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ENERGISE NEW IDEAS LAB

SUMMARY REPORT

09 August 2019

New Delhi

PARTNERS



Baker Hughes 



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THE ENERGISE IMPACT TRACK



Cleaner energy and its responsible production lie at the core of the United Nation's Sustainable Development Goals, the Paris Climate agreement and the Government of India's growth strategy. Niti Aayog's "Strategy for New India @ 75" includes the goal to provide access to affordable, reliable, sustainable and green energy. Increasing the share of renewable energy (RE), investing in energy efficiency measures and improving waste management are other key elements of the Niti Aayog Strategy.

India2022, powered by Xynteo, is a coalition of global and Indian businesses, committed to creating a new model of growth in India by 2022, the 75th year of India's independence. Energise impact track is one of four focus areas for the coalition. Its mission is to

make business-led, large-scale, systemic changes that accelerate the availability and utilisation of sustainable, innovative sources of energy and energy-efficient solutions to support Government of India's goals for the country's energy transition. The impact track is supported by India2022 coalition partners Shell, TechnipFMC and Baker Hughes.

The goals of the Energise impact track are:

- Expanding energy access
- Improving energy-effectiveness and efficiency
- Increasing the use of indigenous non-fossil-fuel energy sources
- Exploring technology solutions that maximise value in waste

ABOUT ENERGISE NEW IDEAS LAB

The aim of the Lab was to strengthen fellowship and collaboration towards solving some of the challenges identified across six thematic areas, in a workshop format through a co-creative ideation process, aiming to identify specific opportunity areas in which we could drive impact.

CARBON CAPTURE, UTILISATION AND STORAGE

Explore innovative methods and commercially viable technologies to capture and utilise carbon dioxide in a sustainable manner to enable carbon negative systems.

INDUSTRIAL INTERNET OF THINGS

Use Industrial Internet of Things for industrial applications to allow interconnectivity of industrial assets to enable performance management, energy management, predictive maintenance, remote monitoring and other such uses.

COLD CHAIN

Develop cold storage and transport solutions that are green and energy efficient, in both urban and rural areas.

SMART GRID

Deploy commercially viable smart grid solutions for advanced metering, demand response, distributed generation, energy storage and other such uses.

WATER

Employ renewable energy, innovative technologies, and energy efficient solutions in desalination, industrial wastewater recycling, and potable water generation to help India address its water crisis.

HYDROGEN

Explore and identify the right technologies and deploy innovative and cost-effective solutions/technologies for increasing the uptake of hydrogen or hydrogen-based fuels for industry, transportation and other uses.

PARTICIPANTS

The India2022 Energise New Ideas Lab, facilitated by Xynteo, gathered a select group of C-level executives and senior business leaders from our partner organisations, together with innovators, sector experts and policymakers to identify opportunities for practical action in six thematic areas.

Amit Roy, Engineering Manager (Application Engineering team) - TPS, Baker Hughes

Anindya Chowdhury, Country Manager - Energy Transitions Programme, Shell India

Anshul Chawla, Country Manager, India, Stockholm International Water Institute

Ashish Bhandari, CEO - India & South Asia, Baker Hughes

Ashutosh Sharma, Product Head, Ecolibrium Energy

Ashwin Krishna, Director, Promethean Energy

Charu Jain, Consultant, Pluss Advanced Technologies

Chetna Sharma, Strategy and Business Advisor, Shell India

Gurumurthy Santhanakrishnan, India Country Manager - M&C, Baker Hughes

Jayesh Barve, Principal Engineer, GE Global Research Center

Dr LM Das, Emeritus Professor, Indian Institute of Technology, Delhi

Nitin Prasad, Chairman, Shell Companies in India

Praveen Palakeezhil, Key Account Manager - ONGC, Baker Hughes

Dr RK Malhotra, President, Hydrogen Association of India

Reena Suri, Executive Director, India Smart Grid Forum

Sharad Mittal, Commercial Manager, India Growth Projects, Shell India

Subhashini Chandran, Managing Director, Xynteo India

Vishnu Sasidharan, Vice President, Pluss Advanced Technologies

YK Jain, Co-founder, Antriksh Photonergy



LEADERS SPEAK



Nitin Prasad

Chairman
Shell Companies in India

“This session has been filled with many innovative ideas. I am happy that we have collaborated to nurture new ways of looking at challenges. The next step is to take these ideas to fruition. It is easy to kill an idea and incredibly hard to nurture it so I urge you to keep faith, move forward and keep refining the work that has started here today. It is together, that we can build a better future.”



Ashish Bhandari

CEO, India & South Asia
Baker Hughes

“I am a convert and the reason was the huge opportunity here (India2022 coalition). You have access to the best companies of India and to the top leaders from every industry. We started the day with a creative exercise and by asking really broad questions — ‘why can’t we have clean energy’, ‘why can’t we offer basic health services’. Let’s see if we can take the ideas from this workshop and drive them to a conclusion.”

HOW WE STARTED

We began by creatively articulating what we would like to achieve over the course of the day.



DESIGNING BLUEPRINTS FOR ACTION

CARBON CAPTURE, UTILISATION AND STORAGE

India emits about 2.1 billion tonnes of carbon dioxide per annum, making it the third-largest emitting country in the world. India has progressed well on two of its three Paris agreement goals. Emissions per rupee of GDP have reduced by 21% from 2005 to 2018, against a target of 33-35% by 2030¹. Share

of non-fossil-fuel-based installed capacity of electricity generation reached 35% by mid-2019, against a target of 40% by 2030². The third goal, to create an additional carbon sink, remains largely unfulfilled. The current capacity is 0.3 billion tonnes against a target of 2.5-3 billion tonnes by 2030. Carbon capture, utilisation and storage (CCUS) technologies can play a major role in bridging the gap to achieve this goal.

INTERVENTION AREAS

- 1. Capture** – Typical solvents used for carbon dioxide require low sulphur and nitrogen content in input gas streams. Thus power plants which are regulated to limit sulphur and nitrogen oxides' emissions and have invested in doing so could be primary targets for capturing carbon dioxide.
- 2. Transportation** – Existing high-pressure pipeline infrastructure can be explored to be used for carbon dioxide transport. Closely located sources and users of carbon dioxide can be mapped to help in reducing transportation costs.
- 3. Utilisation** – Projects in areas other than Enhanced Oil Recovery (EOR) and chemical manufacturing can be explored where carbon dioxide is used as a feedstock. These could include production of materials such as melamine or fuels such as methanol, as well as more experimental fields, for instance, building materials such as concrete.



¹ Source: <https://unfccc.int/sites/default/files/resource/INDIA%20SECOND%20BUR%20High%20Res.pdf>

² Source: http://www.cea.nic.in/reports/monthly/executivesummary/2019/exe_summary-06.pdf



IDEA THAT EMERGED

Explore means to create a commercially attractive CCUS ecosystem in India

THE OPPORTUNITY

With carbon emissions rising, there is a need to create a commercially viable solution to help address this challenge. Given that India2022 partners also have expertise in certain areas within this space, there is an opportunity to create an impact.

PROPOSED SOLUTION

- Capture carbon dioxide from concentrated sources which are near potential users/sinks of carbon dioxide such as oilfields, chemical manufacturing plants needing carbon dioxide, and any other potential users/sinks.
- Identify or develop incentive mechanisms that can support the development of a CCUS ecosystem.

POTENTIAL PARTNERS

- India2022 Energise partners have the domain knowledge and the expertise to design the systems and provide the technology to capture, transport, compress, and inject carbon dioxide for EOR.
- Large industrial players with significant carbon dioxide emissions can provide a site for capturing these emissions, and chemical manufacturing companies, especially those in Gujarat, could potentially use carbon dioxide as feedstock.

NEXT STEPS

- Scope the best technology solutions jointly with India2022 partners for capturing carbon dioxide for EOR purposes.
- Map sources and sinks of carbon dioxide and categorise uses based on affordability and volumes of carbon dioxide, and identify promising start-ups in the CCUS space and explore opportunities to work with them.



"The marginal cost of carbon dioxide and what each end-use industry can afford needs to be mapped with the volume of carbon dioxide that it can offtake. This would help in prioritising target industries."

ASHISH BHANDARI
BAKER HUGHES

"The landscape of CCUS in India should be explored with the aim to identify the means by which the CCUS market can be enhanced. The means could include policy advocacy, research and development, pilot projects or supporting innovative start-ups."

CHETNA SHARMA
SHELL INDIA



DESIGNING BLUEPRINTS FOR ACTION

COLD CHAIN

Around 35-40% or USD 15 billion³ of agricultural produce is wasted in India every year due to insufficient storage and transportation solutions. The carbon footprint of this food loss is estimated to be 3.3 giga tonnes of carbon dioxide equivalent⁴. To address this, 10 million tonnes of additional cold storage capacity is needed in India in the next five years, at an investment of USD 350 million⁵.

INTERVENTION AREAS

1. **Transportation** – Accelerate the deployment of low carbon transportation solutions for perishable goods and pharmaceutical products for medium distances (under 24 hours).
2. **Urban last mile** – Develop low carbon last-mile delivery solutions in urban settings in partnership with retailers.
3. **Large-scale cold storage** – Develop integrated energy efficient and clean energy solutions for medium- and large-scale cold storages with partners such as mega food parks.

IDEAS THAT EMERGED | 1

Low carbon transportation solutions for perishable goods and pharmaceutical products that integrate with urban last-mile delivery.

THE OPPORTUNITY

Due to growth in the urban retail market, several products with varied temperature and storage requirements need last-mile cold transport solutions.

PROPOSED SOLUTION

- Develop a “low carbon delivery solution” for the retail business segment, using a combination of technologies such as phase change materials, thermal storage solutions and electric/non-diesel transport.
- Demonstrate operational savings due to decreased resource consumption and innovative payment models (such as Pay as You Go or Shared Savings) to drive faster adoption of this solution.

POTENTIAL PARTNERS

- India2022 partners have expertise in providing clean energy solutions and equity capital for cold storage solution providers.
- Partnerships need to be developed with technology providers for thermal energy storage and digital solutions, transport companies for electric/CNG-based vehicles and retail chains to serve as customers.

NEXT STEPS

- Engage with partners to develop the solution and identify customers.
- Develop and operationalise a pilot project to test the solution.



³ Source: <http://coldstarlogistics.com/blog/92000-crore-agricultural-produce-is-wasted-a-year-in-india/>

⁴ Source: <http://www.fao.org/3/i3347e/i3347e.pdf>

⁵ Source: http://publication.assoacham.tv/data/product-file/139_Cold%20Chain%20Report_Final%20Draft.pdf



IDEAS THAT EMERGED | 2

Integrated decarbonisation solution for medium- and large-scale cold storages

THE OPPORTUNITY

In a bid to reduce food losses and increase farmers' income, several government-supported mega food parks are being established across India, which will also host cold chain units.

PROPOSED SOLUTION

- Develop integrated solutions for decarbonised or green cold chains in partnership with food parks, food manufacturers and technology providers.
- Build a consortium of solution providers from renewable energy companies to digital technologies, and focus on reducing operational costs to deliver the solution.

POTENTIAL PARTNERS

- India2022 partners have renewable energy and energy efficient (refrigeration) technologies.
- Partnerships need to be developed with technology providers for energy storage, digital and other solutions; cold chain solution providers; food parks and food processing industries.

NEXT STEPS

- Engage with key partners identified to understand their needs and solution offering.
- Forge partnerships to create a package of solutions and develop the market strategy for their implementation and onboard customers.



"Need a business model and technology-led delivery approach for developing cold chain infrastructure at farm gate level."

SHARAD MITTAL
SHELL INDIA

"The food losses at farm gate or in urban regions is largely due to a lack of awareness. Facilities need to cater to Indian conditions for food storage and transportation."

CHARU JAIN
PLUS ADVANCED TECHNOLOGIES



DESIGNING BLUEPRINTS FOR ACTION

WATER

Providing solutions to address challenges facing India such as water scarcity and lack of access to clean water could offer significant market opportunities for the future⁶. India is facing its worst water crisis in history and the demand for potable water will far outstrip its supply by 2030⁷. The World Bank estimates⁸ that India may suffer a possible 6% reduction in its gross domestic product by 2050 because of the current pace of climate change and mismanagement of water. The newly elected government of India is focused

on solving India's water crisis on a war footing⁹. Therefore, the opportunities are present, and the policy environment is favourable for India2022 to intervene with critical solutions for India's water crisis.

INTERVENTION AREAS

- Hypersaline wastewater or reject brine** – Develop solutions with cement/concrete manufacturers to utilise desalination reject brine in the production of concrete/cement with the aim of reducing harmful effects of reject brine on the environment and carbon footprint of cement/concrete production.
- Zero Liquid Discharge (ZLD)** – Develop innovative technology solutions in partnership with start-ups, academia or research and development institutions to reduce the capital cost component of ZLD, with the aim of unlocking ready acceptance by industries.
- Freshwater production technologies** – Develop solutions in partnership with service or technology providers or start-ups for RE-enabled reduction of operational costs, for making these solutions more affordable and accessible for communities in need.



IDEA THAT EMERGED

To develop modular and affordable wastewater treatment systems combining innovative technologies and hybrid RE

THE OPPORTUNITY

The opportunity exists for any entity that is willing to purchase water, including water-intensive industries or industrial clusters facing acute water shortages due to source pollution, drought, over-extraction and strict regulations, or businesses with water-related corporate mandates.

⁶ Source: <https://www.goldmansachs.com/citizenship/environmental-stewardship/market-opportunities/water/>

⁷ Source: <https://www.thehindu.com/sci-tech/energy-and-environment/india-faces-worst-water-crisis-niti-aayog/article24165708.ece>

⁸ Source: <http://www.catchnews.com/india-news/by-2050-india-may-lose-6-of-gdp-due-to-water-crisis-world-bank-1462464332.html>

⁹ Source: <https://www.news18.com/news/india/modi-announces-rs-3-5-lakh-crore-for-jal-jeevan-mission-in-his-independence-day-speech-2271151.html>



PROPOSED SOLUTION

- The solution should be suitable for captive use within industrial and commercial premises.
- The business model could be Build-Own-Operate (BOO) or to deliver water as a service (eg, a Water Service Company or WESCO).

POTENTIAL PARTNERS

- Energise partners can provide technology and expertise in flow monitors, measurement and control solutions, RE integration and hybrid RE system sizing.
- Partnerships to be developed with technical excellence centers of India2022 partners, desalination reject brine management solution providers, innovative wastewater treatment technology providers, and modular, decentralised and hybrid RE technology providers.

NEXT STEPS

- Engage with key identified partners to understand their needs and solutions offering.
- Forge partnerships to create a package of solutions and develop a strategy for onboarding of customers and market penetration.



“Alternative water generation solutions (such as zero mass) should only be explored after exhausting all available technological options for water to be reused or recycled, among others.”

ANSHUL CHAWLA

STOCKHOLM INTERNATIONAL WATER INSTITUTE

“A large number of service/solution providers already exist in the market. However, they focus on specific parts of the value chain and work in isolation. The need of the hour is to have an end-to-end player that integrates all solutions or services.”

GURUMURTHY SANTHANAKRISHNAN

BAKER HUGHES



EMERGING SPACES

INDUSTRIAL INTERNET OF THINGS



Industrial Internet of Things (IIoT) refers to the concept of connecting machines and equipments in industries for useful applications. It covers technologies such as machine learning, artificial intelligence, big data and machine-to-machine communication and automation, used individually as well as synergistically. The industrial IIoT market in India is expected to become a USD 5 billion market by 2020, with manufacturing industries forming 18% of this market¹⁰. Start-ups make up 60-70% of the industrial IIoT ecosystem in India¹¹.

IDEA THAT EMERGED

IIoT-based process optimisation for large industries

THE OPPORTUNITY

Significant value additions can be unlocked for industries in fast-moving consumer goods (FMCG), metals, mining, refineries and petrochemicals sector through:

- Optimisation of business process workflows
- Benchmarking of key parameters against industry best practices
- Connecting different systems to remove data silos within industries

PROPOSED SOLUTION

- Enable optimised process flows within plants by developing new systems, for instance, alerts that will notify appropriate personnel about low inventories for taking intermediate steps in a process supply chain.
- Facilitate benchmarking with data transparency, by creating an automated, self-assessment tool.

POTENTIAL PARTNERS

Large industries or FMCG companies could be potential off-takers of industrial IIoT systems. The Confederation of Indian Industry could provide industry data to develop sector-level benchmarking tools and assessment. We can engage with start-ups in the industrial IIoT space for specific applications.

NEXT STEPS

- Prepare a proposal that can be presented to India2022 coalition partners and other industries.
- Explore how to organise nominally paid capacity building or discovery workshops on possible value addition applications for potential offtake partners.



¹⁰ Source: <https://www.thenewsminute.com/article/industrial-iiot-surpass-consumer-space-india-2020-report-85441>

¹¹ Source: <https://iiot.electronicsforu.com/content/tech-trends/smart-india-iiot-future/>

"The business case for industrial IoT is not always very clear to industries, creating scepticism towards adoption. Higher upfront costs and unclear payback timelines also deter industries from investing in industrial IoT technologies."

ASHUTOSH SHARMA
ECOLIBRIUM ENERGY

"We are seeing the evolution of industry – from industry 1.0, which was manual labour intensive, to industry 2.0 that had assembly lines, to industry 3.0 which is moving towards automation and connectivity, to the current industry 4.0 which has smart devices connecting assets to each other, termed as IoT."

ASHWIN KRISHNA
PROMETHEAN ENERGY



EMERGING SPACES

SMART GRID



At present, India has an installed electricity generation capacity of 357 GW, with the increase in demand projected to go up to 900 GW by 2032¹². Additionally, 40,000 MW will be installed through rooftop solar generation by 2022¹³. The Government of India expects 10% penetration of EVs in the country¹⁴ by 2027. To support this energy demand and to achieve the target aggregate technical and commercial losses of below 10% by 2027¹⁵, the grid infrastructure will need to be updated. India will be investing USD 44.9 billion¹⁶ in smart grid infrastructure by 2027.

IDEAS THAT EMERGED | 1

Isolated smart grid solutions for commercial and industrial sectors

THE OPPORTUNITY

There is a need to integrate smart energy systems in the planning stage of greenfield project for energy intensive sectors such as airports, IT parks and industrial areas for maximising gains.

PROPOSED SOLUTION

Create a plug-and-play solution, independent of distribution companies (DISCOMs), for greenfield projects at airports, IT parks and industrial areas that combines generation, storage and smart monitoring, and allows for seamless integration of services with existing systems.

POTENTIAL PARTNERS

We can explore working with facility managers, technology providers and certified energy consultants for their support. We could engage with business alliances to get access to their networks.

NEXT STEPS

Conduct a pre-feasibility study to understand the current smart grid ecosystem and develop a viable solution offering to develop a market entry strategy.

IDEAS THAT EMERGED | 2

Rural last-mile connectivity integration of micro-grids and the national grid

THE OPPORTUNITY

Around 26.03 million new rural household subscribers have been added to the grid under the government's



¹² Source <http://dot.gov.in/sites/default/files/Reji%20Kumar%20Smart%20Grids%20DoT%20%283%29.pdf>

¹³ Source <http://pib.gov.in/newsite/PrintRelease.aspx?relid=191337>

¹⁴ Source <https://dhi.nic.in/writereaddata/Content/NEMMP2020.pdf>

¹⁵ Source http://www.indiasmartgrid.org/reports/India%20Smart%20Grid%20Roadmap_2016.pdf

¹⁶ Source <https://www.researchandmarkets.com/reports/4084985/india-smart-grid-market-forecast-2017-2027>



Saubhagya scheme by July 2019¹⁷. Due to extra demand there is a need to provide enough power in the grid to service this demand in rural areas.

PROPOSED SOLUTION

Integrate micro-grids that are run by solar, diesel or batteries with the main grid for increasing grid reliability and availability. Micro-grid operators can take care of meter reading, billing and collection of tariff from rural customers, while the grid could supply the electricity and own the generation assets to boost reliability and availability for the last mile in remote rural areas.

POTENTIAL PARTNERS

We can work together with state government DISCOMs and micro-grid operators as they are working on such models. Partnerships with energy service providers and implementation agencies that are working in a similar area can also be explored.

NEXT STEPS

- Explore synergies with Energise impact track's Integrated Solutions for Rural Communities project being piloted in Assam, as a potential pilot opportunity.
- Conduct a pre-feasibility study to understand the potential for integration of micro-grids with the grid.

¹⁷ Source <https://saubhagya.gov.in>

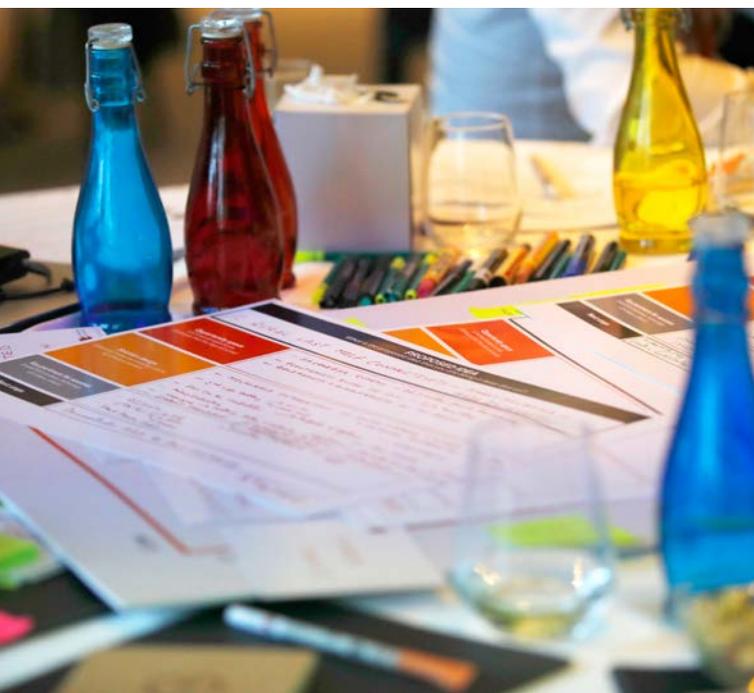


"Interoperability of technology is the bedrock of smart grids."

YK JAIN
ANTRIKSH PHOTONERGY

"The need for having skilled resources and manpower along with awareness about upgradation and maintenance of technologies in this sector is crucial for scale-up."

REENA SURI
INDIA SMART GRID FORUM



EMERGING SPACES

HYDROGEN



Given the rising pollution levels and the need for finding cleaner energy alternatives, Hydrogen can be a good alternative to fossil-fuel-based energy sources. The hydrogen market in India was valued at USD 50 million in 2017 and is projected to reach USD 81 million by 2025, growing at a CAGR of 6.3%¹⁸.

IDEAS THAT EMERGED | 1

Hydrogen from biomass

THE OPPORTUNITY

India produces 450-500 million tonnes of biomass per year¹⁹ and there is a strong push from the government to find alternative uses for biomass. Hydrogen turbines can be an alternative use for hydrogen that is produced from biomass.

PROPOSED SOLUTION

Use a decentralised model for producing and consuming hydrogen from the gasification process which requires consistent quality and quantity of biomass. Captive uses of hydrogen can offer another cost-effective model.

POTENTIAL PARTNERS

Oil and gas industry, R&D labs and technology suppliers for alternative uses of hydrogen could be potential partners for these projects.

NEXT STEPS

Connect India2022 partners with R&D institutes for help in producing hydrogen from biomass. Energise team to work with key stakeholders to establish the idea's techno-commercial viability and support the installation of least one commercial scale hydrogen production unit from biomass.

IDEAS THAT EMERGED | 2

Hydrogen from electrolysis of water

THE OPPORTUNITY

The long-term projected cost of producing hydrogen from renewables is expected to be less than USD 2/kg²⁰. Hydrogen production through water electrolysis can help India achieve its carbon dioxide emissions targets.

PROPOSED SOLUTION

Partner with industrial clusters for cost-effective supply of low carbon hydrogen.

POTENTIAL PARTNERS

Renewable energy organisations and refineries could be potential partners to produce low carbon hydrogen at low cost.

¹⁸ Source <https://www.alliedmarketresearch.com/press-release/india-hydrogen-market.html>

¹⁹ Source: <http://www.eai.in/ref/ae/bio/bio.html>

²⁰ Source: <https://www.iea.org/publications/reports/the-future-of-hydrogen/>



NEXT STEPS

Engage with water electrolysis companies to understand the cost break-up of water electrolysis technology to produce hydrogen and explore the feasibility of producing hydrogen using waste heat from renewable energy sources.

IDEAS THAT EMERGED | 3

Fuel cell technology for use in transport

THE OPPORTUNITY

The global hydrogen fuel cell vehicle market was valued at USD 278 million in 2016 and is projected to reach USD 12,133 million by 2023, growing at a CAGR of 72.4%²¹.

PROPOSED SOLUTION

Collaborate with fuel cell technology providers to explore the feasibility of using the technology on a commercial scale in the transport sector.

POTENTIAL PARTNERS

Work with educational institutions, private players and fuel cell developers to understand the technology and its commercial viability.

NEXT STEPS

Identify the best-suited technology and understand where fuel cells technology can be applied.

²¹Source <https://www.alliedmarketresearch.com/hydrogen-fuel-cell-vehicle-market>



“The Hydrogen-CNG fuel mix, which is presently being adopted for public transport fleets, should not be seen as a long-term solution. This is more of a transition solution, until fuel cells or other hydrogen-based fuels enter the market and are scaled.”

Dr LM DAS
INDIAN INSTITUTE OF TECHNOLOGY, DELHI

“Hydrogen has the potential to compete with batteries.”

Dr RK MALHOTRA
HYDROGEN ASSOCIATION OF INDIA



