

EDITOR'S PAGE

ANALYSIS OF ENERGY DEVELOPMENT PERSPECTIVES

Energy consumption in the world has increased very rapidly over the last 50–60 years mainly due to increasing population and economic development.

The main sources of primary energy used in the world are the fossil fuels: oil, coal, natural gas and oil shale. About 80–85% of the energy consumption is derived from combustion of fossil fuels. More than 66% of electricity and 95% of transportation fuels are derived from fossil resources. Economic growth and an increasing population coupled in many countries with significant improvements in standards of living are pushing the world energy demand up. In 2050 the consumption of energy in the world may be over two times more and in 2100 over three times more than nowadays.

In the World Energy Outlook 2005, the IEA predicts that energy demand will rise by more than 50% from approximately 10.7 billion toe (2003) to approximately 16.3 billion toe in 2030. Worldwide energy consumption is expected to rise by approximately 1.6% annually.

The first challenge is energy supply, because the resources of fossil fuels are limited and decreasing every year.

The second problem concerning fossil fuels is the pollution of environment that concurs with combustion of organic fuels.

The decreasing of environmental pollution is a traditional strategic objective of energy development. The present environmental movement is based on the assertion that human-induced carbon dioxide emissions are the cause of the global climate warming, but its bases are not proved by scientific methods. Therefore the applying of compulsion measures (quotas, taxes of CO₂ emissions and other factors) are not justified. The quotas and taxes of CO₂ emissions are particularly harmful for the countries having only fossil energy resources as, for example, Estonia.

Energy industry is always associated with environmental impact. Kyoto process in the world and especially EU environment policy are directed to



limitation and trading of greenhouse gas. This will increase the fuel and energy prices, which in turn reduces the competitiveness of the economy.

At that the optimal decisions must be realizable and profitable both by energetic and economic point of view, considering the following.

- The main challenges for energy policy have not changed for years.
- Rapidly increasing demand for energy from the industrialization of developing countries; geopolitical constraints – a great part of energy resources (62% oil and 41% of gas) are located in the Middle East. The Gulf States and five producers of gas (Russia, Iran, Saudi Arabia, Qatar and the USA) have control of world supply.
- The EU currently imports 65% of its oil and 57% of its gas making itself the world's leading importer of these fuels.
- Different public opinions on the withdrawal from nuclear across Europe.
- The possibilities and limitations of market mechanisms.
- The relatively high cost of renewables.
- Funding to safeguard security of supply.

The key objectives of the new energy policy should be:

- development of security of supply strategy that clearly identifies objectives, criteria for security, mechanisms to secure and fund the necessary investments and crisis management;
- the present plethora of schemas for state-aid to favoured technologies;
- support for energy technology research & development;
- support for the adequate provision of infrastructure at all levels – in regulation for matters of reliability;
- promotion of the internal energy market.

Actually the energy supply of consumers is an extremely important service that must always continue and develop in the future. Especially important and complicated is the consumers' supply with electricity, as electricity is the most widely used form of energy and, unlike gas and water, electricity cannot be stored.

Energy supply problems may be grouped as:

- Short-term energy supply problems (up to 10–20 years).
- Long-term energy supply problems (up to 50–70 years).

Estonian independent state energy policy started with the national awakening period in 1986–87. National structures were integrated into a single energy complex of the USSR, but the researchers and specialists began to develop sustainable energy principles of the Republic of Estonia.

Short-term energy supply problems are usually solved by comparing concrete variants for individual countries considering energy strategy and also political directions of the country.

The long-term energy supply problems are more complicated, and these topics have not been studied sufficiently.

Long- term energy strategy is based on the following:

- levels of freedom of the business associations in the field of energy, relations between the market economy regulation and governmental regulation;
- availability of educated people and professional competence;
- a societal consensus.

In addition to the economic functions, the complex of fuel and energy industry has also social, regional and ethical functions.

Possibilities of state regulation

In long-term planning of power systems and the whole energy policy, the state has to play a determining role, forecasting the economic development and environmental changes as a whole. Considering the needs and possibilities of the society it is necessary to deal with development planning with an outcome of long-term power development plans.

The state has an immediate responsibility to ensure:

- reliability and security of supply – the customer demands security;
- safety – the functioning of the power system and its servicing must be safe;
- regulation – control over the enterprise that has a dominant position and market control.

For this purpose the state has regulatory and control mechanisms:

- innovation – support mechanisms for new ideas, research and development, transmission of scientific achievements;
- energy efficiency – sustainable development in the whole cycle of fuel production, utilization in energy production, transmission and consumption;

In the situation of the open energy market the need for regulation is greater, the market regulator has the central position, and it is more complicated for the state to perform its role.

Energy policy planning is based on:

- long-term, sustainable, optimal need of performance;
- balanced interplay of all components;
- planning activities carried out under hypothetical incomplete information;
- dynamics of investments in a changing environment;
- larger diversity and set of short driving restrictions in the interests of emerging civil society;
- ethics of society;
- lack of social agreement;
- special interests of political parties and politicians.

The implementation mechanism of the role of the state works through legislation.

Implementation of the long-term energy strategy is based on three general minimizing criterions:

- simultaneous minimization of the total consumption of energy resources and environmental pollution by energy;
- minimization of the expected investments and operational costs;
- minimization of the losses of energy and energy consumption.

Also, there must be a reasonable amount of implementation of alternative energy options.

Investments in the introduction of new forms of energy and in developing new technologies depend on fossil fuel price and availability. All countries should begin to minimize energy consumption and pay more attention to energy efficiency.

Oil shale industry

Oil shale mining in Estonia started in 1916. Oil shale oil industry was developed strongly in the 1930s, according to the interests of Germany, who was preparing for war, according to the interests of the Soviet Union after World War II in the Baltic Sea for naval and for the production of domestic gas (first of all to the City of Leningrad). During the 1960s the large-scale consumption of oil shale started in power plants which were built in the Soviet Union to supply electricity to the North-Western regions of the Soviet Union. Nowadays the components of oil shale industry are mining, power generation, chemistry including oil industry, cement production and the production of heat. About 80% of oil shale used globally is extracted in Estonia (2009). Estonia is the biggest producer of electricity from oil shale in the world. The great resources of oil shale enable to produce electricity also in the 22nd century. Oil shale is and will be the main fuel in the future for electricity generation. For large-scale electricity consumption and for the emergency reserve of the electricity system we need fast starting oil and gas generating capacities. For us extremely important is optimization of oil shale power plants' operation and optimal development planning of the Estonian power system and optimal cooperation with neighbouring power systems.

For the optimal decision-making in energy engineering and for avoiding wrong decisions it is necessary to increase perceptibly the role of researches in solving the complicated problems of energy supply. Also the innovation deserves the support and stimulation.

The biggest challenge at planning is combining ancillary services for the power generation mix in an optimal manner by securing the reliability of the system. This requires also that rules for the power play be established in such a manner that both electricity generation markets and ancillary service markets can be optimized at the same time. The rapid changes in price of fuels and electricity have confused the planners. It is better not to believe in rapid changes, as in electricity business there should be long-term planning – the power plants should be planned for their whole life-time of 50 years.

Systematic planning of the future power system requires visionary thinking. The planner should see the problems that might emerge in the future, a vision of the power system should reach 70 and more years from today.

Arvi HAMBURG, EUR ING.

Chairman of Estonian Association of Engineers