GENERATION ADEQUACY

An ASSESSMENT OF THE INTERCONNECTED EUROPEAN POWER SYSTEMS 2008-2015

Update to year 2007

(Prepared in co-operation with UCTE, NORDEL, UKTSOA, ATSOI, BALTSO)

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1 AIMS OF THE ETSO GENERATION ADEQUACY 2007-2015 UPDATED REPORT:

This report sets out the main updates at year 2007, per regional Geographical blocks, to the forecasts and data used in the ETSO generation adequacy Report over the European Electricity system for the period 2008-2015.

It is only intended to highlight the main changes in forecasts both on generation and load side occurred in year 2007 in the European Energy markets.

The adequacy analysis for the ETSO region is based on data and forecasts provided from UCTE, NORDEL, ATSOI, UKTSOA and the Baltic TSOs (for the first time in year 2006) issued and published 2 years before the covering period of the adequacy analysis in the ETSO area.

ETSO first generation adequacy report covering the period 2007-2015 was issued in year 2005; the second one covering the period 2008-2015 was issued in year 2006.

For year 2007 it was decided to provide an additional report where an update in the forecasts issued in year 2007 in respect to the one used in here 2006 is described per ETSO Block.

This update version is based on the:
- the UCTE System Adequacy Forecasts 2007-2020 issued on January 2007, for the Main UCTE and UCTE former-Centrel Block.
- Great Britain Seven Years Statement (SYS) published on 2007 for the Great Britain Block
- Ireland's Generation Adequacy Report 2007-2013, and recently signed connection agreements with EirGrid
- Nordel's power balance 2009/10 issued in June 2006 and best estimate - scenario 2015 prepared in spring 2007
- Baltic power balances from Baltic Grid 2025 study.

This update of the report is not intended to provide a new comparison for the reliability of the ETSO system or a new analysis of the ETSO Generation adequacy but it is aimed to describe, where it is the case, the difference between the original forecasts submitted in year 2006 and the new forecasts in year 2007.

2 EXECUTIVE SUMMARY

- UCTE Main Block, Spain & Portugal and Italy forecast adequate Remaining Capacity until 2015
- GB and Nordel see increased wind generation capacity and a lower forecast demand than previously submitted
- ROI, UCTE former-CENTREL block and Baltic countries forecast potential insufficient capacity after 2010/11 due to generation plant closures
- SE UCTE forecasts Remaining Capacity below ARM criteria until at least 2012
- Romania and Bulgaria see capacity close to adequacy levels, with post-2009 generation investments improving the situation

3 GLOBAL RESULTS UPDATES TO YEAR 2007

3.1 Regional Block Analysis – Updates to year 2007

UCTE Main Block

UCTE generation adequacy forecasts for the period 2007-2020, issued in year 2007, confirms that in the main UCTE area sufficient Remaining Capacity is available at the moment to be over ARM criteria. But in scenario A, a regular decrease of Remaining Capacity is foreseen over next years, so that the criteria would no longer be met in 2015. The UCTE main block, globally exporter today, woud thus have a decrease in its potential for export, and 20 GW of further investments would be necessary in 2020 to reach ARM again.

According to scenario B, the situation could be maintained at the present level over the whole period 2007-2020.

UCTE-CENTREL Block (with Western Ukraina) (for convenience in this report the former CENTREL countries have been labelled UCTE-CENTREL)

The UCTE generation adequacy forecasts for the period 2007-2020, issued in year 2007, confirmed that the situation of the former-CENTREL block looks comfortable in the present years, with a Remaining Capacity almost doubled compared to ARM criteria.

But in scenario A, this situation would quickly deteriorate after 2010, mainly under the effect of decommissioning of fossil fuel plants. ARM criteria would no longer be met after 2013 unless decommissioning are compensated by new investments as foreseen in scenario B. Then owing to fossil fuel plant decommissioning (Large Combustion Plant Directive) and to an increasing share of renewable energy sources, remaining available capacity is decreasing from 2007 to 2015.

Nordel Block without Iceland

Since the last submission the most significant changes have been on the supply side, in 2015 also in the demand side. As a result there will be no major changes in the remaining capacity.

Commissioning of the new 1600 MW nuclear power unit in Finland has been postponed after 2010. On the other hand, some old fossil fuel power plants, which were decommissioned in the last submission, are expected to be still available in 2010. The wind generation is assumed to contribute 6 % of the installed capacity at peak on the Nordic level. This increases the available capacity. The earlier estimate was 0 %. After these adjustments the remaining capacity in 2010 is about the same as in the last submission.

The growth of the demand and supply between 2010 and 2015 is expected to be slightly lower than in the last submission. The remaining capacity in 2015 slightly increases in both scenarios.

Great Britain

National Grid indicate that since the original submission of forecasts, demand in Great Britain has not behaved as expected and forecasts given in National Grid's recently published 2007 Seven Year Statement (SYS) are now much lower than in the 2005 edition. In the 2005 SYS, Average Cold Spell (ACS) peak demand growth totalling 1.5GW was projected between 2004/05 and 2006/07. In the event, ACS peak demand fell in both 2005/06 and 2006/07, with sharply rising end-user electricity prices over the two years being a likely major factor.

The declines in demand in 2005/06 and 2006/07, allied with a slow recovery now projected for 2007/08 and 2008/09 result in the latest ACS peak forecast given in the 2007 SYS being up to 3GW lower than the corresponding projections in the 2005 SYS (for example, the revised forecast load for Jan 2008 7p.m. is now 59.301GW compared with 61.974GW previously).

In both scenarios it is assumed that those coal and oil plants which have opted out of the Large Combustion Plant Directive will close as per our latest internal forecast.

All wind generation is assumed to contribute 35% of installed capacity at peak; the remainder is counted as non-usable capacity.

Both scenarios include the development of the Britned interconnector with the Netherlands.

Scenario A:

In Scenario A only those new CCGT developments that National Grid have currently known to be under construction have been included, and National Grid has assumed that the commissioning of such sites will not occur any earlier than forecast in our internal view.

When considering wind developments National Grid has taken a "safe" assumption that 50% of contracted plant will proceed between now and 2010, and only 33% between 2010 and 2015. This reflects the degree of uncertainty posed by a large number of relatively small projects and the slippage of new developments observed over the past few years.

National Grid assumed that AGR nuclear plant does not get extended beyond the end of currently published life-spans.

Scenario B

In Scenario B National Grid assumed that AGR nuclear plant receives a 5-year extension up to a 40-year life-span.

National Grid has based the forecast of new generation capacity on its latest internal planning background. **This has resulted in significantly more wind generation in this view than in the forecast previously submitted.**

Scenario B also includes an allowance for mothballed capacity and the proposed interconnector between Wales and the Republic of Ireland.

Republic of Ireland

The Republic of Ireland indicates that the most significant changes since the last submission have been registered on the supply side. The closure of 1300 MW of Heavy Fuel Oil fired generation has been announced by ESB Power Generation. These units are due to close over the period 2007 to 2011. However two new gas-fired combined cycle power plants are also due to connect within this timeframe. Notwithstanding this additional capacity, EirGrid's latest Generation Adequacy Report indicates that there is a requirement for further plant in 2011.

Scenario A should include the further interconnection that is now being developed.
Current plans are to have a 500 MW East-West (Ireland-Wales) interconnect or in place by 2015 (or earlier).

At the moment, imports from Northern Ireland are limited to 330 MW, and exports to 170 MW. However, beyond 2012, once transmission links between the two jurisdictions have been reinforced (and with the All-Island electricity market already in place), the whole island will be treated as a single area from a generation adequacy perspective.

Baltic Countries

Generation adequacy forecast for Baltic countries was updated in August 2007 and it confirms that in Baltic area sufficient Remaining Capacity will be not longer met from 2010, mainly under the effect of decommissioning of Ignalina nuclear power plant (1300 MW).

In scenario A the adequacy feature is no longer met from 2010. The lack of available generation capacity to reach ARM will be about 1,0 GW in 2015.

Commissioning expected in scenario B cannot fulfil adequacy requirement (ARM) in 2010 as well. But planned expansion of fossil fuel generation in all Baltic countries for the period 2010-2015 could change capacity mixture and the Remaining Capacity would become higher than ARM.

Spain and Portugal

The UCTE generation adequacy forecasts for the period 2007-2020, issued in year 2007, confirmed that in scenario A the adequacy is met over the period 2007-2015 thanks to undergoing developments generation in Spain. Without further investments, the situation would quickly worsen after 2015, with a need for 10 GW investments by 2020.
In scenario B, a slow raise of Remaining Capacity could be expected to improve adequacy in further years.

Italian block

Thanks to expected commissioning of new conventional thermal plants, the Remaining Capacity of Italy is increasing. If these investments were actually confirmed and achieved, the situation of Italy would become quite different from what it was in the past. The Remaining Capacity would become higher than ARM from 2007. After 2015, the Remaining Capacity gets back under the ARM criteria. 7GW further investments would be needed in 2020 in scenario A, likely to be realised if considering scenario B.

South Eastern UCTE block

The situation of this block is very tightened all along the period. Remaining Capacity is at the moment significantly under the ARM criteria. The decided increase of capacities from now to 2010 is likely to improve the situation, but is still not sufficient to reach the adequacy criteria in scenario A.

In scenario B, adequacy criteria could be reached around 2012.

Romania + Bulgaria block

Remaining Capacity of the block remains close to the adequacy indicative level over 2007-2020 period. After a small decrease in 2008-2009, new investments in generating capacities are supposed to improve the situation of the block, in scenario A as well as in scenario B.

4 APPENDIX 1 – METHODOLOGY

Under the terms of this Report, generation adequacy assessment consists in investigating the ability of the generating units to match the system load evolution.

The Updated Report is based on the Methodology of the ETSO Generation Adequacy report for 2008-2015 where the assessment adequacy is based on:

- the comparison between the **installed generating capacity** with the actual or forecast load, taking into account unavailable or unusable generation capacity resulting from outages, overhauls and reserves required in operational time frame.
- the estimation, according to the UCTE methodology, if there is sufficient capacity to supply demand in the various member states. The UCTE methodology is a deterministic approach focussed on power balance at peak load time, which allows the assessment of generation adequacy on the basis of the reserve availability at this time (expressed as the ratio "remaining capacity" over installed capacity)

The load corresponds to a common synchronous reference for the ETSO network, measured at the third Wednesday of January at 19.00 and the third Wednesday of July at 11.00, under normal climatic conditions.

The adequacy analysis is based on the UCTE methodology. This methodology relies on a relatively simple comparison of the "Remaining Capacity" (RC) to the "Adequacy Reference Margin" (ARM), for each country and for the global ETSO.

The **Remaining Capacity** is obtained by deducing from the "Net Generating Capacity" (NGC) all the non-usable or reserve capacity.

The Adequacy Reference Margin is defined as the sum of two terms:

- a proportion of the Net Generating Capacity set to 5% or 10% according to the country considered depending on its electric system characteristics,

- a "Margin Against the Peak Load" that compensates the fact that the analysis is made at a predefined synchronous time points (e.g. 3rd Wednesday of January 19:00 and July 11:00) and not specifically at the peak load of the country.

For the global overview of reliability at ETSO level the ARM is calculated as 5% of total NGC plus the sum of individual margins against peak load – knowing that the peak load of each country are not synchronous.

In this method, we consider that capacity exchanges between countries are infinite, which is, of course not the case.

The simplified feature used in this report to characterise the reliability of ETSO system is then, for each of the studied time points:

Remaining Capacity > Adequacy Reference Margin

with ARM = 5% Net Generating Capacity + Margin against the daily peak load

The Remaining Capacity (RC) can be interpreted as the capacity that the system needs to cover the difference between the peak load of each country and the load at the synchronous reference time, and, at the same time to cover demand variations (resulting for example from weather conditions) and longer term unplanned outages which the power plant operators are responsible to cover with additional reserves.

This positive or negative balance, indicating whether a certain area or region has generating capacity that it could export without endangering its own reliability, or whether it needs to import power in order to ensure reliable supplies.

Due to significant differences among the different power systems in Europe it is very difficult to define a common margin of spare generation capacity over and above peak demand to ensure a reasonable level of security. Nevertheless the following approximations, issued from analysis of the random factors which affect each of the national system, have been considered as a reasonable.

Considering a level of risk for each national system corresponding to 1% is consistent for the UCTE system and some national systems with RC at peak load representing 5% of the national generating capacity.

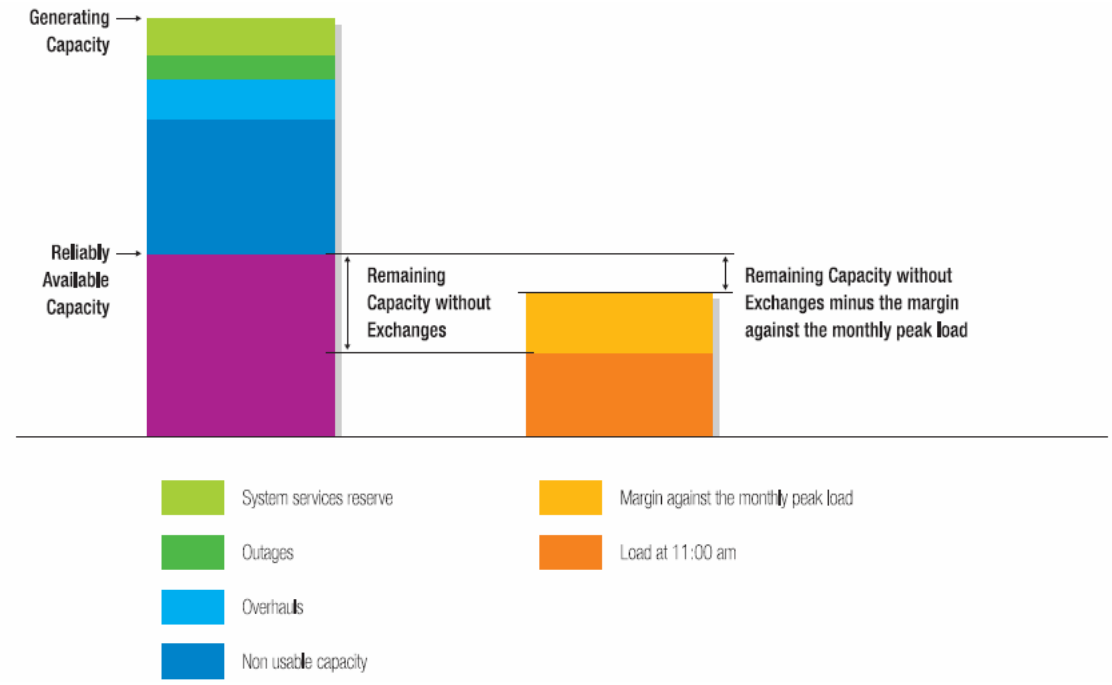
For some other national systems, more sensitive to random factors (load variations or unavailability of generation), RC should represent around 10% of the national generating capacity. Small, isolated or weakly interconnected systems need larger reserves to enable the same security as in large area.

These indicative level of margins are called Adequacy Reference Margin (ARM). Thus when considering individual countries, **generation adequacy will be assessed on the basis of the comparison between RC and ARM**. ARM is not used as an indication for the Nordel System. The additional peak load demand between normal and cold temperature conditions occurring once in ten years is used instead of ARM.

This method is also applied to assess generation adequacy for the whole UCTE system or for larger geographical blocks; in this case the synchronous peak load of the blocks is estimated by the sum of the peak loads of the individual countries.

This approximation leads on one hand to an overestimation of the peak load for the largest geographical blocks and to a conservative view of the level of adequacy. On the other hand, considering the synchronous peak load of large size blocks leads to rely on the assumption that it is always possible to carry where needed the generating power available in a country in any other country of the block, whereas the capacities of the transmission system actually limit these possibilities.

Here below is shown the graph illustrating the Power Balance according to UCTE methodology:



Another step is to take into account the role of interconnections in security of supply. Imports can secure a system, provided that export capacities exist in the neighbouring systems and that interconnections capacities allow for the associated transits.

In order to estimate the export capacities or import need a simplified approach consists in comparing the Remaining Capacity to the ARM:

Remaining Capacity > ARM means possibility of export

Remaining Capacity < ARM means need of import

The comparison of RC with the transfer capacities gives a first estimation of the possible contribution of interconnections to security of supply.

However, where there is a risk of a regional energy shortage (especially for systems depending on hydro conditions like the Nordel region), then specific calculations must to be performed in order to check if the available energy is sufficient to supply the yearly consumption.

Two scenarios are taken into account for the generation capacity evolution:

- **Scenario A "Conservative**": only new generation projects known as firm are integrated.

- **Scenario B "Best estimate":** it takes into account future power plants whose commissioning can be considered as reasonably probable according to the information available for the TSOs.

5 APPENDIX 2 – ASSUMPTIONS AND ABBREVIATIONS

Assumptions and Abbreviations below are used in the report.

Abbreviation	Complete title
ARM	Adequacy Reference Margin
BALTIC COUNTRIES	Baltic Countries is a regional group of three Transmission system operator companies: - OÜ Põhivõrk for **Estonia** - AS Augstsprieguma tikls for **Latvia** - LIETUVOS ENERGIJA AB for **Lithuania**
UCTE-CENTREL	A grouping of the former CENTREL countries' TSOs: - ČEPS, a.s. **- of the Czech Republic;** - Hungarian Power System Operator Company MAVIR Rt.of **Hungary;** - PSE-Operator S.A. **of Poland;** - Slovenská elektrizačná prenosová sústava, a.s. – SEPS a.s. - **of Slovakia**
ETSO	European Transmission System Operators
JIEL	JIEL is a regional group composed by two transmission system operator companies: - MEPSO **of FYROM;** - EKC of **Serbia and Montenegro**
Main UCTE	The main UCTE is a regional group of transmission system operator companies: - VERBUND-Austrian Power grid AG of **Austria** - ELIA of **Belgium**, - NOS BIH of **Bosnia Herzegovina** - HEP of **Croatia** - RTE of **France** - VDN of **Germany** - CEGEDEL of **Luxembourg** - TenneT of **the Netherlands**, - ELES of **Slovenia** - SWISSGRID of **Switzerland**
MPL:	Margin to peak load: is the difference between the demand at the reference time and the peak demand.
NGC	Net generating capacity: the net generating power capacity is the sum of the net maximum output of all power stations.
NORDEL	Nordel is an association for electricity co-operation in the Nordic countries: - **Denmark,** - **Norway,** - **Finland,** - **Iceland** - **Sweden**
Non Usable Capacity:	It may be due to lack of primary energy (for example wind energy), temporary limitations of capacity in hydroelectric power stations and multi-purpose installations (for example heat extraction in combined heat and power plants, water debit for irrigation), capacity of power stations in test operation whose commissioning date is uncertain, limitations due to transmission network congestion etc.
Outages:	A statistical average value (expected value) is used in the forecast.
RAC	Reliably Available Capacity: is the national generating power capacity after deducting non-usable capacity, estimated (planned) overhauls and (forced) outages of thermal power stations as well as system services reserves; this is in fact the estimated available capacity in average operating conditions in peak hours.
RC	Remaining Capacity: is not a surplus of capacity
RCRL	Remaining Capacity at Reference Load : the remaining capacity at the reference load is obtained from the expected available capacity minus the reference load.
RL	Reference load: its the common reference time to set load. The load of each country (including transmission losses) is recorded for the 3rd Wednesday in January at 19:00 and 3rd Wednesday of July at 11:00 (this latter not available for NORDEL), without taking into account power exports. The projections of load are made under normal climatic conditions, e.g. outdoor temperatures corresponding to the statistical average and normal development of economic activities are assumed in these forecasts. NORDEL load figures correspond the estimated synchronous peak demand of the whole region. RL does not

	represent the peak load
SAF	System Adequacy Forecast
SAR	System Adequacy Retrospect
Scenario A:	"Conservative": only new generation projects known as firm are integrated.
Scenario B:	"Best estimate": it takes into account future power plants whose commissioning can be considered as reasonably probable according to the information available for the TSOs.
TSO	Transmission System Operator
UCTE	Union for the Coordination of Transmission of Electricity