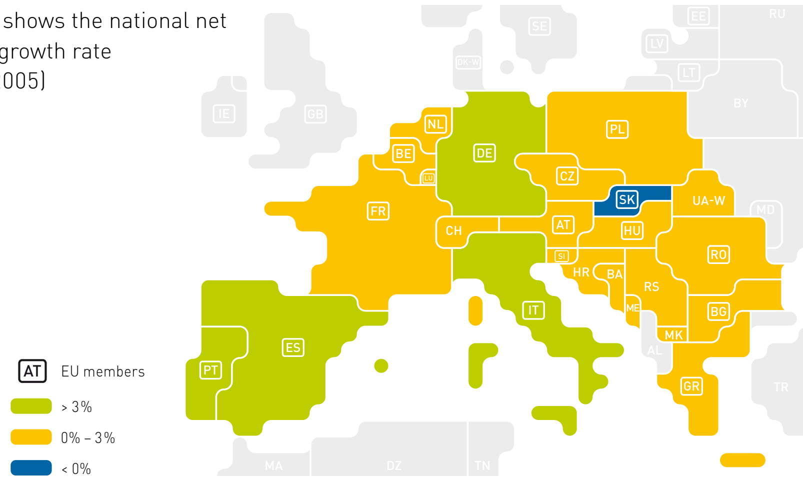
Generation

The national generating capacities (NGC) spread by primary sources in December 2006 are as follows:

Country	Hydro Power GW	Nuclear Power GW	Fossil Fuel GW	RES w/o Hydro GW	Not Clearly Identified GW	NGC 2006 GW	NGC 2005 – 2006 GW	NGC 2005 – 2006 %
AT	11.3	–	5.9	1.0	–	18.2	0.3	1.7
BA	2.1	–	2.0	–	–	4.1	0.1	2.0
BE[4]	1.4	5.8	8.2	0.8	–	16.2	0.1	0.8
BG	2.9	2.9	6.6	–	–	12.4	–	–
CH	13.4	3.2	0.3	0.3	0.2	17.4	0.0	0.1
CS	3.5	–	6.4	–	–	9.9	–	–
CZ	2.2	3.5	10.6	0.1	–	16.	0.1	0.6
DE	9.1	20.3	70.3	24.4	–	124.1	4.8	4.0
ES	18.7	7.5	37.3	12.2	–	75.7	2.9	4.0
FR	25.5	63.3	24.8	2.4	–	116.0	0.2	0.2
GR	3.1	–	8.1	0.6	–	11.8	0.5	4.5
HR	2.1	–	1.7	0.1	–	3.8	0.0	0.3
HU	0.0	1.8	5.3	0.4	0.7	8.2	0.1	0.6
IT	21.0	–	66.3	2.5	–	89.8	2.8	3.2
LU	1.1	–	0.5	0.1	–	1.7	0.0	0.7
MK[5]	0.5	–	1.0	–	–	1.5	–	–
NL	0.0	0.4	19.3	2.3	0.0	22.1	0.1	0.5
PL	2.3	–	29.8	0.2	–	32.3	0.2	0.7
PT	4.9	–	6.7	2.0	–	13.6	0.8	6.1
RO	6.3	0.7	10.8	–	–	17.8	- 0.0	- 0.04
SI	0.9	0.7	1.3	–	–	2.8	0.0	1.8
SK	2.4	2.2	2.3	0.0	0.7	7.6	- 0.4	- 5.4
UA-W	0.0	–	2.5	–	–	2.5	–	–
UCTE	**134.8**	**112.4**	**327.1**	**49.3**	**1.6**	**625.3**	**13,8**	**2.3**

4 data from present draft of SAR 2007
5 data updated by the TSO

The following image shows the national net generating capacity growth rate (2006 compared to 2005)

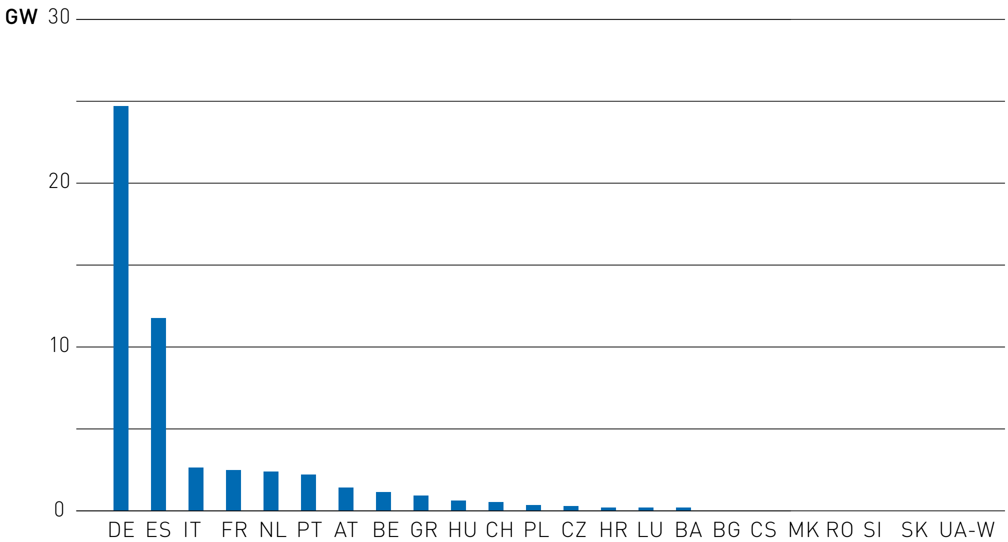


The growth rate is based on the capacity at the end of 2005 and 2006.

Generating capacity increased all over UCTE except in Slovakia, due to the shutdown of the Jaslovske Bohunice 440 MW nuclear power plant on 31 December 2006.

In 2006, higher annual growth rates were recorded in Portugal with a strong increase of +6.4% and in Greece with an increase of +4.5%. Germany, Spain and Romania recorded a +4% in growth rate whilst Italy's was up +3.8%.

The following figure shows the generation capacity of National Renewable Energy Sources (RES) excluding hydro plants at the end of 2006.



RES w/o Hydro Generation Capacity (31.12.2006)

2.2 Scenario for the next 10 years

Load

The following table shows the expected load annual growth rate for UCTE Members (Reference scenario):

Country	From 2008 to 2018 (in %) Mid-Term (2008 – 2013)	Long Term (2013 – 2018)
AT	2.0	1.5
BA	2.2	1.9
BE	1.2	0.9
BG	0.8	1.0
CH	1.0	0.8
CZ	1.4	1.0
DE	0.6	0.6
ES	2.7	2.2
FR	1.0	1.0
GR	3.0	3.0
HR	4.0	2.5
HU	2.0	2.0
IT	2.2	2.2
LU	2.0	2.1
ME	0.9	1.9
MK	3.0	3.0
NL	2.0	2.0
PL	2.4	1.9
PT	3.1	3.1
RO	3.0	2.8
RS	1.4	1.4
SI	2.5	2.0
SK	1.7	1.5
UA-W	p. m.[6]	p. m.

Generation

TSOs usually receive a high number of requests from generators asking for connection to the grid: these include both conventional thermal generation facilities, mainly coal and gas fired units, and facilities running on renewable energy sources, in particular wind generation. Although one new nuclear unit is currently being bult in France, in the long run, several countries like Belgium and Germany may shutdown part of their present nuclear units. Nuclear power, however, is still an open option under discussion in several European countries.

The table below gives an overview of the evolution of the generation over the next 10 years, estimated from all the projects that have been brought to the knowledge of the TSOs.

The table gives net figures, the decrease in existing generation due to power plants shutdown having been deduced.

6 pro memoria

Country	From 2008 to 2018 Mid-Term (2008 – 2013)/GW	From 2008 to 2018 Long Term (2013 – 2018)/GW	of which wind Mid-Term (2008 – 2013)/GW	of which wind Long Term (2013 – 2018)/GW
AT	+ 4.0	+ 1.4	+ 0.4	+ 0.5
BA	+ 0.5	+ 1.1	–	+ 0.2
BE	+ 4.7[7]	- 1.5	+ 1.2[8]	–
BG	+ 0.1	+ 3.1	–	+ 0.4
CH	+ 1.5	+ 3.7	–	–
CZ	+ 0.5	+ 1.0	+ 0.4	+ 0.5
DE	+ 38.8	+ 13.2	+ 14.7	+ 8.7
ES	+ 17.7	+ 17.6	+ 10.8	+ 7.0
FR	+ 12.6	+ 10.1	+ 8.1	+ 3.5
GR	+ 4.0	+ 3.3	+ 1.4	+ 1.0
HR	+ 1.4	+ 1.0	+ 0.4	+ 0.5
HU	+ 1.5	+ 2.0	–	–
IT	+ 17.9	+ 22.0	+ 5.0	+ 4.0
LU	+ 0.2	+ 0.1	<< + 0.1	<< + 0.1
ME	n. a.[7]	n. a.	n. a.	n. a.
MK	+ 0.1	+ 0.6	–	–
NL	+ 9.0	+ 3.0	+ 1.2	+ 2.2
PL	+ 3.0	- 1.1	+ 1.6	+ 0.2
PT	+ 7.6	+ 4.6	+ 3.0	+ 1.7
RO	+ 2.7	+ 2.3	+ 0.4	+ 0.8
RS	- 0.2	+ 1.6	–	–
SI	+ 0.9	+ 2.0	+ 0.1	–
SK	0	+ 0.1	+ 0.1	+ 0.1
UA-W	p. m	p. m.	p. m.	p. m.
Total	**+ 128.7**	**+ 91.1**	**+ 49.2**	**31.3**

It is worth mentioning that these figures are not the TSOs' best estimate, as could be shown in System Adequacy Forecast 2008 – 2020, available on UCTE website.

Synthesis for the UCTE

For the coming 10 years, **the net installed generation capacity** due to both new projects already addressed to the TSOs and expected decommissioning of plants or due to energy policy objectives **would reach approximately 220 GW** in the UCTE, 80 GW of which corresponding to wind farms projects.

This additional generation capacity must be compared with the expected increase in consumption over this period. With an average annual growth rate as mentioned above (from 0,6 % for Germany to 4 % for Croatia), **the total increase in consumption should only reach approximately 90 GW**.

A conservative scenario for forecasted generation that takes into account the commissioning of new power plants considered as certain and the shutdown of power plants expected during this period leads to much lower figures for generation capacity: scenario A described in the System Adequacy

7 from 2006 to 2013
8 not available

Forecast (SAF) 2008 – 2020[9] amounts to an increase in generation capacity of only 100 GW for the same period, including 75 GW over the next five years. This scenario nevertheless underestimates the new units that will be commissioned after a period of 5 – 6 years since they are currently at such a preliminary stage that their current state of progress does not provide enough information to allow their implementation and commissioning dates to be considered to be certain.

TSOs can build a best estimate scenario between these two extremes, taking into account future plants for which the commissioning date can be considered to be reasonably reliable according to the information available to the TSOs. Scenario B in the SAF 2008 – 2020, generated in such a way, amounts to an installed generation increase of 160 GW for the same period, including 92 GW over the next five years. It is nevertheless worth mentioning that even in that case, where the total amount of expected generation capacity increase may sound reasonable, there may still be a high degree of uncertainty on where and when these generation projects will actually be built.

It is also worth noting that in any case, wind power capacity should represent a significant proportion of the expected generation mix over the next 10 years, as is already the case in some countries like Spain or Germany. The amount and location of wind generation capacity is important for transmission network development issues because highly volatile power output (between maximal rated power and almost nil when wind conditions are unfavourable) is inherent to this generation process, with a typical associated load factor[10] much lower than that of thermal units. In addition, regarding the location, new wind farms are usually located in areas with poor transmission networks, so new lines and infrastructure needs to be planned in order to be able to evacuate this generation capacity. The consequence is that highly contrasted and variable power flows can be experienced on the transmission network, particularly if the wind farms are concentrated in neighbouring areas. These power flows, that are difficult to predict at the planning stage, lead to specific network developments in order to assess that the transmission grid, which was originally not designed for that purpose, can withstand all these situations and ensure secure operation of the system in any case.

Moreover, since the development of generation projects and thus the increase in generation capacity is strongly linked to market conditions, it is absolutely uncertain whether all these projects (whatever their energy source) will be confirmed. This introduces **a lot of uncertainties on both volume and location of future generation units, thus on the associated transmission needs.**

At the same time the TSOs have the obligation to connect every new unit and are expected to develop their respective network in order to alleviate any network constraint which would prevent all these generation units to be operated efficiently.

Actually, TSOs are facing problems because the commissioning time of new generation/consumption facilities (typically 3 – 5 years for CCGT) is much shorter than the commissioning time of new grid assets (typically 7 – 10 years for a new 400-kV-overhead-line), mainly due to the duration of the authorization procedures. Neither generators nor consumers commit themselves to realize their project while asking for connection, nor while accepting TSOs proposal for connection. To allow connections of new generation/consumption facilities and efficient operation of the system, TSOs must launch the grid reinforcement process before being sure that the project that have trigged the need for additional transmission capacity will actually be realized. Thus, TSOs face the risk of stranded assets if those projects are finally cancelled.

Therefore it should be pointed out that the early support of the relevant Authorities is absolutely necessary to TSOs during the permitting process of these grid projects, otherwise the new lines will not be available in time to match the transmission needs triggered by the connection of the new generation units.

Regulators should also be aware that all these projects are parts of TSOs' needed investments and should provide the adequate regulation in order that the relevant transmission facilities can be committed in time and their cost recovered.

9 The System Adequacy Forecast (SAF) 2008 – 2020 is available on UCTE website.
10 The load factor is the ratio of the average power generated over a year to the generating capacity.

3 DEVELOPMENT OF INTERCONNECTIONS

The future needs for each interconnection are described on the basis of what TSOs expect according to the hypotheses for load and generation development (e. g. interconnections which are expected to be congested in the future). Those needs have been assessed either by each TSO individually or through bilateral grid studies. These analyses are based on forecast of the load, the generation development and the market behaviour used in the Transmission Development Plan of each TSO.

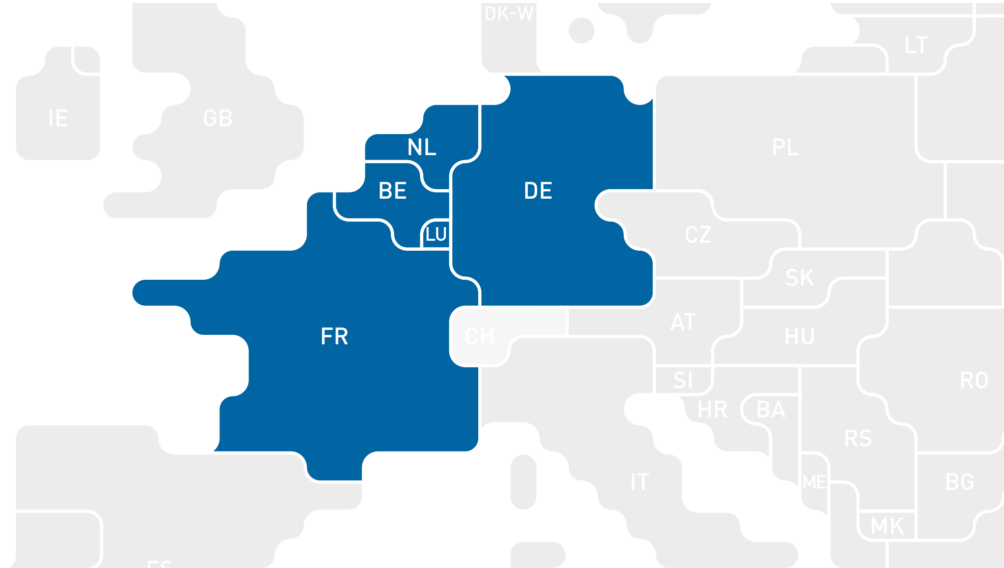
A short overview is given of the additional transmission equipment that has a direct or indirect impact on congested interconnections. To deal with this congestion, TSOs have decided to implement different developments or, in some cases, to start new grid studies. Most of the reinforcements mentioned have already been described in the respective TSO Transmission Development Plan.

The projects listed below aim to integrate the European market. According to the experience of the TSOs, all of theses projects are needed to reach this objective.

For each UCTE Regional Forum, the development of interconnections inside the forum is presented first, followed by an overview of the evolution of the interconnection with non-UCTE TSOs. Borders with no significant congestion, for which no development is needed for the moment, are not mentioned.

Appendix 1 presents detailed information about on going interconnection development projects.

3.1 UCTE Regional Forum Central West



3.1.1 Internal borders between TSOs of the UCTE Central West region

Belgium – France Interconnection

With the installation of the new 400 kV Avelgem (BE) – Mastaing (FR) interconnection line and the new phase shifter in Monceau (close to the 225 kV Chooz (FR) – Jamiolle (BE) interconnection line), the maximum NTC [11] values from France to Belgium have increased from 2 250 MW to 3 200 MW (in winter).
The power flows on the interconnection network in northern France are usually high and unpredictable and depend on market prices in Great Britain, France, Belgium, the Netherlands and Germany. Currently, the 225 kV Moulaine – Aubange interconnection line is the most limiting element on this border.

In the long term, the development of generation units (thermal units and wind turbines) in the north of France will create congestion on the Belgium – France interconnection lines.

Elia's (BE) decision to commission a phase shifter in Zandvliet and two phase shifters in Van Eyck (spring 2008) will result in an estimated gain in NTC of approximately 300 MW for both winter and summer.

RTE (FR) and Elia (BE) have also decided to **reinforce the 225 kV Aubange (BE) – Moulaine (FR) line in 2010** (TEN-E project). The estimated gain in NTC is approximately 300 MW in winter and around 150 MW in summer.

In addition, RTE (FR) is carrying out a large study covering all of northern France in order to determine the appropriate reinforcements in its internal grid close to the interconnection. Considering the first results, Elia (BE) and RTE (FR) have decided to plan a **new study (2008)** in order to identify solutions for this congestion.

11 Net Transfer Capacity

Belgium – Germany Interconnection

Currently, there is no tie-line between Belgium and Germany.

In the long term, the development of generation units (thermal units and wind turbines) in the UCTE Central West region on the one hand and further market integration on the other will increase the need for additional interconnection capacities.

Elia (BE) and RWE TSO (DE) have decided to start a **joint study to** further examine the impact an interconnection Belgium – Germany would have on market efficiency.

Belgium – The Netherlands Interconnection

Due to their central position in Central Western Europe, the Dutch and Belgian grids are subject to significant (un-)expected power flows as the power exchanges through several interconnections (France – Belgium, Belgium – Netherlands and Netherlands – Germany) depend on market prices in Great Britain, France, Belgium, the Netherlands and Germany.
In the long term, the development of generation units (thermal units and wind turbines) is expected to be significant with projects on both sides of the BE – NL border.

To secure the Belgian grid as well as the Central Western Area, **3 Phase-Shifter Transformers (PSTs)** will be installed in the spring 2008. One of them will be installed **at Zandvliet (BE), the two others at Van Eyck (BE)**. Those PSTs have been installed at Belgium's northern border in order to cope wih (un-)expected flows.

TenneT TSO will commission a **new 380 kV substation at Borssele (NL)** in 2008.
Elia (BE) and TenneT TSO (NL) have decided to start a new **joint study (2008)** to further examine the impact of the new generation plants and to identify the optimal regional solutions.

France – Germany Interconnection

Because of its limited capacity, the 225 kV line **Ensdorf (DE) – Saint-Avold (FR)** must generally be opened and is therefore only used in certain specific conditions as maintenance or an emergency.

RWE TSO (DE) and RTE (FR) have launched a **new study** to identify the possibility of increasing capacity on the line. Development of generation on both sides of the border will create a new situation on this part of the interconnection in the future. In addition, environmental constraints in France could limit the possibility to use conventional strategies (installation of a second circuit, conductors change, etc.).

Germany – Netherlands Interconnection

The situation between Germany and the Netherlands is characterized by grid constraints with the result that a joint auction for grid capacity between both countries was implemented in 2000. Transit flows in the BENELUX area have increased and new phase shifting transformers will be installed on the Belgian grid close to the Dutch border. The two additional phase shifting transformers in the Diele (DE) substation will increase transfer capacity between both countries. The demand for cross-border transmission capacity will remain high as the electricity market continues to evolve.

TenneT TSO and RWE TSO have decided to build a **new 400-kV-line** between **Doetinchem (NL) and Niederrhein (DE)** to increase capacity on this border. Therefore at the moment, permitting procedures are being prepared.

Luxembourg – Belgium Interconnection

Sotel, the industrial grid in Luxembourg, is interconnected to Belgium through 220-kV- and 150-kV-overhead-lines for their own needs. Under normal operation conditions, there is no active interconnection with the public grid in Luxembourg, which is connected to Germany.

Due to load growing and to ensure the security of supply, the Cegedel Net grid in the southern section of Luxembourg has to be reinforced. This reinforcement will also be useful for a future interconnection between the public grid and the neighbouring countries in this region.

In order to enhance the security of supply for the whole grid of Cegedel Net, a **study** has been launched to create an additional permanent interconnection with the neighbouring grids in the southern region. The study is being carried out in consultation with Elia [BE], RTE [FR] and RWE TSO [DE]. Based on the outcome of the study that recommends a new interconnection in the southern part of the grid, Cegedel Net and Elia have decided to set up a **project** to build this new interconnection between Aubange [BE] and Bascharage [LU].

Luxembourg – Germany Interconnection

The public grid in Luxembourg is interconnected to the German RWE TSO grid through 220-kV-overhead lines.
A large pump/storage power plant in Luxembourg is also interconnected through dedicated 220-kV-overhead-lines to the grid of RWE TSO but these interconnections are not used for the public grid.

Cegedel Net and RWE TSO will study the impact on the transfer capacity of the restructuring of the 220/380 kV grid along the LU – DE border and how to ensure on a long term basis the liability of the LU – DE interconnection taking into account the ongoing load growing in Luxembourg, the new interconnection with the Elia [BE] grid and possible transit flows.

Due to the small size of Luxembourg, a major outage will impact the whole country and its economy, that is why Cegedel Net applies a more severe n-x criterion (outage of a bus-bar system in a substation; failure of a tower of a multi-system line) to evaluate the security of supply for the whole country.

Luxembourg – France Interconnection

There is no existing connection between Luxembourg and France.

SOTEL, the industrial grid operator, wants to increase its exchange possibilities for its internal consumption (about 390 MW).

Therefore SOTEL and RTE have decided to build a **new 225-kV-line between Moulaine (FR) and Belval (LU)**.

Cegedel Net (LU) is also studying the possibility of an interconnection with France.

3.1.2 UCTE Central West TSOs borders with non-UCTE countries

United Kingdom

With Belgium (BE)
Elia and National Grid have started a **joint study** to determine the interest for the market of a 1 000 MW DC cable connection between Belgium and the United Kingdom.

With France (FR)
The capacity of the Direct Current (DC) submarine cable between Great Britain and France is fixed at 2 000 MW. **New studies** have been launched to identify the opportunity of increasing this capacity to 3 000 MW.

With The Netherlands (NL)
A new HVDC (High Voltage Direct Current) **link** between the UK (Isle of Grain, Kent) and the Netherlands (Maasvlakte) with a transmission capacity of **1 320 MW** should become operational **in 2010**.

Nordic Countries (Denmark, Norway, Sweden)

Germany (DE) with:

- **Denmark**
  One DC-submarine cable exists between Denmark East and Germany. The nominal capacity of this HVDC connection is 600 MW in both directions. The AC [12] connection to Denmark West was upgraded till 2007 to 950 MW northbound and 1 500 MW southbound. Studies are currently being carried out into the possibility of increasing capacity on this AC connection.
- **Norway**
  E.ON Netz (DE) and Statnett (NO) are conducting a feasibility study for the first HVDC connection between Germany and Norway. The capacity analysis ranges from 700 to 1 400 MW. Expected commissioning date should be after 2015.

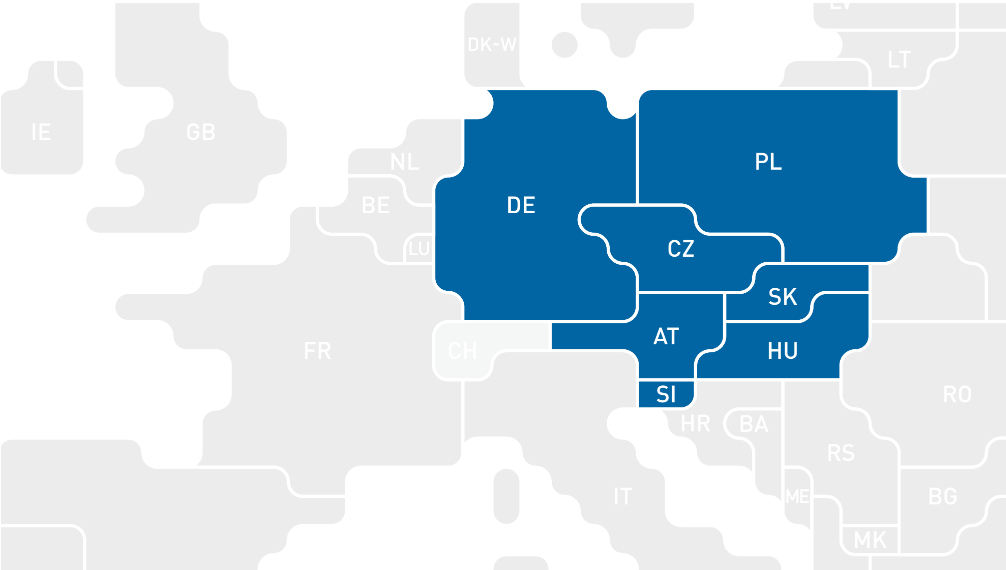
The Netherlands (NL) with Norway

- The construction of a new HVDC link between Norway (Feda) and the Netherlands (Eemshaven) with a transmission capacity of 700 MW has been completed at the end of 2007. Operation will start at the beginning of 2008.

---

12 Alternating Current

3.2 UCTE Regional Forum Central East



3.2.1 Internal borders between TSOs of the UCTE Central East region

Austria – Czech Republic Interconnection

In order to increase the (n-1) - security and transmission capacity for the existing V437 Slavetice (CEPS) – Durnrohr (APG) tie-line and alleviate significant limitation of transmission capacity on the CEPS-APG profile during maintenance in the future, a bilateral agreement has been reached to increase capacity by installing the second 400 kV system. The project is expected to be completed in 2008.

Austria – Germany Interconnection

The border lines between Germany and Austria are not subject to congestions today (relating to program flows). Nevertheless, due to physical constraints, high deviations occur between programs and physical flows. There are considerations to construct a 380-kV line around 2017 (status: idea/option) connecting APG (St. Peter) and E.ON Netz (Isar).

At a later stage, it is possible to switch the Memmingen (DE) – Westtirol (AT) system from 220 kV to 380 kV.

TIWAG-Netz AG considers to reconstruct the existing 220 kV line connecting Silz and Oberbachern (E.ON Netz) as a 380-kV-line in the long term (status: idea/option).

Austria – Hungary Interconnection

Installation of the second 400 kV circuit of the interconnection. The Hungarian part of the Wien SO (AT) – Szombathely (HU) line is already available.

Austria – Slovakia Interconnection

Joint studies to be launched into the benefits of a new 400-kV-double-circuit-line Stupava (SK) – Bisamberg/Wien SO (AT), after 2020.

Czech Republic – Germany Interconnection

At present there are four 400 kV tie-lines on the Czech – Germany interface. There are two 400-kV-lines between CEPS and E.ON Netz: Hradec (CEPS) – Etzenricht (E.ON Netz) and Prestice (CEPS) – Etzenricht (E.ON Netz). There is a 400 kV double tie-line between CEPS and Vattenfall Europe Transmission: Hradec (CEPS) – Rohrsdorf (Vattenfall Europe Transmission).

With the increase of wind power generation in Germany and in order to increase the power exchange capability between Czech Republic and Germany, studies of a possible installation of new double circuit 380-kV-line Hradec (CZ) – Vernerov (CZ) – Vitkov (CZ) – Mechlenreuth (DE, E.ON Netz) line have been launched and the project is due to be completed by 2016.

Hungary – Slovakia Interconnection

Joint studies to be launched into the benefits of a new 400-kV-double-circuit-line Sajoivanka (HU) – Moldava or Rimavska Sobota (SK), after 2015.

Poland – Slovakia Interconnection

Joint studies to be launched into a possible new 400 kV interconnection Byczyna (PL) – Varin (SK), after 2018. Some reinforcements in the Polish internal network are necessary before this new interconnection between Poland and Slovakia.

Poland – Germany Interconnection

Possibility of converting the 220 kV Krajnik (PL) – Vierraden (DE, Vattenfall Europe Transmission) double circuit line into a 400-kV-line, after 2015.

Possibility of building a third interconnection between Poland and Germany: Baczyna (PL) – German border (DE), after 2015. Reinforcements in the Polish internal network are necessary before this third interconnection is realised.

The development of **Slovenia-Hungary interconnection** is described in § 3.4.1.

3.2.2 UCTE Central East TSOs borders with non-UCTE countries

Poland – Lithuania Interconnection

Connection of the Baltic countries to UCTE via a new 400 kV Elk (PL) – Alytus (LT) double circuit line before 2015.

Reinforcements in the Polish internal network are necessary before the connection between Poland and Lithuania is realised. The final internal reinforcements will be known after arrangements with the Lithuanian TSO.

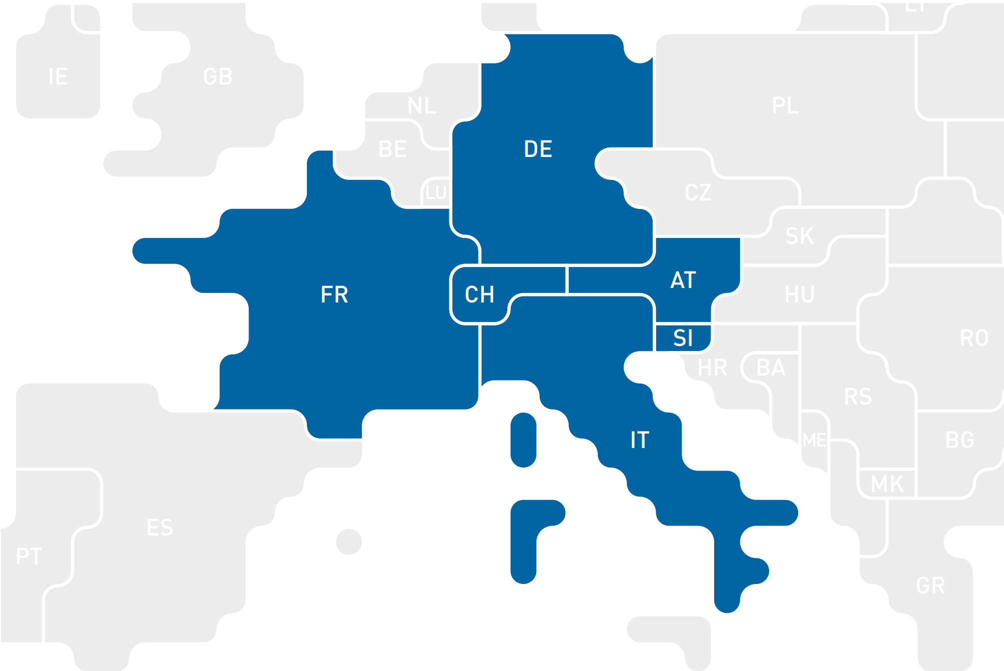
Poland – Ukraine Interconnection

Modernization and resumption of existing 750-kV Rzeszow (PL) – Khmelnitskaya (UA) line after 2010.

Slovakia – Ukraine Interconnection

Strengthening and boosting the capacity on the existing 400 kV interconnection between Ukraine and Slovakia with circuit doubling: V. Kapusany (SK) – Mukachevo (UA), after 2015.

3.3 UCTE Regional Forum Central South



3.3.1 Internal borders between TSOs of the UCTE Central South region

Interconnection Austria – Italy

In the short term the installation of a **220/220 kV Phase Shifting Transformer for the Lienz – Soverzene tie-line** at the Lienz substation is planned to improve (N-1)-security and to increase transmission capacity slightly.

In order to significantly increase transmission capacity between Austria and Italy, a **new 380-kV-line between Cordignano (IT) and Lienz (AT)** had previously been planned for the long term. In order to limit the environmental impact, plans were made to remove the existing 220 kV Soverzene (IT) – Lienz (AT) tie-line. The Italian connection point was submitted for a strategic environmental assessment and has to be agreed with the local authorities. Presently, no progress has been made on this project. An environmental impact assesment for authorisation is now required for authorisation.

For further significant uprating of the transmission capacity between Austria and Italy, a study into a **new 380-kV-double-circuit-line (GIL[13]) between Innsbruck (AT) and Bressanone (IT)**, passing through the planned Brenner Base Tunnel (BBT-Project), has been carried out by TERNA and TI-WAG-Netz AG (TEN-E Study). The new line is dependent on the Brenner Base Tunnel railway project.

A **renewed section (about 30 km) of the 110-/132-kV**-tie-line between Italy (TERNA) and Austria (TIWAG-Netz AG) would connect the existing **Prati di Vizze (IT) – Steinach (AT)** substations/lines, linking Tirol and the province of Bolzano via the Brenner pass. The existing Prati di Vizze – Brennero line, currently operated at medium voltage, would be used.
In addition, a **new 220-kV-tie-line** between Austria (APG and TIWAG-Netz AG) and Italy (TERNA) at Reschenpass is currently being studied.

13 Gas Insulated line

France – Italy Interconnection

Some congestion occurs on the interconnection lines between France and Italy as soon as there are significant exchanges between France and Switzerland and France and Italy.

A bilateral study (TEN-E project) by RTE and TERNA shows great benefits in **increasing the capacity of the 400-kV-lines close to the border** (Cornier (FR) – Montagny (FR) – Albertville (FR) – La Coche (FR) – La Praz (FR) – Villarodin (FR) – Venaus (IT)) **with high temperature conductors**, taking best advantage of existing network by installing high temperature conductors on the currently out of voltage
Albertville (FR) – Grande Ile (FR) Nº3 line and connecting it to one existing circuit Allbertville(FR)-Rondissone(IT). A **phase shifting transformer will also be installed on the 220 kV** Trinité Victor/ Menton (FR) – Camporosso (IT) **interconnection line**.

In the medium term, TERNA and RTE are launching a **feasibility study** in order to establish the suitability of using the new emergency tube of the Frejus motorway tunnel to install a **new 1 000 MW HVDC France – Italy interconnection**.

RTE and TERNA have also studied **long term development** of the interconnection through railway infrastructure of the Lyon (FR) – Turin (IT) (TEN-E project). This option is less promising than the above one through the motorway tunnel.

France – Switzerland Interconnection

The power flows on the interconnection lines between France and Switzerland depend, on the one hand on the level of exchanges between France and Switzerland and also France and Italy, and on the other, on the schedules of the hydro electric generation units in the Alps.
There is some congestion, especially on the 220-kV-interconnection-lines. A new **study is planned in 2008**.

Italy – Slovenia Interconnection

In order to increase the transfer capacity with Slovenia, resolve current congestion in north-eastern Italy, improve the security of supply and secure the operation of the grid within Slovenia, a **new double circuit 380 kV interconnection between Italy and Slovenia is planned**, linking Udine Ovest (IT) and Okroglo (SI) substations. The existing operational constraints at the Italy-Slovenia border will be reduced. Other internal reinforcements are required in order to eliminate all congestion in the area.

Two **PST** will also be installed on the existing interconnection lines: 220 kV Padricano (IT) – Divaca (SI) (Padricano, Italian side, under construction for 2008) and 400 kV Divaca (SI) – Redipuglia (IT) (Divaca, Slovenian side, jointly agreed for 2009) in order to improve the security of supply in both Slovenia and Italy, secure the grid operation and better utilise the existing transmission system and regional market.

Italy – Switzerland Interconnection

In 2006, two interconnection lines proposed by private investors (the so-called »Merchant Lines«) were authorized by the authorities of the countries involved:

- **380 kV Cagno (IT) – Mendrisio (CH);**
- **150 kV Villa di Tirano (IT) – Campocologno (CH).**

A new **study** to investigate the sustainability of a **380 kV** line between **Lavorgo (CH) and Morbegno (IT)** must be launched in the future.

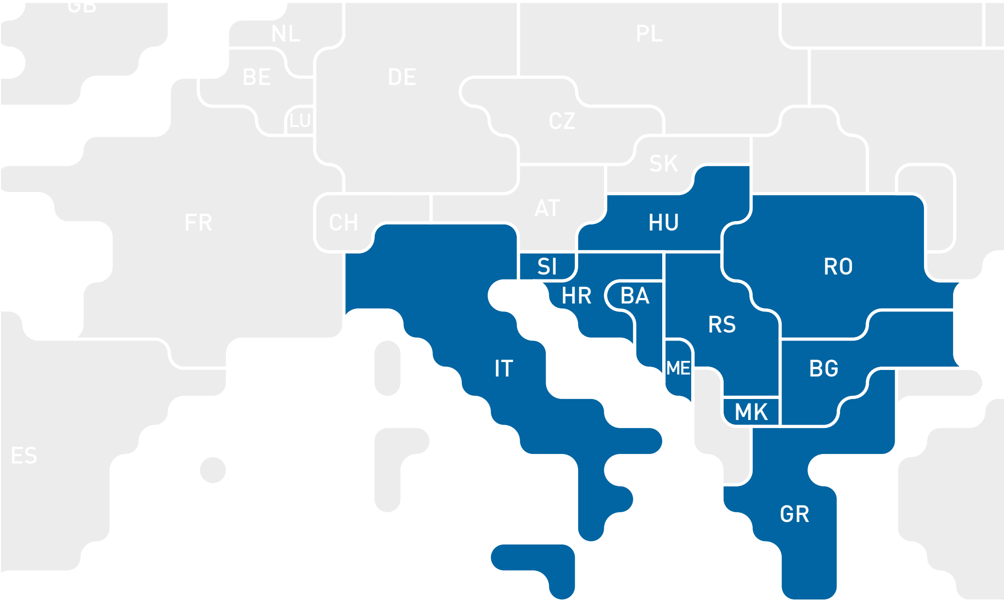
3.3.2 UCTE Central South TSOs borders with non-UCTE countries

Interconnection Italy – Tunisia

In June 2007, an agreement was reached by the Italian Minister of Economic Development and the Tunisian Minister of Industry and Energy, appointing TERNA and the Tunisian company Steg to set up a joint venture to create the electricity interconnection, manage international transits of electricity on the link and launch a bid to build a power plant in Tunisia.

A new interconnection cable will join the peninsula of Cap Bon in Tunisia with Sicily, to carry electricity generated by a new power plant in El Haouria, Tunisia. The plant will generate 1 200 MW, 800 MW of which will be supplied to Italy and 400 MW to Tunisia. The undersea cable will be a 170 km double cable with 1 000 MW capacity, 200 MW of which will be guaranteed to the free access share. Commercial operation is due to start in 2011.

3.4 UCTE Regional Forum South East



3.4.1 Internal borders between TSOs of the UCTE South East region

Hungary – Romania Interconnection

The construction of a new 400 kV interconnection overhead line (OHL) Bekescsaba (HU) – Nadab (RO), 60 km in length (20 km on the Romanian Side) and 1 212/1 212 MVA, will improve the security of entire interconnection operation and offer a reserve path for the export-import contracts from/to the Western electricity market.

Hungary – Croatia Interconnection

A new 400 kV interconnection line between Ernestinovo (HR) and Pecs (HU) (double line) is being built. This double tie-line between Croatia and Hungary is expected to increase steady state security in South Eastern Europe region. The import capacity of Croatia and surrounding countries from central Europe and Ukraine is also expected to be increased.

Hungary – Slovenia & Slovenia – Croatia Interconnections

The first interconnection between Slovenia and Hungary via a new 400 kV double circuit line Cirkovce (SI) – Pince (Hungarian border) and the new interconnection between Slovenia and Croatia should be completed by 2011.

FYROM – Albania & Albania – Italy / Montenegro – Italy Interconnections

A 400 kV interconnection line between Bitola (MK) and Elbasan (AL) (OHL) and 400 kV HVDC submarine cable Durres (AL) – Foggia (IT) is being considered.

These two elements are supposed to be a backbone of Corridor 8 (EBRD – gas, oil and energy connection between Bulgarian coast on the Black Sea and the Albanian coast on the Ionian Sea). The coastal section of Corridor 8 would be finalized by including 400 kV Chervena Mogila (BG) – Stip (MK) and Bitola (MK) – Elbasan (AL) OHLs. The final outcome would be the possibility of exporting power to Italy through the submarine HVDC cable to Foggia. Several feasibility and technical studies are ongoing, but transmission capacity on this cable is still unclear due to the numerous reinforcements required on the Albanian transmission system if this connection is made.
The possibility of interconnecting Italy with Montenegro is still under evaluation as an alternative to the Albania-Italy interconnection.

Albania – Montenegro Interconnection

A 400-kV-line between Tirana (AL) and Podgorica (ME) is under construction. This interconnection line establishes a stiff connection of Albania with its neighbours and allows the safe operation of the Albanian system also under emergency conditions. The transmission line between Tirana and Podgorica will represent a valuable asset for Albania and constitute an important missing link in the regional power network. The continuous connection between Tirana and Montenegro allows also Albania to participate in the international regional electricity market. From the technical point of view, the project is technically straightforward and it does not carry any particular technical risk.

Serbia – Romania Interconnection

Six options for a new 400-kV-interconnection-line between Serbia and Romania line have been taken into consideration within a system study completed in July 2007. The system study proposed three options to be further investigated as part of a feasibility study that will follow up the system study. Maximum increase in NTC at the Serbian – Romanian border was 160 MW in winter and 260 MW in summer.

Serbia – FYROM Interconnection

New 400-kV-interconnection-line between Serbia and FYROM Nis – Stip. Maximum increase of NTC at Serbian – FYROM border, according to the study carried out for this new line, is 250 MW in winter.

Bulgaria – FYROM Interconnection

New 400 kV Cervena Mogila–Stip OHL between Bulgaria and FYROM will be in operation at the end of 2008. This line will improve the security of the interconnections in the region.

Greece - Bulgaria Interconnection

A new 400 kV interconnection line between Nea Santa (GR) – Maritsa East 1 (BG) is under consideration. This line is expected to not only increase transfer capacity from Bulgaria to Greece, but also improve power system security and stability when Turkey is connected to UCTE in the future.

Italy – Croatia Interconnection

The construction of a 400 kV HVDC submarine cable with 500 – 1 000 MW capacity between Dalmatia in Croatia and the Marche Region (presumably at Candia substation) in Italy is under consideration and a feasibility study has been launched in 2007. This undersea connection will be the first direct connection between these two countries with inter-regional importance for the Internal Electricity Market.

Greece – Italy Interconnection

The interconnection with Italy has increased the reliability of the Greek system, while a new link for energy trading has been established between south-eastern Europe and the rest of Europe. A preliminary study is foreseen to assess the possibility of a second DC link between Italy and Greece.

Interconnection Bosnia & Herzegovina – Croatia

A new 400 kV interconnection line between the two countries is under consideration. The project will have a bilateral and regional impact; it will enhance security of supply in both systems and boost exchange and transit capacities in the region.

Finally, a recent development is presented below:

Interconnection FYROM – Greece

The new Meliti (GR) – Bitola (MK) interconnection line entered into operation in 2007. The new line increased NTC by 100 MW from the northern interconnections.

3.4.2 UCTE South East TSOs borders with non-UCTE countries

Interconnection Greece – Turkey

A 400 kV OHL between Greece and Turkey, N. Santa (GR) – Babaeski (TR), is under construction. The line is expected to be available in 2008. This line will be used to synchronise the Turkish system with the UCTE zone.

Interconnection Romania - Turkey

For the long term (2018), a 400 kV Constanta (RO) – Pasakoy (TR) DC link via subsea cable is under consideration.

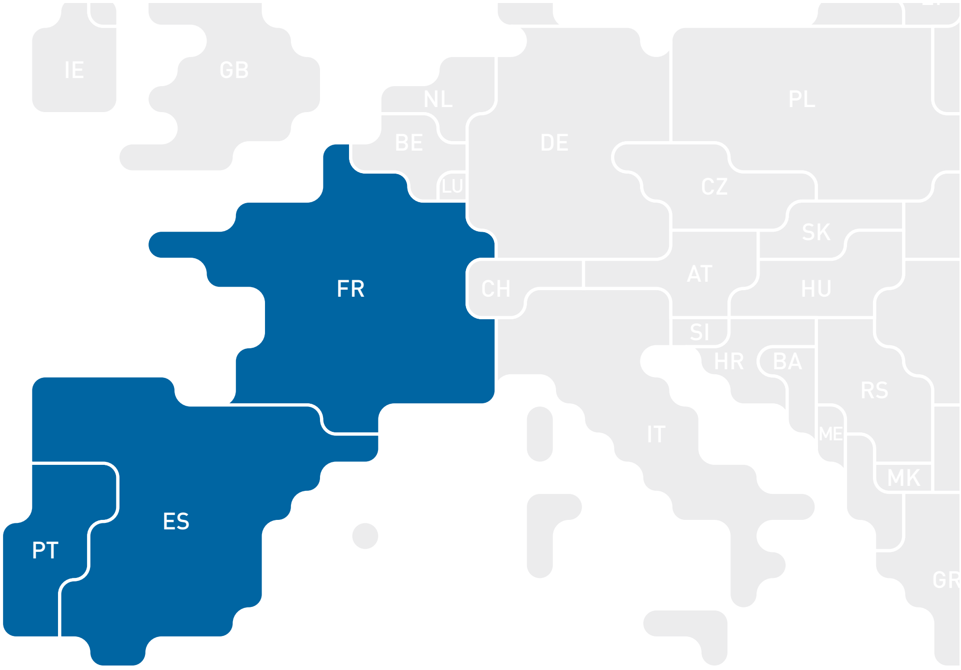
It is also worth mentioning the following:

Interconnection Bulgaria – Turkey

There are two 400 kV OHL between:
Maritsa East 3 (BG) – Babaeski (TR) with thermal rating of 1 310 MVA.
Maritsa East 3 (BG) – Hamitabat(TR) with thermal rating of 1 715 MVA.
These OHL are not used at present and will be put in operation when the synchronous work between Turkey and UCTE is possible.

Four years ago, the OHL Maritsa East 3 (BG) – Babaeski(TR) was in operation to supply passive island in Turkey.

3.5 UCTE Regional Forum South West



3.5.1 Internal borders between TSOs of the UCTE South West region

France – Spain Interconnection

At present there are only four tie-lines (2 of 220 kV and 2 of 400 kV) between France and Spain, the last one having been built in 1982, and they face continuous congestions. France and Spain have the shared goal to increase their transfer capacities. Their objective is to reach a short-term capacity of 2600 MW NTC, and 4000 MW NTC in the long term. A new interconnection line is required for each stage.

The technical studies were updated jointly by REE (ES) and RTE (FR) in 2007 in order to take into account the strong development of wind power in Spain, of thermals plants in both countries and also the growth of consumption in Spain.

For the 2600 MW stage, the project involves a new 400-kV-double-circuit-line between Baixas (FR) and Santa Llogaia or Vic (ES) (in the latter case, the new line would replace the existing single circuit line). This project is classified as Priority Project by the European Commission. On 10 January 2008, RTE and REE jointly decided to set up a common structure and launch a joint project to be able to propose a route to the relevant authorities before 30 June 2008, following Mario Monti's recommendations. (M. Monti was appointed European Union Coordinator for the France Spain electrical interconnection on 12 September 2007).

On the other hand, the way to reach the long term objective of 4000 MW NTC could be another interconnection through central-western Pyrenees. New joint studies have to be carried out into this matter.

Portugal – Spain Interconnection

In the short term, a new interconnection line through the Duero corridor is expected in 2009 **(400 kV Aldeadávila (ES) – Lagoaca / Duero Internacional (PT) line)**, as well as some changes in the topology of the existing 220-kV-lines in the same area.

In the long term, the outcome of recent studies is the building of **two new interconnections, one in the North and one in the South**, in order to reach an NTC value of 3000 MW in both directions.

- New northern interconnection 400 kV Cartelle / Pazos (ES) – Vila Fria – Vila do Conde – Recarei (PT).
- New southern interconnection: 400 kV Guillena / Puebla de Guzman (ES) – Tavira (PT).

These new lines will be built with double circuit towers, although only one circuit will be installed initially.

Besides, REE (ES) and REN (PT) intend to launch a new joint study in order to identify further reinforcements of the network for the long term.

This set of projects aim at developing and integrating the Iberian Electricity Market (MIBEL).

3.5.2 UCTE South West TSOs borders with non-UCTE countries

Spain – Morocco Interconnection

The second circuit 400 kV Tarifa (ES) – Fardioua (MA), with AC submarine technology, was commissioned in June 2006. No other projects are currently scheduled, although in the future new connections with Morocco and / or with Algeria can be considered.

4 TRANSMISSION NETWORK DEVELOPMENT

A brief overview of the transmission facilities having a direct or indirect impact on internal congestions is shown country by country in Appendix 2.

Synthesis

UCTE TSOs should spend around € 17 000 M between now and 2012 on developing the international interconnections and the internal transmission grid.

This includes works on approximately 12 000 km of transmission lines (either new lines, replacements, upgrades or refurbishment), substations and other related equipment. The different projects behind these figures are described and justified in the Transmission Development Plan provided by each TSO.

It must be noticed that most of these projects refer to overhead lines. If due to external pressure solutions with more extensive use of underground cables would have to be considered the investment costs would be dramatically increased.

Also the dates for commissioning take into account the time necessary for the licencing procedures as they can be anticipated by TSOs provided that the process does not suffer any undue delay. However, the impact of the permitting procedures on the integration of the European market should be highlighted. UCTE therefore fully supports the European Commission in its plans to promote projects leading to better integration of the European market and to support the TSOs in the permitting procedures. This principle should also be extended to the internal projects.

According to the present draft of the European Commission 3 rd Energy Package, which specifies that TSOs should provide a 10-year investment plan and update it every 2 years, the next version of the European Transmission Development Plan should be available in 2010. By that time, it should be possible to take advantage of the measures already in progress within TSO associations, like setting up a shared database for network studies, encouraging and coordinating multilateral studies with harmonised scenarios in order to implement a common global assessment and prioritise transmission grid development projects at European level. In particular, this would rely on joint estimations of cross-border NTC increase due to the new projects.

APPENDIX 1

DETAILED INFORMATION ON INTERCONNECTION PROJECTS

Regional Forum Central West

Regional Forum Central West

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
BE – NL	Congestion on the South and North borders	The three Phase Shifting Transformers (PSTs) shall improve the management of critical situations in the 380 kV grid caused by high North-South or South-North power flows and facilitate allocation of an increased and less volatile interconnection capacity to the market parties.	PSTs (located on the northern border)	under construction	Spring 2008	Installation of 3 PST 380 kV, 1 400 MVA, +25°/-25° • 1 at Zandvliet • 2 at Van Eyck TSOs in charge: Elia
NL – NO	Market coupling Norway – Netherlands	After the project is completed, both Norway (hydro system) and the Netherlands (thermal system) will be able to optimise the use of production capacity	NorNed HVDC link	construction completed; project in testing phase	2008	New HVDC link between Norway (Feda) and the Netherlands (Eemshaven), DC voltage 450 kV, transmission capacity 700 MW, length 580 km, TSOs in charge: TenneT TSO & Statnett
FR – LU	Consumer connection	SOTEL (Luxembourg) has asked RTE for a 225-kV-line to feed its industrial consumption in Belval	Moulaine (FR) – Belval (LU) 225-kV-line	Permitting	2009	Creation of a 225 kV Moulaine (FR) – Belval (LU) line. TSOs in charge: RTE & SOTEL

Regional Forum Central West

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
FR – BE	Congestion on the 225-kV-line between the Lorraine area (FR) and Belgium	The project will increase the electricity transmission capacity between France and Belgium, since congestion constraints are identified on the 225 kV Moulaine-Aubange circuit due to N-1 contingency on the 400 kV network.	Moulaine (FR) – Aubange (BE) 225-kV-line	Permitting	2010	The new project will upgrade the existing 225 kV Moulaine (FR) – Aubange (BE) line (installation of the 2nd circuit and replacement of conductors). Studies are being carried out into further increasing this interconnection capacity. TSOs in charge: RTE & Elia
NL – UK	Market coupling United Kingdom – Netherlands	Project results in: • enhanced diversity and security of supply for both markets • open access for all market parties by explicit auction and market coupling • increase of interconnection capacity and market trans-parency	BritNed HVDC link	Intention to construct	2010	New HVDC link between the UK (Isle of Grain, Kent) and the Netherlands (Maasvlakte), Transmission capacity 1320 MW, length 260 km, TSOs in charge: TenneT TSO & National Grid
LU – BE	Security of supply for the public grid	New interconnection between the Cegedel Net public grid in LU and Elia in BE to improve security of supply for the Cegedel Net grid	New interconnector in the southern section of the LU grid	Under study	2011	New 220-kV-line between the substations of Bascharage [LU] and Aubange [BE] TSOs in charge: Cegedel Net & Elia

Regional Forum Central West

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
DE – NL	Congestion in the area around the German – Dutch border	Overloads due to high North-South power flows through the auctioned frontier between the Netherlands and Germany in peak hours of wind in-feed	Line Doetichem (NL) – Niederrhein (DE)	Preparing of permitting procedure	earliest in 2013	60 km new double circuit 40 kV OHL TSOs in charge: TenneT, RWE TSO
FR – BE	Congestions on the France – Belgium border	Constraints appear on the France – Belgium interconnection, due to development in generation in northern France	Strengthening of present interconnection or new interconnection project	Under study	2012 – 2015	Study to launch. TSOs in charge: RTE & Elia
DE – NO	Interconnection Norway – Germany	Statnett and E.ON Netz are carrying out a study into the first Norway-Germany interconnector. The aim is coupling the hydro-dominated Norwegian electricity system and the wind and thermal dominated electricity system in northern Germany	NORD.LINK	Feasibility study	≥ 2015	HVDC transmission system 700 – 1 400 MW. Feasibility study performed by Statnett and E.ON Netz.
BE – UK	Establish a direct power exchange capability	Create trading capacities by coupling the Belgian grid (Elia) and the British grid (NG)	Under study with National Grid	Under study	tbd [14]	HVDC link TSOs in charge: Elia & National Grid

14 To be determined

Regional Forum Central West

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
DE – BE	Establish a direct power exchange capability	New interconnection between the 400 kV Elia and RWE TSO grids on the central western Europe market	Under study	Under study	tbd	Investigation of grid extension options TSOs in charge: Elia & RWE TSO
DE – FR	Increase the power exchange capacity on the DE – FR profile	Identification of possibilities to improve the Ensdorf (DE) – St. Avold (FR) interconnection	Ensdorf (DE) – St. Avold (FR) line	Under study	tbd	TSOs in charge: RTE & RWE TSO

Regional Forum Central East

Regional Forum Central East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
CZ – AT	To increase the (n-1) security and transmission capacity of the existing V437 Slavetice (CEPS) – Durnrohr (APG) tie line	The project will increase the (n-1)-security and north-south transmission capacity at the CEPS – APG interconnection. It will also alleviate severe transmission capacity limitation on the CEPS – APG profile during maintenance.	V438: Slavetice (CZ) – Durnrohr (AT) tie-line	Decided, budgeted e and prepared on CEPS side. Authorisation required on the Austrian side, type of authorisation procedure agreed with authorities (starting in 2008)	2008	This project is the result of bilateral agreement that has been reached between CEPS and APG to improve the existing V437 tie-line by installing the second system. Project participation was agreed to be proportional to the length of the line from the border. TSOs in charge: CEPS & APG
CZ – DE	Increasing power exchange capacity between the Czech Republic and Germany.	This project will increase the current power exchange capacity between the Czech Republic and Germany	Hradec (CZ) – Vernerov (CZ) – Vitkov (CZ) – Mechlenreuth (DE, E.ON Netz)	• Initial negotiations have been launched between the two sides – mutual information exchange of future network development plans • A joint study between E.ON Netz and VE-T on the impact of wind generating plants on the systems is expected to be carried out and reflected in this project.	First planning is due on 2016	It resulted from the discussions between CEPS and E.ON Netz to build a new 380-kV-double-circuit overhead interconnection line between Germany and the Czech Republic through two new 400 kV-substations TSOs in charge: E.ON Netz & CEPS. The findings and recommendations of the above mentioned study will be used as a basis for future negotiations between three sides: CEPS, E.ON Netz and VE-T.

Regional Forum Central East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
AT – DE	Increasing power exchange capacity between Austria and Germany	This project will increase the current power exchange capacity between Austria and Germany	380-kV-tie-line St. Peter (APG) – Isar (E.ON Netz)	Idea / Option	2017	New 380 kV double-circuit overhead interconnection line between Germany and Austria TSOs in charge: E.ON Netz & APG
AT – DE	Increasing power exchange capacity on AT – DE profile	Upgrading existing 220 kV grids in southern DE and western AT	Line Oberbachern (DE) – Silz (AT)	Idea / Option	Long term	145 km long new 400 kV double-circuit overhead line. (62 km existing line already designed for 400 kV) TSOs in charge: E.ON Netz & TIWAG-Netz AG
HU – SK	Improve the security and reliability of the network of both partners, increase transmission capacity in the north – south direction	Increase the power exchange capacity on Hungary – Slovakia profile. Possible effects will be evaluated in frame of joint studies	Sajóivánka (HU) – Moldava or Rimavská Sobota (SK) 400 kV double line	Idea, System plan	After 2015	Depending on the decision of both partners, this project will be Sajóivánka (HU) – Moldava or Rimavská Sobota (SK) 400 kV double line TSOs in charge: MAVIR & SEPS
PL – DE	Increasing power exchange capacity on PL – DE profile	Possible effects of this project will be evaluated in joint studies	Krajnik (PL) – Vierraden (DE)	Idea	After 2015	This project is the conversion of an existing 220-kV-double-circuit line into a 400-kV-line. TSOs in charge: VE-T (DE) & PSE Operator (PL) Financing scheme: not yet decided

Regional Forum Central East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
PL – DE	Increasing power exchange capability on PL – DE profile	Possible effects of this project will be evaluated in joint studies	Baczyna (PL) – German border (DE)	Idea	After 2015	This is the 3rd 400 kV interconnection between Poland and Germany with reinforcement of Polish internal grid. TSOs in charge: VE-T (DE) & PSE-Operator (PL) Financing scheme: not yet decided
PL – SK	Increasing power exchange capacity on PL – SK profile	Possible effects of this project will be evaluated in joint studies.	Byczyna (PL) – Varin (SK)	Under study	After 2018	This is a new 400 kV interconnection between Poland and Slovakia with reinforcement of Polish internal grid. TSOs in charge: SEPS (SK) & PSE-Operator (PL) Financing scheme: not yet decided
PL – LT	Incorporation of Baltic States into Internal Electricity Market (IEM) of European Union.	Possible effect should be evaluated in joint studies.	Elk (PL) – Alytus (LT)	Planning	≤ 2015	This is a new 400-kV-double-circuit interconnection between Poland and Lithuania together with Back-To-Back 1 000 MW station in Alytus (LT) and reinforcement of Polish internal grid. TSOs in charge: subject of decision. Financing scheme: not yet decided

Regional Forum Central East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
PL – UA	Resumption of existing and not used interconnection	It will increase the power exchange capacity on PL – UA profile Possible additional power flows from PL to SK are expected, caused by power imports from UA.	Modernisation and resumption of 750 kV Rzeszow (PL) – Khmelnitskaya (UA) OHL and installation of back-to-back 2x600 MW-converters in the Rzeszow 750 kV (PL) substation	Planning	≥ 2010	The project is the modernisation and resumption of existing 750 kV interconnection between Poland and Ukraine TSOs in charge: Subject of decision. Financing scheme: not yet decided
SK – UA	Increasing power exchange capability on SK – UA profile, accommodation of transits/imports of electricity	Possible effects will be evaluated in joint studies, as well as within IPS/UPS study or UA/MD interconnection study (if applicable)	2x400 kV line V. Kapušany (SK) – Mukachevo (UA)	Idea	After 2012	This new project will strengthen and reinforce the existing 400 kV interconnection between Ukraine and Slovakia with circuit doubling. TSOs in charge: subject of decision. Financing scheme: not yet decided
SK – AT	Creating an interconnection line between Austria and Slovakia	Possible effects will be evaluated in joint studies	2x400-kV-tie-line Stupava (SK) – Bisamberg/Wien SO (AT)	Idea	After 2020	New 400 kV SK - AT double-circuit interconnection TSOs in charge: SEPS (SK) & APG (AT)
AT – HU	Increasing the (n-1)-security and transmission capacity of the existing tie-line Wien SO (APG) – Györ (MAVIR)	The project will increase the (n-1)-security and transmission capacity on Austria – Hungary profile.	Tie-line Wien SO (AT) – HU border (Györ), 2nd System	Planning phase	2010	Installation of the 2nd system on the tie-line from Wien SO (AT, APG) to the border (both systems have already been installed on the Hungarian side) TSOs in charge: APG

Regional Forum Central South

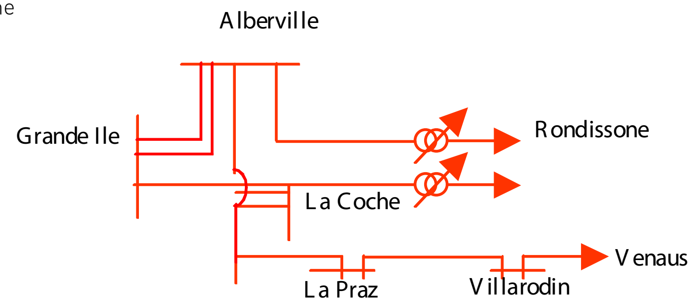
Regional Forum Central South

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
FR – IT	Take higher benefit from existing 220 kV Trinite – Victor (FR) – Camporosso (IT) interconnection line	The congestion level on 220 kV Trinite Victor Camporosso interconnection line is expected to increase with generation projects in Marseille area, with the result that this line will have to be open most of the time. The project is aiming at alleviating the congestion, allowing for closed operation of this line	PST on this line	Under study	2011	Installation of a PST in France or in Italy. TSOs in charge: RTE & TERNA

Regional Forum Central South

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
FR – IT	Increase of transfer capacity on France – Italy border	The 400 kV France-Italy interconnection relies on the only substation of Albertville on the French side; it is made up of a recently constructed double circuit line with big section conductors Albertville (FR) – Rondissone (IT) and an older axis, Albertville (FR) – La Coche (FR) – La Praz Saint André (FR) – Villarodin (FR) – Venaus (IT) – Piossasco (IT). The project aims to take best advantage of the existing network and increase the capacity of the latter axis, which limits transmission capacity towards Italy.	Upgrade the connection at the Italian – French border	Under study	2012	Replacement of Albertville (FR) – La Coche (FR) – La Praz (FR), La Praz (FR) – Villarodin (FR), Villarodin (FR) – Venaus (FR) and Venaus (IT) – Piossasco (IT) circuits by high temperature conductors is planned. Rehabilitation of a 400-kV-line currently out of voltage (Albertville (FR) – Grande Ile (FR) №3), with high temperature conductors and connection to one existing Albertville (FR) – Rondissone (IT) circuit. TSOs in charge: RTE & TERNA

Scheme



Regional Forum Central South

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
IT – SI	Congestions on Italian – Slovenian border	Increase the capacity of the current interconnection on the north-eastern Italian border, which has a low level of security and a low transfer capacity. The 380 kV Redipuglia (IT) – Divaca (SI) line is particularly congested, limiting power exchanges with Slovenia. TEN-E Project	New 380-kV-line on the north-eastern Italian border with Slovenia	Pre-authorisation phase	2013	New 380-kV-double-circuit line between Udine Ovest (IT) and Okroglo (SI). TSOs in charge: TERNA & ELES
IT – SI	Congestions on Italian – Slovenian border	Increase the capacity of the current interconnection on the north-eastern Italian border which has a low level of security and a low transfer capacity. Low security of supply on the Slovenian network. TEN-E Project	New 400 kV PST	Jointly agreed	2009	400/400 kV PST in Divaca (SI) substation TSO in charge: ELES
IT – SI	Congestions on Italian – Slovenian border	Increase the capacity of the current interconnection on the north eastern Italian border which faces low level of security and transfer capacity. The 220 kV Padriciano (IT) – Divaca (SI) line is particularly congested, especially in N-1 condition.	New 220 kV PST	Under construction	2008	220/220 kV PST on Padriciano (IT) – Divaca (SI) Interconnection, in Padriciano (IT) TSO in charge :TERNA

Regional Forum Central South

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
IT – AT	Constraints on Italian – Austrian border	Due to low line capacities on the north-eastern Italian border, there are limitations and congestions in case of Italian power import. The project aims to increase the transfer capacity of this border	New 380 kV Cordignano (IT) – Lienz (AT) line	Idea	Long term	New 380-kV-line between Cordignano (IT) and Lienz (AT). The existing 220 kV Soverzene (IT) – Lienz (AT) interconnection line would be dismantled to minimize the environmental impact. TSOs in charge: TERNA & APG
IT – AT	Increase of transfer capacity on Italian – Austrian border	In the 2003 TEN-E Study, the possibility of increasing transfer capacity between IT and AT within the Brenner Base Tunnel project was investigated. The GIL solution seems the most feasible, using the planned pilot tunnel of the Brenner Base Tunnel.	GIL Innsbruck – Bressanone	Under study	Long term	New 380 kV GIL interconnection through the planned Brenner Base Tunnel TSOs in charge: TERNA & TIWAG-Netz AG
IT – AT	Constraints on Italian – Austrian border	In order to increase security of supply and transmission capacity between Austria and Italy, a new tie-line at Reschenpass is currently being studied	220-kV-tie-line Reschenpass	Under study	Mid-Term	380/220 kV substation directly located at the border and erection of 220 kV connection till Graun and upgrade of the existing line Graun – Glorenza. Additional connection of 110-kV distribution grid in Austria at the new substation. TSOs in charge: TERNA, APG & TIWAG-Netz AG

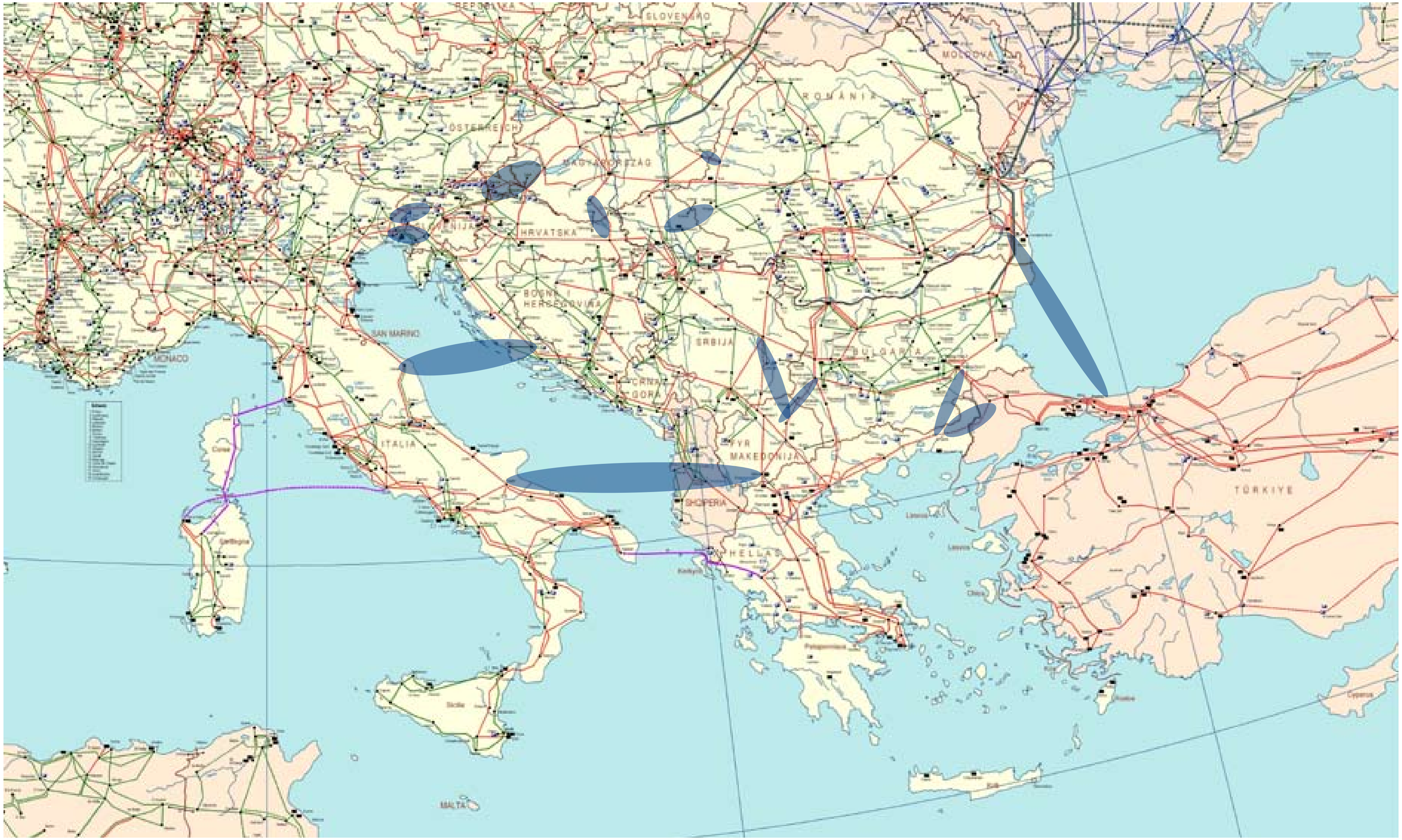
Regional Forum Central South

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
IT – AT	Constraints on Italian – Austrian border	In order to increase transfer capacity between Italy and Austria, a new link across the Valico del Brennero (Brennerpass) could be renewed.	110-/132-kV-line Prati di Vizze (IT) – Steinach (AT)	Under study	2011	The project on both sides (Italy and Austria) comprises the upgrading of the existing line Prati di Vizze (IT) – Steinach (AT), currently operated at medium voltage and the installation of a 110 kV/132 kV PST in Steinach (AT). TSOs in charge: TERNA & TIWAG-Netz AG
IT – CH	Cross border Italy – Switzerland	Increase of current power exchange, evacuation of future generation capacity in Switzerland	380-kV-line Lavorgo (CH)– Morbegno (IT)	Idea	2020	380-kV-line between Lavorgo (CH) and Morbegno (IT); different option are on the table TSOs in charge: swissgrid & TERNA
FR – CH	Cross border France – Switzerland	Elimination of current bottlenecks on the French – Swiss border, evacuation of future generation capacity in Switzerland and increase of current power exchange capacity between France and Italy	Different projects are currently studied	Under study	tbd	tbd TSOs in charge: RTE, swissgrid (& TERNA)

Regional Forum Central South

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
FR – IT	Increasing transfer capacity on French – Italian border	In the 2005 TEN-E Study, the possibility of increasing the transfer capacity between Italy and France has been investigated. The HVDC solution seems the most feasible, using existing infrastructure corridors.	HVDC cable Piossasco (IT) – Grande Ile (FR)	Under study	Mid Term	New HVDC underground cable interconnection between Piossasco 400 kV (IT) and Grande Ile 380 kV (FR), 1 000 MW. TSOs in charge: TERNA & RTE
IT – TU	Interconnection line between Italy and Tunisia	In June 2007, an agreement was reached between the Italian Minister for Economic Development and the Tunisian Minister for Industry and Energy, appointing TERNA and the Tunisian company STEG to set up a joint venture to create the electricity interconnection, manage international transits of electricity on the link and launch a bid to build a power plant in Tunisia.	New HVDC submarine cable between Tunisia and Sicily	Jointly agreed by the Ministries	2011	A new interconnection cable will join the Cap Bon peninsula in Tunisia with Sicily and carry electricity generated by a new power plant in El Haouria, Tunisia. The plant will generate 1 200 MW, 800 MW of which will be directed towards Italy and 400 towards Tunisia. The submarine cable will be a double cable, 170 km in length, and have a 1 000 MW capacity, 200 MW of which will be guaranteed to the free access share. TSO in charge: TERNA & STEG

Regional Forum South East



Regional Forum South East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
MK – BG	Establishing East – West Corridor in south western Europe (SEE)	Increase Italy's imports from the Balkans (BG, RO) Strengthen the sparse structure of the Balkan networks. 400 kV interconnection MK – BG will increase transfer capacities in North – South direction in SEE. This line is also part of East – West corridor in SEE and creates opportunities for increased power exports towards Italy from countries with surplus power (BG, RO).	Stip (MK) – C. Mogila (BG) 400-kV-line	under construction	2008	Length: 150 km TSOs in charge: MEPSO & NEK
MK – AL & AL – IT / ME – IT			Bitola (MK) – Elbasan (AL) – Tirana (AL) – Durres (AL) – Foggia (IT) 400 kV OHL & DC cable Montenegro – Italy is an alternative to Albania – Italy	under study	2012	OHL length ~ 200 km cable length ~ 350 km TSOs in charge: MEPSO (MK), ATSO (AL), TERNA (IT) and possibly EPCG (ME)
AL – ME	Alleviate congestion in the region	To establish a stiff corridor from GR – AL – ME up to the Adriatic line.	Tirana (AL) – Podgorica (ME) 400-kV-line	Under construction	Third quarter of 2009	400 kV Line Tirana2 (AL) – Podgorica (ME) with length 157 km (128.5 km on Albanian side, 76 km of which with double circuit and 28.5 km on Montenegrin side) The contract for the construction is signed with Dalekovod Company TSOs in charge: ATSO & EPCG

Regional Forum South East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
HU – RO	Strengthening East – West and North – South corridors	Strengthen the interconnection to South and increase the transmission capacity	400-kV-line Bekescsaba (HU) – Nadab (RO)	under construction	2008	Increase exchange capability between HU – RO TSOs in charge: MAVIR & Transelectrica
HU – HR			400-kV-double line Pecs (HU) – Ernestinovo (HR)	under construction	2010	TSOs in charge: HEP-OPS & MAVIR
GR – TR	Northern Borders	Alleviate the import limitations from the northern interconnections mainly due to the sparse structure of the Balkan networks	N. Santa (GR) – Babaeski (TR) 400-kV-line	under construction	To be commissioned in 2008	Possible operation for temporary local exchanges with an islanded part of the Turkish power system. Length 130 km TSOs in charge: HTSO & TEIAS
GR – BG			N. Santa (GR) – Maritsa (BG) 400-kV-line	under study	tbd	New interconnection line between GR – BG, length 130 km approximately TSOs in charge: HTSO & NEK
SI – HU **&** **SI – HR**	East border	Connection to new power system and increase of power exchange capability.	400-kV-double-line Cirkovce (SI) – Pince (HU) border for connection as Cirkovce (SI) – Heviz (HU) and Cirkovce (SI) – Zerjavinec (HR)	preparation for authorization	2011	1 st 400-kV-interconnection-line between Slovenia and Hungary. The line already exist on Hungarian and Croatian sides TSO in charge: ELES
GR – IT	Increase of interconnection capacity	Increase the transfer capacity between Greece and Italy	Second HVDC link between Greece and Italy.	Preliminary study foreseen	tbd	400 kV DC interconnection TSOs in charge: TERNA & HTSO

Regional Forum South East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
HR – IT	Create a subsea interconnection between Croatia and Italy	Create the first direct connection between Croatia and Italy, which is of inter-regional importance for Internal Electricity Market	400 kV HVDC subsea cable between Croatia and Italy	under study	2014	500 – 1000 MW TSOs in charge: TERNA & HEP-OPS
MK – RS	North – South Corridor in SEE	MK, AL and GR imports from the North are currently limited, due to sparse structure of the Balkans networks The project aims at increasing the transfer capacity	Stip (MK) – Nis (SR) 400-kV-line	under study	2010	length ~ 220 km TSOs in charge: MEPSO & EMS
RO – TR	South East border	Enable the power export to Turkey	400 kV DC submarine cable Constanta (RO) – Pasakoy (TR)	under study	2018	Length 400 km TSOs in charge: Transelectrica & TEIAS
RO – RS	Eastern corridor	Increase security of entire interconnection operation	400-kV-line Sacalaz(RO) – Novi sad (RS)	under study	2015	Length 128 km TSOs in charge: Transelectrica & EMS
RS-HU	Strengthening the interconnection between HU and RS	Create a new 400 kV line between Serbia and Hungary	New 400 kV line Pecs (HU) – Sombor (RS)	Idea	tbd	400-kV-single-line This project is in very initial stage TSOs in charge: MAVIR & EMS

Regional Forum South West

Regional Forum South West

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
PT – ES	Portugal – Spain Duero Interconnection	Alleviate the congestion on the 220 kV network in the Duero area.	New 400 kV Duero interconnection Aldeadávila (ES) – Lagoaça (Duero Internacional , PT)	Permitting (almost under construction)	2009	New OHL interconnection line Aldeadávila (ES) – Lagoaça (PT). AC Voltage 400 kV Transmission Capacity: 1 690 MVA (winter) Length: 1 km in Spain, 5 km in Portugal TSOs in charge: REN & REE
PT – ES	Portugal – Spain Duero Interconnection	Alleviate the congestion in the 220 kV network on the Duero area.	Changes in the topology of the 220-kV-lines in this area	Permitting (almost under construction)	2009	Changes in the topology of the 220-kV-lines in this area. These changes, mainly in the Portuguese 220 kV network, lead to substitute the existing line Aldeadavila (ES) – Bemposta (PT), by a second circuit Aldeadavila (ES) – Pocinho (PT). TSOs in charge: REN & REE

Regional Forum South West

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
PT – ES	Portugal – Spain South Interconnection	Alleviate the congestion that occurs on the existing 400 kV line Alqueva (PT) –Brovales (ES) at low levels of exportation from Spain to Portugal. Besides, the project enables the total integration of Spain and Portugal inside MIBEL.	New 400 kV South interconnection Guillena (ES) – Puebla de Guzman (ES) – Tavira (PT)	Under construction (Guillena (ES) – P. Guzman (ES)) Defining final route (P. Guzman (ES) – Tavira (PT)).	2010 – 2011	New OHL Double Circuit line between Guillena (ES) – Puebla de Guzman (ES) and Tavira (Sotavento, PT). On the section P. Guzman (ES) – Tavira (PT) initially only one circuit will be placed. AC Voltage 400 kV Transmission Capacity: 1 700 MVA (winter) Length: 152 km in Spain, 40 km in Portugal TSOs in charge: REN & REE

Regional Forum South West

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
FR – ES	Constraint on France – Spain border	The total interconnection faces a high level of congestion limiting the transmission capacity. Limitations on production of wind power energy in the Iberian system. The project aims at eliminating these constraints.	New 400-kV-interconnection-line in the eastern part of the border	Defining final route	2011 – 2012	New double circuit line between Baixas (FR) and Santa Llogaia / Ramis or Vic (ES) AC Voltage 400 kV Transmission Capacity: 2*2 160 MVA (winter) Length: Strategy Baixas –Vic: 50 km in Spain, 57 in France. or: Strategy Baixas-Sta Llogaia: 28 km in Spain, 40 in France Included in the Priority Interconnection Plan (TEN-E Guidelines). A European Coordinator has been appointed by the European Union for this project. TSOs in charge: RTE & REE

Regional Forum South West

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Description of Project
PT – ES	Portugal – Spain North Interconnection	Alleviate the congestion on the existing 400-kV-line Cartelle (ES) – Lindoso (PT) at low levels of exportation from Spain to Portugal. Besides, the project enables the total integration of Spain and Portugal in MIBEL.	New 400 kV North interconnection	Under environmental studies	2013 – 2014	New OHL double circuit line between Cartelle-Pazos (ES) and Vila Fria (PT) – Vila do Conde (PT) – Recarei (PT). On the section Pazos (ES) – Recarei (PT) only one circuit will be placed. AC Voltage 400 kV Transmission Capacity: 1 700 MVA (winter) Length: 110 km in Spain (up to Cartelle), 112 km in Portugal (up to Recarei) TSOs in charge: REN & REE

APPENDIX 2

UCTE MEMBERS
INTERNAL GRID DEVELOPMENT

AT – AUSTRIA

Operational Constraints

The 380/220 kV transmission Verbund-APG grid is characterised by a well developed system in northern Austria (so called »Danube«-Axis: St. Peter – Ernsthofen – Dürnrohr – Bisamberg – Wien SO) and south-western Austria (Kainachtal – Obersielach – Lienz – Tauern – Zell/Ziller – Westtirol). The main problems are the noticeable gaps in the 380 kV transmission grid, especially in north-to-south direction. These gaps are causing severe congestion on the old, weak 220-kV-north-south lines and violations of the (n-1) security.

Due to the age and low transmission capacity of the 220 kV Zell/Ziller – Strass – Thaur – Silz – Westtirol line, TIWAG-Netz AG is carrying out a study into upgrading this 220-kV-line to a 380-kV-line. In the meantime, the line capacity will be increased by mounting new conductors and the load flow could be partly redirected to parallel 220 kV lines with load flow reactors.

Beside these difficulties within Austria, the weak tie-line to Italy (220 kV Lienz – Soverzene (TERNA) line) causes operational difficulties within the Central South Regional Forum. Furthermore, congestion is expected at the border with E.ON (St. Peter) in the near future.

Heavy north-to-South-Congestions

APG is strongly affected by market-price driven power plant operation and increasing international power exchanges (imports and exports). These influences are causing heavy north-south flows and, especially in the north, high east-west flows within the APG grid. Serious congestion in the Austrian network occurs on the three 220-kV-lines from the north to the south. Since 2001 the (n-1) criterion was repeatedly violated, especially in the winter season, although extensive congestion management measures had been taken.

Verbund-APG has to take countermeasures to reduce these congestion and ensure security of supply. This is done by re-dispatching of power plants, special switching within network operation and by operating three phase shifting transformers (PST) since December 2006. The installation of the three 220/220 kV PST (one for each north-south line) was an emergency measure to alleviate the north-to-south congestion.

Main internal projects in Austria – closure of the 380 kV line ring

Due to Austria's central location in Europe and the resulting high utilization of the transmission grids in combination with the gaps in the 380 kV grid, the closure of the Austrian 380 kV line-ring and the further development of certain 380 kV interconnections (tie-lines) to neighbouring control areas are still the main issues. Beside these congestion-driven investments, the renewal of the old 220-kV-lines and carefully undertaken maintenance activities will ensure the future security of supply in Austria.

Main internal projects for Verbund-APG:

1. 380 kV Südburgenland – Kainachtal (currently being erected) line;
2. 380 kV St. Peter – Salzach neu line;
3. 380 kV Salzach neu – Tauern line;
4. 220/220 kV PST at the Lienz substation for the Lienz – Soverzene tie-line.

Main internal projects for TIWAG Netz AG:

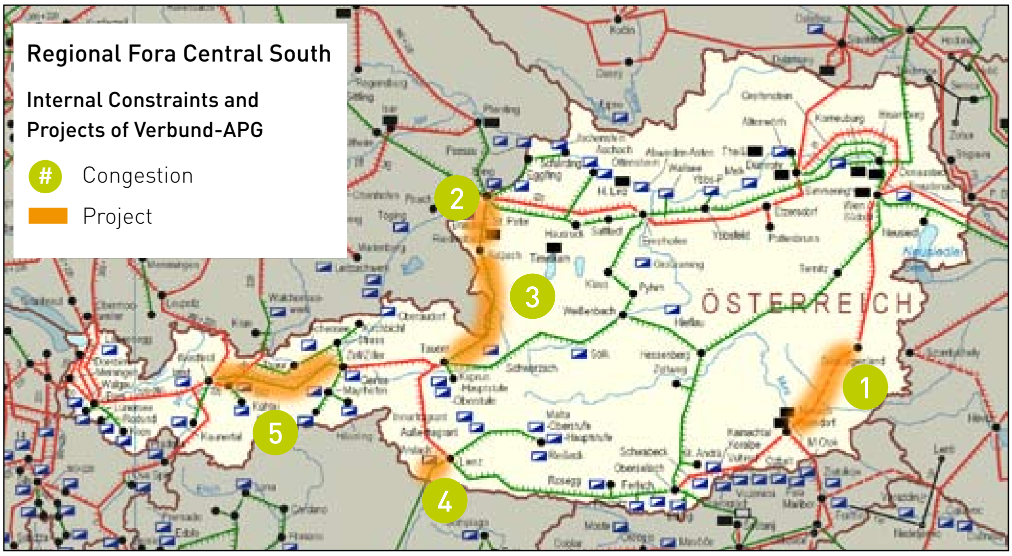
5. Reinforcement of the line Zell/Ziller – Strass – Thaur – Silz – Westtirol, 220 kV or upgrade to 380 kV;

- TIWAG-Netz AG is also carrying out a TEN-E study into the influence of new planned (pump) storage power plants (approx. increase of 1 500 MW) on the existing and planned transmission grid in Tyrol (including the 400-kV-line through the Brenner Base Tunnel (BBT).

VKW-Netz AG (and Vorarlberger Illwerke AG):

- Upgrades and extensions to substations, additional transformer.

Figure 1: Internal Constraints and Projects



BE – BELGIUM

At the moment, significant increases in electricity consumption, by industrial customers in the Port of Antwerp in particular, have been announced. In parallel, it is necessary to increase the import capacity of the Belgian system.

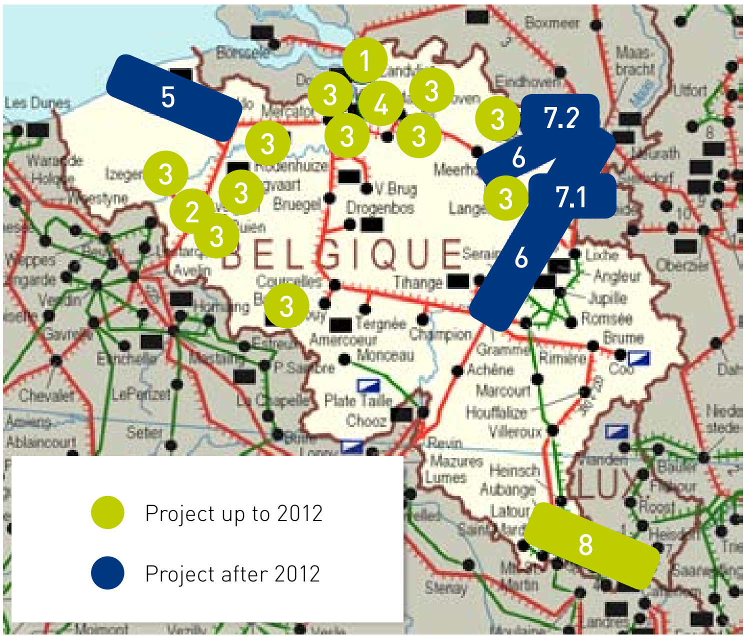
The relevant projects will allow new generators in the Antwerp area to be connected via a new 380 kV substation in Lillo (item 4). These projects will therefore not only help open up the Belgian market, but also improve security of supply.

To increase its import capacity, Elia has already decided to install two additional 400 / 150 kV transformers (in Avelgem (item 2) and Zandvliet (item 1) respectively) and 150 kV capacitor banks in several substations (12 banks of 75 MVAR each, item 3).

A project of a new 220 kV connection (2 times 500 MVA, item 8, under study) aims at increasing the exchange capacities with Luxembourg.

In the long term, Elia is considering several possible reinforcements aiming at increasing further the Belgian import capacities and / or contributing to the integration of the European market (items 5 – 7).

Figure 2: Projects & Studies in Belgium



BG – BULGARIA

The transmission grid of the Bulgarian Electical Power System is connected by tie-lines with the following countries: Romania, Serbia and Greece. There are also two lines to Turkey, which are temporarily out of operation.

When all transmission elements of internal network are in operation, the »n-1« security criterion for the Bulgarian internal grid is met without constraints.

The major developments in the Bulgarian High Voltage network are as follows:

- 400 kV Stip (FYROM) – Chervena Mogila (BG) OHL[16];
- 400 kV Maritsa East 1 (BG) – Nea Santa (GR) OHL – in negotiation progress;
- Several internal 400 kV OHL with a total length of approximately 500 km in connection with the commissioning of the Belene Nuclear Power Plant (NPP);
- 400 kV Zlatitsa – Plovdiv internal OHL

Figure 3: Map of the Bulgarian Network

16 Overhead Line

CH – SWITZERLAND

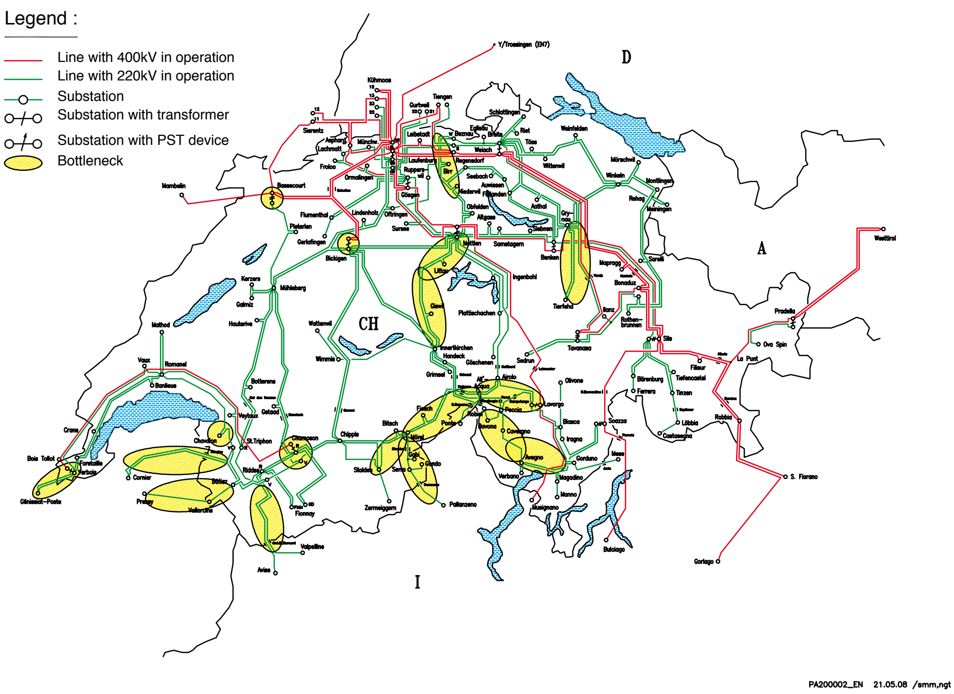
The Swiss Federal Department of the Environment, Transport, Energy and Communication appointed a high level working group (WG) on Transmission Lines and Security of Supply in 2005 to deal with the needs of the network development in the future. In February 2007, the WG released the final report regarding the Swiss strategic network 2015 (T+5, T+10). The following planning criteria were considered:

- Elimination of current and future bottlenecks and decreasing the load on critical network elements;
- (n-1)-security;
- Security of supply and voltage stability;
- Connection and evacuation/transmission of new and increased power injection/absorption (pump);
- Coordination of the corridors;
- European interconnection.

In view of the development of hydro power generation and pump storage power plants in the Swiss Alps, internal constraints to be faced will be caused by the evacuation and draining of the power flows on the North/South axis.

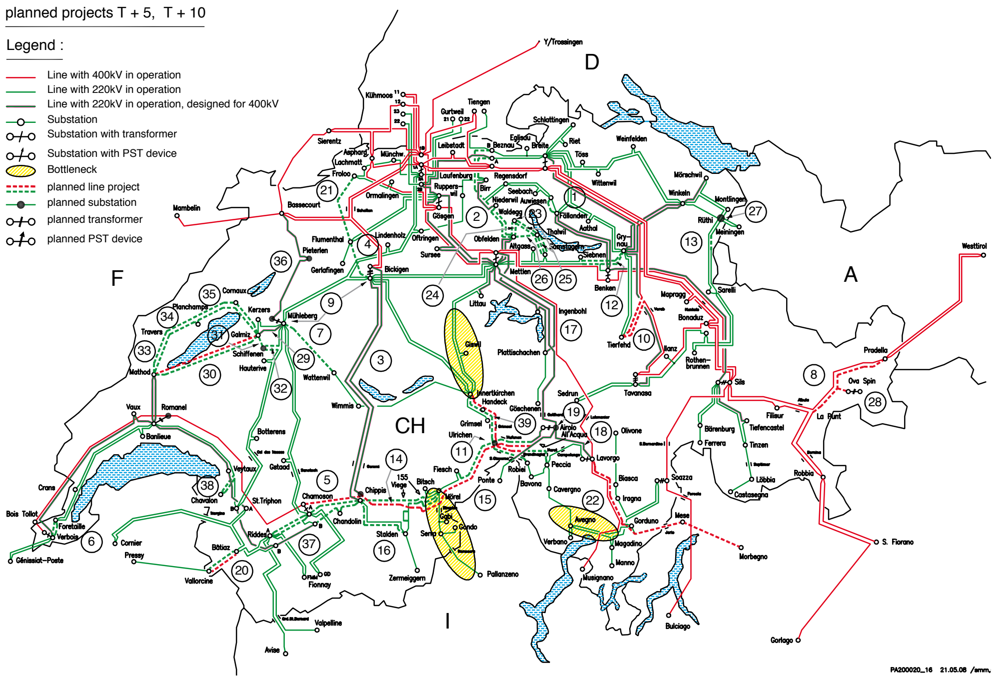
The following map shows the main areas where congestion will occur if the grid is not developed:

Figure 4: Forecasted Congested Areas in Switzerland



The following map shows the main congested areas concerned with grid development:

Figure 5: Swiss 380 & 220 kV Grid Development and Congested Areas



The planned projects will eliminate most of the existing and future congestion.

CZ – CZECH REPUBLIC

Development of the Czech transmission system with regard to possible internal congestion and other issues related to export/transit of electricity through the Czech network system is driven by following trends:

1. Refurbishments of existing coal-fired power stations and plans to build several new stations with nominal power of 660 MW;
2. Connection of renewable sources, including wind farms, to the transmission system;
3. Local rapid growth of consumption due to revitalization of heavy industry and new industrial zones in North Moravia (in the northeast of the Czech Republic)
4. Influence of international cooperation, support of Internal Electricity Market and possible enlargement of UCTE to include the Ukraine/IPS transmission system.

In the northwest part of the Czech Republic close to the border with Germany, the program for refurbishment of existing coal-fired power stations and plans to build new units with nominal power up to 660 MW are under preparation. These IPP[17] plans will lead to concentration of installed power in this region and a need to transfer surplus power from this region into consumption centres in the eastern part of the transmission system. To ensure security of supply and allow connection of the new units, CEPS has to build one new 400 kV substation, two new 400 kV lines and double three existing ones. The total length of upgraded or newly-erected lines will be up to 250 km.

Two new substations will be built to directly connect large wind farms to the Czech transmission system. These substations are planned to be close to existing transmission lines. The total power from wind farms connected to Czech grid will reach 400 MW.

Due to revitalization of heavy industry and new industrial zones in North Moravia (in the northeast of the Czech Republic), rapid growth of consumption is announced. Planned decommissioning of old coal-fired units connected to distribution voltage level will increase demand on additional transformation capacities and will lead to the construction of a new 400 kV substation.

The transmission system in the Czech Republic is connected to UCTE through Germany, Poland, Slovakia and Austria. The Czech Republic is located in the centre of the Central Eastern Europe region and its interconnection with its neighbours is relatively strong. Nevertheless, border profiles, especially with Germany, Poland and Austria, are highly utilized by commercial flows and also parallel flows from other TSOs. An auction mechanism on all profiles was introduced in recent years as a way to relieve congestion. The Czech transmission system's central location predetermines its important role in the integration of European market. Higher volatility of energy source/sink origin/destination, energy transfer on long distances, frequent changes of TSO balances, IPS system connection and further factors will cause more frequent occurrences of congestion on Czech profiles. Therefore, greater energy transits from north to south and east to west are expected and several projects to cope with these trends are currently being prepared.

Czech – Austria profile: To increase the (n-1) – security and transmission capacity of the existing V437 Slavetice (CEPS) – Durnrohr (APG) tie-line, a bilateral agreement has been reached between CEPS and APG to upgrade the existing V437 tie-line by installing the second system (see project №1 on the map). Project participation was agreed to be proportional to the length of the line from the border. This investment should be realised in 2008.

Czech - Poland profile: To strengthen the CEPS' network system on the interface with PSE, CEPS will reinforce the internal network on the North Moravian section of the Czech system, which will increase the north-south transmission capacity. The existing V403 Prosenice – Nosovice line (see project №2 on the map) will be replaced by new double line. The project should be completed after 2015. The second project on this part of grid is the construction of the new V458 Krasikov – Horni

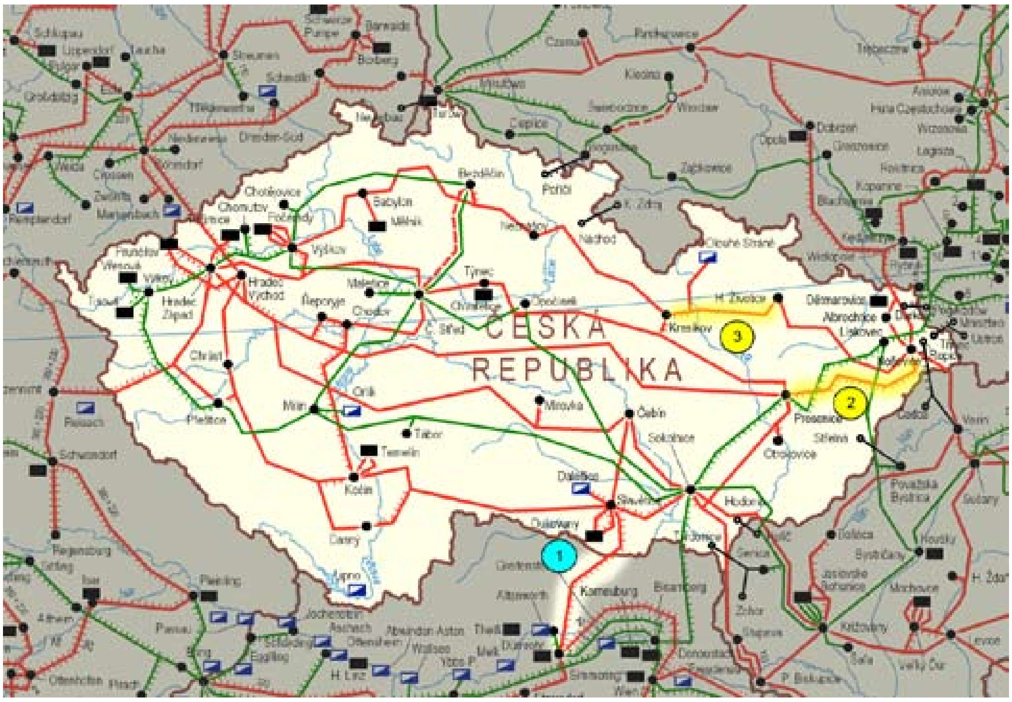
17 Independent Power Producer

Zivotice line (see project №3 on the map). This line will boost the northern section of the CEPS' network system and close the mesh on this part of the system. The line is planned to be completed in 2012 – 2013.

Czech – German profile: Discussions between CEPS and E.ON Netz to build a new 380 kV double-circuit overhead interconnection line between Germany and the Czech Republic through two new 400 kV substations (E.ON Netz ↔ CEPS) Hradec – Vernerov – Vitkov – Mechlenreuth (see project № 4 on the map) were launched between the two TSOs. It is expected that a joint study between E.ON Netz and VE-T focusing on the impact of wind-power generating plants to the systems will be carried out and reflected in this project. The findings and recommendations of the abovementioned study will be used as a basis for the future negotiations between three parties: CEPS, E.ON Netz and VE-T. First planning is due after year 2016.

Czech – Slovak profile is well dimensioned and no serious congestion is expected at present or in the near future. Several projects have been discussed for the long term.

Figure 6:
Map of Projects in the Czech Network
(internal and interconnection tie-lines)



DE – GERMANY

Germany's transmission grid is directly connected by tie-lines to the following countries: Netherlands, Luxembourg, France, Switzerland, Austria, Czech Republic, Poland and Denmark. In northern Germany there are also DC – cable interconnections with Denmark and Sweden.

Due to significant changes in the structure and location of generation units in Germany an increase in north – south transit flows is expected; these already have significant influence on the internal German grid as well as on some international interconnections. These changes in the in the feed-in situation result primarily from the following developments:

- Nuclear consensus (large number of nuclear power plants in southern Germany which will be shut down);
- Increase of renewable energy, especially offshore and onshore wind farms in northern Germany;
- Increasing number of new thermal power plants, primarily concentrated in short term in the west and in long term in the north and east of Germany.

Until 2018, generation capacity is expected to increase by some 52 GW including 23,4 GW from offshore and onshore wind farms. Moreover, in view of the requests for interconnections of the power systems in Ukraine and Moldova as well as the Baltic TSOs to the UCTE system (independent from the ongoing UCTE-IPS/UPS-Study), significant transit from east to west is expected.

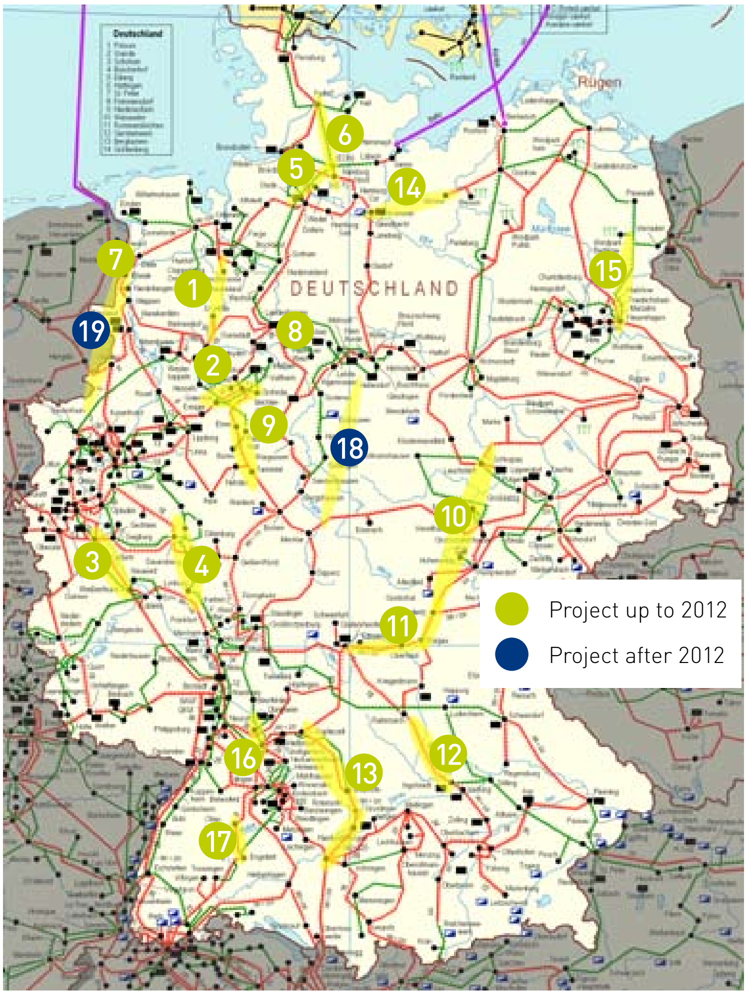
A large number of projects in Germany also involve the connection of new conventional generation units and offshore/repowering projects for Renewable Energy Sources (RES) to the transmission grid.

These developments, as well as progress towards the creation of the internal electricity market (IEM) will have a major impact on utilization of the network. Significantly higher energy transit from North to South and East to West are therefore expected. This can lead to further investment in new transmission lines, reactive power devices and FACTS[18] , which will be described further in detail in the next edition.

Several projects and studies were launched to investigate the impact on the international transmission system and to avoid congestion situations in the future (e.g. Dena study 2005). Figure 7 highlights major internal grid development projects with significant impact on the transmission capacities of the German transmission grid. Several of the projects are currently subject to approval procedures.

18 Flexible Alternating Current Transmission Systems

Figure 7: Internal Grid Development Projects in Germany



No	Grid development project
1	400 kV OHL Ganderkesee – Wehrendorf
2	400 kV OHL Gütersloh – Bechterdissen
3	400 kV OHL Neuenahr – Weißenthurm
4	400 kV OHL Dauersberg – Hünfelden
5	400 kV OHL Hamburg/Nord – Dollern
6	400 kV OHL Audorf – Hamburg/Nord
7	Phase shifting transformers at Diele
8	Capacitors at Dollern, Borken, Landesbergen
9	400 kV OHL second circuit Bechterdissen – Twistetal
10	400 kV OHL Halle/Saale – Schweinfurt
11	Upgrading from 220 kV to 400 kV OHL Redwitz – Grafenrheinfeld
12	Upgrading from 220 kV to 400 kV OHL Raitersaich – Irsching
13	Upgrading from 220 kV to 400 kV OHL Kupferzell – Dellmensingen
14	400 kV OHL Hamburg/Krümmel – Schwerin
15	400 kV OHL Neuenhagen – Bertikow
16	400 kV OHL Mannheim – Neurott
17	400 kV OHL Engstlatt – Oberjettingen
18	400 kV OHL Wahle - Mecklar
19	400 kV OHL Diele – Niederrhein

ES – SPAIN

The new infrastructure planned for the transmission network (220 kV and 400 kV voltage levels) are presented in the first draft of the document »Planificación de los Sectores de Electricidad y Gas 2007 – 2016. Desarrollo de las Redes de Transporte«.published by the Government in July 2007. The final version will be published at the beginning of 2008. This Master Plan includes works to upgrade existing lines, new lines, new substations and enlargements or enhancements to the existing ones, new transformer units and new reactive compensation equipments.

The development plan in Spain for the next 10 years is quite ambitious. There are several reasons for this huge number of new projects. Firstly, the growth of demand in Spain will be still quite significant. On the other hand, regarding the new generation plants, the number of expected projects is also quite high even taking into account only those whose construction is more certain. In addition, renewable sources, mainly wind power generation, are usually located in quite isolated areas where there is no transmission infrastructure. The main reasons for the new infrastructure are to resolve existing and future congestions, support the distribution network (enhancement of the security of supply), connect and evacuate new generation capacity, and supply the numerous new high-speed trains, a development to which the Spanish government has committed itself.

The main internal projects on the 400 kV network in Spain planned for the coming years are as follows.

Northern area

The north western area is characterized by the high number of generation projects (present and future) mainly combined cycles and wind power farms. This situation produces constraints in the north-south flows and northwestern – northeastern flows. The new projects planned to alleviate these congestions are:

- 400 kV double circuit Mesón-Cartelle
- ASGA project between Galicia and Asturias, closely connected with the evacuation of wind power energy
- 400 kV North axis (Soto-Penagos-Abanto-Gueñes-Ichaso), related to the northwestern – northeastern flows
- 400 kV double circuit Sama-Velilla and the 400 kV Asturias Ring, that alleviates the congestions related to the evacuation of generation capacity from Asturias to the central area.

Eastern area

There are consumption-production imbalances between the Navarra/Aragon area (with surplus production; mainly combined cycles and wind power farms) and the Catalonian and Levante (Mediterranean coast) areas, characterised by high and increasing demand). This situation produces constraints in the north-Levante flows and north–south flows in the Mediterranean axis and requires major upgrades on the 220 kV network in Catalonia and on the Mediterranean axis to increase security of supply. The new projects planned to alleviate these congestions are:

- 400 kV double circuit Vitoria – Castejon – Muruarte
- 400 kV double circuit La Serna – Magallón
- 400 kV axis Teruel – Mudejar – Morella, Fuendetodos – Mezquita – Morella and Morella – La Plana, related to the north-levante flows
- 400 kV double circuit Aragón – Monzón – S.Pallars, related to the constraints between Aragón and Cataluña
- 400 kV double circuit Mezquita – Platea – Turis, related to the constraints between Aragón and Castellón.
- Upgrade of the 400 kV axis La Eliana – La Plana, in the Levante axis
- New 400 kV axis Cofrentes – Ayora – Pinilla, to solve congestions between Valencia and Castilla, and to integrate wind power energy

The new HVDC project (COMETA) that connects Morvedre and Santa Ponsa (Mallorca) represents the connection of an isolated system (the Balearic Islands) to the UCTE system through the Spanish mainland.

In addition, the new 400 kV double circuit Vic/Senmenat – Bescano – Ramis Sta. Llogaia will alleviate the Catalonian area in contingencies and develop the transmission network in a poorly-meshed area, thus enhancing the security of supply and allowing new generation capacity to be connected to the network. Moreover, it is closely related to the new interconnection with France by the eastern border.

Southern area

The southern area has several dispersed generation and demand cores that produce changing flows depending the market conditions. The new projects planned to alleviate the congestions of this area are:

- Upgrades to the evacuation of generation capcity in the Murcia region.
- 400 kV axis Arcos – La Roda – Cabra – Guadame that alleviates the congestions in evacuation from the Cadiz region
- New 400 kV axis Guillena – Brovales – Arroyo S. Servan – Almaraz, that connects several existing and new generation points and the high demand in Sevilla. Besides it can be also related to the new southern Portugal-Spain interconnection
- 400 kV axis Caparacena – Baza – La Ribina, that alleviates congestions in the east-west flows between Murcia and Andalucia, and allows the integration of new renewable energy projects.
- Reinforcement of the 400 kV Ring of Sevilla

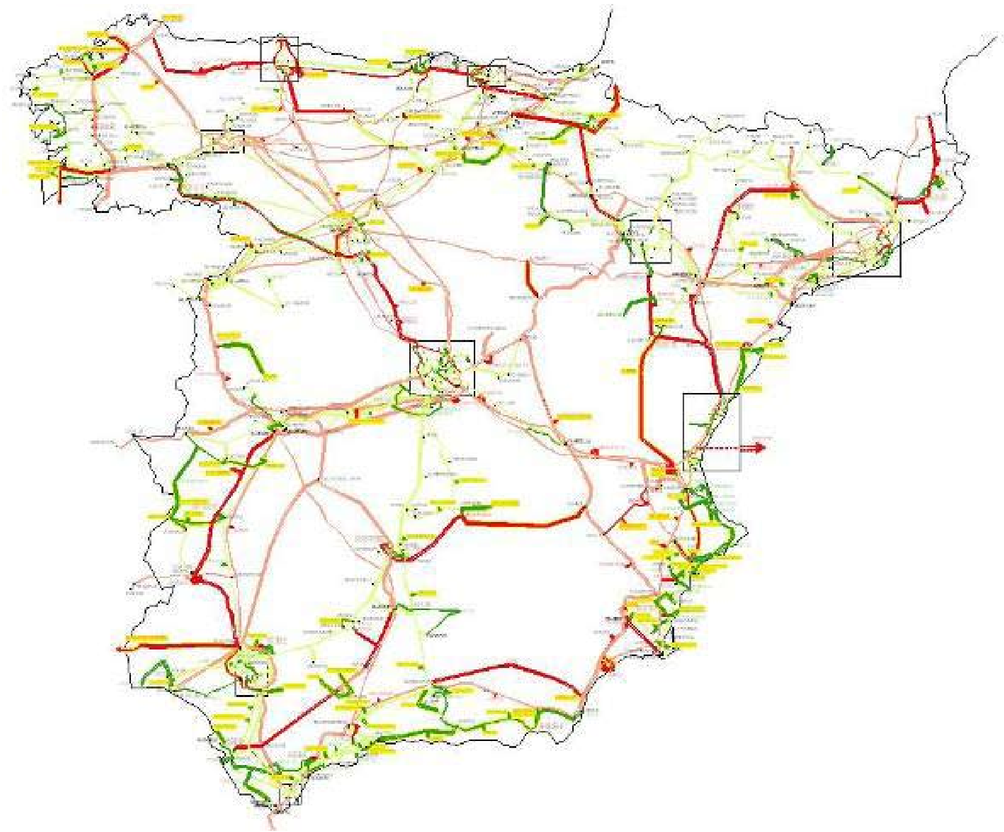
Central area

This area is characterized by the high and increasing demand in Madrid, whereas the main generation areas are located far away. This situation produces high congestion in the flows towards the centre of the country, Madrid. The new projects planned to alleviate these congestions are:

- The SUMA project and the 400 kV axis Trives-Aparecida-Tordesillas that alleviates the congestion of the northwestern flows towards Madrid.
- Reinforcement of the 400 kV Ring of Madrid
- Upgrading of the 400 kV lines between Aldeadavila, Almaraz, the Portuguese border and Madrid
- 400 kV double circuit Manzanares-Brazatortas, and the Transmanchega project, related mainly to the wind power energy.

The figure below shows the main lines planned in the Spanish transmission network, identified by the darker lines (dark red = new 400 kV network, dark green = new 220 kV network).

Figure 8: Main Infrastructure Planned in Spain 2007 – 2016



Source: »Planificación de los Sectores de Electricidad y Gas 2007 – 2016 – Desarrollo de las Redes de Transporte« Primer Borrador – Julio 2007 MITYC

FR – FRANCE

Given that generation capacity will essentially be developed in northern and southern France, the constraints faced will be the evacuation of the power flows on the north/south axes and the south-east axes.

North

The power flows on the interconnection network in northern France are usually significant and unpredictable, and depend on market prices in Great Britain, France, Belgium, the Netherlands and Germany.

Some projects have been decided or are currently being studied to solve these congestions by:

1. changing the conductors on the 400 kV Avelin – Weppes – Warande double axis, close to the interconnection with Belgium and Great Britain (ongoing works);
2. reorganising (short term) the 225 kV network in this area (Mastaing area), to create new opportunities for (thermal) producers and for the entire 90 kV network (wind turbines);and carrying out a large study covering all northern France in order to determine the appropriate reinforcements in the internal grid close to the interconnection (mid and long term).

East

3. A new line is currently being constructed between Marlenheim and Vigy to increase security of the supply in the Alsace area.

In the Lyon and Alps area, to avoid the re-dispatching due to the weak capacity of the local existing network, the main projects are as follows:

4. construction of a new double line between Chaffard and Grande-Ile (this axis has been in operation since the end of 2007);
5. changing the conductors (short term) on the 400-kV-line Albertville – Montagny – Cornier, to facilitate the use of hydroelectric power stations (pumps) without any restrictions.

South

6. Given the increase in generation capacity in the southeast, the following projects are required: build (short term) a new double axis Feuillane – Ponteau – Realtor for new thermal producers;
7. change (short term) the conductors on the double-circuit 400 kV Tamareau – Tavel line between the southeast and the southwest, to avoid congestion in the event of unbalanced situations between these two areas.
8. The security of supply in the southeast will, in the short term, be increased after full reorganization of the local network using PST, changing of conductors or doubling existing axis.
9. The Gaudière Rueyres 400 kV line must be reinforced (in the medium term) to be adapted for wind turbine development.

West

The local network needs to be reorganised to:

10 increase the local security of supply;

11 and also create new opportunities for producers.

Normandy

The creation of a new axis is necessary to deal with:

12 the loss of synchronism constraint due to the future connection of EPR[19] nuclear plant;

13 congestion with new thermal producers (coal) near Le Havre.

Other projects

At the same time, RTE has decided to rehabilitate several substations to deal with short circuit constraints and install capacitors for supporting the voltage level in case of contingencies particularly in south-eastern 8 and western France 10, and on Paris mesh 14 .

Long term horizon

The expected development of generation capacity in south-eastern France could create in this area some risks of loss of synchronism that RTE should deal with.

Figure 9: Internal Grid Development Projects & Studies in France

19 European Pressurized water Reactor

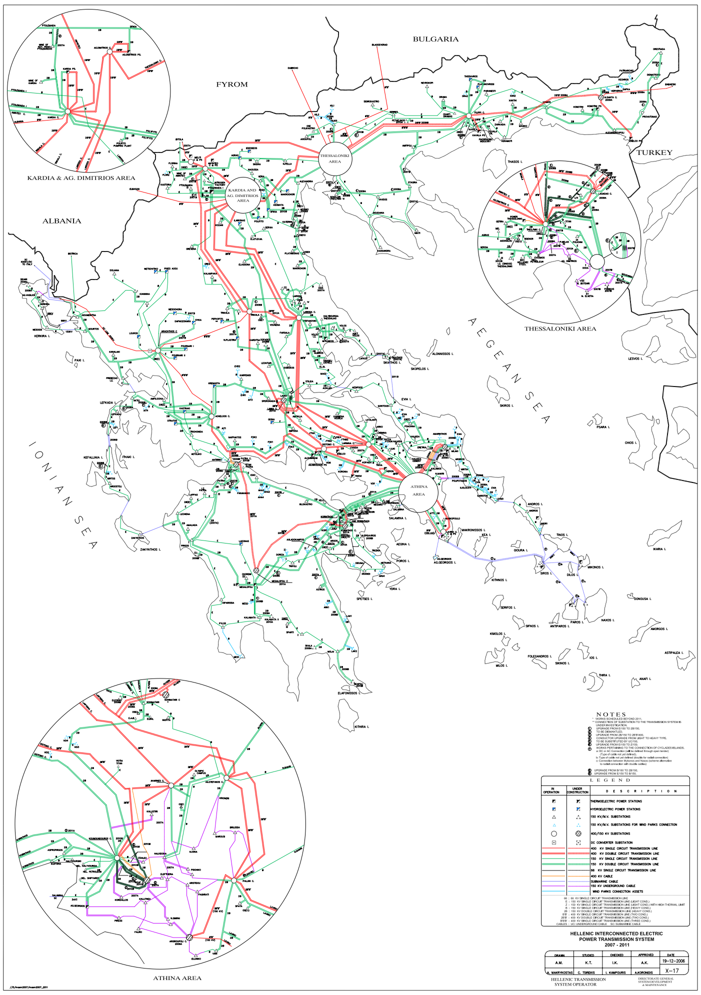
GR – GREECE

One important characteristic of the Greek system is a large power transfer from the north of the country to the south, due to the fact that the main generation units are located in the north and most energy is consumed in the south. Several transmission system projects have been planned over the coming years to strengthen the southern section of the transmission network. These projects consist of five new 400/150 kV substations and 510 km of 400-kV-transmission-lines.

As for new projects affecting Greece's interconnections and international exchange transfer capacities, two new EHV S/S will be constructed:

1. N. Santa S/S, will be used for the 400 kV interconnection with Turkey. This S/S will be connected with the rest Greek system with a new 400 kV OHL (double circuit) that will operate parallel to the existing 400 kV OHL (single circuit) Filippoi – Thessaloniki. Transfer capacity from north-eastern Greece will thus be increased.
2. Lagada S/S, will be used to divert the existing Thessaloniki (GR) – Blagoevgrab (BG) interconnection line. Currently, two interconnection lines from Bulgaria and FYROM end up at Thessaloniki S/S.

Figure 10: Map of the Greek Transmission Grid



HR – CROATIA

The **2x400 kV Ernestinovo – Pecs** overhead line, already under construction, will strengthen connection between two systems (Croatian and Hungarian) which have different generation mixes and provide for additional transit capacities on the north-south route, increasing security of supply in participating and neighbouring systems. It is also expected to mitigate possible congestion in Croatia's internal system in the east-west direction (400 kV Ernestinovo – Žerjavinec line). The Ernestinovo substation will become even more important as a node connecting grids in four countries (Croatia, Hungary, BIH and Serbia).

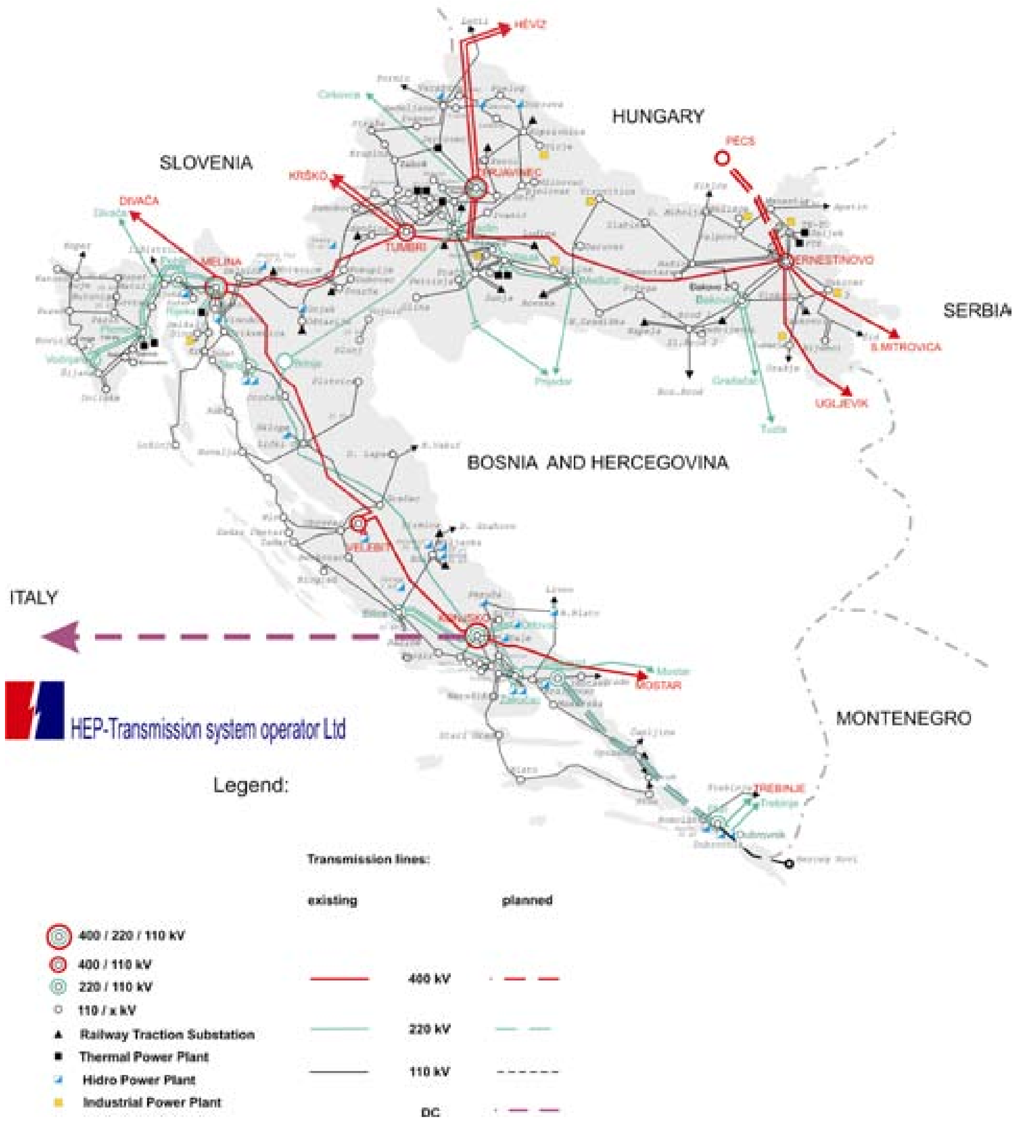
The feasibility study on the **2x200 (400) kV Zagvozd – Plat** overhead line has been launched. The line should be built for 400 kV voltage, but will be operated at 220 kV in the first phase. This line will increase possibilities for electricity exchange with neighbouring BiH and provide new transit capacity in the region (predominately in the southeast to northwest direction).

The pre-feasibility study on the project for a **400 kV interconnection line between Croatia and Bosnia and Herzegovina** has been launched. The significance of this project is bilateral and regional as this line will enhance security of supply in both systems and strengthen the exchange and transit capacities in the region.

A construction of a **400 kV HVDC submarine cable** with a 500 – 1000 MW capacity between Dalmatia in Croatia and Marche Region (probably the Candia substation) in Italy is under consideration and a feasibility study was launched in 2007. This subsea connection will be the first direct connection between these two countries and will be of inter-regional importance for Internal Electricity Market.

Transmission limitations and overloads are possible in some cases on Croatia's internal system between the south and the north (400 kV Tumbri – Melina – Konjsko overhead line), mainly due to the specific shape of Croatian internal network. In order to mitigate this possible congestion, the construction of new 400 kV Tumbri - Velebit - Konjsko internal line is currently being studied.

Figure 11: Croatian Electric Power System



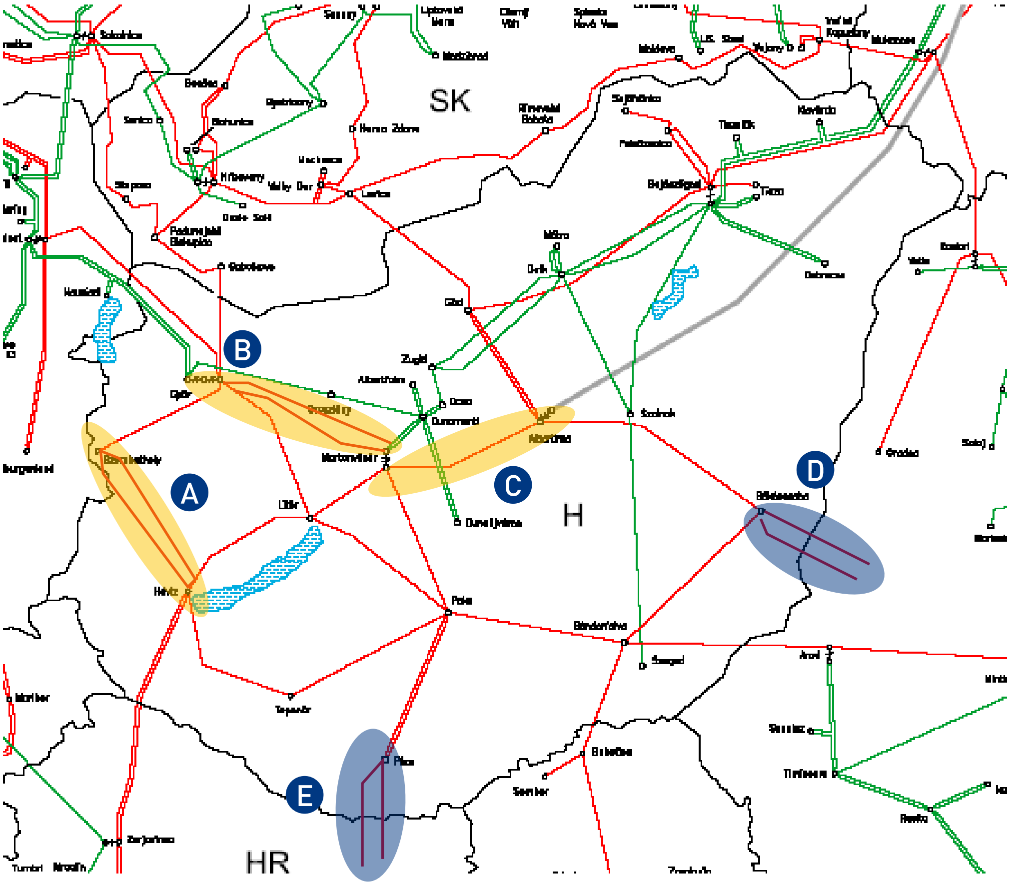
HU – HUNGARY

Import limitations can occur from the North according to the n-1 security criterion. Interconnections can be overloaded during maintenance or high north-south transit flows. The Pécs – Ernestinovo 400-kV-double-line (E on the map) and the Békéscsaba – Nadab 400-kV-line (D on the map) will improve the connection and increase transmission capacity between Hungary and Croatia and between Hungary and Romania.

Our strategy is to decrease the function of the distribution network in the international power transfer so the transmission network needs to be made independent of the distribution network that is owned by distribution companies.

The internal network upgrade in western Hungary (A, B, and C on the map), which will increase the system transmission capacity between northern and southern MAVIR grid, reduces the involvement of the 120 kV distribution network and the 400 (220)/120 kV transformers.

Figure 12: Map of Hungary's Transmission Development Projects



- Ⓐ 400 kV Szombathely – Hévíz double line
- Ⓑ 220 kV Oroszlány – Dunamenti, Oroszlány – Győr lines and 400 kV Győr – Martonvásár lines
- Ⓒ 400 kV Albertirsa – Martonvásár double-line
- Ⓓ 400 kV Békéscsaba (HU) – Nadab (RO) line
- Ⓔ 400 kV Pécs (HU) – Ernestinovo (HR) double-line

IT – ITALY

Due to the development of generation facilities between 2002 and 2010, concentrated in the northern and southern Italy, the current congestion in the northern market zone is expected to increase, whilst new congestion will occur in the southern section of the grid. The respect of N and N-1 criteria is not longer met unless the grid is extended.

Figure 13: Congested Areas – Northern Italy

The existing and forecasted congestion is represented in the figures; due to the constraints shown, part of the available generation cannot be use to cover the demand for electricity.

The significant increase in installed generation capacity in northwest area of Italy (more than 7000 MW from 2002 up to 2010) will lead to a deterioration in the security of supply and to new congestion during peak and off-peak periods.

Figure 14: Congested Areas – Southern Italy and Sicily

The first critical section is located between Piemonte and Lombardia regions; large power exchanges flows are expected from west to east; this will jeopardize transits toward the Milan area. More generally, in the medium term, an increase in the transits between North and Central North market zones is forecasted, and the congestion between Lombardia and Emilia Romagna will cause market splitting with higher frequency than today.

Another area often congested is the North-East, where the high transit flows from Slovenia and the generation of Monfalcone and Torviscosa power plants can only be managed with automatic tripping devices.

As already mentioned, the development of generation will also involve the southern regions, where an increase of about 7000 MW is expected by 2009. Large flows are therefore expected from the South market to the Central South zone. Several congestion areas are expected on the Adriatic coast 380 kV Foggia – Larino – Villanova axis, where the transits caused by power generation of new power plants in Villanova and Foggia (about 2000 MW) will come in addition to already existing transits caused by Foggia and Brindisi limited pole production.

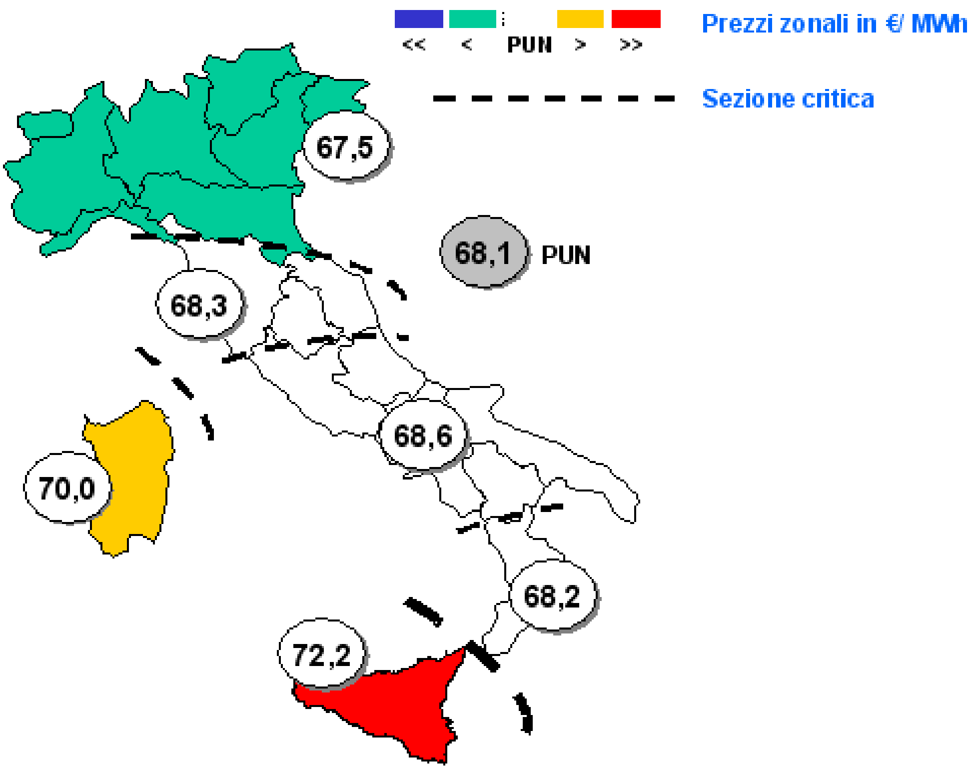
Congestion is also expected in the Calabria region due to the total installed capacity by 2009 (4000 MW CCGT + 1600 MW oil); internal reinfurbisment is needed to deal with operation constraint.

As for the main islands of Sardinia and Sicily, the current interconnections with the mainland need to be reinforced in view of the forecasted development power plants running on renewable energy sources.

The effects of the abovementioned congestion can be found also in the analysis of electrical market results, and in particular:

- Considering the differences in the zonal prices;
- Considering the market splitting over a consistent period of time.

Figure 15: Day-Ahead Market Prices [€/MWh] and Main Market Splitting



Fonte: GME

Therefore, the following grid projects are included in TERNA Development Plan for the National Transmission Grid (NTG):

Northern Italy

- 380 kV Trino – Lacchiarella double circuit;
- 380 kV La Casella – Caorso double circuit (rationalization in Lodi area);
- 380 kV Redipuglia – Udine Ovest double circuit;
- 380 kV single circuit line connecting the Sandrigo – Cordignano and Venezia N. – Salgareda axes;
- 380 kV Voghera – La Casella single circuit;
- 380 kV Carpi Fossoli – Sermide single circuit line;
- 380 kV Dolo – Camin double circuit;
- Refurbishment of 220 kV Avise – Villeneuve – Chatillon line.

Infrastructure to enhance NTG in Central Italy:

- Upgrading to 380 kV of existing 220 kV Calenzano – Colunga line;
- 380 kV S. Barbara – Tavernuzze – Casellina single-line;
- 380 kV Fano – Teramo single line.

Infrastructure to enhance NTG in Southern Italy:

- 380 kV Foggia – Larino – Gissi – Villanova double-line;
- 380 kV Montecorvino – Benevento double circuit;
- Refurbishment of 380 kV Benevento – Foggia line;
- 380 kV Altomonte – Laino single-line;
- 380 kV single line between Candela and a substation in Matera – S. Sofia 380-kV-line;
- Installation of two 380 kV PST between South and Central South market zones.

Infrastructure to enhance NTG in Major Islands:

- 500 kV HVDC link between Sardinia and Italian Peninsula (SA.PE.I.);
- 380 kV Sorgente – Villafranca – Scilla – Rizziconi double circuit;
- 380 kV Chiaramonte Gulfi – Ciminna single circuit;
- 380 kV Ciminna – Sorgente single circuit;
- 380 kV Paternò – Priolo single circuit;
- 380 kV Ittiri – Codrongianos single circuit line;
- 220 kV Partinico – Fulgatore single circuit line.

LU – LUXEMBOURG

Due to new clients connected at 220 kV in the southern part of the grid and the increasing load, reinforcements are required to maintain the security of supply in this region. This will be done by closing the mesh around the capital of Luxembourg.

Another mesh must be closed in the south between Schifflange and Oxylux to be n-1 secure.

This internal reinforcement in the Cegedel Net grid will also have a strong positive impact on the available capacity for the DE-LU-BE interconnection.

Some other projects are underway to increase and upgrade the capacity of 220 kV overhead transmission lines, in order to allow for an 80°C end temperature on the conductors also during the summer when the load tends to peak.

Due to environmental obligations, new lines more frequently have to be built as underground cables, which will considerably increase their cost.

Figure 16: Transmission Grid Development in Luxembourg

ME – MONTENEGRO

Over the next 5 – 10 years, many fundamental changes will be made to Montenegro's transmission system. The first confirmed change is the:

- Installation of 400 kV Podgorica – Kashar (Albania) OHL

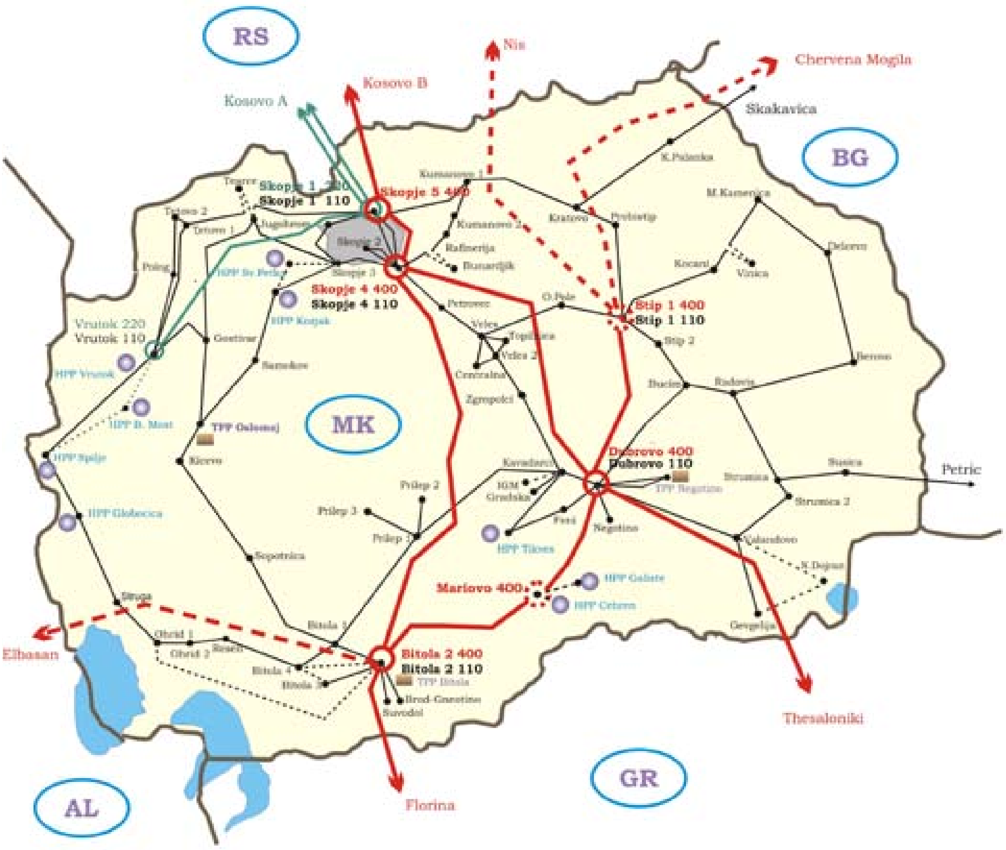
Besides this new interconnection line, several upgrades are planned for the 110 kV grid and generation and transmission are expected to be developed according to the »Development Plan for the Montenegrin Power System until 2020«.

Figure 17: Montenegro's Transmission Grid

MK - FYROM

One of most important internal projects is the construction of the new 400/110-kV SS[20] Stip. This substation will be connected at the planned 400 kV interconnection Dubrovo (MK) – C. Mogila (BG). The network is currently characterized by voltage drop problems and overloaded lines on the eastern sections. These problems are a consequence of weak links in the eastern/south-eastern region with the 400 kV network and major generation capacities in the country. The new SS Stip will resolve these problems and improve quality and security of supply in the eastern part of the network.

Figure 18: FYROM Electric Power System Development



20 Substation

NL – THE NETHERLANDS

The Dutch transmission grid is connected by tie-lines to Germany and Belgium.

In 2008 the HVDC cable with Norway will also come into operation. A HVDC cable connecting the Netherlands with the United Kingdom is currently being studied.

The Netherlands is currently a net importer of electricity. This results in power flows from Germany and Belgium towards the Dutch system. The transmission grid also experiences significant power flows due to the bulk of wind power in-feed and power flows resulting from market transactions in the central west area.

At national level, the additional transmission equipment required is determined by the development of load demand and the connection of new power facilities.

The highest load demand is in the Randstad area in the Western Netherlands.

Load growth is moderate at a level of 2% and doesn´t play a major role in constraints in the 380 kV grid. However due to increasing load demand the structure of some 150 kV grids needs to be rearranged which also requires adaptations to the 380 kV grid.

TenneT TSO has received a large number of requests for connection of new power facilities to the Dutch transmission grid.

The requests are spread out over the entire grid however the majority have been requested at large production sites in the West (Maasvlakte) and North (Eemshaven).

To meet the future needs for 380 kV and 220 kV transmission, TenneT TSO has decided to launch the following projects and studies to solve congestion.

1. Erecting a new 380 kV substation in Borssele.
   This substation is required to connect new power facilities in the Borssele area. It will also increase the thermal rating of the interconnector from Belgium to the Netherlands which is currently limited by a 380/150 kV transformer in Borssele.
2. New double circuit 380 kV line from Maasvlakte to Bleiswijk (Randstad380 project).
   This new 380 kV line is required to facilitate the connection of new power facilities in the Randstad area near Maasvlakte. It will also relieve the extremely constrained 150 kV network in the southern section of the Randstad area.
3. New double circuit 380 kV line from Bleiswijk to Diemen (Randstad380 project)
   This new 380 kV line is required to relieve the extremely constrained 150 kV network in the northern part of the Randstad area due to unbalanced generation and load.
4. Feasibility study regarding the increase of transmission capacity from northern Netherlands towards the 380 kV ring. The study investigates the possibilities for a new 380 kV line in combination with the uprating of an existing 220 kV line from Eemshaven to Ens.

Figure 19: Transmission System Development in the Netherlands

PL – POLAND

From UCTE's perspective, the Polish power transmission system is a border system. Therefore, as regards the development planning process, it is interested not only in new synchronous interconnections with neighbouring UCTE members, but also in the completion of new inter-ties with other neighbouring systems in non-UCTE member countries.

For the second group of systems, the study should consider both synchronous and/or asynchronous interconnections. The mode of interconnection should be selected on the basis of technical and economic reasons.

Because of future uncertainties on the operation of the Polish power transmission system (for example the increasing role of renewables) and targets that new interconnections should meet, studies and analyses show that, in many cases, the expected increase in transfer capacity with a new interconnection can only be achieved if it is accompanied by investments on internal grid (new transmission lines and substations).

The expected commissioning dates for the presented projects are uncertain and consistent with PSE-Operator's current Development Plan for 2006 – 2020.

Other investment projects required to meet the TSO targets in addition to the development of interconnections are specified in the abovementioned Development Plan.

Poland – Germany profile:
Krajnik (PL) – Vierraden (DE): conversion of existing 220 kV double circuit line into a 400 kV line (see project № 1 on the map)
Baczyna (PL) – German border (DE): 3rd 400 kV interconnection between Poland and Germany with reinforcement of Polish internal grid (see project № 2 on the map).

Poland – Slovakia profile:
Byczyna (PL) - Varin (SK): new 400 kV interconnection between Poland and Slovakia with reinforcement of the Polish internal grid (see project № 3 on the map).

Poland – Ukraine profile:
Rzeszów (PL) – Khmelnitskaya (UA): modernization and resumption of existing 750 kV interconnection between Poland and Ukraine (see project № 4 on the map).

Poland – Lithuania profile:
Ełk (PL) – Alytus (LT): new 400 kV double-circuit interconnection between Poland and Lithuania together with back-to-back 1 000 MW station in Alytus (LT) with reinforcement of the Polish internal grid (see project № 5 on the map).

Figure 20: Transmission Grid Development in Poland

PT – PORTUGAL

The Portuguese transmission network development plan contains a significant number of new projects to be put into service across the country in the coming years. These projects will either capture new renewable energy or increase exchange capacities with Spain. The following large ones will be completed by 2012:

To improve load feed and receive new renewable energy in the north, REN will complete the following projects to reinforce the grid in the area:

1. Lagoaça – Macedo de Cavaleiros, Vila Pouca de Aguiar – Valdigem, Macedo de Cavaleiros – Chaves B, Chaves B – Vila Pouca de Aguiar lines and Macedo de Cavaleiros and Vila Pouca de Aguiar substations.

REN will also complete the following projects to reinforce the grid in the north to increase interchange capacities:

2. Armamar – Recarei, Lagoaça – ›Pocinho‹, 400 kV lines and Armamar substation and changing voltage operation from 220 to 400 kV of present Pocinho-Valdigem 2 line.
3. Changing voltage operation level of the Armamar-Bodiosa and Bodiosa-Paraimo lines from 220 kV to 400 kV.

To solve some constrains that could appear on the North/South coast axis caused by new generation capacity that will appear in the centre and the south, REN has decided to work on the following projects:

4. 400 kV Lavos-Paraimo and Batalha-Lavos lines.
5. 400 kV Marateca-Fanhões line.

The following projects will be completed to meet special requirements for the High Speed Train project on the Lisboa-Elvas (Madrid) railway:

6. 400 kV Falagueira – Estremoz, Estremoz – Évora, Évora – Palmela and Ferreira do Alentejo – Évora lines.

REN will build a new 400 kV line in the South to solve some congestion in the Algarve region and prepare for a new interconnection with Spain:

7. 400 kV Portimão-Tavira line.

REN will also rehabilitate several old substations and install capacitors for low voltage level contingencies.

Figure 21: Transmission Grid Development in Portugal

RO – ROMANIA

Supported by an adequate infrastructure and a functional competitive electricity market in Romania, Transelectrica is now actively cooperating at international level to further develop regional electricity markets in Central and South-Eastern Europe. It is also trying to extend the current UCTE borders and EU rules for electricity markets.

One of Transelectrica's main achievements has been to boost the security of the Romanian power system by completing strategically important project to rehabilitate/modernise the system. Besides the investment projects already started or at various stages in the decision-making process, Transelectrica also aims to launch new rehabilitation projects for existing substations and build new transmission capacities.

The following major investment projects have been started:

- A project to increase the rated voltage level of the Gutinas-Bacau-Roman-Suceava axis from 220 kV to 400 kV, a project that will make supplies to consumers in central and northern Moldova more reliable and increase the power transit capacity in the area. The project will also close the 400 kV mesh between northern Moldova (Suceava) and northern Transylvania (Cluj area), thus contributing to the interconnection with the Republic of Moldova at 400 kV through the future Suceava (RO) – Balti (MD) OHL, which also constitutes an interconnection with Ukraine.
- 400 kV Oradea-Nadab (RO) – Bekescsaba (HU) interconnection OHL – commissioning in 2008;
- Construction of 400 kV Arad-Nadab OHL;
- Rehabilitation of several substations.

Prospects from 2008 to 2018:

- 400 kV Gadalin (RO) – Bistrita (RO) – Suceava (RO) – Balti (MD) OHL;
- Increasing the voltage rated level of the Porţile de Fier-Reşiţa-Timişoara-Arad axis from 220 kV to 400 kV, a project that will strengthen the western section of the Romanian transmission grid for further interconnection projects with Serbia and Hungary;
- 400 kV Timisoara (RO) – Vrsac (RS) OHL;
- Subsea cable interconnection between Romania and Turkey.

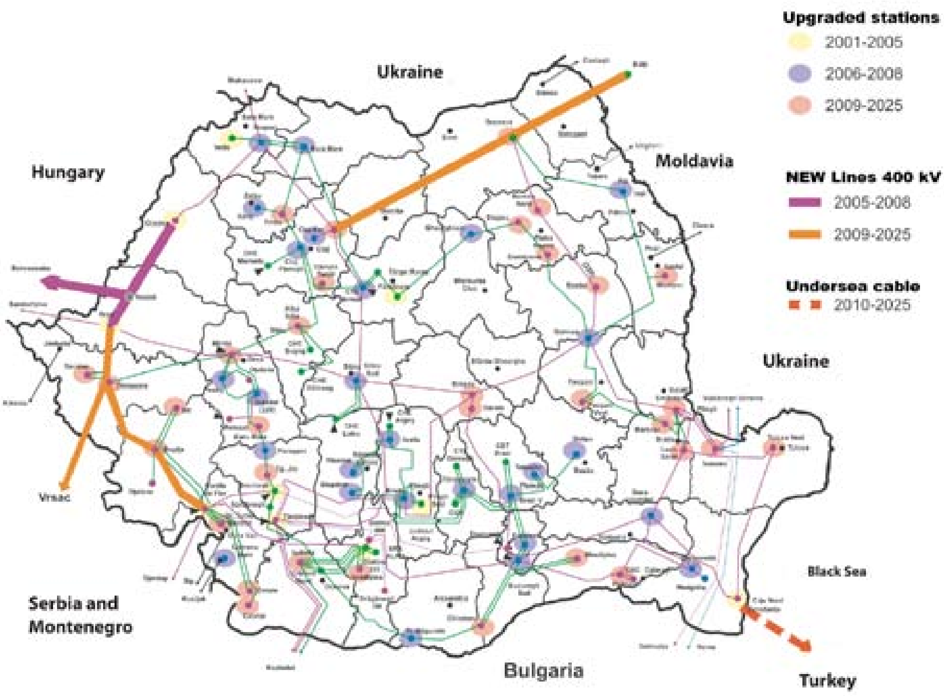
There has been major development in the Bucharest area in recent years and this has led to a much higher increase in consumption than the country's average. This high level of consumption is causing several congestion situations in the Bucharest area.

Major investment in the transmission network is also required in the Dobrogea area (south-eastern Romania, near the Black Sea), to evacuate the higher power flows expected following investment in generation capacities (2x700 MW additional units of NPP[21] Cernavoda; around 1000 MW from wind farms; around 1000 MW installed in other TPP[22]), a new back-to-back 200-MW substation in Isaccea and a new 400 kV, 600 MW subsea cable, between Romania and Turkey.

Studies are currently underway into the development of a comprehensive electricity network to support all these changes.

21 Nuclear Power Plant
22 Thermal Power Plant

Figure 22: Transmission Grid Development in Romania



RS - SERBIA

The N-1 security criterion is not always met on the Serbian transmission network when there are east-west electricity transits in south-eastern Europe. Contingency of 400 kV Mladost-Mitrovica line causes overloads in 110 kV network because electricity is redirected east-west through the 110 kV voltage network. EMS has not yet decided to build another 400 kV Mladost-Mitrovica line. This 400 kV OHL is shown by dashed line in the figure below.

Figure 23: Transmission Grid in Serbia

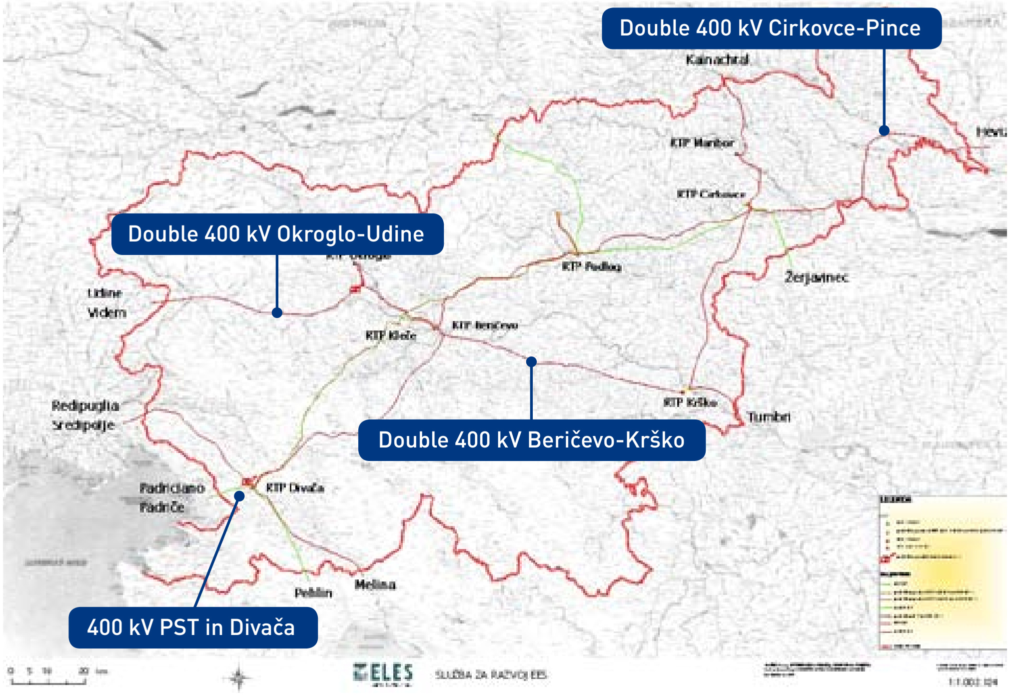
SI – SLOVENIA

The Slovenian transmission network is connected to the UCTE European electricity transmission system via the electric power systems (EPS) of Austria, Croatia and Italy. These connections with the neighbouring TSOs are strong and, due to its geographical position, the Slovenian system is integrated into three regions: the Central South Region (CSE) (Italy, Germany, Austria, Switzerland, France), the Central East Region (CEE) (Germany, Poland, Czech Republic, Slovakia, Hungary, Austria) and the South East Region (SEE) (Croatia, Serbia, Montenegro, Bosnia and Herzegovina, FYROM, Albania, Romania, Bulgaria and Greece). Due to its position, the Slovenian EPS is also highly subject to inter-trade processes and power flows between these regions.

The increased power deficiencies in western Europe and an inexpensive energy surplus in the east led to an increase in long-distance trading to an extent large enough to cause enormous changes in transmission network conditions of the last decade. Physical power flows resulting from commercial contracts (east – west) on the other UCTE members' borders exceeded 1800 MW in 2005 on the Slovenian - Italian border. Consequently, the security of the Slovenian electric power system operation was threatened on many occasions.

Power balances in UCTE-wide regions change and thus the direction of power flow also changes. This can in fact reverse the power flow direction on the Slovenian – Italy interconnection and result in operational problems on the other borders. Due to its size and availability of production capacities, the Slovenian transmission system operator can not efficiently respond to such physical changes in power flows. To improve security of supply in Slovenia and secure grid operation, the strategic course for further development takes into account the accepted investments in the 400 kV grid, namely the 400 kV Krško-Beričevo double line and the 400 kV Cirkovce-Pince interconnections towards Hungary and Croatia, and Okroglo-Udine (Figure 23). The strengthening of the 400 kV connections to the neighbouring grids will further increase the link between the Slovenian transmission grid and the UCTE, thus making it much more exposed to negative impacts of the anticipated high power flows which may even exceed 2500 MW. To control and regulate power flows on the border with Italy, a 400 kV phase-shifting transformer (PST) will be installed in RTP Divača, which will ensure the appropriate operational reliability of the Slovenian transmission grid also required by the operational rules under UCTE. An upgrade of the 220 kV internal network to 400 kV is expected.

Figure 24: Slovenian 400 kV Grid Development



SK – SLOVAKIA

The Slovak TSO – SEPS a. s. – regularly prepares its transmission development plan, which contains network evolutions and developments up to 17 years in advance in order to meet the system needs and to guarantee the overall system security and reliability of supply. Most of these reinforcements, particularly concerning transmission lines are stated below and accompanied by an appropriate description and geographical map.

International projects

The Slovak transmission system has a relatively strong interconnection capacity with its neighbours (apart from Austria), but due to the prevailing power flows in this part of the UCTE, persistent congestion occurs on the Slovakia – Hungary profile. In relation to the strengthening of the interconnectors, joint studies and respective negotiations with partners are in progress or being prepared:

- 48 project »2 x 400 kV Stupava (SK) – Bisamberg / Wien SO (AT) tie-line« – Erection of a new 400-kV-double-circuit interconnection between Slovakia and Austria. Possible effects and feasibility will be subject to a joint system study. Project and negotiations are currently stopped.
- 24 project »2 x 400 kV Varín (SK) – Byczyna (PL) tie-line« – The main driver for this project is the increase in north-south power exchange capacity. The project is currently being studied, the construction is expected in long – term horizon, after 2018.
- 20 project »2 x 400 kV Sajóivánka (HU) – Moldava or Rimavská Sobota (SK) tie-line« – The main driver is to improve the security and reliability of the network of both partners and increase the transmission capacity in the north – south direction on the congested profile. Possible effects will be evaluated by joint studies. Expected construction: after 2012.
- 49 project »2 x 400 kV V. Kapušany (SK) – Mukachevo (UA) tie-line« – aiming to increase the power exchange capability on SK – UA profile and accommodation of electricity transits / imports. The plan is to strengthen and reinforce the existing weak 400 kV interconnection between Ukraine and Slovakia with additional circuit doubling. The project is presently only an idea, possible effects will be evaluated as part of joint studies, as well as within IPS / UPS study or UA / MD interconnection study (if applicable). Expected timescale for construction is after 2012.

Internal projects

The objective of the internal projects stated in this transmission plan is related to strengthening and reinforcing the Slovakia's internal grid as well as an upgrade from 220 kV to 400 kV. Nevertheless, another driving force is to ensure and enhance the overall reliability and security of supply of the transmission system and customers connected to the transmission grid.

- 45 Set of projects »2 x 400 kV Sučany – Medzibrod – L.Mara line« – the project is directly influenced by the replacement of the old 220 kV equipment with 400 kV equipment (lines, transformation 400 / 110-kV) and currently in authorization phase.
- 44 Set of projects »2 x 400 kV Lemešany – Moldava – USS line« – switching from 220 kV level to 400 kV, thus enhancing reliability and security of supply for a major customer (steel factory). Project currently in authorization phase.
- 46 Set of projects »2 x 400 kV Gabčíkovo – V.Ďur line« – dedicated to ensure secure and reliable power output in case of commissioning of the new blocks 3 and 4 in NPP Mochovce and strengthening of the south – western Slovak transmission system. Project is currently in planning phase.
- 47 Set of projects »2 x 400 kV Lemešany – V. Kapušany line« – restoration of the old weak line with circuit doubling. Line loop into new substation 400 kV in order to improve system security & reliability and accommodate transits in eastern Slovakia. Project is currently in the planning phase.

Figure 25: Transmission Grid Development in Slovakia

Contact

Boulevard Saint-Michel, 15
B-1040 Brussels – Belgium
Tel + 32 2 741 69 40
Fax + 32 2 741 69 49

info@ucte.org
www.ucte.org