THE STATE R&D PROGRAM "ENVIRONMENTALLY-FRIENDLY GEOTHERMAL POWER ENGINEERING OF UKRAINE" AND THE RESULTS OF ITS IMPLEMENTATION

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ABSTRACT

The main lines of activity within the framework of the State Program "Environmentally-Friendly Geothermal Power Engineering of Ukraine" are defined along with the results obtained in the process of its implementation. It is shown that State's support of the Program has provided great contribution to the successful solution of a number of important organizational, R&D and practical problems in the field of geothermal power engineering of Ukraine.

1. THE POWER-GENERATION STRATEGY OF UKRAINE

The power-generation strategy of Ukraine, developed by the President's order, up till 2003 and in the year's to follow has been and will be governed by the reliable analytical forecasting of the energy production and consumption prospects. The forecasting rests on clear understanding that the fossil fuel reserves are rather limited, the vitally important environmental issues are yet to be settled and the possibilities of harnessing non-traditional energy sources, including those of geothermal origin, are realistic.

The distribution of real and predicted energy-consumption in Ukraine still retains the inherited from the USSR deformed management pattern which is characterized, in particular, by considerable amounts of energy consumed in the industry. Hence, comes the dominance of outdated power-intensive industrial technologies and general overloading the Ukrainian economy with energy-intensive branches: metallurgy, chemical industry, production of construction materials like cement, etc. The analysis reveals that even with current rate of industrial modernization and revival extended into the coming decades the level of total energy consumption as of 1990 (300 mln. tons of conditional fuel) will not have been exceeded even by 2030.

The dynamics of changes in distribution of energy sources utilized in Ukraine points to the drop in nuclear power engineering share and the increase in that of renewable energy sources. The above-mentioned development means gradual approaching to the European power engineering standards which is a necessary condition to be met on the way to joining the European Community.

An important component of the economic and ecological strategy of Ukraine is the sustainable development of Ukrainian Industrial and Energy Complex in the direction of energy saving and the reduction of negative anthropogenic environmental impact. The necessity of successful resolution of the issue is closely related to the number of long-term international commitments of Ukraine, in particular at the preparation of a procedure of ratification by the Supreme Council of Ukraine of the Kyoto Protocol and the UN Frame Convention on climate change.

The most reasonable mechanism of implementating the Kyoto Protocol's provisions appears to be the introduction of the so-called joint projects (clause 6). Apart from purely energy-focused project, a vide range of issues is accepted: extension of plantation areas, reduction of transport-generated harmful releases, spreadings green-house gases recovery and utilization technologies, etc. Energy-focused projects may be devoted to energy saving and, accordingly, to the reduction in energy consumption, renovation of energy-generating plants and the propagation of renewable power engineering technologies. It is well known, that 94 % of the total quantity of antropogenic CO_2 releases into the Earth's atmosphere is produced by energy-generating plants. Currently the EU countries satisfy 5.6 % of their energy demand from renewable sources and are planning to make it 12% by 2010. This also means 402 mln. tons of CO_2 releases less per year.

The place of renewable power engineering in the Kyoto Process is defined by the volume of promising joint projects directly targeted at the introducing in the power systems of a number of countries the modern technologies based the utilization of the energy of biomass and small rivers as well as construction and commissioning of power plants tapping the energy of the Sun, wind and geothermal fields.

According to the assessment of this country's experts Ukraine has real possibilities to reduce the annual releases of green-house gases by about 80 mln. tons through the use of the viable potential of renewable energy sources.

The provision of means for the rapid realization of this potential in power engineering and industry presents an important economic, ecological and political challenge. One of such means is the support by the State of renewable power engineering in general and geothermal one in particular.

The State R&D Program "Environmentally-friendly Power Engineering of Ukraine" was launched by the Cabinet of Minister's Decree in 1996. The main goal of the Program-implied fundamental research work as well as the design and pilot-scale activities was the development of material and technical base for the commercial production and introduction in Ukraine and abroad of competitive and cost-effective geothermal power generating systems.

The R&D under the Program are divided into the following structural parts:

1. Resource base of geothermal power engineering.
2. Environmentally-friendly geothermal energy utilization technologies.
3. Geothermal heat supply to cities, settlements and industrial objects.
4. New technologies of geothermal energy utilization in agriculture.
5. Geothermal power engineering.

A total of 19 projects are being implemented under the Program. So far the implementation results are the following:

- scientific and methodical problems solved;
- 6 technologies of geothermal energy extraction and utilization developed;
- design documentation of 7 pilot-plant geothermal units developed;
- 2 geothermal power-generation installations constructed and commissioned;
- proposals to the World Bank regarding 5 big investment projects prepared.

The program is budgeted by the State, the annual average volume of funds being 100 thous. USA.

An important item of the Program is the studies on the realistic assessment of the resource base of geothermal power engineering development in Ukraine. The studies have already yielded the development of up-to-date techniques of geothermal resources assessment which made it possible to draw a convlusion about geothermal-energy potential of Ukraine. It has been found that technically available resource potential in this country is sufficient to build geothermal installations having 12.4 thous. MW thermal and 414 MW electric capacity. Commercial explotation of these capacities will result in the annual generation of 51.14 MWh of heat and 2.36 MWh of electricity which in turn will bring about 7.78 mln. tons saving in conditional fuel and the reduction in CO_2 emissions almost by 17 mln. tons every year.

A cadastre of the 880 wells drilled on the territory of Ukraine has been compiled containing geologic and hydrometric characteristics of parametric, wildcat, exploratoratory and depleted oil wells that represent real geothermal potential.
A number of up-to-date geothermal power engineering technologies has been also developed within the framework of the Program:

1. Intensive circulation technology of geothermal resources development implying the injection of spent heat carrier back onto the collector under development with the purpose of replenishing the reserves of thermal waters and maintaining original average reservoir pressure. The technology is applied in operating objects.
2. Efficient technology for comprehensive utilization of thermal waters containing dissolved or free gas fuel (methane). The technology implies gas separation with the eventual use of degassed thermal water for the production of heat and the free gas as fuel for the generation of electricity. The technology is development and introduced on a pilot-plant unit in Crimea for the first time in the world.
3. Modern technology of geothermal heat supply to industrial and municipal customers based on home-made equipment (heat exchangers, heat pumps, separators, heat-supply networks).
4. A set of technical solutions related to drying vegetable raw material by means of equipment operating on geothermal heat carriers.
5. Technology for producing refrigeration based on the use of geothermal energy.
6. Technological solutions in the field of underground accumulation of thermal energy including the solar variety in summer time.

The development of above-listed technologies includes the elaboration of relevant design documentation, production specifications, software, test specimens of equipment including testing and monitoring instruments. A number of projects under the Program is being implemented in cooperation with organizations from CIS Countries under bilateral agreements. The list of organizations involved runs as follows:

- Institute of electrification of agricultural production (Russia);
- Stock Company "Turbokon" (Pyetropavlovsk Kamchatsky, Russia);
- Engineering State University of Kamchatka (Russia);
- Stock Company " Kamchatenergo" (Russia);
- Stock Company "Nauka" (Russia);
- Institute of Geologic Sciences of the National Academy of Sciences (Byelorussia);
- Integrated Institute for Power Engineering and Nuclear Research (Byelorussia);
- Institute "Kazsyelenergoproyekt" (Kazakhstan);
- Center of Renewable Energy Sources attached to the Institute of Automation of the National Academy of Sciences (Kyrgystan);
- Institute of Physics of the National Academy of Sciences (Azerbaijan);
- Physical and Engineering Institute "Fizica-Solnce" (Uzbekistan).

2. CONCLUSIONS

Over its implementation period the active State R&D Program "Environmentally-Friendly Geothermal Power Engineering of Ukraine" has yielded the solution to a considerable number of organizational, scientific, technological and practical problems in the field of geothermal power engineering of Ukraine serving at the same time as a proof of state a support of this country’s power engineering based on non-traditional energy sources.