Solar Energy in Cyprus: Challenges, Curtailments, and Solutions for a More Flexible Grid

Description

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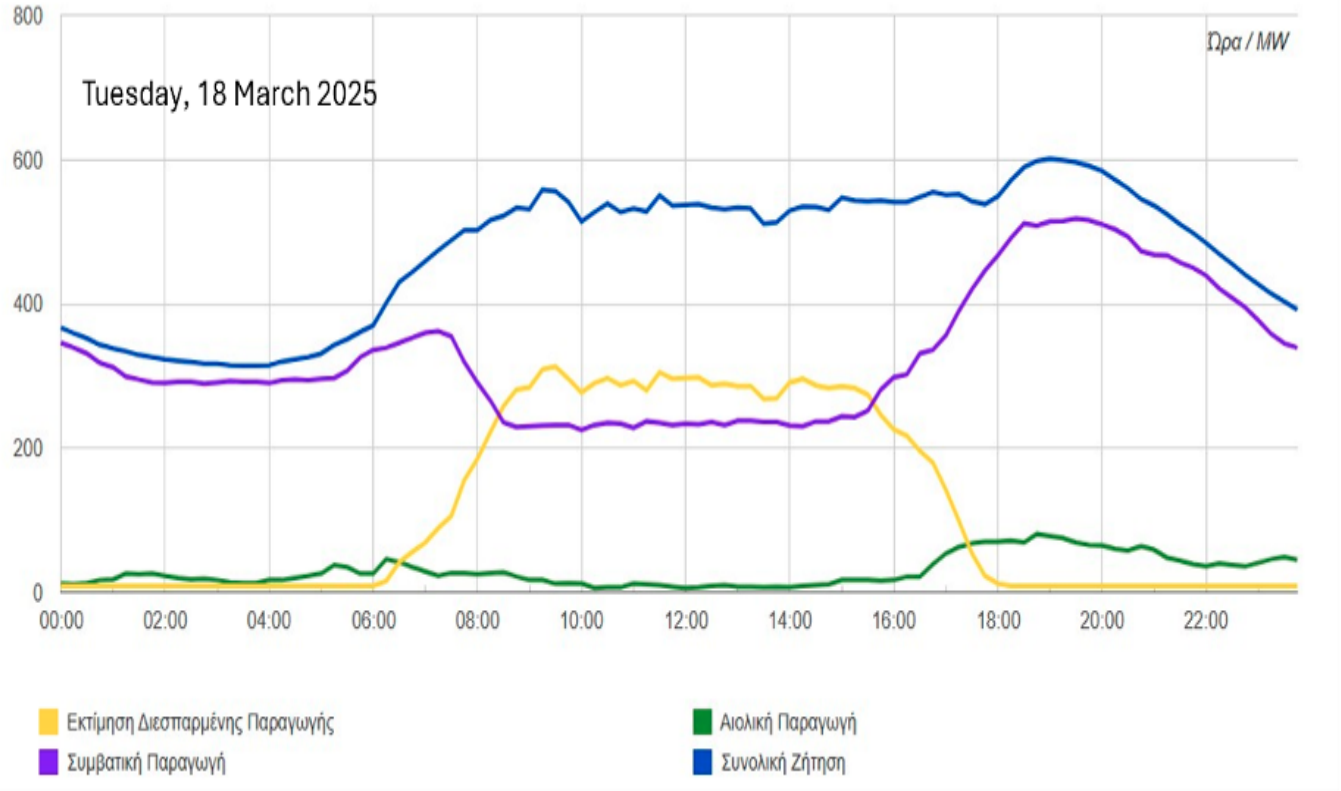
Recently the Cypriot electricity system has made it a habit to curtail a significant portion of solar Photovoltaic (PV) generation during daylight hours, to the irritation of PV system owners and the society at large. This is happening due to what we call ‘overgeneration’. While the sun is shining, much of the available solar power (the yellow curve in the accompanying graph) is left unused because the necessary balance between supply and demand cannot be maintained. We’ve been having warm weather lately, but not warm enough to turn our air conditioning units on, so our demand for electricity is relatively low and only rising during the evening hours and turn on the lights and electrical appliances (the blue curve). We have also installed a lot of PV systems lately; more than 830 Megawatts, are now connected to the grid! But when we produce more than we can consume the system risks instability, and even a total blackout. This is why the Transmission System Operator remotely turns off some of the PV generation to preserve the balance starting from commercial, large PV systems, but from 2023 onwards also curtailing the generation of smaller systems affecting potentially about 30,000 households.



Source: The Transmission System Operator, Cyprus

These 830 Megawatts installed are about their nominal power, what they would be capable of producing under ideal, favourable conditions. In practice this is very rarely reached because the sun is not hitting them at the right angle as it travels in the sky throughout the day, and hence the typical generation curve of PV systems resembles a bell shape with its highest point at around midday. Or it would look like this in our case, only for the top of the bell to be loped off due to curtailments, as mentioned. The situation has reached a point where policy makers are now discussing measures to introduce ‘zero export’ for some systems that will not be curtailed but will not be allowed to export their electricity to the grid either and will only be able to use it locally, at the point of consumption.

You may ask why we don’t shut down completely all the thermal generation (the purple curve) during those hours to lower the consumption of oil and diesel in our power plants, reduce emissions and avoid these cuts. The reason is that the system needs a minimum level of generation from mechanical, spinning units, to maintain its stability and ensure it is ready to respond to sudden changes in weather conditions that affect the output from renewables, like when it becomes cloudier. This minimum level, mandated by national and European grid rules, currently stands at 210 Megawatts but is very often raised to

higher levels in anticipation of the evening peak, where some generators need to be kept online and spinning ready to rapidly increase their output to satisfy this demand.

To minimize future curtailments and make full use of Cyprus' abundant solar energy, solutions such as energy and electricity storage, demand response programmes, interconnections, and improved grid flexibility must be introduced. Investing in energy storage would allow excess solar power to be used when needed by deploying batteries, or using other technologies (such as very hot, molten salts, or compressed air), for longer timeframes that can span several hours, days, weeks – and even seasons! We could even store it in other chemical carriers such as hydrogen, that could be then used for other purposes, for example in industry and transportation.

Advanced grid management techniques could enable a more dynamic balance between renewable and conventional generation. Upgrades to the electricity grid involve digitalisation, widespread adoption of smart meters, better forecasting of electricity generation from renewables, and cybersecurity enhancements, to name just a few.

Other measures should involve dynamic pricing schemes to allow consumers to shift their demand towards times when prices will be lower. Electric Vehicles (EVs) are a prime example of such a case where they can charge in the sunnier parts of the day, enjoy lower costs, and help with reducing curtailment. Or even better they could store electricity during those times only to give it back to the grid when needed through an upcoming technology that is called Vehicle-To-Grid (V2G).

As the country moves toward its renewable energy goals and electrifies a lot of its demand, tackling these challenges will be crucial for energy independence and crucially, lower prices.

The Energy, Environment, and Water Research Centre (EEWRC) of the Cyprus Institute is modelling the Cypriot electricity grid using tools such as IRENA FlexTool to investigate several flexibility solutions that could alleviate curtailment and will present interesting insights soon.

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