

Master Thesis: AI for Comprehensive Electricity Demand Modeling

Job Offer

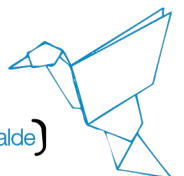
Topics:

The Basque Center for Applied Mathematics is offering an internship position within the Machine Learning (ML) research group led by Iñigo Urteaga. The selected candidate will work on a Master's Thesis in collaboration with Endesa, focused on applying Artificial Intelligence to electricity demand forecasting and probabilistic scenario generation, with the aim of assessing the value of advanced AI models for energy-sector applications.

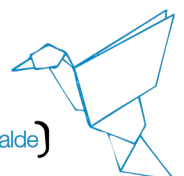
Energy-sector decision-making requires both accurate demand forecasts for day-to-day operations and market participation, and probabilistic future scenarios for strategic planning and risk management. While forecasting focuses on predicting demand as accurately as possible, scenario generation aims to capture uncertainty, variability, and potential extreme events. Recent advances in Artificial Intelligence for time series, including foundation models such as Chronos, TimeGPT, and PatchTST, as well as generative approaches such as Normalizing Flows and diffusion models, offer new opportunities to address both challenges within a unified framework.

The main objective is to assess the added value of advanced AI architectures compared with traditional statistical and Machine Learning approaches, such as ARIMA, across different operational dimensions, including forecasting accuracy, uncertainty, and short- to long-term performance.

To this end, the project will develop a complete and reproducible benchmarking framework for both electricity demand forecasting and probabilistic scenario generation, enabling an empirical comparison of different AI, statistical, and Machine Learning models.

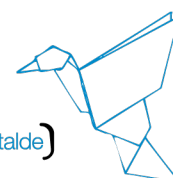


	The project will make use of: • Hourly electricity consumption data from different customer types and portfolios. • Hourly and daily weather variables. • Calendar and holiday information. The main tasks to be carried out will be: • Exploratory analysis and preprocessing: Clean and prepare the consumption data, align time series, and analyse exogenous variables such as calendar and weather information. • Baseline model development: Implement and tune classical statistical models (e.g., ARIMA/SARIMAX) and traditional Machine Learning approaches. • Advanced AI model development: Implement and adapt time-series foundation models and generative AI architectures for demand forecasting and future scenario generation. • Benchmarking and evaluation: Design a rigorous and reproducible evaluation framework to compare models based on point forecasting accuracy and the probabilistic quality of generated scenarios, using different performance metrics. • Results analysis and thesis writing: Analyse the results from an operational perspective for Endesa and document the methodology, results, and conclusions in the final Master's Thesis.
PI in charge:	Iñigo Urteaga



Salary and conditions:	This Master's Thesis will be co-supervised by researchers from BCAM and professionals from Endesa. The position is paid by Endesa (€400/month), with an expected dedication of 20 hours per week, and will take place during the first semester of 2027. The student will be based at BCAM in Bilbao, with 1–2 in-person visits to Endesa's headquarters in Madrid.
Nº Positions offered:	1
Contract and offer:	9 months
Deadline:	31st October 2026, 14:00 CET (UTC+1)
How to apply:	Applications must be submitted on-line at: https://joboffers.bcamath.org

Scientific Profile Requested	
Requirements:	- Proficiency in Python programming and familiarity with its main scientific libraries, including NumPy, pandas, and SciPy. - Practical experience in Machine Learning/Deep Learning projects, with knowledge of libraries such as scikit-learn, PyTorch, or Keras.
Skills and track-record:	Although the requirements can be adapted to the different candidate profiles, a strong candidate needs to possess the following skills: - Previous experience in time series analysis, processing, and modelling. - Familiarity with advanced architectures, such as Transformers, diffusion models, or Normalizing Flows. - Experience with version control tools (Git) and good practices for code reproducibility and documentation.



Application and Selection Process	
Formal Requirements:	The selected candidate must have applied before the application deadline online at the webpage: https://joboffers.bcamath.org The candidates that do not fulfil the mandatory requirements will not be evaluated with respect to their scientific profile.
Application:	Required documents: • CV • Letter of interest in English describing which topics the candidate is interested in researching. • 2 recommendation letters • Academic record: including undergraduate and master-level courses attended and grades and scientific results achieved, and research statement is NOT required (leave blank in application form).
Evaluation:	Based on the provided application documents of each candidate, the evaluation committee will evaluate qualitatively: the adaption of the previous training and career to the profile offered, the recommendation letters, the main results achieved (papers, proceedings, etc.), the statement of past and proposed future research and other merits; taking in account the alignment of these items to the topic offered.
Incorporation:	As soon as possible



This position is funded by Endesa

