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Assessment of net zero energy building design in Saudi Arabia: Case study at Al Khobar City
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Abstract
The current electricity peak demand in the Kingdom of Saudi Arabia (KSA) is about 55 Gigawatt (GW) out of which 72% is used for Heat Ventilation and Air conditioning system (HVAC). The peak demand is projected to reach 120 GW by the year 2032. The Saudi Government initiated a massive program to improve HVAC energy consumption efficiency in 2007. Furthermore, the new initiative under King Salman for renewable energy has been adopted in this study as part of the vision 2030 in which more details are still yet to be announced. For this purpose, the following suggested model were tested on each house to facilitate a multiple sizable savonius vertical wind turbines with an integrated PV (BIPV) system, which will be designed to fully cover the annual household energy needs. The turbines can be installed in and around any public area such as parks, roads, public facilities, or business offices. Aeroleaf Wind Turbines were designed to produce power up to 300 watts for each turbine. Low wind speed start-up, working with any wind direction, and the less noise were some advantage of VAWT- Savonius model. The results showed that the power output, with speed of minimum speed of 12-15 m/s generate 40-80 watts with an efficiency of 31~35%. In addition to the BIPV system, the model incorporated the use of PCM materials and solar hybrid air conditioning. The results gained from previous analysis showed a 20% reduction of cooling load when utilizing PCMs materials in comparison to standard construction materials. Moreover, the use of solar hybrid conditioning results showed that EER 5.41% and 12.24 % COP, while the consumption of power reach to 5.35%. © 2017, Society of Petroleum Engineers.

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