

# Perspectives for development of the European grid on the background of EU 20/20/20 goals and market integration

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# ENTSO-E is *THE* European TSO platform

defined by Regulation (EC) 714/2009 on cross-border electricity trading

Fully operational since 1 July 2009

41 TSOs from 34 countries

- 532 million citizens served
- 912 GW net generation
- 305,000 km of transmission lines managed by the TSOs
- 3,400 TWh/year demand
- 380 TWh/year exchanges

Major roles:

- Drafting (binding) **EU network codes**
- **EU Generation adequacy** report
- **Ten Year Network Development Plan**
- **Summer/Winter Outlooks**
- **Fostering TSO cooperation**



# Drivers for grid development

## EU energy policy goals...

### Sustainability

- More renewables far from loads
- New electricity uses (mobility with electricity, heat pumps...)



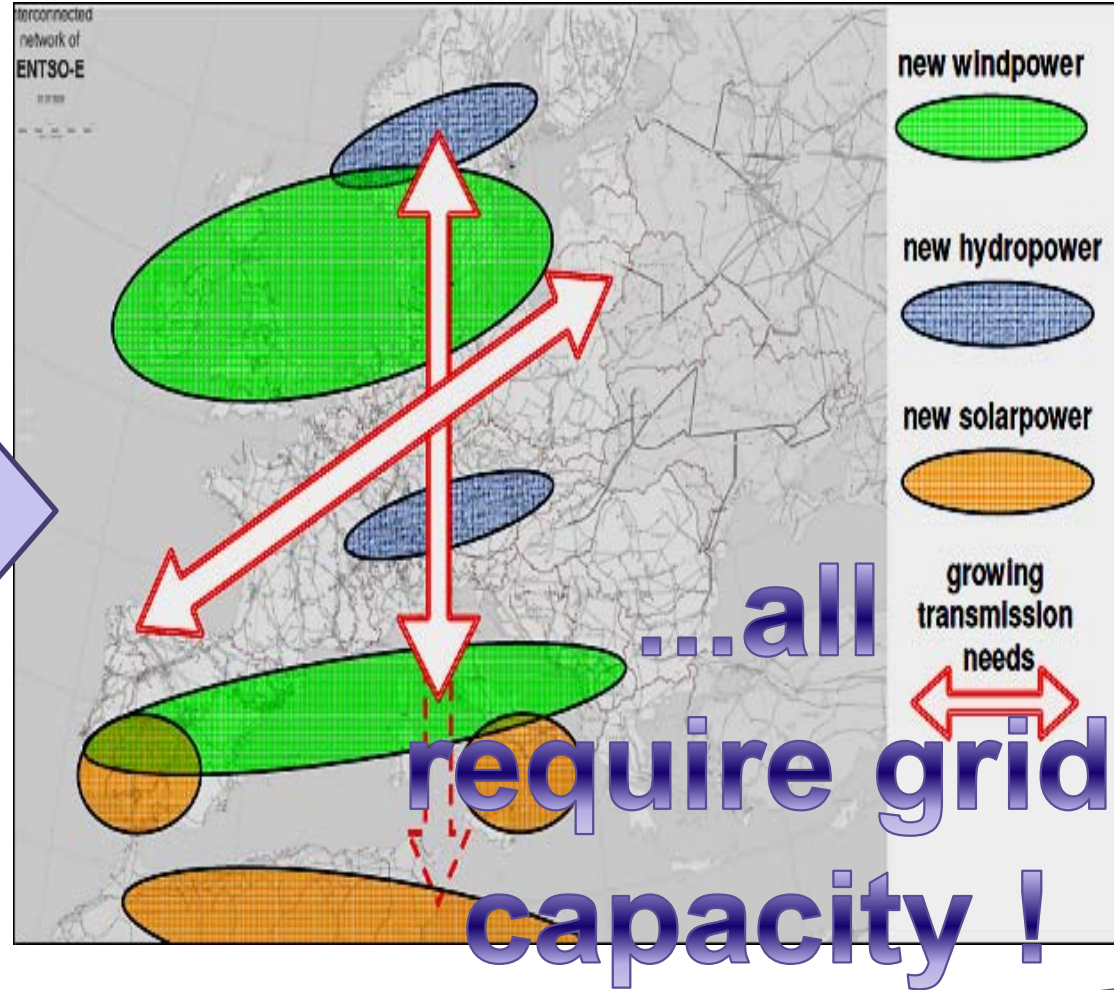
### Competitiveness / Market integration

- Optimal resources sharing
- More long distance trans-european flows



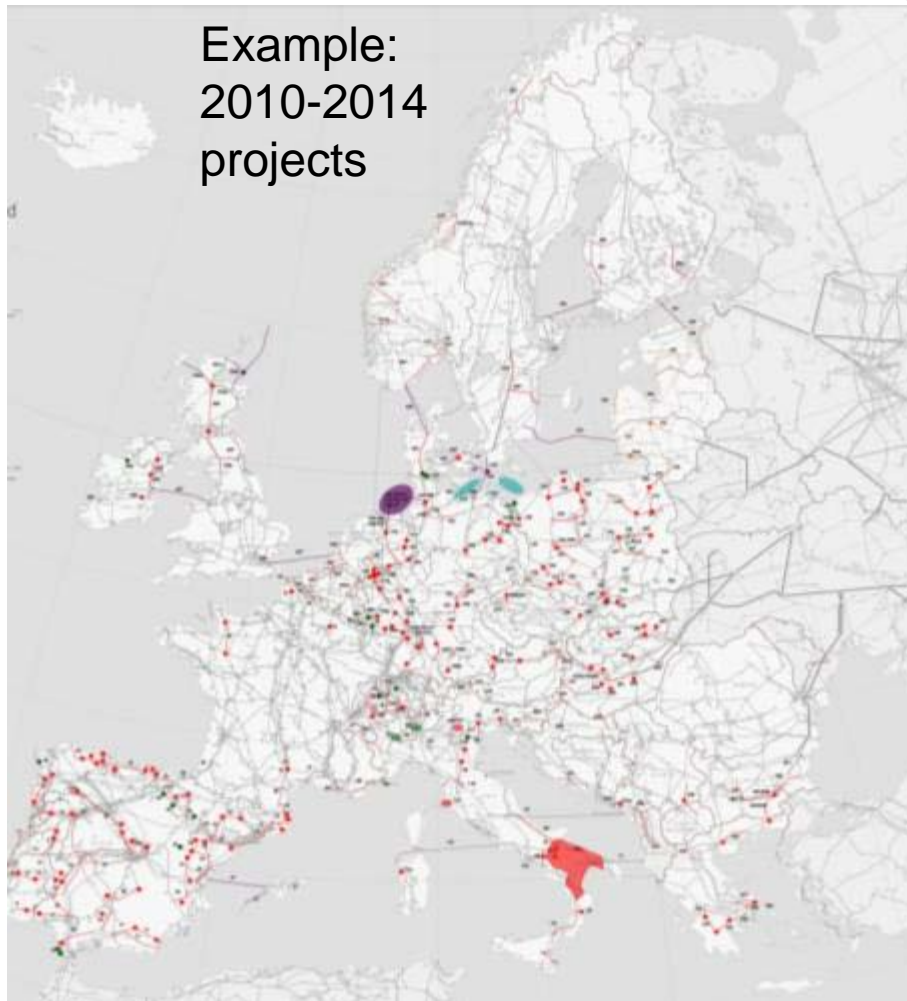
### Security of Supply

- Continuity of supply of remote/isolated areas
- Prevent large disturbances



# Pilot TYNDP 2010 – projects derived from investment needs

Example:  
2010-2014  
projects

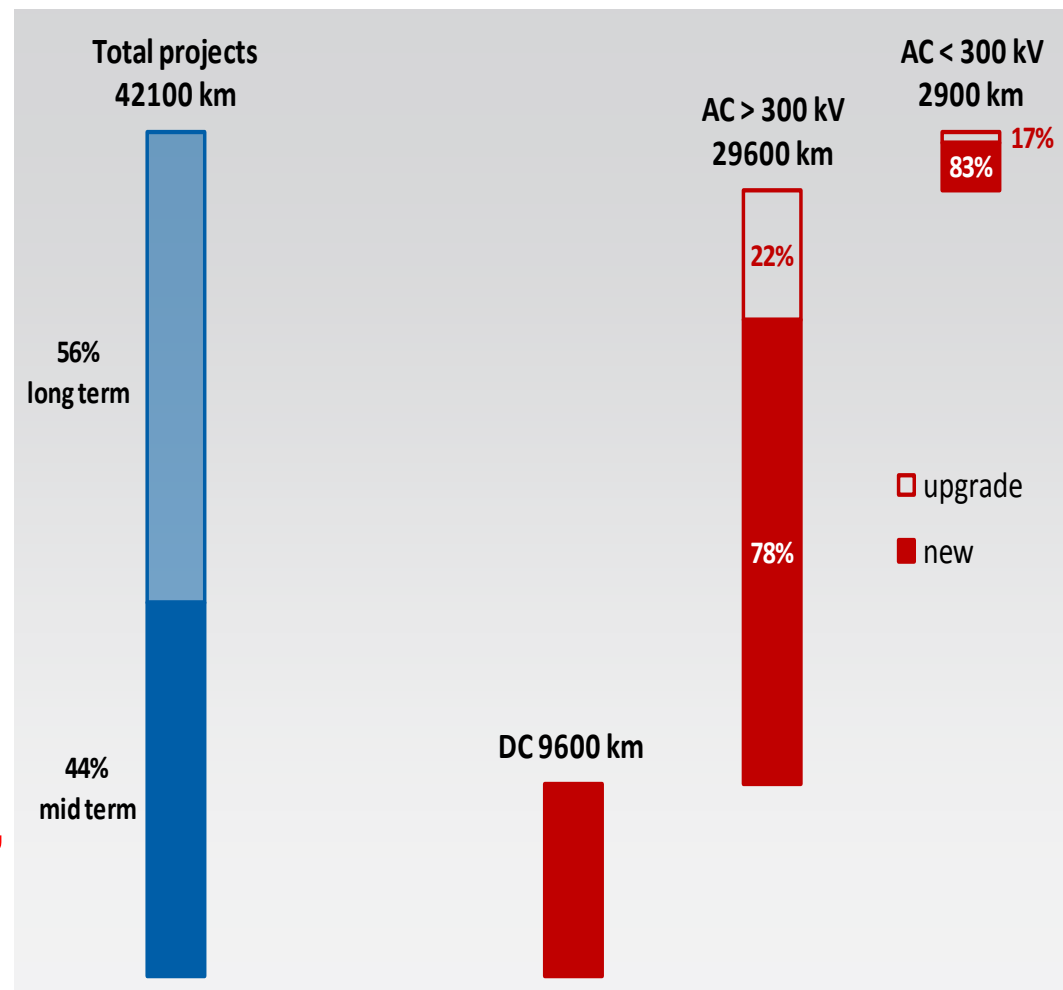


Example:  
2015+ inv.  
needs



# Major challenges: Acceptance, cost, regulation

The 500 projects represent  
~14% of existing lines



€23 to 28 billion for first 5 years,  
about €100 billion until 2020

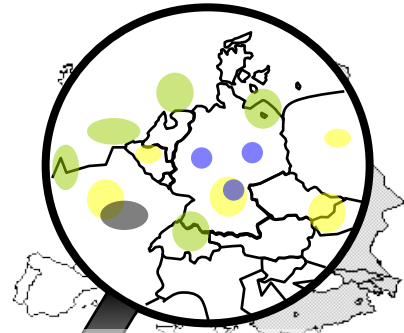
# ERGEG opinion on the Pilot TYNDP



## ERGEG appreciates ENTSO-E's effort ... **Improvements** are suggested:

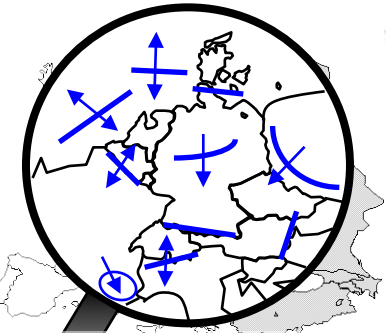
- Enhanced and more completed **scenario development** needs to be provided.
- Harmonised methods and detailed **criteria for grid planning** should be developed as prerequisite for project assessment. Investments should positively **address social welfare**.
- **Network and market modelling** shall serve as the basis for the project selection.
  - Require a **top-down approach**, comprehensive assessment of **resilience**.
  - A top-down approach is needed for ERGEG to assess to what extent the projects fulfill the objectives of integration of the IEM. **Market analysis based on several scenarios** should be broadened and detailed.
  - For such a long list of projects, a clear **prioritisation** is essential.
- **Third party projects** should be reported to ENTSO-E proactively by responsible parties.

# Main TYNDP 2012 deliverables



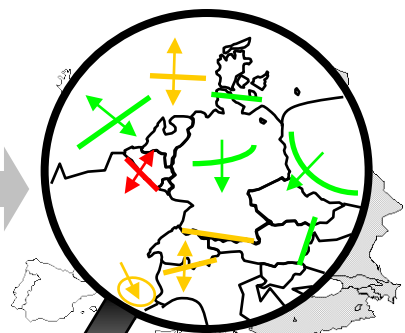
G/L dev. areas  
+ technical needs

**Market studies**



Expected bulk flow patterns

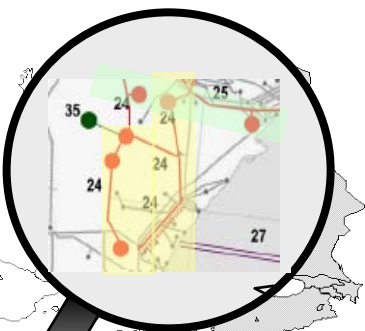
2020  
in 2020  
(+)



Transmission adequacy



NTCs  
2010



Proposed projects

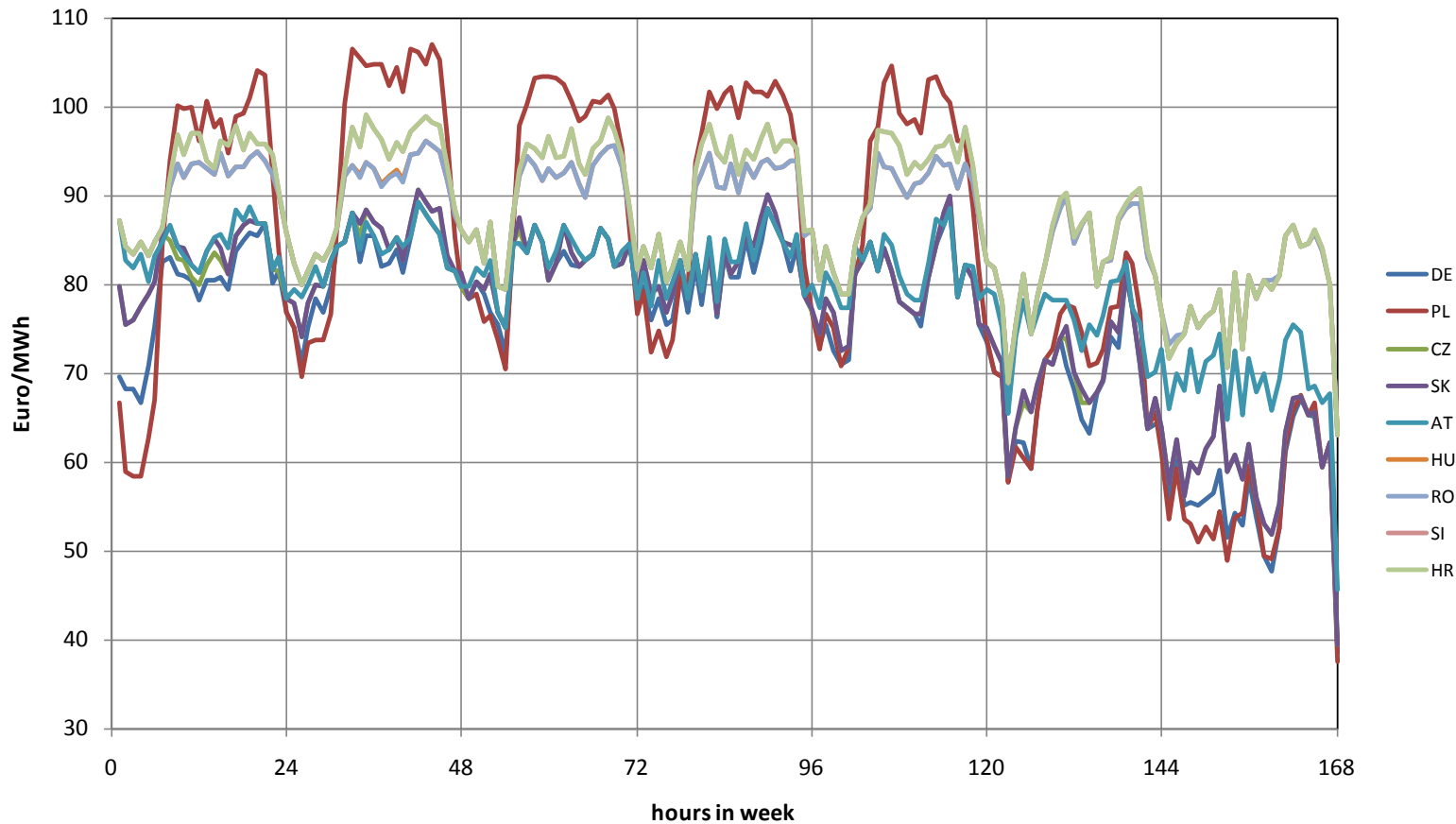
**Network studies**



Grid transfer capability increases

# Market modeling, e.g. scenario EU2020

Average marginal cost all weeks by hour by market area  
CCE Area - Grid 2020 Scenario EU202020 (year 2020)



- High CO<sub>2</sub> prices cause high price level in whole CCE region (particularly in Poland during peak load)
- Marginal costs do not reflect consumers prices (e.g. fees, grid costs, RES feed-in tariffs are not included)



# Projects of European significance – Definitions

- *A Project of European significance* is...
  - ... a set of EHV assets (with at least one part in Europe);
  - ... all contributing to a same grid transfer capability increase across a grid boundary, valuated in MW;
  - ... matching the following thresholds:
    - main equipment > 220 kV for OHL AC and > 150 kV else
    - Grid Transfer Capability increase either
      - enabling > 500 MW of additional NTC; or
      - enabling or securing output of > 1 GW/1000 km<sup>2</sup> of generation (new and/or existing); or
      - securing for > 10-year load growth for an area > 3 TWh/yr.

EC Reg. 2010/617 on notification of infrastructures

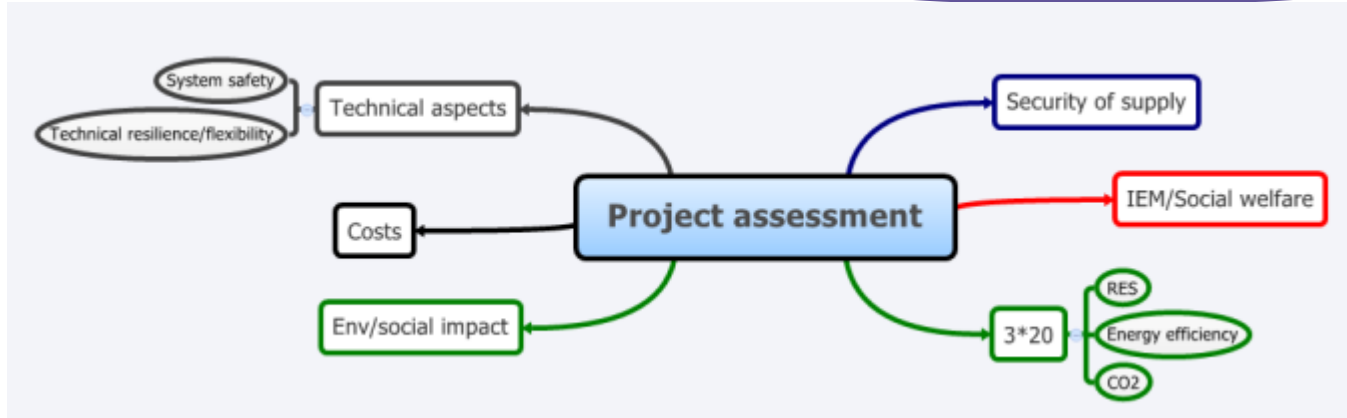
EC 2009/72

# Anticipation of development concerns by 2020



- 5-6 main development concerns
  - North-South power flows
    - RES (North Seas, South to EU)
    - Load in Italy, South Germany
  - Better integration of Baltic states, British islands, Iberian peninsula
  - East-West flows in S-E Europe
- Probably about 100 projects
  - Increasing the grid transfer capability on specific locations
  - Clustering about 500 investments

# New ENTSO-E project assessment summary



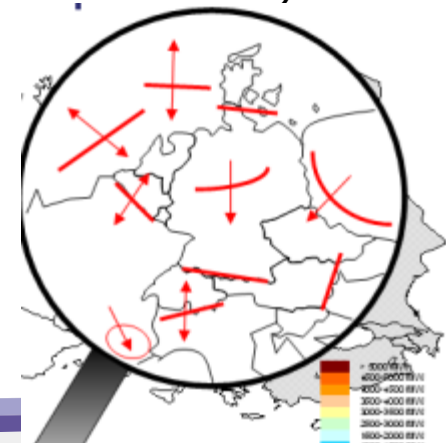
Project/ cluster	B1. SoS Δ	B2. Social and Economic Welfare Δ	B3. RES Δ	B4. Losses variation (Energy efficiency) Δ	B5. CO2 Δ	B6. Technical resilience Δ	B7. Flexibility Δ	Environmental / Social impact	GTC In MW
<i>Project A, Name, description ...</i>									100
<i>Project B, Name, description ...</i>									200

# Benefit indicators

- B1. Improved security of supply** is the ability of a power system to provide an adequate and secure supply of electricity in normal conditions.
- B2. Social and economic welfare** on electricity markets is characterised by the ability of a power system to reduce congestions and thus providing an adequate grid transfer capability, reflecting to the needs and willingness to pay of market players and consumers.
- B3. RES integration.** Support to RES integration is defined as the ability of the system to allow the connection of new RES plants and unlock existing “green” generation, while minimising curtailments.
- B4. Losses variation (Energy Efficiency)** of a transmission grid is the ability to minimise thermal losses in the power system.
- B5. CO2 emissions** is a result of B2 and B3 (unlock of carbon-free generation), as well as B4.
- B6. Technical resilience/system safety** is the ability of the system to withstand increasingly extreme system conditions (exceptional contingencies).
- B7. Flexibility** is the ability of the proposed reinforcement to serve in different possible future development paths or scenarios.

# Grid transfer capability

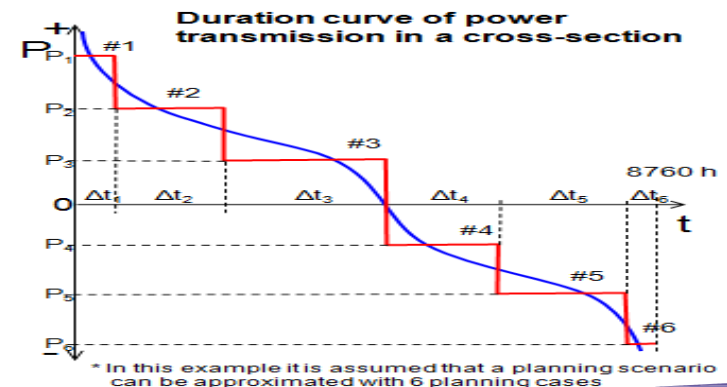
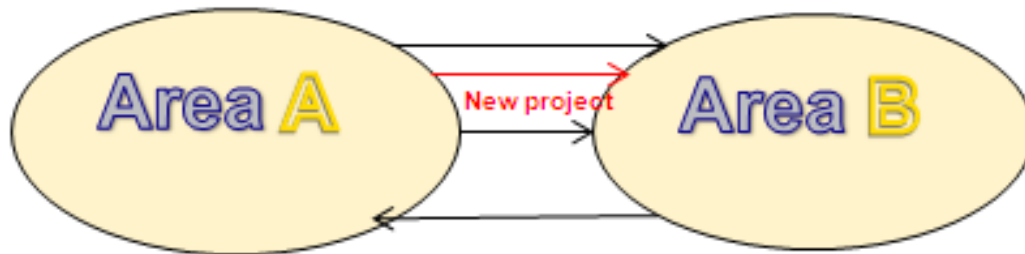
- **Grid Transfer Capability (GTC) is the ability of the grid to transport electricity across a boundary**, i.e. from one area to another. It depends on the considered state of consumption, generation and exchange, as well as the topology and availability of the grid.
  - It is expressed in MW, and represents maximum transfer capabilities between two areas calculated under certain conditions. Conditions will be defined for each planning case.
  - The Grid Transfer Capability is oriented, which means that across a boundary, there may be two different values.
- **Boundary is defined between two areas** (price zone, area within a country or a TSO)
  - A boundary can vary from one scenario to another
- GTC variation is used to calculate benefit indicators



# GTC high level methodology

- **First step : load flow calculation in the reference cases**
  - Reference cases selected to represent the year
  - Direction of GTC calculated, summation of all circuits that cross the boundary
- **Second step : Maximum grid transfer capability**
  - For each case, Maximum GTC is found by maximising the flow until ENTSO-E planning standards no longer respected
  - Maximum GTC calculation is done with and without the project/cluster
- **Third step : Total benefit of reinforcement**
  - The benefit is calculated by taking the difference in MW with and without the project/cluster for each case, weighting each case and summing the cases

$$Benefit = \sum_{i=1}^{TC} Benefit_i * (Hours_i / Hours_{total})$$



# An even longer term vision needed

- **Transmission grid infrastructures peculiarities:**

- **Long life cycle**

- Decision today..
  - Commissioning 2020..
    - Economic value 2020 – 2050 +

*Changing the structure of the grid is a slow process  
Longer term approach (20 to 30 years) also needed*

- **Target year 2050:**

- Define policy targets, underlying scenarios
- Identify candidate technologies, grid structures/architecture; R&D efforts

- **Intermediate target year (2030...)**

- Ensure a viable path between present and long term
- Avoid short term decisions leading to stranded investment

# Towards 2050 pan European System: the ENTSO-E study roadmap

- A ENTSO-E Study Roadmap will be available by July 2011 (after consultation process)
- Describe a comprehensive study package covering all relevant electricity highways issues:

Technological  
issues

Economical/financial  
issues

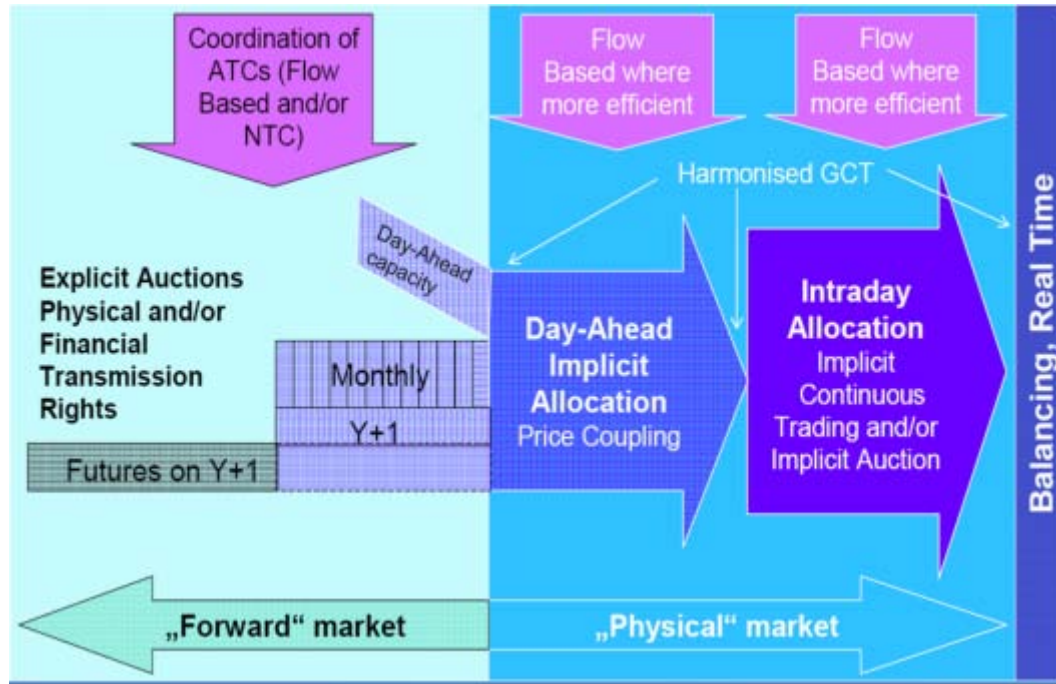
Political/sociopolitical  
issues

- In context of SET plan, the realization of study package will be done by a large consortium (TSOs, DSOs, universities, institutes, manufacturers, ...).
- First comprehensive concept on **Electricity Highways System** (also showing important corridors) available by end 2014



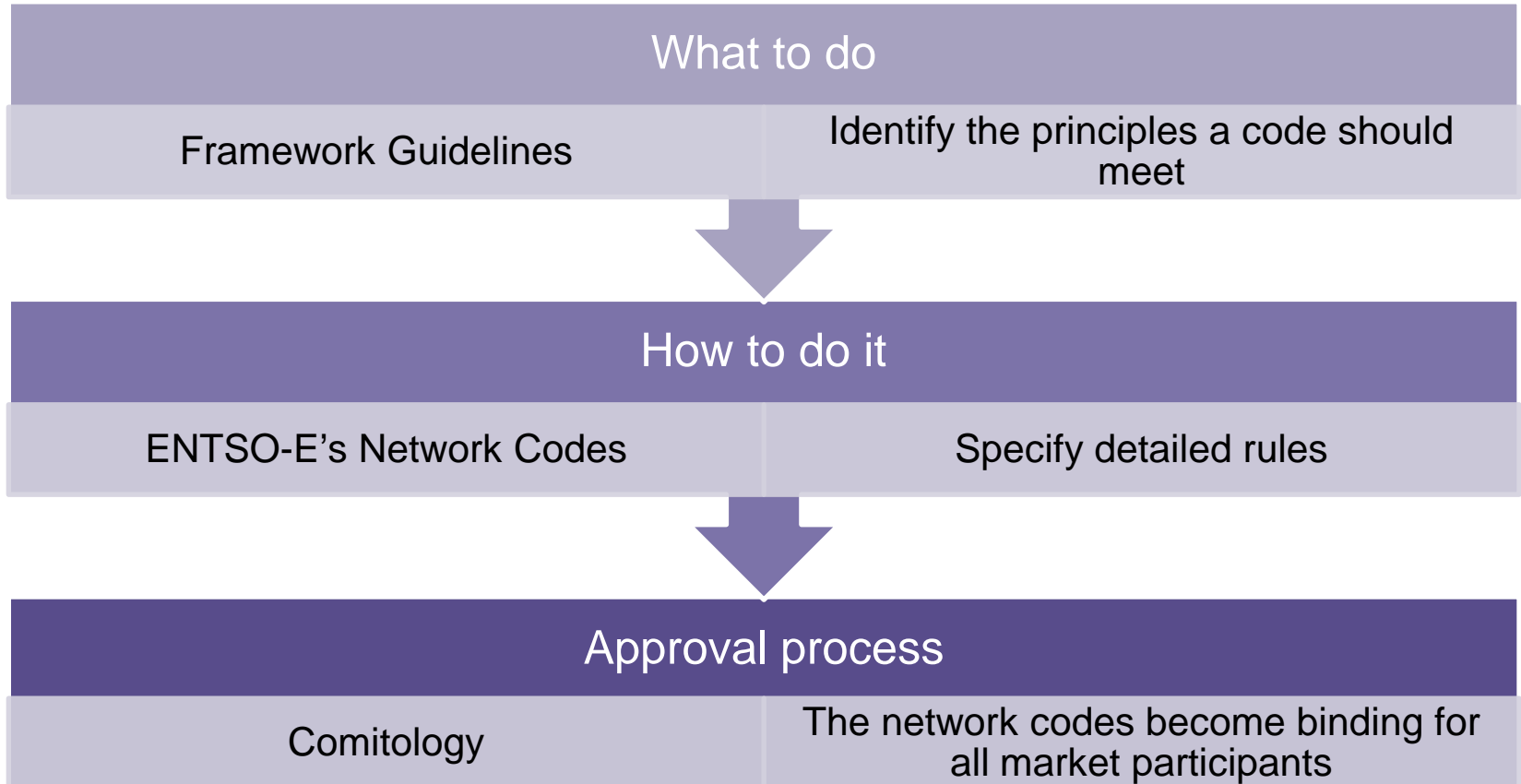
# Infrastructure is also about market integration

## 2014 Target Model



- **Towards harmonised market rules**
  - A consensus view amongst stakeholders of a model for market integration
  - A medium term view for progressive implementation in the EU by 2015 (2014?)
- Addresses **all** timeframes in a logical and sequential way
  - Developed in parallel with the regional market integration initiatives
  - Act as a benchmark for consistency and cross border harmonisation

# Network code development process



# Summing up

## Challenges for grid development:

- EU energy policy goals, especially SoS and RES, require massive development of transmission grids, both between and within countries
- Permitting and public acceptance is the key issue ; without radical changes policy objectives will not be met
- A huge financial effort requires new financing tools and regulatory stability

## ...and for integrating markets:

- Implement the EU Target model for market design across Europe by 2014

**The network codes and TYNDPs will form the basis for meeting the challenges but politics, regulation and the public need to do their parts.**