UPIŲ ENERGIJOS VIETA TARP ATSINAUJINANČIŲ ENERGIJOS ŠALTINIŲ LIETUVOJE

Narimantas Ždankus

Energy consumption in Lithuania

TWh/year

Year	91	93	95	97	99	01	03	05	07	09
Electric	11.9	6.7	6.4	6.7	6.5	7.2	7.9	8.8	9.6	9.2
Thermal				9.6	8.2	8.2	8.3	8.1	8.0	7.8
Auto			0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.1
Total				16.9	15.4	16.2	17.1	17.8	18.6	18.1

UC recomendations

At present time 15% of supplied energy in Lithuania are received from renewable energy sources.

Guidelines of UC strongly recommend to 2020 increase employment of renewable energy sources by 8% and reach 23% level.

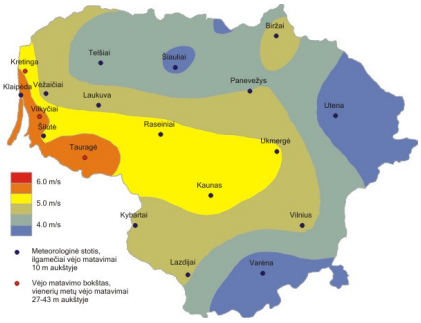
Wind energy

1 – 3 % of solar energy converts into wind energy

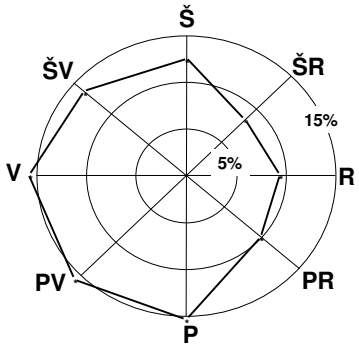
2005 total power of the world wind power plants was 59 GW, production – 1 %

2008 total power of all wind power plants in Lithuania was 52 MW, production much less 1 %

The most powerful “Vėjų spektras” has 15 E-70 type units, total P=30 MW; Laukžemės – 16 MW; Anužių – 2 MW.



Lithuanian wind rose



Hydropower energy

Much more concentrated, but resources of it in Lithuania are small. If all surface runoff (220 mm/year) from theritory (65300 km^2) is collected and volume (14,4 km^3) from average altitude (Z=98 m) passed through turbines, energy of 3,84 TWh would be produced. Actually energy would be >4 times less, not more than 1,0 TWh, what is 5,5 %.

River flow power

$$P = \rho g H Q, \text{ where } H = Z_u - Z_d \text{ or } H = \frac{v_u^2 - v_d^2}{2g}$$

Produced energy

$$E = \eta P t = \eta \rho g H Q t = \eta \rho g H V$$

ıg: η=0,8; ρ=1000kg/m^3; g=9,81m/s^2.
or H=1m; V=1m^3; E=7850Ws=0,0028kWh.
20 0,0436

e turbine of Kaunas HPP working 24 h at H=20m with
m^3/s V=15·10^{6}m^3 and E=600,000kWh, what corresponds
50.4 t of fuel oil

Fotoelementų baterijų laukas Kinijoje

Each m^2 Lihuania receive 926 ÷ 1042 kWh/year of solar energy.

Accepting efficiency of foto elements 15% only, area of 120 km^2 requires to get consumed per year energy 18.1 TWh.

Total area of building roofs in Lithuania is about 150 km^2. The area is sufficient to get all consumed energy.

The only "small problems": price of solar elements and technical possibilities.

Bio-fuel

Wood industry, producing 6 million m^3 timber per year (2008 – 5.8) generate a lot of waste – up to 1 million m^3. Thermal value of 1 m^3 of wood is 2.28 MWh/t. Thus utilisation of wood waste may give 2.28 TWh/year, what contains 12.6% from present energy consumption.

Agriculture produce 0.5 million t of straw each year. Value of it – 1.5 TWh of energy – 8.3% more.

Flammable **comunal and industrial** waste in quantity 1.3 million t per year may give 6% more.

Accumulation, storage and saving, not search of new sources and means of production, is solution of energy problems.

Accumulation – lifted water or compressed air. Pumped storage hydropower plants – the best way for **short** time accumulation. Kruonis HPP has top reservoir of 3 km^3 area. It may store 40.7 million of m^3 water at level 100 m higher bottom reservoir and accumulate E=0.0111 TWh, what corresponds 22% of daily energy consumption 18.1/365=0.0496 TWh.

The most convenient **storage** of fuel. Storage of water or compressed air requires large volumes. Storage of hot water is also inconvenient and requires complex technical measures.

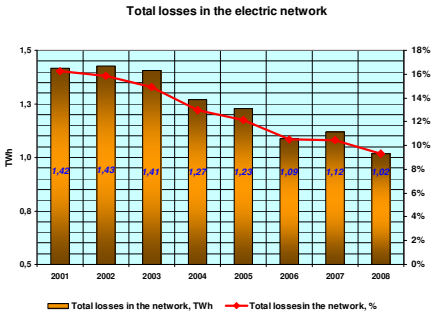
Kuro šilumingumas

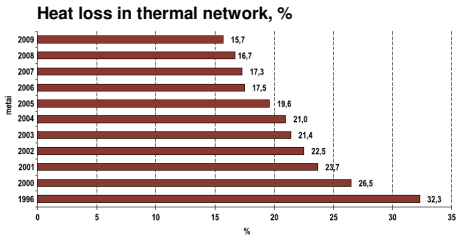
Kuro rūšis	Šilumingumas	
Mazutas	38-41MJ/kg	10,6-11,4kWh
Dyzelinis kuras	42,7	11,9
Benzinas	46,2	12,8
Akmens anglis	30,2	8,4
Malkos	8,4-11	2,3-3,1
Durpės	15	4,2
Gamtinės dujos	35,2	9,8
Elektra	3,6	1
HE V=1m^3, H=1m	0,00785MJ	0,00218

Pumped storage hydropower plant

Save of energy is the main way of solution present energetic problems.

Large scale savings – modernization of supply network. Loss of electric energy in the network during period 2001 – 2008 were decreased from 16% to 9%, what allow to save 0.4 TWh electric energy. Loss of thermal energy, due to modernization of network, reduces stable during period 1996 – 2009. They were decreased from 32,3% to 15,7%, what gives significant economical effect.





Small scale savings – means savings of energy by individuals in their everyday life. Reducing dwelling loss of heat, using modern saving energy lamps of light, collectors of sun radiation energy may result in great savings of energy in the scale of all country. Wind or hydro power energy development in the scale of country is doubtful, although for single person in favourable conditions it may give significant use.

Conclusions

1. Renewable sources of energy are great reserve of energy, which may and should be developed with great intensity.
2. Further economy development success depends on achievements in creation of new energy accumulation and saving methods, first at all hydropower.
3. Individual efforts in the field of renewable energy sources development, energy saving and storage should be encouraged and supported by government.