



Introduction

- Rising CO₂ emissions have resulted in global warming and climate change.
 - Solution is to promote renewables and develop carbon capturing techniques.
- Solar energy: 10,000 times greater than the world's total energy consumption.
 - Can be converted to electricity using Photovoltaic (PV) and Concentrated Solar Power (CSP) technologies
- CSP has experienced significant growth in recent years because:
 - Thermal storage to cover resource uncertainty
 - Dispatchable and provides flexibility to grids
- Compared to PV
 - CSP is expensive ways to make it cheaper?
- Optimizing the operational strategies of CSP plants is one way of cost reduction.

Problem Statement

- A CSP plant has more than 10,000 mirrors and large turbomachinery.
- Maintenance and mirror washing results in loss of power production time, especially during peak DNI hours.
- Direct Normal Irradiance (DNI) driving force of CSP
- Predict DNI to find ideal time to perform maintenance activities.
- Schedule maintenance activities when predicted DNI is not enough for the plant to operate at a reasonable capacity.
- Do not schedule maintenance for periods when resource is high.



The 110-megawatt Crescent Dunes Solar Energy Facility in Nevada. Source: SolarReserve

DNI Prediction Using Deep Learning for Optimization of Concentrated Solar Power (CSP) Plants

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DNI	Normal component of
	solar irradiance
Day, Month,	Timestamp (2008 –
Year	2021)
Temperature	Weather data
Pressure	Weather data
GHI	Global component of
	solar resource
Solar Zenith	Solar positioning angle

- Batch Size
- Number of Layers
- Nodes in Layers





Actual vs predicted DNI using unseen testing data

[4] K. Liaqat, "Modeling, Optimization, and Software Development for Concentrated Solar Power Plants," Florida State University, 2021.

