

Workshop REScoop June 12th, 2017

## Workshop 4 : Utility Storage

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## Contents:

- Emelcat sccl presentation
- Need of storage, possibilities
- General view of Technology
- Law and Rules
- Economical examples

## *Emelcat sccl:*

Aim:  
developing  
the storage  
vector in the  
electrical  
system.

Our task: definition, development,  
installation and management of  
electrical storage systems,  
providing them with a system of  
management and optimal control  
from the point of view of durability,  
efficiency and integration of it at  
system and electricity market.

UPC's spin-off, it  
was designed in  
2012, founded  
in 2014 and  
activated in  
2015.



*Montserrat MD (presidenta i directora, Doctora Enginyera), Joan ES (vicepresident, Geòleg), Joan GG (secretari i Enginyer de Suport), Enric CLI (Interventor, Doctor Físic), Aniol AA (Enginyer Optimització), Jordi LID (Enginyer Informàtic)*

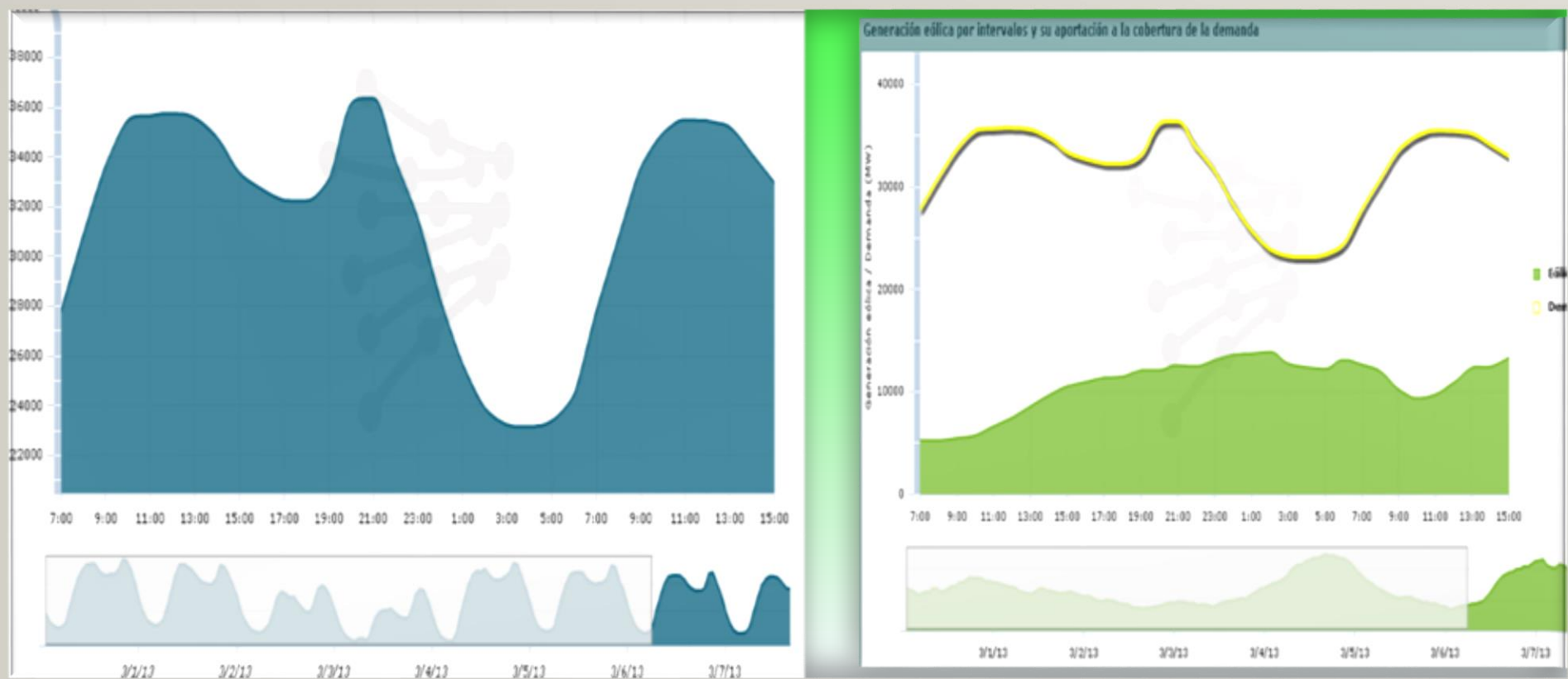


*Jordi RF (Enginyer Tècnic), Oriol MD (Enginyer industrial), Francesc TB (Aparelladors), Cristina BB (Doctora Química), Arnau FS (Doctor Químic), Claude PS (Especialista Telecomunicacions), M<sup>a</sup> del Mar JA (Empresària), Òscar VP (Enginyer Tècnic), Jordi RC (Doctor Enginyer), Josep MR (Enginyer Industrial), Silvia DA (Doctora Metge), David OS (Economista), M<sup>a</sup> Teresa SQ (Mestra), Jordi CB (Informàtic), Adrià CG (Arquitecte)*

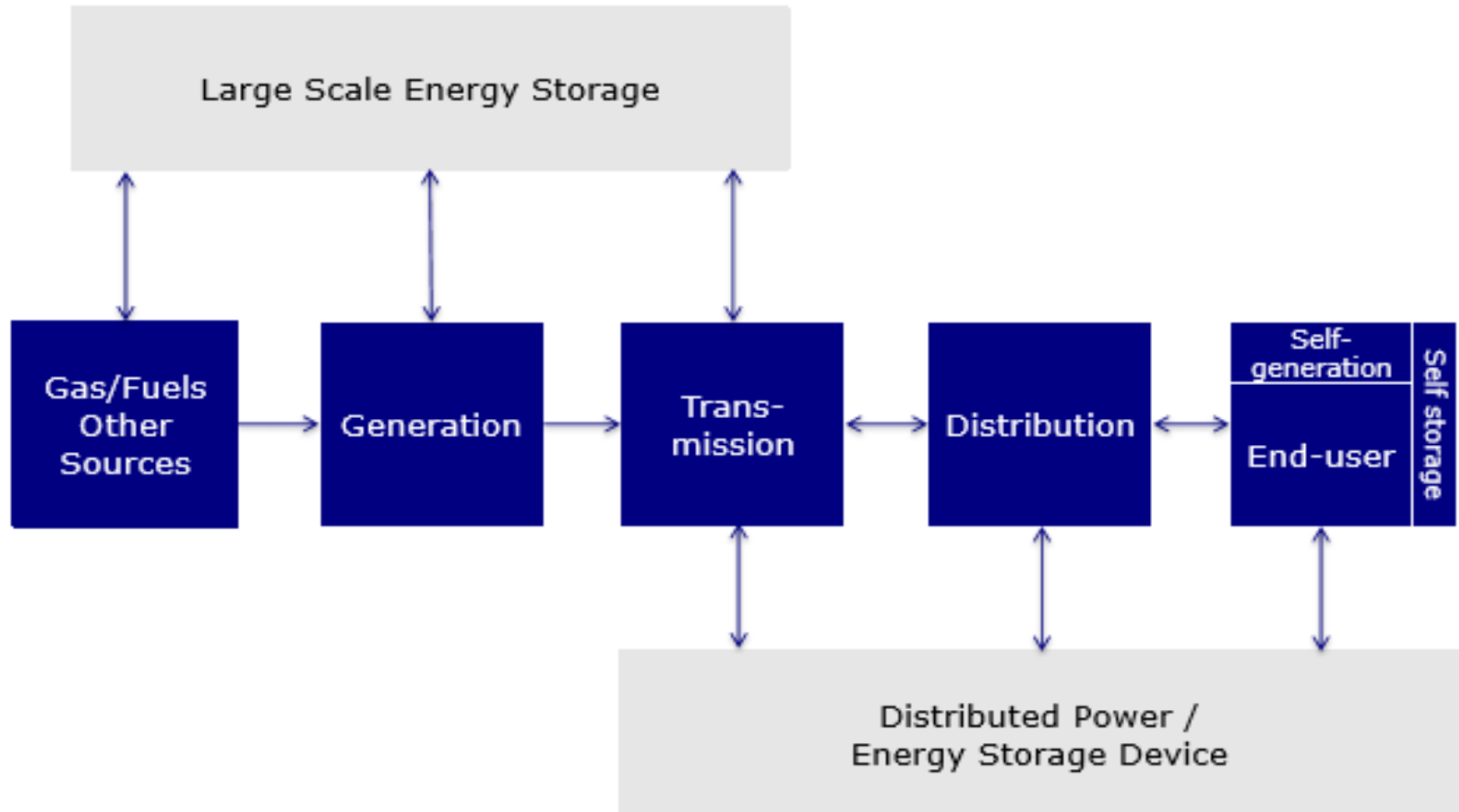
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## ■ Generation and consumption balance

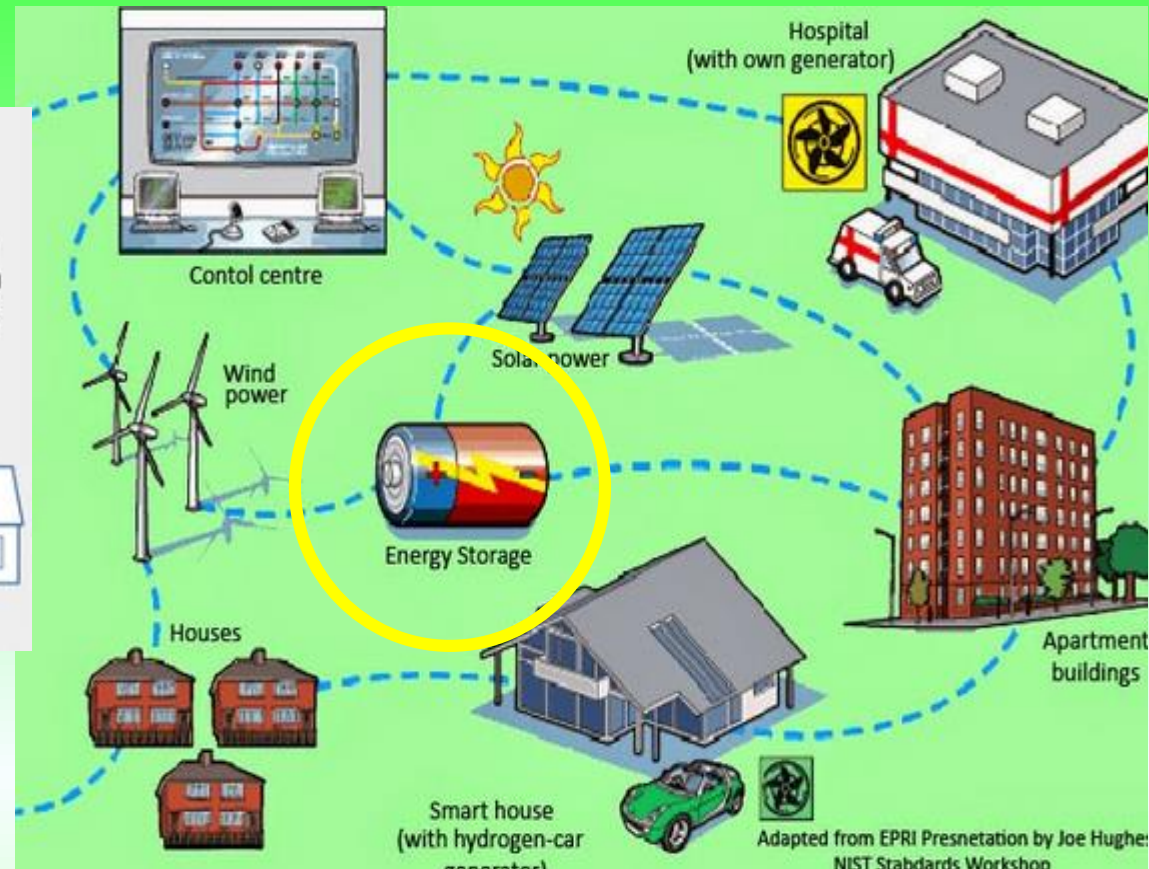
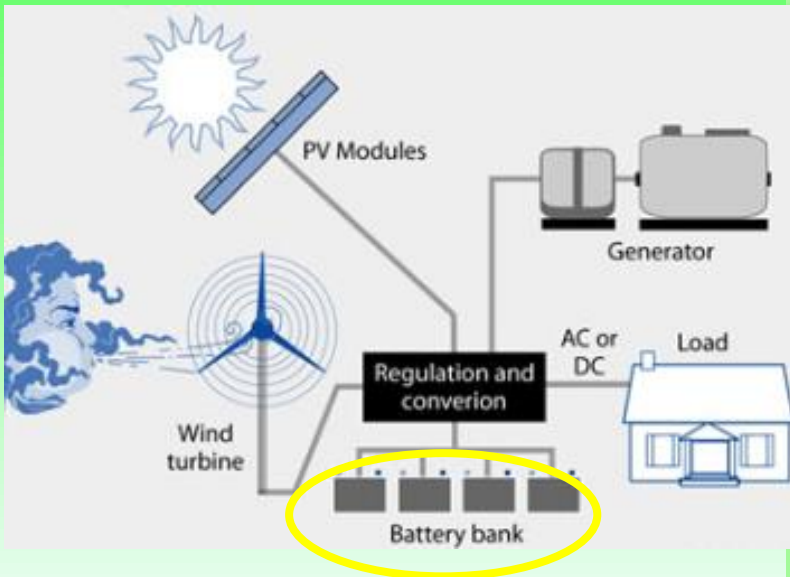


## ■ Need of storage at different levels



**Source:** Adapted from (Makansi, 2008).

- Consumption / Energy Management
  - Residential equilibrium
  - Smart city



Adapted from EPRI Presentation by Joe Hughes  
NIST Standards Workshop





## Energy unities

- Distributed energy: generation, consumption and storage.
- Increase of efficiency : from 8 to 25% of current losses in grids.
- Storage is ability of regulation.
- Link between local consumption and generation.
- Interconnected or not.
- New vision of the grid.

## Urban Energy Unit :

- SCADA with a control module of optimization for management.
- Generation elements.
- Electric grid to interconnect all the elements.
- A battery to regulate and balance the system.
- Protections.
- Efficiency consumptions.
- Element to charge vehicles.

All dimensions are possible, we are working in the range between 50kW to 1MW in power with 100kWh to 3MWh in energy.

## Rural Energy Unit :

- Estorelot: *“Tools manageability of power plants with renewable sources and cogeneration.”*



- Others:

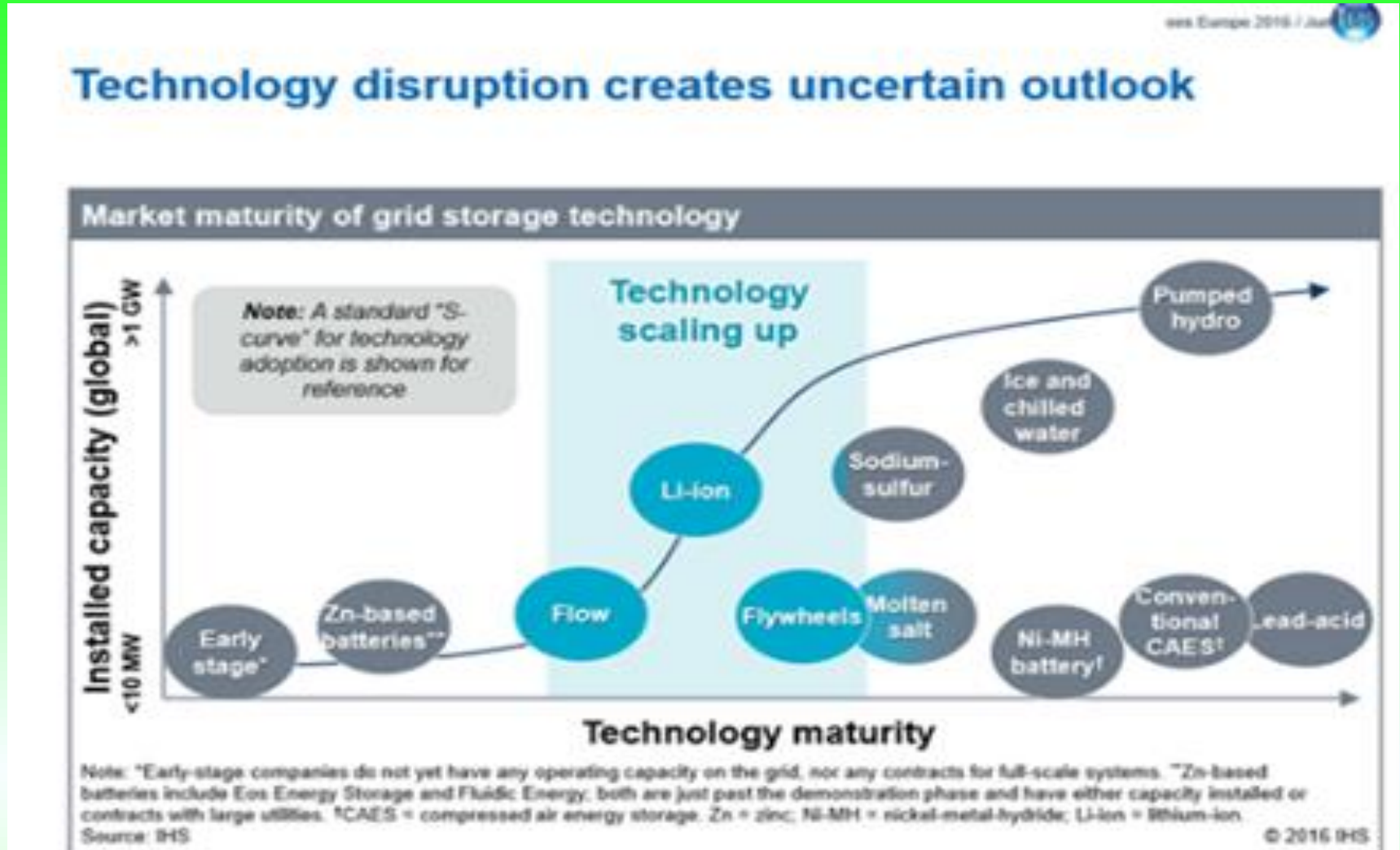


Similar to urban energy unit element. In this case more generation than consumption. Easy participation in system regulation and its markets.

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## ■ Storage technologies:

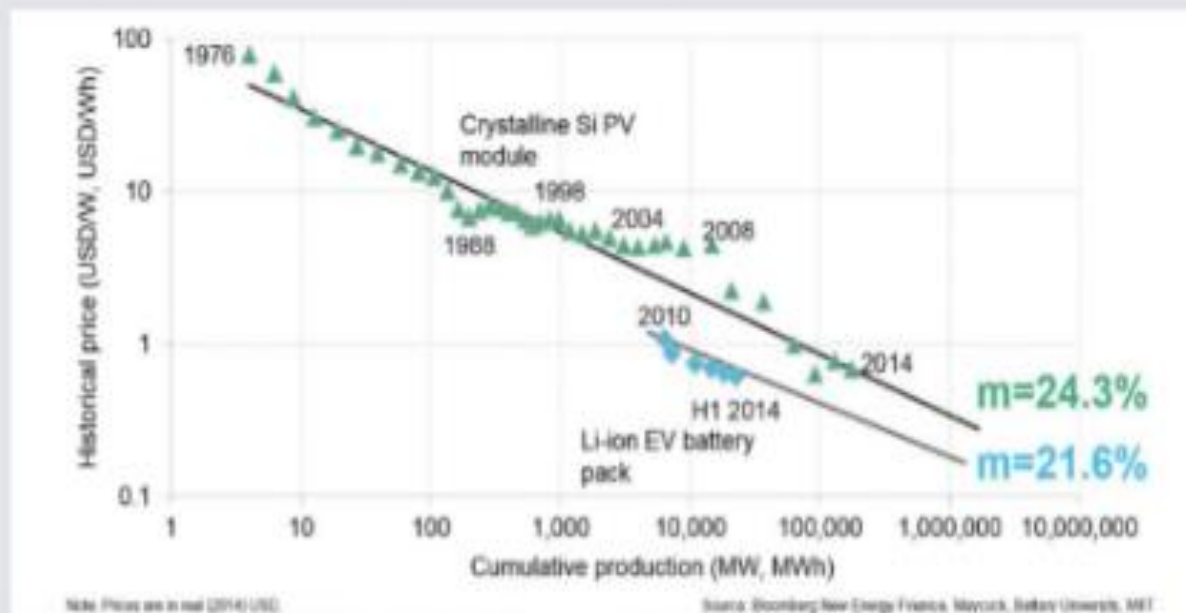


## ■ Evolution of the market.

**The costs of lithium-ion EV batteries are declining fast – we are experiencing a similar development as in solar PV**



Li-ion electric vehicle battery experience curve compared with solar PV experience curve



Michael Liebreich, Bloomberg New Energy Finance 2015



The map displays the global distribution of COVID-19 cases as of March 2020. The data is summarized in the following table:

Country	Number of Cases
Estats Units d'Amèrica	189
Canadà	23
Mèxic	9
Veneçuela	15
Colòmbia	5
Brasil	143
Bolívia	5
Argentina	5
Regne Unit	29
Polònia	155
Espanya	3
Itàlia	3
Finlàndia	4
Suècia	4
Noruega	4
Ucraïna	3
Turquia	3
Egipte	6
Irak	6
Iran	7
Pakistan	7
Índia	28
Tailàndia	2
Indonèsia	3
Papua Nova Guinea	5
Austràlia	6
Nova Zelanda	2
Sud-àfrica	4
Madagascar	2
Namíbia	2
Botswana	4
Angola	2
República Democràtica del Congo	2
Kenya	2
Etiòpia	2
Sudan	2
Libia	2
Níger	2
Mali	2
Algeria	2
Algèria	2
Marroc	2
Argènia	2
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Mali	2
Algeria	2
Algèria	2

*543 Operative projects based on batteries, 1 259 MW; 921 Total batteries projects, 2 737 MW*

## European projects between 1 to 10MW

*Projects on the table*



*European projects in  
operation*



Black Start, Electric Supply Reserve Capacity - Non-Spinning, Electric Supply Reserve Capacity – Spinning, Load Following (Tertiary Balancing), Ramping, Voltage Support, Electric Energy Time Shift, Electric Supply Capacity, Transmission Congestion Relief, Transmission Support, Frequency Regulation,

Renewables Capacity Firming, Distribution upgrade due to solar, Distribution upgrade due to wind, Transmission upgrades due to solar, Transmission upgrades due to wind, Onsite Renewable Generation Shifting, Electric Bill Management with Renewables, Renewables Energy Time Shift,

Electric Bill Management, Grid-Connected Commercial (Reliability & Quality), Grid-Connected Residential (Reliability), On-Site Power, Microgrid Capability, Resiliency, Demand Response.

Transportable Transmission/Distribution, Upgrade Deferral, Stationary Transmission/Distribution Upgrade Deferral,

Transportation Services,

### Services of utility management :

Black Start, **Electric Supply Reserve Capacity - Non-Spinning**, Electric Supply Reserve Capacity – Spinning, **Load Following (Tertiary Balancing)**, Ramping, **Voltage Support, Electric Supply Capacity**, Transmission Congestion Relief, **Transmission Support, Frequency Regulation.**

- 83 projects = 649 089 kW ; medium size 7 916 kW.
- 62 in operation projects = 491 409 kW ; medium size 8 056 kW.
- Smaller one: 15 kW.
- Larger ones:  
48 MW per 15 min /  
12 MW per 8h.



Germany  
5MW / 5MWh  
Lithium ion

Spain  
1MW / 3MWh  
Lithium ion



# *EMELCAT sccl*



*Usa,  
1MW / 3.2 MWh,  
Bateria de Fluxe*



*Canada,  
1MW / 6.3 MWh,  
NaS*

## Storage linked with renewables generation :

Renewables Capacity Firming,  
**Distribution upgrade due to solar,**  
Distribution upgrade due to wind,  
**Transmission upgrades due to solar,**  
Transmission upgrades due to wind,  
**Onsite Renewable Generation Shifting,**  
**Electric Bill Management with**  
**Renewables, Renewables Energy Time**  
**Shift.**

- 46 projects = 84 871 kW; mean 1 845 kW.
- 36 in operation 19 509 kW; mean 557 kW.
- Smaller one = 2 kW
- Larger one = 30 MW.



USA

1MW / 1MWh  
Lithium polymer

China

1MW / 3MWh  
Lithium polymer



## User storage Systems:

**Electric Bill  
Management, Grid-  
Connected Commercial  
(Reliability & Quality),  
Grid-Connected  
Residential (Reliability),  
Microgrid Capability,  
Resiliency, Demand  
Response, Electric  
Energy Time Shift.**

- 115 projects = 296 655 kW; average facility 2602 kW.
- 72 in operation = 130 280 kW; average facility 1835 kW.
- Smaller one: 4 kW;
- Larger one 85 MW.

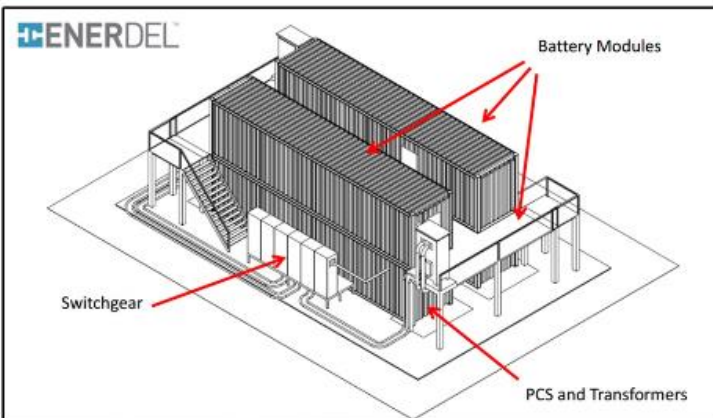


Germany  
13MW / 13MWh  
second life Lithium-ion

Korea  
1MW / 1MWh  
Lithium-ion







## EnerDel Sochi BESS

The Sochi BESS project was part of a regional electrical infrastructure upgrade by Federal Grid Company of Russia to support the 2014 Winter Olympics. The remote nature of many of the sites and the fragile infrastructure left the regional susceptible to outages.

EnerDel commissioned a 1.5 Mw (2.5 MWh) to protect Psou Substation's critical loads against supply interruptions. Primarily functioning as a UPS, the system also provides ancillary services of frequency regulation and peak shaving....

[Read More](#)

Technology Type	Lithium-ion Battery
Rated Power in kW	1,500
Duration at Rated Power (HH:MM)	2:00.00



10 MWh / 6MW  
(bateria io Liti)  
Bedfordshire,  
Leighton  
Buzzard,



## Storage to improve the grid:

Transportable  
Transmission/Distrib  
ution Upgrade  
Deferral, Stationary  
Transmission/Distrib  
ution Upgrade  
Deferral.

- 10 projects = 15 650 kW ; average facility 1 739 kW.
- 8 in operation = 12 650 kW average facility 1 807 kW.
- Smaller one 250 kW.
- Larger one 2,4 MW.



USA

1MW / 7,2 MWh

NaS

USA  
2MW / 12MWh  
NaS



## Transportation Services



- 22 projects = 36 025 kW;  
average facility 1 716 kW.
- 15 in operation 26 995 kW;  
average facility 1 925 kW.
- Smaller one 525 kW
- Larger one 7 MW, but little  
energy, usually big capacitors.

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## European Commission proposes new rules for consumer centred clean energy transition

- *Proposal for a revised electricity Directive . New figures: active consumer, **energy storage**, 'local energy community', 'aggregator', 'independent aggregator', 'demand response', 'recharging point.*
- *Proposal for a revised electricity regulation.*

***'active customer'** means **a customer or a group** of jointly acting customers **who consume, store or sell electricity generated on their premises, including through aggregators, or participate in demand response or energy efficiency schemes provided that these activities do not constitute their primary commercial or professional activity;***

***'local energy community'** means: an association, a cooperative, a partnership, **a non-profit organisation** or other legal entity which is **effectively controlled by local shareholders or members, generally value rather than profit-driven, involved in distributed generation and in performing activities of a distribution system operator, supplier or aggregator at local level,** including across borders.*



*'**aggregator**' means: a **market participant** that **combines** multiple customer loads or generated electricity for sale, for purchase or auction in any organized energy market; / '**independent aggregator**' means an aggregator that is not affiliated to a supplier or any other market participant;*

*'**energy storage**' means, in the electricity system, deferring an amount of the electricity that was generated to the moment of use, either as final energy or converted into another energy carrier.*

the procurement of **non-frequency ancillary services** by a distribution system operator shall be transparent, non-discriminatory and marketbased ensuring effective participation of **all market participants** including renewable energy sources, demand response, **energy storage facilities** and aggregators



The transmission system operator shall perform at regular intervals or at least every five years a public consultation for the required storage services in order to assess the potential interest of market parties.

The electricity market of the next decade will be characterised by more variable and decentralised electricity production, an increased interdependence between Member States and new technological opportunities for consumers to reduce their bills and actively participate in electricity markets through demand response, self-consumption or storage.

Price signals should also allow for adequate remuneration of flexible resources (including demand-response and storage),

TSO and DSO shall not be allowed to own, manage or operate energy storage facilities and shall not own directly or indirectly control assets that provide ancillary services.

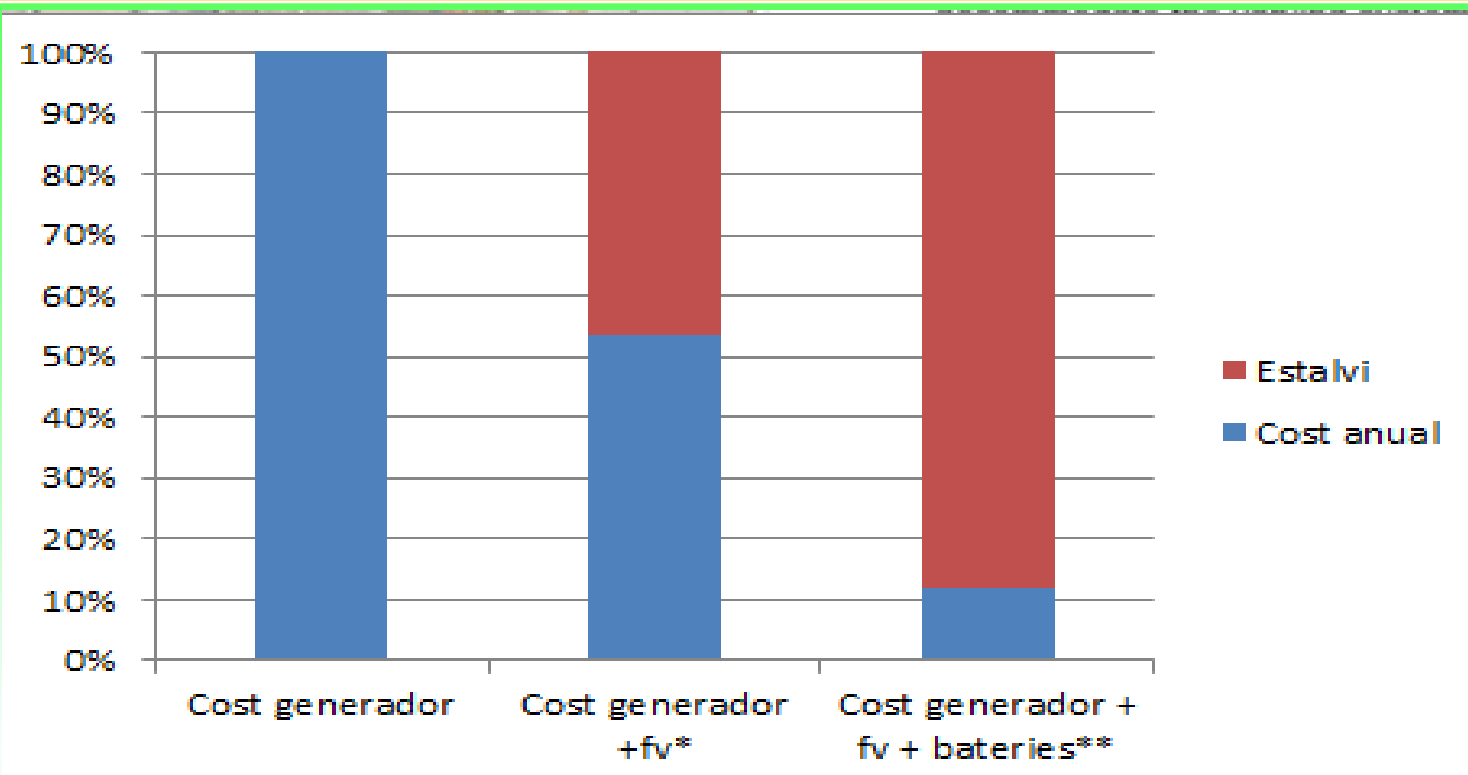
## Spanish Rules:

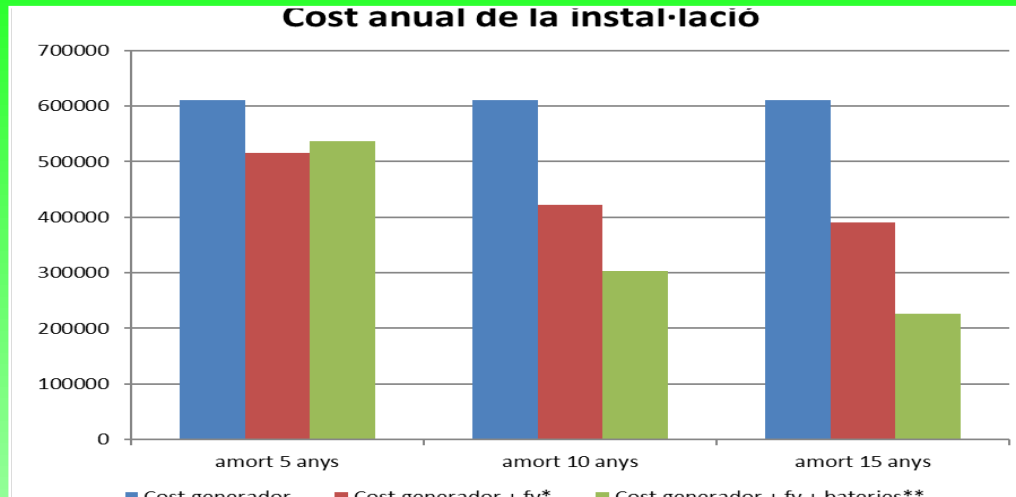
- *“Resolució de 18 de desembre de 2015”, Distributed generation can participate in ancillary services.*
- *“RD d’autocomsum 900/2015”, accepted storage facilities at the distribution level but with special fee and conditions.*

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*Optimization; 400kW / 1.8MWh battery + 900 kWp*



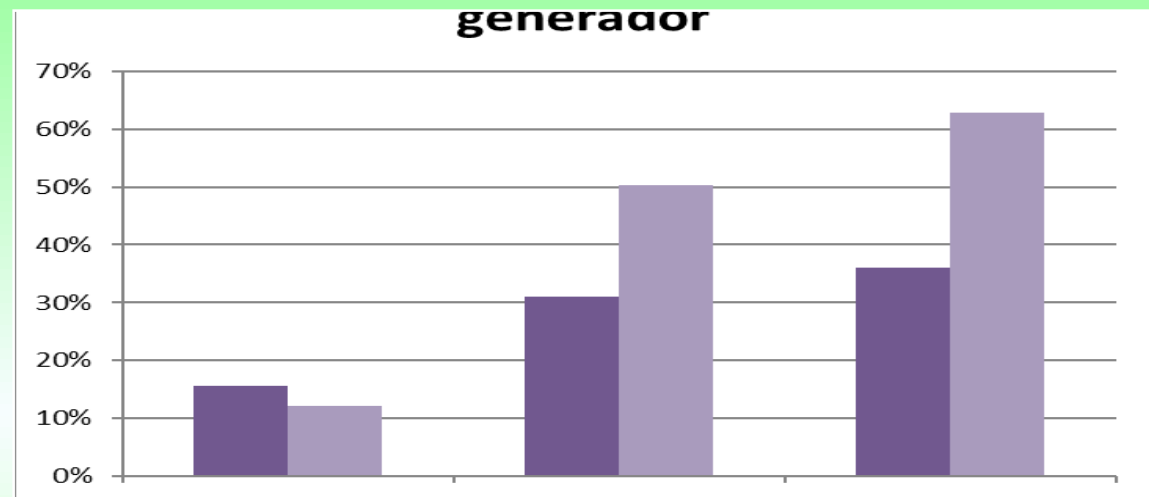


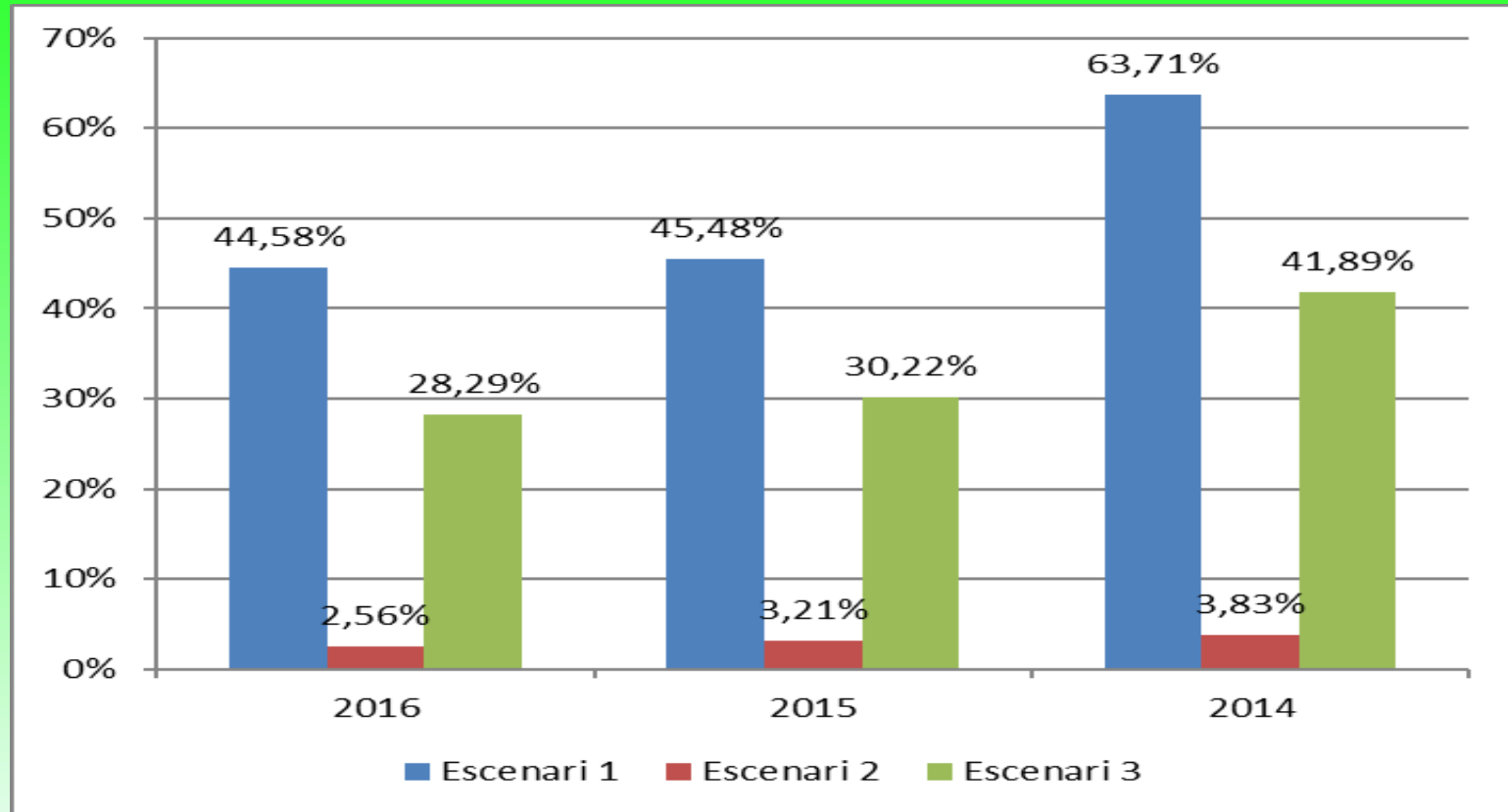
Cost considering amortization:  
 genset;  
 genset+phv ;  
 genset+phv +bat  
 5; 10 ; 15 year

### Saving:

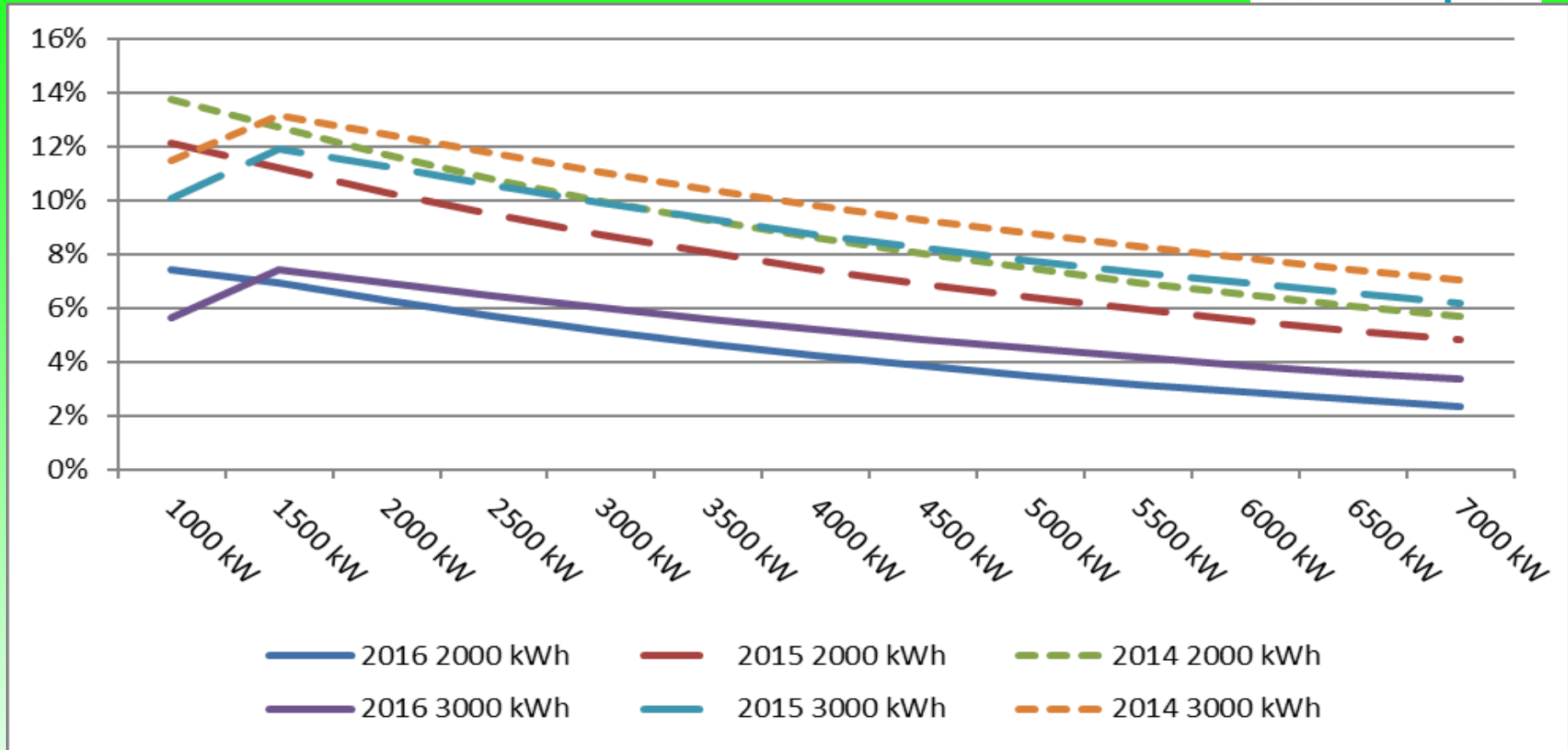
genset vs. phv;  
 genset vs. phv +  
 battery

5 ya, 10ya, 15ya



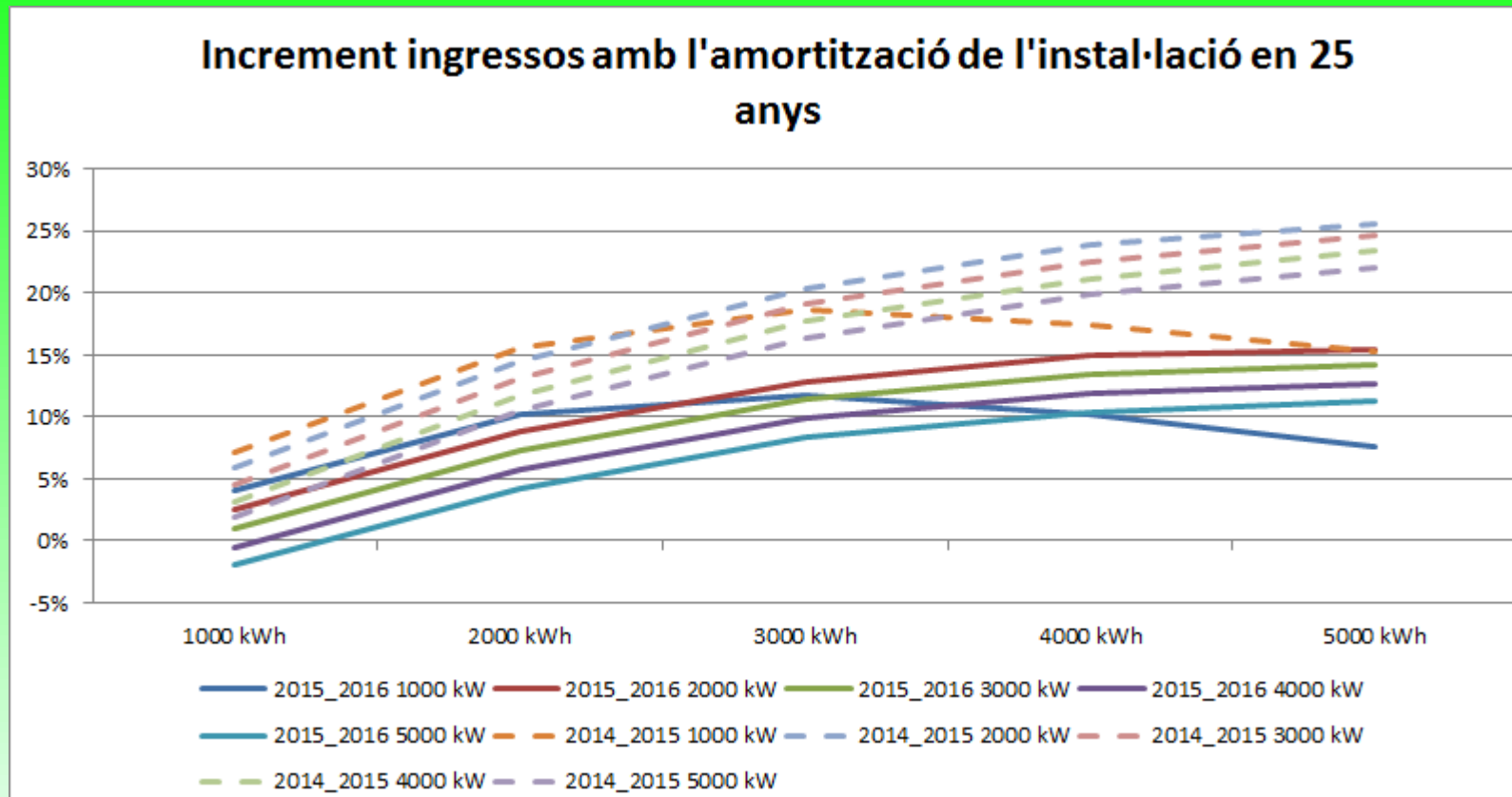


*Increase of turnover (with 4MWh/3MW battery):  
Different operation modes and years.*

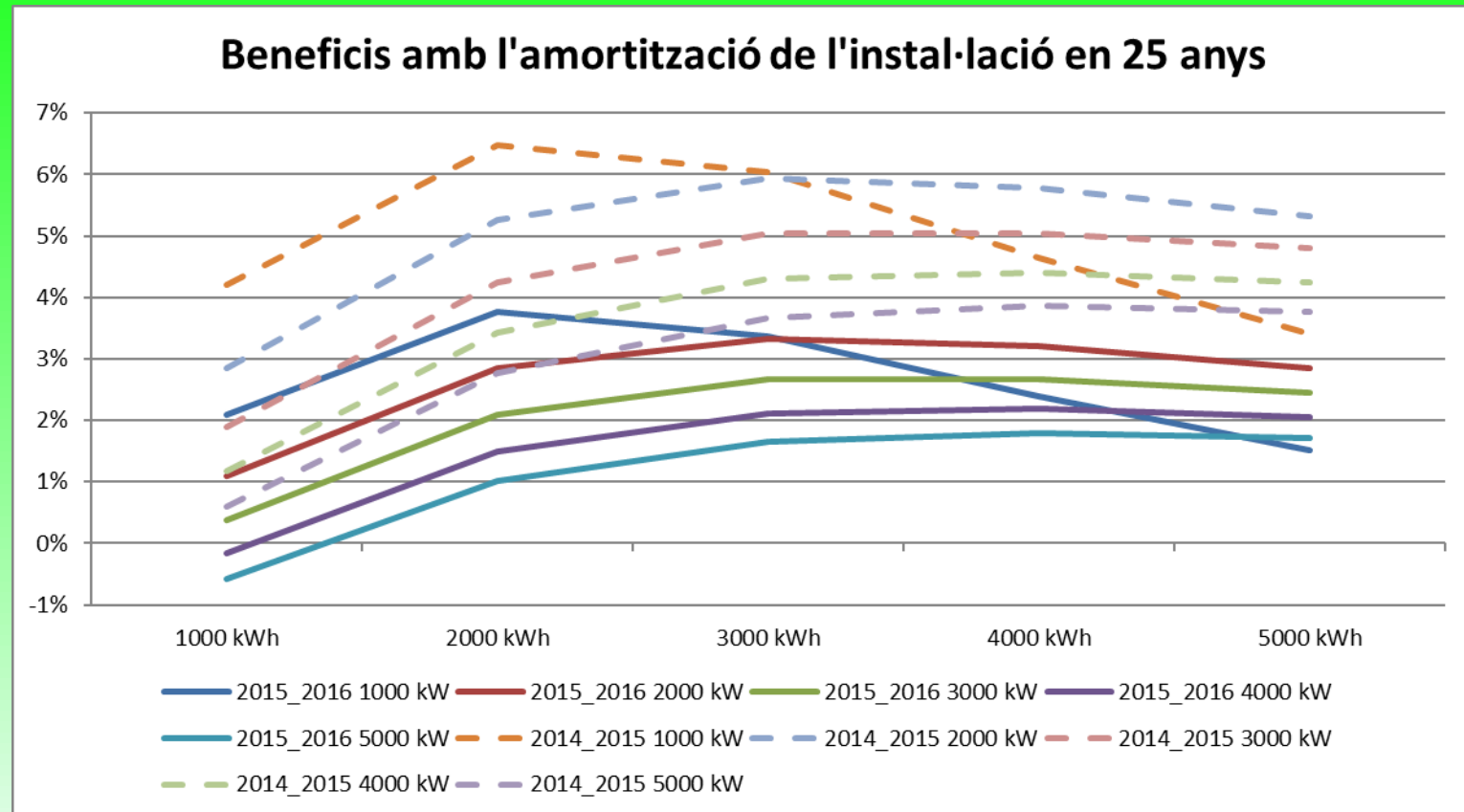


**Annual profit:** *Effect of change of prices for different batteries (amortization included)*





*Increase of turnover Effect of change of prices for different batteries (amortization included)*



**Annual profit: Effect of change of prices for different batteries (amortization included)**

# Gràcies

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