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Electrolysis economics in the E3 report are not accurate (too high)

Additional submitted attachment is included below.

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June 27, 2019

California Energy Commission Dockets Office, MS-4
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: Comments on the "Draft Results: Future of Natural Gas Distribution in California" presentation by E3, Docket # 19-MISC-03

ITM Power is pleased to submit the following comments relating to the draft results generated by the Energy and Environmental Economics, Inc. (E3) and the University of California at Irvine (UCI) for a research project (Study) designed to inform the investigation of the role of the natural gas system in the decarbonization of the California energy system.

1. The study uses inaccurate information relating to the cost, efficiency and benefits of hydrogen via electrolysis and therefore the cost of a renewable gas energy system.
2. This inaccurate information leads E3 to conclude that hydrogen is too expensive and that it should not be a preferred route forwards.
3. The gas system is a existing asset which has cost taxpayers billions of dollars to create. It remains useful in a decarbonized energy system and is more resilient to natural disasters than electrification.
4. The study from E3 concludes an opposite view than that of well respected agencies such as the International Energy Association (IEA)[1] and the Fuel Cells and Hydrogen Joint Undertaking (FCHJU)[2] which conclude that hydrogen and synthetic natural gas (SNG) are viable and a critical part of the future of renewable energy.

[1] IEA. The Future of Hydrogen: Seizing Today's Opportunities Full report available at: https://www.iea.org/topics/hydrogen/

[2] FCHJU Development of water electrolysis full report available at: https://www.fch.europa.eu/sites/default/files/study%20electrolyser_0-Logos_0_0.pdf

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5. Further evidence of the inaccurate electrolyzer cost, taken from table 3 of another report[3] written by respected industry representatives below:

1.2.2. Hydrogen technology cost and performance (Section 4)

A comprehensive cost and performance data of all technologies involved in Power-to-Hydrogen systems (production, logistics, etc.) is elaborated and agreed upon with the contribution of key industry experts for the years 2017 and 2025. An overview of input parameters for ALK and PEM electrolysers is given in Table 3.

		ALK						PEM					
		2017 @ P atm			2025 @ 15 bar			2017 @ 30 bar			2025 @ 60 bar		
Nominal Power	UNITS	1 MW	5 MW	20 MW	1 MW	5 MW	20 MW	1 MW	5 MW	20 MW	1 MW	5 MW	20 MW
Minimum power	% Pnom	15%			10%			5%			0%		
Peak power – for 10 min	% Pnom	100%			100%			160%			200%		
Pressure output	Bar	0 bar			15 bar			30 bar			60 bar		
Power consumption @ P nom	kWhe/kg	58	52	51	55	50	49	63	61	58	54	53	52
Water consumption	l/kg	15 l/kg											
Lifetime – System	Years	20 years											
Lifetime – Stack @ full charge	hr	80 000 h			90 000 h			40 000 h			50 000 h		
Degradation – System	%/1000 h	0,13%/ 1000 h			0,11%/ 1000 h			0,25%/ 1000 h			0,20%/ 1000 h		
Availability	%/year	>98%											
CAPEX – Total system Equipment	€/kW	1200	830	750	900	600	480	1500	1300	1200	1000	900	700
OPEX – Electrolyser system	%CAPEX	4%	3%	2%	4%	3%	2%	4%	3%	2%	4%	3%	2%
CAPEX – Stack replacement	€/kW	420	415	338	315	300	216	525	455	420	300	270	210

Table 3: Summary of electrolyser selected cost and performance data

6. The cost projection for base case learning on p11 of the E3 draft report show electrolysis costs starting too high in 2020 (the $/kW figure is too high for grid scale electrolysis) and declining in a linear fashion to 2050. The price of any technology will rapidly decline initially as production rate increases then decrease slower and eventually plateux. This is not reflected in this scenario. Even in the rapid learning case the cost per kW starts too high and declines too slowly between 2020-2040.

7. Producing graphs of $/kW is meaningless unless the size and manufacturing rate is described. For grid scale systems, as would be required for a state wide system, the size (MW/GW) and manufacturing rate/volume (GW/year) are required to properly asses the declining costs of technology.

[3] Study on early business cases for h2 in energy storage and more broadly power to h2 applications, full report can be viewed here: https://www.fch.europa.eu/sites/default/files/P2H_Full_Study_FCHJU.pdf

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Conclusion

ITM Power provides these comments to help the state understand the role that hydrogen and renewable gas can play in California's energy future. The state needs to proceed in a thoughtful and well-reasoned manner in order to bring about maximum benefit to its residents. In ITMs opinion this can only be achieved using a balanced approach to renewable energy that is agnostic and resilient to changes in weather, transportation types and natural disasters.

ITM has been a stakeholder in many reports around the world looking to analyse how hydrogen can help to decarbonise society. Almost all of these studies have recognised the positive benefit hydrogen can bring to both vehicular (as a fuel for fuel cell powered zero emission transportation) and energy markets.

ITM urges the commission to re-evaluate the data used by E3 and instruct them or others to widen their data pool and question the existing data they have used to ensure it is not forming an unbalanced opinion of electrification being the only route forwards.

Kind regards,

Steve Jones

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