THE LATVIAN ELECTRICITY SUPPLY TRILEMMA: SECURITY, SOCIAL EQUITY AND THE ENVIRONMENT

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Summary

The Latvian electricity supply trilemma of security, social equity, and the environment has been dynamically changing. Subsequent to the state regaining independence in 1991, substantial changes have taken place in the Latvian energy sector. Through the use of loans made available by international institutions, the major power plants have been reconstructed, utilising the most modern available technologies. The requirements and stipulations set out in the European Union directives have been incorporated into Latvian law. Electricity prices and the pricing principles have approached those in other European countries. As the market has been gradually developing, Latvian electricity consumers have gained the option of selecting their electricity supplier. Several mechanisms have been established for protecting consumers' interests, including the Public Utilities Commission, the Ombudsman and others. Latvia can be proud of its outstanding environmental preservation results in the field of electricity supply. Latvia is among the "greenest" countries in the world with regard to electricity generation. Renewable energy resources, including at the Daugava HPPs, provide 65% of the electricity generation in the country. Latvia is among the three best-performing EU countries with the lowest amount of greenhouse gas emissions.

Keywords: Latvia, electrical energy, Latvenergo AS, Daugava HPPs, Nord Pool Spot

General description

After regaining independence, Latvia's transmission network continues to operate in a synchronous mode within the international BRELL (Belarus-Russia-Estonia-Latvia-Lithuania) high voltage loop. Latvia's base load capacities were insufficient, the lacking electricity was imported from Lithuania, Estonia and Russia. The price of electricity could not be increased nationally because the post-inflation purchasing power of the population was

very low and funds for investment were scarce. In the mid-1990s, active cooperation began among the energy companies of the Baltic States, resulting in a positive evaluation of several possible cross-border connection projects.

The Energy Law was adopted in 1998. At the time of the adoption of this law, the large state-owned enterprises were undergoing privatisation. Latvenergo too was to be privatised. The majority of people felt that, from the point of view of supply security and price stability, the largest national electricity supply company should not be privatised. Taking into consideration the petition against the privatisation, which was signed by one fifth of the country's population (307,000), the Energy Law was amended. It states: Being a national economy object of state importance, the public limited company Latvenergo is owned by the state, and the Daugava HPPs and the Riga CHPPs, electricity transmission networks and the distribution and telecommunications networks owned by Latvenergo AS may not be privatised or alienated.

In 2000, the Law on Regulators of Public Utilities was adopted, and in 2004, the Public Utilities Commission (the Regulator) was transformed into an institutionally and functionally independent state organisation. A separate department responsible for the energy sector operates under the Regulator.

The Electricity Market Law was adopted in 2005. It defines the preconditions for the operation of an efficiently functioning electricity market. The law allows all consumers to freely select their electricity suppliers and obligates the traders to ensure a safe and high-quality electricity supply.

Complying with EU Directive 2009/72/EC concerning common rules for the internal market in electricity, the Latvian government has separated the electricity supply functions: generation, transmission and distribution. Latvenergo AS has been transformed into a company with subsidiaries Sadales tīkls AS and Latvijas elektriskie tīkli AS, retaining the electricity generation function under the governance of the Group. An independent company, Augstsprieguma tīkls AS, was established in 2011, and the functions of the transmission system operator were vested into it by law; it is supervised by the Ministry of Finance.

Analysis of the Latvian trilemma

The methodology of the "Energy Trilemma" complex energy policy assessment of the world's countries was developed and first used in 2010 [1]. In the late 2012, in preparation for the 22nd World Energy Council (WEC) congress, the experts of WEC published another edition of the World Energy Trilemma. The analysis encompasses all 94 WEC member countries. Documents published by WEC provide a general explanation of the evaluation methodology.

The WEC analysis divides countries into four groups (A, B, C and D) depending on their GDP value per capita. All OECD countries are included in Group A. Latvia, with the specific indicator at 14.5 thousand USD per capita [2], has been included in Group B, ranking the 14th among its 23 countries. Estonia and Lithuania are ranked the 13th and 12th in Group B respectively. The Czech Republic ranks the 11th in Group B. The energy policy of the Baltics has thus been rated highly overall.

In 2012, in terms of energy performance indicators, Latvia was ranked among the WEC countries [1] as the 64th in energy security, the 50th in social equity, and the 13th in environmental impact mitigation, while in contextual performance being the 32nd in political strength, the 38th in societal strength, and the 72nd in economic strength.

Assessment of the Latvian energy sector cites the diversity of electricity generation and the five-year energy consumption growth as the main positive indicators, while noting the ratio of energy generation to consumption and the oil stock reserves as the negative ones.

Strengths and weaknesses of the energy sectors of the Baltic States

	Lithuania	Latvia	Estonia
Ratio of energy generation to consumption	- -	- -	+ +
Diversity of electricity generation	-	+	- - -
Five-year energy consumption growth	+	+	+
Oil stock reserves	+ +	- -	+

A broader description of the Latvian energy sector is provided below.

Electricity security

Electricity consumption in Latvia decreased significantly after 1991. The Latvian power plants could nevertheless provide only a maximum of 65% – 75% of the rated demand (see Figure 1).

The amount of electricity generated by the Daugava HPPs fluctuates depending on the water flow, and the use of the installed capacity of 1570 MW is low (see Table 1). The electrical capacity of co-generation plants depends on the demand for heat. Renewable energy sources account for a considerable share in the national electricity supply. The remaining demand is covered by co-generation power plants, which use imported natural gas, as well as by electricity imports. For the purposes of improving the efficiency of electricity generation, the two Riga CHPPs were reconstructed by replacing the old equipment with modern and highly efficient combined cycle gas turbines (CCGT), which also considerably increased the electrical capacities of these plants.

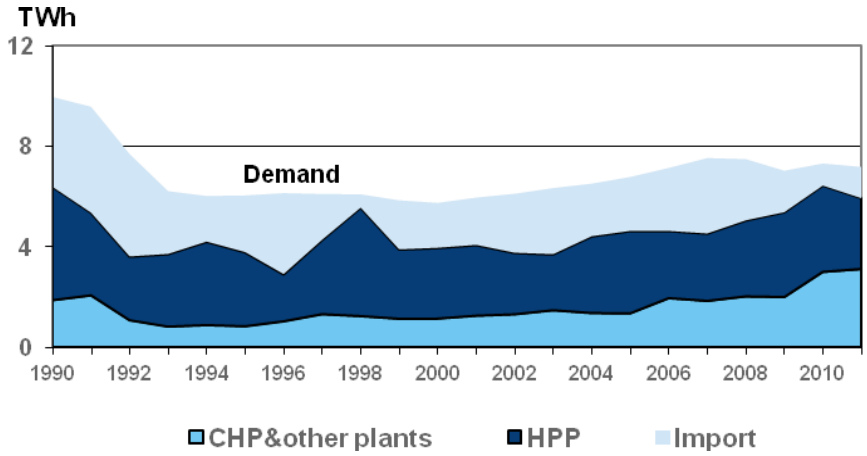

Figure 1. Demand for electricity and electricity generation in Latvia

Table 1. Electricity supply in Latvia in 2011

Power plants	Installed capacity, MW	Available capacity, MW	Generated electricity, GWh
Daugava hydropower plants	**1570**	**200**	**2809**
Riga combined heat and power plants	**806**	**640**	**2335**
Other combined heat and power plants	**120**	**110**	**594**
Other power plants using renewable energy sources	**75**	**40**	**243**

Further growth in electricity consumption is expected in Latvia, and new base load capacities in the range of 300-500 MW are required to cover it. The Lithuanian Visagina NPP project is under preparation in the Baltic region with the installation of a Hitachi ABWR

nuclear reactor (1340 MW) planned. Latvenergo AS, with a 20% share (270 MW), is among the possible participants in the project. Participation in this project would ensure the diversification of energy resources for electricity generation without increasing CO_2 emissions.

The Daugava hydropower plants, with reservoir capacity sufficient for weekly adjustment, generally provide electricity supply during peak hours (see Figure 2).

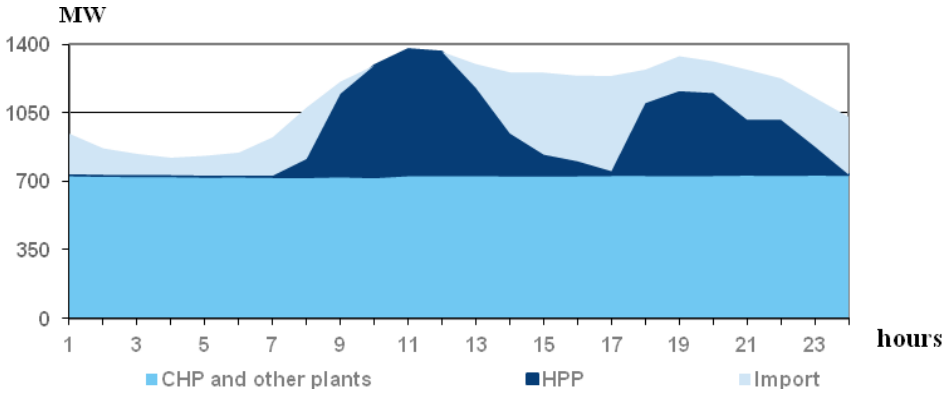

Figure 2. Typical daily electricity supply in Latvia during peak load (January 2011)

The length of the transmission network (110 – 330 kV) in Latvia measures 5,236 km [3]. This network, together with the transmission networks of the neighbouring countries (BRELL), has successfully provided a continuous electricity supply in Latvia. The highest possibility of a blackout of the Latvian electricity supply system to date was on 9 January 2005, when five of the six 330 kV lines providing connections to the neighbouring countries failed during a storm (wind speed > 30 m/s). Only the line to Lithuania was in operation (Jelgava – Panevezys).

The length of the distribution network (0.4 – 20.0 kV) in Latvia measures 90,928 km. Peculiar features of the distribution network is the high specific length of power lines – 40 km per 1000 residents – and a relatively low density of energy consumption. A large share of overhead power lines crosses forests. In winter conditions, trees falling due to the weight of snow present a threat to the power lines. In January 2010, under extreme weather conditions, mass disconnections of distribution networks occurred and thousands of consumers were left without electricity supply. To mitigate this negative impact, approximately 150,000 trees were cut near power lines during the following years and a gradual replacement of overhead lines by cable lines in the problem areas was initiated. Lately, in order to improve the frequency of disconnections (SAIFI) and duration of disconnections (SAIDI) indices, particular attention has been focused on improving the operational security of the distribution network and the quality of the electricity supply.

Expansion of the transmission network has been started in the Western part of the country (the Kurzeme Ring), where the total length of new 330 kV power lines will measure 340 km. The costs of these works will be partially funded by the EU Cohesion Fund.

After the Baltic States joined the EU, the connection of the transmission networks with other EU countries was started. The first DC cable connection between Estonia and Finland, the Estlink-1 (350 MW), was constructed in 2006. Construction of the second (Estlink-2) cable has been commenced, and creation of the Sweden – Lithuania and Poland – Lithuania connections is expected in the future. There are no plans to join the West European electricity networks in a synchronous mode in the near future.

The Latvian energy system received practically no investments during the first years of Latvian independence. Due to the low electricity prices and the large debts owed by customers, all revenues were put towards maintaining the operational capacity of the energy system. When the first profits were received, these resources were required for overhauls that had been postponed for many years.

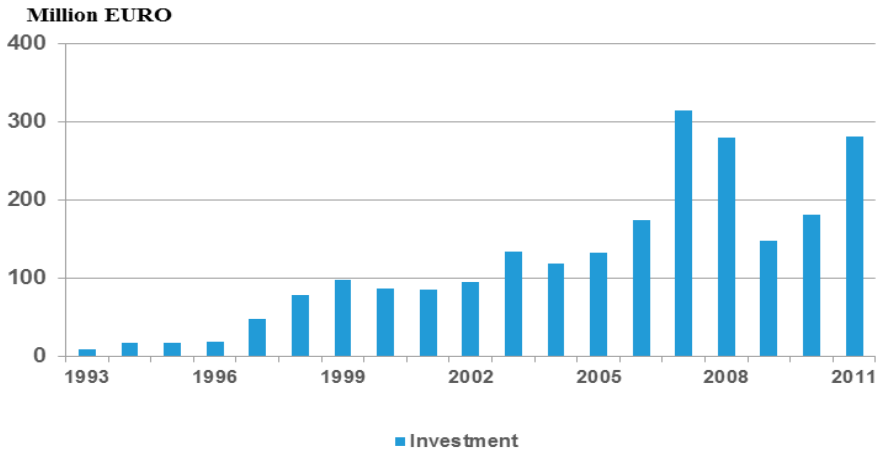

Figure 3. Capital investments in the power system by Latvenergo AS

The first loans from international banks for the refurbishment of the hydropower units of the Ķegums HPP and the Pļaviņas HPP were used starting from 1997 (see Figure 3). The international long-term credit rating agency *Moody's* has set the credit rating of Latvenergo AS at Baa3 (stable) in 2011.

Social equity

During the period following 1990, the shares of electricity consumer groups in the total consumption changed considerably. Industrial and agricultural consumption has seen a marked decrease, while consumption by the service sector and households has increased (see Figure 4).

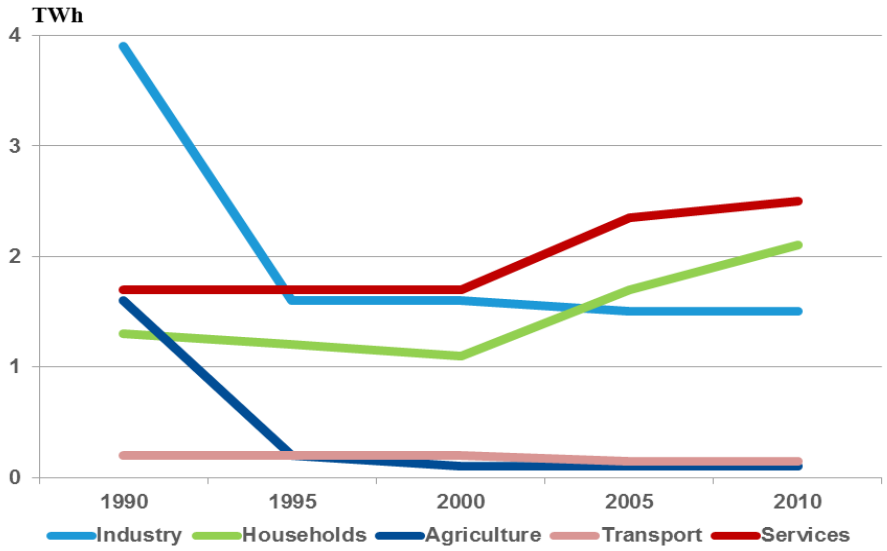

Figure 4. Proportions of electricity consumer groups in the total electricity consumption [4]

Following the restoration of independence, the costs of energy resources imported for electricity generation increased dramatically in comparison to the prices during the Soviet period. Regulated electricity tariffs were increasing at a slower pace because the government sought to keep them proportionate to the population's purchasing power (see Figure 5). The low regulated rates did not permit energy companies to allocate resources for investing. The relation of electricity prices between households and industrial consumers was not compatible with the market economy either. Industrial consumers had to pay higher prices than households. When the national economy was restructured, the role of certain groups of electricity consumers changed in Latvia – industrial and agricultural consumption decreased, while the consumption by services and households increased. The inadequate structure of electricity prices did not promote the development of industry. In compliance with the EU Directives 96/92/EC, 2003/54/EC and 2009/72/EC, electricity trading was gradually transformed from a system of regulated tariffs to a free electricity market. The Single Buyer was created as part of Latvenergo AS, which was used to purchase electricity from the energy companies of other countries and other Latvian producers, including ones generating from renewable energy sources, for whom higher purchase rates had been set. The energy company, being the only seller, was still selling electricity to end users at regulated tariffs.

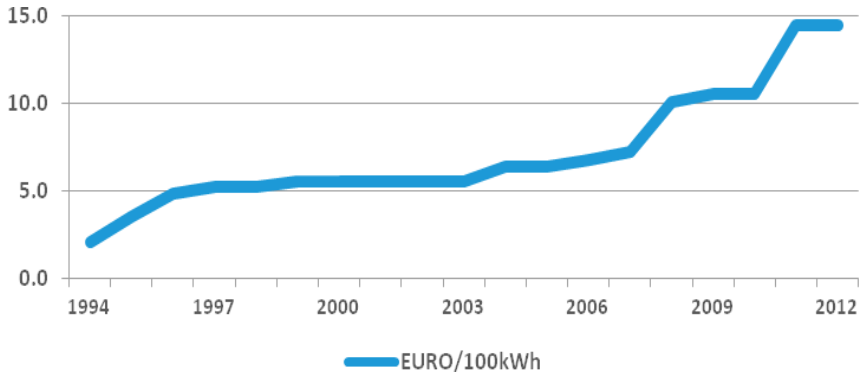

Figure 5. Electricity prices for Latvian households [5]

Following the unbundling of Latvenergo AS pursuant to the requirements of EU directives, the Regulator began to set the tariffs of the transmission and distribution systems, as well as the sales tariffs for procurement from domestic generators defined by law. The mandatory procurement component includes the subsidised domestic producers, i.e., power plants using renewable energy sources and co-generation plants. This mandatory procurement has gradually increased and for households it exceeds 10% of the total electricity price now. The share of this component is even higher for the industry sector. The distribution network services and the market price of electricity account for the largest portion of the end price, with the rest being composed of the mandatory procurement component, sales services and VAT.

The requirement of the EU Directive 2003/54/EC regarding opening of the electricity market was fulfilled in 2007, when electricity consumers became entitled to participate in the free market. In practice, however, the process of changing electricity suppliers started in 2008, when the gradual lifting of regulated tariffs was commenced. As the first step, on 15 May 2008, regulated tariffs were lifted for approximately 1,500 of the biggest corporate consumers accounting for 50% of the total electricity consumption in Latvia. The next stage in lifting the regulated tariffs was implemented on 1 April 2012, when regulated tariffs were lifted for another portion of corporate consumers (with the input protection device of 100 A and above), resulting in deregulation of 65% of the Latvian electricity market.

Yet another step towards the opening of the market was taken on 1 November 2012, when the regulation of tariffs was abolished for all corporate consumers, accounting in total for 75% of the Latvian consumption. The addition of household consumers to the electricity market is expected to conclude in the early 2014. Market deregulation has fostered competition in electricity trading. Several electricity traders have been registered in Latvia.

When Latvia joined the EU in 2004, electricity prices were very low in comparison to other EU countries. The prices of electricity for households in Latvia were low in 2011 as well according to EUROSTAT data [4], and Latvia ranked the 22nd among the 27 EU countries on this index. In comparison to the European average, the prices for households in Latvia are 40% lower (see Figure 6), whereas the prices for industrial consumers in Latvia have approached the average EU prices.

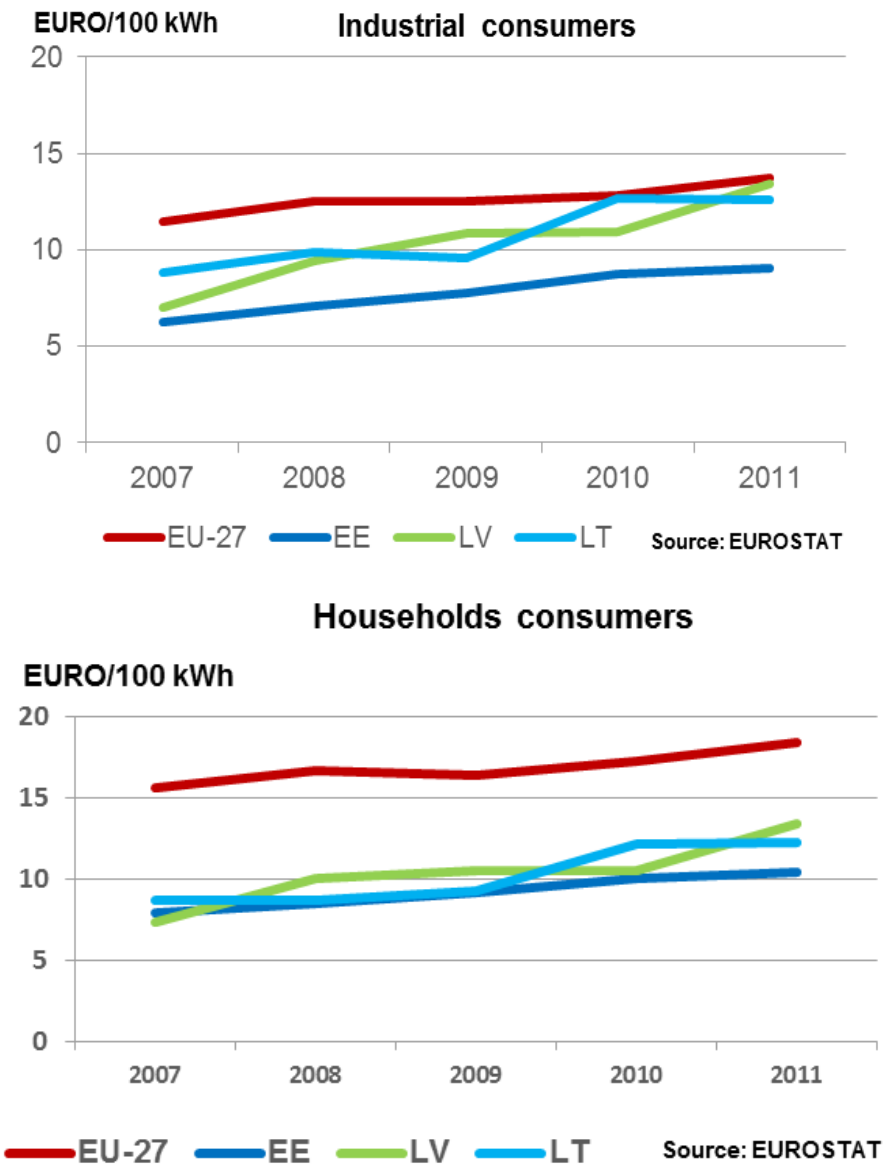

Figure 6. Comparison of electricity prices for end users

In 2010, Latvenergo AS began selling electricity in Estonia (Elektrum Eesti OU) and Lithuania (Elektrum Lietuva UAB). At the end of 2012, the share of Latvenergo AS on the partially liberalised Baltic market amounted to approximately one third, i.e., approximately 8.3 TWh per year (see Figure 7). All the Baltic countries have joined the unified Nord Pool Spot electricity exchange in 2013.

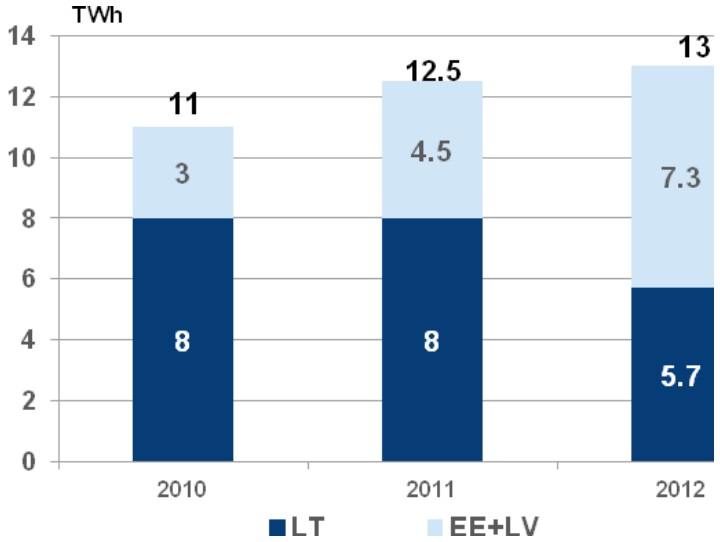

Figure 7. Electricity trading amounts of the Baltic countries in exchanges

Environmental impact

The Latvian electricity sector has a negligible impact on the environment. An 80% share of the required electricity is generated from renewable energy sources and at modern co-generation plants, where the combined cycle gas turbines (CCGT) are used. The efficiency of the reconstructed modern Riga co-generation plants is very high, with a fuel utilisation rate of up to 87%. The share of electricity generated by hydropower plants is considerable, at 30% – 40% of the consumption.

In 2011, three medium-capacity and fifty small-scale co-generation power plants generated 2884 GWh electricity, and the HPPs generated 2870 GWh. CO_2 emissions from electricity generation totalled 741 tons in this year, and their specific index was 120 g CO_2/kWh, which is many times lower than the global average.

It should be noted that the Latvian electricity sector is among the "cleanest" in the 27 EU Member States and takes the third place after Austria and Sweden [6]. Significant increase in the use of renewable energy sources for electricity generation is not required in Latvia. Directive 2009/28/EC requires Latvia to increase the use of renewable energy sources considerably by 2020. We believe that this policy is not appropriate towards a country with such a high index of renewable energy source use in the electricity sector.

The use of the combined cycle gas turbine (CCGT) technology in the reconstruction of the Riga TEC-1 and Riga TEC-2 medium-capacity CHP plants and the construction of the Imanta CHP plant has greatly contributed to the reduction of power plant emissions. Latvia's participation in the construction project of Visagina NPP in Lithuania will guarantee the conservation of the current emission level and preservation of the environment.

The Latvenergo public limited company, which is the owner of the Daugava HPP cascade, is socially responsible for the ecological situation of this river. The company regularly subsidises the fish stock replenishment and lowers the water level in the river, enabling the sanitary maintenance of the river banks and the preservation of architectural monuments.

Conclusions

Despite the considerable social changes that have taken place, Latvia has secured a safe, high quality electricity supply since 1991. There have been no mass long-term interruptions in the electricity supply due to disconnections in the transmission network. The development of power plants and electricity networks has secured a continuous electricity supply. Measures for securing long-term electricity supply have been initiated and implemented – hydropower plants have been refurbished and the equipment of co-generation plants has been fully replaced. Electricity network substations have been renovated.

Particular attention lately has been paid to improving the operational security of the distribution network and the quality of electricity supply.

Latvia joined the European Union in 2004 and has liberalised its electricity trading. The internal electricity market has been created in Latvia, and the electricity prices for households are among the lowest between the EU countries. The majority of the country's electricity supply is provided by Latvenergo AS, a company with a stable credit rating.

Latvia can be proud of its outstanding performance in the environmental preservation in the area of electricity supply. The share of renewable energy sources used for electricity generation is high – at 65%. CCGTs are used in fossil fuel-fired power plants, and they are operated mainly in the co-generation mode, producing a low amount of CO_2 emissions. Latvia is among the three best-performing EU countries regarding the amount of greenhouse gas emissions in the electricity sector and the first in the efficiency of CHPPs.

Following the restoration of independence, Latvia's electricity supply policy has been balanced and has secured a continuous supply, social equity, and a clean environment. As the country becomes economically stronger, structural and financial measures in the energy supply structure have been implemented to ensure successful long-term functioning of electricity supply.

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