# Guidelines for the 2025 Competition on Electric Energy Consumption Forecast Adopting Multi-criteria Performance Metrics

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## Abstract

Forecasting of electric energy consumption can be a very difficult tasks when handling building-level data. However, an accurate forecast is needed to boost the potential of energy management systems. The need to forecast energy consumption grows as our reliance on renewable energy sources, such as solar and wind power, grows. This means that to meet consumer demand with renewable energy generation, energy management systems must operate based on accurate energy forecasting models for both short and long-term periods. Energy consumption forecasting techniques that can manage a variety of scenarios, including varying prediction time frames, accessible data, data frequency, and even data quality, have been the subject of intense research. There is no one-size-fits-all approach, where certain situations call for different approaches. The goal of this competition is to compile and evaluate the most recent advances in energy consumption forecasting techniques.



***Keywords***: Data processing; Energy consumption forecast; Green Computing; Machine learning; Smart buildings


## Competition outline

**Goals**: Obtain accurate electric energy consumption forecast for a smart building based on historic data regarding overall and area electric energy consumption, weather information, external temperature, rooftop photovoltaic panels generation, other sensors data (e.g. movement, CO2). The competition targets both forecasting methods and data pre-processing methods aiming at providing a good environment for discussion and comparison of results of the different approaches used by the applicants.

**Rules**: The organizers will provide raw data regarding a smart building. One year of historical data with 5 minutes sampling will be provided 2 months ahead of the competition week to enable the participants to get familiar with the data and their format, performing some experiences, and creating the initial models.

Two weeks before the competition week, historical data for the following 40 days will be provided, to enable applicants to refine their models.

Finally, the competition will be held during a full business week (i.e. 5 working days). For each competition day, applicants must submit their consumption forecasts for the following day in periods of 15 minutes. Immediately after the daily submission deadline, the real data from the forecasted day will be provided and can be used to generate the forecast for the next competition day.

Applicants are free to use or not to use data pre-processing. Applicants can use the same forecasting model for the whole competition week or use different models for each competition day and period.

All competition rules will be presented in detail in the “Competition guidelines” document that will be made available in the competition website.

**Contributions**: The competition aims to bridge the gap of knowledge between AI scientists and energy experts. We propose a real problem in the energy domain. So, we challenge experts to provide new and efficient prediction models that can provide good

solutions to the problem. Not only that, but we also intend the model to be designed generally enough to handle different case studies of the same problem.

## Registration and participation

**The registration of participants is mandatory** and must be made online using the following form: link

The participants can register as single individuals or in teams.

The competition will take place over a total period of five days, demanding a total of 5 different submissions:

- Forecasted values for the first day;
- Forecasted values for the second day;
- Forecasted values for the third day;
- Forecasted values for the fourth day;
- Forecasted values for the fifth day.

Participants will have prior access to the temperature forecast, for each of the five days of the competition, with an error of 10% (i.e., between [-10%, 10%]).

Datasets will be published in: https://zenodo.org/records/14275645

## Submissions

Each submission must provide an hourly 24-hour forecast of energy consumption, meaning that each submission is required to have 24 values. In total, the participants must submit results for 5 days.

The submission will be made by email until 22:59 (GMT) of each competition date. The email must be sent to: log@isep.ipp.pt, zav@isep.ipp.pt, pnf@isep.ipp.pt, and jan@isep.ipp.pt.

In your submissions, please add the subject as: *Application for the 2025 Competition on Electric Energy Consumption Forecast*

**In each submission, the participants must attach the following:**

- the results obtained for that day;
- the execution time;
- (optional) execution energy consumption;
- the code used to generate the results (equal in all submission days);
- a simple readme to describe how the code can be executed (equal in all submission days);
- the description of the forecast model used (equal in all submission days);
- declaration of authorship (equal in all submission days).

## Competition timeline

**Before competition:**

- **01/12/2024**: release of the v1.0 of the dataset, including one year of data from a smart building with readings taken every 5 minutes;
- **30/12/2024**: release of the v2.0 of the dataset, including 40 days of data from a smart building with readings taken every 5 minutes;

**During competition:**

- **05/01/2025, until 01:00 (GMT)**: release by email of the forecasted weather temperature for the day (06/01/2025) with 1-hour readings;
- **06/01/2025, until 22:59 (GMT)**: submission of forecasted data for the first day;
- **07/01/2025, until 01:00 (GMT)**: release by email of the forecasted weather temperature for the day (07/01/2025) with 1-hour readings, and the real consumption of the previous day (06/01/2025);
- **07/01/2025, until 22:59 (GMT)**: submission of forecasted data for the first day;
- **08/01/2025, until 01:00 (GMT)**: release by email of the forecasted weather temperature for the day (08/01/2025) with 1-hour readings, and the real consumption of the previous day (07/01/2025);
- **08/01/2025, until 22:59 (GMT)**: submission of forecasted data for the first day;
- **09/01/2025, until 01:00 (GMT)**: release by email of the forecasted weather temperature for the day (09/01/2025) with 1-hour readings, and the real consumption of the previous day (07/01/2025);
- **09/01/2025, until 22:59 (GMT)**: submission of forecasted data for the first day;
- **10/01/2025, until 01:00 (GMT)**: release by email of the forecasted weather temperature for the day (10/01/2025) with 1-hour readings, and the real consumption of the previous day (09/01/2025);
- **10/01/2025, until 22:59 (GMT)**: submission of forecasted data for the first day;

**After competition:**

- At SSCI conference: winner announcement.

Datasets will be published in Zenodo: https://zenodo.org/records/14275645

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## Results evaluation

The results will be evaluated according to:

- Root mean square error (RMSE);
- Execution time;
- (optional) Energy consumption.

# Bibliography regarding energy forecast

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