

## **Wind Energy: Navigating the compelling road ahead**

Peter F. Green, National Renewable Energy Laboratory

While the current prospects for wind energy are good, the road ahead may not be smooth; hurdles associated with policy, science, and economics lie ahead. In 2016, the net cumulative capacity of wind power increased to 82.1 GW, 11% over the prior year. The first off-shore wind farm also came on-line in the US in 2016. Today wind contributes more than 20% of the electrical energy generating capacity in 5 states and over 10% in fourteen states. The wind vision study predicts a generating capacity of 224 GW by 2030 and 404 GW by 2040, with onshore and offshore wind generation in 50 states. The expiration of the federal Production Tax Credit in 2019, together with new challenges associated with curtailment of wind as increasingly larger quantities of wind must be incorporated into the grid pose inherent challenges. Environmental concerns with regard to the impact on wildlife – particularly birds, as well as resilience to extreme events, such as tornadoes and hurricanes, introduce additional uncertainty. On the other hand, continuing strong drivers for wind use include lowest-cost bulk power, domestic jobs, reductions in water usage, and reductions in pollution (healthcare costs and premature deaths). The promise of the most sophisticated computational tools together with highly collaborative national laboratory/academia/industry interactions devoted to improving our understanding of wind forecasting and wind plant phenomena, thereby optimizing the energy generated by wind farms -the Atmosphere-to-electrons (A2e) program -is compelling. New developments in the design and manufacturing of components, turbines, and plants will enable the objectives of the A2e program to be realized. The recently proposed system management of atmospheric resource through technology (SMART), which takes advantage of A2e and the latest developments in power electronics and sensors, is proposed to reduce the unsubsidized cost of wind power by 50% below current costs, and achieving over 200 GW by 2030. This presentation will briefly discuss factors that influence the future impact of wind power on society.