Vision

We deliver fuel cell power for a sustainable planet
Ballard by the numbers

- **42 YEARS**
- **>900 EMPLOYEES**
- **1,400 PATENTS & APPLICATIONS**
- **26 years Nasdaq**
- **28 years TSX**
- **4 STRATEGIC SHAREHOLDERS**

- **1,300+ TRANSIT BUSES**
- **2,200+ TRUCKS**
- **7 TRAIN PROJECTS**
- **5 SHIPS IN DEVELOPMENT**
- **HIGH-POWER DENSITY STACK DEVELOPMENT PROGRAM**

- **850 MW FUEL CELL PRODUCTS DELIVERED**
- **>6.5 MILLION MEAs PRODUCED**
- **>100 MILLION KILOMETERS IN OPERATION**
- **>30,000 HOURS IN BUS OPERATION**
- **2030 COMMITMENT TO CARBON NEUTRALITY**
We continuously invest in our technology and product development

Unit cell components
MEA, bipolar plates

Fuel cell stacks
14th generation

Fuel cell modules
8th generation

Fuel cell vehicle integration
application engineering/after sales service

Humidified and pressurized system

Freeze-start from -30°C

IP protection

>30,000 hours life time
We are strategically positioned with two growth platforms

TECHNOLOGY SOLUTIONS
Solving difficult technical challenges in customers’ existing PEM fuel cell programs or addressing new business opportunities

POWER PRODUCTS
Delivering high value, zero emissions fuel cell products that deliver lasting performances
# Power Products Portfolio

<table>
<thead>
<tr>
<th>Fuel Cell Stacks</th>
<th>Fuel Cell Modules</th>
<th>Complete Fuel Cell System</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCvelocity™-9SSL</td>
<td>FCveloCity™-MD</td>
<td>FCgen™-H2PM</td>
</tr>
<tr>
<td>4kW to 26kW</td>
<td>30kW</td>
<td></td>
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<tr>
<td>FCgen™-LCS</td>
<td>FCveloCity™-HD</td>
<td></td>
</tr>
<tr>
<td>2.3kW to 63.4kW</td>
<td>85kW, 100kW</td>
<td></td>
</tr>
<tr>
<td>FCgen™-HPS</td>
<td>FCwave</td>
<td></td>
</tr>
<tr>
<td>140 kW</td>
<td>200kW</td>
<td></td>
</tr>
<tr>
<td>FCgen™-1020ACS</td>
<td>FCmove™</td>
<td></td>
</tr>
<tr>
<td>400W to 3kW</td>
<td>70kW</td>
<td>1.7kW &amp; 5kW</td>
</tr>
</tbody>
</table>

- Direct H₂
- Indoor and outdoor
- Rack-mountable
- Customized available

**Note:** The 4kW to 26kW range is for Fuel Cell Stacks, and 2.3kW to 63.4kW is for Fuel Cell Modules.
Today we have three platforms of liquid cooled stacks to address mobility applications.

<table>
<thead>
<tr>
<th>Power Level</th>
<th>Features</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 29kW/stack</td>
<td>- &gt;10,000 stacks produced</td>
<td>Bus</td>
</tr>
<tr>
<td></td>
<td>- 15,000hrs</td>
<td>Forklift</td>
</tr>
<tr>
<td></td>
<td>- 2.2kW/L*</td>
<td>Truck</td>
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<tr>
<td></td>
<td>- Operating 70°C</td>
<td></td>
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<tr>
<td>Mobility Stack</td>
<td></td>
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</tr>
</tbody>
</table>

| up to 96kW/stack    | - >25,000hrs                                       | Bus          |
|                     | - 4.5kW/L*(M2)                                     | Forklift     |
|                     | - Freeze start (-30°C)                             | Truck        |
|                     | - Operating 80°C                                   |              |
| Heavy-Duty Stack    |                                                    |              |

| Up to 140 kW/stack  | - Stack technology demonstration platform           | Lorry        |
|                     | - 4.3kW/L*                                        |              |
|                     | - Freeze start (-28°C)                             |              |
|                     | - Operating >90°C                                  | Airplane     |
| High Power Stack    |                                                    |              |

* Power density excluding compression hardware.
### Ballard’s current fuel cell module offering for HD mobility

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>30, 85 &amp; 100kW</strong>&lt;br&gt;Legacy Mobility Platform (7th generation)</td>
<td>- &gt;1,500 modules produced&lt;br&gt;- 15,000hrs&lt;br&gt;- IP 55&lt;br&gt;- Separate air and cooling kits</td>
<td><img src="image1" alt="Bus" />, <img src="image2" alt="Truck" />, <img src="image3" alt="Train" /></td>
</tr>
<tr>
<td><strong>70 &amp; 100 kW</strong>&lt;br&gt;HD Mobility Engines (8th generation)</td>
<td>- &gt;25,000hrs&lt;br&gt;- Freeze start (-25°C)&lt;br&gt;- Engine bay and roof top&lt;br&gt;- IP6K9K</td>
<td><img src="image1" alt="Bus" />, <img src="image2" alt="Truck" />, <img src="image3" alt="Train" /></td>
</tr>
<tr>
<td><strong>200kW</strong>&lt;br&gt;HD Power System&lt;br&gt;Marine &amp; Rail</td>
<td>- &gt;25,000hrs&lt;br&gt;- Marine certified&lt;br&gt;- Cabinet configuration&lt;br&gt;- Stand alone or containerized&lt;br&gt;- Multiple modules to MWs</td>
<td><img src="image4" alt="Ship" />, <img src="image3" alt="Train" /></td>
</tr>
<tr>
<td>Power Level</td>
<td>Features</td>
<td>Applications</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>1.7 &amp; 5kW</td>
<td>▪ 7,000hrs</td>
<td></td>
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<tr>
<td></td>
<td>▪ Systems can be coupled to 60kW</td>
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<tr>
<td></td>
<td>▪ High reliability</td>
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<tr>
<td>Backup Power</td>
<td>for critical infrastructure</td>
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<tr>
<td>for critical</td>
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<tr>
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<td>▪ Stand alone or containerized</td>
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</tr>
<tr>
<td></td>
<td>▪ From 200kW to 1MW</td>
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<tr>
<td>FCwave™</td>
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<tr>
<td>Modular Stationary Power System</td>
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<tr>
<td>1.5 MW</td>
<td>▪ Containerized system</td>
<td></td>
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<tr>
<td></td>
<td>▪ High durability</td>
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<tr>
<td></td>
<td>▪ Compact system footprint</td>
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<tr>
<td></td>
<td>▪ MW’s power plant</td>
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<tr>
<td>FCgen® H2PM</td>
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<tr>
<td>1.7 &amp; 5kW</td>
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<tr>
<td>Power System</td>
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<tr>
<td>ClearGen™ II</td>
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<tr>
<td>Large Scale</td>
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<tr>
<td>Stationary</td>
<td></td>
<td></td>
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<tr>
<td>Power System</td>
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</tbody>
</table>
Ballard Motive Fuel Cell Stack Product Family

A family of high power density stacks to cover the full range of bus, truck, rail and marine applications

**Ballard Fuel Cell Stacks**

*Increasing active area*

**Ballard Fuel Cell Stacks**

**Net Power (kilowatts)**

- **FCgen®-LCS-M**
- **FCgen®-HPS**
- **FCgen®-LCS-H**
- **FCgen®-LCS-X**

**Product introduction date:**
- **FCgen®-LCS-M** → M1 - 2020
  - M2 - Q3/2021
- **FCgen®-HPS** → 2021
- **FCgen®-LCS-H** → 2022
- **FCgen®-LCS-X** → 2023

*Additional stack products are available for other applications, such as forklifts, backup and stationary power.*
Value Proposition

Depth of intellectual capital
- ~900 total employees
- Completely specialized in fuel cell technology

Extensive intellectual property
- Own, license and access to ~2000 patents/applications

Comprehensive testing and prototyping
- 50+ test stations, testing <100W to 333kW
- Scalable MFG processes
  - Prototyping to high volume, rolled materials processing

Diplomas
- Bachelor Degrees: 121
- Masters Degrees: 55
- PhD’s: 24

Fuel Cell System
- Balance of Plant: 33%
- Plates: 11%
- Stack: 11%
- Fuel Reforming: 7%
- Power Managers: 1%
- MEA / Seals: 21%
- SOFC: 1%
- SOFC: 1%

Fuel Cell System
Technology Solutions

- Over 30 programs, including 4 major automotive OEMs
- Audi is prime on HyMotion program; multi year $60-100M contract extension signed until August 2022
- ‘Autonomous vehicle’ & ‘shared mobility’ trends will enhance fuel cell value proposition
Technology Solutions Case Studies

**Automotive**
- Access to Ballard’s expertise for the design and manufacture of the next generation fuel cell stack
- Transfer of select automotive-related fuel cell IP is considered

**Bus**
- License and technology transfer to enable best-in-class motive products to be locally manufactured in China

**Trams/Rail**
- Develop advanced fuel cell modules customized for rail applications

**Large Scale Marine and DG**
- Support development of breakthrough catalyst technology intended to reduce manufacturing cost

**Research**
- Research and supply of components for a customer’s internal testing programs

**Materials Suppliers**
- Support development of breakthrough catalyst technology intended to reduce manufacturing cost
Mission
Help customers solve difficult technical & business challenges in fuel cell programs through delivery of custom, bundled technology solutions

Solutions
Technical expertise, IP portfolio, supply of prototype technology to drive future opportunities

Customized Technology Solutions to support all stages of technology development

Product Development
Testing Services & Stations
Licensing & Technology Transfer
Component Design & Manufacturing
Systems Design & Integration
Product Development

Leverage infrastructure, experience and knowledge for custom development of modules, stacks and MEAs
Product Development

- Product design & research of components, fuel cell modules and stacks
- Deep understanding of optimising balance-of-plant components, plates, seals, membrane, catalyst and ionomers design for using multiple many materials, processes and suppliers
- Stack and system simulation and modeling to allow for investigation of a wide range of scenarios at the component, stack and module level
- Feasibility and trade-off studies related to performance, operating without CVM, freeze start, durability, cost and power density
- Prototyping and validation activities for balance-of-plant components, plates, seals, MEA and assemblies
Test Services & Stations

- Factory Acceptance Testing
- Test products under specific customer conditions
- Test and validate products under extreme conditions
Test Services & Stations

- State-of-the-art fuel cell testing facility
  - Collect 400,000+ hours annually
  - 24/7 operation, simulate real duty cycles
  - Test station capacity < 100 W to 333 kW

- 100+ automated test stations and specialized test tools
  - Environmental: 10 temperature and humidity chambers
  - Stack diagnostics: Current mapping, reference electrodes, water management, freeze protocols, SEM
  - Accelerated stress tests (AST): Membrane durability, cell reversal tolerance, voltage cycling, start-up/shutdown, ice tolerance

- Component, stack and system level testing
  - Shock and vibration, EMC/EMI and fire protection testing
Licencing & Technology Transfer

- Two stack assembly joint-ventures in China
- FCveloCity® power module assembly with 3 Integrator Partners
Technology Transfer

- Licensing Ballard’s intellectual property can accelerate a strategic partner’s time to market and help overcome any technical design or manufacturing barriers

Typical licensing models include:
- Design and processing intellectual property
- Product licenses
- Manufacturing localization

Technology transfer support from subject matter experts may include technical documentation and data transfer, on-site and remote engineering support and training programs
Component Design & Manufacturing

- 20,000m² facilities in Burnaby, Canada
- Current capacity of 1.5 million MEAs, 10,000 stacks and 200 modules annually
State-of-the-Art Manufacturing

• High volume manufacturing and prototyping equipment
  o Robotics, liquid injection molding and roll-to-roll processing
  o Proven yields in excess of 99%
  o SPC run charts Full traceability on raw materials

• Develop custom components to customer specifications or provide off-the-shelf components
  o Leverage Ballard or customer component technology
  o Collaborate on component development and bring advanced technology to the table
  o Ability to combine various membrane, catalyst and ionomers

• Engineering builds of stack and module until Technology Transfer and License or product scale-up is contemplated
- Module integration under engineering supervision
- Supporting customer integration and function for new applications including expanding the scope as required by the customer
Systems Design and Integration

• Significant technology development

• Broad and deep internal expertise drawing on >25 years of bus integration

• Extensive proprietary design and analysis tools

• Work closely with multiple component suppliers is key to success

• Can deploy local applications engineering and service teams to support customer integration activities
Summary

Ballard has a long history of leadership in fuel cell stack development and supply.

Technology Solutions offers a cooperative model to partners for accelerating fuel cell development programs and builds the foundation for long term partnerships.

Component prototyping and high volume production leverage existing manufacturing infrastructure.

Our technology development activities position us well to work with partners to jointly develop products for all applications.