Open Quartz:
Building an open source AI solar forecast for everyone
with Rachel Tipton and Zak Watts
What to expect

- About Open Climate Fix
- Why solar/renewable forecasting?
- Quartz Solar live solar forecasting service
- Open Source Quartz Solar model:
  - Model
  - Use cases & potential impact
  - Demo!!!
- Questions
from quartz_solar_forecast.forecast import run_forecast
from quartz_solar_forecast.pydantic_models import PVSite

site = PVSite(latitude=51.75, longitude=-1.25, capacity_kwp=1.25)
predictions_df = run_forecast(site=site, ts='2023-11-01')
About OCF

- Founded in 2019
- Non-profit product lab developing open-source AI solutions to decarbonise the electricity grid
- 40 years experience in AI & energy
Solution

Energy Industry

Researchers

Photo copyright: Daniel Prudek
Open Source Code and Datasets

- All code made available on GitHub
- Models and datasets on Hugging Face
  - 500 people have signed up and downloaded datasets on Hugging Face
  - URL: https://huggingface.co/openclimatefix
- EUMETSAT data on Google Public Datasets
  - 15 years (and dozens of TBs) of geostationary satellite data
  - Accessible in an easy-to-access format (Zarr) for machine applications
  - 16,000 downloads of the EUMETSAT datasets
The challenge of spinning reserves
National Grid ESO

- Quartz Solar Forecast used in the control room
- Used for real-time balancing decisions
- 5 mins to 36 hours ahead
- All open source
Our Live Service Models

- Solar PV data
- Numerical Weather Predictions (NWPs)
- Satellite Imagery
- Topographic data

Training data:
- ~60TB Satellite Imagery
- ~40TB NWP Forecasts
- ~10GB PV Data
- ~1GB Topographic map

ML Model

Improved solar PV generation forecast

- National
- Regional
- Individual sites
Quartz Solar Performance

- **3x better** than National Grid ESO’s previous forecast (2 hour horizon)

- R&D ongoing - models implemented:
  - MetNet: A Neural Weather Model for Precipitation Forecasting
  - Skilful precipitation nowcasting using deep generative models of radar
  - Temporal Fusion Transformers for Interpretable Multi-horizon Time Series Forecasting

MAE (%) = Mean Absolute Error Normalised By Capacity

![Graph showing improvement from adding satellite imagery](chart.png)
Sites Use Cases

- Flexibility markets
- Home Energy Management
- Home Energy Optimisation
- EV Charging Optimisation

Who actually uses this?
- Smart home operators
- Startups in this space
- Experts in battery optimisation
- Research and academia
- Hobbyists
Our Models - Site

- Trained using over 1,000 household sites in the UK.

Model: Gradient Boosted Tree.
  - Thousands of decisions trees.

Decision Tree for PV output

Map of UK solar sites
Open Quartz

- Use open NWPs GFS + ICON
  - Cloud cover, temperature, visibility, short and long wave radiation, precipitation
  - Open Meteo
- Use a pretrained model
  - With the ability to support new models.
- Forecast 48 hours ahead
- 15 minute forecast resolution
- Forecast in four lines of code
- Embedding complex ML and data ingestion, making it accessible to anyone.
- 6% MAE
Open Source Solar Forecast - Demo

pip install quartz-solar-forecast

Scan QR code to go to the Quartz Solar Open Source repo.
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Quartz Open Source Roadmap

- Additional data inputs:
  - More weather data (NWPs)
  - Live PV data
  - Include tilt and orientation
- Integrating and trying out new models
- More diverse solar training datasets
- Experiment
Questions?

Wanna get involved?
Check out **good first issues** on GitHub:

https://github.com/openclimatefix/Open-Source-Quartz-Solar-Forecast

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