TECHNOLOGY FACTSHEET

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HYDROGEN TRANSPORT BY TRAILER (LIQUID)

Date of factsheet	1-8-2018
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Sector	Hydrogen
ETS / Non-ETS	non-ETS
Type of Technology	Transport of liquid hydrogen by hydrogen trailer
Description	Transport of liquid hydrogen by hydrogen trailer. Assumed is a diesel-based truck to transport hydrogen.
TRL level 2020	TRL 9
	Matured

TECHNICAL DIMENSIONS

	Functional Unit		Value and Range		
Capacity	MW				*5,55*
			5,55	-	*5,55*
Potential	MW	NL		*unlimited*	
			-	-	-
Market share	%				-
			Min	-	*Max*
Capacity utlization factor	1,00				
Unit of Activity	PJ/year				
Technical lifetime (years)	30,00				
Full-load running hours per year	8.760,00				
Progress ratio	1,00				
Hourly profile	No				
Explanation	Yang and Ogden (2007) report 4000 kg hydrogen per day, or 120*4000*365 MJ/year = 5.5 MW				

COSTS

Year of Euro	2015

	Euro per Functional Unit	Current			2030			2050		
Investment costs per year	mln. € / MW			0,13			0,12			0,10
		0,13	-	0,14	0,12	-	0,14	0,10	-	0,14
Other costs per year	mln. € / MW			0,27			0,27			0,27
		0,27	-	0,27	0,27	-	0,27	0,27	-	0,27
Fixed operational costs per year (excl. fuel costs)	mln. € / MW			0,01			0,00			0,00
		0,01	-	0,01	0,00	-	0,00	0,00	-	0,00
Variable costs per year	mln. € / MW			-			-			-
		Min	-	*Max*	*Min*	-	*Max*	*Min*	-	*Max*
Costs explanation	[1] assume 31 dollar (2007) per year of driver costs. For the investment cost development, we look to [1] and [3]. In [2], cost data is also reported, but for their model they have units of euro/MW, i.e. independent of fleet size or distance. They do not describe distance or fleet size, but they do describe cost developments over time. We extrapolate their cost developments to data in [1] and [3]. The costs from [1] and [3] have been amended to reflect 2015 euros.									

ENERGY IN- AND OUTPUTS

	Energy carrier	Unit	Current			2030			2050		
Energy carriers (per unit of main output)	*Main output:* Hydrogen	PJ			-1,00			-1,00			-1,00
			-1,00	-	-1,00	-1,00	-	-1,00	-1,00	-	-1,00
	Hydrogen	PJ			1,00			1,00			1,00
			1,00	-	1,00	1,00	-	1,00	1,00	-	1,00
	Diesel	PJ			0,02			0,02			0,02
			0,02	-	0,02	0,02	-	0,02	0,02	-	0,02
		PJ			-			-			-
			Min	-	*Max*	*Min*	-	*Max*	*Min*	-	*Max*
Energy in- and Outputs explanation	Based on the CO2 output noted below. 0.28 kg CO2/kg H2 out times 7042*10^3 kg CO2 per PJ H2 / 3.23 (kg CO2/L diesel) gives the number of L diesel used per PJ of H2. 27.78*10^6 L diesel has an energetic value of 1 PJ. (.28*7042*10^3/3.23)/(27777777.8) = 0.02198 PJ diesel/PJ H2/out.									

MATERIAL FLOWS (OPTIONAL)

	Material	Unit	Current			2030			2050		
Material flows					-			-			-
			Min	-	*Max*	*Min*	-	*Max*	*Min*	-	*Max*
					-			-			-
			Min	-	*Max*	*Min*	-	*Max*	*Min*	-	*Max*
Material flows explanation											

EMISSIONS (Non-fuel/energy-related emissions or emissions reductions (e.g. CCS)

	Substance	Unit	Current			2030			2050		
Emissions	CO2	kton			1,97			1,97			1,97
			1,97	-	1,97	1,97	-	1,97	1,97	-	1,97
	0	0			-			-			-
			Min	-	*Max*	*Min*	-	*Max*	*Min*	-	*Max*
					-			-			-
			Min	-	*Max*	*Min*	-	*Max*	*Min*	-	*Max*
					-			-			-
			Min	-	*Max*	*Min*	-	*Max*	*Min*	-	*Max*
Emissions explanation	Yang and Ogden (2007) report 280g CO2/kg H2. 1 PJ hydrogen corresponds to 7042*10^3 kg. This is 1972*10^3 kg CO2.										

OTHER

		Current			2030			2050		
Other				-			-			-
		Min	-	*Max*	*Min*	-	*Max*	*Min*	-	*Max*

REFERENCES AND SOURCES

Yang, C., & Ogden, J. (2007). Determining the lowest-cost hydrogen delivery mode. International Journal of Hydrogen Energy, 32(2), 268-286.

Alessia De Vita, Pantelis Capros, Stavroula Evangelopoulou, Maria Kannavou, Pelopidas Siskos, Georgios Zazias (E3Modelling), Sil Boeve, Marian Bons, Rob Winkel, Jan Cihlar (Ecofys), Louise De Vos, Niels Leemput, Pavla Mandatova

Amos, Wade A. Costs of storing and transporting hydrogen. No. NREL/TP-570-25106; ON: DE00006574. National Renewable Energy Lab., Golden, CO (US), 1999.

Mintz, M. Folga, S. et al. (2002). Cost of Some Hydrogen Fuel Infrastructure Options. Argonne National Laboratory

Simbeck, Dale, and Elaine Chang. "Hydrogen supply: cost estimate for hydrogen pathways–scoping analysis." National Renewable Energy Laboratory 71 (2002).