

PROGNOSIS

Intra-hour prediction of solar electricity generation from photovoltaics

Project duration: from 04.2018 to 10.2021

Report submitted: 01.2022

Publishable Summary

The PROGNOSIS project is related to the development of a tool for intra-hour forecasting of solar irradiance over a specific area. The innovative concept of PROGNOSIS is based on the fact that the tool is based on models that do not utilize any meteorological data or specialized equipment but only the power output of a dense grid of connected Photovoltaics (PVs).

The continuous PV input data has been integrated to energy maps over various regions and the attenuation from the normalized power output has been calculated to predict the motion and development of clouds/aerosols in time as these clouds can cause a decrease in the solar irradiance reaching the PV when they cast a shadow over it. Through the development of this dynamic flow map of the power output of the PVs, the solar irradiance can be visualized and predicted, not only for individual PVs, but over entire regions.

Regarding the development of the forecasting model, a machine learning approach was adopted, which can provide accurate predictions based only on the knowledge acquired from historical data. For PROGNOSIS, a model based on the “Recurrent Neural Network” architecture has been built using the historical PV power data. The estimation of clear-sky PV electricity production is also important for determining the attenuation in the energy maps. Thus, a data-driven method was developed for the calculation of the clear-sky signal. The issue of incorporating spatial dependency into our forecasting model was also examined. Results indicate that our model can capture the overall trend and fluctuations of the power output and provide good predictions, not only for PVs in Cyprus and Spain but also in countries with different climates.

PROGNOSIS is essentially a real-time decision-making tool primarily for the energy sector since the resulting forecasting can facilitate the decision-making process for the visualization, management and optimization of microgrids and electricity systems.

The main technological outcomes of the project were the improvement of the algorithms – both in terms of accuracy but also to include spatial variability and the incorporation of real-time data from PV inverters into the developed software. Furthermore, on the business side, the PROGNOSIS tool has potential in a sector that is under a complex transition to becoming more decentralized, with near-zero marginal costs, and especially digitalized. Digital tools that allow automatic and rapid actions will be increasingly important and PROGNOSIS can provide even more value than the one suggested in this report.

For the project continuation, two further projects were the direct outcome of this collaboration: (a) a proposal entitled “Matching complementary EnErgy consumers to boost the creation of new and optimized Energy Communities”, coordinated by IVE (and CUT being a partner) has been submitted for funding, and (b) Dr Alexandros Charalambides (coordinator of PROGNOSIS) has received a grant under the 2022/23 Fulbright Visiting Scholar Program to visit USA in order to improve PROGNOSIS with data from USA and also to investigate any business opportunities for PROGNOSIS in the USA.

Project consortium

Coordinator and all contact details:

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Participating countries and financing:

Country	Number of organisations involved	Project costs in EUR	Public funding in EUR
Cyprus	2	172'720	172'720
Spain	1	111'000	73'044
<i>Total</i>	<i>3</i>	<i>283'720</i>	<i>245'764</i>

Funding agencies involved and contracts

Funding Agency	Contract N° and Title
Cyprus Research Promotional Agency	KOINA/SOLAR-ERA.NET/1216/0014 (PROGNOSIS)
Spanish State Research Agency – Ministry of Science, Innovation and Universities	PCI2018-093043

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