

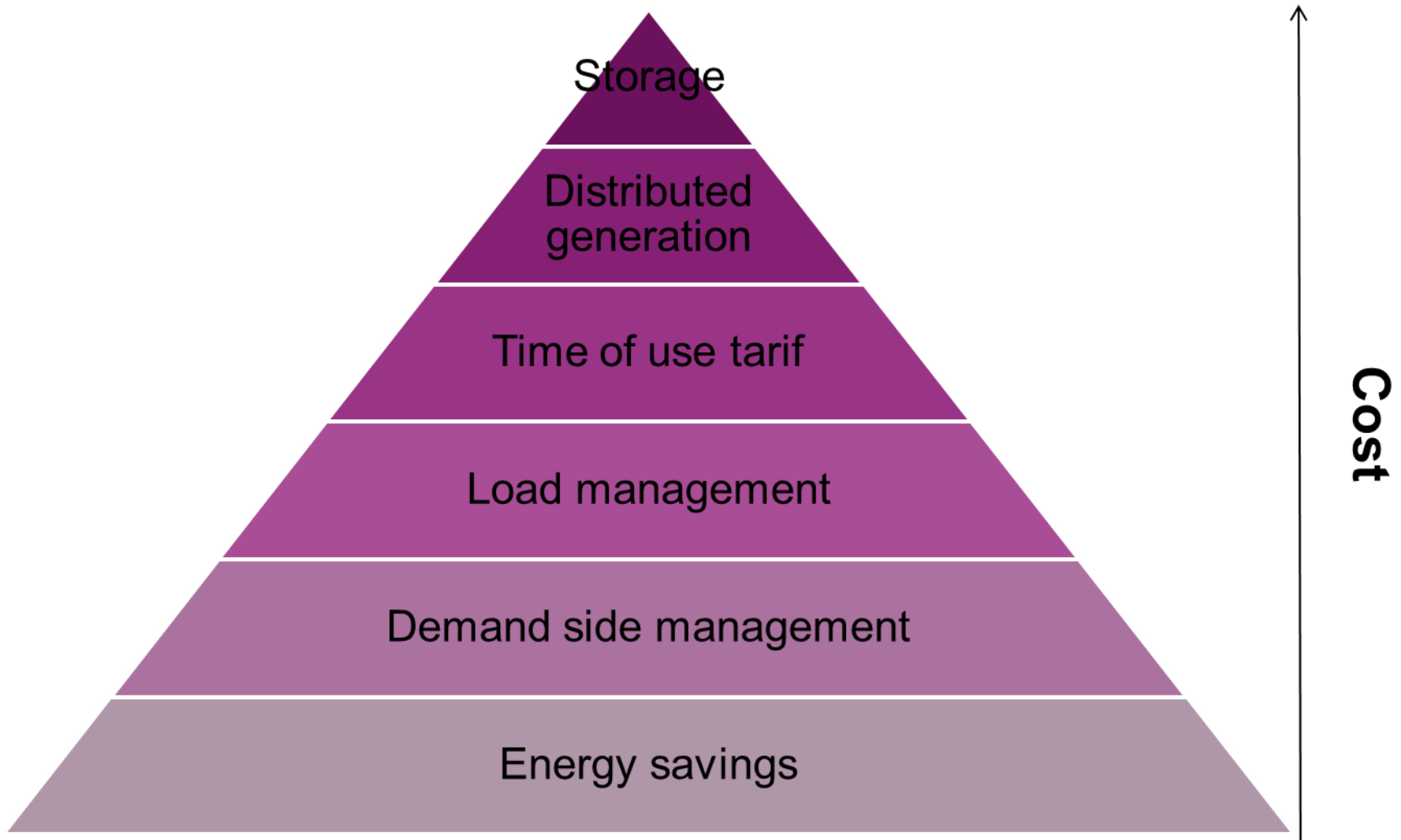
# STORAGE MARKET DEVELOPMENT AND PRICE ROADMAP

Repowering Europe May 2016 | Marion PERRIN



## AGENDA

- **Need for electricity storage: applications**
- **Market evolution**
- **Present prices**
- **Storage learning curve / Price roadmap**
- **European storage?**



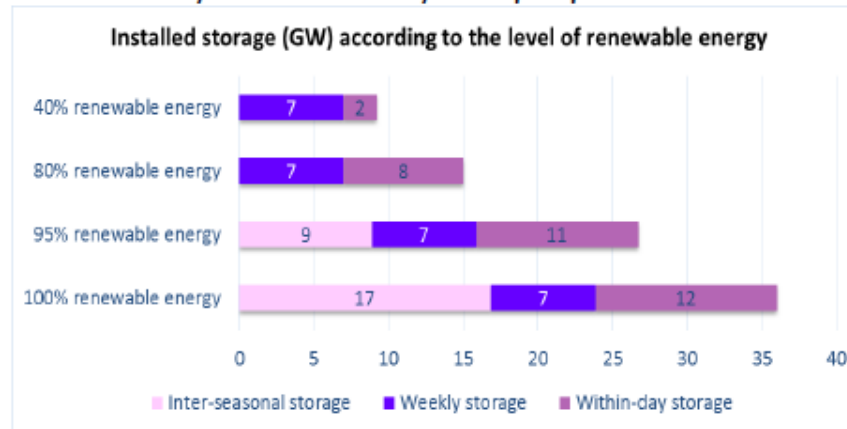
# Need for storage: scenario ADEME 100% renewables FR 2050



Result 3

Flexibility and storage are essential

- The market share of each storage type depends on mix constraints:
  - Short term storage share increases with PV capacity: about 20% (8 GW) of PV capacity for mixes above 80% RE.
  - Inter-seasonal storage is not necessary under 80%RE share in the mix, if syngas is used only for electricity mix purpose

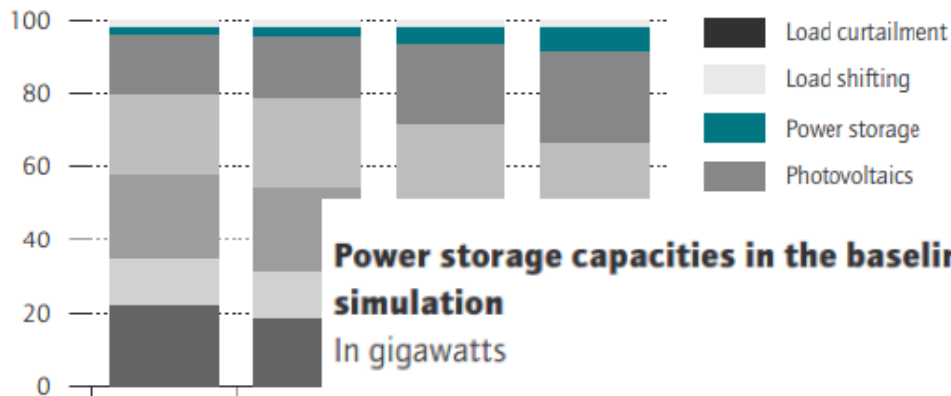


- Dynamic Demand Side Management and short-term storage provide the same services for the system

# Need for storage: scenario Germany 100% renewables 2050

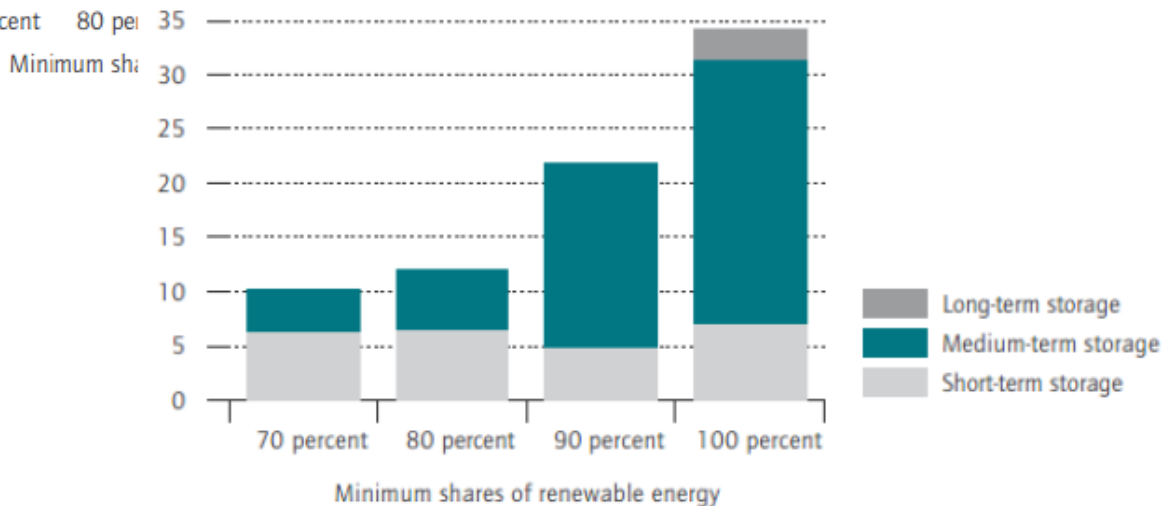
## Power supply in the baseline scenario of the long-term simulation

Shares in percent



## Power storage capacities in the baseline scenario of the long-term simulation

In gigawatts



## NO NEED OF STORAGE FOR THE ELECTRICAL SYSTEM IN THE SHORT TERM

- Long term storage (e.g. power to gas) only needed with RE shares higher than 70 to 80%

### FR

- First need is weekly storage
- From 40% share on, need of intraday storage
- At 80% RE, 8GW weekly, 7GW short term storage needed
- The focus is put on « distribution grid support » (hundreds of kW/kWh)
- water heaters represent a 13 to 20 TWh intra-day flexibility

### DE

- First need is on short term storage (frequency regulation)
- At 80% RE, 5GW weekly, 7GW short term storage needed
- Focus is put on larger scale storage (MW) for frequency regulation and on residential storage for PV self-consumption

## AGENDA

- **Need for electricity storage: applications**
- **Market evolution**
- **Present prices**
- **Storage learning curve**
- **European storage?**



avicenne  
ENERGY

INFORMATION FOR GROWTH  
[www.avicenne.com](http://www.avicenne.com)

The rechargeable battery  
market 2014-2025

MAY 2015

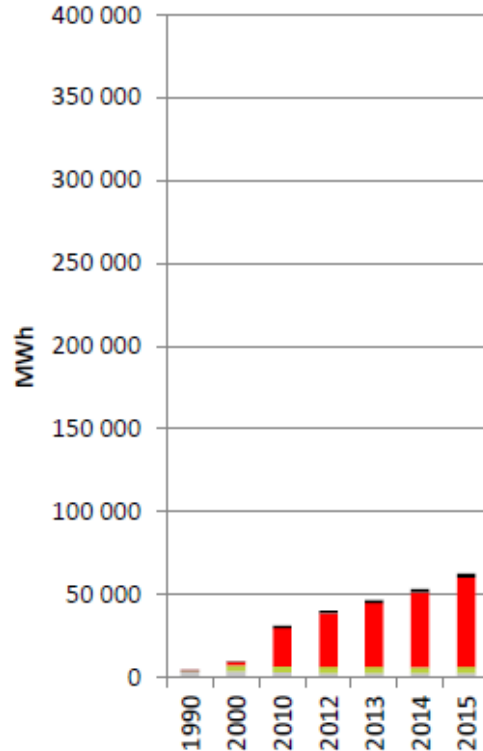
24<sup>th</sup> Edition

CONTACT

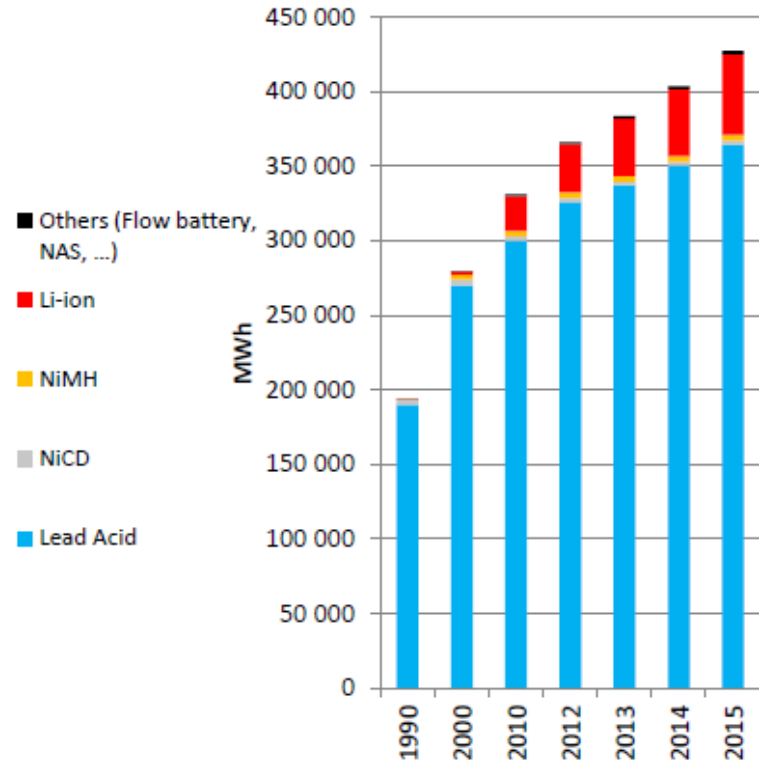
Christophe PILLOT  
 + 33 1 47 78 46 00  
[c.pillot@avicenne.com](mailto:c.pillot@avicenne.com)

## THE WORLDWIDE BATTERY MARKET 1990-2015

Lithium Ion Battery: Highest growth & major part of the investments  
 Lead acid batteries: By far the most important market (90% market share)



Source: AVICENNE ENERGY, 2015



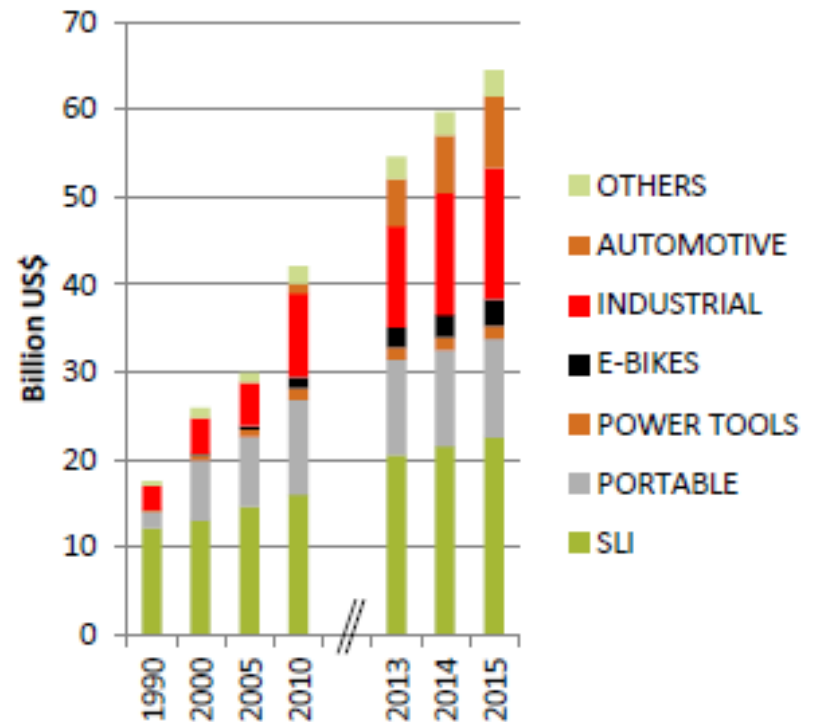
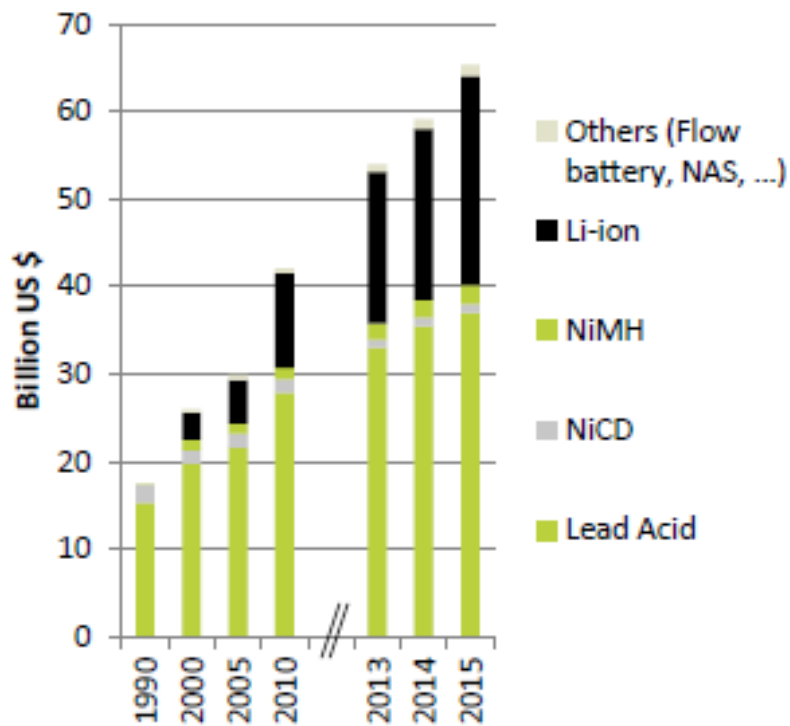
2015: Estimations



## THE WORLDWIDE BATTERY MARKET 1990-2015

60 BILLION US\$ in 2014 – Pack level<sup>1</sup>

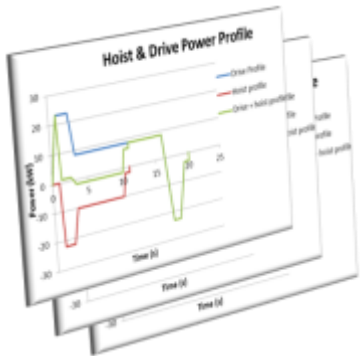
5% AVERAGE GROWTH PER YEAR (1990-2014)



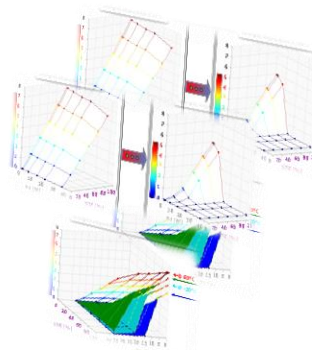
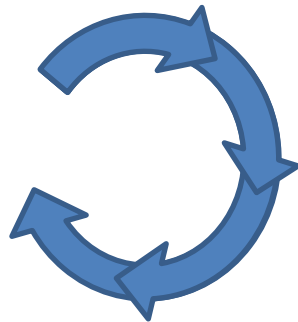
## Which technology to select for my application ?



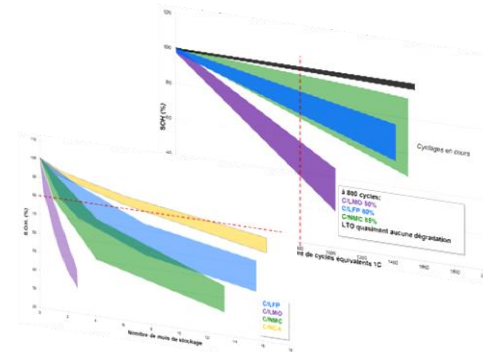
## What is the optimal management ?



Use profile



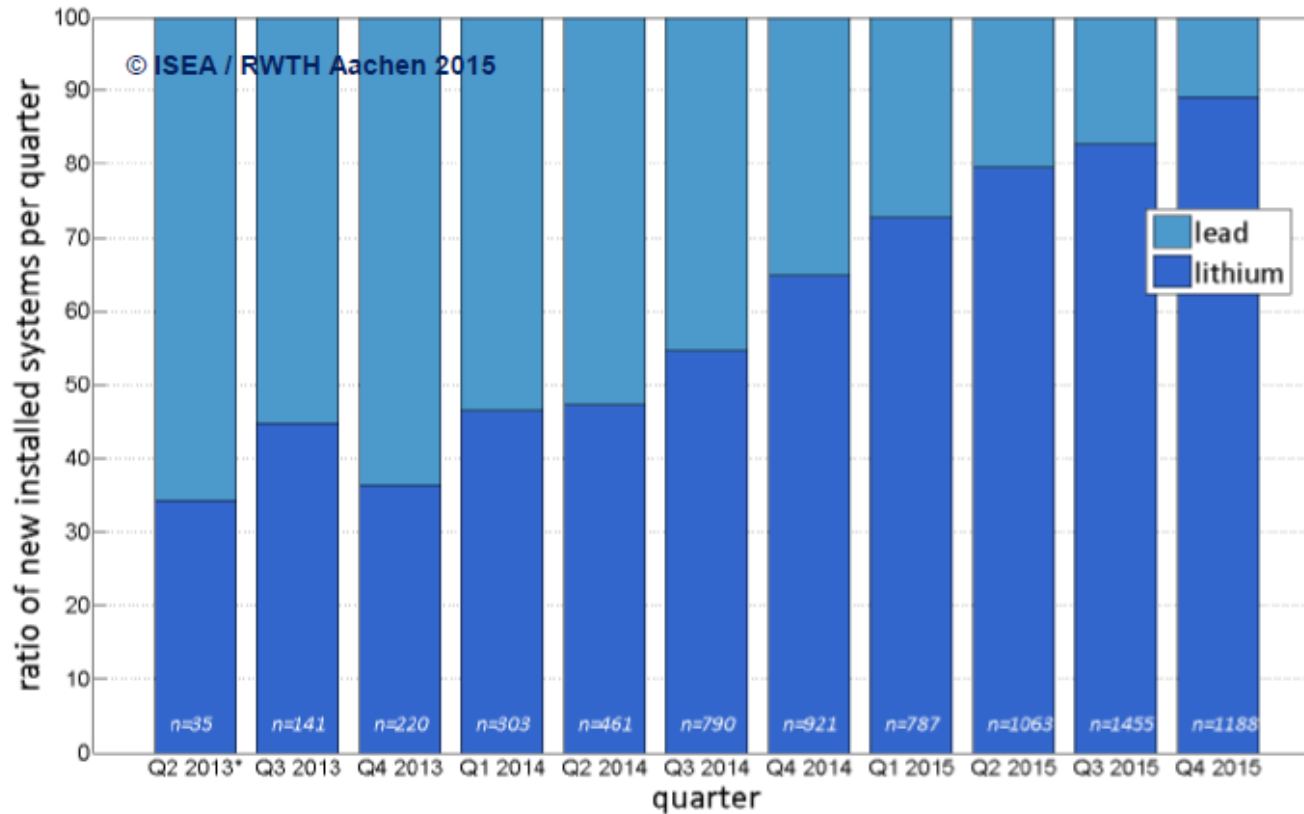
Performances beginning of life



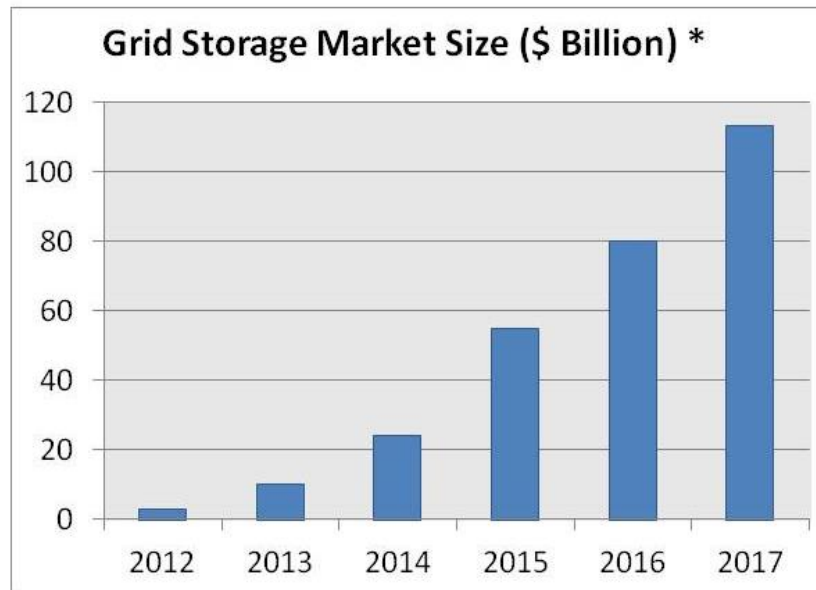
Performances during operation



## Share of lead-acid and lithium-in batteries



- "IMS Research predicts that energy storage sales will jump from only \$200 million in 2012 to a massive \$19 billion as early as 2017."
- California Public Utility Commission (CPUC) in its Sept. 3 2013 proposed decision on energy storage...mandated 1.3 GW of energy storage into the grid by 2020.



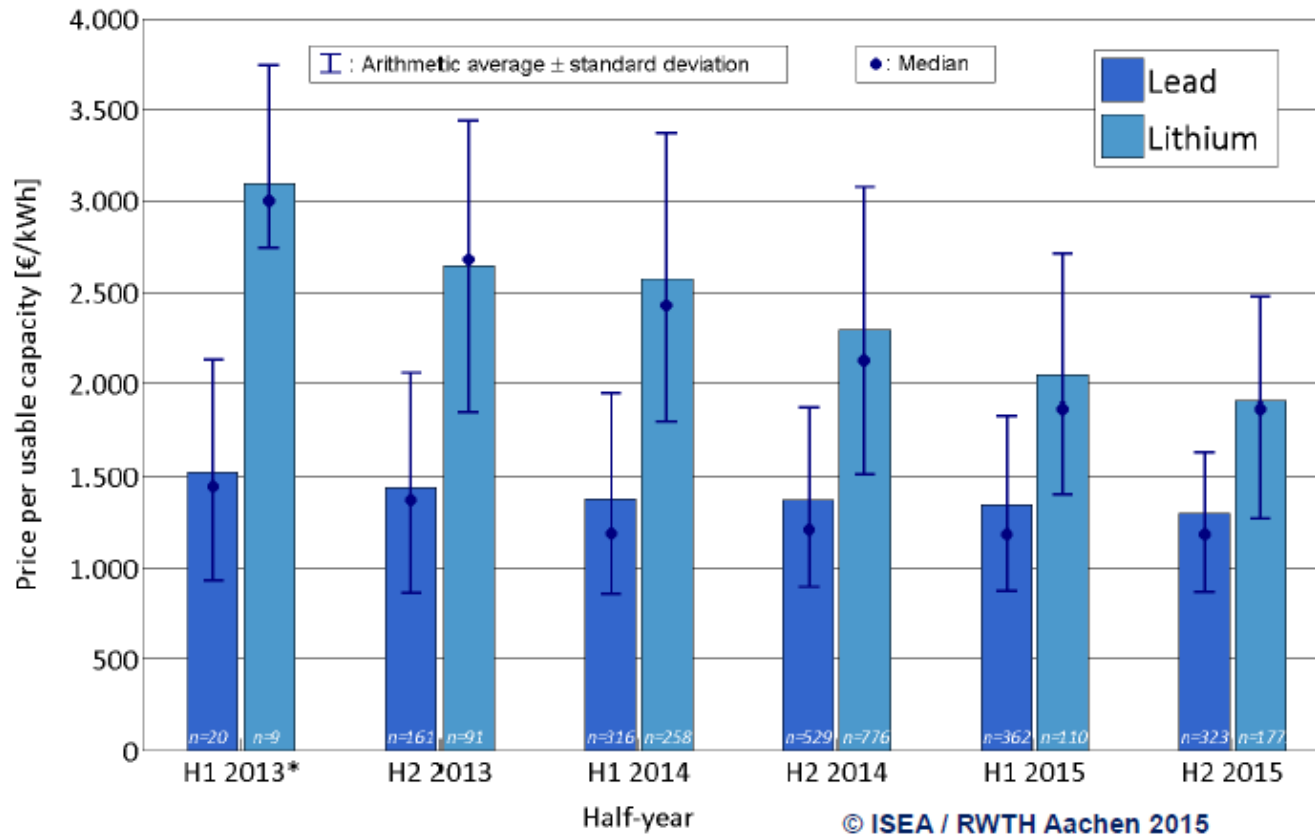
## AGENDA

- **Need for electricity storage: applications**
- **Market evolution**
- **Present prices**
- **Storage learning curve**
- **European storage?**

## End of 2015 on small cells

- **NMC « low-cost » : less than 1.5€ for one 18650 ( $2 \times 3.6 = 7.2\text{Wh}$ ) => 200€/kWh**
- **NCA : 2.8€ ( $3.1 \times 3.65 = 11.3\text{Wh}$ ) => 250€/kWh**
- **LFP base 26650 : less than 3€ ( $3 \times 3.2 = 9.6\text{Wh}$ ) => 300€/kWh**
- **LTO no price for volumes, pas de prix sur les volumes, sampling of 18650 at 3.4€ ( $1 \times 1.8 = 1.8\text{Wh}$ ) => 1900€/kWh**

## Development of retail prices (incl. VAT)

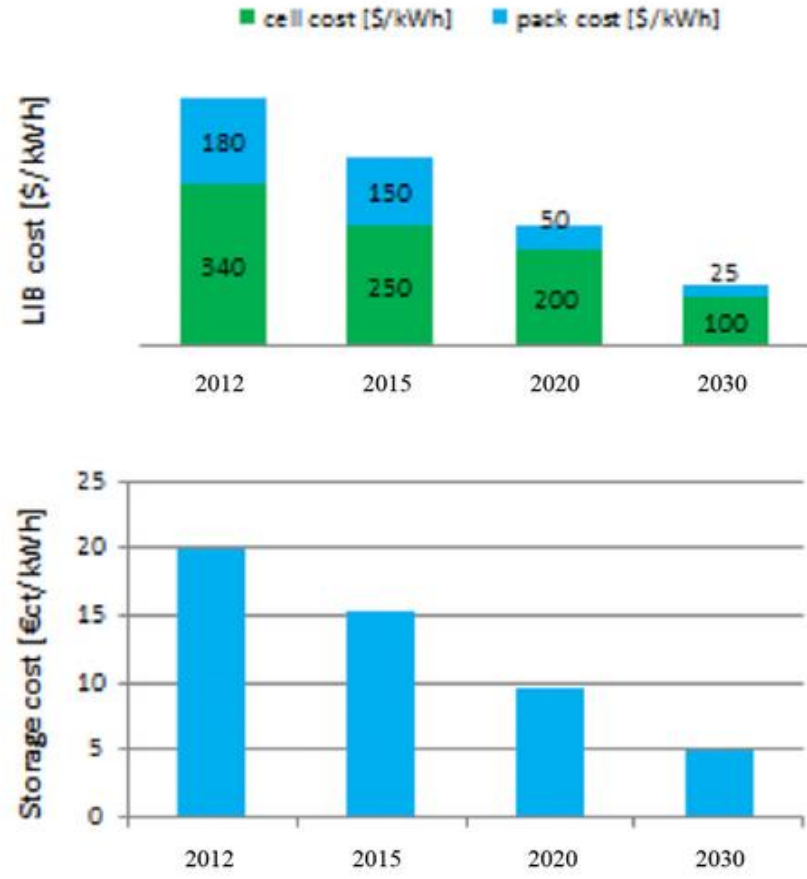
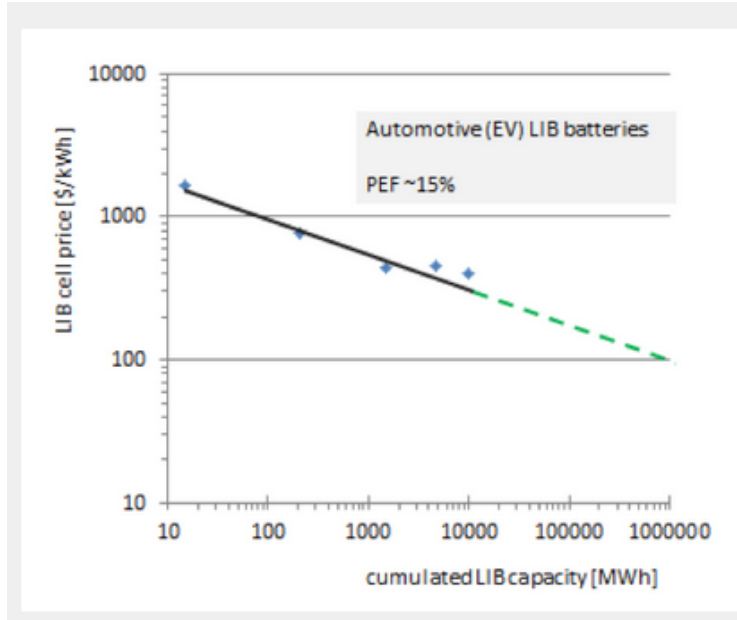


## AGENDA

- **Need for electricity storage: applications**
- **Market evolution**
- **Present prices**
- **Storage learning curve**
- **European storage?**



# LEARNING CURVE OF LI-ION



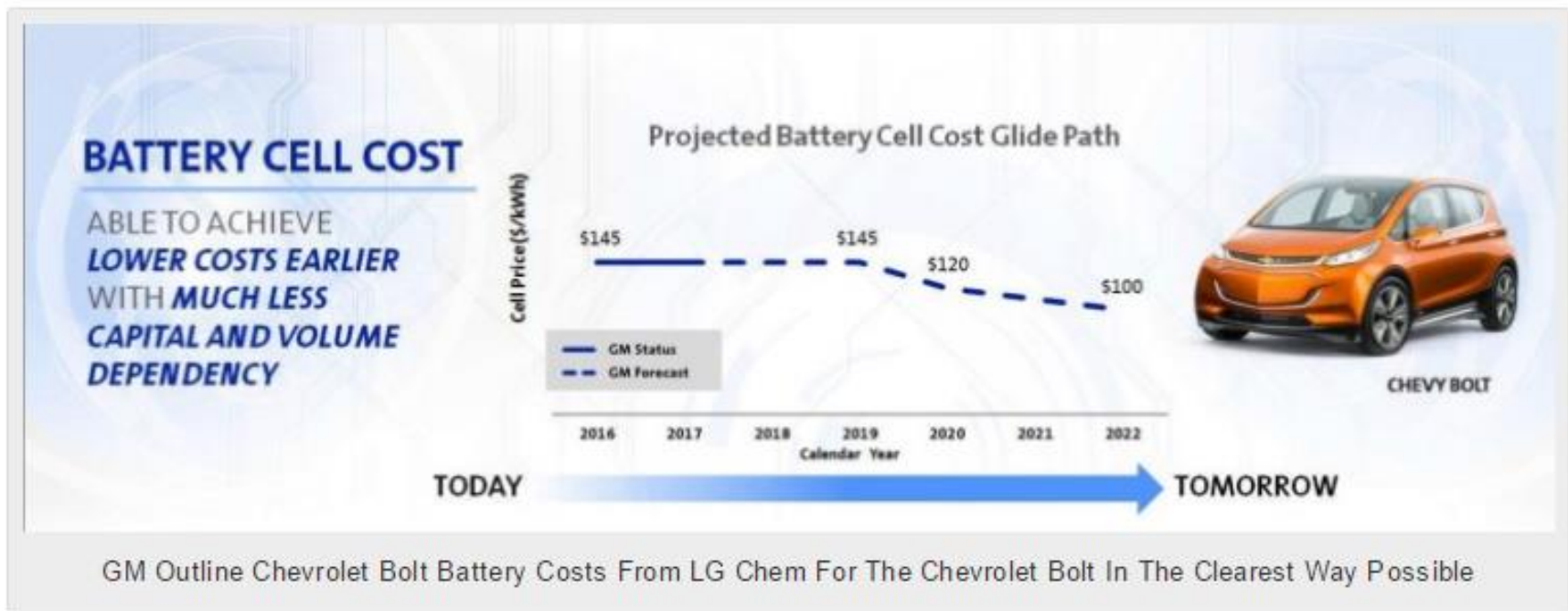
15% cost decrease for each doubling of the installed capacity 100€/kWh once 1TWh reached  
Possible in 2030 provided market growth of 31% per year

# How cheap can Li-ion become?

General Motors rattled the electric vehicle world on October 1st when they announced that the battery cell costs inside the new Chevrolet Bolt was an "industry-leading" **\$145/kWh** from its annual Global Business Conference.

The declaration was significant for a couple reasons.

For starters, it is unprecedented for any automaker to *actually* disclose specific battery pricing. Secondly, that confirmed \$145/kWh price-point ended a long standing argument on how price competitive 2nd generation plug-ins could be, and just how low today's battery costs actually were.



Turns out, that LG Chem is pretty *none-to-happy* with GM in a report filed by Autoline Daily (from the **1:50 mark**). John McElroy says E-Today in South Korea is reporting that:

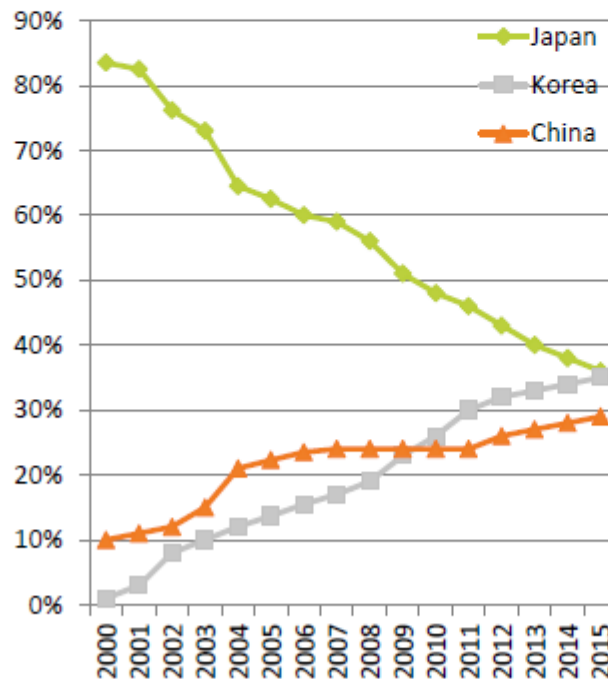
## AGENDA

- **Need for electricity storage: applications**
- **Market evolution**
- **Present prices**
- **Storage learning curve**
- **European storage?**

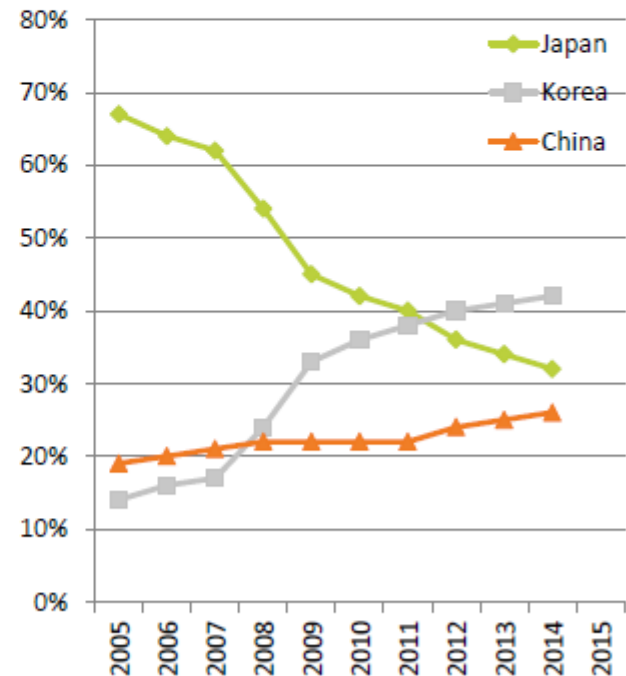
## JAPANESE, CHINESE & KOREAN MARKET SHARE

Japanese market share (value) decreasing: from 84 % of the market in 2000 to < 40% in 2014

Rechargeable battery<sup>(1)</sup> market by country



LIB market by country



(1) Excluding lead acid batteries

The rechargeable battery market 2014-2025

MAY 2015

24<sup>th</sup> Edition

CONTACT

Christophe PILLOT  
+33 1 47 78 46 00  
c.pillot@avicenne.com

## GOOD NEWS FOR PV STORAGE?

### COMMUNIQUÉ DE PRESSE CONJOINT - PROJET D'ACQUISITION DE SAFT GROUPE PAR TOTAL

09 Mai 2016



Paris - Total et Saft Groupe annoncent avoir signé un accord de rapprochement suite auquel Total vient de déposer auprès de l'Autorité des marchés financiers (AMF) une offre publique d'achat volontaire sur les actions Saft Groupe.

Le projet d'offre vise l'ensemble des actions Saft Groupe au prix de 36,50 euros par action, coupon de 0,85 euro par action détaché, soit un prix d'acquisition de 950 millions d'euros.

Le prix proposé fait ressortir une prime de 38,3% par rapport au cours de clôture du vendredi 6 mai 2016 (26,40 €) et une prime de 41,9% sur la moyenne six mois et de 24,2% sur la moyenne d'une année pondérées par les volumes. Cette offre valorise la société sur la base de ses derniers comptes publiés à 9 fois son EBITDA 2015, faisant ressortir une prime de contrôle substantielle au regard des multiples des sociétés du

Storage is **one** of the flexibility options for grid integration of renewables

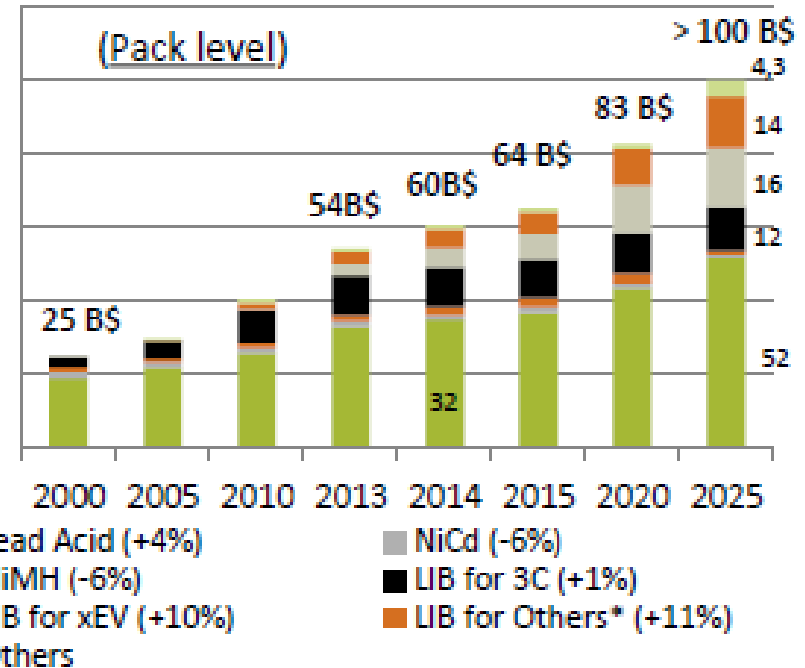
Expected growth of the market until 2025 according to Avicenne

+ 4% for lead-acid

+ 10 % for Li-ion in vehicles

+ 11% for Li-ion in “energy storage”

=> 2 major technologies with lead-acid still dominating in 2025



Others: Automatic handling equipment, forklifts, back-up, UPS, Telecom, medical devices, Residential ESS, Grid ESS, ... 227

