DIALOG FORUM ON DRIVERS AND IMPEDIMENTS FOR REGIONAL COOPERATION ON THE WAY TO SUSTAINABLE NUCLEAR ENERGY SYSTEMS

LITHUANIAN NPP PROGRAM: NUCLEAR OPTION IS IMPORTANT AND ATTRACTIVE

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Presentation plan

- **Introduction;**
- **Current status and prospects of a nuclear power programme in Lithuania;**
- **Driving forces and impediments for embarking nuclear programme;**
- **Expected role of Lithuanian nuclear system in 2030 and 2050;**
- **Role of Lithuania in deployment of nuclear energy;**
- **Vision of back-end fuel cycle services for the national nuclear power programme;**

Presentation plan

- **Concept of sustainable nuclear energy system;**
- **Vision of ”Energy independence” and ”Security of supply”;**
- **Experience and plans for cooperation with other countries in energy projects;**
- **Possible drivers and impediments for cooperation with other countries in nuclear projects;**
- **Benefits and disadvantages of cooperation with other countries in nuclear energy projects.**

LITHUANIA

Area: 65.200 km²

Population: 3.2 mln.

GDP:

fast growth in 2000-2008 by 7.4%,

reduction in 2009 by 14.8%;

growth in 2010: 1.4%

in 2011: 5.9%

GDP in 2011: *US$ 13259 per capita*

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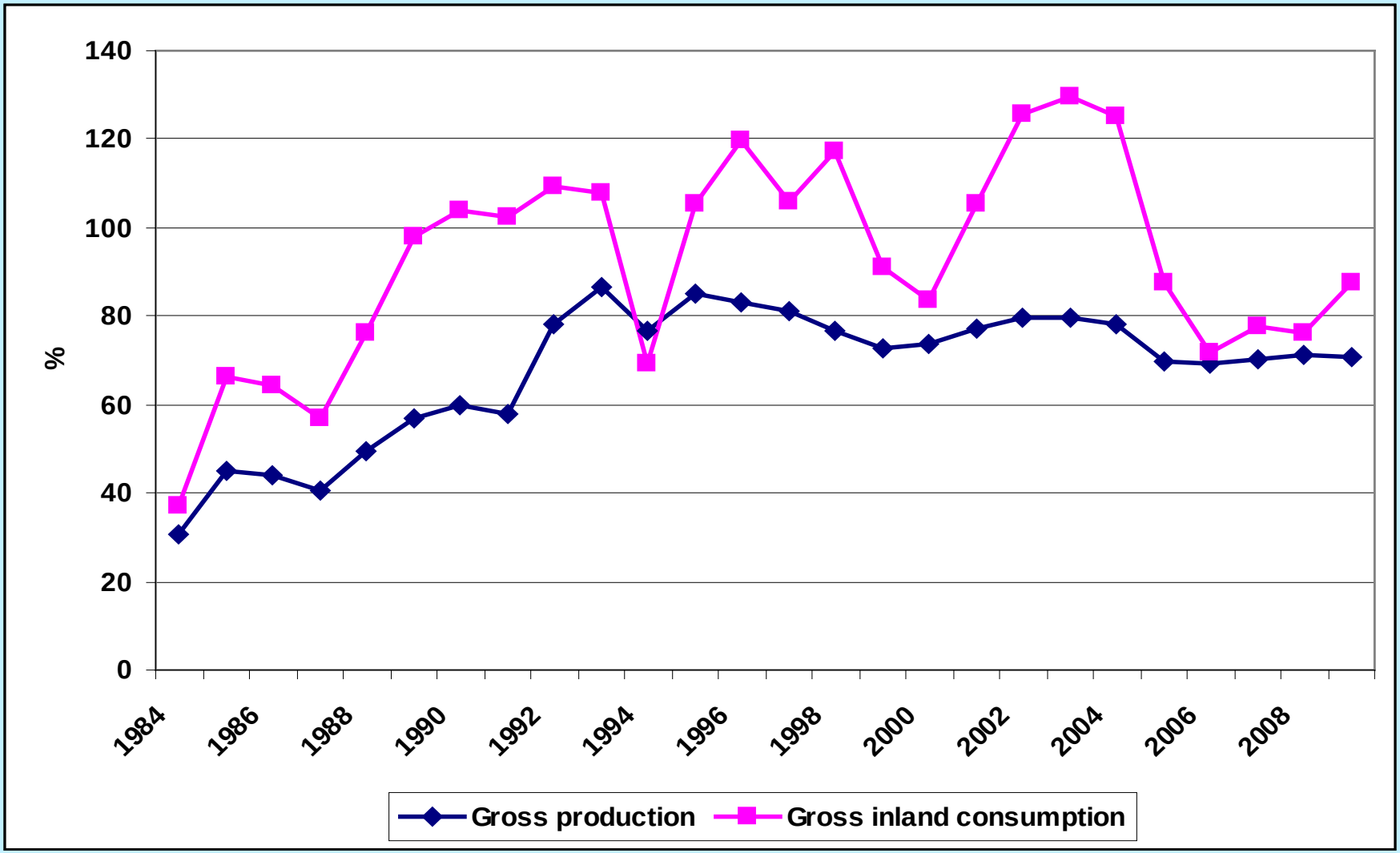
Role of Ignalina Nuclear Power Plant (1)

- **Ignalina Nuclear Power Plant - a twin-unit plant with two RBMK-1500 reactors; *one was kept in operation over the period 1983-2004, another – in 1987-2009*;**
- **In 1990 Lithuania declared its independence and Ignalina NPP *with two largest in the world RBMK-1500 reactors* came under authority of the Lithuania Republic since 1991;**
- **Lithuania *was the 31st country in the world* using nuclear energy for generation of electricity.**

The share of Ignalina NPP in the electricity balance



Role of Ignalina Nuclear Power Plant (2)

- Total cumulative **production (**in 1984-2009**) is more than 307 TWh;**
- Since 1992 its share was about **75-88% of the total electricity generation;**
- **Electricity production cost was lower** than at all other existing plants (except from hydro power plants);
- **Stabilizing role** for the country's national economy;
- **High contribution into primary energy balance and energy security**;
- **Low level of emissions** from electricity generation in Lithuania..

National energy policy documents and activities (1)

- **NES-2002: the Strategy *"is based on the continuity of the safe nuclear energy"*;**
- **Communiqué from February 27, 2006 signed by Prime Ministers of the Baltic States; its intention – *"to coordinate actions of Lithuania, Latvia and Estonia and to start preparation for construction of new NPP"*;**
- **Construction of new NPP was foreseen also in NES-2007;**
- **On June 27, 2007 the *Law on Nuclear Power Plant* was approved by the Seimas;**
- **On April 29, 2008 the Government and private company "NDX energija" signed an agreement and *National Investor Company* (LEO LT) for construction of new nuclear power plant was established;**

National energy policy documents and activities (2)

- **On February 2, 2009 the IAEA special mission confirmed that the Environment Impact Assessment Report *complies with the common international practice and procedures;***
- **On April 21, 2009 this *EIA* report was approved by the Ministry of Environment: *construction of new NPP with a capacity up to 3400 MW at the chosen location is admissible;***
- **Preliminary program of preparatory works for construction of new NPP since 2008 is going on and *more than 30 technical projects currently are completed*;**

but

- **On March 2, 2009 the Constitutional Court announced: to not violate the Constitution of the Republic of Lithuania *amendments to the Law on Nuclear Power plant are required*;**

National energy policy documents and activities (3)

- **After long-lasting discussions in the Parliament two decisions were made: 1) *to disband LEO LT, 2) to invite a Strategic Investor from foreign countries* with high specific knowledge, strong financial capability and experience for the project with very large scope;**
- **On July 14, 2011 the *Strategic Investor "Hitachi-GE"* from Japan was selected;**
- **On June 21, 2012 the *Concession to be granted to the Visaginas NPP project development company* and the selection of "Hitachi" as the Strategic Investor, as well its ABWR technology was *approved by the Seimas*;**
- **The Concession agreement should be signed until the end of 2012;**

National energy policy documents and activities (4)

- **On June 21, 2012 the *new Law on Nuclear Power Plant* was approved by the Seimas;**
- **On June 26, 2012 the *National Energy (Energy Independence) Strategy* was approved by the Seimas;**
- **Approval of these documents by the Seimas *creates an opportunity for regional partners* (Estonia, Latvia and possibly Poland) and the Strategic Investor *to conclude discussions on establishment of the Project development company* and signing agreements on conditions approved by the Seimas;**
- ***Project development company will carry out* design works and *after Final Investment Decision* (expected in 2015) will start construction of NPP.**

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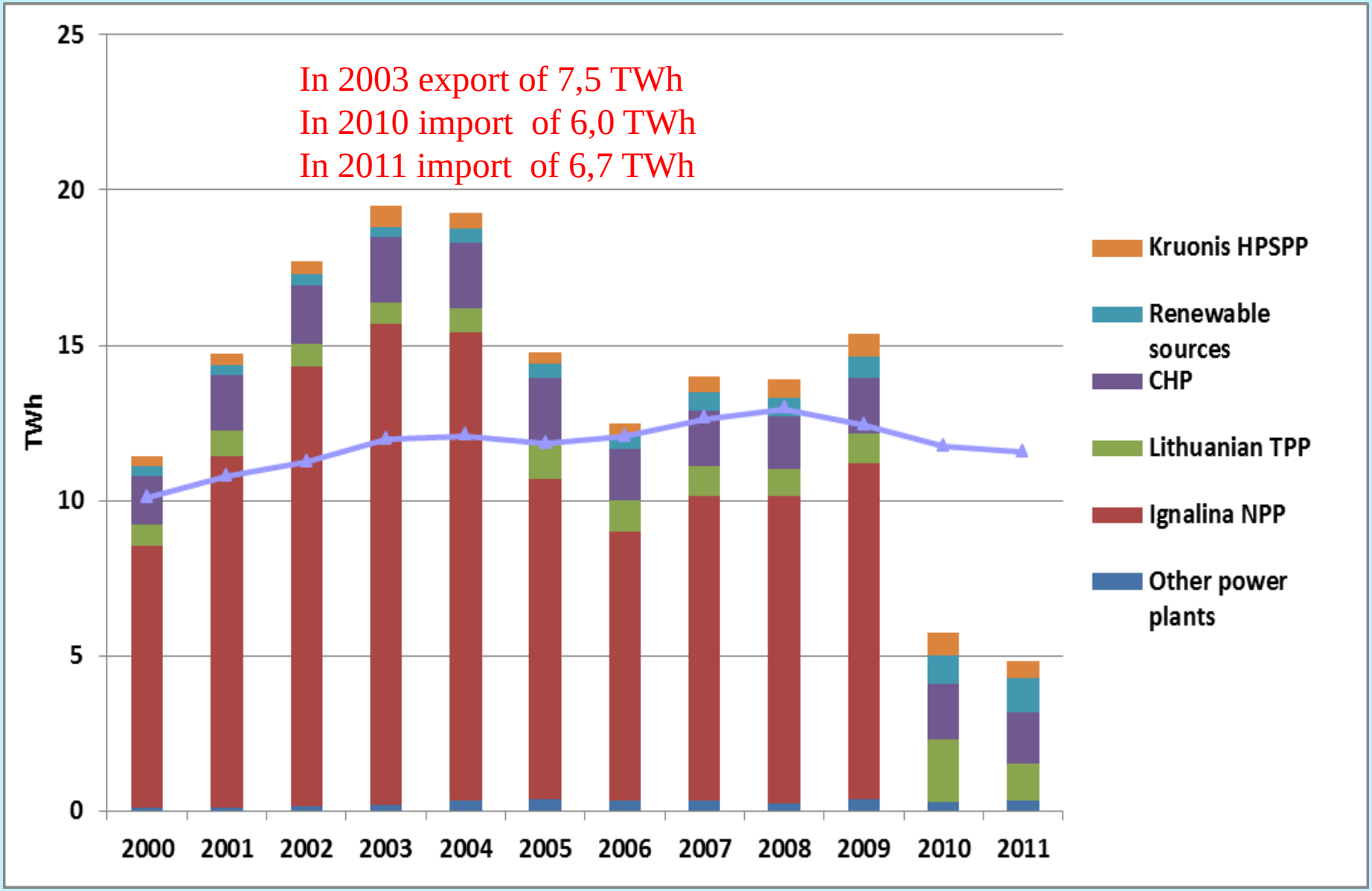
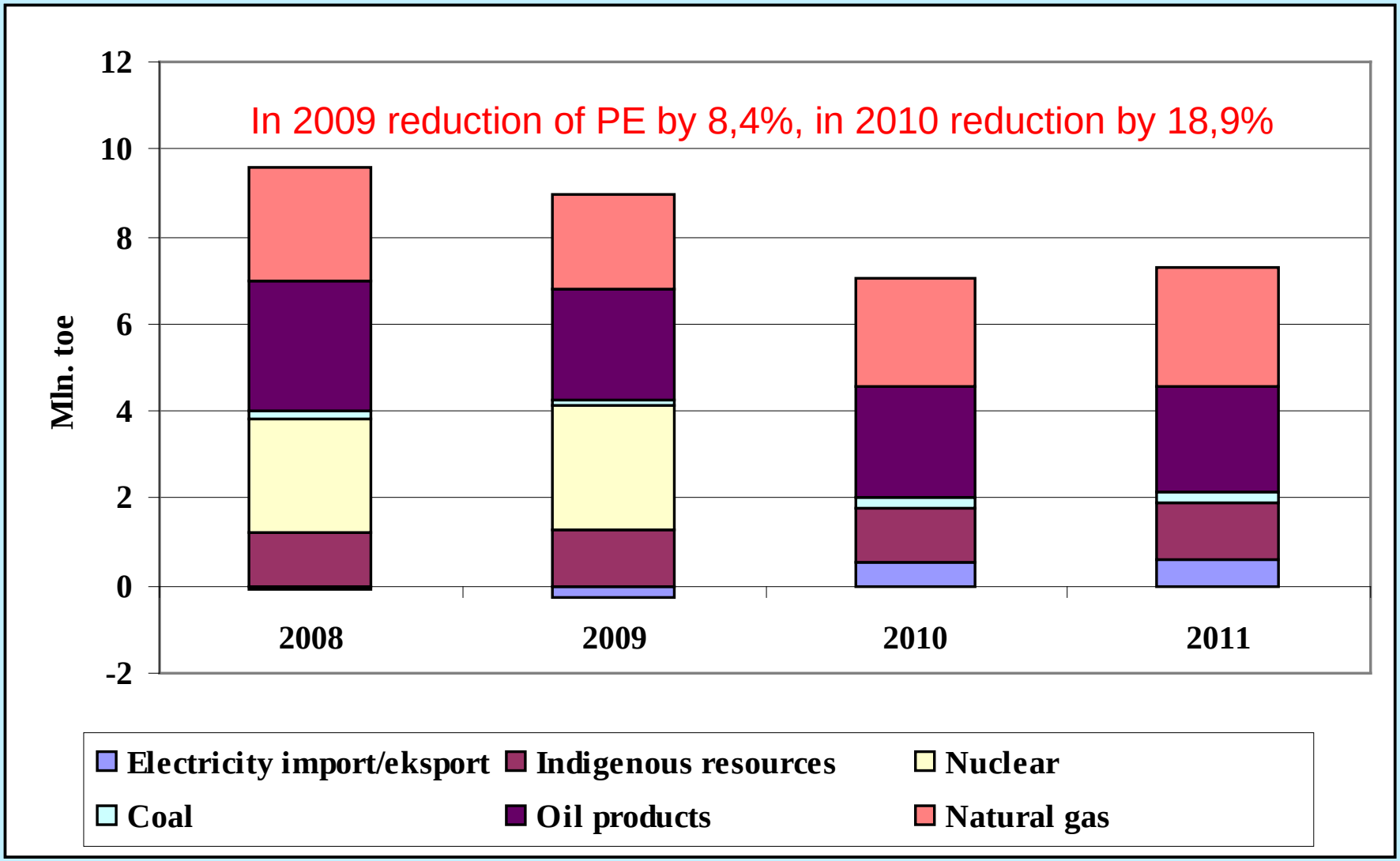
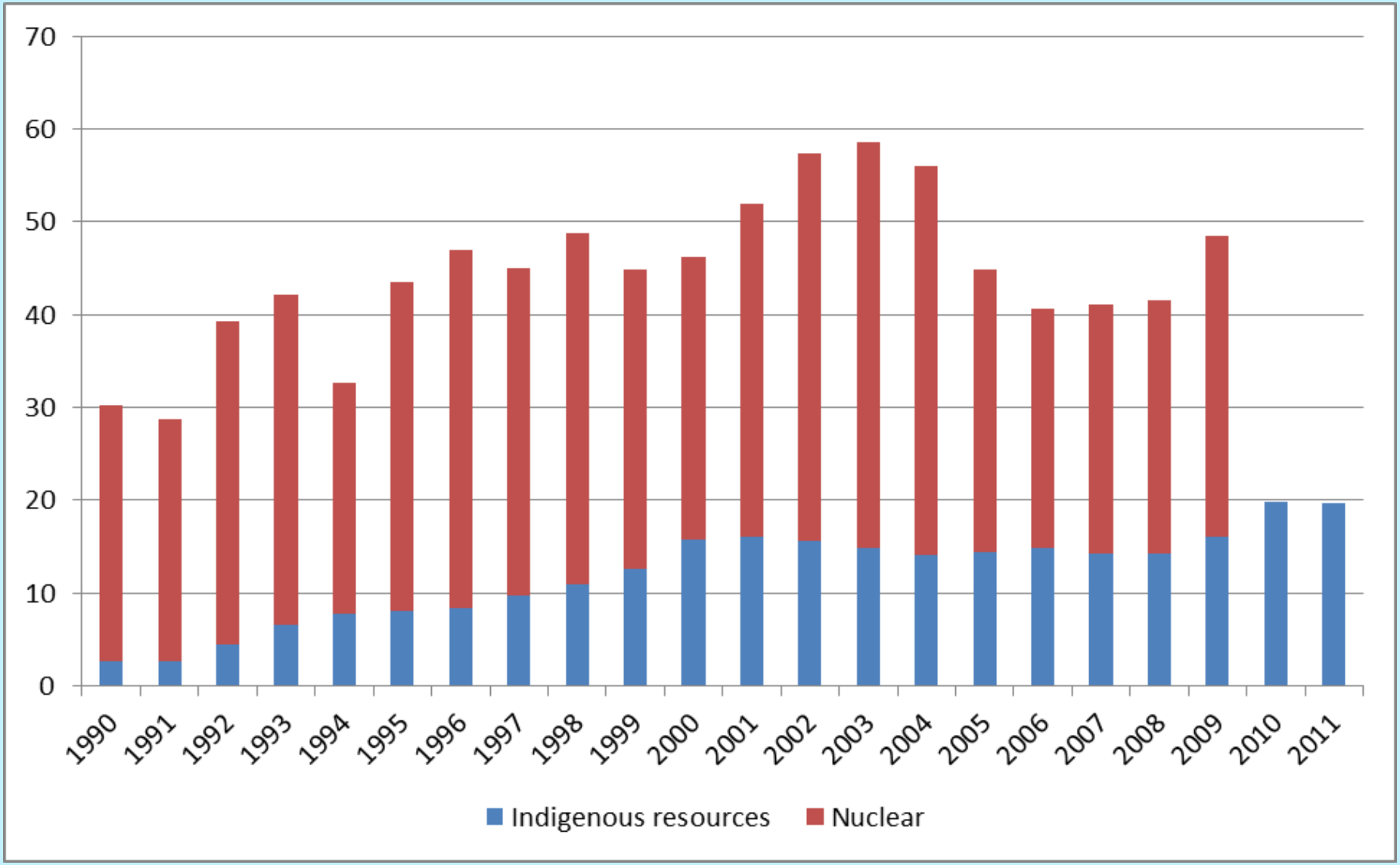
Electricity production and consumption



Changes in primary energy consumption

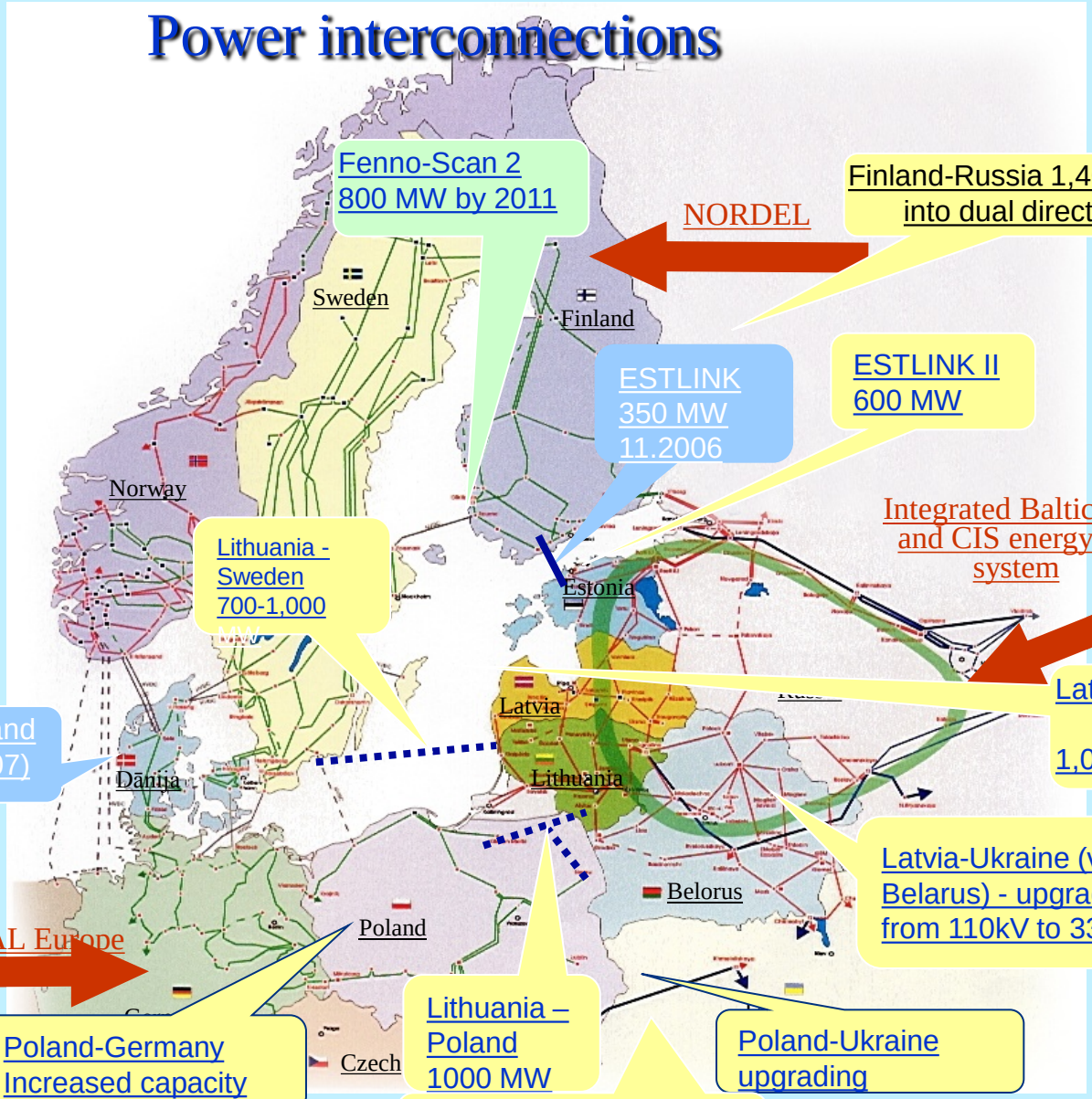


Energy self-sufficiency indicators



Lithuanian gas system

Power interconnections



Finalised

Decided/under implementation

Feasibility study phase

Current status of the energy sector

- **Lithuania currently is strongly dependent on import of major primary energy sources and electricity. *In addition, supply of primary energy sources is not diversified* – the country depends on Russia for 100% of its natural gas, and for more than 90% of its crude oil and almost 100% of coal requirements;**
- **Owing to absence of interconnections with Western energy systems, closure of the main electricity generation source and dramatic changes in the structure of power generating capacities *Lithuania is vulnerable for restrictions of energy supply and energy prices*.**

Driving forces for nuclear option for Lithuania (1)

- ***Nuclear is the major option seeking to reduce high country's dependence on import*** **of primary energy and as well of electricity;**
- **Lithuania *has existing nuclear infrastructure, technical support organisations, nuclear regulatory body*, etc.;**
- **Favourable experience accumulated from the *safe and reliable operation of Ignalina NPP*;**
- **A general *attitude of the political parties and society is positive*;**
- ***Trends in the EU emission trading*** **and market developments.**

Attractiveness of nuclear option for Lithuania

An opportunity to construct new nuclear power plant was analysed in various studies by applying modern methods of energy planning **(MAED for energy demand forecasting and MESSAGE for optimisation of the energy sector development)** ***which were provided by the IAEA*****.**

As an example:

Analyses of Energy Supply Options and Security of Energy Supply in the Baltic States, IAEA-TECDOC-1541, Vienna, 2007.

Major impediments for embarking nuclear option

- ***Implementation of nuclear option requires very large investments (about 5-7 billions Euro);***
- **Competitiveness of electricity generated by new nuclear power plant in the future electricity markets *currently cannot be certainly confirmed*;**
- **Activity of green parties against nuclear energy is growing and *public acceptance is decreasing*;**
- **Logistic of large nuclear units requires many changes in the existing Lithuanian transport infrastructure;**
- ***Due to lack of management experience and many unexpected shortages one can expect delay of construction of nuclear power plant and reduction of its competitiveness in the electricity market.***

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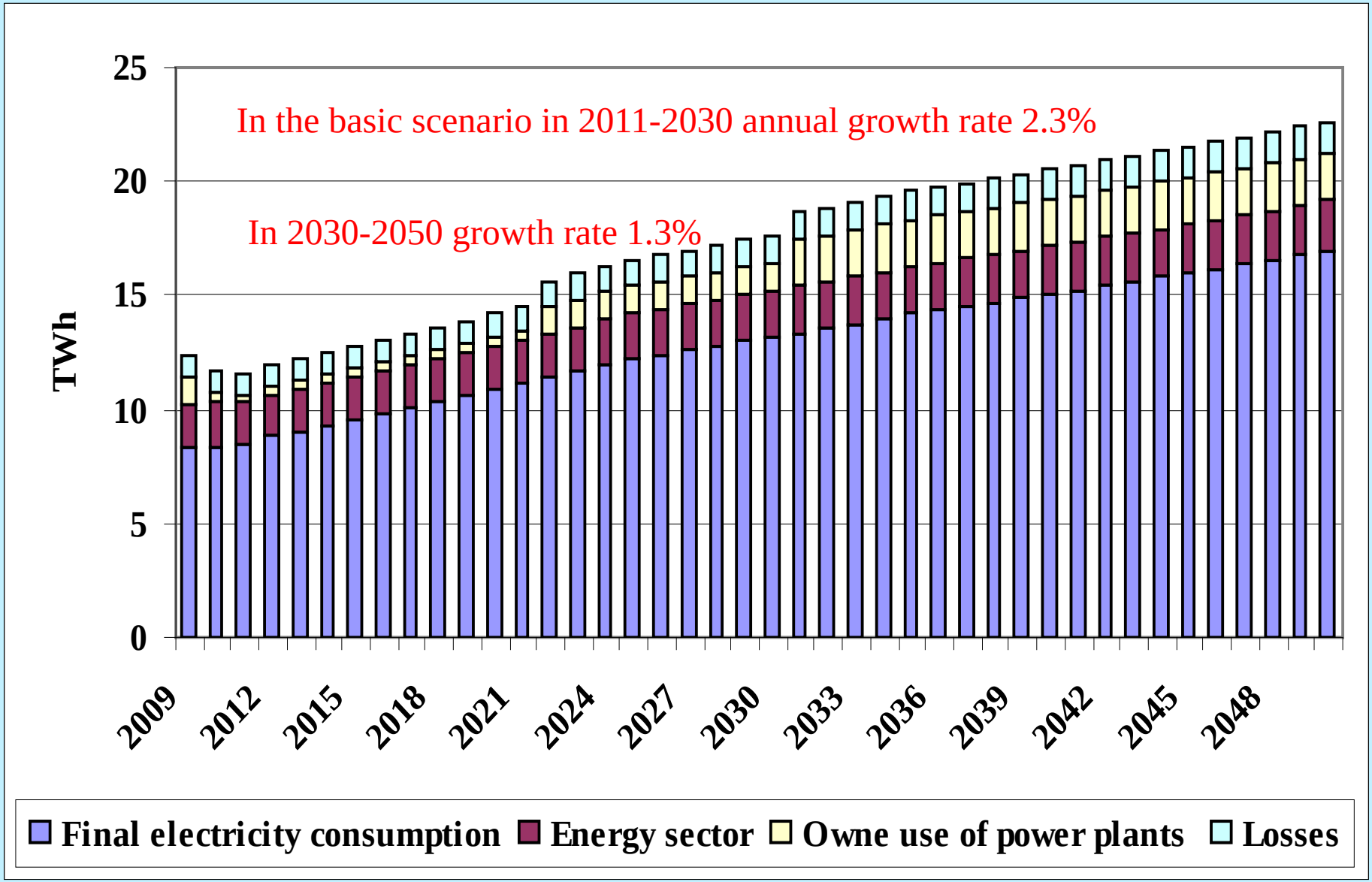
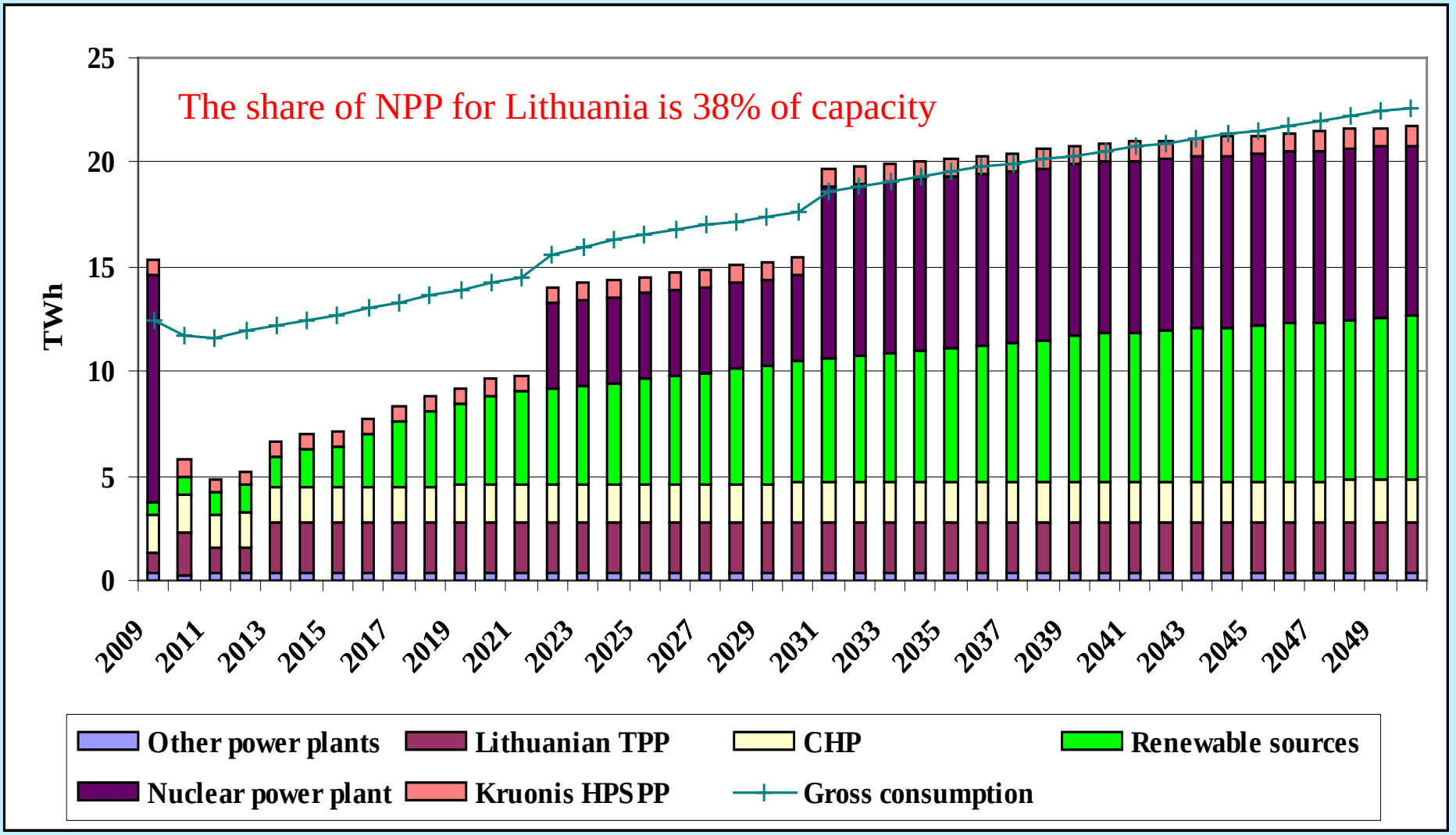
Expected growth of electricity demand in Lithuania



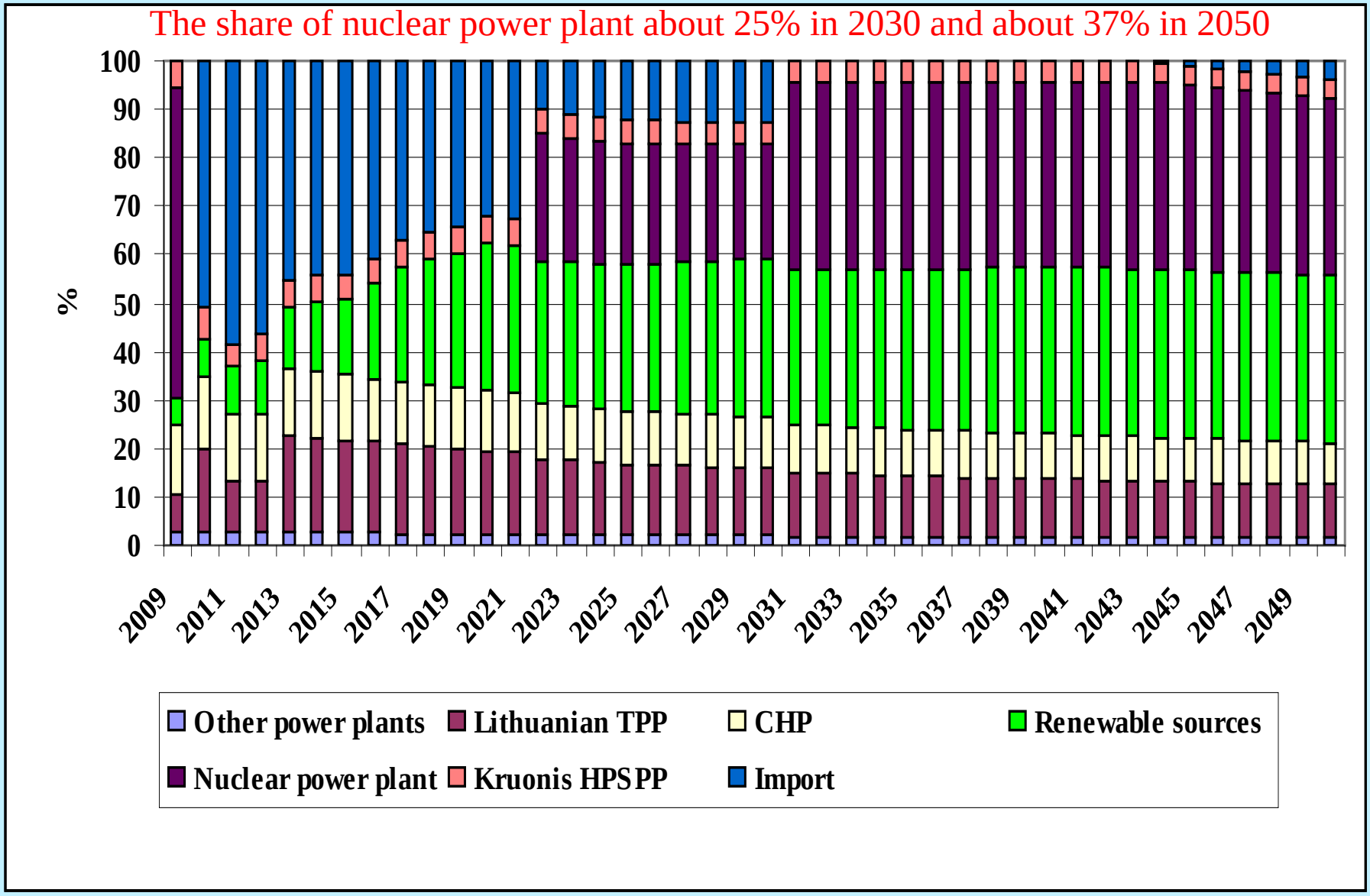
Development of nuclear power plant

- ***Licensing and designing in 2012-2015, construction and testing in 2015-2022;***
- **Having ”Hitachi” as Strategic Investor of nuclear power plant, the *Advanced Boling Water Reactor* (ABWR) with *capacity of 1350 MW* will be constructed;**
- **The *Nuclear Regulatory Commission* (NRC) nominated the ABWR reactor *as one of the most advanced and safest technologies* on the current market;**
- ***3 independent duplicated safety systems* will be constructed and placed in separate rooms and connected to separate energy sources;**
- ***All nuclear fuel cycle services will be provided by foreign suppliers*;**
- ***One can expect that one more unit* could be constructed in early 30-ies but currently this option is not under consideration.**

Expected electricity generation in Lithuania



Expected role of nuclear power plant



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Deployment of nuclear energy

- **Nuclear energy could be very important source increasing energy security and major source for *base load of power systems in the Baltic States*;**
- **Visaginas NPP is *planned as regional power plant* and in a case Poland will participate as a regional partner it could become *important as initial experience for expansion of nuclear energy in Poland*;**
- ***Success* in stages of construction and operation of NPP in Lithuania *could be important stimulus for further deployment of nuclear energy in other countries* of European Union;**
- **Deployment of nuclear energy could be realized through *transfer of knowledge on safe and reliable nuclear power plant operation* to other countries.**

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Back-end fuel cycle and waste (1)

- **To ensure long–term safety, the disposal of nuclear waste shall be designed in a way that does not call for continuous supervision;**
- **The main principle for the *waste management at the new nuclear power plant is to utilise existing solutions at Ignalina NPP* (designed or already in use) to maximum extent;**
- ***Capacity of storages will be extended when necessary*;**
- **After removal from the reactor, the *spent fuel will be stored inside in storage pools, then will be either moved to long-term storage facilities*, reprocessed or disposed;**

Back-end fuel cycle and waste (2)

- ***The waste produced during normal operation*** **(such as isolation materials, paper, old working clothes, plastic, etc.)** ***has low radioactivity*****;**
- ***The intermediate–level waste*** **mainly consists of the ion exchange resin from the purification system and the evaporator bottom from the sewage water treatment;**
- **The** ***operating waste of the new nuclear power plant will be solidified, dried and absorbed in a suitable medium*****;**
- ***The low–level and intermediate–level operating waste will be disposed of in the final repository constructed for them*****;**
- **Lithuania** ***has no national laws or legal provisions prohibiting transit or return of spent nuclear fuel and high level radioactive waste to other countries*****.**

Back-end fuel cycle and waste (3)

- **The Law on the Management of Radioactive waste:**
- **Radioactive waste *must be transported, exported or transported in transit in accordance with the provisions of the international agreements* ratified by the Republic of Lithuania, laws of the Republic of Lithuania and other legal acts regulating transportation of radioactive substances;**
- **Radioactive waste *may be transported only to such states that have the administrative and technical capacity to receive it, as well as the regulatory and other structures, needed to manage radioactive waste in accordance with the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management.***

Back-end fuel cycle and waste (4)

- **COUNCIL DIRECTIVE 2011/70/EURATOM of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste**
- ***The establishment of uniform safety standards*** **to protect the health of workers and of general public;**
- **Member States shall establish and maintain national policies on spent fuel and radioactive waste management.** ***Each Member State shall have ultimate responsibility for management of the spent fuel and radioactive waste*****;**
- **Member States** ***shall establish and maintain a national legislative, regulatory and organisational framework*** **('national framework')** ***for spent fuel and radioactive waste management*** **that allocates responsibility and provides for coordination between relevant competent bodies.**

Back-end fuel cycle and waste (5)

- **Each Member State *shall establish and maintain a competent regulatory authority* in the field of safety of spent fuel and radioactive waste management;**
- **Each Member State *shall ensure the implementation of its national programme for the management of spent fuel and radioactive waste* ('national programme'), covering all types of spent fuel and radioactive waste under its jurisdiction and all stages of spent fuel and radioactive waste management from generation to disposal;**
- **Member States *shall bring into force the laws*, regulations and administrative *provisions necessary to comply with this Directive before 23 August 2013*.**

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Sustainable nuclear energy issues (1)

- **Based on requirements of the EU directives *the major principles in the energy sector development are: competitiveness, energy security and sustainability*;**
- **One of the most important strategic goals in Lithuania is *implementation of sustainable development provisions*;**
- **Benefits from usage of nuclear energy to sustainability: *saving of fossil fuels, preconditions for growth of the country's economy with low impact on environment, use of low carbon technology and reduction of CO_2 emissions*;**
- **The first priority *regarding sustainable nuclear energy system in Lithuania is given to its economics*: construction of new NPP should be transparent and electricity generated by this plant should be competitive in the electricity market;**

Sustainable nuclear energy issues (2)

- **Economic efficiency of the new NPP *cannot be achieved by reduction of investments into safety systems* – safety and reliability of the new NPP operation *might comply all international safety standards*;**
- **The next priority is very *low harmful impact of nuclear energy system* on environment;**
- **Waste management shall be performed in accordance with *requirements of the Law on the Management of Radioactive waste and corresponding regulations which are consistent with the EU legal acts*;**
- **Safety guarantees in the nuclear energy are based on the requirements of the *Law on Nuclear Energy and legal acts, on the requirements of treaties to which the Republic of Lithuania is a party, also on the recommendations of the IAEA and other international organisations or bodies*;**

Sustainable nuclear energy issues (3)

- ***It is prohibited to export nuclear materials, equipment and technologies to the countries which have not acceded to the 1968 Treaty on the Non-Proliferation of Nuclear Weapons and other treaties to which the Republic of Lithuania is a party and have not assumed obligations to apply the nuclear materials safeguards system approved by the IAEA*;**
- ***Physical protection* of nuclear energy facilities and nuclear materials *is also a constituent part* of ensuring nuclear safety implemented in accordance with the Law on Nuclear Safety;**
- **Lithuania has no specific national requirements on nuclear energy system sustainability.**

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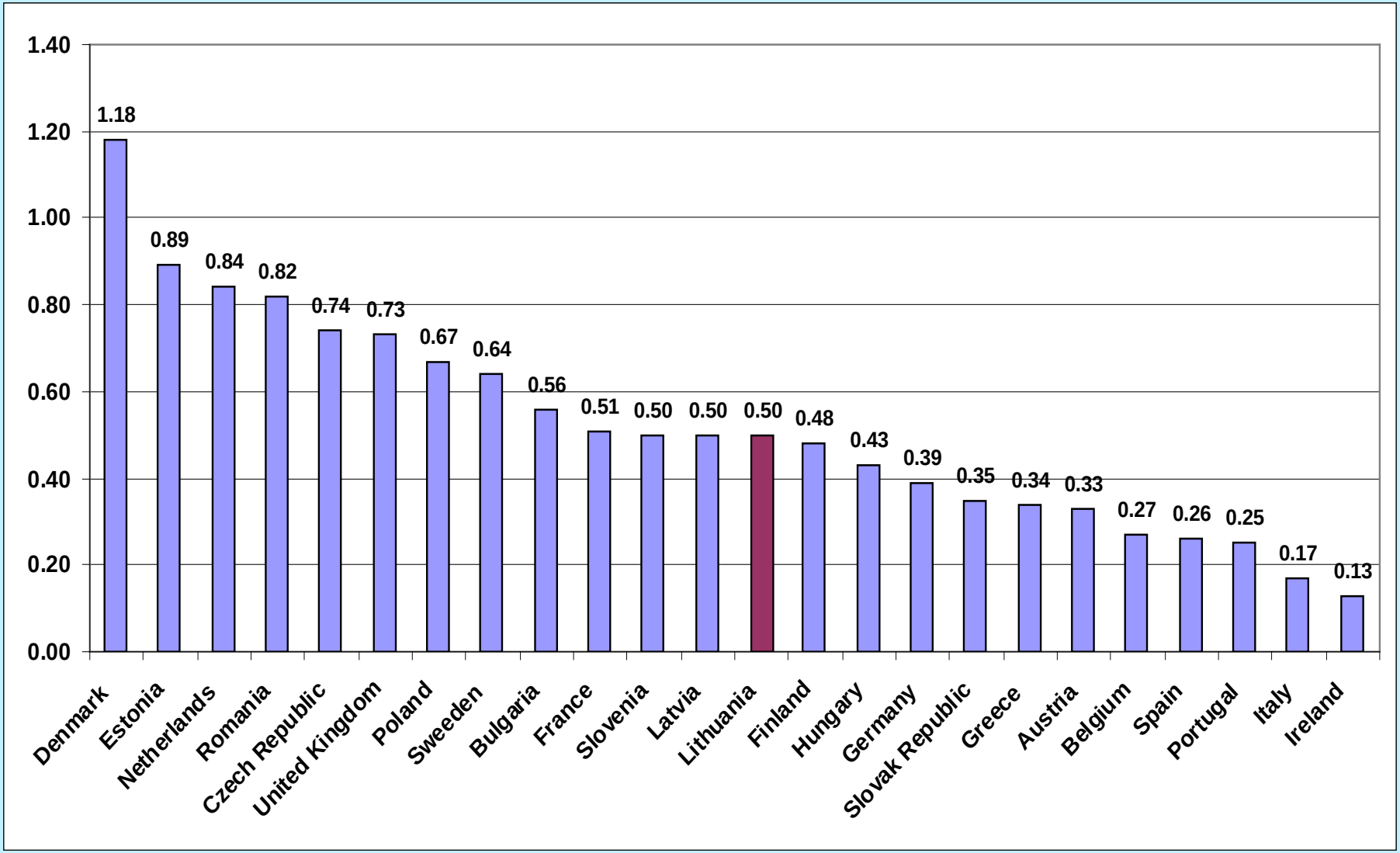
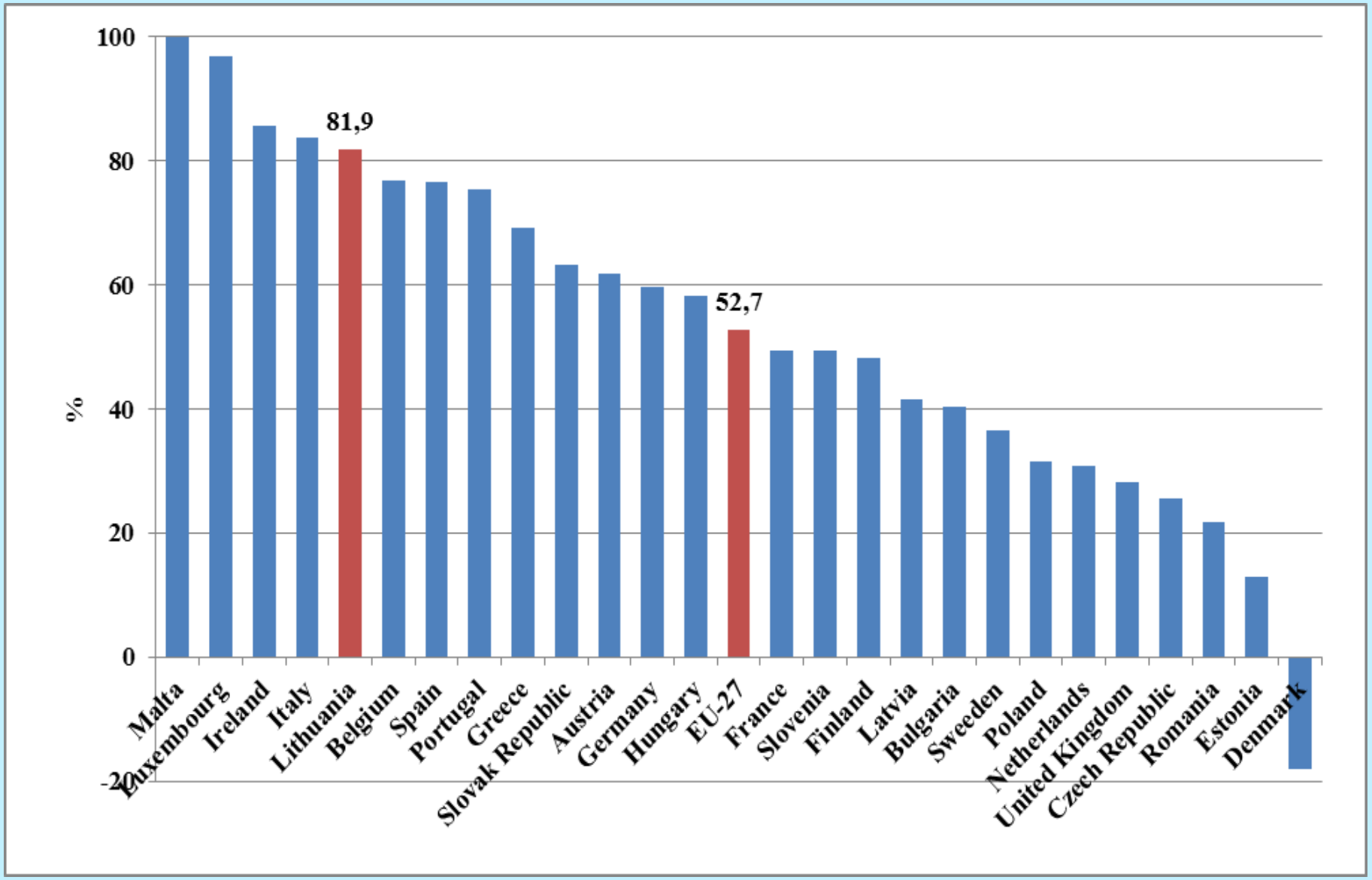
Energy independence

- **In principle *Energy independence* in each country could be measured by energy self-sufficiency indicator, i.e. *ratio of total energy produced from all local sources and gross country's primary energy consumption*;**
- **According to this indicator only Demark from the EU-27 countries was fully independent in 2009, internal country's energy production was about 18% bigger than total primary energy consumption;**
- ***The indicator of dependence on energy resources imported from other countries* illustrates what is the share of imported energy in the structure of the country's primary energy balance: *in 2010, this indicator on average in the EU-27 was equal to 52.7%, and in Lithuania – 81.9%;***

Energy self-sufficiency indicators in 2009



Indicators of energy dependence in 2010



Security of energy supply (1)

- ***Energy security – the whole complex of the State's actions and measures*** **which secure to the degree that fuel and energy services are available to** ***ensure conditions for the stable economic development and protection of national welfare as well as minimization of risks*** **associated with supply and use of fuel and energy services;**
- **To reduce country's vulnerability to pressures and threats,** ***energy security in a wider sense includes energy supply, economic, technological, environmental, social and cultural dimensions*****;**
- **In addition, key problems in Lithuania include** ***dependence on a single supplier of natural gas, very high gas prices*****, absence of direct interconnections with energy systems of Western Europe;**

Security of energy supply (2)

- ***The most important strategic provisions*** **of the national energy policy are the following:** ***construction of LNG terminal, diversification of natural gas supply, construction of new NPP and integration of the country's energy systems into EU energy systems*****;**
- **Due to the high security of nuclear fuel supply and a big fuel inventory in the core,** ***the electricity generated by nuclear power plants is considered as a local energy source,*** **irrespective of the country from which the nuclear fuel was imported;**
- **In many cases** ***construction of new NPP in Lithuania is assumed as the major measure seeking to ensure the country's energy independence*****.**

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Experience for regional cooperation (1)

- ***Common history, long-term cooperation and national policies harmonised with the EU policies*, norms and standards *create favourable conditions in the Baltic States for close cooperation*, and in particular in the energy sector;**
- **The Baltic States *altogether have a comparatively diverse energy mix, which is mainly based on large contribution from oil shale in Estonia, hydro resources in Latvia complemented with imported natural gas and oil products, and increasing share of renewable energy sources*;**
- **Existence of the *underground gas storage in Latvia* and *oil refinery in Lithuania* is important factor which contributes to energy security;**

Experience for regional cooperation (2)

- **The power and natural gas systems are well interconnected;**
- ***Energy supply and energy security measures are less expensive if they are regionally planned and implemented*. Many measures could be implemented without duplication among isolated entities within national boundaries;**
- ***Cooperative regional Baltic investment is suitable for construction of NPP, modernisation of regional gas storage facility, construction of regional LNG terminal, for construction of interconnections* with Sweden, Finland and Poland and in particular for integration of the Baltic power system with grids of ENTSO-E;**
- **Integrated regional energy policy could also include a joint emergency plan to meet energy supply crises.**

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Drivers for regional nuclear cooperation

- **Given the small size of the individual national energy markets, *investments for very large projects are more secure and on a stronger financial and technical basis* if they are shared or *made on coordinated efforts* of the Baltic States;**
- ***Construction of new NPP in Lithuania and in particular integration of the Lithuanian power system into continental European power system only make financial, technical and economic sense if they are supported by all three Baltic States*;**
- ***Cooperation with Poland in nuclear project* would be also important factor increasing its economical and political attractiveness.**

Impediments for regional nuclear cooperation

- ***Management of large regional projects*** **requires specific experience and necessity to coordinate continuously efforts and actions;**
- **Due to certain differences of economies, legal basis, public acceptance, environmental issues, etc. many *actions might be approved by governments and parliaments in each country*;**
- **Longer procedures could cause not enough smooth process of construction and possibly *delay of NPP commissioning as well as increase of electricity generation cost.***
- **One can expect problems when *sharing responsibilities between partners*, in particular related with waste managements, competitiveness of NPP in electricity market, etc.**

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Benefits of cooperation with other countries (1)

- **Significant financial support by leveraging *Japanese as well as US government support for the project is expected*;**
- **The major benefit is expected from the Strategic Investor Hitachi which is *one of the largest companies in the world* covering wide range of business segments and power systems are one of its key business segments;**
- **Large experience of nuclear projects, high knowledge and large financial resources are promising *effective and efficient management of construction*;**
- **Hitachi will provide to the Visaginas NPP project *the most recent design with on-time and on-budget construction experiences;***

Benefits of cooperation with other countries (1)

- **Hitachi will provide also: support for *licensing framework, proven and highly reliable key components, long-term partnership with regional industries and local companies, optimum construction methods, operator training, fuel supply and O&M support services*;**
- **In addition *significant contribution is expected from the world's leader in nuclear industry "Exelon Nuclear Partners, LLC"*. This company will be engaged into construction of new NPP in Lithuania as the Owner's Engineer and based on contract which was signed on 9 December 2011.**

THANK YOU VERY MUCH
FOR YOUR ATTENTION!

Project of new nuclear power plant in Lithuania