The Emerging Low Cost Silicon Metal Producer

AGM JUNE 2019
This presentation includes certain

“FORWARD-LOOKING STATEMENTS”

All statements, other than statements of historical fact, included herein, including, without limitation, statements regarding future plans and objectives of the company, are forward-looking statements that involve various risks, assumptions, estimates and uncertainties, and any or all of these future plans and objectives may not be achieved.

The term Metallurgical Silicon Metal, Mg Si, and Silicon are used interchangeably and refer to high purity silicon between 98.0% Si and 99.5% Si. The terms SoG Si, Solar Grade Silicon and Polysilicon are used interchangeably and refer to high purity silicon used to produce solar cells for solar panel. Depending on the production method used, chemical or metallurgical, the purity ranges from 5N+ (99.999% Si) purity for Si produce metallurgically to 6N and 9N for Si produce via the chemical route.

These statements reflect the current expectations or beliefs of HPQ-Silicon Resources Inc. ("the Company") and are based on information currently available to the Company. There can be no assurance that such statements will prove to be accurate, and actual results and future events could differ materially from those anticipated in such statements. All of the forward looking statements contained in this presentation are qualified by these cautionary statements and the risk factors described above. Furthermore, all such statements are made as of the date this presentation is given.

An investment in the Company is speculative due to the nature of the its business. The ability of the Company to carry out its plans as described in this confidential presentation is depending on obtaining the required capital. There is no assurance that the Company will be able to successfully raise the capital required or to complete each of the growth initiatives described. Investors must rely upon the ability, expertise, judgment, discretion, integrity and good faith of the management and Board of the Company.
Silicon Metal End Markets

Silicon Metal
- Typical Composition: >98.5% Si
- Primary End Markets: Aluminum(40-45%), Silicones (35-40%), Solar cells (20-25%)

Chemical Grade
Mg Si +
High Purity Si
<table>
<thead>
<tr>
<th>Megatrends</th>
<th>Implications</th>
<th>End Customer Product</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population Growth</strong></td>
<td>Growing middle class China and India: consumption economy</td>
<td>• Silicones: healthcare, cosmetics, packaging</td>
</tr>
<tr>
<td><strong>Urbanization</strong></td>
<td>India, Brazil, and other emerging markets: infrastructure build</td>
<td>• Silicon: aluminum for cars, housing growth</td>
</tr>
<tr>
<td></td>
<td>Lightweighting of vehicles Electric vehicles</td>
<td>• Silicon: Silicone sealants for construction applications</td>
</tr>
<tr>
<td></td>
<td>Growing demand for solar, and other sources of renewable energy</td>
<td>• Silicon as alloying agent for aluminum to replace steel in vehicles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Prospects for silicon alloys in batteries</td>
</tr>
<tr>
<td><strong>Energy Efficiency</strong></td>
<td></td>
<td>• Higher consumption of silicon for polysilicon used to make solar panels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Prospects for silicon Base Energy Storage</td>
</tr>
<tr>
<td><strong>Alternative Energy &amp; Sustainability</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SILICON METAL (Si) NEEDED FOR ELECTRIC CARS
A HISTORY OF SUCCESSFUL RESULTS

The aluminum alloy chassis of Tesla car is 10% Silicon!

- **Aluminum silicon alloy makes the aluminum lighter and stronger**
- **Silicon also found in the battery anode**
- **Silicon in the windshield**

**PLUG- IN EV SALES**
(annual)

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>566,000</td>
</tr>
<tr>
<td>2030E</td>
<td>20,000,000</td>
</tr>
</tbody>
</table>
Silicon demand continues to be driven by chemical sector

Silicon consumption by intermediate end-use, '000 t

- MCS
- TCS
- Aluminium
Greenfield plants will provide the majority of new capacity

Contribution to the expected growth in annual production capacity outside China and the CIS between 2010 and 2020, %

- Greenfield: 58%
- Conversions: 16%
- Brownfield: 20%
- Creep: 6%
New Greenfield plants needed to meet anticipated demand requires scale (> 30,000 MTY):

- Capex Cost range between US$8 to US$9 per Kg of annual capacity or US$ 240M to US$ 270M investments\(^1\)
- OPEX are high with little cost control options (70% of Operating Cost are process driven and variable)

New HPQ PUREVAP\(^{TM}\) plants maximum scale efficiency reached at 5,000 MTY

- Capex Cost between US$8.59 for 2.5K plant down to US$5.93 per Kg of annual capacity at 5k MT per year\(^2\)
- Representing investment between US$ 21M to US$ 30M investments
- Lowest operating cost process with capacity to control OPEX cost

1. Source Ferroglobe, Viridis.iq, GmbM, Bloomberg, PCC se and Iceland Project
2. Source Budgetary Studies PyroGenesis Canada Inc.
Global silicon cost curve is relatively flat

- Operating cost in 2018, $/t

- Production, '000 t

- Components:
  - Quartz
  - Electricity
  - Reductants
  - Transport
  - Electrodes
  - Other Costs

- Cost range from 0 to 2500 $/t
HPQ intend to maximize the proprietary advantages of its PUREVAP™ process with the following two prong strategy:

- Near-term cash flow niche market silicon metal applications (Chemical Grade Si, batteries,...), and
- High Purity silicon for advanced PV applications
Mg Si Addressable Markets

Silicon market outlook

Silicon prices will support greenfield investment after 2019

US spot price 5.5.3 grade silicon vs. avg. operating cost at plants outside China and the CIS, $/t

PUREVAP™ estimated operating cost to produce 2N Si
(To be firm up during Gen3 Pilot Plant)
HPQ GLOBALLY RENOWNED TECHNICAL PARTNERS

PyroGenesis Plasma Expertise: One of the largest in the World

- +25 years of experience & > 70 employees
- >60 Patents worldwide (issued or pending)
- 40,900 ft² Manufacturing facility
- The inventors of Plasma Atomization (Gold Standard)

- World Leader In Advanced Plasma Processes
- Technology Sold To US Navy For Use On Aircraft Carriers
- Technology Tested and Validated By DARPA
- Leaders in High Purity Spherical Metal Powders for Industrial 3D printing
- Developer of PUREVAP One-Step Process To Produce High Purity Low Boron Silicon Metal
- Developer of DROSRITE™: a Green Aluminum Recovery from Dross process
- Agreements With Global Manufacturers and Trading Houses
Renewable solar energies:

Solar Grade Si market:
US$ 7.1 B in 2018
- to exceed -
US$ 11.8 B by 2028

SOLAR ON THE VERGE OF A PARADIGM SHIFT!

LCO benchmark value ($/MWh)

- Natural Gas CHP
- Wind - offshore
- Biomass - incineration
- PV - Crystalline silicon (no tracking)
- PV - Crystalline silicon (with tracking)
- Natural Gas CHP
- Coal
- Wind - onshore

SOLAR ENERGY ALMOST AT GRID PARITY
DEMAND READY TO EXPLODE!

GW Installed
% of electricity Generated

Solar Energy will grow from ~2% of global electricity generation today to >10% by 2030

(Source: Canadian Solar)
Solar power is at the cusp of fulfilling its renewable energy potential. But process improvements to produce Solar Grade Silicon Metal (SoG Si) have plateaued, creating a “Catch 22.”
THE SOLUTION TO THE SOLAR INDUSTRY’S “CATCH 22”

Technological innovation is needed to lower per unit costs, but the High Capex & Low Margins increase the degree of difficulty of executing an innovation-oriented business plan.

Source: The capital intensity of photovoltaics manufacturing: barrier to scale and opportunity for innovation† (Energy Environ. Sci., 2015, 8, 3395)
The PUREVAP™ QRR, a new proprietary (patent pending) carbothermic process:

That will bring about:
- ↓ SoG Si Capex 60% - 86%
- ↓ SoG SI Cash Cost 30% - 60%
- ↓ CO₂ Release by Up to 96%

SiO₂ 98.5+% Carbon

4N + Si with low boron <1 ppm

A ONE STEP PROCESS
A French Company fully dedicated to the field of energy transition

Created in 2001 by a team of engineers and scientists with longstanding expertise in Silicon Purification and Crystallisation - Solar Silicon - Photovoltaic Cells - Photovoltaic Modules

Now Part of YRIEL Group, active in Fine Chemistry, Aromatic and Renewable Energies

23 Patents to their name

 Obtained, an independently confirmed world record conversion efficiency of 21.1% with monocrystalline ingots, for a solar cell made with 100% “SoG Si UMG”
HPQ TECHNOLOGICAL SOLUTION  
FROM QUARTZ TO SOLAR WAFERS

How HPQ will implement its technological solution
By Combined Expertise In Three Critical Steps:

- The PUREVAP™ technology of PyroGenesis transforms Quartz (SiO₂) to High Purity Silicon Metal (4N+ Si < 1 ppm B) in one step - “PUREVAP™ Si”
- PyroGenesis and Apollon Solar experts are developing a streamlined metallurgical pathway (UMG) for upgrading the “PUREVAP™ Si” to HPQ Solar Grade Silicon Metal (SoG Si)
- Apollon Solar has the expertise to transform HPQ SoG Si into high performance multicrystalline and monocrystalline solar cells: “wafers”

HPQ QUARTZ  
PYROGENESIS’ PUREVAP™ PROCESS

SoG Si TO WAFER WITH APOLLON
PUREVAP™ UMG CAPEX DISRUPTIVE POTENTIAL

Capex (US$ Cost per Kg of Annual Capacity)

- Not Optimized Purevap UMG (5N+) (Canada)
- Optimized Siemens Solar (6N - 7N) (China)
- Optimized Siemens Solar (6N - 7N) (US & Europe)
- Standard Siemens Solar (6N - 7N) (China)
- Standard Siemens Solar (6N - 7N) (US & Europe)
- Standard Siemens Electronic (9N - 11N) (China)
- Standard Siemens Electronic (9N - 11N) (US & Europe)
- FBR Reactor (6N - 7N) (China)
- FBR Reactor (6N - 7N) (US & Europe)
- Elkem UMG (5N+) (Norway)
- FerroGlobe UMG (5N+) Spain
Global Solar Installation Demand Forecast (GW): (Average of GTW-Bloomberg-HIS projections)

- 2018 ~ 97 GW ≈ 388,000 MT demand for Polysilicon (SoG Si)
- 2019 ~ 113 GW ≈ 418,000 MT demand for Polysilicon (SoG Si)
- 2020 ~ 129 GW ≈ 451,000 MT demand for Polysilicon (SoG Si)

* Estimates will be firm up after Pilot plant phase
70% of the GHG generated by any solar project comes from the production of SoG Si

(source: Energy Policy, February 2014, Pages 229-244)

HPQ’s SoG Si is poised to produce the lowest carbon footprint

SoG Si in **CHINA**, world’s largest producer, generates 141 Kg of CO\textsubscript{2} per Kg of SoG Si

SoG Si in **GERMANY** using the same process, generates 87 Kg of CO\textsubscript{2} per Kg of SoG Si

SoG Si in **QUEBEC** with the PUREVAP™ expected to produce 5.4 Kg of CO\textsubscript{2} per Kg of SoG Si
Silicon anode lithium-ion batteries

Greater energy storage capabilities

Allows for smaller sizes batteries for electronic devices and electric cars

Energy storage for renewable energy sources

Replacing graphite with silicon, the anode capacity can increase battery charge 10X

Anode Chemistry Option

Graphite

Silicon

10x
A By-Product of PUREVAP™ is production of Si with application in the battery market

Replacing graphite with Silicon Metal (2N+)
↑ Anode battery charge 10X

Silicon Anode market for Lithium Ion batteries ↑ 43.6%
CAGR between 2016 to 2022

Silicon Anode market for Lithium Ion batteries to exceed the US $1 billion mark by 2022

US $400 Billion

43.6%

US $1 Billion

(Source: marketsandmarkets.com)
R&D being done to develop to produce porous nanoparticles of Si

Combining HPQ Purevap 2N+ Si and PyroGenesis Powders expertise to produce amorphous nanoparticles of Si

**Paraclete Energy’s standard silicon metal products:**

<table>
<thead>
<tr>
<th>Product</th>
<th>Purity</th>
<th>Yield</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>nSiO</td>
<td>≥99.5%</td>
<td>100g</td>
<td>$250</td>
</tr>
<tr>
<td>nSiH</td>
<td>≥99.5%</td>
<td>100g</td>
<td>$500</td>
</tr>
<tr>
<td>nSi</td>
<td>≥99.5%</td>
<td>100g</td>
<td>$500</td>
</tr>
<tr>
<td>nSi/C</td>
<td>≥99.5%</td>
<td>100g</td>
<td>$700</td>
</tr>
<tr>
<td>nSi/Cg</td>
<td>≥99.5%</td>
<td>100g</td>
<td>$800</td>
</tr>
<tr>
<td>nSi/Cg/IP</td>
<td>≥99.5%</td>
<td>100g</td>
<td>$900</td>
</tr>
</tbody>
</table>

**SM-Silicon™** - Nanoparticle silicon metal with a proprietary Surface Modifier that acts as artificial SEI for cycle stability. *

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type/Form</td>
<td>Crystalline Powder</td>
</tr>
<tr>
<td>Purity</td>
<td>≥99.5%</td>
</tr>
<tr>
<td>Surface Purity</td>
<td>0% SiO2, air stable (except nSi)</td>
</tr>
<tr>
<td>Total Metals Impurities</td>
<td>≤0.5%</td>
</tr>
<tr>
<td>APS</td>
<td>150nm (For PSD other than D50 150nm – Contact PE for a quote.)</td>
</tr>
<tr>
<td>BET / SSA</td>
<td>30 m²/g</td>
</tr>
<tr>
<td>Tap Density</td>
<td>0.8 g/cm³</td>
</tr>
<tr>
<td>Color</td>
<td>Gray to dark gray (except nSiO: yellowish brown)</td>
</tr>
<tr>
<td>Morphology</td>
<td>Non spherical</td>
</tr>
<tr>
<td>mp</td>
<td>1414°C</td>
</tr>
</tbody>
</table>

* The composition would change by the specific surface modifier so identified for each respective product, (SM-Silicon™, SM-Silicon/C™, SM-Silicon/PL™, nSi/C, nSi/Cg, nSi/Cg/P, nSiO, nSiH) be it custom SM for our SM-Silicon™ or C, graphene, polymer or oxygen for the other R&D products.
**PILOT PLANT FULLY FINANCED**

**ADVANCING TO PRODUCTION**

Pilot Plant Commissioning and Commercial Production

<table>
<thead>
<tr>
<th>Icon</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Gear" /></td>
<td>Output capacity of 50 tonnes per year; Operational Q4 2019</td>
</tr>
<tr>
<td><img src="image2.png" alt="Person" /></td>
<td>First demonstration Solar Cell from HPQ UMG SoG Si expected mid 2020</td>
</tr>
<tr>
<td><img src="image1.png" alt="Gear" /></td>
<td>Improving Process, Scaling, Seeking Mg Si Customers Using Gen2, Preparing For Commercialization</td>
</tr>
<tr>
<td><img src="image3.png" alt="Money" /></td>
<td>Order of first 2,500 tonnes per year commercial plant planned in 2021</td>
</tr>
<tr>
<td><img src="image4.png" alt="Battery" /></td>
<td>Using Gen3 50 TPA pilot plant to produce and sell Mg Si Powders for the Silicon Anode market for Lithium Ion batteries by 2020</td>
</tr>
</tbody>
</table>
WHY INVEST IN HPQ?

HPQ PUREVAP™
The successful innovation that will reduce the cost barriers to renewable energy

Advances from bench testing confirms cost savings potential and set the stage for Pilot Plant testing, with a new focus on Mg Si, SoG Si at commercial production, and the battery industry.
WHY INVEST IN HPQ?

PUREVAP™ PROCESS

VERSUS TRADITIONAL SILICON METAL PROCESS:

Low purity feedstock → High Purity Silicon Metal
98.5% SiO₂ + Reactive Carbon
→ (99.73%Si)R (99.99+% Si)A

THE ONLY 1-STEP PROCESS WORLDWIDE

↓ 35% Capex
↓ 20% Opex

Vs. Traditional Mg Si Smelters

Traditional Metallurgical Silicon Metal Plant that NEED:

High purity feedstock → Metallurgical Silicon Metal
From 98.0% Si to 99.5% Si

VERSUS ACTUAL PROCESS FOR SOLAR GRADE SILICON:

Disruptive technology for Solar Energy

↓ 60% (China - Lowest) to 86% Capex

↓ 30% (China - Lowest) to 60% Opex

Reduce the use of aggressive chemicals

Reduce production of dangerous by-products during refining

↓ 96% Energy Carbon Footprint
MANAGEMENT AND BOARD SUMMARY

Management

Bernard J Tourillon, BAA, MBA
Chairman, President, CEO and Director

Patrick Levasseur
Vice-President, COO and Director

Noelle Drapeau, LLL, MBA, PMP
Corporate Secretary and Director

Francois Rivard
CFO

Independent Director (*)

Richard Mimeau, B.Sc.
Director

Peter Smith, PhD, P. Eng.
Director

Robert Robitaille, B.A., L. Ph.
Director

Daryl Hodges H. BSc, M.Sc.
Director

Major Investors

Management & Board ≈ 9.7% ≈ 10.5% (FD)
PyroGenesis ≈ 9.7% ≈ 12.1% (FD)
Investissement Quebec ≈ 8.8% (FD)
Strategic Investors ≈ 2.8% ≈ 6.2% (FD)
Key Investors ≈ 18.8% ≈ 21.2% (FD)

Consultants/ Technical Advisors

Marcel Drapeau, BA, BSC. Comm, LLL
PyroGenesis Canada
Apollon Solar SA
Marc Richer-Lafleche, P, Geo, PhD

Transfer Agent

Computershares

Auditors

Raymond Chabot Grant Thornton
**Present Carbothermic process**
Quartz to silicon metal (Si)

- SiO₂ 99.5% + Low Ash Coal + Wood Chips
- Electric Arc Furnace
- Energy Consumption: 12,000 kWh/t

**Present Chemical process**
MG-Si to SoG-Si

- MG Silicon Metal Is Dissolved In Hydrochloric Acid To Form Trichlorosilane (HSiCl₃)
- Trichlorosilane (HSiCl₃) is Further Refined
- SIEMENS Reactor
- Solar Grade Silicon Metal Polysilicon 99.9999+% Si

Energy Consumption: between 72,000 to 120,000 kWh/t
Present Metallurgical Process Used By Elkem Solar and Ferroglobe

Mg Si

Slag Treatment

Leaching

Solidification

Post Treatment

98.5% to 99.0% Si

TO

5N+ SoG Si