Question 2.3.2 New system services: Which kind of new system services, delivered by storages, grid boosters or DSM are needed in electricity systems supplied mainly with high PV and wind generation?

Answer

In Germany, the distribution of renewable energy generation is currently – and presumably in the future as well – very uneven. While there already is a large number of wind turbines in northern Germany, in the south, they are lacking, with Bavaria being last place among the so called “Flächenländer” (Bundesländer that are not just cities) in terms of wind turbines per area. This imbalance is exacerbated by the distribution of residential and industrial loads, which is just the opposite: The north is populated relatively sparsely, while the west and the south are centers of population and industrial activity. This all leads to an increasing need of transmission of large volumes of electrical energy from the north to the south. This need is to be met by grid expansion projects, for example HVDC-lines like Südlink or Ultranet. But these and many other projects are delayed due to a combination of slow planning processes and opposition of locals. Thus, alternatives have to be explored.
One alternative is the so called curative redispatch that is able to increase the transmission capacity of existing lines during normal operation. Currently, lines can only be partially utilized due to the need to provide (n-1)-safety. So, if a line is projected to be overloaded in case of a fault in the grid, it currently is preemptively utilized less by changing the outputs of generators (redispatch). In most cases, the potential fault never occurs, delivering the redispatch unnecessary in hindsight.
Curative redispatch changes this: Here, the ability of lines to withstand currents higher than their rated current for up to one second is utilized. After this time, the line is relieved by fast-acting assets that keep relieving the line until either the fault has been solved or classic redispatch has been deployed.
This version of (n-1)-safety requires assets that act fast enough so not to risk exposing the lines to those higher currents for more than one second. In current pilot projects in Germany, battery storage and offshore wind parks are employed to provide curative redispatch and simulations have shown a huge savings potential in preventive redispatch with a relatively small effort. Thus, in countries with a similar generation and load distribution like Germany, curative redispatch (provided for example by grid boosters) can be a viable way to use the existing grid more efficiently.