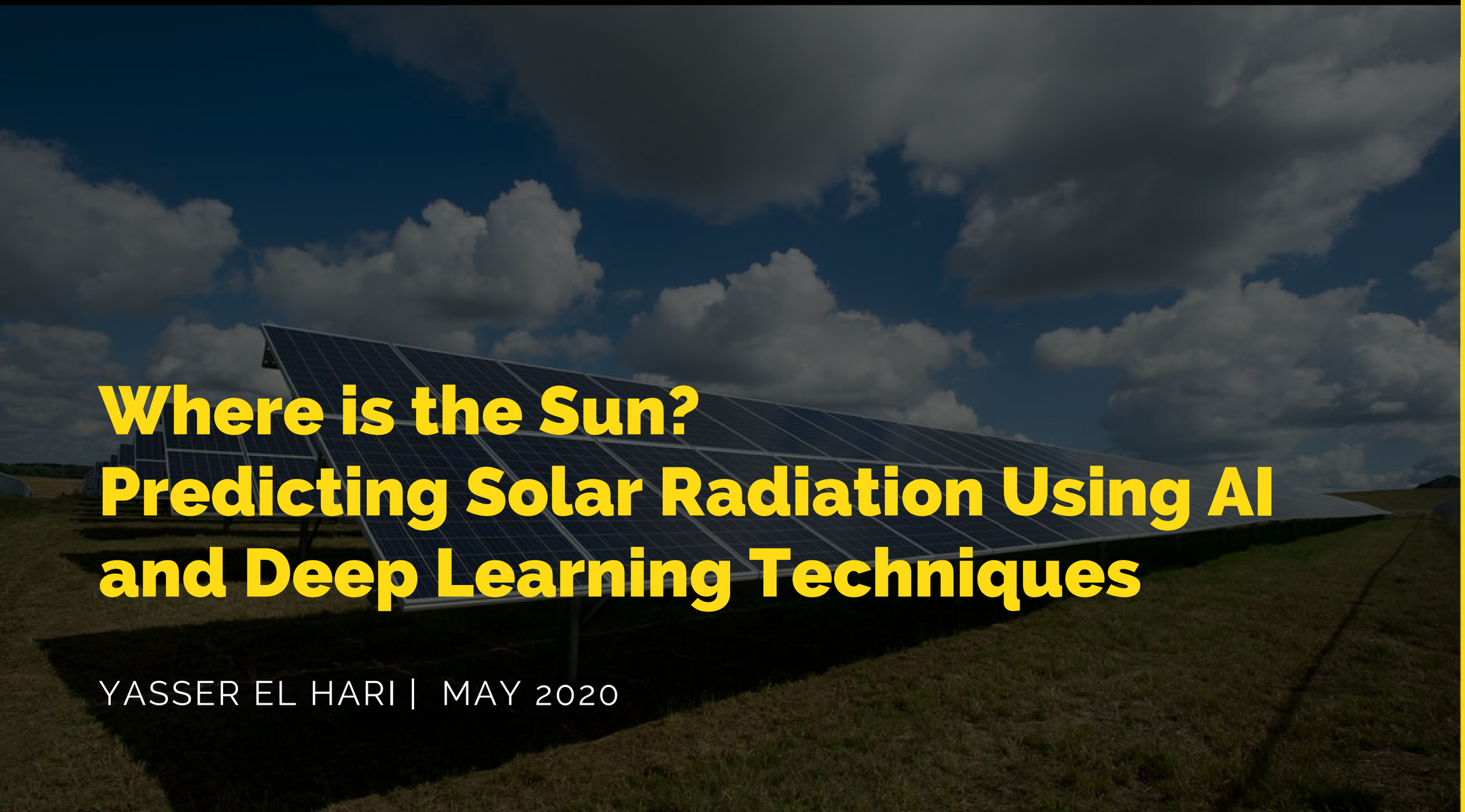
FLATIRON SCHOOL



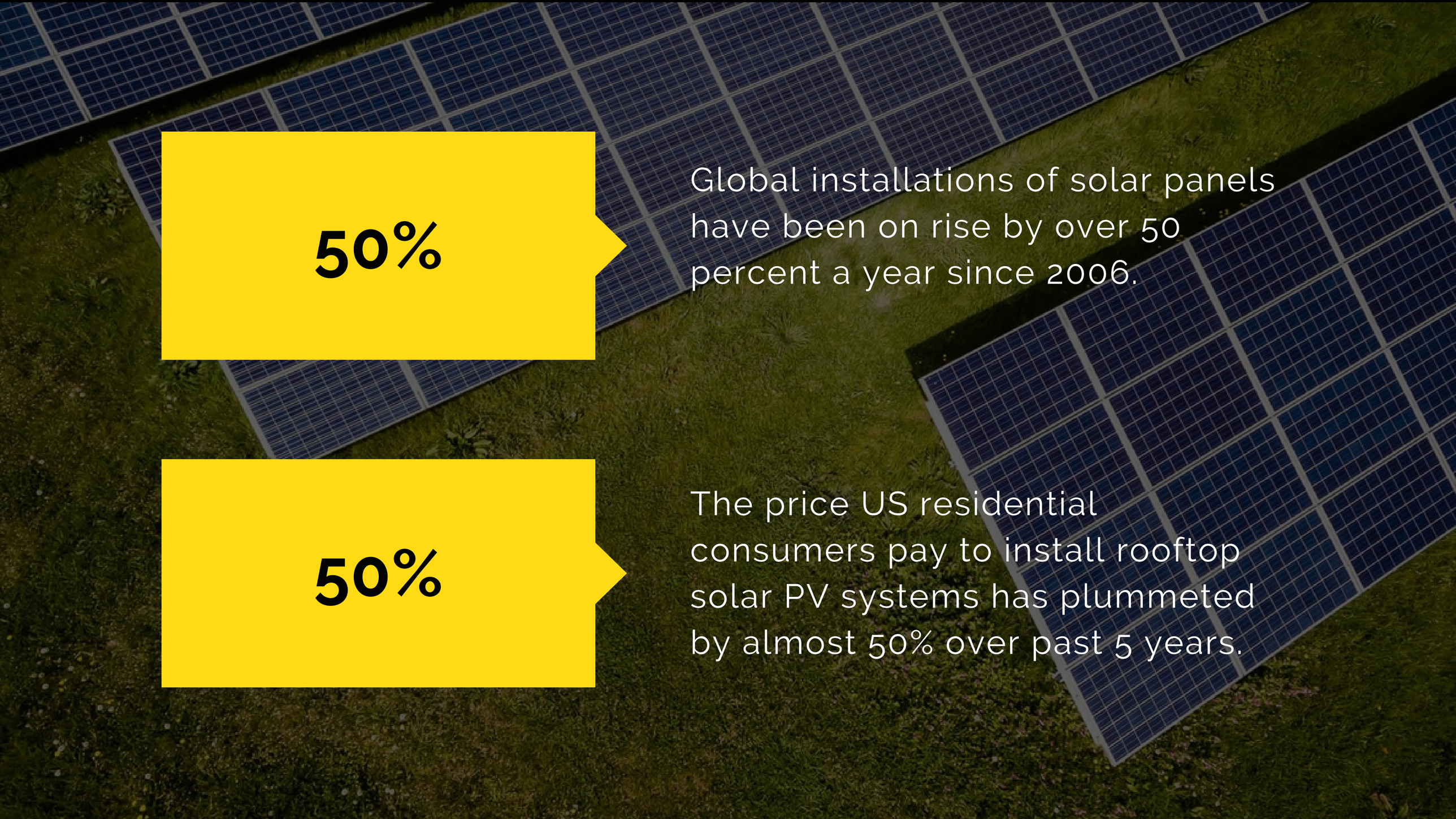
Where is the Sun? Predicting Solar Radiation Using AI and Deep Learning Techniques

YASSER EL HARI | MAY 2020

WHERE IS THE SUN? PRESENTATION

AGENDA

Business Background
How Does Solar Work?
Central Question
Why Should We Care?
Data Sources & Modeling
Business Implications
Questions

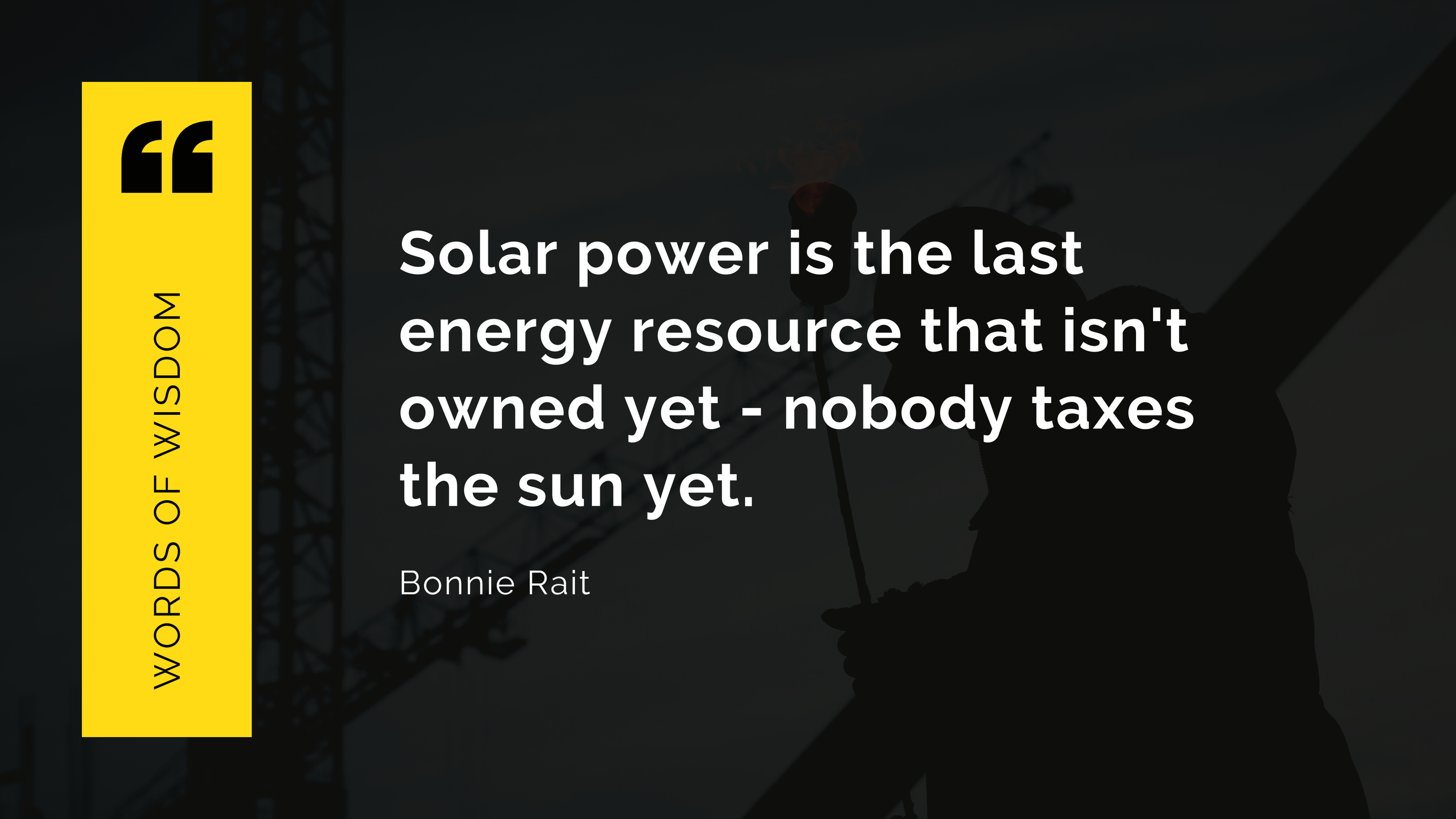


50%

Global installations of solar panels have been on rise by over 50 percent a year since 2006.

50%

The price US residential consumers pay to install rooftop solar PV systems has plummeted by almost 50% over past 5 years.



WORDS OF WISDOM

Solar power is the last energy resource that isn't owned yet - nobody taxes the sun yet.

Bonnie Rait

Buying a solar panel is a one-time and often a lifetime investment ...

but ...

CENTRAL QUESTION

Can we predict solar radiation and thus help minimize cost for the end consumers and support switch to the renewables?

Why should we care?

Timing is Everything

The sooner we know how much radiation there is going to be, the cheaper the cost for the end consumers.

Predictability is Everything

A more precise prediction of solar radiation will drive the energy cost down and thus help accelerate switch to solar energy.

Precision is Everything

Precision is important to identify the cost. Solar power plants don't get paid for more sunshine than predicted.

Data Sources

NASA DATA

Data from a NASA metereological research lab and focuses on one particular site in the state of Washington.

The dataset includes solar radiation from January 1981 to April 2020.

ADVANTAGES

Data is captured by satelites hence it is very precise.

LIMITATIONS

There are many missing values hence a lot of data cleaning.

Methodology

Step 1

Extensive data cleaning due to missing values.

Step 2

Decomposing the time series in order to identify patterns.

Seasonality is 365 days.

Step 3

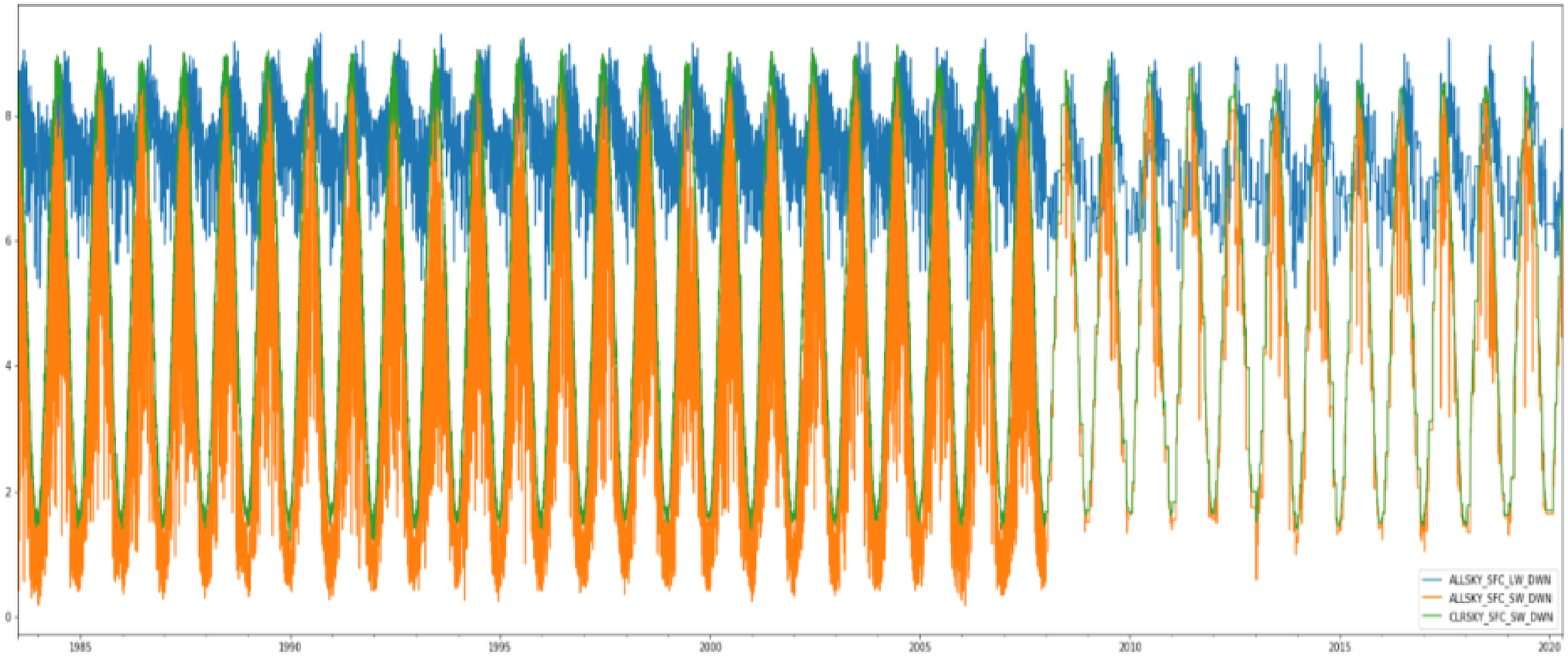
SARIMAX modeling using the parameters identified at Step 2.

Step 4

Analyzing the modeling metrics & the business metrics (cost).

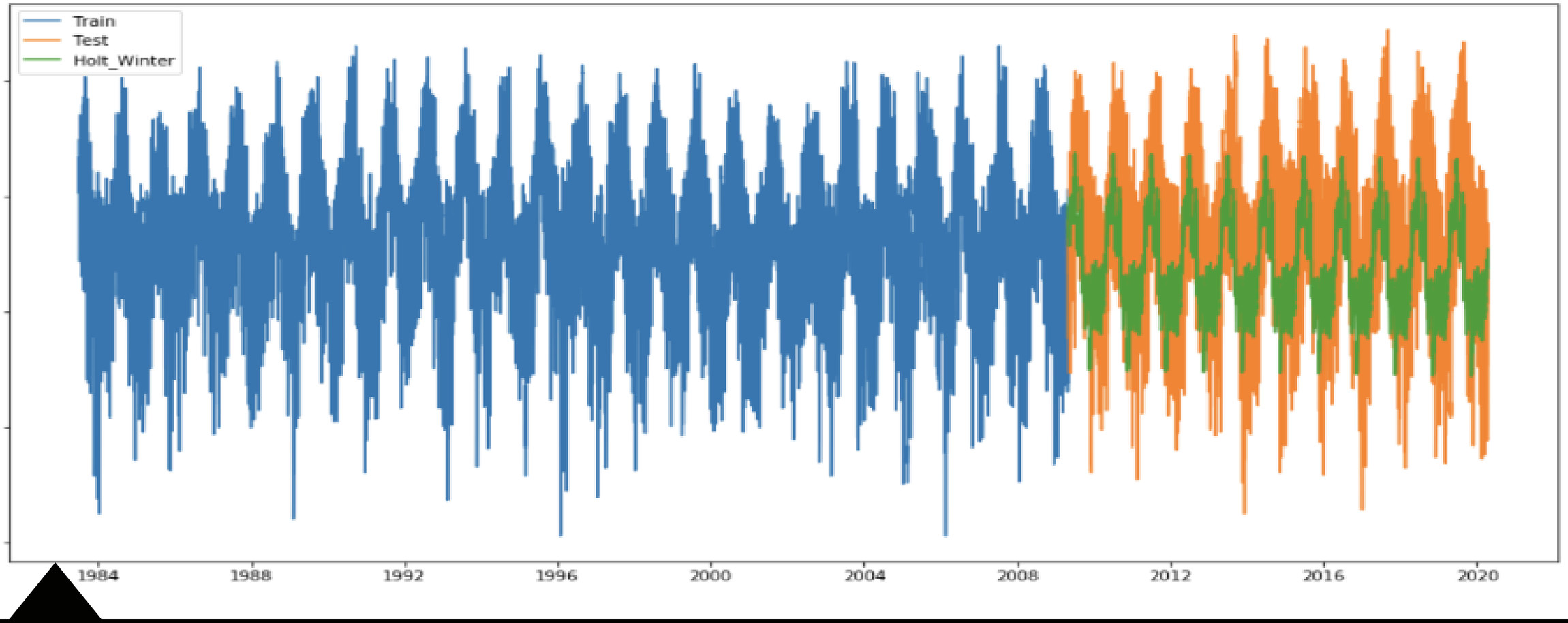
Implications.

VISUALIZATION OF THE TIMES SERIES



Unlike expected, there is no trend in the time series data, which is likely caused by the presence of ozone. Yet, we can still observe yearly seasonality. The peak of radiation occurs in the summer and the lowest radiation occurs in winter.

THE HOLT-WINTER MODEL



The model picks up the patterns in solar radiation in the test data 2010-2020 based on the deep learning from 1984 - 2010. The model yields errors in prediction which are subsequently used in the calculation of the actual market cost.

THE SARIMAX PREDICTION MODEL

The SARIMAX prediction model yields more precise results by minimizing the errors, which translates into a more precise prediction of the actual cost in market.

BUSINESS IMPLICATIONS

More Precise Cost

More precise cost benefits both end consumers and solar energy providers.

Predictable & Best Cost for End Consumer

The more predictable solar radiation, the cheaper the cost for the end consumers and greater predictability of financials for solar plants.

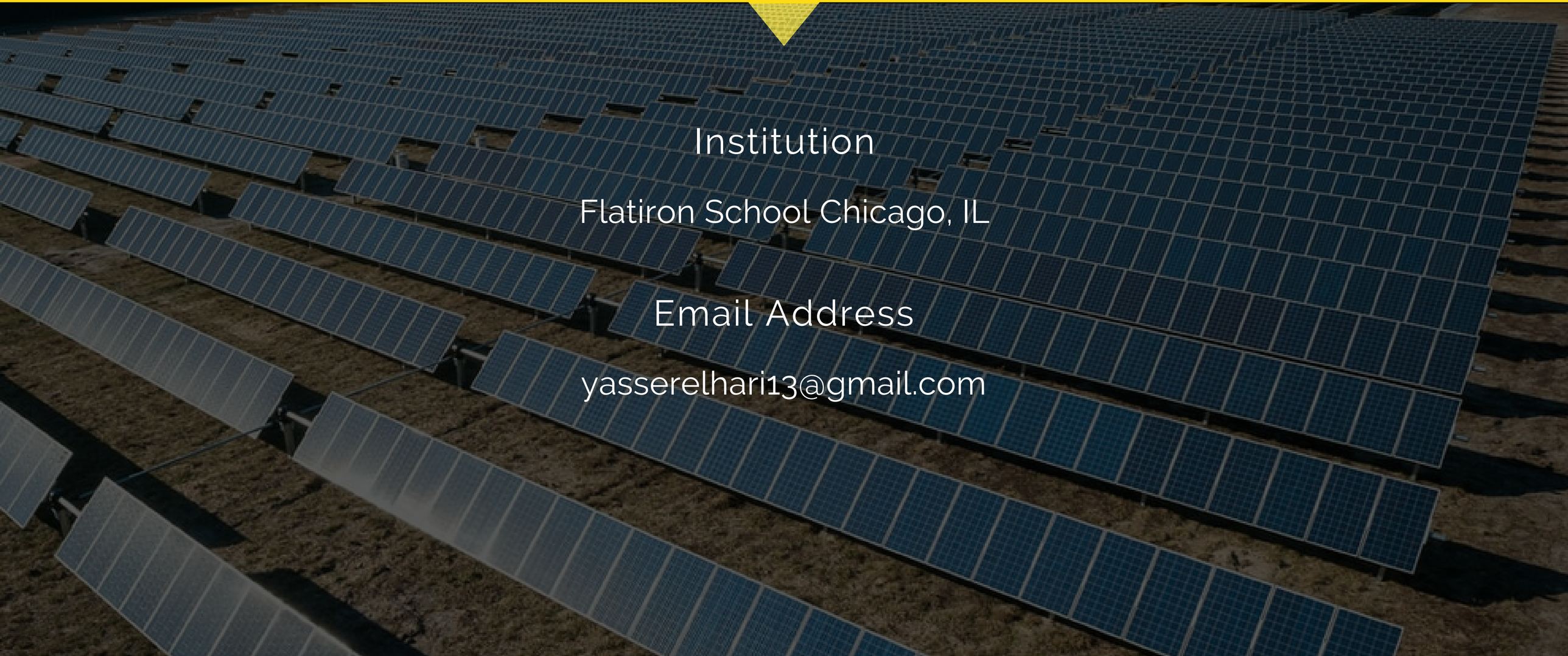
Solar Energy Sector Development

Sector advencements overall - predictability of solar radiation supports both energy providers and end consumers and thus contributes to the switch to renewable energy

Questions

Ask anything you have ever wanted to know about solar power.

THANK YOU & CONTACT



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