Analysis of Energy Supply Disturbances and Energy Security of Supply in Lithuania

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PSAM9,
18-23 May, 2008
Hong Kong, China

Presentation outline

- **The scheme of methodology** for energy security of supply analysis
- State of **Lithuanian** energy sector
- **Scenarios** of energy supply disturbances
- **Conclusions**

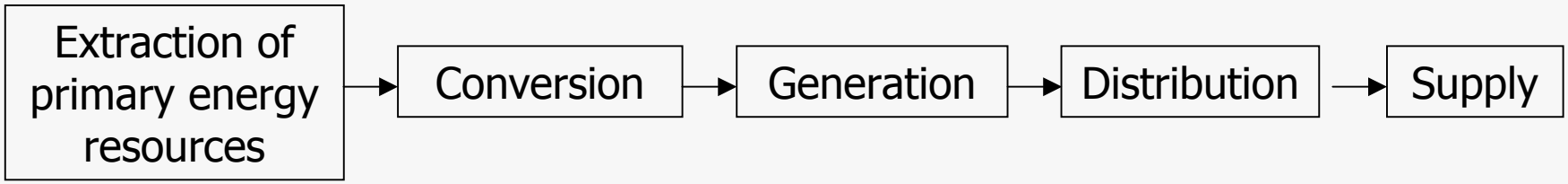
Concept of energy security of supply (ESS)

• State then energy demand of country (region), citizenry, society, government and economy is satisfied by available fuel-energy resources on normal and marginal conditions.

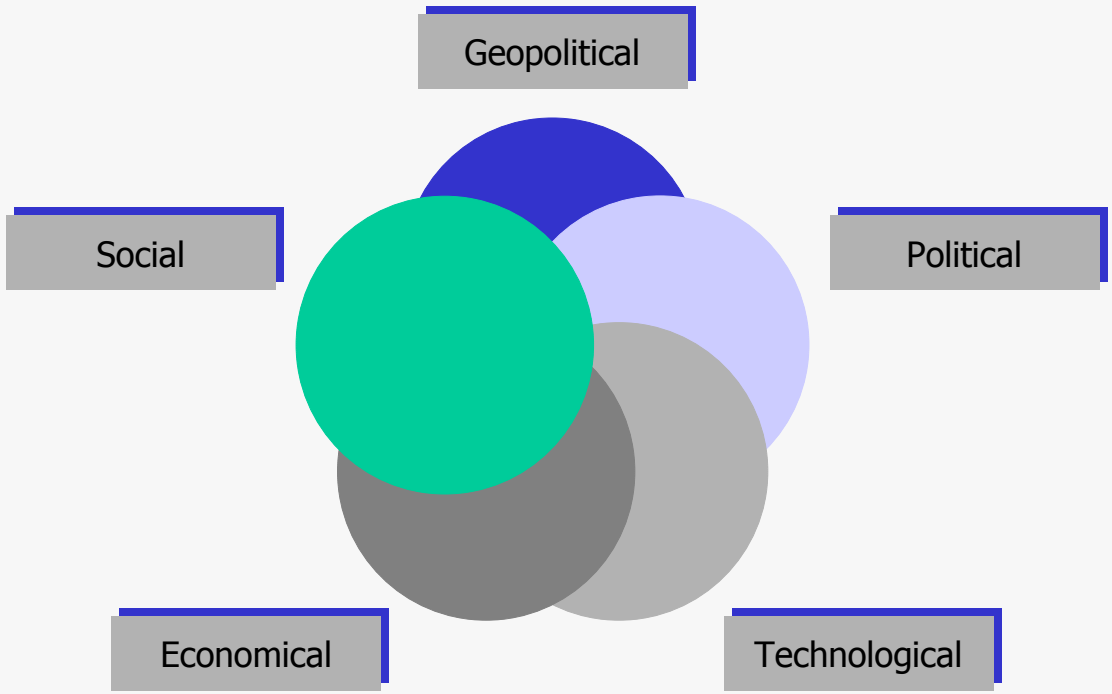
• Security of essential energy interests (personal, public, government) from internal and external threats.

• The International Energy Agency describes conception "energy supply security" as a reliable possibility to obtain proper energy quantity for reasonable price.

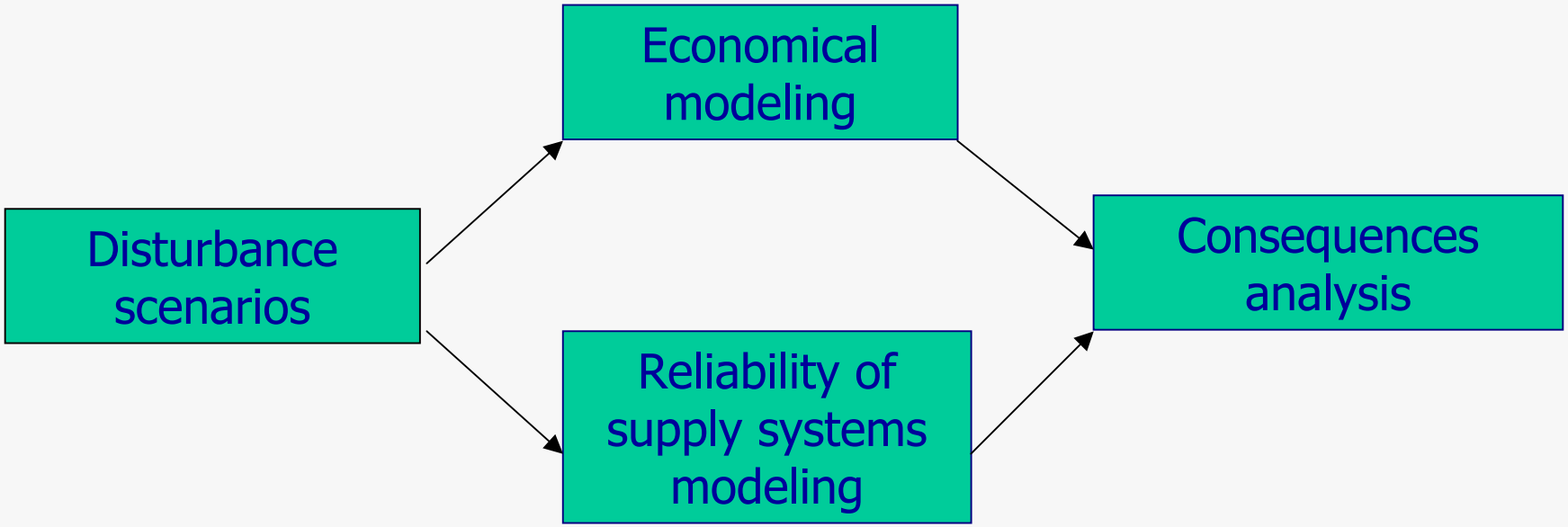
Elements of ESS



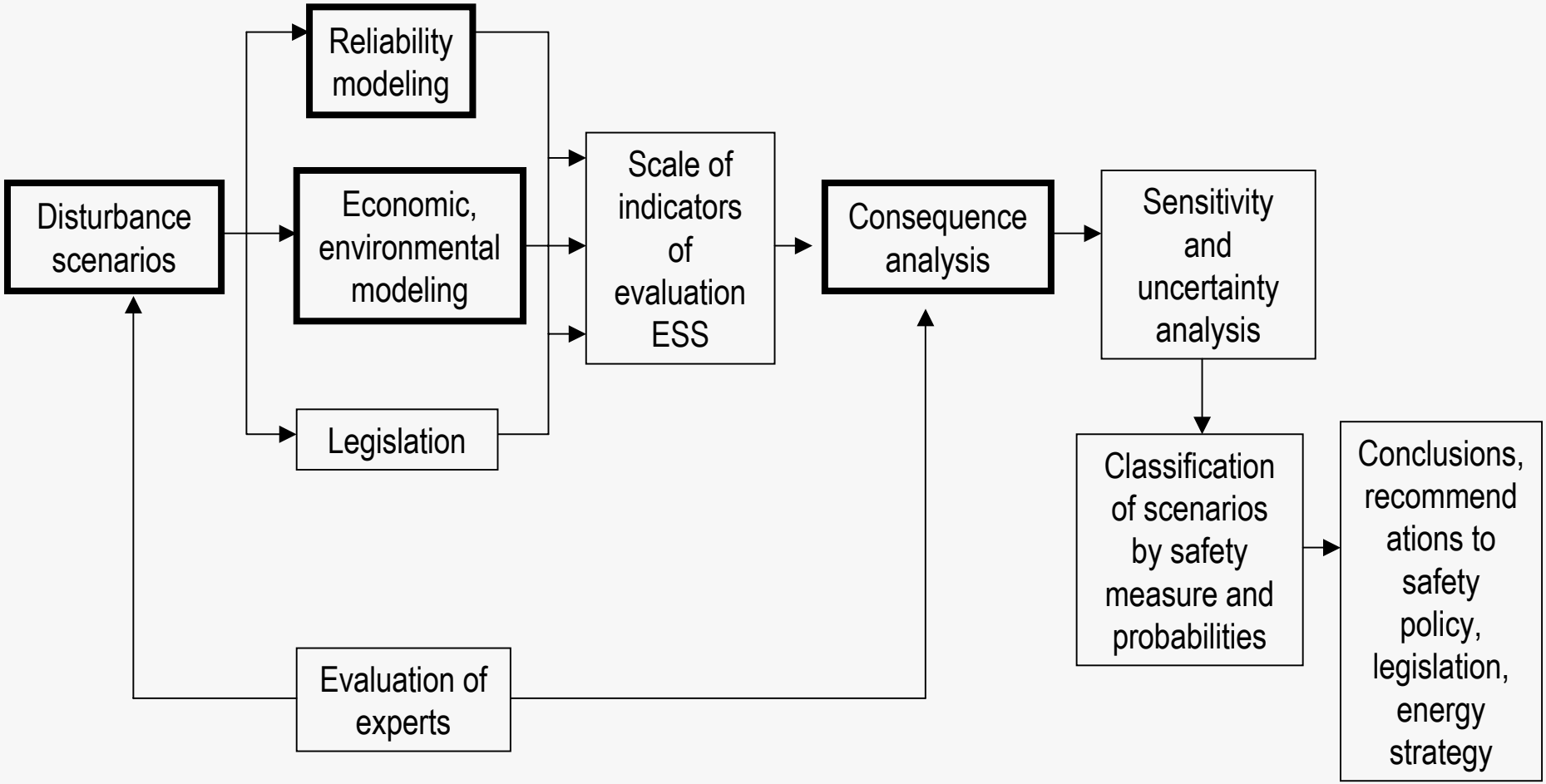
Research environment of ESS



Integrated ESS methodology (Principal scheme)

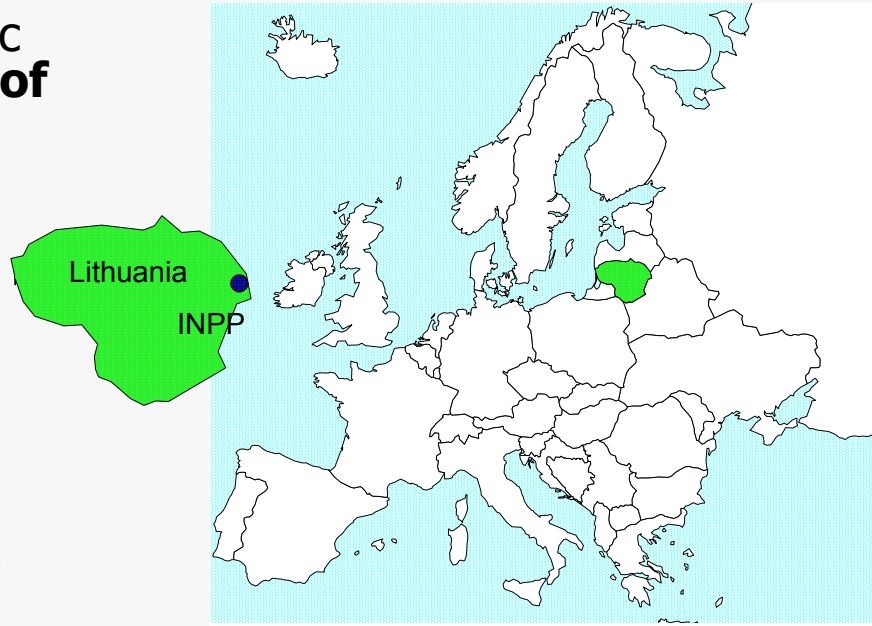


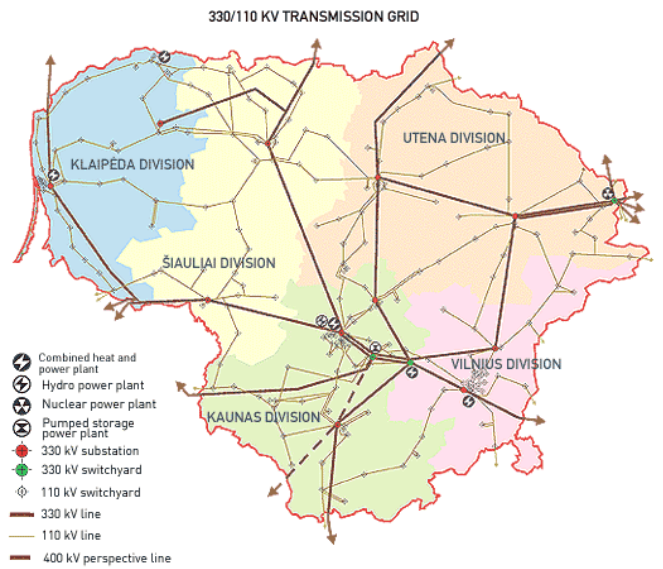
General scheme of methodology



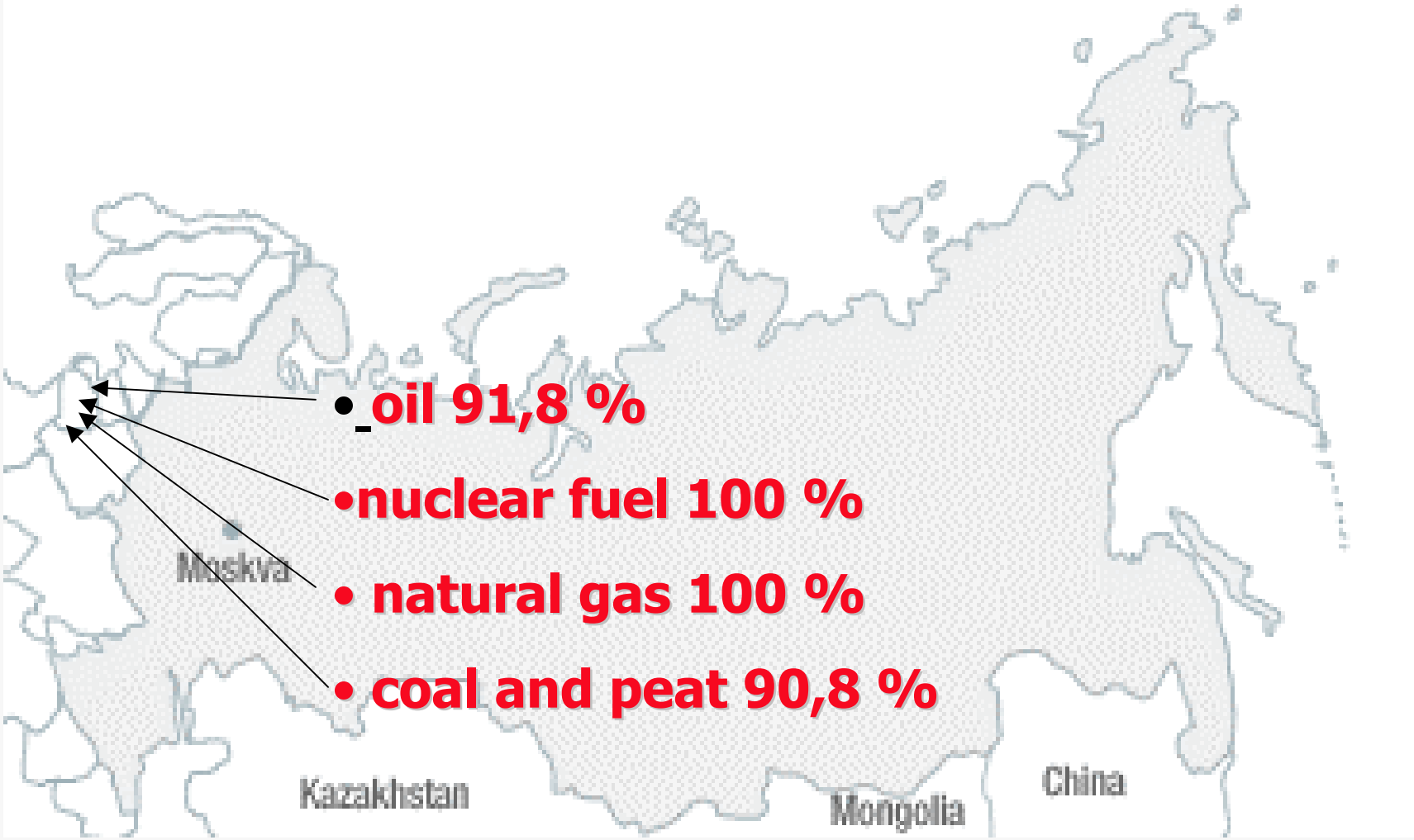
Electricity sector in Lithuania

- **Nuclear** still is the main source of electric energy in Lithuania: it covers **60 - 86% of total electricity production.**
- **Two RBMK-1500** type reactors (the most advanced version of the former Soviet Union channel type reactor design series) **were build in Lithuania.**
- Presently Ignalina NPP operates one reactor (unit 2). The unit 1 was closed in 2004 under joint Lithuania and EU agreement. **The unit 2 is scheduled to be closed in 2009.**
- All **nuclear fuel** imported from Russia because of RBMK reactors specifics.
- **Transfer network** is enough integrated only to east neighboring energy systems: Latvia, Belarus, Kaliningrad district of Russian federation.
- No network to West Europe electricity systems. **Strategical connections** to Poland and Sweden are planned.





Present situation of energy security of supply



The main threats of Energy sector in Lithuania

- High level of supply of **primary energy resources** from one country (natural gas, nuclear fuel);

- **Closing of Ignalina NPP** and takedown of it's reactors till installation of competitive power generating sources and implementing tools of energy supply network, especially intersystem connection to Poland and Sweden;

- Old heat supply systems and electricity transmission network, **slow modernization** of technologies.

Basic scenario

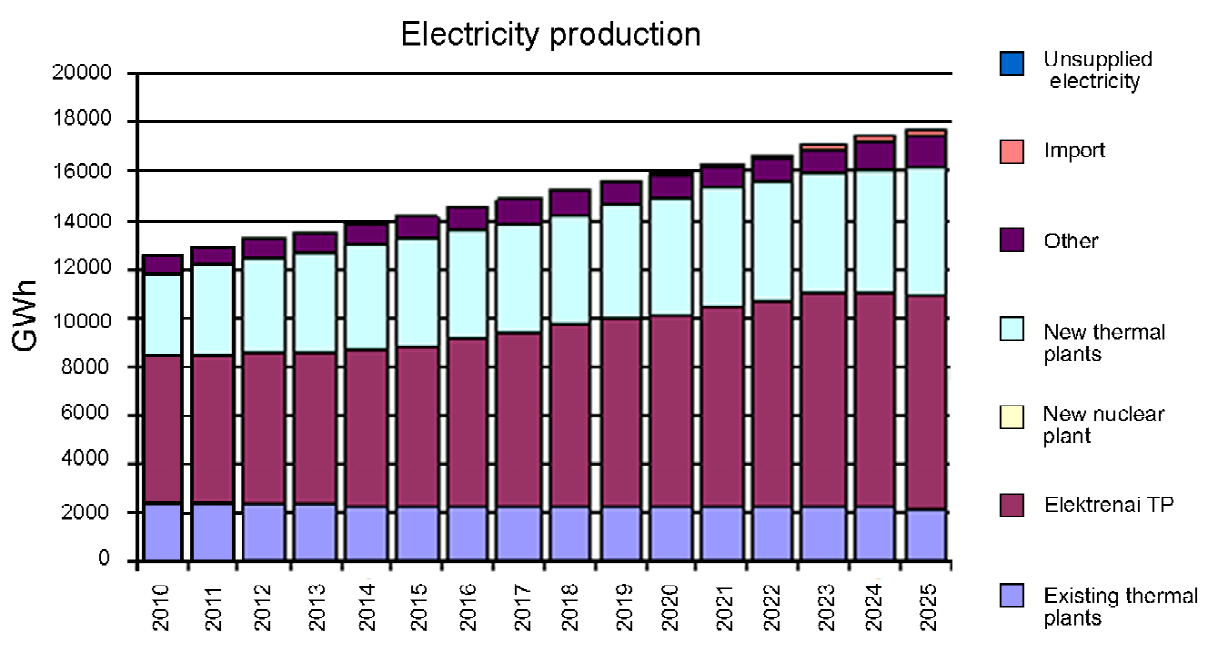
Basic scenario shows current situation of energy sector when primary energy supply disturbances doesn't exist (till 2025).

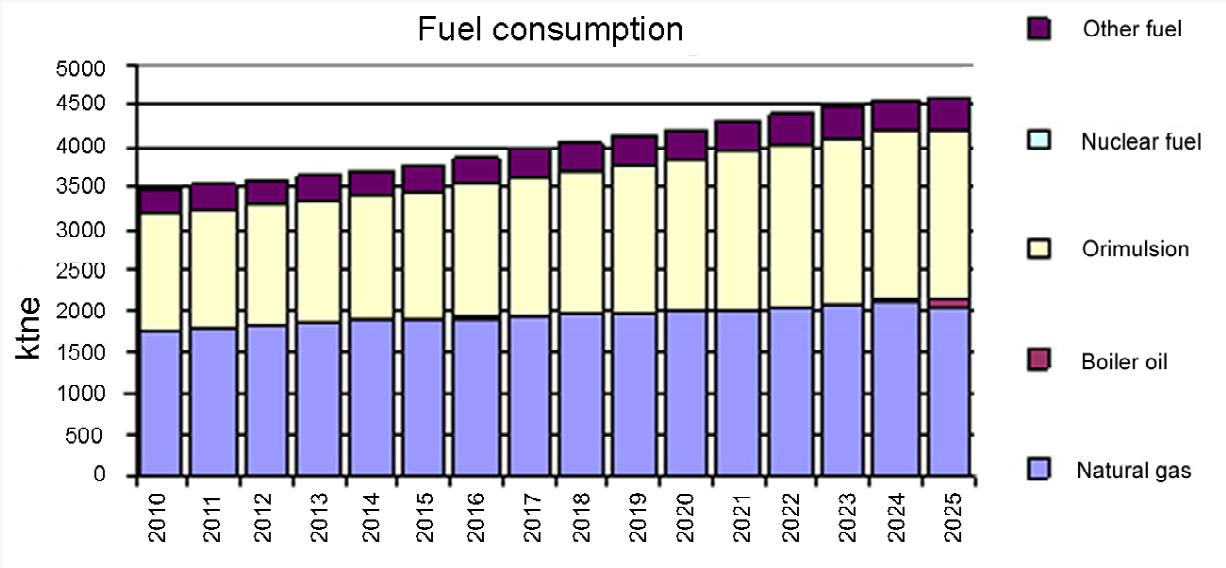
Fuel and primary energy sources are supplied as it was predicted by demand for electric energy and heat production;

Prices of primary energy resources changes by average high forecasts of fuel prices.

Primary energy resources and fuel highly consumed in Lithuania are: oil products (boiler oil and orimulsion), gas, and nuclear fuel.

Basic scenario





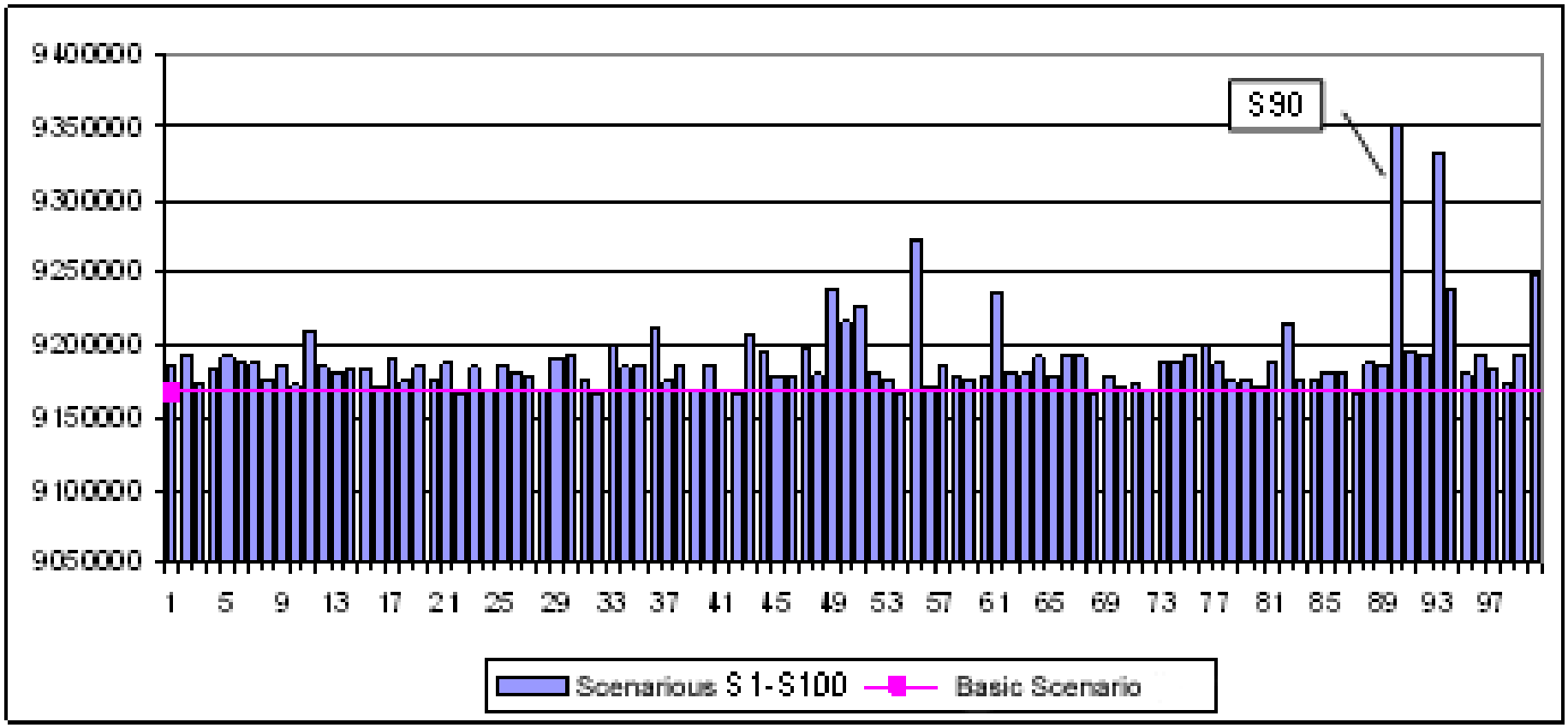
Scenarios of disturbances

Scenarios of disturbances were modelled considering to four parameters: part of energy supply deviation of basic supply scenario; term of primary energy resources or fuel supply disturbances from basic scenario; price deviation of fuel or primary energy resources from predicted price projected in basic scenario; the moment (year) of supply deviation.

Probabilities were chosen considering real Lithuanian situation:
very high probabilities of deviations from basic scenarios were chosen for gas supplying (to Lithuania it can be supplied only by pipelines from Russia),
smaller probabilities of deviations from basic scenario were chosen for oil (it's possible to transport oil over Butinge terminal from other countries).

For comparison there were developed 110 different long term energy supply disturbance scenarios.

100 scenarios



Scenarios SG1, SG2, SG3

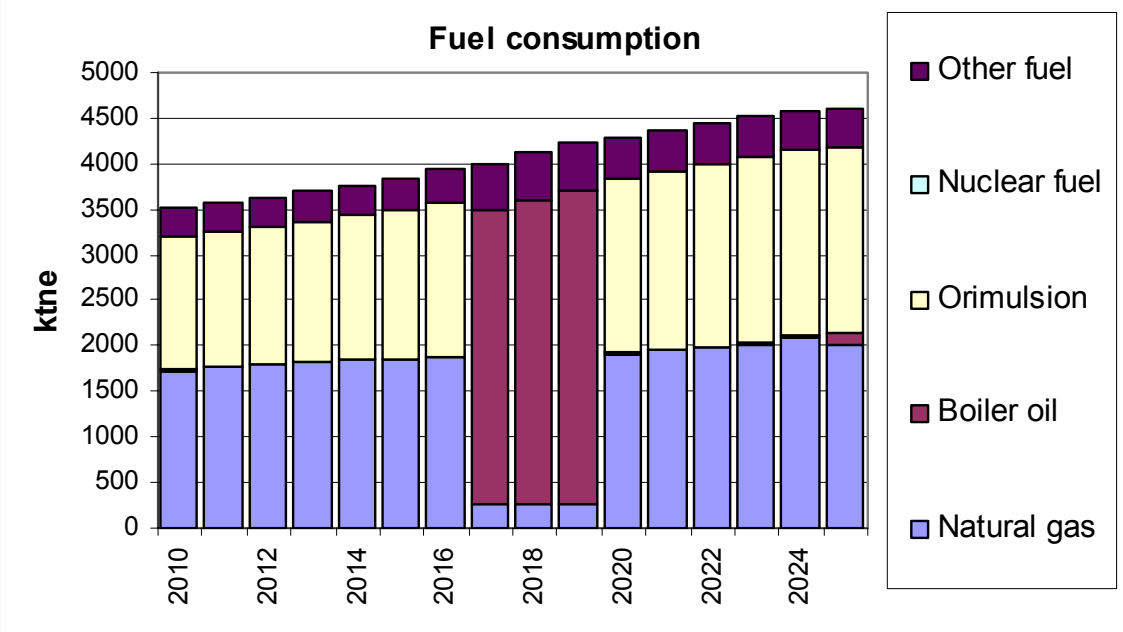
Aiming to find out how Lithuanian energy system would react to big disturbances, i.e. when supply of several main fuel types is disrupted, three scenarios SG1, SG2, SG3 were analyzed. Main assumptions of these scenarios are:

SG1 – gas and orimulsion supply is disrupted in the period of 2017-2019;

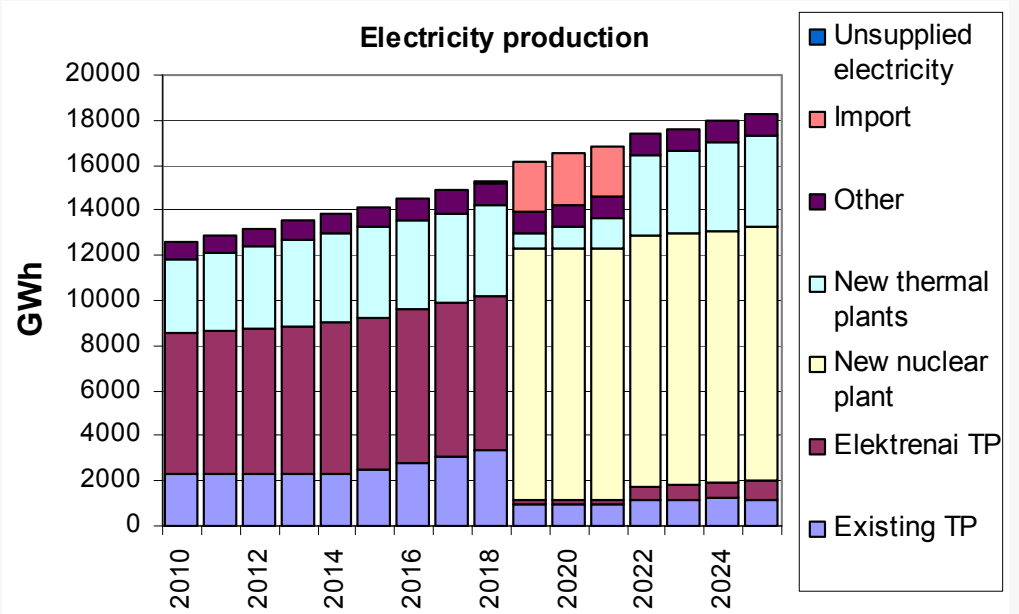
SG2 – gas and heavy fuel oil supply is disrupted in the period of 2019-2021;

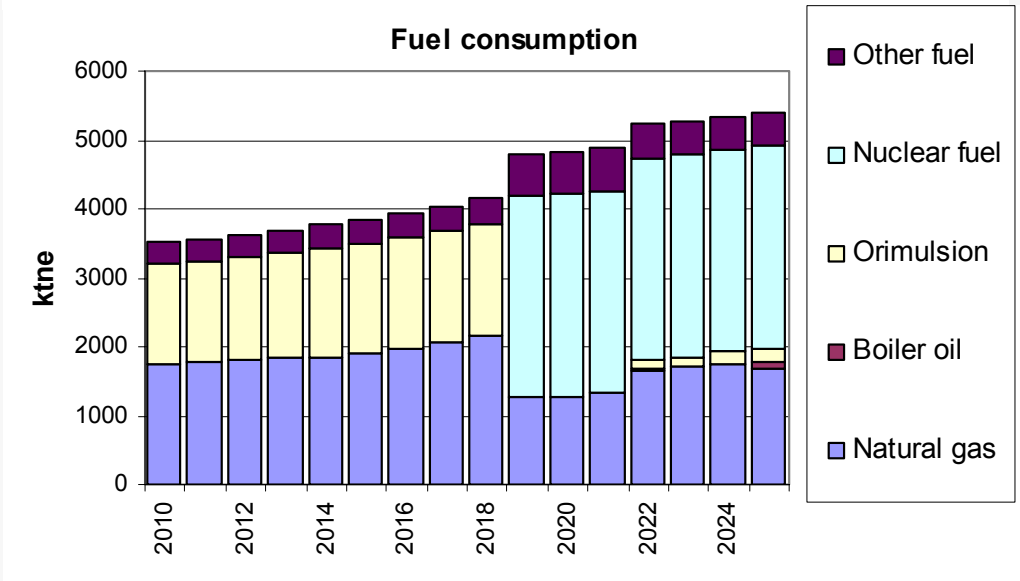
SG3 – gas, heavy fuel oil and orimulsion supply is disrupted in the period of 2019-2021.

SG1 scenario



SG3 scenario





Summary and conclusions 1

Lithuanian situation of energy safety of supply compared to other European countries is quite complicated because of few countries supplying **primary energy sources** (for the most part is supplying from Russia). That's because in Lithuania it must be completed full energy supply analysis, including stages: **scenarios of disturbances, economical modelling, reliability of supply systems, consequences analysis**. All these stages are very important performing Lithuanian analysis, consequences to Lithuanian economy should be rated in general scale. In the short run Lithuania have to **take important decisions** – construction of power plants, including NPP, and this have to be **based on estimation of energy security of supply**.

Summary and conclusions 2

- Low level disturbances (reducing to 50% from basic scenarios) of different fuel types (gas, oil, boiler oil, orimulsion, nuclear fuel) doesn't make substantial harm to Lithuanian energy system.

- When gas supply decreases up to 95 % for a year, gas supply is stopped to Lithuanian enterprises but electricity and heat is producing by boiler oil then, therefore costs of energy production rise by 51 mln. $ per year average. This is precritical situation.

- Critical situation is gained when supply of two fuel types is stopped to Lithuania.

Thank you for Your attention!

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