of Ukraine «Kyiv Polytechnic Institute». Series Radiotechnique Radioapparatus Building, Eddition 59. 2014. P. 21-28.
2. Rusyn V. Modeling and Control of Chaotic Multi-Scroll Jerk System in LabView. *Bulletin of National Technical University of Ukraine «Kyiv Polytechnic Institute»,* Series Radiotechnique Radioapparatus Building. Edition 62. 2015. P. 94-99.
3. Rusyn V.B. Hyper-chaotic lorenz system: modelling and analysis of the information properties. Перспективні напрямки наукової думки: 2018 *: зб. наук. праць «ΛΌГОΣ» з матеріалами міжнар. наук.-практ. конф.,* м. Тернопіль, 18 квітня, 2018 р. URL: https://ukrlogos.in.ua/documents/18_04_2018_185.pdf.
4. Rusyn V.B. Control of chaotic rossler system. Інноваційний розвиток: освіта та наука XXI століття: 2018 *: зб. наук. праць «ΛΌГОΣ» з матеріалами міжнар. наук.-практ. конф*., м. Київ, 19 червня, 2018 р. URL: https://ukrlogos.in.ua/documents/19_06_2018_132.pdf.
5. Rusyn V.B. Modeling and analysis of a new chaotic generator. *Naukowy i innowacyjny potencjał prezentacji: kolekcja prac naukowych «ΛΌГОΣ» z materiałami Międzynarodowej naukowo-praktycznej konferencji*, Opole, 18 listopada 2018 r. Tom 7. s. 34-35.

RENEWABLE ENERGY AS A KEY TOOL OF SUSTAINABLE DEVELOPMENT AND ENERGY SECURITY OF UKRAINE

Olena Skuibida
Zaporizhzhya National Technical University
Ukraine

Sustainable development has been defined as a modern solution of the problems of environmental degradation. Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs. It is crucial to harmonize economic growth, social inclusion and environmental protection in order to achieve sustainable development. In 2015 the 2030 Agenda for sustainable development was adopted and its 17 sustainable goals were presented. Among them were affordable and clean energy, climate action, good health and well-being, responsible consumption and production, sustainable cities and communities, clean water and sanitation etc..

Generally accepted, that the use of renewable energy sources is the key step for decarbonising of the economy and solving the problem of global warming. One of the main causes of climate changes is the use of fossil energy sources. Emissions of pollutants in the air from combustion of traditional fuels can be divided into the following groups: carbon compounds (oxide and carbon dioxide, cyanide compounds); sulfur compounds (hydrogen sulfide, sulfuric anhydride, organic compounds); nitrogen compounds (ammonia, nitrogen oxides); compounds of fluorine and chlorine; poisonous aerosols (vapors and fog of

sulfuric, nitric, hydrochloric acids, mercury of organic compounds, radioactive dust). Outdoor air pollution is one of the leading ground for death worldwide. Annually it is responsible for nearly 3.7 million deaths from heart attacks, strokes, lung cancer, chronic obstructive pulmonary disease and others.

For example, when burning 1 kg of coal or 1 m^3 of natural gas an average of 1.8...2.5 kg of CO_2 and other harmful and dangerous substances enter into the atmosphere. The compound CO_2 makes more than 50% of the overall contribution of greenhouse gases to climate change. Carbon dioxide has a stifling effect, causes headache, dizziness, hearing impairment and drowsiness.

In 2015 the Paris Climate Change Agreement have being approved for maintenance the average temperature increase on the planet well below +2 ° C compared to pre-industrial levels and to endeavor to limit the temperature rise to +1.5 ° C from preindustrial level. In 2018 195 countries have signed the Paris Agreement within the United Nations Framework Convention on Climate Change. Global warming is a well-known fact, which is confirmed by the growth of atmospheric air temperature, rising sea level, melting glaciers and decreasing the mass of snow. Scientists predict that global warming will lead to changes in agriculture and stockbreeding, flora and fauna, hydro and meteorological processes and aquatic ecosystems as well as it will increase morbidity because-of the problems with water and food supply, heat loads and the transformation of mechanisms for the spread of diseases. Climate change, air pollution and the onflow of ultraviolet radiation as a result of the destruction of the ozone layer can interact with each other, exacerbating adverse effects on human body.

Solving climate change and fostering sustainable development are 2 sides of the same coin: sustainable development cannot be achieved without climate action. Investments on sustainable development will help to prevent climate change by reducing greenhouse gases emissions. Climate change can be considered as an indicator of sustainable development. It is already impacting public health, food and water security, migration and peace. Renewable energy plays the leading role to achieve sustainable development goals.

Ukraine ranks 21st place among the world's largest emitters of CO_2 from combustion of energy resources. According to Energy Trilemma Index produced by World Energy Council, Ukraine ranks 57th among 125 countries of the world (and 113th on the dimension of environmental sustainability) [1].

According to the State Statistics Service of Ukraine the structure of total energy consumption is characterized by the significant amount of nuclear power (38.2%), natural gas (26.3%), coal (23.2%), and renewable energy (7.7%). In the renewable energy sources structure the part of biofuels and wastes accounted for 79.8%. In the structure of electricity production, the largest share of renewable energy sources belongs to hydropower. However, in 2017 the segment of hydropower and wind energy decreased by 1.0 % and 0.9 % respectively, with simultaneous increase of solar energy by 1.4 % and biofuels by 0.5 % [2].

Ukraine has considerable potential for the use of renewable energy sources. For example, the biomass potential of Ukrainian agricultural sector is about 33 million tons of conventional fuel per year, which is almost three times higher than the same indicator in Germany. Nearly 2.5 thousand of households in Ukraine

have small solar power plants that are connected to the general network and operate at a green tariff. The state has established production of licensed wind power installations [3].

Ukraine has started the cooperation with the EU on renewable energy issues in 1992. With the adoption of the Treaty establishing the Energy Community, Ukraine has undertaken to implement a number of EU's directives and regulations at the state policy level as well as to adapt national energy legislation to European legal requirements. According to Decision D/2012/04/MS-EnC on the implementation of Directive 2009/28/EC and amending Article 20 of the Energy Community Treaty, Ukraine committed to reach 11% of energy from renewable sources by 2020. Furthermore, by signing the Paris Agreement and developing the New Energy Strategy "Security, Energy Efficiency, Competitiveness" for the period up to the 2035 Ukraine has committed itself to strengthen energy efficiency measures and to reach 25% of renewable energy sources in gross final energy consumption. According to expected nationally-defined contributions (Paris Agreement), Ukraine should reduce its greenhouse gas emissions by 2030 up to the level not exceeding 60% of 1990's emissions [4, 5]. In accordance with the National Inventory Report the total amount of greenhouse gas emissions in Ukraine was about 944.4 million tons of CO_2-equivalent in 1990.

The experience of the USA, Germany, Japan and others has shown that progress of renewable energy can only be achieved through the implementation of a state policy that covers all areas of the national economy and coordinates administrative, legislative and financial measures. An increase in the use of renewables will enable Ukraine to create conditions for reducing the level of energy intensity of gross domestic product, optimizing the energy balance structure, decarbonizing the economy, reducing the technogenic overload on the environment and deterioration of public health as well as fostering the progress of sustainable development.

References:

1. Дячук О.А. Внесок України до нової глобальної кліматичної угоди. *Економіка і прогнозування.* 2016. №1. С. 129-141.
2. Енергетичний баланс України за 2017 рік. Експрес-випуск: Державна служба статистики України. URL:http://www.ukrstat.gov.ua/express/expr2018/12/192.doc.
3. Лось Л. В. Терлецький М.Д. Перспективна альтернативна енергетика. *Вісник Житомирського національного агроекологічного університету.* 2013. № 1(1). С. 203-214.
4. Очікуваний національно-визначений внесок (ОНВВ) України до нової глобальної кліматичної угоди: Аналітичні матеріали «Україна – 2030: політика розвитку і клімат». URL: http://www.menr.gov.ua/docs/klimatychna-polityka/INDC_Analytical_UNDP.docx.
5. Прогнозування викидів парникових газів в Україні до 2030 р. та подальшу перспективу: Агентство США з міжнародного розвитку (USAID). URL: http://www.menr.gov.ua/docs/klimatychna-polityka/USAID_MERP.docx.