

Analisis perbandingan teknis dan ekonomis sistem photovoltaic terhubung jaringan jenis thin film dan polycrystalline di wilayah tropis asean menggunakan system advisor model = Technical and economical comparative analysis of on grid thin film and polycrystalline photovoltaic system in tropical asean area using solar advisor model

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Deskripsi Lengkap: <https://lib.ui.ac.id/detail?id=20414714&lokasi=lokal>

Abstrak

Dalam suatu sistem photovoltaic (PV) terdapat berbagai macam jenis modul surya yang dapat digunakan seperti mono-crystalline, poly-crystalline, dan thin film. Untuk mengetahui efektivitas penggunaan thin film solar cell pada sistem PV di wilayah ASEAN yang berkoordinat dari 80 LS sampai dengan 80 LU, dilakukan analisa perbandingan teknis dan ekonomis antara modul surya jenis thin film dan crystalline. Simulasi dilakukan dengan menggunakan Solar Advisor Model dengan rentang waktu selama 12 bulan. Output sistem PV thin film tertinggi diperoleh di kota yang berkoordinat 8.60 LS dengan nilai rata-rata GHI 5.46 kWh/m²/hari yaitu sebesar 21,161 kWh dan selisih output antara sistem PV thin film dan polycrystalline sebesar 7.76%. Sedangkan kota dengan koordinat 2.20 LS dengan nilai rata-rata GHI 4.43 kWh/m²/hari, selisih output antara sistem PV thin film dan polycrystalline sebesar 10.52%. Hal ini berarti penggunaan sistem PV dengan modul surya jenis thin film di kota yang memiliki nilai rata-rata GHI yang tinggi kurang optimal dibandingkan dengan penggunaan sistem PV thin film di kota yang memiliki nilai GHI yang lebih rendah. Sistem PV thin film bekerja lebih optimal saat nilai GHI dibawah 500 W/m² yaitu terjadi kenaikan output diatas 10%. Pada saat nilai GHI tinggi yaitu diatas 1000 W/m², kenaikan output antara sistem PV thin film dan polycrystalline hanya sebesar 4~5%. Perubahan sudut tilt terhadap selisih output antara sistem PV thin film dan polycrystalline menghasilkan rentang selisih output sebesar 9~12%. Sedangkan Perubahan sudut azimuth menghasilkan prosentase selisih output dalam rentang 9~10%. Hal ini menunjukkan perubahan sudut tilt dan azimuth tidak terlalu mempengaruhi kenaikan output sistem PV antara sistem PV thin film dan polycrystalline. Nilai LCOE yang paling rendah diperoleh di kota dengan koordinat 8.70 LS yaitu sebesar 18.85 ¢/kWh dengan prosentase selisih LCOE antara sistem PV thin film dan polycrystalline sebesar 15.13%.

In a system of photovoltaic (PV) there are various types of solar modules that can be used such as mono-crystalline, poly-crystalline and thin film. To determine the effectiveness of thin film solar cell in the region with coordinate from 80 north latitude to 80 south latitude, conducted a technical and economical comparative analysis between thin film and polycrystalline solar modules. Simulations carried out by using Solar Advisor Model with a span of 12 months. The highest Thin film PV system output obtained in city with coordinate 8.60 south latitude with the average value of GHI 5.46 kWh/m²/day in the amount of 21.161 kWh and the difference between the output of thin film and polycrystalline PV systems is 7.76%. While city coordinate 2.20 south latitude with an average value of GHI 4.43 kWh/m² /day, the difference between the output of thin film and polycrystalline PV systems is 10.52%. This means that the use of thin film solar modules PV systems in a city that has an average high value of GHI is less optimal compared with the use of thin film PV systems in cities that have a lower value GHI. Thin film PV systems work more optimal when GHI values below 500 W/m², there is an increase in output above 10%. At the time of high

GHI score is above 1000 W/m², the increase in output between thin film and polycrystalline PV systems is only by 4 ~ 5%. Changes in the difference of tilt angle between the output of thin film and polycrystalline PV system produces difference output ranges between 9 ~ 12%. While changes in the azimuth angle made the percentage of difference generating output in the range of 9 ~ 10%. It shows changes in tilt and azimuth angle do not unduly influence the rise in output of a PV system between the thin film and polycrystalline PV system. Lowest LCOE values obtained in the city with coordinate 8.70 south latitude that is equal to 18.85 ¢ / kWh with the percentage difference between the LCOE of thin film and polycrystalline PV systems is 15.13%.