Charting a Pathway to a Geothermal Future

Virtual Island Summit 2025

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CARICOM ENERGY SOURCES: OVERALL

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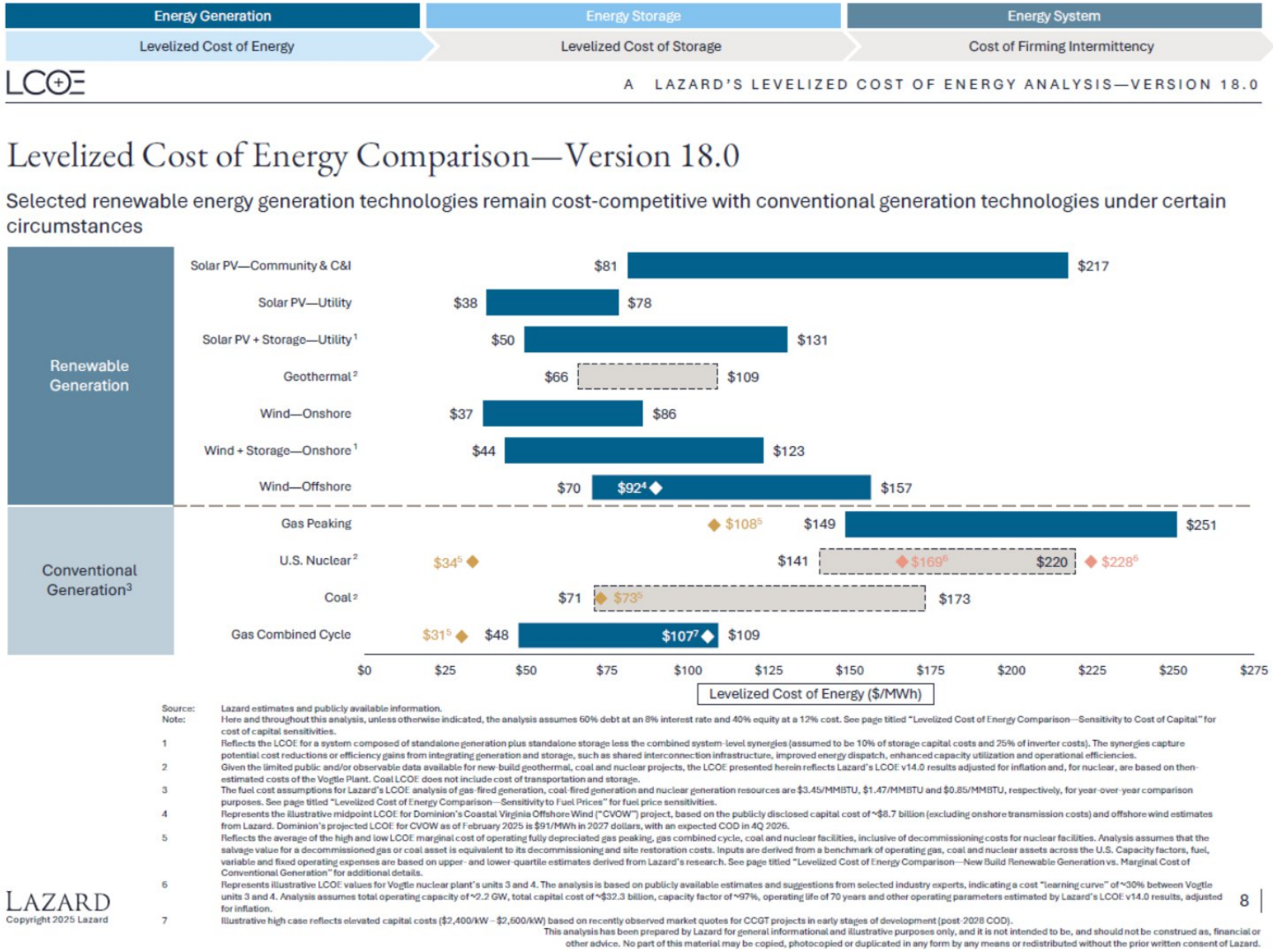
Secure, Affordable, Low-Carbon

	SHORT TERM (1-5 YEARS)	MEDIUM TERM (5-10 YEARS)	LONG TERM (>10 YEARS)
ENERGY EFFICIENCY	All countries: **develop & execute projects**		
SOLAR PV: DISTRIBUTED AND UTILITY SCALE	All countries: **develop & execute projects**		
WIND ONSHORE/OFFSHORE	All countries: assess resources then develop & execute **onshore** projects	ONSHORE & OFFSHORE	ONSHORE & OFFSHORE
GEOTHERMAL	Assess resources, develop & execute **optimal** project(s) for **OECS** country needs	**Connect all OECS islands** via submarine cable, if commercially feasible	Assess & develop **mega scale** projects for export
HYDROGEN	Develop & execute **niche** projects: Barbados (storage) and T&T (waste heat)	Develop & execute **niche** projects: Barbados (storage) and T&T (waste heat)	All countries: develop & execute projects if there is a source of low-cost power (< 3 USc/KWh) & offtake
LNG / FLARED GAS		Flared gas from Venezuela or gas from Guyana, Trinidad and Suriname	Flared gas from Venezuela or gas from Guyana, Trinidad and Suriname
GREEN / KHAKI AMMONIA			T&T if source of low-cost power (<3 USc/KWh) from geothermal or offshore wind or flared gas
SMR (NUCLEAR)			Larger electrical demand islands

LOCE of Geothermal



Geothermal LOCE Key Assumptions

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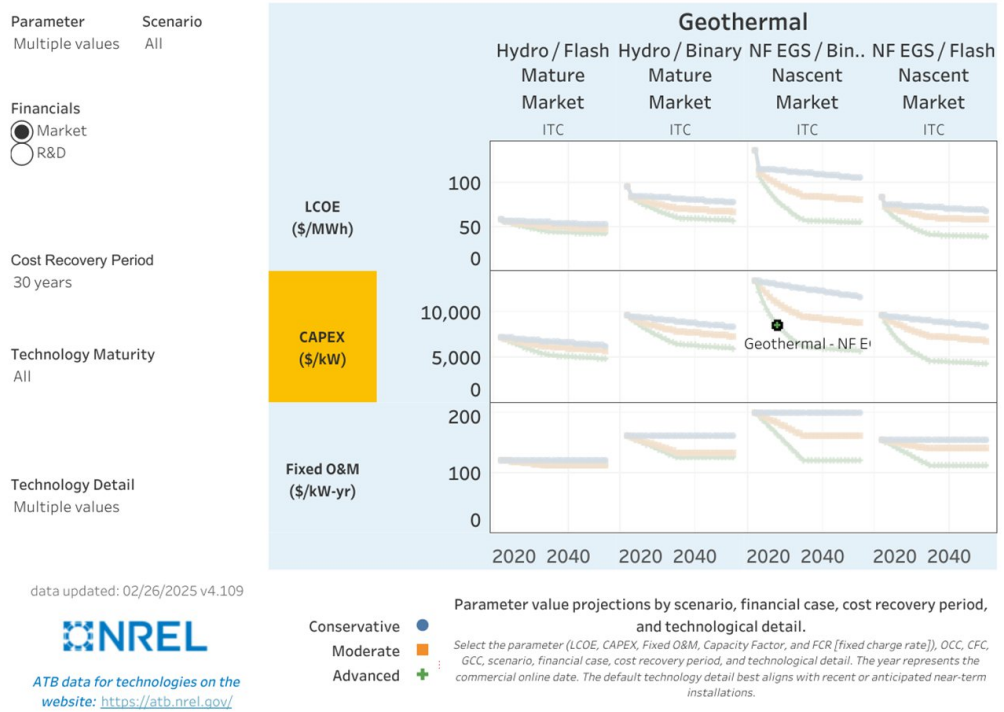
Key Assumptions

Lazard V 18.0 2025 Levelized Cost of Energy - Key Assumptions							
		Geothermal		Wind -Onshore		Solar Utility	
		Low	High	Low	High	Low	High
Net Facility Output	MW	250		300		150	
Total Capital Cost	$/KW	5,000	6,460	1900	2300	1150	1600
Fixed O&M	$/KW-yr	14.5	15.75	24.5	40	11	14
Variable O&M	$/MWh	9.05	24.8				
Capacity Factor	%	90%	80%	55%	30%	30%	20%
Construction Time	Months	36		18		15	
Facility Life	Years	25		30		35	
Debt/Equity Ratio	%	60/40		60/40		60/40	
Cost Debt/Equity	%	8%/12%		8%/12%		8%/12%	
Levelized Cost of Energy	$/Mhr	66	109	37	86	38	78

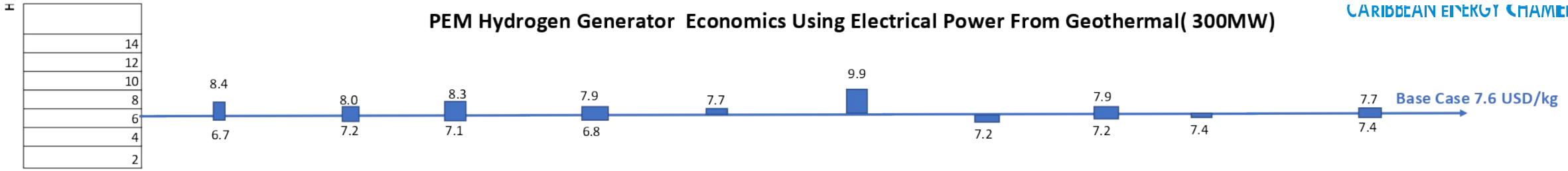
7 - 11 USc/Kwhr At Tail Gate Of Power Plant Is Possible



Recent Public Geothermal Power Purchase Agreement Pricing- NREL 2023

Project*	State	Size (megawatts [MW])	Pricing ($/megawatt-hour [MWh])	Term (years)
Hell's Kitchen	California	40	75	25
Whitegrass	Nevada	3	67.5	25
Star Peak	Nevada	12.5	70.25	25
Casa Diablo	California	16	68	20
Puna	Hawaii	46	70	30
Makushin	Alaska	30	69	30
Geysers - Sacramento	California	100	99	10
Geysers - Oakland	California	2	70	12

Geothermal Power to X



Low Case	1500	25%	1.1	52	11%	0.070	90%	9%	30	70%
High Case	2500	0%	1.5	60	15%	0.110	80%	15%	20	50%
Base Case	2000	12%	1.25	57.50	11%	0.070	80%	12%	20	60%
Variable	Electrolyzer US Installed Costs[4](2022 USD/KW) (Assumes a generating capacity of >200 MW)	Reduction in TIC due to innovations every 5 years (% of TIC reduction)	Adjustment factor for installing in the Caribbean versus US (Impacted by shipping costs and construction and project delivery productivity in a T&T environment.)	Electrolysis Operating Costs[4](USD/KW/yr)	Electrolysis Major Maintenance cost every 5 years to replace stack(% of installed cost)	Electricity Cost from Geothermal Generation(USD /KWhr)	Onstream Factor for electrolyzer to match geothermal factor(%)	Discount Rate (%)	Economic Life(Yrs)	Debt Financing %

	Cost of Hydrogen (USD/Kg)
Low Case when all the variables are low	5.1
Base Case when all the variables are base	7.6
High Case when all the variables are high	13.5

Fixed assumptions

Cost of debt	5%
Tax rate	35%
Loan Tenor	10 years

4. US Department of Energy- Department of Hydrogen . 2024 Report - Production Cost Scenarios with Electrolyzer PEM Technology

For hydrogen to be competitive for green ammonia production its cost should be < 4 USD/kg.
Current cost of hydrogen for grey ammonia is 1.5 to 2 USD/kg.

Current Competitiveness Of Green Ammonia

Platts

	July 31 ,2025
Middle East Delivery to NWE - Grey Ammonia(USD/ton)	**550-560**
Middle East Delivery to NWE with Carbon Tax - Grey Ammonia(USD/ton)	**611-621**
US Delivery to NWE(USD/ton)	**575**
Middle East Delivery to NWEGreen Ammonia(USD/ton)	**837**

Cost of Producing Green Ammonia

	kg/MT	USD/Kg	Cost USD/MT
Hydrogen	175	4	700
Nitrogen	825	0.03	24.75
Operating and Maintenance Cost(USD/MT)			30
NH3 Plant Capital Recovery@9% IRR (USD/MT)			40
Total Cost(USD/MT)			**794.75**

Ammonia as a Marine Transportation Fuel

Argus Ammonia August 7, 2025	
	USD/MMBTU
NWE Grey ammonia as a fuel	29.3
NWE Green ammonia as a fuel	71.96
NWE Marine Gas Oil	17.2
NWE Marine Gas Oil including carbon cost	23.7

Conclusions

- In the short to medium term the best option for geothermal is for electrical power to meet in country's needs, and if economic, then export of electrical power to adjacent islands could be pursued. This addresses the need for secure, affordable and low carbon energy.

- Considering the challenges of the high upfront capital costs for geothermal projects the focus should be on identifying and advancing actions to enhance:
  - Capital efficiency
  - Cost of financing

- In the longer-term Power to X and other options should be considered.
  - Given the long development period for such projects short term attention could be considered once it doesn't divert scare resources away from advancing priority work on meeting the country's base load electrical power needs.

https://caribbeanenergychamber.org/

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