Energy
Net-Zero Emissions

[Chair]

Nathwani, Jatin, Founding Executive Director of Waterloo Institute for Sustainable Energy (WISE), and Professor and Ontario Research Chair in Public Policy for Sustainable Energy, University of Waterloo, Canada

[Speakers]

Atrey, Milind Diwakar, Institute Chair Professor, Mechanical Department, Indian Institute of Technology (IIT) Bombay, India

Hagen, Tim van der, Rector Magnificus/President, Executive Board, Delft University of Technology, Netherlands

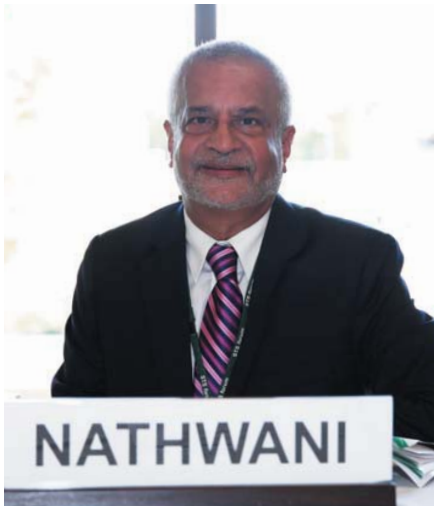
Ishizuka, Hiroaki, Chairman, New Energy and Industrial Technology Development Organization (NEDO), Japan

Pecresse, Jerôme, President and CEO, GE Renewable Energy, France

Priyanto, Unggul, Chairman, Agency for the Assessment and Application of Technology (BPPT), Indonesia

Shimizu, Ryosuke, Executive Vice President, CSO and Director of Corporate Planning Division, Chiyoda Corporation, Japan

Opening Remarks



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The chair opened the session by emphasizing that radical innovation is urgently needed for a net-zero emissions future. However, the current state of innovation in the energy sector is incremental, not keeping up with our energy consumption which will double within the next 3-4 decades. We need innovative solutions to meet the twin challenges of a low-carbon world combined with equitable energy. Paths leading to net-zero emissions include primary energy shifts from high carbon to low carbon and then to renewable energy, energy storage along multiple paths to counter uneven global distribution of renewable resources, and electrification of the economy.

The session speakers were then invited to offer comments. It was argued that our primary focus should be on functionality. Thus, the energy revolution can be defined as a problem of logistics, including storage, transport, and conversion. We need to think of strategic processes, such as useful applications of waste and creation of useful byproducts, as well as efficiency and breakthrough new technologies.

The discussion then turned to measures in Japan for reducing CO_2 emissions. Japan's New Energy and Industrial Technology Development Organization (NEDO) is making dedicated efforts to overcome the difficult hurdles to increasing use of renewables. NEDO's work includes innovative wind power, utilizing hydrogen for a new system of power supply coordination, and low carbonization efforts especially through hydrogen toward creating a Hydrogen Society.

The next topic was India's innovative efforts for net-zero emissions and reducing greenhouse gas emissions. India's growth rate requires increased energy, so it is making steps toward a renewables target of 175 GW by 2022, Prime Minister Modi is a leader in the International Solar Alliance, and the rail network is being electrified. The Indian Institute of Technology Bombay has been supporting India's efforts, including taking a cryogenic approach for truck transport.

It was then noted that renewables are already mainstream and have become the cheapest form of energy vs. conventional sources, and it was argued that the next revolution for energy will be dispatchable green electrons. New players are investing in renewables and new segments of the market are opening. However, we need more innovation to keep up with increased demand, including digital solutions, automation, and more investment in grid hardware and software.

Chiyoda Corporation's work was then discussed, including its efforts to tackle climate change for net-zero emissions. Hydrogen will be the great connector of different sectors such as electric power, transport, industry and private in the future. Renewable energy will be introduced to the power sector first, and then electric power and hydrogen will follow as energy carriers to couple the sectors. However, issues include uneven distribution of solar, wind, and rain precipitation in terms of time and geography, and for this, hydrogen presents various solutions for storage and transport. Chiyoda has developed liquid organic hydrogen carrier technology named SPERA Hydrogen and is preparing a NEDO-funded demonstration project to be operated in 2020.

Finally, the topic was national action on greenhouse gas reduction in Indonesia. Efforts include environmentally-friendly agriculture technology, including improving irrigation networks and biogas. The country has constructed wind and solar power plants as well as electric mass transportation. It also focuses on the use of biofuels, wastewater system improvement, and application of waste disposal in environmentally-friendly processes.

Discussion

Following the opening remarks, a group discussion was held. One discussion was on industry approaches and needs, financing and investment, new technologies, and long-term needs. Another discussion focused on energy efficiency, especially on optimizing energy use in buildings such as through better materials that look toward the future, and creating regulations that would make this obligatory.

The discussion also encompassed reducing methane emissions, which can be thought of as a low-hanging fruit, the feasibility of carbon sequestration, and bridging technologies and energy market changes toward energy of the future especially in countries that depend on fossil fuels.

A further discussion was started by asking the following questions: a) What does every country need to do to accelerate and disseminate technology innovation? b) What is the role of global financing and what kinds of financial networks do we need? c) How can we

integrate wisdom between industry and academia to tackle the energy problem? Regarding question a), it was argued that modern nuclear reactor technology that is affordable, safe, reliable, and does not pose nuclear weapon relevance is important. PV and wind technologies are affected by supply and demand. At the same time, they are intermittent. So, we need to approach these technologies from a system optimization perspective. This will also help reduce cost. A relevant issue is how we can achieve the goal of complete elimination of the fossil fuel dependence. This can be done through thermal power generation along with CCS or PV and wind with energy storage technologies. It was noted that efficiency increase in thermal power generation can have an enormous effect on CO_2 emissions. Regarding question b), the discussion centered around the 3Es = Energy, Environment, and Economy. In general, each country has its own priorities amongst the 3Es. The discussion then moved on and it was stated that we need to price the carbon in order to address the issue of importance and the cost of energy. We need to monetize the environment. Each country should establish its own roadmap: whether its energy mix will depend on biomass or geothermal, or natural gas, etc. The developing world can capitalize on technology from the developed countries. For this, we need international cooperation for technology transfer. Financing must be done freely by everyone, including governments and the private sector. Regarding question c), it was concluded that academia is very important in the race to decarbonize the energy mix. Academic research in collaboration with industry can help invent disruptive technologies.

Another discussion was on how individuals should be responsible for their use of renewables, recycling and the need for longer lifetimes of components, and responsibility at an individual level such that people adopt efficient devices and have an overall understanding of their own use of energy. The final discussion was on the necessity of a technical approach to energy such as through microgrids and utilizing ICT technology to communicate, the importance of hydrogen, and making commercially viable technologies such as CCS.