

Cost optimization of Solar CSP Plants: Benefits of thermal storage in solar energy

Why an expensive solar thermal power plant with thermal storage may become more interesting than a large low cost PV installation.

The Middle East is experiencing intense competition for utility scale photovoltaic installations, with generation prices now below conventional power plants. For many, this is the ultimate victory of PV over its competitors. This is only one side of the coin. Even low cost power is useless if nobody demands that power. This input may even become a detriment to distribution and stability of power, and add additional cost elsewhere in the system, as many grid operators will tell. From the viewpoint of demand - PV is not the optimum solution. The following picture shows typical PV power production.

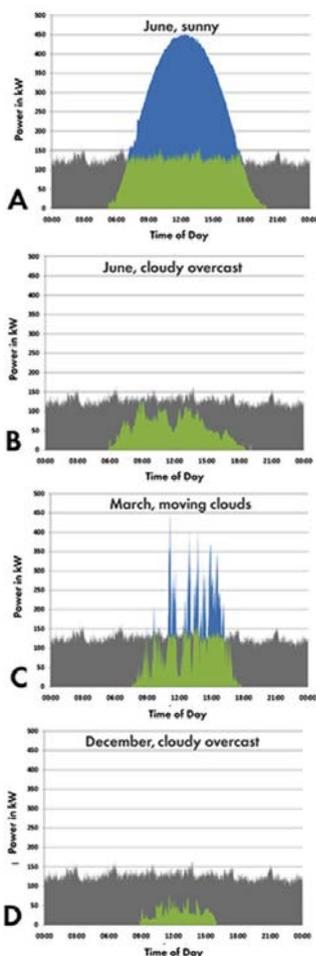


Figure 1: PV generation, various days¹.

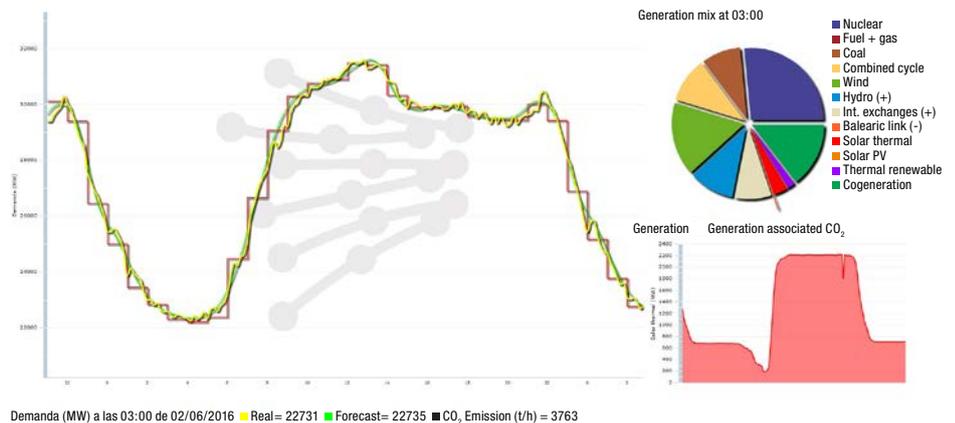


Figure 2: Spanish demand vs. solar thermal production².

PV production does not always match demand, is not as constant as required, and can even be unavailable on short notice. Certain measures can be taken to address these issues, such as active management in the inverter stations, oversizing the PV plant, including electricity storage with batteries or other technologies, etc. These should be added to the cost of PV generated power if we are to fairly compare with other technologies. Today's grids still require an alternative and predictable power source to secure full time supply. Energy markets are moving to demand driven market price deals. Here solar thermal power generation has clear technical advantages, and may become competitive with PV.

How to provide dispatchable solar energy

The most profitable solutions offer constant power at peak demand. In addition, selecting the best solution requires optimization; involving technical feasibility and low cost. For PV, only high cost battery storage is a proven 'on-board' solution.

As the penetration of PV in national grids increases, it is clear that PV power will maintain market value only if generators can offer dispatchable power. This is a great opportunity for any competing storage driven renewable plant.

Thermal solar power plants offer efficient storage solutions. Several methods of heat storage are available: steam, thermal oil, and molten salts (industry standard). Each has unique economical and technical advantages. Solar thermal power plants with storage can change solar energy into dispatchable power, covering peak demand hours even if

they occur after sunset (24 hour production also possible). Furthermore, a grid operator may use the other advantages of this technology, such as having a rotating turbine for power generation. This offers a well-known power generation profile and quality fitting well with existing grid technology. This can avoid the cost of any further grid upgrades when adding solar power as a renewable energy source.

This behavior is demonstrated in the next figure indicating electricity demand in Spain on a normal summer day in 2015. At the bottom right of this graph is the hourly generation of solar thermal plants during a day of operation.

Projects would increase long term stability if they would reflect the advantages of reliable energy and peak demand coverage in their models. This can be done by including variable tariff considerations in new project contracts, instead of flat tariffs that do not encourage peak demand coverage.

1. Source: SMA, http://www.sma.de/fileadmin/_processed_/csm_bckground_a02694ce1b.png
 2. Source: ESTELA, Red Eléctrica de España



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