

Commercial and industrial renewable energy demand

C&I renewable energy offtake agreement demand outlook

Aaron Barr | October 2019



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- Acquisition of MAKE and Greentech Media (GTM)
- Leaders in renewables, EV demand and grid-connected storage
- Over 500 sector-dedicated analysts and consultants globally, including 75 specifically to power and renewables
- Located close to clients and industry contacts



Wood Mackenzie offices



Wood Mackenzie Power & Renewables offices

About Analyst: Aaron Barr



Aaron Barr
Principal Consultant

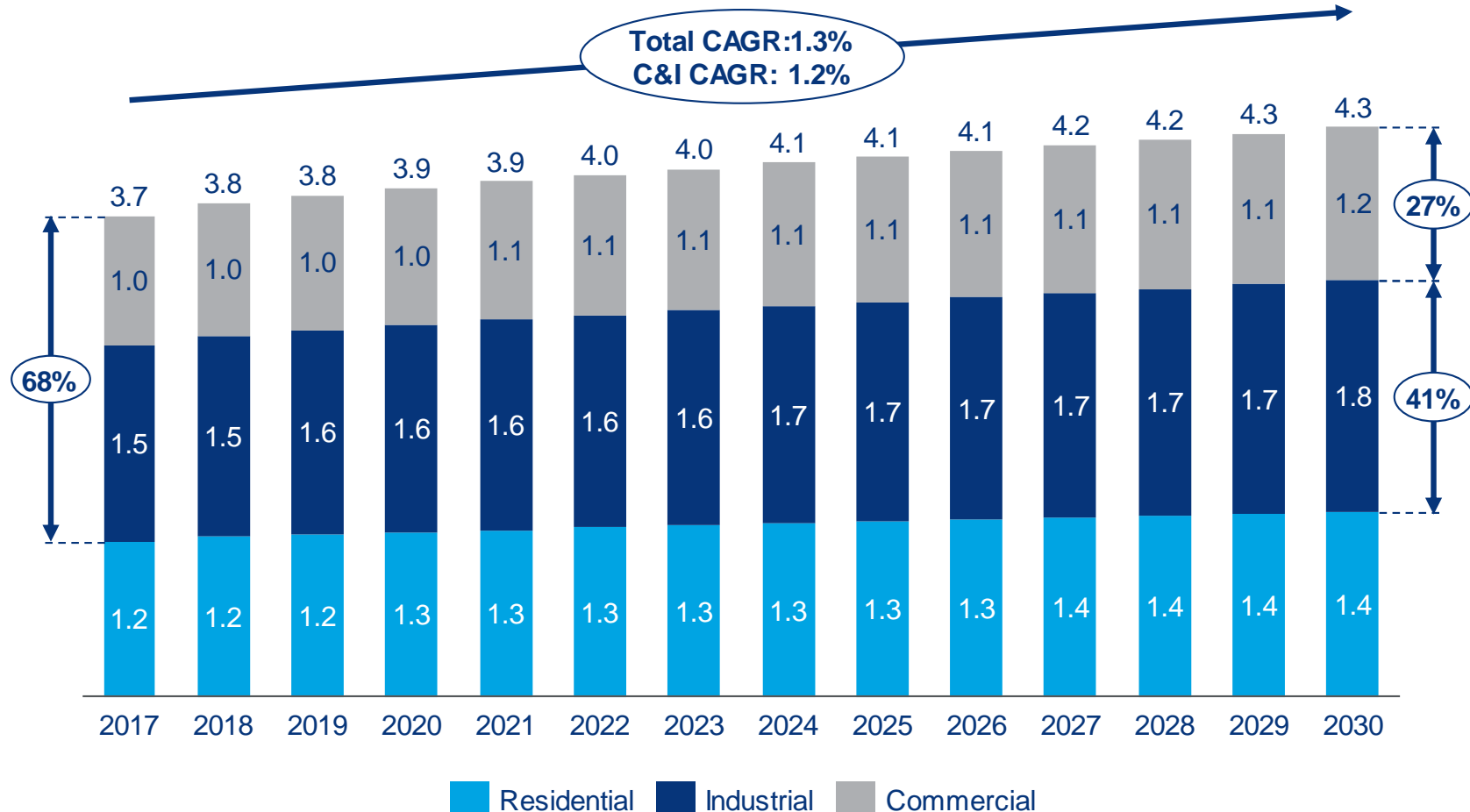
- » Expertise in wind O&M, wind turbine technology, market assessment and financial analysis
- » 6 years with Wood Mackenzie
 - » Lead author for multiple Research reports:
 - » Global Wind Energy Turbine Trends Market Report
 - » Global Wind Energy Operations and Maintenance Sector Report
 - » Global Renewable Energy Levelized Cost of Electricity (LCOE) Research Note
 - » Principal consultant on over 50 consulting projects:
- » 9 years with GE wind energy in various engineering leadership roles
 - » Wind turbine conceptual design, advanced micro-siting and reliability engineering
- » BS in Mechanical Engineering, Virginia Tech
- » MBA from University of North Carolina, Chapel Hill
- » Located in Greenville, SC, USA

1. Market environment for C&I renewable energy demand

United States electricity demand will continue to be driven by C&I sector

C&I segment will continue to serve as a critical client set for foreseeable future

United States electricity demand (Pwh)

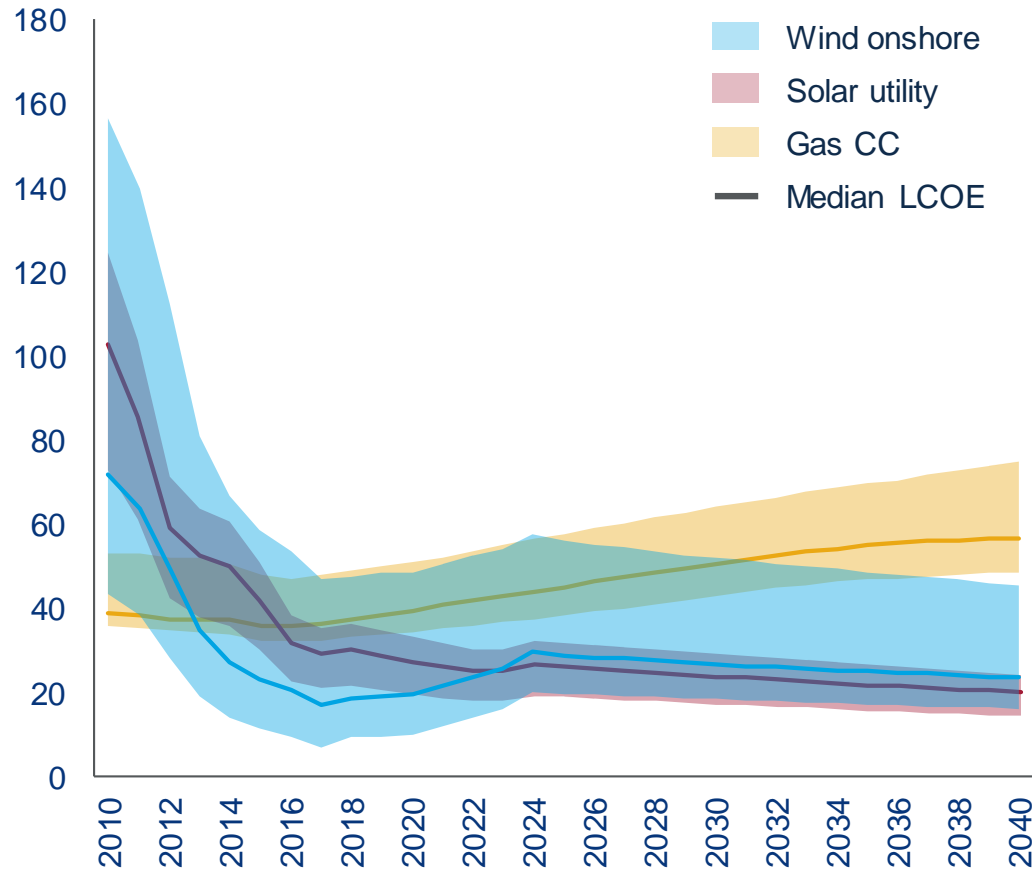


- C&I segments comprise ~70% of US electricity demand
- Industrial efficiency increasing 177 workers in 2019 have equal output as 1,000 in 1950*
- Electrification within energy intensive industries driving some power growth
- Growth in concentrated power demand from data centers
- Services economy driving commercial growth and differentiation based on sustainability

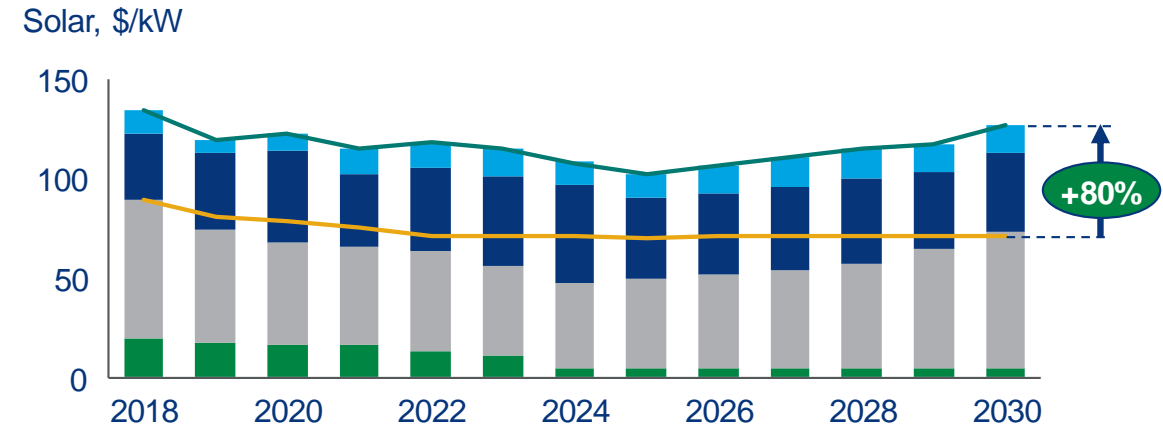
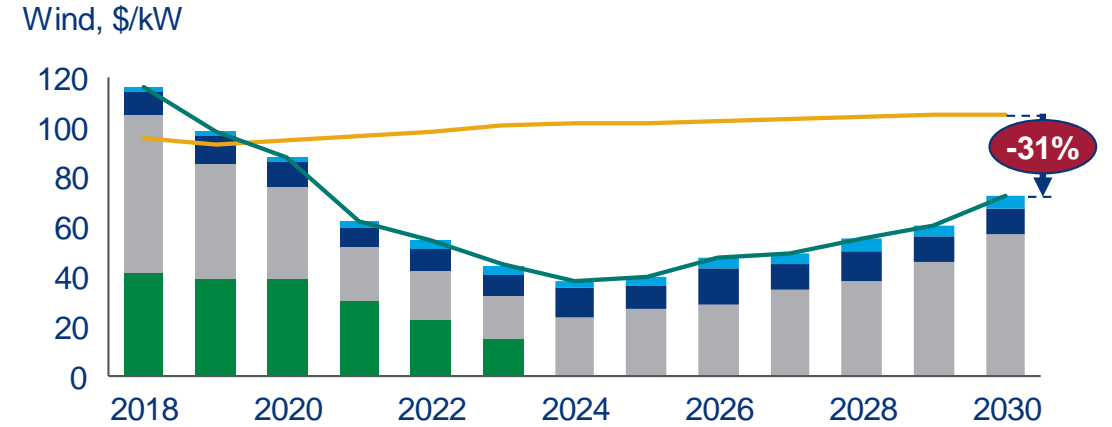
Levelised Cost of Energy (LCOE) and Net Cost of New Entry (NetCONE) outlook

New analytic measures, such as NetCONE, point to solar leadership to meet future power demand

US LCOE range & medians (2018 \$/MWh)



Wind and Solar NetCONE – ERCOT West



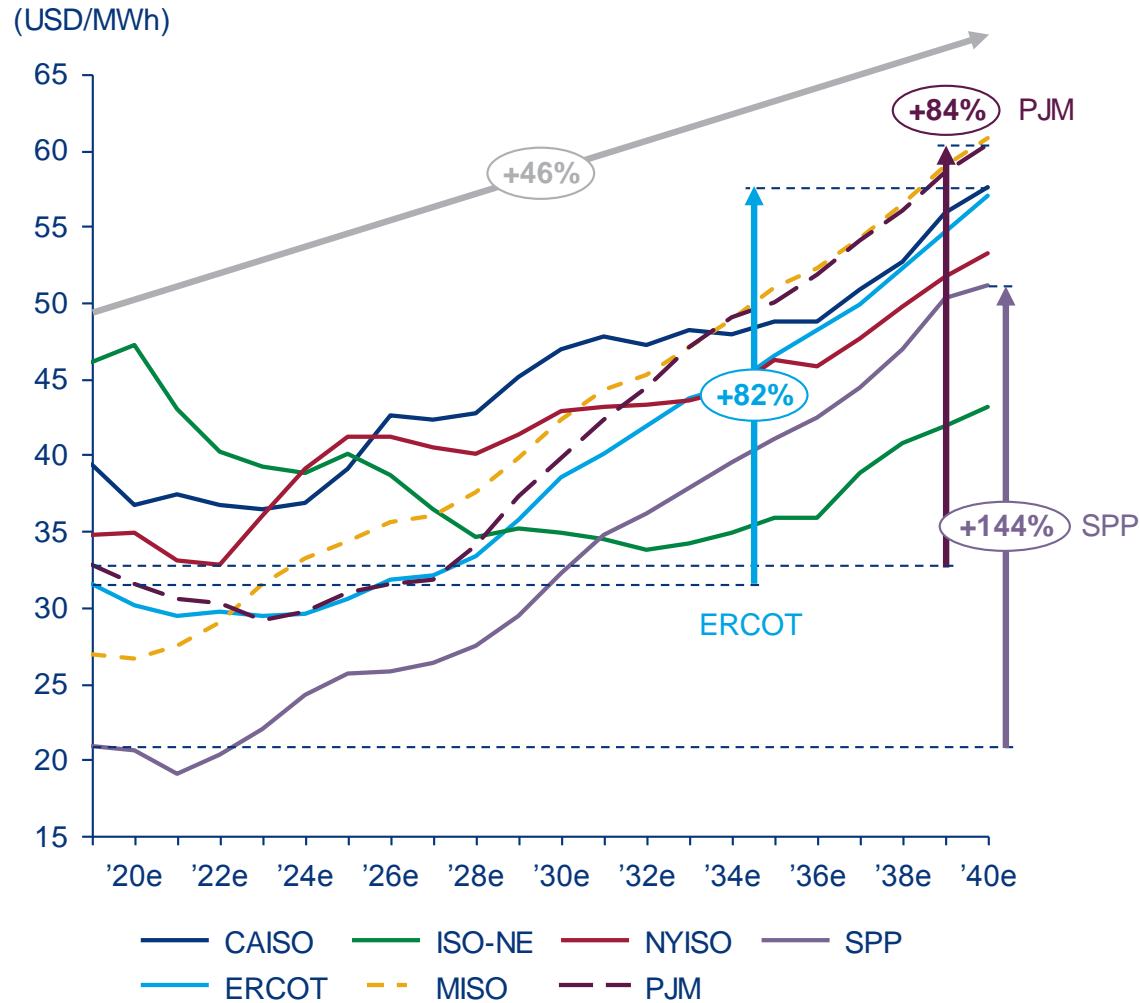
- Capacity revenue
- SRMC margin
- CONE
- Scarcity revenue
- Tax credits
- Net revenue

Note: LCOE lines represent medians
 Ranges represent US ranges for utility-scale projects
 NetCONE analysis derived from H1 Federal Carbon Case
 Source: Wood Mackenzie

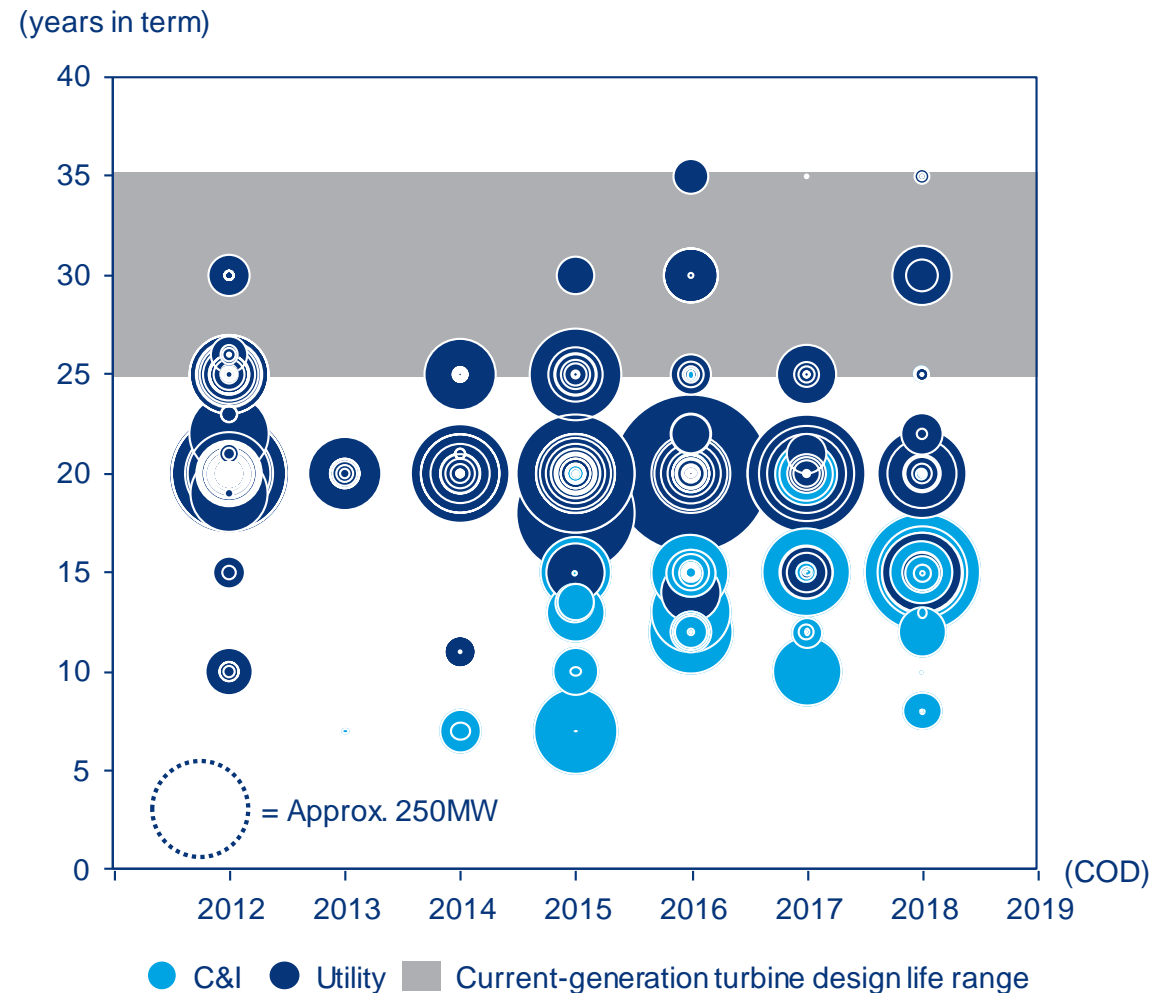
Long-term power price to rise significantly in all major wholesale markets

Increases drive hedging interest from buyers and assuage developer fears over short tenors and merchant tails

Average wholesale power price forecast for US ISOs, 2019 to 2040



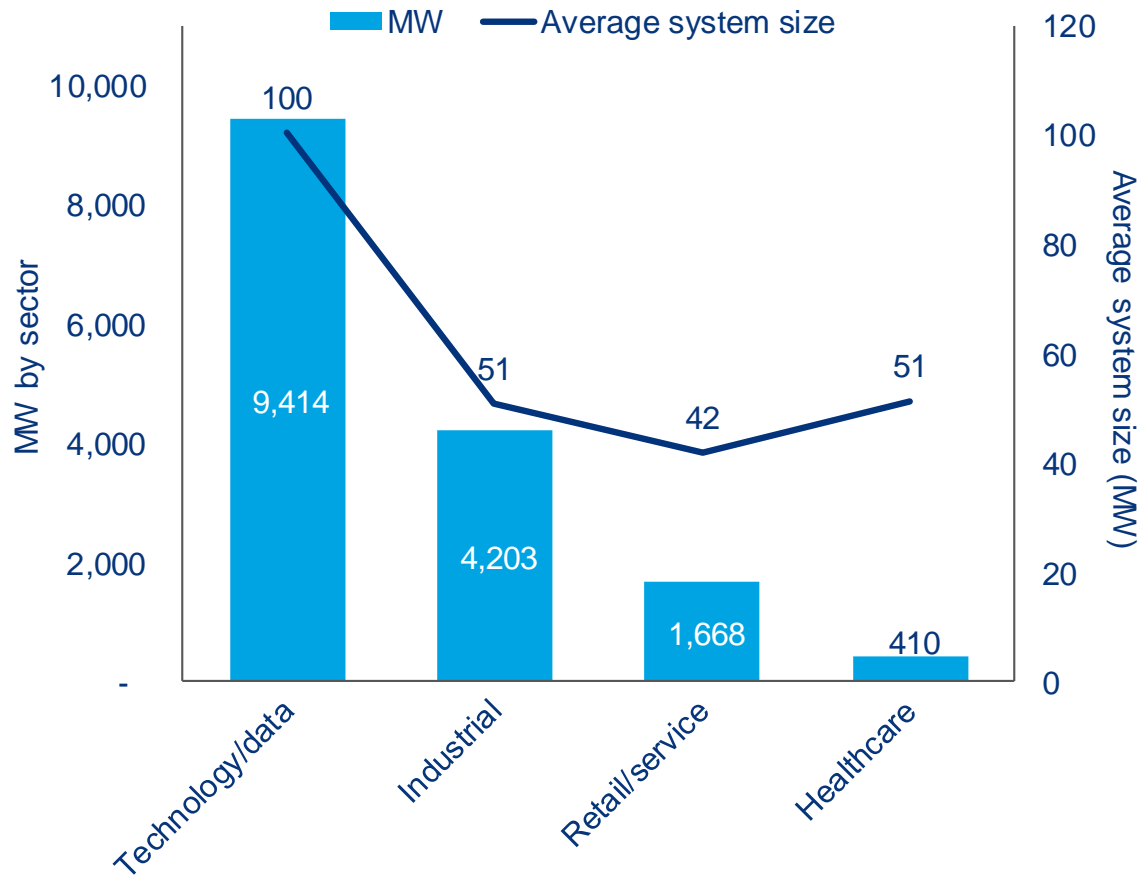
Utility and C&I contracts by term length, COD and size, 2012 to 2018



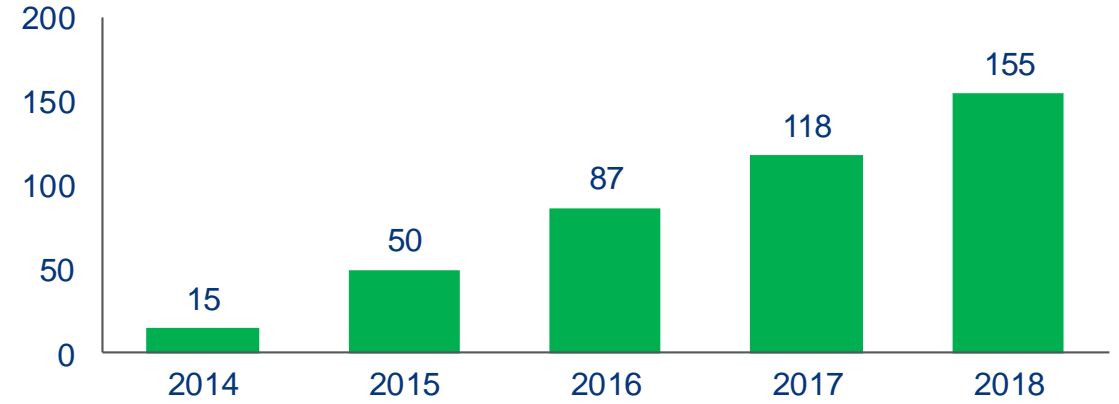
Support for renewables is surging across the C&I sector

Peer pressure building as RE100 ranks grow, mirroring new entrant activity

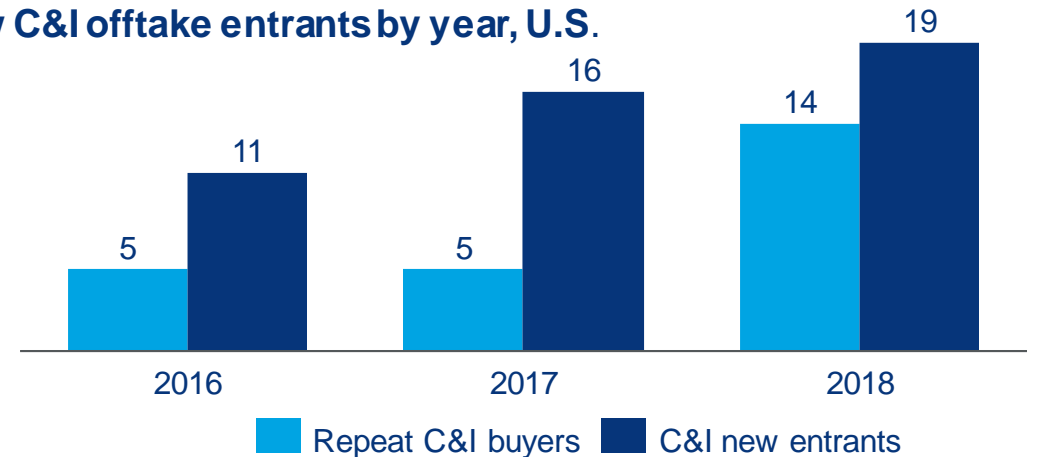
Renewable C&I capacity, operational and in-development



Cumulative RE100 signatories by year



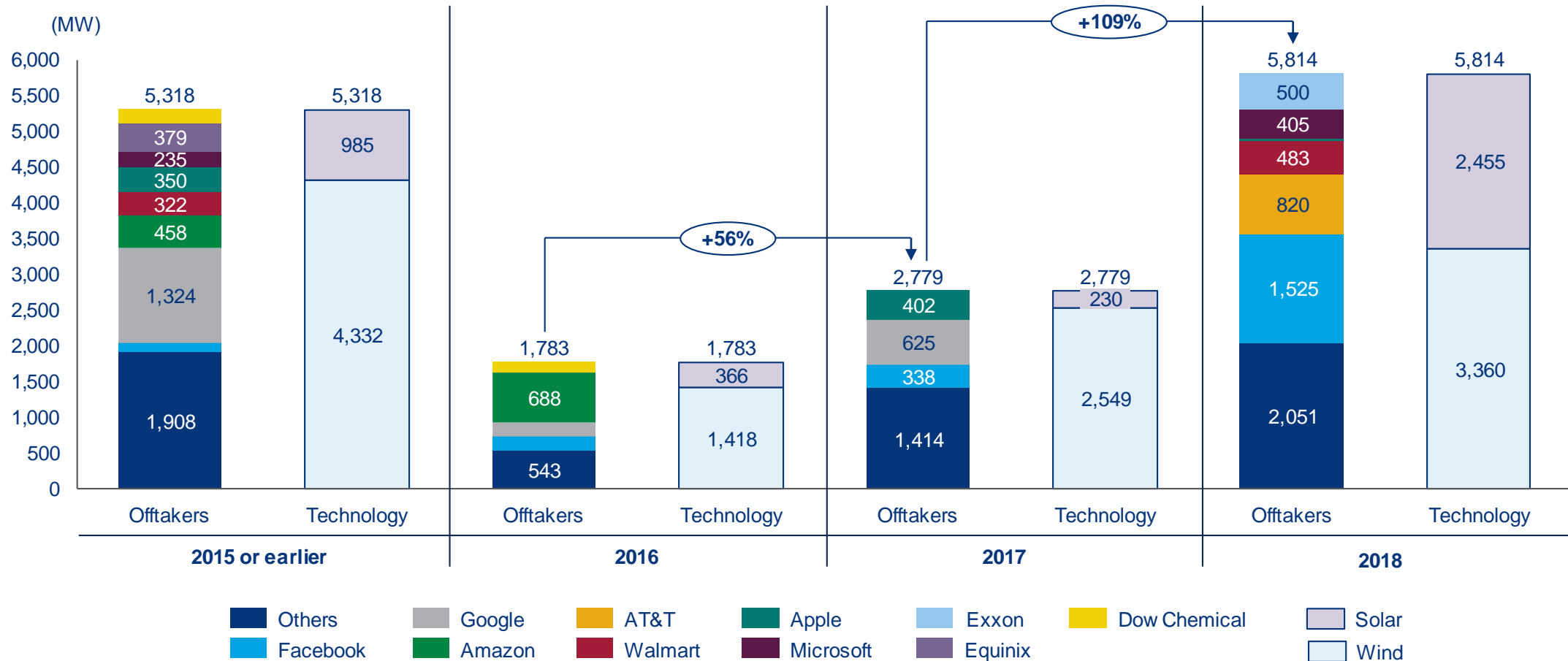
New C&I offtake entrants by year, U.S.



Top 10 solar and wind C&I offtakers by procurement year

Substantial increase in C&I deals YoY takes place as PTC phaseout loom and Section 201 tariff scare abates

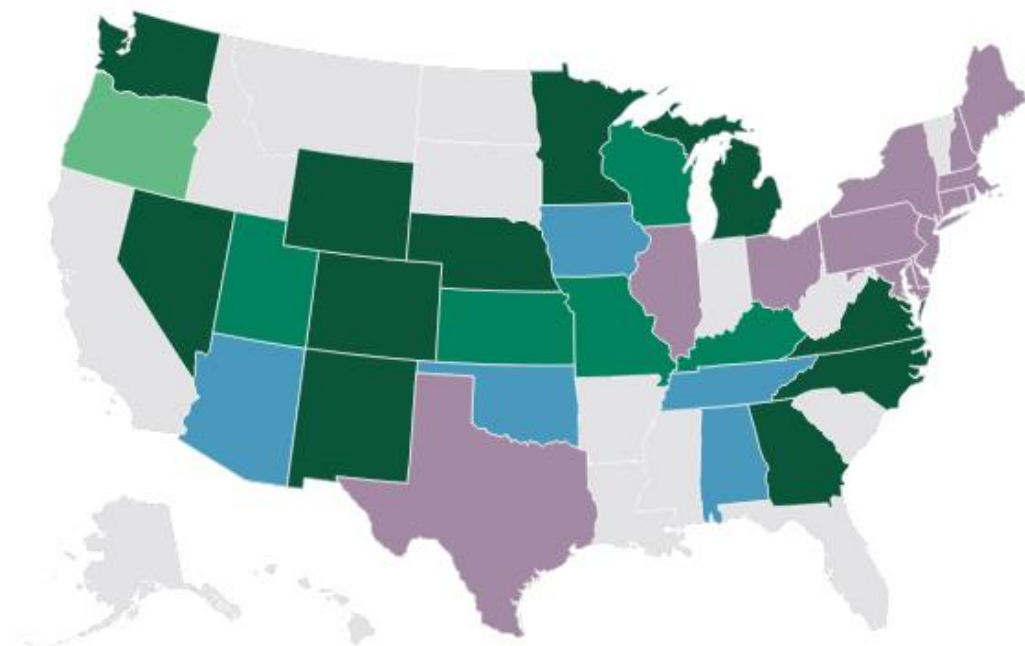
Select solar vs. wind C&I capacity deals by year of offtake announcement



Many C&I customers in regulated markets can't buy VPPAs, Green Tariffs are an option

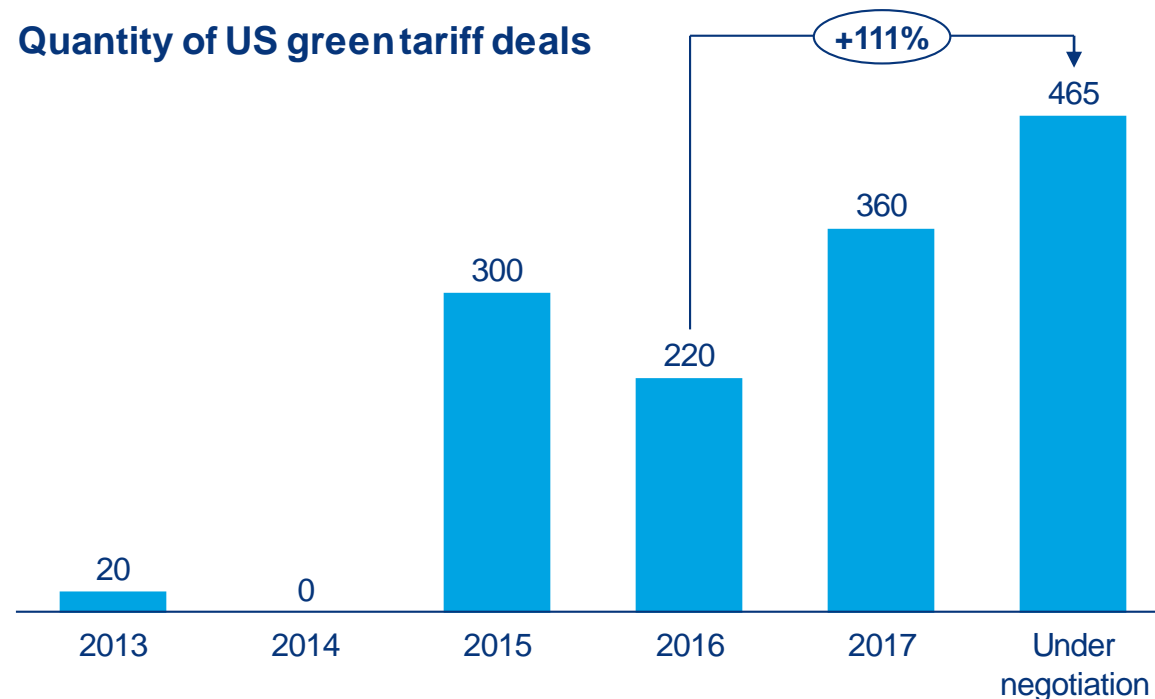
Utility engagement in the renewables sector is increasing, with green tariffs the latest product on tap

State of green tariff programs, United States



Green tariffs in place, deals executed	Singular green tariff transactions
Green tariffs in place, no deals	Retail choice available
Considering green tariff (at PUC level)	No large scale RE access

Quantity of US green tariff deals



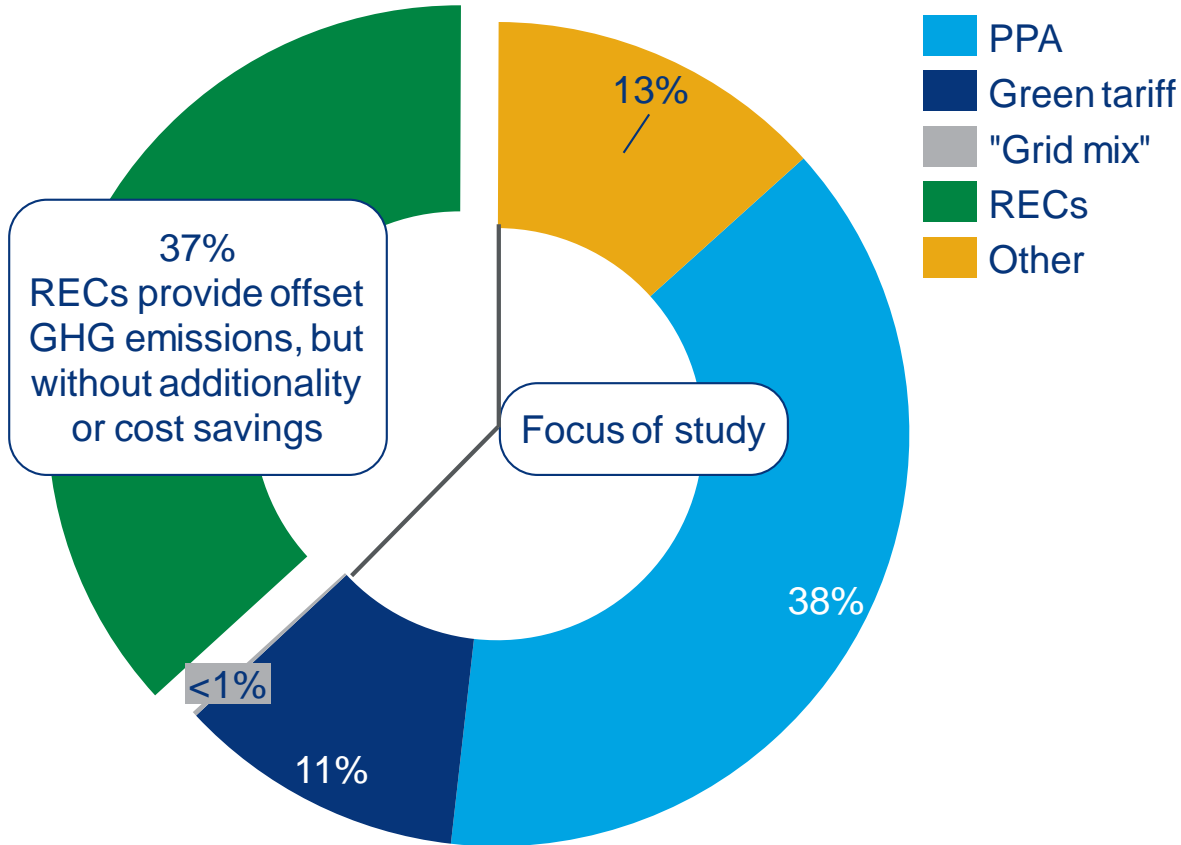
- Green tariffs provide hedge against increasing power prices.
- US green tariff programs remain in their infancy but provide option to smaller and less sophisticated C&I RE buyers
- Utility engagement is critical, particularly in regulated markets

C&I renewable energy demand forecast overview

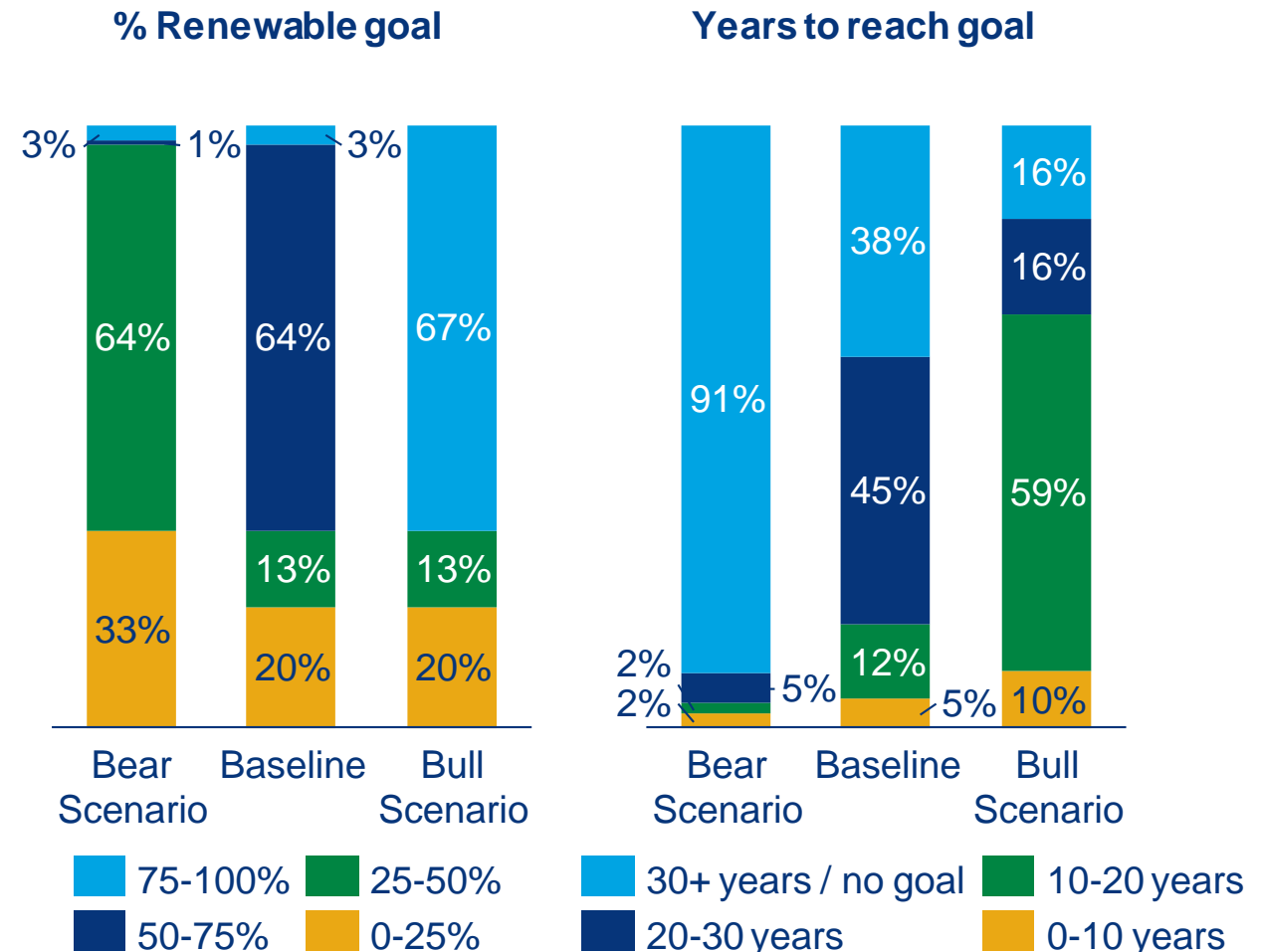
Scenario analysis of F1000 demand, considers RE goals, adoption rates and REC use

Analysis considered every company in the F1000, including stated and expected renewable energy goals

Global renewable energy procurement, CDP companies



Behavior of Fortune 1000 companies – number of companies



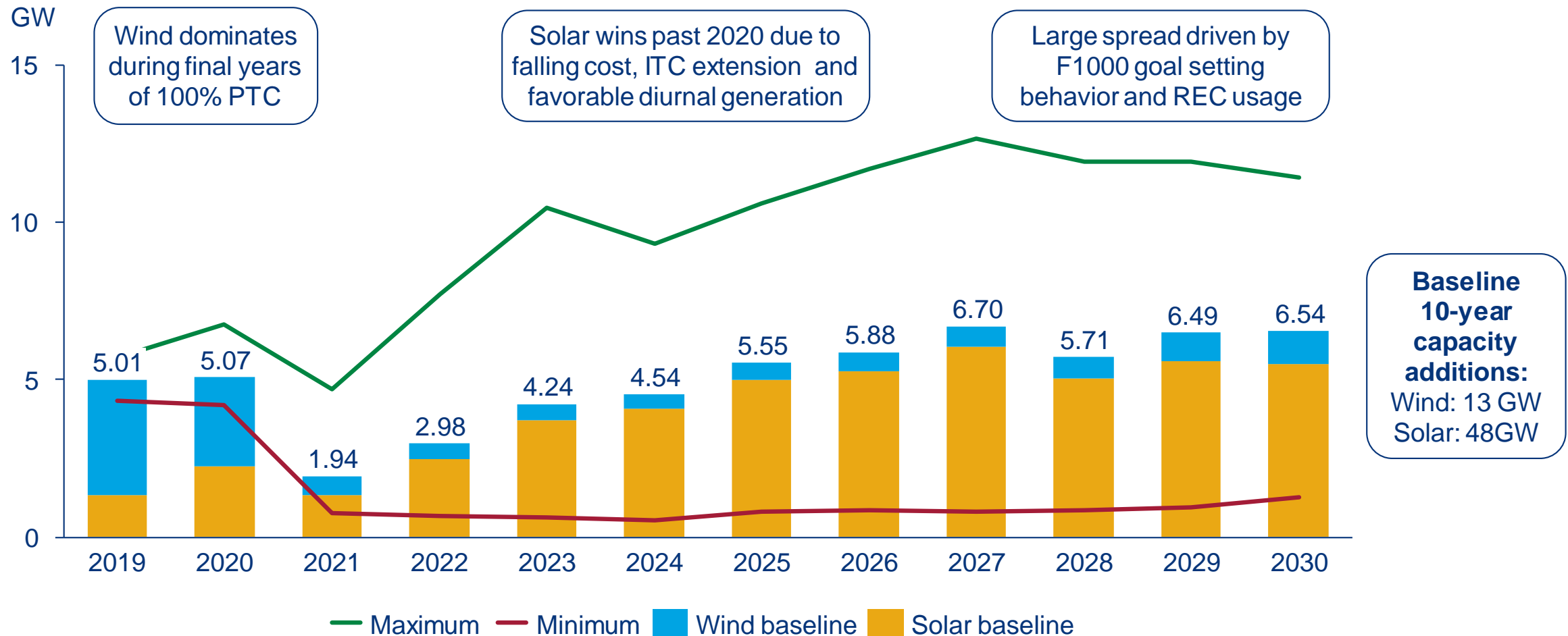
Note: CDP is Carbon Disclosure Project

Source: Wood Mackenzie

Additional capacity to meet C&I demand - forecast and potential range

Wind is the best option in near-term due to PTC, solar expected to be preferred C&I supply for long-term

Wind v. solar forecast for C&I demand, 2018-2030 (GW)



Q&A

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