



## CASE STUDY

# High resolution modeling captures €4.5 Billion in costs in the EU power system.

**Looking ahead to the impact low-carbon and negative emissions will have on the EU power system, changing the resolution to 5-minute intervals showed up to 100% increase in some battery usage - a significant increase in accuracy when compared to using hourly resolution. Using this higher resolution also captured more system costs, with the annual total increasing by 3%. While this may seem small, it represents about €4.5 Billion for a large power system like the European Union.**

How does one accurately model this commitment and dispatch? High-resolution modeling is important when it comes to understanding flexibility as the value of storage, power to gas and batteries, and these these are not adequately captured at hourly resolution.

While one methodology for running large annual simulations is to split it into monthly or weekly packets, solve with an overlap and then stitch the results back together (time domain partitioning), PLEXOS was able to run the full model without splitting it. The research was led by Fiac Gaffney working with Paul Deane, who had conducted similar modeling on the Irish system.

With sub-hourly, high-resolution modeling, everything is faster: solvers and solving techniques have improved, the PLEXOS architecture has evolved and, of course, the cloud is now available for running operations.

At higher temporal resolution, constraints start to bind; that is, they are captured in the model and impact the objective function. Constraints like ramp rates, run-up profiles and shutdown profiles may not get captured fully in hourly modeling. A 400MW CCGT that can ramp at 30MW/min will not be picked up at hourly resolution but at 5 minutes it will. When a constraint is captured in linear programming it produces a shadow price. This is a useful metric, for example, to understand how much to pay for an extra unit of ramping.

**Since 1999, traditional methods for modeling have only seen a 25-times increase in improvement. PLEXOS has seen a 500-fold improvement and can handle far more sophisticated and complex environments/problems.**