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Hybrid Renewable Power Systems

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Abstract : In line with the Kingdom's Vision 2030, the Saudi Green initiative was announced aimed at reducing carbon emissions by more than 4% of the global contribution. The initiative included plans to generate 50% of its energy from renewables by 2030. The geographical location of Saudi Arabia makes it among the best countries in terms of solar irradiation and has good wind resources in many areas across the Kingdom. Saudi Arabia is a wide country and has many remote locations where it is not economically feasible to connect those loads to the national grid. With the improvement of battery innovation and reduction in cost, different renewable technologies (primarily wind and solar) can be integrated to meet the need for energy in a more effective and cost-effective way. Saudi Arabia is famous for high solar irradiations in which solar power generation can extend up to six (6) hours per day (25% capacity factor) in some locations. However, the net present value (NPV) falls down to negative in some locations due to distance and high installation costs. Wind generation in Saudi Arabia is a promising technology. Hybrid renewable generation will increase the net present value and lower the payback time due to additional energy generated by wind. The infrastructure of the power system can be capitalized to contain solar generation and wind generation feeding the inverter, controller, and load. Storage systems can be added to support the hours that have an absence of wind or solar energy. Also, the smart controller that can help integrate various renewable technologies primarily wind and solar, to meet demand considering load characteristics. It could be scalable for grid or off-grid applications. The objective of this paper is to study the feasibility of introducing a hybrid renewable system in remote locations and the concept for the development of a smart controller.

Keywords : battery storage systems, hybrid power generation, solar energy, wind energy
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