DEVELOPMENT AND IMPLEMENTATION OF AN IMPROVED METHODOLOGY FOR GENERATION ADEQUACY ASSESSMENT

MANDATED BY THE PENTALATERAL ENERGY FORUM TO THE TSO'S

CEER/IEA
EXPERT WORKSHOP V ON REGIONAL RESOURCE ADEQUACY

PARIS, 15 JANUARY 2015

amprion

APG
AUSTRIAN POWER GRID
STROM BEWEGT

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Rte
Réseau de transport d'électricité

swissgrid

TenneT
Taking power further

AGENDA

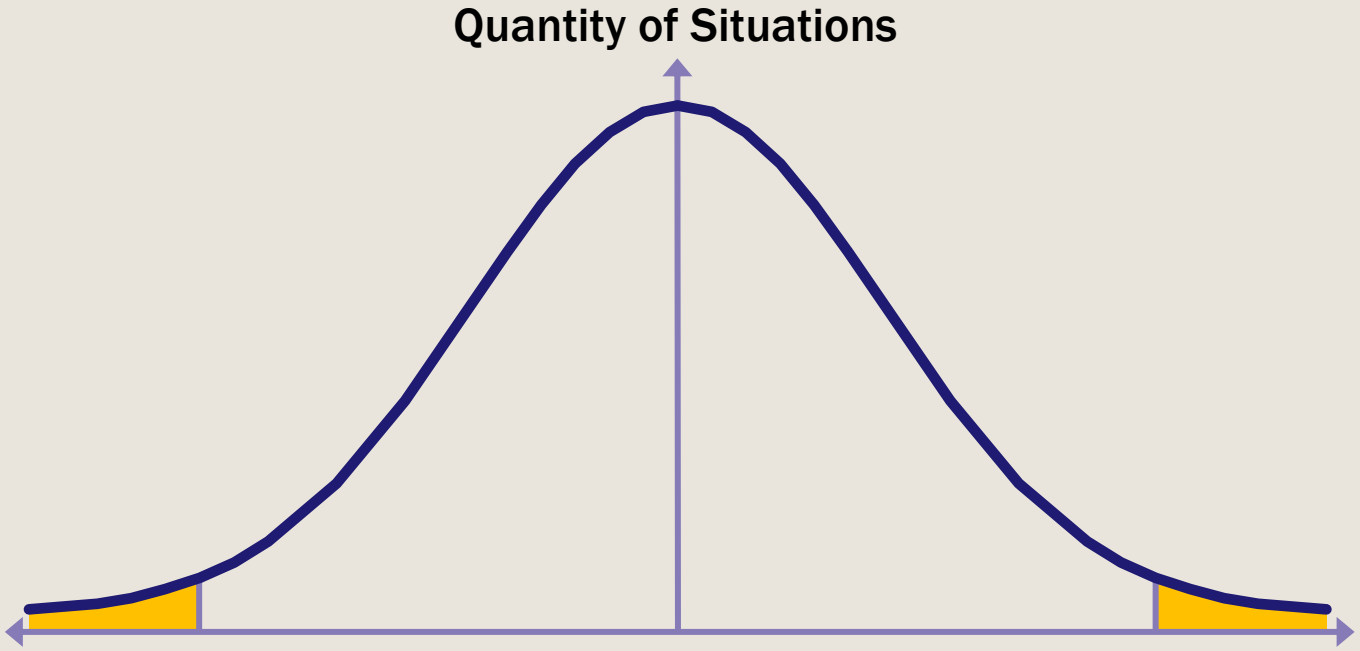
- Process
- Challenges in adequacy assessment
- Developing and implementing a new advanced methodology
- Main results 2015/2016 and 2020/2021
  - Main results, sensitivity cases (climatic conditions, reserves, demand side response)
- Observations, conclusions and next steps

PROCESS


Development of new methodology, data definition and collection
Draft results and interim report
Improvement of data and modelling
Final results, report and recommendations

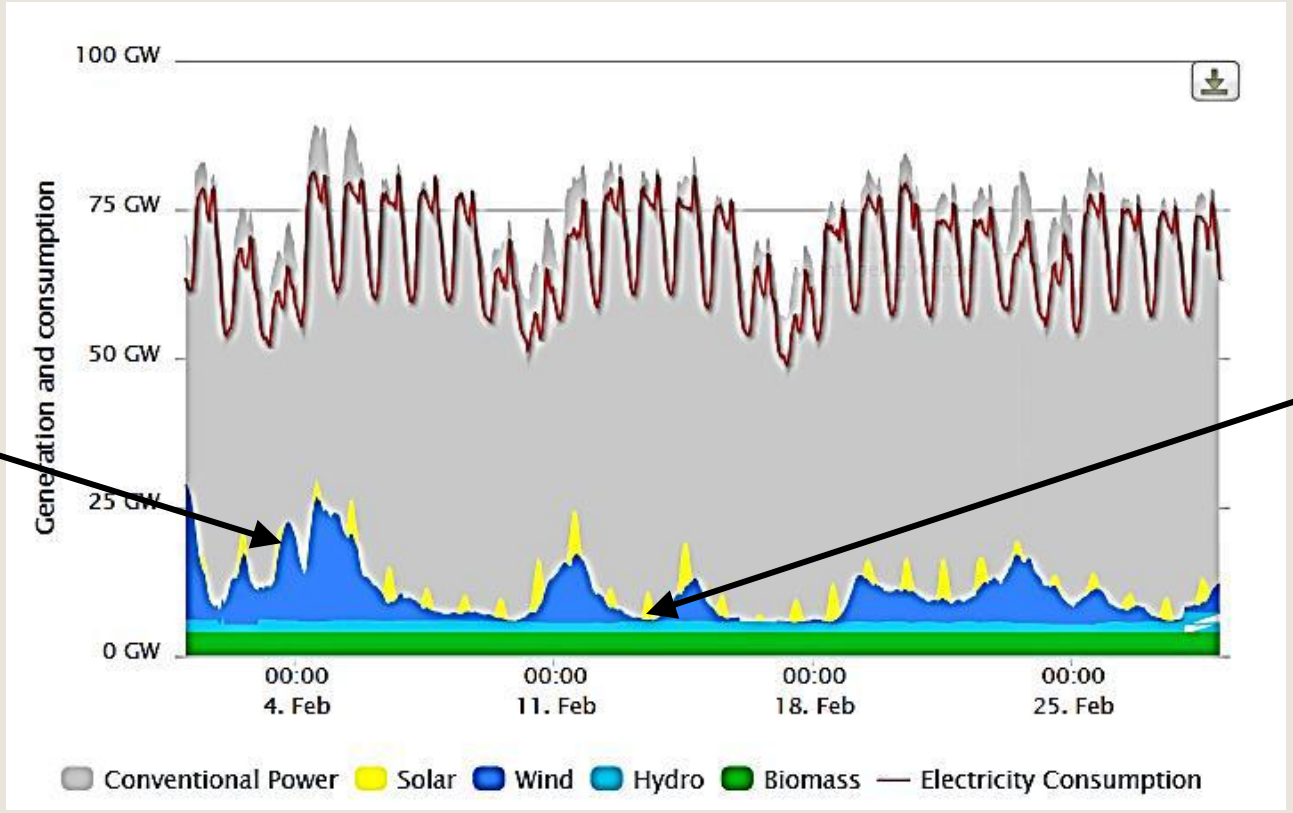
CHALLENGES IN ASSESSING ADEQUACY

- Core to adequacy analysis is the inclusion of extreme conditions
- The analysis of average conditions only would not be sufficient



FLUCTUATING IN FEED OF RENEWABLES

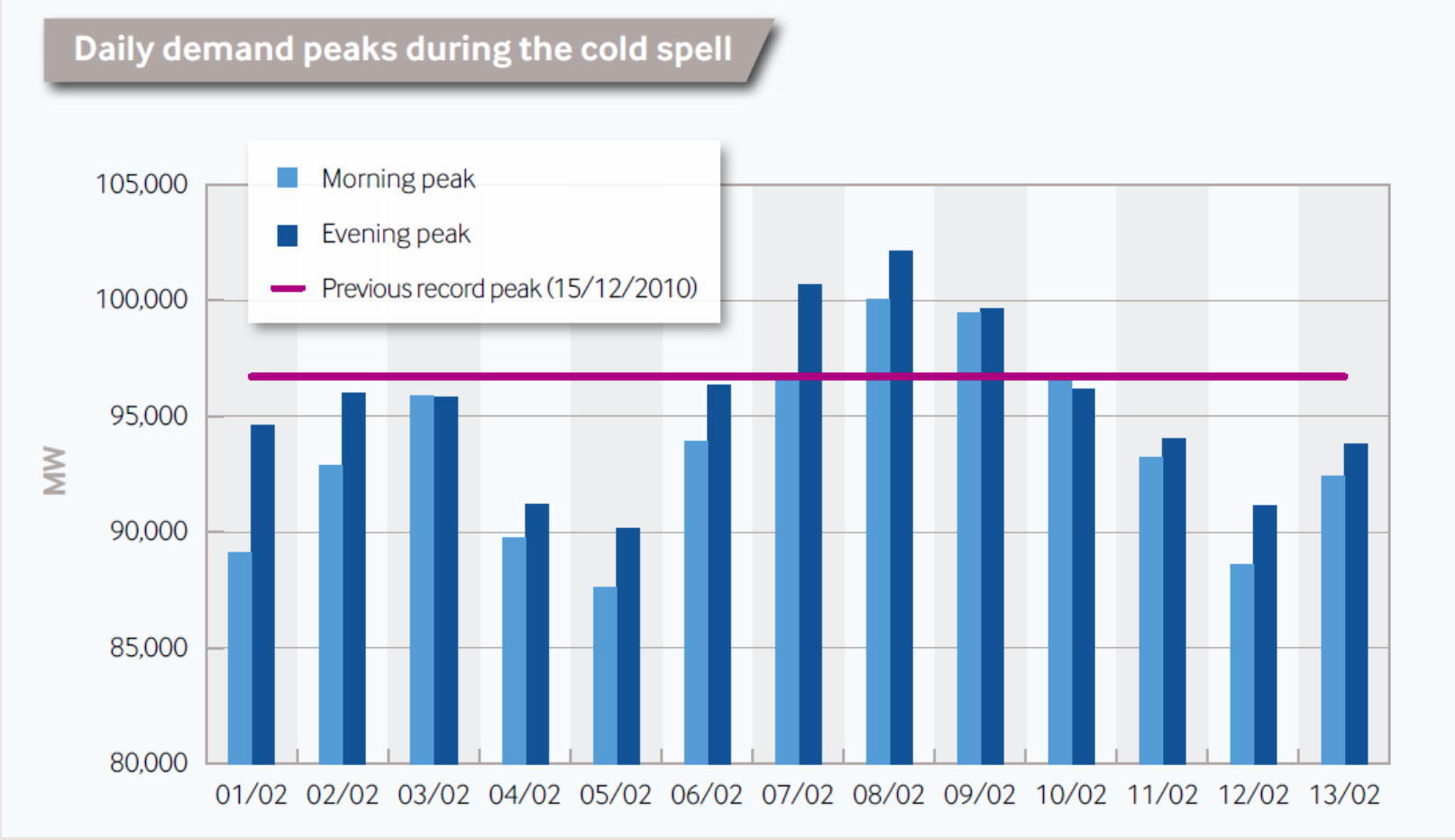
Example of fluctuating RES in feed in Germany during cold spell in Feb 2012



Adequacy support from RES production is highly variable.

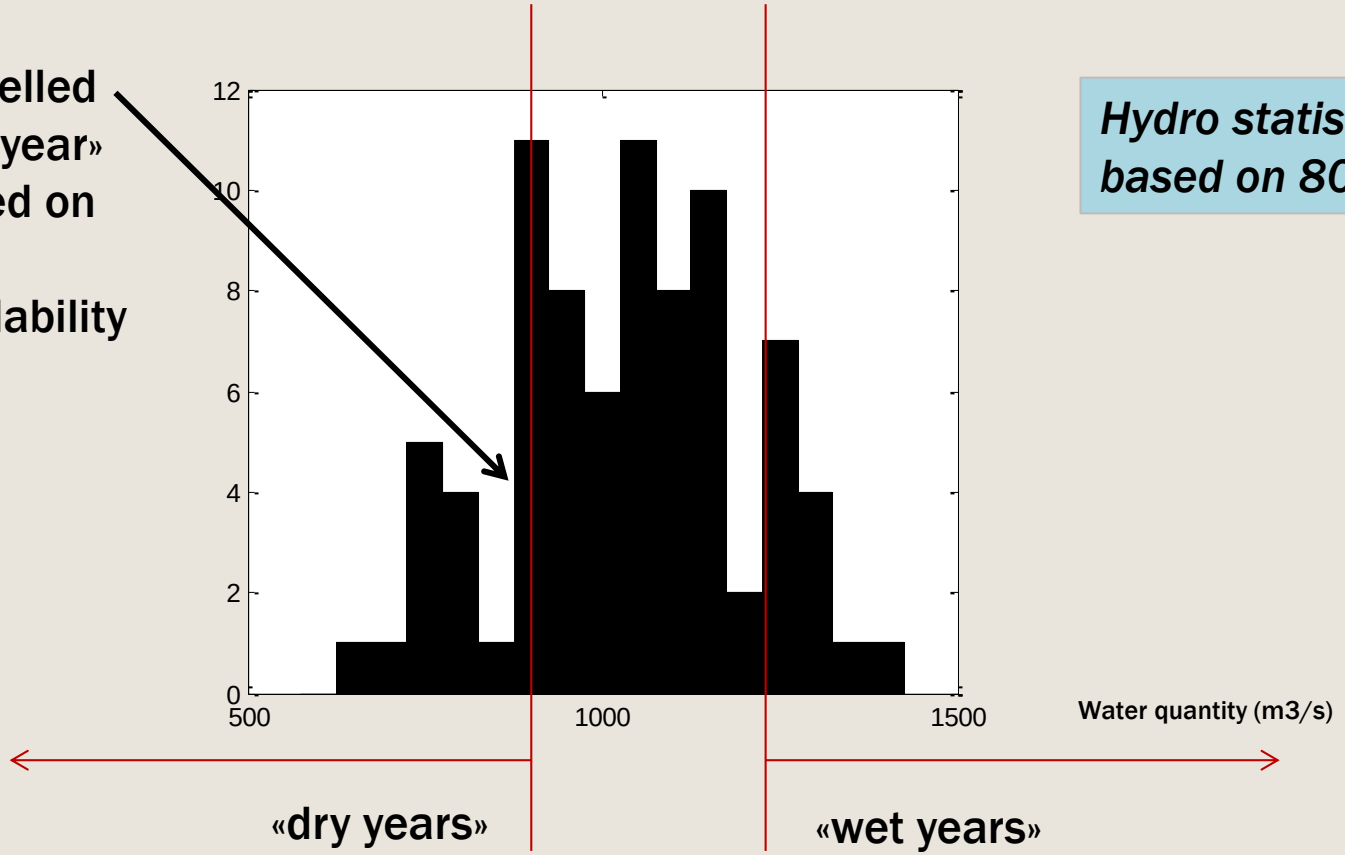
IMPACT OF COLD SPELL ON PEAK LOAD

- **Situation Feb. 2012 in France**



DIFFERENT HYDRO YEARS

- Defining extreme years for hydro is difficult



Hydro statistics based on 80 years

DEVELOPING A NEW METHODOLOGY TO MEET THE NEW CHALLENGES

- TSO are moving away from a country specific point in time assessment to an integrated chronological probabilistic assessment

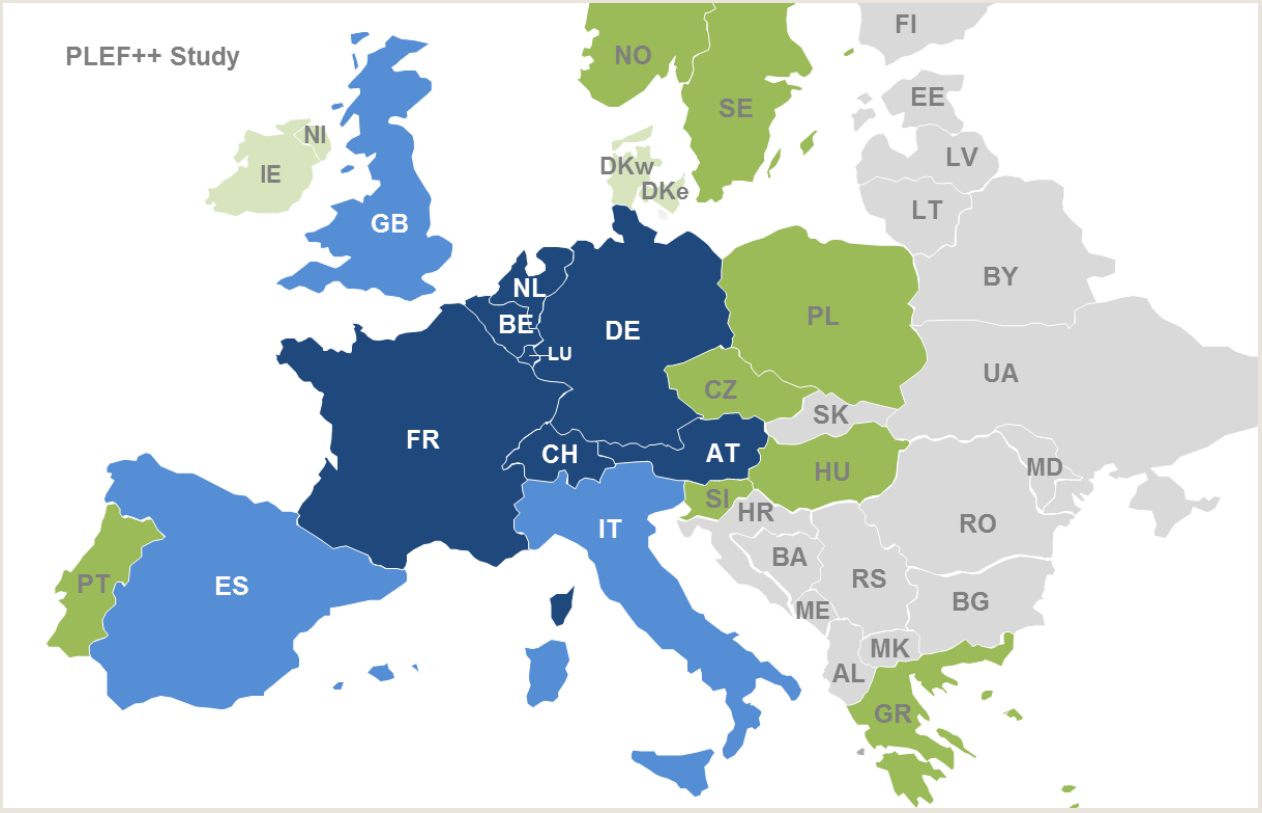
- TSOs work together to develop and apply an **advanced new common methodology** which makes use of:
  - Integrated assessment because of interconnected system
  - Common scenario's and assumption guaranteeing mutual consistency
  - Multiple advanced models
  - Improved input data to capture main contingencies susceptible of threatening security of supply

- Goal is to cover (combinations of) rarely occurring events

- New methodology is in line with stakeholders expectation and with ongoing ENTSO-E work

INTEGRATED ASSESSMENT NECESSARY BECAUSE OF INTERCONNECTED SYSTEM

Besides interconnection capacity also different levels of detail regarding supply and demand modeling in the PLEF and the periphery areas are applied



Each PLEF country (except LUX) is represented as a single market node.

Interconnection modelling is based on NTCs (market capacities)

Detail in modelling

Higher *Lower*

LOSS OF LOAD EXPECTATION (LOLE) AS A MEASURE FOR ADEQUACY

- On the next slides results of the adequacy analyses are presented using the so called **LOLE** indicator
- Loss of Load Expectation (LOLE), expressed in hours per year, is defined as the expected number of hours per year for which the available generating capacity is insufficient to cover the demand.
- LOLE is a statistical measure of the likelihood of failure to cover demand
- LOLE is calculated by the TSOs with advanced computer models that simulate the operation of the electricity system and evaluate the LOLE at every hour throughout the year. The LOLE of the year is then the sum of all these hourly contributions

MAIN RESULTS FOR 2015/16 & 2020/21

2015-2016

Climate Years 2001-2011

LOLE (h)

OP res / Strat res	WITH WITH isolated	WITH WITH interc.	NO WITH interc.	NO NO interc.
BE	177	0	4	42
FR	217	14	27	27
AT	0	0	0	0
CH	1251	0	0	0
DE	1	0	0	0
NL	0	0	0	0
LU	8760	0	0	0
REG	n/a	14	28	49

„Base Case“

Climate Year 2012

LOLE (h)

OP res / Strat res	WITH WITH isolated	WITH WITH interc.	NO WITH interc.	NO NO interc.
BE	419	6	51	197
FR	369	144	180	180
AT	0	0	0	0
CH	1797	0	0	0
DE	0	0	0	0
NL	0	0	0	0
LU	8760	0	0	0
REG	n/a	144	181	224

„Base Case“

2020-2021

Climate Years 2001-2011

LOLE (h)

OP res / Strat res	WITH WITH isolated	WITH WITH interc.	NO WITH interc.	NO NO interc.
BE	308	0	0	7
FR	151	6	10	10
AT	3	0	0	0
CH	1086	0	0	0
DE	0	0	0	0
NL	32	0	0	0
LU	8760	0	0	0
REG	n/a	6	10	17

„Base Case“

Climate Year 2012

LOLE (h)

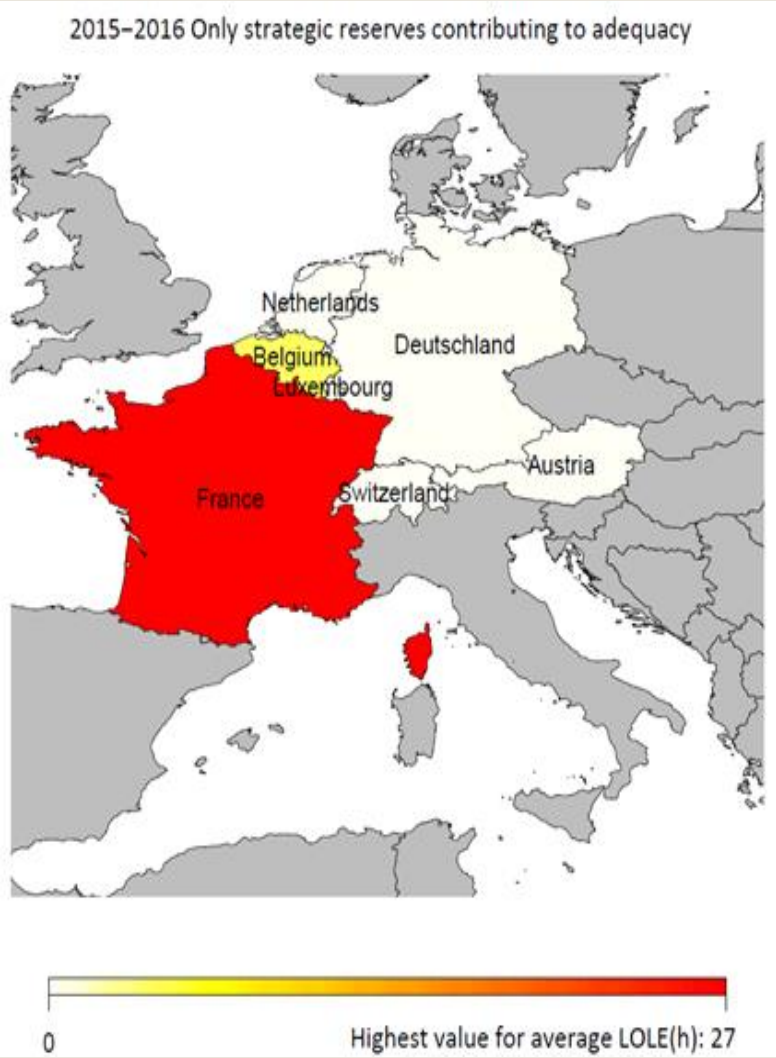
OP res / Strat res	WITH WITH isolated	WITH WITH interc.	NO WITH interc.	NO NO interc.
BE	277	0	0	3
FR	290	84	111	111
AT	0	0	0	0
CH	1608	0	0	0
DE	0	0	0	0
NL	30	0	0	0
LU	8760	0	0	0
REG	n/a	84	111	114

„Base Case“

Average LOLE (expressed in hours per 12 months)

- **at national level (BE and FR)**
- **at regional level**

MAIN RESULTS FOR 2015/16
BASE CASE – CLIMATE YEARS 2000-2011

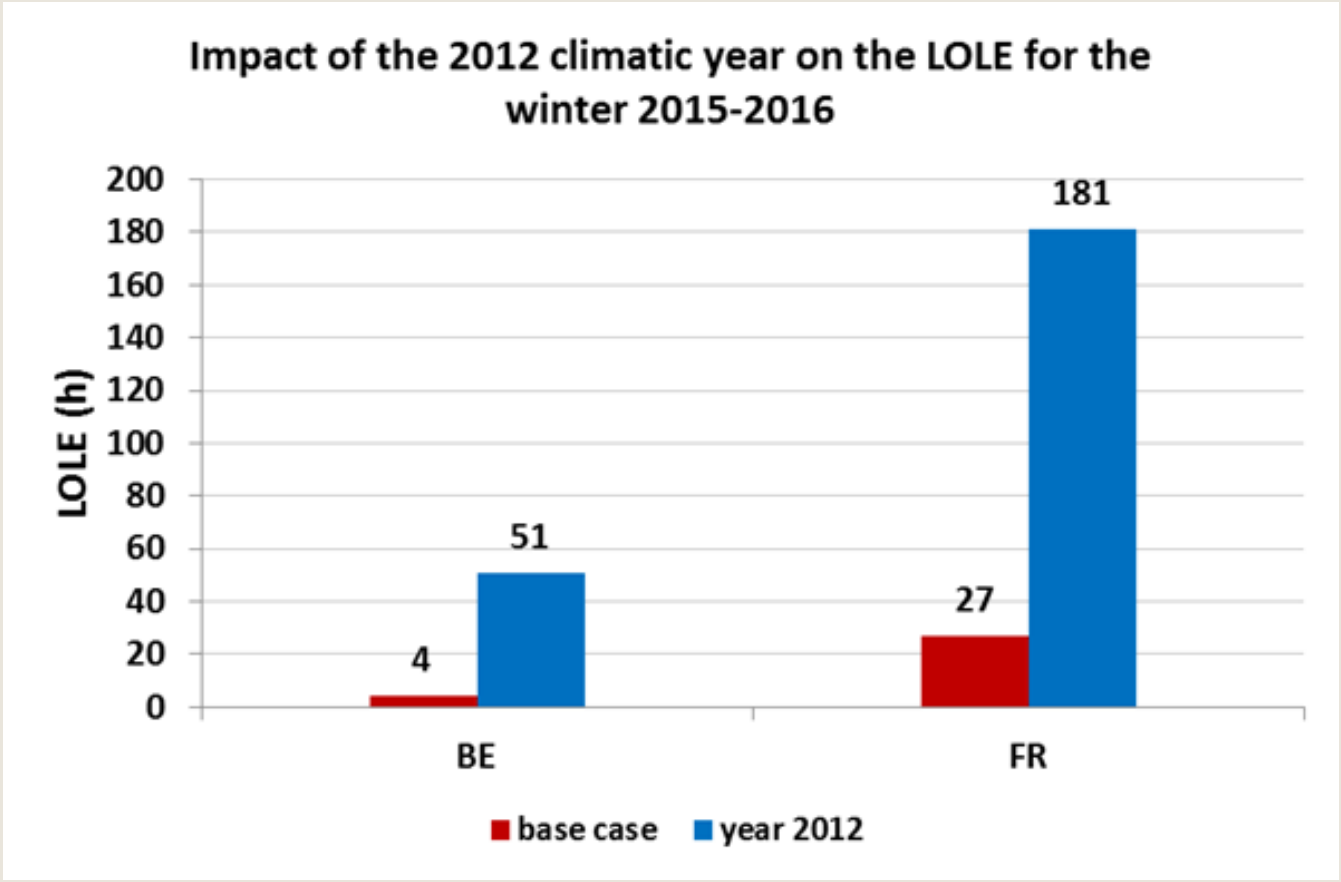


- **Case Study: Interconnected with strategic reserves without operational reserves, situations where demand is not met are only expected to occur in France and Belgium**
- **Highest value for average LOLE is 27 h (expressed in hours per 12 months)**

MAIN RESULTS FOR 2020/21
BASE CASE – CLIMATE YEARS 2000-2011

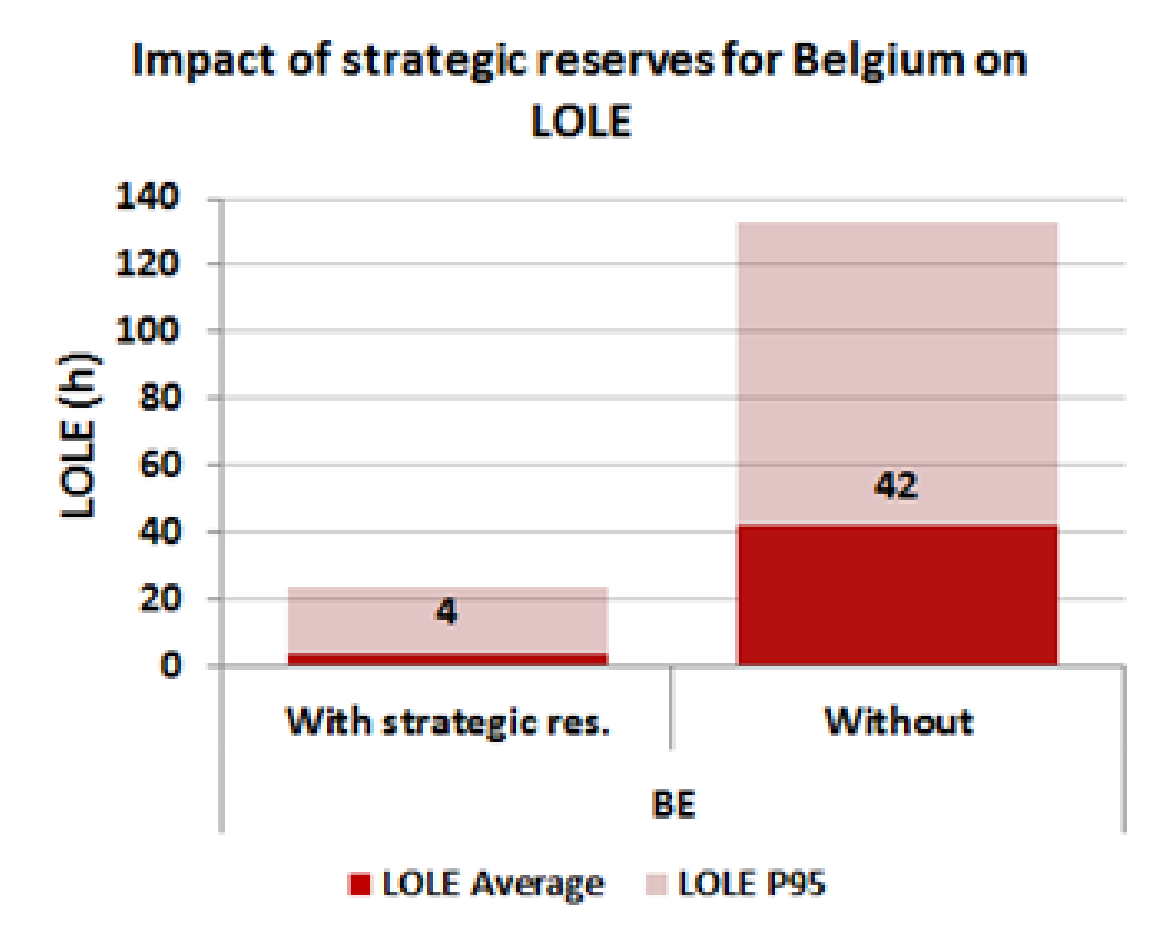
- **Case Study: Interconnected with strategic reserves without operational reserves, situations where demand is not met are only expected to occur in France**
- **Highest value for average LOLE is 10 h (expressed in hours per 12 months)**

SENSITIVITY RESULTS FOR 2015/16
CLIMATE YEAR 2012



- **Sensitivity Study: Impact of the climate year 2012, situations where demand is not met are expected to occur in Belgium and France**

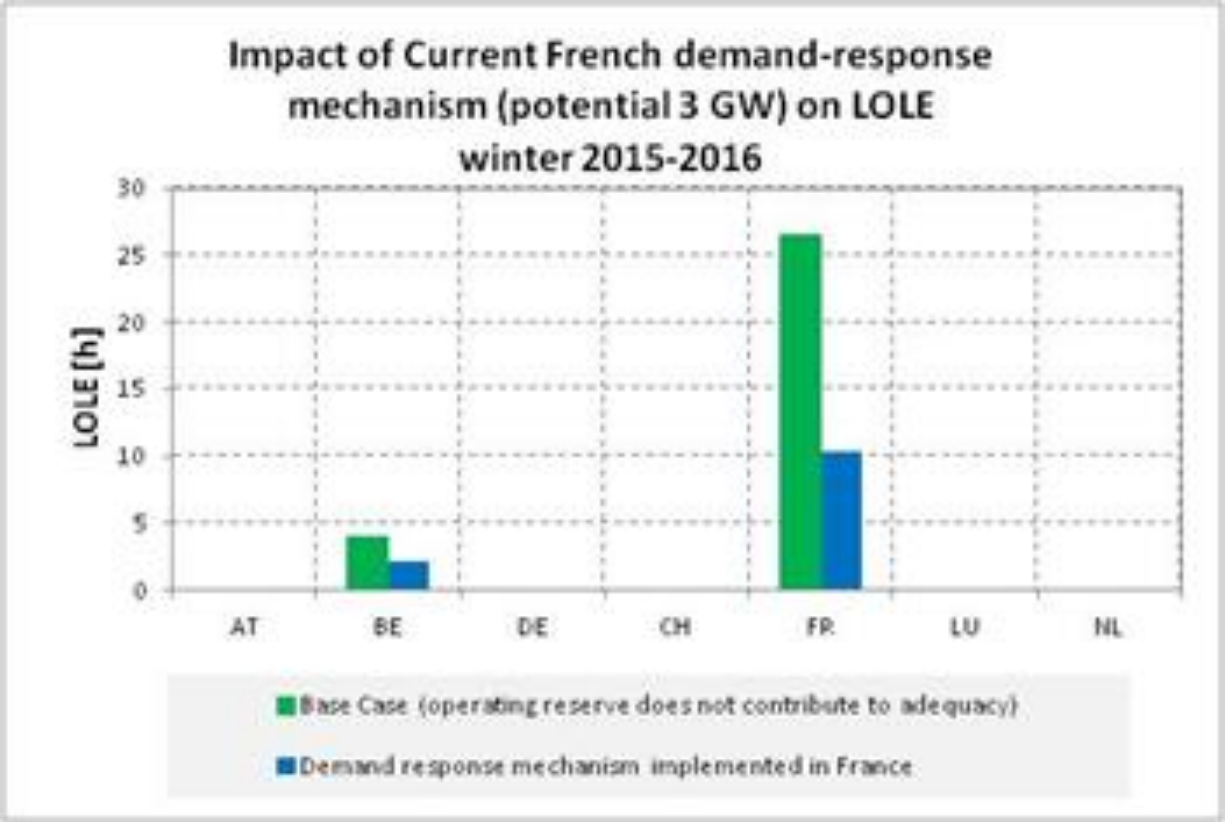
SENSITIVITY RESULTS FOR 2015/16
RESERVES



- **Sensitivity Study: Impact of *all reserves*, situations where demand is not met are expected to occur in Belgium**

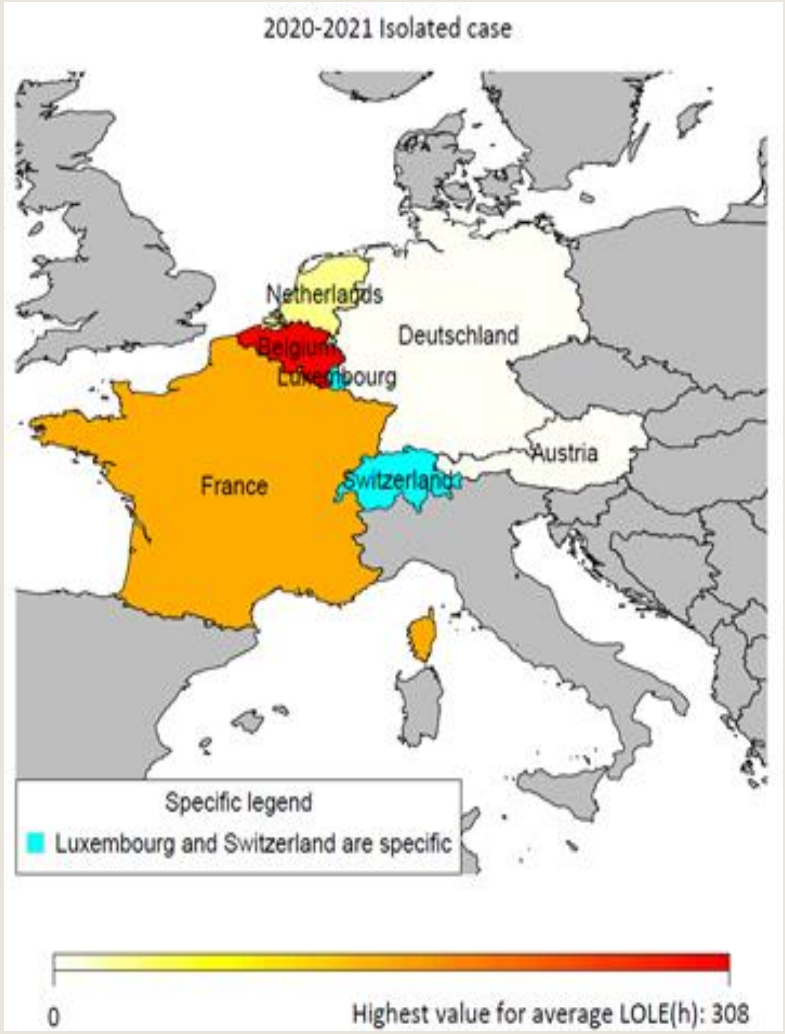
SENSITIVITY RESULTS FOR 2015-2016
DSR HELPS TO RESOLVE ADEQUACY ISSUES

- Demand-response mechanism implemented in France (such as Tariff options) **helps match supply to demand during times of tension**



(results are based on climate years 2000 – 2011)

SENSITIVITY RESULTS FOR 2020/21
ISOLATED CASE



- **Hypothetical case study: Isolated with strategic reserves and operational reserves, situations where demand is not met are expected to occur in France the Netherlands and Belgium**
- **Luxemburg: most generation capacity connected to neighbouring grid**
- **Switzerland: typical hydro country and also rely on interconnection**

RESULTS FOR 2020/21
INTERCONNECTED CASE

Interconnected case for winter 2020-2021				
	LOLE (h)		ENS (GWh)	
	Average	P95	Average	P95
BE	0	0	0	0
FR	6	27	15	65
AT	0	0	0	0
CH	0	0	0	0
DE	0	0	0	0
NL	0	0	0	0
LU	0	0	0	0

- **Case Study: Interconnected with strategic reserves and operational reserves, situations where demand is not met are only expected to occur in France**

RESULTS OF THE ADEQUACY ASSESSMENT

- Adequacy issues are occurring in Belgium and France
- Interconnection is crucial. Entire PLEF region is benefiting already today
- Isolated National approaches are not sufficient to assess adequacy in the existing IEM. National and regional studies are both needed and complementary
- Generation adequacy is sensitive to climatic conditions
  - The use of coherent weather data is of key importance for adequacy assessment in NW Europa
  - First model was implemented, but further improvements needed
- Reliable and up to date market information is crucial (e.g. information about mothballing, etc)
- Demand Side Response
  - Mechanisms were successfully implemented in France
  - Future assessments requires additional data

MAIN ACHIEVEMENTS OF THE PLEF STUDY

- Significant step towards a harmonized, integrated regional adequacy assessment
- A probabilistic methodology was successfully implemented using a chronological approach with an hourly resolution for the year 2015/2016 and the year 2020/2021
- First time a regional-wide temperature-sensitive load model and harmonized probabilistic hydrological data have been employed
- Approach adopted is a big improvement in comparison to the existing deterministic approaches
- TSOs exchanged their technical know-hows of their related systems and adequacy methodologies and strengthened their collaboration through the regional initiative
- New methodology is in line with stakeholders expectation and with ongoing ENTSO-E work

NEXT STEPS

- PLEF advanced methodology will be introduced to ENTSO-E to fuel the evolution of its methodology
- Although, extreme climate year 2012 was included in the analyses, there might still be some extreme conditions which TSOs have not captured because of insufficient historical data
  - e.g. is it enough to have 13 years of climate data (wind, solar, and load)?
- Some parameters are not optimized for adequacy analyses and are difficult to gather
  - supply and demand response to prices and its modelling

DISCLAIMER

- It must be noted that the conclusions in the PLEF report are inseparable to the hypotheses described and can only be read in this reference framework
- The hypotheses were gathered by the TSOs according to their best knowledge at the moment of the data collection and validated by ministries and regulators
- The TSOs emphasize that the TSOs involved in this study are not responsible or reliable in case the hypotheses taken in this report or the estimations based on these hypotheses are not realized in the future