TECHNOLOGY FACTSHEET



	arge-scale Temporal	Electricity	y Storage								
Date of factsheet	2-8-2021										
Author	Sam Lamboo										
Sector	Electricity generation										
ETS / Non-ETS	Non-ETS										
Type of Technology	Storage										
Description	Lithium-ion (Li-I) batteries store electricity through a reversible chemical reaction. The basic components are a container, electrodes, and an electrolyte. By loading the battery, the									battery, the	
	electricity is transformed into chemical energy, while during discharge, electrochemical reactions occur at the two electrodes generating a flow of electrons through an external circuit (DNV KEMA, 2013).										
	Li-ion batteries can be used for a variety of applications in large-scale energy storage such as frequency regulation, temporal storage, and integrating renewables into the grid (making them more dispatchable). This factsheet focuses on long-term electricity storage applications with high energy capacity and discharge times of over 1 hour.										
TRL level 2020	TRL 9										Constanting and
	Li-ion batteries are one of the most used technologies for electrochemical electricity storage (IRENA, 2015) and have in recent years become the most installed battery for stationary applications (JRC, 2018; Kessel et al., 2017).										for stationary
TECHNICAL DIMENSIONS		/ - /									
	Functional Unit	Value and Range									
Capacity	kWh						240,000.00)	1		
	Global			240,000.00			- 2030			240,000.00)
Potential				N/A			-			-	
			-	-	-	Min	-	Max	Min	-	Max
Market share	Global utility scale electricity	%		See explanation			-			-	
Canacity utilization factor	storage		-	-	-	Min	-	Мах	Min	-	Max
Full-load running hours per vear									1.00		
Unit of Activity	PJ/year										
Technical lifetime (years)	15 years (Cole and Frazier, 2020). 2	00-2,000 cycles	s (ADB, 2018)								
Progress ratio	70% (JRC, 2014)										
Hourly profile	No				(5) 1	2010)					
	The potential for all battery types is comes to potential installed capacit 99% market share (Kessels et al., 20 is not included in the data set beca storage is not yet clear.	s high as there a cy. As of 2016, L 117). From the l use it covers all	are no significa Li-ion batteries battery energy utility-scale sto	nt space or resourc have 0.6% of the u storage systems, L prage applications	tility-scale of tility-scale of i-ion is the of (both temp	ts, instead the electricity stor dominant tech oral and powe	e demand for s age market sha nology with a er applications)	torage and cost are at 829 MW, market share of and the market	s are usually de which is domir 565% (Kessel e t share of Li-ior	etermining fact nated by pump et al., 2017). Th n batteries for	tors when it oed hydro at he market share temporal
COSTS Year of Euro Investment costs Other costs per year Fixed operational costs per year (excl. fuel costs) Variable costs per year	Reports on lifetime vary from 5-20 v from 0-20,000 cycles depending on currently the most commonly used 2015 Euro per Functional U € / kWh € / kWh € / kWh Investment costs are based on 4-ho 67-501 €/kWh in 2030. Cole and Fra McKinsey (2015). Li-ion batteries ar to the rapid development of Li-ion I	years (Cole and the chemistry for s chemistry for s nit our utility scale azier (2020) dra e experiencing patteries, the o	Frazier, 2020; I of the Li-ion ba stationary applie 258.00 <i>Min</i> 6.45 - (60 MWe) Li-ion w from various rapid developm Ider sources ha	EA-ETSAP & IRENA ttery (IRENA, 2017 cations. Current 312.00 - - 7.80 - 7.80 - n batteries (Cole all recently published nent and detailed of ve not been includ	A, 2012). A n). The reference 323.00 Max 8.08 2.61 nd Frazier, 2 d sources. The cost breakd led in the rational second	nedian of 15 ye ence chemistry 122.00 <i>Min</i> 1.71 - 2020). IRENA (2 he investment owns can be s anges given he	ears has been y used here for 2030 176.00 - - 2.46 - 2.46 - - 2017) give larg costs are com care and diffic re.	used here (Cole r cycle lifetime is 247.00 <u>Max</u> 3.46 2.61 er ranges for inv parable to othe ult to obtain due	& Frazier, 2020 s Lithium Iron F 74.00 <i>Min</i> 1.04 - vestment costs r (older) source e to confidentia	D). Cycle lifetin Phosfate (LiFeF 2050 132.00 - - - 1.85 - - - : 175-733 €/kW es such as JRC ality issues (IRI	me reports vary 204 or LFP), 185.00 <i>Max</i> 2.59 2.61 Wh in 2016 and (2014) and ENA, 2017). Due
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EMISSIONS (Non-fuel/energy-related emissions or emissions reductions (e.g. CCS)												
	Substance	Unit	Current				2030		2050			
				-			-			-		
Emissions			Min	-	Мах	Min	-	Max	Min	-	Max	
				-			-	-		-	-	
			Min	_	Мах	Min	-	Max	Min	-	Max	
				-			-	-		-		
			Min	-	Max	Min	_	Max	Min	-	Max	
				-			-			-		
			Min	-	Max	Min	_	Max	Min	-	Max	
Emissions explanation												
OTHER												
Parameter	er Unit			Current			2030			2050		
Depth of discharge	%			80.00			-	-		-	_	
	,,, 		80.00	-	80.00	Min	-	Max	Min	-	Max	
Charge time	Hours			2.50			-			-		
		10013		-	4.00	Min	-	Max	Min	-	Max	
Discharge time Hours	Hours			2.50			-			-		
			1.00	-	4.00	Min	-	Max	Min	-	Max	
Self discharge	% / month			5.00			-	T		-	I	
			1.50	_	6.00	Min	-	Max	Min	-	Max	
xplanation Charge and discharge times are own estimations based on literature. JRC (2014) states that minimum time necessary to charge a unit is approximately 6 minutes.												
REFERENCES AND SOURCES												
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2 IRENA (2015) - Renewables and Electricity Storage: a technology roadmap for REmap 2030												
3 JRC (2014) - Energy Technology Referency Indicator (ETRI) projections for 2010-2050												
4 Fu, R., Remo, T. and Margolis, R. (2018) - U.S. Utility-Scale Photovoltaics-Plus-Energy Storage System Costs Benchmark												
5 Cole, W. and Frazier, A. W. (2020) - Cost Projections for Utility-Scale Battery Storage: 2020 Update												
6 IEA-ETSAP & IRENA (2012) - Electricity storage technology brief												
7 SANDIA (2019) - SANDIA Energy S	Storage Database accessed on Janua	ary 18th 2019 (h	ttp://energysto	rageexchange	.org/)							
8 Lyon projects (2019) - List of projects accessed on 29-04-2019 (https://www.lyoninfrastructure.com.au/projects/)												
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11 Sauer et al. (2007). Detailed cost calculations for stationary battery storage systems. Second International Renewable Energy Storage Conference (IRES II) Bonn, 1921.11.2007												
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