Making Ideas Work

Idam Infrastructure Advisory Private Limited

EXECUTIVE SUMMARY

Report on

Niche Markets for Japanese Technologies in India's Energy Sector

Submitted to

NEDO

New Energy and Industrial Technology Development Organization

Prepared by

Idam

Idam Infrastructure Advisory Pvt. Ltd.

An ISO 9001:2015 Certified Company

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1. Background

New Energy and Industrial Technology Development Organization (NEDO) is a national research and development agency that creates innovation by promoting technological development necessary for the realization of a sustainable society. NEDO acts as an innovation accelerator to contribute to the resolution of social issues by developing and demonstrating high-risk innovative technologies having practical application. NEDO, with a mandate to play a critical role in promoting the development of innovative and high-risk technologies in new market areas, engaged Idam Infrastructure Advisory Pvt. Ltd. (Idam Infra) to identify niche markets for Japanese technologies in India's energy sector.

This provides a unique opportunity for Japanese technology solution providers to invest with the support of NEDO. The detailed report presents broad-based analytical assessment of India's Energy Sector to facilitate entry of potential Japanese technology providers in the Indian market. The report serve objective to:

- Provide an overview of the Indian market, institutional structures governing sub-markets, analysis of Japanese technologies, their readiness and applicability in the Indian context.
- Identify specific Japanese technologies that have a niche market in India.
- Provide guidance to NEDO to undertake a detailed assessment of these technologies to prepare market entry strategies.

The assignment was intended as short duration study in March 2020 to work out business strategies for Japanese Technology providers to enter the Indian Market during FY 2020-21. Idam Infra had carried out a detailed study of Indian Market needs and identified Japanese Technologies (seeds) that had favorable market conditions in India. The report was submitted to NEDO on 31March 2020. However, this report is updated till April 2021.

This executive summary covers the key findings in the report for consumption by Japanese Industries and stakeholders to devise their market entry strategy in India's Energy Sector.

2. Drivers for Technology Domain Selection

The driver-based approach for each technology domain anticipated by NEDO regarding the parameters such as market size, technology need, and challenges resulted in the validation of the most appropriate technology domains. The key drivers in selected energy sector include:

2.1. Renewable Energy (RE) Sector

- RE installed capacity as of 30 April 2021 was 95.012 gigawatt (GW) (24.8% of the total installed capacity).
- The Government of India (GoI) has set a target to achieve 175 GW by 2022 and 450 GW by 2030 which would mean:
  - 55% of total installed capacity and 40% of total energy input.
  - New Technologies in large and rooftop solar, off-shore wind, small hydro, etc. are needed to meet the target.

- Power system operators require advanced technologies for large-scale variable RE (VRE) integration to increase the operating range of the existing Thermal Power Stations (TPS) without an increase in the operating cost.
    - With higher VRE, existing TPS would be required to operate more flexibly.
- Power-electronic inverters are an integral part of solar photovoltaic (PV) plants as static power systems reduce system inertia.
    - Latest solar PV inverter technologies with grid stabilizing devices are required for future solar capacity addition in the grid to maintain system inertia.
- New forms of grid stabilisation techniques like Virtual Power Plants (VPP), Vehicle-to-Grid (V2G) have significant potential in India.

2.2. Energy Storage

- Energy storage systems (ESS) are required for large-scale VRE integration at the transmission level.
- ESS would help in integrating the distributed RE in distribution networks and deferring capex in the distribution system.

2.3. E-Mobility

- GoI had launched National Mission for Transformative Mobility and Battery Storage on 7 March 2019 to boost sale of Electric Vehicle (EV) and introduce battery manufacturing ecosystem in India.
    - Japan, leading in Li-Ion technology, can help Indian companies to set up manufacturing facilities in India.

2.4. Conventional Energy

- In India, a large (> 40 GW) coal-based capacity is stranded across the country.
    - No new coal-based capacity is likely to be added soon.
- Ministry of Environment Forest and Climate Change (MoEFCC) has mandated Flue Gas Desulpharisation (FGD) and other environment protection systems.
    - Indian power industry needs cost effective technologies suitable for Indian coal.
- Significant flexibilization of thermal power would be required to integrate large variable RE.
- GoI has focus on Ultra Super Critical (USC) and AUSC TPS.
- GoI has announced the Development of Advanced Ultra Supercritical (AUSC) Technology for TPS on a Mission Mode.
- GoI has set up National Centre for Clean Coal Research and Development (NCCCR&D) as a national level consortium on clean coal research and development.

- AUSC technology is a must as it involves the development of materials for AUSC technology within India.

- Share of Air Blown Integrated Coal Gasification Combined Cycle (IGCC) technology will be about 15% and 60% in 2032 and 2047 respectively among the total IGCC technology in terms of new capacity addition in case of faster adoption.

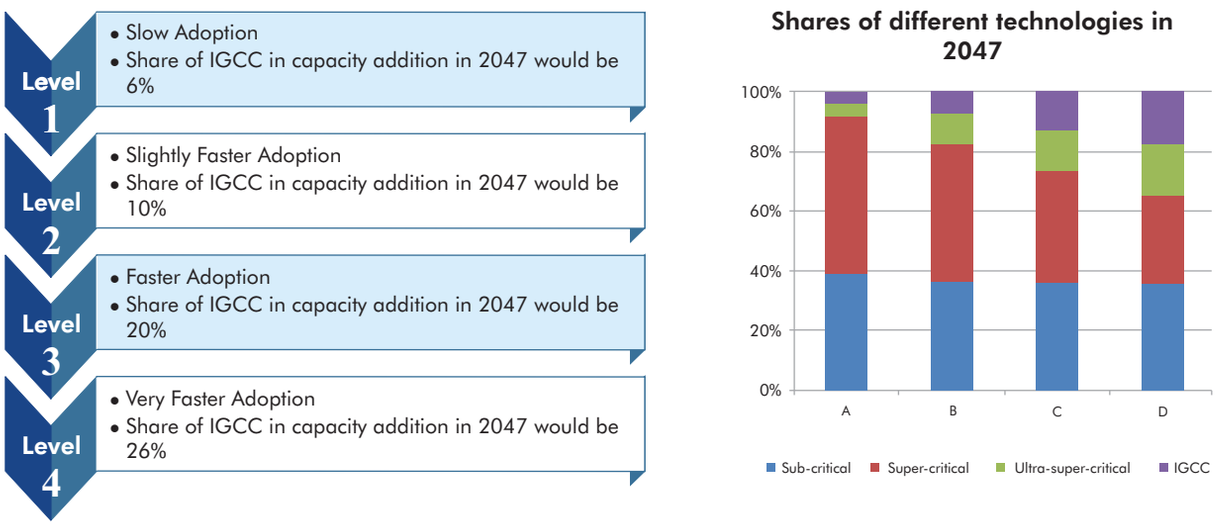


Figure 1: IGCC Technology at Various Levels of Adoption

2.5. Gas Grid

- GoI has set a target of raising the share of natural gas in a primary energy basket to 15% by 2030 from the current 6.2% which would require multi-billion dollar investments.
- Japan with its strong expertise in Liquefied Natural Gas (LNG)related technologies and Gas Grid could be a potential investor in India's Gas Grid.
- New efficient technologies that can save energy while converting the liquid to gas and vice versa would play an important role in the gas grid system.
- Demand for efficient, cost-effective equipment used at LNG terminals, storage facilities, pipelines, compressor station and city gas stations shall increase. Similarly, demand for competitive Engineering Procurement and Construction (EPC) and operations and maintenance (O&M) services will increase.

Figure 2 illustrates the technology domains considered for Japanese Industry readiness.

Figure 2: Technology Domains

3. Technology Needs Assessment

Table 1 presents the parameters for broad assessment of the Indian market for the identified technologies:

Table 1: Parameters for the Assessment of Indian Market

Parameters Considered	Parameter Description	Reference Guideline for Japanese Manufactures
Market Size	Whether the Indian market provides significant scalability potential for the technology/ domain in consideration.	Strong market size with a high potential for replication presents possible greater interest for Japanese manufactures/ businesses.
Technology Assessment	Whether there are specific and suitable technologies identified to meet the market needs.	Assessment of technology has been done from the point of view of distinctiveness among the technology and competitors. The lower assessment refers to the possibility of obsolete/irrelevant technologies in the segment.
Policy, Legal and Regulatory Challenges	Whether the technology has a definite policy, legal and regulatory framework in place.	Strong policy, legal and regulatory framework is essential for countering the associated risks for international manufacturers.

Parameters Considered	Parameter Description	Reference Guideline for Japanese Manufactures
Infrastructure/ Environment	Whether the technology can be made sustainable with present infrastructure/eco-system challenges.	Strong positioning of technology in the discussion represents the resilience of technology to overcome infrastructure/ environment challenges.
Commercial and Competitiveness Challenges	Whether the Japanese manufacturer can enter the Indian market with a reduced probability of competition in the Niche segment.	Strong positioning of technology in the discussion represents higher possibility of Japanese manufactures to attract better return on investments.

Table 2 presents the result of analysis on the above parameters considered as strong and weak parameters for each of the identified technologies.

Table 2: Analysis of Technologies

Technologies	Market Size	Technology Assessment	Policy, Legal and Regulatory Challenges	Infrastructure Environment	Commercial and Competitiveness Challenges
Floating Solar	◕	◕	◕	◕	◑
Solar Roofs/BIPV/ Solar Coating or Solar Skins	◑	◑	◕	◑	◕
Offshore Wind Turbine	◕	◕	◕	◕	◕
Large-Scale (Grid-Level) Energy Storage	◕	◕	◑	◑	◑
BTM Energy Storage	◕	◑	◕	◑	◑
Charging Infrastructure	◕	◕	◑	◕	◑
Gas Grid/LNG Terminal/LNG/LPG	◕	◕	◕	◕	◑
Coal Fired - Supercritical (SC)	◕	◑	◕	◕	◕
Integrated Coal Gasification Combined Cycle (IGCC)	◕	◑	◕	◕	◕
Coal Fired Plants - Environmental Measures Equipment	◑	◑	◕	◑	◕
Energy Saving/Energy Efficiency	◕	◕	◕	◑	◑
High-Efficiency Air Conditioning	◕	◕	◕	◕	◑
Tri-Generation (Electricity, Heating and Cooling)	◕	◑	◑	◕	◑
Net Zero Energy House (ZEH)/ZEB	◑	◑	◕	◕	◑

Legend: ● Strong ○ Weak

Figure 3 represents Indian Technology Needs that are the most important from Japanese technology supplier perspective and Indian Niche Markets.

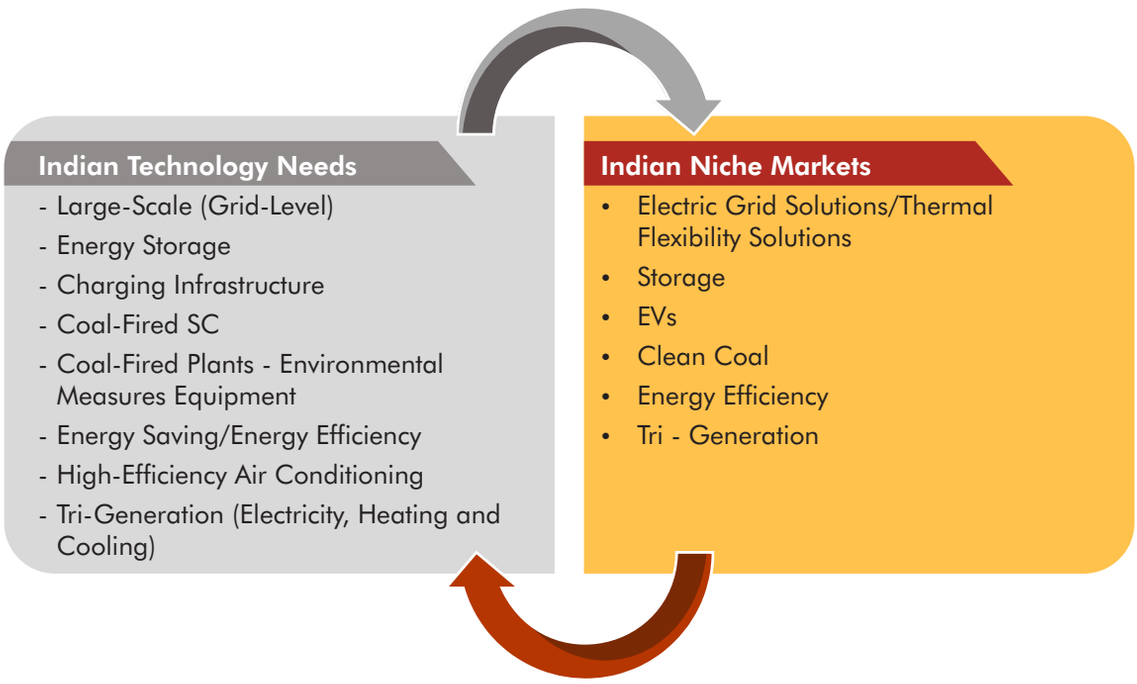


Figure 3: Indian Technology Needs and Indian Niche Markets

4. Assessment of Japanese Technologies

The Technology Landscape identifies the potential for Japanese technology in India's energy sector based on:

- Status of commercialization.
- Applicability in the Indian context along with probable sectors.
- Potential clients that can be targeted by Japanese manufacturers.

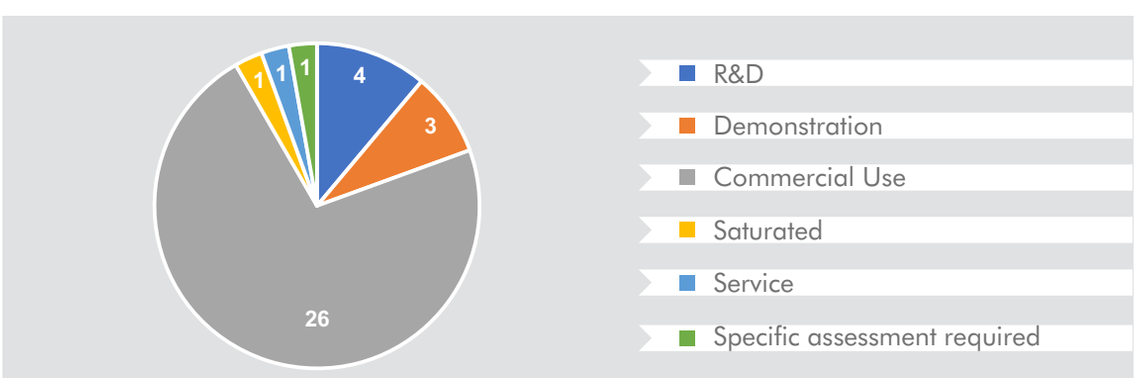


Figure 4: Technology Landscape

- Out of 36 technologies, four technologies are in R&D stage, three in Demonstration stage and 26 technologies are for Commercial use.

- Overall, for NEDO, there are 26 technologies for promotion in India, based on the Indian market readiness.

5. Assessment of Indian Market Readiness

Figure 5 represents the technologies that have potential applications in changing the dynamics of the energy sector in India.

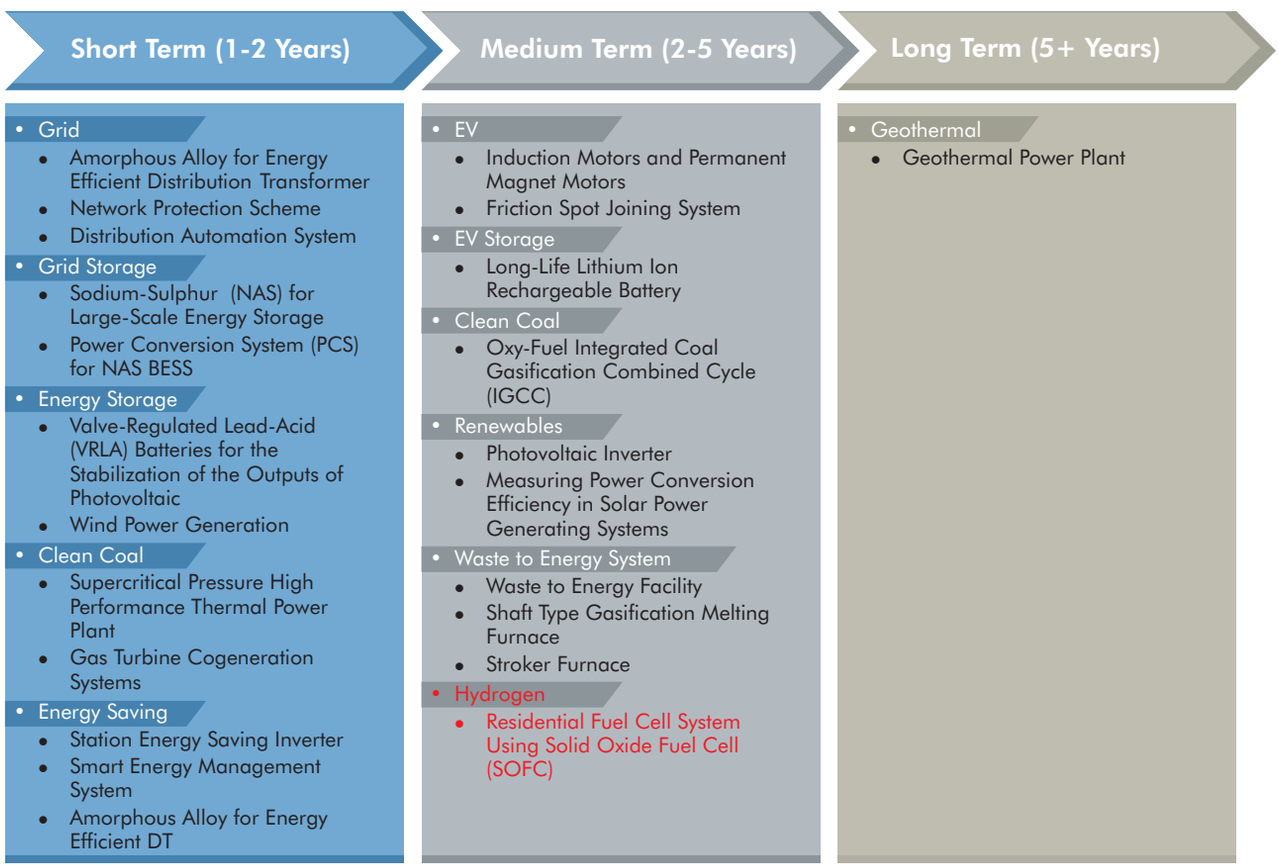


Figure 5: Assessment of Indian Market Readiness

6. Technology Mapping

Figure 6 depicts the technology mapping as per the needs of the Indian market and the availability of Japanese technologies.

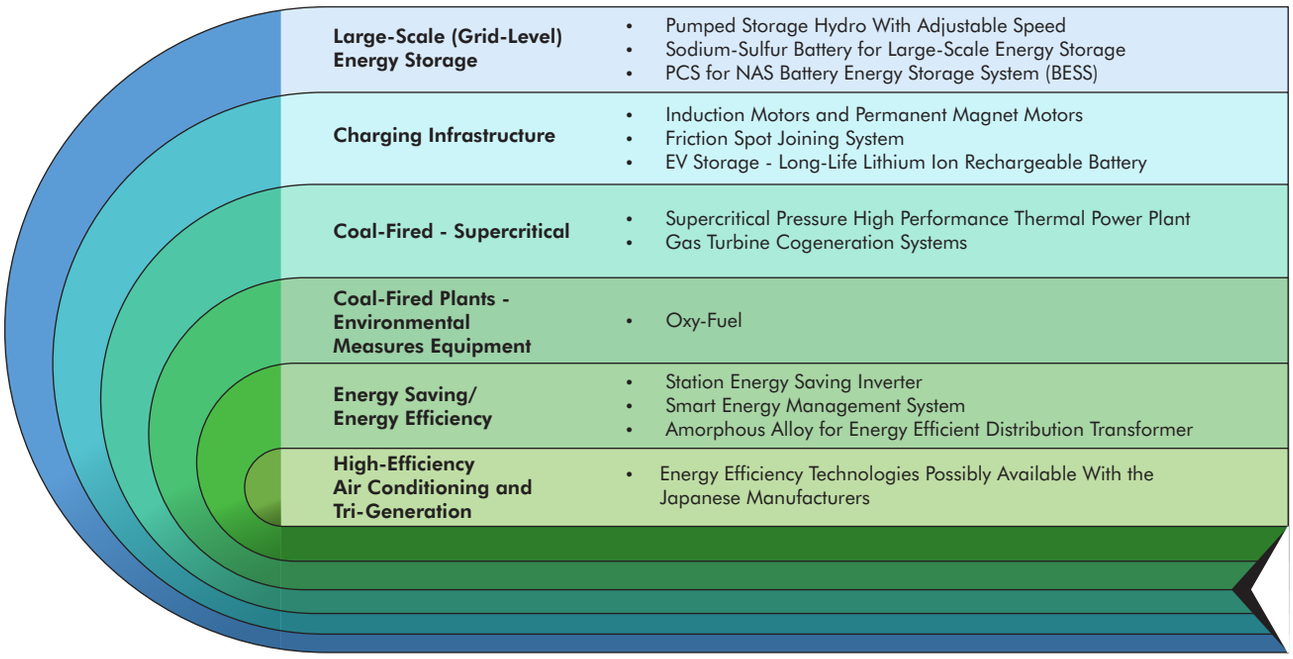
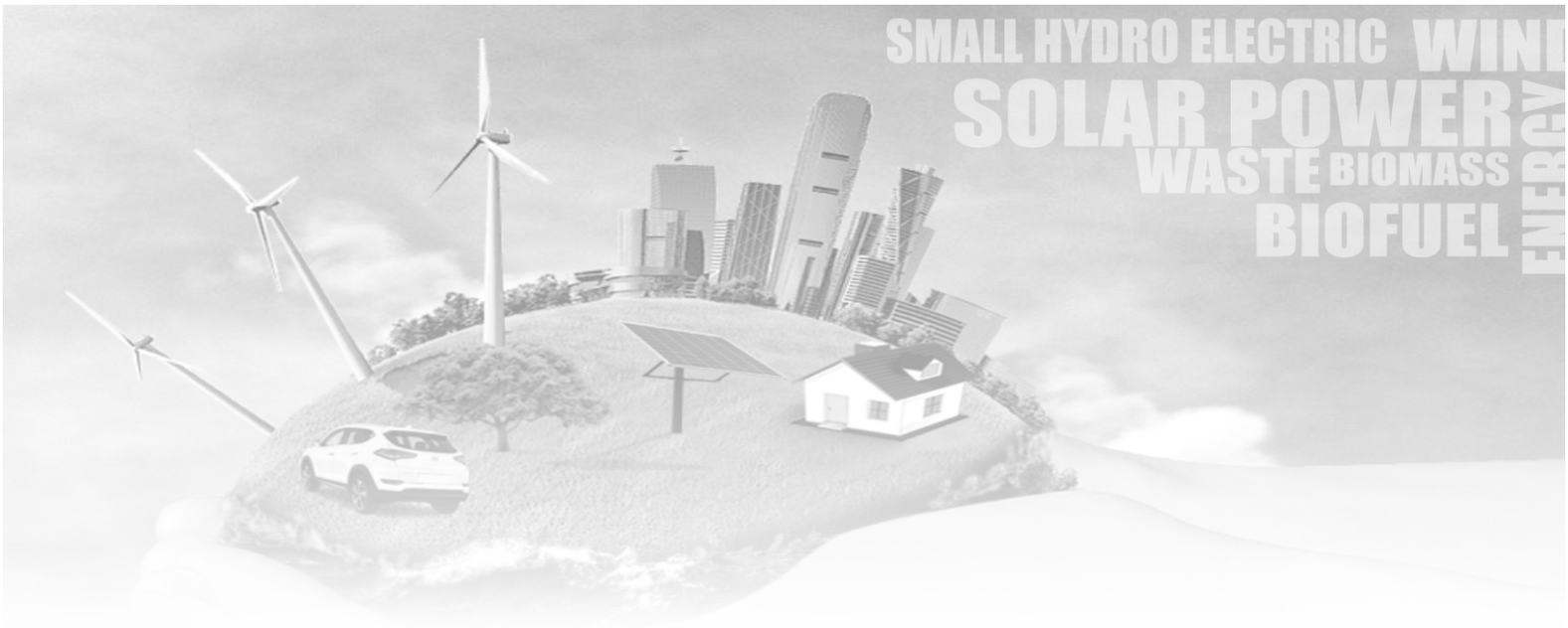


Figure 6: Technology Mapping

7. Recommendations

NEDO and its technological partners shall undertake a detailed market assessment of the following technologies for entering the Indian Energy Sector.

Figure 7: Technologies for Entry in India's Energy Sector



For Report/Queries/Business Enquiry, Contact NEDO/Idam Infra

New Energy and Industrial Technology Development Organization

Representative Office in New Delhi
15th Floor, Hindustan Times House,
18-20 Kasturba Gandhi Marg,
Connaught Place, New Delhi – 110 001
Phone: +91 11 4351 0101
Web: www.nedo.go.jp/english

Idam Infrastructure Advisory Pvt. Ltd.
An ISO 9001:2015 Certified Company

Technopolis Knowledge Park, 5th Floor,
Mahakali Caves Road, Chakala,
Andheri East, Mumbai – 400 093
Phone: +91 22 6862 0300
Email: contact@idaminfra.com
Web: www.idaminfra.com

Organisational Profile

Idam Infrastructure Advisory Pvt. Ltd. (Idam Infra), an ISO 9001:2015 certified company, is a company engaged in advising Project Developers, Electricity Regulatory Commissions, Government Departments and Ministries, Lenders, Banks and Financial Institutions and Multilateral Agencies on a wide range of issues in the power sector.

Since its inception in 2007, the team at Idam Infra has gathered a multitude of experience along with rich insights in policy formulation and analysis, regulatory framework design, commercial diligence, financial structures and corporate strategic aspects across the value chain of the energy infrastructure, especially in the market assessment studies.

Further details can be accessed on company website: **www.idaminfra.com**

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