

Government of the Republic of Lithuania
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(Energy Independence) Strategy
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Lithuania
for final approval by
Seimas Resolution

National Energy (Energy Independence) Strategy

October 6, 2010

Vilnius

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Executive Summary

The purpose of this National Energy (Energy Independence) Strategy (henceforth – Strategy) is to define the main objectives of the Lithuanian state in the energy sector, setting national targets for implementation of strategic initiatives through the years 2020, 2030 and 2050. The **main goal** of the Strategy is **Lithuania’s energy independence before year 2020**.

Like many other countries in Europe, Lithuania is facing challenges in the energy sector on three main dimensions: energy independence, competitiveness and sustainability of the energy sector. This situation was determined by historic and political circumstances as well as scarce internal energy resources.

Most of fuel resources used in Lithuania are imported. After the shutdown of Ignalina Nuclear Power Plant (NPP), the country is not able to satisfy its internal electricity demand. Lithuanian electricity network is not connected to the European electricity system and therefore electricity can be imported only from a very limited number of countries.

Lithuanian energy sector 2010–2020

In order for Lithuania to become a fully-fledged member of the European Union (henceforth – EU), Lithuanian energy sector should be entirely integrated into the European energy system. The country must have sufficient capacity to satisfy internal energy demand and, with regard to energy related questions, should be able to flexibly and effectively cooperate with the EU and other countries.

The Strategy outlines a number of initiatives to be achieved in the fields of electricity, heating, gas, oil, renewable energy and energy efficiency.

In the **electricity energy**, the focus will be on implementation of strategic projects which have crucial impact on ensuring the country’s energy independence.

- **Full integration into the European energy system:**
 - Completion of **Lithuania–Poland power link** *LitPol Link*;
 - Completion of **Lithuania–Sweden power link** *NordBalt*;

- **Synchronous connection to the European Continental Network** along with our EU neighbours Latvia and Estonia;
- Integration with European markets for electricity.
- Ensuring sufficient local electricity **generation capacities to cover domestic demand** (estimated at 12–14 TWh in 2020) through:
 - Construction of a new nuclear power plant in Visaginas;
 - Increase of electricity generation from renewable energy sources.
- Implementation of the **3rd EU energy package**:
 - Unbundling of transmission activities from generation and supply;
- **Liberalization of the energy market.**

The vision of the **heating sector** is to increase energy efficiency in the heat production, distribution and consumption while at the same time shifting from mainly gas-based production towards biomass. The state will support initiatives increasing heat consumption efficiency, utilization of waste energy potential, and increase in the use of biomass. The target for decrease in households' and public buildings' heating consumption by 2020 is 30–40% compared to 2009, which will allow to save annually as much as 2–3TWh of heat.

In the **gas sector**, Lithuania will strive in the long run to decrease gas consumption while diversifying the sources of gas supply in the short run. To this end, Lithuania will construct an LNG terminal in Klaipėda, undertake all efforts to build an underground gas storage facility and a gas pipeline linking the country to Poland and the rest of the EU. Lithuania will also promote competition in the gas market by separating gas supply and gas transmission functions.

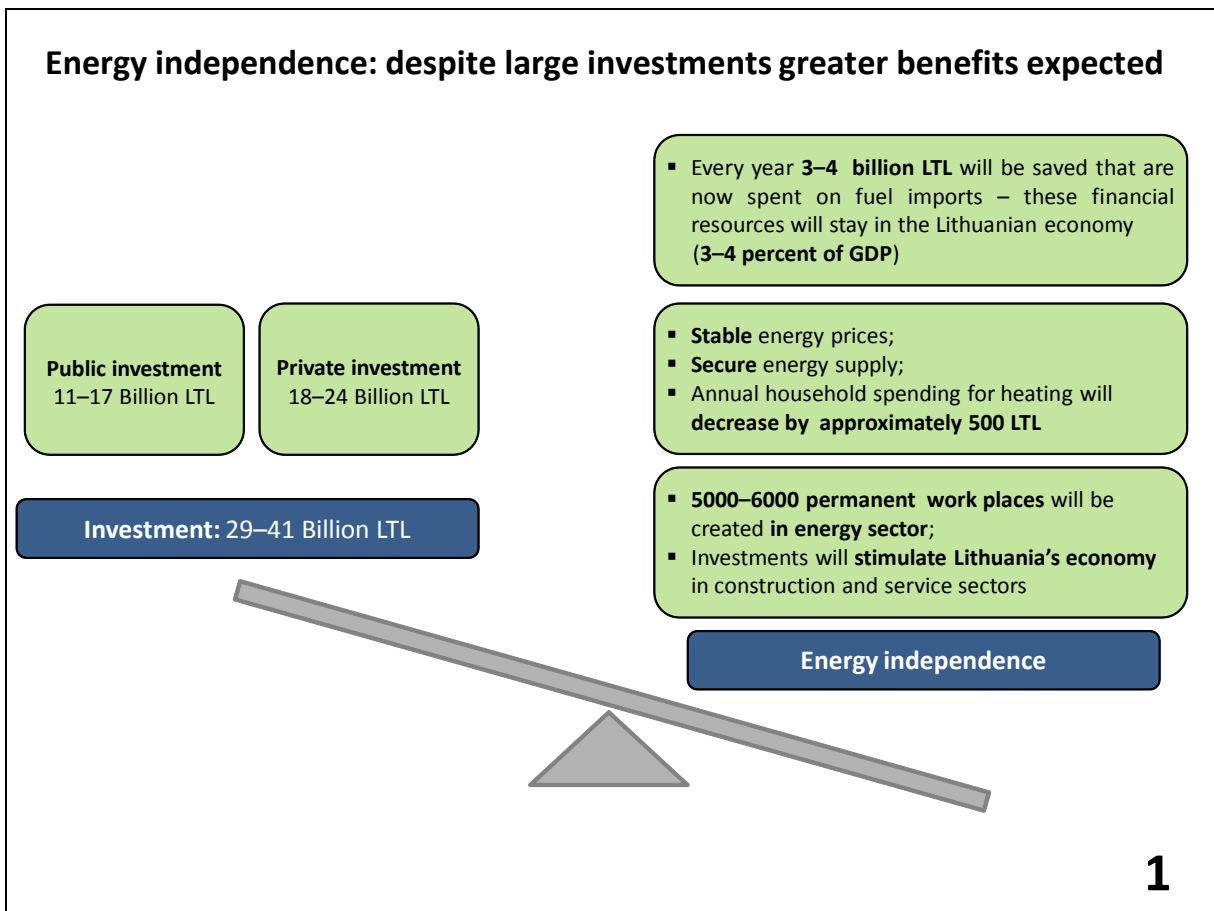
In the **oil sector** the goal is to gradually reduce consumption of oil and increase competition in the market.

Lithuania will progressively increase the use of **renewable energy sources** in the production of electricity and heating as well as in the transport sector. The state will aim to reach the target of 23% of renewable energy in final energy consumption, including no less than 20% of renewable energy in the electricity sector, 60% in the district heating sector and 10% in the transport sector. Suitable and clear market conditions will be gradually introduced while giving preference to the most economically feasible technical solutions of the renewable energy.

Energy efficiency: the target is to achieve annual savings of 1.5% of the total final energy consumption, in the period through 2020.

The initiatives outlined in the Strategy will have a positive impact on the environment – **by 2020 Lithuania will reduce CO₂ emissions by 23%** (compared to 2008).

In 2020 Lithuanian energy sector will be fully independent of energy supply from a single source. Electricity demand will be covered by using the new nuclear power plant in Visaginas and production from renewable energy sources. In addition to diversified imports of oil and oil products though *Klaipėdos nafta*, supply of natural gas will be diversified through the LNG terminal.



Strategic initiatives that will bring energy independence will cost 11–17 billion LTL for the Government. Additional 18–24 billion LTL will be attracted from private investors. The investment will yield annual savings of 3–4 billion LTL (3–4% of Lithuanian GDP), which are currently spent on imported energy resources. What is more, after implementation of the strategic

projects the country will benefit from a reliable energy supply and more stable energy prices. Each household will on average save 500 LTL per year on heating costs alone. 5–6 thousand permanent work places will be created. The investment will also stimulate construction and services sectors.

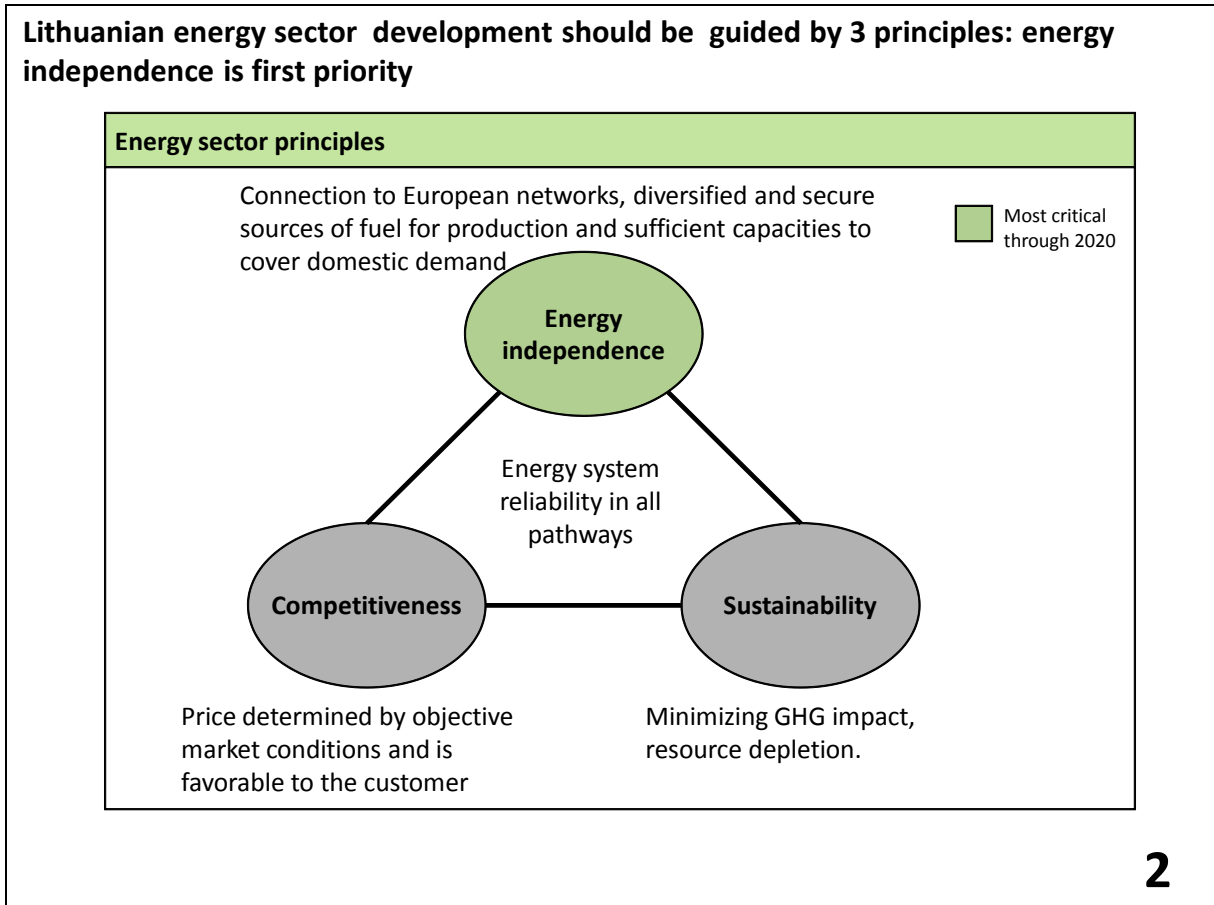
Lithuanian Energy Sector through 2050

In the period through 2050, Lithuania will progressively move towards a fully sustainable, carbon free economy. Electricity will be produced by nuclear power and renewable energy sources, with focus on decentralized generation. Centrally supplied heat will be produced only from renewable energy sources.

The country will increase the efficiency of energy consumption. New breakthrough technologies are expected to be developed in the period through 2050. In order to timely react to the technological development and make good use of new technologies, Lithuania will promote its own capabilities and competences, mainly in the nuclear power management and energy production from renewable energy sources. The country will monitor existing technologies, and support their implementation in the sector once they become economically viable, so that Lithuania can become a regional hub in modernization of energy space.

General Policy Guidelines

Energy Sector Principles



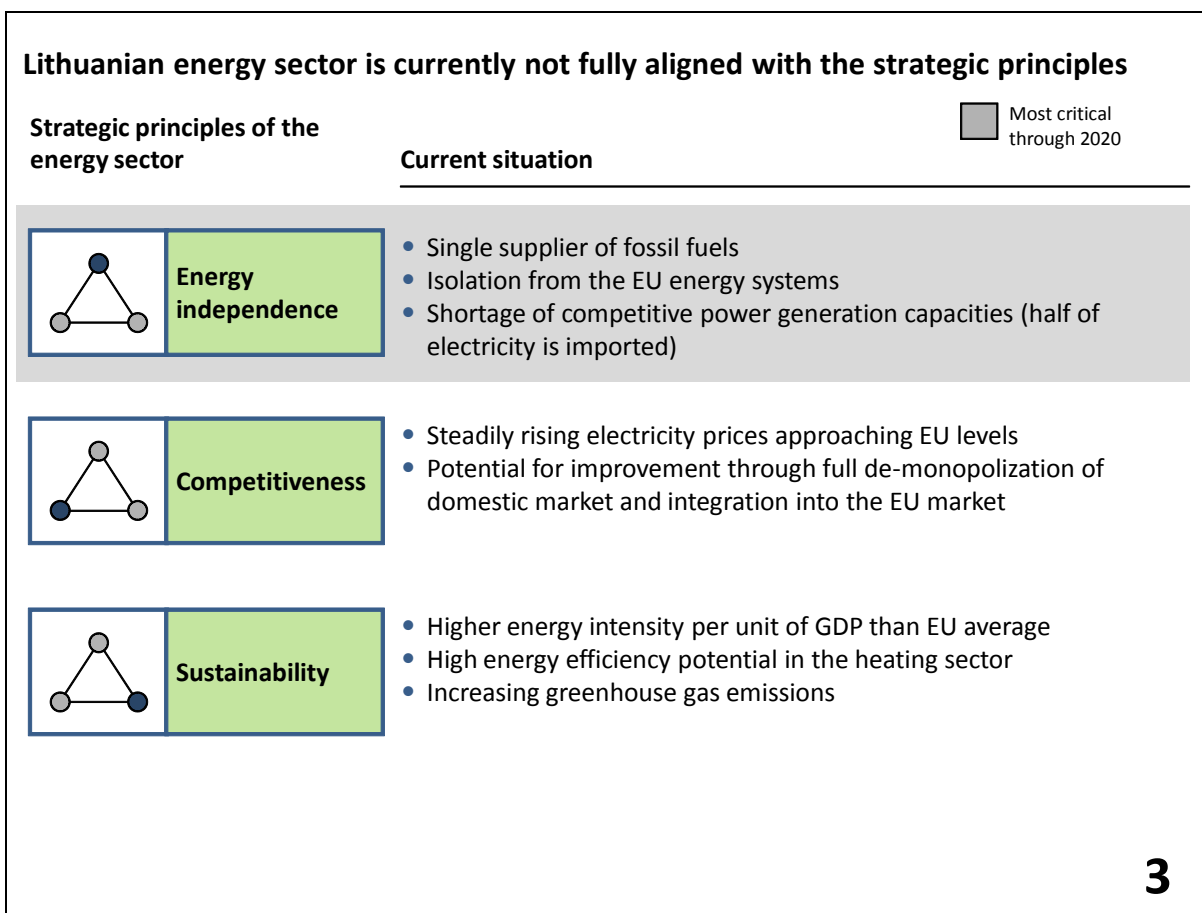
Following the analysis of the energy sector and evaluation of the main challenges the Strategy is grounded according to three interconnected principles:

- i. **Energy independence.** Lithuania will cover its domestic energy demand from local and diversified sources. This is a necessary condition for continuous functioning of the energy system and prevention of energy supply interruptions.
- ii. **Competitiveness.** The state will connect to European energy markets and will reform existing energy sector monopolies. This will guarantee favourable energy prices for the

consumers and ensure sufficient investments into the energy sector to develop the missing energy infrastructure.

- iii. **Sustainability.** Both production and consumption of energy must be based on the principles of sustainable development. Emissions of greenhouse gas and resource depletion will be reduced to make the energy sector sustainable. Nuclear energy and promotion of renewable energy sources will ensure sustainable energy production.

Current Status



After the shutdown Ignalina Nuclear Power Plant (NPP), local electricity generation capacities are being increased and electricity sector is being restructured in order to ensure competitive and continuous electricity supply. Currently a new electricity generation capacity is being built in Elektrėnai, internal electricity network is being strengthened, construction of electricity links with Sweden and Poland has been started, and electricity power exchange has been established. However, despite success in the development of the sector, full energy

independence has not been achieved and consumers still can't buy electricity at competitive prices.

Energy independence

After the shutdown of Ignalina NPP, Lithuania's energy system became highly dependent on import of electricity and fossil fuels. Lithuania is isolated from EU energy systems: there are no electricity interconnections with Continental Europe and the country is dependent on the sole external gas supplier. In addition, Lithuania imports half of its electricity consumed from neighbouring countries, with most of the remainder of electricity generated by using fossil fuels supplied by a single source.

This situation creates additional threats to the consumers. Lithuanian energy consumers are more vulnerable to energy supply interruptions or large price fluctuations than in countries with diversified and self-sufficient energy systems.

Competitiveness

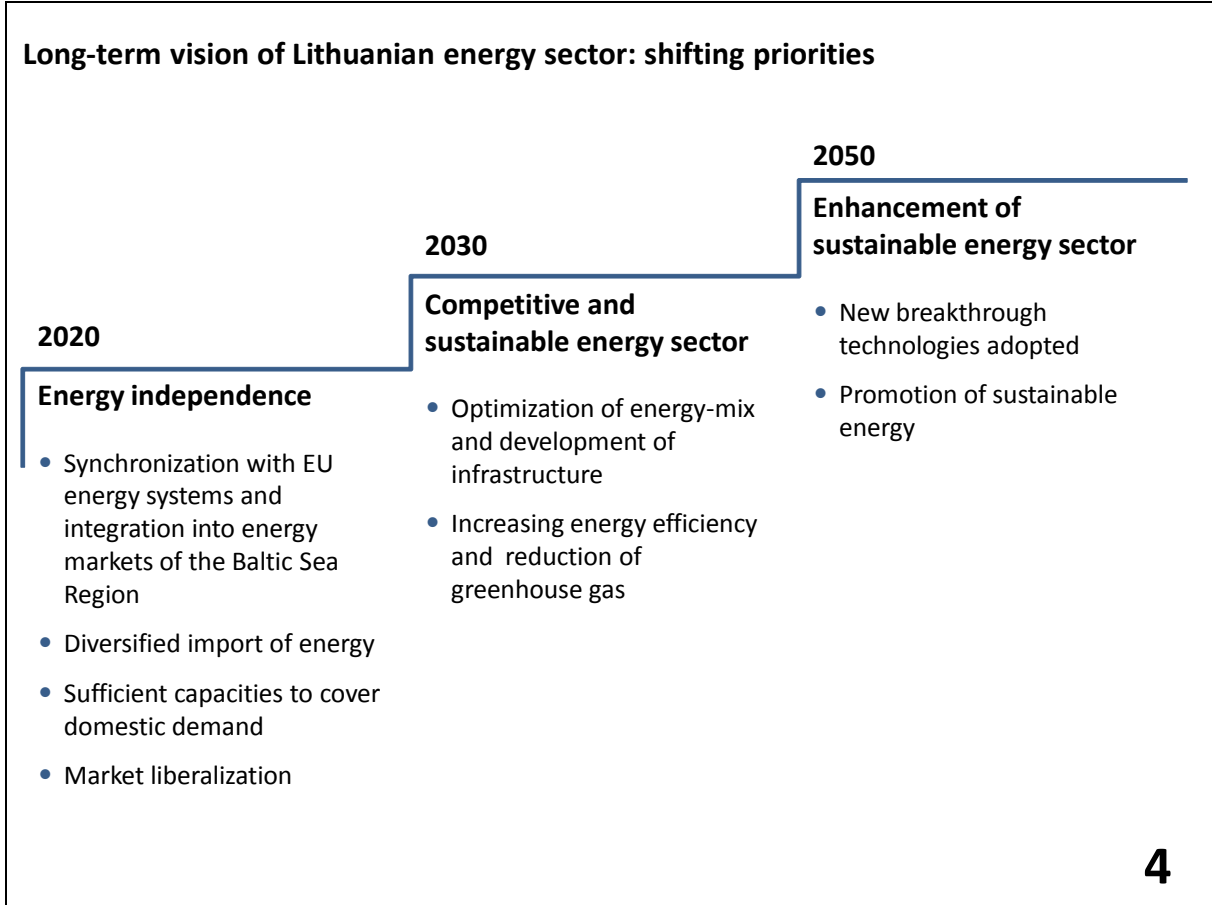
The energy sector is not fully competitive. The country's energy market, pursuant to the 3rd EU energy package, is being made more competitive through implementation of ownership unbundling in the electricity and gas sectors. In the electricity sector, ownership of electricity generation is being unbundled from transmission. In the gas sector, ownership of gas transmission and supply is being separated.

Sustainability

The energy sector also faces sustainability challenges. Energy intensity per unit of GDP is 2.5 times higher than the EU average. This reveals vast untapped potential for energy efficiency, especially in heating and transport sectors.

Lithuania's dependence on fossil fuels has caused CO₂ emissions to increase, especially after the closure of the Ignalina NPP. This creates additional difficulties for sustainable development of the energy sector.

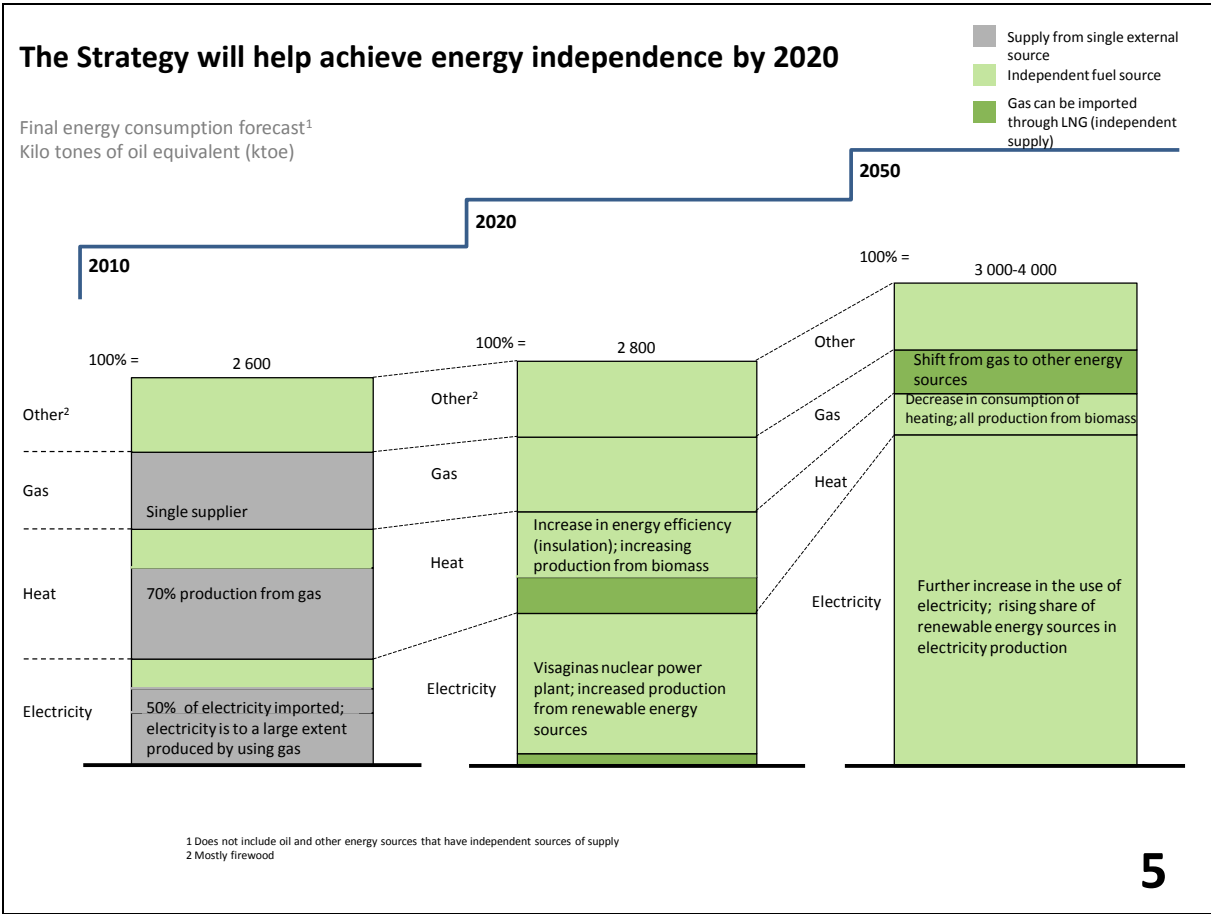
Strategic Vision



The vision of Lithuanian energy sector is based on all three main principles. However, in different periods of time (2010–2020, 2020–2030, 2030–2050) the main focus will be on different principles.

Until 2020, country's highest priority is energy independence. In this period, Lithuania will construct enough generation capacities to cover local electricity demand. Electricity and gas transmission systems will be connected to the European Union electricity and gas infrastructure, thus securing alternative energy supply sources.

New electricity generation capacities as well as electricity and gas connections with EU networks will allow Lithuania to eliminate dependence on the single supplier of energy sources, will ensure that internal energy demand is satisfied, and will allow to reap benefits from participation in the single EU energy market.



In the period from 2020 to 2030, the Strategy aims at creating a competitive and sustainable energy sector. Lithuania will continue to increase the share of environmentally-friendly energy sources in the energy mix and will further enhance the energy infrastructure in order to fully support advancements in renewable energy production. As a result, by 2030 Lithuania will have a competitive energy market with most of the energy produced from the nuclear and renewable energy sources and will have achieved low levels of greenhouse gas emissions.

In the period from 2030 to 2050, the main priority of the Strategy is to further increase the sustainability of Lithuanian energy sector. In this period, new breakthrough technologies will be selectively adopted, focusing on the sustainability of energy production and consumption. As a result, by 2050 Lithuania will be fully independent from imports of fossil fuel and will produce its energy only from nuclear and renewable energy.

Lithuania's Energy Policy in the European Union

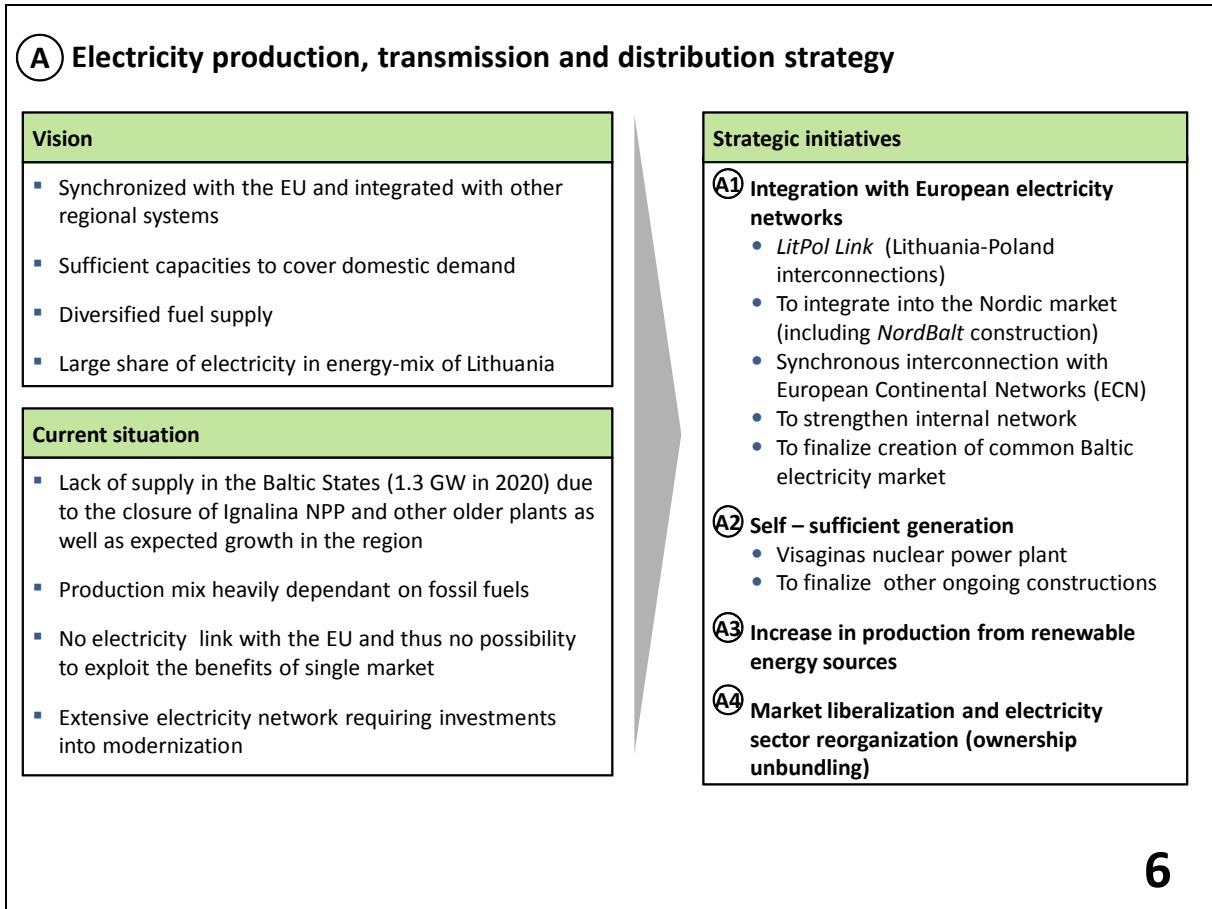
The vision, goals and strategic initiatives of the Lithuanian energy sector are in line with the guiding principles of EU's energy policy – security of energy supply, competitiveness and sustainability.

With regard to the status of energy security in Lithuania and priorities of its energy policy, Lithuania's main initiatives in the context of EU's energy policy focus on abolishing the energy isolation, creating a single internal EU energy market, improving the regulatory environment as well as on strengthening the external dimension of EU's energy policy. Lithuania will make efforts to contribute to the implementation of these initiatives in the following ways:

- 1) Abolishing energy isolation of Lithuania:
 - i. To implement the Baltic Energy Market Interconnection Plan (BEMIP), which foresees the realization of crucial energy generation and interconnection projects as well as the integration of energy markets in the Baltic Sea Region;
 - ii. To consolidate EU's financial instruments, necessary for implementation of priority energy infrastructure projects in Lithuania and throughout the region.
- 2) Strengthening EU's internal regulatory instruments and external energy policy:
 - i. To form regulatory environment, necessary for the creation of EU's energy market and its effective functioning;
 - ii. To simplify the decision-making procedures for realization of EU's priority energy infrastructure projects;
 - iii. To apply (based on the principle of reciprocity and aiming for equal market conditions and sustainable development of the energy sector at global level) the same environmental standards both to energy produced in the EU and imported from third countries.

Strategic Goals

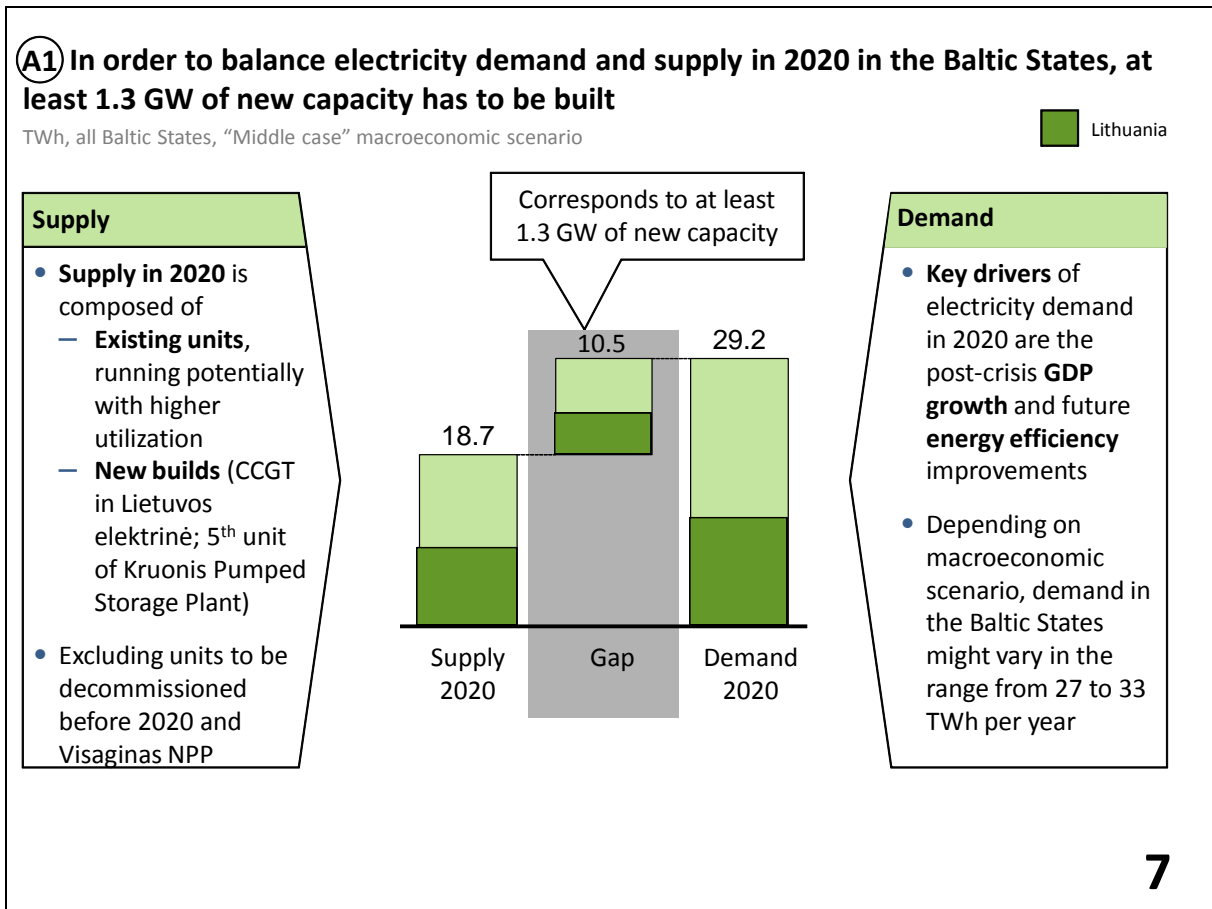
A. Electricity



After shutdown of Ignalina NPP, Lithuania turned from net electricity exporter into net electricity importer. Consequently, Lithuania is facing major shortcomings in electricity production. Around half of the electricity consumed is imported from neighbouring countries, mostly from Russia. The country is also very dependent on electricity produced from fossil fuels which is imported from the single source.

In terms of infrastructure, Lithuania has a relatively old electricity grid with no interconnections with Continental Europe and Scandinavia. The interconnections are essential for Lithuania in order to increase the energy independence and to benefit from a single EU energy

market. With growing economies of Lithuania and the Baltic States, a considerable lack of electricity supply will arise in the Baltic countries by 2020, amounting to a deficit of 1.3 GW of installed capacity.



Based on the requirements of the 3rd EU energy package, Lithuania is undertaking a thorough reform of the electricity sector by separating transmission from generation and supply activities.

Main tasks of the reform:

- i. Separating electricity transmission from production and forming a strong Transmission System Operator (LITGRID AB), capable of connecting Lithuania to the European Continental Network for synchronous operation;
- ii. Consolidating majority state-owned electricity production capacities (in Lietuvos Energija AB) to help ensure energy independence of the country;

- iii. Merging the two distribution network operators to achieve synergies and better satisfy the interests of consumers.

As of January 1, 2010, Lithuania started to gradually liberalize its electricity market. Market operator Baltpool was established, organizing the activities of the electricity market according to the principles of NordPool electricity market. This is the first major step towards creating an effective Lithuanian electricity market as a part of a single electricity market in the Baltic Sea Region and Continental Europe.

Strategic Initiatives till 2020

Strategic initiatives in the electricity sector consist of creating electricity interconnections with neighboring countries to exploit common market benefits and building new local electricity generation capacities based on nuclear and renewable energy. These initiatives will help to provide competitive electricity prices for consumers, ensure Lithuania's security of electricity supply, and substantially increase the sustainability of the electricity sector.

- A1. **Integration with European energy systems.** The major electricity goal for Lithuania is connection to the European Continental Network (ECN) for synchronous operation. Lithuania will connect to the ECN for synchronous operation before commissioning the new nuclear power plant in Visaginas. The main tasks are to achieve political agreement on connection to ECN and to fulfill technical requirements to be set by the ENTSO-E (including building of necessary infrastructure, ensuring operation capability in fully isolated mode).
 - i. **Lithuania–Poland power connection.** The power link between Lithuania and Poland *LitPol Link* is of primary importance, necessary for connection to ECN and integration into the European electricity market. The connection of 1000 MW line will be built in 2 stages: the first line with the capacity of 500 MW by 2016 and the second line with the capacity of additional 500 MW by 2020. Total cost of the line – 950 million LTL. After construction of the first line in 2016, Lithuania will connect to ECN. When all conditions for connecting to the ECN are fulfilled, the converter station in Alytus will be transformed to operate asynchronously with the IPS/UPS electricity system. After connecting to the ECN for synchronous operation, this converter station will be used for the Hrodna electricity transmission line.

- ii. **Lithuania–Sweden power connection.** *NordBalt* electricity line with capacity of 700 MW will be built by the end of 2015. It will allow connect to Scandinavian electricity network, to trade electricity with the Nordic countries, and to access cheaper balancing reserves. Total price of the project – 1.9 billion LTL.
- iii. **Internal network strengthening.** Lithuania will strengthen the internal network needed for stable synchronous operation with the ECN and for the Visaginas NPP. In order to interconnect the Baltic States, priority will be given to transmission lines going from the North to South. Transmission lines Klaipėda–Telšiai, Kruonis–Alytus, electricity distribution point in Bitėnai, and other necessary projects will be undertaken. Total price for the internal market strengthening is 300–700 million Lit.
- iv. **Connection to the ECN for synchronous operation.** Main tasks: close cooperation with the Baltic States; disconnection from the IPS/UPS system; stable autonomous operation of the system in the period of transition to synchronous operation with the ECN. Connection to the ECN for synchronous operation will be implemented together with Latvia and Estonia by building the electricity line to Poland *LitPol Link* and constructing converter stations in Alytus and Narva.








A2. **Self-sufficient generation**

- i. **New nuclear power plant.** The main strategic project in electricity generation until 2020 is the construction of the Visaginas nuclear power plant. Although the investment is large, it is equal to around 10 years of payments for imported gas to produce the same quantity of electricity. In this regard, the Visaginas NPP is the most viable option to close the electricity supply gap. It will additionally bring a number of benefits. At the same time, the issue of nuclear waste management will be taken care of already in the planning phase of the Visaginas NPP project. The NPP will operate for more than 50 years.

Changes in the electricity system that are necessary for interconnection with ECN are also essential for the Visaginas NPP. Internal electricity network and domestic reserving capacity will be strengthened to accommodate the NPP. Electricity generated in Visaginas NPP can be exported to the Continental Europe using the *LitPol Link*. The *NordBalt* project will help to decrease cost of reserve capacities necessary for the work of the NPP.

The Visaginas NPP will provide a high degree of energy independence and power supply for the whole region. The new build will have a favorable impact on the local economy by attracting unprecedented levels of investment to Lithuania, creating jobs and orders for local companies. Visaginas NPP will pay a substantial contribution to curbing CO₂ emissions in the power sector in the Baltic countries. The amount reduced (2.4 million tons) amounts to 10% of CO₂ emissions in 2008. Depending on capacity, the NPP will cost 12.4–15.4 billion LTL. The plant is scheduled to be commissioned in 2020.

A2 Building new NPP is the most viable option to close the gap

Nuclear scores well on all the criteria...		... while other technologies have some important drawbacks	
Criteria	New NPP	Option	Drawbacks
 Energy independence	<ul style="list-style-type: none"> High energy independence due to the possibility to import fuel potentially from multiple countries It is a regional project ensuring additional generation capacities for Estonia, Latvia, Lithuania and Poland 	 Hard coal	<ul style="list-style-type: none"> High environment pollution Economically unattractive due to high CO₂ emission price
 Competitiveness	<ul style="list-style-type: none"> Positive impact on export balance Potential boost of economy during construction period From the economic point of view, more attractive than other options 	 Gas (piped)	<ul style="list-style-type: none"> Low energy independence – fuel coming from one source 10-years payments for imported gas equal to investment into nuclear
 Sustainability	<ul style="list-style-type: none"> No CO₂ emissions, High contribution to EU's CO₂ emissions reduction targets 	 Gas (LNG)	<ul style="list-style-type: none"> Business case not attractive due to unstable fuel prices
		 Import only	<ul style="list-style-type: none"> Very low level of energy independence Negative impact on export/import balance

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ii. **Finalization of other ongoing constructions.** Construction of 9th block in Lietuvos elektrinė power plant will be finished (price – 900 million LTL) and 5th block of Kruonis Pumped Storage Plant will be built (price – 300 million LTL).

A3. **Electricity generation from renewable energy sources** will be among state's top priorities in the energy sector. Major focus is put on the use of biomass in the CHP plants

and on the use of wind power. The state will create conditions to reach 500 MW of installed wind capacity by 2020. Priority is also put on full realization of hydro energy.

Renewable energy in 2020 will constitute no less than 20% of total electricity consumption. However, the development of renewable energy sources will not be promoted beyond the technical and economically feasible level.

A4. Market liberalization and electricity sector reorganization. The ongoing reorganization of the electricity sector will be finalized by 2012. Electricity generation, transmission and distribution will be separated on the basis of ownership to increase the overall efficiency of the system.

The ownership unbundling will increase overall efficiency of the system, help protect new electricity market participants against discrimination, optimize utilization of the infrastructure, encourage investment, and ensure competitive prices for the consumers.

Regulated electricity tariffs for industrial and household consumers will be abolished by 2015.

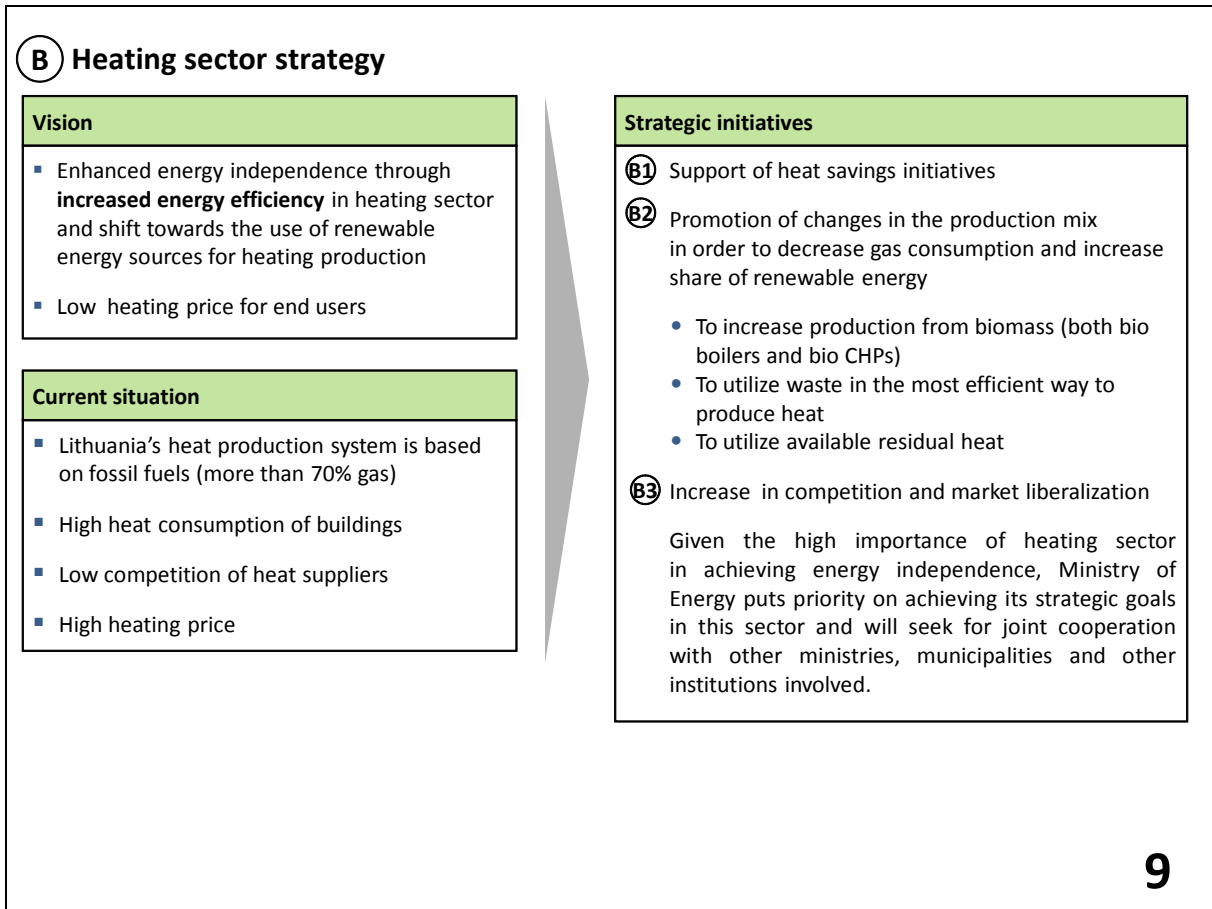
For all the ongoing and planned projects to be implemented in electricity production, transmission and distribution, a total of 14–20 billion LTL for the next 10 years will be needed. Additional 12–15 billion LTL will be raised from private investors. The highest priority will be given to the connection to the ECN for synchronous operation and building of Visaginas NPP.

Strategic Outlook for 2020–2030

In the period from 2020 to 2030 will be produced enough electricity to cover domestic demand, which is estimated to be 13–17 TWh per year in 2030. Most of this supply will be covered by the Visaginas NPP and electricity generated from renewable energy sources. Furthermore, after establishing electricity links with the Nordic countries and the ECN, Lithuania is going to participate in a fully liberalized and integrated electricity market.

No major investments are planned for the period 2020–2030. However, the electricity grid will be continuously developed and measures to increase efficiency of the network will be taken, primarily through effective use of smart grid technologies. Overall, the state will continue to encourage sustainability of the electricity sector by promoting renewable energy sources and increasing efficiency in the electricity production value chain.

B. Heating



Lithuania has a developed centralized heating system with around 65% of consumed heat produced in centralized systems. The share of centralized heating in the whole heating sector remained fairly constant over the last years.

The major problem in the heating system is inefficiency at the point of consumption – the average yearly heat consumption of Lithuanian buildings is 220 kWh/m², which is substantially higher than the average of Nordic countries (128 kWh/m²). Reducing this inefficiency can bring substantial savings of heating costs and would lower emissions of greenhouse gas.

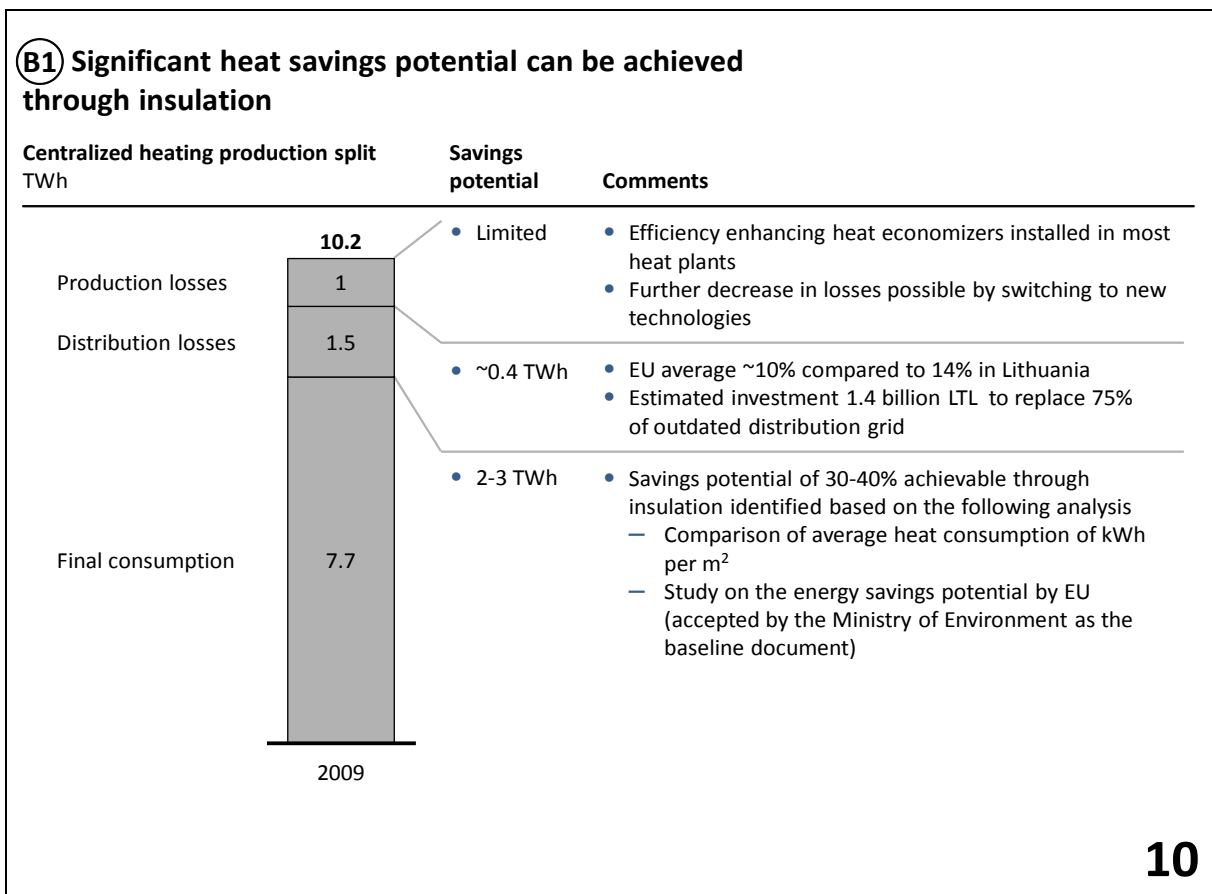
In addition, the heat is being produced mainly from fossil fuels – approximately 70% is produced from gas, which is imported from a single source. Increasing energy production from renewable energy sources can diversify energy sources for heat production and reduce negative impact of the heating sector on the environment.

Heat consumption efficiency

There is a possibility to decrease annual heat consumption of households and public buildings by 2–3 TWh by 2020. Compared to 2009, these savings would amount to 30–40% of final heat consumption. Lithuania will strive to realise most of the identified savings potential, as reducing heat consumption is very beneficial for the state – increased energy independence and positive impact on the local economy, energy consumers – reduced heating bills, and the environment – reduced emissions of greenhouse gas. Lithuania will implement all economically justified energy efficiency initiatives.

Heat Savings in Production and Distribution

Apart from savings in heating consumption, further savings will be sought in production and transportation of heat by identifying of economically viable investments into the network. In heat transmission, as much as 0.4 TWh is expected to be saved by gradual replacement of outdated heat transmission grid. In heat production, savings will be achieved by replacing old less efficient boilers with newer heat production technologies and CHP plants.

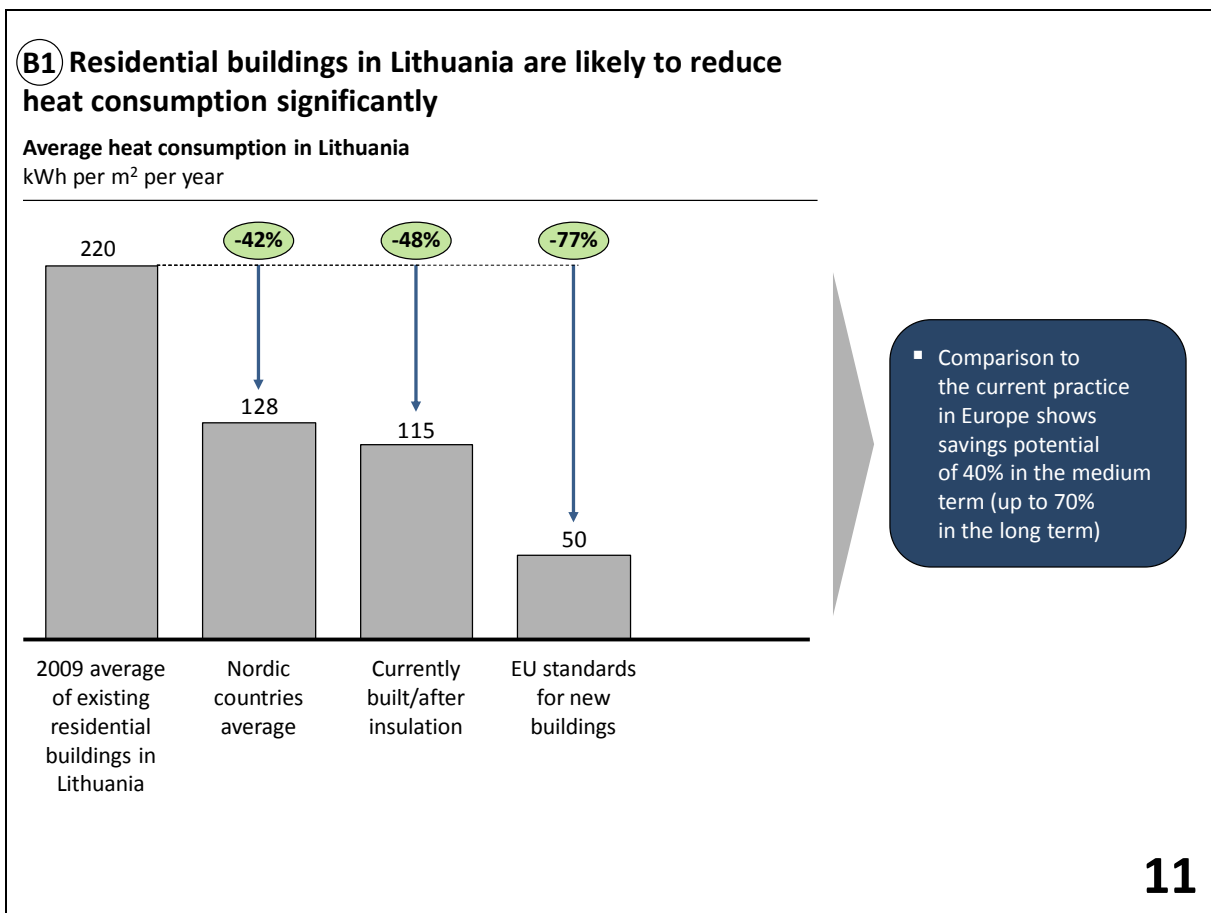


Strategic Initiatives till 2020

B1. Heat consumption savings. The heat consumption in buildings will be reduced by 30–40% compared to 2009 level). In order to achieve this, sources for financing of insulation projects have to be secured. Also, since the investment level is substantial, there is a need to prioritize insulation projects – houses that are least energy efficient will be renovated first.

The initiative will increase energy independence of Lithuania – consumption of gas for heating will decrease. This will lead to annual savings of over 400 million LTL that would otherwise be spent on natural gas import. For heat consumers, investment into the efficiency of heat consumption will bring annual savings of approximately 600 million LTL on heating costs – or over 500 LTL per household.




Renovation will also increase economic and social value of the renovated real estate, especially in the least energy efficient houses.



Renovation will make the heating sector more sustainable by decreasing CO₂ emissions. As a result of efficiency gains, emission of 1.1 million tonnes of CO₂ equivalent will be prevented, which represents more than 5% of total greenhouse gas emissions of Lithuania in 2008.

In order to achieve a substantial large energy efficiency improvement, 5–8 billion LTL will have to be invested. Renovation of buildings will be financed by the state, EU funds, and home owners. The estimated payback period is 10 years.

B1 Investment into insulation to achieve 30-40% heat reduction has many benefits

Benefits of insulation		Costs of insulation
 <p>Energy independence</p> <ul style="list-style-type: none"> Higher energy independence due to decrease in import of gas ✓ ~400 million LTL annual savings on natural gas imports – 0.32 bcm (12% of total consumption in 2009) 		<ul style="list-style-type: none"> Costs of insulation to achieve annually 2-3 TWh savings of heat energy equals to 5-8 billion LTL Need to prioritize throughout the implementation as the investment level is substantial
 <p>Competitiveness</p> <ul style="list-style-type: none"> ~600 million LTL annual savings on heating costs by final consumer (payback period ~10 years) ✓ Local construction and insulation companies benefit from increased demand for insulation projects 		
 <p>Sustainability</p> <ul style="list-style-type: none"> Decreased CO₂ emissions (~1.1 million tones or - 4% of total greenhouse gas emissions of Lithuania in 2008) ✓ 		

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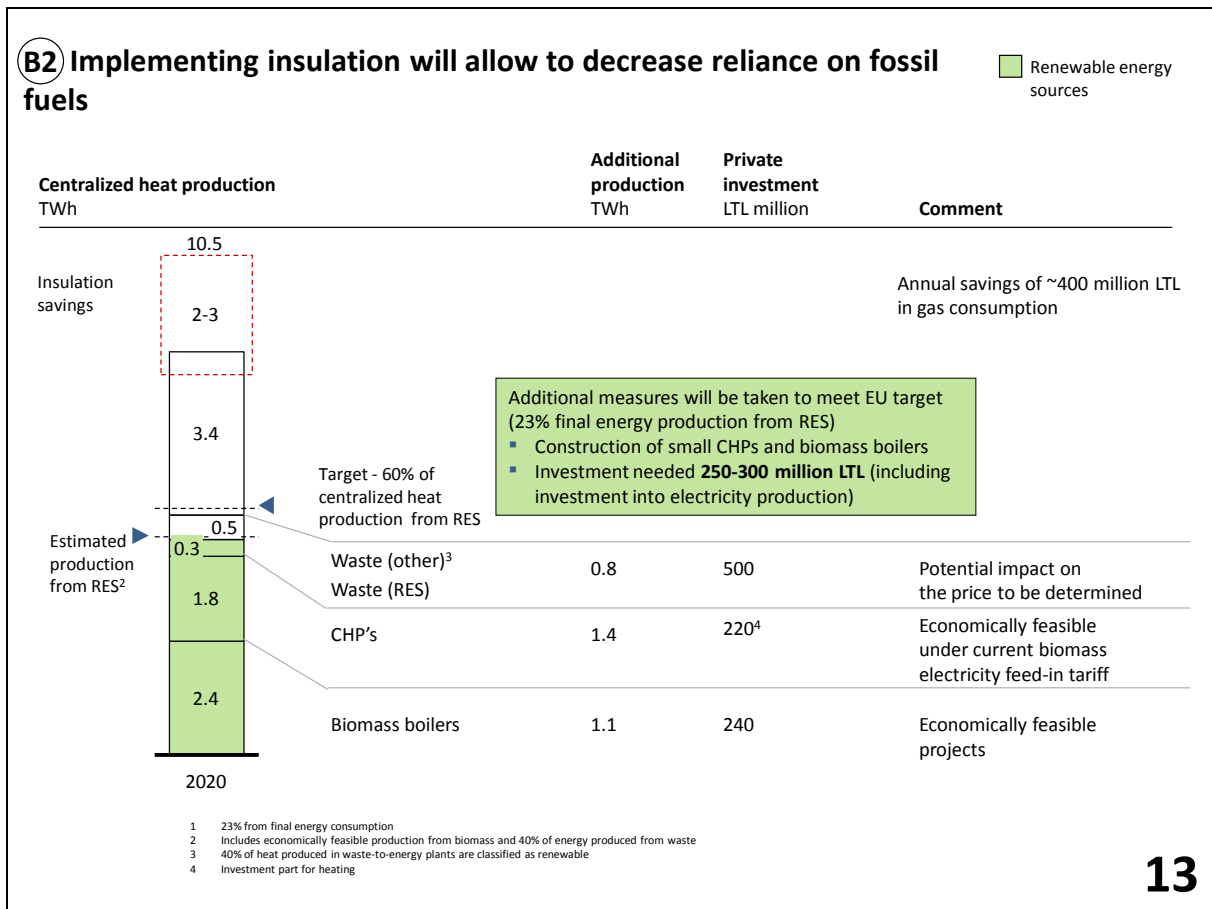
B2. Increasing the share of renewable sources in district heating

- i. **Increasing the use of biomass.** The state will encourage economically viable investment into heat production from biomass with priority on CHP plants (yearly additional production of 1.4 TWh). Another 1.1 TWh of heat will be produced in biomass boilers. Investment into this production will not increase heat prices.

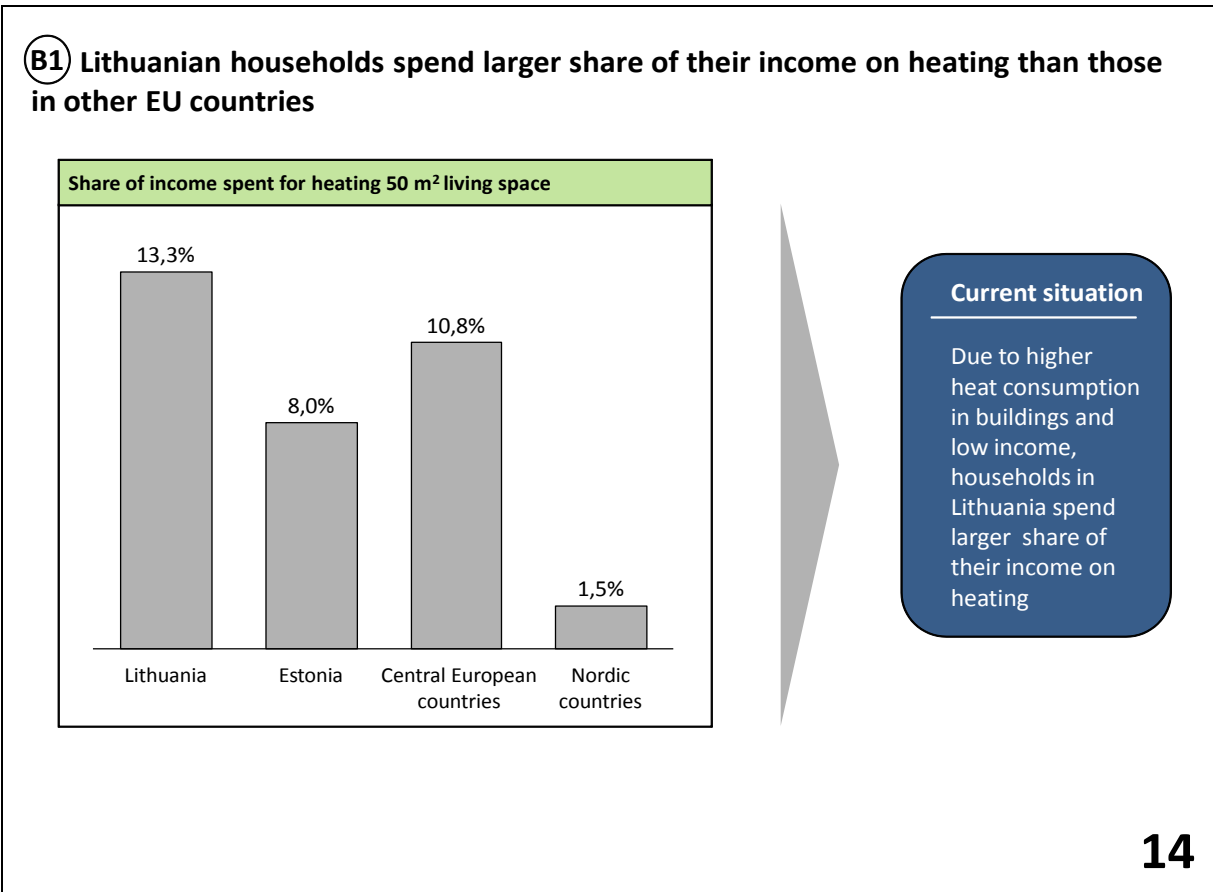
However, in order to reach the EU goal of energy production from renewable energy sources for Lithuania (23% from final energy consumption) the state will need to support 0.65 TWh of heat production from renewable energy sources on top of economically feasible production mentioned above. Investments into the additional production will amount to 250–300 million LTL. To make this investment attractive for private investors, tariff for electricity produced in CHP's might be increased (resulting increase of total electricity price of up to 3.5%), and the price of heat might be increased by less than 1%.

It is important to note that if energy efficiency initiatives are not implemented, additional heat production from renewable energy sources necessary to reach the EU goal for Lithuania of 23% will constitute 700–900 million LTL.

Decisions on building of bio-boiler and its size or bio-CHP's will be determined on case by case basis in coordination with heat consumption particularity in the central heating systems.



- ii. **Utilization of waste energy potential.** Waste incineration plants will be first built in or near the largest cities. It is projected that the waste energy plants will produce 0.8 TWh of heat annually. Possible locations for other waste incineration plants will be decided upon on a national level taking into account that it is crucial to ensure that all waste incineration plants get sufficient supply of waste.
 - iii. **Use of solar energy.** The use of solar energy for preparation of hot water will be encouraged.
 - iv. **Residual heat.** Wherever it is economically feasible, residual heat from electricity plants will be used, a potential example being the proposed Elektrėnai–Kaunas line, allowing use of heat generated by Elektrėnai power plant to provide heat for Kaunas residents.
- B3. **Increasing the level of competition and liberalization of the market.** The State will encourage competition among heat producers by gradually introducing the principles of free market. Transparent and efficient procedures for connection of new heat production facilities to the grid will be established.

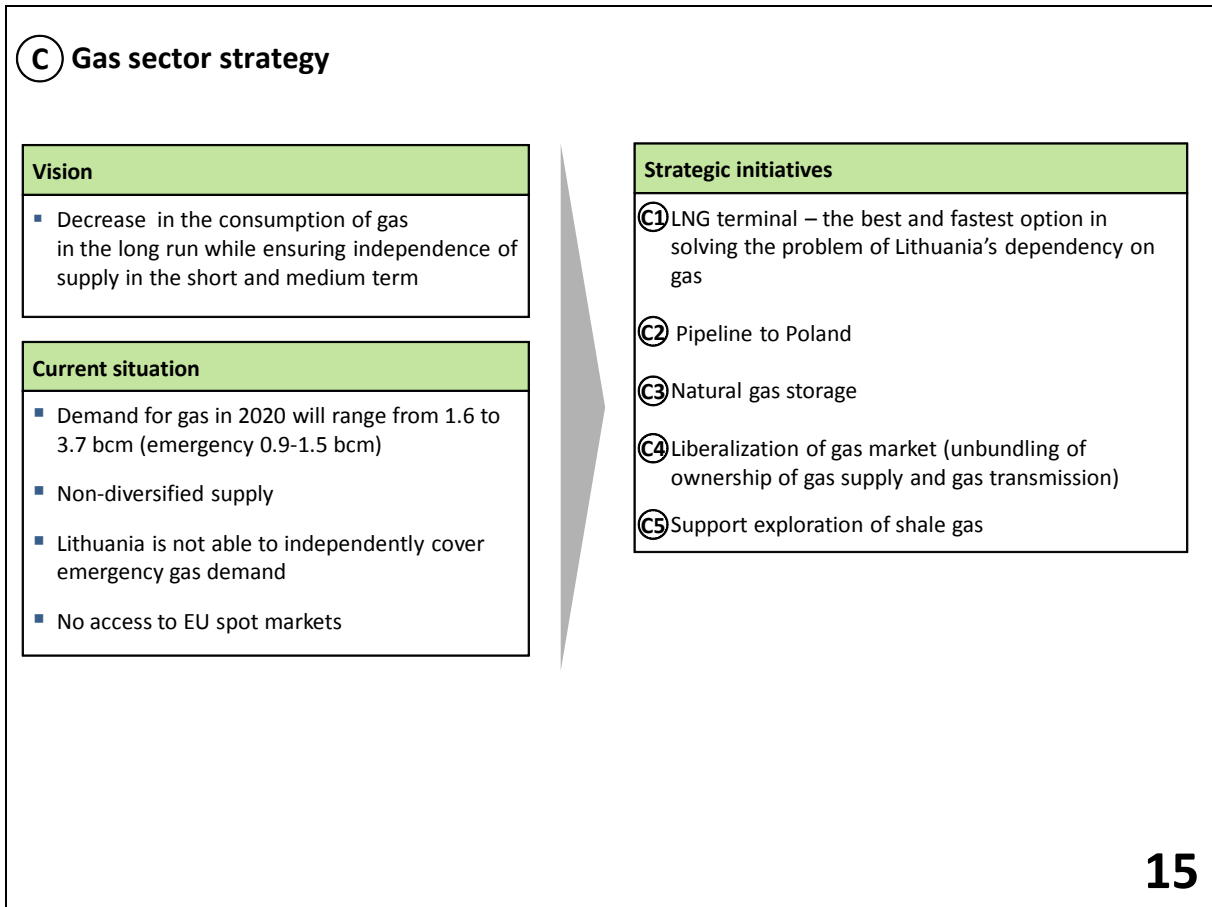


Strategic Outlook for 2020–2030

Continuing the trend of increasing energy efficiency, the demand for centrally produced heat will decrease by more than 3.5 TWh in comparison with 2009 and will amount to 6.5 TWh per year in 2030.

There are three major priorities in the heating sector for the period 2020–2030. First, increasing the efficiency of heat consumption will remain an important initiative. The state will further encourage insulation of buildings that are energy inefficient. Second, sustainable production of biomass will be promoted so that more heat could be produced from this fuel source. Third, improvements in the heating system will be implemented to make heat production and transmission more efficient. All these priorities will help to make the energy system independent and sustainable.

C. Gas



The vision for the gas sector is to decrease the consumption of gas in the long run while ensuring diversification of gas supply in the medium term.

Currently the supply of gas is undiversified, emergency supply is not covered and the country has no access to EU gas spot markets.

In order to cover emergency gas demand from alternative sources, reliable annual supply of 0.9–1.5 bcm of gas should be provided for (the demand for gas in 2020 is forecasted to range from 1.6 to 3.7 bcm per year). To achieve this, several alternatives could be implemented while construction of LNG terminal in Klaipėda is economically the most viable option.


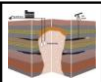


Strategic Initiatives till 2020

C1. **LNG terminal.** The priority is put on building LNG terminal as it has all the desired functionalities:

- i. Supply of natural gas will be diversified and the country will not be dependent on a single supplier of gas;
- ii. Emergency natural gas reserve function will be provided – Lithuania will be able to independently cover emergency demand for gas;
- iii. The country will gain access to gas spot markets;
- iv. Preconditions for forming a primary gas market in Lithuania will be fulfilled.

C1 LNG terminal (potentially combined with UGS) is the most attractive gas supply

■ Preferred alternatives

	⊕ Key pros	⊖ Key cons	
<p>A</p> <div style="border: 1px solid black; padding: 5px; display: flex; align-items: center;"> <div style="flex: 1;"> <p>LNG terminal</p>  </div> <div style="flex: 2;"> <ul style="list-style-type: none"> ▪ Emergency reserve function ▪ Access to EU spot market ▪ Diversification of supply ▪ Potential for expansion for relatively low cost </div> </div>			<ul style="list-style-type: none"> ▪ In small sizes, more expensive than UGS ▪ Operating on the gas spot market might require new skills to fully benefit from price arbitrage and to secure the emergency function
<p>B</p> <div style="border: 1px solid black; padding: 5px; display: flex; align-items: center;"> <div style="flex: 1;"> <p>UGS</p>  </div> <div style="flex: 2;"> <ul style="list-style-type: none"> ▪ Cheap in small sizes ▪ All the emergency volume physically stored in Lithuania </div> </div>			<ul style="list-style-type: none"> ▪ No diversification, no access to spot markets ▪ Long and risky construction
<p>C</p> <div style="border: 1px solid black; padding: 5px; display: flex; align-items: center;"> <div style="flex: 1;"> <p>Pipeline to Poland</p>  </div> <div style="flex: 2;"> <ul style="list-style-type: none"> ▪ Attractive investment cost </div> </div>			<ul style="list-style-type: none"> ▪ Functionalities dependent on contractual agreements – not fully in Lithuanian control ▪ Investments in reverse flow on <i>Yamal</i> would be needed to secure emergency function
<p>D</p> <div style="border: 1px solid black; padding: 5px; display: flex; align-items: center;"> <div style="flex: 1;"> <p>Combination of LNG and UGS</p>  </div> <div style="flex: 2;"> <ul style="list-style-type: none"> ▪ Summer/winter demand balancing ▪ Higher storage capacity than LNG terminal tanks only </div> </div>			<ul style="list-style-type: none"> ▪ Lengthy process for UGS development with risk of unsuitability of currently identified sites ▪ Higher capex than LNG solution providing the same emergency coverage

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In comparison with the underground gas storage and the pipeline to Poland, the LNG terminal provides the fastest solution to the problem of dependence on gas imports. In order to connect the terminal with Lithuanian gas transmission grid and to efficiently use terminal's capacity, gas pipelines from the terminal to the Klaipėda gas distribution

station, and from Klaipėda to Jurbarkas will be built which will create a circular natural gas transmission system.

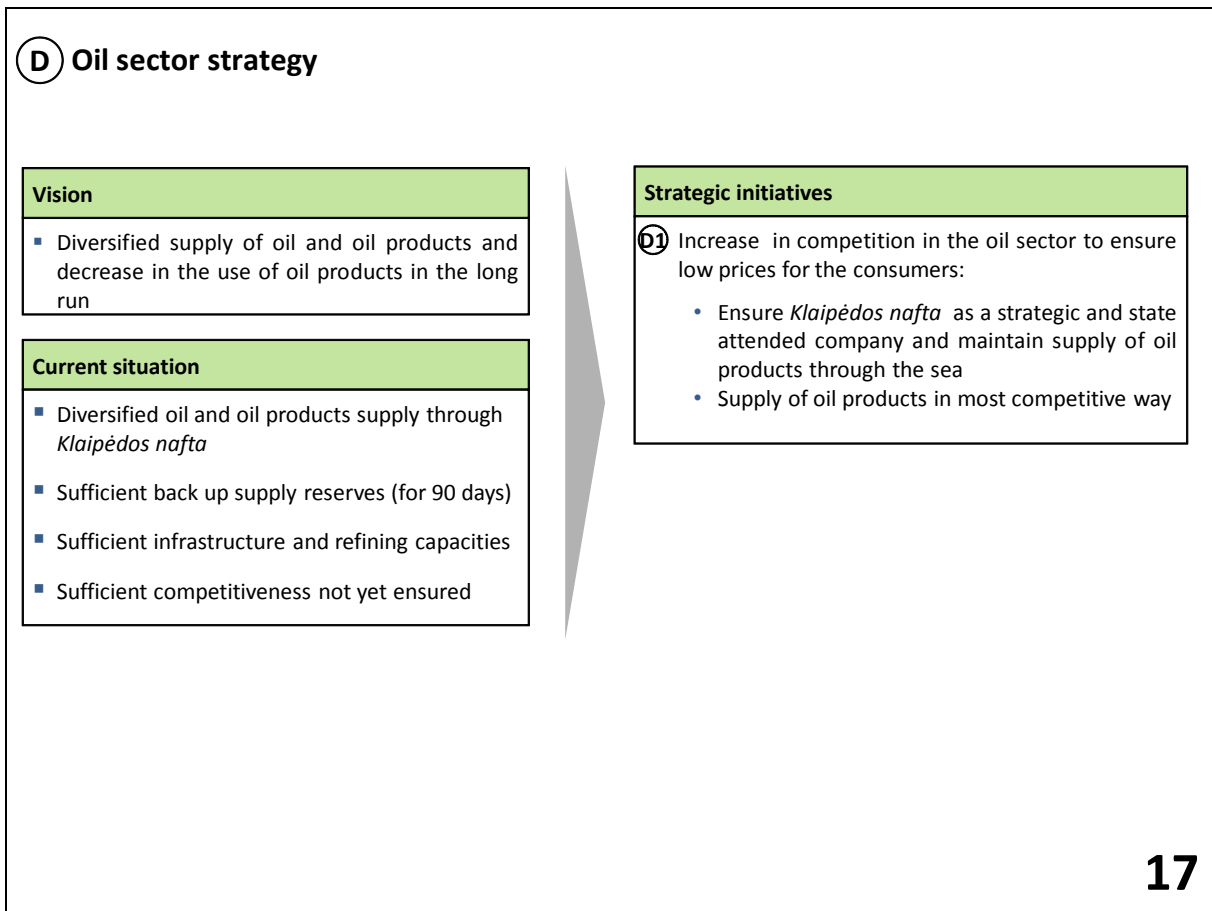
- C2. **Connection with Poland.** Gas pipeline between Lithuania and Poland is strategically important on a regional level, allowing connect the gas networks of the Baltic States with Poland and Western European gas networks. This pipeline has benefits similar to the ones of the LNG terminal. However, Lithuania would not have full control over flows of gas in the pipeline, which is critically important in times of emergency.
- C3. **Underground gas storage.** It is a good alternative because the entire emergency volume would be physically stored in Lithuania. However, the UGS does not provide diversification of supply and access to gas spot markets. This project is best suited to be implemented together with the LNG terminal.
- C4. **Liberalization of gas market.** According to the 3rd EU Energy Package and in order to bring better level of services for consumers of gas, the activities of gas transmission and supply will be effectively separated by ownership unbundling. This will ensure fairer prices to gas consumers and more investment into development of gas infrastructure. What is more, the unbundling will allow easier supply of gas from different suppliers to the same customer.
- C5. **Shale gas.** Lithuania will support exploration of shale gas in the country and will support economically feasible and environmentally balanced shale gas extraction and import.

Strategic Outlook for 2020–2030

By 2020 Lithuania will have the LNG terminal and, depending on timing of project completion, will have a gas interconnection with Poland. The country will have diversified gas supply and the adequate infrastructure; therefore, no major investments are planned for the sector during 2020–2030. In this decade further reduction of gas consumption, especially in electricity and heat generation, will remain a priority.

Depending on the technology development and the EU regulatory framework, Lithuania may consider other investment opportunities, such as domestic shale gas extraction. If shale gas is discovered in Lithuania by 2020, the country will thoroughly assess options of commercial shale gas extraction.

D. Oil



Oil for the Mažeikiai oil refinery is supplied via the Būtingė oil terminal. Oil and oil products can be transported by rail and sea through the port of Klaipėda. The strategic company AB „Klaipėdos nafta“ ensures alternative supply of oil and oil products. An oil products reserve of no less than 90 days is maintained.

The most substantial shortcoming of the oil sector is that there is not enough competition in the oil products' market and therefore consumer interests might be violated. Also, despite having the refinery in the country, prices for oil products are on average more expensive than in the neighbouring EU countries.

Strategic Initiatives till 2020

D1. **Increasing competition in the oil sector.** In order to guarantee supply of oil products, strategic state control of AB „Klaipėdos nafta“ will be retained. In order to ensure favourable prices to customers, supply of oil products will be based on the most competitive way.

D1 Oil supply independence already achieved, further investment will focus on economic benefits

Area	Current situation
Supply	<ul style="list-style-type: none"> ▪ Supply base diversified as oil is imported via the <i>Būtingė</i> oil terminal and oil products can be imported via <i>Klaipėdos nafta</i> ▪ Dependent on import as local offshore reserves limited (further exploration conducted, but potential limited)
Infrastructure	<ul style="list-style-type: none"> ▪ Sufficient infrastructure for rail and ships
Refining and storage	<ul style="list-style-type: none"> ▪ Refining production plant owned by <i>PKN Orlen</i> ▪ Sufficient storage capacities (90 days)
Demand	<ul style="list-style-type: none"> ▪ Oil products demand in Lithuania constant in the recent years, consumption amounting to ~2.6-2.7 million tons annually ▪ 82% of oil products, refined in the <i>Orlen Lietuva</i>, are exported

- No major investments are necessary in the upcoming years in the oil sector to ensure energy independence

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Strategic Outlook for 2020–2030

Consumption of oil products will gradually decline; crude oil for refinement will be imported from diverse sources; infrastructure will be adequate for the country's demand for oil and oil products. Therefore, investments will be largely directed towards maintenance of the existing infrastructure.

E. Renewable Energy Sources

E Renewable energy sources sector strategy

Vision	Strategic initiatives
<ul style="list-style-type: none">▪ Increase in energy production from renewable energy sources in order to diversify energy-mix and boost energy independence▪ Preference on the most economically feasible technical solutions▪ Implementation of EU requirements and targets	<p>E1 Increase in the share of renewable energy in electricity, heat and transportation – targets are aligned with overall EU goals</p> <ul style="list-style-type: none">– Electricity<ul style="list-style-type: none">• 20% (mainly from biomass and partially wind)• Construction of the 5th unit of Kruonis Pumped Storage Plant– Heat<ul style="list-style-type: none">• 60% of centralized heat production (from biomass)– Transportation<ul style="list-style-type: none">• 10% from biofuels <p>Ministry of Energy will ensure creation of favourable market conditions for optimal energy production from renewables.</p>
Current situation	
<ul style="list-style-type: none">▪ Current share of renewable energy sources in the final energy consumption is 15%▪ EU target for Lithuania for 2020 is 23% of renewable energy sources in the final energy consumption▪ Majority of energy from renewable energy sources is currently being produced from biomass	

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With a view to reaching the goals set in the Strategy on Promotion of Renewable Energy Sources, the vision is to increase the use of renewable energy sources to a level which would substantially strengthen Lithuania's energy independence and diversify the energy mix. In the efforts to promote renewable energy sources, Lithuania will follow its target set by the EU: to increase the share of renewable energy sources in the final energy consumption to at least 23% by 2020.

Currently, the share of renewable energy sources in the final energy consumption amounts to around 15%. The largest part of it is covered by biomass, which will continue to play a leading role in the energy production from renewable energy sources. Given Lithuania's natural conditions, the potential of wind and hydro energy is also not fully exploited yet.

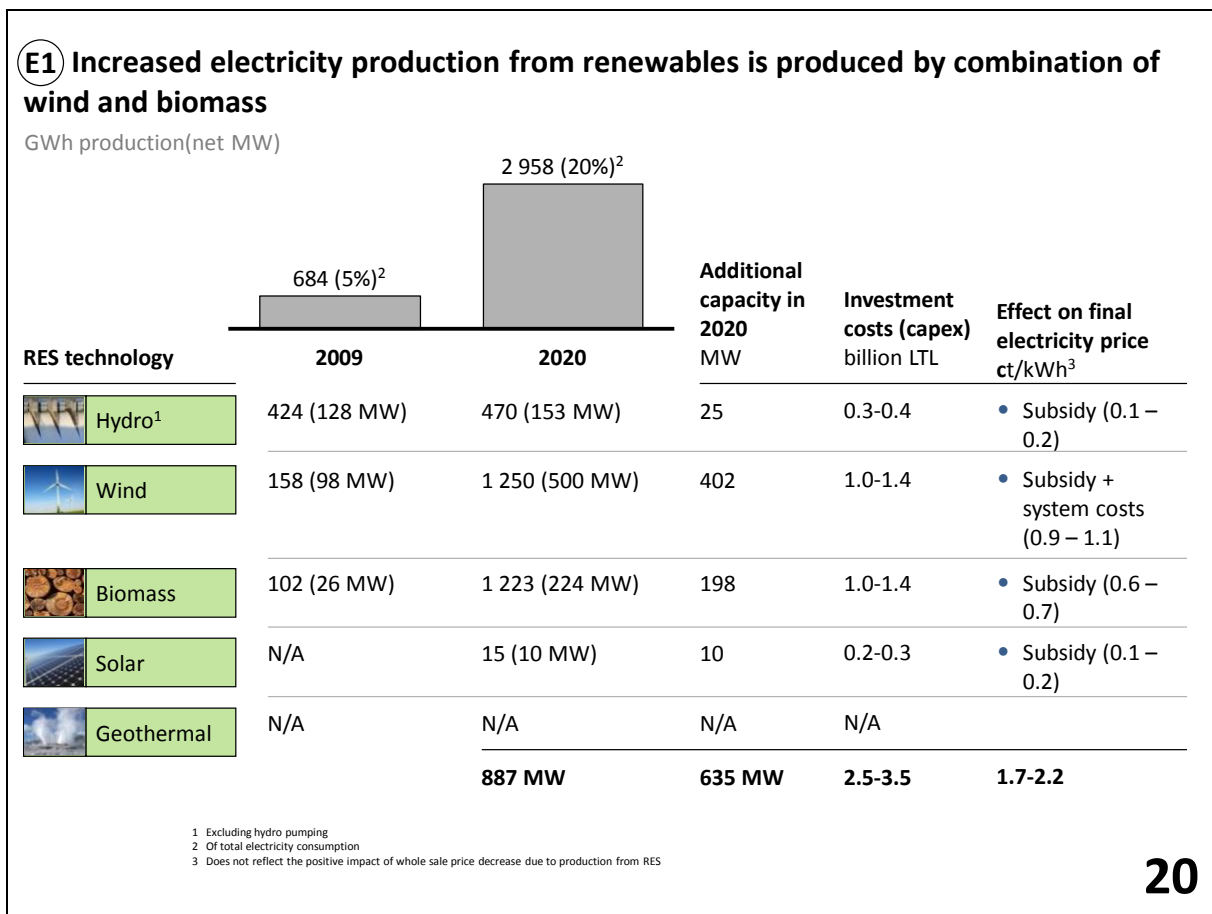
In its efforts to promote renewable energy, Lithuania will take steps to gradually introduce suitable and clear market conditions that would take into account total costs of energy produced

from renewable energy sources, including back-up capacity, balancing and grid expansion costs. The state will also set priorities on the most economically viable renewable energy technologies.

Strategic Initiatives till 2020

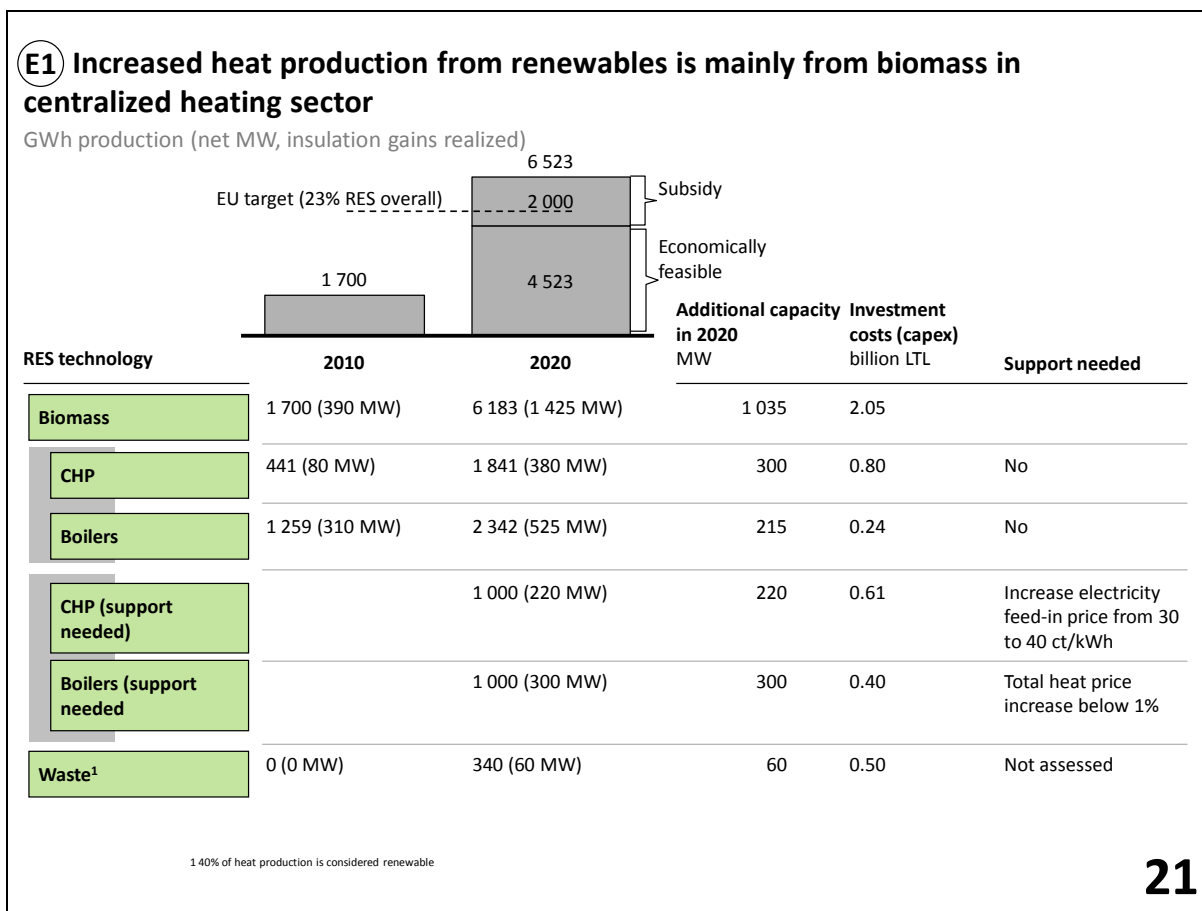
E1. Increase in the share of renewable energy sources

- i. Electricity sector.** The state will aim for at least 20% of electricity to be generated from renewable energy sources, mainly coming from biomass CHP plants and wind power plants. In order to reach this goal, Lithuania will have 500 MW of installed wind energy capacity, 10 MW of solar energy, at least 224 MW of biomass, and 153 MW of hydro energy.



- ii. Heating sector.** Renewable energy sources will cover at least 60% of centralized district heating, mainly by unlocking the biomass potential. In this regard, it is very important to ensure that sufficient biomass resources availability at competitive prices. Infrastructure

for wood biomass collection will be developed, proper management of flows of wood products will be ensured and the use of straw substantially increased.

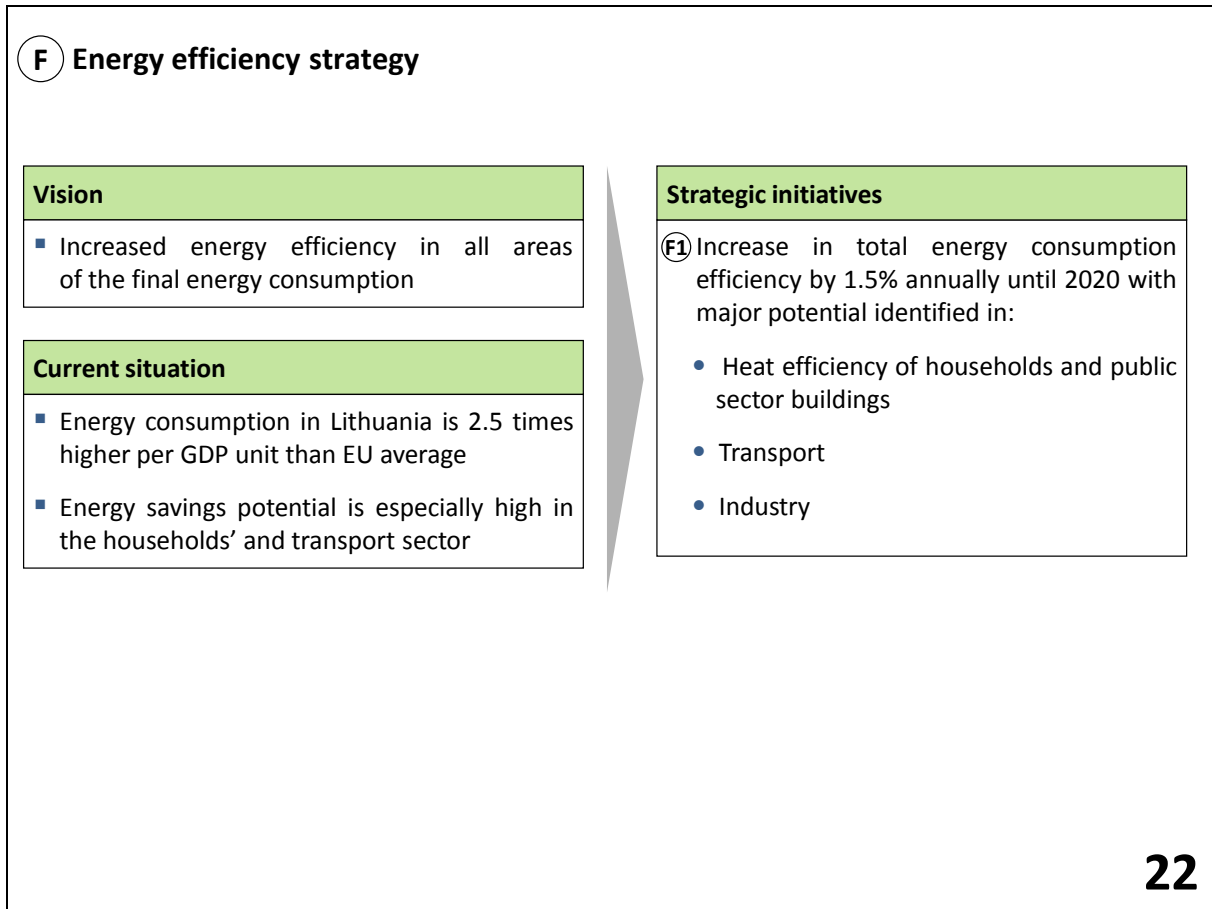


iii. **Transport sector.** Bio-fuel will account for no less than 10% of the final fuel consumption.

Strategic Outlook for 2020–2030

During the period of the year 2020–2030 Lithuania will aim for higher sustainability of the energy sector, primarily through increasing the share of renewable energy sources in final consumption of the electricity, heat and transport sectors. The country will encourage investment into sustainable forms of energy production in accordance with technically feasible and economically beneficial prospects of increasing energy production from renewable energy. In this period transport sector will become more sustainable by gradual switch to electricity powered vehicles.

F. Energy Efficiency



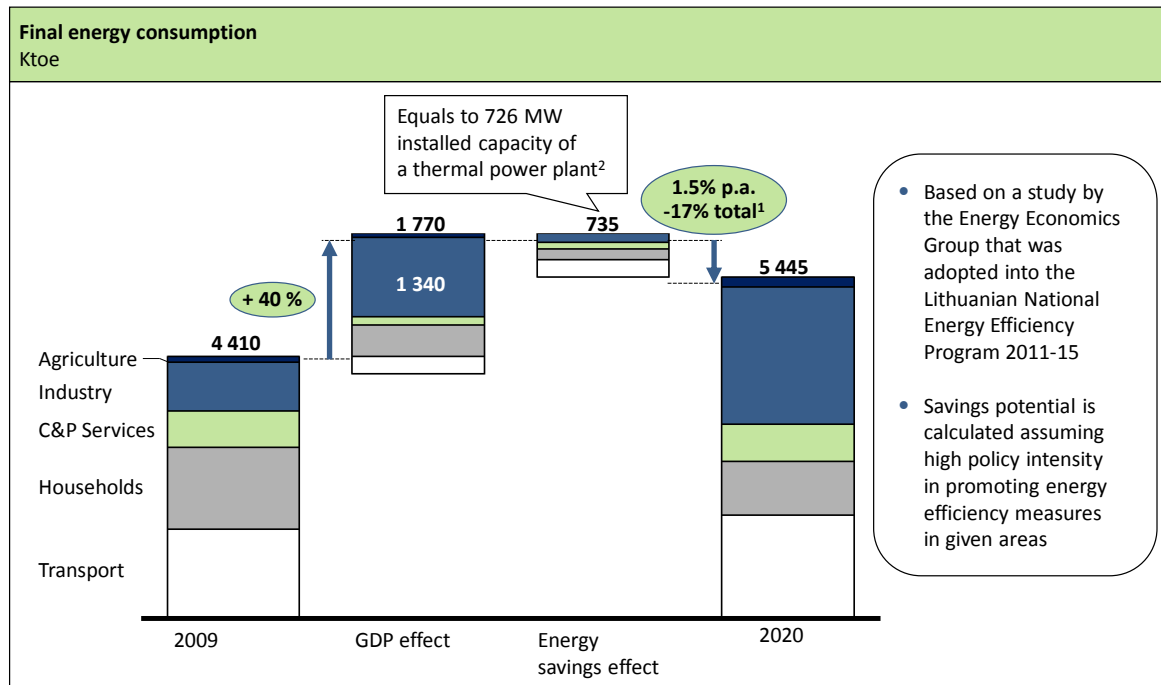
The energy consumption per unit of GDP is 2.5 times higher than the EU average and can be reduced significantly if the overall energy savings are increased.

The total savings potential of final energy consumption in Lithuania by 2020 is approximately 17% compared to the final energy consumption in 2009. Realization of this potential would imply yearly savings of 740 kilotons of oil equivalent (ktoe) by 2020.

The largest saving potential exists in the household and transport sectors, where energy efficiency measures are constitute 65% of total energy savings. The potential for households amounts to 290 ktoe and for the transport sector 300 ktoe.

Taking into account the total amount of energy that can be saved the overarching strategic goal in energy efficiency is to achieve 1.5% annual savings of the total final energy consumption by 2020.

F1 Total energy savings potential in Lithuania until 2020 is ~17%



¹ Savings related to 2009 final energy consumption
² Assuming that a standard power plant operates 7,000 hours/year, excludes savings in transport

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Strategic Initiatives till 2020

F1. Increase total energy consumption efficiency

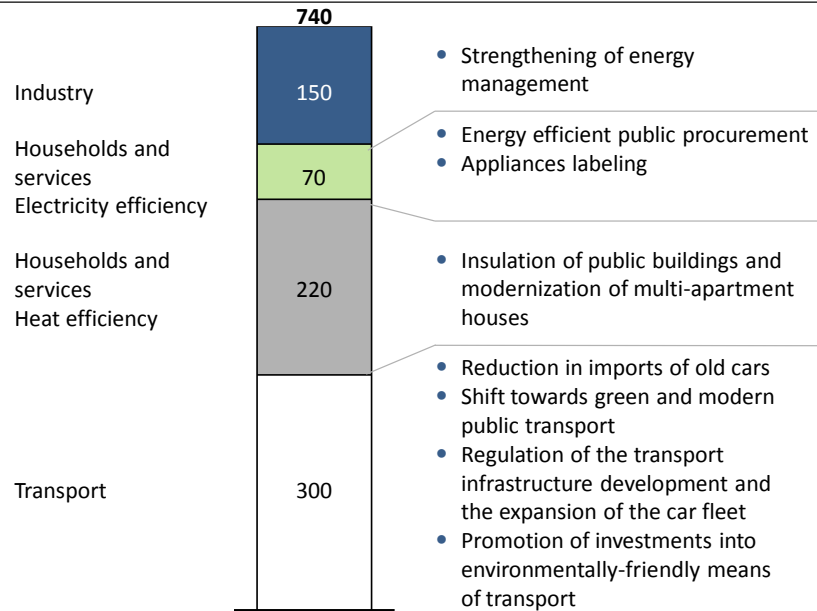
- i. **Energy efficiency in residential and public buildings.** Energy efficiency will be increased by insulation and modernization of buildings. It will bring 220 ktoe energy annual savings from heating and 70 ktoe savings will be reached by more efficient public procurement, and labeling of appliances.
- ii. **Energy efficiency in the transport sector.** Energy efficiency of the transport sector will be improved by reducing the imports of old cars, a shift towards modern public transport, optimizing transport infrastructure and promoting investments into environmentally-friendly means of transport.

F1 Insulation and transport improvements are the biggest energy efficiency levers

Energy savings till 2020

Ktoe

Major levers



Current situation

- Insulation – very slow progress (details in the heat section)
- Transportation – Ministry of Transport and Communication identifying specific measures to achieve potential

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Strategic Outlook for 2020–2030

By 2030 the energy efficiency of Lithuanian energy sector will be gradually approaching the EU average. The government will set strict energy efficiency norms for new buildings and will take measures to increase energy efficiency in the transport sector. The country will aim for at least 1.3% annual improvements in energy efficiency.

G. Environment and CO₂ Reduction

G Environment protection and CO₂ reduction strategy

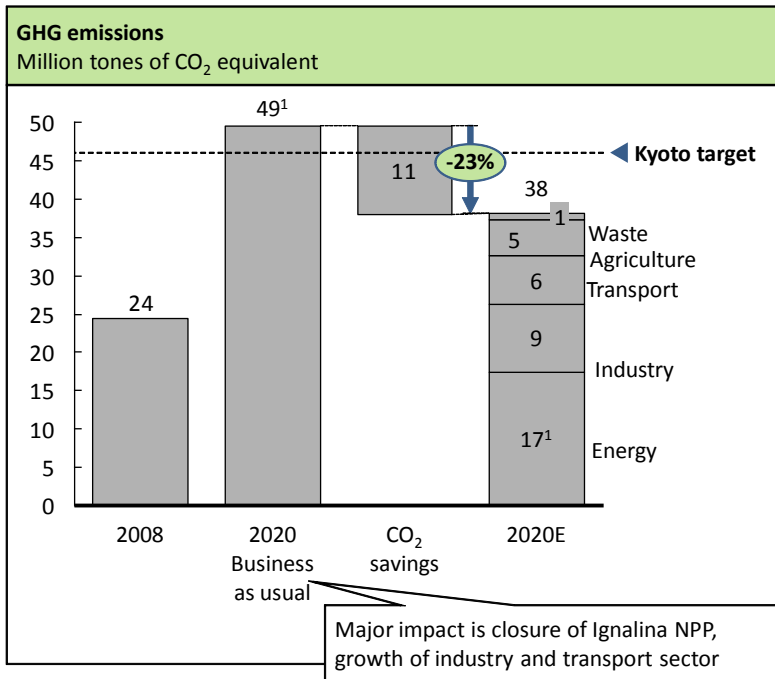
Vision	Strategic initiatives
<ul style="list-style-type: none">Energy sector is environmentally friendly and meets international environmental conventions such as the Kyoto protocol, EU Climate Change Package (CO₂ – maximum rise of GHG production till 2020 by 15 % compared to 2005)	<p>① Several measures are in place to decrease the emission levels – those related to the Ministry of Energy are:</p> <ul style="list-style-type: none">Construction of a new nuclear power plantIncrease in production of energy from renewable energy sourcesEnergy efficiency measures <p>Lithuania will meet all relevant targets of EU and international environmental conventions in 2020</p>
Current situation	
<ul style="list-style-type: none">Sharp decrease in CO₂ emissions after 1990Increase of CO₂ emissions in 2010 due to closure of Ignalina NPP and increased use of older thermal plants whose operation is based on fossil fuelsIncrease in CO₂ emissions has been mitigated by importing a part of electricity from abroad	

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Up until the end of 2009, Lithuania had a good record of greenhouse gas (GHG) emissions. However, at present Lithuania is facing a major rise in greenhouse gas emissions due to the closure of Ignalina NPP and the resulting increase in use of older thermal power plants.

The potential for the reduction of total emissions by 2020 is 23% compared to the emissions in 2008. The industry, agriculture, and electricity production sectors have most potential for the reduction. There is a potential to reduce the emissions by approximately 20–30% in each of the three sectors. GHG emissions in the transport sector can be curbed by 5–10%.

G1) Currently planned measures in CO₂ reduction are sufficient to meet international targets



- Currently planned measures for CO₂ reduction sufficient to meet Kyoto target
- Specific target is set by EU on non-ETS GHG (all apart from energy and industry) – max. 15% increase over 2005 production will be also met as projections indicate max 14% increase

¹ Exact size dependent on the share of electricity imports versus local production in 2020

Lithuania is already taking a number of measures to decrease the level of CO₂ emissions. Three measures, which are thoroughly described in other parts of the Strategy, will have the largest impact.

G1. Measures that will allow to decrease emissions of greenhouse gas by 23%:

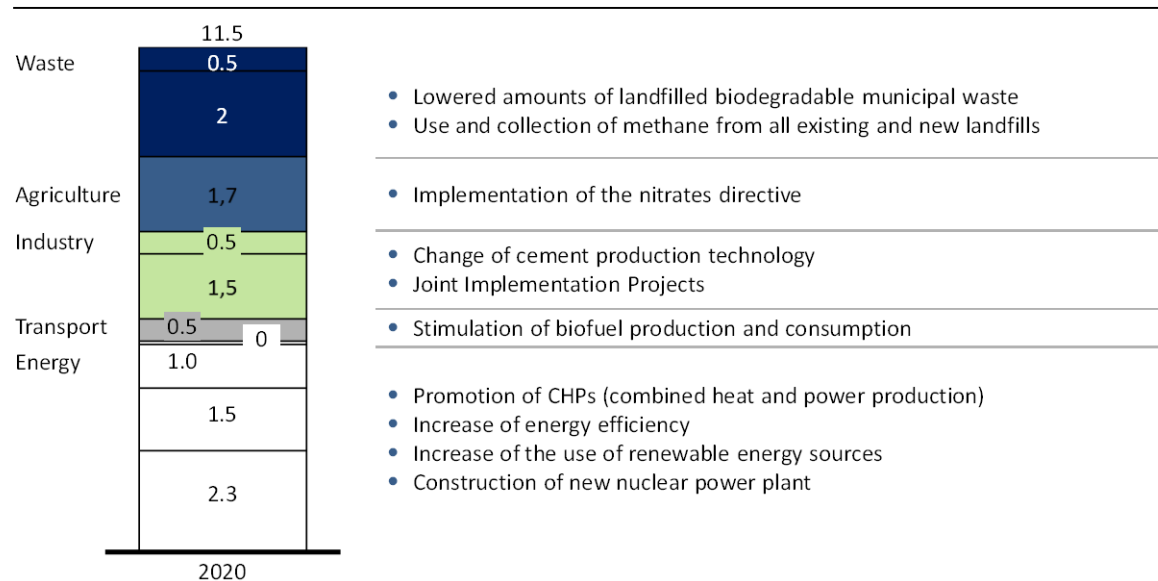
- i. Construction of the Visaginas nuclear power plant;
- ii. Increasing energy production from renewable energy sources;
- iii. Increasing efficiency of energy consumption.

G1 Several planned projects have significant impact on expected greenhouse gas emissions in 2020

GHG savings

Million tones of CO₂ equivalent

Main GHG savings levers



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Timely and comprehensive implementation of these measures will enable Lithuania to tap the full potential of curbing GHG emissions and limiting their maximum increase to 15% by 2020 compared to 2005 as required by the EU Energy and Climate Package. If the three initiatives are not implemented, more expensive options of reducing the emissions will have to be taken.

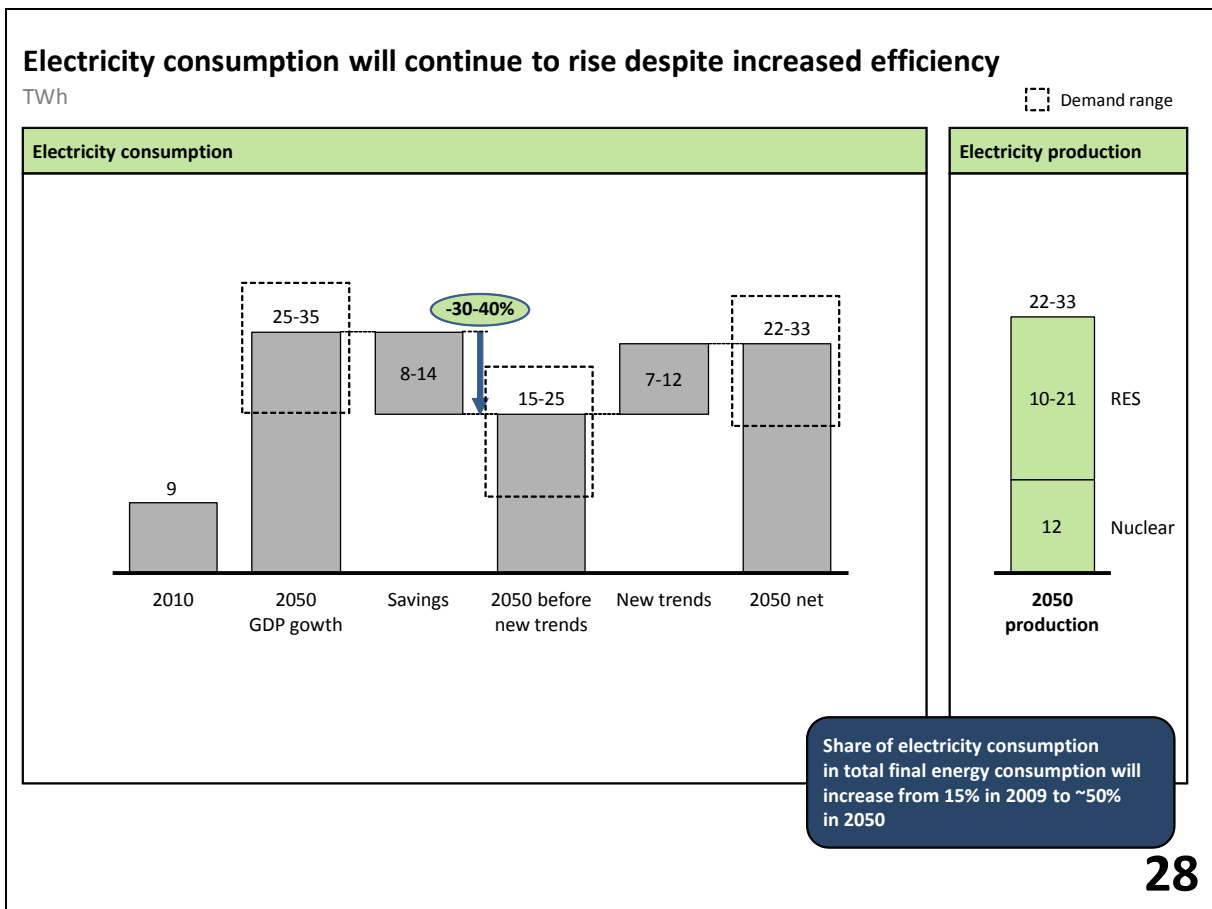
In the period till 2030 the emissions of GHG will further decline due to continuous increase of energy production from renewable energy sources and gains in the efficiency of energy production, transportation and consumption (on average by 1.3% annually).

Lithuanian Energy Sector through 2050

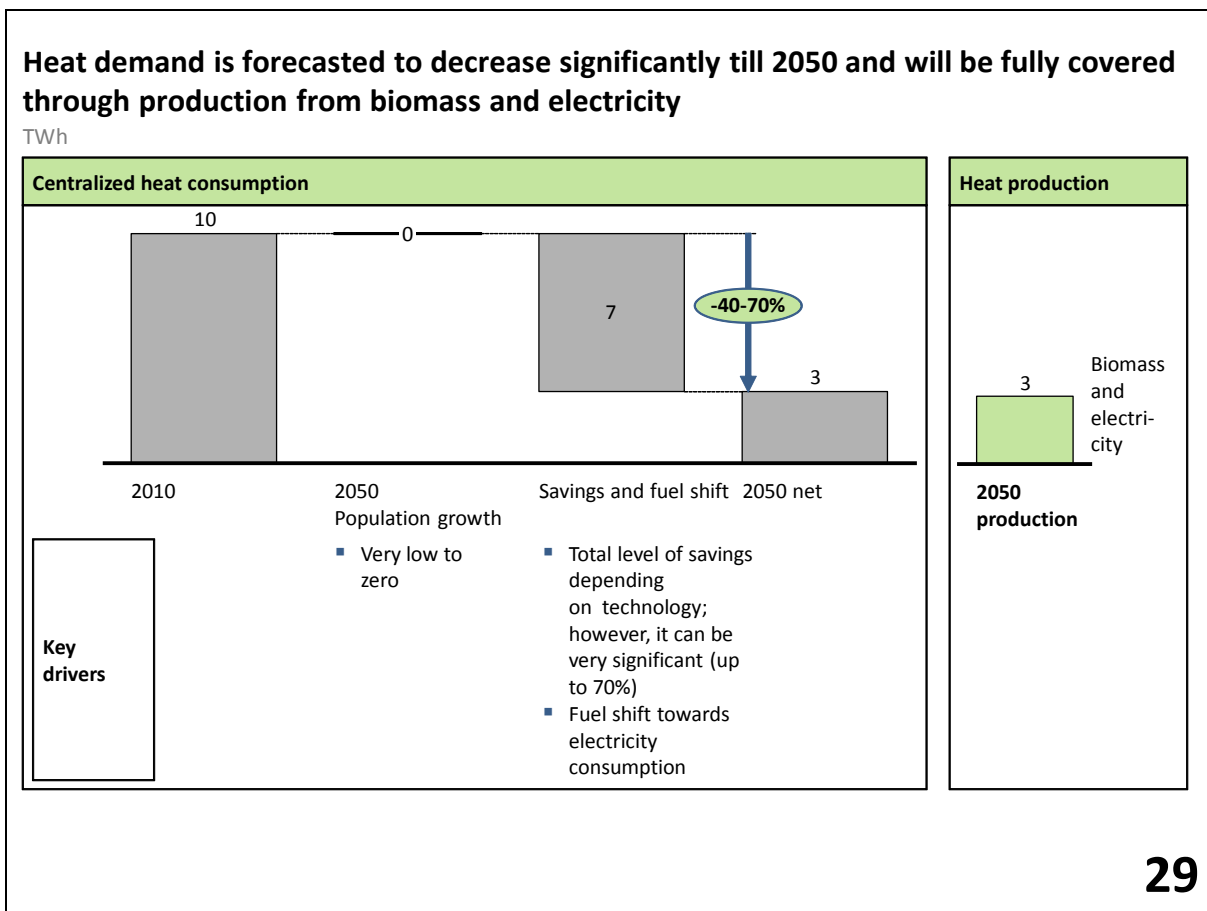
Strategy's key objective for 2050 is the increased focus on sustainability in the energy sector. The basic principles of the energy sector will remain the same: energy independence, sustainability and competitiveness. In line with EU policies and in order to create a more environmentally friendly energy sector, the State will strive to make the energy sector as sustainable as possible.

Lithuanian energy mix will gradually shift towards production based only on carbon free fuels:

- i. Electricity production will shift towards only nuclear power and renewable energy sources;
- ii. Heat will be produced only from renewable energy sources;
- iii. There will be a significant increase in energy consumption efficiency.



In 2050 Lithuanian consumers will use significantly more electricity (22–33 TWh), mostly due to a shift towards use of electricity-based technologies and electric vehicles. After 2030 electricity generation will gradually become more decentralized and, in order to provide for adequate functioning of the electricity system, the State will need to create a legal and functional decentralized electricity regulation environment. A system that will efficiently balance centralized and decentralized electricity generation will be created. To this end, higher investment levels into economically beneficial smart grid technologies will be necessary.



It is expected that in the period till 2050 breakthrough technological changes will occur having a profound positive impact on the energy sector. One of the areas of improvement will be the heating sector, where technological improvements in energy efficiency will lead to up to 70% reduction of heat used as compared to 2009.

In the long run, economics of current technologies will change substantially and new revolutionary technologies that are not yet known or widespread might become dominant in the energy sector. Technologies like efficient electricity storage, wireless power distribution, energy

production based on hydrogen and mini nuclear power plants are promising but not yet suitable for large scale use.

Lithuania will timely react to the predicted technological development. In order to stay competitive and make good use of new trends and technologies, **Lithuania is going to:**

- i. **Develop its own capabilities and competences.** This includes training of specialists and developing scientific research in areas most relevant to Lithuanian energy sector, in particular: nuclear energy, nuclear safety, nuclear waste management, nuclear decommissioning, power system management and environmentally friendly technologies (bio-energy and CO₂ management).
- ii. **Monitor existing technologies** that are promising but not yet economically beneficial for development in Lithuania. Among others, 3 technologies will be followed: electric cars (until it is proven as a dominant trend in transportation), carbon capture and storage, distributed generation and energy storage.
- iii. **Analyse new tendencies in the energy sector**, choose and adopt technologies suitable to Lithuania.

With regard to sustainable development of the energy sector, it is important not only to consider the technological dimension, but also to promote awareness on energy saving in the society. With a view to increasing efficiency of energy consumption in multi-dwelling buildings, transport, trade and service sectors, Government will devise programmes on changing consumer habits in the society. These programmes will, first of all, include:

- i. **Informing** – constantly providing information to consumers about energy-efficient products, alternative energy sources and ways to save energy in daily life.
- ii. **Motivating** – creating favourable financial conditions for consumers to purchase energy-efficient products and encouraging them to save energy by means of mass media.
- iii. **Obligating** – energy saving as an obligatory social norm.

The National Energy Strategy will be continuously updated to keep track of technological and infrastructural developments in the energy sector.

Lithuanian National Energy Independence Strategy needs to be continuously updated

Reaction of Lithuania to dramatic technological development

Develop own capabilities and competence

- Training of specialist and scientific research supporting topics most relevant to the Lithuanian energy strategy and to build and export competence
 - Nuclear energy, safety and storage of nuclear waste
 - Decommissioning of nuclear power plant
 - Build up of new nuclear power plant and related supply chain
 - Environmentally friendly technologies (bioenergy and CO₂)
 - Biomass production
 - IT and grid competence

New trends

- Positive attitude towards new trends
- Constantly following new trends in the energy sector and selecting of technologies suitable for adoption

Wait and see

- Wait and see approach for certain technologies – adopt once proven and economically feasible for Lithuania
 - Electric cars – wait with major investments into infrastructure until it is proven as a dominant trend
 - CCS – given current technology, no capacities available
 - Distributed generation and energy storage

Update Strategy every few years to reflect on these changes

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