



**GREEN ENGINEERING
FUMED SILICA MANUFACTURING**



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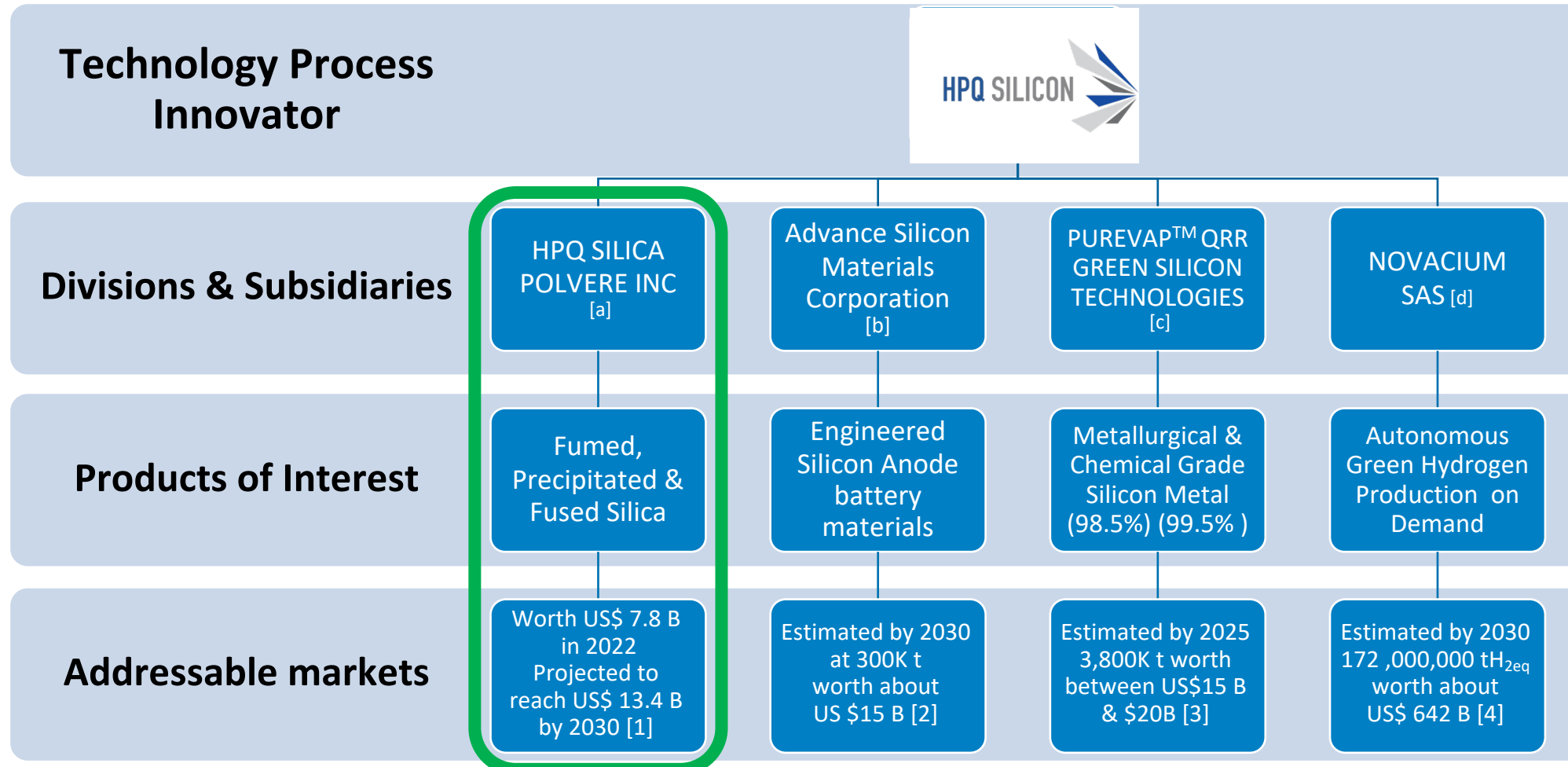
The Corporation is a technology company engaged in **green** engineering processes that is: 1) Developing the Fumed Silica Reactor (FSE), a new plasma process that will allow a direct Quartz to Fumed Silica transformation; 2) Developing the PUREVAP™ Quartz Reduction Reactor (QRR), a new carbothermic process to transform Quartz into **green Silicon** (patent granted in the United States & pending in other jurisdictions); 3) Aiming to become a manufacture of **green Silicon** anode materials; and 4) Working with NOVACIUM SAS developing a compact process for the production of **green hydrogen** via hydrolysis of silicon and other materials.

The terms Silicon, Silicon Metal and Si are used interchangeably. Metallurgical Grade Silicon or MG Si refers to Silicon Metal of a purity between 98.0% Si and 99.5% Si. High Purity (HP Si) or Upgraded Metallurgical Grade Silicon (UMG Si) refers to Silicon Metal of a purity between 99.9% Si and 99.99% Si.

— HPQ PLAN: DEVELOP & MONETIZE GREEN ENGINEERING SOLUTIONS

Strategy centered around 3 initiatives:

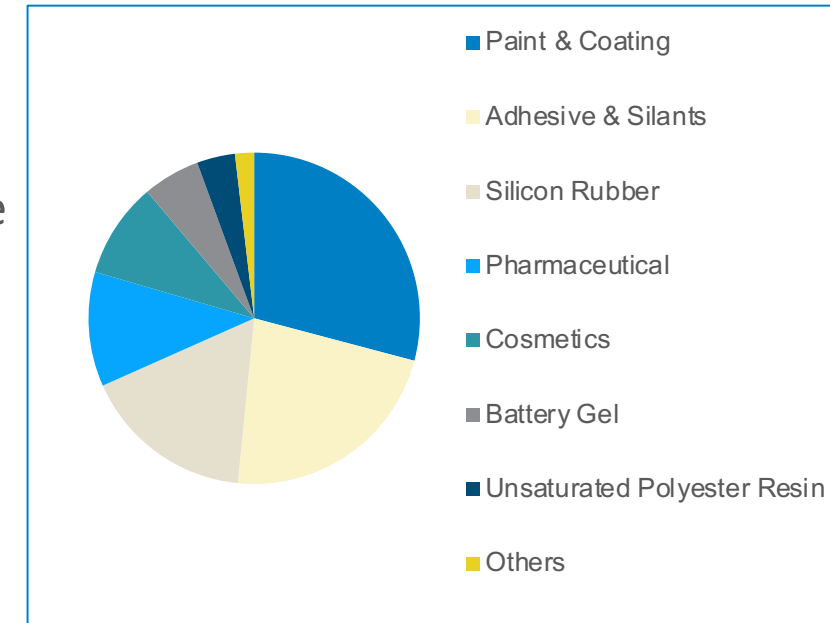
- Green Fumed Silica Manufacturing, Green engineered SiO_x battery materials & Green Hydrogen on demand without electricity
- Measured & achievable growth plans to start commercializing our Green Fumed Silica Reactor technology by the end 2024



— OVERVIEW OF THE FUMED SILICA MARKET

- ▶ Fumed Silica (Pyrogenic Silica) is a white, fluffy, and colloidal micro-particle with reinforcing and thixotropic properties. It is a versatile value-added white microscopic powder with a high surface area and low bulk density
- ▶ Due to its unique properties commercial applications encompass various industries including personal care, pharmaceuticals, agriculture (food & feed), adhesives, sealants, construction, batteries and automotive to name a few.
- ▶ The primary driver of the fumed silica market is increased demand from the major end-use industries
- ▶ But environmental issues associated with conventional manufacturing process to make Fumed Silica are hindering market growth
- ▶ The key players in the market are Evonik Industries (Germany), Cabot Corporation (U.S.) Wacker Chemie AG (Germany), and Tokuyama Corporation (Japan) [1]
- ▶ In 2022, sales of Fumed silica, also known as Pyrogenic Silica, reached US\$1.3 billion and is expected to grow at a rate of 5% CAGR [2]

Fumed Silica Market (%) by Industry



Source: MRFR Analysis

— FUMED SILICA REACTOR: A NEW DISRUPTIVE PROCESS

- ▶ End 2021, HPQ signed an agreement with PyroGenesis covering the acquisition of a new Fumed Silica Reactor IP, its development and future commercialization of silica materials (Fumed, Precipitated and Fused Silica) that can be produced by the Fumed Silica Reactor
 - These materials (Fumed, Precipitated and Fused Silica) are part of the Specialty Silica Market, a **market expected to grow to US\$13.4 billion by 2030**, with a projected Compound Annual Growth Rate (CAGR) of 7.0% [1].
- ▶ The \$2 million cost related to the constructing of a 50 tonnes per year (TPY) pilot plant and its operation during the testing phase are covered by the following parties:
 - The Federal Government of Canada (SDTC) pays ≈ 33% of the cost
 - The Quebec Government (TED) pays ≈ 30% of the cost
 - HPQ Silica Polvere Inc (an HPQ subsidiary) pays ≈ 29% of the cost, and
 - PyroGenesis Canada Inc will cover the remaining ≈ 8% and act as operator of the testing program
- ▶ Starting mid 2022, while PyroGenesis was working on the design of the Fumed Silica Reactor, HPQ Silica Polvere Inc finance a new series of tests to validate that the reactor design **can produce Commercial Grade Fumed Silica** at Lab Scale

— 2023 FUMED SILICA REACTOR DEVELOPMENT MILESTONES

- ▶ In Q2 2023, **commercial grade fumed silica** was produced using the lab scale Fumed Silica Reactor (“FSR”)
- ▶ During Q2 and Q3 HPQ Polvere was approached by three (3) major Fumed Silica participants interested in testing our material. NDA were signed, samples sent for analysis & review of **commercial potential** of the material
- ▶ In Q4 Independent testing done at McGill University confirmed the HPQ Polvere FSR capability of **producing Commercial Grade Fumed Silica in one step** at lab scale

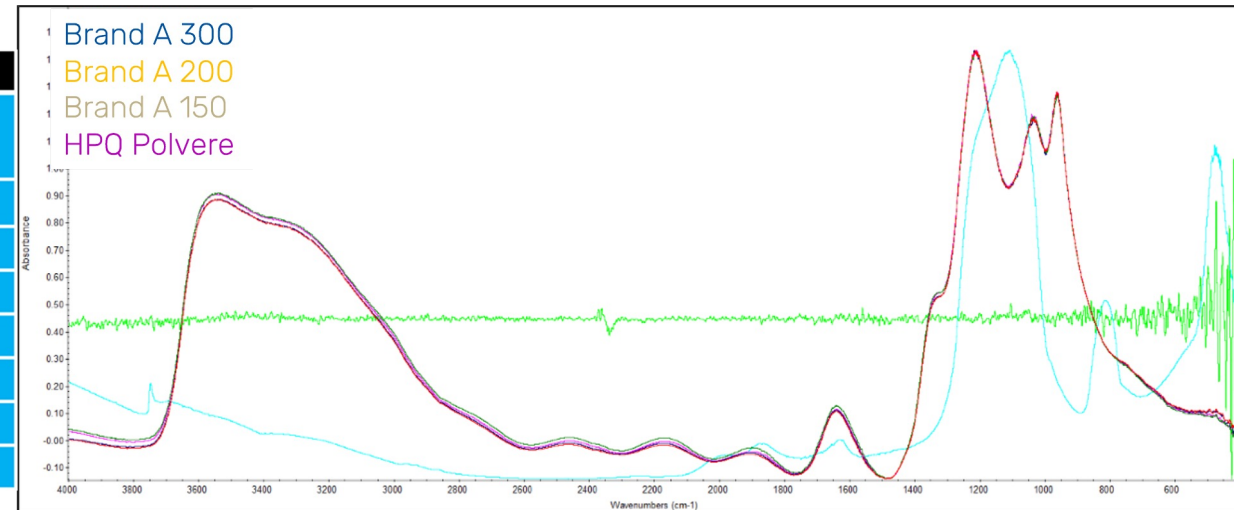
Key takeaway from the McGill Report about Polvere Fumed Silica:

- ▶ As the table and graph below indicate, **HPQ Fumed silica has a rheology between Commercial brand A 150 & A 200 material but is very close to brand A 200**

Behavior in relation to water Hydrophilic

Test Methods	Unit	Fumed Silica Commercial A	Fumed Silica Commercial B	Fumed Silica Polvere
BET Surface Area	m ² /g	125 – 175	175 – 225	135 – 185
Ignition Loss (LOI)	%	≤ 1.5	≤ 1.5	≤ 1.5
Moisture	%	≤ 1.5	≤ 1.0	≤ 1.0
pH Value		3.7 – 4.7	3.7 – 4.5	4.7 – 6.7
HCl	%	< 0.020	< 0.020	Nil
Viscosity	(cP)	27,597	118,000	90,780
Thickening Efficiency	mPas	Good	Excellent	Excellent

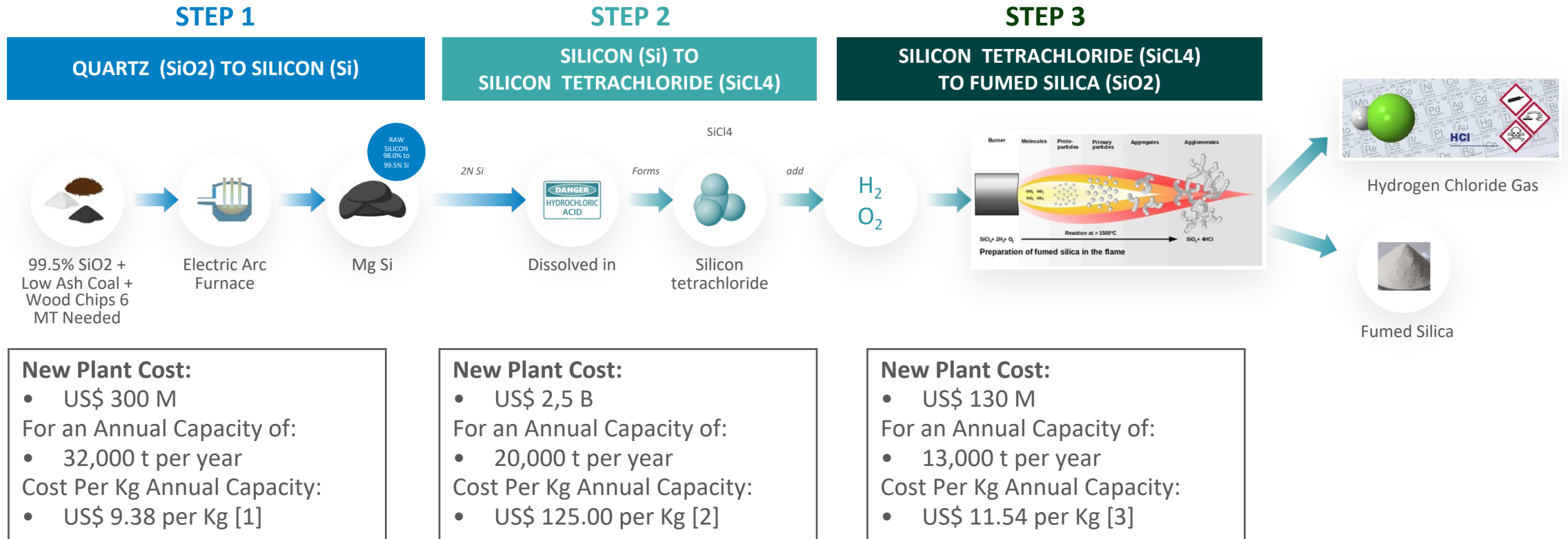
[1]



- ▶ Chemically, HPQ material is identical to the Commercial Brand A 150, 200, and 300 products.

— CONVENTIONAL PROCESS TO MAKE FUMED SILICA

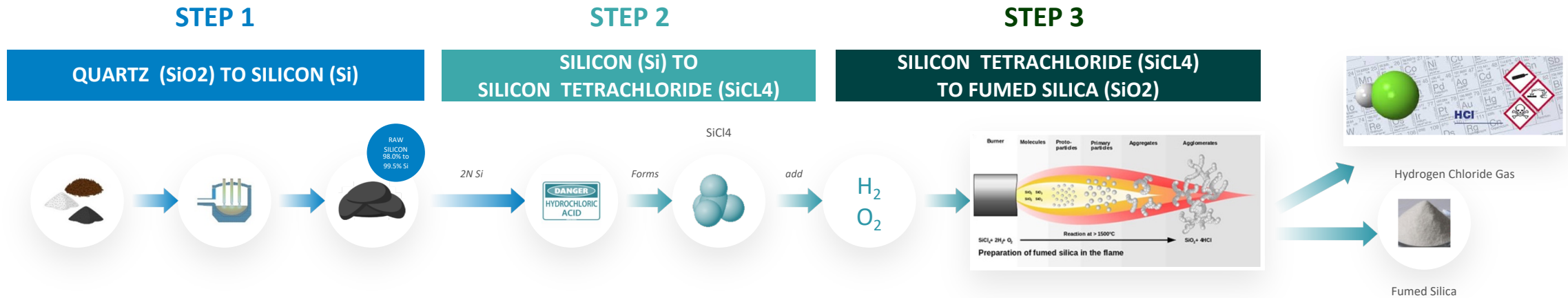
A CAPITAL INTENSIVE 3 STEPS PROCESS



Presently, large vertically integrated chemical companies control the **Fumed Silica market** as the **US\$ 145.91** per Kg of Annual Capacity CAPEX represents a **massive barrier to entry**

— CONVENTIONAL PROCESS TO MAKE FUMED SILICIA

AND IT'S A LOW MARGIN INDUSTRY



Industry-wide, EBITDA margins are in the low 20% range [1]

Some of the reasons for the low margins can be attributed to :

- Energy consumption is in the 100 – 120 kWh. per Kg of Fumed Silica produced range [2]
- Cost associated with handling the dangerous chemicals needed to make SiCl4 combined with the costs associated with treating the 2.4 Kg of HCl produced per Kg of Fumed Silica [3]

Carbon emissions-related taxes are going to erode the already limited margins further:

With the Carbon Footprint associated with conventional Fumed Silica manufacturing in the 8 – 17 kg of CO2 eq per Kg of Fumed Silica produced range [2]

- The newly enacted 90€ per tonne (t) carbon taxes in Europe [4] will further reduce the margins of conventional Fumed Silica producers by between **720€ and 1 530 € per t of Fumed Silica produced or sold in Europe** [4]

— POLVERE FUMED SILICA REACTOR (FSR)

USHERING A PARADIGM SHIFT IN FUMED SILICA MANUFACTURING

A LOW CAPEX ONE STEP PROCESS

QUARTZ (SiO₂) TO FUMED SILICA

FUMED SILICA REACTOR



A LOW CAPEX AND OPEX PROCESS

HPQ Polvere commercialization strategy is based on building a first 1,000 tonnes per year (TPY) Fumed Silica Reactor and then scaling up capacity to meet demand with an additional 1,000 TPY Fumed Silica Reactor

HPQ Polvere management internal feasibility study, based on PyroGenesis rough order of magnitude studies, indicates that HPQ FSR will have:

- Capex between US\$ 9.00 and US\$ 10.00 cost per Kg of annual capacity [1]
- Energy consumptions between 10 – 15 KWh. per Kg of Fumed Silica [2]
- EBITDA margins between 60% and 65% [3]
- Payback period per 1,000 TPY Reactor of around 1.7 years [4]

FURTHERMORE, THE FSR IS AN ULTRA-LOW CARBON FOOTPRINT PROCESS

Fumed Silica Reactor (FSR) Carbon Footprint projected between:

- 1 – 2.5 kg of CO₂ eq per Kg of Fumed Silica produced range [5]

Carbon emissions-related taxes will not affect HPQ FSR margins:

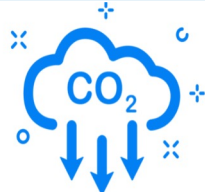
- Presently, at 90€ per tonne (t), carbon taxes in Europe [6] will only cost producers of Fumed Silica using an FRS between 90€ and 225€ per t of Fumed Silica produced or sold in Europe



— HPQ POLVERE FUMED SILICA REACTOR

A disruptive green tech about to upend fumed silica manufacturing

As the table below clearly indicates, HPQ Polvere Fumed Silica Reactor (FSR) disruptive advantages represent a significant threat to traditional Fumed Silica Manufacturers



	FUMED SILICA MANUFACTURING		
	USING TODAY CONVENTIONAL PROCESSES	WITH HPQ POLVERE FUMED SILICA REACTOR	HPQ POLVERE DISRUPTIVE ADVANTAGES
CAPEX (Cost per Kg of capacity)	US\$ 145.91	US\$9.50	93% Less [1]
Energy Consumption (kWh / Kg of Fumed Silica)	100 – 120 [2]	10 – 15 [3]	87.5 to 90% Less
EBITDA Margins	20%	60% - 65%	3X better [4]
GHG Impact (Kg CO2 eq / Kg of Fumed Silica)	8 – 17 [5]	1 – 2.5 [6]	84 to 88% Less
European Carbon Taxes (90€ per tonne released [7])	720€ - 1 530€	90€ - 225€	630€ to 1 350€ Less
HCl Production (Kg / Kg Fumed Silica)	2.4 [8]	0	NO HCl GAZ

Yet, **HPQ Silica** one step Fumed Silica Reactor process also represents a **unique opportunity** for traditional Fumed Silica **manufacturers** looking for a low capex, opex and **low carbon process** to meet new demand for the low carbon Fumed Silica materials **end buyers are looking for**.

— FUMED SILICA INDICATIVE TIMELINE

- Fast track to commercialization and monetization

PROJECTS	2024	2025	2026	2027
FUMED SILICA	Engineering – Construction – Commissioning of Fumed Silica Pilot Plant	Pilot plant testing and validation of technology	<p>Fumed Silica production using the 50 TPY pilot plant</p> <p>Engineering studies to build first 1,000 TPY FSR</p> <p>1000 TPY Fumed Silica Reactor (FSR) commercial plants Construction – Commissioning</p>	Fumed Silica production from our first of many 1,000 TPY FSR plant

FUMED SILICA INITIATIVE UPCOMING CATALYSTS

- Finish building and starting the commissioning of the test pilot plant
- Start FSR testing program with the aims of:
 - Producing 170 kg/day continuous feed, thereby validating scalability of Fumed Silica Reactor
 - Producing materials with surface areas between 90 & 300, thereby validating the range of material of the FSR
 - Sending and selling materials to Parties interested in securing offtake agreements
- Finalize, during 2024, an Offtake agreement or other transaction (Joint Development or Collaboration Agreements) regarding the building of our first 1,000 TPY FSR plant
- Validate that the Fumed Silica Reactor can also produce Precipitated and Fused silica

— UPCOMING CATALYSTS

01. GREEN FUMED SILICA INITIATIVE

- Finish building and starting the commissioning of the test pilot plant
- Start FSR testing program with the aims of:
 - Producing 170 kg/day continuous feed
 - Producing materials with surface areas between 90 & 300
 - Sending materials to Parties interested in securing supplies
- Finalize Offtake agreement or other transaction (Joint Development or Collaboration Agreements) for first commercial plant

02. ENGINEERED SiOx BATTERIES MATERIAL INITIATIVE

- Demonstrating our control of the industrial process needed to make commercially our engineered SiOx material by:
 - Making 18650 industrial batteries using graphite and a percentage of our engineered SiOx
 - Testing and comparing the performance of these batteries versus similar batteries made only with graphite
 - Improving the performance of our engineered SiOx batteries

03. GREEN HYDROGEN ON DEMAND WITHOUT ELECTRICITY INITIATIVE

- Building a first prototype for commercialization of Novacium autonomous process for making hydrogen via hydrolysis

HPQ CAPITAL STRUCTURE

Major Investors	Basic	Fully Diluted
IQ (Investissement Québec)	8,7%	8,0%
PyroGenesis Canada Inc.	5,6%	8,0%
Management & Board	6,3%	10,4%
Strategic Investors	7,0%	6,0%

	52 weeks		
	Price	Low	High
(As of Jan 16, 2024)	\$ 0,245	\$ 0,20	\$ 0,42

	Million
Basic Shares Outstanding	367,2
Options (Average Price \$0.46 / Duration 4 years)	17,7
Warrants (Average Price \$0.373)	9,4
Fully Diluted Shares Outstanding	394,4
Market Capitalization (Basic)	\$ 89,9
Market Capitalization (Fully Diluted)	\$ 96,6
Cash. Cash equivalent and in the money options and warrants	\$ 3,3

— MANAGEMENT, BOARD & OTHERS



Management

- ▶ Bernard J. Tourillon, BAA, MBA
Chairman, President, CEO and Director
- ▶ Noelle Drapeau, LLL, MBA, PMP
Corporate Secretary and Director
- ▶ Francois Rivard
VP, CFO
- ▶ Derick A. Lila, MSc, MA
Director Marketing Communications



Independent Directors

- ▶ Richard Mimeau, B.Sc.
Director
- ▶ Peter Smith, PhD, P. Eng.
Director
- ▶ Robert Robitaille, M.B.A., L. Ph.
Director
- ▶ Daryl Hodges H. BSc, M.Sc.
Director
- ▶ Patrick Levasseur
Director



Consultants

- ▶ Marcel Drapeau, BA, BSC. Comm, LLL
- ▶ PyroGenesis Canada Inc
- ▶ Karl Rheinberger and Ludmila Livertovsky



Transfer Agent

- ▶ Computershare



Auditors

- ▶ KPMG S.E.C.N.R.L.



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— REFERENCES AND SOURCES

In the following pages, you will find supplementary information, references and/or the sources of key points made in the presentation

Page 3

- a) HPQ Silica Polvere Inc (“Polvere”) is a 100% owned HPQ subsidiary. HPQ acquired the Fumed Silica Reactor intellectual properties from PyroGenesis Canada Inc (“PCI”), subcontracted to them the R&D associated with developing the technologies, agreed to an exclusive equipment procurement deal and granted PCI a royalty payment equal of 10% of Polvere Fumed Silica sales, with set minimums. PCI does have the option to sale its Royalty in exchange for 50% of HPQ remaining equity stake in Polvere.
- [1] Fumed Silica Market Outlook (2022-2030) (<https://www.factmr.com/report/2301/fumed-silica-market>) Specialty Silica Market projected to reach \$13.4 billion by 2030, exhibiting a CAGR of 7.0%, Says Coherent Market Insights (CMI). <https://www.globenewswire.com/news-release/2023/08/03/2718371/0/en/Specialty-Silica-Market-projected-to-reach-13-4-billion-by-2030-exhibiting-a-CAGR-of-7-0-Says-Coherent-Market-Insights-CMI.html> Specialty Silica Market projected to reach \$13.4 billion by 2030, exhibiting a CAGR of 7.0%, Says Coherent Market Insights (CMI). (<https://www.globenewswire.com/news-release/2023/08/03/2718371/0/en/Specialty-Silica-Market-projected-to-reach-13-4-billion-by-2030-exhibiting-a-CAGR-of-7-0-Says-Coherent-Market-Insights-CMI.html>)
- b) Advance Silicon Materials Corporation (“ASMC”) formally HPQ NANO Powders Inc, is a 100% owned HPQ subsidiary that is responsible for all aspect related to silicon materials for batteries and other high value silicon materials.
- [2] QY Research, SNE Research, Shinhan Securities / NBM June 2023 Deck page 11
- b) PUREVAP™ QRR Green Silicon Technologies are 100% owned by HPQ. HPQ acquired the QRR Intellectual properties from PyroGenesis Canada Inc (“PCI”), subcontracted to them the R&D associated with developing the technologies, agreed to an exclusive equipment procurement deal and granted PCI a Royalty payment equal of 10% of HPQ PUREVAP™ QRR Silicon metal sales, with set minimums. HPQ is therefore financing 100% of the development cost of this technology and will collect 90% of the Silicon metal sales made with the QRR.
- [3] Data compiled from information found in the presentations made by CRU International Limited (“CRU”), a world-leading metal market research firm, during their Silicon Market Outlook conferences of November 2018, November 2020, and October 2022. Information further validated by Straits Research Silicon Metal Market: Information by Product Type (Metallurgical and Chemical), Application (Aluminium Alloys, Silicone, and Semiconductors), and Region — Forecast till 2030, report that indicated that the global silicon metal market size was valued at USD 12.4 billion in 2021, and is expected to reach USD 20.60 billion by 2030, growing at a CAGR of 5.8% during the forecast period (2022–2030).
- c) Novacium SAS. In 2022, HPQ partnered with three leading French research engineers to create Novacium, a “jeune entreprise innovante (J.E.I)” based in Lyon, France, working in high-added-value material fields connected to renewable energy. Presently HPQ only owns 20% of the equity of Novacium, making Novacium an affiliated company of HPQ Silicon Inc, but accounting rules require that we consolidate Novacium operations in our financial statement.
- [4] Deloitte’s 2023 global green hydrogen outlook, page 13

Page 4

- [1] Marketsandmarkets.com fumed silica report global forecast to 2022
- [2] <https://www.factmr.com/report/2301/fumed-silica-market>

Page 5

- [1] Specialty Silica Market projected to reach \$13.4 billion by 2030, exhibiting a CAGR of 7.0%, Says Coherent Market Insights (CMI). (<https://www.globenewswire.com/news-release/2023/08/03/2718371/0/en/Specialty-Silica-Market-projected-to-reach-13-4-billion-by-2030-exhibiting-a-CAGR-of-7-0-Says-Coherent-Market-Insights-CMI.html>)

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Page 6

[1] Source PyroGenesis Inc.

Page 7

- [1] Conversion of Quartz to Silicon Metal (Si), with an average Capex of around US\$9.38 per kilogram of annual capacity (for reference, the PCC BakkiSilicon Plant in Iceland cost US\$300 million for an annual capacity of 32,000 tonnes).
- [2] Conversion of Si to Silicon Tetrachloride (SiCl₄), with an average Capex of approximately US\$125.00 per kilogram of annual capacity (e.g., Wacker Chemie AG Polysilicon's US production plant cost US\$2.5 billion for an annual capacity of 20,000 tonnes).
- [3] Burning Silicon Tetrachloride (SiCl₄) with Hydrogen and Oxygen to produce Fumed Silica (SiO₂), incurring an average Capex of around US\$11.54 per kilogram of annual capacity (Wacker Chemie AG's US Fumed Silica plant cost US\$150 million for an annual capacity of 20,000 tonnes).

Page 8

- [1] Average EBITDA margins of 20% are derived from two sources, (https://www.chemistryviews.org/details/news/10193941/Evonik_Acquires_Huber_Silica/) and (<https://corporate.evonik.com/en/investor-relations/despite-difficult-environment-third-quarter-better-than-second-225109.html>).
- [2] Frischknecht, Rolf, et al. "Life cycle inventories and life cycle assessment of photovoltaic systems." International Energy Agency (IEA) PVPS Task 12 (2020).
- [3] Cai, H., Wang, X., Kelly, J. C., & Wang, M. (2021). Building Life-Cycle Analysis with the GREET Building Module: Methodology, Data, and Case Studies (No. ANL/ESD-21/13). Argonne National Lab. (ANL), Argonne, IL (United States).
- [4] The Wall Street Journal article, April 18, 2023, "World's First Carbon Import Tax Approved by EU Lawmakers"

Page 9

- [1] According to a rough order of magnitude study by PyroGenesis, our one-step process for making Fumed Silica is estimated to cost about CAD\$13 million, which equals an average Capex per kilogram of annual capacity between US\$9.00 and US\$10.00.
- [2] PyroGenesis Canada Inc.
- [3] Management has calculated the EBITDA margins for the Fumed Silica Reactor (FSR) based on data derived from third party sources and publicly available information. These figures will be updated upon completion of the pilot testing phase. The 5% range in HPQ Polvere's EBITDA margins takes into account PyroGenesis' option to convert its 10% royalties into a 50% ownership stake in HPQ Polvere's remaining equity.
- [4] Management has calculated the Payback for the Fumed Silica Reactor (FSR) based data derived from third party sources and publicly available information. These figures will be updated upon completion of the pilot testing phase.
- [5] The 1 Kg eq of CO₂ per Kg of Fumed Silica is based on Hydro Quebec data that indicate in Quebec 1.3 g of CO₂ are generated eq per kWh. While the 2.5 is based on the Canadian average for electricity generation carbon intensity of 150 g per kWh.
- [6] The Wall Street Journal article, April 18, 2023, "World's First Carbon Import Tax Approved by EU Lawmakers"

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Page 10

- [1] Management has calculated the Capex advantage for the Fumed Silica Reactor (FSR) versus the industry
- [2] Frischknecht, Rolf, et al. "Life cycle inventories and life cycle assessment of photovoltaic systems." International Energy Agency (IEA) PVPS Task 12 (2020).
- [3] PyroGenesis Canada Inc
- [4] Management has calculated the EBITDA margins for the Fumed Silica Reactor (FSR) versus the industry
- [5] Frischknecht, Rolf, et al. "Life cycle inventories and life cycle assessment of photovoltaic systems." International Energy Agency (IEA) PVPS Task 12 (2020).
- [6] The 1 Kg eq of CO₂ per Kg of Fumed Silica is based on [Hydro Quebec data](#) that indicate in Quebec 1.3 g of CO₂ are generated eq per KWh. While the 2.5 is based on the Canadian average for electricity generation carbon intensity of 150 g per KWh
- [7] The Wall Street Journal article, April 18, 2023, "[World's First Carbon Import Tax Approved by EU Lawmakers](#)"
- [8] Cai, H., Wang, X., Kelly, J. C., & Wang, M. (2021). Building Life-Cycle Analysis with the GREET Building Module: Methodology, Data, and Case Studies (No. ANL/ESD-21/13). Argonne National Lab. (ANL), Argonne, IL (United States).