NIKOLA™

Jesse Schneider

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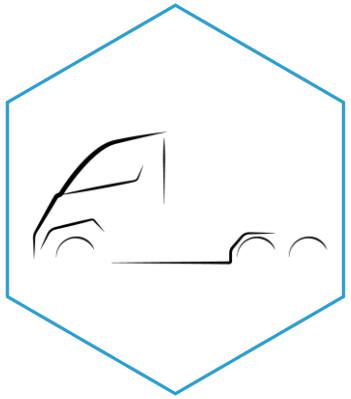
CLEAN FUEL,
ZERO EMISSION TRUCK
NO COMPROMISE

Hydrogen & Fuel Cell, Class 8, Heavy Duty Truck Commercialization

Nikola Motor

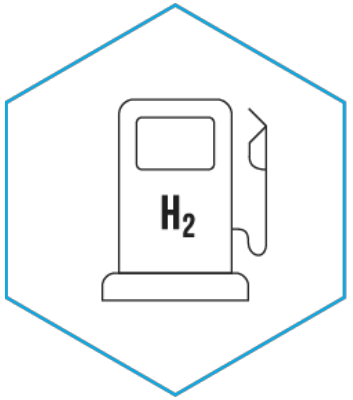
Zero Emission Trucking + Low Carbon H_2 :



Fuel cell trucks

- Long Range, Heavy Duty 40T Commercial Vehicle
- High Torque & Horsepower
- Zero Tailpipe Emissions and very low WTW

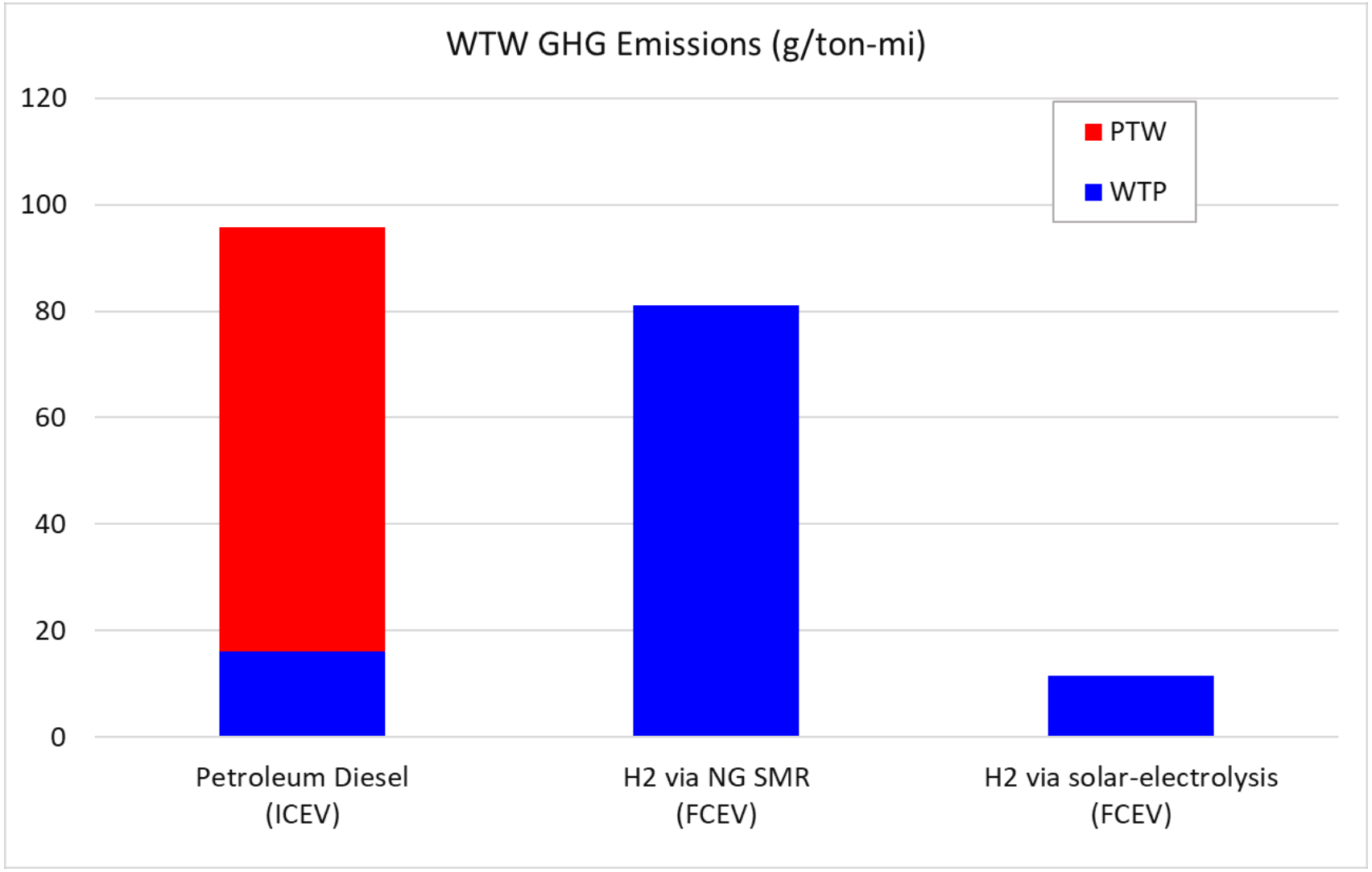
+



Hydrogen station

- Fast Fueling
- On-Site Hydrogen (8T) Generation from Grid with Supplemented Renewable Energy
- Onsite Storage (10T)
- Heavy Duty & Light Duty Fueling

Environmental Impacts: GHG Emissions* (Update: October 15, 2019) -Class 8 Combination Long-Haul Trucks

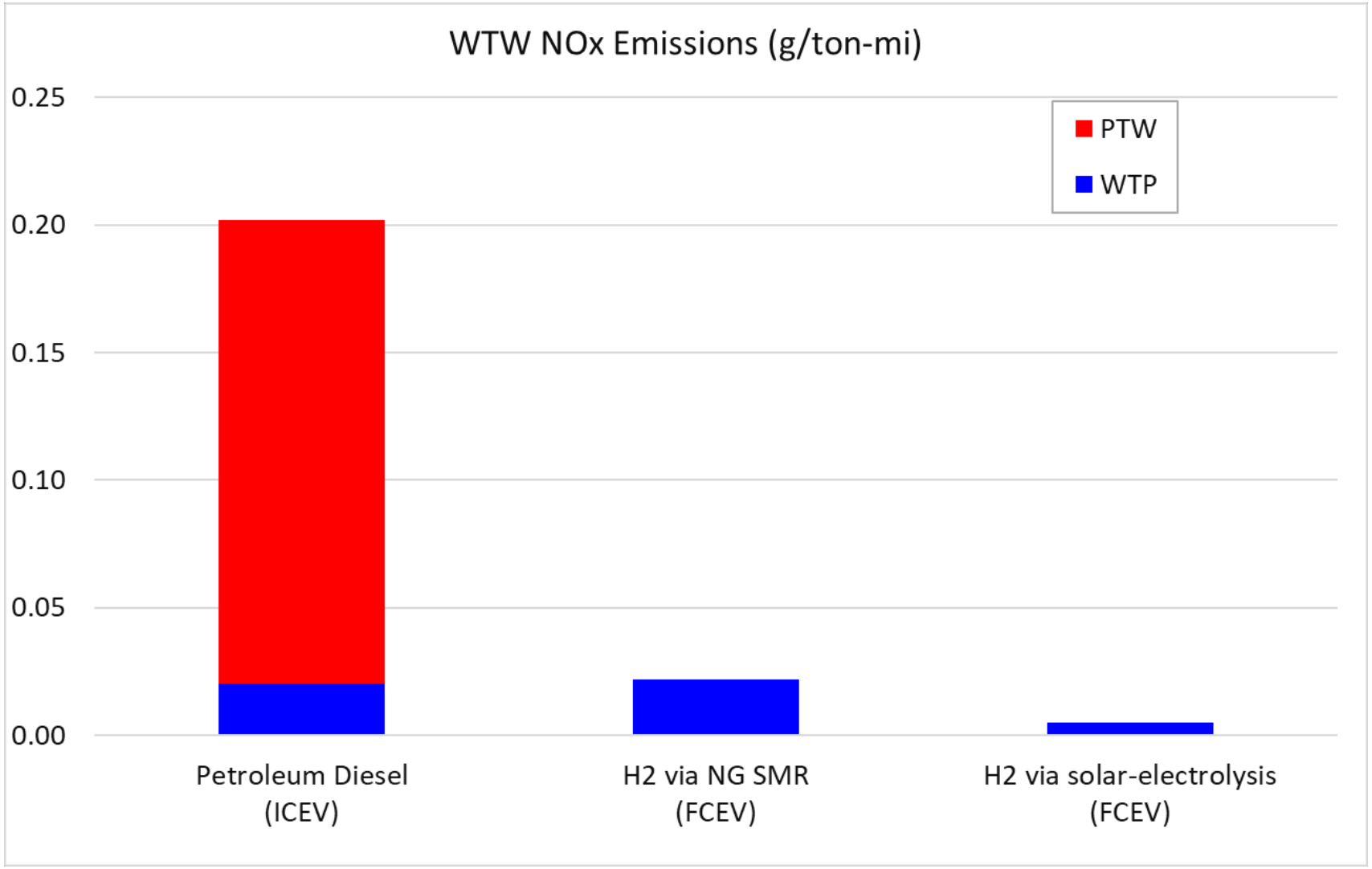


Acronyms:
WTW: Well-to-Wheels
GHG: Greenhouse Gas
WTP: Well-to-Pump
PTW: Pump-to-Wheels
ICEV: Internal Combustion Engine Vehicle
H2: Hydrogen
NG: Natural Gas
SMR: Steam Methane Reforming
FCEV: Fuel Cell Electric Vehicle

*Using Argonne National Laboratory GREET® (2019) model https://greet.es.anl.gov/

Argonne NATIONAL LABORATORY

Environmental Impacts: NO_x Emissions* (Update: October 15, 2019) -Class 8 Combination Long-Haul Trucks



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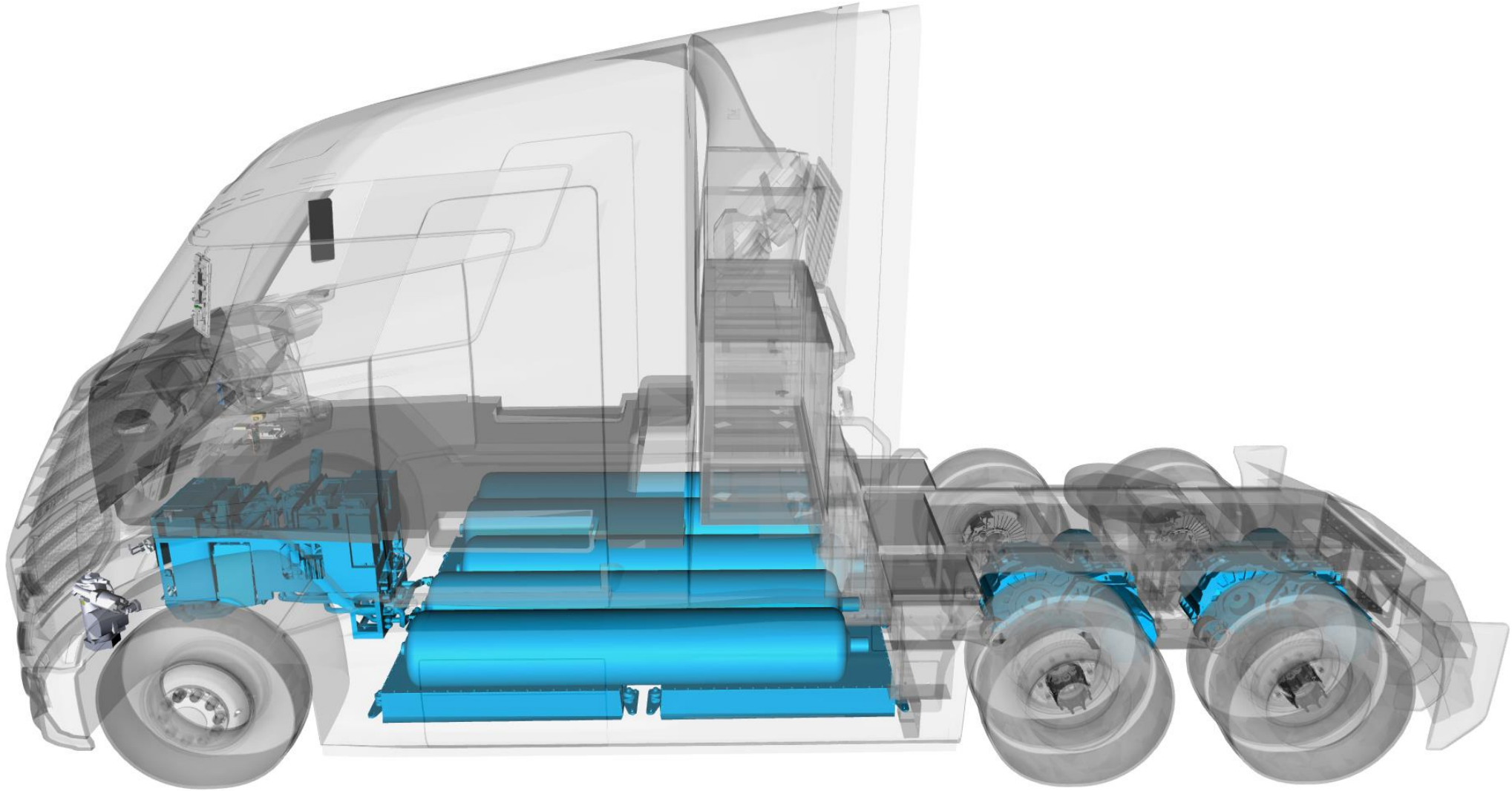
Argonne NATIONAL LABORATORY

First Purpose-Built Class 8, Fuel Cell Electric Truck



NIKOLA TWO™

- 240 kW FUEL CELL POWER
- 125kW-250 kWh BATTERY
- Four Wheel Independent E-DRIVE
- 600+ MILES OF RANGE
- AUTONOMOUS CAPABILITIES

NIKOLA TWO™

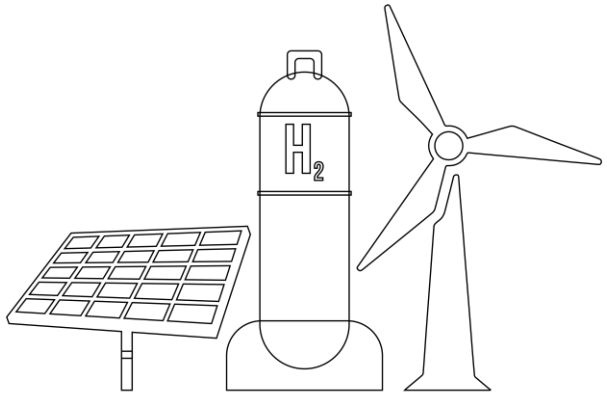
- 14,000 ORDERED
- 800 TRUCK ORDERS FROM ANHEUSER-BUSCH INBEV
- TRUCKS ARE T.C.O. LEASED ACCORDING TO MILEAGE WITH ALL FUEL & MAINTENANCE INCLUDED

8t/Day Pilot Station

Green Power + Electrolysis = Green Hydrogen

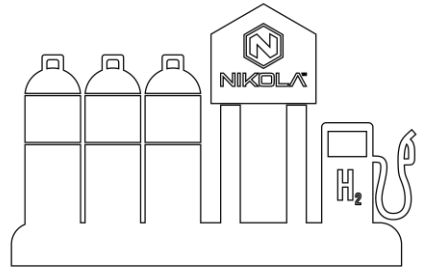
70mpa heavy duty & light duty
8T/Day Station Development Concept

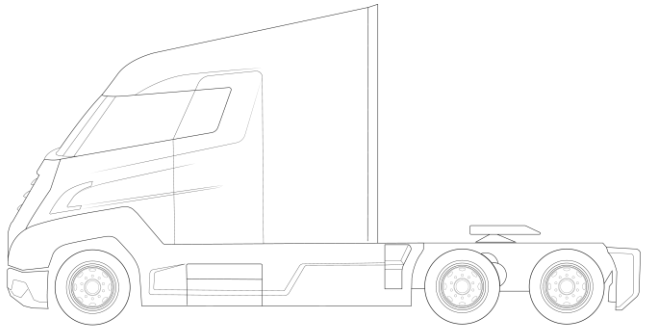
Hydrogen Generation Onsite for both Heavy Duty and Light Duty: 8T example

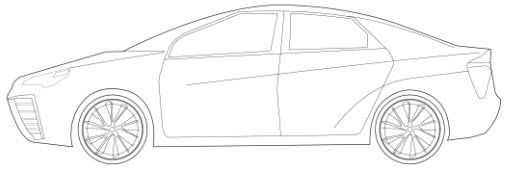


150 *trucks Per day*

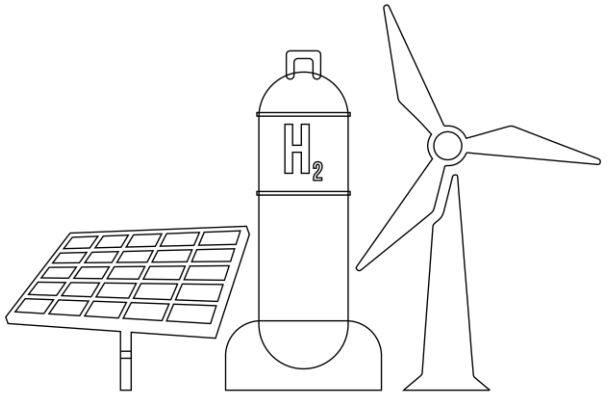
100 *cars Per day*





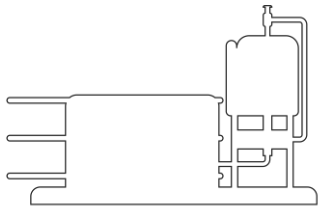


Key to Cost Parity with Fossil Fuels: using Renewable/ Nuclear < $0.04 / kWh

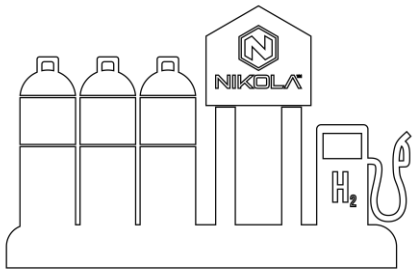


Hydrogen Generation with renewables & grid with low cost electricity

<$0.04 / kWh @Cost of electricity

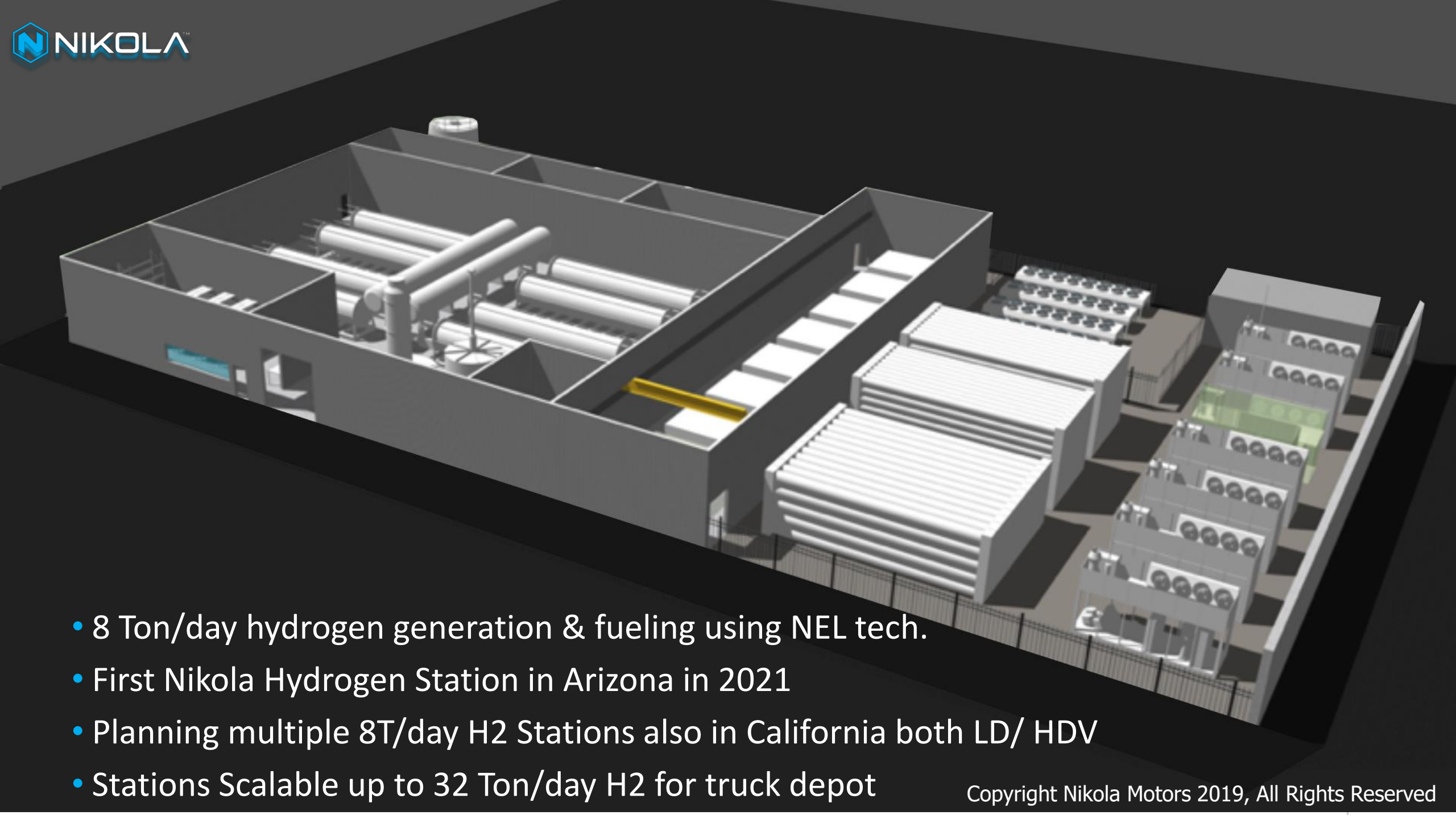


Alkaline Electrolysis "tried and true" technology



70 MPa Hydrogen Fueling for heavy duty applications

<$6.00 / kg Sale price of hydrogen



- 8 Ton/day hydrogen generation & fueling using NEL tech.
- First Nikola Hydrogen Station in Arizona in 2021
- Planning multiple 8T/day H2 Stations also in California both LD/ HDV
- Stations Scalable up to 32 Ton/day H2 for truck depot

New Fueling Equipment & Standards for Heavy Duty Fuel Cell Electric Trucks are being developed by an industry consortium MOU to enable safe, fast fueling

Industry 70 MPa Heavy Duty Fueling Equipment DEVELOPMENT

Nikola **NEL** **Air Liquide**

Hyundai **Shell** **Toyota**

Project is funded by the partners and HD hardware prototypes will be tested in 2020 (Lab/ Field)

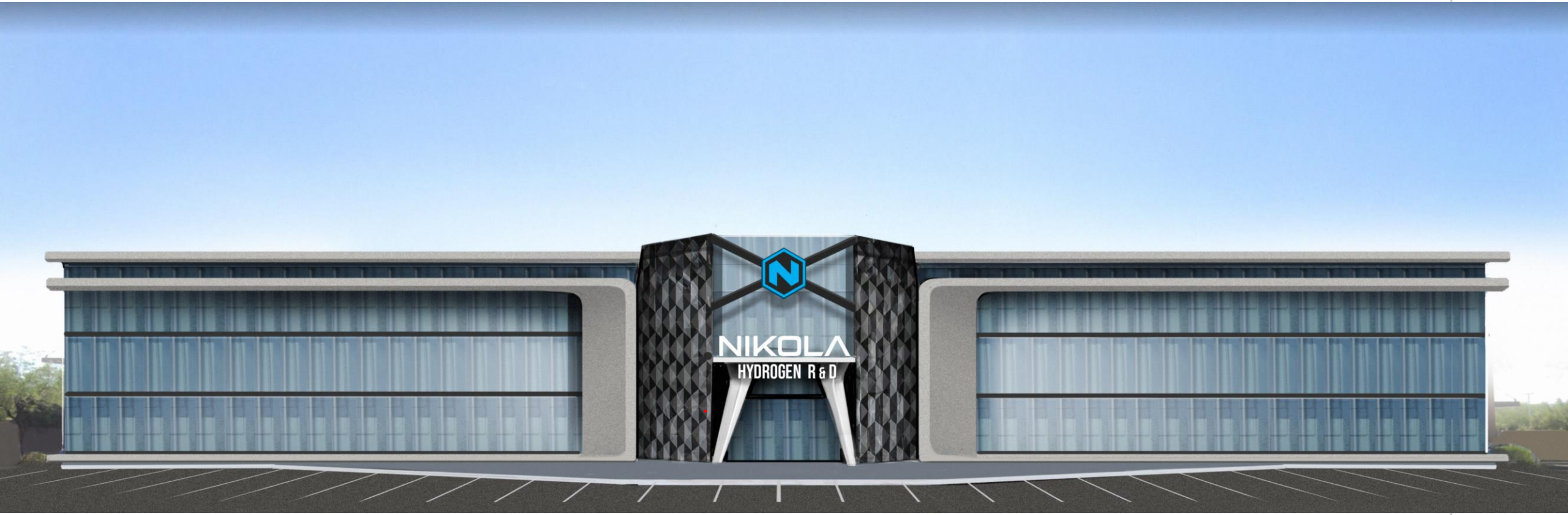
- HD H70HF Fueling Nozzle
- Receptacle
- Hose
- Breakaway

Fast Fueling with Hydrogen Development In Arizona:

70 *MPa*
High flow

15 *min*
HD fueling

80 *kg*
Full fill



8T / day hydrogen Development station for Fuel Cell Truck Fleet Testing

HD Fuel Cell Lab
Fuel cell & battery test stands

Extreme Environmental chambers:
Fuel cell systems (350kW)
Battery & E-Motor
Vehicle Dynamometer (1350kW)

Hydrogen Infrastructure R&D

70mpa heavy duty & light duty hydrogen station R&D

Nikola Demonstration Stations

Demo station #1: Nikola HQ (Phoenix, AZ)

- **Station Timing:** Completed Q1 2019
- **Station Features:** 1,000 kg of Hydrogen (H2) Storage, 70MPa Compression, and Dispensing to 60 g/s

Demo station #2: 2-Ton/Day / Fuel Cell R&D Facility (Phoenix, AZ)

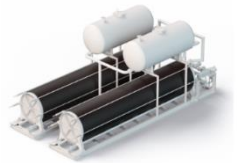
- **Station Timing:** Est. Q3 2020
- **Station Features:** 2 T/D H2 Production, Storage, Compression, and Dispensing
- **Other:** hydrogen tank test chambers , High Flow development dispenser system, FC test stations and high flow component test bench
- Fleet Test Trucks Starting Q1 2021

8-TON PILOT STATION: 8 T/Day (Phoenix, AZ)

- **Station Timing:** Est. Q3 2021
- **Station Offers:** 8T Light Duty & HD H2 Production, Storage, Compression, and Dispensing

Demo Station #1

Main Hydrogen Station Components



NEL A-1000 electrolyzer
2,000 kg/day

20 & 50 MPa Hydrogen Storage

Hydrogen Station fueling

Heavy-Duty Fuel Cell Truck Standards Priorities

Topics		Focus	Output
Nikola Hyundai Toyota Air Liquide Nel Shell	HD Fueling Protocol High-Flow 70MPa	• New Fueling Protocol • 80kg in 15 minutes H70 Fueling • New HD Communications	• ISO TC 197, WG 27 NWIP (December NWIP Proposal: US /Germany) & Asian countries • Harmonize with SAE
	HD Fueling Hardware High-Flow 70MPa	• New ISO/SAE H70HF Interface: Nozzle, Receptacle, Hose, Breakaway	• Hardware - Lead ISO • Harmonize with SAE
	HD Vehicle Safety Safety Requirements	• Update existing standards with HD FCEV • Update GTR13 Phase II	• UN GTR #13, Standardize requirements that can be adopted globally
	HD Fuel Economy Test Standard	• New World HD Dyno Cycle Test Procedures & Hydrogen Consumption	• New Document SAE • Harmonize with ISO
	Tunnel HD FCET Vehicle Safety	• Independent HD Hydrogen Safety Study	• International Report for LD & HD Tunnel Safety

to conclude

- Together with large OEM (Iveco) & Tier 1 Partners Nikola Motor Fuel Cell Hybrid Truck Purpose Built, Class 8 Chassis enabling 600+ Miles (1000km+). Over 14,000 Truck orders+
- Hydrogen, Fuel Cell, & Battery Development & Testing Center in Arizona
- Nikola + NEL are vertically integrated for H2@Scale
  - Nikola 8 tons H2 / day Stations starting in Arizona & Fleets
  - Nikola to mass produce FC Class 8 Trucks & Own stations
  - NEL to start mass production of electrolyzers
- Nikola stations will be available to customers and public fueling Heavy Duty / Light Duty fueling at 70MPa. 8 ton/day stations across USA starting in Arizona, California, then US rollout.
- For Hydrogen to be competitive, LC electricity costs < $0.04/kWh

to conclude

- Fuel Cell Hydrogen Trucks using renewable hydrogen give significant reduction in GHG & NOx WTW emissions. Renewables and nuclear are the lowest cost electricity, need to get this cost (<$0.04/kWh) for hydrogen generation to kickstart the H2/FC industry.
- The industry & government should work together to accelerate Heavy Duty Codes & Standards Research and Collaboration with international and US standards
- Need for Public/ Private Partnership H2@Scale & Fuel Cell Truck Demonstration Projects for fleet vehicles to help kick start public demonstration
  - Large Scale (8T+) Publicly available fueling site near key commercial routes that have potential to grow to critical mass (100’s of Class 8 HD/ LD vehicles, multiple tons of hydrogen) using renewable/ nuclear power

IVECO

NIKOLA™

Stay tuned…

Nikola's first H_2 station at new headquarters:

Largest Gaseous H_2 VEHICLE STATION in USA – 1T STORAGE