IREC2018 The 9th International Renewable Energy Congress
March 20 - 22, 2018, Hammamet, Tunisia
IEEE PES Power & Energy Society®

Keynote: The energy challenge of Renewables

Sümer ŞAHİN
Bahçeşehir University, Faculty of Engineering and Natural Sciences
Beşiktaş, İstanbul, TÜRKİYE

The global energy consumption along with the growth of population and economic development is growing at a yearly rate of about 1,5%. But, the emissions are growing faster at a yearly rate of about 2,5% in the last decade. The share of the fossil fuels in the commercial primary energy production is ~ 88%, which are **Polluting (CO, CO_2, SO_x, NO_x, etc.),** non-renewable and have limited reserves. And coal, the most pollutant fossil fuel, is still the most rapidly growing source of primary energy in the world. According to IEA 450 scenario, instead of reducing a factor of 2 the yearly CO_2 emissions in 50 years, the path indicates to more than doubling that. The shares of nuclear and renewable as clean energy sources remain modest with 7 and 5 %, respectively. There is no hope to limit the temperature increase to 2 ºC at the turn of the century.

Coal is not only the major chemical pollution source with gas and ash output, but causes also significant radioactive pollution. Coal reserves contain in average 1.3 ppm uranium and 3.2 ppm thorium. At present the World coal consumption releases yearly ~10.000 ton uranium and ~20.000 ton thorium to the environment. In concrete terms, coal power plants release per unit energy production 100 times more radioactive pollution than nuclear power plants.

Solar PV is a growing market in EU, USA, China, Japan and other countries. At present, solar thermal electricity is based mainly on steam turbine conversion system. However, advanced technologies have great prospects for terrestrial high temperature electricity with solar collectors using dry conversion system, based on Liquid Salt Coolants/Supercritical CO_2 Turbine combination. On the other hand, Daily and seasonal fluctuations represent severe obstacles to provide base load electricity. Solar electricity with ultra-light reflectors in space and thermo-electric or thermionic conversion systems can provide continuous, constant power, can open new dimensions in MW and GW energy range but requires hard technology,.

Fission Nuclear Energy is the most reliable, clean energy source to provide base load electricity. It has renewable potential with multiple re-utilizations of higher actinides in the spent nuclear fuel. Full exploitation of uranium and thorium resources can meet world energy needs for tens of thousands years. Intensive research is pursued on the development of Generation IV reactors for electricity generation with higher efficiency, safety, lower cost, process heat, hydrogen production, thorium utilization and nuclear waste incineration.

Fusion is the ultimate energy form. It is the greatest technology challenge the mankind is facing. The most promising fusion reactions make use of the isotope deuterium, which is $^2H_1$, abbreviated D. They are (D,T), (D,D) and (D,$^3He_2$). D is present in water as heavy hydrogen with abundance of 0.015% in average, i.e., there is one atom of $^2H_1$ for every 6700 atoms of $^1H_1$. However, this tiny amount of D in 1 liter of natural water releases fusion energy equivalent to as much as 300 liters of gasoline. In other words, deuterium in sea water can cover world energy needs for billions of years.

The abundance of $^3He_2$ in natural helium is 0.0138 %, i. e., ~ 1/8000. Earth has very scarce $^3He_2$ resources. On the other hand, it is estimated, based on sample measurements that the first 50 cm of Moon dust contains ~ 10^9 kg of $^3He_2$. Jupiter and Saturn atmospheres contain each ~ 10^{22} kg $^3He_2$. Uranus and Neptune atmospheres contain each ~ 10^{20} kg of $^3He_2$. An energy source indefinitely!!! Fusion technology research is making great progress worldwide, but there is still a long way.

Prof. Dr.-Ing. Sümer Şahin is now adjoint Professor at Bahçeşehir University in İstanbul, Türkiye following his duty as the Dean of Faculty of Engineering at the Near East University in the Turkish Republic of Northern Cyprus. He received his Diplom-Ingenieur (MS) degree in Mechanical Engineering at the University of Stuttgart (Stuttgart, Germany) in 1967 and Doktor-Ingenieur (Ph.D.) degree in Mechanical Engineering at the same university in 1970. In the past, he worked as a Professor at Atilim University (Ankara, Türkiye); Gazi University (Ankara, Türkiye); Erciyes University (Kayseri, Türkiye); King Saud University (Riyad, Saudi Arabia); as an Associate Professor at Ege University (İzmir, Türkiye) and Karadeniz Technical University (Trabzon, Türkiye); as an Advanced Research Scientist at the Ecole Polytechnique Fédérale de Lausanne (Lausanne, Switzerland);and as a NATO Post-Doctoral Fellow at the Oak Ridge National Laboratory, USA.. In 1997**,** he worked at the Universität Innsbruck, (Innsbruck, Austria) as a Visiting Professor**.** In1987, he served as the President of the Turkish Scientific and Technical Research Council of Türkiye (TUBITAK) and Vice-Chairman of the Intergovernmental Committee on Science and Technology for Development of the United Nations General Assembly (New York, USA). He has published close to 170 scholarly papers in reputable journals and about 150 international conference papers on a wide array of topics in nuclear and solar energy; and also given Invited Talks and Seminars in 16 different countries around the globe. His research interests and activities cover Neutron Transport Theory, Nuclear Radiation Shielding, Thermionic Space Craft Reactors, and Space Craft Nuclear Propulsion, Fusion Technology, Fusion-Fission (Hybrid) Reactors, Nuclear Waste Transmutation, Alternative Fuels for CANDU Reactors, Accelerator Driven Systems, and Concentrated Solar Power. He has, at different universities, given lectures on Nuclear Engineering, Reactor Physics, Modern Physics, Heat Transfer, Thermodynamics, Radiation Safety, Physical Aspects of the Energy Production, Nuclear Reactor Design, Fusion Technology and Heat Pipes in Turkish, English, French and German languages.