

Trends of Stationary Battery Storage Systems in Germany – A Database Analysis

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Strommarkttreffen „Batterien: Kostenentwicklung, Technologien, Anwendungen“
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Introduction

- Increasing number of large scale stationary battery projects worldwide

Selected projects:



100 MW / 129 MWh, Hornsdale Power Reserve, Australia

Source: <https://hornsdalespowerreserve.com.au/>



16 MW / 6 MWh, Shin-Chungju Substation, South Korea

Source: Kokam, Ike Inkwan Hong, 2015



48 MW / 50 MWh, EnspireME, Jardelund, Germany

Source: EnecoGroup, 2018



Build-up of a battery project database for Germany as a basis for evaluation of market development, technology trends and techno-economic data

The Battery Storage Database

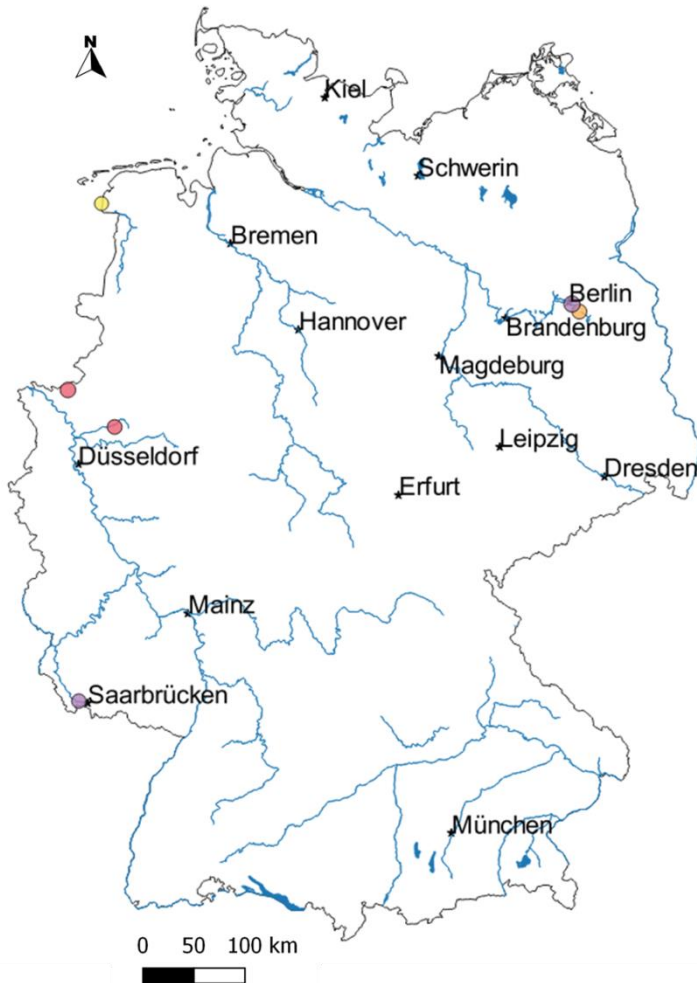
- Contains information about large scale stationary battery storage systems in Germany (without PV home storage systems for private households)
- Continuously updated regarding battery storage systems which are decommissioned, in operation or planned
- Includes more than 140 projects (Status: July 2018) of which 59 projects with a system size of ≥ 1 MW and/or ≥ 1 MWh have been considered in the present analysis
- From the selected 59 projects, 50 projects are classified as commercial projects and 9 as research and development projects
- Sources include scientific as well as non-scientific literature, company information, web-sites and personal communications

Overview of data categories

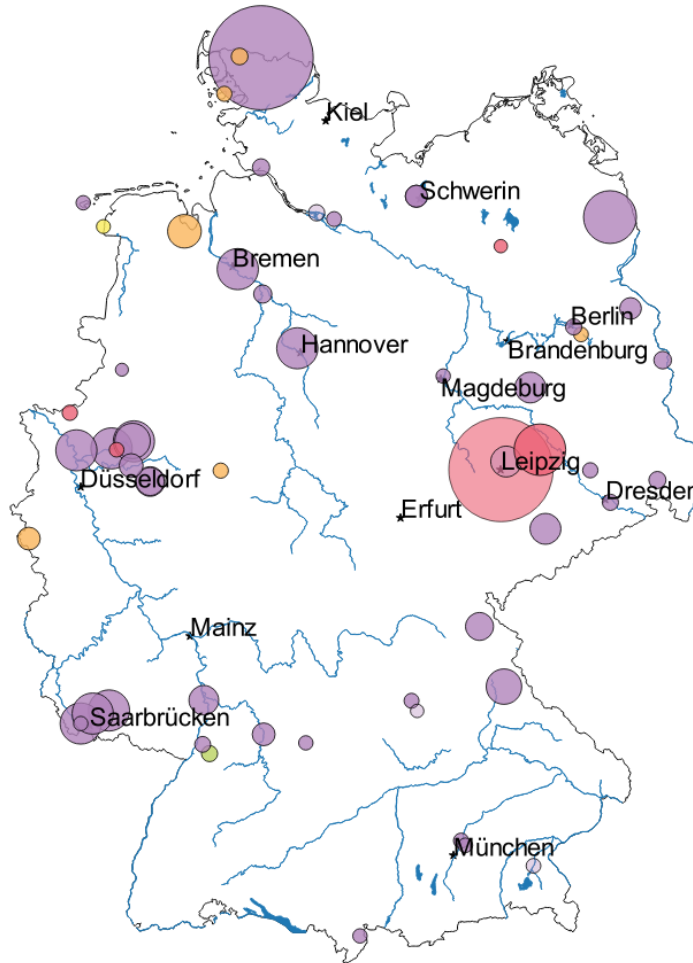
Location	Power	Capacity	Operator	Cell chemistry	System integrator	Cell manufacturer
Commissioning date	Application field	Classification (Commercial/R&D)	Investment	Lifetime	Notes	Sources

Locations of Stationary Battery Storage Systems in Germany

2012



2018



Battery type

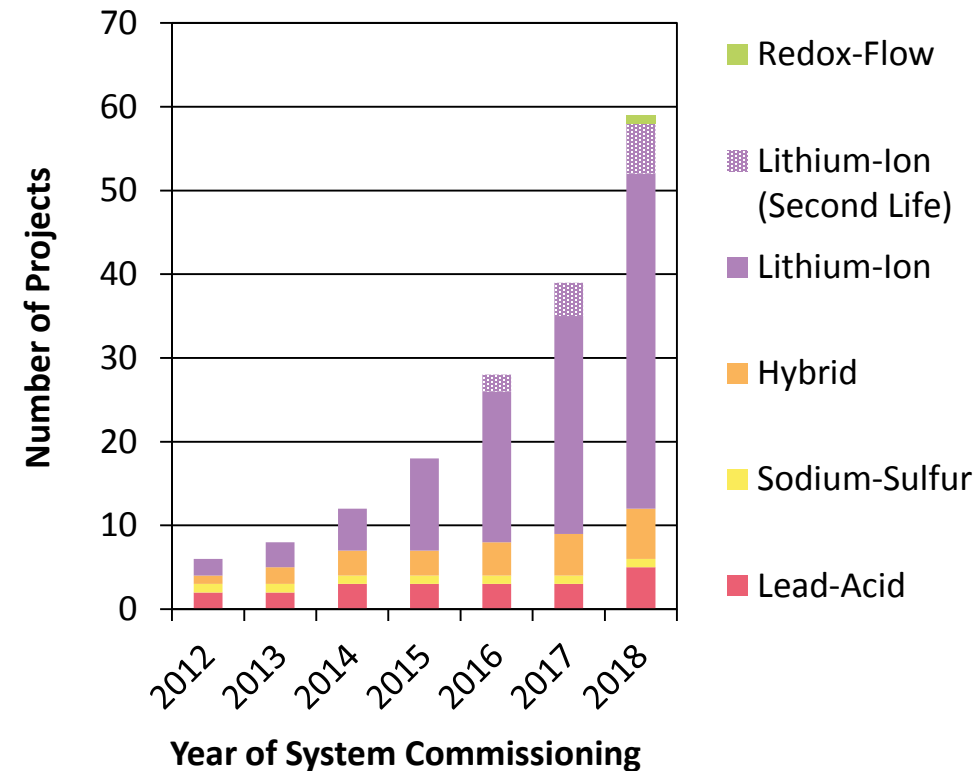
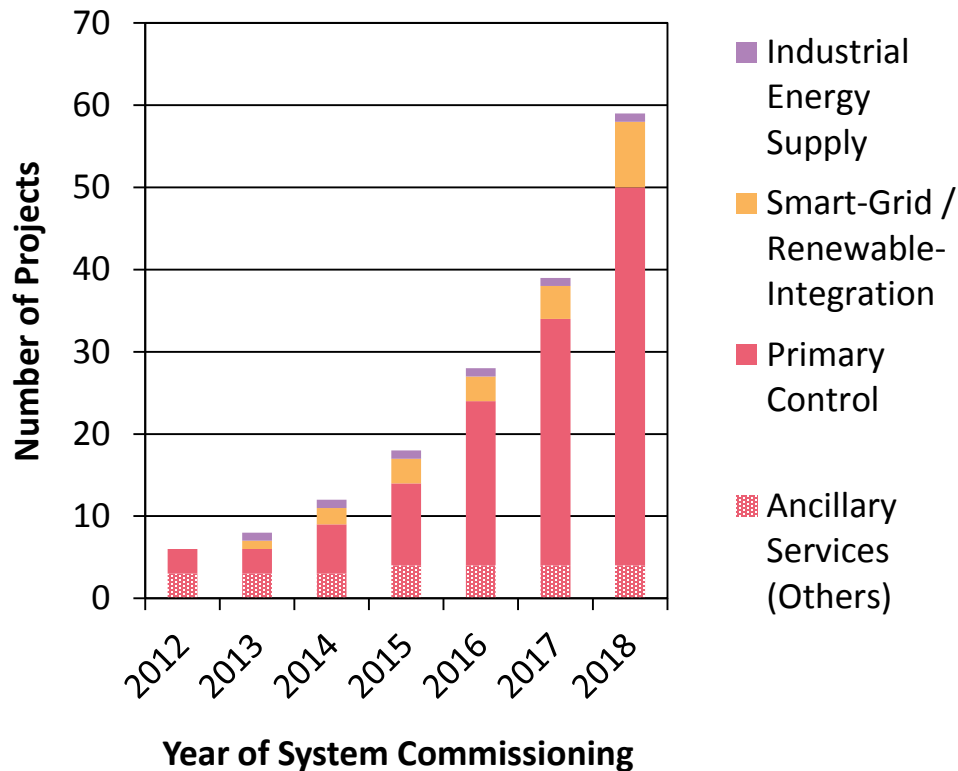
- Redox-Flow
- Lithium-Ion (Second Life)
- Lithium-Ion
- Hybrid
- Sodium-Sulfur
- Lead-Acid

Battery power

- 5 MW
- 50 MW

2018 projects partly under construction

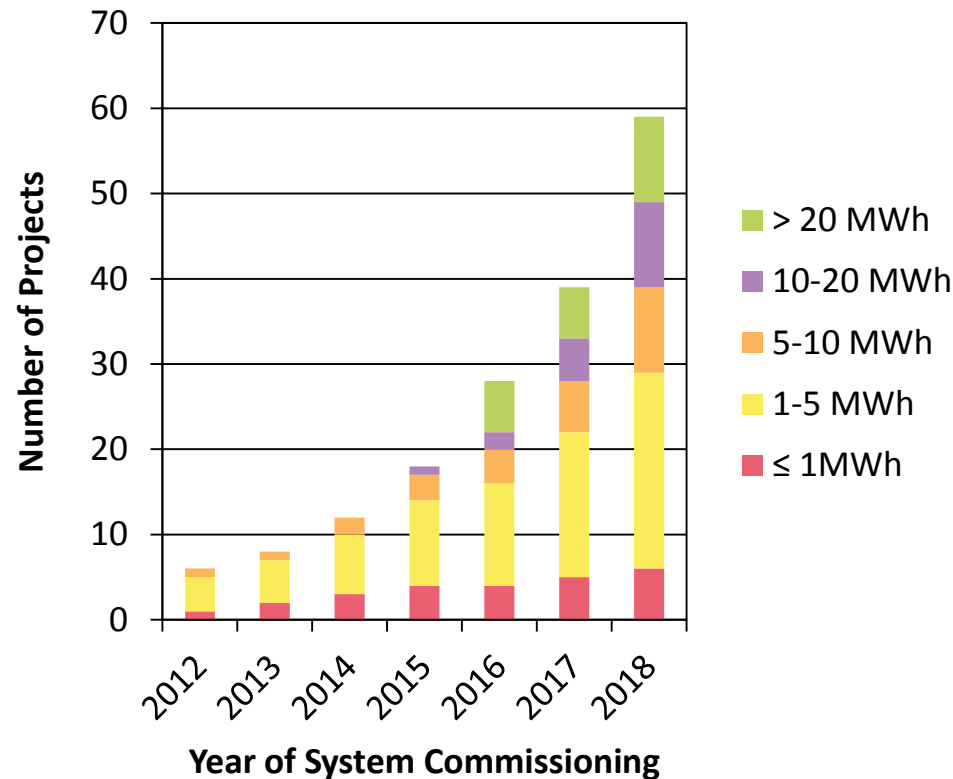
Development of Battery Projects



Hybrid systems (2018): 2 x Li-ion + Redox-Flow, 2 x Li-ion + Lead-Acid, 2 x Li-ion + Sodium-Sulfur

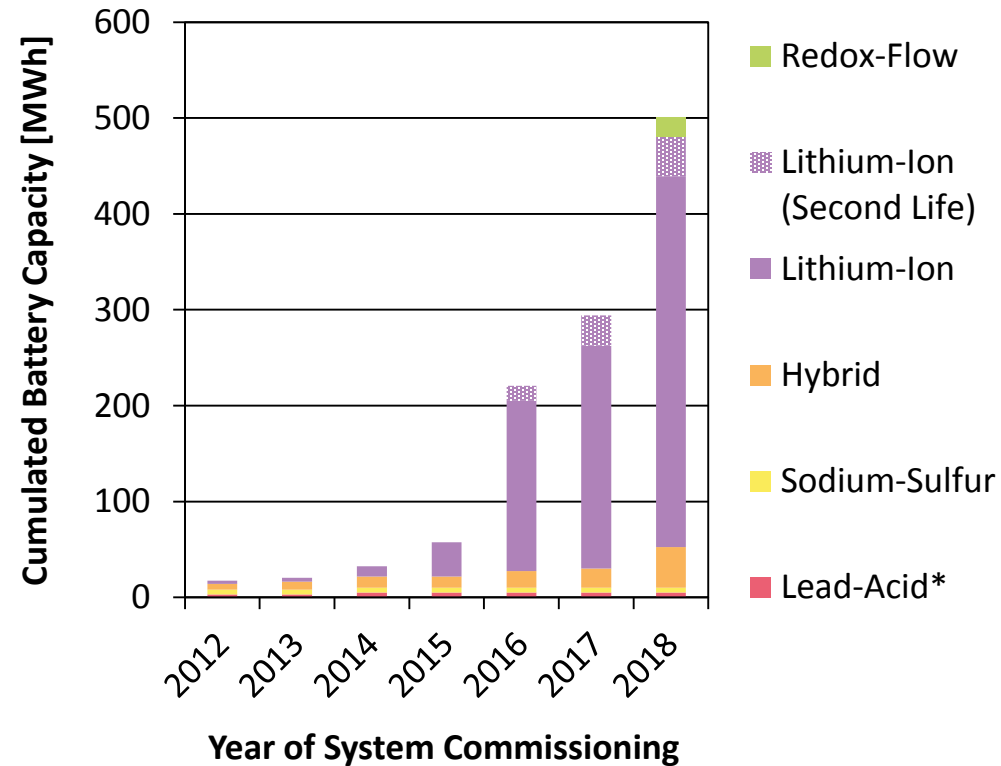
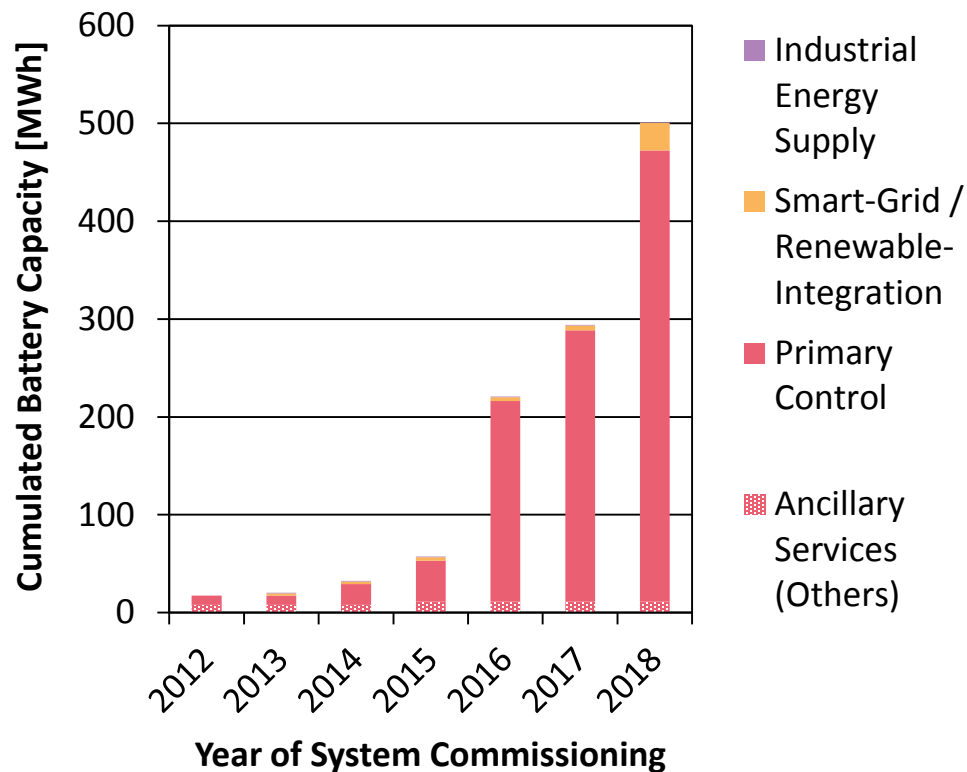
- Increasing number of battery projects (2012: 6 projects -> 2018: 59 projects)
- Main application field: provision of primary control power
- Most projects are based on Lithium-Ion cell chemistry

Development of Battery Projects



- Most battery projects are realized in the segment 1-5 MWh (2018: 23 out of 59 projects)
- Trend towards larger projects (> 5 MWh up to > 20 MWh) from 2016 on
- Largest project (single location): 50 MWh (2018)

Development of Cumulated Battery Storage Capacity

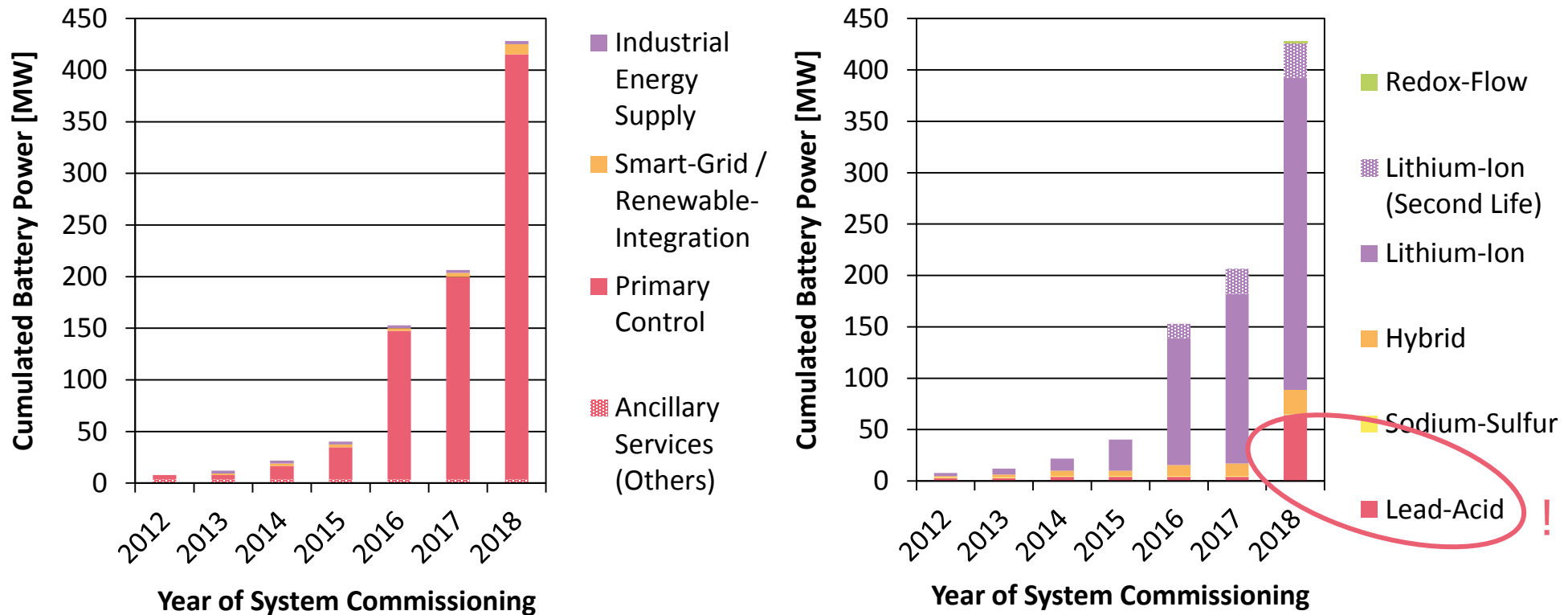


*: Missing Data for 2018 Lead-Acid Projects

- Cumulated battery storage capacity (2018) sums up to approx. 0.5 GWh (Pumped hydro power Germany 2018 approx. 38.5 GWh [1])
- Lithium-Ion is the dominant cell chemistry regarding the installed capacity

[1] Stenzel, P. et al., Energiespeicher, BWK, 5, 2018

Development of Cumulated Battery Power



- Cumulated battery power (2018) sums up to approx. 430 MW (Pumped hydro power Germany 2018 approx. 6,225 MW [1])
- Cumulated battery power for primary control approx. 400 MW (after system commissioning of all 2018 projects; Primary control tender Germany: 620 MW [2])

[1] Stenzel, P. et al., Energiespeicher, BWK, 5, 2018; [2] www.regelleistung.net, 09.07.2018

Prequalified Power for Ancillary Services in Germany (June 2018)

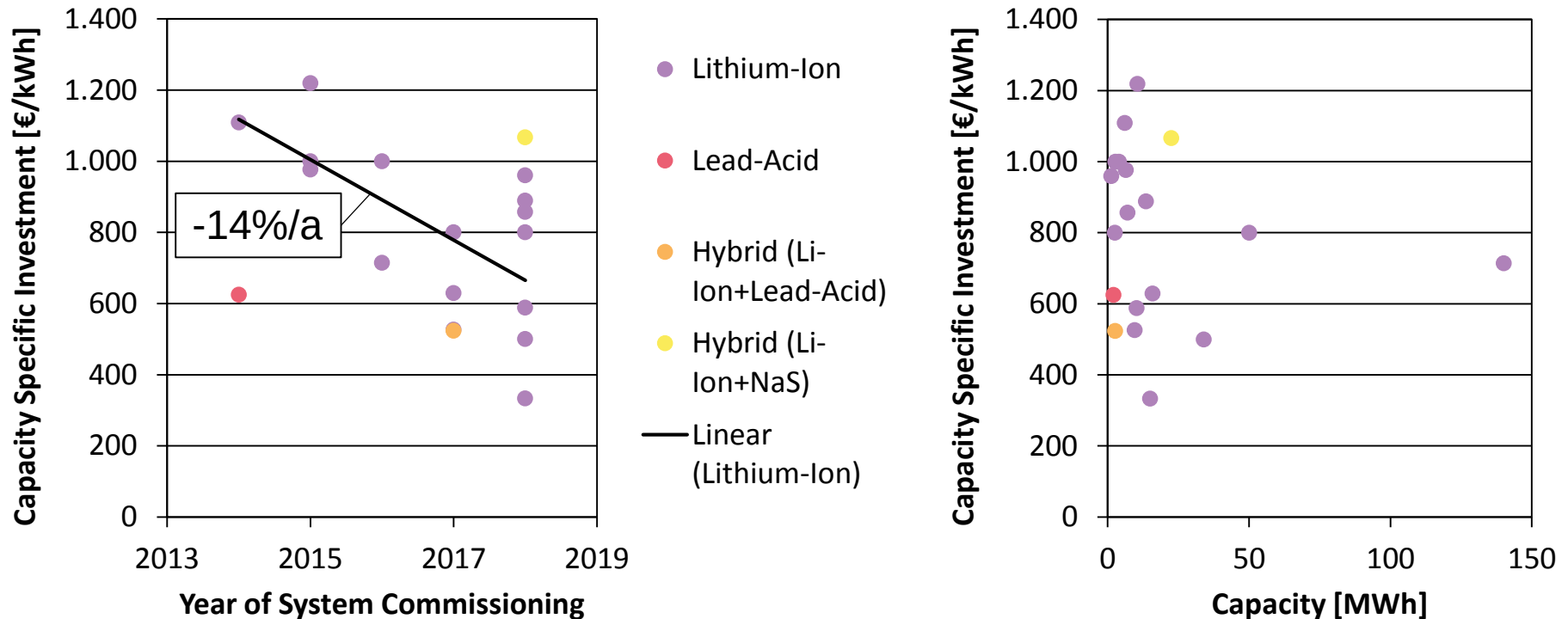
Technologie	PRL	SRL+	SRL-	MRL+	MRL-
Kernenergie	0,50	0,42	0,42	2,04	2,04
Braunkohle	0,67	1,24	1,24	5,11	5,15
Steinkohle	0,69	1,56	1,56	5,19	4,98
Gas	0,23	2,99	3,03	8,58	8,27
Öl	0,00	0,31	0,02	2,03	0,14
Biogas/-masse	0,02	1,41	1,78	1,68	2,27
Wasser	3,08	13,93	13,76	14,94	15,04
Batteriespeicher	0,23	0,00	0,00	0,00	0,00
Nachfrage/DSM	0,07	0,51	0,61	0,78	0,69
Windkraft	0,00	0,00	0,00	0,00	0,09
Sonstige	0,00	0,05	0,08	0,21	0,50
Summe (in GW)	5,44	22,42	22,50	40,56	39,17

Übersicht der Präqualifizierten Leistung (in GW) je Primärenergieträger/Kategorie in Deutschland

Quelle: www.regelleistung.net, 17.07.2018

Development of Battery Capacity Specific Investment

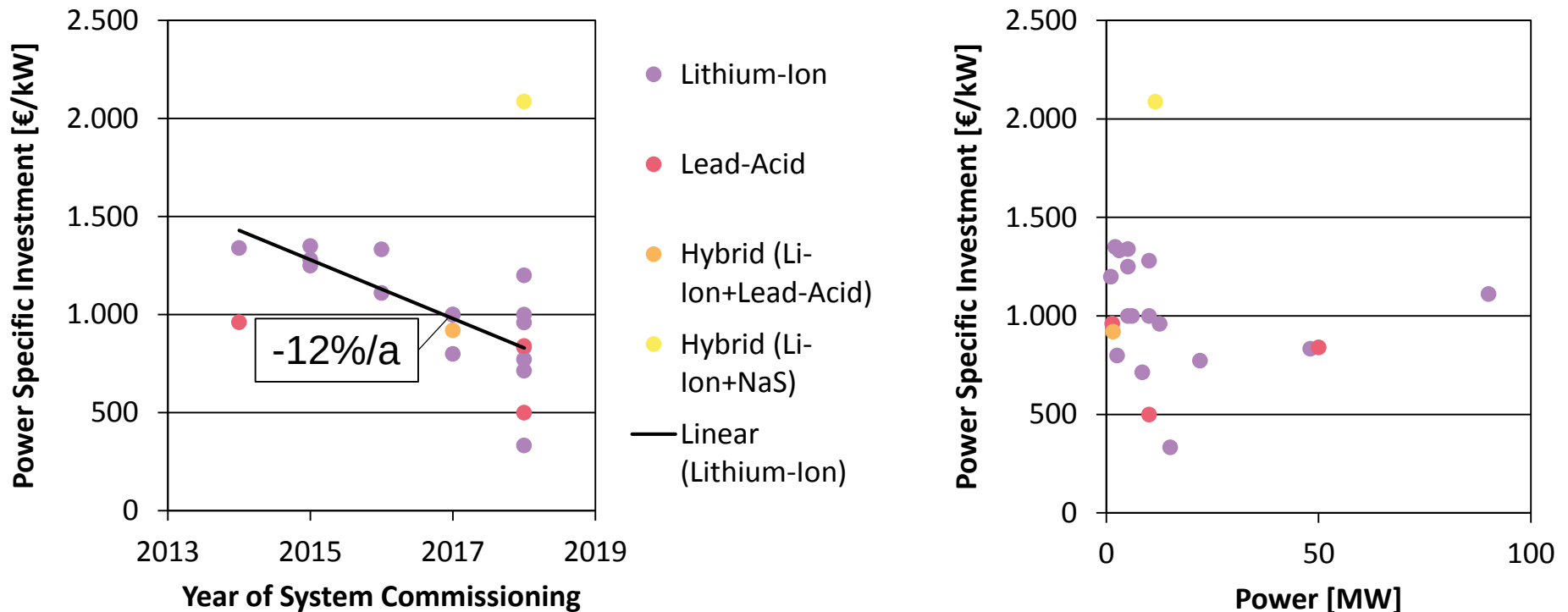
Capacity specific Investment = Total investment per storage capacity



- Rapidly falling capacity specific investment (-14%/a) with Lithium-Ion batteries setting the benchmark
- No clear correlation of investment with increasing storage capacity
- Large investment bandwidth for comparable system size (storage capacity)

Development of Battery Power Specific Investment

Power specific Investment = Total investment per battery power (nominal power)



- Rapidly falling power specific investment (-12%/a) with Lithium-Ion batteries setting the benchmark
- Power specific investment of Lead-Acid batteries (2018) are in the same order of magnitude compared to Lithium-Ion batteries - **Lifetime?!**

Thank You for Your Attention

Contact

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Related Publications

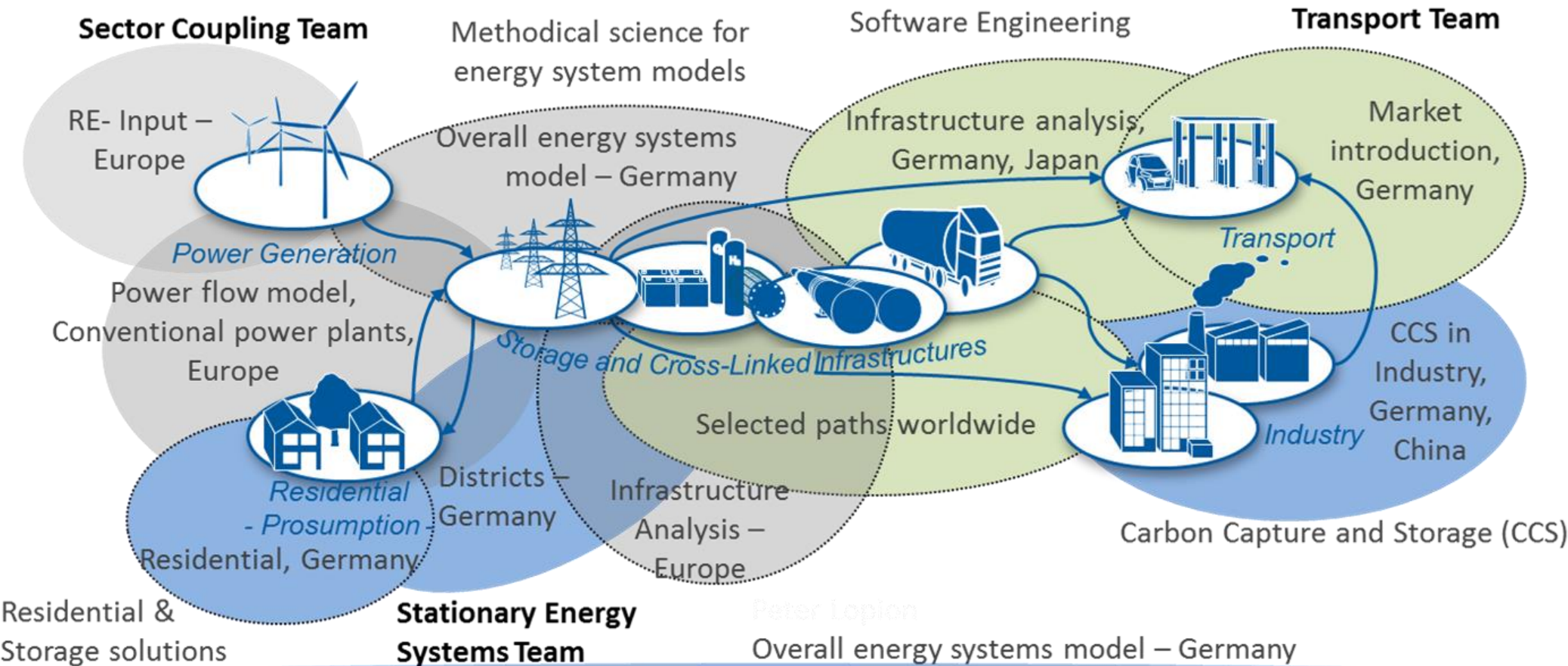
Jahresübersicht Energiespeicher 2018

https://www.researchgate.net/publication/325226016_Energiespeicher

Pumped Hydro Power Plant Database Germany (Status April 2018):

https://www.researchgate.net/publication/325335787_Kraftwerkdatenbank_PSW_Deutschland_April_2018

Research Topics within the Process and Systems Analysis Group



Web: http://www.fz-juelich.de/iek/iek-3/DE/Forschung/_Process-and-System-Analysis/_node.html