A DRL-Based Framework for Optimized Scheduling and Delivery in a Green Hydrogen Hub

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This supplementary document compiles the key modelling assumptions, component efficiencies, and cost coefficients, used to parameterize the technical analyses reported in the paper.

1) PEM Electrolyzer Parameters

Table I lists the electrochemical and cost coefficients that define the PEM electrolyzer model adopted in this study [1].

TABLE I
ELECTROCHEMICAL AND COST PARAMETERS OF THE PEM ELECTROLYZER

$\mathfrak{I}_1$	$\mathfrak{I}_2$	$\mathfrak{I}_3$	$\mathfrak{I}_4$	$\mathfrak{I}_5$	$\mathfrak{I}_6$	$\mathfrak{I}_7$
99.5%	-9.5788 (m^2/A)	-0.0555 $(m^2/A \times ℃)$	0	1502.7083 (m^4/A)	-70.8005 $(m^4/A \times ℃)$	0

F	α_{mk}	μ^{PEM}
96485.34 (C/mol)	0.002016 (kg/mol)	36 ($/kg) per year

2) Compressor, Hydrogen Tank, and Electrical Storage Parameters

Table II consolidates the thermodynamic constants and operating-cost coefficients used to model the hydrogen compressor, hydrogen tank, and on-site electrical storage systems, as sourced from [2]-[4].

TABLE II
THERMODYNAMIC AND OPERATIONAL PARAMETERS FOR COMPRESSOR, HYDROGEN TANK, AND ELECTRICAL STORAGE UNITS

Compressor				
γ	R^{gc}	μ^{comp}	ϱ^{ih}	ϱ^{is}
1.41	4.124 kJ/(kg·K)	1 ($/kg) per year	14.31 (kJ/kg.K)	0.8
Hydrogen tank				
μ^{tank}	SoC^{HT}_{max}	SoC^{HT}_{min}	$\eta^{H_2}_{ch}$	$\eta^{H_2}_{dc}$
32 ($/kg) per year	0.9	0.05	0.9	0.9
Electrical storage				
SoC^{ES}_{min}	SoC^{ES}_{max}	η^{ES}_{ch}	η^{ES}_{dc}	μ^{ES}
0.1	0.9	0.95	0.95	0.0005 ($/kWh)

References:

[1] F. Scheepers, M. Stähler, A. Stähler, E. Rauls, M. Müller, M. Carmo, and W. Lehnert, “Temperature optimization for improving polymer electrolyte membrane–water electrolysis system efficiency,” *Applied Energy*, vol. 283, Art. no. 116270, 2021.
[2] S. Shafiee, H. Zareipour, and A. M. Knight, “Considering thermodynamic characteristics of a CAES facility in self-scheduling in energy and reserve markets,” *IEEE Trans. Smart Grid*, vol. 9, no. 4, pp. 3476–3485, Jul. 2018.
[3] M.-R. Tahan, “Recent advances in hydrogen compressors for use in large-scale renewable energy integration,” *Int. J. Hydrogen Energy*, vol. 47, no. 83, pp. 35275–35292, Sep. 2022.
[4] M. Jadidbonab, H. Abdeltawab, and Y.A.R.I. Mohamed, “A Hybrid Traffic Flow Forecasting and Risk-Averse Decision Strategy for Hydrogen-Based Integrated Traffic and Power Networks,” *IEEE Syst. J.,* pp. 1-13, July 2024.