



# UCTE Transmission Development Plan

Update 2009

union for the co-ordination of transmission of electricity

# **UCTE TRANSMISSION DEVELOPMENT PLAN**

DEVELOPMENT OF INTERCONNECTIONS

April 2009




## Table of contents

	Executive Summary	3
1	Introduction	5
2	Development of Interconnections	8
3	Appendix	28



## EXECUTIVE SUMMARY



In order to meet the objectives of the European energy policy, the transmission grid must be developed while maximizing the security of supply and minimizing the total cost for customers (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.

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.

Since rising generation capacity is strongly linked to market conditions, it 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.

In June 2008, UCTE published the first release of its Transmission Development Plan, giving an overview of the expected European Extra High Voltage grid development. Most of those investments have already been presented in the TSOs' respective Transmission Development Plans.

The present document aims to update the information on on-going interconnection development. Nevertheless, it should be kept in mind that cross-border and internal investments are both important to the European market. The overview of internal network development is given in UCTE Transmission Development Plan, Edition 2008, available on UCTE website: [www.ucte.org](http://www.ucte.org).

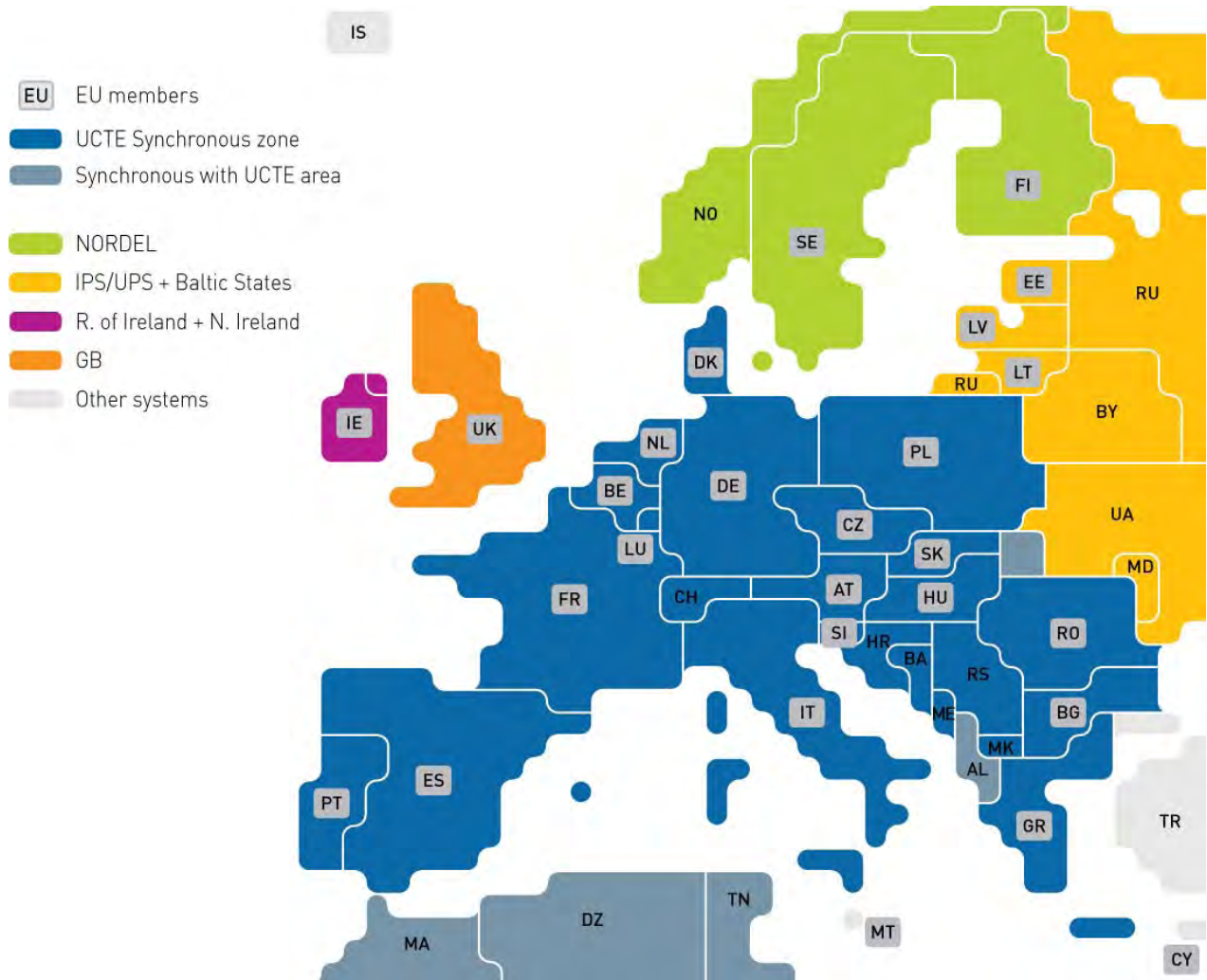
It is very important to emphasise the impact that permitting procedures have on the integration of the European market. UCTE fully supports the European Commission in its plans to promote projects leading to the better integration of the European market and to support the TSOs in the permitting procedures. 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 Community-wide Ten-Year Network Development Plan should be provided by TSOs every two years. The first release 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

The European grid is operated into five synchronous areas: NORDEL, Great Britain, Ireland, IPS/UPS & Baltics and UCTE.




UCTE covers 23 countries : 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 Yugoslav Republic of Macedonia (MK), the Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Serbia (RS), Slovenia (SI) and Slovakia (SK).

UCTE has published its first Transmission Development Plan (TDP) in June 2008. This document presented the projects and studies conducted by European TSOs by the end of 2007 for developing the European EHV<sup>1</sup> grid.

The aim of the present document is to update the information given in UCTE TDP on European cross-border grid development.

NB: The fact that the description of European TSOs' internal development is not addressed here does not mean that it is less important. Actually both types of projects aim at – and are necessary for - increasing the European

<sup>1</sup> Extra High Voltage



Security of Supply, developing and integrating the Internal Energy Market and fostering the use of Renewables Energy Sources (RES).

The present document is the fruit of reflections and coordination within the five UCTE Regional Fora: Centre West (BE-DE-FR-LU-NL), South West (ES-FR-PT), Centre South (AT-CH-DE-FR-IT-SI), Centre East (AT-CZ-DE-HU-PL-SI-SK) and South East (BA-BG-GR-HR-HU-IT-ME-MK-RS-RO-SI).

The data collected for this update is based on the status of projects and studies conducted by European TSOs by February 2009.


The creation of the new European TSOs' Association, ENTSO-E, on 19.12.08, provides a new framework which will facilitate the coordination between all the European TSOs.

According to the present draft of the European Commission, the 3rd Energy Package, which specifies that TSOs should provide a Ten Year Network Development Plan (TYNDP) and update it every two years, the next step is to issue the first release of the TYNDP by 2010, in the framework of ENTSO-E.





## 2 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.

The present document focuses on 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 here have already been described in the respective TSO Transmission Development Plans.

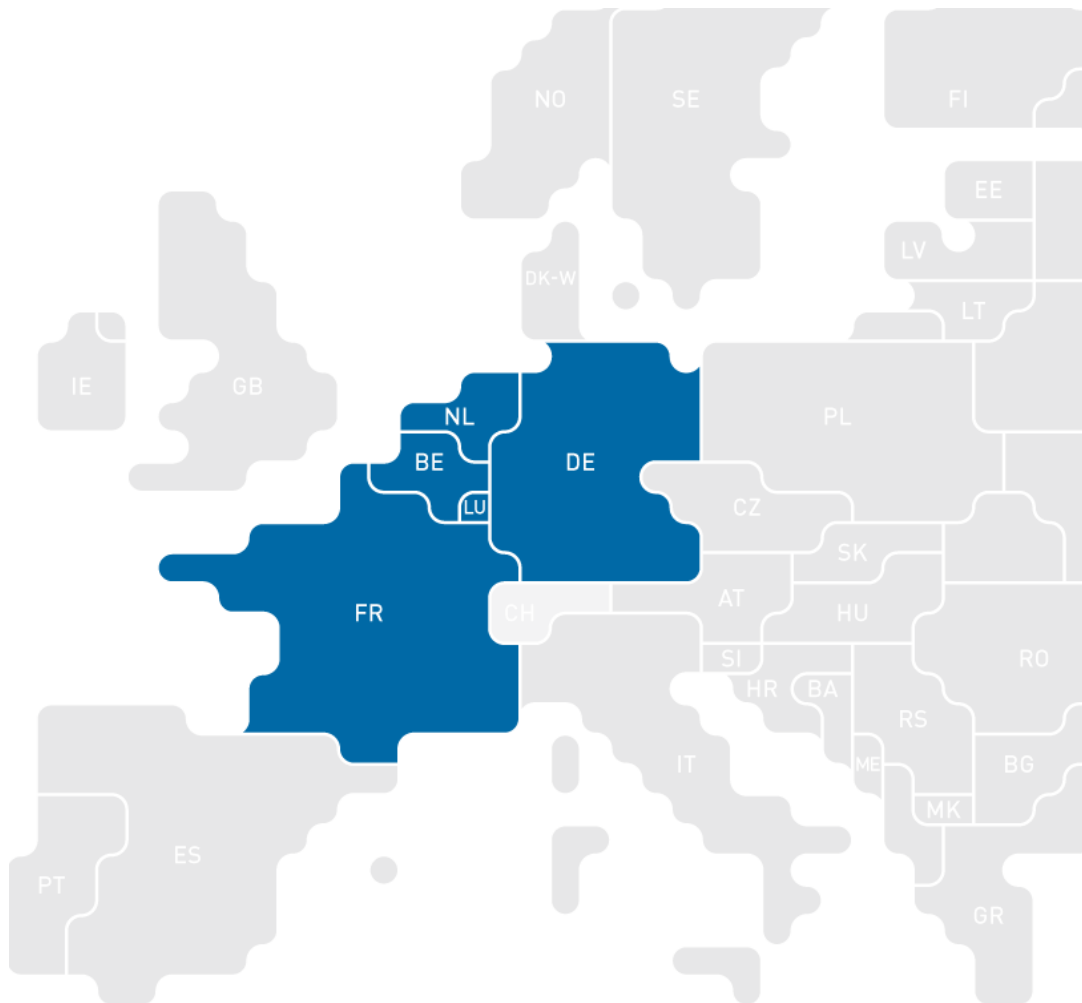
The projects listed below aim to integrate the European market. According to the experience of the TSOs, all of these projects are needed to reach this objective.

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.

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

NB: An overview of European TSOs' internal grid development is given in UCTE Transmission Development Plan, Edition 2008, available on UCTE website [www.ucte.org](http://www.ucte.org).

## 2.1 UCTE Regional Forum Centre West




### 2.1.1 Internal borders between TSOs of the UCTE Central West region

#### BELGIUM – FRANCE INTERCONNECTION

RTE (FR) and Elia (BE) have decided to reinforce the 225-kV Aubange (BE) – Moulaine (FR) line (TEN-E project). The project consists in upgrading the existing line by the installation of the 2nd circuit and the replacement of conductors.

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. In the mid 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. Currently, the 225-kV Moulaine (FR) - Aubange (FR)



interconnection line is the most limiting element on this border. The estimated gain in NTC<sup>2</sup> is approximately 300 MW in winter and around 150 MW in summer. The line is expected to be commissioned in 2010.

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) are conducting a study in order (i) to determine the impact of important amounts of new generating units that are expected to come in the North of France and (ii) to identify potential new interconnections and/or to optimize the operation of the existing grid.

## **BELGIUM – GERMANY INTERCONNECTION**

A study is in progress, aiming at determining the impact of an interconnection Belgium (Elia) – Germany (RWE TSO) on both grids and on the whole Central Western Europe (CWE) region. Two routes have been examined: region Aachen/Düren Verlautenheide (DE) – Lixhe (BE) and Brume (BE) – Dahlem (DE).

The most promising route especially with regard to the permit procedures is the interconnection between Lixhe (BE) and the region Aachen/Düren Verlautenheide (DE).

The main goal of this project is to establish a new interconnection capacity for improving the system security within the CWE region, allowing the integration of new conventional and massive renewable power plants and, by doing so, further integrating the regional market.

The classical security analysis for the interconnection and the internal grids of Elia and RWE TSO has been carried out. Within these analysis no severe violation of the (n-1)-criteria was found in case of using a controllable interconnector. The technology of the considered interconnection can be AC<sup>3</sup> cable in combination with phase shifting transformer as well as HVDC<sup>4</sup> cable. Before implementing such an interconnection into the grid several steps have to be done within this project. The next step consists in evaluating the impact of a new interconnection between Belgium and Germany on the CWE market. Then, depending on the results:

- Detailed routing of the connection Lixhe (BE) - region Aachen/Düren Verlautenheide (DE)
- Technical assessment of implementation of an AC cable in combination with a phase shifting transformer
- Technical assessment of the implementation of an HVDC interconnection by DC<sup>5</sup> cable

## **BELGIUM – THE NETHERLANDS INTERCONNECTION**

Three phase shifting transformers of 1400 MVA have been installed in 2008, two of them in Van Eyck and one in Zandvliet. These PSTs secure the transfer capacity of Belgium on both borders (Belgium – The Netherlands and Belgium – France). By a better handling of the loop flows through Belgium the whole CWE grid can be used in a more efficient way while the controllability increases the Security of Supply of the whole region.

TenneT TSO (NL) and Elia (BE) are performing a study that aims at analyzing the cross impact and the inter-dependency of scenarios and investments in Belgium and in The Netherlands. The multiple demands for connection on both sides of the border have to be taken into account. The objective is twofold at the moment:

---

<sup>2</sup> Net Transfer Capacity

<sup>3</sup> Alternating Current

<sup>4</sup> High Voltage Direct Current

<sup>5</sup> Direct Current



check the short-circuit current in the region and develop a long term vision on the EHV grid. No specific scenario has been defined at the time being.

## **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 – THE NETHERLANDS INTERCONNECTION**

RWE TSO (DE) and TenneT (NL) have carried out a feasibility study for the construction of a new interconnector. As a result, a new 60-km double-circuit-400-kV-line between Doetinchem (NL) and Niederrhein (DE) was decided by signing a Memorandum of Understanding (MoU).

This new connection increases the interconnection capacity of the two countries by 1000-2000 MW. A more homogeneous distribution of the flows on the Dutch-German interconnectors is attained. This leads to a significant increase of the security of supply for both countries. The existing congestion on the German-Dutch border is decreased which facilitates the evolving European electricity market. Furthermore, the commissioning of this interconnector enlarges the flexibility of the network that is needed to accommodate large penetration of Renewable Energy Sources. The increase of cross border capacity also increases the level of security of supply in the whole CWE region.


The feasibility phase has been completed and the approval procedures have been started. This project has been reported in RWE TSO's Grid Development Plan 2008 and in the Quality and Capacity Plan 2008-2013. The borderpoint has been fixed and currently the permitting procedures are ongoing. Furthermore, the first necessary environmental studies concerning the routeing are carried out. The commissioning of this new interconnector is expected earliest in 2013.

## **LUXEMBOURG – BELGIUM INTERCONNECTION**

The public grid of Cegedel Net is interconnected to Germany and has no interconnection to the Belgium grid of ELIA. Sotel, an industrial grid in Luxembourg, is interconnected to Belgium through 220-kV and 150-kV-overhead-lines for their own needs in industry. Under normal operation conditions, there is no active interconnection with the public grid in Luxembourg.

In order to enhance the security of supply for the grid of Cegedel Net, a study carried out by Cegedel Net in consultation with ELIA (BE), RTE (FR) and RWE TSO (DE) proposed an additional permanent interconnection with the neighbouring grids in the southern region. Cegedel Net and ELIA have launched a project to build this new interconnection between Aubange (BE) and Bascharage (LU) that is in the permitting phase by Elia and Cegedel Net.

Depending on the successful completion of the permitting procedures, the expected commissioning date is 2012. This new interconnection will have a positive impact on the interconnection capacity of Belgium. It also initiates an exchange capability with Germany through Luxembourg.



Due to consumption growth and to ensure the security of supply, the grid of Cegedel Net in the southern section of Luxembourg has to be reinforced. This reinforcement will be useful also for the future interconnection with ELIA.

## **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.

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. Cegedel Net has to consider how to ensure on a long term basis the liability, taking into account the ongoing load growing in Luxembourg and the new interconnection with the ELIA (BE) grid and their possible transit flows.

## **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.

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

Cegedel Net (LU) had also analysed the possibility of an interconnection with France.

## **2.1.2 UCTE Central West TSOs borders with non-UCTE countries**

At the moment United Kingdom is connected to the UCTE grid via a HVDC connection joining France.

### **UNITED KINGDOM**

- **with France**  
The capacity of the DC submarine cable between Great Britain and France is fixed at 2000 MW. New studies have been launched to identify the opportunity of increasing this capacity to 3000 MW.
- **with the Netherlands**  
A new HVDC (High Voltage Direct Current) link between the UK (Isle of Grain, Kent) and the Netherlands (Maasvlakte) with a transmission capacity of 1320 MW should become operational in 2010.
- **with Belgium**  
Even with those two interconnections, the exchange capability of United Kingdom will only reach 4% of the installed generation. Elia and National Grid are studying the interest of an additional HVDC connection (700 up to 1300 MW) between Belgium and United Kingdom. Such a connection will increase the liquidity of both markets, the access capability, the competition and the Security of Supply of both countries.



## NORDIC COUNTRIES (DENMARK, NORWAY, SWEDEN)

### Germany 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 connection capacity to Denmark West is 950 MW northbound and 1500 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 1400 MW. Expected commissioning date should be after 2015.

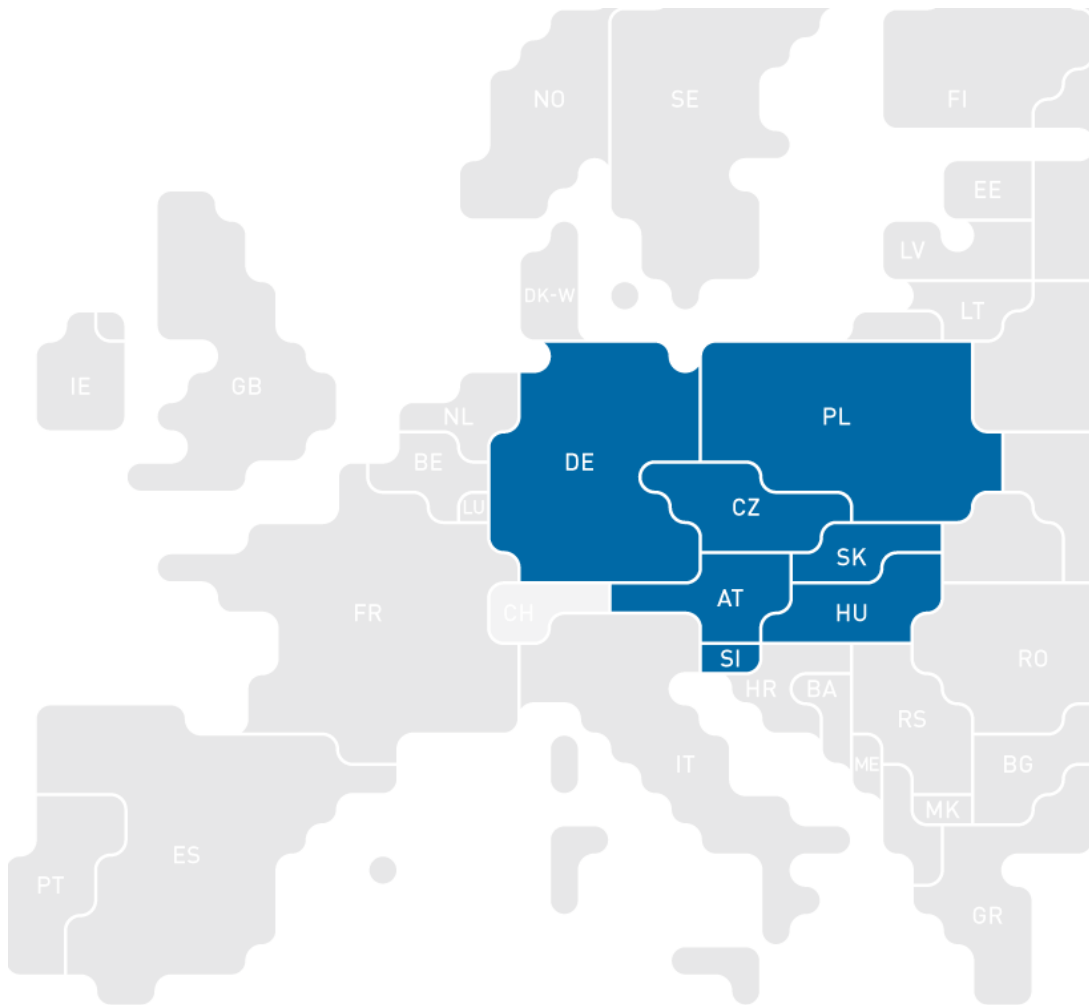
### The Netherlands with:

- **Norway**

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

A feasibility study has been launched in order to look into the possibilities of establishing a power link between Denmark and the Netherlands. The provisioned link is a HVDC cable with 600-700 MW capacity in both directions. In the feasibility study, 2016 is foreseen as the commissioning year of this link.

## 2.2 UCTE Regional Forum Centre East



### 2.2.1 Internal borders between TSOs of the UCTE Central East region


#### AUSTRIA – CZECH REPUBLIC INTERCONNECTION

The second circuit of the existing Slavetice (CZ, CEPS) – Dürnrrohr (AT, APG) has been put into operation in November 2008.

#### AUSTRIA –GERMANY INTERCONNECTION

The border lines between Germany and Austria are not subject to auctions today. APG and E.ON Netz increased the capacity of the 220-kV-line St. Peter (AT) – Simbach (DE) in 2008 by installing high temperature conductors. Nevertheless, due to high physical flows, the existing 220-kV-lines between the grid of APG and E.ON Netz are often heavily loaded, near to the (n-1) criterion.





With the increase of power generation in Germany and new big storage power plants in Austria, E. ON Netz and APG expect a further increase of the power exchange between Austria and Germany. Therefore, APG and E.ON Netz consider to construct a 400-kV-line connecting APG (St. Peter) and E.ON Netz (Isar or Pleinting) around 2017. Further development of Austria-Germany interconnection is described in chapter 2.3.1 hereafter.

## **AUSTRIA – HUNGARY INTERCONNECTION**

The installation of the second 400 kV circuit on the existing interconnection Wien SO (AT) – Győr / Szombathely (HU) is foreseen in 2010 for the Austrian section of the line. The Hungarian part of the line is already equipped with the second circuit.

## **AUSTRIA – SLOVAKIA INTERCONNECTION**

One of the solutions under consideration is a 400-kV-line connection between Stupava (SK) and Bisamberg / Wien SO (AT), to be put into operation after 2020.

Another possible option suggested by SEPS and MAVIR would be a new interconnection between SK and AT (from Gabčíkovo substation (SK) to Vienna (AT)) via Hungary, using one circuit of the existing 400-kV-line Győr (HU) - Vienna (AT) in combination with the project Gabčíkovo (SK) – Győr (HU). However, this solution is strongly depended on agreement of negotiation of the involved TSOs (SEPS, MAVIR and APG). The expected time horizon is after 2014.

## **CZECH REPUBLIC –GERMANY INTERCONNECTION**

At present four 400-kV tie-lines exist on the Czech Republic - 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) and one 400-kV-double circuit line between CEPS and VE Transmission: Hradec (CEPS) – Rohrsdorf (VE Transmission).

With the increase of wind power generation in Germany and in order to increase the power exchange capability between the 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. The completion of a new 400-kV-line between CEPS and E.ON Netz seems not possible before 2016.

Possible increase of interconnection capacity between CEPS and VE Transmission is under consideration: either a new 400kV double tie-line (OHL on new route) or a reinforcement of the existing 400-kV double tie-line Hradec (CEPS) – Röhrsdorf (VE Transmission) to maintain the security of supply and to support the market development in Central Eastern Europe (CEE).

## **HUNGARY – SLOVAKIA INTERCONNECTION**

Currently there are joint negotiations in progress between Slovakian and Hungarian TSOs. At the last common meeting both TSOs agreed on the joint pre-contract subscription. The main subject of this agreement will be three possible interconnections between Slovakia and Hungary, namely: 400-kV double circuit line Gabčíkovo substation (SK) - Hungary, 400-kV double circuit line Rimavská Sobota substation (SK) - Sajóivánka (HU) and 400-kV double circuit line Velké Kapušany substation (SK) - Hungary. The realisation of one or several of the three interconnections mentioned above will be the matter of next joint negotiations between Slovakian and Hungarian TSOs. The most likely horizon for realisation is after the year 2014.

Comment: Project Moldava (SK) - Sajóivánka (HU) 400-kV double circuit line was replaced by the project Velké Kapušany (SK) - Hungary 400-kV double circuit line because of more positive influence on electricity flows on the common border between Slovakia and Hungary (better exploitation of this interconnection).



## **POLAND – SLOVAKIA INTERCONNECTION**

Joint studies are 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. Joint negotiations are in progress.

## **POLAND – GERMANY INTERCONNECTION**

On Polish-German interface two interconnectors are existing: the 220-kV double tie-line Krajnik (PL) – Vierraden (DE, VE Transmission) and the 400-kV double tie-line Mikulowa (PL) – Hagenwerder (DE, VE Transmission). To support the market development in CEE, RES<sup>6</sup> integration and to maintain security of supply, both PL and DE TSOs, PSE Operator and VE Transmission, have agreed to convert the 220 kV Krajnik (PL) – Vierraden (DE, VE Transmission) double-circuit line into a 400-kV-line and to install phase shifting transformers on 400-kV-tie-lines Krajnik (PL) – Vierraden (DE) and Mikutowa (PL) – Hagenwerder (DE) before 2013. For the most part, this OHL<sup>7</sup> is already erected as 400-kV line.

Furthermore, in order to support the market development in CEE, RES integration and to maintain security of supply, possibility of building a third interconnection between Poland and Germany: Baczyna or Plewiska (PL) – Eisenhüttenstadt (DE, VE Transmission) after 2015 is under consideration and studies. First preparation measures are expected in switchgear station Eisenhüttenstadt already in 2009 in connection with a power station connection project. Reinforcements in the Polish internal network are necessary before this third interconnection can be commissioned.

The development of SLOVENIA - HUNGARY interconnection is described in § 2.4.1.

## **2.2.2 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 together with back-to-back 1000 MW converter station in Alytus (LT).

Reinforcements in the Polish internal network are necessary before the connection between Poland and Lithuania is realised. The final internal reinforcements shape of the Polish and Lithuanian grids is known. The project will be implemented in two steps and completed in 2020.

### **POLAND – UKRAINE INTERCONNECTION**

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

### **SLOVAKIA – UKRAINE INTERCONNECTION**

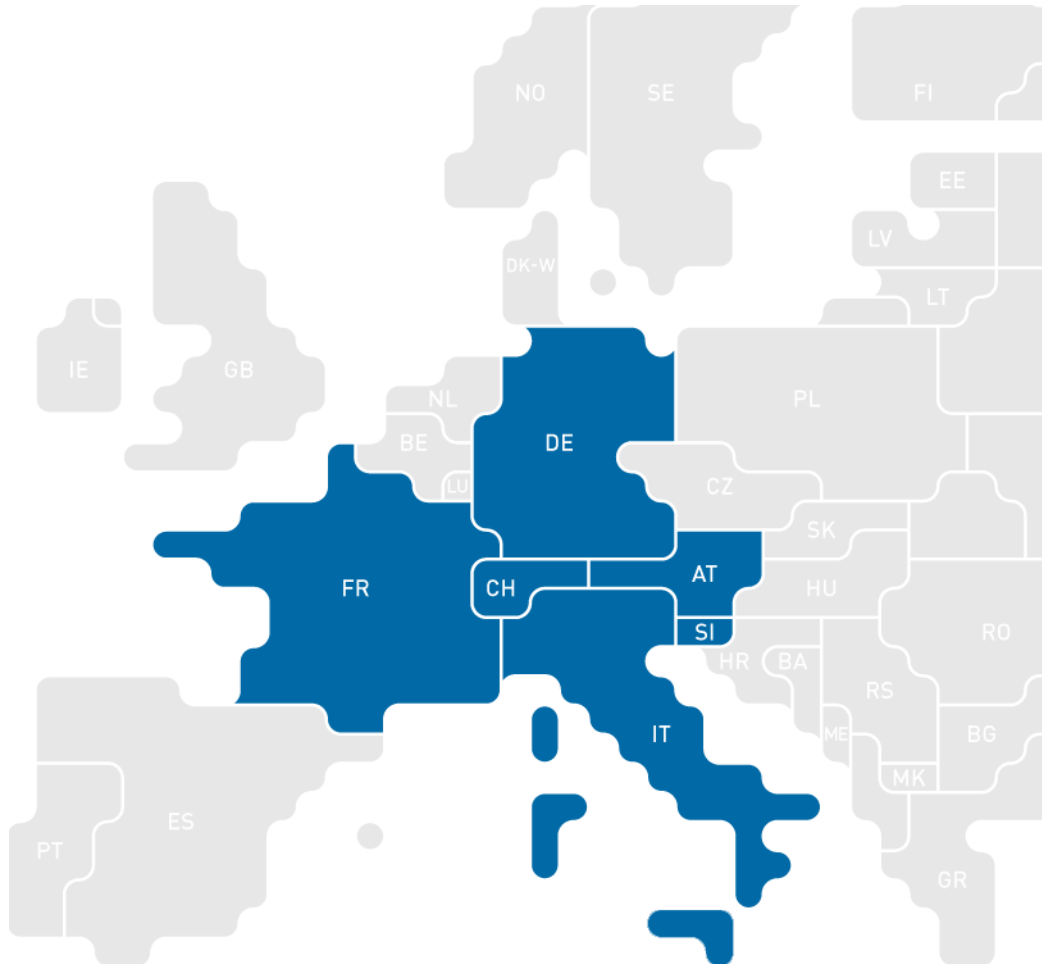
Strengthening and boosting the capacity on the existing 400-kV interconnection between Ukraine and Slovakia with circuit doubling: V. Kapusany (SK) – Mukachevo (UA), after 2015.

---

<sup>6</sup> Renewable Energy Sources

<sup>7</sup> Overhead line

## 2.3 UCTE Regional Forum Central South



### 2.3.1 Internal borders between TSOs of the UCTE Central South region

#### AUSTRIA –GERMANY INTERCONNECTION

In addition to the development described in Chapter 2.2.1, the following should be mentioned:  
possible change of operating voltage of the circuit Memmingen (DE, RWE TSO) – Westtirol (AT, APG) from 220 kV to 380 kV in mid-term.

TIWAG-Netz AG (AT) suggests to change the existing 220-kV-line connecting Silz and Oberbachern (DE, E.ON Netz) to 380-kV-operation in the long term (this would need to reconstruct the line on the German section).



## **GERMANY - AUSTRIA - SWITZERLAND INTERCONNECTION**

A new joint study has to be launched in 2009 by EnBW TNG (DE), RWE TSO (DE), swissgrid and VKW Netz, focusing on the increase of current power exchange between Germany and the central part of the Alps and investigating possibilities for grid extension options in the area.

## **AUSTRIA –ITALY INTERCONNECTION**

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

In order to significantly increase transmission capacity between Austria and Italy, a new 380-kV line between a new substation on Sandrigo (IT) - Cordignano (IT) line and Lienz (AT) had previously been planned for the long term.

For further significant uprating of the transmission capacity between Austria and Italy, a study into a new 380-kV double circuit line between Innsbruck (AT) and Bressanone (IT), passing through the planned Brenner Base Tunnel (BBT-Project), has been carried out by TERNA and TIWAG-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 Tyrol 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.

## **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 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) n°3 line and connecting it to the bus bar of the existing Albertville (FR) substation. A phase shifting transformer will also be installed on the 220-kV Trinité Victor / Menton (FR) – Camporosso (IT) interconnection line, in the Camporosso (IT) substation.

In the medium term, TERNA and RTE have launched a feasibility study in order to establish the suitability of using the new emergency tube of the Frejus motorway tunnel to install a new 1000 MW HVDC France-Italy interconnection.

## **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 joint study has been started in 2008 and will be finalized in 2009-2010.

### **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 PSTs have been planned 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: the first one has been installed in 220-kV Padricano (IT) substation (in operation since March 2008), the second one will be installed in 400-kV Divaca (SI) substation (under construction).

### **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), in operation since June 2008;
- 150-kV Villa di Tirano (IT) – Campocologno (CH), under construction, will be in operation in 2009-2010.

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

## **2.3.2 UCTE Central South TSOs borders with non-UCTE countries**

### **INTERCONNECTION ITALY – TUNISIA**

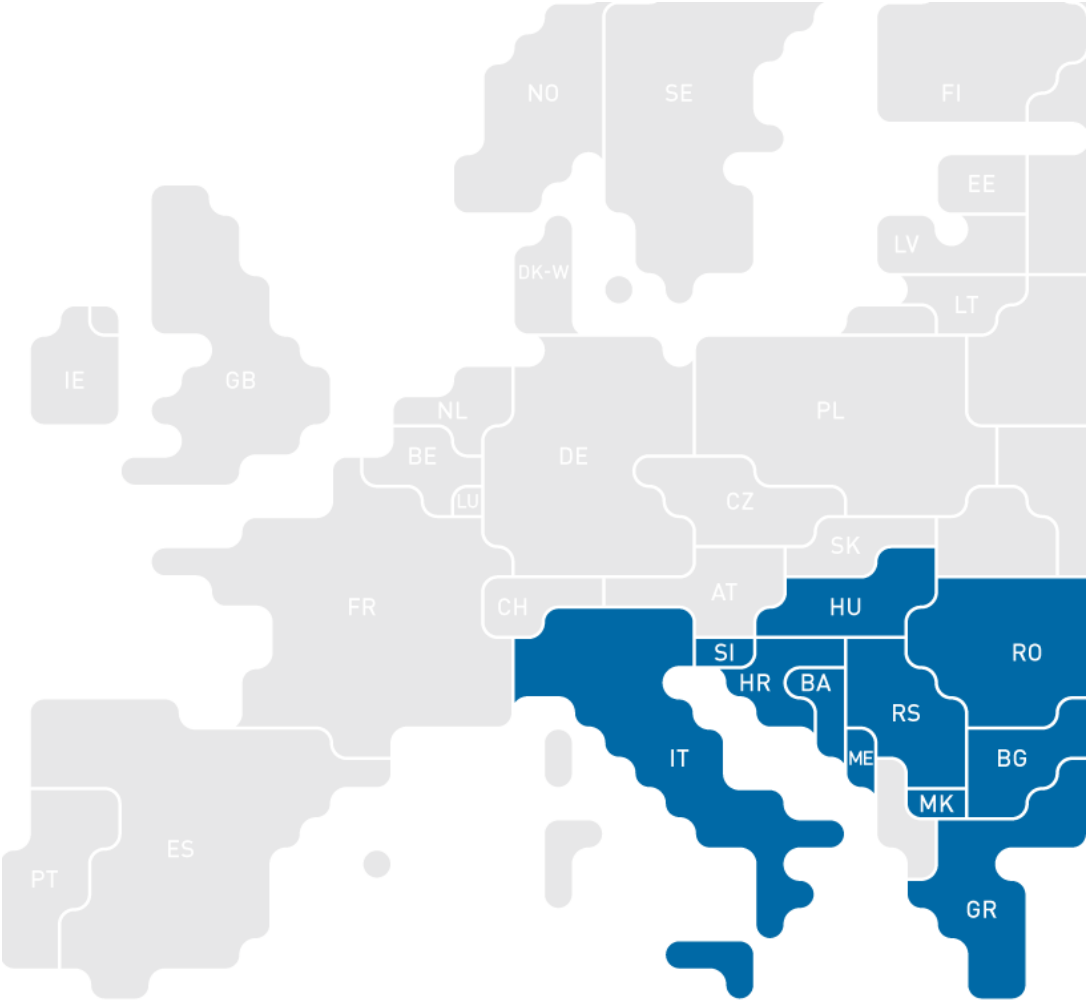
In June 2007, an agreement was reached by the Italian Minister of Economic Development and the Tunisian Minister of Industry and Energy, appointing Terna and the Tunisian company Steg to set up a joint venture to create the electricity interconnection, manage international transits of electricity on 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 1200 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 1000 MW capacity, 200 MW of which will be guaranteed to the free access share. The authorisation process started in July 2008 and the commercial operation is due to start in 2016.

### **INTERCONNECTION ITALY – MALTA**

On 5 June 2008, Terna and Enemalta, public operator of the network in Malta, signed an agreement of collaboration for the feasibility study of a new interconnection link between Malta and Italy. The study of the new undersea cable will analyze the economic, technical and regulatory aspects and the conclusion is expected within 2009.

## 2.4 UCTE Regional Forum South East



### 2.4.1 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 1212 / 1212 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 2013.

## **FYROM – ALBANIA INTERCONNECTION**

A 400-kV interconnection line between Bitola (MK) and Elbasan (AL) is being considered. This line is supposed to be a part of the backbone of Corridor 8, a foreseen gas, oil and energy connection between the Adriatic and the Black Sea.

## **MONTENEGRO – ITALY INTERCONNECTION**

A 500-kV HVDC submarine cable (thermal capacity 1000 MW) between Tivat (ME) and Villanova (IT) is being planned. "Agreement for carrying out the preliminary project and proceeding to the implementation phase of the new undersea interconnections between transmission grids of Italy and Montenegro" was signed (end of 2008). Feasibility and technical studies have been completed and a new study - on the reinforcements required on the Montenegro transmission system - has been launched in 2008.

## **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 does not carry any particular 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.

Prefeasibility study for the line has been carried out on Romanian side. EMS got donation to carry out project design, prefeasibility and environmental study for this line.

## **SERBIA – FYROM INTERCONNECTION**

New 400-kV-interconnection-line between Serbia and FYROM Nis (SR) – Stip (MK). Maximum increase of NTC at Serbia – FYROM border, according to the study carried out for this new line, is 250 MW in winter. Two more substations will be connected to the Serbian side: 400 [220] /110 kV Leskovac 2 and 400/110 kV Vranje 3. These



substations will make the operation of transmission network in South Serbia independent of the engagement of hydropower plants connected to 110 kV level.

### **BULGARIA – FYROM INTERCONNECTION**

The new 400-kV Chervena Mogila (BG) –Stip (MK) OHL between Bulgaria and FYROM entered into commercial operation in January 2009 as Chervena Mogila (BG) – Dubrovo (MK) until the construction of the 400/110 kV substation Stip (MK) is completed. 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 planned. 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 - 1000 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.

### **GREECE – ITALY INTERCONNECTION**

The interconnection with Italy has increased the reliability of the Greek system. A preliminary study is foreseen to assess the possibility of a second DC link between Italy and Greece.

### **BOSNIA & HERZEGOVINA – CROATIA INTERCONNECTION**

A new 400-kV interconnection line between both 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.

## **2.4.2 UCTE South East TSOs borders with non-UCTE countries**


### **GREECE - TURKEY INTERCONNECTION**

The 400-kV OHL between Greece and Turkey, N. Santa (GR) – Babaeski (TR), has been completed during the summer 2008. The line will be put into operation when the synchronous connection of Turkey to UCTE is possible.

### **ROMANIA - TURKEY INTERCONNECTION**

For the long term (2018), a 400-kV Constanta (RO) – Pasakoy (TR) DC link via undersea cable is planned.





It is also worth mentioning the following:

### **BULGARIA – TURKEY INTERCONNECTION**

There are two 400-kV OHL between:

- Maritsa East3 (BG) – Babaeski(TR) with thermal rating of 1310 MVA.
- Maritsa East3 (BG) – Hamitabat(TR) with thermal rating of 1715 MVA.

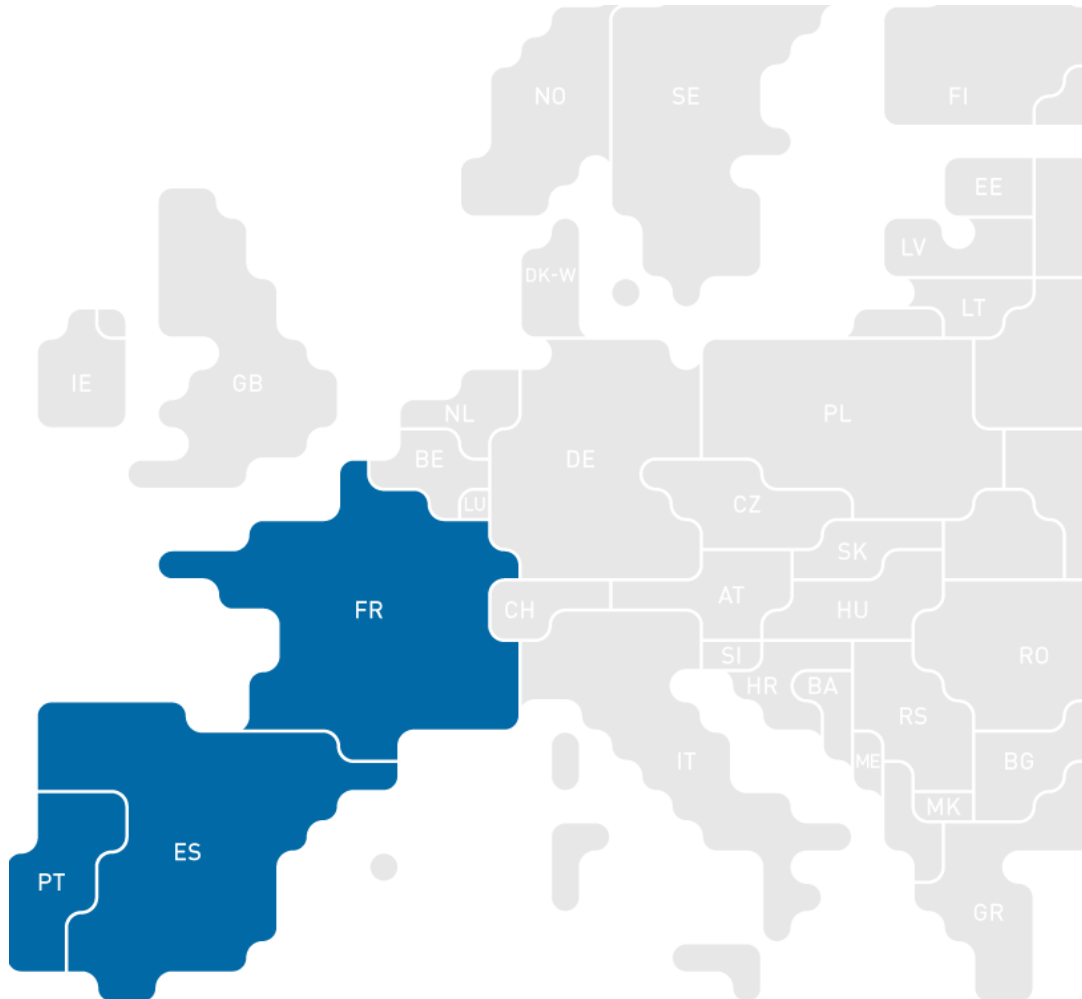
These OHL are not used at present and will be put in operation when the synchronous operation between Turkey and UCTE is possible.

Five years ago, the OHL Maritsa East3 (BG) – Babaeski (TR) was in operation to supply passive island in Turkey.

### **INTERCONNECTION ITALY – ALBANIA**

In August 2008, a new interconnection line proposed by private investors (the so-called “Merchant Lines”) was authorized by the authorities of the countries involved. The new HVDC line (400 kV, 500 MW) will connect the Brindisi Italian substation with Valone (AL).

## 2.5 UCTE Regional Forum South West




### 2.5.1 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 initial project involved a new 400-kV-double-circuit-line between Baixas (FR) and Santa Llogaia or Vic (ES) (in the latter case, the new line would have replaced the existing single-circuit-line). This project, to reach the 2600 MW stage, was classified as Priority Project by the European Commission and Mario Monti was appointed European Union Coordinator for the France-Spain electrical interconnection on 12 September 2007. 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.

However, based on the reports of an independent consultant, and on several informative sessions with the affected stakeholders, the proposal that the European Coordinator of the Spain-France interconnection published at the end of June of 2008 consisted of a solution in DC, totally undergrounded for the cross-border section of the interconnection (Baixas-Sta Llogaia), with a terrestrial drawing up, and using as far as possible existing infrastructures within a certain area.


This "exceptional solution" that implies undergrounding represents, according to the European Coordinator, "the best technical, economic and environmental commitment, considering the expectations of the local populations", and discards the option of AC voltage since this solution "only allows the undergrounding in limited sections". Therefore this alternative is by the moment the unique feasible one for the development of the Spanish-French interconnection by the Eastern Pyrenees.

In the French-Spanish summit held in Zaragoza on 27 June 2008, both Governments agreed to accept the proposal of the European Coordinator, and to create a Joint Venture that will carry out the technical and environmental studies, take care of the financing of costs related to the study, the administration procedures and the construction of the line. This new company, named INELFE, is working on the design of the project. Due to the big impact that the DC consideration has in the project, the new expected commissioning date is 2014.

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 2010 (400-kV Aldeadávila (ES) - Lagoaca (PT) line), along with new 400-kV connection between Laoaca (PT) – Armamar (PT) and Recarei (PT) substations (near Porto). Starting in 2009, some changes in the topology of the existing 220-kV lines in the same area will be implemented, mainly in the Portuguese 220 kV network. In 2008, some environmental requirements forced to change some features of the project, that lead to substitute on border zone crossing Douro river the two existing 220 kV lines Aldeadavila (ES) – Bemposta (PT) and Aldeadavila (ES) - Pocinho (PT) by a single circuit 400 kV line and a double circuit 220 kV line, with separated circuits, using new cables of higher capacity. In a first temporary phase of the project scheduled for 2009, the two existing lines will be replaced by two 220 kV lines Aldeadavila – Lagoaca 1 and 2. After the new 400 kV interconnection Aldeadávila - Lagoaça has been established in 2010, the two 220 kV lines across the border will be utilized to constitute the two interconnection lines Aldeadávila - Pocinho 1 and 2.



In the long term, the outcome of last 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 (ES) / Pazos (ES) – Vila Fria (PT) - Vila do Conde (PT) – Recarei (PT).  
This new project requires to build a new 400 kV double circuit line Cartelle-Pazos-border and set the 400 kV level in Pazos, in Spain, and a 400 kV new double circuit line border - Vila Fria - Vila do Conde - Recarei together with new Vila Fria and Vila do Conde 400 kV substations, in Portugal.  
The expected commissioning date is 2013/2014. The project is under environmental studies.
- New southern interconnection: 400-kV Puebla de Guzman (ES) – Tavira (PT).  
This new project requires to build a new 400 kV double circuit line Guillena - Puebla de Guzmán – border and set the 400 kV level in Puebla de Guzmán, in Spain, and a new 400 kV double circuit line border – Tavira – Portimão, along with new Tavira 400 kV substation, in Portugal.  
The expected commissioning date is 2011. Guillena (ES) – P. Guzmán (ES) is under construction and P. Guzmán (ES) – Tavira (PT) is permitting.

Both of these new interconnection lines will be built with double circuit towers, although on the cross border section only one circuit will be installed initially.

Besides the explicit herein mentioned, REE (ES) and REN (PT) have launched a new joint study in order to identify further reinforcements of the network for the long term, namely in centre-south and northern border zones.

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

## 2.5.2 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.






### 3 APPENDIX

## DETAILED INFORMATION ON INTERCONNECTION PROJECTS

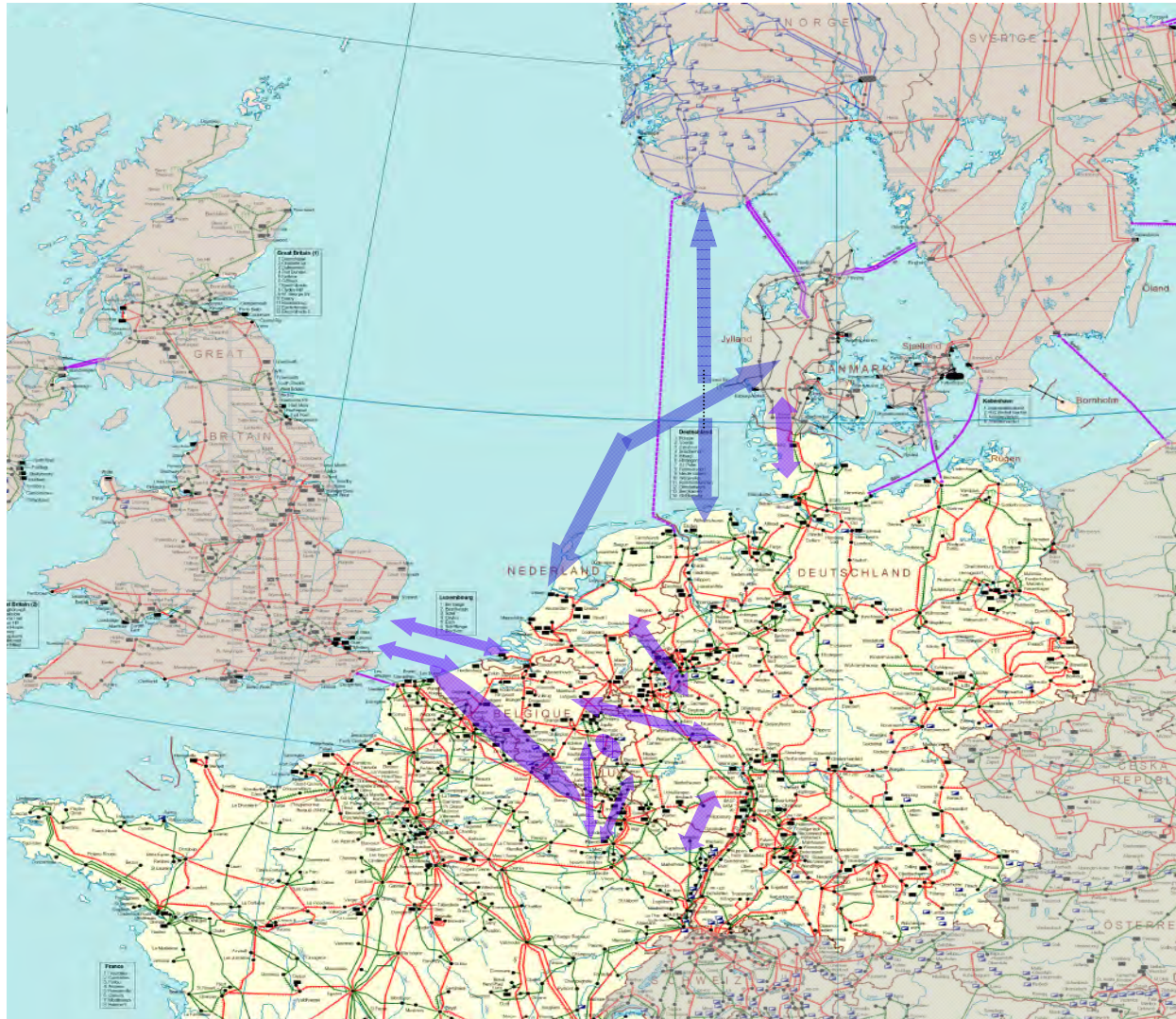


The information given hereafter is based on the status of projects and studies by February 2009.

**Caption for the indicator of progress shown in the tables**

- : Project progressing well
- : Certain delay expected
- : Project facing important delays

## Regional Forum Central West



## Regional Forum Central West

Border	Project Driver	Expected Effects	Project	Present status	Expected Date	Progress	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)	Completed	2008		Installation of 3 PST 380 kV, 1400 MVA, +25°/-25° <ul style="list-style-type: none"> <li>● 1 at Zandvliet</li> <li>● 2 at Van Eyck</li> </ul> TSO in charge: Elia
NL-NO	Market coupling Norway – Netherlands	Thanks to the project, both Norway (hydro system) and the Netherlands (thermal system) will be able to optimise the use of production capacity.	NorNed HVDC link	Completed, connection in service	2008		New HVDC link between Norway (Fedra) 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 Belval 225 kV-line	Permitting	2010	▲	Creation of a 225-kV Moulaine (FR) – Belval (LU) line.  TSOs in charge: RTE & SOTEL
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 (FR) – Aubange (BE) circuit due to N-1 contingency on the 400-kV	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




## Regional Forum Central West

Border	Project Driver	Expected Effects	Project	Present status	Expected Date	Progress	Description of Project
		network.					interconnection capacity. TSOs in charge: RTE & ELIA
<b>NL-UK</b>	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 transparency.	BritNed HVDC link	Under construction	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 and National Grid
<b>LU-BE</b>	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	Design & Permitting	2012	▲	New 220-kV-underground cable between the substations of Bascharage (LU) and Aubange (BE)  TSOs in charge Cegedel Net & ELIA
<b>DE-NL</b>	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 Doetinchem (NL) – Niederrhein (DE)	Planned	earliest in 2013		60-km new double circuit 400-kV OHL  TSOs in charge: TenneT & RWE TSO
<b>FR-BE</b>	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 consideration	2012-2015		Study in progress.  TSOs in charge: RTE & ELIA

## Regional Forum Central West

Border	Project Driver	Expected Effects	Project	Present status	Expected Date	Progress	Description of Project
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	Under consideration	≥2015		HVDC transmission system 700 - 1400 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 consideration	tbd <sup>1</sup>		HVDC link  TSOs in charge: Elia & National Grid
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 consideration	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.Avoid (FR) interconnection	Ensdorf (DE) – St. Aavoid (FR) line	Under consideration	tbd		TSOs in charge: RTE & RWE TSO
NL-DK	Market coupling Denmark – Netherlands	The purpose of the link is to allow for the exchange and integration of wind energy and increase the value of renewable energy into the Dutch and Danish power	Cobra project	Under consideration	2016		HVDC link Capacity 600 - 700 MW in both directions Total length of about 350 km TSOs in charge: TenneT TSO and Energinet.dk

<sup>1</sup> to be determined




## Regional Forum Central West

Border	Project Driver	Expected Effects	Project	Present status	Expected Date	Progress	Description of Project
		systems and to increase security of supply.					
DE-DK	Strengthening AC connections	Identification of possibilities to increase capacity on the AC connections	Under study	Under consideration	tbd		TSOs in charge: E.ON Netz & Energinet.dk


## Regional Forum Central East



## Regional Forum Central East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Progress	Description of Project
CZ - AT	To increase the (n-1) security and transmission capacity of the existing V437 Slavetice (CZ) – Durnrohr (AT; 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, APG) tie-line	Completed	2008		This project is the result of bilateral agreement that was reached between CEPS and APG to reinforce 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)	Under consideration	First planning is due on 2016	T.  	It resulted from the discussions between CEPS and E.ON Netz to build a new 400-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 & VE-T.

## Regional Forum Central East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Progress	Description of Project
<b>CZ - DE</b>	Increasing the (n-1) security and interconnection capacity on the Czech German (VE Transmission) interface.	Maintain the security of supply and support the Central Eastern Europe Market development	Increase of interconnection capacity on the Czech German (VE Transmission) interface.	Under consideration	After 2016		Possible new overhead line (new route) or reinforcement of existing OHL Hradec (CZ) – Röhrsdorf (DE, VE Transmission).  TSOs in charge: VE Transmission & CEPS .
<b>AT - DE</b>	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 (AT, APG) – Isar/ Pleinting (DE, E.ON Netz)	Under consideration	2017		New 380-kV double-circuit overhead interconnection line between Germany and Austria  TSOs in charge: E.ON Netz & APG
<b>HU - SK</b>	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, Veľké Kapušany (SK) - Hungary 400-kV double line or Gabčíkovo (SK) - Hungary 400-kV double line	Under consideration	After 2014		Under consideration are three projects: Sajóivánka(HU)- Rimavská Sobota (SK) 400-kV double line, Veľké Kapušany (SK) - Hungary 400-kV double line (this project replaces interconnection Moldava (SK) - Sajóivánka (HU)) and Gabčíkovo (SK) - Hungary 400-kV double line. Joint negotiations are in progress.  TSOs in charge : MAVIR & SEPS

## Regional Forum Central East



Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Progress	Description of Project
PL - DE	Increasing the (n-1) security and interconnection capacity on the PL - DE profile	It is expected that the project will decrease the loop flow from DE to PL and to CZ/SK. It will increase security of supply and the power exchange capacity between PL and DE on PL/DE/CZ/SK synchronous profile (CEE market development) and support the RES integration	Krajnik (PL) - Vierraden (DE) (including PST installation in Krajnik (PL) and Mikulowa (PL))	Planned	Before 2013	▲	This project is the conversion of the existing 220-kV double circuit line into a 400-kV line together with phase shifting transformers installation on 400 kV lines: Krajnik (PL) – Vierraden (DE) and Mikulowa (PL) – Hagenwerder (DE) (was agreed by TSOs: PSE Operator and VE Transmission) TSOs in charge: VE Transmission (DE) and PSE Operator (PL). Financing scheme: not yet decided.
PL - DE	Increasing power exchange capability on PL – DE profile	Possible effects of this project will be evaluated in joint studies. It is expected that the project will support the CEE market development, RES integration and maintain security of supply	Baczyna / Plewiska (PL) - Eisenhüttenstadt (DE)	Under consideration	After 2015	▲	This is the 3rd 400-kV interconnection between Poland and Germany with reinforcement of the Polish internal grid. TSOs in charge: VE-T (DE) and PSE-Operator (PL) Financing scheme: not yet decided
PL - SK	Increasing power exchange capacity on PL – SK profile	Possible effect of this project will be evaluated in joint studies.	Byczyna (PL) - Varin (SK)	Under consideration	After 2018	▲	This is a new 400-kV interconnection between Poland and Slovakia with reinforcement of Polish internal grid. Joint negotiations are in progress.

## Regional Forum Central East


Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Progress	Description of Project
							TSOs in charge: SEPS (SK) and PSE-Operator (PL) Financing scheme: in preparation
PL - LT	Incorporation of Baltic States into Internal Electricity Market (IEM) of EU.	Possible effect should be evaluated in joint studies.	Elk (PL) - Alytus (LT)	Planned	1 <sup>st</sup> step 2015  2 <sup>nd</sup> step 2020		This is a new 400-kV double-circuit interconnection between Poland and Lithuania together with Back-To-Back 1000 MW station in Alytus (LT) and reinforcement of the Polish and Lithuanian internal grids. 1 <sup>st</sup> step of implementation: Internal PL and LT transmission grids reinforcements to make possible power import capacity of 600 MW from Lithuania to Poland. 2 <sup>nd</sup> step of implementation: Additional PL and LT transmission grids reinforcements to make possible power transfer capacity of 1000 MW. TSOs in charge: PSE Operator (PL) & Lietuvos Energija (LT) Financing scheme: in preparation



## Regional Forum Central East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Progress	Description of Project
PL - UA	Resumption of existing and not used interconnection	It will increase the power exchange capacity on PL – UA profile	Modernisation and resumption of 750-kV Rzeszow (PL) - Khmelnitskaya (UA) OHL and installation of back-to-back 2 x 600 MW-converters in the Rzeszow 750-kV (PL) substation	Planned	≥ 2010		The project is the modernisation and resumption of existing 750 kV interconnection between Poland and Ukraine TSOs in charge: PSE Operator (PL) & Ukrainian TSO 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)	2 x 400-kV line V. Kapušany (SK) - Mukachevo (UA)	Under consideration	After 2014		This new project will strengthen and reinforce the existing 400-kV interconnection between Ukraine and Slovakia with circuit doubling. If the interconnection between Velké Kapušany (SK) and Hungary is realised, the reinforcement of existing interconnection between Slovakia and Ukraine will not be taken into account. TSOs in charge: subject of decision. Financing scheme: not yet decided
SK - AT	Creating an interconnection line between Austria and	Possible effects will be evaluated in joint studies	2 x 400-kV tie-line Stupava (SK) – Bisamberg / Wien SO (AT)	Under consideration	≥2020		New 400-kV SK - AT double-circuit interconnection. Remark: Another possible option suggested by SEPS and



## Regional Forum Central East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Progress	Description of Project
	Slovakia						MAVIR would be a new interconnection between SK and AT (from Gabčíkovo substation (SK) to Vienna (AT)) via Hungary by using one circuit of existing 400kV line Gyor (HU) - Vienna (AT) in combination with the project Gabčíkovo (SK) – Gyor (HU) in the time horizon after 2014. However, common negotiations are needed. TSOs in charge : SEPS (SK), APG (AT) & MAVIR (HU)
<b>AT - HU</b>	Increasing the (n-1)-security and transmission capacity of the existing tie-line Wien SO (APG) – Győr / Szombathely (MAVIR)	The project will increase the (n-1)-security and transmission capacity on Austria – Hungary profile.	Tie-line Wien SO (AT) – HU Border (Győr / Szombathely), 2 <sup>nd</sup> System	Design & Permitting	2010		This project is the installation of the 2 <sup>nd</sup> circuit on the existing tie line from Wien SO (AT, APG) to the border (both systems have already been installed on the Hungarian side, one is connected to Győr and the other to Szombathely). TSO in charge: APG

Regional Forum Centre South



## Regional Forum Central South

Border	Project Driver	Expected Effects	Project	Present status	Expected Date	Progress	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	Design & Permitting	2011		Installation of a PST in Italy.  TSOs in charge: TERNA (& RTE)
FR-IT	Increase of transfer capacity on France - Italy border	The 400-kV France - Italy interconnection relies on the only substation in Albertville on the French side; it is made up of a recently constructed double 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 existing network and increase the capacity of this axis, which limits transmission capacity towards Italy.	Upgrade the connection at the Italian - French border	<i>French side:</i> Design & Permitting  <i>Italian side:</i> Under construction	2012		Replacement of Albertville (FR) - La Coche (FR) - La Praz (FR), La Praz (FR) - Villarodin (FR), Villarodin (FR) - Venaus (IT) 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) n°3), with high temperature conductors and connection to bus bar in the existing Albertville (FR) substation.  TSOs in charge: RTE & TERNA


## Regional Forum Central South

Border	Project Driver	Expected Effects	Project	Present status	Expected Date	Progress	Description of Project
IT-SI	Congestion 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	Planned	Long Term		New 380-kV double-circuit line between Udine Ovest (IT) and Okroglo (SI).  TSOs in charge: TERNA & ELES
IT-SI	Congestion on Italian – Slovenian border	Increase the capacity of the current interconnection on the north-eastern Italian border which has low level of security and a low transfer capacity. Low security of supply on the Slovenian network. TEN-E Project	New 400-kV PST	Under construction	2011	▲	400/400-kV PST in Divaca (SI) substation  TSO in charge : ELES
IT-SI	Congestion 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	Completed	2008	▲	220/220-kV PST on Padriciano (IT) – Divaca (SI) Interconnection, in Padriciano (IT)  TSO in charge: TERNA
IT-AT	Congestion on Italian – Austrian border	Increase n-1 security and capacity on Italian - Austrian border	New 220-kV PST	Design & Permitting	2011	▲	220/220 PST in Lienz (AT) substation TSOs in charge: APG (& TERNA)


## Regional Forum Central South

Border	Project Driver	Expected Effects	Project	Present status	Expected Date	Progress	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 interconnection between Italy and Austria	Under consideration	Long term		An optimized route of existing 220-kV Soverzene (IT) – Lienz (AT) interconnection line would be used to minimize the environmental impact. TSOs in charge: TERNA & APG
IT-AT	Increase of transfer capacity on Italian-Austrian border	In the 2003 TEN Study, the possibility of increasing transfer capacity between Italy and Austria 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 (AT) – Bressanone (IT)	Under consideration	Long term		New 380-kV GIL interconnection through the planned Brenner Base Tunnel.  TSO's 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 consideration	Long 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	Progress	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)	Design & Permitting	2011		The project on both sides (Italy and Austria) comprises the upgrading of the existing line Prati di Vizze – Steinach, 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)	Under consideration	Long Term		380-kV-line between Lavorgo (CH) and Morbegno (IT); different options 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 consideration	Long Term		tbd  TSOs in charge : RTE, swissgrid (& TERNA)

## Regional Forum Central South

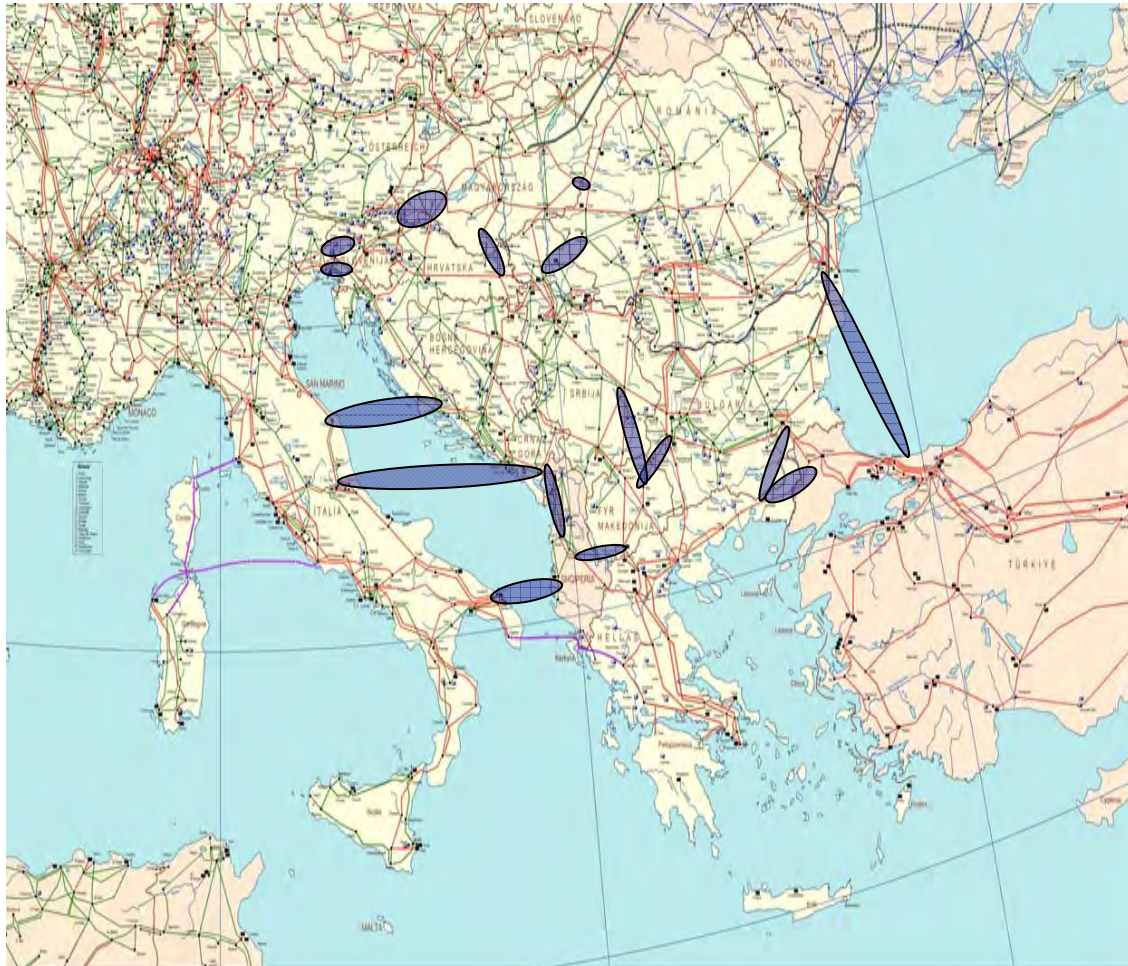
Border	Project Driver	Expected Effects	Project	Present status	Expected Date	Progress	Description of Project
FR-IT	Increasing transfer capacity on French - Italian border	In the 2005 TEN Study, the possibility of increasing the transfer capacity between Italy and France has been investigated. The HVDC solution seems the most feasible, using existing infrastructure corridors.	HVDC cable Piossasco (IT) – Grande Ile (FR)	Planned	Mid Term		New HVDC underground cable interconnection between Piossasco 400-kV (IT) and Grande Ile 400-kV (FR), 1000 MW.  TSOs in charge: TERNA & RTE
DE-AT	Increasing power exchange capacity between Germany and Austria	Upgrading existing 220 kV grid in southern DE and western AT	Line Oberbachern (DE) – Sitz (AT)	Under consideration	Long Term		TSOs in charge: E.ON. Netz and TIWAG Netz;  Project suggested by TIWAG Netz, not confirmed by E. ON Netz.
DE-AT/CH	Increasing power exchange capacity between Germany, Austria and Switzerland	Increase of current power exchange between Germany and the central part of the Alps. Transmission and evacuation of future generation capacity in the Alps	Interconnection between Germany and the alpine region	Under consideration	Long Term		TSOs in charge: ENBW TNG, RWE TSO, swissgrid & VKW Netz
IT-MT	Interconnection line between Italy and Malta	In June 2008, Terna and Enemalta signed a cooperation agreement on a feasibility study for a new link between Malta Island and Italy.	New submarine cable between Italia and Malta	Under consideration	Mid-Term		TSOs in charge: TERNA and ENEMALTA



## Regional Forum Central South

Border	Project Driver	Expected Effects	Project	Present status	Expected Date	Progress	Description of Project
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	Design & Permitting	2016		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 1200 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 1000 MW capacity, 200 MW of which will be guaranteed to the free access share. TSOs in charge : TERNA & STEG

## Regional Forum South East





## Regional Forum South East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Progress	Description of Project
<b>MK-BG</b>	Establishing East – West Corridor in south-eastern Europe (SEE)	<p>Increase Italy's imports from the Balkans (BG, RO). Strengthen the sparse structure of the Balkan networks.</p> <p>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).</p>	Stip (MK) – C. Mogila (BG) 400-kV-line	Completed	11/2008	▲	<p>Length: 150 km</p> <p>TSOs in charge : MEPSO &amp; NEK</p> <p>The line has been commissioned as Dubrovo-C.Mogila because the 400/110kV SS Stip is still under construction</p>
<b>MK-AL</b>			Bitola (MK) – Elbasan (AL) OHL	Under consideration	2012		<p>OHL length ~ 200 km</p> <p>TSOs in charge : MEPSO (MK) &amp; ATSO (AL)</p>
<b>ME-IT</b>			Tivat (ME) – Villanova (IT) 400-kV OHL & DC cable	Planned	Mid Term	▲	<p>Sub-sea cable total length ~ 375 km</p> <p>TSOs in charge : TERNAL (IT) &amp; EPCG (ME)</p>
<b>AL-ME</b>	Alleviate congestion in the region	Establish a stiff corridor from Greece, Albania and Montenegro up to the Adriatic line	Tirana (AL) – Podgorica (ME) 400-kV-line	Under construction	Third quarter of 2009	▲	<p>400-kV-line Tirana 2 (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 the Montenegrin side).The contract for the construction is signed with Dalekovod Company. TSOs in charge: ATSO and APCG</p>

## Regional Forum South East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Progress	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)	Completed	2008	▲	Increase exchange capability between Hungary and Romania 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	Completed	2008	▲	The line will be put in operation when the synchronous connection of Turkey to UCTE is possible. Length 130 km TSOs in charge : HTSO & TEIAS
GR - BG			N. Santa (GR) – Maritsa (BG) 400-kV-line	Design & Permitting	2012-2015	▲	New interconnection line between Greece and Bulgaria Length 130 km approximately TSOs in charge : HTSO & NEK
SI - HU and 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)	Design & Permitting	2013	▲	First 400-kV interconnection line between Slovenia and Hungary. The line already exists on Hungarian and Croatian sides. TSO in charge : ELES

## Regional Forum South East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Progress	Description of Project
GR-IT	Increase of interconnection capacity	Increase the transfer capacity between Greece and Italy	Second HVDC link between Greece and Italy	Under consideration	tbd		400-kV DC interconnection  TSOs in charge : TERNA & HTSO
HR-IT	Create a sub-sea 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 sub-sea cable between Croatia and Italy	Under consideration	Mid -Term		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 construction	2011		Length ~ 220 km  The first part of the line Nis - Leskovac on Serbian side is under construction and is expected to be put in operation in 2009.  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)	Planned	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 consideration	2018		Length 128 km  Pre-feasibility study for the line has been carried out on Romanian side. EMS got donation to carry out project design, prefeasibility and




### Regional Forum South East

Border	Project Driver	Expected Effects	Project	Present Status	Expected Date	Progress	Description of Project
							environmental studies for this line.  TSOs in charge : Transelectrica & EMS

Regional Forum South West





## Regional Forum South West

Border	Project Driver	Expected Effect	Project	Present status	Expected Date	Progress	Description of Project
PT-ES	Portugal-Spain Douro interconnection reinforcement	Alleviate the congestion on the 220-kV network in the Douro area, making possible the reception of the new amount of power stations under construction (~ 500 MW) or under permitting process (~ 300 MW) in the Douro river system.	New 400 kV Douro interconnection Aldeadávila (ES) - Lagoaça (Douro Internacional, PT) and associated changes in the topology and cables of some 220-kV lines of the area	Construction (PT) or Permitting (almost under construction (ES))	2009/2010		<p>New 400 kV OHL interconnection line Aldeadávila (ES) - Lagoaça (PT) - Armamar (PT) - Recarei (PT), including new Lagoaça (PT) and Armamar (PT) 400 kV substations.</p> <p>On river crossing, a new 220 kV double line with separated circuits Aldeadavila (ES) - Pocinho (PT) 1 &amp; 2 will substitute the existing two 220 kV lines Aldeadavila (ES) - Bemposta (PT) and Aldeadavila (ES)-Pocinho (PT). The other corridor on this area will be used to build the 400 kV single circuit line. At Lagoaça (PT) substation several existing 220 kV lines will be opened.</p> <p>AC Voltage 400 kV and 220 kV 400 kV Transmission Capacity: 1700 MVA (winter) Length 400kV : 1km in Spain, 60km+40km+5km in Portugal (Recarei-Armamar-Lagoaça-border) Length 220kV : 1km in Spain,</p>



## Regional Forum South West

Border	Project Driver	Expected Effect	Project	Present status	Expected Date	Progress	Description of Project
							5km+12km in Portugal TSOs in charge : REN & REE
PT-ES	Portugal-Spain Southern interconnection	Alleviate the congestion that occurs on the existing 400-kV line Alqueva (ES) – Brovaes (PT) 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.Guzmán (ES)  Permitting (P.Guzman (ES) – Tavira	2011		New OHL double-circuit line between Guillena (ES) - Puebla de Guzman (ES) - Tavira (PT) - Portimão (PT), including new P.Guzmán (ES) and Tavira (PT) 400 kV substations. On the interconnection section P.Guzman (ES) - Tavira (PT), initially only one circuit will be placed.  AC Voltage 400 kV Transmission Capacity: 1700 MVA (winter) Length: 153 km in Spain (Guillena –border), 110 km in Portugal (Portimão -border) TSOs in charge : REN & REE
FR-ES	Constraint on France-Spain border	The total interconnection faces a high level of congestion limiting the transmission capacity.  Limitations on the production of wind power energy in the Iberian system.	New HVDC interconnection line in the eastern part of the border	Design & Permitting	2014		Included in the Priority Interconnection Plan (TEN-E Guidelines). A European Coordinator has been appointed by the European Union for this project.  Political agreement on a new

## Regional Forum South West

Border	Project Driver	Expected Effect	Project	Present status	Expected Date	Progress	Description of Project
		The project aims at eliminating these constraints.					<p>underground HVDC line between Baixas (FR) and Santa Llogaia (ES)</p> <p>Transmission Capacity: being defined Length: 28 km in Spain, 40 in France. TSOs in charge : RTE &amp; REE</p>
PT-ES	Portugal-Spain Northern interconnection	<p>Alleviate the congestion on the existing 400-kV line Cartelle (ES) –Lindoso (PT) at low levels of exportation from Spain to Portugal.</p> <p>Besides, the project enables the total integration of Spain and Portugal in MIBEL.</p>	New 400-kV Northern interconnection	Design & Permitting	2013/2014	▲	<p>New 400 kV OHL double circuit line between Cartelle (ES) -Pazos (ES) and Vila Fria (PT) - Vila do Conde (PT) - Recarei-(PT), including new Vila Fria (PT), Vila do Conde (PT) and Pazos (ES) 400 kV substations.</p> <p>On the interconnection section Pazos (ES) – V. Conde (PT), only one circuit will be placed. On the section Vila do Conde (PT) – Recarei (PT) both circuits will be installed.</p> <p>AC Voltage 400 kV Transmission Capacity: 1700 MVA (winter) Length: 110 km in Spain (Cartelle -border), 112 km in Portugal (Recarei-</p>



## Regional Forum South West

Border	Project Driver	Expected Effect	Project	Present status	Expected Date	Progress	Description of Project
							border) TSOs in charge : REN & REE

Besides the explicit herein mentioned, REE and REN have launched a new joint study in order to identify further reinforcements of the network for the long term, namely in center-south and northern Portuguese border zones.

## Contact

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

[info@ucte.org](mailto:info@ucte.org)  
[www.ucte.org](http://www.ucte.org)

