MAR17-2016-000975

Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

The Terawatt Challenge

NANCY HAEGEL, National Renewable Energy Laboratory

In response to concerns about accelerating climate change, the world is uniting to both envision and enable a global energy system that supports a sustainable environment and broad economic prosperity. Growth in the technology and the deployment of renewable energy has been dramatic. Evidence can be seen in the growth of photovoltaics (PV) and wind as contributors to worldwide electricity production over the last decade. PV and wind provided 1.2% and 3.7% of global electricity production in 2015, compared to 0.1% and 1.3% respectively in 2005 [1,2]. These numbers indicate both the rapid increase in the rate of deployment, as well as the remaining work to be done to extend this trend to transform a massive energy system and provide a significant fraction of the world's future energy demand with renewable energy. Based on recent trends, it is highly likely that global cumulative PV installation will reach terawatt scale in the next few decades. The challenges, as well as the resulting impact, vary greatly depending on whether we envision 1 TW (˜15% of 2015 global electricity capacity), 3 TW (˜50% of 2015 global electricity capacity) or 10 TW, a level that could drive electrification of transportation and industrial sectors and production of solar fuels. This presentation will draw upon the work of the 2016 GA-SERI (Global Alliance of Solar Energy Research Institutes) Terawatt Workshop to assess the feasibility and summarize the challenges for PV as a primary energy source. These challenges include the continuing demand for improved efficiency and reliability, the required magnitude of capital expenditure, the need for a sustainable industry (both financially and environmentally), as well as needs for grid modernization and consistent policies that support global climate goals. Physicists can play important roles in addressing this full range of challenges, from materials science to public policy, as well as in education of the public and its future leaders. [1] REN21, 2016, Renewables 2016 Global Status Report, Paris, REN21 Secretariat. [2] REN21, 2005, Renewables 2005 Global Status Report, Paris, REN21 Secretariat.