## TECHNOLOGY FACTSHEET



LITHIUM-ION BATTERY F	OR POWER APPLICAT	ΓΙΟΝS									
Date of factsheet Author	29-4-2019 Sam Lamboo										
Sector	Electricity generation										
TS / Non-ETS	Non-ETS										
ype of Technology	Storage		h o novonsiblo o	h a miaal yaa atia	n The basis of				n alantualuta (		hattan, the
Description	Lithium-ion (Li-ion) batteries store electricity is transformed into che (DNV KEMA 2013). Li-ion batterie the grid (making them more dispa	mical energy, whil s can be used for a	e during discha variety of appl	irge, electroche lications in large	mical reactions -scale energy s	occur at the t storage such as	wo electrodes frequency reg	generating a flo gulation, tempor	w of electrons al storage and	through an e integrating r	xternal circuit
RL level 2020	TRL 9 Li-ion batteries are one of the mo demonstration stage of technolog automotive industry), leads to the	gical development	(JRC ETRI 2014)	), but the recent	rapid develop	ment of Li-ion	storage techn	ology (including			
ECHNICAL DIMENSIONS											
Capacity	Functional Unit kW						Value and Rar 2,000	ige			
				1,000			-			20,000	)
Potential	Global	GWe		Current N/A			2030			2050	
/larket share		%	-	– See explanatior	-	Min	-	Max	Min	-	Max
		,,,	-	-	-	Min	-	Max	Min	_	Max
Capacity utlization factor Full-load running hours per year											
Init of Activity	PJ/year										
echnical lifetime (years) rogress ratio								10 years (JRC E	ETRI, 2014). Up		cles (IRENA, 20 9% (JRC ETRI, 2
lourly profile xplanation	No kW is used as functional unit beca										, <u>,</u>
	stored in the battery. Typical power capacity refers to p systems of 6-40 MW operational The potential for all battery types potential installed capacity. As of share is not included in the data s applications is not yet clear. Reports on lifetime vary from 8-1	(Luo et al. 2015). T is high as there ar 2015, Li-ion batter et because it cover	ypical storage of e no significant ies have 0.2% of rs all utility-scal	spacity is 0.5-1 space or resou of the utility stor storage applic	2 MWh (JRC E rce constraints rage market sh rations (both te	TRI, 2014), and , instead dema are, which is d emporal and po	ranges up to 2 and for storage ominated by p ower applicatio	20 MWh (Luo et and costs are u umped hydro at ons) and the ma	al., 2015). sually determi 99% market s rket share of Li	ning factors v hare (IRENA 2 -ion batteries	vhen it comes 2015). The mar
COSTS ear of Euro	2015										
	Euro per Functional	Unit		Current			2030			2050	
nvestment costs	€ / kW		130	170	200	110	140	170	110	140	160
)ther costs per year	€ / kW			-			-			-	I
ixed operational costs per year	€ / kW		Min	-	Max	Min	-	Max	Min	-	Max
excl. fuel costs)				2.38			1.96	•		1.96	
	C / M/M/h		1.82	2.38	10.00	1.54	1.96	10.00	1.54	1.96	2.24
· · · · · · · · · · · · · · · · · · ·	€ / MWh While a distinction can be made b case of Li-ion batteries, obtaining difficult to obtain due to confiden JRC ETRI (2014), the main source between short-term and tempora	cost estimates is p tiality issues (IREN used for costs, spe al storage solutions	2.00 eries for short- articularly diffi A, 2017). cifies costs for a s and do not, or	– 2.60 – term applicatio cult because wh short-term appl	2.60 ns (<1h) and te ile Li-ion batte ications. The o aborate the co	2.00 emporal storag ries are experi ther sources, I st estimates. C	– 2.60 – se (>1h), these encing rapid de RENA (2017) a Cost estimates	2.60 distinctions are evelopment, de nd FCH JU McKin from other sour	2.60 not always cleat tailed cost breat nsey (2014), do ces can vary gr	– 2.60 – arly made in l akdowns are o not make a reatly, especia	2.24 2.60 iterature. In th often scarce an clear distinctio ally from older
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Ariable costs per year  Ariable costs per year  Costs explanation  Energy IN- AND OUTPUTS  Energy carriers (per unit of main output)  Energy in- and Outputs explanation  Emissions  Emissi	While a distinction can be made be case of Li-ion batteries, obtaining difficult to obtain due to confider         JRC ETRI (2014), the main source between short-term and temporate reports, Chen et al. (2009) report to (at least) 2030, and similar sho IRENA (2017), 2013 for FCH JU More Reference fixed operation & maintenance defined by JRC ETRI as production         Reference fixed operation & maintenance defined by JRC ETRI as production         Energy carrier         Main output:         Electricity         Electricity         Electricity         Move and the mount of electricit issions or emissions reductions (endet)         Substance         Mours         Hours         %         Hours         % / month         Charge and discharge times are output and the store of t	cost estimates is p itiality issues (IREN used for costs, spe al storage solutions CAPEX cost of up t rtcomings are also cKinsey (2015). Intenance (FOM) costs e (VOM) costs are h-related O&M cost e (VOM) costs are h-related O&M cost p PJ PJ PJ PJ PJ PJ PJ PJ PJ PJ PJ PJ PJ	2.00 eries for short- articularly diffic A, 2017). cifies costs for a s and do not, or to 4,000 USD/ky encountered in sts are calculat only provided f ts that vary wit -1.00 1.11 <i>Min</i> electricity output <i>Min</i> electricity output <i>Min</i> <i>Min</i> electricity output <i>Min</i> <i>Min</i> 2 <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Solution</i> <i>Min</i> <i>Min</i> <i>Solution</i> <i>Min</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Solution</i> <i>Sol</i>	-         2.60         -         term applicatio         cult because whether         short-term apple         only shortly, el         W. Despite the sen other literature         ed using JRC ET         for 2013 by JRC         h electrical genered         -1.00         -         1.111         -         1.111         -         1.111         -         1.111         -         1.111         -         1.111         -         0.50         -         -         0.55         -         0.55         -         0.55         -         0.50         -         -         0.50         -         -         -         -         -         -         -         -         -         -         -         -         -	2.60 ns (<1h) and tender ile Li-ion batter ications. The organization aborate the construction of the	2.00 emporal storageries are experies ther sources, I st estimates. Of these sources is the assumption is assumed the xclude person <i>Min</i> <i>Min</i> ficiency of 90% <i>Min</i> ficiency of 90% <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i> <i>Min</i>	-         2.60         -         (2.17) a         cost estimates         have been used         rent (2020) set         have been used         rent (2020) set         a         voM costs rend         nel, fuel, and Comment         2030         -	2.60 distinctions are evelopment, der nd FCH JU McKin from other sour d because they a differ in year per sts are 1.4% of in main the same i O2 costs. <i>Max</i> <i>Max</i> <i>Max</i> sed on JRC ETR <i>Max</i> <i>Max</i> <i>Max</i> <i>Max</i> <i>Max</i> <i>Max</i> <i>Max</i>	2.60         not always cleated cost breader alled cost breader alled cost breader and all all all all all all all all all al		2.24 2.60 iterature. In the often scarce and clear distinction ally from older ude projection (2014), 2016 f Max Max Max Max Max Max Max Max