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Evaluation of PV Orientation Effect on Mismatch between Consumption Load and PV Power Profiles

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Abstract : Renewable energy and in particular solar photovoltaic energy is emerging as a reasonable power generation source. The intermittent and unpredictable nature of solar energy can represent a serious challenge to the utility grids, specifically at relatively high penetration. To minimize the impact of PV power systems on the grid, self-consumption is encouraged. Self-consumption can be improved by matching the PV power generation with the electrical load consumption profile. This study will focus in studying different load profiles and comparing them to typical solar PV power generation at the selected sites with the purpose of analyzing the mismatch in consumption load profile for different users; residential, commercial, and industrial versus the solar photovoltaic output generation. The PV array orientation can be adjusted to reduce the mismatch effects. The orientation shift produces a corresponding shift in the energy production curve. This shift has a little effect on the mismatch for residential loads due to the fact the peak load occurs at night due to lighting loads. This minor gain does not justify the power production loss associated with the orientation shift. The orientation shift for both commercial and industrial cases lead to valuable decrease in the mismatch effects. Such a design is worth considering for reducing grid penetration. Furthermore, the proposed orientation shift yielded better results during the summer time due to the extended daylight hours.

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