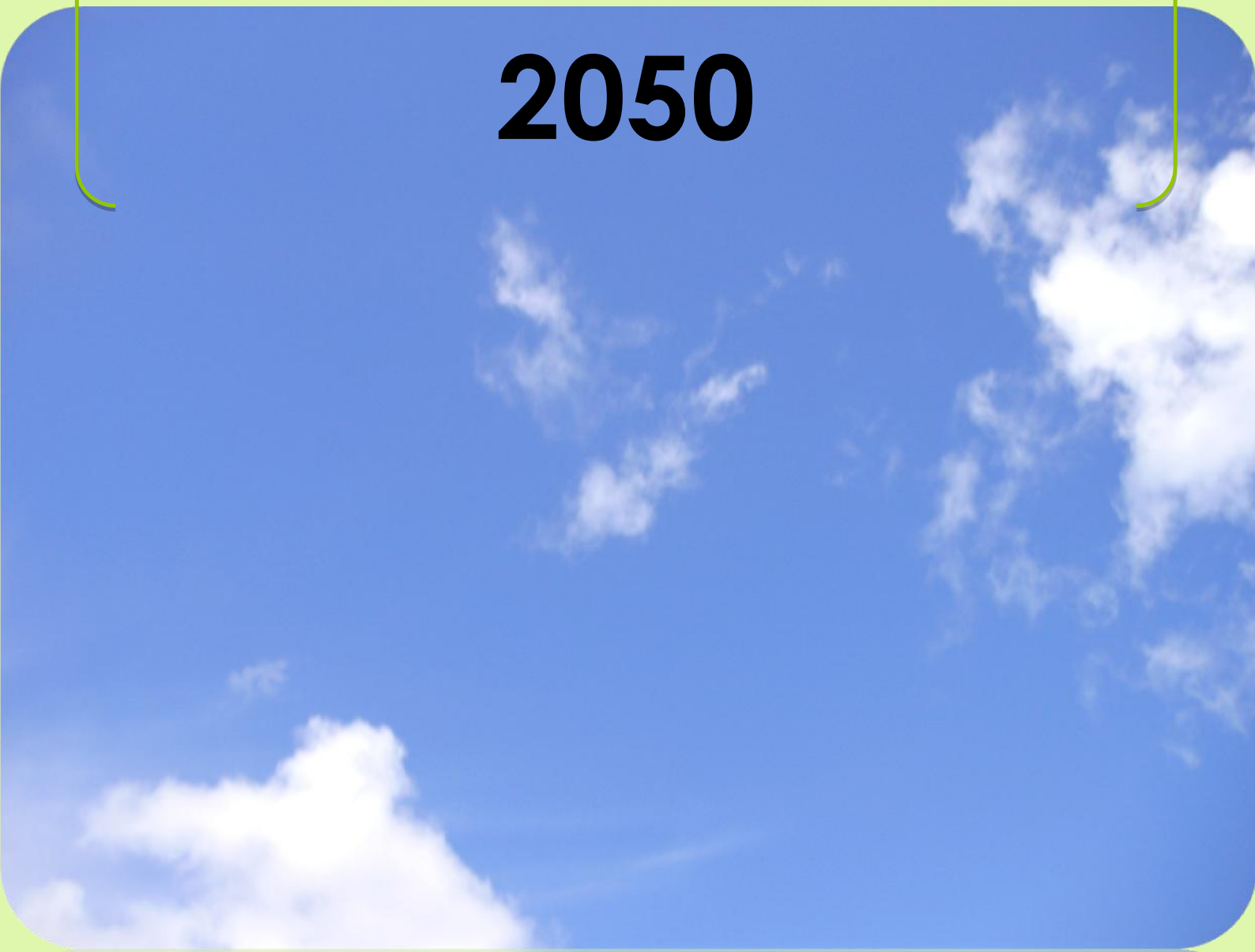
Green Energy Strategy Of Latvia

2050



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Scientists of the Riga Technical University Institute of Environmental Protection and Heating Systems have created the Strategy for the Green Energy 2050, which is based on the studies of energy efficiency increase and implementation of measures related to renewable energy resources in Latvia carried out over the last five years. The strategy sets short and long-term objectives for sustainable development of the energy sector. In order to achieve reduction of energy consumption and independence from fossil fuels, the drafted strategy involves 3 parallel avenues: adjustment of energy consumption by launching energy management policies on the national level, introduction of new technological solutions and expansion of applied scientific research starting from the modelling of the national energy policy and ending with creation of innovative energy technologies. The strategy incorporates the solutions to the existing challenges that are important today, such as lowering the cost of heat within 2 to 3 years, as well as those aspects that will become essential in the next 5 years, for example, the balance of use of biomass, wind power, sun power and other renewable energy sources.

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1. New Era of Energy Policy

It's high time to address drafting of a sustainable energy strategy and implementation of goals sustained therein. Over the last decade, the leading Member States of the EU policy have not just contemplated the development of the Green Energy: they have implemented these ideas on their national level. Currently, new goals have been set forth: many EU Member States have elaborated their energy industry development strategies where the Green energy industry strategy of Denmark 2050 drafted and adopted by its government, stands out as the most challenging among them.

Latvia has undertaken 4 types of international commitments, directly underpinning the national green energy growth opportunities:

- **Energy efficiency increase on the end user side within the period 2009 - 2016.**
  - 9% energy consumption decrease;
- **Expansion of use of Renewable Energy Resources (RER) in the energy sector by 2020.**
  - Proportion of the end use - 40% (33.6% in 2010);
- **Expansion of RER use in transport by 2020.**
  - Proportion of bio fuel by energy storage - 10% (In 2010 – 2.3%);
- **Dynamics in Greenhouse Gas Emissions' (GGE) reduction over the period 2013-2020 (compared to 2005):**
  - -21% ETS (members of the EU Emissions Trade Scheme) sector;
  - +17% non-ETS (emissions outside EU Emissions Trade Scheme) sector.

Latvia can and is able of meeting the challenge posed by the leading EU Member States to follow the energy strategy of growth. This country is fully capable of adjusting its economy in a coherent way, friendly to environment and climate.

The state long-term energy strategy outlines realistic goals describing the long-term development hypothesis (2050) and comparing the projected goal against the real achievement mid-term, which initially could be defined as a 2-year period but starting with 2020 – as a 5-year period. That means guidance of the energy sector towards flexible development and shaping of a realistic energy consumption management on the national level.

The national energy supply strategy should concentrate on elements highly promising to achieve:

- From the point of view of cost-effectiveness economically justified development of the energy sector;
- From the aspect of the climate change mitigation and environment pollution ecologically justified development of the energy sector;
- Transport system independent of fossil fuel.

The implementation of this process and the priority sectors are determined by costs and development of technologies. Therefore to achieve independence from fossil fuels, the strategy should contain at least three parallel avenues which would merge together here and there to branch off again.

1st Avenue

Transition to more energy-efficient energy consumption and use of renewable energy resources:

- Higher energy efficiency of use;
- Increased application of biomass and biogas;
- More renewable energy from off-shore and land wind power.

2nd Avenue

Integration of new solutions in the energy sector and transportation system:

- Green transport sector;
- New age in energy policy management;
- Transition from fossil fuel to independent energy system on the national and regional level.

3rd Avenue

Research, development and demonstration:

- Modelling of the national energy supply system, establishment of progress monitoring and control system thereof;
- Detailed demonstration and preparation for a high market demand. Integration in the transport sector and energy network;
- Growth of the green energy supply system on the basis of research, demonstration and preparation for the market demand.

1.1. Transition Principles to Energy Independence

The principles incorporated in the Green Energy Development Strategy of the national energy industry sector comprise financial, environmental, climate, socio-economical and management aspects.

- ***Cost Efficiency.*** Cost efficiency measures are economically justified; they ensure a maximum energy supply security and a high reduction of the fossil fuel use relative to each LVL invested.

  Consequently, there is no emphasis on large-scale equipment requiring high investment.

  Contrary to use of expensive technologies, full attention should be paid to research, development and demonstration which could increase the competitiveness of these Technologies long-term with lower inputs.

- ***Minimum Impact on Public Funding.*** The cost and benefit distribution for transition to the so-called Green Growth should not cause adverse effects on the government budget. All outlays should be fully covered by consumers of energy resources (both, enterprises and households).

- ***Renewed Competitiveness.*** Implementing the transition of the Green Growth, it should be noted what impact the latter would exercise on the competitiveness of the business environment in Latvia. The mechanisms of price and tariff formation and factors influencing them should be transparent and predictable in long-term to facilitate taking of relevant decisions by consumers and investors targeted at further growth.

- ***Flexibility Principle.*** The forecasts of the energy sector development are based on regular analyses of the operation and management of the energy sector, furthermore, the implementation of new technology solutions should be adjusted to processes taking place on the European Union and global energy market, e.g., in case of the price increase for biogas, a transition should be made to less costly renewable resources (wind, solar power etc.) with the help of higher investment.

- ***Full-bodied Use of the International Cooperation.*** The transition process should make use of all opportunities available globally and in the European Union. An isolated country from the point of view of power resources is not our goal. Latvia should start uptake of advantages offered by the international market.

- ***Security of the Energy Supply System.*** There should be a secure national energy supply system in place, however ensuring of security measures must be commercially justified. The existing practice of achieving security through investment into high power energy units should be discontinued. The security of energy supply must be achieved through modern diffused production and smart network technologies. The energy prises will be stabilised by lower primary power consumption and essential reduction of the fossil fuel.

- ***Bottom-up Model.*** Involvement and activity modelling of every energy consumer is more suitable to Latvia's energy sector as the whole as it provides better opportunities for implementation of realistic energy efficiency and renewable energy resources' projects on the consumer side as well as achieve reduction of the fossil fuel use.

- ***Support to Centralization Principle in Heating Supply.*** A centralized heating supply through the heat load centres is commercially more advantageous and more friendly-to-environment and climate than construction of individual boiler systems for heating. The business economy principle should be observed, i.e., the wholesale goods should cost less than retailed goods.

- ***Flexibility of Energy Industry System.*** Renewable resources should be selected which are commercially justified from the point of view of the circulation cycle analysis, as well

as environmentally and climate friendly. The amounts of their use should vary depending upon prices, availability of resources, development of innovative Technologies and impact on the climate change mitigation policies.

- ***Market Model.*** In the transition period to the Green Growth, competitive electric power and energy resources' markets (e.g., of natural gas) should be established. The progress of the country towards a united Nordic Countries' electrical energy market and revision of the transmission system operator's surcharges which are higher in Latvia than in other countries will make a beneficial impact on the competitiveness of this country.
- ***Business Model.*** The production, management and marketing of the heating power and electrical power should be based on business economy. Within the transition period to Green Growth, co-funding is available exclusively in case of full withdrawal of subsidies for fossil energy resources in any form of the power production and transition to use of renewable energy resources.
- ***Gradual Approach.*** The issues related to use of the renewable energy resources and increase of the energy efficiency should be addressed step by step observing priorities and avoiding implementation of all measures simultaneously.
- ***Sustainable Development Model.*** Energy network system development must be a long-term process thinking 30-40 years ahead in regard of natural resources, mitigation of the climate change, socio-economic development etc.
- ***Level Mark Model.*** The heat energy tariff regulation model should be urgently adjusted to motivate the owners of the energy sources to increase energy efficiency and seek commercially sound solutions of the operation of energy sources. That could be a long-term solution.
- ***Assessment Model.*** Setting forth of the goal is not sufficient to implement the intended measures. Controlling and monitoring measures must be put in place for analysis and assessment of the intended operational measures and making of adjustments if appropriate to the further steps towards the Green Growth.

1.2. Wide Spectrum of Energy Policy Instruments

The government strategy should incorporate a wide spectrum of ambitious energy policy instruments:

- Measures immediately influencing Latvia's energy policy (1st avenue);
- Measures planned and prepared for transition to energy-efficient independence from fossil fuels (2nd avenue);
- Measures targeted at development and improvement of energy technologies (3rd avenue).

Energy efficiency improvement measures and use of the renewable resources over the whole territory is no less important In Latvia.

The Strategy mostly comprises incentives related firstly to efficient use of biomass as a national wealth and secondly – to well-considered uptake and gradual integration into energy network system of power obtained from the Sun.

1.3. Strategy of Essential Impact and Benefits within the Context of the State Economic Development

The Government Strategy outlines a road of transition from fossil energy resources to independent energy supply, emphasizing the energy consumption reduction and justified application of the renewable resources as most essential issues of the first decade.

In Latvia, a relevant and stable experience has been acquired in use of the renewable resources for operation of the centralized heating supply boiler systems; already in 2011 and 2012 it can be immediately transferred to energy sources with high tariffs for thermal energy.

In long-term, the Green Growth incentives will enable to reach a lower energy consumption and higher proportion of the renewable energy resources, as well as ensure the energy supply security, reduce greenhouse gas emissions, open up good business opportunities for Latvian entrepreneurs and implementation of the climate solutions in Latvia and globally.

1.4. Less Fossil Fuel

The new government incentives in more efficient use of the biomass and more targeted application of the European Union co-funding will allow reduction of the fossil fuel consumption and achievement of 40% proportion of renewable resources in the total volume of the energy end use.

Although the implementation intensity of both above measures has been slower than planned, Latvia is still fully capable to meet the targets of 2020.

The research study of 2008 on implementation opportunities of the feasible measures and projection for implementation of the EU goals [RTU IEPHS] according to the Green Scenario (see the middle column of Figure 1) demonstrates that contrary to data provided by CSB (see column on the left of Figure 1) the results of 2010 have moved away Latvia from reaching its goal.

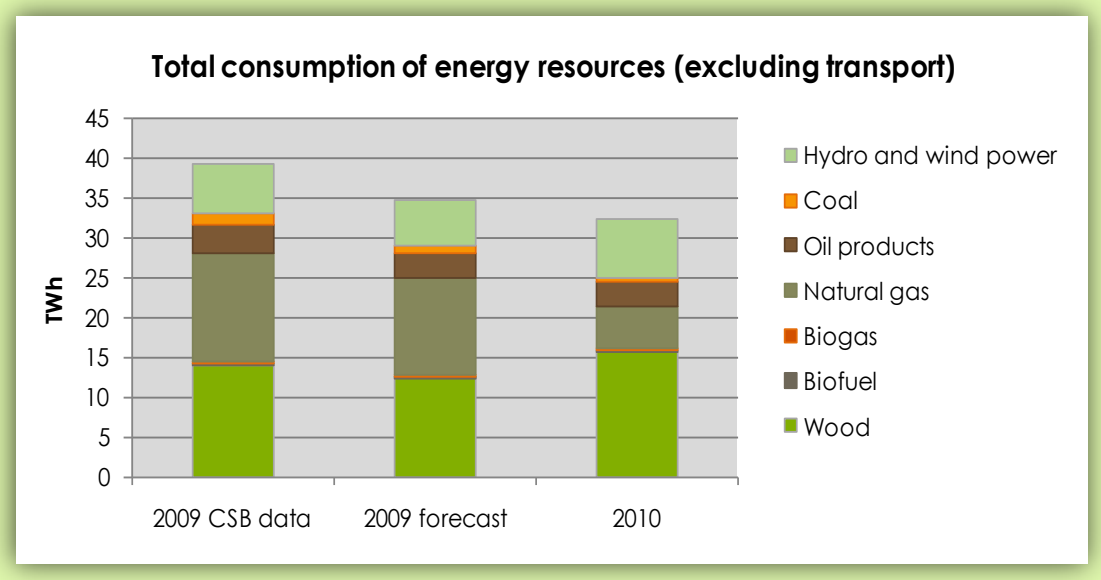

Figure 1. Consumption of the fossil fuel and RER in 2010 and 2020.

That means, the current policy instruments are evidently too weak and incapable of ensuring delivery of the intended targets, furthermore, not only the energy consumption has grown but also the proportion of the natural gas in the overall energy audit has increased. *Eurostat* data demonstrate that the increase of the natural gas use in 2009 was by 5.4% higher than in 2008, while in 2010 – by 3.3% higher than in 2009.

In case Latvia undertakes to develop the Green Growth over the next half of the century, the national energy sector will have to make a huge step forwards in use of the renewable energy resources discontinuing the use of fossil fuels. Latvia has started to move towards the green energy industry since the restoration of independence and by 1999, the collapse situation of the industrial sector from the point of view of energy resources consumption had stabilized (see Figure 2). After the year 2000, the fossil fuel consumption statistics show the increase. Projecting changes in the fossil fuel consumption, account should be taken of the national energy policy measures, because no delivery of the green targets will be possible without them.

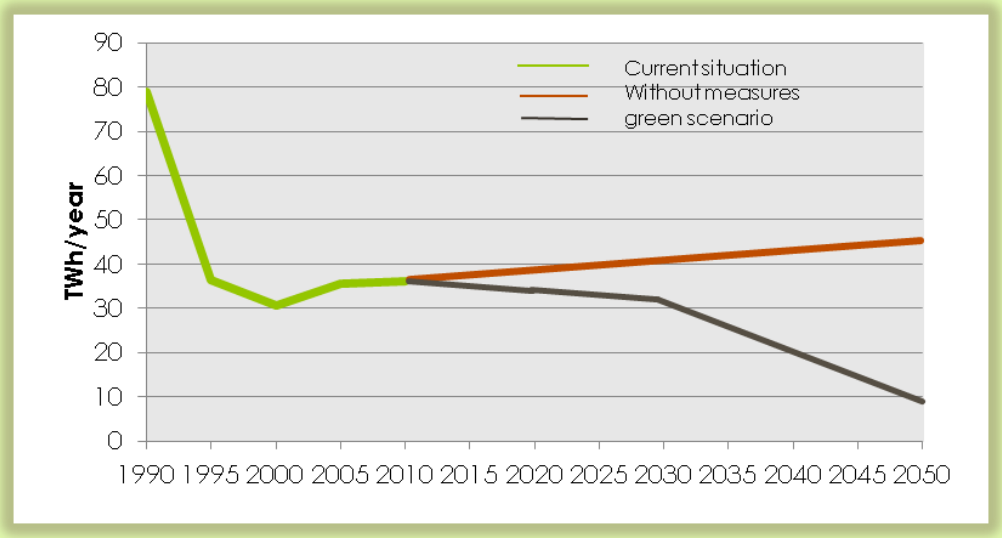

Figure 2. Consumption of fossil fuels in 1990 – 2050 (including transport)

The period from 1993 to 1999 was the time of challenge for adjustment of the centralized heat supply system over which 20 local boiler houses were upgraded replacing fossil fuel with wood chips with the help of credit lines provided by governments of Sweden, Denmark and the Netherlands and advice of international and local experts. The appropriateness of the process steps introducing the boiler houses powered by wood chips can be ascertained also nowadays when other energy sources co-funded by the EU have been joined to the system. They have resulted in the concrete heat energy tariff values of the Latvia centralized heat supply system: in bio mass based boiler houses the energy production tariff is even two times lower than that of the energy produced in a natural gas-powered boiler system.

The economic data and the practical experience acquired is slowly dissolving the myth of comfortable gas-power boiler houses being the sole and only appropriate solution. Together that certifies the role of knowledge and information in the implementation of measures related to renewable energy resources.

To complete the optimum fossil fuel reduction scenario in 2050, the measures started in 2020 will not be sufficient, new impulses and incentives will be needed after that date.

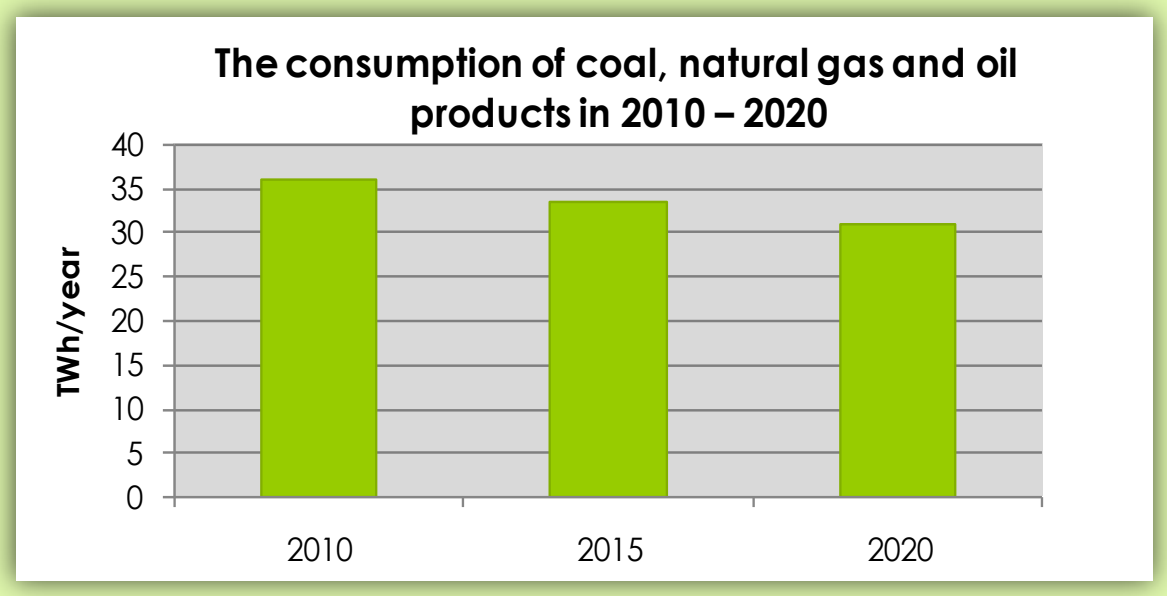

Figure 3. Use of fossil fuel in energy sector in 2010 – 2020 (transport sector included)

This country enjoys some experience in use of the renewable energy resources in the energy sector however the situation in the transport sector is different. There the renewable energy resources should reach 10% proportion in 2020. Having in view the current progress (3.77% in 2010), the green target in transport sector is reachable if first real measures are planned already in 2012 and gradually continued over time.

1.5. More Renewable Energy

The commitment of the government to enlarge the role of renewable energy resources will enable reaching of the goal incorporated in the EU energy and climate package: in 2020, the proportion of renewable resources in the final consumption of energy is 40%.

Thus Latvia will continuously occupy a position among the most progressive renewable energy user countries on the European Union and Global level.

In the period up to 2020, the main emphasis must be on a more complete use of biomass, without neglecting the use of the wind

energy after 2020 and use of the sun energy primarily in multi-apartment houses thus ensuring hot water supply.

Electricity production from renewable energy resources finds itself in a specific situation. Despite the ability to achieve the energy supply from renewable resources in the amount of 70 – 80% already in this decade, the regulatory enactments and policy instruments in force, hinder this development. The government should change the existing mandatory procurement system, where the sources of renewable energy must compete on equal basis with the fossil fuel powered co-generation stations. The tariffs of the natural gas cogeneration (condensation) stations incorporate their installation cost essentially discriminating the set-up of renewable energy power stations.

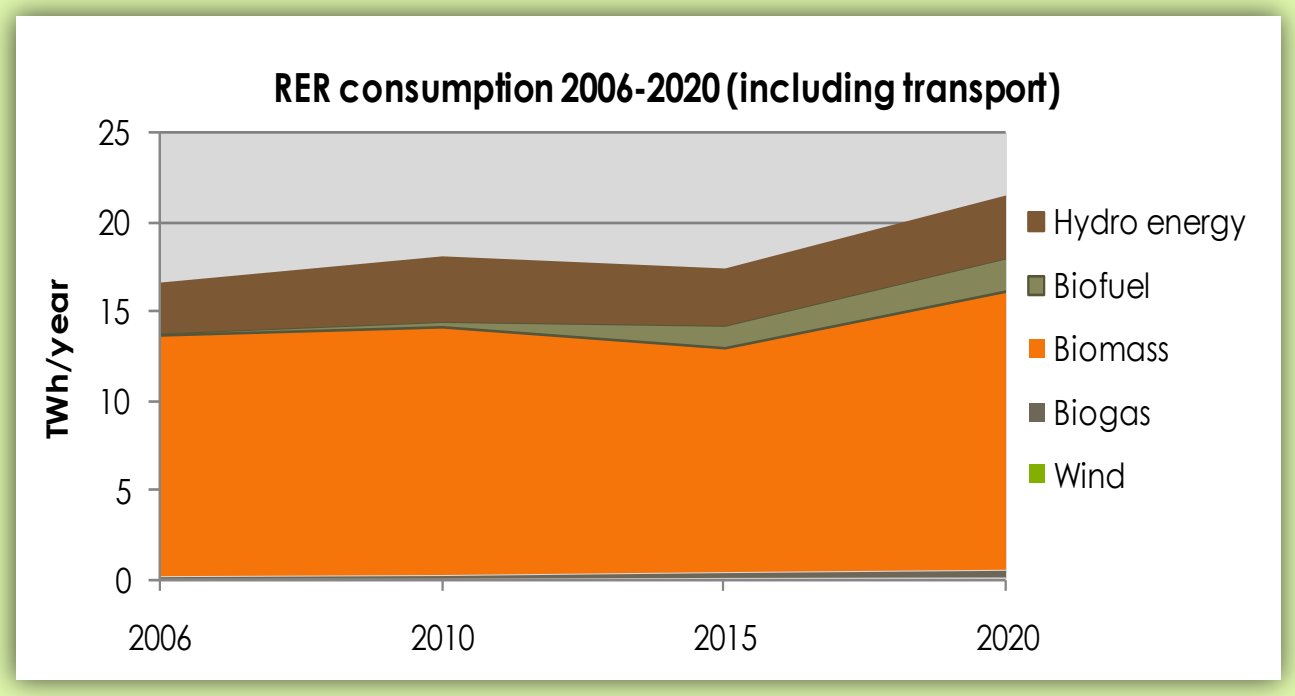

Figure 4. More renewable energy in 2006 – 2020

The government should define precise conditions for use of renewable energy resources for heat and electrical energy production long-term. They should be based on area development plans incorporating power plans.

1.6. Lower Energy Consumption from 2006 to 2020

The energy final consumption predictions make use of the time models projecting future events on the basis of the past events and trends, final consumption models projecting the consumption for every group of energy consumers on basis of the consumption history and polling, as well as econometric models: a complex and robust analysis including the variations in the number of population, economy, energy consumption alterations and structural changes.

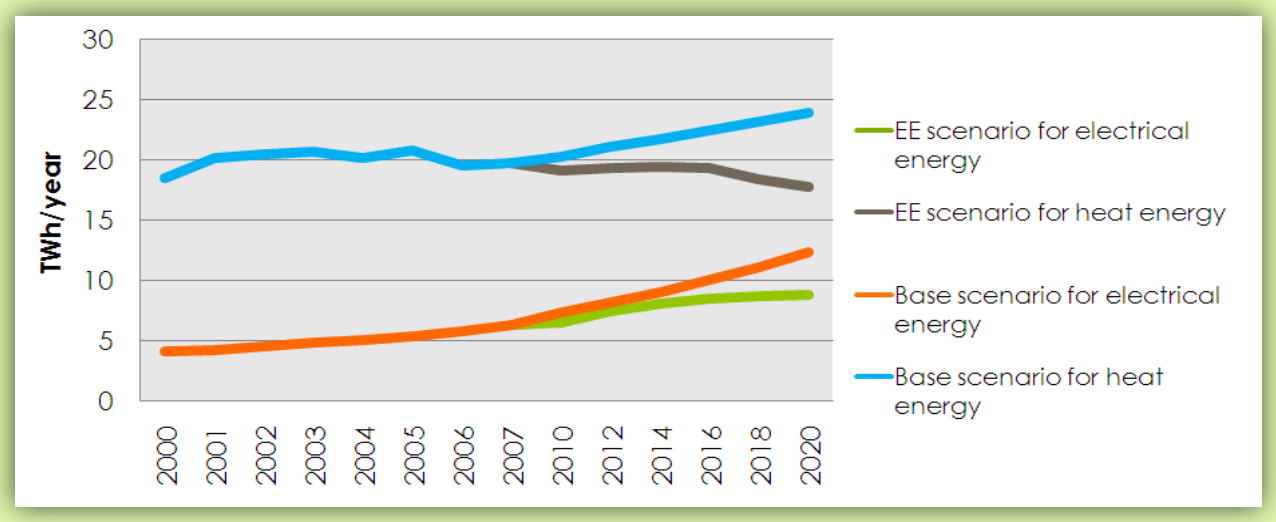

Figure 5. Total final consumption of electrical and heat energy for both projected scenarios

Figure 5 compares the heat energy and electrical energy final consumption projected scenarios: - „Base scenario" and „Average final consumption of the EU in 2004". The final consumption projections of the former are based on energy intensity indicators of Latvia in 2007, future GDP growth, alteration in numbers of people's homes corrected by the final energy efficiency pursuant to the „First Energy Efficiency Action Plan of Latvia for 2008 – 2010" [5]. The latter scenario is based on a future GDP growth, alteration in numbers of people's homes and assumption that Latvia's economy will reach the average energy intensity indicators of the EU Member States around 2015.

According to the Base scenario the heat energy consumption will see a yearly increase while according to the "Average final consumption of the EU in 2004" by 2016 it will grow very insignificantly starting to decrease post 2016. That is explained by the implementation of energy efficiency measures in all sectors especially in household consumption and services sector. The final consumption of electrical energy will grow according to both scenarios, while following the latter scenario its growth rate will largely slow down around 2016, because the average consumption level of the EU 2004 will be reached by then both, in the sector of services and in the sector of homes.

1.7. High Security of Energy Supply

According to the EU energy and climate package of 2020, Latvia has committed itself to reduce the energy consumption by increasing the energy efficiency (in the sectors of household, services, agriculture and partly also in the industrial sector, energy sector, transport and others) and implement changes in the balance of energy resources in the direction of increase of renewable resources.

At the same time, this means less dependence upon fossil energy resources and lower energy consumption contributing to increase of the energy supply security. On the other hand, the dependence upon renewable energy resources relates to other aspects of energy supply security as well as new challenges. The lower consumption of the primary energy and essential reduction of fossil fuels will stabilize the energy prices and reduce the impact of energy supply crises.

Hydro-power, energy of biomass, wind and the sun enables diversification of the energy resources and provides a key to justification of the energy security solutions. It provides higher energy supply security than dependence upon fossil fuels, the conditions dictated by their suppliers and commercial advantageousness.

The government is capable of ensuring a high energy supply security level both short-term and long-term

Latvia possesses power grid interconnections and alongside an opportunity to receive the lacking energy from the neighbouring countries a capability of transferring the surplus power across the border but the power of the existing interconnects is insufficient. Establishment of a wide network of interconnections is one of the main guarantees security and competitive price.

Latvia is capable of solving issues related to diversification of its electrical energy markets from its neighbouring states (Nord Pool and Network of Russia), providing a stronger development of infrastructure and changing the energy production and consumption structure, relying more strongly on biogas and biomass (also on wind energy towards the end of the decade), as well as flexible energy consumption.

1.8. Less Greenhouse Gas Emissions in 2050

Alongside with energy industry, agriculture and transport, the sources of the Greenhouse gas emissions in Latvia are also industrial processes, waste management, as well as application of solvents and other products. The distribution of Latvia's GGE by sectors is reflected in Figure 6.

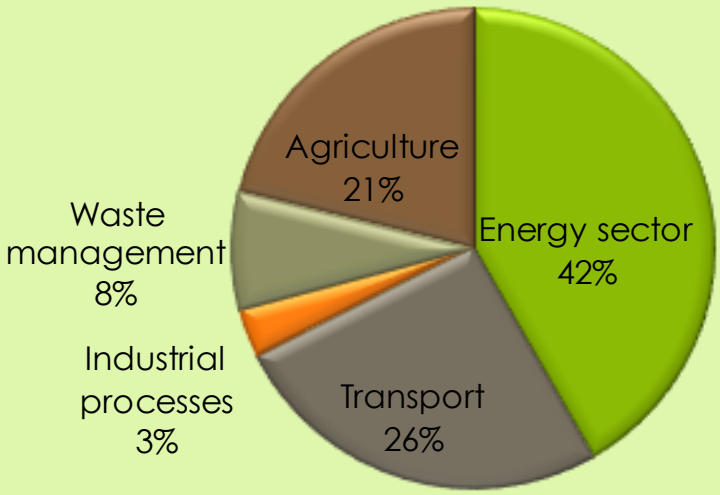

Figure 6. Latvia's GGE by sectors (2009)[1]

The international climate commitments of Latvia for 2020 are expressed in allowable greenhouse gas emission changes for both, the operators of the emission trade schemes (ETS) and stakeholders not participating in emission trade scheme (non-ETS):

[1] Source: Annual national GGE inventory data (www.meteo.lv)

- 21%	In ETS sectors – incineration systems with power above 20 MW, in energy-consuming sub-sectors of industry: cement production, manufacturing of building materials, paper and steel industry;
+17%	In non-ETS sectors – transport, agriculture, waste management, separate sub-sectors of industry, small-scale energy equipment (projection made in 2007).

Lower GGE in 2020 and 2050 are connected with the transition of the energy sector to energy-efficient energy consumption on the end user side, as well as with renewable energy resources: in the period 2013 – 2020 as well as up to 2050, the gradual decrease in use of the fossil fuel will allow to reach the 20% GGE level in the energy sector in comparison with 1990 (see Figure 7).

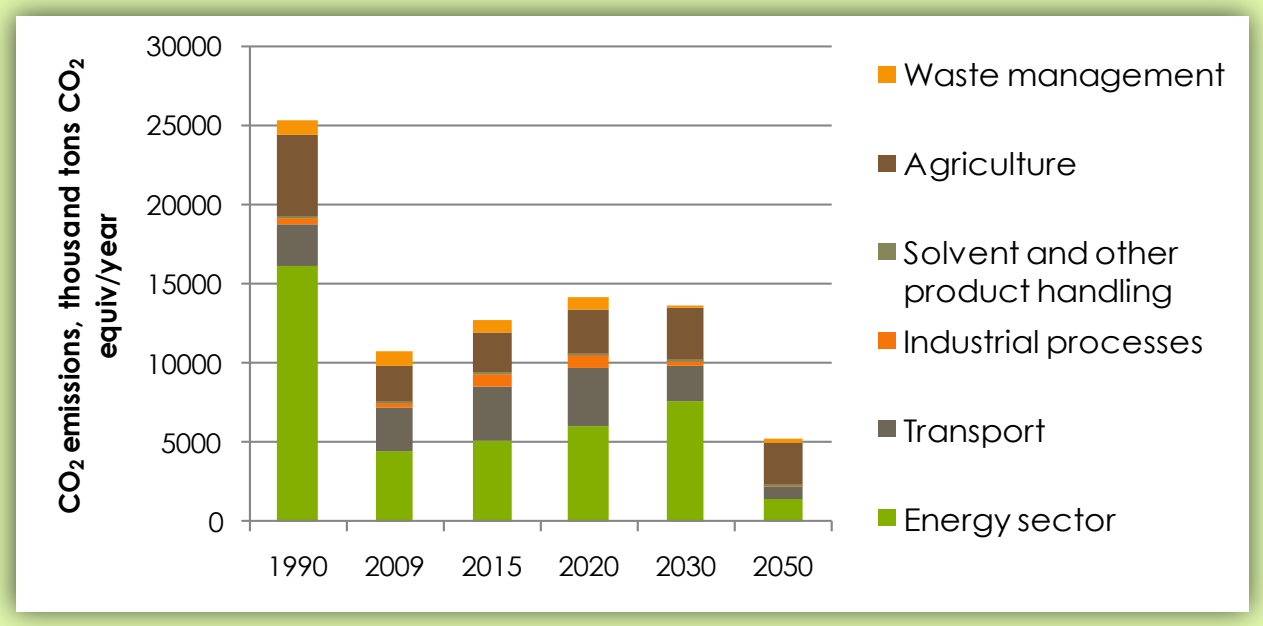

Figure 7. GGE of Latvia in 1990, 2009, 2020 and 2050 (including transport)

1.9. Transition to the Green Growth

Guiding an economically substantiated development from fossil fuels to independent economy, other countries will also work their way towards the green economy eventually resulting in the global growth of renewable resources' technologies and energy-efficient solutions.

If Latvia strives towards the green growth status it should implement measures targeted at research, development promotion, encouragement of demo projects and trials of energy technologies both, on the levels of Latvia's and overseas equipment.

With climate strategies of industrial enterprises and local communities the government will be able to create a new Green Growth economy nationally. It will be implementable through formation of the green technology laboratories and establishment of an innovation fund. The first steps along this road have been made by establishing a national-

importance centre „Environment and Energy", which will benefit from the EU co-financing for acquisition of the laboratory testing equipment.

1.10.New Incentives Loaded with Green Growth Potential

The large-scale new incentives in the Energy Strategy 2050 will help Latvia to develop economically and achieve that innovative energy technologies will contribute to the Green Growth of the country over the next 10 to 40 years. Priorities for the next 10 years will be as follows:

- ***regular analysis of the energy sector development and policy instruments*** using the system dynamics modelling method, which will enable to control and monitor the ongoing activities in the country and energy sector and draft proposals for adjustment;
- ***reduction of energy consumption*** in all power system elements due to increase in energy efficiency on the part of energy producers and energy end-users and reduction in energy loss in power transmission systems, which will allow to reduce the volume of primary energy resources on the national level;
- ***wider and more efficient use of biomass*** for energy purposes, starting from individual heating in a private house and ending with a 100 to 140 MWe CHP plant in Riga due to development of wood and forest residues, fast-growing shrubs and other cultivated crops, improvement of technological solutions for biomass use and increase in energy efficiency;
- ***energy efficient use of biogas*** is associated with establishment of two types of biogas systems: installation of biogas purification facilities to allow biogas to enter the pipelines for natural gas and energy efficient use of biogas in CHP plants, while producing heat and electricity;
- ***use of wind energy*** in the Baltic Sea and on land is associated with the problem of efficient consumption of a high volume of produced electricity due to non-uniformity of wind speed, therefore the simultaneous construction of a wind farm and large accumulator plants (such as compressor plants) will provide the possibility of creating an energy efficient system;
- ***use of solar power*** for heat and electricity production is associated with the purchase of relatively expensive technologies, however the fact that solar energy costs will always be zero is the leading aspect for the future prospects of solar stations;
- ***expansion of smart power grids*** throughout Latvia will provide an opportunity to regularly inform the end users of the efficiency of energy consumption and options to reduce energy consumption.

1.11.Flexible Strategy

It is possible to achieve independence from fossil fuels, only by implementing a set of measures and a systematic approach to provide high energy efficiency within the overall energy consumption. This means that if demand for energy services (lighting, heating, technologies for industrial use, etc.) grows, Latvia will be able to meet such demand by offering renewable energy resources.

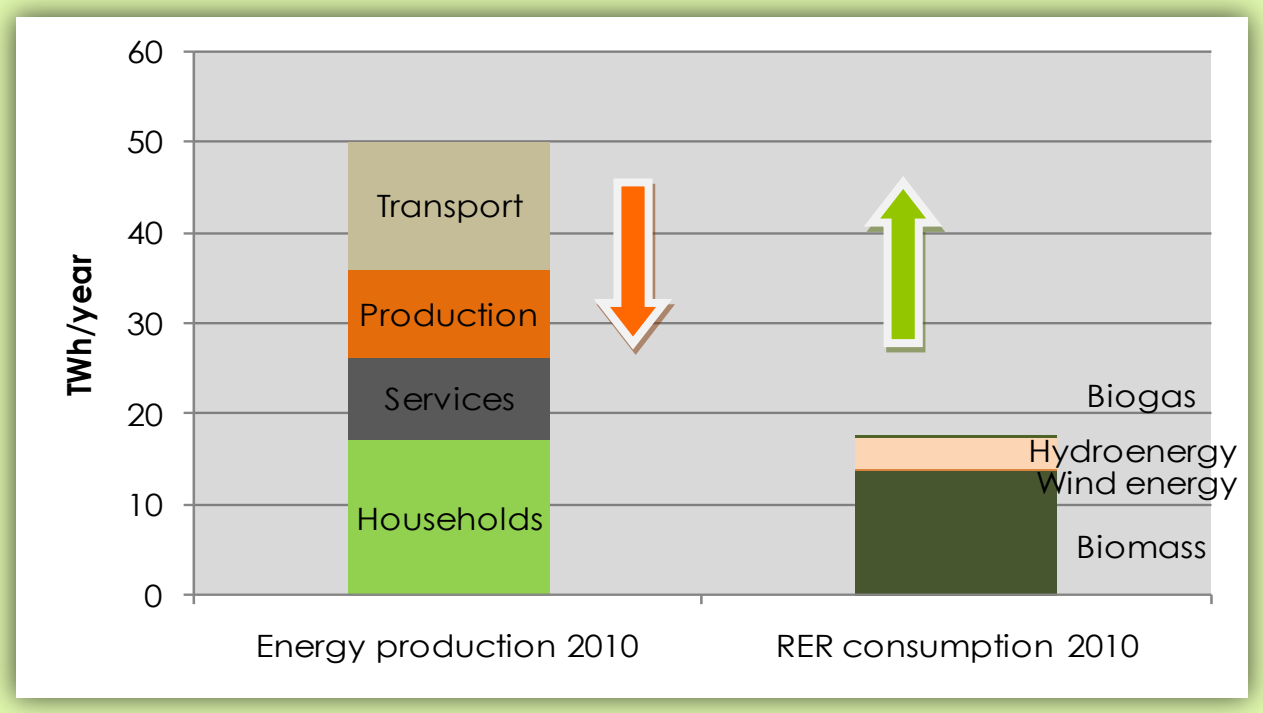

Figure 8. Structure of energy end-users and RER in 2010

The government will provide a strong and economically sound transition to green energy development. Based on the current knowledge and experience, the key focus should be placed on the following elements:

- increase in energy efficiency at all stages of energy supply systems (energy sources, energy transmission and on the energy user side);
- establishment of balanced electric power consumption;
- efficient use of biomass resources (including biogas) in co-generation systems and partly in transport sector;
- increase in the share of renewable energy resources in central and private heat supply;
- broader use of wind energy and other renewable sources of energy;
- changes in the possibilities of use of the existing renewable energy resources, such as water resources; increase in energy conversion and creation of smart power grids;
- entry of large energy users (volume wise) into the economy;
- construction of large biomass extraction plants.

No one can predict economic growth, technological development or fuel and carbon prices in 40 years to come therefore it is not possible to precisely define the best power system in 2050. The question of how to predict the values that are dependent on technological development, energy prices and dynamics in GGE changes remains open.

Technologies, which are now relatively expensive, can be very important in the long run. Among them are electric cars, solar energy, wind energy accumulation, as well as carbon capture and storage systems.

The relationship between biomass, wind and solar energy will depend on various factors which are currently not known.

- Option 1: the amount of biomass will continue to grow and it will be cheap. This will reduce the need for wind energy.

- Option 2: increase in energy efficiency will not happen as planned. This will increase the need for larger amounts of biomass.
- Option 3: there is a rapid development of other renewable energy technologies. For example, the use of solar energy technology will become economically most advantageous. These and other options are summarized in the figure illustrated in the chart.

All of this emphasizes the need for a flexible strategy, which ends with the opportunities for technology development. Problems that are related to energy supply safety and impact on climate change can also be resolved in a different way.

1.12. Three Avenues of Incentives

Latvia's strategy for energy until 2050 – from fossil fuels to green energy – has been drafted as a strategy with 3 directions or parallel avenues, each with a different period of implementation (see Figure 9).

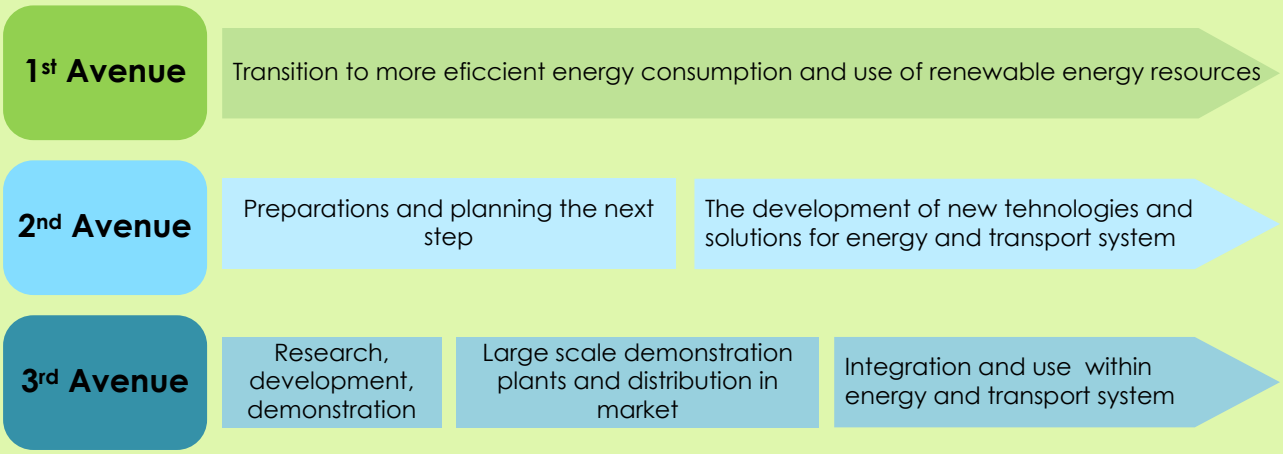

Figure 9. Graphic presentation of the three-avenue strategy

The first transition stage (1st Avenue) must involve every possible activity in the areas where transformation can take place already now, with relatively low investment and significant savings on the purchase of energy resources. It is important that equipment is cost effective and has a long operating life, while the decision-making process is short.

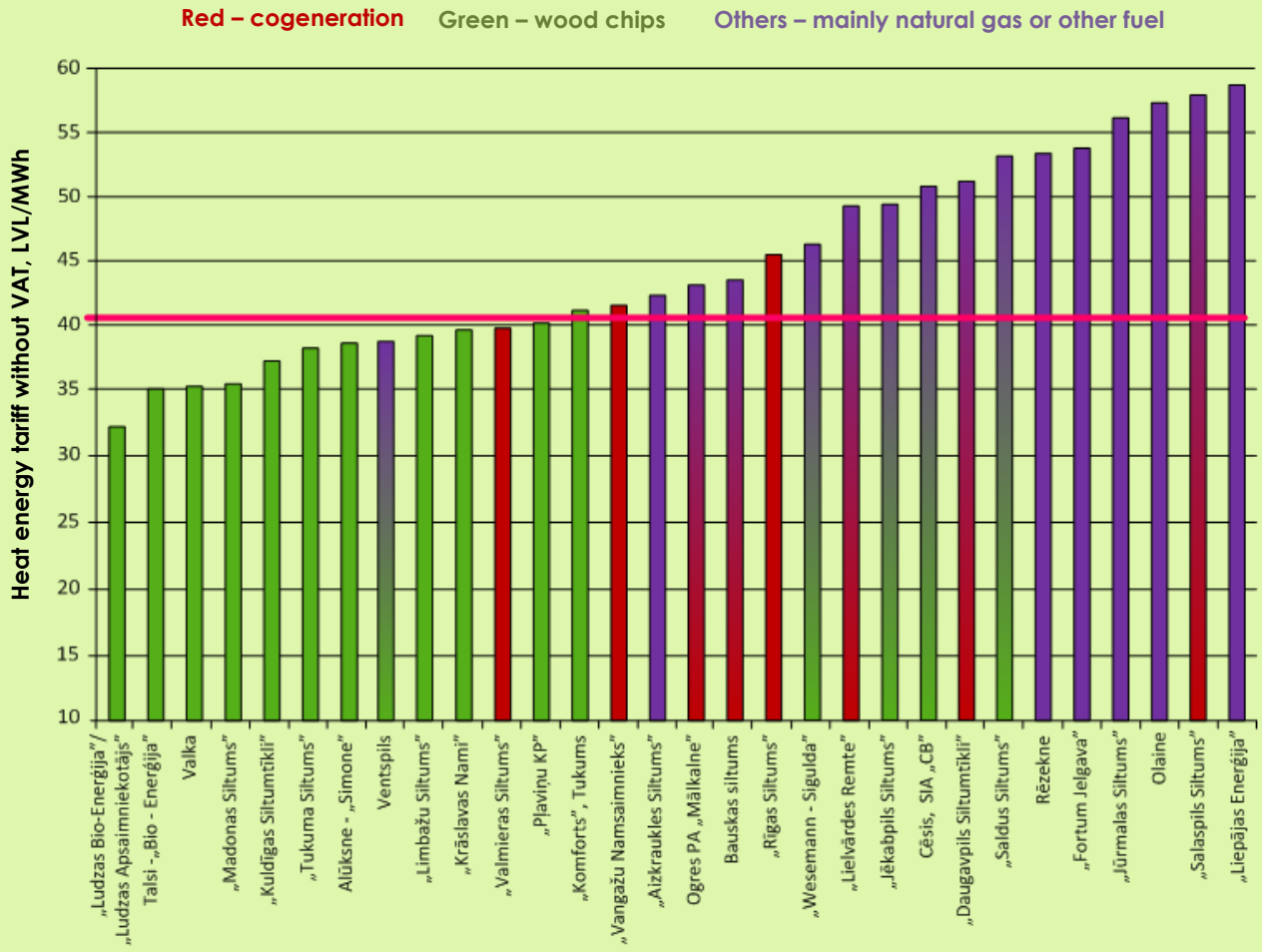

Figure 10. Heat energy tariffs of the centralized heat supply systems in Latvia's cities and municipalities (heating season 2008/2009)

By implementing the 1st Avenue, it would be possible, for example, to eliminate discrimination of Latvia's population through introduction of the level mark model for heat energy tariffs. The heat energy tariffs of the centralized heat supply systems in various Latvia's cities and municipalities given in Figure 10 show that the tariffs of the boiler houses powered by wood chips are lower than the tariffs of the natural gas boiler houses.

By introducing the level mark model – the highest possible heat energy tariff in Latvia, which would be based on the level of the heat tariff of a more expensive and cost-effective boiler house powered by biomass, it is possible to do so in 2 to 3 years time, by setting a transition period to boiler houses with a higher tariff. This way will provide an opportunity to change over from the boiler houses powered by fossil fuels to the boiler houses using renewable energy resources and protect the heat energy users from unreasonably high prices of the heat energy.

In addition, the areas which can help to promote the achievement of short-term and long-term goals will be involved.

The preparation and planning step (2nd Avenue) covers areas where an initial preparation and set-up of the system is required before implementation of special activities.

The technological development step (3rd Avenue) includes areas where there is a need for additional knowledge, analysis, research and development, as well as demonstrations and preparations for market activities before the commencement of any specific operations within the future energy and transport systems.

Each strategic direction (step) involves activities that can be started immediately. The package of measures incorporated into the strategy includes incentives aimed at increasing energy efficiency and amplifying the share of renewable energy resources. These activities are as follows:

- the right framework conditions for future power and heat production;
- increased use of wind energy;
- greater use of biomass;
- sustainable use of biogas;
- Increase in high efficiency of energy consumption;
- Increase in energy efficiency in households and buildings;
- a unified and intelligent energy system;
- transition to the Green Energy in the transport sector;
- energy system with adequate financial support;
- transition to the Green Growth through research, demonstrations and preparation for the market;
- efforts to transition at the global level;
- the EU becomes independent from fossil fuels;
- long-term GGE reduction in the agricultural sector;
- efficient and environmentally friendly use of the Baltic Sea resources.

1st Avenue: examples

Analysis of Energy Policy

Regular analysis of the energy sector development and policy instruments using the modelling method will enable to control and monitor the ongoing activities in the country and energy sector and draft proposals for adjustment.

Government action must include the following:

- Drafting of a methodology that provides guidelines for the development of power plans and validation, testing and improvement of such power plans.
- Mandatory inclusion of regional and district power plans into a territorial plan.
- Establishment of the evaluation criteria system for all activities in the energy sector (selection of co-financing, evaluation of the energy system performance, assessment of tender results, etc.), taking account of the experience of the EU countries in Scandinavia.
- Establishment of the system for control and monitoring of power plans.
- Regular analysis of Latvia's energy sector performance using the system dynamics modelling method or another time-tested/approved modelling method.
- Establishment of a national energy sector management system, by setting up a unified state agency with the involvement of independent EU experts and leading Latvia's scientists.
- Involvement of research organizations/universities into drafting of power plans, laws and regulations. Each piece of legislation should be based on scientific study, which gives grounds for calculations and results thereof using time-tested methods.
- Establishment of a national and municipal rotary fund of energy efficiency.
- Establishment of a tax incentive system for energy efficiency through intensification of energy consumption reduction and use of renewable energy resources.

Improved Energy Efficiency of Buildings

A number of versatile measures aimed at improving the energy efficiency of the existing buildings should be implemented so that renewal and replacement would be profitable. At the same time, improvements must be addressed already now in order to reach the set goals by 2020.

Government action must include the following:

- Setting up of a work group to deal with implementation of the new directive on the energy efficiency of buildings.
- Revision and improvement of the minimum energy efficiency requirements for buildings, including requirements for the following energy consuming systems in buildings: heating, cooling, lighting, ventilation and hot water production.
- Establishment of a functioning quality control system for energy audits.
- Support for scientific research on low-energy buildings, new insulation materials and indoor air quality.
- Drafting of standard procurement documentation and contracts.
- Establishment of a quality control system for construction projects.
- Introduction of the CO_2 tax for buildings with increased energy consumption.
- Subsidies for the renovation of buildings.
- Support for operations of power service companies.
- Raising of people's awareness of energy efficiency in buildings.
- Establishment of a one-stop-shop for building renovation.
- Drafting of options for using the champion effect and support thereof on the national level.
- Drafting of documents for simpler decision-making procedures on the energy efficiency measures: namely, setting up a system that enables the building manager to make decisions without the owners' consent.

Improved Energy Efficiency of Power Systems

Reduction of energy consumption in all power system elements due to increase in energy efficiency on the part of energy producers and energy end-users and reduction in energy loss in power transmission systems will allow to reduce the volume of primary energy resources on the national level.

Government action must include the following:

- Implementation of smart power grids with bilateral meters in case of using small renewable energy resources, providing the energy users with comprehensive information and other intelligent energy system components.
- Normalization of energy losses in Latvia's energy systems by setting the maximum losses in energy transmission systems.
- Normalization of energy efficiency in Latvia's energy sources by setting the minimum efficiency limits for heat and electricity generation.
- Implementation of a single concept for funding in tenders as support for improvement of energy efficiency among energy producers, in transmission systems and among end-users.
- Establishment of a control and monitoring energy system for routine detection and analysis of energy efficiency.
- Establishment of a national energy management system for energy consumption reduction: raising of energy users' awareness, encouraging reduction of electricity use in the case of excessive consumption, implementing a bonus system, etc.

Promotion of Biomass Use

The use of biomass is of very high importance, and it is also possible in combination with natural gas. Short-term use of biomass in the boiler houses of centralized heat supply systems and large CHP plants (above 20 MWe) could reduce fossil fuel use and thus reach the goal: 40% of energy from renewable sources by 2020.

Government action must include the following:

- Establishment of a single professional institution that deals with implementation of the directive on renewable energy.
- Revision and improvement of the minimum energy efficiency requirements for energy sources of heating supply systems, including requirements for the following performance indicators of the energy sources: heat load duration curve, the consumers' load per kilometre of the heating line, boiler efficiency values in conditions with three different loads, consumption of energy for the system's own use, etc.
- Establishment of a functioning quality control system for energy audits of energy supply systems.
- Introduction of the level mark model for heat energy tariffs in Latvia's centralized heat supply systems within 1 year.
- Acceptance of a methodology for determining the heat energy tariffs with analysis of alternative options for the development of centralized heating systems.
- Channelling of financial resources intended for science to research on the development of efficient biomass technologies.

Promotion of Wind Energy Use

Increase in the share of wind energy in the first decade is possible for the reason that wind energy projects will receive financial support from the EU.

Government action must include the following:

- Harmonization of the legislation on electricity tariffs of wind farms, differentiating between large and small wind stations.
- Analysis of alternatives regarding the inclusion of the 1500 MWe wind farms into the national energy system: without accumulation, with accumulation for both electric car charging and establishment of compressor plants, as well as for development of other accumulation technologies.
- Development or acceptance of the current methodology for the deployment of wind farms in the Baltic Sea by carrying out the study of the power supply system as a whole, with particular emphasis on wind energy farms with power accumulation.
- Launching of the invitation to tender for involvement of international experts (with experience in wind energy use) in the analysis of the possibilities for using wind energy in order to select the optimal long-term solution for Latvia.
- Drafting of regulations for the establishment of wind farms and regulations for monitoring and control after the wind farms start operations.
- Launching of the invitation to tender for the establishment of the 1000 MWe wind farms off shore and the 500 MWe wind farms on the land, using the EU co-financing.

2nd Avenue: examples

Energy Infrastructure Planning

It is important to commence regional energy planning to obtain information on the energy supply system structure and develop the said structure. Time-varying power generators (photovoltaic systems and wind farms) and end-user integration include the need for long-term development of infrastructure. Future gas infrastructure should also be planned, taking into account the use of biogas instead of natural gas.

Government action must include the following:

- Analysis of alternatives regarding the inclusion of the time-varying power generators into the national energy system: with and without accumulation.
- Development or acceptance of the current methodology for the deployment of the time-varying power generators on the territory of Latvia, surveying the development of power supply systems in general (as opposed to making territorial restrictions, but breaking down by priority).
- Launching of the invitation to tender for involvement of international experts (with experience in the use of time-varying power generators) in the analysis of the possibilities for using fluctuating power sources in order to select the optimal long-term solution for Latvia.
- Drafting of the Cabinet's regulations for the establishment of time-varying power generators and regulations for monitoring and control after the fluctuating power sources start operations.
- Launching of the invitation to tender for the establishment of time-varying power generators, using the EU co-financing.

Promotion of Biomass Use

Biomass use in combination with wind energy and possibly also in combination with natural gas and CO_2 capture and storage is the most important factor in the green power plan. The long-term use of biomass in any source and in particular in large CHP plants (above 20 MWe) could reduce fossil fuel use and thus help to achieve the goal: no more than 5% of energy from renewable energy resources in the energy sector by 2050.

Government action must include the following:

- Drafting of a methodology for the analysis of all alternatives regarding zero GGE and testing it in Latvia's conditions.
- Drafting of a renewable energy development plan for Latvia based on regional power plans.
- Involving of independent EU experts in the evaluation of existing project results and in future calls for tenders.
- Drafting of a support plan for promotion of the use of renewable energy resources through tax concessions and special green investment schemes.

Promotion of Wind Energy Use

Increase in the proportion of wind energy is possible for two reasons. Wind energy projects are to receive the EU financial support. Wind energy is cost-effective and robust against future changes in fuel and CO_2 prices. Using wind energy, it is possible to produce a large part of the required power load (2-3 TWh per year), which should be replaced in the next 15 to 20 years.

Government action must include the following:

- Evaluation of the results of the tender and selection of investors for the construction of a 1000 MWe wind farm off shore.
- Evaluation of the results of the tender and selection of investors for the construction of a 500 MWe wind farm on the land.
- Evaluation of the results of the tender and selection of investors for the construction of wind power accumulator plants.
- Establishment of the monitoring and control system of wind farm operation at one of the universities in Latvia.

Solar Energy Use

It is economically viable to start the use of solar energy for hot water supply systems in multi-apartment houses in Latvia, as the hot water load is relatively steady throughout the day.

Government action must include the following:

- Promotion of improvement of the heating system requirements, including requirements for the following performance indicators of solar heating collectors: heat load duration curve, non-uniformity of the hot water load, etc. in order not to undermine the existing heating systems.
- Drafting of regulations on the calculation methodology for the evaluation of the use of solar energy for hot water supply and the impact of this measure of heat tariffs and the total cost of heating in the building.
- Maintaining and regular updating of the database of the best available technologies.

Use of Other Renewable Energy Resources

The use of other renewable energy resources is associated with the development of a financial aid scheme for introduction of innovative and relatively expensive technologies in the national energy sector.

Government action must include the following:

- Promotion of the use of photovoltaic systems for power generation, by developing an economically feasible support scheme and including requirements for photovoltaic system performance indicators therein.
- Promotion of the use of geothermal energy production for power generation, by developing an economically feasible support scheme and including requirements for geothermal plants performance indicators therein.
- Promotion of the use of non-traditional renewable energy resources for power production, by developing an economically feasible support scheme and including requirements for technology performance indicators therein.
- Maintaining and regular updating of the database of the best available technologies.

Transport Sector Shift to Alternative Energy

There are two possible types of solutions in the transport sector: biofuels and electrification using renewable electricity. Since the development of both types involves long-term investment, it is necessary to determine the proportion of each mode of transport already now.

Government action must include the following:

- Development of a national renewable energy concept for vehicles with a systemic approach to analysis, by implementing technology assessment aimed at reduction of GGE of the existing vehicles and introduction of new technologies in the country.
- Support for establishment of electric car charging stations in Latvia.
- Seeking cooperation with other EU Member States regarding the establishment of electric car charging stations.
- Seeking agreement with the EU regarding co-financing for the development of transport powered by renewable energy in Latvia.
- Continuing provision of financial support to biofuel production companies, by substantiating the transition to the second-generation biofuel production with competitive technology.

3rd Avenue: examples

National Green Energy Sector Growth, Based on Scientific Research, Technology Development, Demonstration and Market Preparation

Scientific research is important not only for development of innovative technologies aimed at the use of biomass, sun power, wind power and other renewable energy sources and development of innovative techniques and technological solutions aimed at improvement of energy efficiency, but also for the performance analysis of the existing energy systems and improvement of energy efficiency.

Government action must include the following:

- Development of a professional research and public awareness strategy regarding the need to replace fossil fuels and initiate energy efficiency measures at any level of the energy user.
- Regular analysis of the impact of each measure planned in the energy sector on the overall system, thus avoiding implementation of measures irrelevant for the system that, in the long run, would impede the green growth path in Latvia.
- Development of a scientifically sound heat tariff regulation methodology in the short and long term to level out the tariffs in all centralized heat supply systems.
- Development of a scientifically sound electricity tariff regulation methodology in the short and long term in order to divide the current scheme developed by the companies into two parts: the profit would be channelled to business development, while revenue from excessive energy consumption would be invested in the national energy efficiency fund.
- Development of a scientifically sound natural gas tariff regulation methodology in the short and long term to prevent the marginal cost of connecting new consumers.
- Overall surveying of the development of heat supply systems in the short and long term to establish the supporting criteria of the centralized heat supply system in economic, socio-economic, environmental and climate aspects: centralized heating vs. individual heating.
- Support for the testing of green solutions at the public interest research centre "Environment and Energy" to help assess and sustain innovative technological solutions.
- Promotion of good partnership between universities and large manufacturing companies seeking development of energy-efficient and green growth-based companies in the country;
- Development of evaluation criteria and methodology for any green project to be used at pre-project, project implementation and follow-up phases.
- Promotion of the survey for the establishment of large sources of energy based on economic, technological, socio-economic, environmental and climatic substantiation, in order to professionally evaluate the possibilities of use of different technological solutions: use of heat pumps in centralized heating, establishment of wind power accumulator plants, establishment of solar power accumulator systems, establishment of vehicle charging station networks, etc.
- Development of a qualification system for green workplaces, setting the priorities for involvement of professionals (university graduates in selected fields) in state and municipal institutions.
- Development of an occupational training scheme with changes in the training content in order to provide employees for the green economy in all sectors of the economy.

2. Sources of Funding for Green Growth

Green Growth will result in a significant reduction of fossil fuel imports (national import expenditures may decrease by up to LVL 300 million per year), higher employment and increased use of local resources. Therefore, the economic Green Growth will have a positive impact on national macroeconomic indicators.

This chapter contains only a broad outline of funding sources for the green economy, without analyzing the national macroeconomics.

2.1. Funding Sources for the Green Economy in 2012-2020

Funding for the Green Growth ideas should be found from savings and national economic development. Funds for the introduction of the necessary instruments of the Green Growth Policy can be obtained from various sources, some of which are outlined below.

State budget resources, by making more effective use of funding from the existing institutions, for example, through combining the energy policy with the climate policy, which enables to obtain savings:

- Improvement and development of strategic planning documents, as well as existing policies and legislation;
- Covering the operating costs of the bodies responsible for project monitoring, control and evaluation;
- Covering the costs of establishment and maintenance of the energy efficiency and renewable energy resources database;
- Replenishment of the energy efficiency and renewable energy rotary fund;
- Science and research costs for establishment of the public infrastructure.

Resources from the environmental protection fund, such as the CO_2 tax: extra proceeds from the CO_2 tax revenues in the amount of about LVL 10 million starting

- Co-financing of small projects by the state, through providing co-funding of different EU programmes and climate programmes;
- Establishment of the White Certificate system.

Municipal budget provides co-financing of the EU funds and climate funds in the range of 15 to 25% of the amount of investment:

- Financial support for motivation of energy end-users regarding the implementation of energy efficiency measures.

Resources of the energy efficiency and renewable energy rotary fund, such as contributions from energy resources suppliers and energy producers: AS Latvenergo, AS Latvijas Gāze and centralized heating companies**:**

- Tax returns or concessions for energy efficiency measures;
- Financial support for science and research;
- Voluntary agreements: financial support for those who sign such agreements;
- Subsidies and loans to the public, housing and service sector;
- Educational activities in the public, housing and service sector;
- Covering the costs of energy audits in the industrial sector;
- Interest-free loans to industrial companies;
- Educational activities in the industrial sector.

Private investment, for example, public-private partnership: the so-called (ESCOs), large construction companies together with banks take part in the energy efficiency projects for buildings**:**

- ESCO projects in the public, housing and service sector.

European Union funds, such as the Cohesion Fund and the European Bank for Reconstruction and Development Fund for establishment of a rotary fund and a venture capital fund; projects of strategic importance to the EU (of several hundred million LVL), the European Community programmes (the new financial framework 2014-2020): the Competitiveness and Innovation Programme (innovative technology investment), the LIFE+ Programme, the Intelligent Energy Programme and the EU research funding – from basic research to market

- State guarantee programme for ESCO projects;
- Co-financing for the public, housing and service sector;
- Establishment of large biomass-based CHP units;
- Establishment of small biomass-based CHP units;
- Interest-free loans to the industry sector.

International emission trade resources: the Emission Trade Scheme (ETS) auction revenues. Auctions start in 2012, while the amount funding grows from 2013 (at least LVL 10 million per year).

- Funding of projects from emission trade revenues, by carrying out energy efficiency measures and implementing renewable energy resources projects in the ETS companies (see the Flexible Mechanisms of the Kyoto Protocol).

Green Investment Scheme resources, for example, the Climate Change Financing Instrument – extra funds in 2012; more projects in 2013 and 2014 for the total amount of LVL 70 to 100 million; further green investment will be available if Latvia is able to exceed its set target trajectory in terms of end consumption.

- Co-financing for the public, housing and service sector;
- Co-financing for the development of innovative technology.

Resources from business operators:

- Investment in implementation of renewable energy and energy efficiency projects.

Credit resources, such as the use of the resources from the 2nd pillar pension funds as long-term credit resources**:**

- Credits for project implementation.

Credit lines, such as those from the European Investment Bank (EIB), the Nordic Investment Bank and other banks:

- Credit lines for renewable energy resources and technologies for their development.

2.2. Funding Sources for the Green Economy after 2020

Funding for the Green Growth ideas after 2020 will be found from both the established sources of financing, which are mentioned above, and from the development of new innovative ideas of financing.

A greater role could be played by the harmonized public investment resources, where the policy instruments will be directed towards the Green Growth, by increasing the comfort of the energy end-user and encouraging the reduction of excess energy consumption.

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