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Determining the Optimal Tilt Angle for South-Facing Solar-Photovoltaic Panel Surfaces Case Study in Najran, Saudi Arabia

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Abstract

Optimizing incident energy at the surfaces of solar modules is one of the most important parts of energy extraction. The goal of the solar-energy maximization problem is to maximize the amount of solar energy that strikes the flat surfaces of conventional flat solar-PV modules. The amount of solar energy that strikes the surface of photovoltaic (PV) panels is determined by the tilt angle of the panels. The position of the sun, latitude, and regional topography all affect the optimal tilt angle. This article discusses the optimal fixed-tilt solar-PV system angles for the Saudi Arabian city of Najran (18.00o N, 45.40o E). In addition to using meteorological equipment at the engineering college of Najran University in Saudi Arabia, LSI also gathered data on the city of Najran's horizontal solar radiation from "Climate.OneBuilding.Org." After evaluating the monthly, seasonal, and annual fixed-tilt choices, the optimum solution was selected. Najran's ideal annual tilt was determined to be 20.97 degrees. The annual ideal angle value was rather close to the latitude of the individual place. The range of 20.04 to 26.01 MJ/m^2-day was discovered to be the average solar radiation at the annual optimal tilt. Based on monthly, seasonal, and annual ideal tilts, average annual solar radiation gains were projected to be 9.56%, 8.08%, and 3.32% higher than those of solar-PV modules put horizontally. In comparison to the optimal monthly tilt, the surface at seasonal and annual optimal tilts was predicted to lose 1.36% and 5.70% of its energy, respectively.

Keywords
Optimal tilt Najran, Radiation south-facing, Solar- PV.

Biography

Dr. Saeed Alqaed is currently working as Associate Professor in Mechanical Engineering Department, Najran University, Saudi Arabia. He acquired his Ph.D. in 2017 from the University of Dayton, Dayton OH, USA. His research interests have been vastly diverse, beginning with combined heat and power systems, which led to the dissemination of numerous novel applications in combined heat and power systems to focus on in-building energy informatics, and to community energy reduction, and finally, geothermal energy and renewable energy. He is currently involved in several research projects in solar thermal energy nanoparticles applications in heat transfer processing, sustainable energy, and energy transition.

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