

Opportunity Scanning
of Electronic and
Semiconductor Components –
Hydrogen Economy

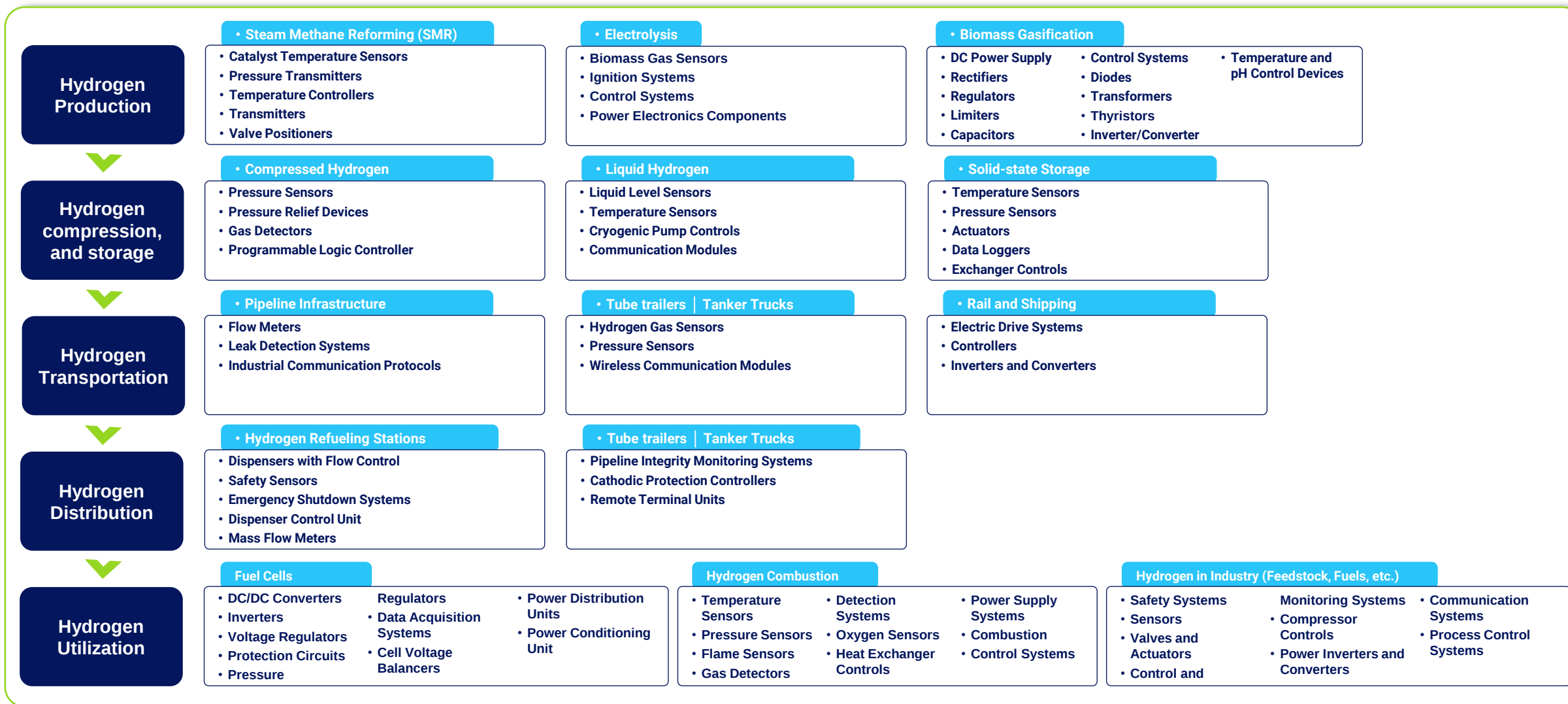
HYDROGEN TANK
H₂

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Electronics Powering the Hydrogen Economy

Electronics are fundamental to the hydrogen economy, providing the necessary control, monitoring, and optimization of processes throughout the hydrogen supply chain, from production and storage to distribution and end-use applications. The development of advanced electronic technologies is crucial for realizing the potential of hydrogen as a clean and sustainable energy carrier.



Electronics Applications

Source: IeB Analysis

Use Cases – Electronics for Hydrogen Economy

These use correctively demonstrate the indispensable role of electronics in optimizing efficiency, ensuring safety, and facilitating the widespread adoption of hydrogen as a clean energy carrier. As the hydrogen economy continues to evolve, advancements in electronic technologies will play a pivotal role in shaping a sustainable and resilient energy landscape.



Companies	Solution Type	Application Area	Solution Details	Impact
Supplier  Customer 	24-module array Silyzer 300 PEM Electrolysis		Electrolyzer capacity of 30 MW	Siemens provides power converters, inverters, and other devices crucial in controlling the electrical power supply to electrolyzers which are used by Air Liquide to contribute the decarbonization of the Normandy industrial basin and mobility by offering low-carbon hydrogen
Supplier  Customer 	Silicon (SiC) MOSFETs Carbideand Silicon IGBTs		The gate-driver family is rated at 1200 V for 400-volt and 800-volt systems	The high level of integration provided by innovative new driver ICs enables the entire driver board, including gate power, to fit onto the outline of the power module of the fuel cell stack to drive the electric motor of fuel cell vehicles
Supplier  Customer 	Plant-wide electrification, power distribution and compressor		Electrolyzer capacity of 140 MW	FlagshipONE uses renewable electricity to produce green hydrogen using Siemens Energy electrolyzers. A further stage in the synthesis process brings in biogenic carbon dioxide from a nearby biomass-fired combined heat and power station

Key Strategic Alliances – Electronics for Hydrogen Economy

Strategic alliances between electronics companies & hydrogen producers are driven by a shared interest in advancing sustainable and clean energy. Entry into the hydrogen economy allows electronics companies to diversify their business. This may involve customizing new technologies, products, or services related to hydrogen production, storage, or utilization in electronic applications



Key Partnerships and Collaborations

- Spanish utility Iberdrola SA (BME: IBE) has struck partnerships with Ingeteam and Nel Hydrogen Electrolyser to **deliver a 200-MW-plus green hydrogen project**

- In a separate move, Iberdrola and Ingeteam, a Spanish specialist in electric power conversion, have set up a new company named **Iberlyzer, through which they will realize large-scale electrolyzer plant projects**



2020



- Linde has signed a long-term agreement with Infineon Technologies **for the on-site production and storage of high-purity green hydrogen** as a part of the 'H2Pioneer' research project

- Linde will build, own, and operate a 2 MW electrolyzer plant at Infineon's Villach site in Austria**, which will produce green hydrogen using Proton Exchange Membrane (PEM) technology from ITM Power



2021



- ABB is collaborating with Lhyfe, a world pioneer in the production of renewable hydrogen, and Skyborn, a global leader in renewable energy, **to jointly realize and optimize one of Europe's most ambitious renewable hydrogen projects** ever, SouthH2Port

- ABB will apply critical expertise to optimize the integration of hydrogen and electricity production across the entire ecosystem, including **automation, electrical, and digital technologies**



2022



- Hitachi is **developing a Hydrogen Power Generator** demonstration unit with Gothenburg-based fuel cell manufacturer PowerCell Group.

- PowerCell has provided the power modules and know-how **in fuel cell integration**, and Hitachi has the balance of plant expertise in **power electronics, batteries, cooling, intelligent control, and system integration**

- Hitachi expects to launch a movable variant of this eco-friendly generator for **temporary deployment in late 2024 and the permanently deployable variant in 2025**



2023



- Taiwan-based electronics manufacturing company Delta Electronics has signed a long-term collaboration agreement to access **Ceres' hydrogen energy stack technology portfolio for approximately USD 54.52 Million**

- Delta expects to integrate Ceres' energy stack technology with its own power electronics and thermal management technologies to develop solid oxide fuel cell (SOFC) and **solid oxide electrolysis cell (SOEC) systems for hydrogen energy applications, with production expected to start by the end of 2026**



2024



Power Solutions



Production



Electrical Solutions



SOFC/SOEC

Source: IeB Analysis

Opportunity Assessment for Electronics Components

The demand for electronic components is expanding from advanced rectifiers and control systems in electrolysis to electronic sensors for safety and electronic dispensers in fueling stations. With a surge in hydrogen infrastructure projects and integrating hydrogen technologies with smart grids, there is a growing market for power electronics and smart grid technologies.



Metrics for Opportunities of Electronics Components

Hydrogen Economy	Rectifiers	Inverters	Control Systems	Power Diodes	Power Transformers	Voltage Regulators	Current Limiters	Switching Devices
Hydrogen Production								
Hydrogen Storage								
Hydrogen Transportation								
Fuel Cell Systems								
Refueling Stations								

Note: High, medium, and low are defined by market demand or adoption of electronic components in each node of the hydrogen economy

Legend

High

Medium

Low

Source: IeB Analysis

Key Challenges & Solutions

The hydrogen economy can benefit significantly from advanced electronic solutions addressing energy efficiency, cost reduction, safety, and regulatory compliance. Integrating smart controls, sensors, and automation technologies is crucial for the successful development and widespread adoption of hydrogen as a clean energy carrier.



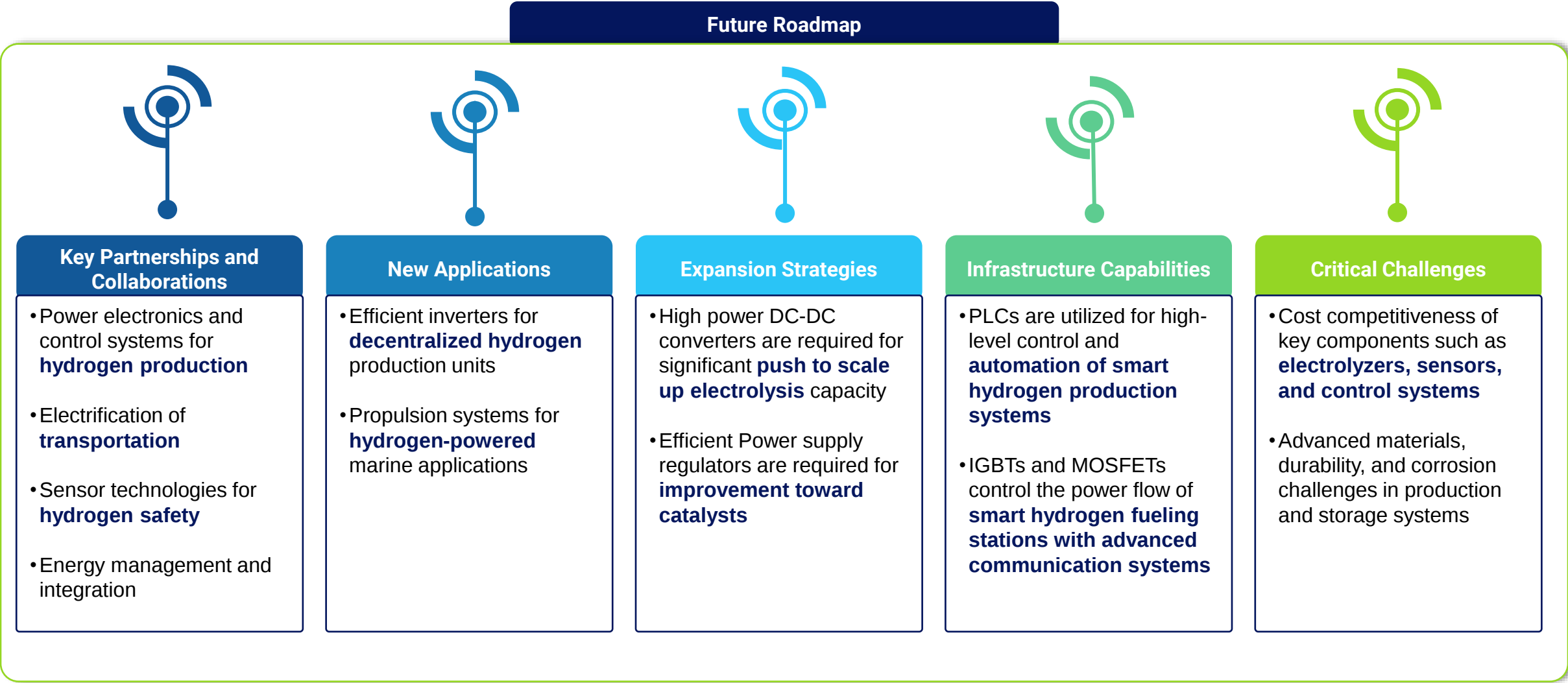
Component	Hydrogen Production	Hydrogen Storage	Hydrogen Transportation	Fuel Cell Systems
Key Challenges	• Cost of electrolyzer technology • Efficiency of electrolysis processes	• Detecting and mitigating hydrogen leaks • Achieving compact and lightweight hydrogen storage solutions for mobile applications	• Infrastructure compatibility with existing and future hydrogen infrastructure • Sensitive to temperature changes, affecting storage efficiency	• Differentiation in output characteristics • Rapid temperature and pressure changes during start-up and shut-down can lead to fuel cell degradation
Key Solutions	• Advanced power MOSFETs and IGBTs, along with economies of scale, can contribute to cost reduction • Advanced sensors and control systems can adjust electrolyzer parameters to optimize efficiency	• Electronic gas sensors are used for leak detection and shut-off mechanisms in case of a detected leak • Advanced electronic control systems optimize storage conditions to maximize volumetric and gravimetric efficiency	• Advanced communication protocols enable interoperability with various refueling stations and hydrogen infrastructure • Advanced temperature sensors regulate heating or cooling elements to ensure hydrogen remains in the desired state	• Customized DC-DC converters • Sophisticated electronic controllers can implement gradual ramp-up and ramp-down procedures during start-up and shut-down, minimizing thermal and mechanical stresses
Key Entities	 	 	 	 



Source: IeB Analysis

Future Outlook

Addressing materials' durability challenges and actively participating in building a comprehensive hydrogen infrastructure are crucial steps in the roadmap ahead. Ultimately, seeking business expansion opportunities as the industry evolves will enable electronics companies to play a pivotal role in shaping the future of the hydrogen economy.



Source: IeB Analysis

leB Solution Framework (1/2)

leB can assist various electronic companies in making well-informed decisions, identifying lucrative opportunities, and developing a strategic roadmap for success in the hydrogen economy.



Strategic Management – New Business Opportunities

Opportunity Landscape

- Detailed technology assessment and pros and cons (current and future)
- Use case analysis – Product/Application landscape | Acceptance level | Technology readiness level | Market readiness level
- Addressable market
- Gaps/unmet needs analysis and prioritization
- Mapping opportunities with various applications within the hydrogen economy, new energy, energy transitions, etc.
- Opportunity market sizing and outlook
- Opportunity attractiveness assessment

Market Analysis

- Market size - How large is the market?
- Estimating the current and future market potential
- Location of projects - Current | Planned | Announced
- Regulations: Country level norms | International norms | Different standards around fuel efficiency, GHG emission, thermal management, energy storage, energy transitions...
- Techno-economic assessment - CAPEX | OPEX | Options for CAPEX reduction | Production cost model | Cost sensitivity analysis | Price analysis

Competitor Analysis

- What strategies and business models are followed by the competitors?
- Direct/Indirect presence in the value chain
- Financing/Co-financing
- Partnerships – Established players | Start-ups | Academia | Consortium
- Rationale of partnership – Technology access | Co-investment/risk sharing | Accessing new geographies/application areas
- Geographical analysis
- Project details
- Best practices

Source: leB Analysis

leB Solution Framework (2/2)

leB insights will enable electronics companies to make informed decisions, engage effectively with customers, and develop a well-planned go-to-market strategy tailored to the challenges and opportunities in the hydrogen industry.



Strategic Management – New Business Opportunities

Customer Assessment

- Identify various customers that are actively adopting or investing in hydrogen-related technologies
- Identify specific use cases or applications related to the hydrogen economy in which customers are interested in or currently implementing
- Identify key challenges customers face in integrating hydrogen technologies into their electronic products or processes
- Identifying customers engaging in partnerships or collaborations with other companies in the hydrogen economy space

Database Creation

- Universal building of potential customers and identify the key decision-makers
- Identify the basic information such as name, contact, details, designation, address, etc.
- Identify the demographic details relevant to the study
- Analyze various customers' preferences, technical requirements, etc.
- Categorization of customers based on various specifications
- Provide various analytics and reporting features which will help you to extract valuable insights from customer data

Go-to-market Strategy

- What areas should electronics companies play in the new business opportunities space?
- Whom should they partner with?
- Which geographies should be the priority for electronics companies?
- How are regulations shaped across different regions?
- What is the outcome of techno-economic assessment?
- Which technologies and markets look feasible?
- How are clients' peers performing in this space?
- Which countries are on their radar?

Source: leB Analysis



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