

CGA Energy Nexus & Annual Technical Conference 2025

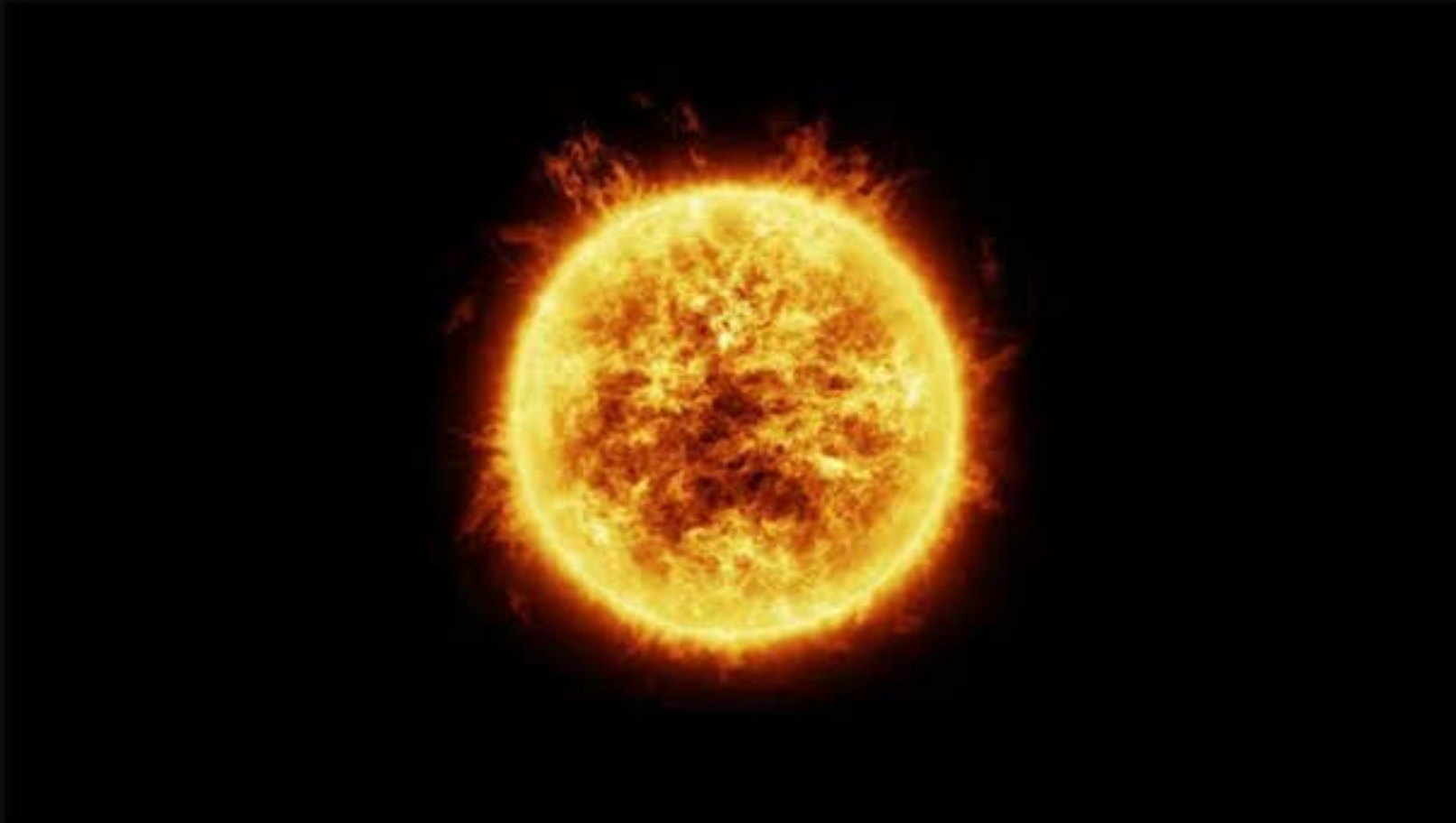
Fundamentals of Hydrogen and the Natural Gas Industry – Technical Challenges

Estelle Feider-Blazer



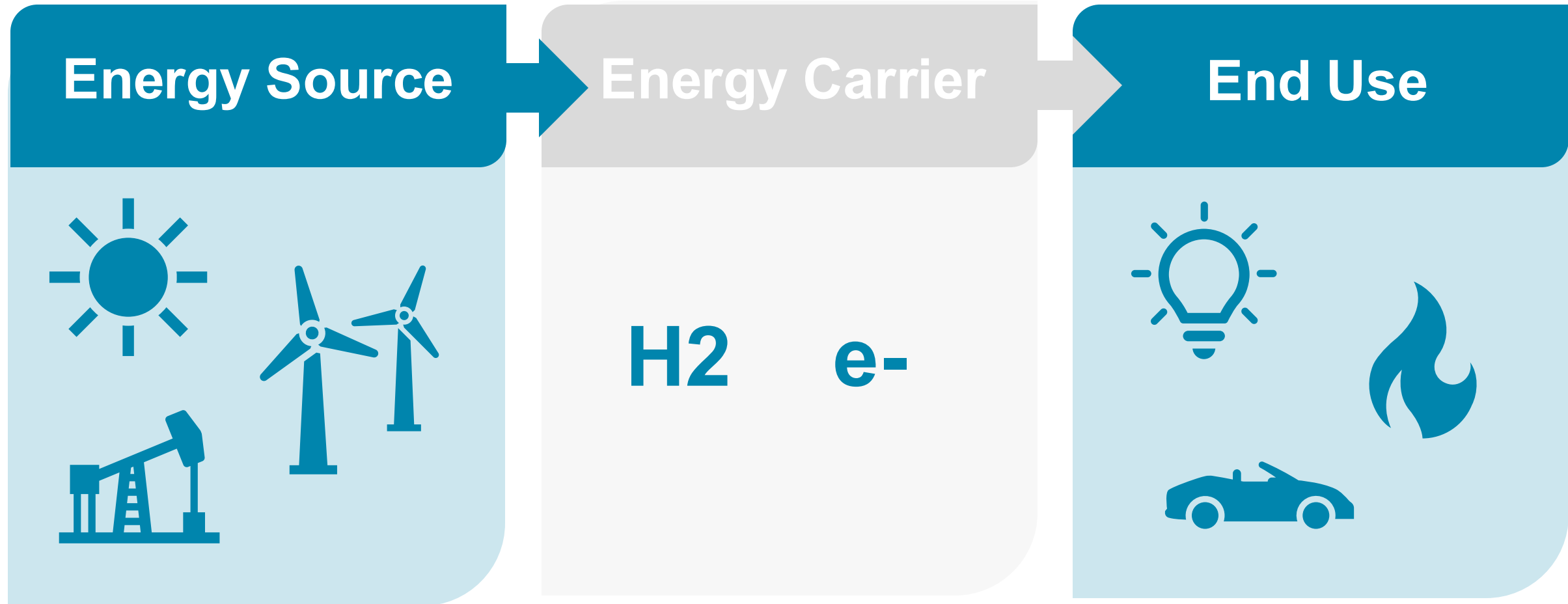
Agenda

1. Hydrogen Introduction
2. The Good and Bad of Hydrogen
3. A Roadmap for Hydrogen Blending



The most abundant element in the universe, but rarely exists in its pure form.

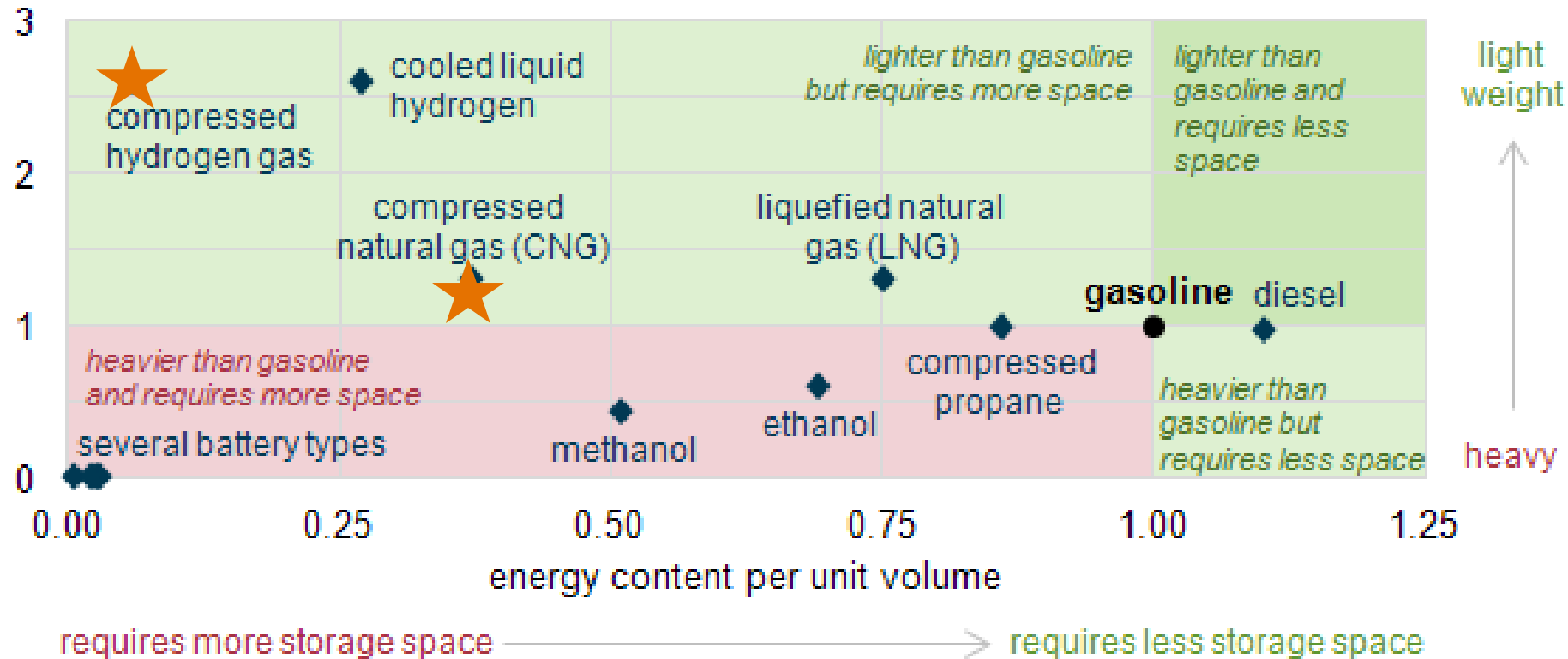
Hydrogen Energy Carrier



Hydrogen Energy Content Comparison

Energy density comparison of several transportation fuels (indexed to gasoline = 1) 

energy content per unit weight



High energy and light weight but requires large storage space

Hydrogen and Natural Gas Comparison

	Natural Gas	Hydrogen	20% H ₂ Blend
Lower Explosive Limit (vol %)	4.4%	4%	4.4%
Higher Explosive Limit (vol %)	15%	75%	18%
Lower Heating Value (MJ/m ³)	35.8	10.8	30.8
Higher Heating Value (MJ/m ³)	39.8	12.7	34.4
Flame Speed (cm/sec)	~30	~300	~40
Wobbe Index (Btu/scf)	1215	1039	1150

Hydrogen Market Overview



Production

- Steam Methane Reforming
- Partial oxidation of oil
- Coal gasification
- Water Electrolysis
- By-product



Transport

- Captive: produced onsite
- Market: shipped to usage location

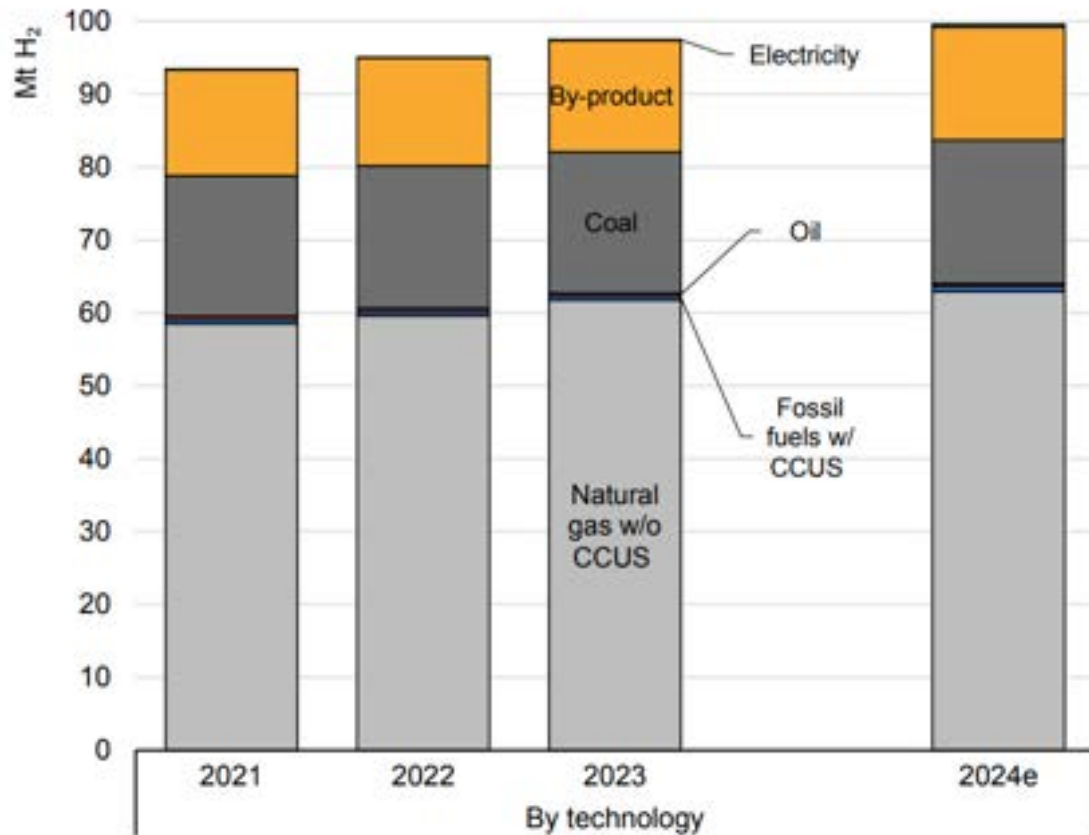


End-Use

- Refining (33%)
- Ammonia production (27%)
- Methanol (10%)
- Steel (3.5%)
- Other (heating) (22%)
- Other (3.5%)

Hydrogen Production

Global Hydrogen Production



- Steady growth in hydrogen production, driven by steam methane reforming
- **Steam methane reforming** is cheapest and most prevalent production method
- **Electrolysis** expected to grow to largest production method due to demand for green hydrogen

Hydrogen production expected to almost double in next decade

Hydrogen Demand: The Blending Question

Is blending the answer to the hydrogen question?



Demand for low emission hydrogen grew 10%



Majority of demand for all hydrogen in refining and industry



Chemical, refining, and shipping driving demand for low emission hydrogen



Transport (personal vehicles) slowing



Power sector moving faster in some countries vs others (energy security plays a role in driving demand)

Canada's Hydrogen Progress – At a Glance



Production

- **3,450 tonnes-H2** per year low carbon H2 deployed
- **80 projects announced**, under consideration or under development
- **5+ Mt H2 / year** announced or under development
- **100** hydrogen and fuel cell companies in Canada



End-Use

- 7 truck and bus, 4 train trails underway
- **22 codes and standards** developed
- **8 operating hydrogen refueling** stations, 21 announced
- **3600** Ontario households and **2100** Alberta customers **serviced by Natural gas blends**

#1 largest clean hydrogen production facility

#2 CO2 storage capacity

\$100B announced project investment

Hydrogen Movement Across Sectors

Consistent engagement in advancing hydrogen technology through all sectors



Cross Industry Partnerships

- CSA ANSI R124/CAN/BNQ 1789-200
- Hydrogen Innovation Fund

Updated Standards and Government Guidance

- Measurement Canada: up to 3% blending
- CSA B149.1 Natural Gas and Propane Installation Code

Hydrogen Projects

- Calgary Region Hydrogen Hub (CRH2)
- HTEC's Burnaby Clean Hydrogen Facility



The Good and Bad of Hydrogen

The Good Side of Hydrogen

Lower GHG
Emissions



Energy Storage
for Renewables



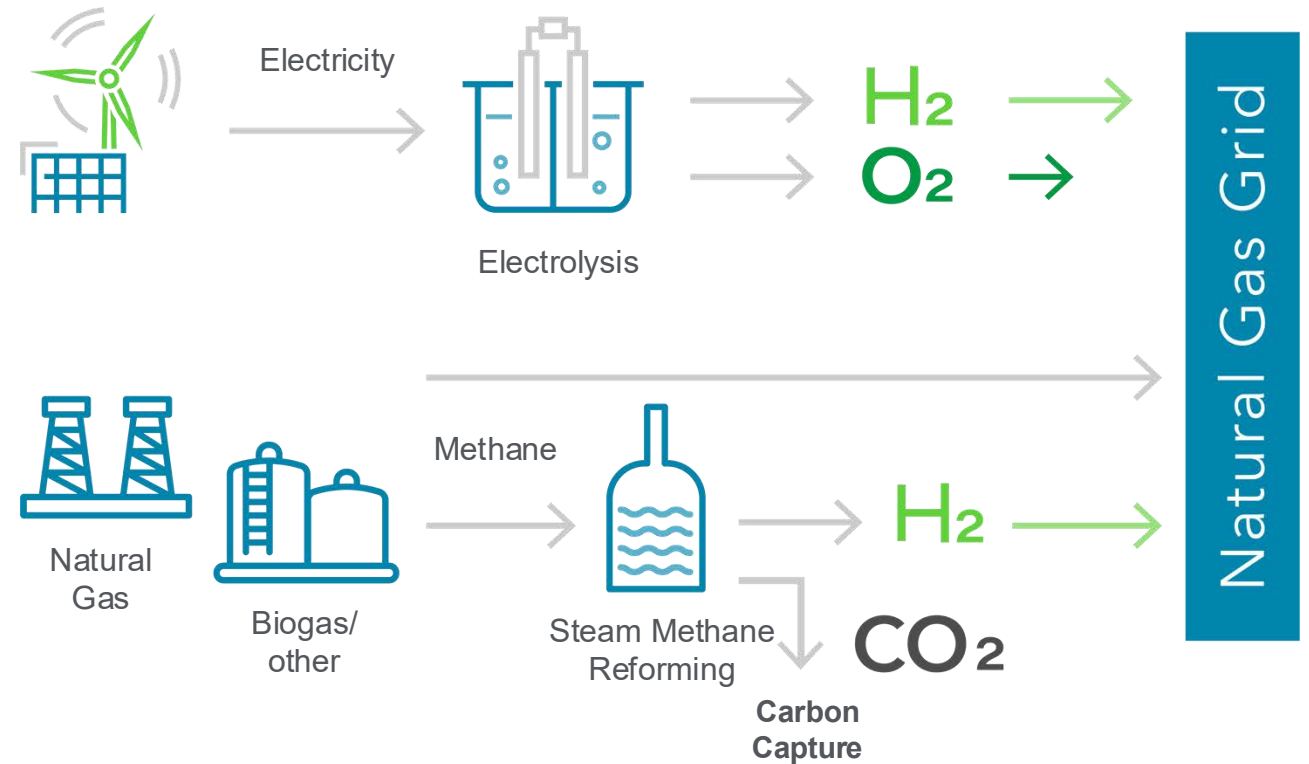
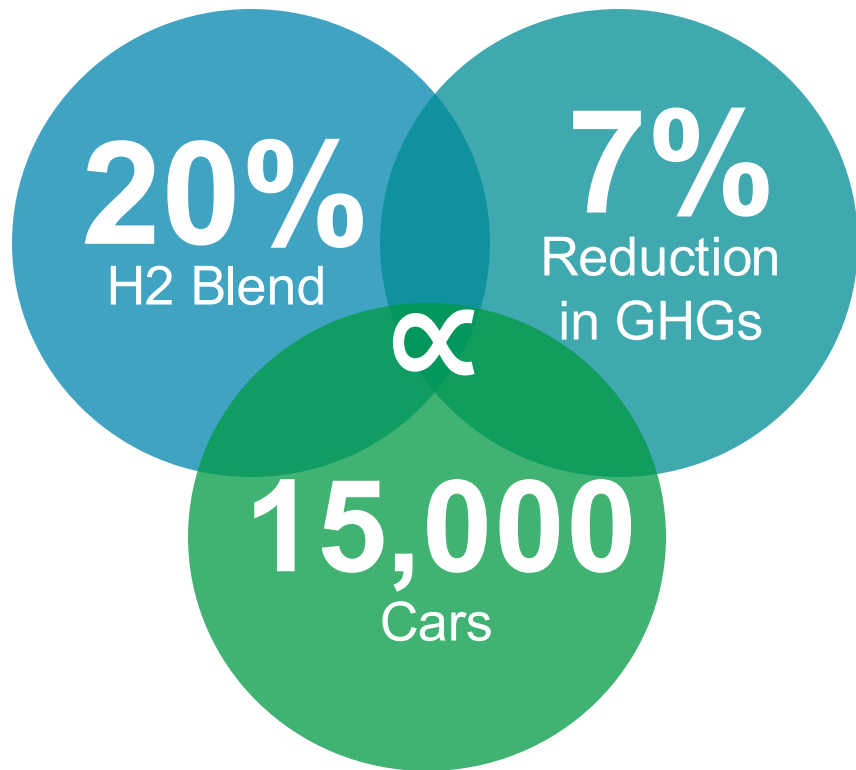
Use Existing
Infrastructure



Leverage Industry
Knowledge



Grid Injection and Existing Infrastructure



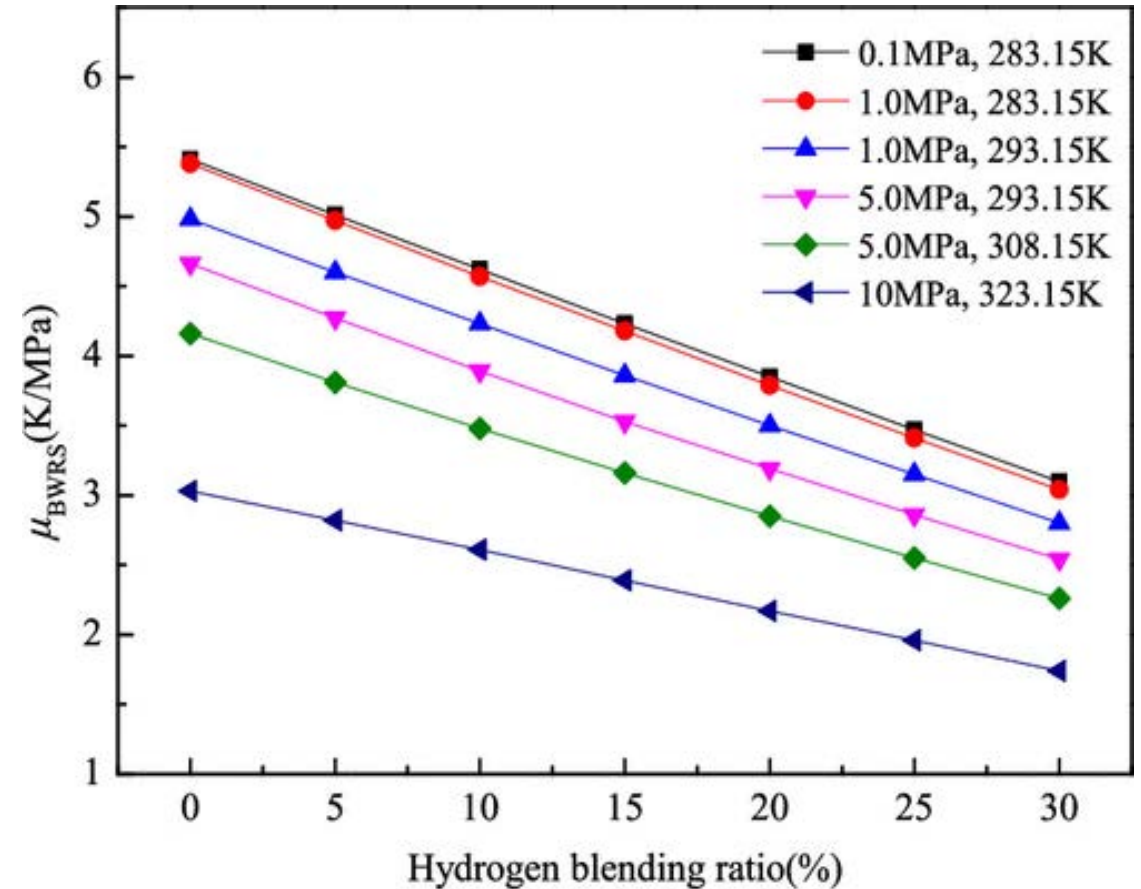
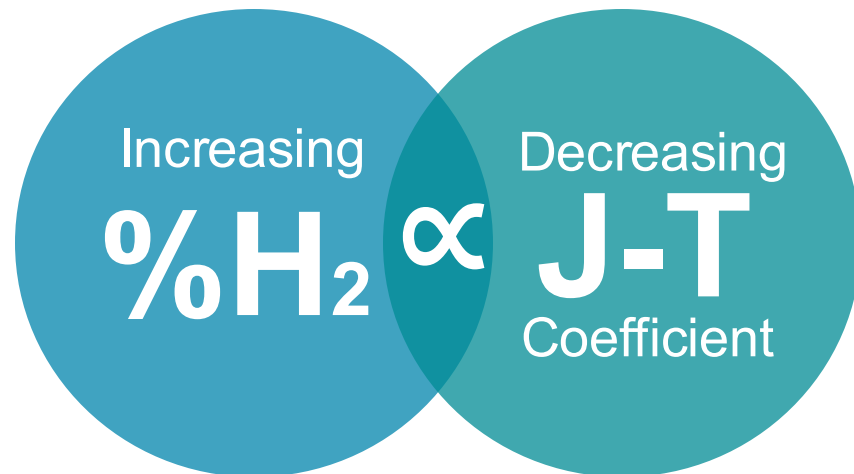
Existing grid can handle up to **20% hydrogen blends** without major changes

Hydrogen Impact on Emissions



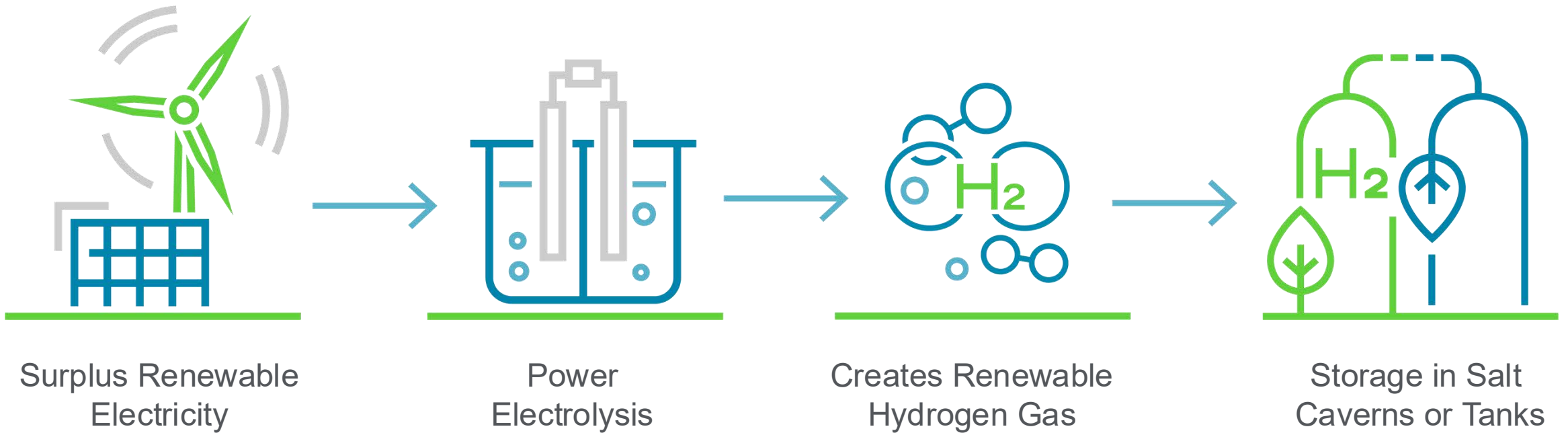
Improves consumer safety and decreases the impact on the planet

Joules-Thompson (J-T) Coefficient



Reduced energy needed for line heaters

Hydrogen as Energy Storage



Explored as a way to 'flatten the curve' associated with renewables

The Downside of Hydrogen

Process
Management
Change



Limits of Existing
Technology

Cost of
Implementation



Alignment of
Standards and
Regulations



A Roadmap for Hydrogen Blending

Hydrogen Roadmap



Contracts, Tariffs,
Industry Standards



Equipment
Compatibility



Standard Operation
Procedures & Training



Data Collection
& SCADA



Measurement
Systems



Accounting
& Billing

Contracts, Tariffs, Industry Standards

Systematic review of standards



Minimum heating value and definitions of allowed hydrocarbons will need to be updated



Existing documentation is either silent about hydrogen or treats it as a contaminant



Quality standards for gas blends need to be created

Hydrogen Roadmap



Contracts, Tariffs,
Industry Standards



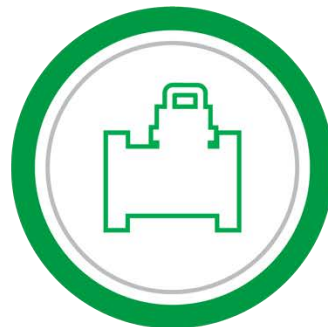
Equipment
Compatibility



Standard Operation
Procedures & Training



Data Collection
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Measurement
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Accounting
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Equipment Compatibility

Full Inventory of Equipment:

- Meters
- Flow Computers
- Control Valves & Regulators
- Pipes & Lines
- Analyzers
- Chromatographs
- More



Full or partial
replacement needed

Firmware, software,
hardware changes

Calibration standard
updates

Hydrogen Roadmap



Contracts, Tariffs,
Industry Standards



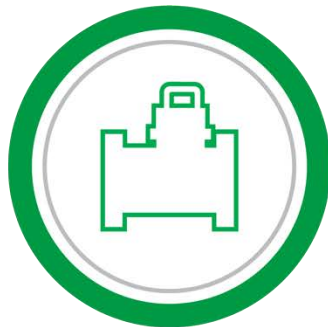
Equipment
Compatibility



Standard Operation
Procedures & Training



Data Collection
& SCADA



Measurement
Systems



Accounting
& Billing

Standard Operation Procedures & Training

Step 1: Update Standard Operation Procedures

- Safety
- Device configuration
- Calibration
- Testing



Step 2: Train Necessary Parties

Hydrogen Roadmap



Contracts, Tariffs,
Industry Standards



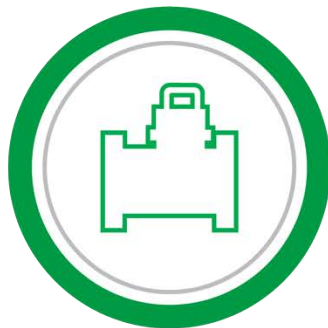
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Standard Operation
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Data Collection
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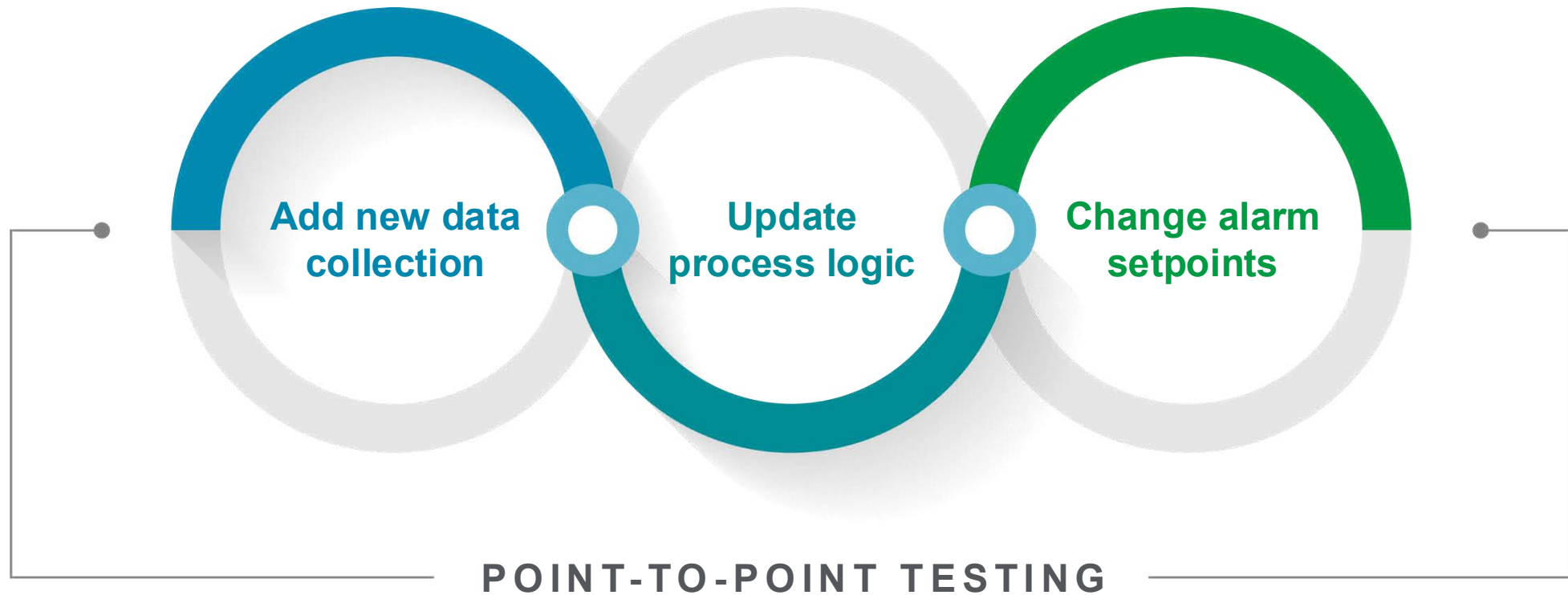


Measurement
Systems



Accounting
& Billing

Data Collection & SCADA Systems



Hydrogen Roadmap



Contracts, Tariffs,
Industry Standards



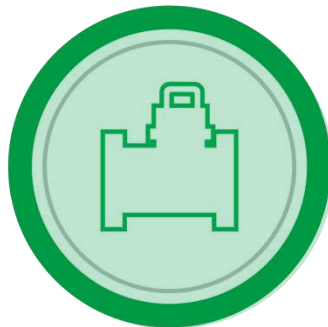
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Standard Operation
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Data Collection
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Measurement
Systems



Accounting
& Billing

Measurement Systems



UPDATE PHYSICAL PROPERTIES TABLES

- Heating value
- Specific gravity
- Compressibility



VERIFY ACCURACY

- Internal Calculations
- Measuring mechanics



ADJUST DATA FLOW

- Internal reports
- customer facing portals

Hydrogen Roadmap



Contracts, Tariffs,
Industry Standards



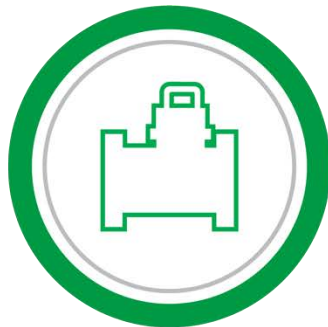
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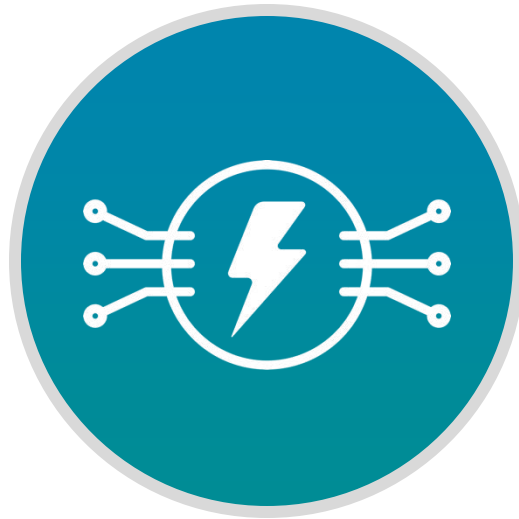


Accounting
& Billing

Hydrogen is Possible



Partner to solve



Energy portfolio mix



Project management



Questions?

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