Energy Sector Development and Economic Sustainability Analysis: Lithuanian State-Funded Smart Grid Project

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Short description of the project

Project title: **Energy sector development and economic sustainability analysis (*supportive measure for updating the National Energy Strategy*);**

Duration: **5 years (2012-2016);**

Budget: **903 932 Eur.;**

Executor: **Lithuanian Energy Institute;**

Status: **National (Lithuanian);**

Final beneficiaries: **Ministry of Energy of the Republic of Lithuania**

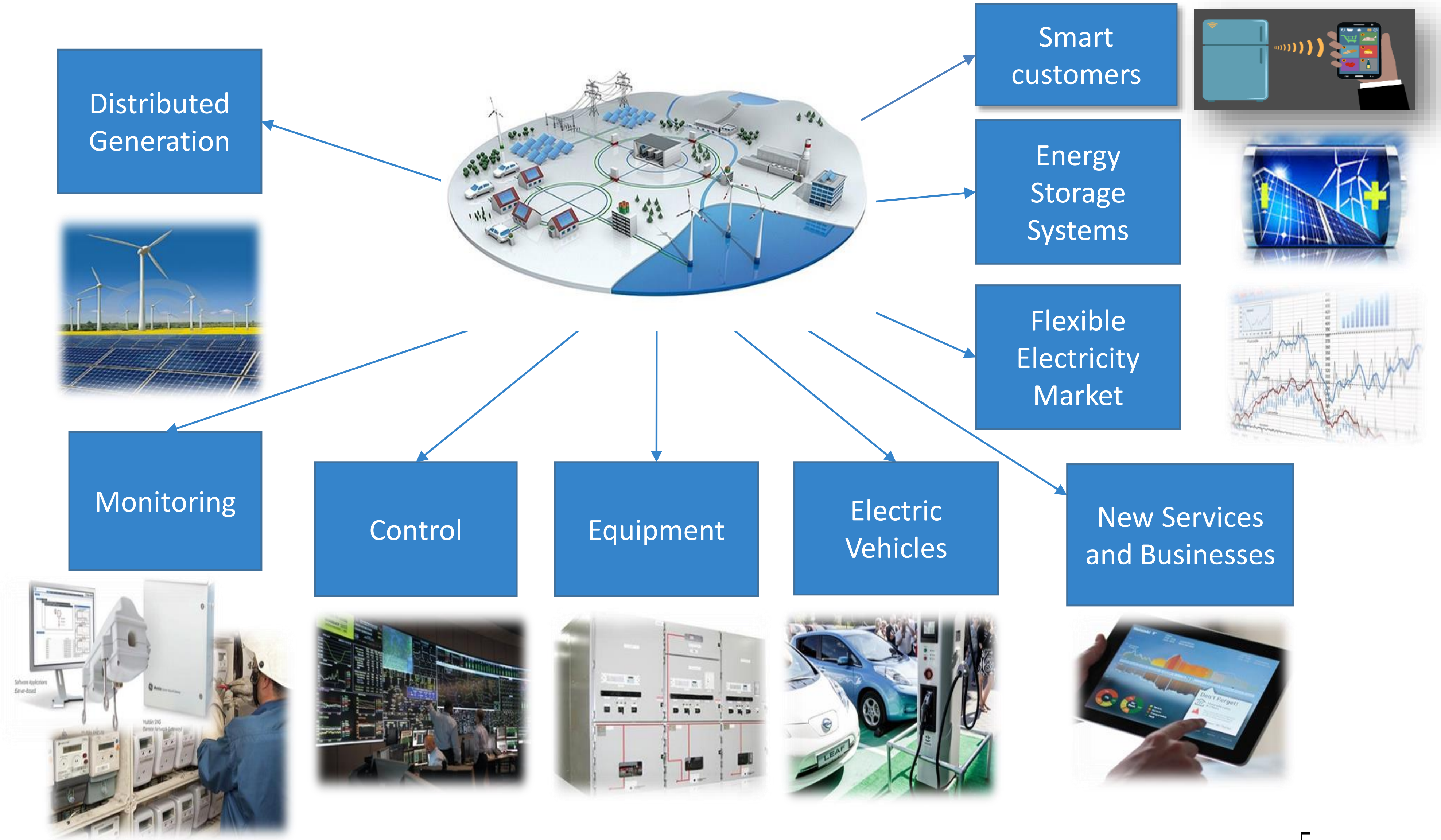
The main overarching objectives

1. To create a planning methodology for the energy sector development and economic sustainability analysis;
2. To investigate possibilities and develop recommendations of sustainable integration of new technologies, optimisation of fuel and energy balance and compliance with climate change targets;
3. To formulate the methodological set-ups for evaluation and upgrade of energy performance on state and municipalities levels;
4. To analyse the technical possibilities of Lithuanian energy system for synchronous operation with Continental Europe (ENTSO-E) network taking into account the future generation scenarios.

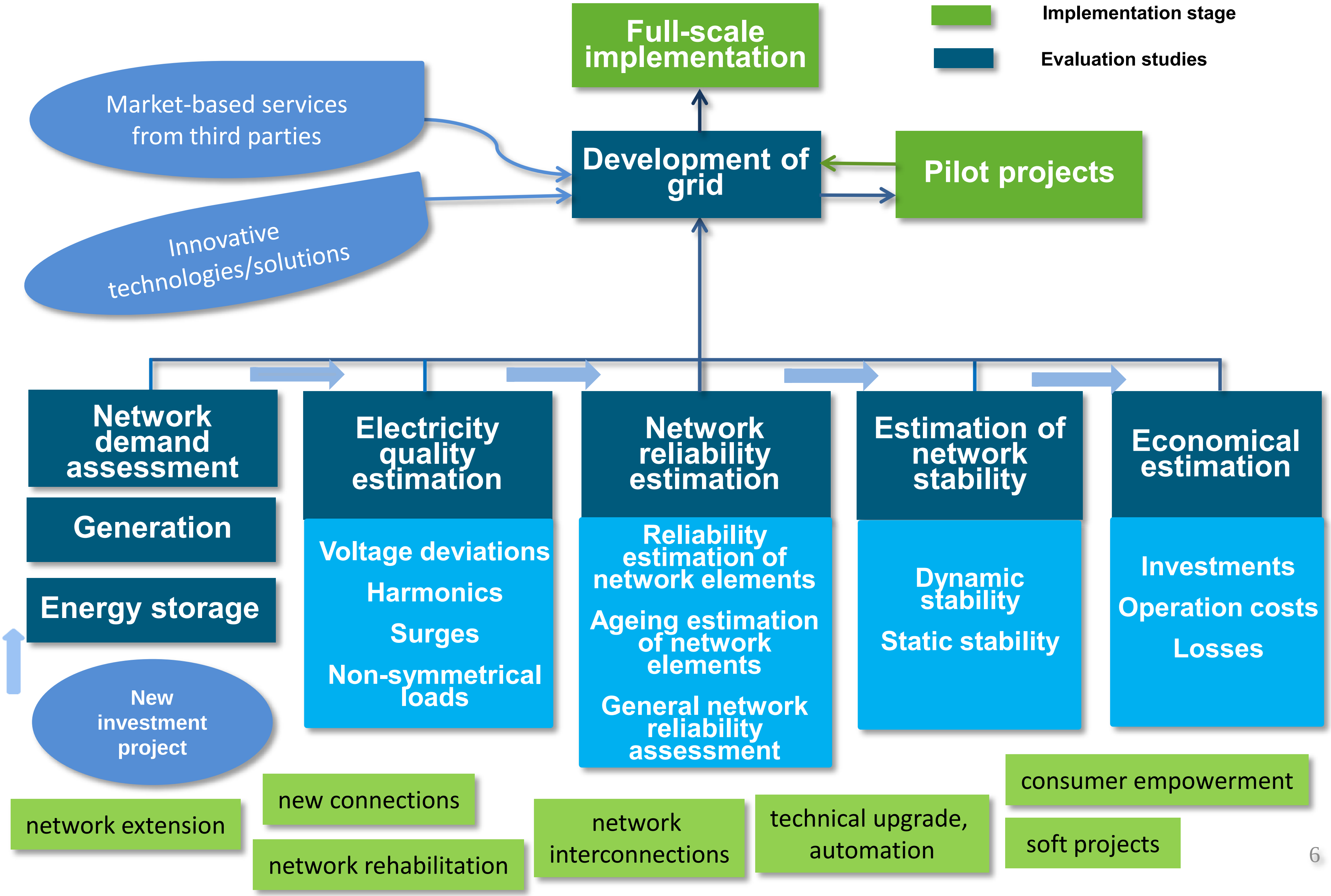
Project Key exploitable results

1. Definition of Enhanced Functions of Smart Grid
2. Network development reference model
3. Optimal integration of future technologies into energy sector
4. Model of Load-Frequency Control of interconnected electric power system
5. Active power balancing mechanism for interconnected power systems
6. Demand side response integration approach

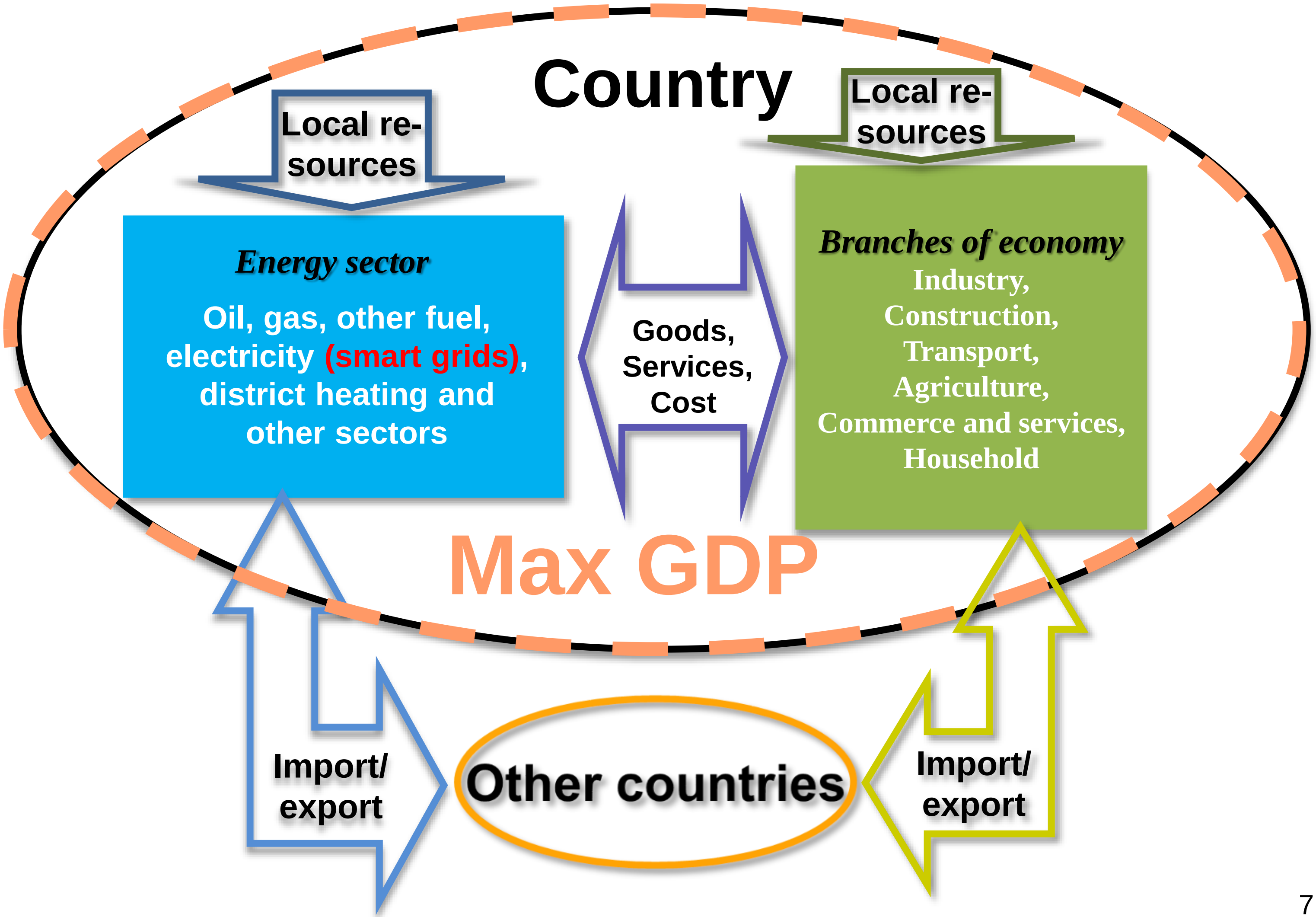
1. Enhanced Functions of Smart Grid



2. Network development reference model

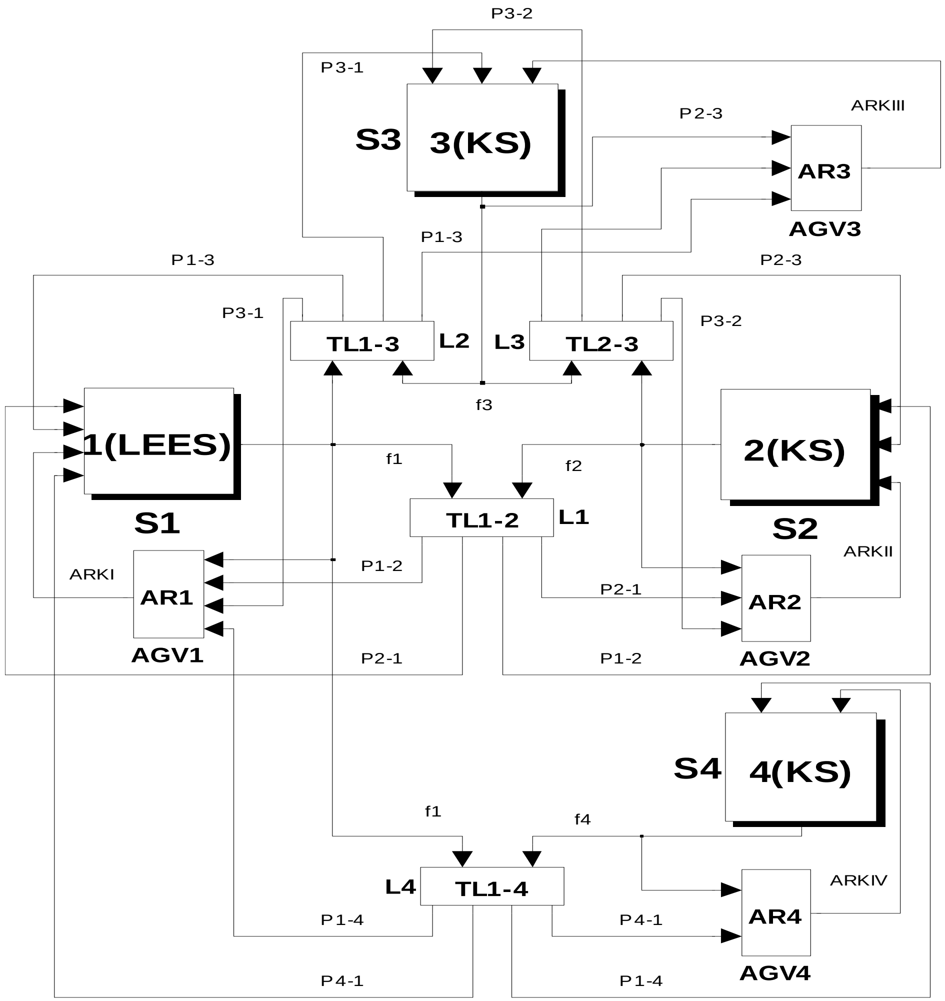


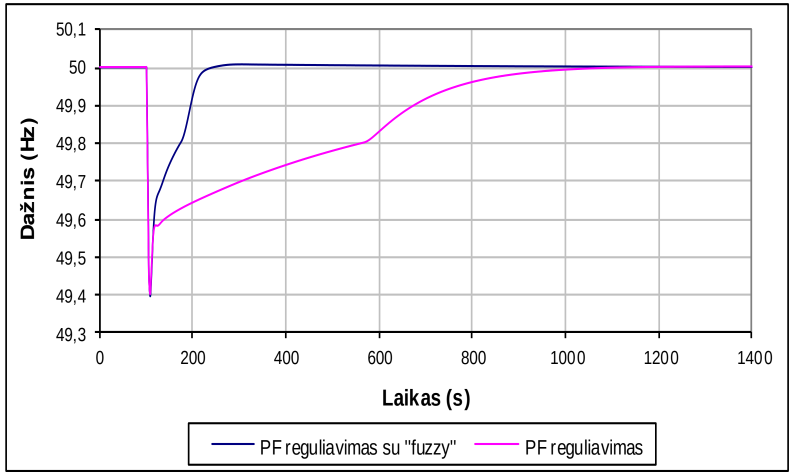
3. Optimal integration of future technologies into energy sector

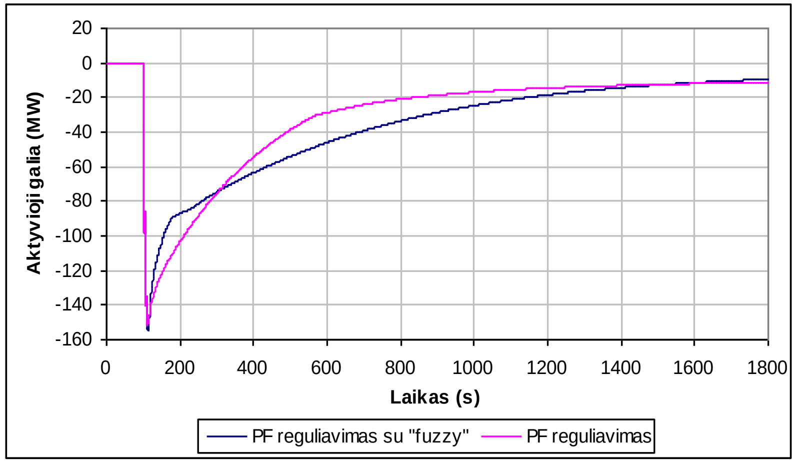


Analytical framework of optimal integration of future technologies into energy sector

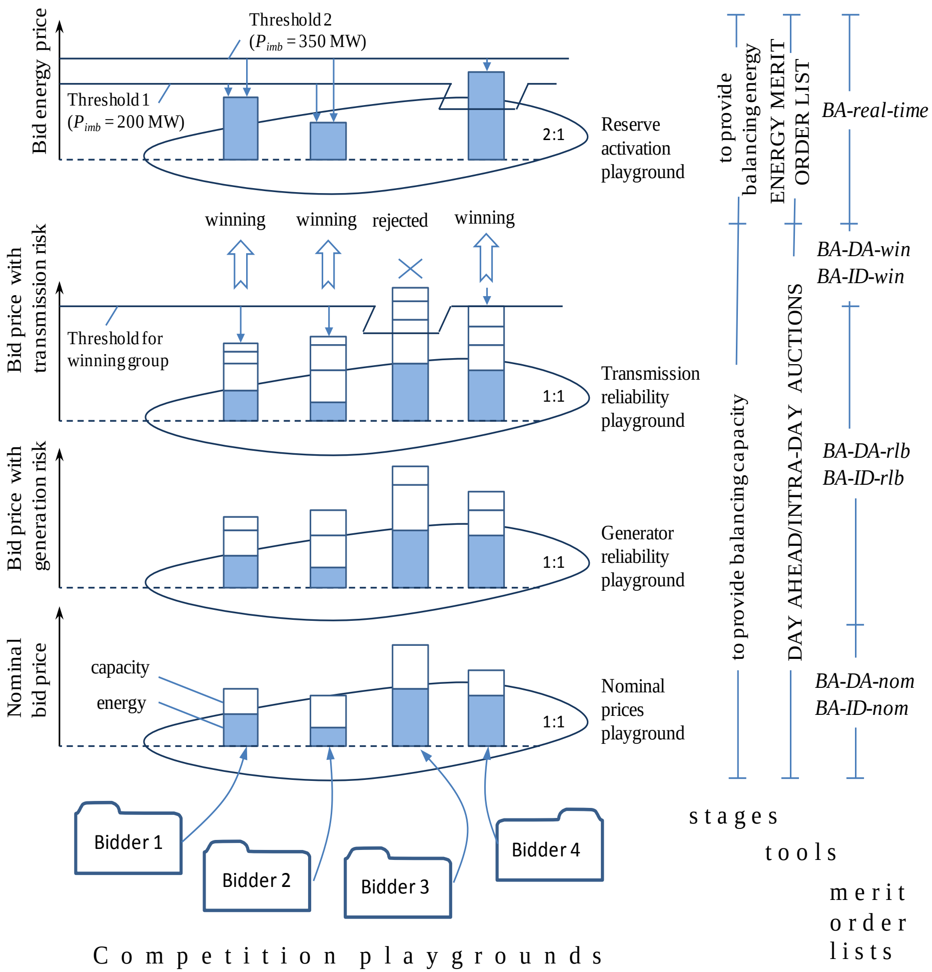
4. Model of Load-Frequency Control of interconnected electric power system

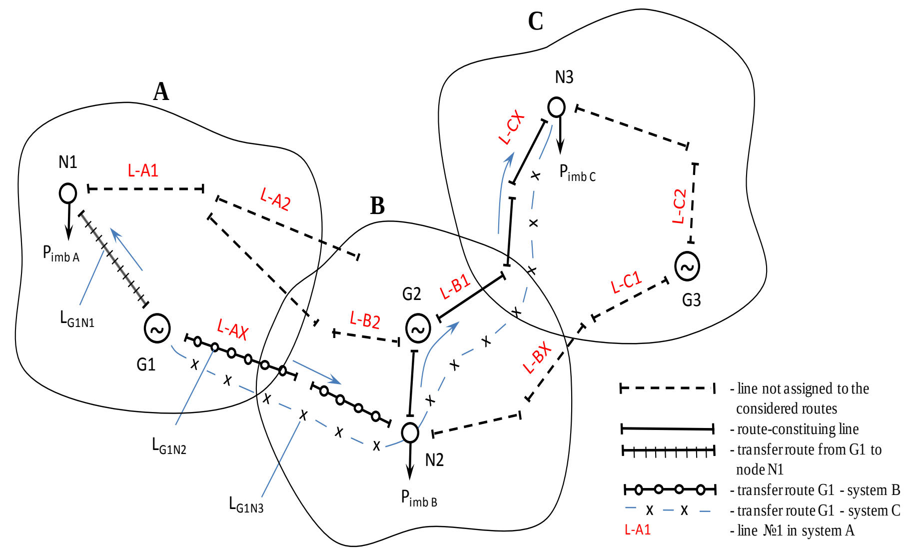




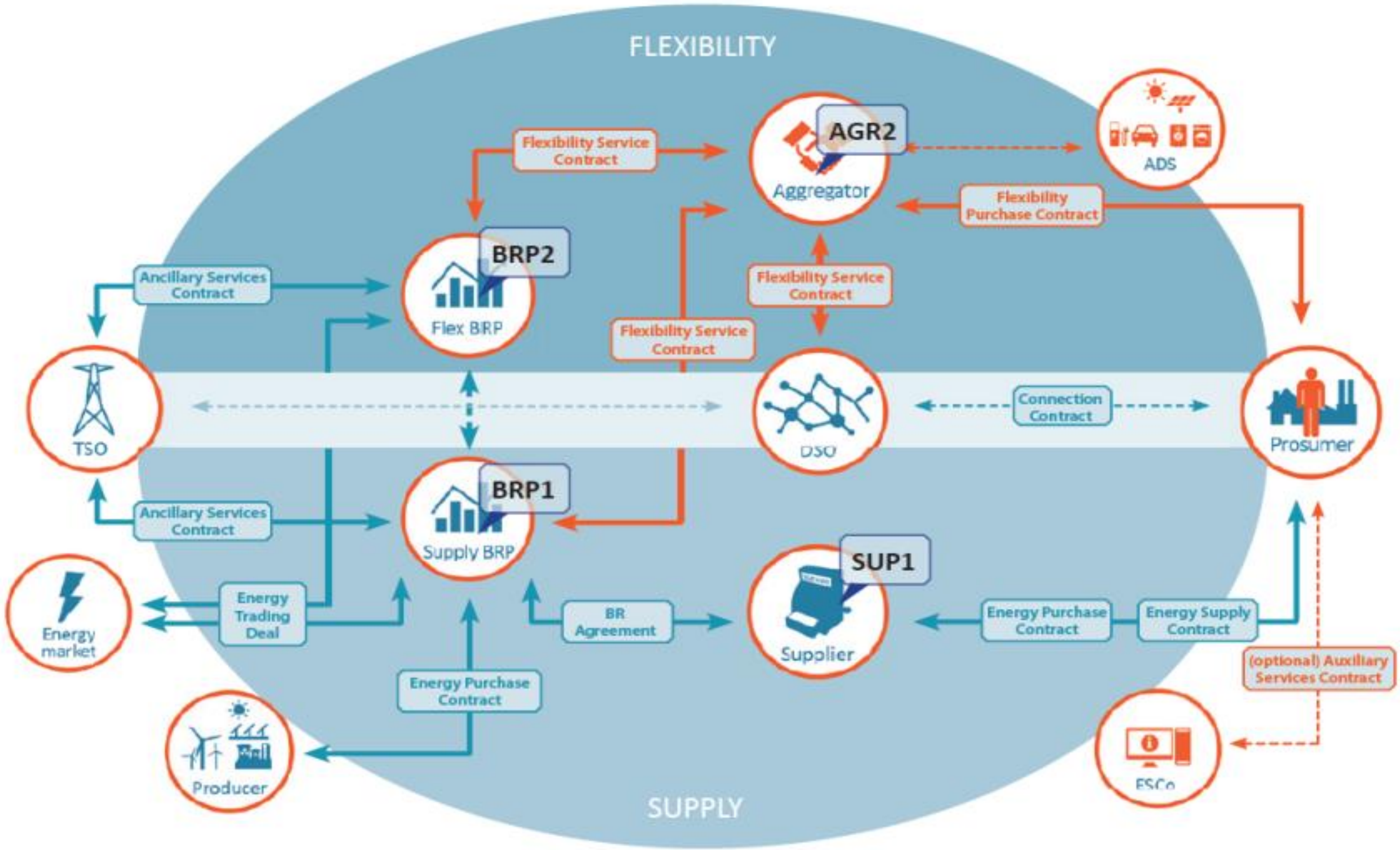


5. Active power balancing mechanism for interconnected power systems





6. Demand side response integration approach



Articles and conferences in 2012-2016

Publications in the journals (ISI) **26**

Articles in journals, referred in international scientific databases **28**

Chapters to books **12**

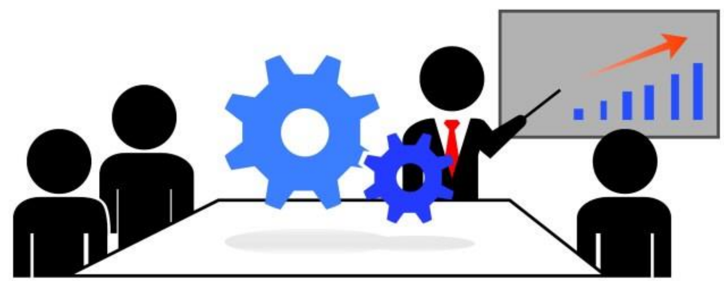
Presentations in the international conferences **62**

Some of them:

- Radziukynas V., Klementavičius A., Kadiša S., Radziukynienė N. ***Challenges for Baltic Power System Connecting Synchronically to Continental Europe Network Electric Power Systems Research*** // *Electric Power Systems Research*. ISSN 0378-7796. Volume 140, November 2016, p. 54–64. (http://dx.doi.org/10.1016/j.epsr.2016.06.043).
- Norvaiša E., Galinis A. ***Future of Lithuanian energy system: Electricity import or local generation?*** (dx.doi.org/10.1016/j.esr.2016.03.001) // Energy Strategy Reviews . ISSN 2211-467X. Vol. 10. 2016. p. 29-39
- Konstantinavičiūtė I., Bobinaitė V. ***Comparative analysis of carbon dioxide emission factors for energy industries in European Union countries*** (http://dx.doi.org/10.1016/j.rser.2015.06.058) // Renewable and sustainable energy reviews. ISSN 1364-0321. 2015. Vol. 51. p. 603-612.

The main lessons learned

- In developing of mathematical models, the scope, structure and accuracy of available data is of crucial importance;
- The engagement of energy sector actors (TSO, DSO, companies, municipalities, associations) would be beneficial for Project development.
- The National Energy Strategy DataBase would be very helpful for future upgrades of this Strategy and the respective models developed in the scope of this Project;
- The rapid deployment of digital technologies brings uncertainties to future technology development and market designs in energy sector. The ways of how to mitigate these uncertainties should be devised and validated.



Needs for future R&I activities coming out of the project

- When developing/upgrading the mathematical models, to better identify the interplay of various influencing factors
- To produce more adequate future scenarios for energy transition and digital energy;
- To make deeper insights into disruptive, breakthrough and cutting-edge technologies
- To better capture future energy price uncertainties;
- To find equilibrium between holistic
development of energy sector models
- To strengthen focus on critical risk identification and contingency management plans in smart energy scenarios

Deployment prospects of the most promising solutions

- The solutions were used by Ministry of Energy for the update of National Energy Strategy (2018)
- The developed algorithms could be used for the investigation of frequency and power control in the analysis of operational control of Baltic Power system;
- Maybe, the suggested approaches will be applied in the future reactive power reserves trading platform.

The identification of needs for further testing

- Validation of sensitivity of analytical framework for integration of smart technologies to simultaneous materialization of several risks;
- Testing for mathematical modeling errors for non-typical scenarios and boundary conditions;
- The validation of the load frequency control algorithm for cascading disturbances;
- The validation of active power reserves trading concept for different Scheduled Time Units (0,5 h, 15 min.).

The identification of needs for further testing – new program

new

Sustainable development modeling& management of energy sector, 2017-2021: ongoing Lithuanian State-Funded Smart Grid Project

Information about the use/need of an inter-regional cooperation

- Majority of developed models could be used on Baltic States scale;
- List of future technologies should be regularly reviewed and updated using contributions from European smart grid sector including European technology and innovation platforms (particularly smart networks for energy transition);
- The consept of active power reserve trading could be extended to cover Continental Europe (Polish) network.

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Questions?

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