

## Solar PV Module recycling: Now and Future

The session started with a welcome address by Dr. Ashvini Kumar, Senior Director, Renewable Energy technology division, TERI followed by His Excellency Nils Ragnar Kamsvåg, Norwegian Ambassador to India. His Excellency briefed the gathering about India and Norway's collaborative efforts in combating climate change. He also discussed the three years' framework agreement that Norway has entered into with TERI, focusing on climate change, sustainability and clean energy. He also raised concern over the end life of Solar PV module and urged researchers, investors and policy makers to bring innovative sustainable solutions for PV recycling.

This was followed by the Keynote Address by Dr. Anil Kumar Jain, Additional Secretary, The Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India. The Honorable Secretary emphasized that there are particular rules regarding solid waste management, hazardous substance disposal such as pesticide and chemicals, medical waste disposal but there are no rules regarding Solar PV disposal or recycling. He stressed on appropriate management of solar PV modules post their end life by adopting efficient recycling strategies. To materialize these efforts there is a need of a strict regulation from the regulatory authority.

Next in line was a session titled, 'Presentation on Solar PV Recycling: Addressing Regulatory, Technology and Environmental Challenges', chaired by the Honourable Additional Secretary himself. The following were the speakers making Thematic Presentations, lined up under it -

- Mr. Amit Kumar Mittal, Technical Director, First Solar, Mumbai
- Mr. Vijay Kumar, Moserbaer, New Delhi
- Mr. V. Ramakrishnan, Director, Poseidon Solar, Chennai
- Dr. Kishor Wankhade, Senior Consultant, Sofies New Delhi
- Dr. Mohan Lal Kolhe, Professor, University of Agder, Norway

Mr. Amit Kumar Mittal, Technical Director, First Solar, Mumbai, highlighted several initiatives taken by First Solar in Solar PV module recycling. Being the world's first lowest carbon footprint company, First Solar is recovering almost 90% of components after module's end life. He also discussed about further R&D policy push and awareness in this sector.

Mr. Vijay Kumar, Moserbaer, New Delhi, stated the alarming amount of waste generation projection through Solar PV by 2030 and 2050 which is 1.7 to 8.0 million tons and 60 to 78 million tons respectively. He discussed various available methods for extraction of different elements such

as Silicon, Aluminum, Silver, Glass etc. from solar PV module after its end life. Mr. Kumar, stressed that the PV recycling should be treated as a separate industry due to the growing amount of solar PV waste in future.

Mr. V. Ramakrishnan, Director, Poseidon Solar, Chennai, described his company's role in the field of solar PV recycling by being one of the first companies in India to start solar PV recycling. His company is engaged in recycling In-Line Solar PV. They provide crucible ready silicon from PV waste. India is one of the leading countries in terms of solar PV installation which also makes it one of the leading countries in the amount of waste that would be generated from solar PV. He insisted that there should be a proper understanding for solar PV recycling amongst manufacturers and developers.

Dr. Kishor Wankhade, Senior Consultant, Sofies New Delhi, drew attention towards one of their projects titled SWAP: Solar Waste Action Plan which creates business model for already existing recycling facilities. The whole project is divided into two aspects: regulatory and incubation for technology transfer. Also, the project aims to produce a positive impact of solar sector by adopting circular economy approach.

Dr. Mohan Lal Kolhe, Professor, University of Agder, Norway, discussed from the policy and regulatory point of view the necessity of a framework for addressing waste from solar PV module. He presented two different scenarios for solar PV waste generation projection by the year 2030 and 2050 (early loss scenario and regular loss scenario).

Next we had a Panel Discussion chaired by Dr. Bharat Bhargava, Ex- D.G., OEC- Energy Centre, New Delhi.

The panel discussion focused on various regulatory, technical and environmental aspects of solar PV recycling. The experts for panel discussion debated upon the life expectancy of solar PV module which can be more than or less than 25 years based on their operation and maintenance. They agreed upon that handling, installation and post implementation maintenance can have either a positive or a negative impact on the life of panel.

The distinguished guests talked about the performance of module. It was stated that if any module is performing much below the expected generation, dismantling might be an option followed by recycling. The panel concluded that in future there will be a large amount of solar PV modules that would have completed their life cycle and would need a strong policy intervention from the government to avoid illegal dumping and creating a recycling industry