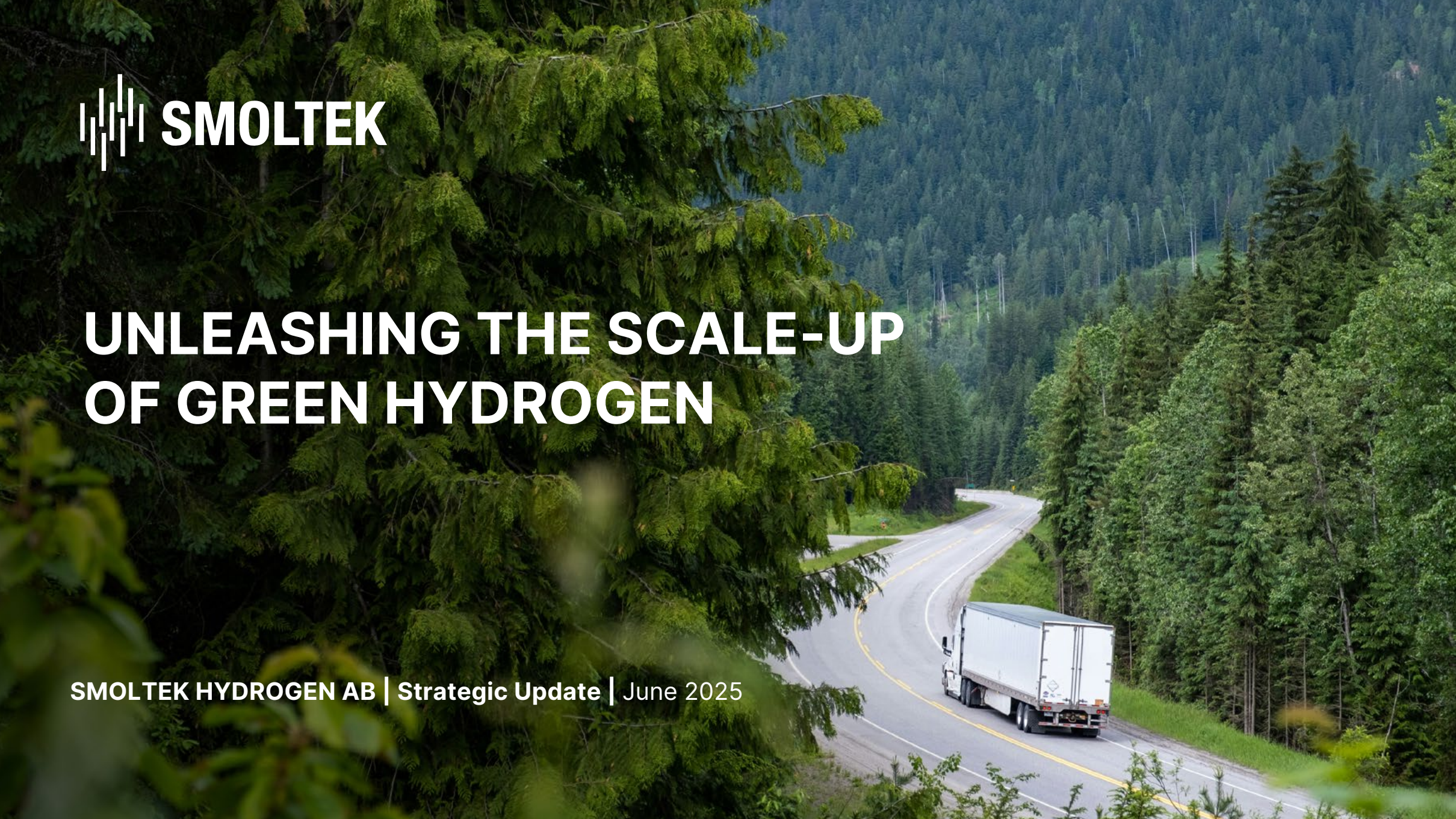
SMOLTEK

UNLEASHING THE SCALE-UP OF GREEN HYDROGEN



SMOLTEK HYDROGEN AB | Strategic Update | June 2025

Executive Summary

Smoltek Hydrogen can create a highly attractive market position based on substantial cost leadership. The company has developed a solution to the most critical obstacle limiting the large-scale adoption of green hydrogen: the extreme scarcity and high cost of iridium catalyst used in PEM electrolyzers.

Our breakthrough product **Smoltek Porus Transport Electrode**, or **Smoltek PTE** for short, uses patent protected carbon nanofiber technology to reduce iridium requirements by 80–95% while maintaining high performance. This innovation succeeds where competitors have struggled for decades – by taking a Catalyst Coated Substrate (CCS) approach where the metallic substrate is coated instead of the plastic membrane.

Smoltek PTE enables PEM electrolyzer manufacturers to overcome the iridium supply constraint that currently blocks their ability to scale production. This is a necessary step to enable the massive scale-up needed for emerging fossil-free applications across heavy industry, transportation, and energy storage.

The technology has proven its effectiveness through rigorous 1,000-hour testing (TRL 4) with independent verification. We are now advancing toward commercial production, with our business model focused on manufacturing and selling the complete PTE component. Our approach leverages standard industrial equipment with our proprietary, patent-protected processes (backed by over 110 patent assets, granted and pending globally).

Investing in Smoltek Nanotech Holding AB today provides exposure to this transformative technology before key commercial milestones significantly impact valuation. This presents a unique opportunity to participate in enabling the global transition to sustainable energy by solving a fundamental constraint that would otherwise make the hydrogen revolution impossible.

Making Green Hydrogen Economically Viable with Breakthrough Catalyst Technology

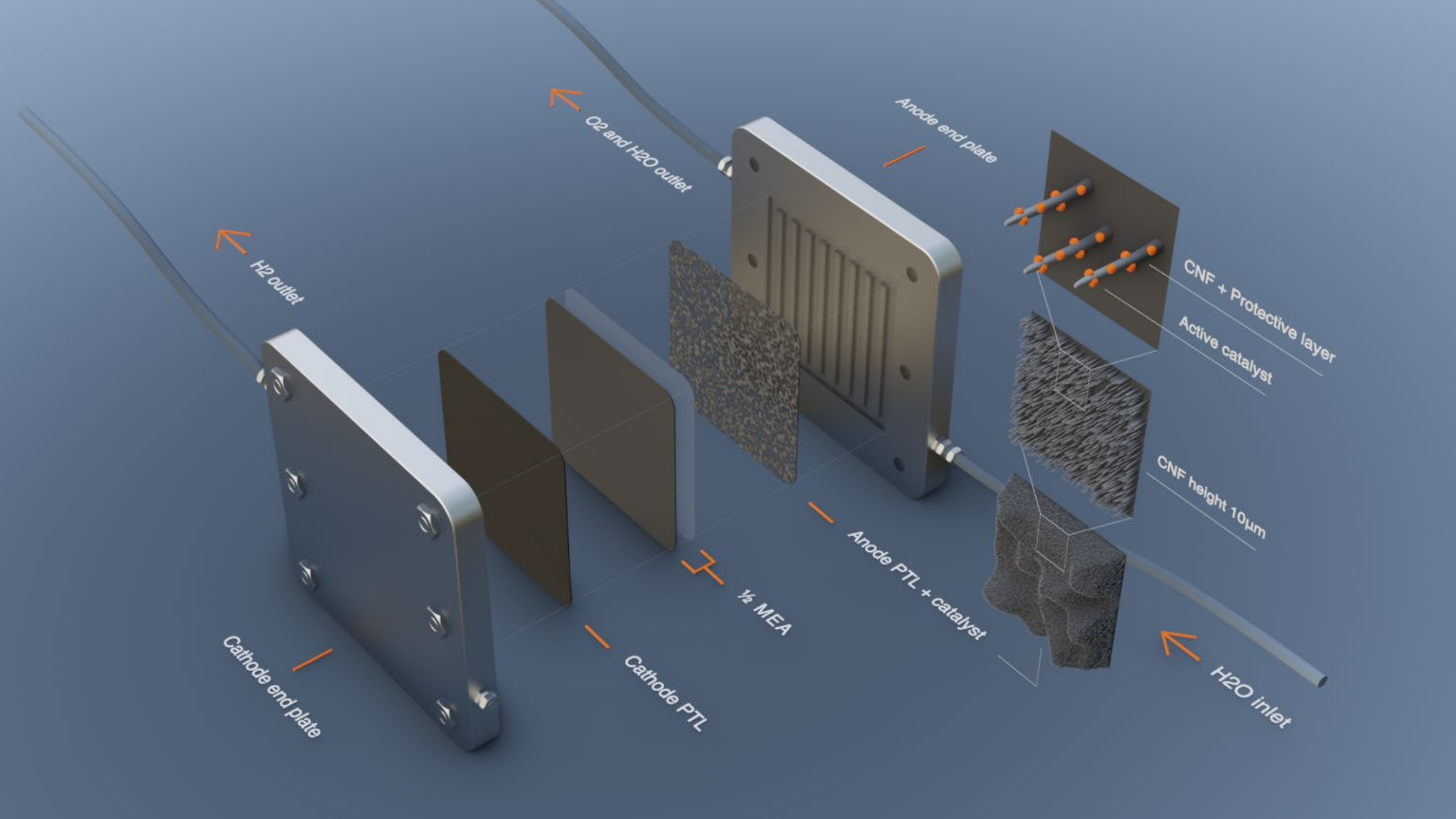
Smoltek Hydrogen is a deep-tech company that has set out to enable the large-scale deployment of green hydrogen solutions by overcoming the critical physical barriers to production.

To make green hydrogen economically viable, Smoltek is reducing the cost of electrochemical cells, by far the most expensive and cost-driving component used in the manufacture of PEM water electrolyzers.

The cost is reduced by Smoltek Hydrogen's breakthrough innovation: A porous transport electrode (PTE) with added nanostructure that increases the active surface area by 30 times.

For global industrial enterprises in the hydrogen sector seeking to reduce catalyst costs by 80% or more while maintaining high performance of PEM electrolyzer cells, Smoltek PTE is a Catalyst Coated Substrate (CCS) that delivers full functionality with minimal precious metal usage. Unlike the prevailing Catalyst Coated Membrane (CCM) approaches, where expensive catalysts are inefficiently buried in thick layers, Smoltek Hydrogen's patent protected carbon nanofiber technology creates a 30× larger active surface area, ensuring nearly all catalyst material actively participates in the reaction.

The anode PTL is Smoltek's porous transport electrode (PTE). CNFs are nanostructures. CNFs are between 3 and 10 µm in height.


O2 and H2O outlet
Anode end plate
H2 outlet
CNF + Protective layer
Active catalyst
CNF height 10µm
½ MEA
Anode PTL + catalyst
Cathode PTL
Cathode end plate
H2O inlet

Enabling the Green Hydrogen Revolution

Hydrogen is the foundation of modern industry, with global demand at 100 million tons per year – expected to double by 2030 and reach 550 million tons by 2050. Today, it's essential for fertilizer production, chemical manufacturing and oil refining. Tomorrow, it will be the cornerstone of global decarbonization efforts, transforming heavy industry, transportation and energy systems worldwide.

But here's the stark reality: 96% of all hydrogen today comes from fossil fuels, releasing a staggering 10 kg of CO_2 for every kilogram of hydrogen produced.

There is widespread agreement that the solution lies in PEM electrolyzers, which convert electricity from intermittent fossil-free sources (hydro, wind, solar) into hydrogen. But this critical transition is not happening fast enough because global enterprises building large-scale PEM electrolyzer facilities are constrained by the limited supply of iridium.

The global production of iridium is only 7–9 tons per year, primarily as a by-product of platinum and nickel mining in South Africa and Zimbabwe. This severe supply constraint creates a fundamental physical barrier preventing electrolyzer manufacturers from scaling production to meet the rapidly growing demand for green hydrogen. While renewable electricity costs represent the largest part of green hydrogen production expenses, this iridium limitation is the critical bottleneck that must be solved to enable the massive scale-up needed for emerging fossil-free applications across for instance steel production, transportation, and energy storage.

This creates an urgent need for a radical solution: the amount of iridium required in PEM electrolyzers must be drastically reduced while maintaining or improving performance.

Smoltek Hydrogen has risen to the challenge: to reduce the need for precious metal catalysts in PEM electrolyzers while maintaining performance and making them even more efficient and cost effective.

This allows manufacturers to overcome the iridium supply constraint and scale up the production of PEM electrolyzers, making clean hydrogen economically competitive with fossil-based alternatives. For investors, this represents an extraordinary opportunity across the hydrogen ecosystem.

Solving The Iridium Challenge

The scarcity and cost of iridium creates what industry experts call “The Iridium Challenge.” To overcome this obstacle, we need a breakthrough solution that addresses both the limited global supply and the fundamental inefficiency in how this precious catalyst is currently used.

Conventional technology uses Catalyst Coated Membranes (CCM), applying iridium-containing slurry to the membrane. This wastes precious metal, as only surface atoms participate in reactions while those buried inside remain inactive.

With global iridium production limited to just 7–9 tons annually, the PEM electrolyzer industry faces a critical supply constraint. At current usage rates of 1–2 mg/cm², the entire world’s annual iridium production could support only 4–5 GW of electrolyzer capacity – just 2% of projected 2030 demand. This supply bottleneck is described by authorities like the International Energy Agency (IEA) as one of the most critical barriers to scaling green hydrogen production with EM electrolyzers.

Beyond the supply challenge, the standard 2 mg/cm² iridium loading translates to $60 million in catalyst costs alone for a single gigawatt electrolyzer. Reducing this to 0.1 mg/cm² would slash these costs to just $3 million – a $57 million saving per gigawatt that makes the difference between economic viability and prohibitive expense. This 95% reduction represents the threshold where it is possible to scale up the production of green hydrogen to the huge volumes the fossil free future needs.

Despite extensive research into various technologies, industry efforts have stalled at 0.5 mg/cm² – still five times higher than the crucial economic threshold of 0.1 mg/cm².

An alternative approach exists – Catalyst Coated Substrate (CCS) – electrodeposition of an extremely thin iridium catalyst layer onto the electrode substrate rather than a thick iridium ink onto the membrane.

This method was previously dismissed because electrode surfaces are too small, but Smoltek Hydrogen has overcome this limitation through our revolutionary carbon nanofiber technology – increasing the active surface area by 30 times.

With this architecture, nearly all catalyst atoms actively participate in the reaction, allowing us to achieve the once-impossible target of 0.1 mg/cm² iridium while maintaining high performance.

Five Failed Approaches

Composite anodes replace most iridium with platinum black, but still require at least 0.5 mg/cm² of iridium and increase overall precious metal costs.

Core-shell structures use cheaper materials (ruthenium or nickel) coated with thin iridium layers, but suffer from durability issues as the core materials leach out in acidic environments.

Manganese-iridium composites scatter individual iridium atoms across manganese oxide, showing promise in laboratories but proving difficult to manufacture consistently at scale.

Nanostructured thin films deposit iridium on crystalline organic whiskers, but the delicate structures are prone to mechanical failure during operation.

Nanoprinting technology precisely places tiny iridium particles on membranes, but requires specialized equipment that limits cost-effective mass production.

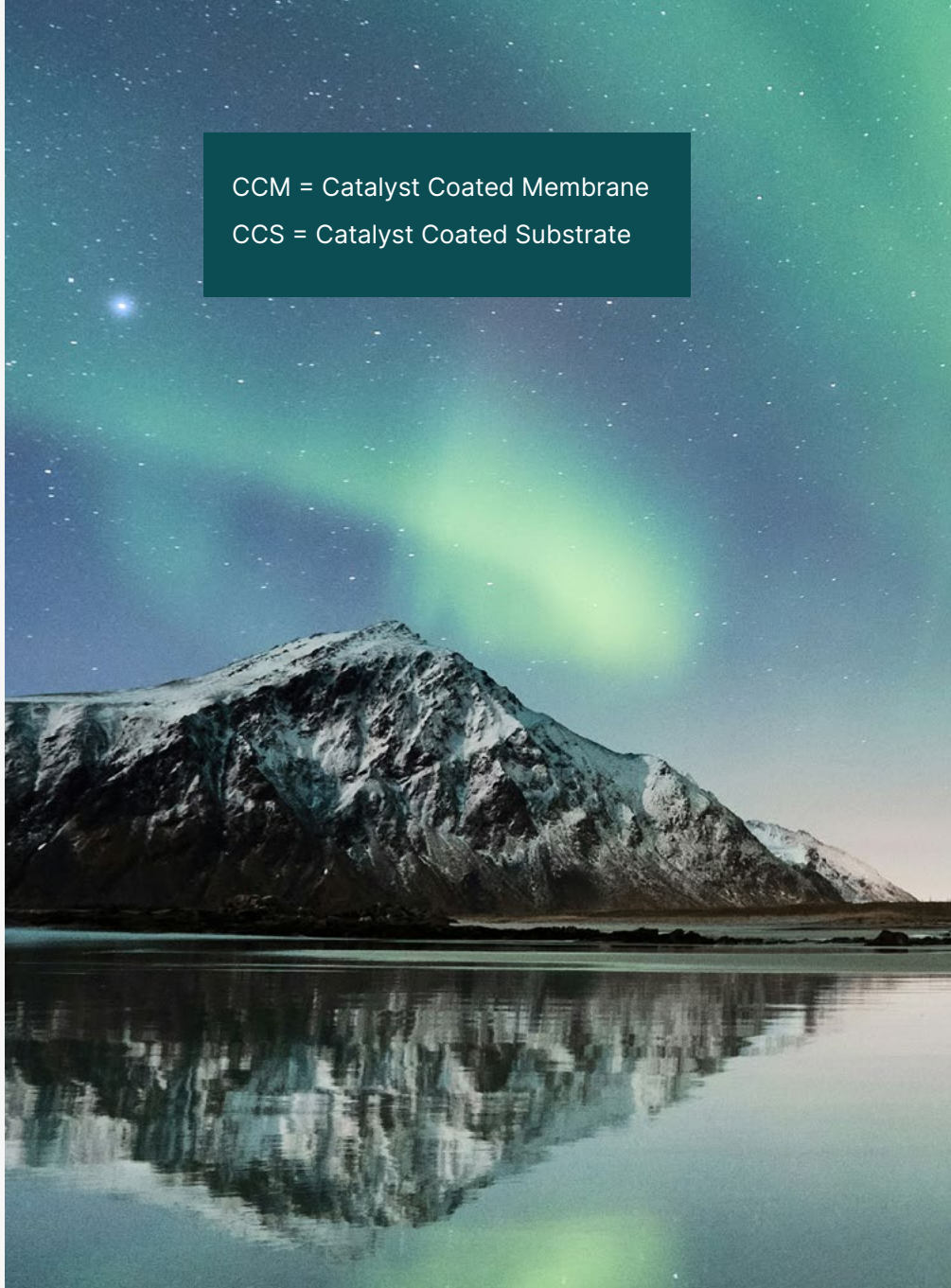
The Porous Transport Electrode Breakthrough

Smoltek Hydrogen's breakthrough in reducing iridium usage centers on our PTE technology. Instead of applying catalyst to the membrane (CCM approach), we coat the electrode substrate (CCS approach) with a crucial innovation: multiplying the available surface area.

By growing vertically aligned carbon nanofibers directly onto a porous titanium layer, we create a forest-like structure that increases the active surface area 30-fold. These nanofibers, 14,000 times thinner than a human hair, transform a standard A4-sized electrode into an effective catalytic surface exceeding 1.8 million mm^2.

Our manufacturing process is straightforward:

- Carbon nanofibers are grown on titanium substrate
- An ultra-thin platinum coating protects against corrosion while maintaining conductivity
- Iridium is precisely deposited atom-by-atom, creating maximum active catalyst sites
- The completed PTE is quality tested and packaged for delivery to electrolyzer manufacturers



Performance Validation

Our technology delivers proven results, which confirm that we have achieved TRL 4 (validated in a laboratory environment):

- **Identical performance:** We achieve the same performance with only 0.1 mg/cm² iridium compared to conventional electrodes requiring 2.0 mg/cm².
- **Proven durability:** Successful 1,000-hour tests completed without signs of irreversible degradation.
- **Independent verification:** PEM expert Dr. Felix Büchi has independently verified and confirmed our technology's capabilities.

We are currently performing tests under industrially relevant conditions to validate TRL 5, a step we expect to reach shortly. Thereafter, our production capabilities, starting in 2026, will accelerate further development towards TRL 6–7.

Intellectual Property & Business Model

Our technology is underpinned by a comprehensive intellectual property portfolio comprising over 110 patents granted or pending across 22 patent families. This protection covers core CNF synthesis, electrode structure design, and manufacturing processes, creating a significant barrier to entry with strategic coverage in key markets including Europe (EPO), USA, China, Taiwan, South Korea, Japan, and India, among others.

Our business model focuses on manufacturing and selling the complete Smoltek PTE to our customers, enabling them to achieve nearly 100% catalyst utilization, with each iridium atom actively participating in the reactions.

The same platform technology can revolutionize fuel cells and other electrochemical applications, positioning Smoltek as a fundamental enabler of the hydrogen economy.

Strategic Advantages Through Customer Lock-In

While many technology companies struggle with customer retention, Smoltek Hydrogen’s business model creates powerful structural advantages that generate exceptional customer loyalty. Our approach – manufacturing and selling complete PTE components that customers integrate into their systems – creates relationships that become increasingly valuable and difficult to replace over time.

Once manufacturers incorporate our PTE components into their designs, they are effectively locked into our technology for several compelling reasons:

1. **Technical Integration Commitment:** Each customer's product undergoes extensive optimization and testing with our PTE components, creating a deeply embedded technical dependency. Their electrolyzer designs become specifically engineered around the unique properties of our nanofiber-enhanced electrodes. Switching would require expensive redesign cycles, re-certification processes, and operational disruptions that few companies can justify once they've committed to a technology path.
2. **Manufacturing Process Adaptation:** Customers adapt their manufacturing processes to work optimally with our PTE components. This includes specialized handling procedures, updated quality control protocols, and customized assembly techniques that become an integral part of their production lines. These process adaptations represent significant investments that are costly to change once implemented, creating a strong incentive to maintain the relationship.
3. **Performance Differentiation:** Products made with our PTE technology achieve a cost advantage that competitors cannot match without also working with us. A manufacturer using our components can produce electrolyzers that operate with 95% less precious metal catalyst, resulting in significant cost savings that create a decisive market advantage. This performance gap creates a competitive barrier that further strengthens our relationship with each customer.
4. **Intellectual Property Protection:** Our technology is protected by an extensive patent portfolio that includes more than 110 issued or pending patents in 22 patent families. This legal framework prevents competitors from independently replicating our process or offering alternative solutions that achieve the same cost benefits. Our strategic patenting approach covers core carbon nanofiber synthesis methods, electrode structure designs, and manufacturing processes, providing multi-layered protection in all major markets, including Europe, USA, China, South Korea, Japan, and India.

This powerful combination of technical, commercial and regulatory factors creates exceptional customer "stickiness," ensuring that each manufacturer that adopts our technology remains a stable, long-term revenue stream as they scale production. The deeper customers integrate our PTE components into their products and processes, the more valuable our relationship becomes for both parties.

For investors, this creates a unique value proposition: a deep-tech company with both revolutionary physical innovation and software-like customer loyalty dynamics. Our growing portfolio of locked-in customers represents a foundation of predictable, growing revenue streams from companies at the forefront of the hydrogen revolution – providing both immediate returns and long-term growth potential in a rapidly expanding market.

Market Potential for Hydrogen

Hydrogen use is poised to increase from today's 100 million tons annually to 550 million tons by 2050. This growth represents a fundamental shift from hydrogen as an industrial feedstock to a universal clean energy carrier.

The figures represent an assessment of the global hydrogen demand based on analyses by the IEA, IRENA and the Hydrogen Council. The current situation (circa 2023) is based on IEA statistics. The 2030 and 2050 projections reflect net-zero/1.5°C scenarios developed to meet global climate goals in line with the Paris Agreement. While the reports show different projections depending on the scenario and assumptions, this is a consolidated picture that illustrates the potential for significant global investment. Predicting the future is always fraught with uncertainty.

Sector	Current (Mt/year)	2030 Projection (Mt/year)	2050 Projection (Mt/year)
Transportation	< 0.1	~ 25	~ 180
Fertilizer Production	~ 53	~ 60	~ 75
Power & Energy Storage	< 0.1	~ 15	~ 70
Industrial Heat	< 0.1	~ 10	~ 60
Steel Production	< 0.1	~ 10	~ 60
Oil Refining	~ 39	~ 45	~ 45
Other Industrial Feed-stock	~ 5	~ 10	~ 40
Building Heating	< 0.1	~ 2	~ 20
Total	**~ 100**	**~ 180**	**~ 550**

Key sector insights:

Transportation: Hydrogen fuels long-haul trucks, ships, and aircraft where batteries aren't viable. Growth driven by fuel cells (direct hydrogen) and synthetic fuels (hydrogen-derived).

Fertilizer Production: Currently uses hydrogen to create ammonia via the Haber-Bosch process. Transition from gray to green hydrogen preserves existing infrastructure while eliminating emissions.

Power & Energy Storage: Hydrogen stores renewable energy from hours to seasons, balancing intermittent supply from wind and solar. Converts back to electricity via fuel cells or turbines.

Industrial Heat: Provides high-temperature process heat (>500°C) for cement, glass, and chemical manufacturing where direct electrification is impractical.

Steel Production: Replaces coal as the reducing agent in direct reduction of iron ore, eliminating CO_2 emissions in steelmaking – an industry responsible for 7% of global emissions.

Oil Refining: Used for hydrocracking and desulfurization. While refining volume remains stable, production shifts from gray to blue/green hydrogen.

Other Industrial Feedstock: Includes methanol production, hydrogenation in food processing, and specialty chemicals manufacturing.

Building Heating: Blended with natural gas in existing networks or used in dedicated hydrogen boilers for residential and commercial heating.

For investors, this growth creates opportunities across production, storage, transport, and end-use applications. Smoltek's technology specifically addresses critical production bottlenecks that would otherwise constrain this market expansion.

Market Potential for PEM Electrolyzer

The coming hydrogen economy represents a fundamental shift in how we use hydrogen. While we currently produce about 100 million tons annually, this is projected to 512 million tons by 2050* – but for entirely different purposes than today's applications.

Hydrogen Production Method	Current (Mt/year)	2030 Projection (Mt/year)	2050 Projection (Mt/year)
Fossil fuels without carbon capture	~ 94	~ 115	~ 8
Fossil fuels with carbon capture	< 1	~ 15	~ 198
Clean electricity via electrolysis	< 1	~ 50	~ 306
Total	**~ 96**	**~ 180**	**~ 512**

** Source: International Energy Agency, 2024*

Data in the table is compiled from the following sources:

- *S&P Global: Petronas sees eight-fold growth in hydrogen demand to 550 mil mt/year by 2050*
- *Hydrogen Council: Hydrogen for Net-Zero*
- *IEA: Net Zero by 2050 Roadmap for the Global Energy Sector*
- *IEA: Global Hydrogen Review 2023*
- *IRENA: Global Hydrogen Trade Report*
- *IRENA: World Energy Transitions Outlook*

The market reality is stark: clean hydrogen production must grow from less than 1 Mt today to 50 Mt by 2030[1] to have any chance of meeting the Paris Agreement targets. This immediate 50x growth in just five years creates extraordinary demand for a viable solution.

What's crucial to understand is that green hydrogen targets entirely new markets distinct from traditional hydrogen uses. The explosive growth in hydrogen demand comes from applications where only fossil-free solutions meet the fundamental requirements:

- In steel production, green hydrogen replaces coal to eliminate CO_2 emissions in ironmaking. Steel production currently accounts for 7% of global emissions[2], creating significant pressure to adopt cleaner methods as carbon regulations tighten. Here, green hydrogen competes with coal-based processes, not gray hydrogen.
- For shipping and heavy transport, green hydrogen provides the energy density needed for long distances where batteries are impractical. These sectors specifically need carbon-free solutions to meet increasingly strict emissions regulations. Using gray hydrogen would defeat the entire purpose.
- In energy storage, green hydrogen converts surplus renewable electricity into storable energy that can be used when needed - a capability that existing alternatives like batteries (limited duration) or pumped hydro (geographic constraints) cannot match at scale.

While renewable electricity costs form the largest part of green hydrogen production expenses, the immediate barrier to capturing these markets isn't price – it's production capacity. We face a concrete bottleneck: the world physically cannot manufacture enough PEM electrolyzers because iridium supply is too limited.

Among electrolysis technologies, PEM (Proton Exchange Membrane) electrolyzers are uniquely positioned for dominance. Their advantages over alkaline technology include:

- **Fast response time** (seconds vs. minutes/ hours), enabling direct coupling with intermittent renewable energy sources.
- **Higher current density** (2–3×), reducing physical footprint and capital cost
- **Higher operating pressure,** eliminating compression stages and reducing system complexity
- **Superior hydrogen purity** (99.999%), critical for fuel cell applications

These advantages have made PEM the fastest growing electrolyzer segment, with with capacity-based market share expected to increase from 15% in 2020[3] to a projected 60% by 2030[4]. Major industry players such as Siemens Energy, Bosch, Cummins, ITM Power, and Plug Power have committed to PEM technology as their primary platform.

In value terms, the PEM electrolyzer market is projected to reach $15–25 billion annually by 2030[5], representing approximately 30% of a broader electrolyzer market expected to exceed $70 billion. This represents a 6-fold increase from today's PEM market size of approximately $2–4 billion.

But this growth faces a critical barrier: iridium availability.

PEM electrolyzers require this ultra-rare precious metal (only 7–9 tons mined worldwide per year as a catalyst. At current technology levels, which require 1–2 mg/cm², total annual global iridium production could supply only 4–5 GW of electrolyzer capacity-just 2% of projected 2030 demand.

For investors, the opportunity is clear: those who don't get in now risk missing out on the entire growth trajectory. Smoltek's technology removes the fundamental material constraint limiting market expansion and positions it as the enabler of the entire green hydrogen revolution.

Sources:

[1] Hydrogen Council, Hydrogen Insights 2021
[2] World Steel Association, World Steel in Figures 2024
[3] Hydrogen Council, Hydrogen Insights 2021
[4] Clean Energy Technology Observatory, EU Joint Research Centre
[5] MarketsandMarkets, Electrolyzers Market worth $78.01 billion by 2030; Grand View Research, Hydrogen Electrolyzer Market Size And Share Report, 2030; International Energy Agency, Global Hydrogen Review 2024

Beyond Electrolyzers: Unlocking New Markets with Our Nanofiber Platform

While our immediate focus remains on PEM electrolyzers, Smoltek Hydrogen's carbon nanofiber technology creates significant opportunities in other electrochemical applications, particularly fuel cells.

Fuel Cells

Our carbon nanofiber technology offers a breakthrough solution to a critical challenge in fuel cell performance: the contact resistance between the bipolar plate and the gas diffusion layer.

The problem we solve: In fuel cells, electrons must travel efficiently from the gas diffusion layer to the bipolar plate. Traditional interfaces create resistance that reduces the fuel cell's efficiency – meaning less electricity generated from the same amount of hydrogen fuel.

Our solution: By placing our carbon nanofibers between the bipolar plate and gas diffusion layer, we dramatically reduce contact resistance. The vertically aligned "spiky" structure of our nanofibers creates multiple direct electrical pathways, allowing electrons to flow more freely across the interface.

Key benefits:

- Higher fuel cell efficiency – more electricity from the same amount of hydrogen
- No need for expensive materials like titanium plates or gold coatings
- Carbon nanofibers provide corrosion protection for stainless steel bipolar plates

Market validation: A global automotive manufacturer is already testing our technology for potential integration into their fuel cell vehicles. Initial results show promising performance improvements that could provide a competitive edge in range and efficiency – critical metrics for consumer adoption of hydrogen vehicles.

Market opportunity: The global hydrogen fuel cell market reached USD 5.9 billion in 2023 and is projected to grow to USD 32.2 billion by 2030[1] (CAGR 27.7%)..

Reversible Solid Oxide Cells

By applying our surface enhancement approach to high-temperature electro-chemical systems, we can dramatically reduce expensive ceramic catalyst materials in reversible solid oxide cells that switch between electricity production and hydrogen generation.

Market opportunity: The global RSOC market is projected to reach USD 2.5 billion by 2028, primarily serving grid-balancing and industrial energy storage applications[2].

Development stage: Initial concept exploration phase.

Direct Ammonia Fuel Cells

Our nanofiber platform could potentially address the catalyst utilization challenges in direct ammonia fuel cells, unlocking applications in maritime propulsion where ammonia is increasingly viewed as a viable zero-carbon fuel.

Market opportunity: The ammonia fuel cell market, valued at USD 240 million in 2022, is projected to reach USD 1.5 billion by 2030[3].

Development stage: Initial concept exploration phase.

Additional Future Applications

While these additional markets represent interesting future diversification paths, our primary focus remains firmly on executing our electrolyzer commercialization roadmap, with fuel cells as our nearest-term expansion opportunity based on direct industry interest and technical readiness.

Sources:

[1] Valuates Reports: Global Hydrogen Fuel Cells Market Research Report

[2] The Brainy Insights: Reversible Solid Oxide Fuel Cell Market; Global Market Insights: Solid Oxide Fuel Cell Market; Market Research Future: Reversible Solid Oxide Fuel Cell (RSOFC) Market

[3] Verified Market Reports - Ammonia Fuel Cell Market Size, Market Growth, Trends & Forecast 2033

Manufacturing & Scale-Up Strategy

Smoltek Hydrogen's manufacturing approach combines innovation with practicality. We've designed a production process that brings our breakthrough technology to market while avoiding the common pitfalls of custom manufacturing infrastructure.

Our production strategy builds on three key principles:

1. **Using established industrial technologies.** We grow our carbon nanofibers using Plasma Enhanced Chemical Vapor Deposition (PECVD) – a well-proven industrial process used across multiple industries. For the platinum and iridium coatings, we use precise deposition techniques that ensure atom-by-atom placement for maximum catalytic efficiency. These standard techniques allow us to manufacture our PTE product efficiently without reinventing manufacturing methods.
2. **Working with commercial equipment providers.** Rather than building custom machines, we partner with established industrial suppliers:

- **SparkNano:** We are collaborating with SparkNano, which has developed a unique method for accelerating the atomic layer deposition process through what is known as Spatial ALD. This technology enables industrial-scale manufacturing of our PTE components.
- **Impact Coatings:** We are evaluating how their PVD equipment can be used for growing carbon nanofibers. This collaboration will determine what types of hardware modifications to their existing PVD tool are needed to enable effective production of our nanofiber structures on PTL substrate, with results expected by Q2 2026.
- **AGC Plasma Technology Solutions:** We are also collaborating with AGC, whose proven plasma-enhanced chemical vapor deposition (PECVD) systems are widely used in industrial applications. Their ready-to-use solution only requires specific component modifications to handle the higher temperatures our process needs. To accelerate our scaling timeline, we have already jointly designed a prototype PECVD system that validates the technology before ordering a full-scale production line.

We will not be developing unique machinery exclusively for Smoltek Hydrogen. Our competitive advantage lies in our patent protected processes and specialized knowledge – not in proprietary equipment. This approach reduces risk and accelerates our path to production.

3. **Creating value through know-how, not customized hardware**. Similar to how digital companies build value using standard servers but unique software, Smoltek creates breakthrough value by applying specialized expertise to widely available manufacturing equipment. Unlike software, our approach is protected by strong patents.

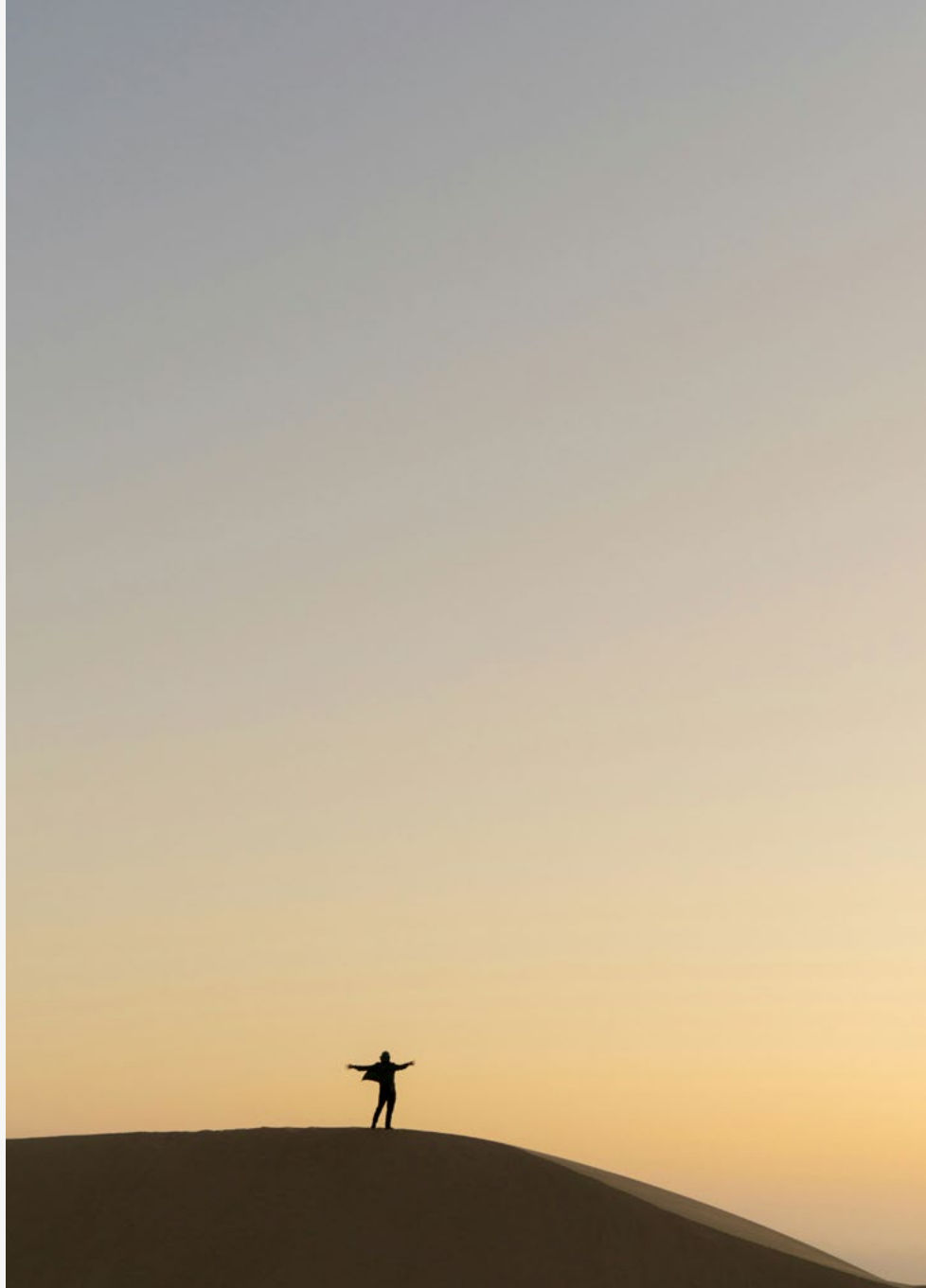
Our manufacturing process involves:

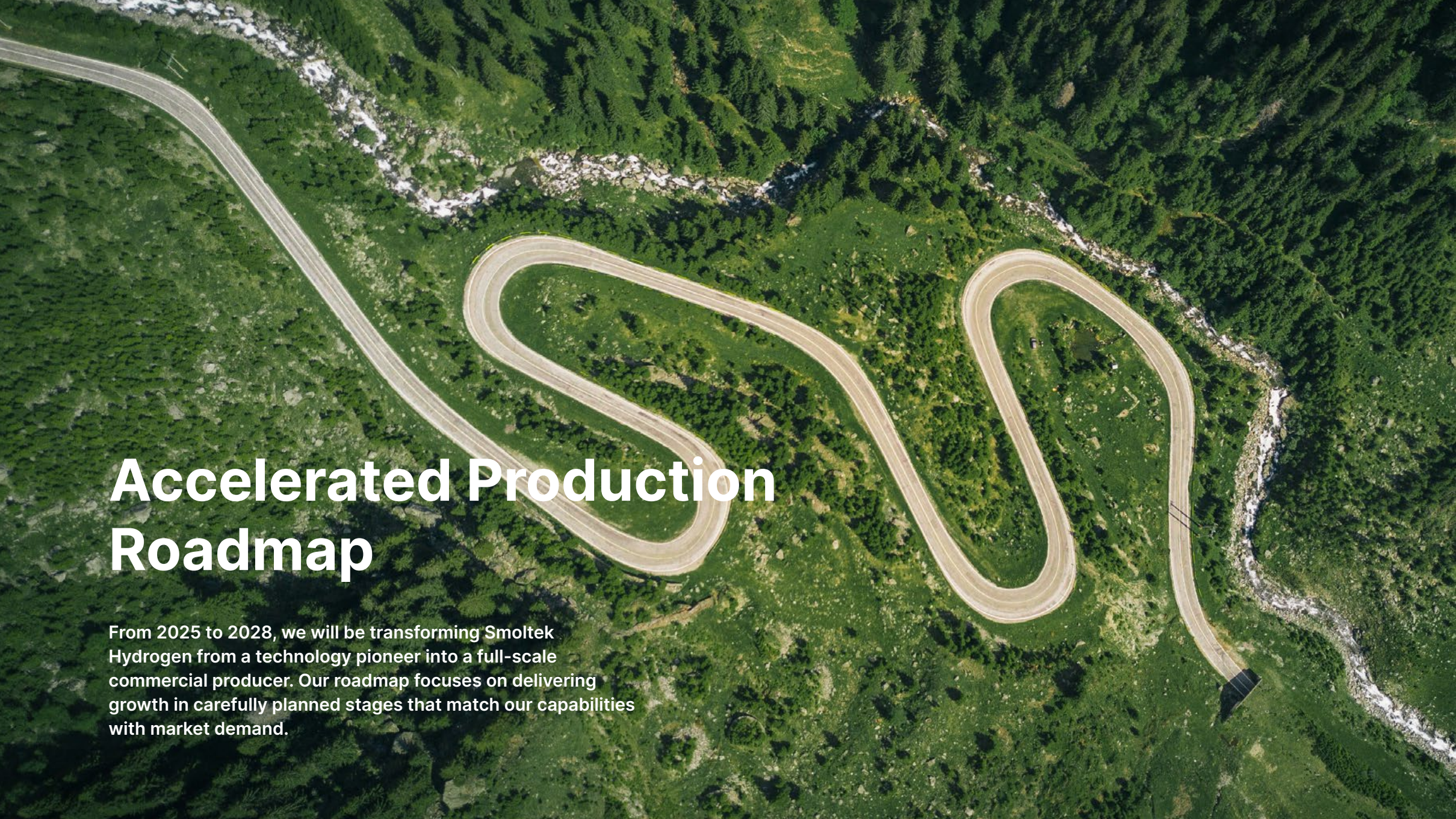
- Sourcing high-quality titanium substrates and precious metals (platinum and iridium)
- Manufacturing complete PTE components using our proprietary nanofiber technology
- Delivering finished PTE products to electrolyzer manufacturers for integration

This strategy allows us to begin production much faster than companies relying on custom machinery. While they might face years of delays and capital-intensive development, our approach enables quicker revenue generation using existing industrial platforms.

Furthermore, we plan for adding manufacturing capacity as the business grows, eliminating the need to start with a large factory before customers are ready for high volume manufacturing. We scale up stepwise, with equipment that can produce components ranging from 5×5 cm up to 2×1 meters.

For investors, this represents a distinctive opportunity: we minimize capital requirements while maximizing value creation through our proprietary processes and products. Through strategic partnership with one or several industrial companies we will be leveraging their established industrial infrastructure rather than building expensive, single-purpose facilities. Depending on business model either we or the partner could own and/or operate the specific manufacturing equipment placed in their premises. We can thereby deliver exceptional returns on invested capital while reaching the market faster.





Accelerated Production Roadmap

From 2025 to 2028, we will be transforming Smoltek Hydrogen from a technology pioneer into a full-scale commercial producer. Our roadmap focuses on delivering growth in carefully planned stages that match our capabilities with market demand.

Immediate Goals (2025–2026)

Our initial production capacity of 500 m²/year in 2026 marks our first commercial step. This capacity allows us to:

- Supply early adopters with Smoltek PTE
- Perfect our quality control processes under real-world conditions
- Generate initial revenue and customer testimonials
- Fine-tune our logistics and supply chain operations

This projection is based on the scenario that we have sufficient capital to make the necessary investments in machinery and development.

Scaling Phase (2027–2028)

In 2027, we will reach 1,500 m²/year (2% market share), marking our transition to meaningful commercial impact.

By 2028, our 8,000 m²/year capacity (5% market share) represents the critical mass where we become an essential supplier to the industry. This capacity level transforms us from an innovative alternative to a mainstream solution addressing the iridium supply constraint.

Key Production Milestones

Year	Production Capacity	Market Share	Strategic Focus
2025	50 m²/year	<0.1%	Process validation with early adopters
2026	500 m²/year	~1%	Expanding customer base and validation
2027	1,500 m²/year	~2%	Operational excellence and margin optimization
2028	8,000 m²/year	~5%	Scaling production to meet growing demand

Business Model

Our business model turns a technological breakthrough into a commercial product that solves a critical industry bottleneck. We manufacture and sell our PTE components directly to PEM electrolyzer manufacturers, allowing them to overcome the iridium supply constraint that currently limits their growth.

Revenue Generation

We sell complete PTE components – not just a coating service – giving our customers a ready-to-use solution they can integrate directly into their manufacturing process. This approach:

- Simplifies adoption for customers looking for a ready-to-integrate component
- Creates higher margins than a service-only model
- Ensures quality control across the entire component
- Builds stronger customer relationships through a physical product

Our cost position reflects the substantial value we create: enabling manufacturers to use electrodes with 80–95% less iridium content, while maintaining performance. For a typical electrolyzer application this translates to approximately $5,500 in cost savings per square meter of electrode area.

Production and Delivery

Our manufacturing process involves three key steps:

1. **Material sourcing:** We purchase titanium substrates and precious metals (platinum and iridium) from established suppliers
2. **Smoltek PTE production:** We use our patent protected process to grow carbon nanofibers and apply catalyst coatings
3. **Quality assurance:** We test each component against rigorous performance standards before shipping

This approach creates several advantages over competitors:

- We maintain full control of the production process
- We can scale production in line with market demand
- Customers receive a consistent, high-quality product

Market Approach

Our initial focus is on establishing a strong relationship with one lead customer - likely a development partner or supplier who intends to sell PTE to their electrolyzer manufacturing customers. While electrolyzer manufacturers themselves may be less inclined to partner directly (as they typically avoid sharing core competencies with competitors), they represent potential customers for our technology or, in some cases, may consider acquiring exclusive rights or the entire Smoltek Hydrogen business. Once proven, we'll expand to serve multiple manufacturers.

This strategy allows us to:

- Perfect our manufacturing processes with a committed partner
- Generate reference cases that reduce adoption barriers for future customers
- Build production capacity in line with actual market demand

Sustainable Competitive Advantage

Our business model is protected by several complementary factors:

- **Cost leadership:** Our dramatically lower iridium usage results in significantly lower production costs, enabling attractive pricing while maintaining high margins
- **Supply security:** When global iridium scarcity intensifies, we can continue manufacturing and delivering when competitors cannot - creating a near-monopoly position for a critical component
- **Patent protection:** Over 110 patents granted or pending across 22 patent families
- **Technical expertise:** Specialized knowledge in carbon nanofiber growth and precious metal deposition
- **Customer integration:** Once adopted, our components become integral to manufacturers' products and processes
- **Scale advantages:** As production volume increases, our manufacturing efficiency will improve

For investors, this creates a compelling opportunity: recurring revenue from the sale of high-margin components to manufacturers in a rapidly growing market, with an exceptionally strong market position based on both cost advantage and supply security when others face material constraints.

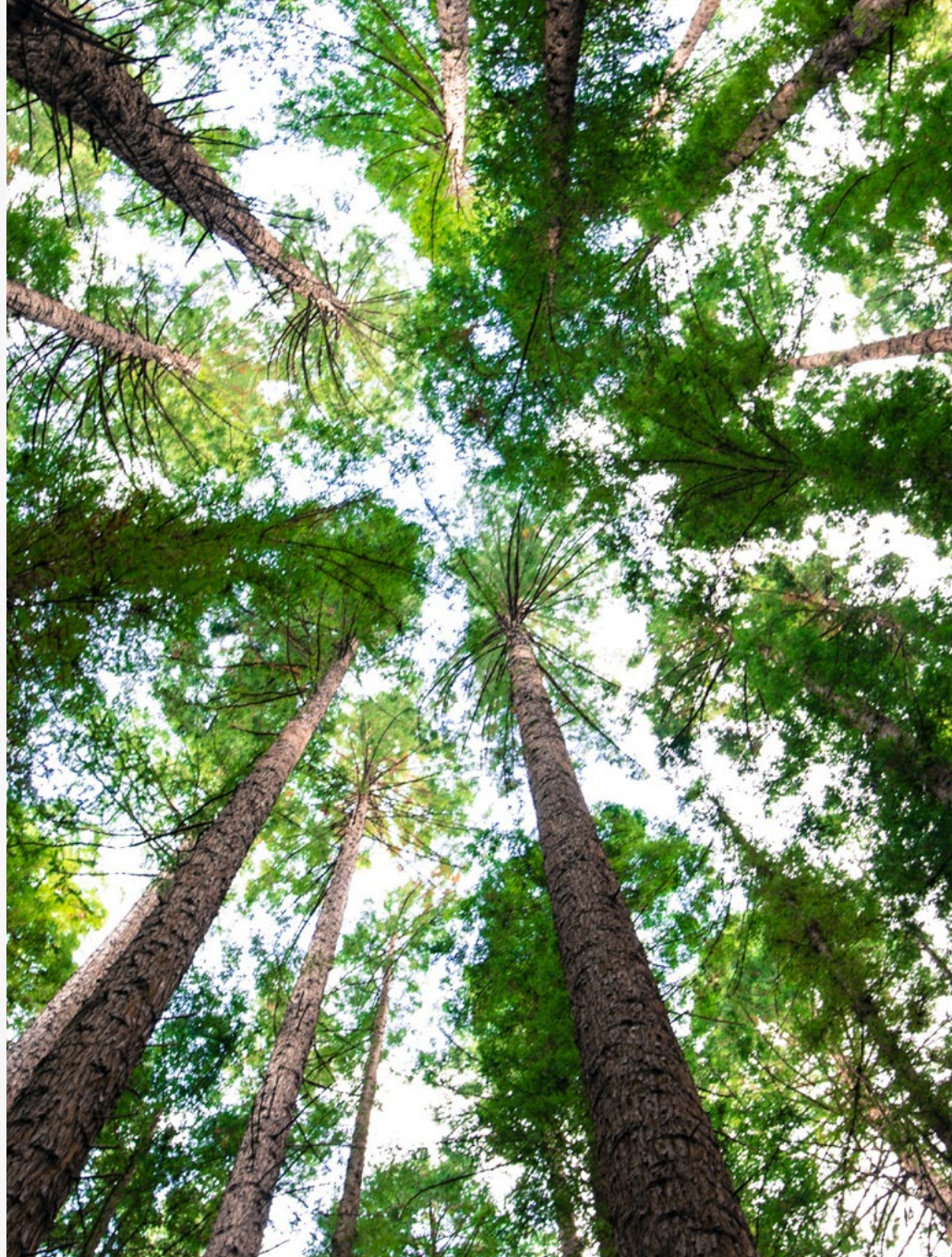
Value Proposition for Customers

PEM electrolyzer manufacturers face two critical challenges that directly impact their growth and market position: the extreme scarcity of iridium and its high cost. Our PTE technology addresses both issues by dramatically reducing the amount of iridium required while maintaining or improving electrolyzer performance.

Solving the Iridium Supply Constraint

For manufacturers, the iridium supply limitation is not just about cost – it's about their ability to scale production at all. With global iridium production capped at 7–9 tons annually, and the industry projected to need 30 tons just for electrolyzers by 2030, manufacturers face a fundamental constraint on growth.

By reducing iridium requirements by 80–95%, we remove this growth ceiling. A manufacturer using our PTE components can produce 5–10 times more electrolyzer capacity without needing to secure additional iridium supply, as the catalyst is already integrated in our delivered components. This translates directly to faster market expansion and greater market share during the critical early growth phase of the green hydrogen industry.



Creating Significant Cost Advantages

Beyond enabling growth, our technology delivers substantial cost benefits:

- **Direct material savings:** At projected 2030 iridium prices of $800,000/kg, reducing usage from 2.0 mg/cm² to 0.1 mg/cm² saves approximately $5,500 per square meter of electrode area.
- **Improved product economics:** These savings represent approximately 18% of initial system costs for PEM electrolyzers. Over the system's 20-30 year lifetime, the 3-5 electrode stack replacements create compounding cost savings, as each replacement delivers the same iridium reduction, significantly amplifying the long-term economic benefits.
- **Strategic flexibility:** Our business model enables attractive margins while still delivering significant value to manufacturers, who benefit from both cost advantages and the strategic ability to scale production beyond previous iridium constraints.

Performance Without Compromise

Many technologies that reduce precious metal content sacrifice performance or durability. Our approach is different:

- **Equivalent performance:** Independent testing confirms that cells using our PTE components match or exceed the performance of conventional electrodes using 20 times more iridium.
- **Proven durability:** Our 1,000-hour durability testing shows no signs of performance degradation after an initial voltage increase, with stable voltage curves throughout extended operation.
- **Simplified integration:** Our complete PTE components require minimal changes to existing manufacturing processes, lowering the barriers to adoption.

Gaining Competitive Edge Through Early Adoption

For electrolyzer manufacturers, incorporating our technology provides a decisive advantage during the industry's formative growth phase:

- **First-mover benefits:** Early adopters can scale production faster than competitors still constrained by iridium availability, establishing market leadership positions.
- **Cost leadership:** Manufacturers can position themselves as cost leaders in a market where economic viability is critical for widespread adoption.
- **Supply chain security:** Reducing iridium dependence shields manufacturers from supply disruptions and price volatility in precious metal markets.

In an industry where scale and cost-effectiveness will ultimately determine the winners, our technology gives manufacturers the tools they need to grow faster and more profitably than their competitors. The manufacturers who embrace this opportunity earliest will have the strongest position as the hydrogen economy expands from today's early stage to mainstream adoption.

Key Risk Factors and Mitigation Strategies

While our roadmap presents a clear path forward, we recognize several key risk factors that must be managed to ensure successful execution:

Technical Risks

Risk: Technical validation cycles at customers may take longer than anticipated, potentially delaying commercial adoption.

Mitigation: We have established a dedicated customer integration team to work closely with manufacturers, providing hands-on support throughout their validation process. Our 1,000-hour durability tests already address many of the standard qualification requirements, shortening the path to approval.

Manufacturing Risks

Risk: Our manufacturing approach faces different challenges depending on which equipment partner we select. Impact Coatings (PVD) and AGC Plasma Technology Solutions (PECVD) each offer distinct advantages and limitations for our carbon nanofiber growth process.

Mitigation: We are pursuing parallel development tracks with both equipment providers, conducting detailed technical evaluations of each approach. This dual-path strategy ensures we have a viable alternative if technical hurdles arise with either solution. Our testing with Impact Coatings will determine if their PVD equipment can be adopted to effectively produce our nanofiber structures (results expected by Q2 2026), while we are working with AGC to modify their PECVD system to handle our required temperature range

Market Risks

Risk: Slower than projected growth in the PEM electrolyzer market would affect our capacity expansion plans.

Mitigation: Our staged capacity increase allows us to match our production to actual market demand. Starting with a modest 50 m^2/year capacity provides sufficient capacity to serve early adopters while validating market assumptions before making larger capital commitments. Each subsequent expansion will be triggered by confirmed customer demand.

Financial Risks

Risk: Initial limited production volumes mean higher unit costs until we reach economies of scale.

Mitigation: Our business model focuses on delivering high-value PTE components that command premium pricing based on the substantial cost savings they enable for customers. This approach ensures healthy margins even at lower initial production volumes, providing financial stability as we scale.

IP Risks

Risk: As we gain market traction, competitors may attempt to circumvent our patents with alternative approaches.

Mitigation: Our comprehensive IP portfolio includes over 110 patents granted or pending across 22 patent families, creating multiple layers of protection. Our strategic patenting approach covers not just core technologies but also manufacturing methods, specific applications, and alternative implementations, creating a robust defensive position in all major markets.

Value Creation for Shareholders

As a wholly owned subsidiary of Smoltek Nanotech Holding AB, our growth directly increases value for shareholders.

Enabling Market Growth: Our technology solves the fundamental iridium supply constraint that currently prevents electrolyzer manufacturers from scaling production. For these companies, the immediate priority is not cost reduction – it's capturing market share in a rapidly growing industry. They need to grow quickly, but cannot without our solution to the iridium bottleneck. This creates urgency for adoption that will drive near-term revenue.

Strategic Valuation Uplift: Holding company valuations typically expand significantly as subsidiaries transition from R&D to commercialization. Based on comparable companies in the clean technology sector, this transition typically results in valuation multiple expansions of 2–5× once commercial validation is achieved.

Industry Ecosystem Development: Our industrial partnerships strengthen Smoltek Nanotech Holding's overall market position, creating opportunities across their technology portfolio.

Solving Industry's Growth Bottleneck: Today, electrolyzer manufacturers are racing to establish market leadership, but they're all hitting the same wall: there simply is not enough iridium in the world to build the electrolyzers needed. By reducing iridium usage by 95%, our PTE components remove this critical barrier, allowing manufacturers to produce 20 times more capacity using the same amount of iridium. This is not just a cost advantage – it's the key that unlocks their ability to grow at all.

Value Capture Opportunity: The significant cost advantage our technology creates - up to $5,500/m^2 compared to conventional approaches - allows us to capture attractive margins while still offering customers a compelling value proposition. This combination of solving an urgent industry bottleneck while delivering cost benefits creates a compelling investment opportunity that will rapidly gain traction as we move from development to deployment.

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Meet the Team

Our exceptional team combines deep scientific expertise with industrial experience to revolutionize the hydrogen economy. Each member brings specialized knowledge in nanotechnology, materials science, electrochemistry, and business development – creating the perfect foundation for commercializing breakthrough innovations.

LEADERSHIP TEAM

Ellinor Ehrnberg, PhD – Founder and President

Ellinor Ehrnberg brings over 30 years of experience driving radical innovation in complex global organizations. With extensive leadership roles at SKF, Husqvarna, Mölnlycke, RISE, and Arthur D. Little, she possesses the rare ability to transform deep technology into commercial success. Her doctoral research at Chalmers University (1996) on technological discontinuities and industrial dynamics directly informs our market strategy and value creation approach.

Fabian Wenger, PhD – Founder and VP Technology

Fabian Wenger combines theoretical brilliance with practical industrial experience across multiple sectors. His background includes senior technology positions at Qamcom, Emerson, SiRF, Saab Ericsson Space, Switchcore, and Ericsson. With a PhD in Theoretical Solid-State Physics (1995), Fabian provides the scientific foundation and technical leadership that drives our material innovation platforms.

Pia Tegborg, MSc – CFO

Pia Tegborg has extensive experience running finance and treasury functions in high-growth companies through previous management positions. She brings valuable expertise in strategic communications to the team. Pia holds an MSc in Business Administration from School of Business, Economics and Law at the University of Gothenburg.

Shafiq Kabir, PhD, EMBA – VP Volume Processes

Shafiq Kabir, the original founder of Smoltek, provided the foundational technology platform for our innovations through his doctoral research in Microtechnology and Nanoscience (2005). After establishing a robust patent portfolio and laboratory infrastructure, he now leads our crucial transition from laboratory precision to industrial-scale processing, working closely with leading equipment suppliers to ensure our surface enhancement processes deliver consistent quality at scale.

Réka Simon-Balint, MSc – VP Quality & Project Management

Réka Simon-Bálint has over 10 years of experience in quality assurance in high-quality manufacturing environments and holds an MSc in Applied Physics and Materials Science. She will ensure all design, testing, and processing protocols meet rigorous quality standards while maintaining operational excellence, environmental compliance, and service reliability.

TECHNICAL EXPERTS

Xin Wen, PhD – Senior Nanotechnology Scientist

Xin Wen specializes in metallic catalyst synthesis and microstructure analysis (PhD in Material Science, 2020) and optimizes our catalyst deposition processes to achieve maximum performance with minimal precious metal loading.

Sankar Sasidharan, PhD – Industrial Postdoc

Sankar Sasidharan, holding a PhD in Chemistry (2015) and possessing expertise in composite materials and functional coatings, bridges theoretical research and practical applications through our collaboration with WISE and Chalmers University of Technology.

Bastien Penninckx, MSc – Nanotechnology Scientist

Bastien Penninckx implements specialized carbon nanofiber growth processes and develops production protocols that translate laboratory precision into repeatable industrial steps.

SCIENTIFIC ADVISORS

Edit Helgee, PhD – Patent Expert

Edit Helgee ensures our intellectual property strategy maximizes protection while creating defensible market positions across all current and future applications.

Amin Saleem, PhD – Technical Expert

Amin Saleem brings specialized expertise from Smoltek Semi, enhancing cross-pollination of semiconductor-grade precision techniques to our hydrogen applications.

Linnéa Strandberg, PhD – Technical Expert

Linnéa Strandberg contributes her expertise in electrochemistry and catalyst degradation, bringing substantial knowledge of PEM cell degradation improvements to our development efforts.

BUSINESS DEVELOPMENT

Emma Rönnmark, MSc – Board Member

Emma Rönnmark contributes practical electrofuel sector insights from her role as Chief Commercial Officer at Liquid Wind, providing valuable green hydrogen market knowledge.

Johan Rask, MSc – Board Member

Johan Rask brings strategic expertise from venture capital and M&A roles, currently serving as CEO of Insplorion AB and board positions across multiple technology companies.

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