
PHAROS
THE GREEK AI FACTORY
Machine Learning
Training Series
Course 10
Time-Series Forecasting and Renewable Energy
JULY 10, 2026 | 12:00 EEST | ONLINE
EuroHPC Joint Undertaking
Co-funded by the European Union
PHAROS GREECE
ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
Υπουργείο Ψηφιακής Διακυβέρνησης και Τεχνητής Νοημοσύνης

Pharos AI Factory

https://www.pharos-aifactory.eu/?cmplz-force-reload=1783606412416

- Pharos AI Factory is Greece's national initiative to accelerate Artificial Intelligence (AI) innovation by providing robust AI and High-Performance Computing (HPC) infrastructure, services and expertise
  - As one of the first AI Factories established under EuroHPC Joint Undertaking, Pharos aims to be a lighthouse of trustworthy AI in Southeastern Europe
- Pharos will design, develop, and deploy a collaborative platform, the "Pharos hub", to support startups and SMEs in AI model development, deployment, and scaling
- The platform will host a range of resources, including AI models, datasets, documentation, and interactive tutorials, while providing direct access to experts for technical support and strategic guidance

Daedalus supercomputer greece

- **Τοποθεσία:** Βρίσκεται στο Τεχνολογικό και Πολιτιστικό Πάρκο Λαυρίου, στην Αττική.
- **Κατάταξη:** Έχει κατακτήσει την **31η θέση παγκοσμίως** στη λίστα TOP500 των υπερυπολογιστών.
- **Απόδοση:** Προσφέρει απόδοση που ξεπερνά τα 60 Petaflops, όντας πάνω από 120 φορές ισχυρότερος από τον προηγούμενο ελληνικό υπερυπολογιστικό κόμβο (ARIS).
- **Πράσινη Τεχνολογία:** Ξεχωρίζει για την ενεργειακή του απόδοση, καθώς αξιοποιεί θαλασσινό νερό για το σύστημα ψύξης του.

Pharos Sectors

https://www.pharos-aifactory.eu/?cmplz-force-reload=1783606412416

Sectors

Language & Culture

Pharos seeks to harness the power of AI to preserve, enrich, and promote the Greek language and cultural heritage in the digital era, through data, models and tools that drive creativity and innovation.

Health

Pharos AI Factory intends to establish and operate a dedicated Health AI Hub, in order to support and boost health-related aspirations.

Sustainability

Pharos AI Factory will enable the development of predictive models and simulation platforms to drive sustainability across multiple sectors.

Who we are

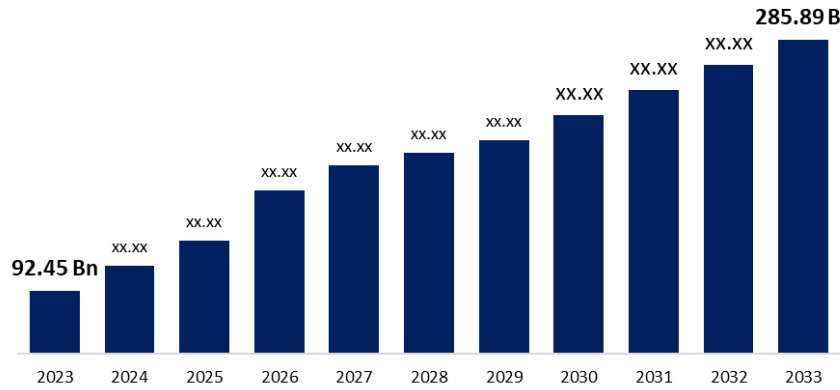
Intelligence Systems Lab

SCHOOL OF INFORMATICS

ARISTOTLE UNIVERSITY OF THESSALONIKI

- Ioannis Vlahavas, Prof
  vlahavas@csd.auth.gr
- Vasileios Kochliaridis, PhD
  vkochlia@csd.auth.gr
- Anestis Ampatzidis, MSc
  aampatzd@csd.auth.gr
- Nick Bassiliades, Prof
  nbassili@csd.auth.gr
- Dimitrios Vrakas, Assoc. Prof
  dvrakas@csd.auth.gr
- Evaggelos Tzotzis, MSc
  tzotzisevangelos@gmail.com

Introduction & Objectives



Accurate forecasts

- Help producers participate more effectively in the Energy Exchange,
- Reduce financial penalties caused by deviations between predicted and actual production, and
- Support better coordination between energy supply and demand

At the same time**, improved forecasting** contributes to

- a more stable and sustainable energy system,
- benefiting consumers and
- reducing the need for backup production from less environmentally friendly sources

Focus: Day-ahead solar energy production forecasting

Problem
Variable production

Method
AI-based forecasting

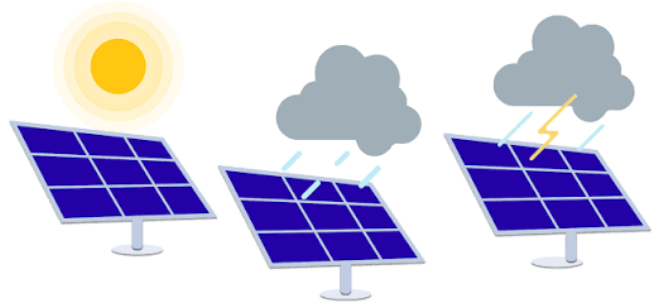
Impact
Better energy decisions

Outline

- Why Forecasting Matters in Renewable Energy
- The Forecasting Challenge
- Why AI and Machine Learning Help
- The Value of High-Quality Data
- From Forecasting to Real-World Energy Decisions
- Continuous Improvement of Forecasting Systems
- Position of this Webinar and Learning Objectives

MOTIVATION

Why Forecasting Matters



- Solar energy production is naturally variable
- Output depends on irradiance, cloud coverage, temperature, humidity, wind, seasonality, and local weather
- Production can change strongly across days — and even within the same day
- Providers must estimate production before it actually happens
- In day-ahead markets, forecasting affects
  - planning
  - trading
  - grid stability, and
  - costs

Forecasting = operational necessity

Core message

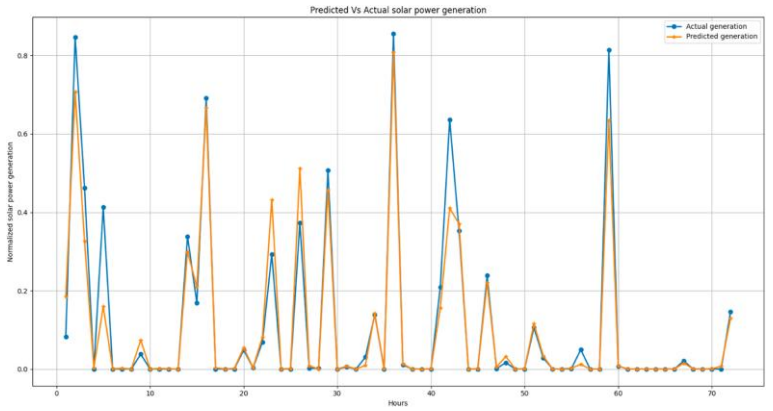
- Reliable Forecasting is not optional
- It is the bridge between:

  - variable renewable production and

  - reliable energy-market participation

PROBLEM

The Forecasting Challenge



- Solar production is influenced by many interacting variables, not one single factor
- It depends on complex relationships between
  - historical production data, meteorological forecasts, geographical characteristics, time of day, season, and the technical characteristics of the production units
- The relationships are often non-linear and time-dependent
- Useful forecasting requires both historical production data and external meteorological information
  - Errors in weather forecasts can propagate into energy forecasts
- The goal is not perfect prediction but reducing uncertainty enough to support decisions

Many variables, complex relations

Typical inputs

- Historical production
- Weather forecasts
- Time of day
- Seasonality
- Location
- Technical unit data

APPROACH

Why AI and Machine Learning Help

- Traditional forecasting methods can be useful, but they often struggle when the system is influenced by many interacting parameters
- Machine Learning learns patterns directly from historical examples
  - without requiring every relationship to be explicitly programmed manually
- Deep Learning extends this idea further
  - Deep Learning models can capture more complex, non-linear relationships in large datasets
- This makes them particularly suitable for time-series forecasting with external influencing factors

AI learns patterns from data

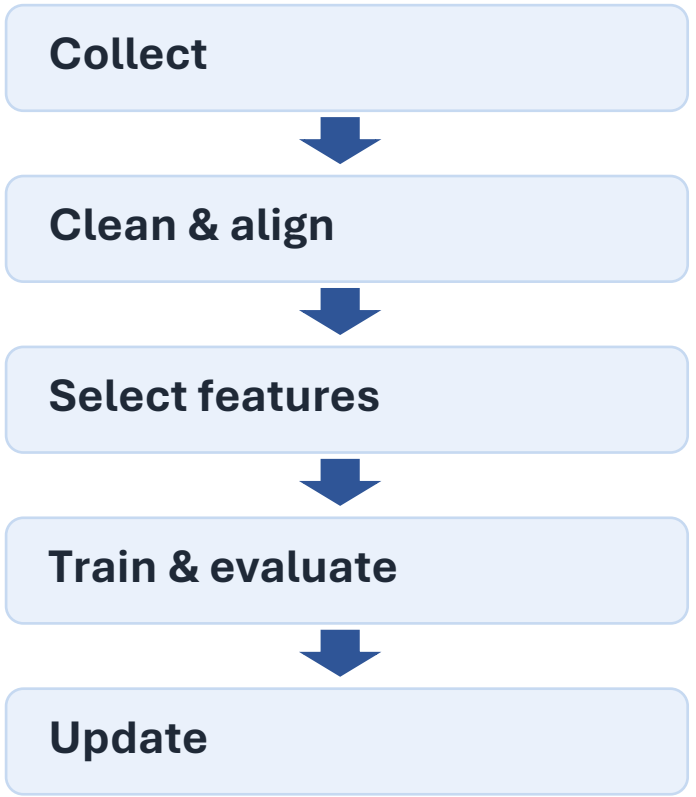
From rules to learning

- **Manual rules**: Define relationships explicitly
- **Machine Learning**: Learn relationships from data

DATA-CENTRIC VIEW

Good Models Need Good Data

- AI is not a magic solution
  - performance depends on data quality
- Historical production and meteorological data must be accurate, aligned, and representative
- Missing values, measurement errors, inconsistent timestamps, and limited history reduce performance
- Feature selection and preprocessing are as important as model choice
- A reliable forecasting solution needs a complete data pipeline



Data quality drives forecast quality

APPLICATION

From Forecasts to Energy Decisions

- Forecasts support decisions before actual production takes place
  - Day-ahead forecasts help producers and aggregators (FoSE)* estimate expected energy production
- Better forecasts reduce imbalance between predicted and actual production
  - They improve market participation and reduce exposure to penalties
- At grid level, forecasting supports better integration of renewable energy
- At a larger scale, they also help grid operators** manage renewable energy more efficiently
- This is why forecasting is not only a technical task
  - It has economic, operational, and environmental importance

Technical predictions → practical decisions

Forecasts support

- Market bidding
- Operational planning
- Supply–demand balance
- Cost management
- Grid stability

*ΦοΣΕ (Φορέας Σωρευτικής Εκπροσώπησης)

**Hellenic Electricity Distribution Network Operator (HEDNO-ΔΕΔΔΗΕ)

CONTINUOUS IMPROVEMENT

Forecasting Systems Must Improve Over Time

- A forecasting model should not be treated as a one-time deliverable
  - Weather patterns, production infrastructure, available data, and market requirements change
- Predictions should be compared regularly with actual production
- Model performance must be monitored using appropriate error metrics
- Retraining and adjustment are necessary when performance degrades
- This continuous improvement cycle is a key part of any serious AI-based forecasting solution
  - The objective is not simply to build a model once,
  - but to create a forecasting pipeline that can remain useful, reliable, and adaptable over time

Improvement cycle

- Predict
- Compare with actuals
- Measure error
- Diagnose problems
- Retrain or adjust

A model is part of a living pipeline

WRAP-UP

Webinar Roadmap and Learning Objectives

- **Part 1**: Why renewable energy forecasting matters and why it is difficult
- **Part 2**: Core Machine Learning and Deep Learning concepts for time-series forecasting
- **Part 3**: Practical solar energy forecasting application and model inference demo

- Participants should understand the motivation, the modelling approach, and the use of trained models for prediction
- **Final goal**: connect theory, implementation, and real energy-market needs

Motivation → methods → application

Take-away

AI-based forecasting can support:

- more reliable renewable production
- better market participation
- more sustainable energy systems

Enjoy the rest of the webinar!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