SOLAR SOUTHWEST INITIATIVE

Baseload and Dispatchable Power

While energy consumers rarely think about it, the power grid upon which we depend for our energy is one of the world's largest machines and has a number of different parts. On the electrical energy generation side, grid managers make three main distinctions between types of generators according to the type of power they output: **baseload**, **load-following**, and **peaker** generators. In addition, power engineers value a generator more if it is **dispatchable**, meaning it can generate more or less power on-demand or on a human-defined schedule.

A **baseload** generator can generate power constantly day and night at an even level. Usually the per kilowatt-hour cost of baseload generators are low. Coal and nuclear plants are commonly used as baseload generators but also large natural gas and hydroelectric plants are used for baseload power.

A **load-following** generator gradually ramps up and down its power output to respond to scheduled changes in power demand over the course of a day. Gas, pulverized coal, and hydroelectric generators are commonly used to follow the load. Solar photovoltaic or CSP without storage can approximately follow the load on sunny days, when peak demand is around mid-day.

A **peaker** plant responds rapidly to changes in power demand that baseload and load-following plants do not; often within less than a minute. Natural gas turbine and hydroelectric plants are used as peakers. Peakers are the most expensive to operate but produce the least amount of power over the course of the year. Some newer types of energy storage, like batteries and flywheels, can also function as peakers, though they are still in the early stages of commercialization and are not yet cost competitive with fossil peaker plants.

To reduce and eventually eliminate the carbon footprint of the electric grid, we will have to develop renewable generators that can output power in ways that partially or completely occupy these roles. While **hydroelectric** facilities with storage (dams) can occupy all three roles, they are limited by geography, water availability, and competing natural and societal uses for water and river valleys. **Geothermal** wells work well as baseload power, though are currently limited to specific hot spots. In decades to come we will see more geothermal baseload power as what has been called Enhanced Geothermal Systems are developed.

Currently, to use the strongest renewable resource we have, the sun, to fulfill these roles, **CSP with Storage** is our most economical and scalable alternative. Paired with enough thermal storage and solar collectors, a CSP plant can operate as **baseload power**. Alternatively a CSP plant with storage can be built to scale up and down to **follow the load**, peaking its power output in mid-afternoon when power demand is highest on summer days. With storage and with a steam generator and turbine already warmed up, a CSP plant with storage can be **dispatched** to meet **peak demand** within a few minutes.

The usefulness of CSP with storage as a **coal and natural gas power plant replacement** is then clear in an era of carbon-constraint and concern about climate stability. Coal moratoria and other measures to curtail the use of coal and natural gas generators should to be paired, along with increased energy efficiency, with a promotion of sustainable replacements for these generators. Furthermore, the

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emergence of plug-in electric vehicles also will eventually increase the demand for clean nightime power, which CSP with storage as baseload can help provide.

Tags The Importance of Energy Storage