



CLEANHORIZON

Detect, analyze, monetize

2017 in energy storage:
an update from the field. Emerging markets and players

F-cell and Battery + Storage
Section F7 – Stationnary batteries

October 10, 2017



A virtuous cycle that keeps bringing battery prices down

Price decrease

Increased profitability

New applications in the money

More favorable regulations

Easier project financing

Industrial supply chain is structured

Public sector involvement

- 200 €/kWh Li-Ion module
- Demand increases
- Supply increases

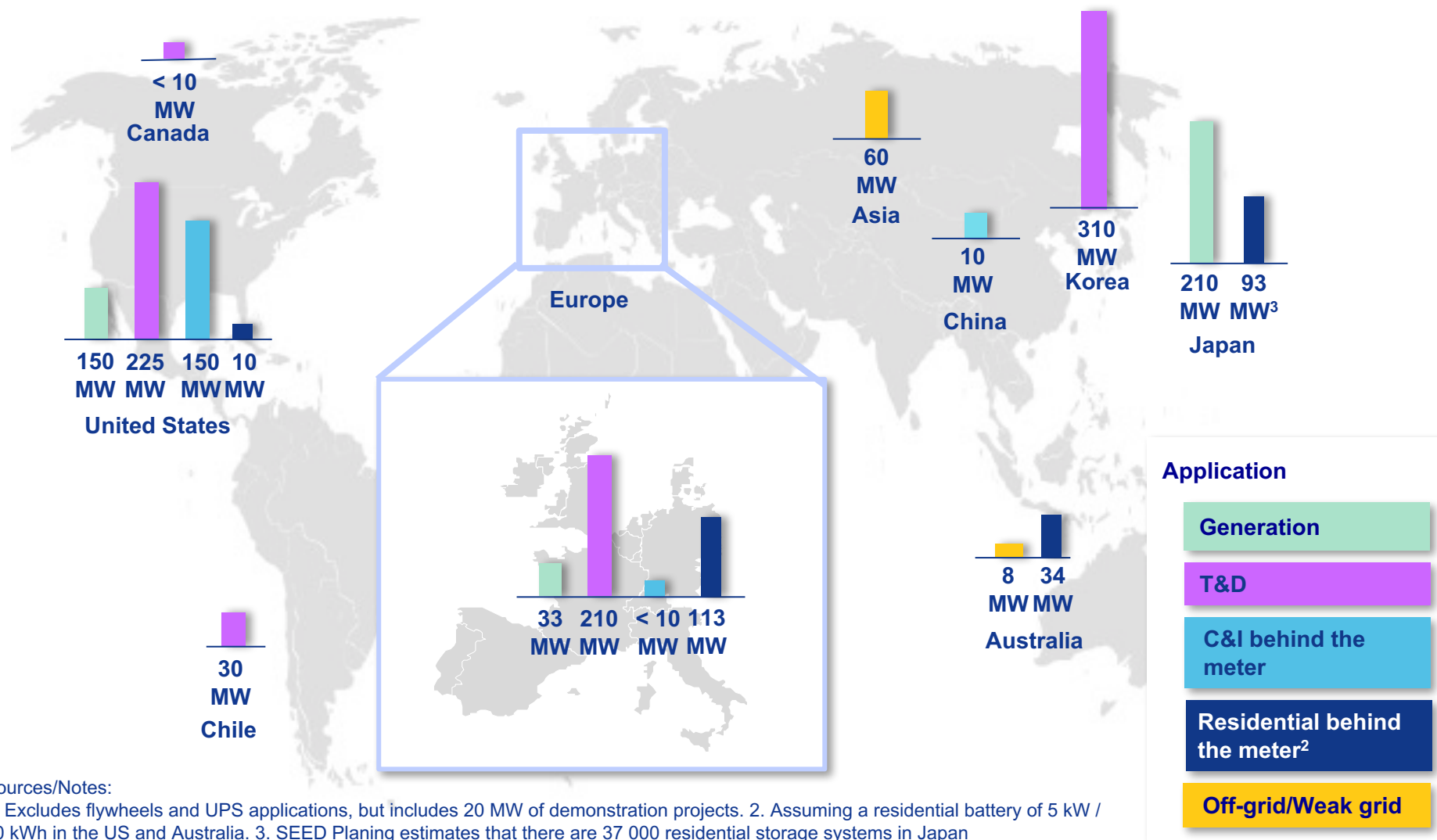
- New factories
- Demand is supported
- New acquisitions & sales
- Tax reliefs put in place

Agenda

- **Demand**
- Supply
- Some impacts

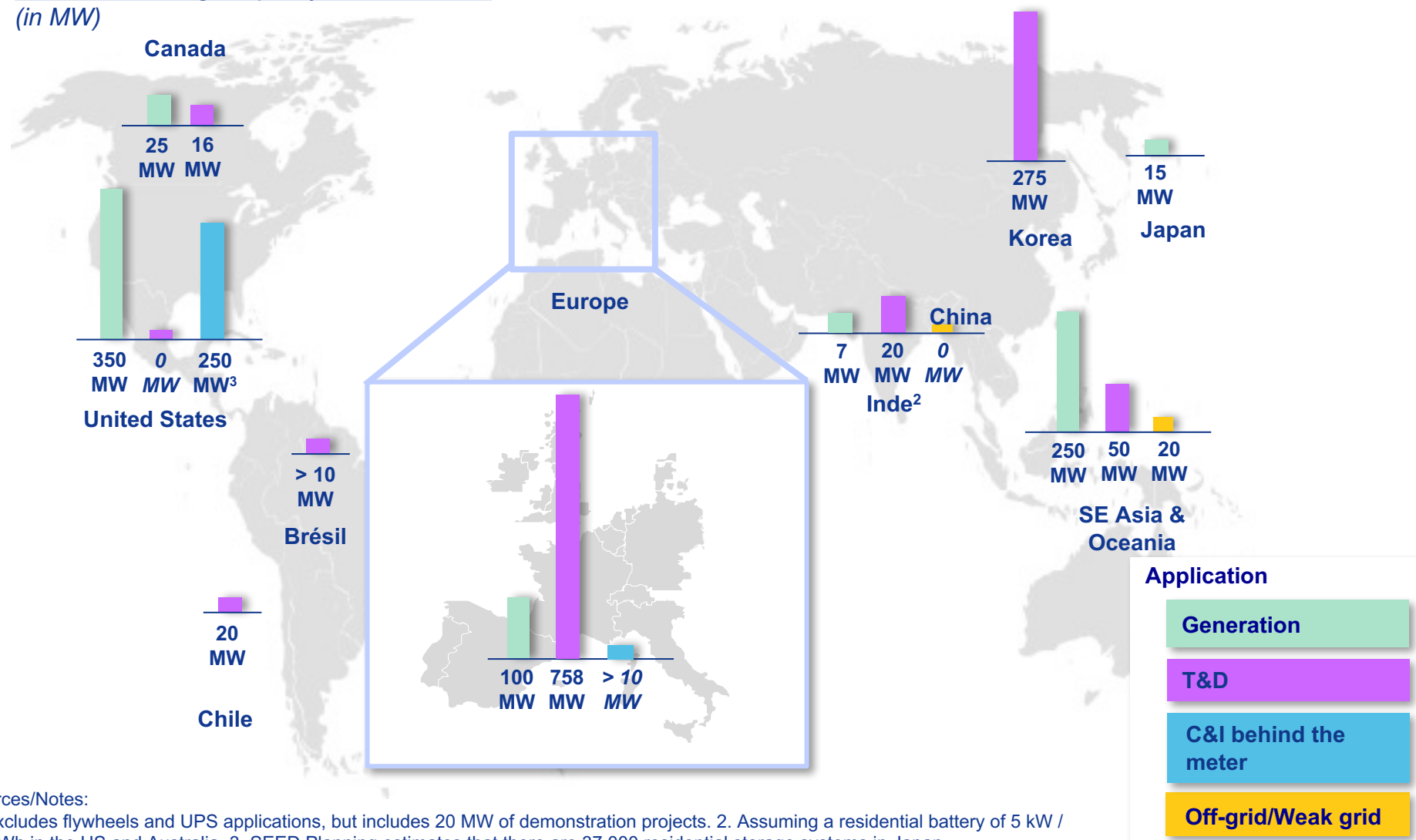
As of Q2 2017, 1.7 GW of storage (excluding pumped storage) is installed globally¹

Global installed capacity as of Q2 2017 ¹ (MW)



...and 2.2 GW of storage are contracted¹ and will be installed in the coming years

Contracted storage capacity¹ as of Q2 2017
(in MW)

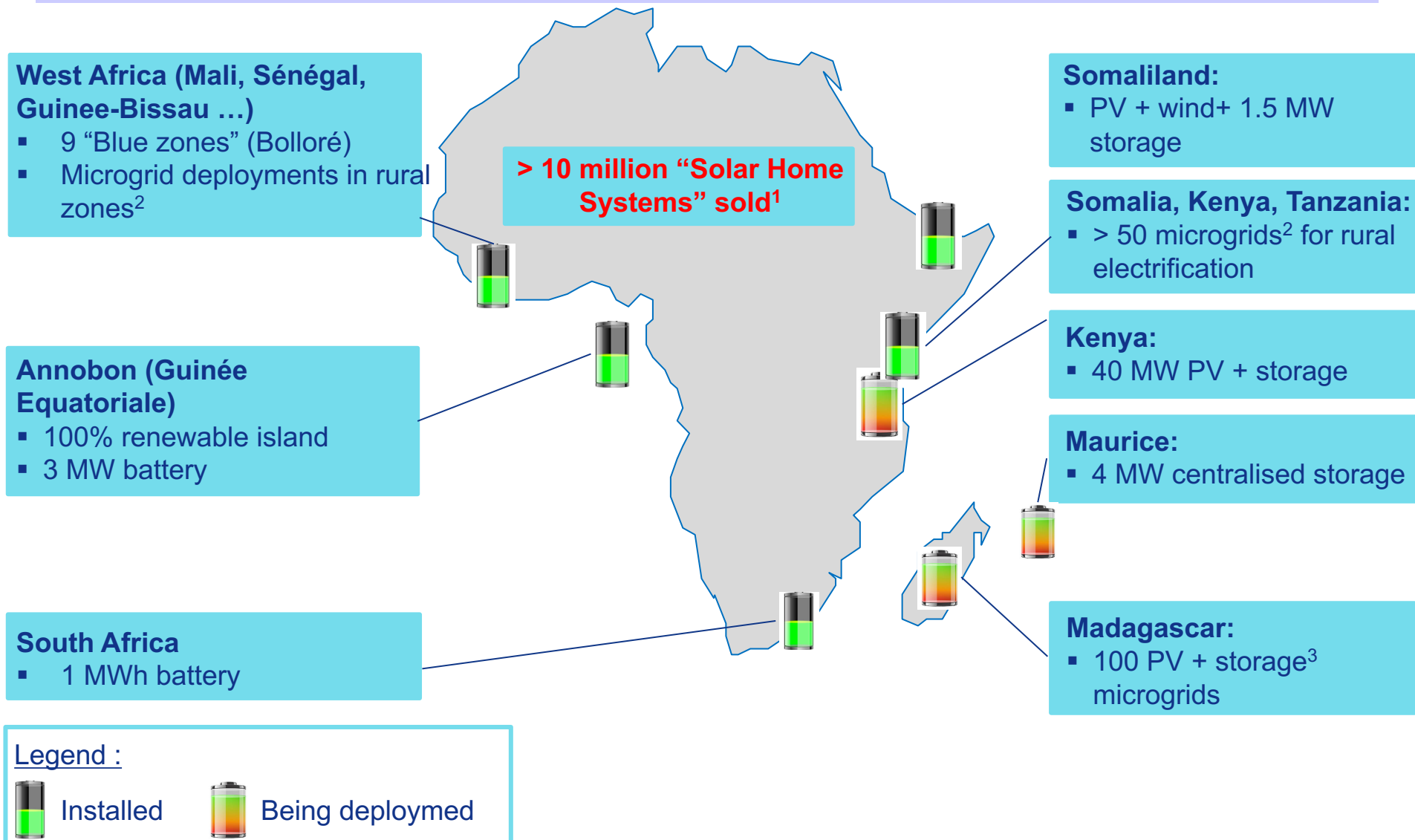


Sources/Notes:

1. Excludes flywheels and UPS applications, but includes 20 MW of demonstration projects. 2. Assuming a residential battery of 5 kW / 10 kWh in the US and Australia. 3. SEED Planning estimates that there are 37 000 residential storage systems in Japan

2. Does not include the 50MW tender withdrew by SECI

Several schemes shape up in Africa, even though most of the business is for small scale systems today



1. Source: GOGLA, 2016 2. Approx 10 to 100 kW 3. For a total of 45 MWh of storage

India is a promising market, but mostly concerns UPS applications today

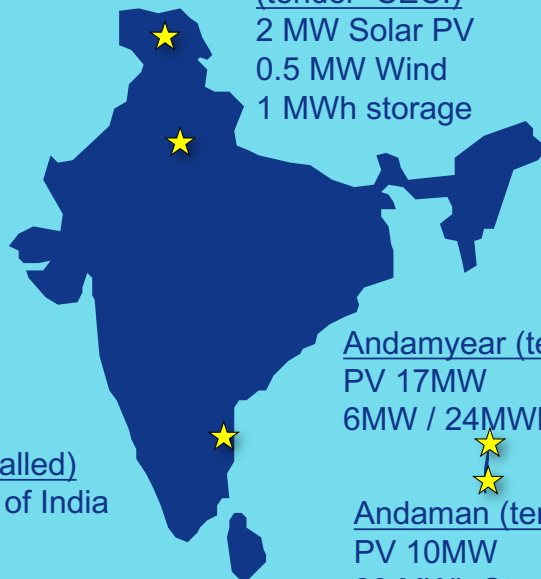
UPS is the most developed application for energy storage in India today

- 60 GW of gensets used for back up
- 2-4 hours of power cuts more than 300 days / year
- UPS market for C&I and residential is sized at 3,5 GWh¹

5 projects @ MW scale to date

New Delhi 10MW frequency regulation (installed)
Panasonic industrial site (AES solution)

Pondicherry 1MWh ViZn (installed)
Pour Power Grid Corporation of India Limited (PGCIL)



Rangreek village: hybrid station (tender- SECI)
2 MW Solar PV
0.5 MW Wind
1 MWh storage

Andamyar (tender- NTPC)
PV 17MW
6MW / 24MWh Storage

Andaman (tender- NLC)
PV 10MW
28 MWh Storage

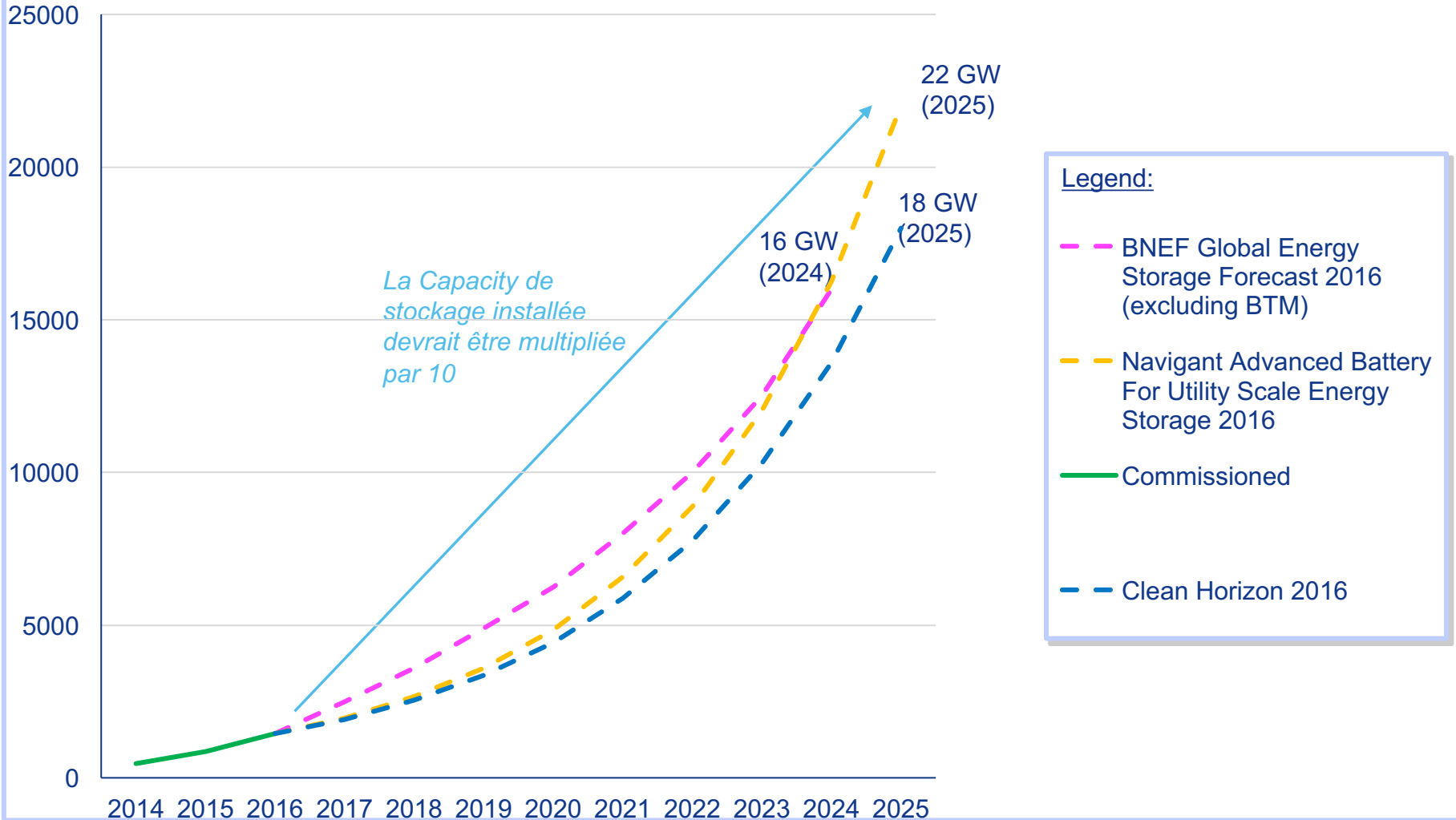
Strong commitment to renewables & EVs

- 100 GW of PV/ 60 GW wind target for 2022 (total installed capacity today is 330 GW)
- 6 million electric vehicles for 2020

- **UPS is the main application for storage today**
- **2 SECI tenders of 50 MW PV with 4MW / 2,5MWh have been cancelled to benefit from future lower prices**
- **A large future market linked to a strong renewable ambition**

Different studies show that the global energy storage market will be as large as 22GW in 2025 (excluding residential)

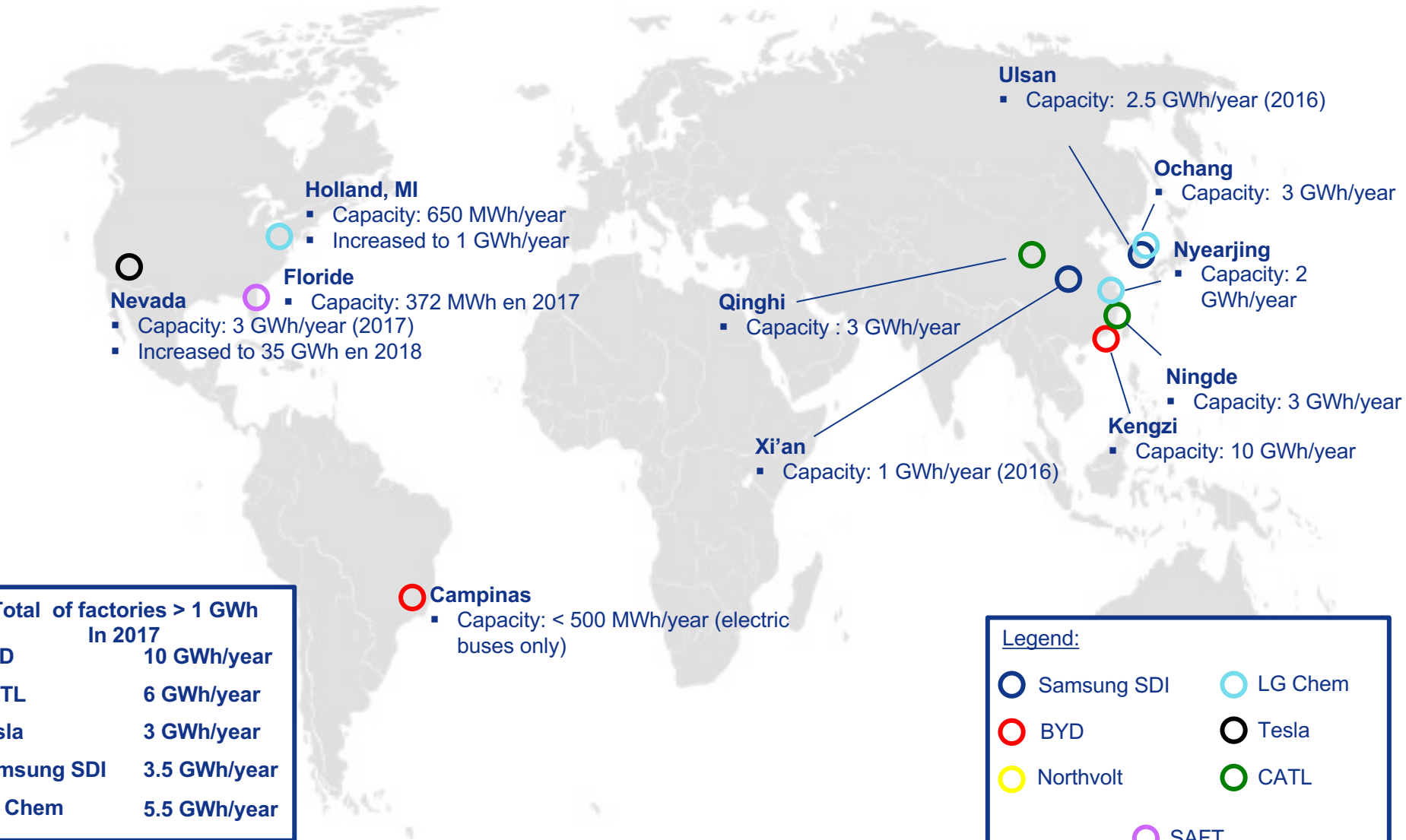
Cumulated installed capacity between 2014 and 2025
(in MW)



Agenda

- Demand
- **Supply**
- Some impacts

Manufacturing sites for EV batteries emerge and increase competition (1/2)



Total of factories > 1 GWh In 2017

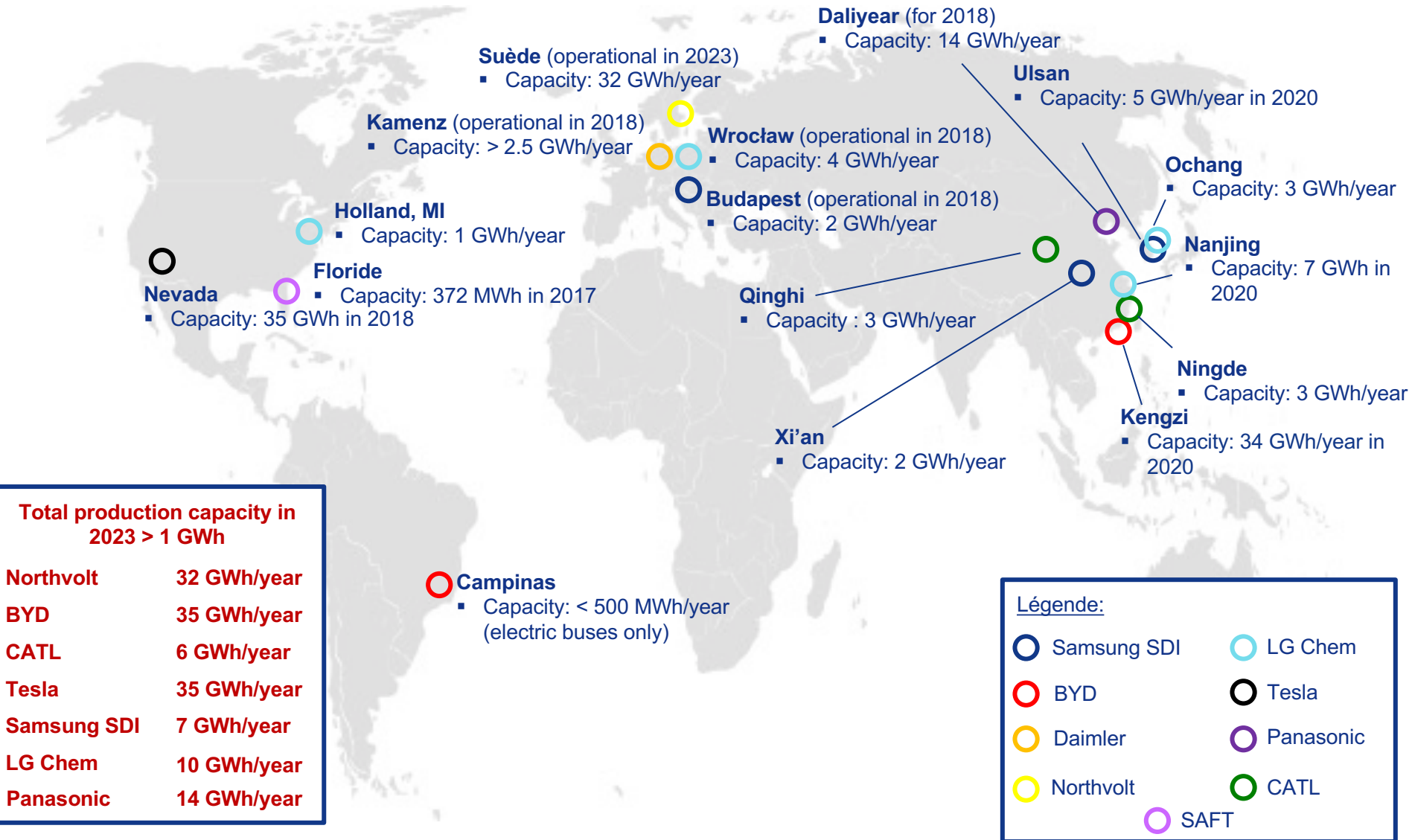
BYD	10 GWh/year
CATL	6 GWh/year
Tesla	3 GWh/year
Samsung SDI	3.5 GWh/year
LG Chem	5.5 GWh/year

Legend:

- Blue circle: Samsung SDI
- Red circle: BYD
- Yellow circle: Northvolt
- Cyan circle: LG Chem
- Black circle: Tesla
- Green circle: CATL
- Purple circle: SAFT

→ 28 GWh/year of production capacity in 2017

Manufacturing sites for EV batteries emerge and increase competition (2/2)



→ Capacity > 139 GWh en 2023

(by the way: Watch for our next Update from the Field analyst report to come out on Monday with a focus on emerging gigafactories worldwide) (sorry for the advert)

CLEANHORIZON
The Energy Storage Experts

Update from the Field – September 2017
A monthly analysis note from the energy storage experts

CLEANHORIZON
The Energy Storage Experts

Update from the Field – July 2017
A monthly analysis note from the energy storage experts

CLEANHORIZON
The Energy Storage Experts

Update from the Field – June 2017
A monthly analysis note from the energy storage experts

CLEANHORIZON
The Energy Storage Experts

Update from the Field – May 2017
A monthly analysis note from the energy storage experts

CLEANHORIZON
The Energy Storage Experts

Update from the Field – April 2017
A monthly analysis note from the energy storage experts

CLEANHORIZON
The Energy Storage Experts

Update from the Field – March 2017
A monthly analysis note from the energy storage experts

Every month, Clean Horizon's team of energy storage experts delivers an analysis of key data and trends affecting the energy storage industry worldwide.

This monthly report updates and analyzes new relevant regulations, monitors commissioned and announced projects, and provides specific focus on key market trends which are likely to have a direct impact on industry stakeholders.

Every month, Clean Horizon's team of energy storage experts delivers an analysis of key data and trends affecting the energy storage industry worldwide.

This monthly report updates and analyzes new relevant regulations, monitors commissioned and announced projects, and provides specific focus on key market trends which are likely to have a direct impact on industry stakeholders.

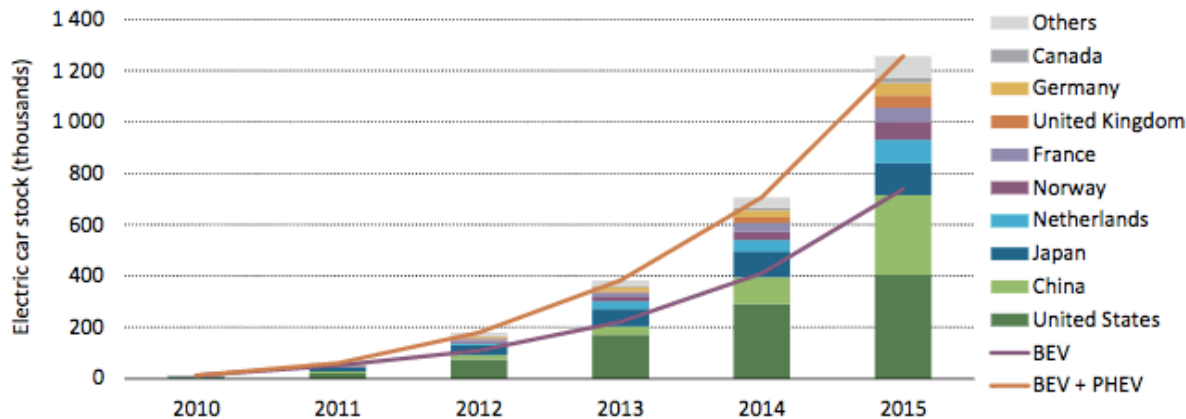
Every month, Clean Horizon's team of energy storage experts delivers an analysis of key data and trends affecting the energy storage industry worldwide.

This monthly report updates and analyzes new relevant regulations, monitors commissioned and announced projects, and provides specific focus on key market trends which are likely to have a direct impact on industry stakeholders.

Second life available batteries volume will exceed installed stationary storage capacity in 2020-2025

More than 1.2 Million EVs were on the roads in 2015¹

Figure 1 • Evolution of the global electric car stock, 2010-15



Note: the EV stock shown here is primarily estimated on the basis of cumulative sales since 2005.

Sources: IEA analysis based on EVI country submissions, complemented by EAFO (2016), IHS Polk (2014), MarkLines (2016), ACEA (2016a), EEA (2015) and IA-HEV (2015).

Source: IEA, Global EV outlook, 2016

- **20 GWh equivalent of second life batteries could be available by 2020³**
- **This is ten times more than the installed stationary storage capacity installed in 2017²**

Sources/Notes:

1. PHEV et BEV have different battery sizes; 2. Excluding UPS type of applications 3. With the following assumptions : A second life battery is in average 20kWh and 80% of the capacity is still available at the end of life of the vehicle after a 5 years lifetime

... and the second life potential could reach 200 GWh in 2030 !

Assuming IEA objectives are reached, the volume of second life batteries could reach 200 GWh in 2030

Table 3 • Electric car stock targets to 2020 based on country commitments

Countries with announced targets to 2020 or later	2015 EV stock (thousand vehicles)	2020 EV stock target (million vehicles)	EV share of all cars sold between 2016 and 2020	EV share in the total 2020 stock	Source
Austria	5.3	0.2	13%	4%	BMVIT, 2012
China*	312.3	4.6	6%	3%	State Council, 2012
Denmark	8.1	0.2	23%	9%	ICCT, 2011
France	54.3	2.0	20%	6%	MEEM, 2011
Germany	49.2	1.0	6%	2%	IA-HEV, 2015
India	6.0	0.3	2%	1%	LBNL, 2014
Ireland	2.0	0.1	8%	3%	SEAI, 2014
Japan	126.4	1.0	4%	2%	METI, 2016
Netherlands**	87.5	0.3	10%	4%	EVI, 2016a
Portugal	2.0	0.2	22%	5%	IA-HEV, 2015
South Korea	4.3	0.2	4%	1%	MOTIE, 2015
Spain	6.0	0.2	3%	1%	MIET, 2015
United Kingdom	49.7	1.6	14%	5%	EC, 2013 and CCC, 2013
United States***	101.0	1.2	6%	2%	IA-HEV, 2015
Total of all markets listed above	814.1	12.9	7%	3%	

Source: IEA, Global EV outlook 2016

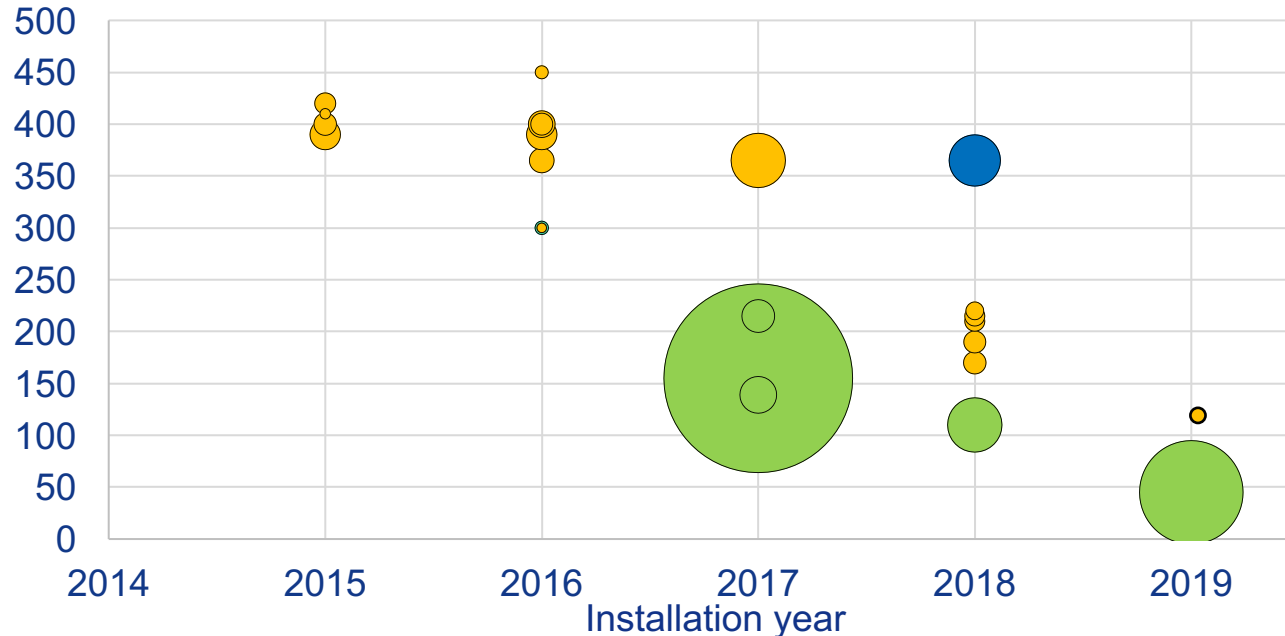
Agenda

- Demand
- Supply
- **Some impacts**

Storage combined with PV starts competing with thermal generation

PV + storage projects globally

Energy price²
(in \$ / MWh)



Legend:

Storage duration

■ < 1h

■ 1h - 2h

■ 2h +

PV size

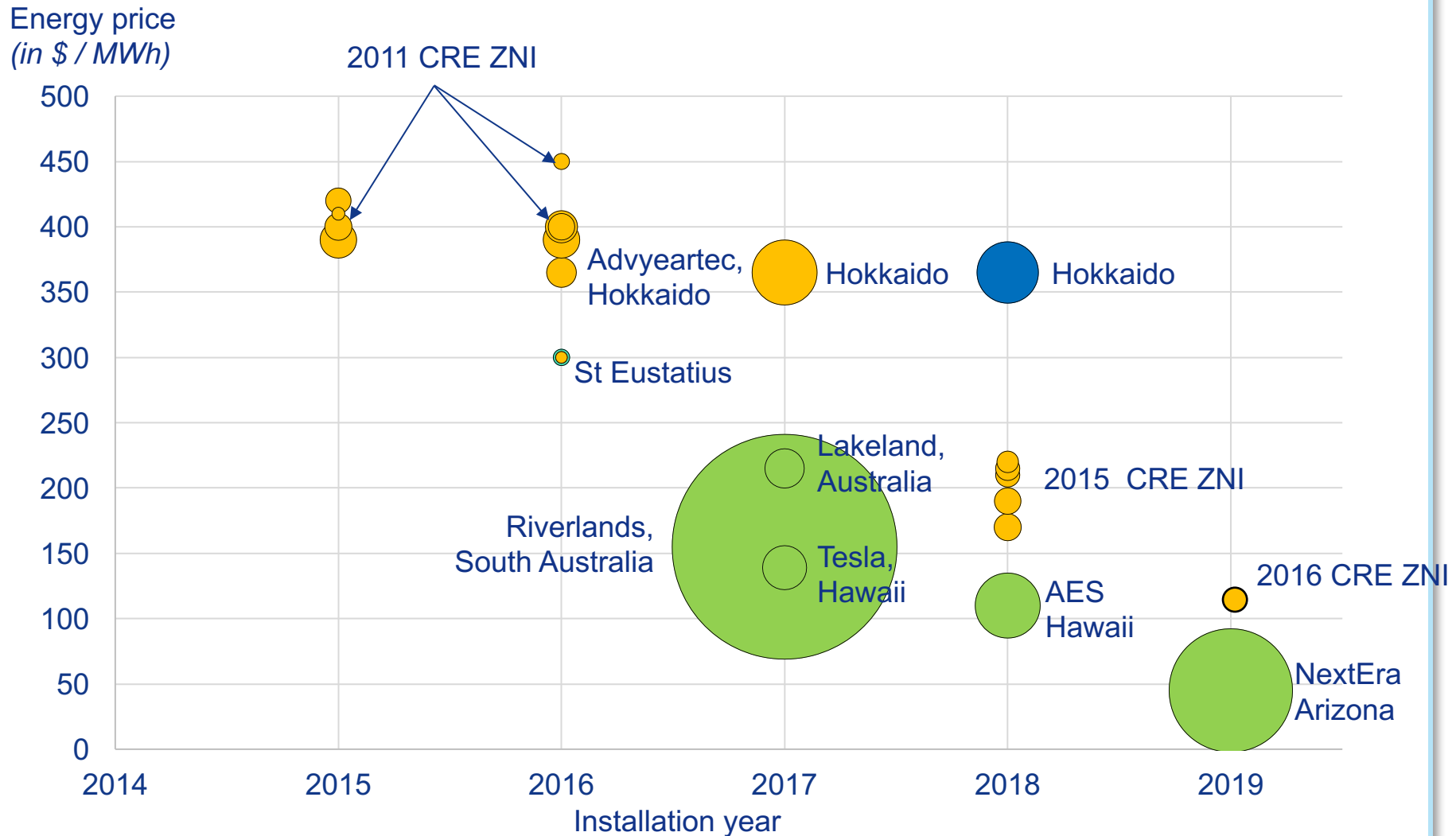
○ 100 MWp
○ 10 MWp
○ 1 MWp

Nevada breaks records with a 100MWp PV plant combined with a 30 MW / 120 MWh battery with a tariff of 45 \$/MWh for 20 years

With falling solar and battery prices, this record will not hold long...

1. PV plus storage announced or installed globally; Off-grid excluded: small projects (< 1 MWp) excluded; projects with no cost data excluded
2. The project revenues represent either: the PPA price, the Feed-in tariff available or the LCOE

France the US and Australia are the first markets to adopt PV plus storage



Merges and acquisitions speed up in the industry: the global energy storage industry is getting structured

Illustration of the recent stakeholders movements



Buys



Buys



Buys



Buys



July 2016



January 2017



May 2017

July 2017

Feel free to contact us for more information!

Join 4000 other storage professionals and subscribe to our TOP 5 newsletter at: www.Cleanhorizon.com

**Michael Salomon Ph.D.
Clean Horizon CEO
ms@Cleanhorizon.com
+33 1 78 76 57 03 (direct)
+33 6 72 61 27 34 (cell)**

