A 10 MW Solar Power Plant West of Fort Worth

LOUISE DILWORTH DAVIS COLLEGE of SCIENCE & ENGINEERING

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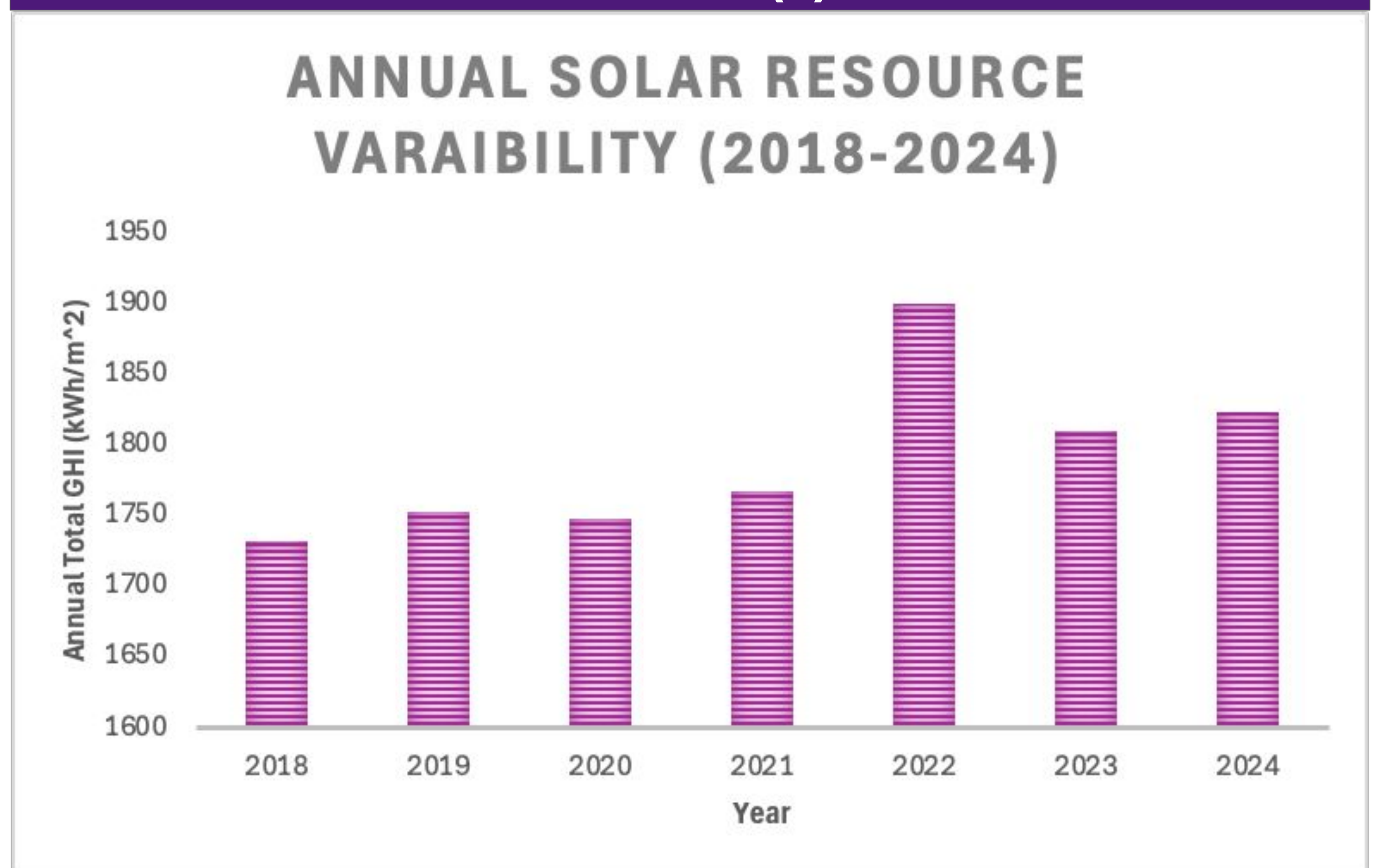
Abstract

This paper presents the design and electrical performance analysis of a 10-MW grid-connected photovoltaic (PV) power plant located west of Fort Worth, Texas. This region is selected for high solar irradiance, flat terrain, inexpensive land, and transmission accessibility. Emphasis is placed on electrical system architecture, including module configuration, DC string sizing, inverter selection, transformer integration, and interconnection with the utility grid. A single-axis tracking (panel pivoting) system is incorporated to maximize incident solar radiation and increase daily energy capture. Parametric studies are performed on tilt angle, tracking strategy, module efficiency, and inverter performance to evaluate their influence on overall system output and electrical efficiency.

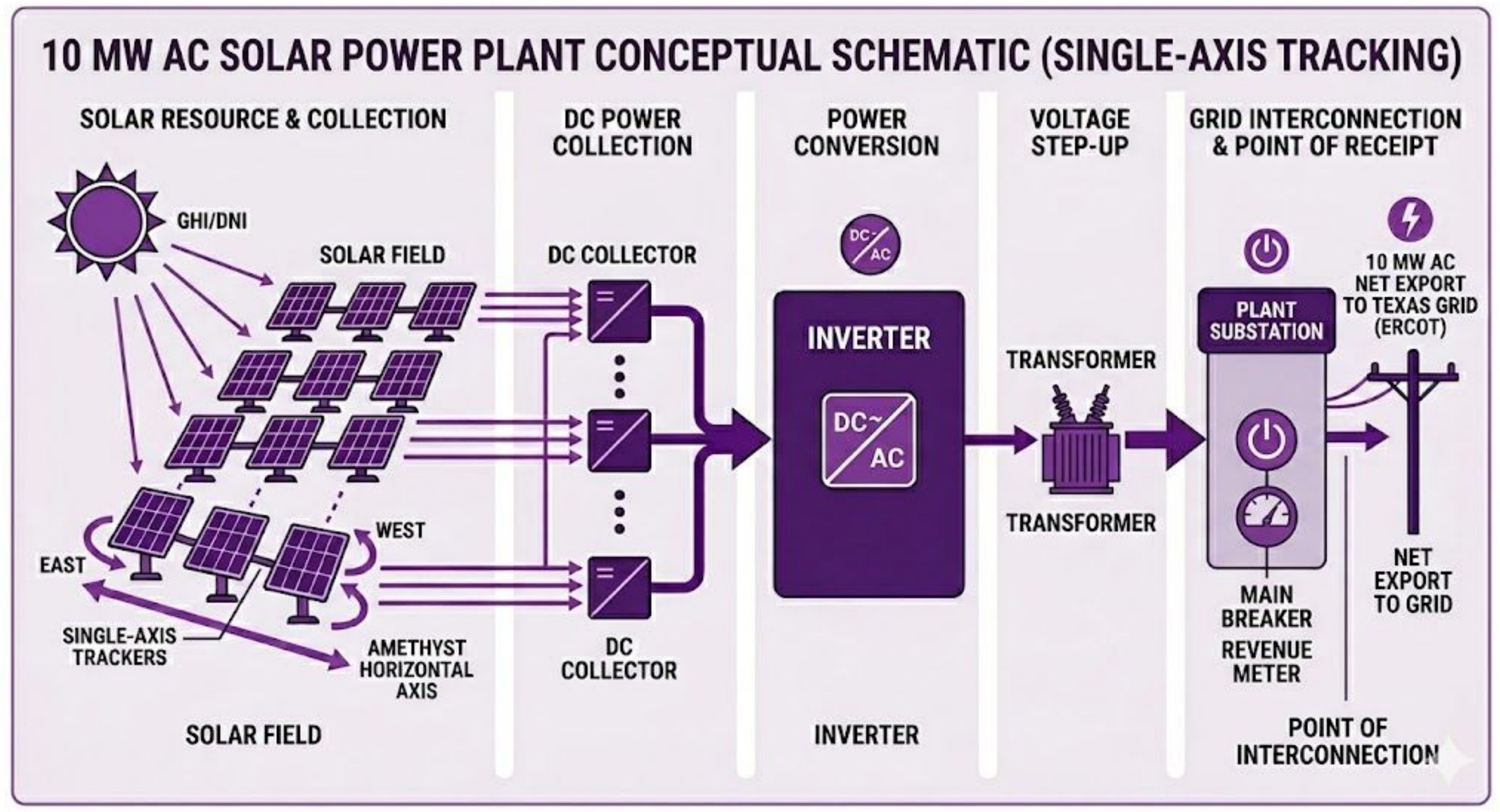
Results (1)



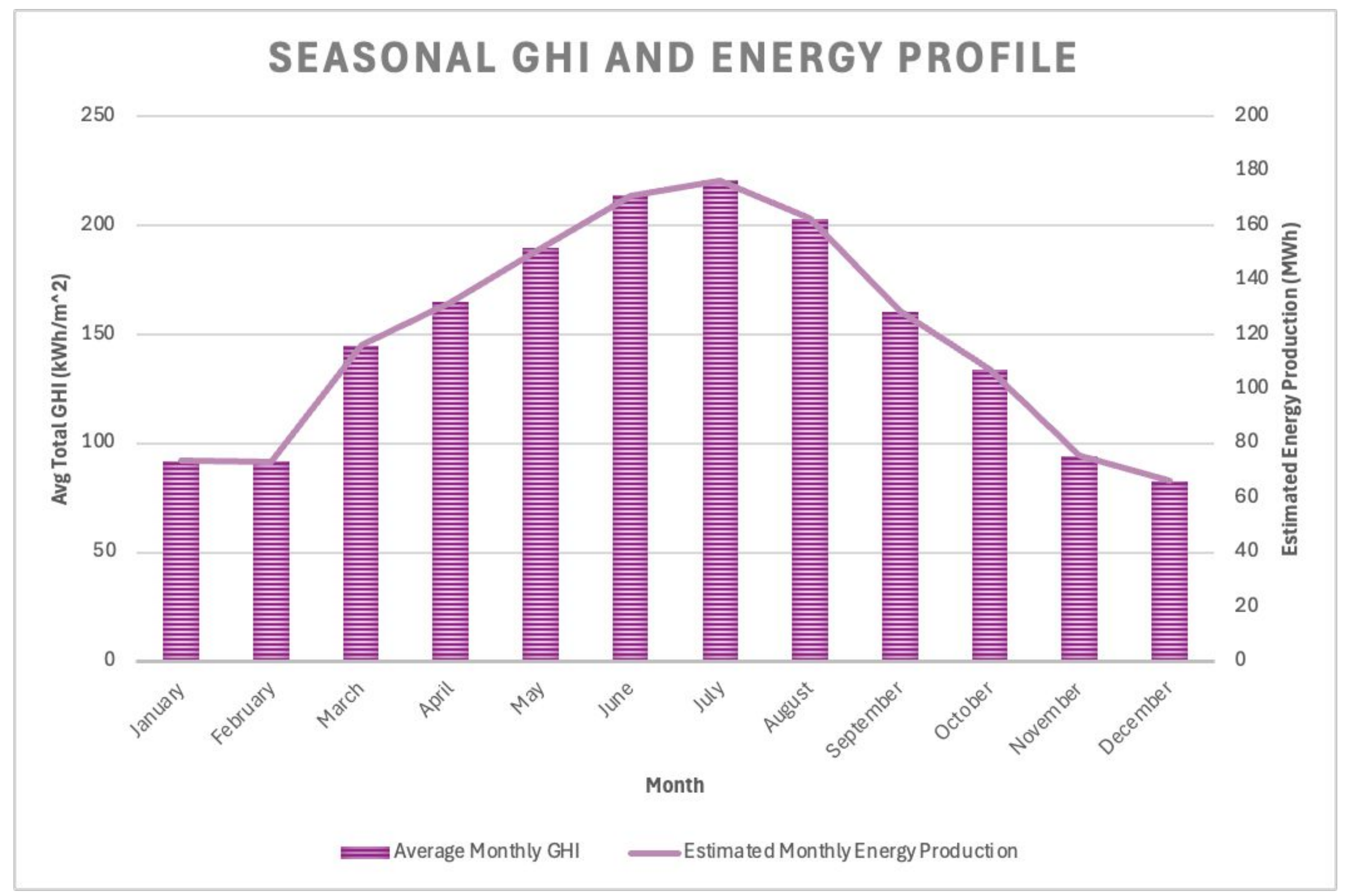
Results (4)

Year	*Total GHI (kWh/m^2)*	*Estimated Energy (MWh)*	*Capacity factor (%)*
2018	1,732.23	13,857.83	15.82
2019	1,752.80	14,022.39	16.01
2020	1,748.22	13,985.78	15.97
2021	1,768.08	14,144.66	16.15
2022	1,899.52	15,196.16	17.35
2023	1,810.26	14,482.04	16.53
2024	1,823.66	14,589.29	16.65
Mean	1,790.68	14,325.45	16.35

System Diagram



Results (2)



Conclusion

This study confirms the technical and financial viability of a 10 MW photovoltaic plant in Aledo, Texas, based on seven years of solar resource data. The system achieves strong energy production and reliability, though high temperatures can reduce efficiency and require careful design considerations. A single-axis tracking system helps offset thermal losses by improving performance during cooler periods. The alignment of peak generation with ERCOT demand further supports grid value and project bankability. Future improvements, including bifacial modules and battery storage, could enhance energy output and mitigate variability, strengthening the system's long-term performance and resilience.

References

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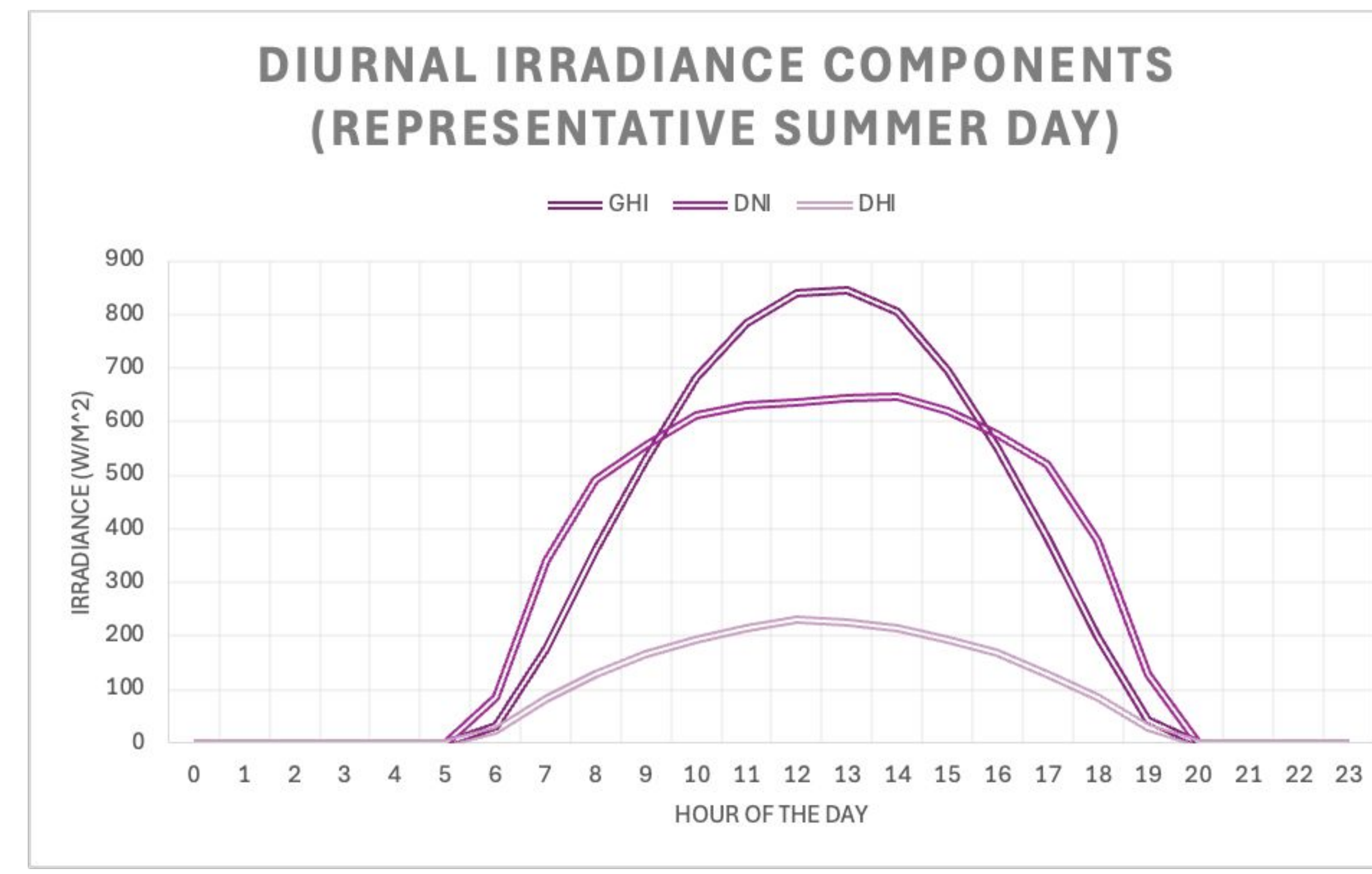
Methodology

$$E_{annual} = P_{dc} \cdot \frac{GHI_{annual}}{G_{stc}} \cdot PR$$

$$T_{cell} = T_{amb} + \left(\frac{GHI}{800\ W/m^2}\right) \cdot (NOCT - 20°C)$$

$$CF = \frac{E_{annual}}{Capacity_{ac} \cdot 8760\ hours}$$

Results (3)



Results (5)