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ONGC

ONGC
ENERGY CENTRE

Shaping the sustainable future

ONGC ENERGY CENTRE

NEW DELHI

~ Vision ~

"Harness science and technology to meet national energy needs of tomorrow in a clean and sustainable manner"

~ Mission ~

**"With ingenuity and determination, With respect and care for environment,
With regards for sustainability, With focus on innovation and creativity"**

From the desk of the Director General

I feel extremely privileged and honored to be leading ONGC Energy Centre (OEC) that is aiming for new and renewable energy other than primary E&P business of parent organization. After all these years of path breaking research starting from proof-of-concept, OEC has reached a stage where we are able to exhibit our achievement up to demonstration level as a team through relentless efforts and determination with valuable guidance and support available to us.

Since, we at OEC are working under the theme of "Company to Country", OEC has undertaken projects which have impact on the Company activities as well as are needed to meet the energy needs of the country.

OEC aspires to attain new heights by expediting the up-scaling/ pilot scale demonstration of various technologies developed by OEC for new/ Renewable energy and striving for sustainability in energy for a better tomorrow.

(Sunil Kumar)
Director General, ONGC Energy Centre

ONGC Energy Centre at a glance

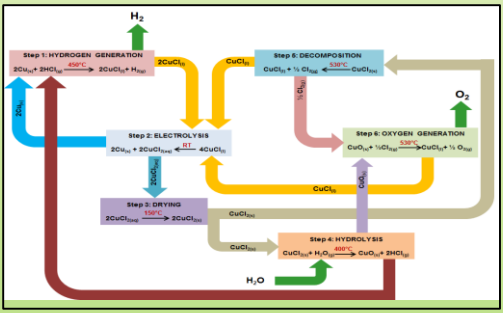
- Geothermal
- Hydrogen
- Rare Gas extraction from Natural Gas
- Solar Thermal
- Biotechnology & CO_2 Valorization
- Produced Water Treatment

ONGC ENERGY CENTRE

RD&D in clean and renewable energy

Cu-Cl thermochemical cycle for Hydrogen Production

- OEC has developed closed- loop copper chlorine (Cu-Cl) thermochemical cycle for generation of Hydrogen from water in collaboration wit ICT Mumbai. Proof of concept and lab scale development has been completed along with development of materials *viz*., electrodes, molten salt system for subsequent solar thermal storage, etc.



Closed loop Cu-Cl Thermochemical cycle

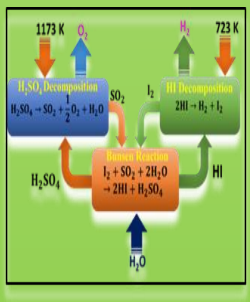
Pilot facility at 25 LPH is operational at H2 shed at IPSHEM Goa

- The maximum temperature requirement for CuCl cycle is 550°C. To optimize the heat requirement, patented molten salt system will be integrated with the existing set up. Performance testing for hydrogen production rate of 100 L/hr is in process. Based on the generated data after successful scale up at IPSHEM Goa, 12 MT/year H_2 generation facility integrated with Concentrated Solar Power, fulfilling the aim of Green Hydrogen is planned at ONGC mini refinery at Tatipaka, Andhra Pradesh to upgrade the existing product to BS-VI level.

Iodine-Sulphur (I-S) thermochemical cycle

• Closed loop I-S thermochemical cycle

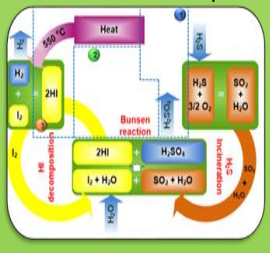
- ONGC Energy Centre has developed hydrogen production process through closed loop Iodine-Sulfur (I-S) thermochemical cycle in collaboration with IIT Delhi. The cycle requires temperature of 450 to 900°C (723 to 1173 K) that can be met by solar thermal heat source integration.
- Several Bridge-The-Gap experiments were completed to develop quartz/glass set up for hydrogen generation at 5LPH.
- After integration of individual sections, further studies on engineering aspects such as purification of acids, effect of cross contamination on closed loop performances, heat integration & process control are in progress.



Closed loop I-S thermochemical cycle

• Open loop I-S thermochemical cycle

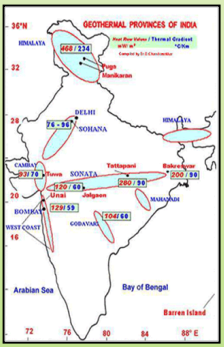
- In partial modification of Closed-loop I-S cycle, OEC in collaboration with CSIR-IIP Dehradun has conceptualized Open-loop process for hydrogen generation at 550°C (823 K) involving generation of SO_2 from H_2S that is used in Bunsen section to produce HI and H_2SO_4. While the HI is decomposed by conventional processes to produce Hydrogen and Iodine, the H_2SO_4 is not decomposed but instead, is directly used for marketing. It is an alternative route of Hydrogen production from H_2S that is produced as a by-product in refineries / gas processing facilities.
- The project has dual benefit of minimizing release of H_2S to atmosphere as well as generation of Hydrogen that can be used as transport fuel or for power generation or re-routed to refinery for hydro-treating of sour crude and other processes.



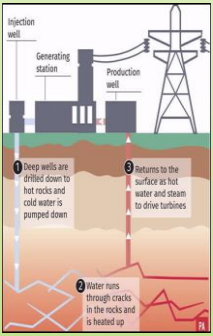
Open loop I-S thermochemical cycle

Putting India on Geothermal map

- Geothermal is the only renewable energy available 24x7 to the mankind, not requiring storage and unaffected by day-night or seasonality variance.
- India has seven geothermal provinces as mapped by Geological Survey of India (GSI).
- Broad estimate suggests that the geothermal power potential in India is approx. 10 GW as per MNRE.
- An MoU has been signed between OEC, UT Administration of Ladakh and Ladakh Autonomous Hill Development Council (LAHDC), Leh for establishing India's maiden Geothermal Field Development Project in Ladakh.
- Puga area in Ladakh is considered as the most potential geothermal field in the Indian sub-continent. The Chumathang geothermal field is another prominent geothermal prospect of Ladakh.
- ONGC Energy Centre has spudded the well on 17.08.2024. A drilling depth of about 46.5 m has been achieved in the campaign within the seasonal window. Multiple challenges were encountered due to unsupportive soft overburden/ initial formation at shallow levels. Drilling operations were suspended on 10.10.2024 due to inclement weather conditions. Presently, the well is plugged in and to be re-entered in the current working season.



Major geothermal resources in India



Schematic diagram for Geothermal energy production

Drilling Operations by OEC in Puga Valley

Vanadium Redox Flow Battery (VRFB)

OEC in collaboration with IIT Madras and M/s. High Energy Batteries Ltd. have developed 1 kW/10 kWh Vanadium Redox Flow Battery (VRFB)-24 cell stack powered by a 2.4 kW solar panel with a power output of 1.4 kW and energy of 10 kWh.

Demonstration of VRFB 24 cell stack with solar charger

	Vanadium Redox Battery	Lithium
Number of cycles (Lifespan)	35,000 + (35-50 years)	- 300 max (3-5 years)
Low self-discharge (once charged stays charged)	✓	✗
Low environmental footprint	✓	✗
Highly expandable	✓	✗
Generates low levels of heat	✓	✗
Charges and dischages simultaneously	✓	✗
Can release energy instantaneously	✓	✗
Suitable for connection to power grid	✓	✗
Small footprint	✗	✓

Benefits of VRFB vs Lithium-ion battery

- The cyclability of the stack was demonstrated using 300 cycles. Based on the encouraging results, scale up for the ddevelopment of 10 kW/ 50 kWh (2 modules of 5kW/ 50kWh each) VRFB for commercial applications has been showcased at India Energy Week 2024.
- The technology is also planned to be demonstrated in remote areas of North East India for stationary applications where logistics challenges are anticipated.

Biotechnology for Energy

Bio-conversion of Unrecoverable Oil to Methane

In order to harness the energy from the unrecovered oil reservoir, ONGC Energy Centre through *in-house* R&D at Bio-Energy Research Lab, KDMIPE, Dehradun has developed a indigenous bioprocess for conversion of unrecovered oil to methane. The process has been successfully tested in 3 depleted wells at Ankhleshwar in Western Onshore Basin wherein net incremental gas production has been observed after incubation period of 3 months. Based on the encouraging results obtained during post-job monitoring, more depleted wells are being planned for similar activities.

Job implementation in depleted/ matured well at Ankleshwar Asset

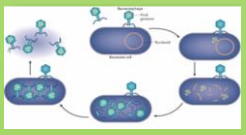
Bioprocess for enhancing Coalbed Methane (CBM)

ONGC Energy Centre in collaboration with TERI has developed an indigenous bioprocess for *in-situ* conversion of coal to methane. The process has been tested in various CBM wells of ONGC in Bokaro Asset and Essar in Durgapur wherein two to four fold increase in gas production has been achieved in a sustainable manner. The developed bioprocess is environment- friendly technology with minimal capital investment to generate biogenic methane in coal seam and thereby, improving the productivity and longevity of the CBM wells/ blocks.

Job implementation in CBM well

Bioprocess to prevent Microbially Induced Corrosion (MIC)

Corrosion caused by SRB (Sulphate Reducing Bacteria)



Bacteriophage life cycle

A lab scale bioprocess has been developed in collaboration with Agharkar Research Institute (ARI), Pune for inhibition of SRB that are responsible for Microbially Induced Corrosion (MIC) in Oil and Gas pipelines and installations.

The bio-process is based on target specific killing of Sulphate reducing Bacteria (micro-organisms) that are main cause of microbial induced corrosion by preventing H_2S production, resulting in H_2SO_4 production.

Field testing is being planned in selected well/pipelines/ flowlines (5 Unmanned Platform) in Mumbai High Asset in next 2-3 months.

CO_2 Valorization

1. Based on the encouraging lab results, field testing of OEC TERI ***bioprocess*** for *in situ* bio-conversion of CO_2 to methane (CH_4) has been implemented to improve the calorific value of the produced gas by reducing CO_2 percentage.

2. OEC in collaboration with ICT Mumbai has developed a CO_2 refinery concept via chemical based process for CO_2 hydrogenation via ***thermochemical process***. The catalyst developed will help in utilizing vent CO_2 from industrial sources such as electricity-generated power, refineries, among others, for production of building block molecules to obtain a wide range of valuable products and chemicals. R&D studies on conversion of CO_2 to methanol has also been taken up further.

Harnessing Wave Energy

Wave Tank Experiment setup

OEC in collaboration with IIT Roorkee has developed a ***point absorber wave energy converter (WEC)*** with optimum float geometry and a linear generator Power take off (PTO) system. The effect of shape, size, and effective density on the performance of the WEC was explored in order to arrive at an optimum geometry. Indian patent has been granted.

Superhydrophobic coatings for Solar PV & Glass Panels

OEC in collaboration with PSGIAS Coimbatore has developed high-performance *super-hydrophobic self-cleaning coatings*.

2 Joint Patents have been granted for the developed high-performance super-hydrophobic self-cleaning coatings.

Advanced ex-Effluent Water Treatment Technology (AEWTT)

Advanced Effluent Water Treatment Plant (AEWTP) was commissioned at North Santhal in Mehsana Asset having processing rate of 500 LPH as feed. The recovery capacity of the plant is approximately 200-300 LPH. The plant had already processed more than 650m3 of produced water and the treated water is being utilized at the installation in various usage. Treated water is tested for germination of seeds as well as gardening and was found to perform as good as normal water. The recovery factor of this indigenously developed technology is 50-60%. Scale-up/ Re-validation of the technology upto 1000m3 per day/ as per requirement of the Assets' through technology-under-incubation mode at ONGC Mehsana and Rajahmundry Asset is under process.

Demonstration of Hydrogen generation Balance of Plant (BoP) with 3KW stack, Hydrogen purification, compression and storage

From Company to Country

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