Revolutionizing the energy transition with green hydrogen

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Ohmium

Key steps to achieve 2070 "Net-Zero" ambition by India

Electricity Sector	Transport Sector	Industry Sector
• Coal-based power generation must peak by 2040 and reduce **by 99 % between 2040 and 2060**. • PV generation capacity must increase to **1689 GW by 2050 and to 5,630 GW by 2070** • Wind generation capacity must increase to **557 GW by 2050 and 1792 GW by 2070**	• The share of Evs in car sales must reach **84 % by 2070** • The share of electric trucks in freight trucks must total **79 % by 2070**, the rest being run mainly on hydrogen	• Coal use in the industrial sector must peak by 2040 and reduce by **97 % between 2040 and 2065** • Hydrogen share in total industrial energy use must increase to **15 % by 2050 and 19 % by 2070**

What is Green Hydrogen?

Hydrogen Overview

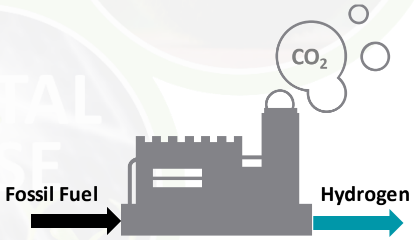
- With the energy sector representing ~75% of greenhouse gas ("GHG") emissions[(1)], the **transition of energy to renewable sources is a crucial component to mitigating global warming and climate change**

*Decarbonization technologies like renewable power and biofuels offer constructive solutions, but **green hydrogen offers the only long-term, scalable and cost-effective option** in sectors such as steel, ammonia and transportation*

Main Types of Hydrogen

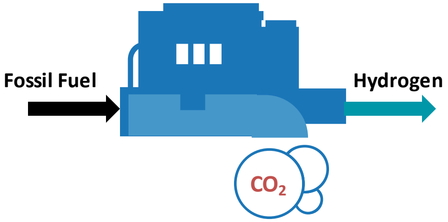
Grey Hydrogen

- Hydrogen produced from natural gas or other light hydrocarbons



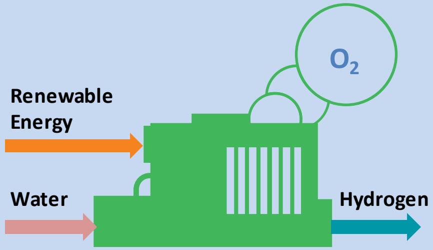
Blue Hydrogen

- Hydrogen obtained in a similar way to grey hydrogen, but with carbon capture, utilization and storage techniques applied



Green Hydrogen

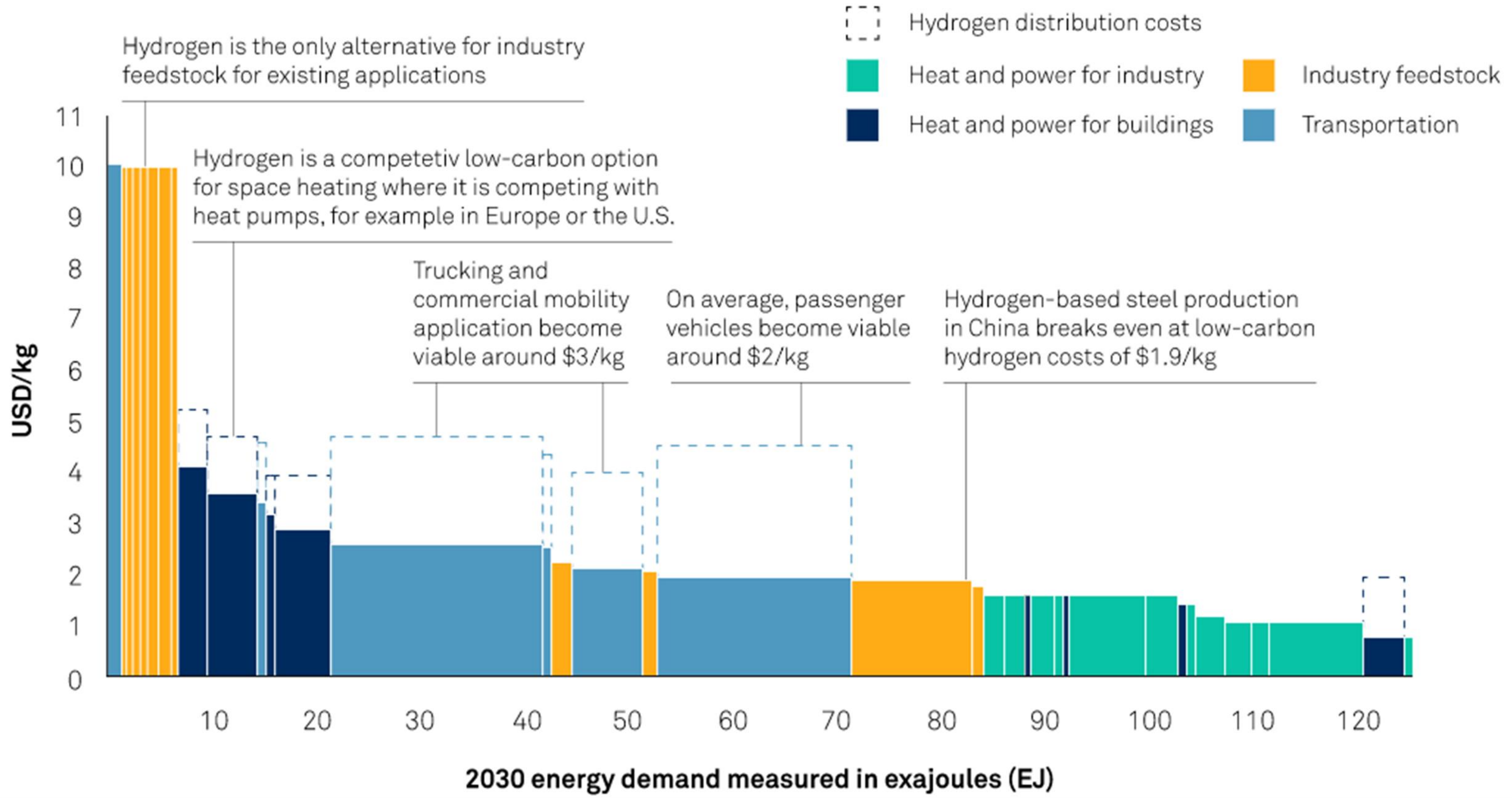
- Also called "clean hydrogen," generated from renewable energy, using water as a feedstock, through a process called electrolysis



Source: IEA, "Greenhouse Gas Emissions from Energy Data Explorer" as of November 10, 2021 | Ohmium Confidential

Cost Curve For Hydrogen Production Across Segments And Regions

Break-even hydrogen costs at which hydrogen application becomes competitive against low-carbon alternative in a given segment



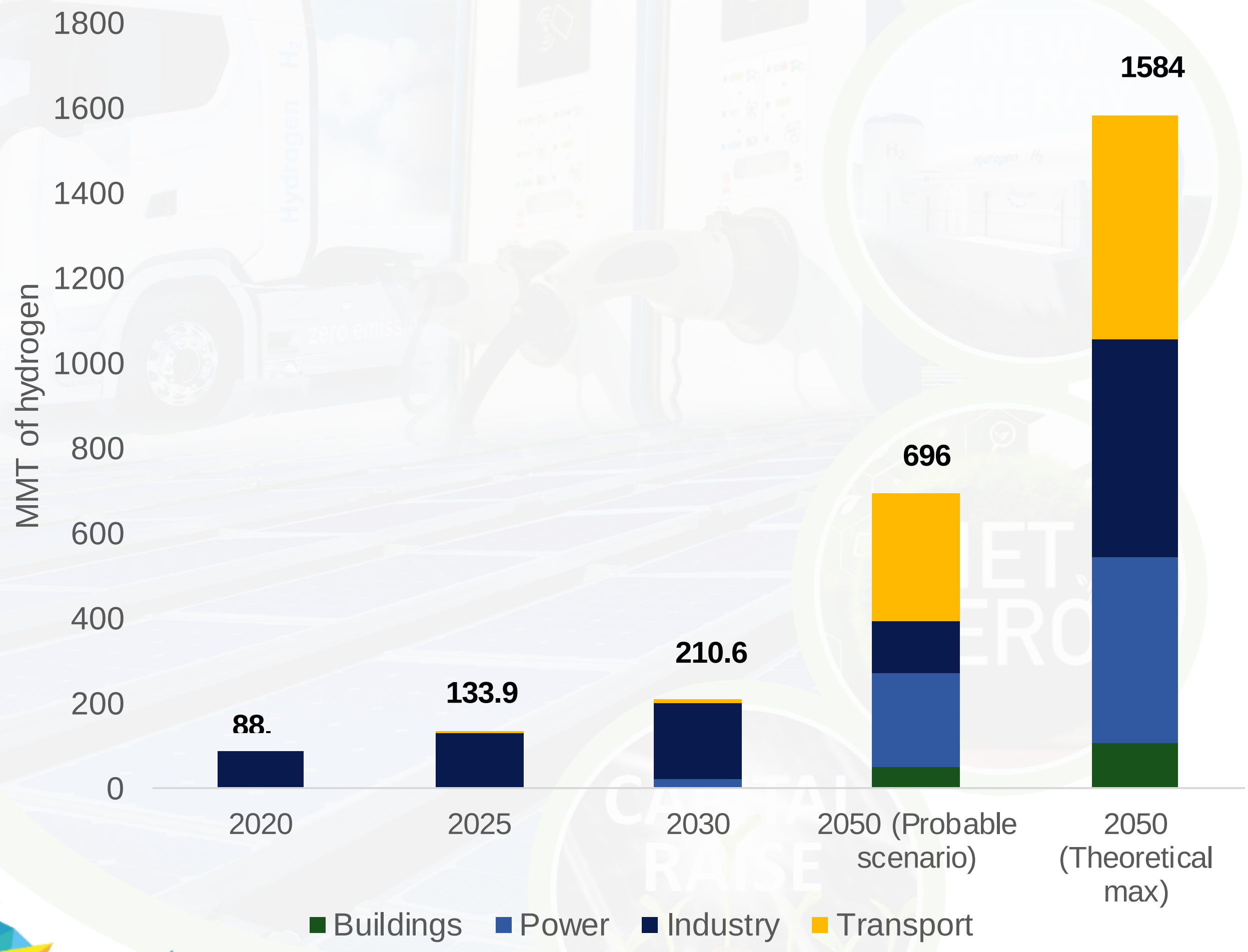
1

Hydrogen for refineries, ammonia production and methanol are viable as of today.

2

Applications in transportation, power and other industries start to become viable in optimal regions in 2-3 years.

Projected global hydrogen demand



696 Mt to 1584 Mt

Annual demand for hydrogen expected by 2050

> $11 trillion

Investment would be made in production, storage and transport infrastructure

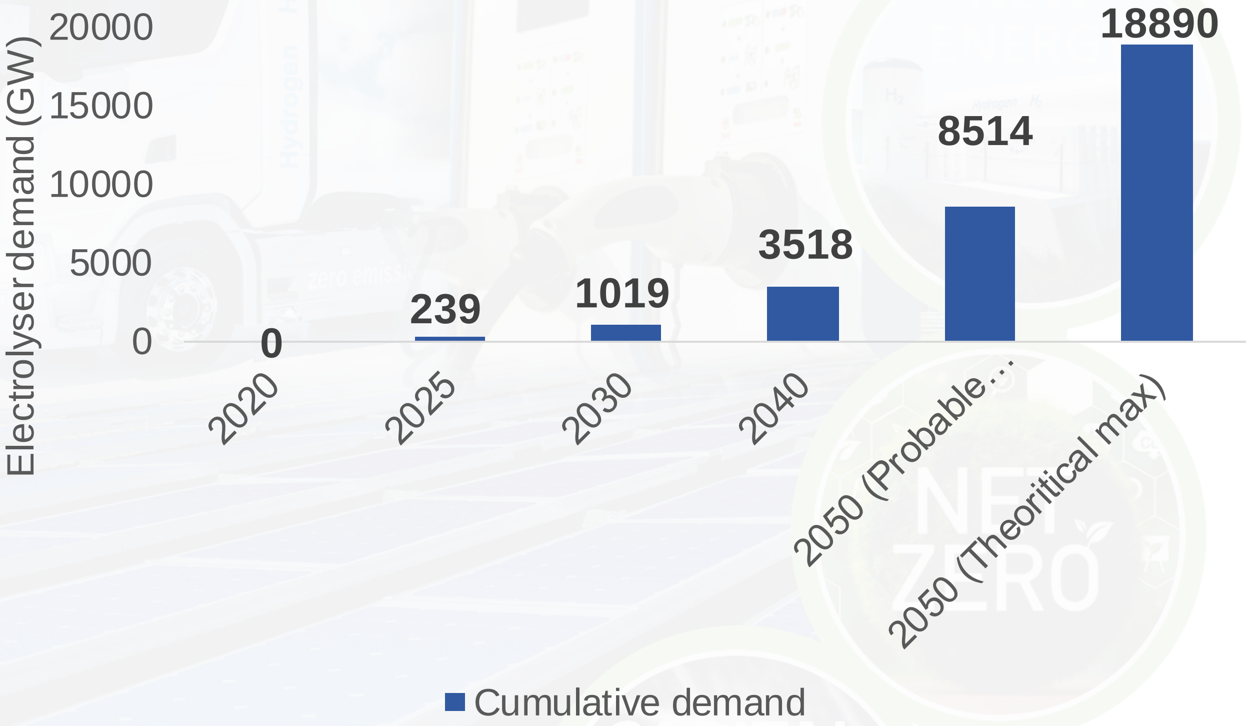
24-50%

Of world's energy in 2050 would be met with hydrogen

$2 - $5 trillion/year

Of economic impact worldwide by 2050

Cumulative Electrolyzer demand globally



Note:
1. Includes Sales and Replacement of Electrolyzer after 15 years.
2. Estimated using hydrogen demand projections to achieve 2050 net zero from IEA

Market opportunity for India

> 60 GW

Of electrolyzer demand to produce 5 million tonnes of green h2 annually by 2030 as targeted by India's H2 Mission

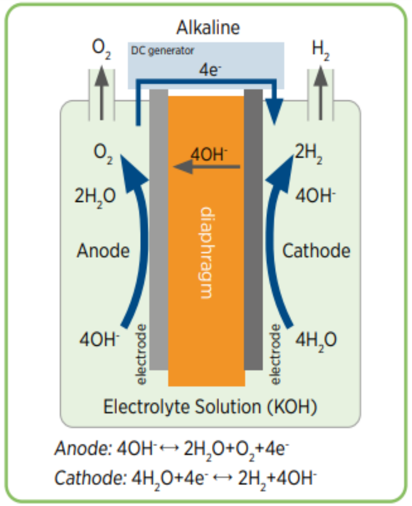
60%

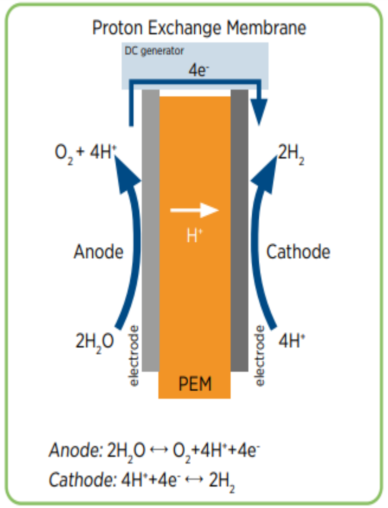
Of the existing manufacturing capacity is concentrated within Europe.

~ 3 GW

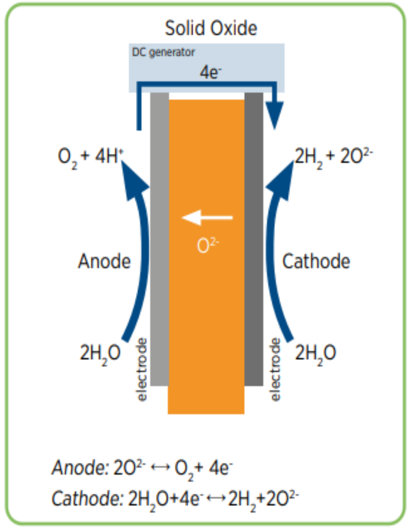
Current manufacturing capacity globally.

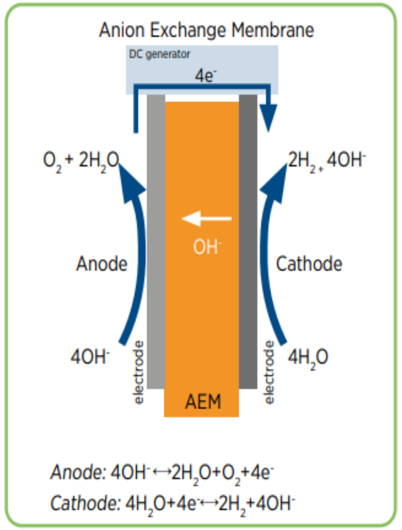
Commercially available





Early deployment





	Characteristic	Alkaline	PEM
Safety	Proton Conductor	30 wt% KOH	Solid Polymer
	Water and Gas Carrier	30 wt% KOH	DI Water
	Chemical Compatibility	KOH Corrosion	Noncorrosive
	Operating Mode	Isobaric Required	Differential Pressure
Renewable	Startup Time	60 + Mins	15 mins
	Turn Down Ratio	2.5 : 1	10 : 1
	Operating Temp. (˚C)	80 - 90	50 - 80
LCOH	Volume / Weight	X	1/3 X
	Elec. Required (kWh/kg)	50 to 73	50 to 73
	Electrode Materials	Non-Precious	Precious Metal
	Current Density (A/cm2)	0.2 – 0.7	1.0 – 2.2
	Cell Ion Conductor (Electrolyte)	Available Caustic Liquid	Solid Polymer

Source: IRENA 2021; Yujing Guo et al, Earth and Environmental Science 371 (2019) 042022, Mark Ruth et al, 2017 Fuel Cell Seminar | Ohmium Confidential

About Ohmium

Mission

Ohmium is making Green Hydrogen a reality today. The company's suite of innovative electrochemical products enables customers to achieve their sustainable energy goals in industrial, transportation and energy projects.

Highlights

- Deep domain expertise in electrolyzer, fuel cell and renewable energy industries.
- R&D Centers in San Francisco Bay, United States and Bangalore, India.
- Manufacturing capacity of 500 MW and ramping toward 2+ GW in India.
- Diverse team of about 300 people.
- Global presence focused on Europe, North America, Middle East, India and Australia.

Ohmium Product Approach

- **Advanced Technology**: Interlocking modular proton exchange membrane (PEM) technology with American IP and Indian based manufacturing cost structure.
- **Scalable:** Rapidly installed standard interlocking modular units to expand projects from MWs to Gigawatts without technology scaling risk.
- **High Performance**: Optimized supply chain and roadmap resulting in low Levelized Cost of Hydrogen (LCOH).
- **Dynamic Operation**: Fully compatible with renewable energy resources with PEM safety.
- **Proprietary Power Electronics:** Flexible and dynamic power electronics for an enhanced operation.
- **Efficient Land Utilization**: Flexible standard modular design for project layout optimization and stacking.
- **Short Production Downtime:** Rack-in/rack-out design for minimum maintenance downtime.

Short downtime

Low installation cost

Operation flexibility

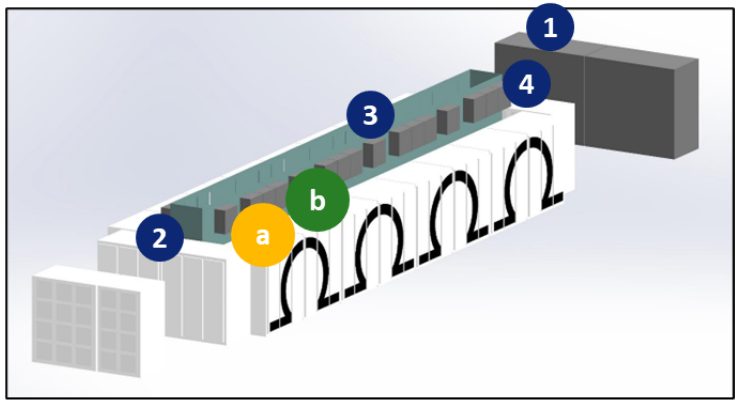
Efficient land use

Scalable standard modular units

Construction in phases

Comprehensive Hydrogen Solution

Production Specs *	Mark I	Mark II
H_2 production	7 x 6.0 kg/hr	7 x 9.0 kg/hr
H_2 pressure	Up to 27 bars	Up to 34 bars
H_2 purity	≥ 99.99% (high)	≥ 99.999% (ultra high)
Dynamic range	10% - 100%	10% - 100%
Ramp-up time	5 sec	5 sec
O_2 Production	Optional	Optional
Inputs		
Power	7 x 300kW_{dc} 480VAC or 415VAC 3ph 50 Hz or 60 Hz	7 x 450kW_{dc} 480VAC or 415VAC 3ph 50 Hz or 60 Hz
Water	7 x 1.4 SLM DI water Or 7 x 2.7 SLM City water	7 x 2.1 SLM DI water Or 7 x 4.0 SLM City water
Other		
Ambient temp.	-25 ˚C to 50 ˚C	
Dimensions (LWH)	8 x (2) Cabinets (1.8 x 1.3 x 1.8 m) Auxiliary Cabinets (1.8 x 1.3 x 1.8 m)	
SCADA & Controls	Fully compatible	
Comm Interface	TCP/IP, RS485	
Conformity	Designed to UL 2264A	

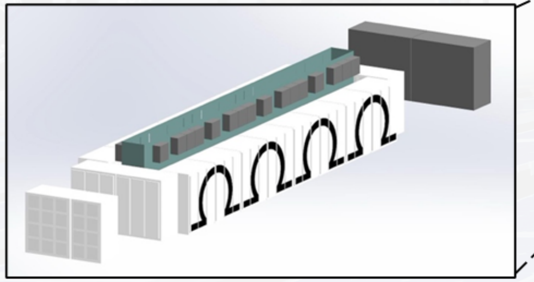


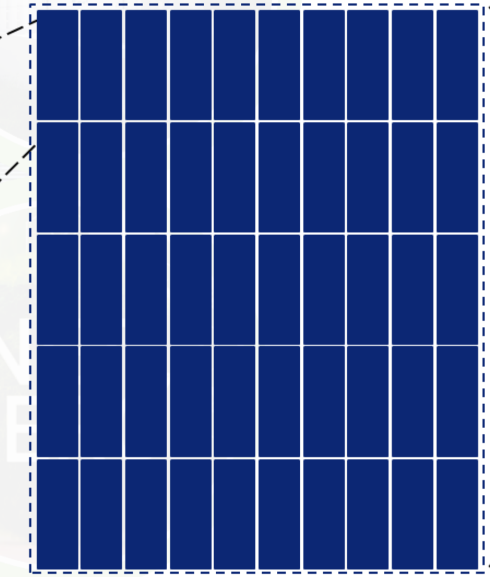
- a Power Electronics Module
- b Hydrogen Module
- 1 Water Module
- 2 Power Distribution Module
- 3 Cooling Module
- 4 Telecom Module

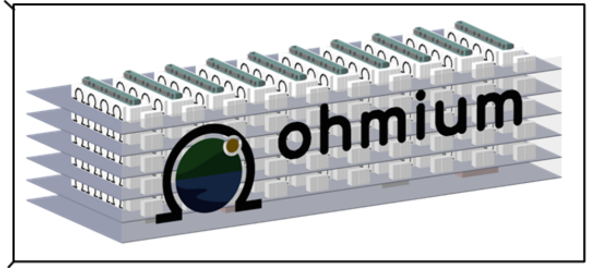
* The information provided herein is for reference only and subject to change.

Ohmium towers – Architecture for the new energy future

- Can be built at fueling stations
- Can be scaled up seamlessly in phases as demand increases
- Can be sized to meet any volume from a few MW to GWs







Rapid design, installation and maintenance for large scale projects

Proprietary stacking design for efficient land utilization

Thank You

For discussions/suggestions/queries email: shaji.john@ohmium.com