Case Study 3 definition

Cost of RES integration and climate change

EDF, April 11, 2018

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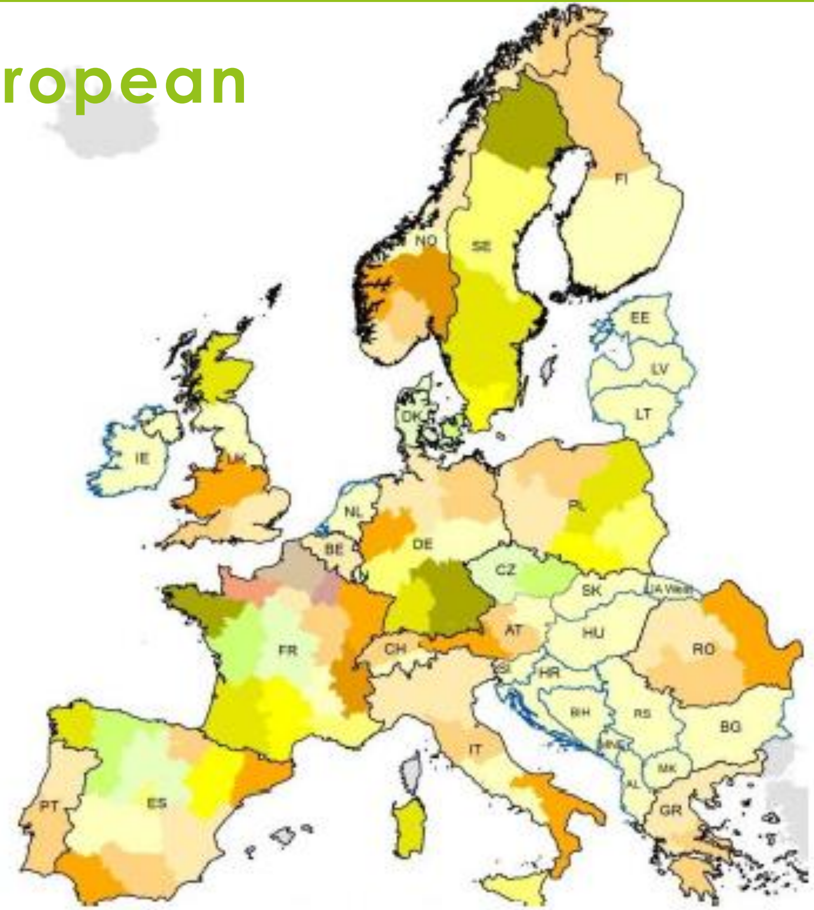
Objectives of Case-Study

Which questions / problems will be addressed

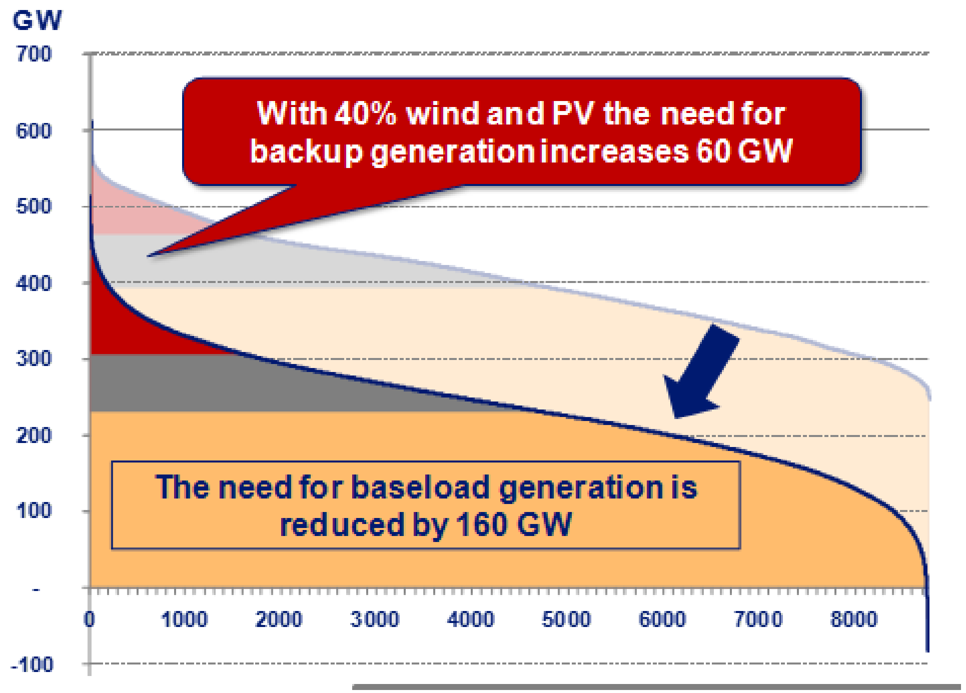
- Case study 3 will focus on the Pan-European electricity sector in 2040 or 2050

- The objective of this case study is to assess the plan4res tool's ability to capture :
  - The cost of RES integration
  - The Value of different flexibility services
  - The impacts of climate change



Which costs are modelled?

- **Electricity generation cost (fixed and variable costs for an optimal generation mix)**

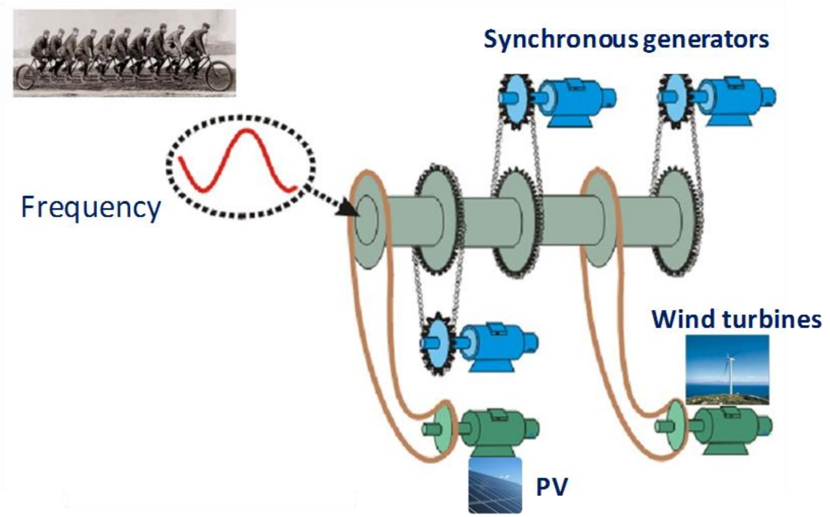


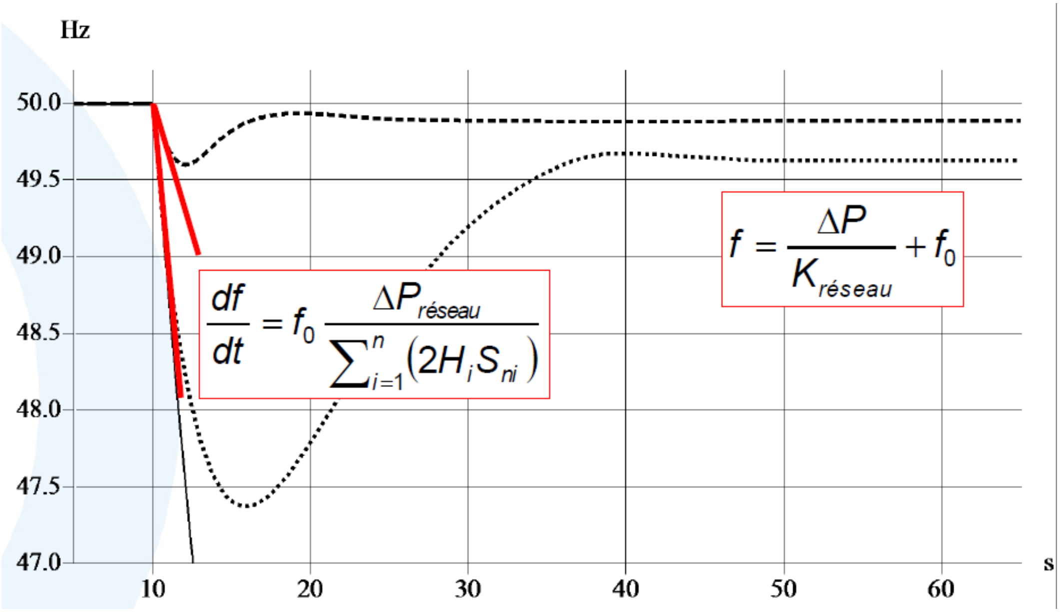
Example of impact of RES integration on generation cost

Source : EDF 60%RES

Which costs are modelled?

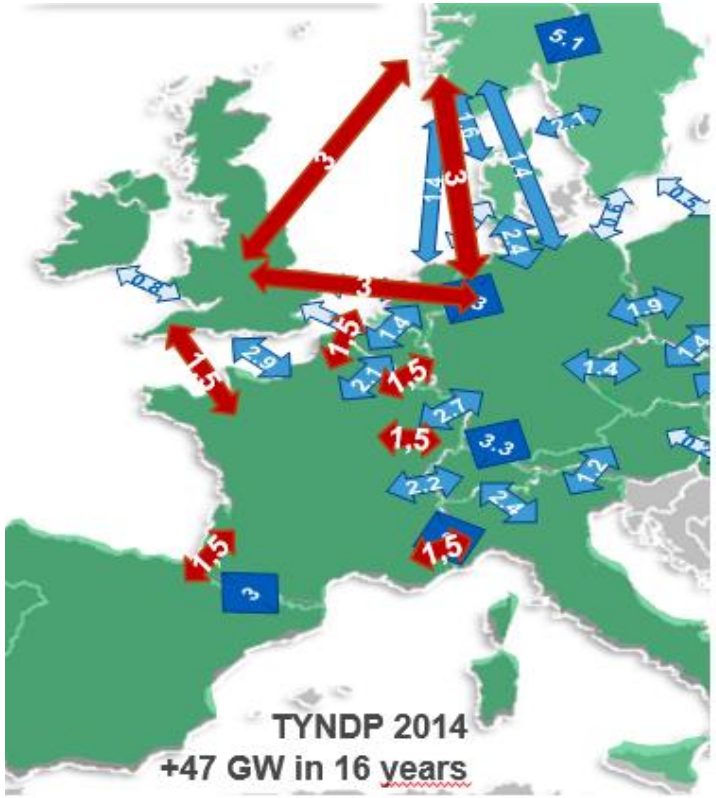
- **Cost to ensure the dynamic robustness of the system**
  - There must be enough inertia in the system to avoid a high frequency drop





Which costs are modelled?

- **Transmission expansion cost modelled with transmission clusters**



simplify

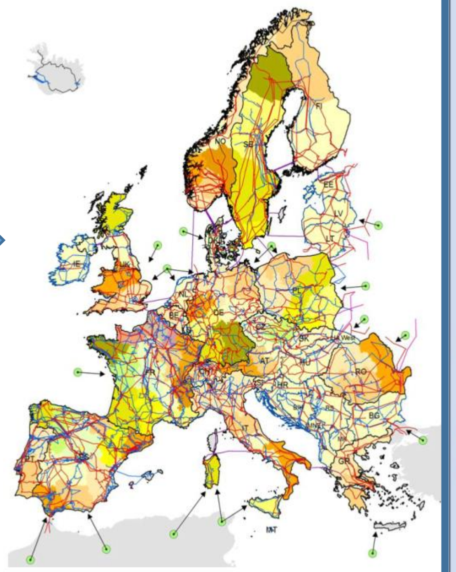


Figure 20: Geographic clustering

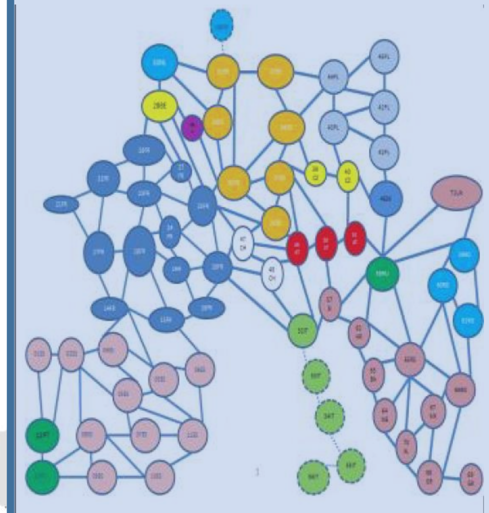
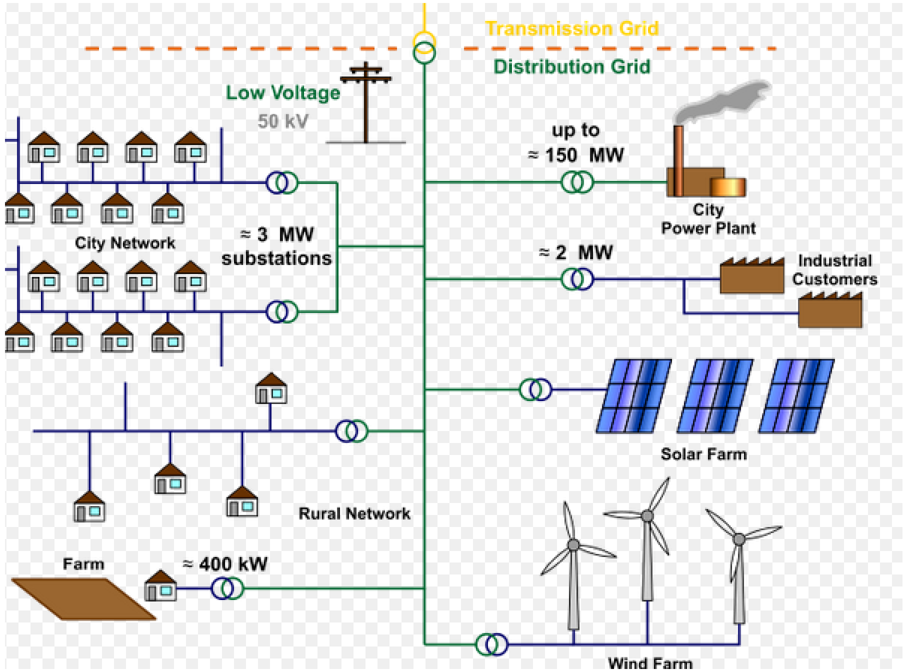
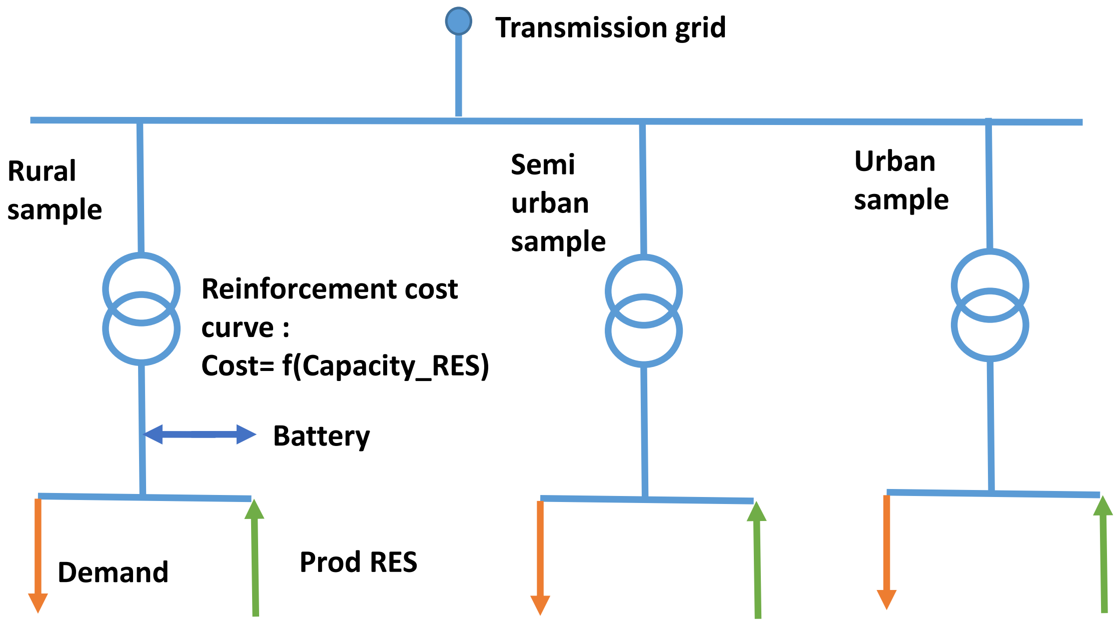


Figure 21: Cluster model for continental Europe

Which costs are modelled?

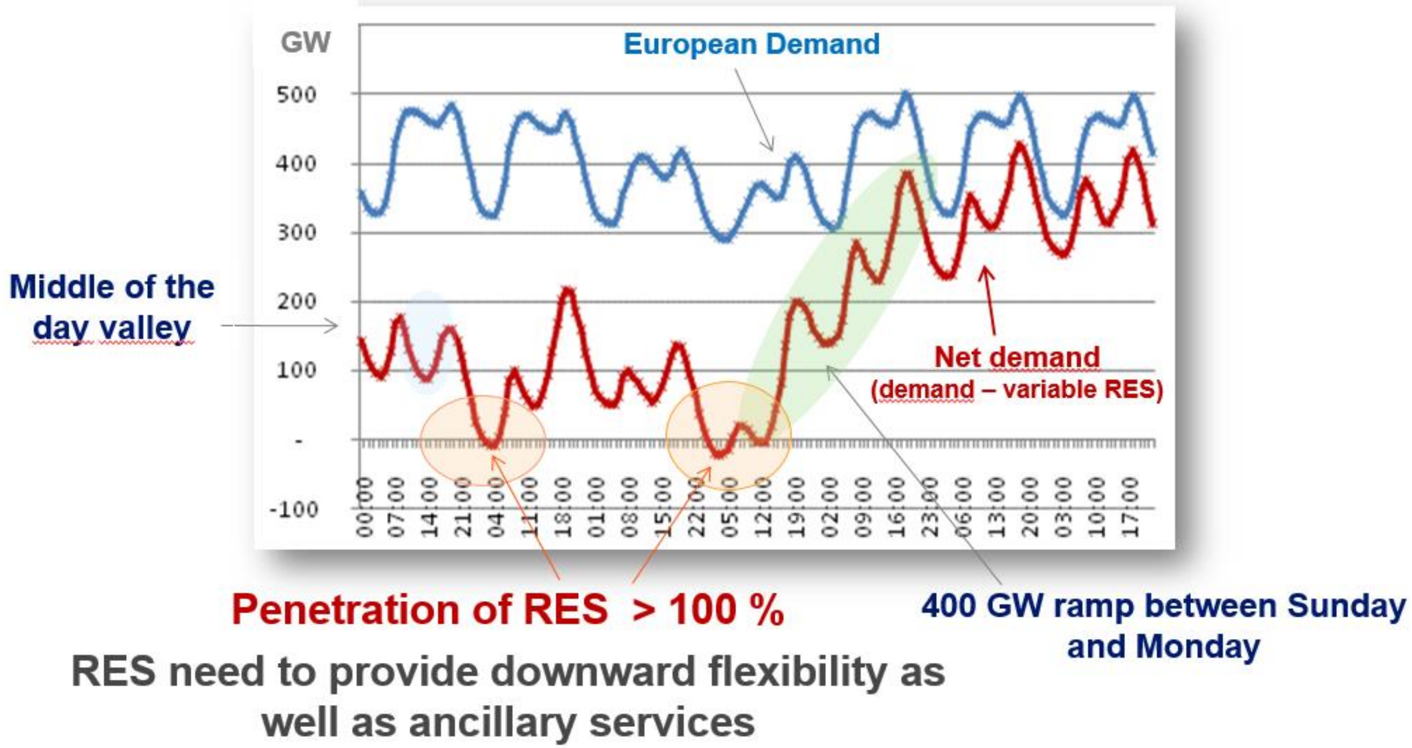
- **Distribution network reinforcement cost modelled with simplified distribution samples**



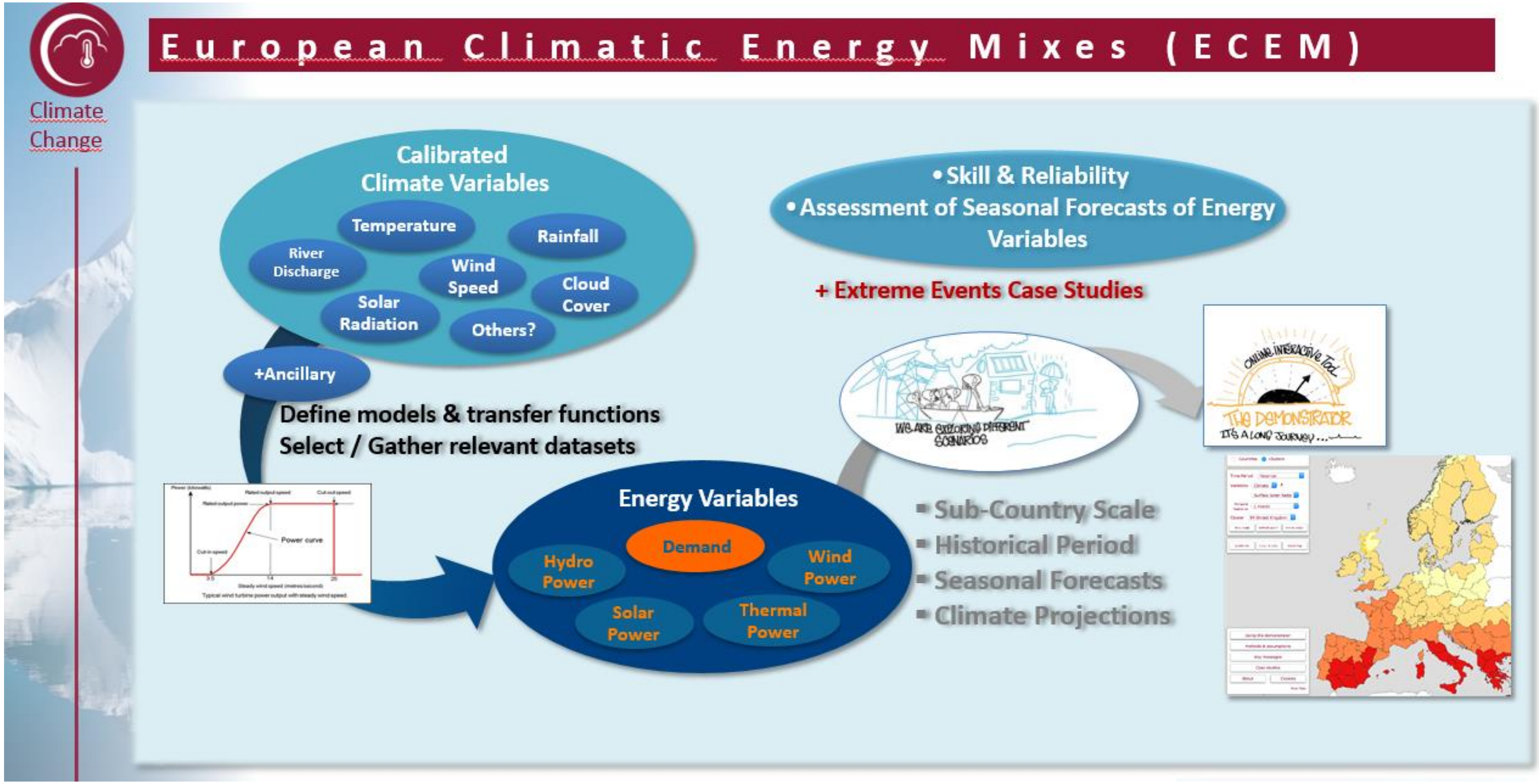


The value of flexibility services?

- **Storages (batteries, hydro generation, power2gas ...)**
- **Demand response**
- ***Electricity Generation assets***



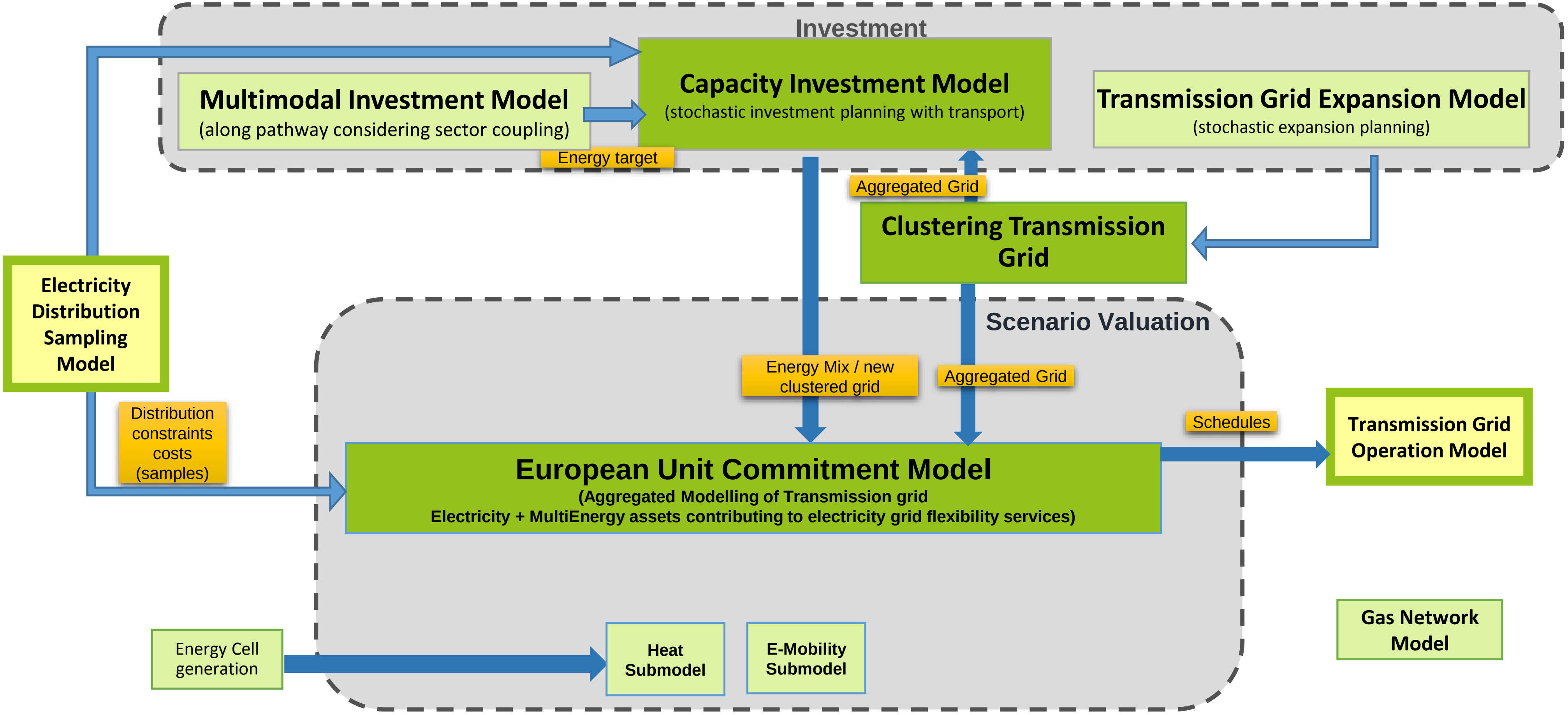
The Impacts of climate change



Modelling and Data

Main challenges

Modelling/outputs

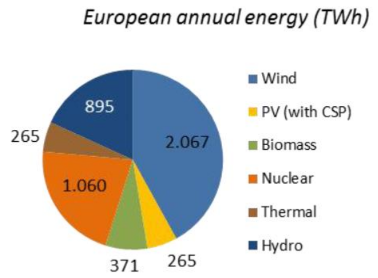


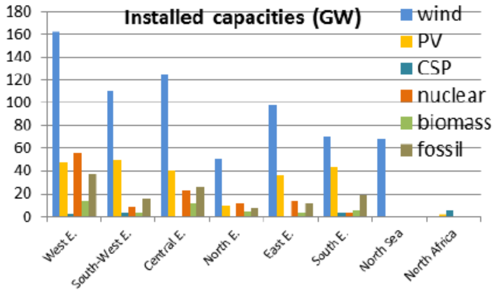
Outputs:
optimal electricity mix (generation & storage) , transmission and distribution reinforcements (simplified)

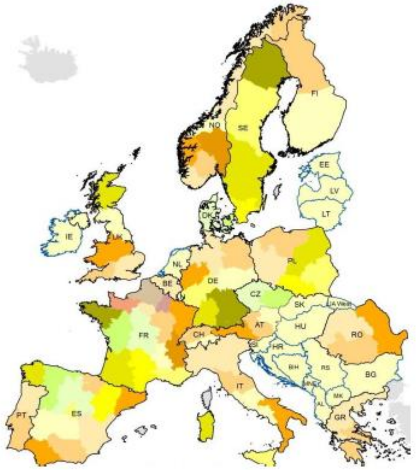
Outputs:
Generation, storage, DR
Schedules
Variable costs
Marginal costs
Generation revenues

European electricity Data

- **Macro scenario ‘see ‘common data’ will provide main data**
  - Annual demand TWh target : including some uses transferred from fossil fuels to electricity:
    - Heating/cooling
    - Non thermo sensitive uses (including electric vehicles)
  - Capacity target : high capacity level of generation with no CO_2 emissions (nuclear, renewable energy sources, hydro generation)
  - Transmission data with high resolution (countries divided into several regions)
  - Distribution cost curve samples and geographical mapping





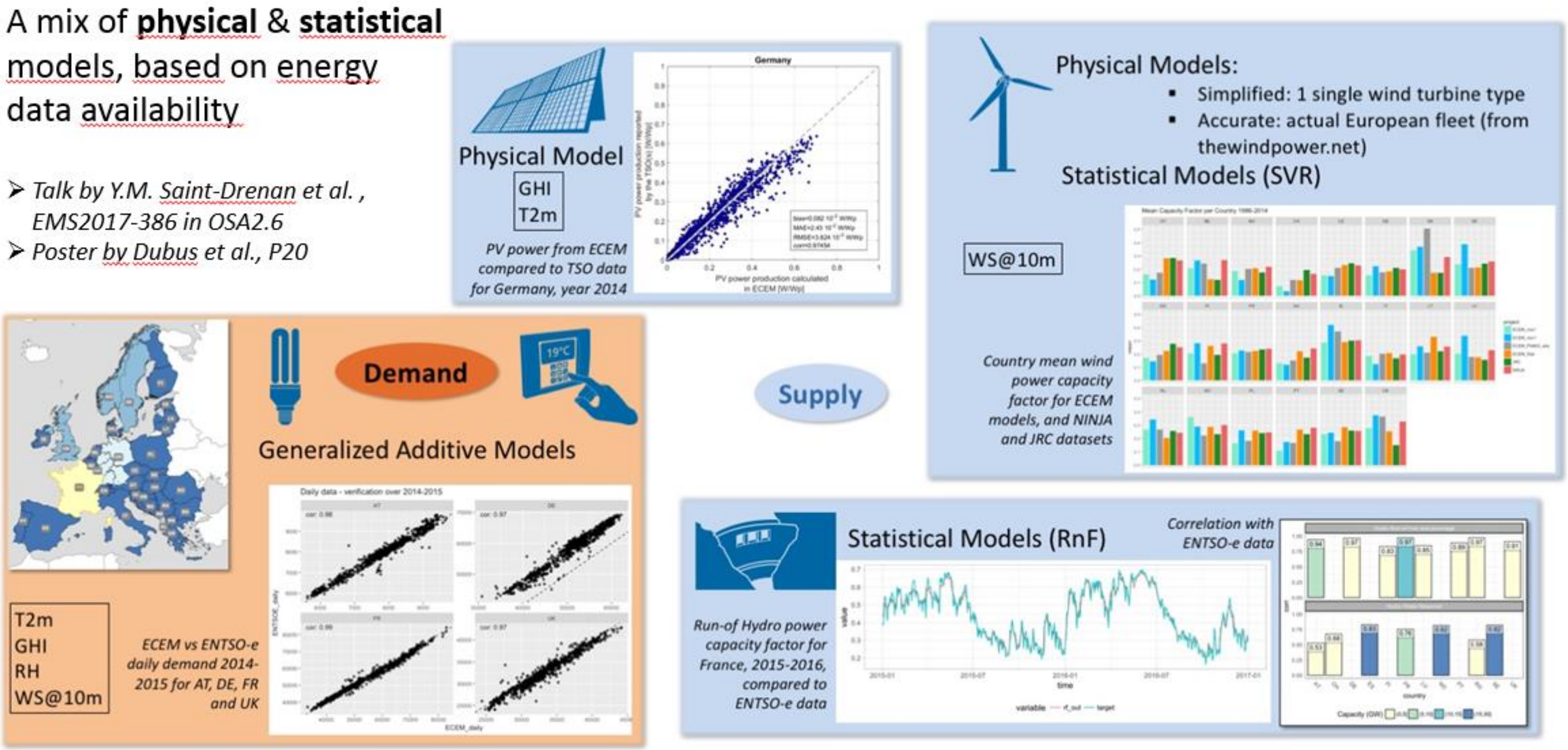


Climatic Data

- ❑ **ECEM project (European Climatic Energy Mixes) will provide temperature, wind and PV load factors, hydro inflows => used to generate demand, RES and hydro generation scenarii.**

Climate Change Service

http://climate.copernicus.eu/ecem-european-climatic-energy-mixes



- ❑ **Difficulties : Data Consistency**

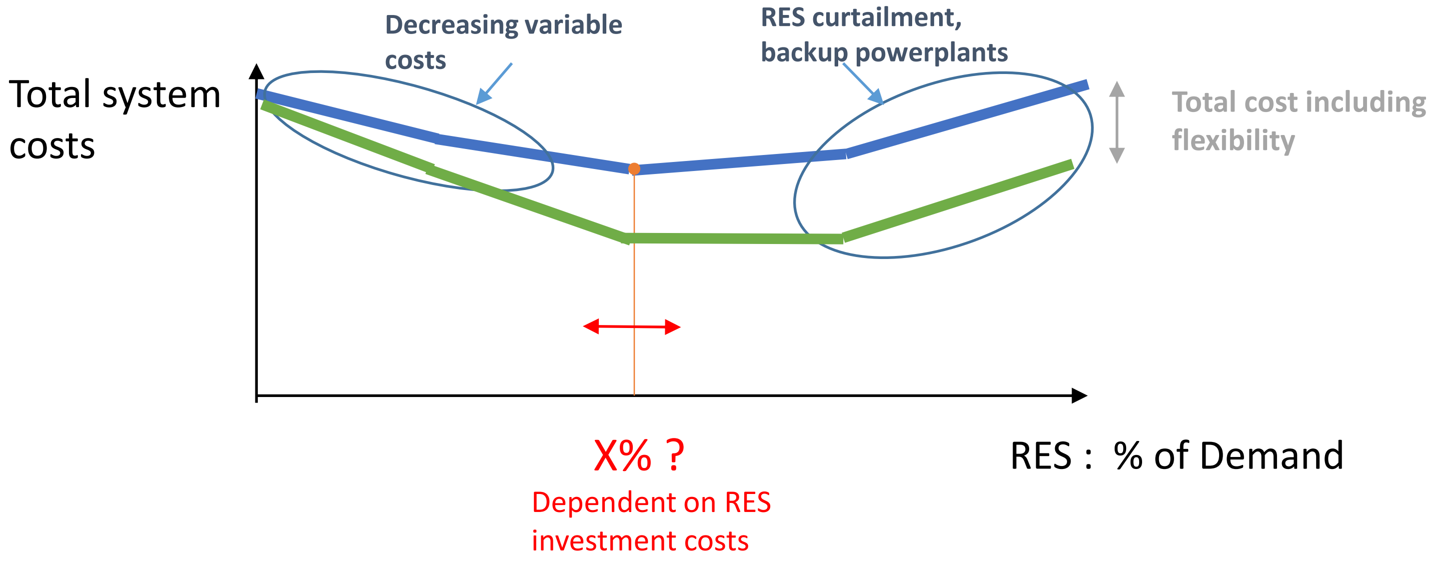
Modus operandi

Case Study protocol

- The results will be obtained by comparing several scenarii :
  - **For assessing the cost of RES integration:**
    - High share of RES (optimistic scenario)
    - Low share of RES (sensitivity analysis, for example 0%, 25%, 50%, 75%)
  - **For assessing value of flexibility:**
    - No flexibility in the initial scenario
    - Addition of flexibilities individually, and collectively among different kinds of storages and demand response
  - **For assessing the impact of climate change:**
    - Simulation with present climate variables (temperature, hydro and RES inflows)
    - Simulation with future (2040/2050) climate variables (temperature, hydro and RES inflows)

Case study outputs

- Impact of RES integration on the European system cost broken-down by categories: total, generation (investment and operational), transmission, distribution
- Value of flexibility : system cost reduction obtained by adding storages and demand response
- Impact of climate change : system cost impact due to climate change



Thank you!

Do you have any questions?