



---

# Electricity Storage as an Indispensable Element of the Energy Turnaround

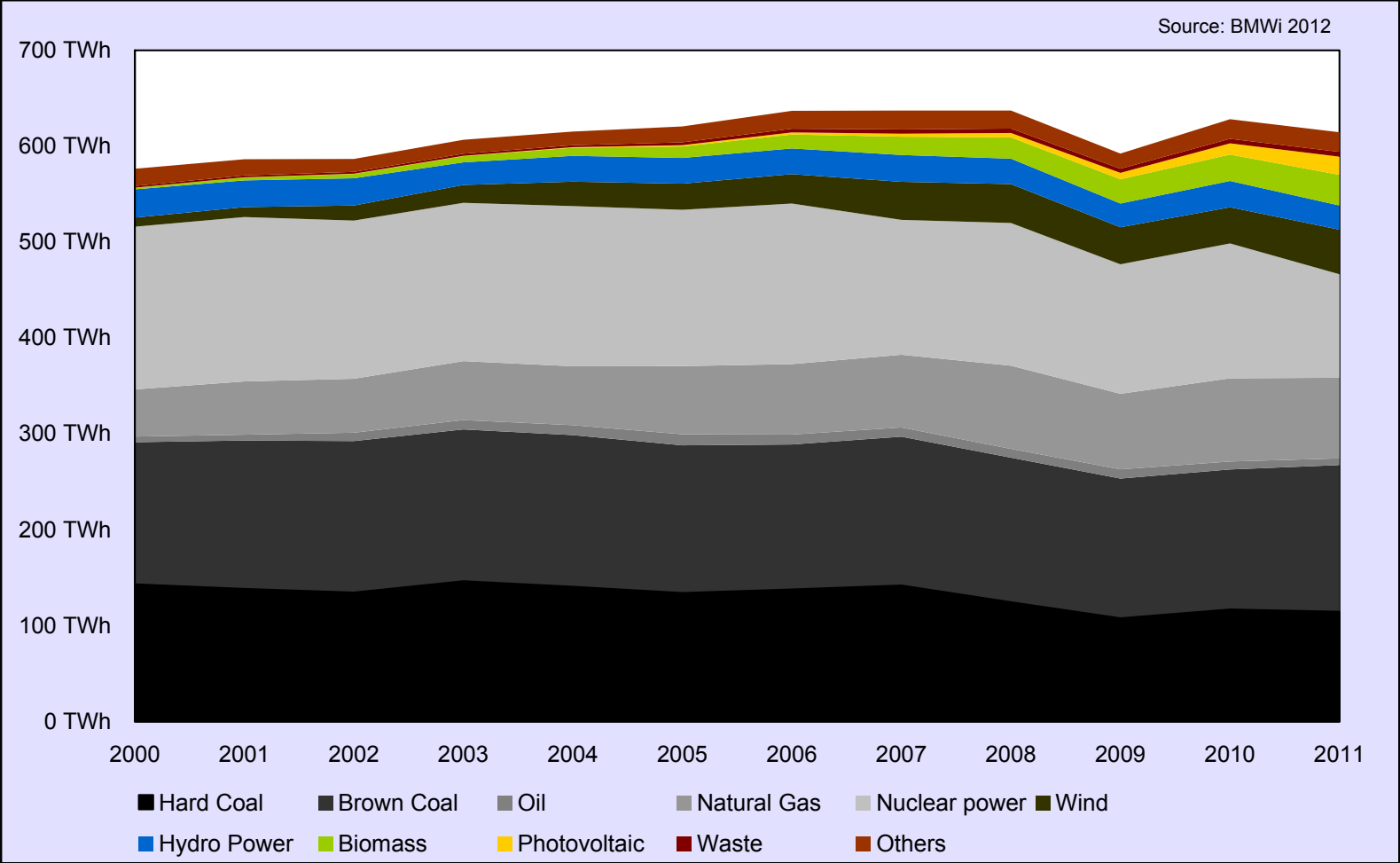
Martin Ammon  
Oaxaca | September 2012

---

## A. Background

# A.Background

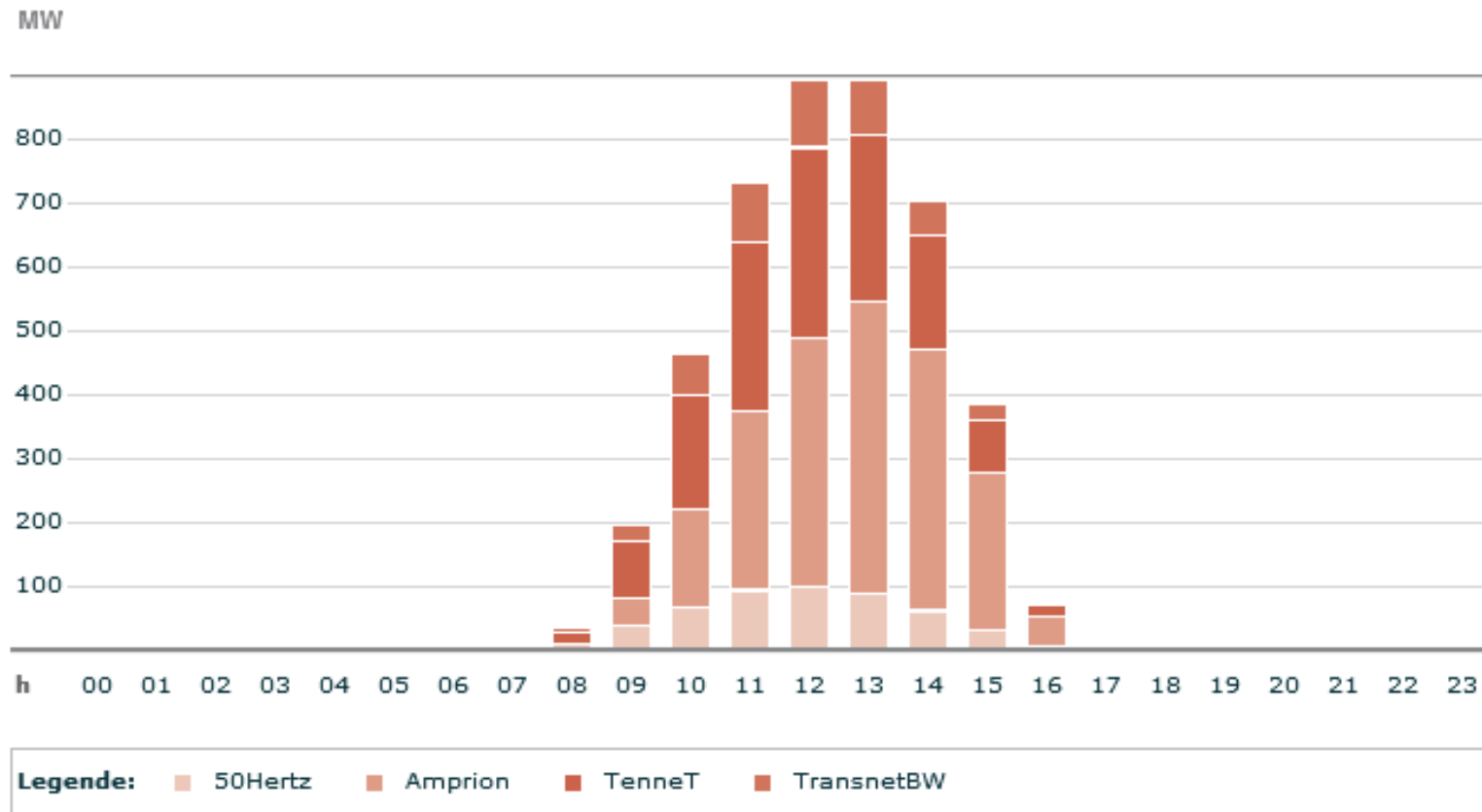
## Renewable Energies in Germany



## A. Background

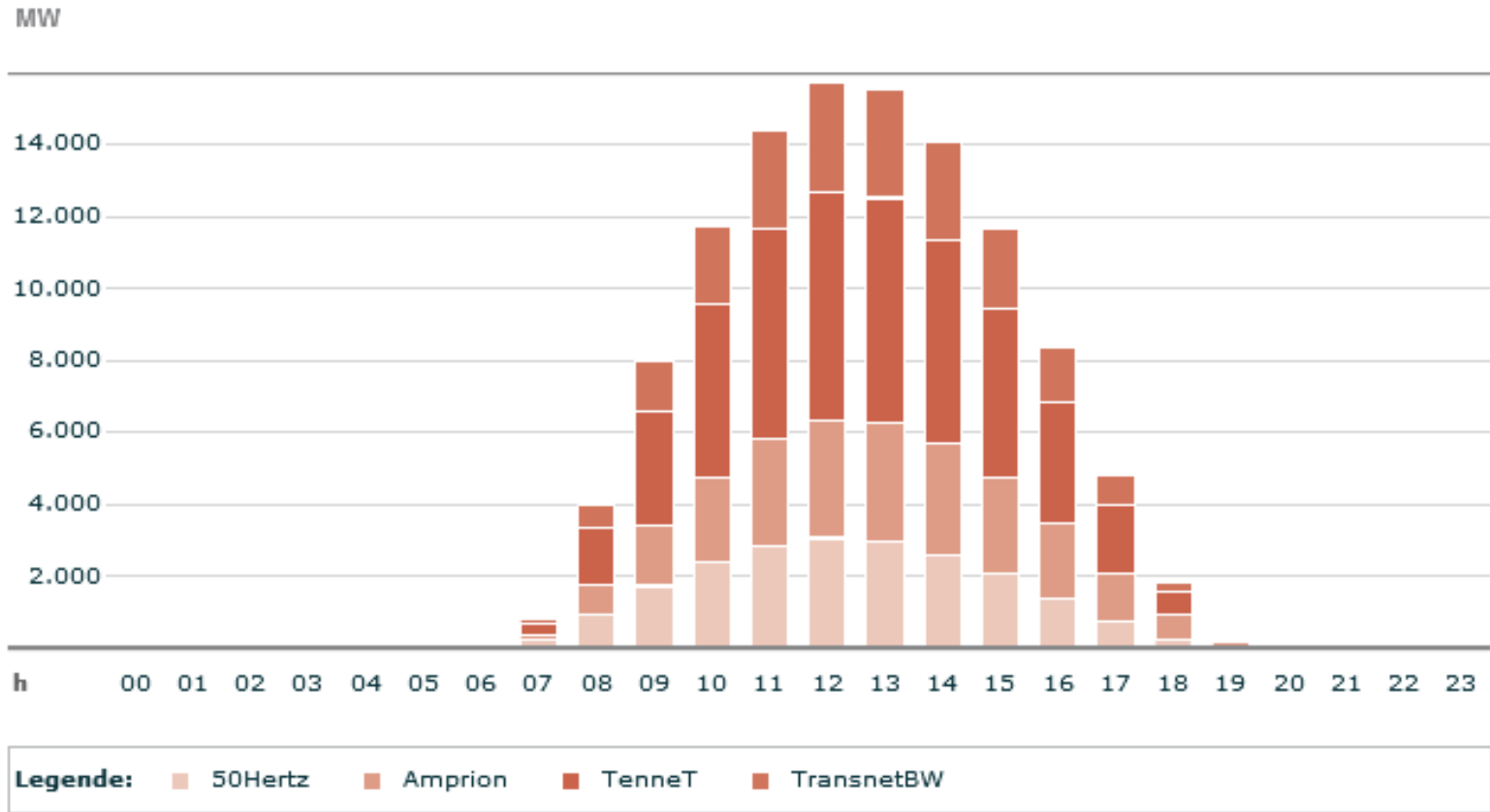
---

### Photovoltaic Energy Power Generation 19.1. 2012



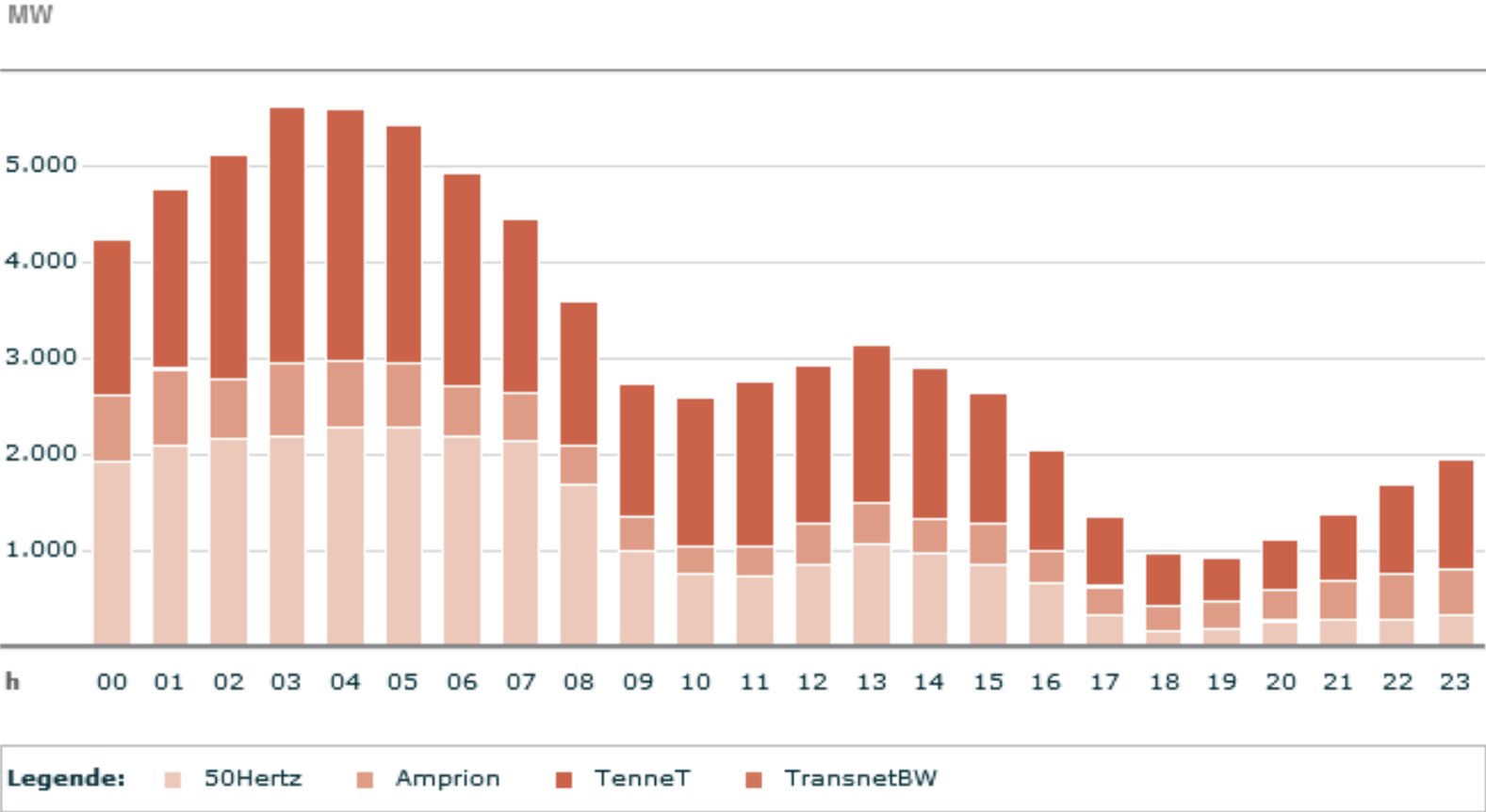
# A.Background

## Photovoltaic Energy Power Generation 17.9.2012



# A.Background

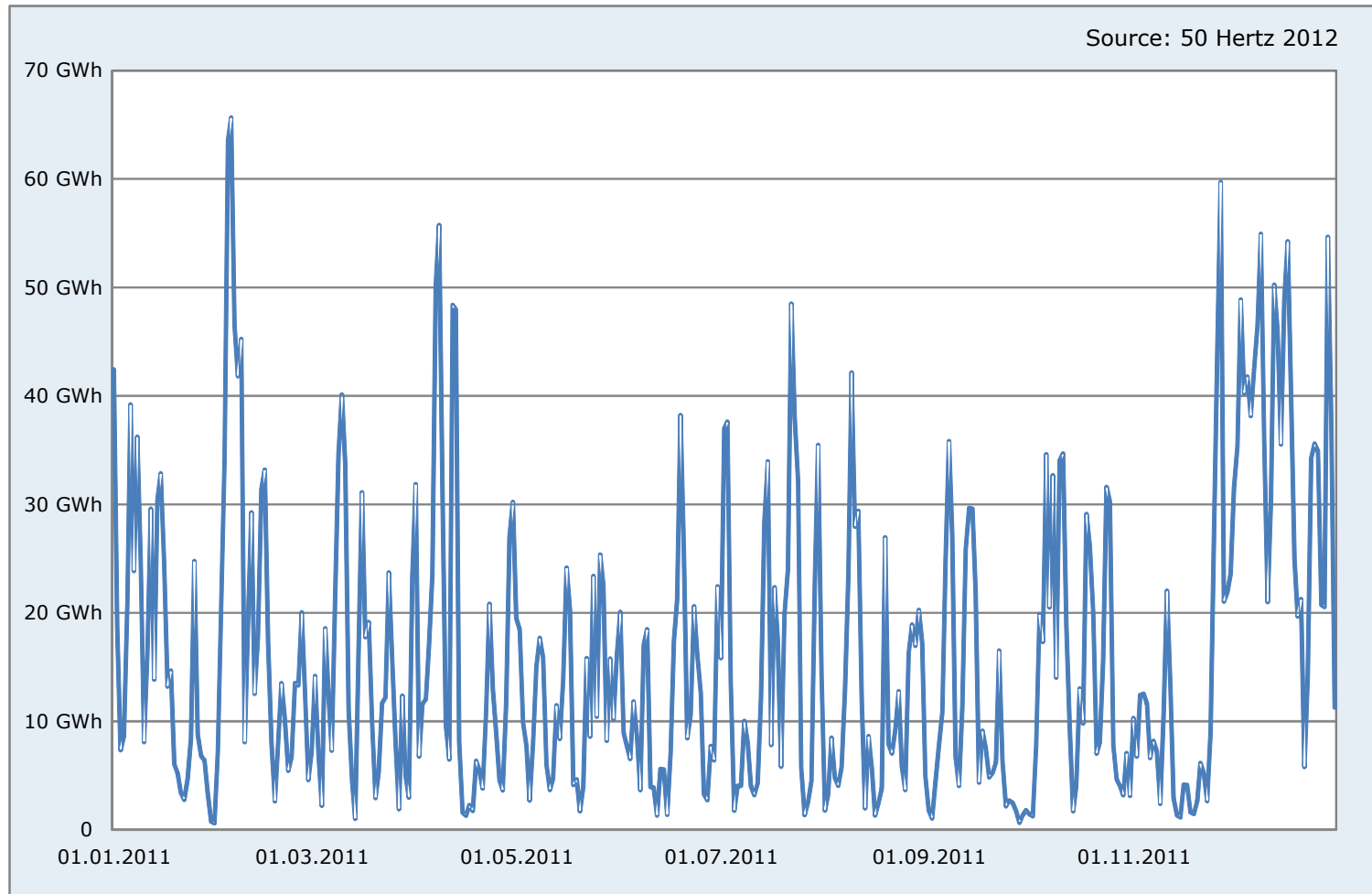
## Wind Energy Power Generation 17.9.2012



# A. Background

---

## Wind Energy Power Generation 2011



## A.Background

---

How to cover the electricity supply of fluctuating renewable energies?

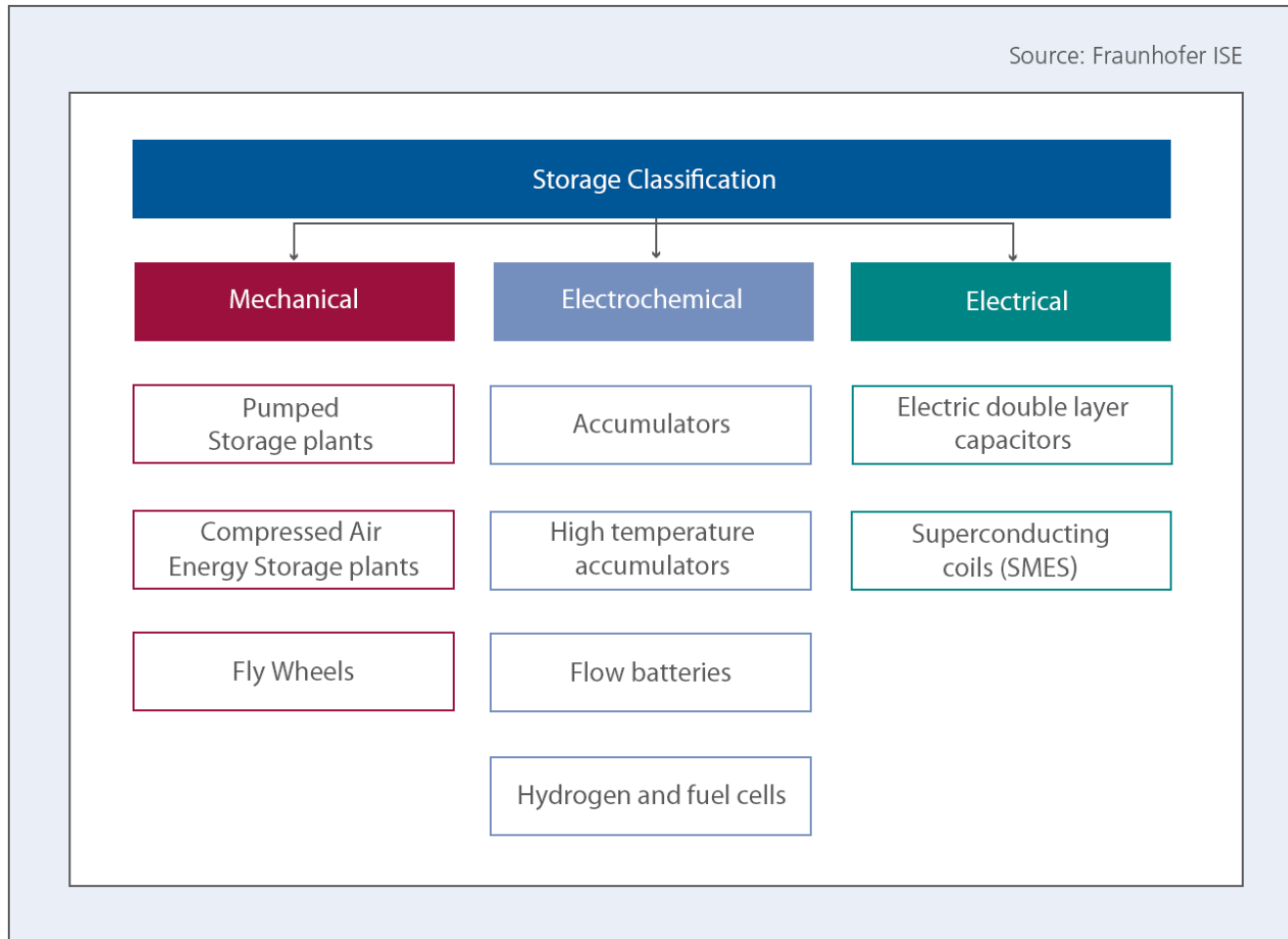
- Backup Power Plants
- Demand Side Management
- Storage Solutions



## B. Electricity Storage Technologies

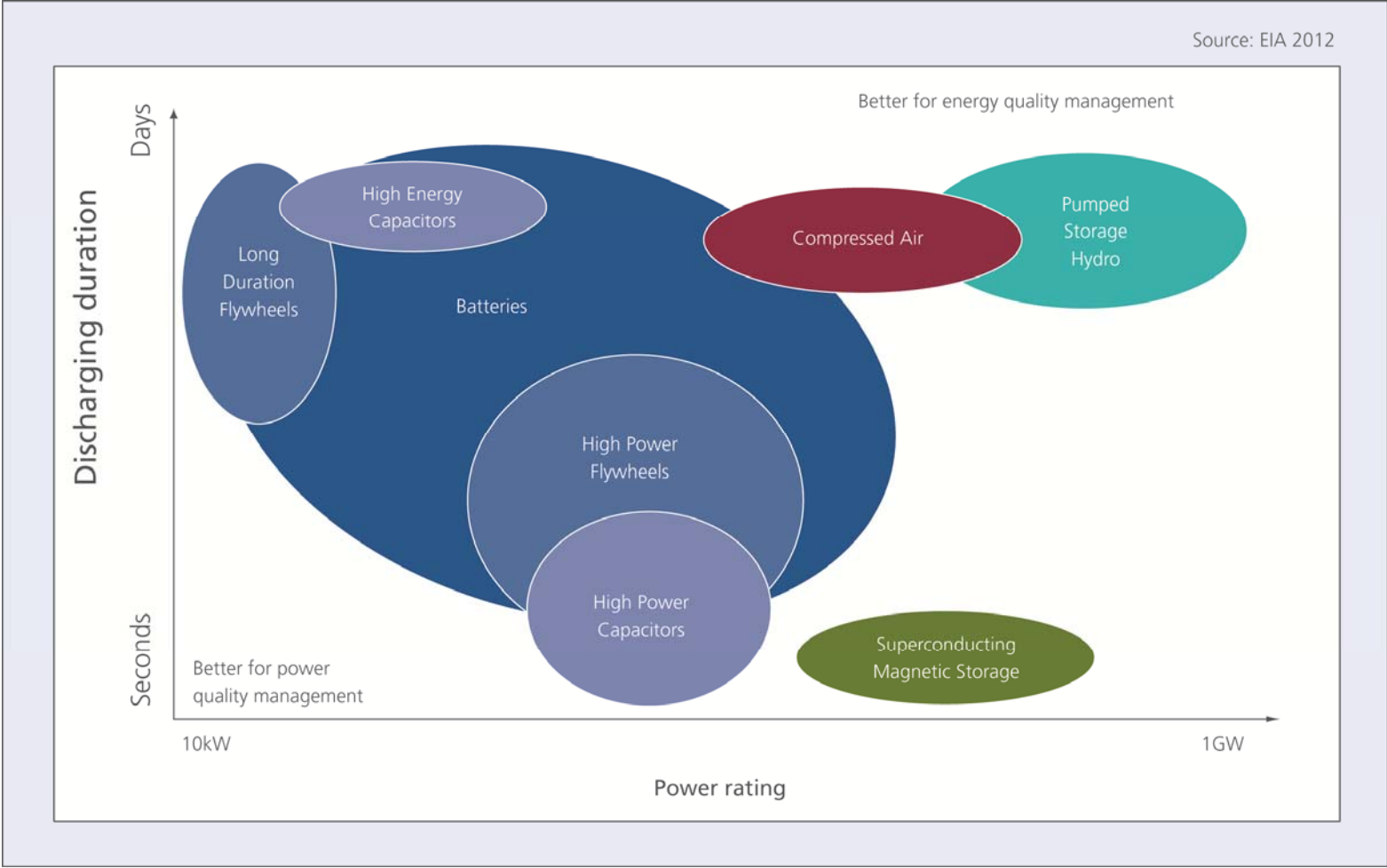
## B. Electricity Storage Technologies

### Classification of Storage Technologies



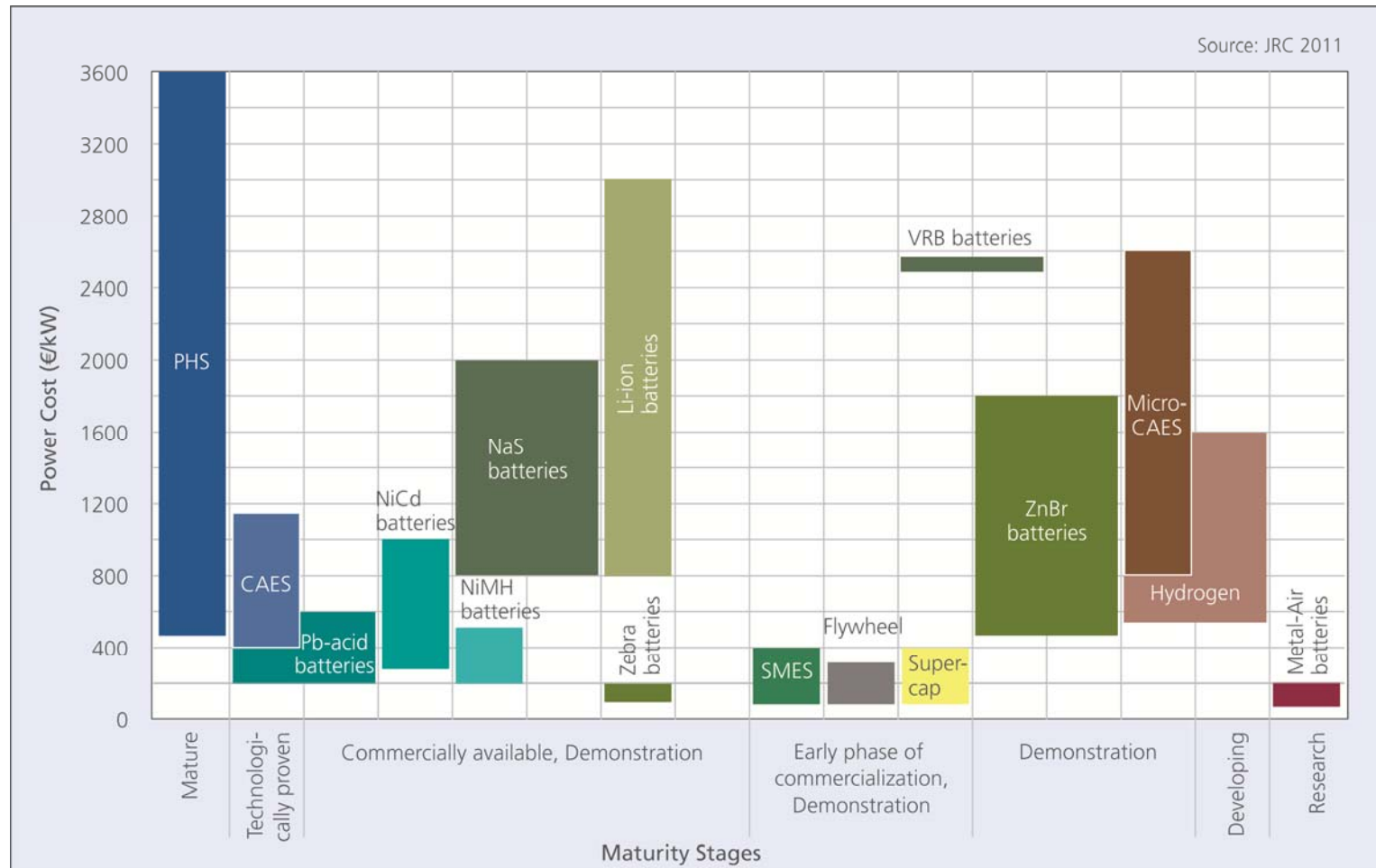
# B. Electricity Storage Technologies

## Classification of electricity storage technologies



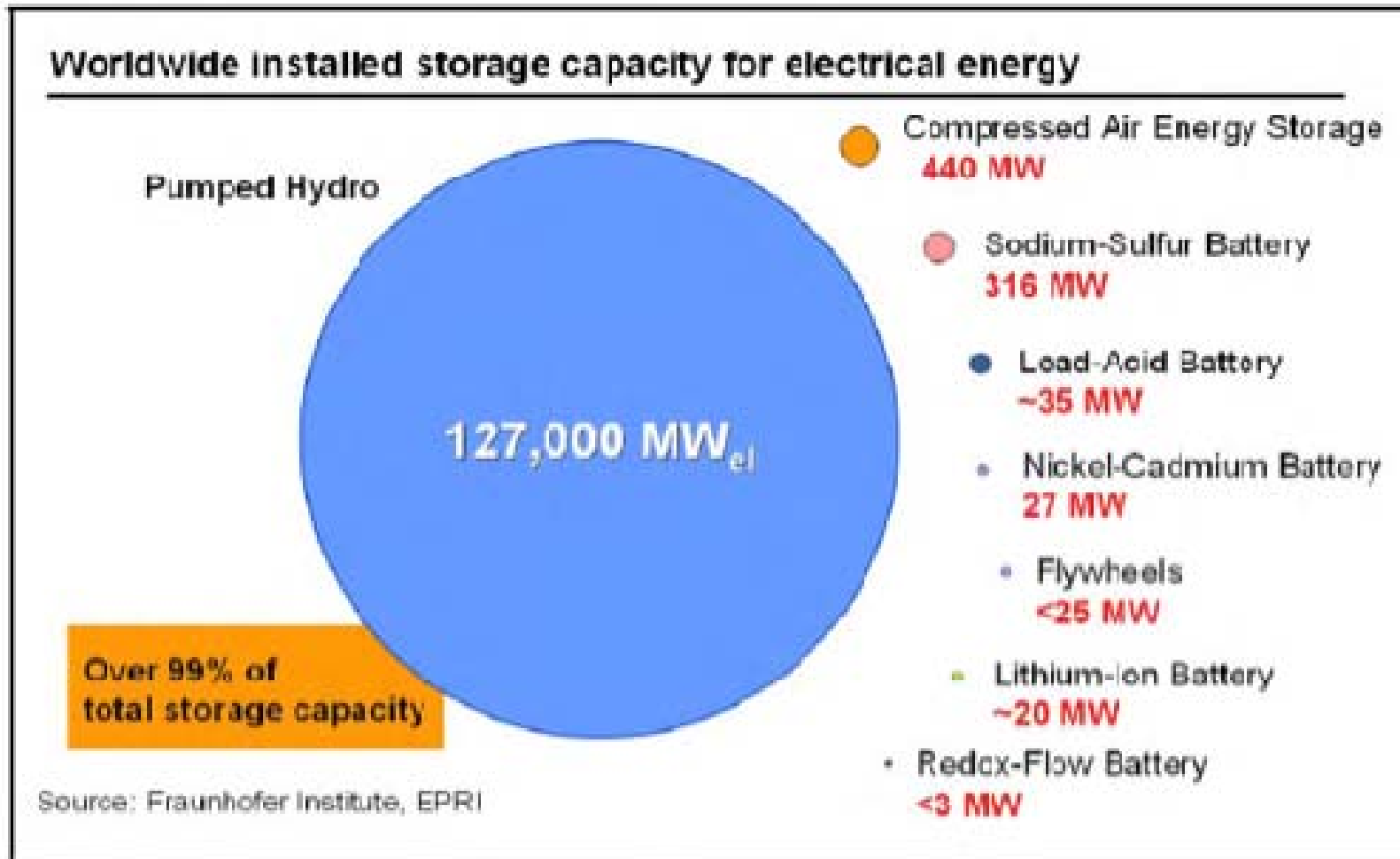
## B. Electricity Storage Technologies

### Technical Maturity of Storage Technologies



## B. Electricity Storage Technologies

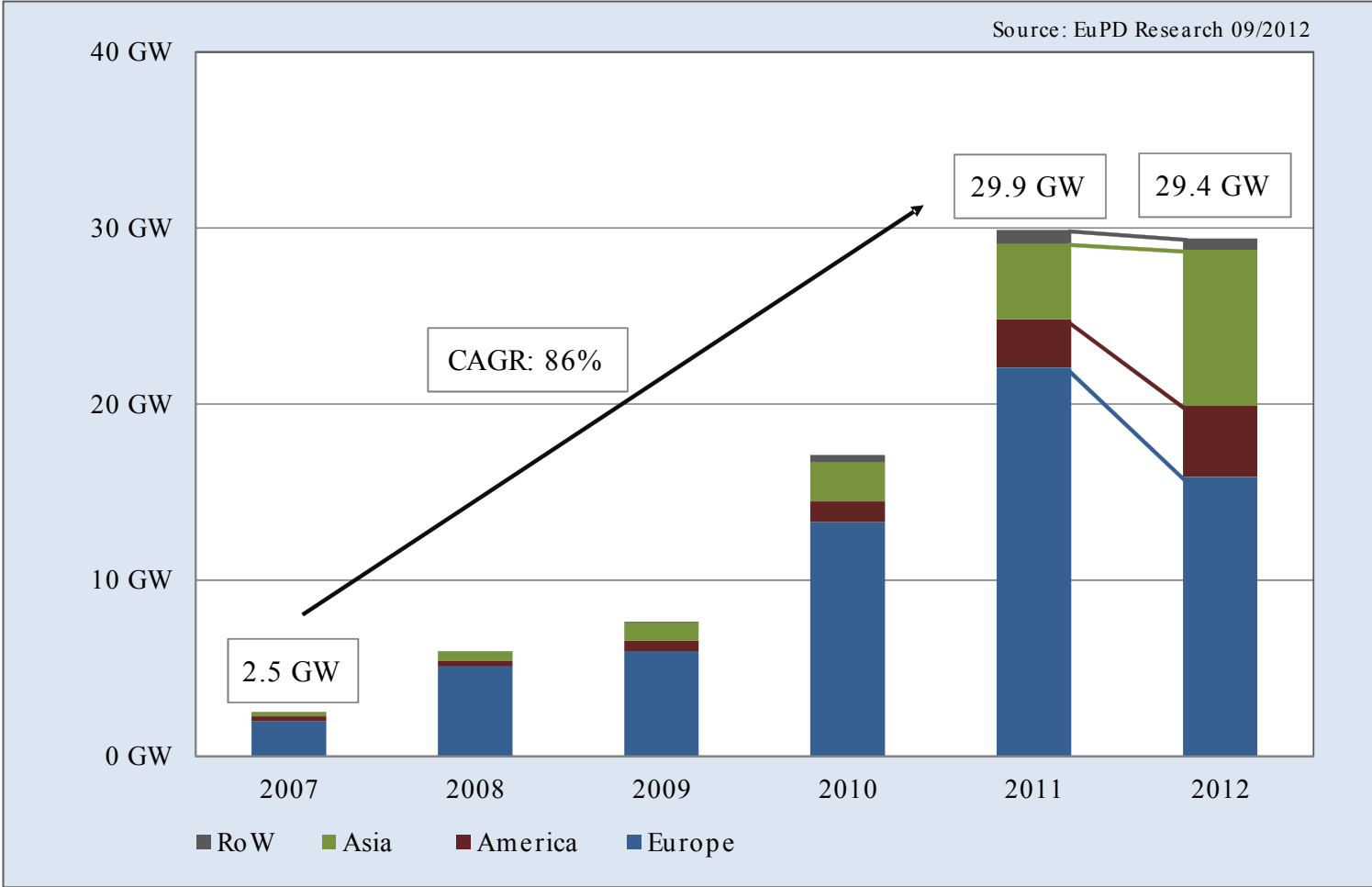
### Global Installed Electricity Storage Capacity



## C. Photovoltaics and Electricity Storage

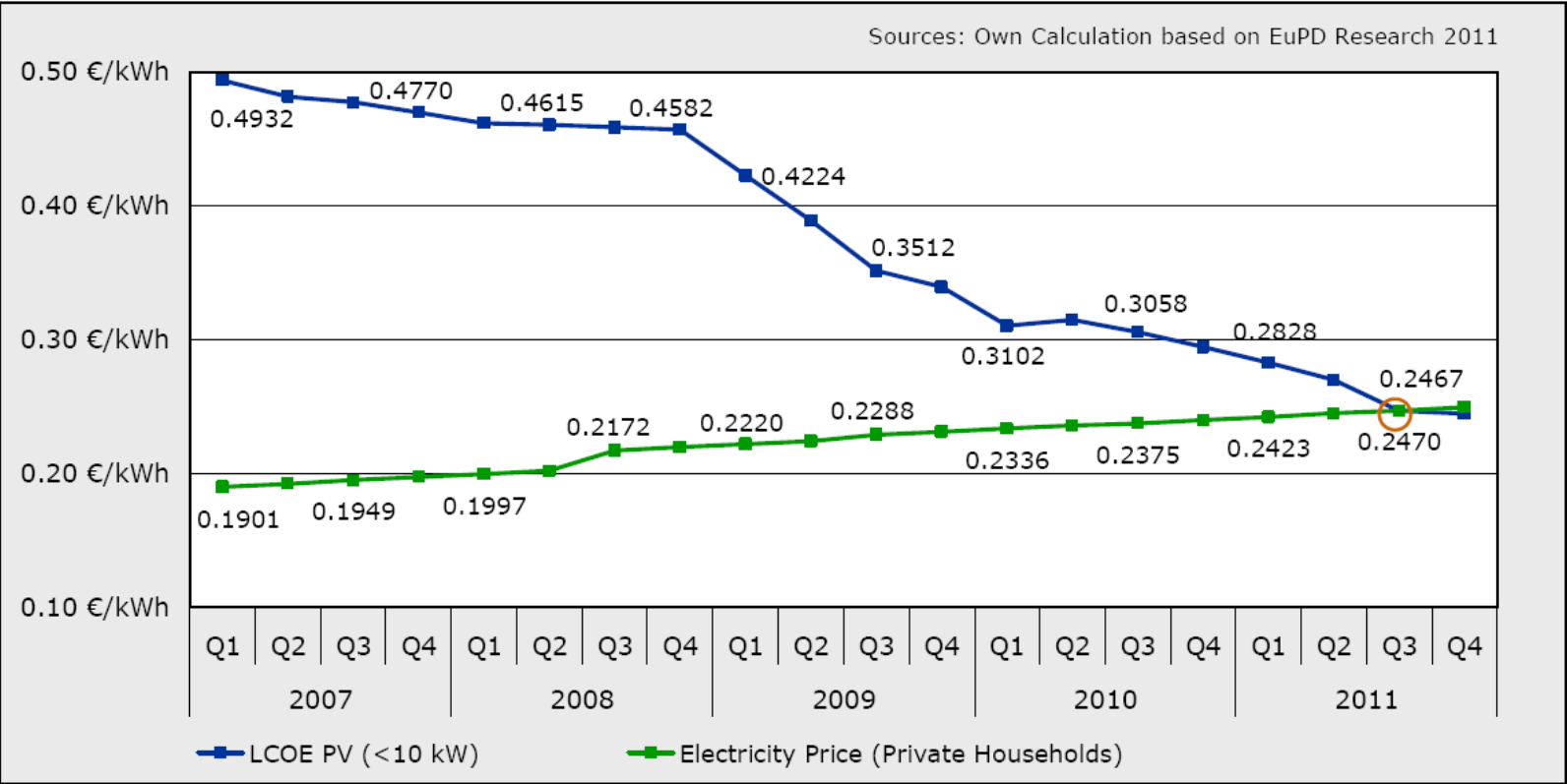
# C.Photovoltaics and Electricity Storage

## Global installed Capacity 2007 - 2012



# C. Photovoltaics and Electricity Storage

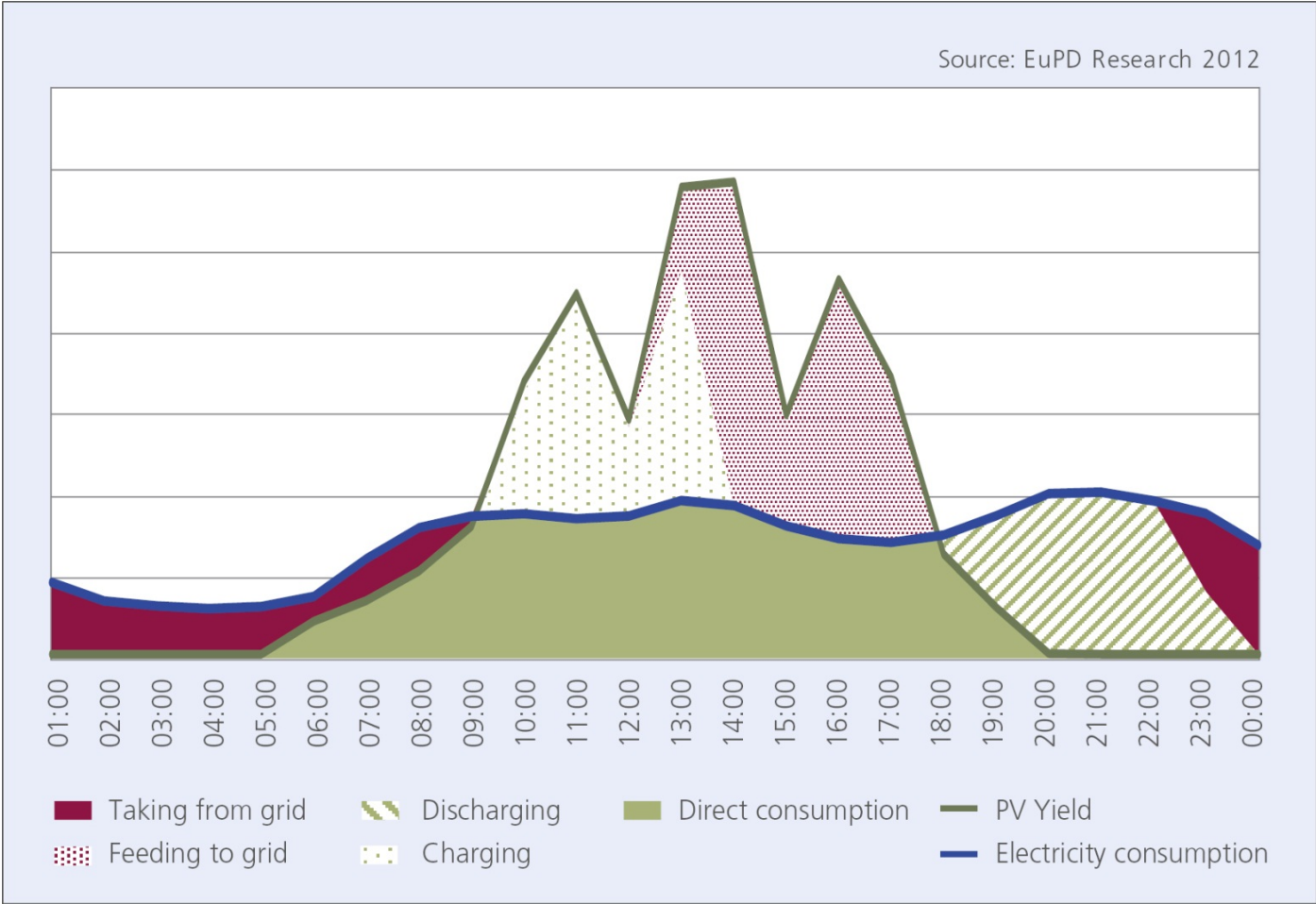
## Grid parity of photovoltaics





# C. Photovoltaics and Electricity Storage

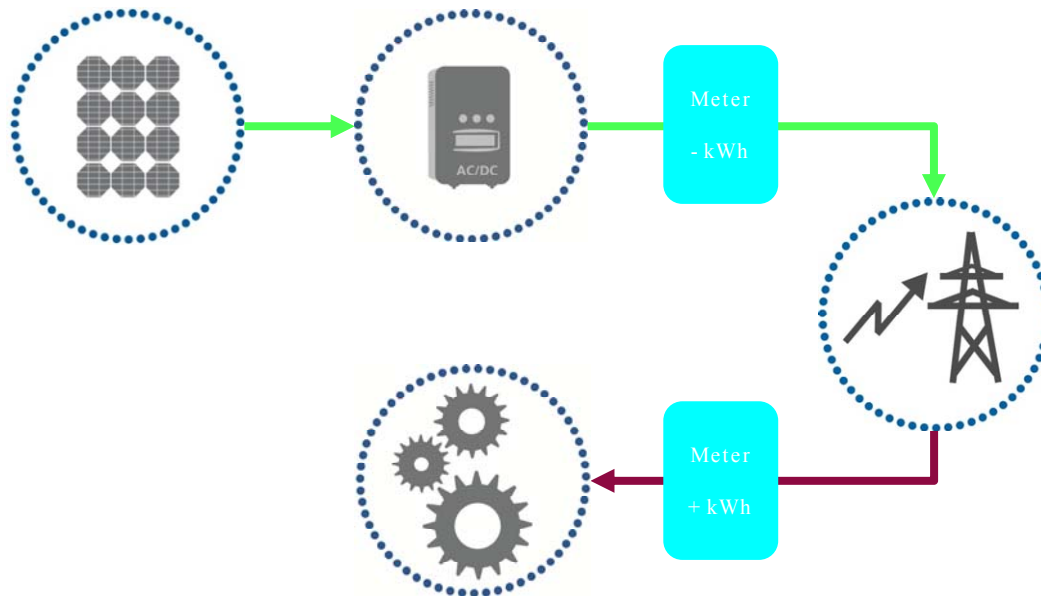
## Load Characteristics of a Household with Storage Solution



## C. Photovoltaics and Electricity Storage

---

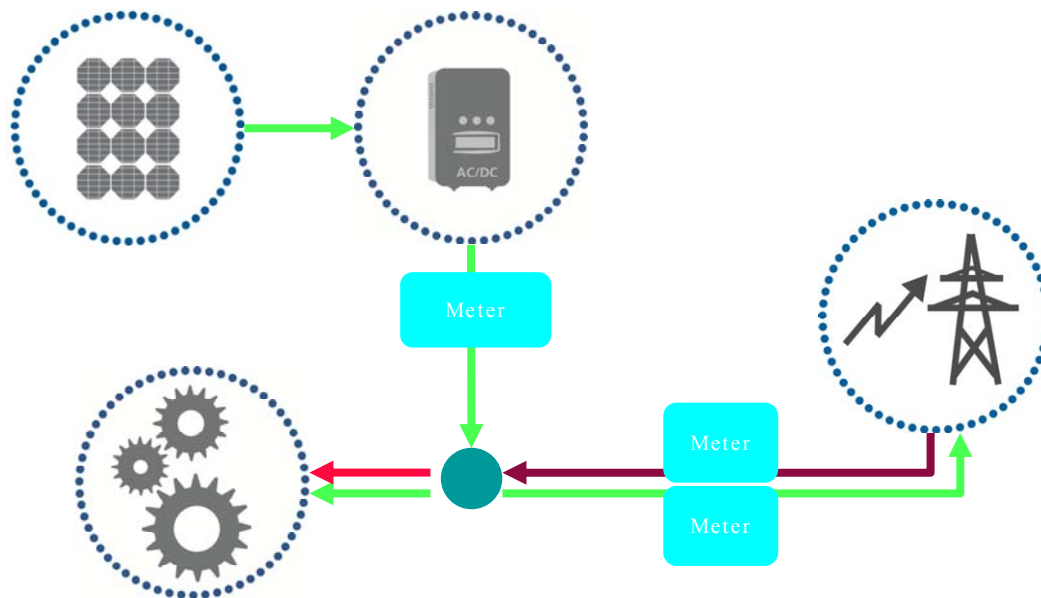
PV-systems used to feed 100% into the grid...



- System owners fed all the power to the grid.
- In return, all power consumed was retrieved from the local grid.

## C. Photovoltaics and Electricity Storage

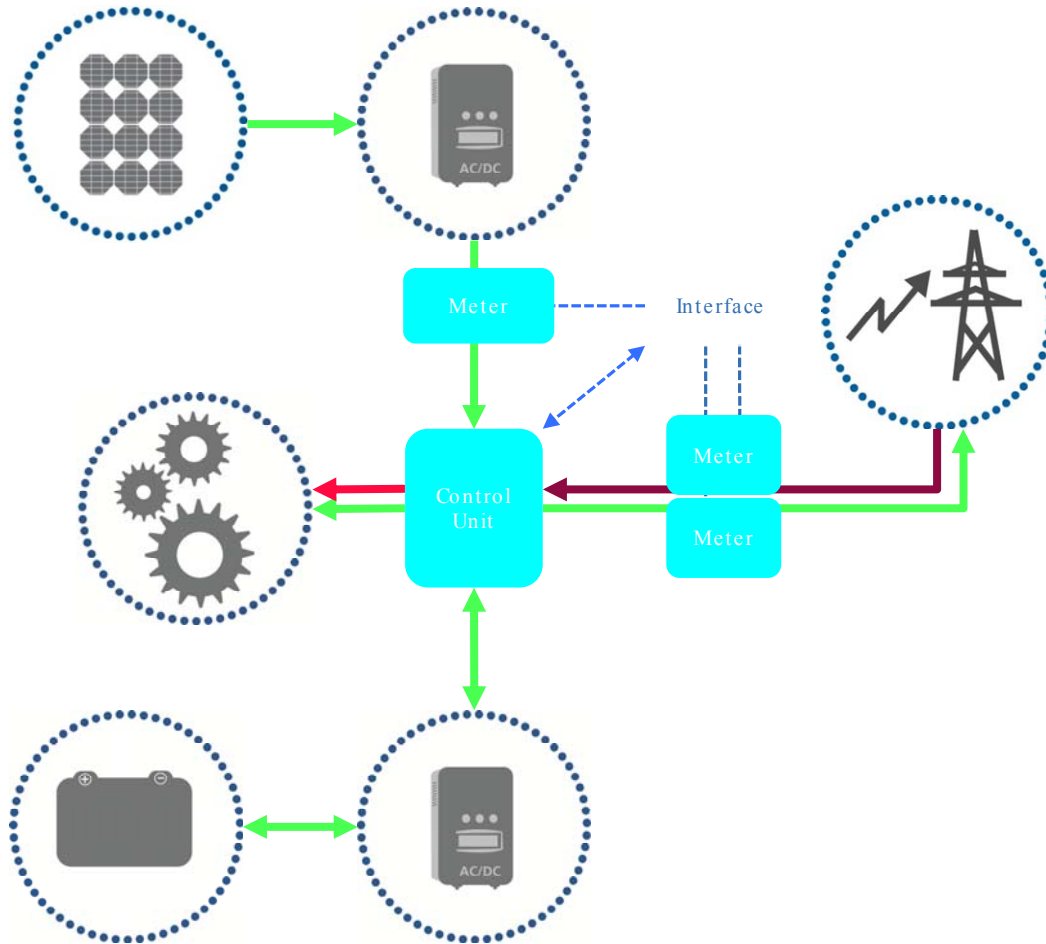
...until self-consumption was subsidized.



- Today, more than 90% of newly installed German residential systems are designed for the use of self-consumption.
- Before feeding the power into the grid, direct consumption takes place “on the premises”.

## C. Photovoltaics and Electricity Storage

Now, storage solutions will be integrated, making the system even more complex.



- Beginning today, storage solutions are added to existing and new systems.
- Additional hardware and software is required for smooth interaction of the integrated energy system with the grid and any appliances.
- This opens the window of opportunity for new entrants and solutions.

# C. Photovoltaics and Electricity Storage

## Lead-acid vs. Li-ion at a glance

Source: EuPD Research 2012

	Lead battery	Li-Ion battery
Provider	✓	✓ ✓
Lifetime	-	✓ ✓
Efficiency	✓	✓
Installation / Maintenance	-	✓ ✓
Price 2012	✓ ✓	-
Potential minimizing costs	✓	✓ ✓
Risk	-	✓
Customer image	-	✓ ✓

# C. Photovoltaics and Electricity Storage

---

Current and Future Challenges - Economic Feasibility

## General Assumptions

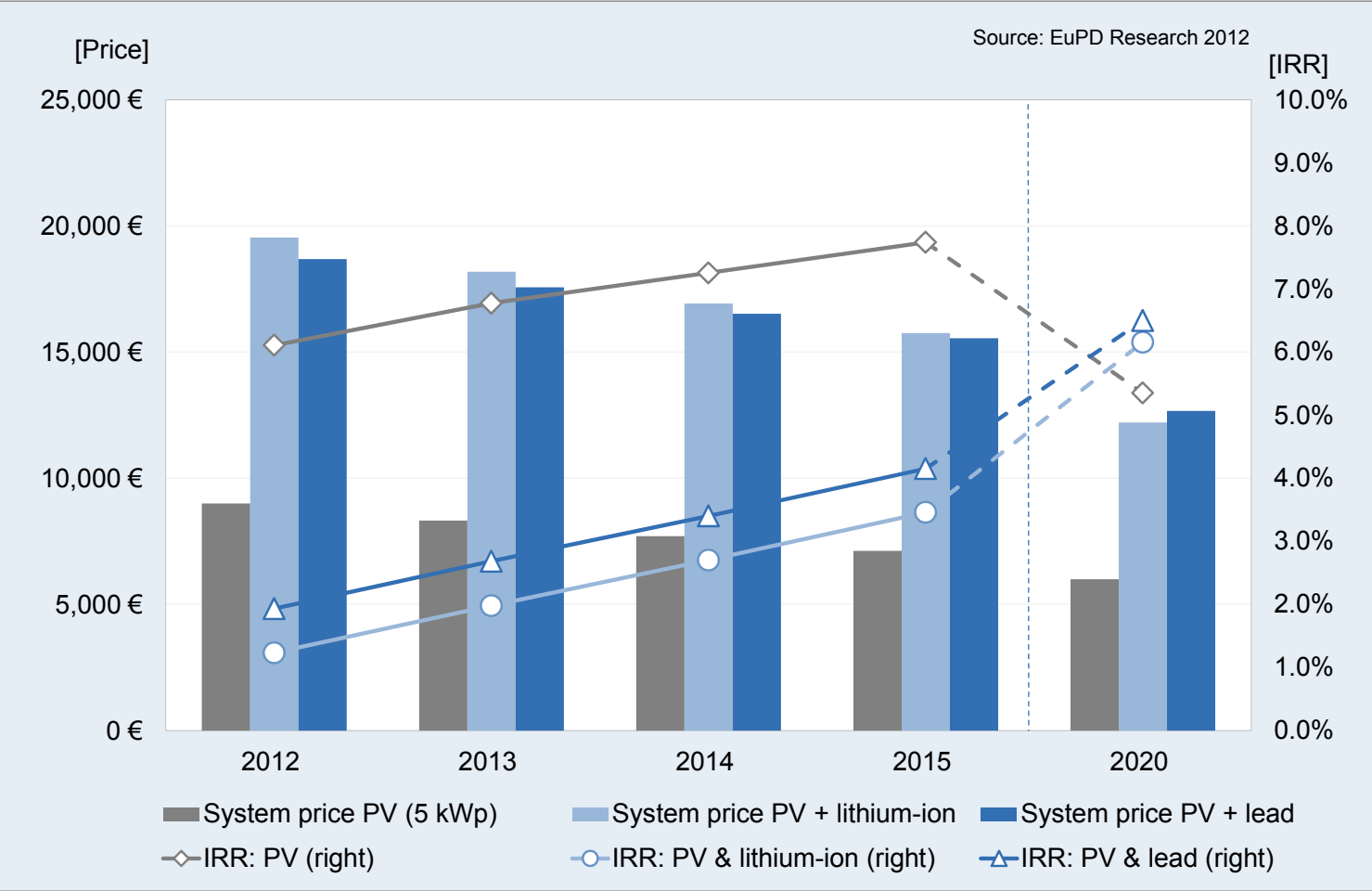
- 5 kWp PV system
- Useable battery capacity 5 kWh
- German location (997 kWh / kWp)

## Future Outlook

Near future	PV System	Lead	Lithium-Ion	Electricity Price	Further BOS
Annual price change	-7.5%	-4.0%	-8.0%	5.0%	-5.0%

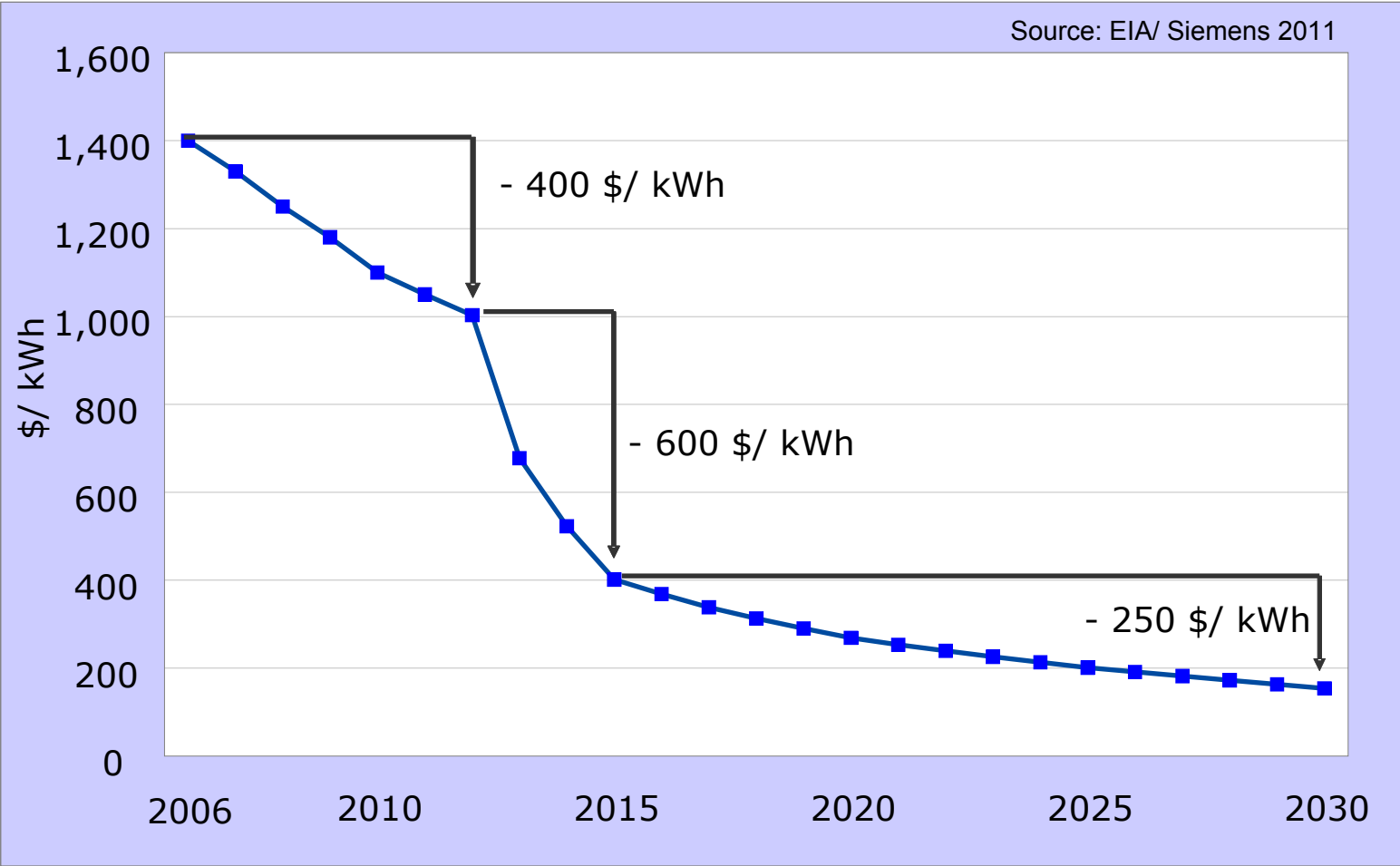
# C. Photovoltaics and Electricity Storage

## Economic Efficiency of Electricity Storage Solutions



# C. Photovoltaics and Electricity Storage

Lithium Ion Battery Price Trends





## C. Photovoltaics and Electricity Storage

### Drivers and Barriers

	Driver	Barrier
<b>State level</b>	<ul style="list-style-type: none"> <li>- support of renewable energies</li> <li>- decentralised electricity generation</li> <li>- imminent end of feed-in tariffs for PV</li> <li>- weak electricity grids</li> </ul>	<ul style="list-style-type: none"> <li>- new support scheme required</li> <li>- empty public treasuries</li> </ul>
<b>Corporate level</b>	<ul style="list-style-type: none"> <li>- new business models</li> <li>- new sales opportunities</li> <li>- ongoing expansion of renewable energies</li> <li>- economies of scale/ further price reduction</li> </ul>	<ul style="list-style-type: none"> <li>- high competitive pressure</li> <li>- limited battery efficiency</li> <li>- limited battery charging cycles</li> <li>- missing experiences</li> </ul>
<b>Facility operator</b>	<ul style="list-style-type: none"> <li>- growing independency from public grid</li> <li>- higher reliable power supply</li> <li>- utilization of price fluctuations on the spot market</li> <li>- rising fuel prices</li> <li>- positive image</li> </ul>	<ul style="list-style-type: none"> <li>- high investment costs</li> <li>- limited lifetime</li> <li>- replacement costs</li> <li>- no experience</li> </ul>

---

Thank you for your attention.

Martin Ammon  
martinammon@gmx.de