



सत्यमेव जयते
Ministry of Power
Government of India



सत्यमेव जयते
Education Department
Government of Gujarat

Open Innovation Challenge 2022 Energy Sector

i-Hub
(A Gujarat Government Enterprise)



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Open Innovation Challenge 2022 - Energy Sector

Challenge ID	Challenge Title	Page No.
NTPC PS 001	Continuous Health Monitoring of Ageing Civil Structures	1
NTPC PS 002	Flood Warning and Forecasting System	2
NTPC PS 003	3-D Mapping / Modelling of the Problem Area of Projects	3
NTPC PS 004	Detection of the Healthiness of Tubes of Various Equipment of Power Plant	4
NTPC PS 005	Development of Biomass Torrefaction Technology	5
NTPC PS 006	Study of the Techno-commercial Impact of Cycling of the Thermal Power Plant and Its Software Simulation	6
NTPC PS 007	Facilitating Coal Ash Export to Neighbouring Countries and Overseas, Developing Unified Market for Coal Ash in India, Ash as a By-product from Its Current Status of a Waste	7
NTPC PS 008	Economical Wearable Hands-free Technology for Remote Assisted Maintenance	8
NTPC PS 009	Remote Communications for Safe Working Environment: Developing Wearable IoT Devices for Detecting Real-time Presence inside a Prohibited Zone and Vital Health Signs and Status of the Worker	9

Challenge ID	Challenge Title	Page No.
NTPC PS 010	Difficult to Monitor whether All Personnel including Workers are Adhering to Safety Precautions during Erection, Commissioning and Maintenance Activities	10
NTPC PS 011	Difficulty to Identify Health of Heavy Machinery using Sound	11
NTPC PS 012	Industries have Several Big Manual Valves which are Difficult to Operate	12
NTPC PS 013	Difficulty for Senior Management to Visually Inspect Equipment / Systems Spread across Large Area of a Power Plant	13
NTPC PS 014	Robots for Performing Non-destructive Examination of Boiler Tubes to Reduce the Time Involved in Ultrasonic Tube Inspection	14
NTPC PS 015	Extracting High-grade Metals like Gold, Silver, Copper and Palladium from E-waste and Separating it for Re-sale / Re-use	15

Open Innovation Challenge 2022 - Energy Sector

Challenge ID: NTPC PS 001

Challenge Title: Continuous Health Monitoring of Ageing Civil Structures

Challenge Description:

The structures of NTPC are ageing and their safety and healthiness is matter of concern. The Non Destructive Testing (NDT) techniques are basically targeted at damaged location, after the damage has already occurred, thereby putting the structure's stability at doubt and its more of damage mitigation rather than prevention. Whereas a Structural Health Monitoring System (SHM) would involve continuous monitoring of structural parameters like Mode Shapes, Frequencies etc. compared to baseline signature, and any deviation / shift from the nascent signature would give an alarm of any impending damage envisaged to the structure much in advance, whereby its prevention and mitigation can be initiated. For ex. any minor internal crack in TG Deck / TDBFP foundation (subjected to dynamic forces) can be easily detected and treated even before it surfaces, thereby leading to ZERO machine downtime attributable to shaft mis-alignments etc.

Exact Problem to be Solved:

- To undertake a comprehensive assessment of various types of structures in the NTPC fleet deployed countrywide via different means. For ex. in form of visits, images or any other technique.
- To define the detailed outcomes and metrics based on which Structural Health Assessment is to be performed (classification / regression radar / lidar parameters).
- To assess various sensor technologies and come up with a mix of the most suitable sensor technologies of NTPC civil structures and foundations identified for undertaking Advanced SHM.
- To create an exhaustive data lake for this purpose based on diversified sensor data (viz. vibration, acoustic, stress, strain, load etc), images, videos, radar / lidar-based information etc.
- To design and deploy a state of art AI – ML and DL based model and providing model output (classification / regression o/p.) on an interactive dashboard.

Target Users: NTPC Stations

Expected Outcomes: Holistic solution on Structural Health Monitoring specific for NTPC.

Potential Impacts: Will greatly support the cause of Industry 4.0. This system is a need of the hour and can potentially save huge sums by accurate predictions in advance preventing costly structural failures.

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Challenge ID: NTPC PS 002

Challenge Title: Flood Warning and Forecasting System

Challenge Description:

Hydropower projects situated at Uttarakhand / Himachal, typically in the Himalayan region are subject to serious natural calamities due to various factors ranging from climate change to sub-surface tectonic activities leading to torrential rains as a result of cloud bursts, glacial movement leading to GLOF / LLOF / debris flow etc. Accurate monitoring and early prediction of such events can help avoid many catastrophes and loss of life and property.

Exact Problem to be Solved:

- To undertake a comprehensive assessment of hydropower projects in the NTPC fleet via site visits.
- The majority of the catastrophes in such areas are in the form of floods hence time series analysis of these phenomena is to be undertaken for accurate flood forecasting. Deep Learning technologies to be explored and used as well.
- To assess the various sensor, power supply, communication technologies typical for such areas and also assess model forecasting technologies and come up with the most suitable solution set.
- To design and deploy state of art analytics on an interactive dashboard, indicating the predictions accurately.

Target Users: NTPC Hydro Power Plants

Expected Outcomes: A sustainable Flood Forecasting solution for NTPC.

Potential Impacts: This system is a need of the hour for Hydro Power Projects specially located in Uttarakhand as run of river projects for saving precious life and property.

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Challenge ID: NTPC PS 003

Challenge Title: 3-D Mapping / Modelling of the Problem Area of Projects

Challenge Description:

Planning / Modification of layout / schemes and routing of piping / cable trays for the retrofitting jobs and in few cases during erection stages are difficult in old plants and in given already erected facilities conditions require site visits and faces issues due to non-availability of drawings and in few cases non-approachability of areas.

Exact Problem to be Solved:

Development of retrofitting schemes / layout and finding solutions of fouling noticed during erection for the site avoiding interference with existing / other facilities.

Target Users:

Project Engineering, Erection and Maintenance

Expected Outcomes:

Development of a low-cost mobile application dedicated to NTPC which uses mobile phone cameras (as latest phones have good camera qualities) for scanning / photography and converting to the 3D model of the portion of the plant wherever issues arise for helping engineering and clear understanding to all.

Potential Impacts:

Clarity on the problem area, time reduction in solution and lesser need of site visits.

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Challenge ID: NTPC PS 004

Challenge Title: **Detection of the Healthiness of Tubes of Various Equipment of Power Plant**

Challenge Description: Detection of the exact problem area of tubes for different equipment is a tedious task and is also time-consuming. Unattended choking and leakages etc. reduce the performance of the equipment and thereby affects the efficiency of the cycle and deteriorates the heat rate.

Exact Problem to be Solved: Detection of faulty tubes and types of issues with the affected tube of equipment in a precise way and a short time duration.

Target Users: Operation and Maintenance

Expected Outcomes: Development of low-cost micro / nano-robots with camera and cleaning system (if possible) which we can insert in the heaters, condenser tubes etc. for mapping the internal conditions of them and cleaning. This shall help in reducing the identification of the problem area and shutdown/maintenance period of the equipment.

Potential Impacts: Reduction in the maintenance time of equipment. Detection of fault in a precise way for deciding the correct and effective maintenance procedure to be followed.

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Challenge ID: NTPC PS 005

Challenge Title: **Development of Biomass Torrefaction Technology**

Challenge Description: Torrefaction technology enhances the quality of biomass and makes it suitable to be utilised in coal-fired power plants in higher ratios. Cost competitive and indigenous torrefaction technology is need of the hour in wake of the national mission on biomass co-firing and has great potential in the Indian market.

Exact Problem to be Solved: Achievement of higher biomass co-firing ratio in power plant.

Target Users: Pellet Manufacturers Supply Pellets to Gencos

Expected Outcomes: Cost competitive and indigenous torrefaction technology.

Potential Impacts: This will enable the achievement of biomass co-firing in a higher ratio to support the goal of the the national mission on biomass co-firing.

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Challenge ID: NTPC PS 006

Challenge Title: Study of the Techno-commercial Impact of Cycling of the Thermal Power Plant and Its Software Simulation

Challenge Description: The components higher VRE scenario entails the need for flexible operation of thermal plants connected to the grid. This leads to cycling / two shifting of thermal plants and cause increased wear and tear in machine / plant. The effect appears in later years after prolong cyclic operation. In such a case, if we are not proactive, making a profit shall be a matter of luck. Analysing its techno-commercial impact is necessary to remain profitable in the long term. Hence, an analytical tool is required for the assessment of the techno-commercial impact of the cyclic operation.

Exact Problem to be Solved: Uncertainty about techno-commercial impact due to the cycling of coal-based power plants.

Target Users: Project Engineering Division

Expected Outcomes: Simulation software for analysis of the techno-commercial impact of cyclic operation.

Potential Impacts: This analysis shall help to assess the impact of cyclic operation and enable a basis for policy advocacy for the inclusion of cyclic cost components that earth byis lightweight earthby in tariff.

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Challenge ID: NTPC PS 007

Challenge Title: Facilitating Coal Ash Export to Neighbouring Countries and Overseas, Developing Unified Market for Coal Ash in India, Ash as a By-product from Its Current Status of a Waste

Challenge Description: Load centre plants cannot meet demand for ash due to schedule restrictions at pit head local market cannot absorb the supply.

Exact Problem to be Solved: Supply chain issues of storage and transport are the main hurdle. Large capacity silos strategically located at plants, bordering areas and ports, linked through Railways typically BTAP wagons.

Target Users: Cement Industries, Construction Materials like Light Weight Aggregates, Metal Extraction Industries

Expected Outcomes: Coal ash can be rewarding as a by-product the extraction of Alumina, Silica, Iron Hydroxide and Rare earths can be hugely rewarding.

Potential Impacts: Coal-based plants are seen as unsustainable but if we utilise the waste we reduce GHG emission by Non-Destructive locations in deviation / shift for ex-misalign mental grinding of the ore and processing it.

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Challenge ID: NTPC PS 008

Segment: Fault Detection and Rectification (OS / IT)

Challenge Title: **Economical Wearable Hands-free Technology for Remote Assisted Maintenance**

Challenge Description:

Expert assistance and guidance is to be provided to field workers by subject matter experts sitting in remote locations using state of the art communication technology.

The technology should be hands-free and wearable by the worker without creating any hinderance to his work. The equipment should be able to send and receive phone calls, surrounding audio, video, and data (as documents and drawings, etc) for the worker to see and interact with.

An AI system should identify and notify the type of problem being faced by the worker and suggest possible solutions.

Exact Problem to be Solved:

Developing economical Wearable hands-free technology for remote assisted maintenance and provide real-time data of the field workers at the job site to solve issues with expert's advice.

Target Users:

Field-workers at Job-sites (Especially in Difficult to Access Locations)

Expected Outcomes:

Using mobility, GPS tracking and other IoT related solutions for establishment of real time connection with experts sitting at remote locations. AI to notify the type of problem and possible solutions and platform to provide remote training exercise for the less-experienced workers at the job-site.

Potential Impacts:

Decrease in downtime of detecting and rectifying technical problems. Increase in productivity and improved maintenance as well as increasing the awareness and skill of the worker.

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Challenge ID: NTPC PS 009

Segment: Workers Safety (OS / IT)

Challenge Title: Remote Communications for Safe Working Environment: Developing Wearable IoT Devices for Detecting Real-time Presence inside a Prohibited Zone and Vital Health Signs and Status of the Worker

Challenge Description: Monitoring of the worker's vitals, warn on exposure to toxic chemicals, and proximity to dangers and give the safety alerts or notify them to take the safety measures and reach out for help if injured. The device should be able to detect environmental conditions (like fire, chemical leakage, etc) and anomalies / failure in machinery / equipment so that prompt action can be taken.

Exact Problem to be Solved: Provide real time data for safety of workers in normal / controlled / prohibited / remote zones.

Target Users: Workers Engaged in Plant Activities

Expected Outcomes: Using health detection sensors and AI to identify sudden health issues, injuries caused, sudden environmental changes, harmful incidents and send notification for help while warning everyone on the incident.

Potential Impacts: Better safety, reduced casualties or deaths related to dangerous tasks to be carried out in prohibited areas. Immediate warnings on incidents and happenings in the plant area.

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Challenge ID: NTPC PS 010

Segment: OS / Safety / BD

Challenge Title: Difficult to Monitor whether All Personnel including Workers are Adhering to Safety Precautions during Erection, Commissioning and Maintenance Activities

It is difficult to ensure worker in a large project are adhering to safety practices and policies. Even though the locations are monitored by CCTV cameras, it is difficult to continuously monitor 100s of cameras to detect such violations.

Challenge Description: An on-line system should leverage the power of AI and ML to continuously monitor work areas and determine whether the workers are wearing safety kits and following instructions as specified.

Not adhering to safety precautions are primary cause of fatal / non-fatal accidents in industries.

Exact Problem to be Solved: Ensure adherence to safe practices by all personnel in a project site.

Target Users: All personnel including workers engaged in labour intensive erection, commissioning, operations, maintenance etc.

Economical video analytics software which processes CCTV feed from entire facility to detect, flag and alert concerned executive about safety violations.

Expected Outcomes: E.g.: People without PPE, not using lifeline rope, not wearing helmet, encroaching in prohibited areas, presence in isolated areas, mass gatherings as required, etc. Provision to automatically alert the concerned safety control room / authorities with minimum of false alarms.

Potential Impacts: Reduce number of fatal / non-fatal accidents.

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Challenge ID: NTPC PS 011

Segment: Thermal Power Plant (OS / BD)

Challenge Title: Difficulty to Identify Health of Heavy Machinery using Sound

Challenge Description:

Thermal power plants have lot of heavy equipments like motors, pumps, valves, heat exchangers etc. Different parts of the equipments will malfunction over time finally resulting in outage. The sound of equipment will change during the starting of an abnormality and experienced people are able to identify it by listening. A cost effective and scalable detection system by analysing sound can solve the problem.

Exact Problem to be Solved:

Not able to detect abnormalities in machinery using sound.

Target Users: Power Plant Management

Expected Outcomes:

A mobile based software which can identify various types of malfunction in an equipment by analysing the sound. If the mobile application can be installed in all power plant personnel smartphones, a scalable preliminary abnormality detection and diagnosis system can be built.

Potential Impacts:

Prevent plant and equipment outage, improve reliability, increase profitability.

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Challenge ID: NTPC PS 012

Segment: Thermal Power Plant (OS / BD)

Challenge Title: Industries have Several Big Manual Valves which are Difficult to Operate

Challenge Description:

Industries have big manual valves in different sizes which are difficult to operate manually and requires multiple people to operate. These valves are not fitted with expensive motorized actuators since they are not operated frequently. A simple mechanical device called F-ROD is used by personnel to operate this valve which possess several safety risk.

Exact Problem to be Solved:

Operate big manual valve in an industry effortlessly and safely.

Target Users:

Personnel who are operating big manual valves during commissioning and routine operation.

Expected Outcomes:

A cheap portable rechargeable motorized actuator which can operate any size & type manual valve in an Industry.

Potential Impacts:

Reduce manual effort, reduce cost and improve safety.

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Challenge ID:	NTPC PS 013
Segment:	Thermal Power Plant (OS / BD)
Challenge Title:	Difficulty for Senior Management to Visually Inspect Equipment / Systems Spread across Large Area of a Power Plant
Challenge Description:	Thermal power plants have equipment / systems spread across a large area. These equipment/systems are generally visited and monitored by semi-skilled manpower. Often its difficult to evaluate the actual site condition by communicating with semi-skilled manpower.
Exact Problem to be Solved:	Difficulty in visually inspecting equipment / systems spread across a large area.
Target Users:	Operation and Maintenance Executives in a Power Plant
Expected Outcomes:	A mobile based software where semi-skilled manpower can visit a particular area and take photos in a smartphone. These photos should be available in a common library which can be accessed by executives. There should be provision to easily identify how a particular area has improved / worsened over time. Since power plant is a protected area, the security of these photos has to ensured by a secure system. The system should be capable of handling large volumes of photos.
Potential Impacts:	Increase efficiency, reduce emergencies, improve safety.

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Challenge ID: NTPC PS 014

Segment: Inspection (NETRA)

Challenge Title: Robots for Performing Non-destructive Examination of Boiler Tubes to Reduce the Time Involved in Ultrasonic Tube Inspection

Challenge Description:

Performing NDE of boiler tubes by hand is slow and difficult enough to make it a major undertaking that requires several days of work, not just for the inspection itself but also for the time to set up and take down the necessary scaffolding. Gecko Robotics has introduced two different robotic boiler tube inspection for water wall as well as for LTSH / Economiser. This system can significantly reduce the time and expense involved in ultrasonic tube inspections. In case of waterwall, the robot climbs the tube wall in vertical direction without the need for scaffolding and produces more precise and accurate data than handheld scanners. In Economiser / LTSH tubes, robot is placed at the top of the tubes which travels in horizontal as well as in vertical direction to measure thickness of the tubes. Gap between two tubes is 50-90 mm, length of coils is 2 - 5 m and number of tubes in each coil is approx. 12-33.

Exact Problem to be Solved:

Time-required for conducting inspection in boiler tubes.

Target Users:

Boiler-inspecting Engineers

Expected Outcomes:

Reduced time and more efficient inspections.

Potential Impacts:

Robot can navigate faults more closely and give accurate information after inspection.

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Challenge ID: NTPC PS 015

Segment: Engineering / BD

Challenge Title: **Extracting High-grade Metals like Gold, Silver, Copper and Palladium from E-waste and Separating it for Re-sale / Re-use**

Challenge Description: The high-grade metals like gold, silver, copper and palladium in the e-waste can be separated for re-sale in conditions that are totally safe. Innovative technological solution can be provided keeping in mind the commercial viability and long term sustainable business option, second by addressing environmental concerns due to metal waste.

Exact Problem to be Solved: Treatment and recycling of high-grade metal waste to value added product.

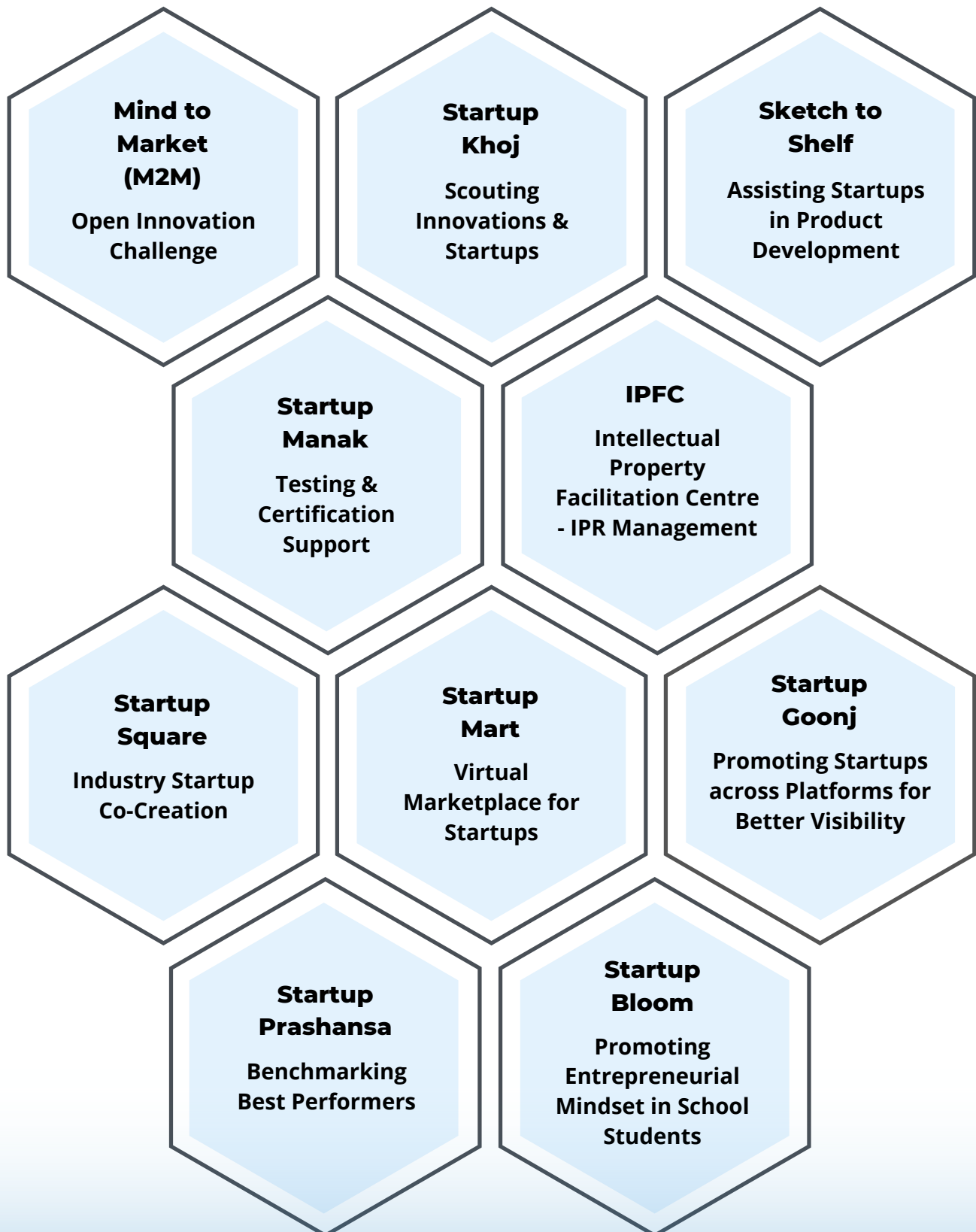
Target Users: E-waste Generators (Industrial Segment)

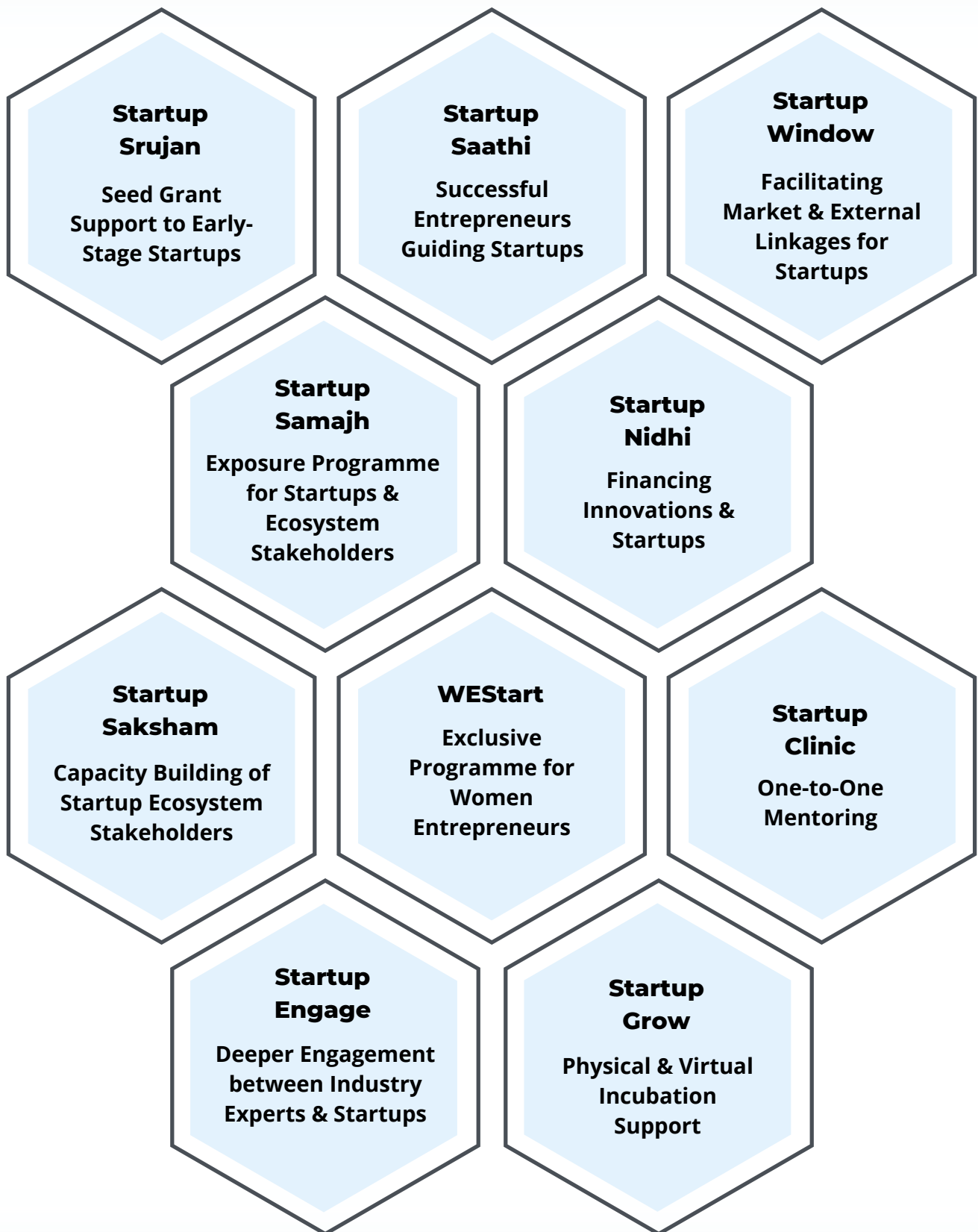
Expected Outcomes: Efficient and cost-effective way of recovering these high grade metals from e-waste.

Potential Impacts: Neutralizing the impact this e-waste create on environment, and also creating value for the generators and collectors of this e-waste.

Gujarat Student Startup & Innovation Hub

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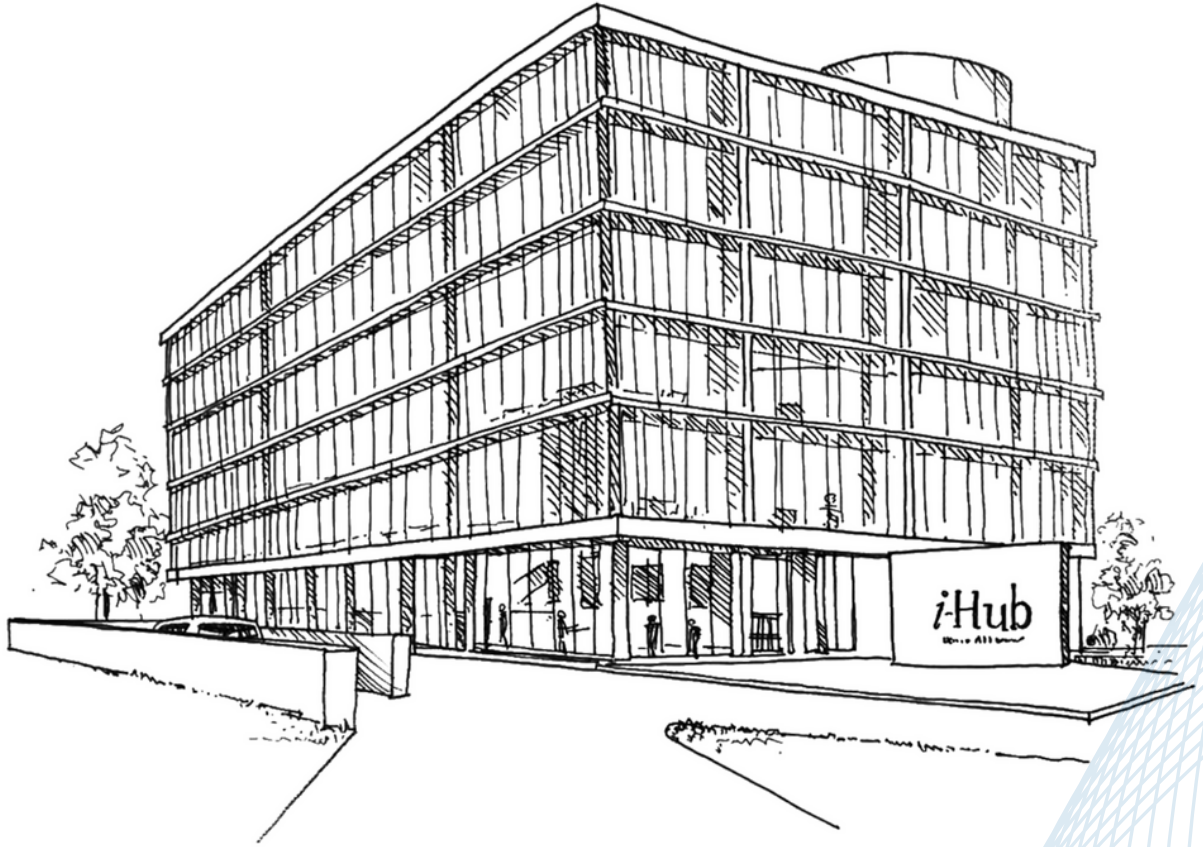


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