Lithuanian Vision for Sustainable Energy

INFORSE-Europe and Atgaja, December 2008

This paper describes a Lithuanian Sustainable Energy Vision. It includes a transition of the energy supply and demand with phase-out of fossil and nuclear energy over a 50-year period, starting with the closure of the Ignalina nuclear power plant in 2009.

Factor 4 for Energy Efficiency

In line with INFORSE's[1] global vision for sustainable energy, the Lithuanian Vision is based on increase of energy efficiency to reach an average level in 2050 similar to best available technologies today. Most energy consuming equipments will be changed several times until 2050, and if new generations of equipment are made with optimal energy performance, and markets are made to promote the most efficient technology, it will not be a problem to reach today's best available technology, even though the efficiency gains required are very large, - in the order of 4 times, similar to an annual increase of efficiency of 3-4% per year from 2010. This will not happen by itself, given that the "natural" technological development in EU has been about 1% per year. It will require concerted actions from stakeholders involved, but if it is done on national scale with EU-scale regulation on energy using products, the market is large for each new generation of efficient equipment, and the costs therefore low. The extra equipment costs will be off-set by energy savings. To realise this, it is, however, necessary to go beyond the conservatism of many market players in this field, and develop a truly enabling market for energy efficiency throughout the society.

The Challenge of Reducing Heat Consumption

For buildings the situation is different from equipment because buildings often have lifetimes of 100 years or more. Most of the houses to be heated in 2050 are probably already built. For Lithuania, the proposed energy conservation plans for domestic and service sectors should be realised and the efforts should be continued in the following decades.

Efficient Transport

For transport is assumed that the conversion-efficiency from fuel to transport-work is increased 2.5 times (from current 15- 20% in combustion engine systems to 50% in fuel cell systems with break-energy recoverage; direct electrically driven vehicles have even higher efficiency), and that the vehicles will be equipped with recoverage of break-energy, so the "end-use" of energy in transport is limited to the unavoidable friction losses in transport (except for aviation). This increase is expected to happen until 2050. Most of the changes are only expected 2030-2050, and the efficiency increase 2000 – 2030 is only expected to be 22%. Faster improvements in transport efficiencies would be possible.

Growth Factors

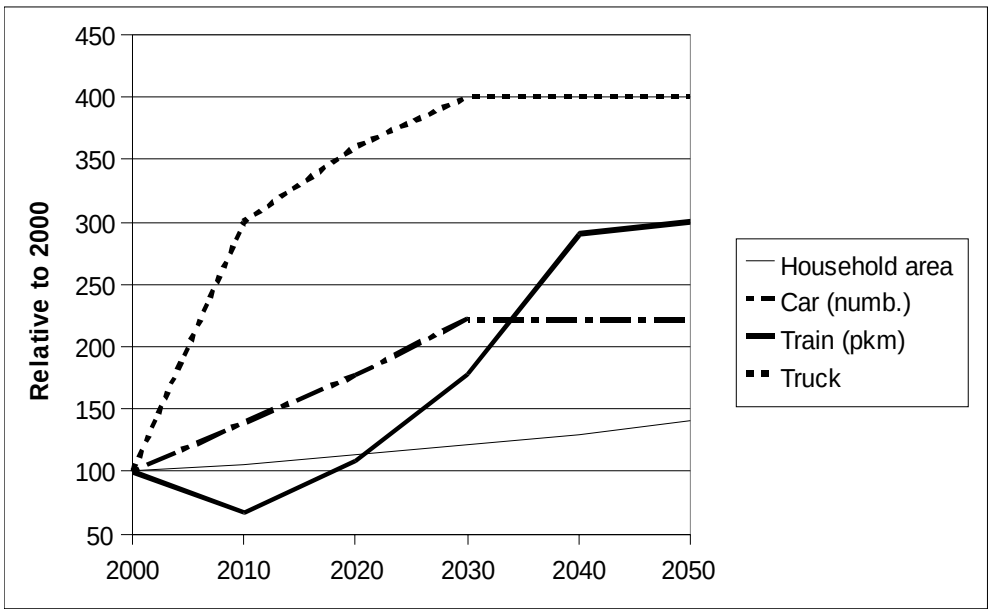
The growth of energy services, i.e. heated floor space, transported goods and people, energy consuming production, is expected to continue for 2-3 decades and then level off for most sectors towards the end of the 50-year period of the vision. Assumed growth in activities for Lithuania:

- Floor space, households: 5% in total 2000 – 2010 following current trends then increasing to 0.9%/year until 2020 and then levelling off to 0.75%/year, so the growth is still higher after 2010 than in the period 2000 – 2010. In this way the living space in 2050 will be 40% larger than in 2000
- Floor space service sectors: 15% in total 2000 – 2010 following current trends, the same increase (15%) in the period 2010- 2020, then growth reduced to 1%/year 2020-2040 and then remaining stable on a level 60% above the 2000 level.
- Electric appliances in households and service: 25% increase for households and 50% increase for service sector in the period 2000 – 2010 following current trends, then

1 International Network for Sustainable Energy, see www.inforse.org

increase similar to floor space, reaching a level in 2050 that is 60% higher than the 2000 level for households and 80% higher for service sector.

- Industry: doubling of production volume 2000 – 2010 following current trends, then stable on the new higher level until 2050. Increase in electricity service demand of 30% 2000 – 2010 following current trends, then further increase to 40% above the 2000-level in 2020 and then stable.
- Personal transport: the vision includes more than a doubling of private car use 2000 – 2030, following current high growth (a 222% increase). Then we expect a stabilisation while rail and bus use is expected to increase 3 times, in spite of the downturn in passenger train passenger since 2000 (they reduced 31% 2000 – 2007 and is expected to decrease further 2% until 2010 before the turning point).
- Freight transport: the vision includes a 4 times increase in the period for road transport and a 3.25 times increase for rail and water transports, based on current strong growth. Pipeline transport is expected to decrease 30% with decreased transport of fossil fuels and a small development of hydrogen pipelines.



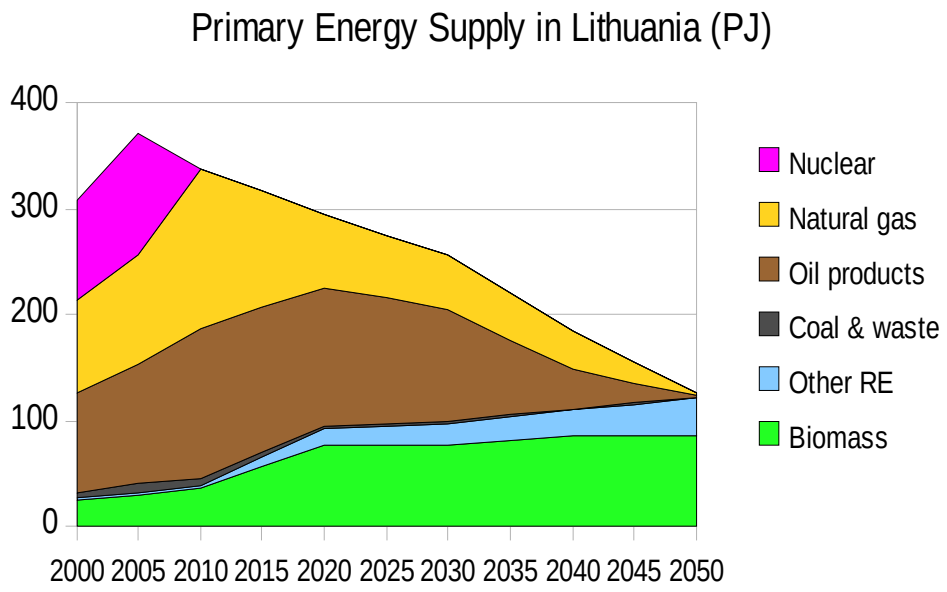
Graph: Development of selected activities 2000 - 2050 for Lithuania

Renewable Energy

As a fraction of primary energy, renewable energy use is expected to reach almost 12% in 2010, 31% in 2020, 38% in 2030, 60% in 2040 and over 95% in 2050. For electricity the renewable share is below the share of primary energy 2000-2010, but then will change until 2020, where it will be 72% and increasing.

The most important developments are in windpower and biomass including important use of agricultural land for biomass plantations, and use of straw for heating. The biomass will be used for heating and for combined heat and power (CHP) production. The use of agricultural land for energy plantations for solid biomass is expected to be 2500 km2 until 2030 (half of the land currently unused or with low production).

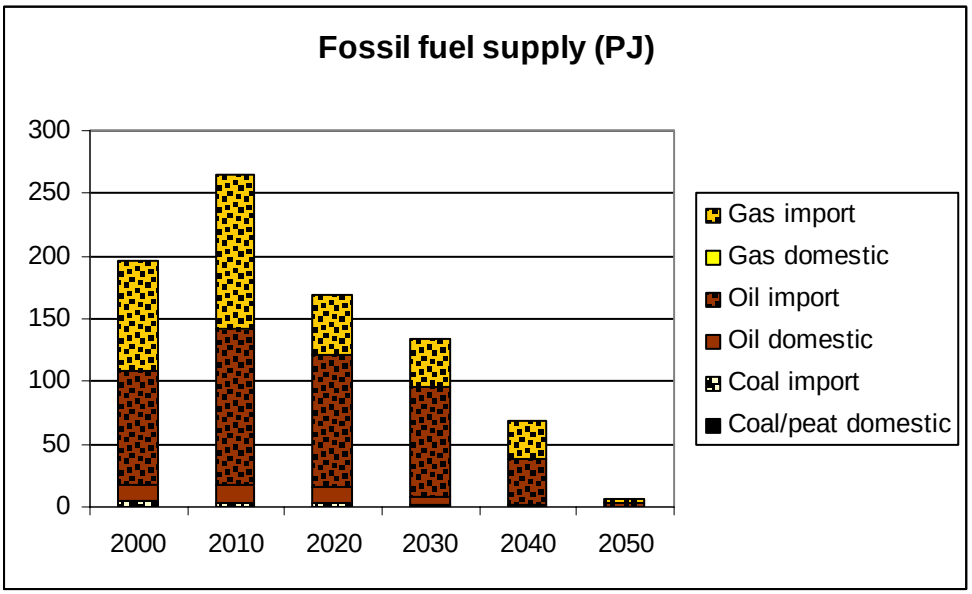
Also increase use of solar heating, solar PV, geothermal and small hydro is included in the vision.



Graph: Change of Energy Supply, following Vision2050

Nuclear and Fossil Energy

Nuclear energy is expected to be phased out as the current nuclear reactor in Ignalina is stopped in 2009. Fossil fuel use is expected to grow until 2010 and then gradually be phased out until 2050.



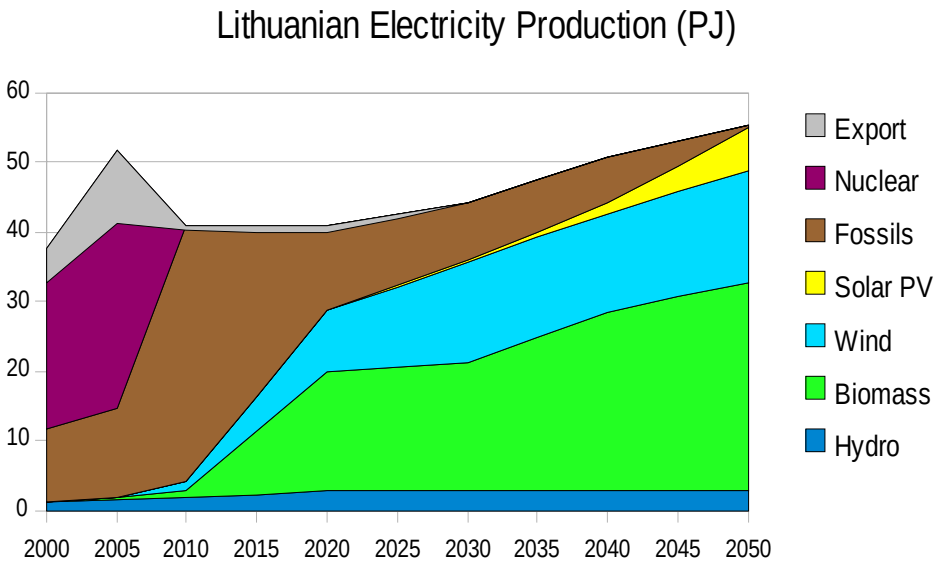
Graph: Fossil fuel development for Lithuania, according to Vision2050

Energy Conversion, Hydrogen& Heat Pumps

The energy conversion system will also have to be changed. The electric grid is likely to increase in importance, because electricity will also be used for transport, directly or via conversion to hydrogen. The increasing dependence on intermittent electricity supply makes it necessary to have energy storage in some forms and maybe flexible electricity consumption.

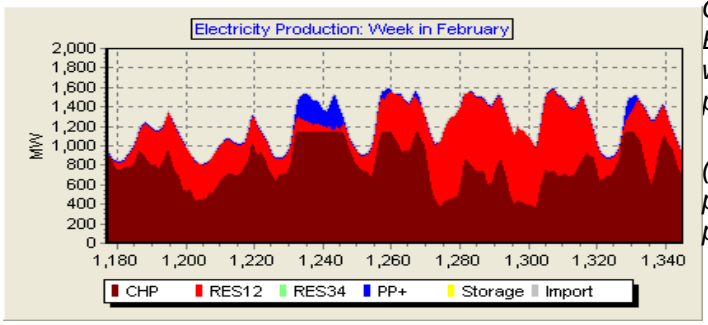
Analysis shows that the existing hydro pump storage and its planned expansion will be sufficient until 2030, maybe longer.

Gas networks are expected to have decreasing importance. They might play a role for transportation of hydrogen or biogas, but probably not for long-distance transport.



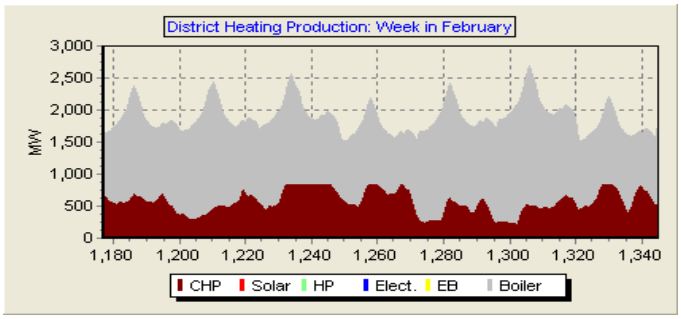
Graph: Development of electricity production and sources, following Vision2050

An evaluation of the hourly variation of electricity and heat loads and the windpower production was made on the EnergyPlan2 model for the year 2020, with input data for the vision's energy balance for 2020 and with variations from typical Danish conditions. The results were that there would be no critical electricity excess or lack of electricity in any hours, but electricity export in some periods with high windpower. If the export is not possible windpower or CHP production could be reduced in these hours.



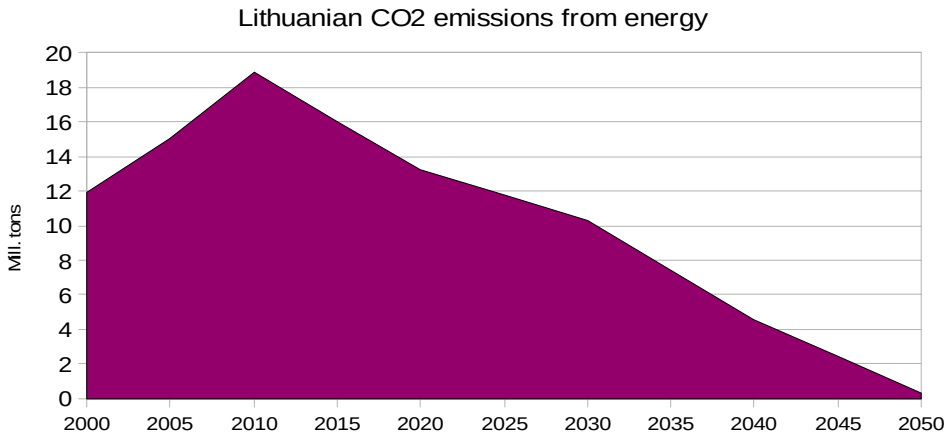
Graphs: Detailed output from the EnergyPlan model for winter weak with high windpower production

(RES12 is wind+hydro, PP+ is power plants without heat production)



Energy Trade

Energy trade is expected to be much less than today, only a moderate electricity exchange is expected. Electricity exchange with little net import or export is likely to continue, to exchange elelctricity from renewable sources such as hydropower (currently imported from Latvia on seasonal basis) and wind power.



Graph: Phase out of CO_2 emissions

The assumptions used in the vision are described in more details in the documents:

Background note for the vision, December 2008, INFORSE-Europe

Actions for sustainable energy development for Lithuania, until 2020
INFORSE-Europe & Atgaja, December, 2008

and

Vision for a sustainable energy development for EU – 25, 2000 – 2050

The documents are available online at www.inforse.org/europe.

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2 EnergyPlan model version 6.80,by prof. Henrik Lund and others, Aalborg University, Denmark, used with data from the Vision2050 for Lithuania for the year 2020