The Ministry of Science and Education of Ukraine

National Technical University of Ukraine

«KPI»

Essay

on the theme:

RENEWABLE RESOURCES

IN UKRAINE

Performed by:

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Ukraine is an energy-rich republic. It has resources of coal, gas and oil. However, there continues to be a shortfall between domestic primary energy production and demand as a result of low investment in domestic capacity. Approximately one-third of Ukraine's primary energy is sourced from coal, while another third is from gas. Nuclear power plays an important role in electricity production, providing 30-40% of electricity supply.

In 1993 renewable energy resources accounted for less than 1% of primary energy demand. This was mainly accounted by the use of large scale hydro to produce electricity, and wood used as a domestic heating fuel. There has been little development of renewable energy due to historically low fossil fuel prices and no need to consider security of energy supply. There has been significant research and development carried out in Ukraine, in particularly wind power and solar power. However, these markets have barely developed beyond demonstration systems. There is considerable renewable resource in Ukraine, but today this has not been widely developed. As fuel prices are raised to market levels and government implements programmes to support and promote renewable energy and energy efficiency, the future role for renewable energy is considerable. In 1996 the National Energy Programme was adopted in Ukrainian parliament, in which much attention is paid to wind, solar and geothermal energy as well as various biomass resources. Particularly the Ukrainian wind fund is designed to support the implementation of 100MW of capacity each year with a target of 2000MW by 2010. The government has also passed a resolution to assist the development of geothermal electric power, which aims to expand installed capacity to 6000 MW over ten years.

Renewable energy installed capacities

There are so many compelling reasons why it is time to move away from using nuclear power and fossil fuels to generate energy: climate change, radioactive contamination, nuclear proliferation, the unsolved problem of nuclear waste, air and water pollution, resource depletion, and of course the need to create a sustainable energy system based on indigenous renewable resources. A global commitment must be made to phase-out nuclear power and fossil fuels. Technology is one of the keys, but the way these technologies are managed and financed is just as important as the way they work. With adequate resourcing this technology can be used to bring an end to the nuclear and fossil fuel nightmare and to start a realistic clean energy programme for future generations.

Energy efficiency equipment should be cost-effective and easy to install. It should also be reliable, durable, and suitable for widespread application. Renewable energy technologies should be convenient to use, easy to operate and maintain, and be economically competitive. They should be long-lasting and their installation and operation should not seriously disrupt human settlements or sensitive ecosystems. Finally, they should generate considerably more energy over a lifetime than is invested in their construction and operation. Central & Eastern Europe can either continue to operate expensive dangerous and polluting nuclear power plants, or begin to implement new policies which will ensure that renewable energy systems are developed by receiving the political and financial support they deserve. It is all too easy to point to old buildings that waste energy, to inefficient industries and so on, but these case studies show that political will can convert old buildings and transform industrial processes. Unfortunately, such commitment still remains the exception rather than the rule. Governments still subsidise and promote the inefficient and polluting technologies of the past. The same is also true of the International Funding Institutions. The region does have the power to change. The successful projects give some examples of how it can be done. Breaking the addiction to nuclear power will require unprecedented political commitment, but the health and security of future generations depend on it. In Central and Eastern Europe, energy efficiency offers one of the best opportunities for lessening dependence on nuclear power and reducing the climate impacts of polluting fossil fuels. However, governments in the region continue to invest large sums of money in nuclear power projects, whilst expenditure on energy conservation has been minimal. Also, the European Union, through Euratom, continues to invest billions of ECU into developing nuclear power in the region. Following the Chernobyl nuclear accident in 1986, there were numerous energy efficiency studies carried out in Ukraine. These studies developed by institutions such as the World Bank and the European Union have shown a huge potential for energy savings. The Ukrainian government has also set up a State Committee on Energy Conservation which has the task of co-ordinating and implementing a national energy savings strategy. In it’s draft document for a ‘Comprehensive Energy Efficiency Programme’, the Committee has shown that 42-48% of Ukraine’s total energy consumption (using 1990 as a base load) could be avoided. A balanced energy policy for any country should aim at energy efficiency with a long-term programme of implementation of renewable sources of energy. Energy from the wind, the sun and the water is constantly available and produces few environmental problems compared with other sources of energy. The treatment of wastes such as biomass, extracting ‘geothermal’ energy from the earth and small-scale hydroelectric schemes also offer good possibilities. The official view from many governments around the world, however, is that renewable energy will be unable to provide more than a small proportion of our energy needs until well into the next century. This pessimistic perception is directly related to the lack of funding which has been made available for research and development. The key to success is good planning and a complimentary mix of renewable energy sources. The role that renewable energy sources could play in Central and Eastern Europe is severely underestimated by decision makers.

The Ukrainian authorities are in favour of wind energy. Development of wind energy technologies and utilization of wind resources are component to it’s electricity policy. The Ministry of Power and Electrification set a goal of the year 2010 of putting into operation a wind power production capacity providing not less than 5% of the electricity production of Ukraine, the equivalent of 15TWh. This is a good start, but does not go far enough. There are of course many problems associated with the production and implementation of these kinds of technologies in the region. The biggest is that there is almost no market for this equipment: the producers do not know how to sell the solar panel or wind generators they produce, while potential customers do not know where to buy such installations. This once again underscores the urgent need for government, business and banking co-operation and collaboration.

Geothermal Geothermal energy refers to the heat within the earth’s surface that can be recovered and used for practical purposes. The earth’s molten core serves as the source of this subterranean heat, which is brought near the surface by underground volcanic activity. Molten rock intrudes into the earth’s crust, heating groundwater to create the steam and hot water that are potentially recovered as viable geothermal resources. These "hydrothermal" resources are typically recovered with well-drilling equipment, and then employed near the point of extraction. For generating electricity, hot water is brought to the surface and "flashed" to steam by the release of pressure from specially designed vessels. In regions where geothermal resources are of lesser quality, binary plant technology is often employed. This technology uses the hot water to flash a secondary – or "working" – fluid (one with a lower boiling temperature), thus providing a gas to directly substitute for the steam. The steam is then used to drive a turbine, which consequently operates an attached generator. Internationally, at least 21 of the world’s countries generate electricity from geothermal energy, while up to 40 countries use geothermal resources for domestic direct heating purposes.

Wind energy

There is great potential for wind power energy in Ukraine. If, for instance, the 2,700 sq.km. of shallow waters in the Black and Asov Seas were used for wind turbines, this would cover the entire electricity consumption of Ukraine. After the Chernobyl accident, several attempts were made to develop wind turbines in Ukraine. The most successful has been the joint venture Windenergo. It was created as a collaboration of a number of former military companies that have the necessary manufacturing facilities and a USA-based company, Kennetec Windpower. Their first type of wind turbine is a 107-kW turbine, of which three started their operation in May 1993. Now 60 of these turbines are running near Donuzlav Bay in Cremea. A new model of wind turbine has been developed with a capacity of 250 kW. Three turbines of this type are now in operation. Beside the Ukrainian wind turbines, the Windenergo produces parts for Kennetec wind turbines operating in the USA, which is partly financing the involvement of Kennetec. The price for each turbine was initially $23,000 US, well below world market price. Now the price is $50,000 US, which is close to world market price. The price increase is due to higher overhead costs of the companies because of a decreased of other production. Increased competition and restructuring are expected to bring prices down again. The wind-electricity is produced at 2.0 US cents/kWh and sold for 2.4 US cents/kWh to the power company. The consumer price is 3.1 US cents/kWh. In 1994, the government of Ukraine created a fund for construction of wind turbines. The initial goal was to finance 100 MW of wind turbines. Since then, the decision has been made to support additional development using part of the national tariff on electricity. Thus, 0.5% of consumer electricity payments, equal to $15 million US annually, will be allocated to the fund. The official Ukrainian energy plan includes the installation of 2000 MW wind turbines by the year 2010. This will cover 10% of the Ukrainian demand for electricity.There is a great potential for wind energy in Ukraine. Especially, Crimean coasts make Ukraine the second country in the world (after Norway) in shallow water areas that are suitable for large wind farms. At present about forty industrial enterprises, previously under jurisdiction of the military-industrial establishment, are engaged in the production process of licensed units for the turbines USW 56-100. These wind turbines are assembled at the Industrial Complex "Yuzhny Machine-Building Plant" (PO "Yuzny Mashinostroitel'nyi Zavod") in Dnipropetrovsk. The first three modern windmills in Ukraine were installed in May 1993 in the Crimea within Donuzlav Bay. In 1994, one GWh of electric energy was generated.

Solar energy is clean energy

Even when the emissions related to solar cell manufacturing are counted, photovoltaic generation produces less than 15% of the carbon dioxide from a conventional coal-fired power plant. Using solar energy to replace the use of traditional fossil fuel energy sources can prevent the release of pollutants into the atmosphere. Using solar energy to supply a million homes with energy would reduce CO2 emissions by 4.3 million tons per year, the equivalent of removing 850,000 cars from the road.

Solar energy uses fewer natural resources than conventional energy sources. Using energy from sunlight can replace the use of stored energy in natural resources such as petroleum, natural gas, and coal. Fossil fuel extraction can use drilling and mining techniques that leave land undesirable for other uses after the energy source has been removed. Photovoltaic (PV) panels can be integrated into building surfaces for the production of power, eliminating additional land use. For example, the 100,000 square foot roof of a typical discount retailer could produce more than a megawatt of solar electricity.

Solar energy systems need less space to produce a megawatt of electricity than coal-fired power when the land devoted to mining is factored in. No land is required when solar systems are integrated into buildings.

Solar energy is a renewable resource. Some scientists and industry experts estimate that renewable energy sources, such as solar, can supply up to half of the world's energy demand in the next 50 years, even as energy needs continue to grow. To avoid an energy crisis, we need to begin shifting our energy reliance away from our finite supply of fossil fuels and towards renewable energy sources such as solar.

Enough sunlight reaches the earth's surface every year to produce approximately 1,000 times the amount of energy produced by burning all fossil fuels mined and extracted during the same time period. If this energy is effectively captured, it could meet human energy needs indefinitely.

In summary, solar energy is a smart energy choice.

Energy Use

At 6.4 quadrillion Btu (quads) in 1999, Ukraine's energy consumption accounts for 1.7% of the world's total. In 1998, the country's vast industrial sector accounted for a disproportionate 61% share of the country's total, with residential standing at 16%, transportation at 14%, and commercial 9%. In 1999, natural gas consumption represented the largest percentage of energy consumption at 44%, with coal and oil at 30% and 11.8%, respectively .Looking at recent trends, Ukraine has followed a continual pattern of reduced energy consumption. Since 1992, Ukraine energy consumption has dropped from 8.86 quads to 6.43 quads in 1999--a 27% drop. This figure is even more impressive when compared to Ukraine's neighbours that are also in transition to market economies. Only Russia, which saw a 25% decrease (from 34.9 quads to 26.0 quads), experienced a similar pattern. Unfortunately, much of the reduced energy consumption in Ukraine is due not to energy saving or energy efficiency but rather to the collapse in industrial production because of the contraction of the economy. As a non-Annex I country under the United Nations Framework Convention on Climate Change and a signatory to the Kyoto Protocol in 1999, Ukraine has agreed to stabilize its emissions of greenhouse gases at 1990 levels by 2008-2012. Since Ukraine's emissions are already more than 30% below 1990 levels, Ukraine has the potential to play a major role in climate change negotiations.

Energy Intensity

In terms of energy consumption per dollar of GDP, Ukraine ranks as one of the most energy-intensive countries in the world because of its inefficient, Soviet-era industries. Ukraine's energy intensity in 1999 at 101.3 thousand Btu/$1990 was more than 8 times that of the United States (12.6 thousand Btu/$1990) and more than 15 times that of Japan (6.5 thousand Btu/$1990). Even more telling is the fact that Ukraine's energy intensity is considerably higher than any of its fellow transition neighbours--including Russia. In 1999, Poland's energy intensity was 28.6 thousand Btu/$1990, Turkey's 14.9 thousand Btu/$1990, Romania's 55.1 Btu/$1990, and Russia's 72.1 thousand Btu/$1990.On the per capita level, Ukraine is more comparable to other countries in transition. Ukraine's per capita energy consumption in 1999 was 127.0 million Btu--substantially lower than the U.S. value of 288.9 million Btu, but closer to Russia (176.7 million Btu) and above Poland (99.3 million Btu), Romania (73.1 million Btu), and Turkey (45.9 million Btu). Similarly, per capita carbon emissions in Ukraine were 2.1 metric tons of carbon per person in 1999; this figure is again lower than both the United States (4.4 metric tons) and Russia (2.7 metric tons) while higher than Romania (1.1) and Turkey (0.8)The Ukrainian government has taken several concrete actions to promote lower energy consumption and better energy efficiency. The National Energy Conservation Information Network was set up to disseminate energy conservation information to the general public, and an international program with the Alliance to Save Energy is helping strengthen the role of Ukraine's nongovernmental organizations and the private sector in raising public awareness of the benefits of energy efficiency. In addition, the United States Agency for International Development, in conjunction with the World Environment сenter, is supporting 18 waste minimization/energy conservation demonstration projects at 10 enterprises located in the Donetsk and Dnipropetrovsk regions of Ukraine. The use of renewable energy in Ukraine was one of the principal goals of the 1996 National Power Energy Program. In 1999, however, renewable energy sources represented only 8.6% of electricity generation, a figure that includes hydropower, solar, wind, tide, geothermal, solid biomass and animal products, biomass gas and liquids, and industrial and municipal wastes. This figure appears low, but it can partially be explained by the fact that the development of renewable resources in Eastern Europe and the former Soviet Union remains limited primarily to expansion or refurbishment of existing hydroelectric units. Indeed, the National Power Energy Program called for completion of new hydropower utilities--such as the Dnеstrovskaja hydro pumping storage station--to reduce dependence on imported energy sources. Yet, renewable energy sources are beginning to find a market in Ukraine. In the Carpathian region of the country, the Environmentally Sound Business Development project is focusing on small business development in wood processing industry to increase the efficiency of the production process by reducing timber use, waste products, and energy consumption. In addition, as part of an alternative energy source program, the Ukrainian State Geology Committee and the Ministry of Coal--along with the United States Agency for International Development, Ukrainian coal companies, and the U.S. coal bed methane industry--are working to identify opportunities to develop coal bed methane as a commercially viable alternative energy source in Ukraine. In addition, the Ukrainian parliament passed a bill in July 2001 that aims to develop alternative energy sources such as solar, and geothermal. Additionally, through the Wind Power Development Project, Ukraine seeks to establish wind power as a significant source of electricity generation by 2020. Of the renewable energy sources, only hydro power makes a significant contribution to Ukraine's electricity supply at present. About 8.7% of total installed capacity is accounted for by hydro plants, but this generates 14.3 bln kWh or about 8% of the country' electricity, table 3. Part of the reason for this low utilisation factor is the fact that most of the major hydro stations are located on the Dnipro River, on which the flow is highly seasonable. However, some of the hydro plant is used at least partly to provide much-needed peaking capacity, to maintain system stability.

In accordance with the National Energy Programme of Ukraine, in 2000 the share of renewables in Ukraine's net generation of electricity had to be 0.8% or 2.1 bln kWh. Because of severe budget constrains during the previous five years, this programme has not been fulfilled. Actually, less than 10% of needed funds have been assigned for renewable energy in 1996- 2000. Therefore, we can consider that in 1999 the real share of renewables was around 0.08%.

Summary

Ukraine is an energy-rich republic. It has resources of coal, gas and oil. However, there continues to be a shortfall between domestic primary energy production and demand as a result of low investment in domestic capacity. In 1993 renewable energy resources accounted for less than 1% of primary energy demand. This was mainly accounted by the use of large scale hydro to produce electricity, and wood used as a domestic heating fuel. There has been little development of renewable energy due to historically low fossil fuel prices and no need to consider security of energy supply. There has been significant research and development carried out in Ukraine, in particularly wind power and solar power. However, these markets have barely developed beyond demonstration systems. There is considerable renewable resource in Ukraine, but today this has not been widely developed. There are so many compelling reasons why it is time to move away from using nuclear power and fossil fuels to generate energy: climate change, radioactive contamination, nuclear proliferation, the unsolved problem of nuclear waste, air and water pollution, resource depletion, and of course the need to create a sustainable energy system based on indigenous renewable resources. A global commitment must be made to phase-out nuclear power and fossil fuels. Technology is one of the keys, but the way these technologies are managed and financed is just as important as the way they work. With adequate resourcing this technology can be used to bring an end to the nuclear and fossil fuel nightmare and to start a realistic clean energy programme for future generation

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## This article was very interesting for me. I have learned a lot of interesting facts about renewable resources of energy. The article is closely connected with my speciality so I think it will help me in studding other subjects as well as choosing my profession.

renewable energy ukraine

Literature:

Журнал: «Енергетика України : сьогодення і майбутнє (Тези доповідей)».

Випуск: «“День енергетики України” Виконавча асамблея Всесвітньої енергетичної ради України, Київ 10 вересня 2003» .