HYZON

Designing the Future of Fuel Cells:

Advances of Hyzon's Single Stack 200kW Fuel Cell System

May 2023

ZERO Emissions ZERO Compromise

EXECUTIVE SUMMARY

Hyzon has proprietary technology to produce high-power fuel cells for heavy-duty trucks. Hyzon's 200kW hydrogen fuel cell system's net output can meet the high-power demands of heavy-duty mobility. "Designing the Future of Fuel Cells" refers to Hyzon's singular goal to accelerate the clean energy transition by providing hydrogen fuel cells to power zero-emission vehicles with no compromise on power or range.

There are ~4.1 million class 8 trucks operating in the United States alone,[i] with ~68 million more heavy-duty trucks operating in the transportation industry globally.[ii] Diesel-fueled trucks account for ~11 billion tons of carbon emissions each year.[iii] As the demands on transport from the global economy continue to increase, a solution must be found to reduce the emissions intensity of the trucking industry.

The enormity of the opportunity is matched by the enormity of the challenges to convert the world's diesel-powered trucking fleet to emissions-free vehicles. Hyzon has a practical solution to help with the transition to clean power. The inertia of the diesel-fueled trucking industry must be fully appreciated.

Although substantial challenges remain, Hyzon has made significant progress towards that goal by taking a pragmatic approach to creating fuel cell systems for widely used heavy-truck platforms.[iv] Hyzon will build upon its 110kW fuel cell experience to commercialize the 200kW fuel cell system. This new offering will accelerate the emissions-free transition by providing the required power and durability for heavy mobility.

TABLE OF CONTENTS

Executive Summary ... 1

Status of Hydrogen Fuel Cell Development ... 3

Advantages of Hyzon's 200kW Design & Process ... 4

Single Stack Architecture Compact and Integrated System ... 4

Multiple Stack: ... 5

Single Stack: ... 6

Technological Hurdles of the Single Stack 200kW Fuel Cell System Design ... 6

System Compactness ... 6

System Complexity & Reliability ... 7

Manufacturing Cost ... 7

Advantages of Hyzon's 200kW Design & Process ... 8

Hybrid Bipolar Plates ... 9

Power Generation ... 10

Reduction in Contact Resistance ... 10

Improved Heat Distribution & Water Management ... 10

Other Benefits of Hybrid BPP Design ... 11

Hyzon's proprietary 7-layer Membrane Electrode Assembly (MEA) Design and Manufacturing ... 11

Manufacturing Expertise ... 13

Development Plan and Path Forward ... 15

Upcoming Milestones ... 16

Appendix ... 17

Hyzon's 15-Cell Short Stack Performance Testing with Different Cathode Stoichiometry at AVL[i] ... 17

Hyzon 15-Cell Short Stack Performance Testing: Cathode Humidity Impact at AVL ... 18

List of Patent Applications Protecting Hyzon's 200kW ... 19

Hyzon Motors USA INC. - Patent Control Summary as of April 19, 2023 ... 19

Government Subsidy Information ... 20

References ... 21

STATUS OF HYDROGEN FUEL CELL DEVELOPMENT

Hyzon continues to advance the state-of-the-art fuel cell systems for heavy truck-duty applications. Decades of experience in on-road fuel cell applications with real-world mileage in fuel cell trucks upfit with Hyzon's 110kW and 120kW ("100kW-range") fuel cell system technology advance the development and manufacturing of the flagship single stack 200kW fuel cell system.

Parallel workstreams allow for a 2024 Start-of-Production ("SoP") of this new offering. Concurrent activities include Membrane Electrode Assembly ("MEA") performance and stress testing, short stack performance and durability testing, Fuel Cell System ("FCS") characterization, in-vehicle testing, factory process optimization, and pilot builds of B- and C-Sample systems.

An integrated management structure with close coordination across operational groups is required to advance development of this multifaceted project. Fuel cell test results feed directly into engineering and manufacturing teams, while vehicle testing and customer demonstrations are regularly monitored by engineering and commercial teams. Results to-date show that the Hyzon unit cell has stable and predictable performance in Accelerated Stress Testing ("AST"), and low sensitivity to Relative Humidity and Cathode Stoichiometry.

Currently, the majority of the hydrogen fuel cell industry is focused on developing and producing fuel cells in the 100kW range. Although Hyzon's fuel cell stack manufacturing is controlled inhouse, BoP components are sourced externally. Since component suppliers have largely positioned themselves to serve the 100kW development efforts, a supplier strategy and supply chain to support the production of the 200kW FCS had to be created. By developing strong relationships with suppliers of key BoP components, such as air compressors, cathode humidifiers, Direct Current/Direct Current ("DC/DC") converters, and coolant pumps, Hyzon has secured access. BoP components are purpose-built by many of these suppliers for the Hyzon 200kW fuel cell systems. To ensure the highest quality, these components are tested and fully validated for the demanding requirements of commercial vehicle operating environments prior to delivery.

Hyzon is laser-focused on the highest quality SoP. When creating breakthrough technology, challenges are expected. Hyzon's highly skilled team has already achieved dramatic technological advances to bring the single stack 200kW to this point of development and is well positioned to overcome the next set of challenges. Hyzon remains on track to meet validation milestones and production goals.

ADVANTAGES OF HYZON'S 200KW DESIGN & PROCESS

Single Stack Architecture

COMPACT AND INTEGRATED SYSTEM

Heavy-duty trucks require high-power output for optimized mobility, fuel economy, and performance. High-power output demands are difficult to meet with individual hydrogen fuel cell systems. To meet the power requirements lacking in a single system truck, Original Equipment Manufacturers ("OEMs") have opted to combine two complete sets of 90-150kW fuel cell systems to generate the necessary power.

Hyzon's 200kW fuel cell system features a single stack that generates enough electricity to meet these requirements.

As explained below in the Bipolar Plate ("BPP") section, Hyzon's proprietary BPP design allows for a compact fuel cell stack with uniform distribution of reactant gases and coolant, and tolerance to shock and vibration loads expected in mobility applications.

Our inhouse anode module design is compact and seamlessly integrates all components to the stack: hydrogen supply injectors, pressure sensors, water separator, purge valves, and recirculation ejector. The fuel cell controller ("FCU") precisely regulates the anode main supply, and water and nitrogen purging. The anode module is directly mounted to the stack housing, minimizing the piping connections, and sealing surfaces.

A fuel cell needs a DC/DC voltage converter to work with a lithium-ion battery in the vehicle, an air compressor motor inverter, a positive temperature coefficient ("PTC") heater (required for pre-heating during sub-zero conditions), and a high voltage ("HV") to low voltage ("LV") DC/DC down-converter for 12/24Vdc power systems.

While other companies are dependent upon third-party suppliers to source multiple components, Hyzon has collaborated with its supplier network to design its own multiple-in-one DC/DC power distribution unit ("PDU") that delivers all the required power conversion and distribution functions.

This PDU is connected to the fuel cell's positive and negative terminals through embedded bus bars, as opposed to externally connected HV and LV connectors and cables. Hyzon's integrated design eliminates the external connectors and cables that are bulky, heavy, costly, and susceptible to water ingression and connection failures.

The single stack, anode module, and PDU form a streamlined high-power-density assembly. The optimized dimensions allow the assembly to be packaged in both bonneted and cabover trucks once it is connected to the other BoP components.

Hyzon's proprietary cathode module design integrates all components into a single unit. The layout reduces several plumbing parts and connections thereby reducing assembly time, saving packaging space, and reducing weight. This is a far more efficient design than other industry alternatives that require a separate humidifier, intercooler, and cathode flow control valves.

The thoughtful layout of other key BoP components such as the air compressor, water pump, fuel cell control unit (FCU), etc., maximizes available space to achieve a high performance and robust fuel cell system.

Another distinguishing fact is the system design and fuel cell production are done entirely inhouse with BoP components sourced from Hyzon's strategic network of suppliers.

MULTIPLE STACK:

To achieve 200kW net output power without a single stack fuel cell system, two 100kW-range systems need to be installed, which requires multiple sets of BoP components.

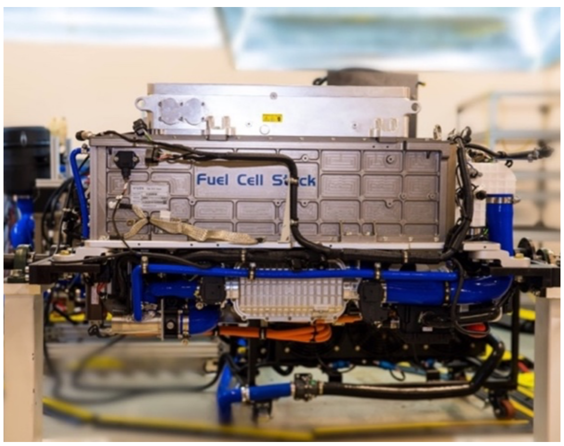
- Boost or bidirectional DC/DC convertors
- Air compressors
- Humidifiers
- Intercoolers
- Water pumps
- Anode components
- Controllers
- 12/24VDC DC/DC convertors
    - Pressure regulators
    - Temperature sensors
    - Electric valves
    - HV cables
    - LV harnesses

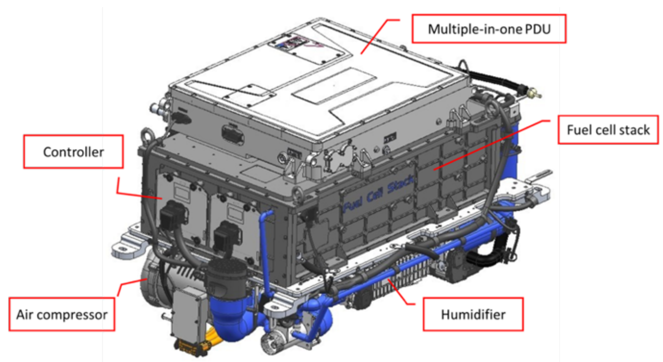
SINGLE STACK:

With Hyzon's single stack 200kW fuel cell system, the packaging space, cost, and integration burden are significantly reduced.

Benefits

- No interoperability issues
- More compact
- Lighter
- Scalable mass production
- Fewer parts
- Lower Cost





Hyzon's Single Stack 200kW Fuel Cell System

Technological Hurdles of the Single Stack 200kW Fuel Cell System Design

Each distinct benefit enjoyed by the 200kW fuel cell system required an innovative approach to overcome its corresponding technological hurdle.

SYSTEM COMPACTNESS

To achieve a comparable net power level, a multiple stack system requires approximately 30% more space for packaging than a single 200kW system. To generate the equivalent power with less space, Hyzon has developed a new and improved fuel cell design. Hyzon has been able to reduce fuel cell system packaging size by increasing the unit cell power density using Hyzon's patented hybrid BPP and MEA design.

SYSTEM COMPLEXITY & RELIABILITY

The greater the complexity of the system, the higher the probability of interoperability issues. It may be problematic to find the source of failure in a complex system due to difficulties in determining which interaction of the multiple components is not performing to specifications, or which component is responsible.

The single stack architecture prevents the need for multiple sets of BoP components (e.g., bidirectional DC/DC convertors, air compressors, humidifiers, water pumps, anode components, controllers), which would be required in the multiple stack architecture favored by Hyzon competitors.

With clear advantages, Hyzon believes that single stack architecture will ultimately be the prevailing industry design. Hyzon has developed sophisticated system controls and software to manage the integrated system design, allowing for crucial real-time insights into stack performance.

The creation of the 200kW is the culmination of years of accumulated R&D and productization. The single-system design is based on the lessons of multiple product development generations dedicated to improving fuel cells.

A drawback of eliminating the need for duplicate parts is a loss of redundancy in the event of a system failure. To obviate the need for redundancy, Hyzon is conducting robust durability testing to verify that the 200kW will perform as expected.

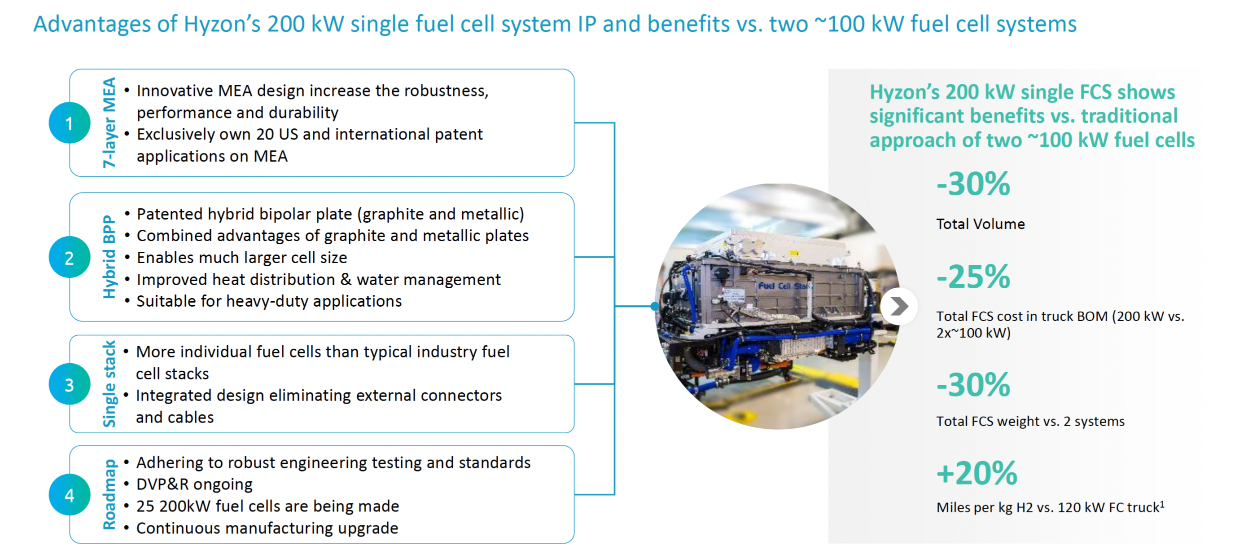
MANUFACTURING COST

Hyzon’s single stack 200kW system costs 25% less to produce than two 100kW-range systems. The single stack system has fewer expensive components such as air compressors, humidifiers, and DC/DC converters which lowers input costs. Labor costs are also lower, as fewer parts need to be installed. Further, Hyzon uses roll-to-roll (or continuous) MEA production equipment, increasing production capacity. The design of the integrated PDU, integrated anode and cathode modules, as well as the roll-to-roll MEA manufacturing process and the hybrid BPP manufacturing approach bring down the total cost of the fuel cell system.

FUEL CELL PERFORMANCE

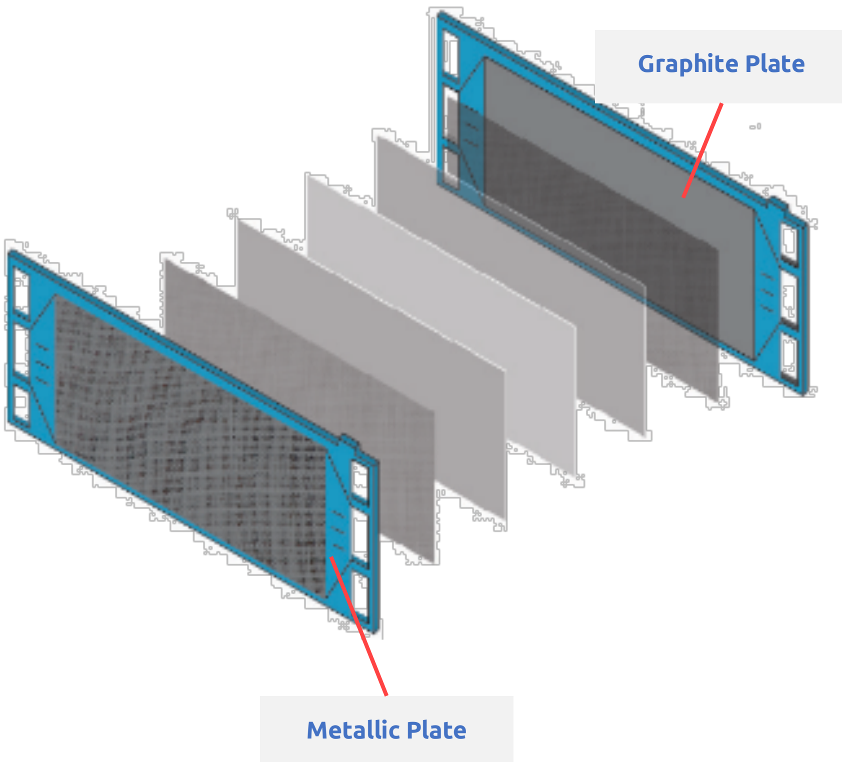
Compared to Hyzon's 100kW-range, the 200kW has much higher fuel efficiency at a given power output, significantly improving the total cost ownership of the trucks. Compared to test data from the 120kW truck, early testing of the 200kW truck at a test track, using similar payload and route simulations on a flat road, showed approximately 20% increase in miles per kg of hydrogen. When the fuel cell operates at higher efficiencies, the integration burden of the cooling system is reduced, as is the stress on the stack and BoP components. Additionally, when two 100kW-range fuel cell systems are used, maintaining both at the optimal operating efficiency simultaneously is more complex than maintaining a single stack 200 kW system at the optimal operating point.

ADVANTAGES OF HYZON'S 200KW DESIGN & PROCESS



1. 200 vs. 120kW at 120kW; Estimated based on early 200 kW truck testing at test track in similar simulated routes on flat road vs. similar use case performance with single 120 kW FCS

Hybrid Bipolar Plates



Hybrid bi-polar plate—MEA schematics

Bipolar plates (BPPs) form the backbone of the fuel cell stack. BPPs play a critical role in distributing reactant gases, coolant, and heat, carrying current from the MEAs to the end plates, removing water, and separating the individual cells. The performance of the stack, as well as its expected lifetime are highly dependent on the proper functioning of BPPs.

In the race to achieve total cost of ownership parity for hydrogen fuel cell systems with the internal combustion engine, BPPs are a competitive focal point. They make up a significant percentage of the stack material cost, volume, and weight, and are thus a key determinant to market adoption.

Graphite plates are a proven technology which typically provide for better durability, but they tend to be bulky, heavy, and difficult to start in cold temperatures (e.g., -30 degrees C). All-metallic plates typically have a thinner plate structure and higher power density, but tend to be challenged by corrosion over time, making long lifetime durability a challenge. While each plate technology type can have its benefits and challenges, Hyzon has taken the best of both, innovating the specific design of the BPP to incorporate the benefits each can provide, while reducing the potential downsides of each.

Hyzon has a patented hybrid BPP. It is comprised of a graphite plate for cathode and a titanium plate for anode. Hyzon's unique flow-field designs on both cathode and anode plate and materials enables not only uniform flow distribution of reactants (H2 and O2) to MEA but also effective removal of product water for high performance and durability. Each side of the plate is independently designed to create a durable, highly conductive flow-field, tailored to the specific requirements and environment with which it interacts. **Through a unique combination of graphite and metallic surface engineering, Hyzon's hybrid bipolar plates are corrosion-resistant, thin, and highly resistant to reactant gas leakage, significantly contributing to the fuel cell stack's durability, power density, and efficiency.** Hyzon's IP tailors the material of each type of plate to the specific mobility high power density use case, minimizing thickness, improving durability, and increasing performance. The process Hyzon utilizes to treat the material and design the structures within the plates enables a hybrid BPP that is highly productive, durable, and high performance from a power density, water management and heat management standpoint.

POWER GENERATION

Hyzon's hybrid plate and sophisticated flow-field designs allow Hyzon to increase cell size and active area without a notable tradeoff in performance. A larger active area enables high power density due to the higher current capability, therefore, more suitable for heavy-duty truck applications. Heavy-duty trucks require continuous high-power to operate, while passenger cars typically run at low-to-medium rated power. Hyzon 200kW with the hybrid BPP can operate continuously at high power, while metallic plate fuel cells usually operate at the middle of the rated power.

REDUCTION IN CONTACT RESISTANCE

In a fuel cell, electrons flow through and along the BPP. Graphite plates can be fabricated to achieve high surface flatness. Due to its stiffness, the graphite plate can support the large thin metallic plate to ensure larger contact surface area between the two plates, resulting in less contact resistance for electric conductivity and more uniform distribution of contact points. Less resistances in both through-plane and in-plane directions contribute to higher stack efficiency.

IMPROVED HEAT DISTRIBUTION & WATER MANAGEMENT

Reduced contact resistance with uniform distribution of contact points permits large stack current fluxing throughout the fuel cell, thus minimizing the possibility of localized hot spots. Superior in-plane thermal conductivity of the graphite plate allows high tolerance of cell-to-cell voltage variation and uniform heat distribution, improving power delivery and thereby reducing the risk of overheating.

Use of a graphite plate enables a much finer and more diversified flow channel design which is needed for a highly uniform cathode air distribution and better water management.

OTHER BENEFITS OF HYBRID BPP DESIGN

The patented hybrid design offers additional benefits that neither the full graphite nor full metallic plates can replicate, as each individual plate has their respective drawbacks. For instance, a full graphite plate is much heavier and thicker. The thickness of the BPP will limit the number of unit cells that can be stacked up. If the stack is too long, it will encounter other issues such as uneven flow distribution among individual cells. The heavier and longer stack may not be able to endure the shock and vibration loads in motive applications. The full graphite plate design therefore has less power density and an inability to make a high-power single stack. The length of the full graphite plate will also become a packaging issue for the available space in heavy-duty trucks.

Alternatively, a fully metallic plate design has shorter use life with the inability to operate at high power for a sustained period of time. Metallic plates are more susceptible to corrosion by the cathode electrochemical reaction. Hyzon's hybrid plates do not encounter corrosion since a metallic plate is used on the anode side.

Hybrid BPP design avoids the leak issue seen in full graphite plate design on the anode side due to the high porosity in the graphite plate where hydrogen tends to leak through.

A hybrid BPP is less expensive to produce because it does not require a complex and high-precision driven stamping and welding process required by full metallic plates.

Hyzon's proprietary 7-layer Membrane Electrode Assembly (MEA) Design and Manufacturing

DESIGN & SOURCING

All the electrochemical reactions to generate power – the hydrogen oxidation and oxygen reduction – take place within the MEA. Its core components consist of a membrane, catalyst, ionomers, gas diffusion layers ("GDL"), and gaskets.

Hyzon designs and manufactures its MEAs in-house, which provides the strategic advantage of controlling the entire development process. Keeping production in-house also creates the opportunity to generate significant intellectual property. Hyzon sources the component parts of an MEA (membrane, catalysts, ionomers and GDL) directly from suppliers. This offers potential procurement savings in comparison to sourcing the MEA from suppliers, but also gives flexibility to design electrodes specific to Hyzon's product needs.

Deep technical knowledge and experience enable Hyzon to select the highest quality components and design the optimal composition, which has a direct impact on the electrode structure, performance, and durability of the catalyst layer coating.

The formulation of the catalyst ink, with precise selection of catalyst materials, additives and solvents enables Hyzon to produce suitable electrode structure for high and robust fuel cell performance.

The figure below illustrates the key stages in designing the catalyst ink features of Hyzon's proprietary MEA.

Sourcing	• Down selection of engineered catalysts and catalyst support based on key electrocatalytic properties • Down selection of ionomers/binders based on conductivity and transport properties and stability • Down selection of solvent, solvent blends and additives based on interaction properties with catalyst and ionomers
Design	• Proprietary design and processing of ink composition to enable optimum catalyst-ionomer interaction for better reactant access and proton transport • Homogeneous and stable ink formulations
Production	• Production of catalyst inks with optimum particle size, viscosity and solids to enable coating to form suitable electrode structure for efficient hydrogen and oxygen reduction for high performance stack

Fuel cell catalyst ink-Material sourcing, design, and production process flow

The prevailing technology for both anode and cathode catalysts are Platinum based. The anode's function is to separate hydrogen molecules into protons and electrons. The cathode catalyst's function is to reduce oxygen in the MEA to produce water.

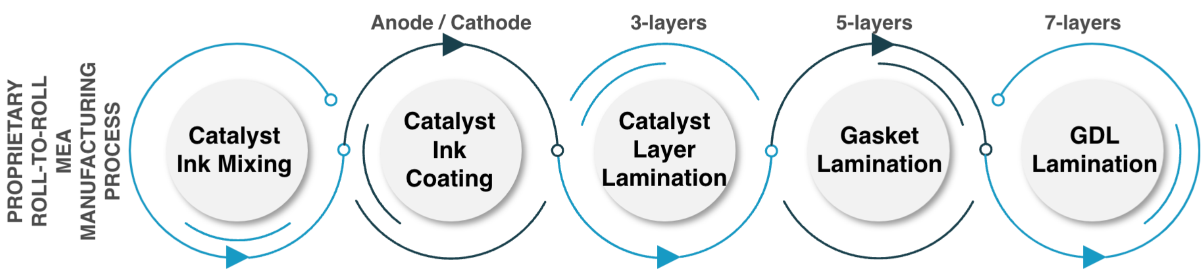
Though there have been significant efforts, both in industry and academia, devoted to developing advanced cathode catalysts and catalyst layers to counter slower oxygen reduction reactions at the cathode compared to hydrogen oxidation reaction at the anode, the anode catalyst layer can also encounter issues, during freeze operations or fuel starvations. These are key technological hurdles for fuel cell development. Hyzon's innovative anode designs increase robustness, creating minimal performance and durability variations within the stack during adverse conditions such as freeze operation.

In Hyzon's cathode catalyst layer architecture, the electrodes have been designed with suitable ionomers and catalysts for enhanced proton transport in the catalyst layer under wider relative humidity conditions. By optimizing the properties of the cathode catalyst layer such as surface area, porosity and pore size, accessibility of oxygen to the catalyst surface is increased, boosting the performance of fuel cells. In addition, selecting and optimizing the GDL facilitates better gas transport and water management.

Hyzon is also developing novel stabilizers to improve membrane lifetime without tradeoff in performance. Hyzon is committed to further improving the performance at high current densities beyond its current designs, using innovative electrode designs. Hyzon currently and exclusively owns 20 US and International MEA-related patent applications.

MANUFACTURING EXPERTISE

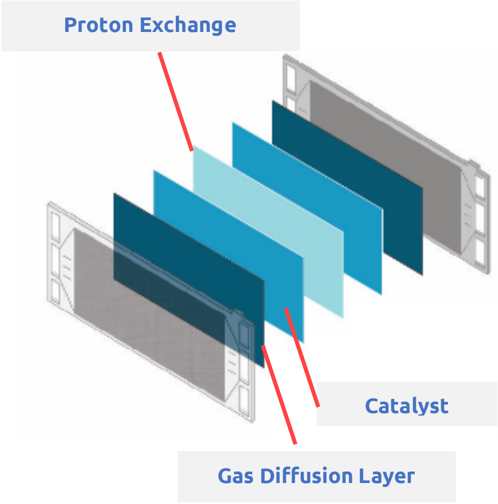
Hyzon also has an innovative MEA manufacturing process shown in the figures below:



MEA production process flow

1. The catalyst ink is processed using proprietary ink mixers and characterized based on key properties such as solids, viscosity and particle size before coating. After validation, the catalyst ink is coated on continuous roll-to-roll coating equipment, followed by the catalyst layer lamination (3-layers), gasket lamination (5-layers) and GDL lamination (7-layers).
2. Cathode catalyst layer is coated on the membrane (the layer where oxygen reduction reaction happens at the cathode in the MEA).
3. Anode catalyst layer on a substrate film, e.g., Teflon, (where hydrogen oxidation happens at the anode in the MEA).
4. The anode catalyst layer on the substrate is transferred to the non-coated side of the membrane by roll-to-roll lamination equipment (anode catalyst layer/membrane/cathode catalyst layer constitute the 3-layer.
5. In the next step, the 3-layer roll is integrated into sub-gasket by roll-to-roll equipment (two sub gaskets: one for anode side and one for cathode side) to form the 5-layers.
6. Finally, gas diffusion layers are integrated by roll-to-roll equipment (one for anode and one for cathode) to form 7-layers, referred to as the MEA.

Illustration of MEA Structure (at right)



We believe Hyzon's custom designed and engineered manufacturing equipment is key for advanced MEA manufacturing.

Currently, the yield rates,v depending on the process step, vary between 93 and 99%, including the design scraps.

Hyzon uses a roll-to-roll/continuous approach to increase production capacity of MEAs. Hyzon is preparing in advance to meet the demands by having multiple coating lines fully functional, with separate coating lines for anode and cathode. Hyzon's custom engineered equipment, 3-layer (catalyst layer lamination), 5-layer (gasket lamination), and 7-layer (GDL lamination) can be quickly and efficiently upgraded to meet higher demand of MEAs for Hyzon's fuel cell stacks.

Hyzon also integrates in-line visual inspection and advanced microscopic tools to increase quality and reduce defects and rejects.

DEVELOPMENT PLAN AND PATH FORWARD

The merits of the single stack 200kW fuel cell system architecture are compelling. Although the progress to date has been impressive, there are still major milestones to accomplish on the path to produce fuel cell systems at scale. Maturing B-sample systems built at Hyzon's Bolingbrook, IL facility is an important step in the product development process. These 200kW fuel cell systems are fully-functional systems as demonstrated in laboratory and vehicle testing today. Each unit assembled in pilot builds increases the data set. As more data is gathered and analyzed, efficiency and quality in production processes can be improved.

As Hyzon advances toward the system SoP, three key initiatives continue:

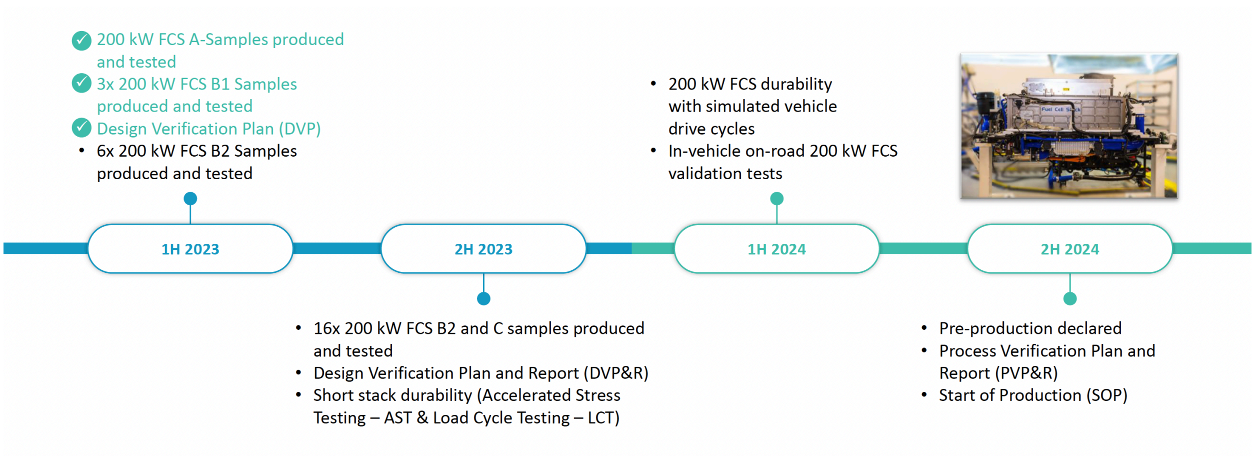
1. **Fuel cell stack and system testing for SoP and durability:**
   Real-world and worst-case operating profiles are simulated in the laboratory environment at Hyzon. This testing is both time and cost efficient, as it allows for many samples and conditions to be run simultaneously, without the complexity of full-vehicle testing. This MEA and short stack testing will continue past SoP; the data collected will provide invaluable insights to inform both production quality and R&D efforts for future products.
2. **Design release and manufacturing qualification:**
   Testing data gathered and pilot build experience will help shape the final engineering design release and provide crucial information to refine the manufacturing process. B-Sample builds using production-intent processes allow manufacturing stakeholders to improve upon the process. Critical assessment of the early production is essential to a successful SoP. Similarly, B-Sample designs are fully functional, even if built using prototype tools. As such, performance and durability should be representative of the C-Sample units. As with any technology development

program, any issues that arise in B-Sample testing can be addressed prior to production design freeze and software release.

3. **On-vehicle durability testing:**
   Vehicle operating profiles can be simulated in the laboratory, but vehicle testing provides an opportunity to evaluate components and systems *in situ*, with representative interfaces and environmental conditions. Both laboratory and in-vehicle testing are crucial for a robust product development program. Considered confirmation testing, vehicle-level testing is resource intensive, but a valuable "final check" to demonstrate that all systems will perform as intended for customers. On road operation and evaluation may involve Hyzon drivers or early-adopters, and can run for thousands of miles, across many different terrains and climactic conditions.

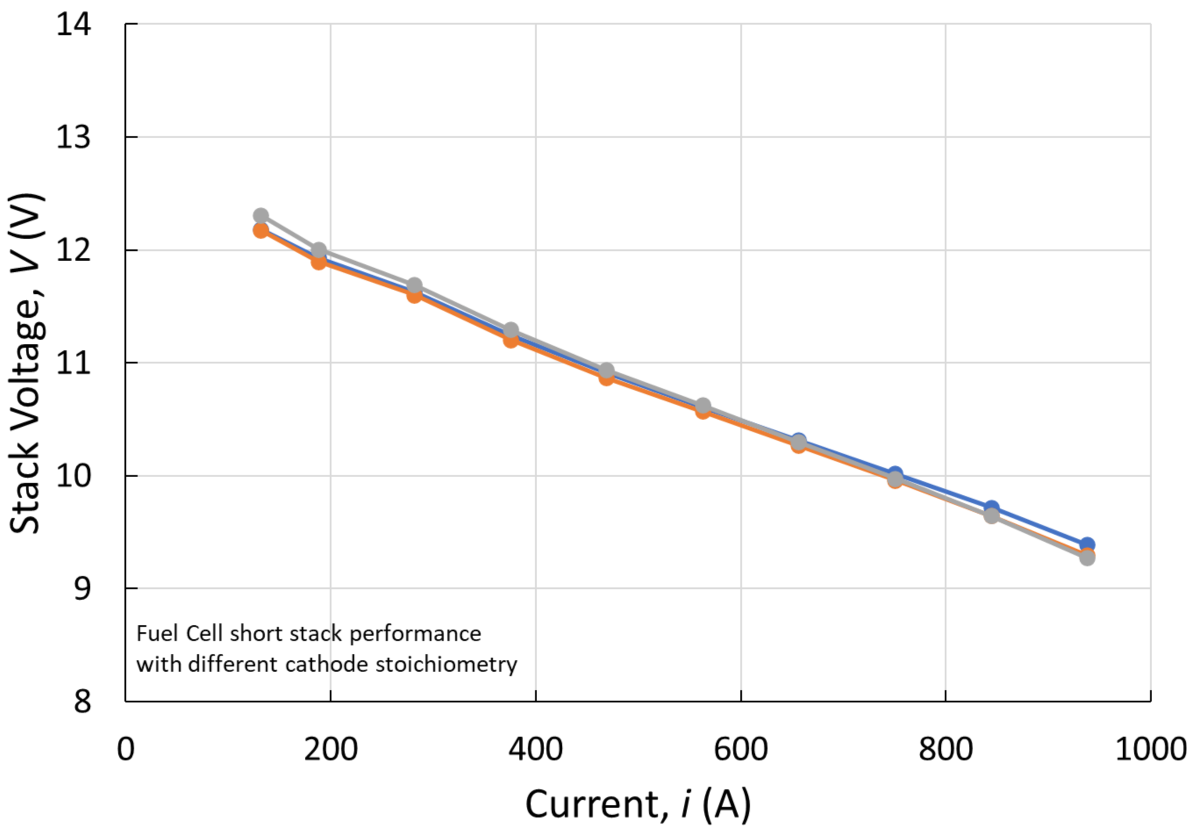
Upcoming Milestones

The chart below shows the major milestones Hyzon plans to execute to bring the 200 kW single FCS through its SoP and durability plan. Several major milestones have already been achieved, including producing and testing three B1 Sample 200 KW FCS's, and completing the Design Verification Plan (DVP). Additionally, the 6x 200 kW FCS B2 Samples are well underway, targeted for testing by end of 1H 2023.



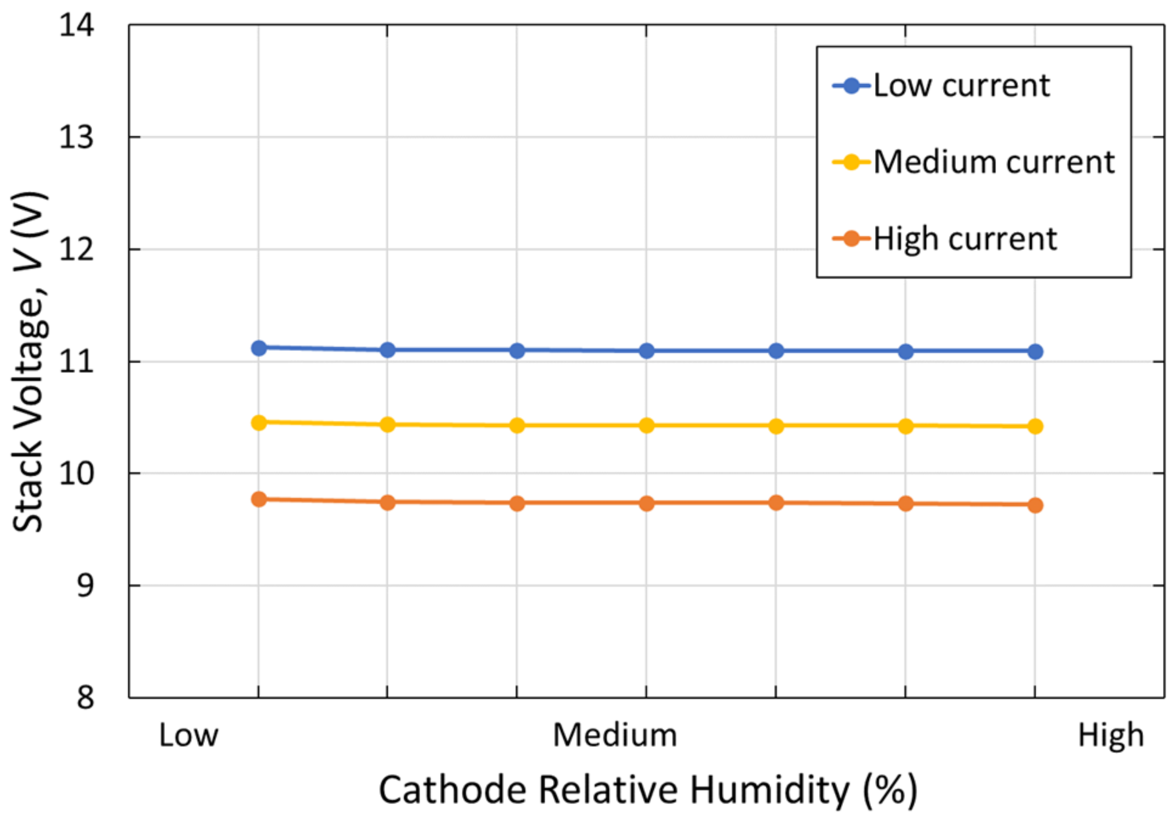
APPENDIX

Hyzon's 15-Cell Short Stack Performance Testing with Different Cathode Stoichiometry at AVL[i]



Hyzon 15-Cell Short Stack Performance Testing: Cathode Humidity Impact at AVL

Hyzon's Short Stack made at Bolingbrook and tested at AVL, Canada



List of Patent Applications Protecting Hyzon's 200kW

Category	#	Description
MEA	20	Covers, electrode design, membrane catalyst, gas diffusion later
BPP (Bipolar plate)	6	Flow field design, durability improvement
Unit cell	6	Sealing, bonding
FC Stack	4	Stack design, assembly
Balance of plant (BOP)	4	Humidifier
Fuel Cell System	2	Modular boost converter
Hydrogen Storage System	1	Modular storage system
Vehicle	7	Semi-truck body, styling, e drive, headlight
Battery	18	Battery SOC management, usability in FCEV

Note: These are exclusively filed by Hyzon Motors. Numbers include patent applications filed/published

Hyzon Motors USA INC. - Patent Control Summary as of April 19, 2023

	Patents Awarded	Patents Applied	Patents Pending	Non-Provisional Applied	Provisional Applied	Totals
Exclusively Owned*	0	68	68	63	5	68
Jointly Owned **	39	56	17	56	0	56
Totals	**39**	**124**	**85**	**119**	**5**	**124**

(*) All Patents Applied are Pending (not Awarded)

(**) Jointly owned with one or more Horizon entities (per IP Agreement) except three unrelated parties (in discovery)

Government Subsidy Information

Programs and legislation that offer funding for hydrogen fuel infrastructure include:

- Hydrogen Infrastructure Finance and Innovation Act (US)[vi]
    - Will create a pilot financing program to provide grants and flexible, low-interest loans for retrofitted or new hydrogen transport infrastructure, storage projects and refueling stations
- DOE Hubs (US)[vii]
    - Includes up to $7 billion to establish six to ten regional clean hydrogen hubs across America. Clean hydrogen hubs will create networks of hydrogen producers, consumers, and local connective infrastructure
- IPCEI Project Hy2Use (Europe)[viii]
    - Thirteen EU members have provided €5.2bn in funding, which is expected to unlock a further €7 billion from private investors
    - Covers and supports a wide range of areas within the hydrogen value chain including: the construction of hydrogen-related infrastructure, such as large-scale electrolyzers and transport infrastructure, for the production, storage and transport of renewable and low-carbon hydrogen; and the development of more sustainable technologies for the integration of hydrogen into the industrial process of multiple sectors

Programs and legislation that offer direct subsidies that could be accessed by hydrogen fuel cell manufacturers include:

- Hydrogen for Industry Act (US)[ix]
    - Will establish a grant program to support commercial scale demonstration projects for end-use industrial applications of hydrogen, including in the production of steel, cement, glass and chemicals
- Innovation Fund (Europe)[x]
    - Will reserve $1 billion for projects involving electrification and renewable hydrogen production and use
- Green Deal Industrial Plan (Europe)[xi]
    - Will facilitate the use of existing EU funds to finance clean tech innovation, manufacturing and deployment. Will also explore avenues to achieve greater common financing at the EU level to support investments in manufacturing of net-zero technologies

Key measures included in the IRA Act that support EV manufacturing include:

- $60 million for the Diesel Emission Reduction Act program
- $2 billion for the Domestic Manufacturing Conversion Grant program
- $3 billion for the Advanced Technology Vehicle Manufacturing program
- A long-term extension of the Advanced Manufacturing Production Credit
- $2.25 billion to reduce air pollution at ports through deploying zero-emission technology
- A strong Environmental and Climate Justice Block Grant program
- A strong Greenhouse Gas Reduction Fund

References

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[i] American Trucking Associations
[ii] Number of registered vehicles globally: 1.45 bn (WhichCar)
5% of vehicles are on-road heavy duty vehicles (U.S. assumption, applied globally) (ecoRI News)

- Global heavy-duty trucks: 1.45 bn x 5% = ~72.5 million
- ~72.5mm less the ~4.1mm (per above bullet) = ~68mm

[iii] ~6,250 gallons of diesel used per truck per year (Proformance Supply)
10,180 grams of carbon emitted per gallon of diesel (Impactful Ninja)

- Carbon emitted per diesel-fueled truck per year: 6,250 * 10,180 = ~63,625,000 grams (~70 tons)

Number of diesel-fueled trucks globally:
Number of registered vehicles globally: 1.45 billion (WhichCar)

- ~14% of registered vehicles are commercial trucks (U.S. assumption, applied globally) (American Trucking Associations)
- ~76% of commercial trucks are diesel-fueled (U.S. assumption, applied globally) (Diesel Technology Forum)
    - Number of diesel-fueled trucks globally: 1.45 billion x 14% x 76% = ~154 million
        - Total tons of carbon emissions from diesel-fueled trucks per year:
            - 70 * 154 million = ~11 billion

[iv] "Cascadia", "Peterbilt" and "DAF" are registered trademarks of their respective owners.

[v] Yield Rate is the number of MEAs measured in square meters of coated roll that would be produced for the inputted materials

[vi] Hydrogen Infrastructure Initiative
[vii] Office of Clean Energy Demonstrations
[viii] Innovation News Network
[ix] Hydrogen Infrastructure Initiative
[x] Chemical & Engineering News
[xi] European Commission