SPACE POWER SYMPOSIUM (C3)
Space-Based Solar Power Architectures / Space & Energy Concepts (1)

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SPACE & ENERGY: OPPORTUNITIES FOR SPACE IN A DISTRIBUTED ENERGY GRID

Abstract

The global energy sector is changing as both environmental awareness and resource reliability have led to a solid movement to diversify the energy mix towards increasing levels of renewable energy sources, like solar, wind and geothermal. The European Union has placed a target of 20

The increased contribution from distributed energy sources (DES), required a robust distribution network as well as large scale buffer capacity. Various research projects have therefore been carried out to investigate the feasibility of achieving contributions by renewables up to 50% and even 100% in large-scale national and (inter)continental areas via so-called "SuperGrids". One of the main benefits for establishing such a global electricity grid is the improved matching of demand and supply and therefore a lower requirement on the level of local energy storage required.

This contribution will focuses on the changing requirements and future needs of an electricity grid based on a high level of renewable power sources. Performing a scenario-based analysis, the requirements on future space-based services and technologies are determined.

A widespread interconnected network requires not only a large-scale infrastructure but also a robust demand/supply management and control system. In these areas, satellite-based services are already extensively used, for example for weather models, site location & maintenance and telecommunication. On the supply side, reliably forecasting the output of distributed sources requires accurate weather models using high temporal and spatial resolution measurements from Earth observations, including cloud coverage, solar irradiance, precipitation and wind speeds.

Real-time data on network performance will be required to ensure high reliability and availability. When evaluating telecommunication options, the key criteria include latency, bandwidth and reliability. Compared to ground-based, glass-fibre links, space-based services will operate at a higher latency (>250ms). For most monitoring and global control systems this might already be sufficient with the added benefit that broadcasting from space provides coverage over a larger area and high availability is ensured. In addition, adding new nodes in the network is modular without the need for additional ground data connections. Finally, a space-based infrastructure can also provide a high level of security using dedicated connections within a non-public network.

In conclusion, the expansion of a terrestrial energy grid offers multiple technical and social-economic challenges for which space-based services and technologies can provide valuable solutions to assure network reliability and availability