


# Energy Storage and the Energy Transition

Energy Storage in Emerging Markets: The Next Frontier

Amy Grace

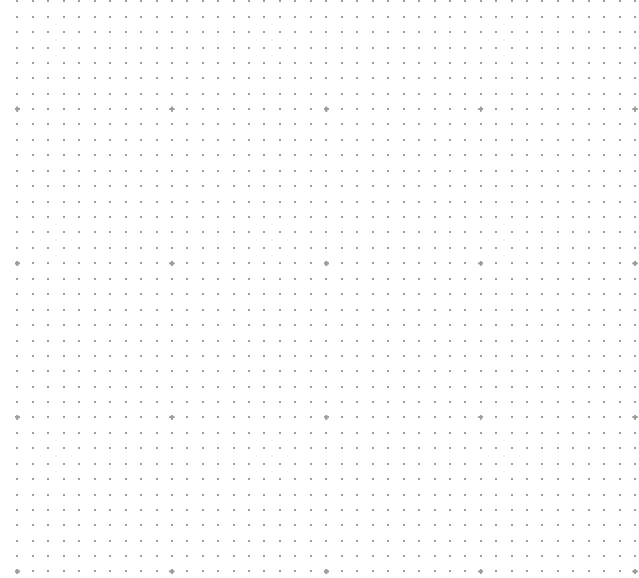
November 5, 2019





Renewable energy today	2
Long-term	10
Flexibility	14

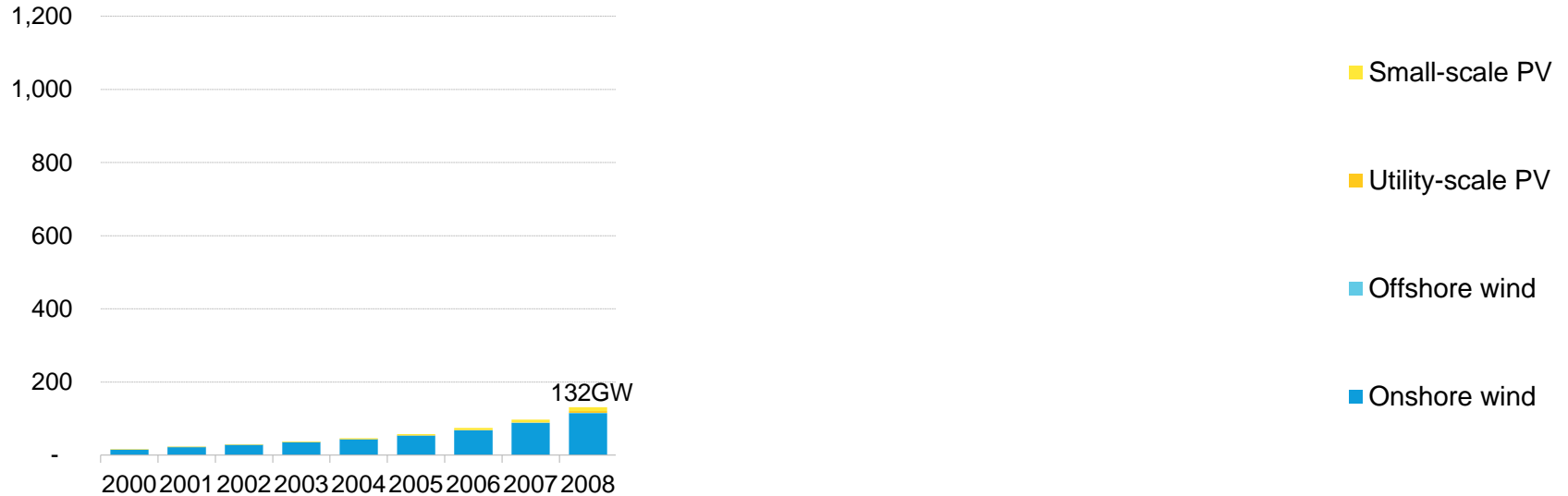
# Renewable energy today



# The view from 2008

## Global wind and solar installations, cumulative

Cumulative GW



Source: BloombergNEF

# Energy transition questions, 2008



## Costs

How to drive down costs of clean energy and reduce dependence on subsidies?

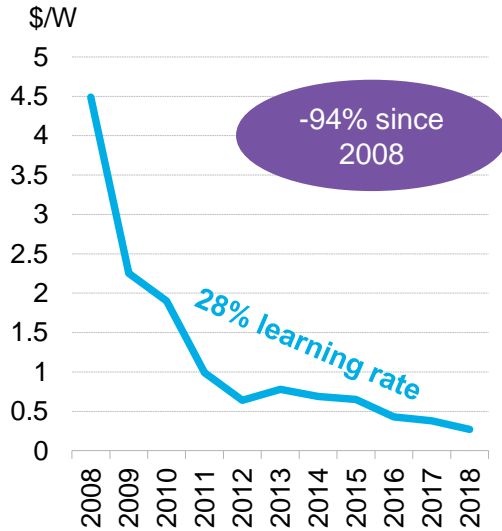


## Scale

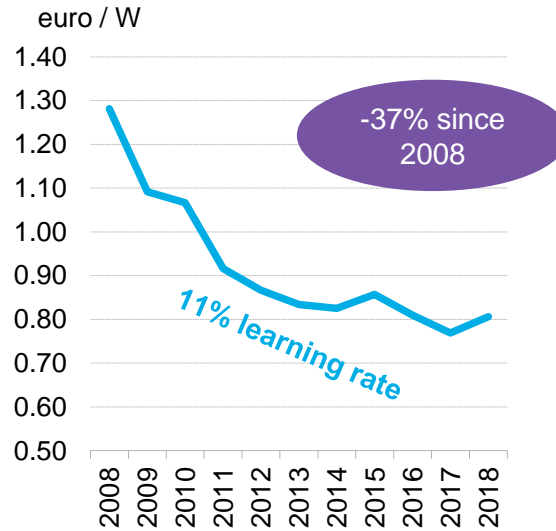
How to scale up deployments? How to raise and deploy the capital required for the energy transition?

# Technology costs plummeted

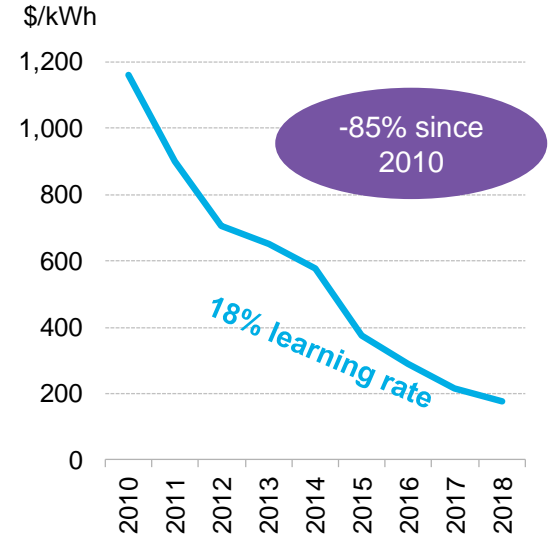
## Solar PV module prices



## Onshore wind turbine prices



## Lithium-ion battery prices

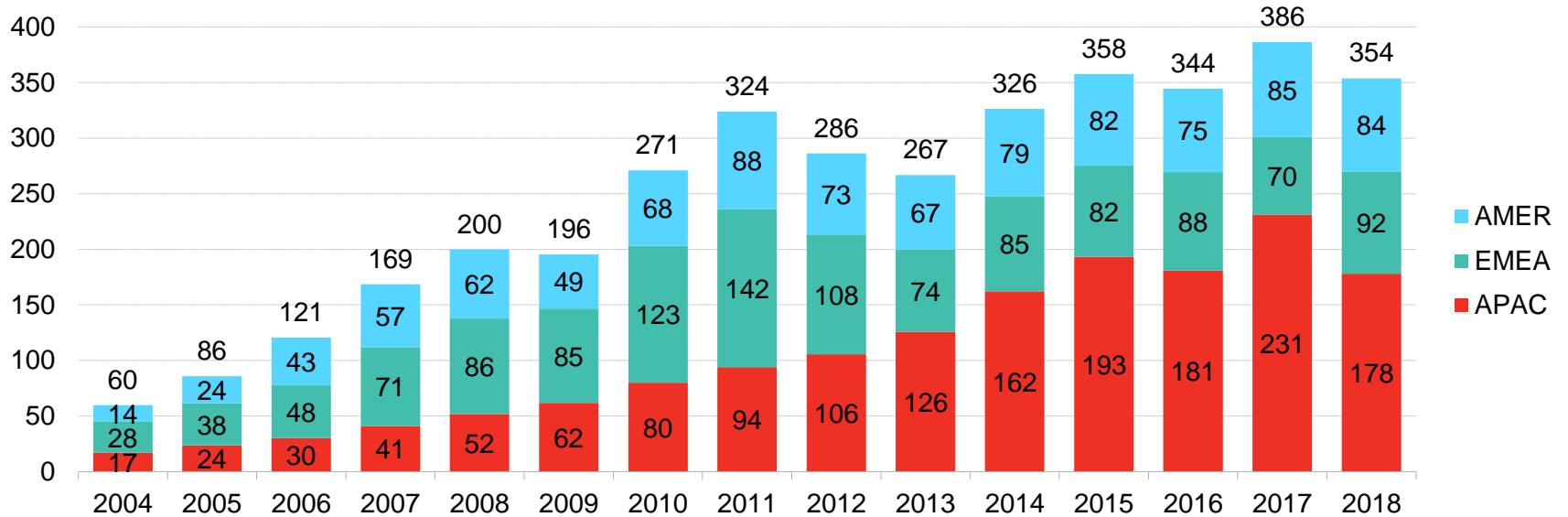


Source: BloombergNEF

# Investment scaled up

## Global clean energy investment

\$ billion

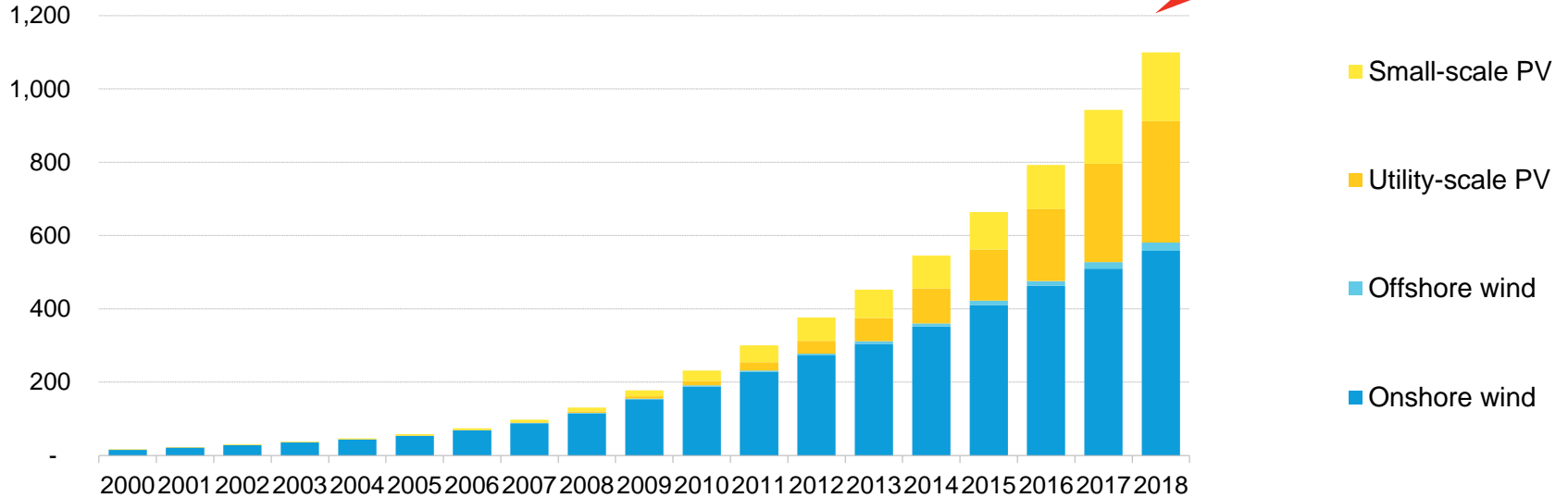


Source: BloombergNEF

# And the rest is history

## Global wind and solar installations

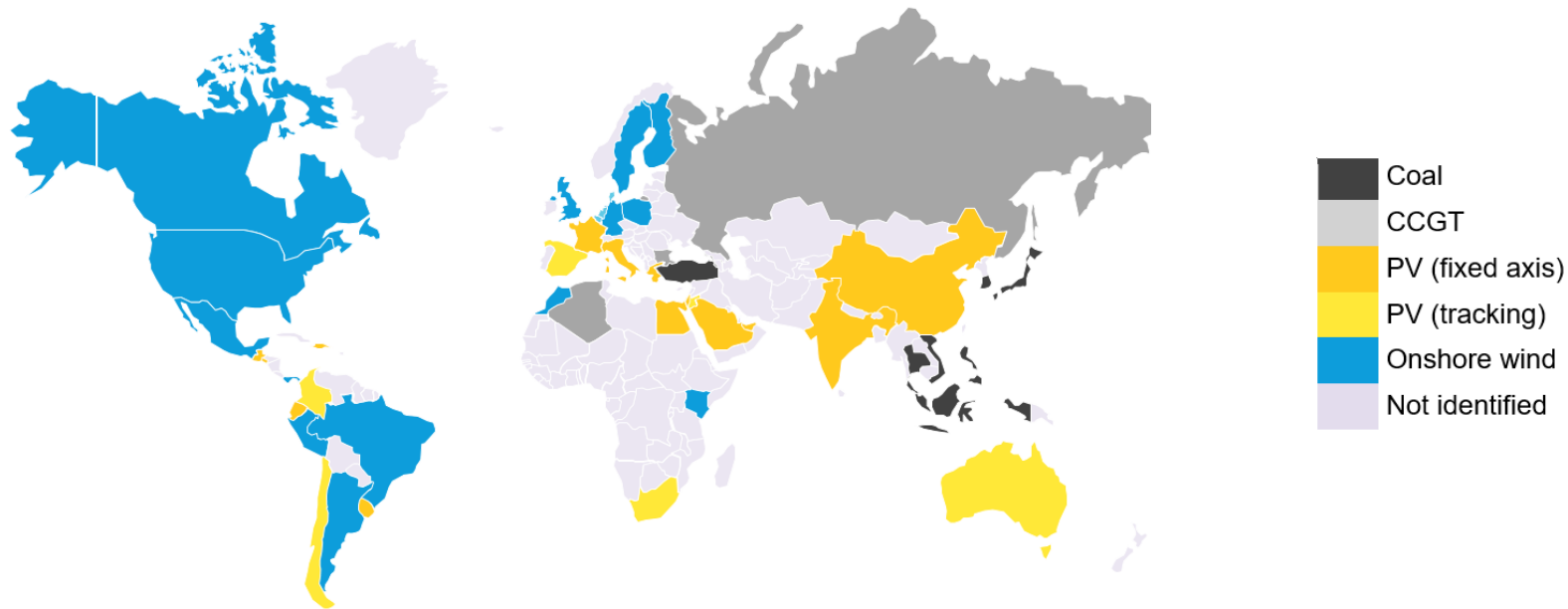
Cumulative GW



Source: BloombergNEF

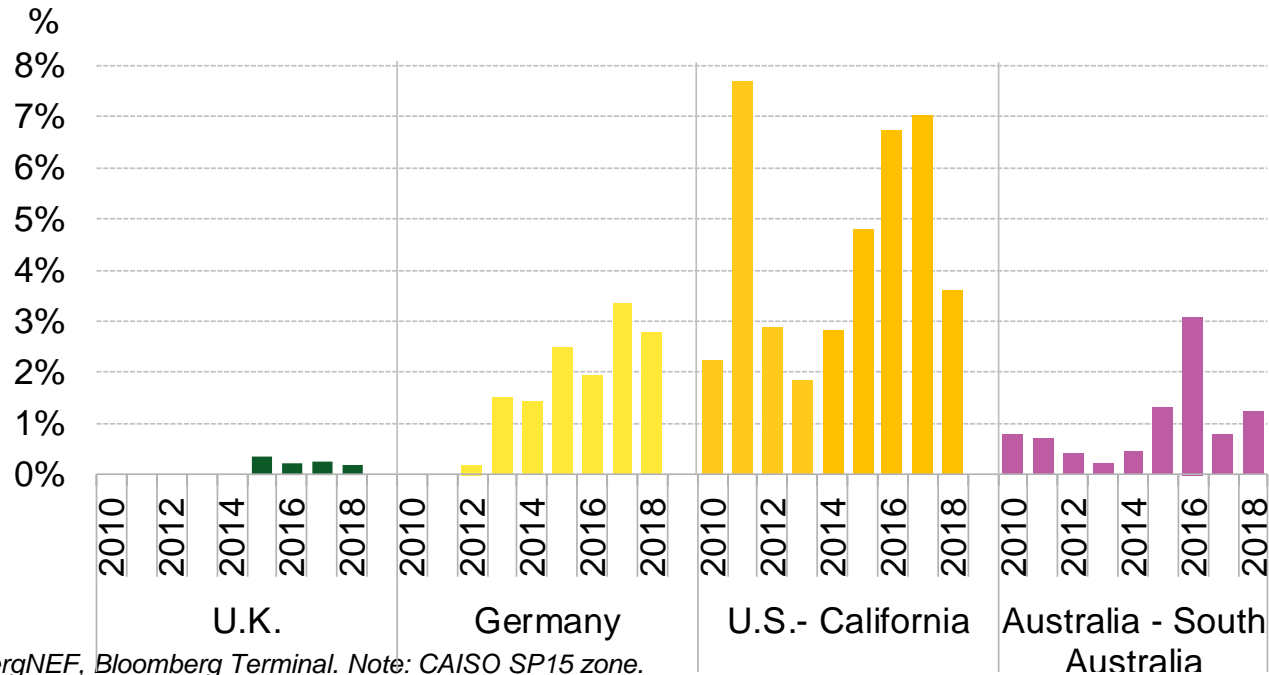


# Most competitive forms of power generation by country, 2019



Source: BloombergNEF Note: Reflective of the cheapest benchmark project for each technology and market

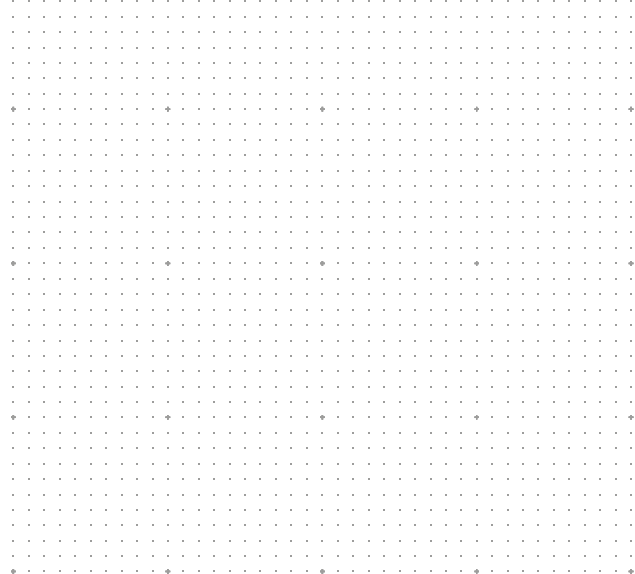
# Negative power prices occurrence duration by market



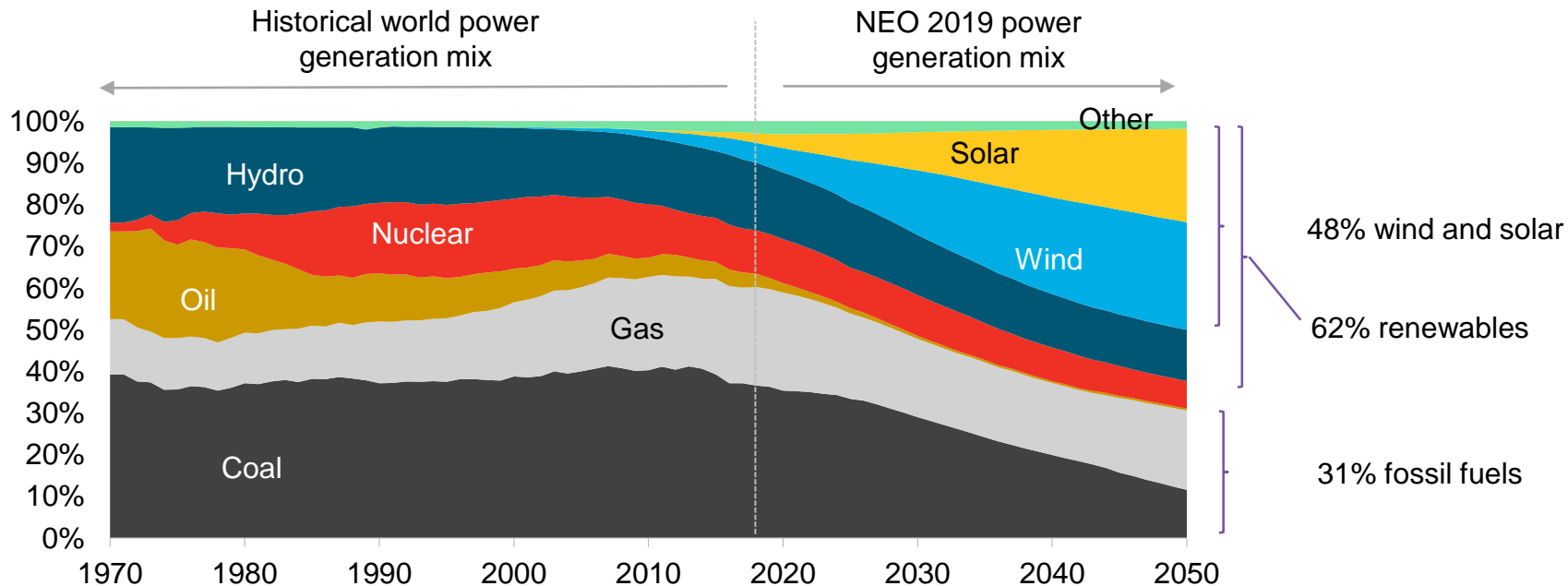
Source: BloombergNEF, Bloomberg Terminal. Note: CAISO SP15 zone.

# Long-term

## New Energy Outlook



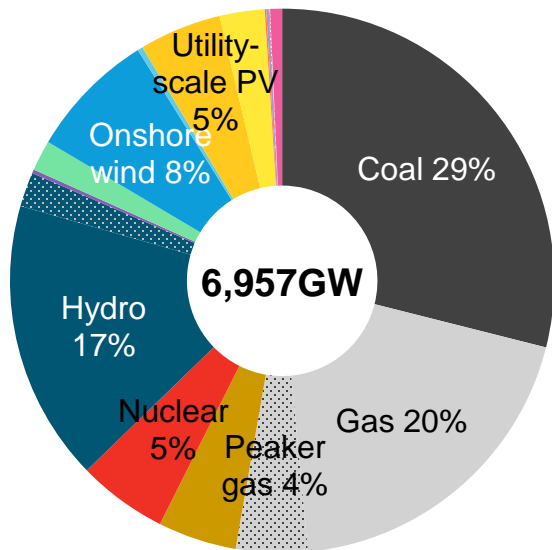
# New Energy Outlook: 50% wind + solar power globally by 2050



Source: BloombergNEF, IEA

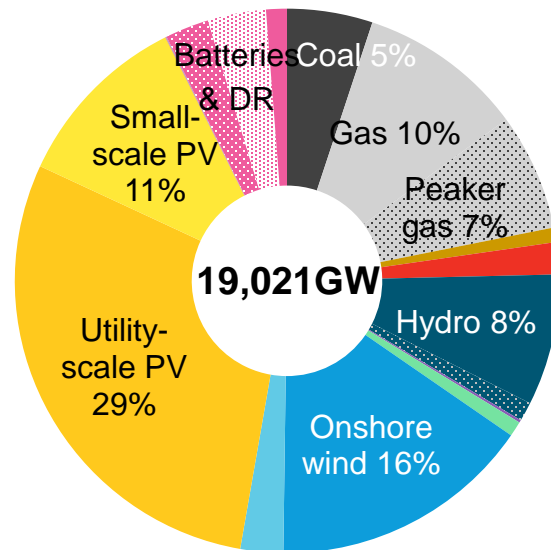
# 71% of new generating capacity is renewable

Total installed capacity, 2018



Source: BloombergNEF

Total installed capacity, 2050

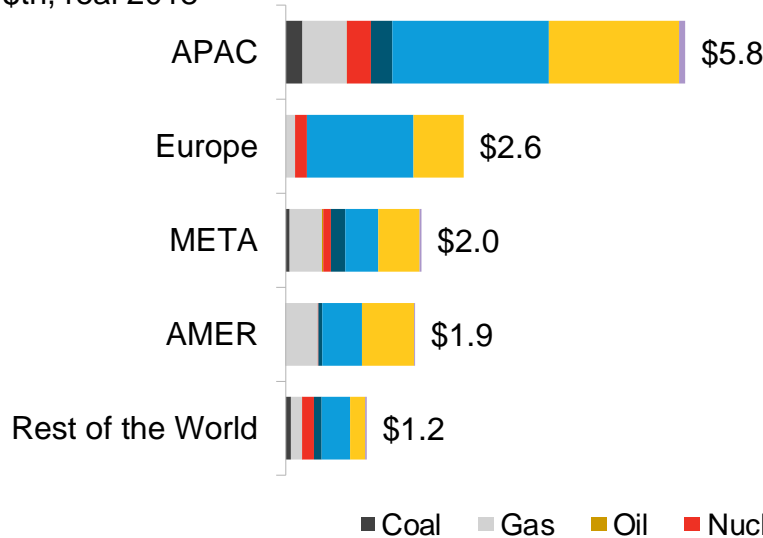


Source: BloombergNEF

# Asia Pacific is the driving force behind global investment

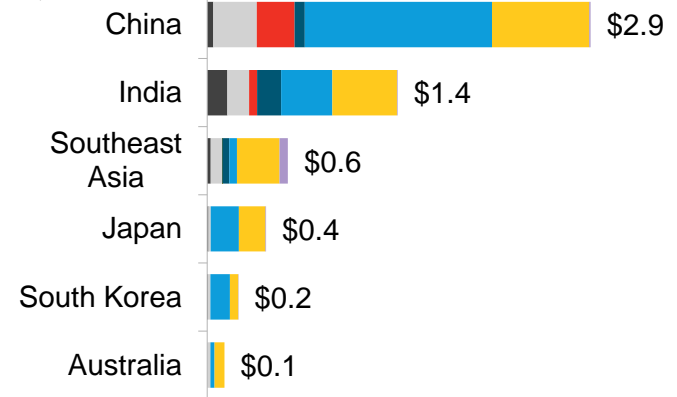
Global investment in power generation by region, 2018-2050

\$tn, real 2018



APAC investment in power generation by region, 2018-2050

\$tn, real 2018

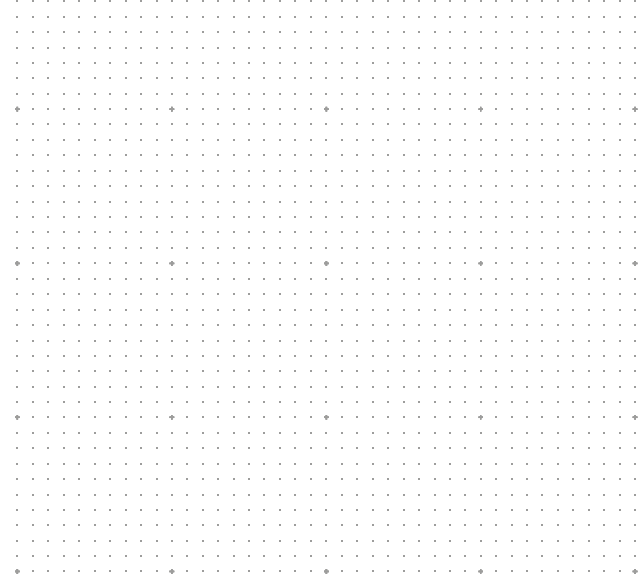


■ Coal ■ Gas ■ Oil ■ Nuclear ■ Hydro ■ Wind ■ Solar ■ Other

Source: BloombergNEF

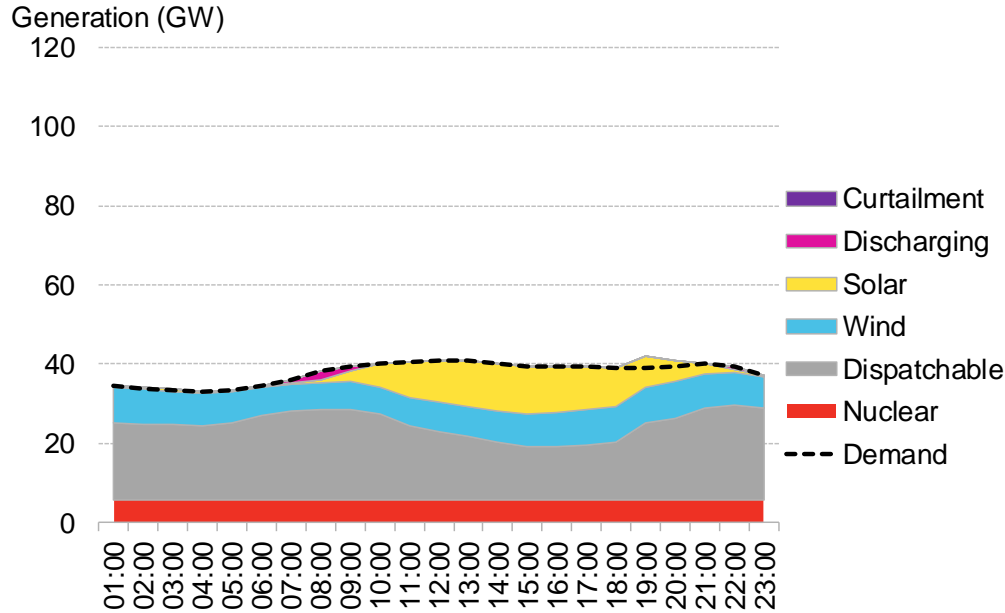
Source: BloombergNEF

# Flexibility



# Iberia intraday generation: a spring day

2020

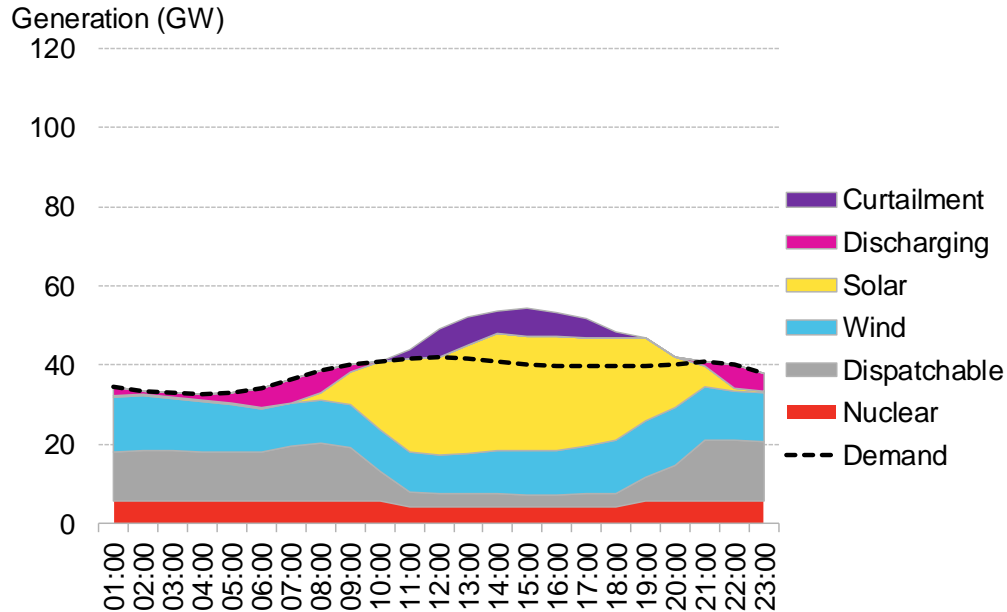


Source: BloombergNEF



# Iberia intraday generation: a spring day

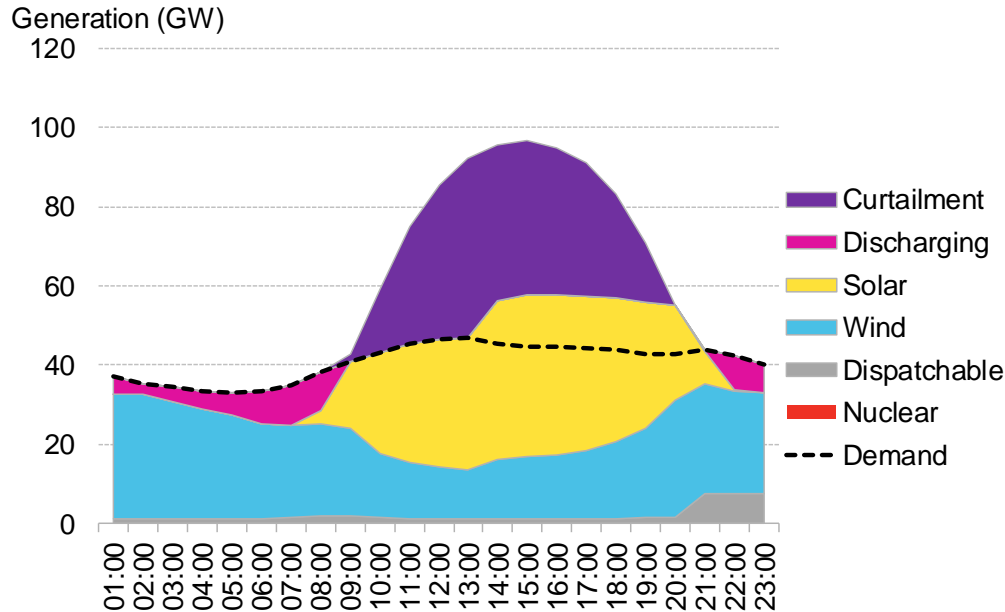
2025



Source: BloombergNEF

# Iberia intraday generation: a spring day

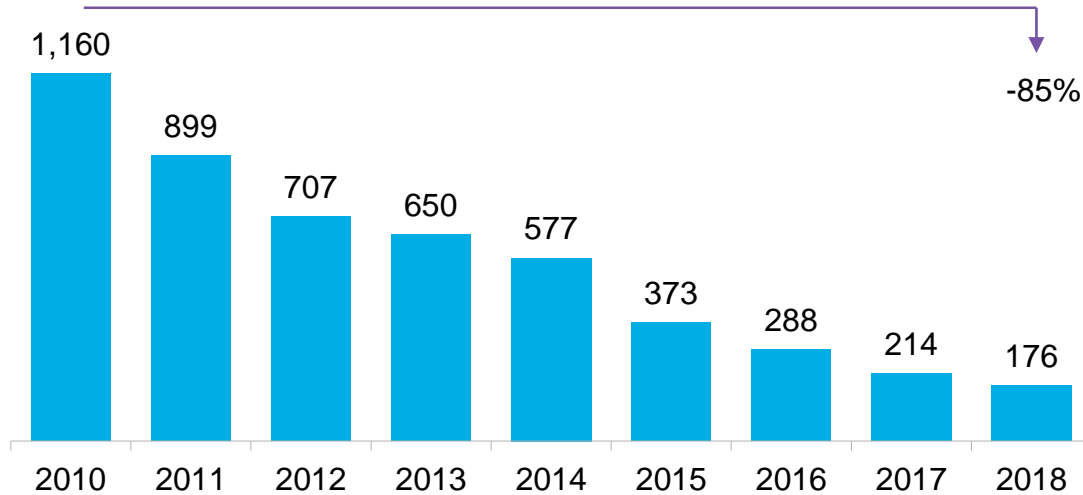
2050



Source: BloombergNEF

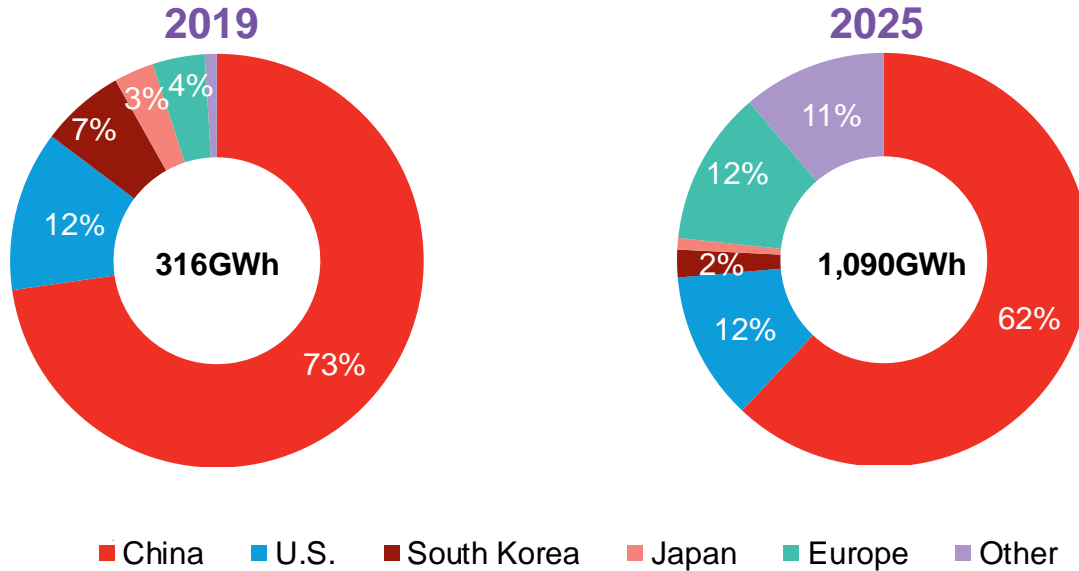
# Lithium-ion battery prices down 85% since 2010

Battery pack price (real 2018 \$/kWh)



Source: BloombergNEF

# Battery manufacturing capacity will more than triple by 2025

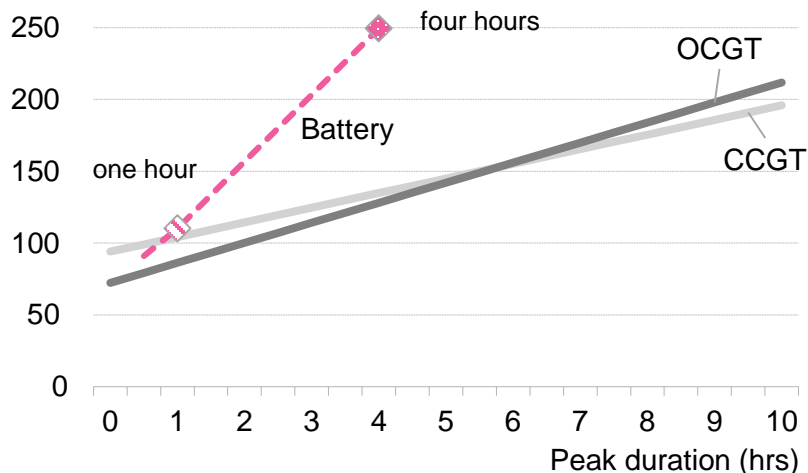


Source: BloombergNEF

# Battery tipping point 1: Peaking, new vs new

## U.S. 2019

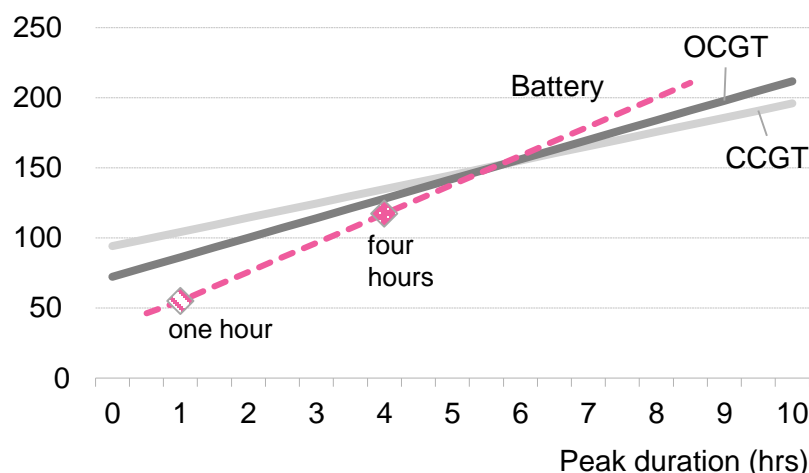
\$/kW/yr (2018 real)



Source: BloombergNEF. Note: Battery levelized cost of capacity include a charging cost. Pink lines denote a trend rather than actual LCOC apart from the one and four storage hour systems

## U.S. 2030

\$/kW/yr (2018 real)

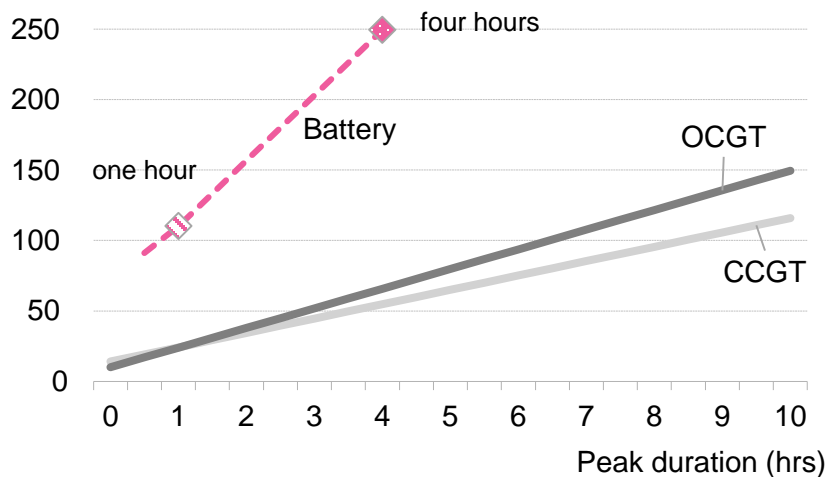


Source: BloombergNEF. Note: Battery levelized cost of capacity include a charging cost. The pink line denotes the cost trend rather than actual projects

# Battery tipping point 2: Peaking, new vs existing

## U.S. 2019

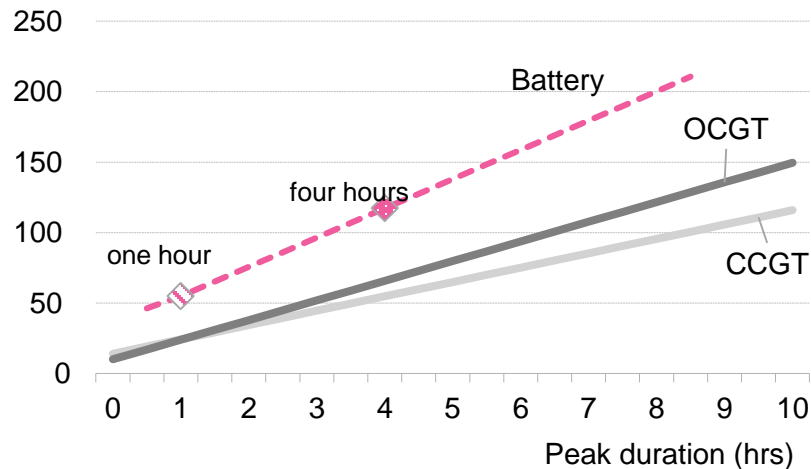
\$/kW/yr (2018 real)



Source: BloombergNEF. Note: Battery levelized cost of capacity include a charging cost. Pink lines denote a trend rather than actual LCOC apart from the one and four storage hour systems

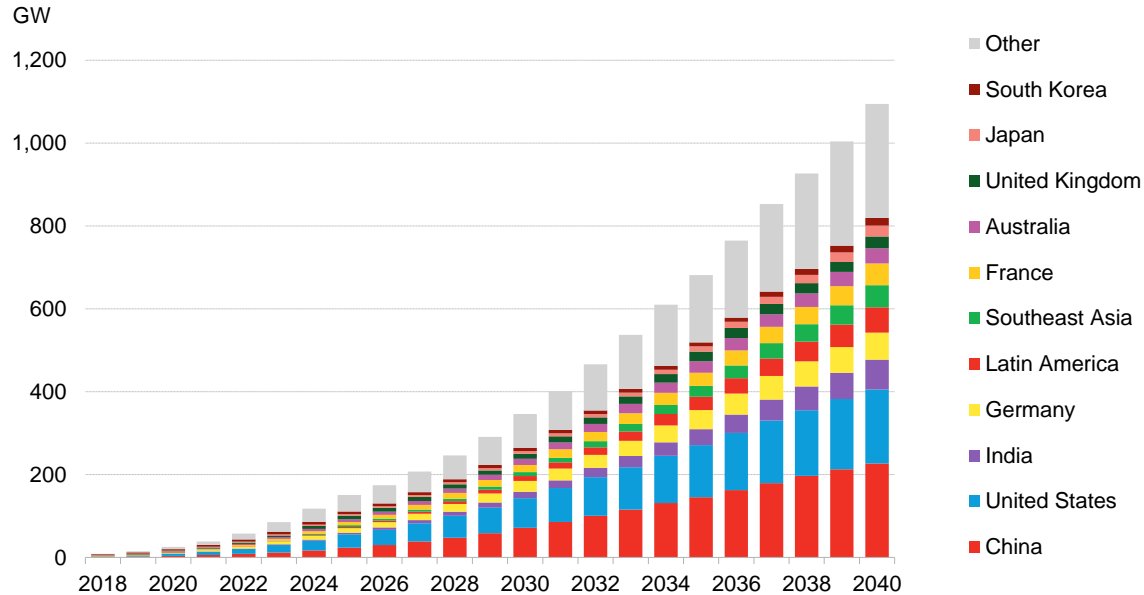
## U.S. 2030

\$/kW/yr (2018 real)



Source: BloombergNEF. Note: Battery levelized cost of capacity include a charging cost. The pink line denotes the cost trend rather than actual projects

# Global cumulative energy storage installations



Source: BloombergNEF

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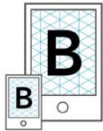
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