IET Renewable Power Generation

A review of planning methodologies used for determination of optimal generation capacity mix: the cases of high shares of PV and wind

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Abstract

It is undeniable fact that energy systems all over the world are at the point of paradigm shift as a need for decarbonisation is eminent and unavoidable. The pressure to decarbonise mounts year after year. Since two-thirds (67%) of all anthropogenic greenhouse-gas emissions (GHGs) come from the energy sector, decarbonisation is more about reducing emissions in the energy system than any other system in the world. Research has shown that wind and photovoltaic (PV) technologies have dominated the markets with some countries having a combined penetration shares as high as 40%. The increased use of intermittent renewable energy resources introduces a need for advanced methods of planning because traditional planning methods give sub-optimal generation capacity mix when the electric grid is faced with high shares of variable renewable energy resources such as PV and wind. In light of this, this review highlights the major changes in planning methodologies when solving for optimal penetration of generation capacity in systems with high shares of PV and wind. The major highlights are placed on why the methodologies need to evolve as penetration levels of PV and wind increase and further highlight what it still missing on the current advanced methods.