Lithuania. Country experience on the use of modelling tools for official energy planning

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Questions addressed

1. What are the **roles of energy system modelling in long-term policymaking**?

2. What methods are used to estimate and account for geospatial factors in long-term energy planning models? If applicable, **how are capacity credit of VRE, transmission constraints and flexibility requirements addressed**?

3. What kind of geospatial **data resolutions**, processing tools and widgets are used and **how and where do you get your data from**?

4. What are the **challenges in representing long-term VRE impacts and limitations of** current geo-spatial tools and **long-term energy models to capture this**?

Modeling of energy sector linked to long-term policymaking in Lithuania

Modelling and analysis of energy sector development and operation in the region (Finland, Estonia, Latvia, Lithuania, Poland including links with third countries);

Modelling and analysis of energy sector development and operation of a single country (Lithuania) including links with neighboring

Modeling of energy sector is used for policymaking in Lithuania. However, politicians often make significant adjustments to the recommendations that emerge from modeling results.

Modelling and analysis of single energy system (Power system, district heating system, etc.);

Coupling of energy models with agriculture and forestry;

Economy models and their linking with energy models;

Modelling of various operational and policy problems in energy systems.

Spatial and temporal resolution used in energy models

Model representing **single node** electricity system combined with up to **13** separate district heating systems. Temporal resolution **- 108 time slices** within a single year *(7 seasons * 2 typical days * (4-10 time slices in each) * 2 wind speed conditions)*;

Electricity system model designed for analysis of generation expansion and grid development issues has **54 high voltage grid nodes**. Temporal resolution **- 57 time slices** within a single year (6 seasons * 2 typical days * (3-6 time slices in each));

Up to **60 regions** in the model analyzing CLEW issues in the country (**5 step** approximation of load duration curve);

Up to **60 demand nodes** in the city district heating system model analyzing district heat generation and grid renovation issues. Temporal resolution **- 29 time slices** within a single year *(7 seasons * 4 time slices + 1 season * 1 time slice)*;

Single node electricity market model with **9 district heating systems**. Temporal resolution – **600 time slices** within a single year *(5 seasons * 2 typical days * 20 time slices in each * 3 wind speed conditions)*

Up to **2000 time slices** for a **single node** district heating system of a town.

Stages in preparation of the National energy strategy

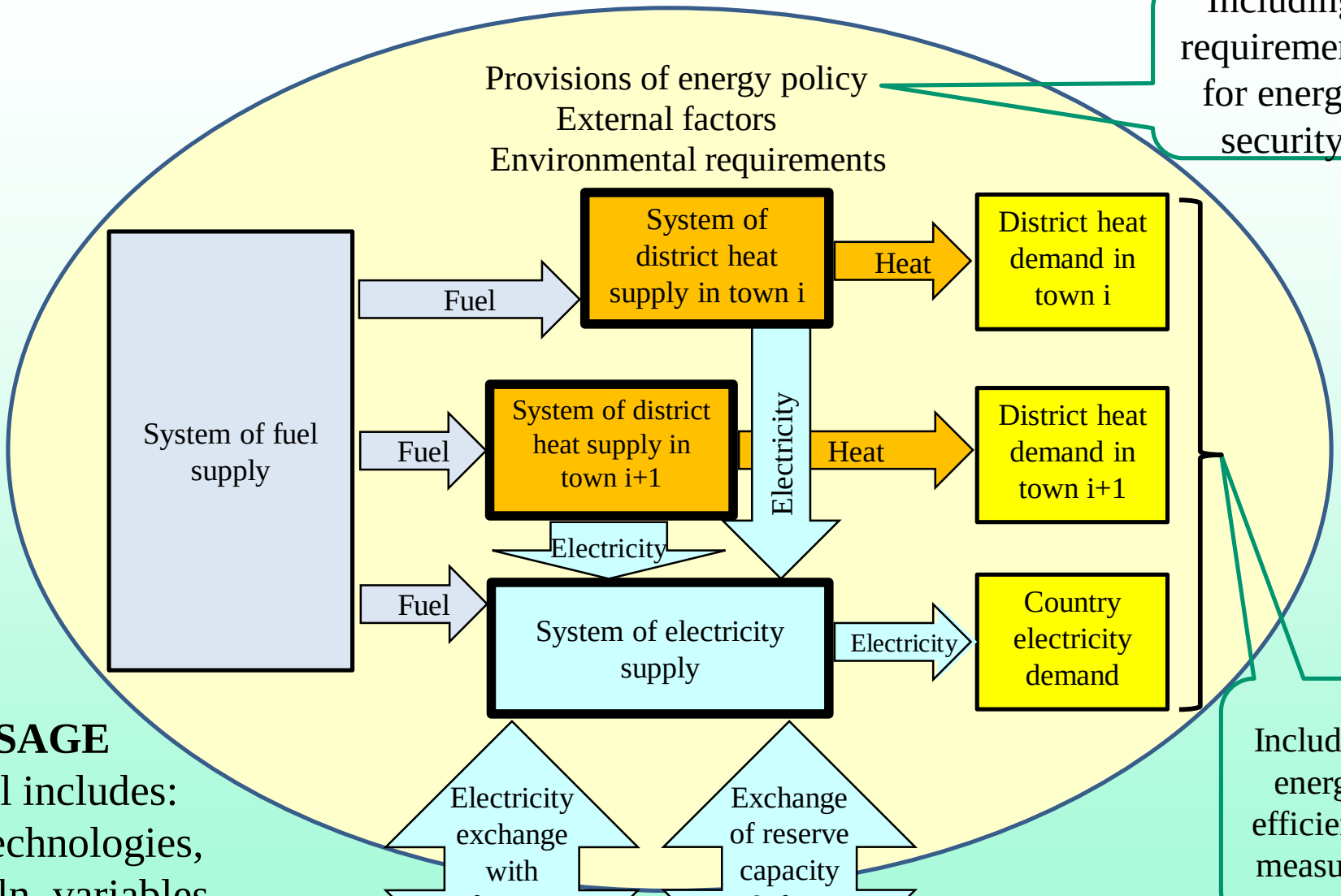
Scenario analysis of energy sector development and operation

Evaluation of energy security for energy sector development scenarios

Analysis of macroeconomic impact of energy sector development scenarios

Preparation of the National energy strategy project

Structure of mathematical model

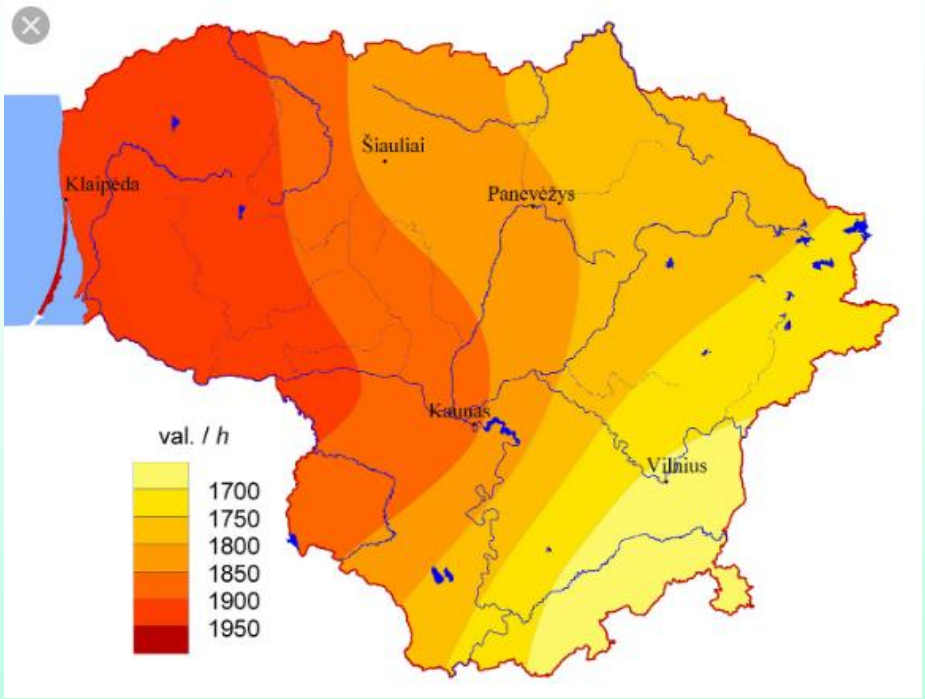


MESSAGE

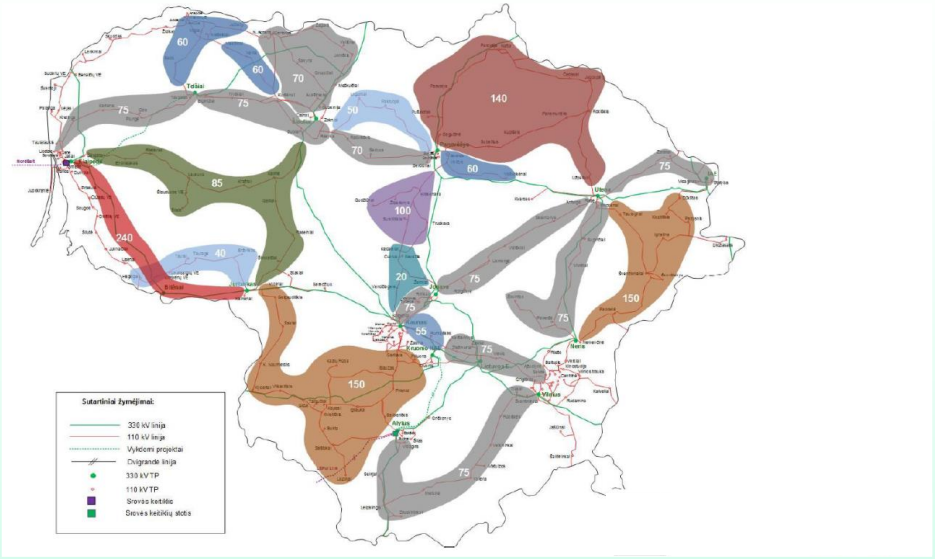
Model includes:
620 technologies,
1,1 mln. variables,
570 thous. equations.

RES. Spatial information used

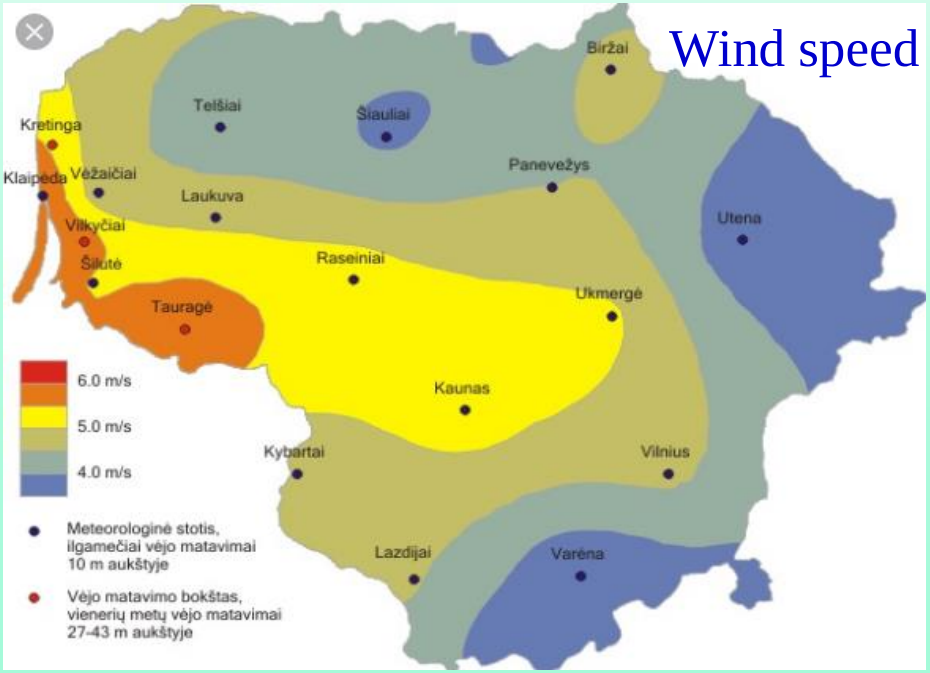
Solar irradiation



Additional throughput capacity of the grid

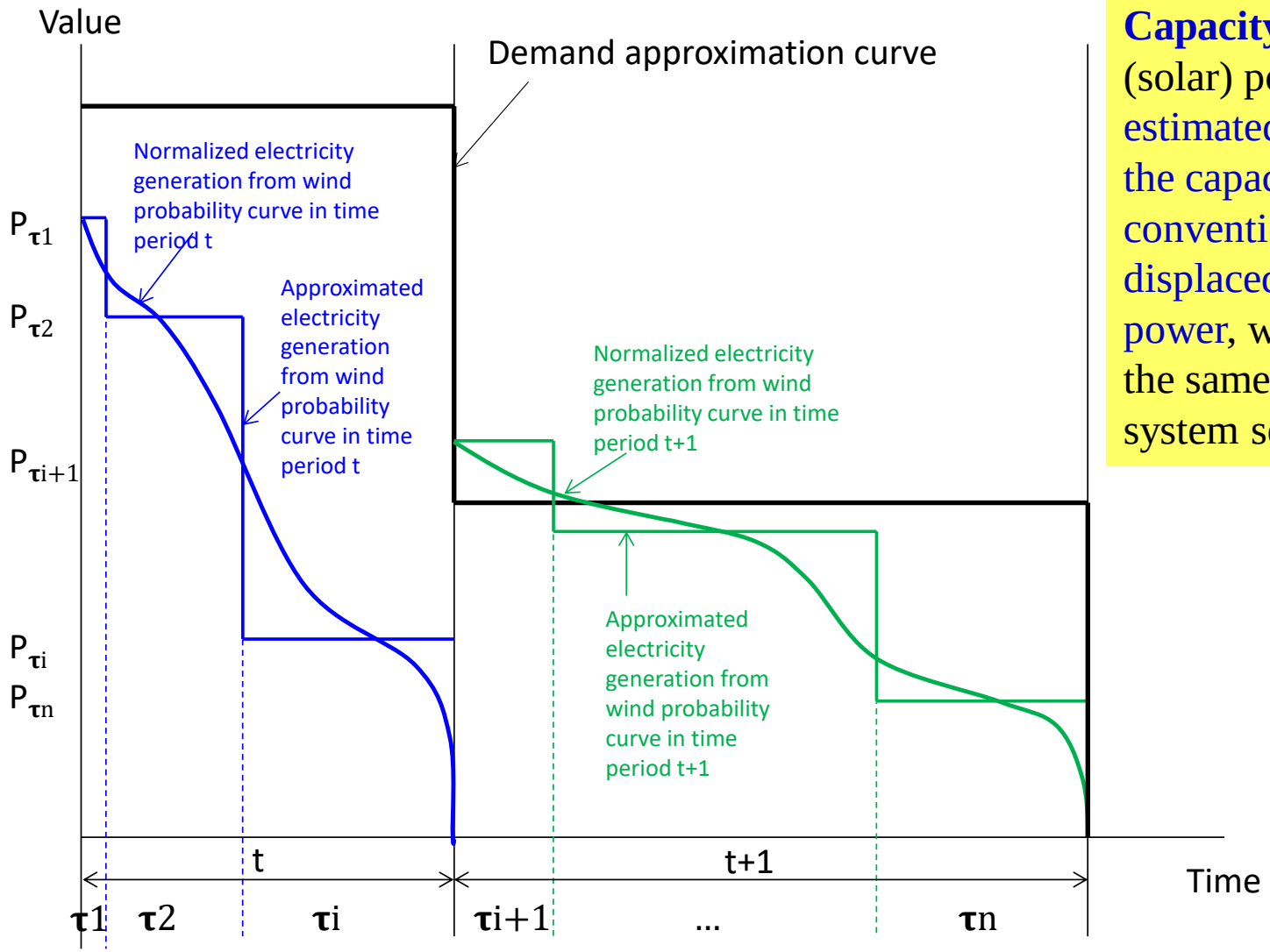


Wind speed



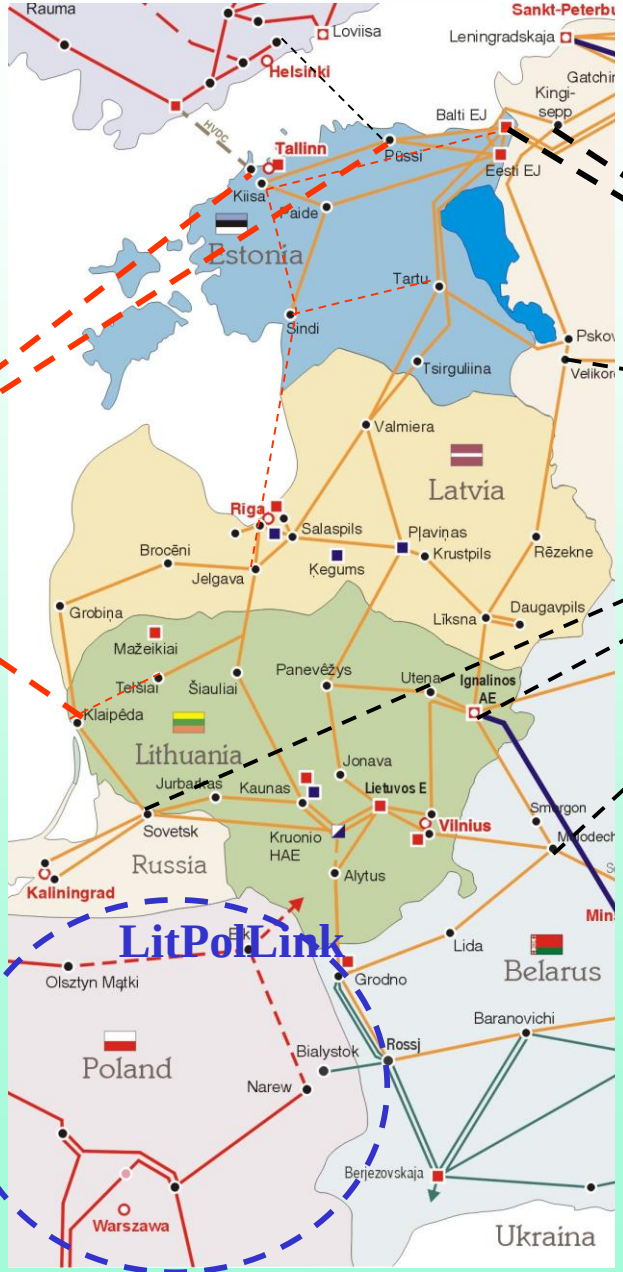
Geospatial data about available **sites** would be beneficial.

Capacity credit and flexibility requirements addressed (Wind power plants)



Capacity credit of wind (solar) power plant, is estimated by determining the capacity of conventional plants displaced by wind (solar) power, whilst maintaining the same degree of system security

Grid expansion and transmission constraints (1)



EstLink

Nordel

NordBalt

Russia

IPS/UPS

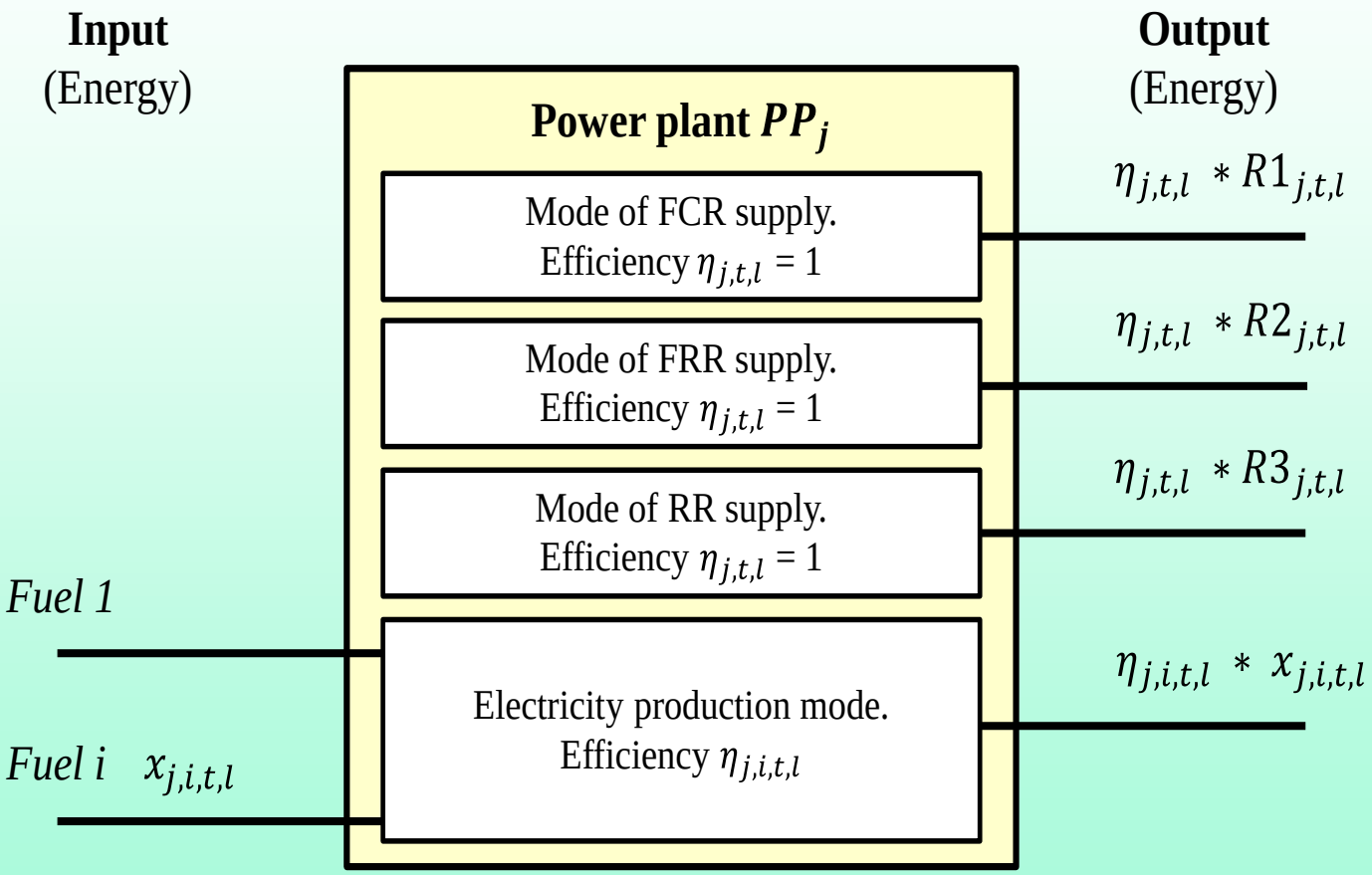
LitPolLink

Polish PS and link with UCTE

Each existing and possible HV line can be represented by separate technology

Nonlinearity of losses in the grid is taken into account.

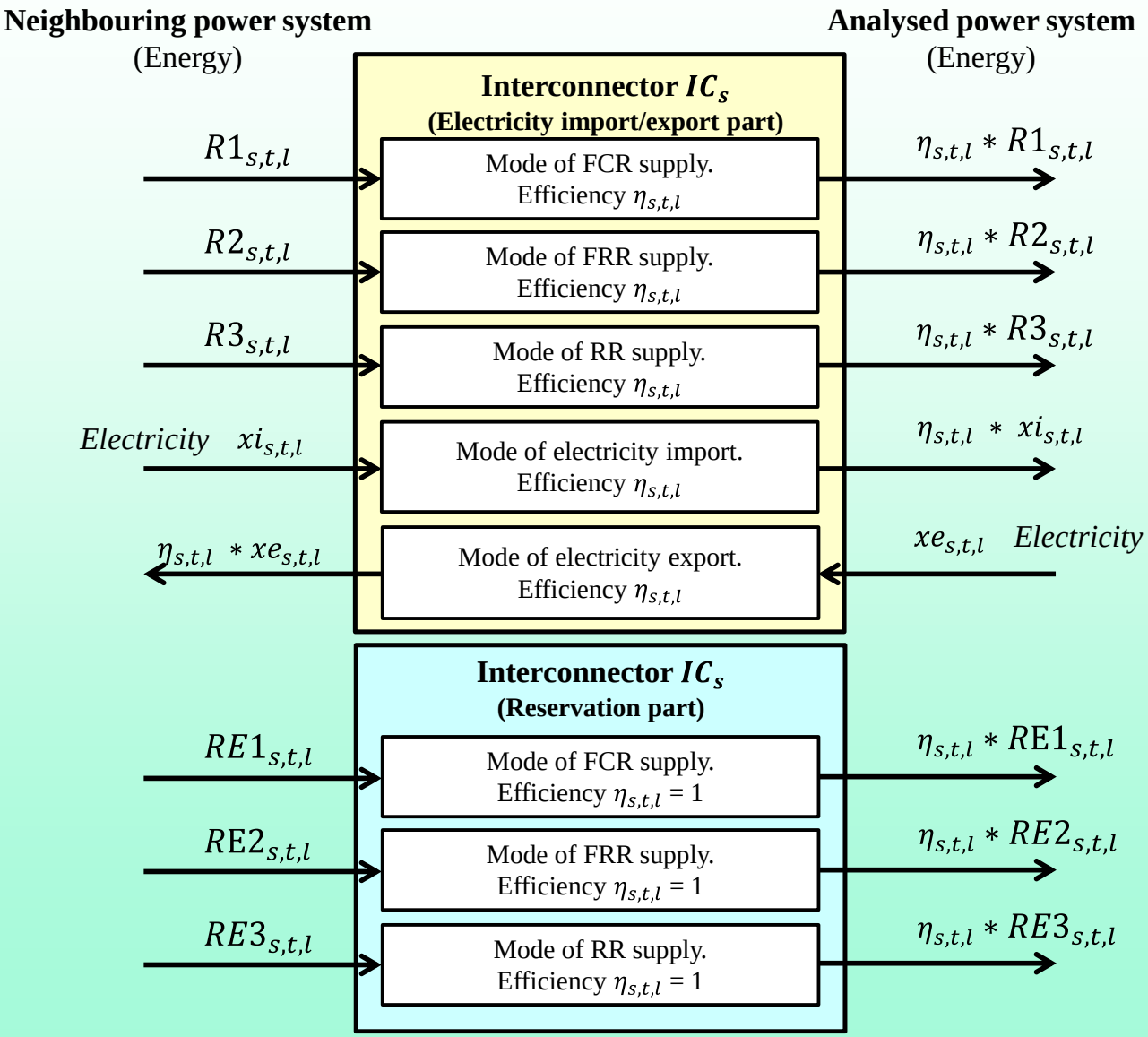
Reserves. Representation of single power plant



Provision of reserves in emergency situations

Electricity supply and balancing of VRE

Reserves. Representation of interconnector and transmission constraints

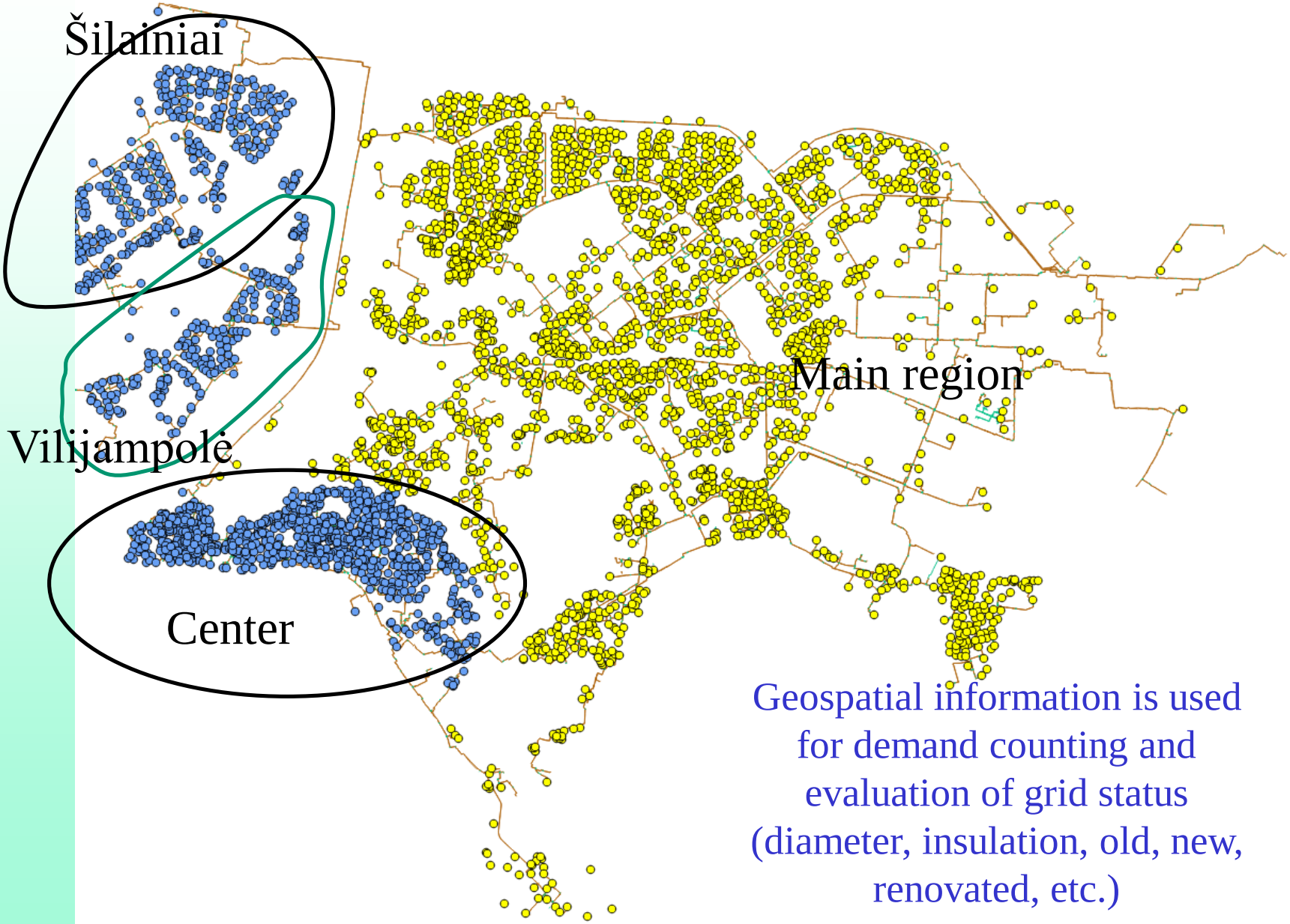


Provision of reserves in electricity import regime

Import/export of electricity and balancing of VRE

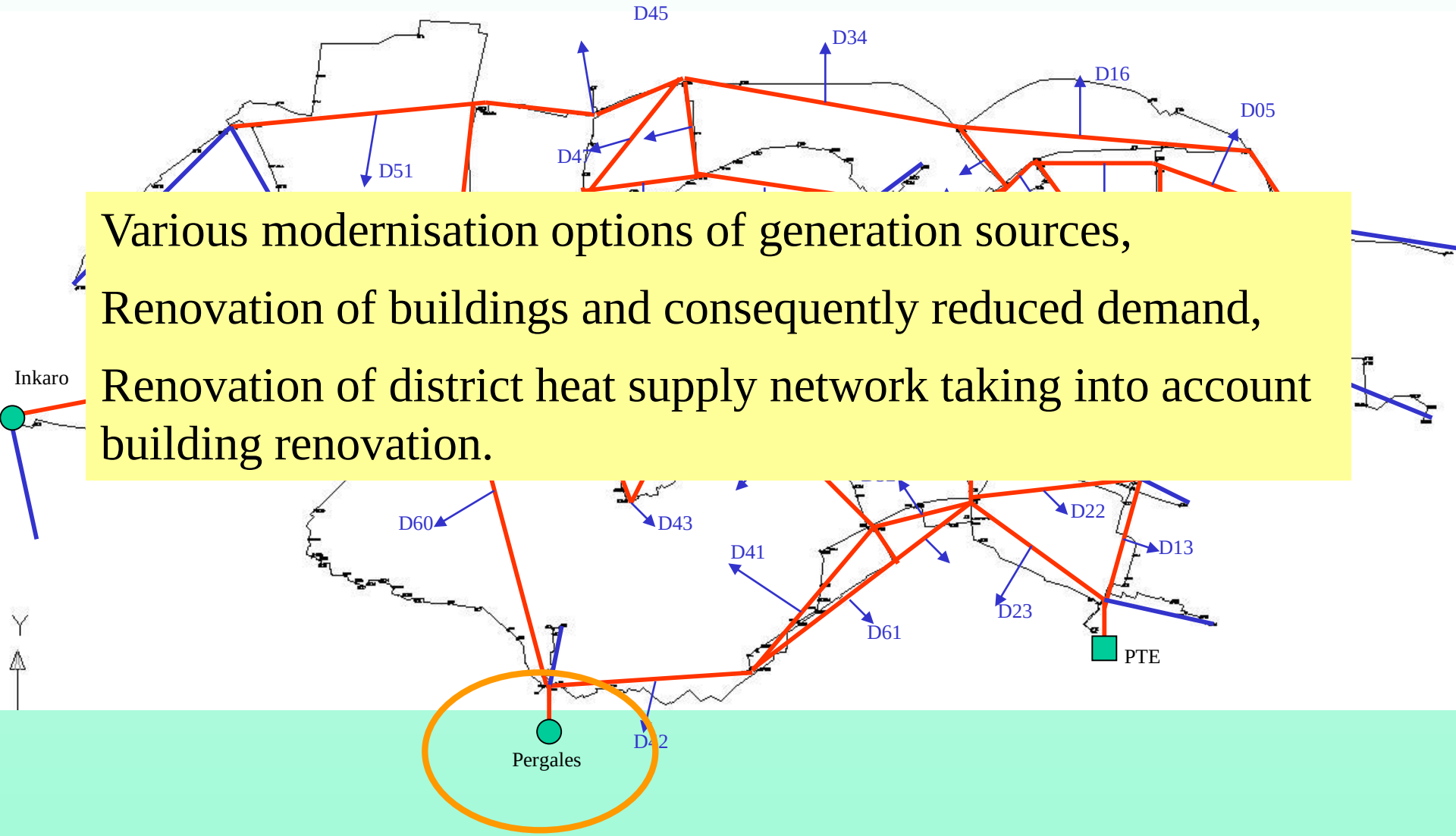
Provision of reserves in electricity export regime

Representation of district heating systems



Geospatial information is used for demand counting and evaluation of grid status (diameter, insulation, old, new, renovated, etc.)

Model of district heating system (1)



Various modernisation options of generation sources,

Renovation of buildings and consequently reduced demand,

Renovation of district heat supply network taking into account building renovation.

Resolutions of geospatial data. Data sources

Resolution: ***Depend on problem to be analyzed*** and ***capability*** of long term energy planning models to handle problems with high spatial and temporal resolution;

Data of higher resolution can be always converted into data of lower resolution but not vice versa. Therefore ***data of higher resolution are more preferable***;

Hourly data about wind speed, solar irradiation, electricity price variation in the market ***do not always allow to see actual situation in the system*** and such resolution is ***not sufficient for modelling of electricity storages***. Nevertheless data of higher temporal resolution are practically not available;

Data sources: ***Energy companies*** *(Electricity transmission company LITGRID, Energy distribution operator ESO, District heating companies);*
Meteorological stations
Geoportal.lt
Departmet of statistics
Others

Challenges in representing VRE impacts and limitations of tools

Not sufficient capability of at least some of mathematical models for analysis of long term energy sector development analysis to reflect correctly operational regimes of energy system. *(Limitation on size of the problem);*

Lack of information about particular possible **sites** for development of generation sources based on RES;

Increasing level of ***confidentiality***;

Higher temporal resolution of data regarding wind speed or solar irradiation ***would give better possibility to evaluate consequences of VRE penetration*** to the structure and operational regimes of power system (and to economic attractiveness of electricity storages in particular);

No comments on geo-spatial tools *(Not sufficient experience).*

Thank you for your attention

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