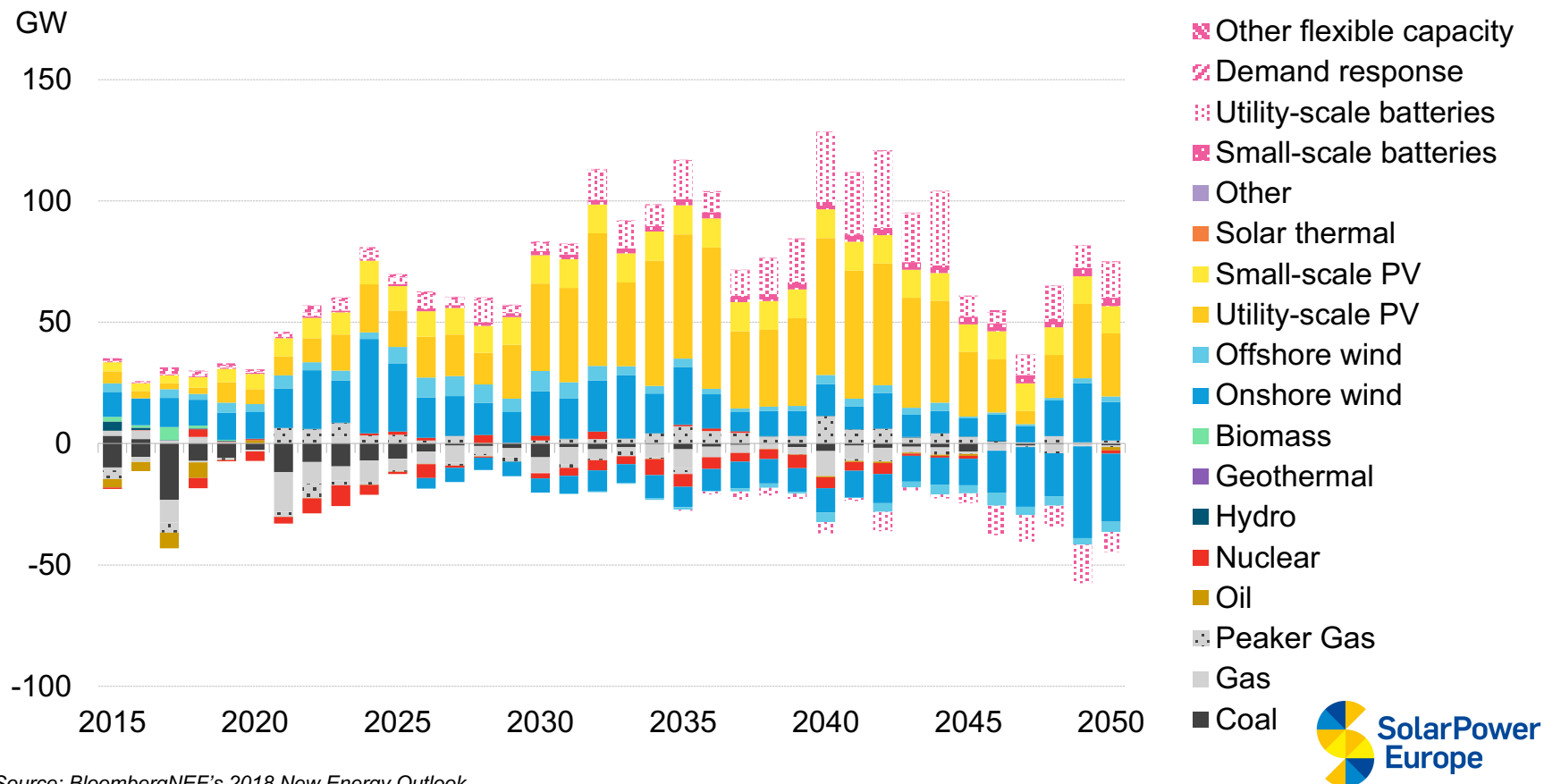


Gross capacity additions and retirements in Europe, 2012-2050

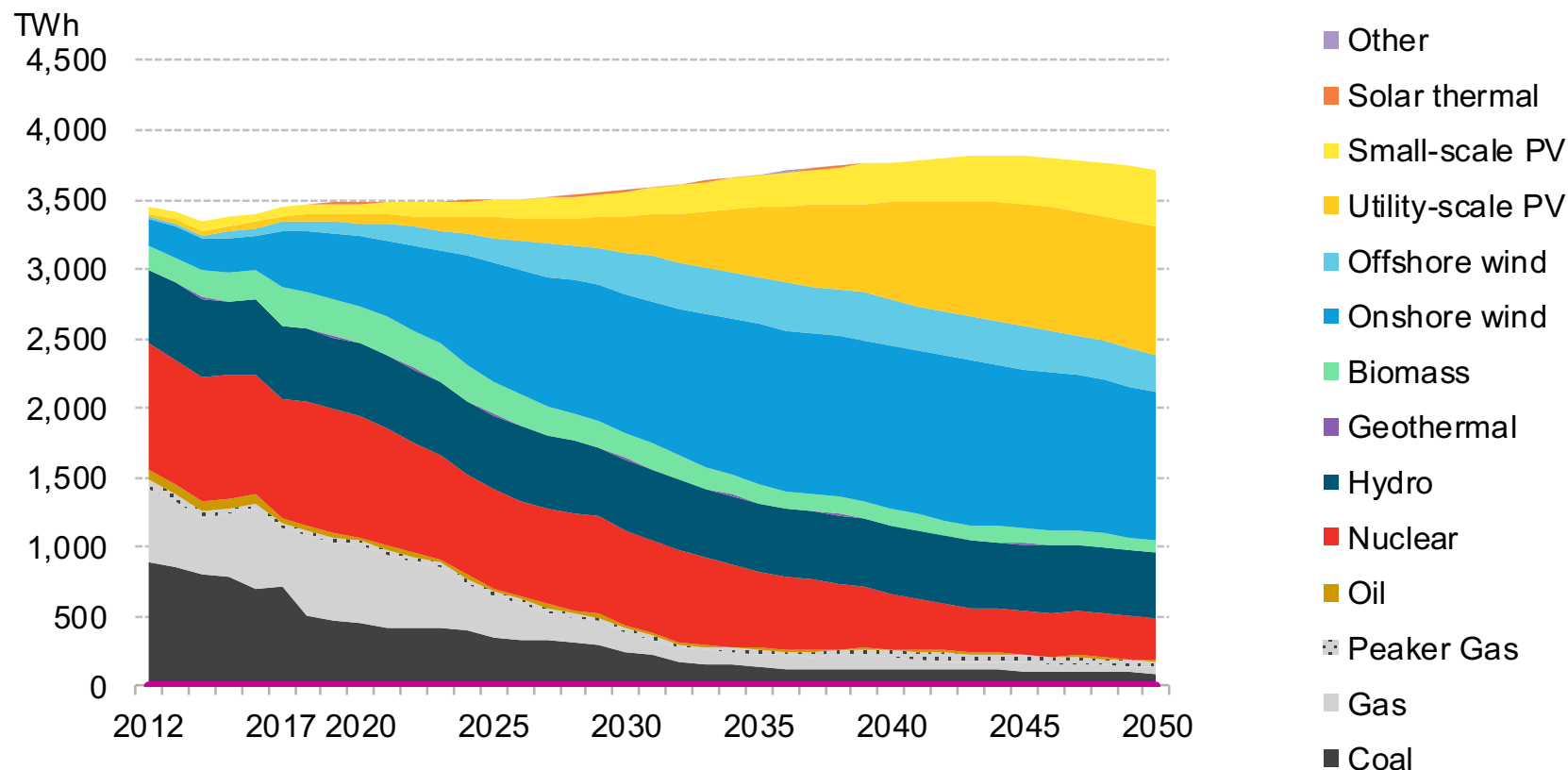
In New Energy Outlook, Bloomberg NEF expects 1.4 TW of solar capacity to be installed in Europe, much more than for any other power generation technology



Source: BloombergNEF's 2018 New Energy Outlook

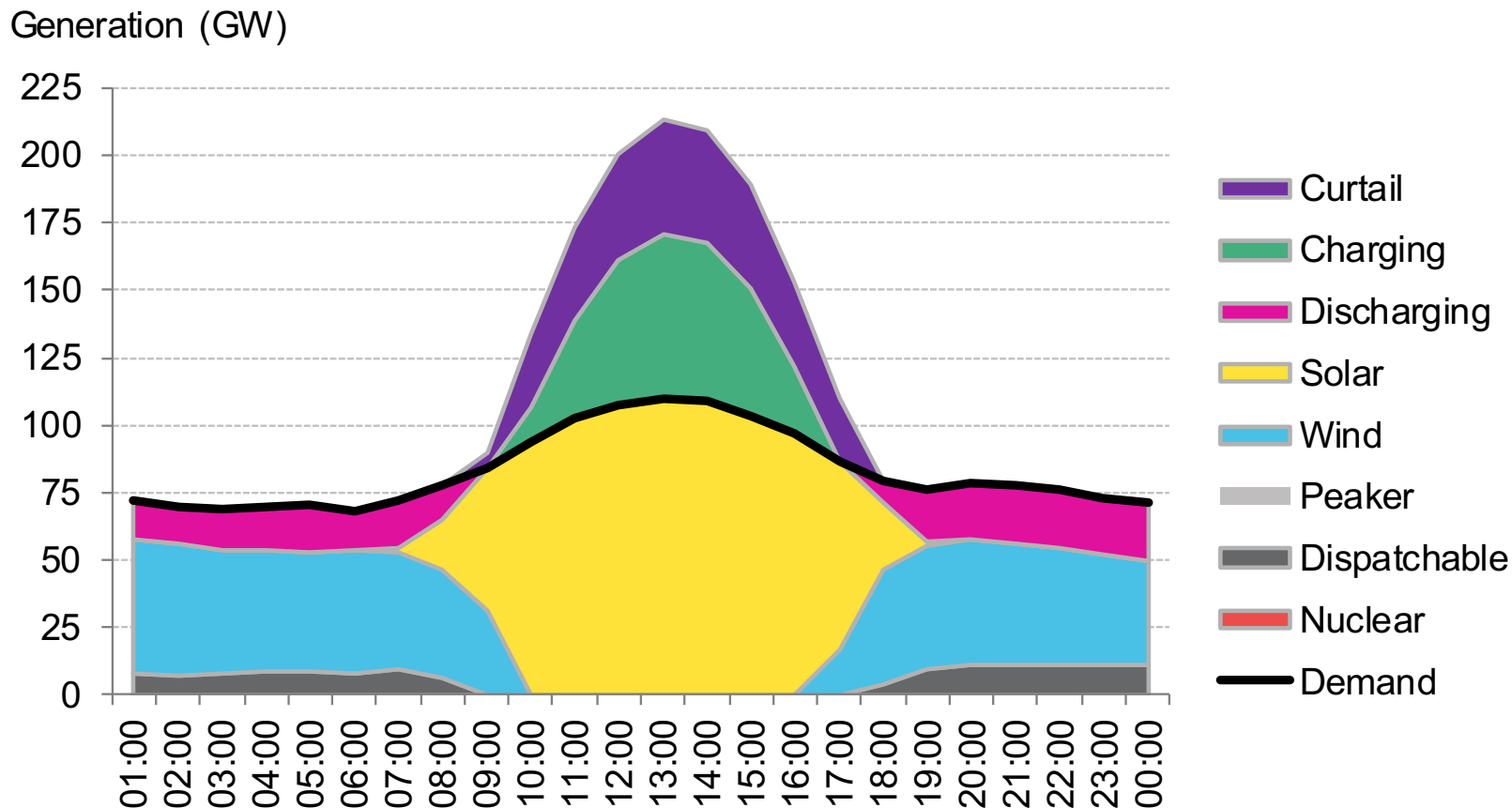
Generation in Europe, 2012-2050

In scenario reaching around 87% renewables in Europe in 2050, Bloomberg NEF expects solar will have 36% share.



Source: BloombergNEF's 2018 New Energy Outlook

Germany intraday generation: typical spring day 2050



Source: BloombergNEF

From 2018 to 2050, the role of Gas in backing up Europe's energy transition

- **Concentrating investments in flexible demand technologies (demand response, heat pumps battery and green hydrogen storage) is essential** to smartly integrate electric vehicles and foster the flexibility of the European electricity system by 2050
- **Gas generation will decline considerably compared to today even with large shares of coal retiring**, only by 2030 it can be cut by half (European Climate Foundation “Energy Union Choices study” Nov 2017). In the medium term, it can support the integration of additional renewable capacities and bridge the gap until the emergence of cleaner flexibility sources such as demand response and storage
- **Europe should continue to innovate and explore different forms of renewable gas to test full potential and impacts.**
- **The future prospect of renewable gases is no reason to slow down electrification and decentralization at this stage:** considerable levels of efficiency and electrification are needed in all scenarios that are compatible with the Paris Climate Change Agreement.



Demonstration of Essential Reliability Services by a 300-MW Solar PV Power Plant



California ISO

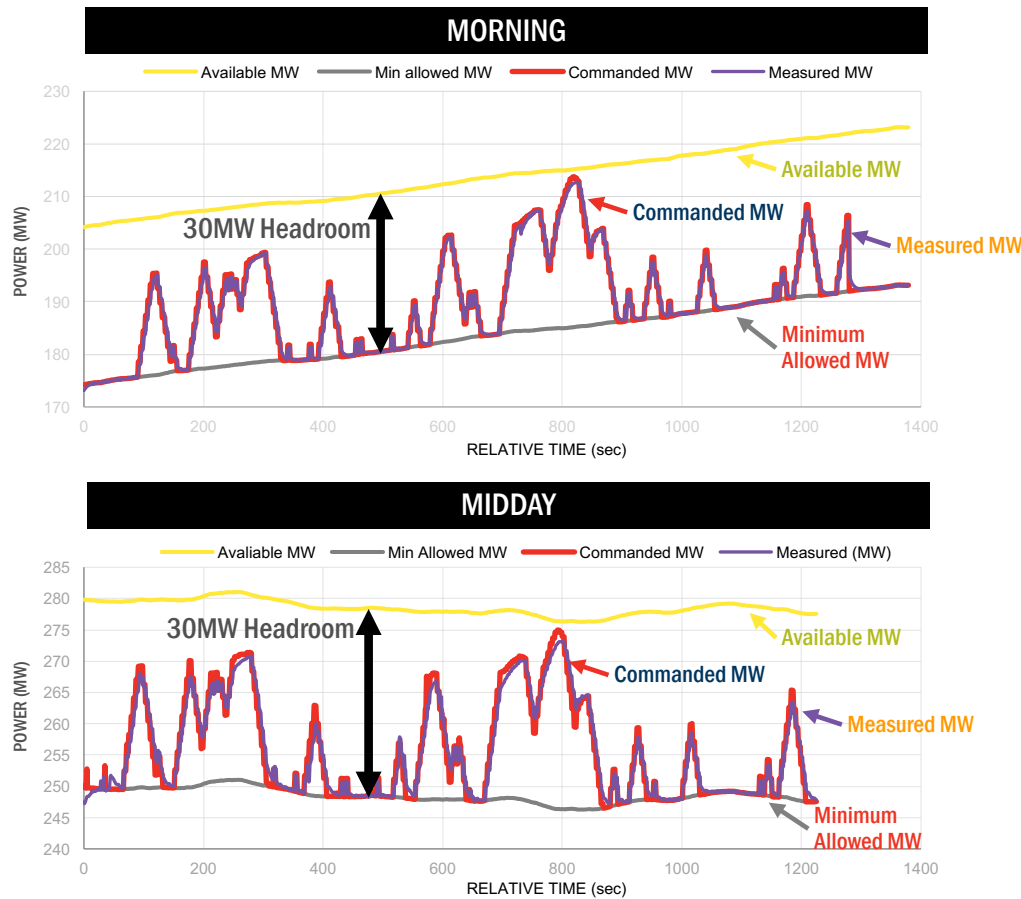


First Solar®

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy

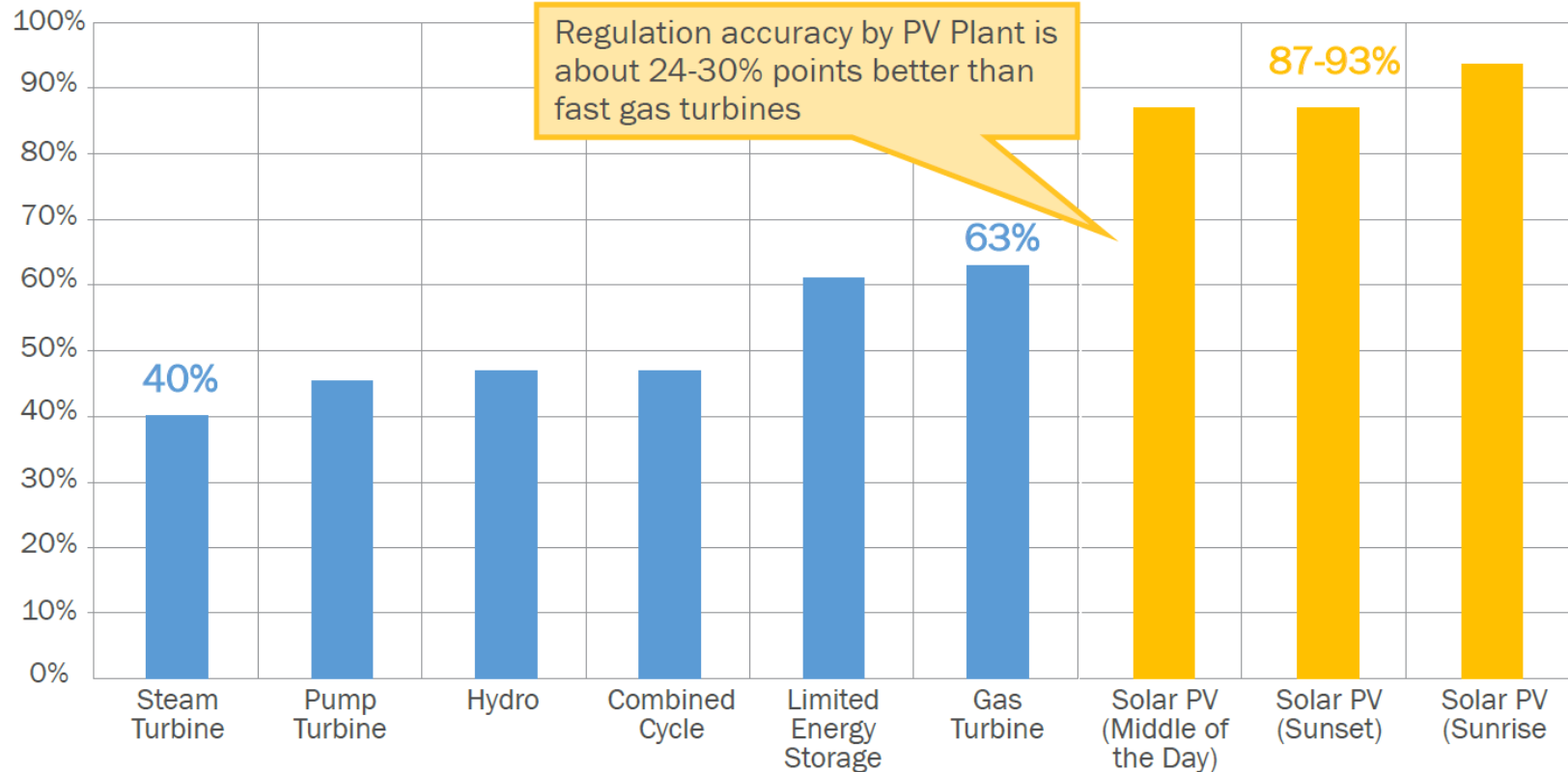


AGC Participation Tests: 300 MW Utility-Scale PV Plant



- 30MW headroom
- 4-sec AGC signal provided to Plant Controller
- Tests were conducted for
 - Sunrise
 - Middle of the day
 - Sunset

PV Plants Outperform Conventional Resources in Frequency Regulation



California ISO

Blue bars taken from the ISO's informational submittal to FERC on the performance of resources providing regulation services between January 1, 2015 and March 31, 2016

<http://www.caiso.com/Documents/TestsShowRenewablePlantsCanBalanceLow-CarbonGrid.pdf>