



**EUROPEAN
BATTERY
ALLIANCE**

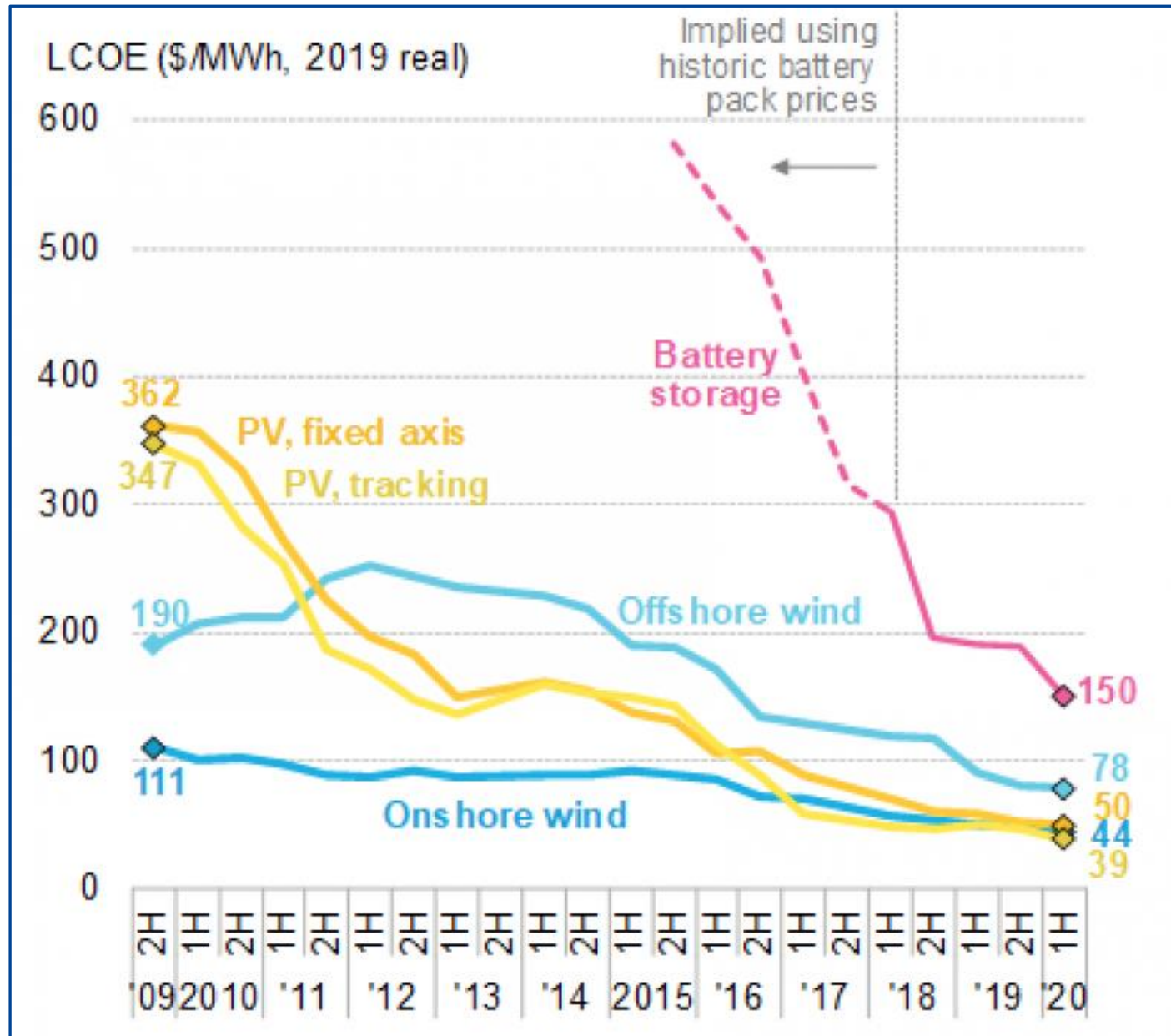
EBA250

Energy Storage, the missing link in a Renewable Energy System

Revision 2021, 10 year anniversary REI

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Why Batteries are hot today



**Battery Storage
fastest
falling costs
in the Power System**

Suitability & Economy Storage Solutions

Lithium batteries provide services in several application, allows value stacking

Business Model		Mechanical			Thermal			Chemical														
		Flywheel	Pumped Hydro	CAES	Thermal	Supercapacit.	Batteries	Hydrogen														
		∞	\$	#	∞	\$	#	∞	\$	#	∞	\$	#	∞	\$	#	∞	\$	#			
Trading																						
CA	Frequency containment	Green	Grey	-	Yellow	Green	1	Yellow	Green	1	Yellow	Grey	-	Yellow	Grey	-	Green	Orange	1	Yellow	Grey	-
	Short-term frequency restoration	Green	Grey	-	Yellow	Green	1	Yellow	Yellow	2	Yellow	Grey	-	Yellow	Grey	-	Green	Grey	-	Green	Grey	-
	Long-term frequency restoration	Green	Grey	-	Green	Green	1	Yellow	Yellow	2	Green	Grey	-	Yellow	Grey	-	Green	Orange	1	Green	Grey	-
	Trading forecast	Yellow	Grey	-	Yellow	Grey	-	Green	Grey	-	Green	Grey	-	Orange	Grey	-	Green	Grey	-	Green	Grey	-
PA	Trading arbitrage	Yellow	Orange	2	Green	Yellow	9	Green	Yellow	12	Green	Grey	-	Yellow	Orange	2	Green	Orange	10	Green	Orange	1
Production																						
CA	Frequency containment	Green	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Green	Green	1	Yellow	Grey	-
	Short-term frequency restoration	Green	Orange	1	Yellow	Yellow	2	Yellow	Orange	1	Yellow	Grey	-	Yellow	Orange	1	Green	Orange	1	Green	Grey	-
	Long-term frequency restoration	Green	Orange	1	Green	Orange	1	Yellow	Yellow	2	Green	Grey	-	Yellow	Orange	1	Green	Orange	1	Green	Grey	-
	Production forecast	Yellow	Grey	-	Green	Orange	1	Green	Orange	3	Green	Grey	-	Orange	Grey	-	Green	Green	1	Green	Grey	-
ID	Schedule flexibility	Yellow	Grey	-	Green	Grey	-	Green	Grey	-	Green	Grey	-	Orange	Grey	-	Green	Grey	-	Green	Grey	-
	Voltage control	Green	Grey	-	Orange	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Green	Grey	-	Green	Grey	-	Yellow	Grey	-
	Backup energy	Yellow	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Green	Grey	-	Orange	Grey	-	Green	Grey	-	Green	Grey	-
	Black start energy	Green	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Green	Grey	-	Yellow	Grey	-	Green	Grey	-	Green	Grey	-
	Peak shaving	Yellow	Grey	-	Green	Green	4	Green	Orange	1	Green	Grey	-	Orange	Grey	-	Green	Green	1	Green	Grey	-
T&D																						
CA	Frequency containment	Green	Grey	-	Yellow	Grey	-	Yellow	Yellow	2	Yellow	Grey	-	Yellow	Grey	-	Green	Orange	3	Yellow	Grey	-
	Short-term frequency restoration	Green	Grey	-	Yellow	Orange	1	Yellow	Orange	3	Yellow	Grey	-	Yellow	Grey	-	Green	Orange	3	Green	Grey	-
	Long-term frequency restoration	Green	Grey	-	Green	Orange	1	Yellow	Orange	3	Green	Grey	-	Yellow	Grey	-	Green	Orange	4	Green	Grey	-
	Black start energy	Green	Grey	-	Yellow	Grey	-	Yellow	Orange	1	Green	Grey	-	Yellow	Grey	-	Green	Grey	-	Green	Grey	-
ID	Voltage control	Green	Grey	-	Orange	Green	1	Yellow	Green	1	Yellow	Grey	-	Green	Grey	-	Green	Grey	-	Yellow	Grey	-
	Peak shaving	Yellow	Grey	-	Green	Grey	-	Green	Grey	-	Green	Grey	-	Orange	Grey	-	Green	Orange	2	Green	Orange	1
Consumption																						
CA	Frequency containment	Green	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Green	Grey	-	Yellow	Grey	-
	Short-term frequency restoration	Green	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Green	Orange	1	Green	Grey	-
	Long-term frequency restoration	Green	Grey	-	Green	Grey	-	Yellow	Grey	-	Green	Grey	-	Yellow	Grey	-	Green	Grey	-	Green	Grey	-
	Peak shaving	Yellow	Green	1	Yellow	Green	1	Yellow	Green	1	Green	Grey	-	Yellow	Green	1	Green	Yellow	8	Green	Grey	-
ID	Voltage control	Green	Grey	-	Orange	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Green	Grey	-	Green	Grey	-	Yellow	Grey	-
	Backup energy	Yellow	Grey	-	Yellow	Grey	-	Yellow	Grey	-	Green	Grey	-	Orange	Grey	-	Green	Orange	1	Green	Grey	-
PA	Self-sufficiency	Yellow	Grey	-	Yellow	Green	1	Green	Green	1	Green	Grey	-	Yellow	Grey	-	Green	Orange	20	Green	Grey	-
	Consumption arbitrage	Yellow	Grey	-	Yellow	Green	1	Green	Green	1	Green	Grey	-	Yellow	Grey	-	Green	Orange	9	Green	Grey	-

CA Cost avoidance ID Investment deferral PA Price arbitrage

Local peak shaving...

Electric Power	700 W
Vacuum Power	200 W
Max Grid Power	700 W



Electric Power	550 W	- 22 %
Vacuum Power	200 W	100 %
Max Grid Power	50 W	- 93 %





Four energy storage
projects totalling about
2,270 MWh.

BRIEF

**PG&E to replace 3 gas plants with
world's biggest battery projects**

Germany's grid could use gigawatt-scale ESS as alternative to 'billions in infrastructure spending'

The net booster should make it possible to transport more power with existing lines and thus to dispense with some new routes.

France's 'virtual power line' takes shape

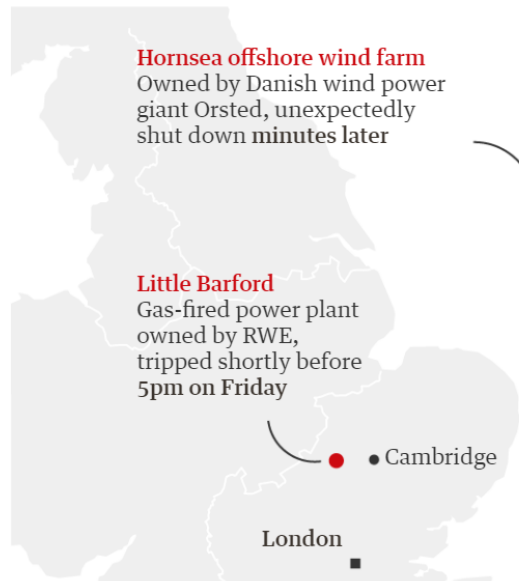
Nidec has deployed a 12 MW/24MWh storage system for French grid operator RTE. The battery – part of a 72 MWh project to prevent grid congestion in peak demand periods – is in an area with abundant renewables, including wind.

Blackout UK 9 Aug 2019

The outage lasted less than an hour, but travel disruption across the country caused major delays for railways well into the night

26,000 were affected in north-west England

110,000 affected in Yorkshire and north-east



500,000 customers affected in Wales, the south-west and the Midlands

300,000 without power in south-east England

The Problem

A string of small-scale generators totalling almost 500MW had automatically shut down at about the same time because of the sudden change in the grid's energy frequency.

The solution

National Grid to bring forward plans for new blackout safeguards

If they had contracted more fast-response battery storage on the network, this power cut could have been prevented.

Added benefit

Figure 65: U.K. average monthly Firm Frequency Response (FFR) prices

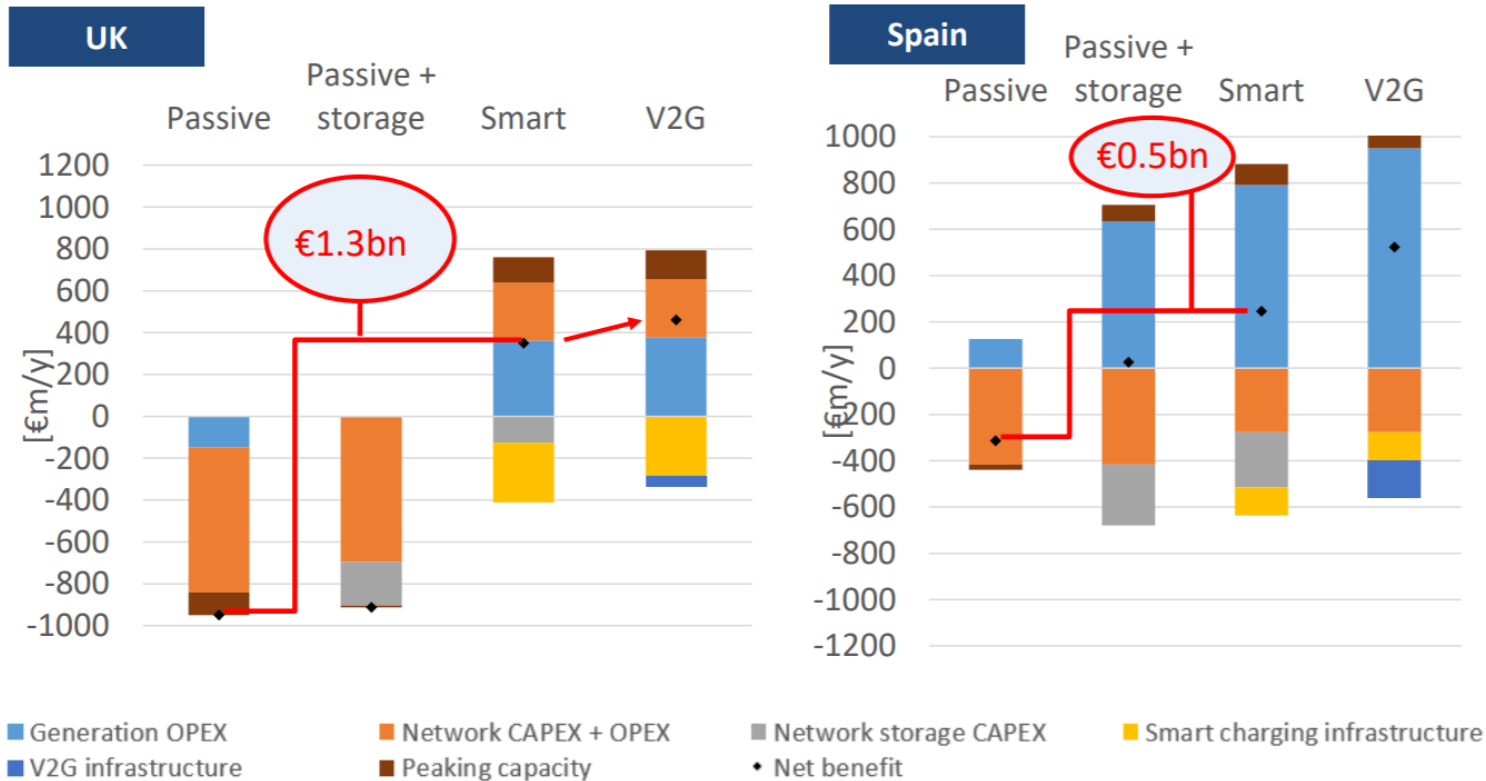


Will EV:s be a burden or benefit to the grid?

High cost of passive charging largely avoided through smart charging, to different levels across countries

Support the power system

Costs & benefits relative to ENTSO-E baseline – 2040

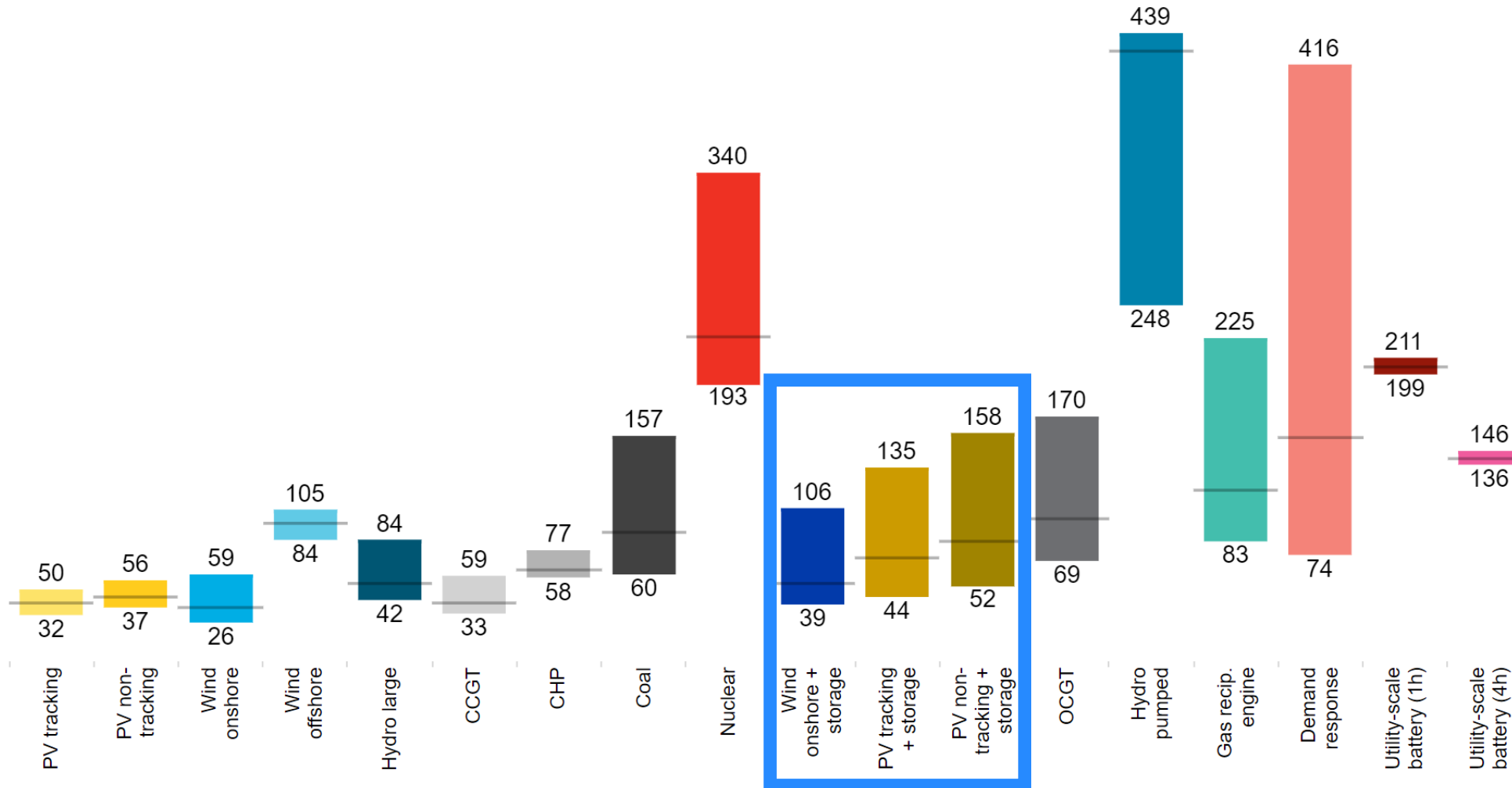


- Passive
- Passive + Storage
- Smart
- Vehicle-to-Grid (V2G)

Added benefit
local energy storage

Tipping point Batteries + Renewable production

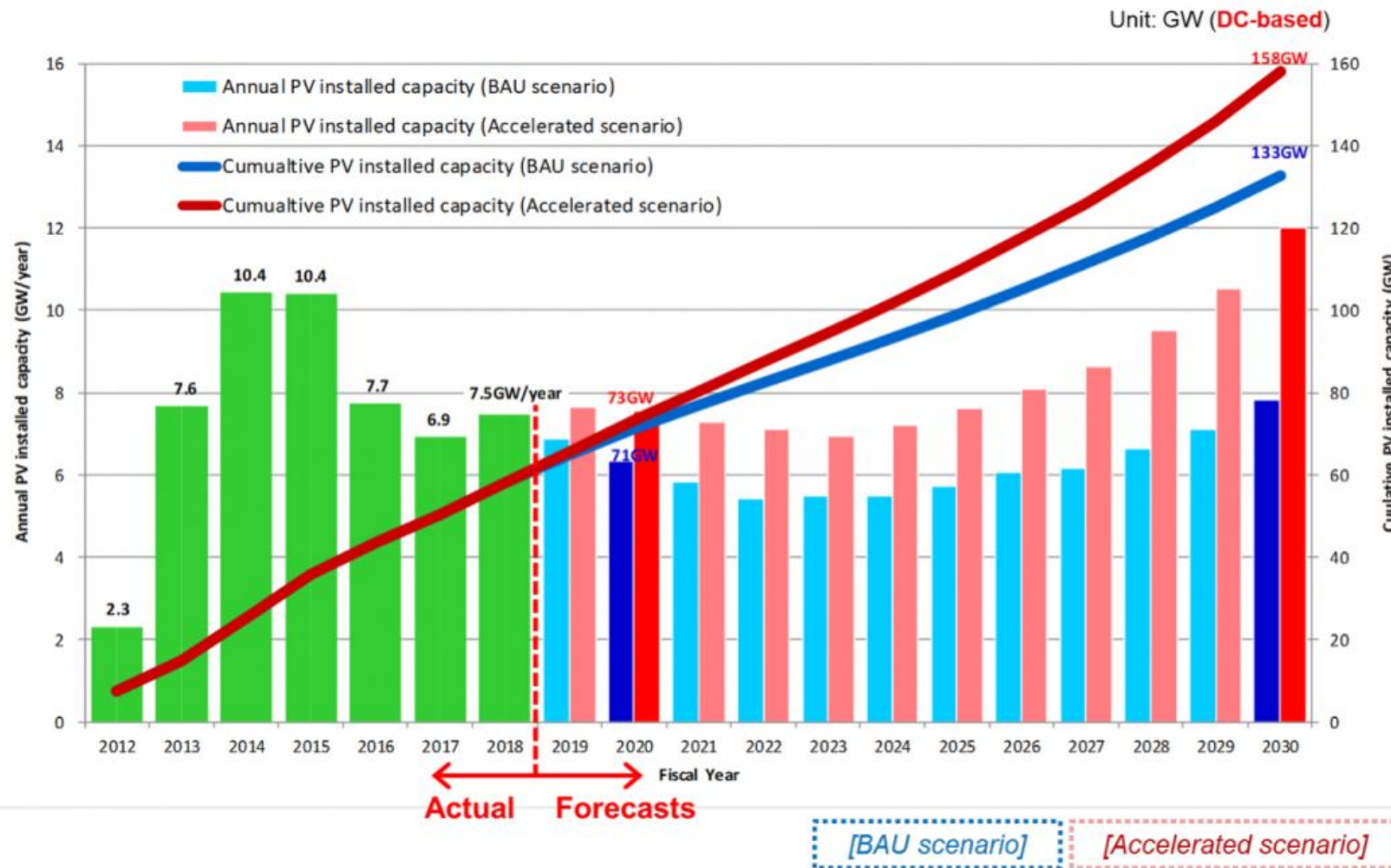
Current LCOE range (\$/MWh, nominal) - United States, 2020 H1



Source: BNEF 2020

Solar + Batteries perfekt fit for Japan?

Why not higher growth ?



Batteries in the Power System

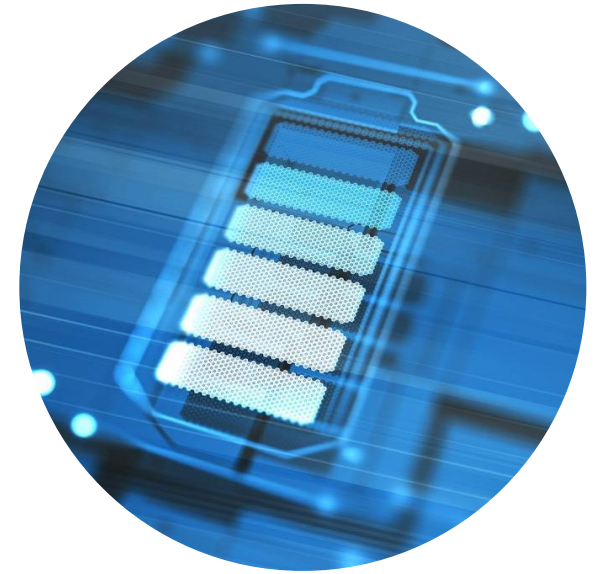
- **Has the fastest falling cost in the power system**
- **Can provide multiple services in different levels in the system**
- **Applications ranging from very local to centralised**
- **Electric vehicles, sector coupling between transport and power**
- **Batteries + renewable production at tipping point**

**Vision for Japan,
Batteries + Renewable Production + Electric Vehicles**

EIT InnoEnergy is the innovation engine for sustainable energy across Europe supported by the European Institute of Innovation and Technology.

EIT InnoEnergy's role in the European Battery Alliance is to provide background data, collect and formulate key questions, recommendations and actions.

EIT InnoEnergy also support the establishment of a European Battery eco-system by promoting a meeting place for key players along the entire value with our EBA250 Workshops.



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