

# **Centre of Excellence in WASTEWATER TREATMENT AND MANAGEMENT**



**PANDIT DEENDAYAL ENERGY UNIVERSITY  
GANDHINAGAR**

# About Centre of Excellence



## Centre of Excellence in Wastewater Treatment and Management

Centre of excellence in Wastewater Treatment and Management is established at PDEU to develop, design and demonstrate high-recovery low-cost water treatment systems for saline groundwater, domestic and industrial wastewaters. Cost-effective technologies and systems are proposed with the aim of lowering energy costs through dramatic improvements in energy efficiency, new bio-based approaches to water recycling, and use of renewable energy. Reject waste streams will be minimized or reduced to zero, thus protecting the environment.

CoE has received various grants through different projects which includes “Low Cost - Renewable Energy Driven (LC-RED) Water Treatment Solutions Centre”, (<https://lc-red.wixsite.com/lcred>) funded by Department of Science and Technology under Water Technology initiative, and “bio-mimetic and phyto-techNOlogies Designed for low-cost purifiCAtion and recycling of water (INDIA-H<sub>2</sub>O)”;  
[www.india-h2o.eu](http://www.india-h2o.eu) funded by Department of Biotechnology. The focus for developments will be in the arid state of Gujarat, where surface water resources are very scarce.

Advanced membrane processes, including biomimetic FO and RO and layer-by-layer assembly of ultra/nano-filtration membranes, will be developed and combined to provide new methods of purifying water from saline groundwater and from municipal and industrial wastewaters, providing water that is safe for drinking or suitable for irrigation. They will be implemented in cost-effective modes in systems incorporating phytoremediation and complementary processes.

Low-cost sensors for real-time monitoring of the key parameters important for efficient operation of membrane processes will be integrated with monitoring and management systems to ease maintenance of performance and ensure sustainability of these systems which have previously suffered from a lack of robust and reliable operational data, leading to frequent early failure and redundancy. The remote monitoring will also make possible collection of data to enable knowledge to be built up about long term performance, feeding into decision support tools for design and operation.

Systems will be developed and integrated to TRL6 as advanced prototypes that will be integrated with renewable energy sources under real operational conditions in the arid and industrialized state of Gujarat, with prospective applications in many other water-stressed and salinized areas such as Rajasthan, Punjab and Tamil Nadu. The development of business models will maximize the use of indigenous supply chains to reduce costs and ensure sustained implementation of the technologies.



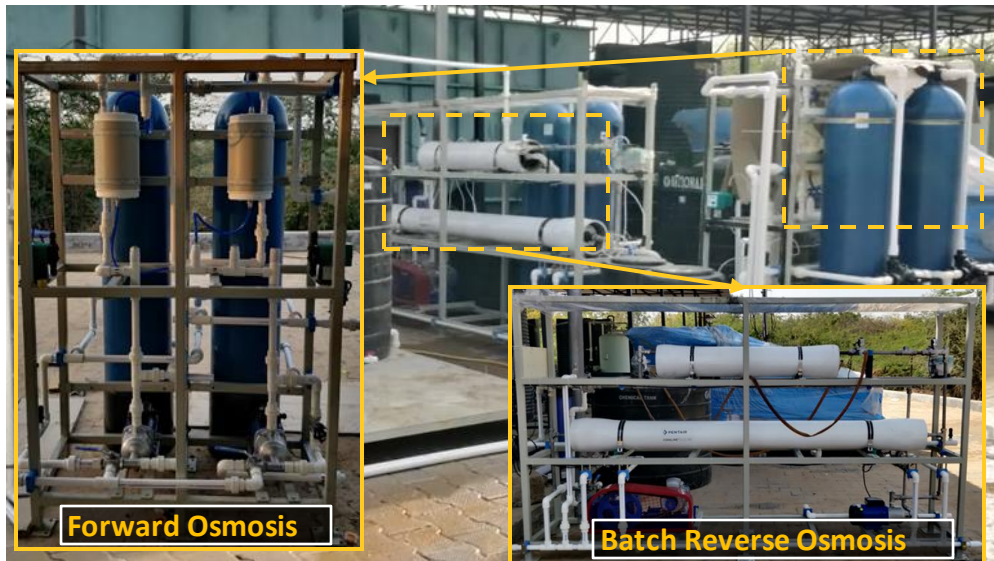


# Equipment installed at CoE

## Integrated Batch Reverse Osmosis – Forward Osmosis

(RR > 80% & SEC < 0.5 kWh/m<sup>3</sup>)

The integrated forward osmosis – batch reverse osmosis concept for brackish water desalination is quite new in the desalination field. Recovery of reverse osmosis system can be elevated using the free piston batch reverse osmosis concept, and the specific energy consumption can be reduced. The system's overall energy consumption can also be compensated using renewable energy sources like solar photovoltaic, wind energy, geothermal energy, etc. The batch reverse osmosis can achieve more than 80% recovery with less specific energy consumption, and forward osmosis technology helps to attain minimal/zero waste discharge.



## Solar powered high recovery RO desalination plant

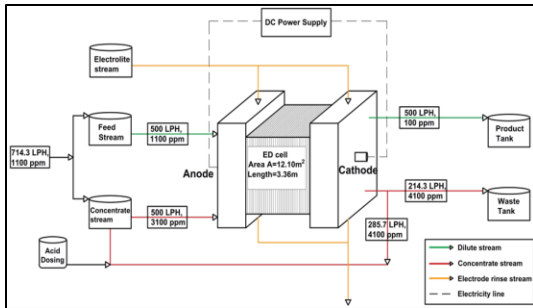
(RR > 70% & GOR > 100)

This work aims to provide an efficient RO plant that uses thermal energy. A steam-Rankine cycle has been designed to drive mechanically a batch-RO system that achieves high recovery, without the high energy penalty typically incurred in a continuous-RO system.

The steam may be generated by solar collector, biomass boilers, or as an industrial by-product. A novel mechanical arrangement has been designed for low cost, and a steam-jacketed arrangement has been designed for isothermal expansion and improved thermodynamic efficiency.



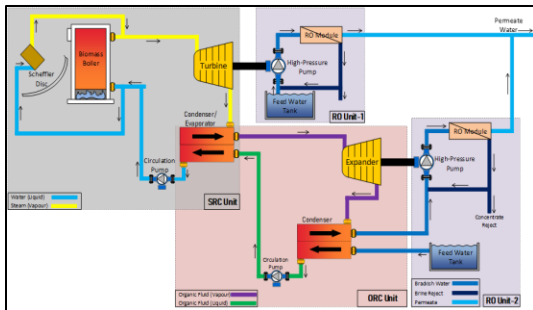
# Equipment conceptualised at CoE



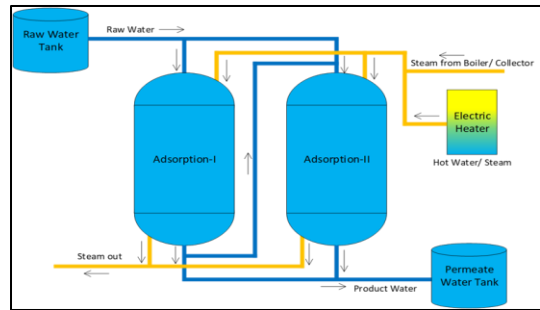
Electrodialysis unit for brackish ground water and reagent recovery from industrial waste water with interchangeable stack



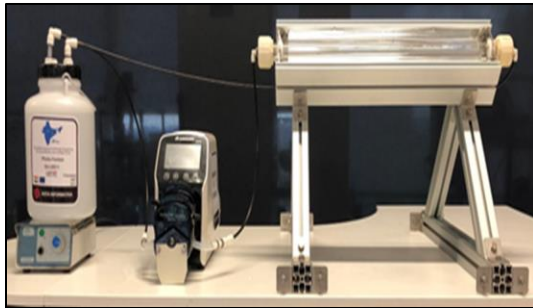
Pilot scale electrocoagulation unit is established to remove suspended, emulsified or dissolved contaminants from wastewater using direct electric current.



Novice solar powered cascade RO for the treatment of brackish water at high recovery (>80%) with low specific energy consumption



Two fixed bed continuously operated adsorption system utilizing natural adsorbent for the treatment of textile wastewater and brackishground water



Solar photo Fenton system utilizes advance oxidation process to treat the textile/industrial waste water



Lab skid NF/RO performance testing unit to test the performance of the NF and RO membrane



Wetland is a natural pre-treatment technique for removal of range of contaminants like organic matter, nutrients, pathogens, heavy metals etc.



Salicornia is a halophytic crop which grows in saline water. It is a revenue generating plant and utilized in reject management.

# About Projects

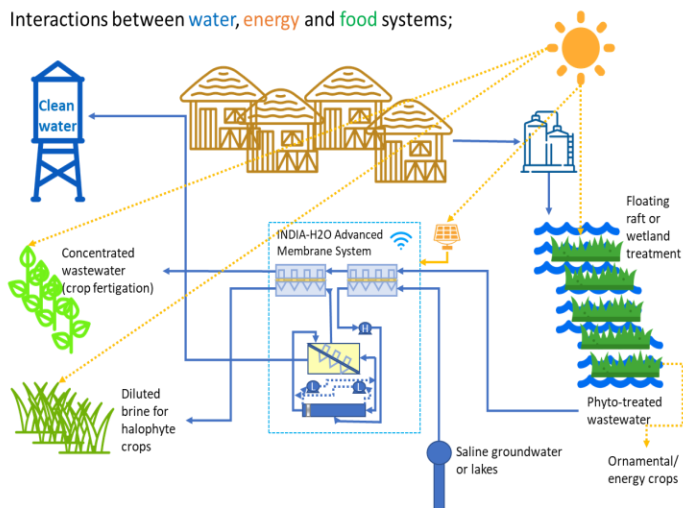


## bio-mimetic and phyto-techNologies DeSigned for low-cost purficAtion and recycling of water (INDIA – H<sub>2</sub>O)

Funded by: Department of Biotechnology, New Delhi

The overall aim of India-H<sub>2</sub>O is to develop, design and demonstrate high-recovery, low-cost water treatment systems for saline groundwater and for domestic and industrial wastewaters. The focus for developments will be in the arid state of Gujarat, where surface water resources are very scarce. Cost-effective technologies and systems are proposed with the aim of lowering energy costs through dramatic improvements in energy efficiency, new bio-based approaches to water recycling, and use of renewable energy. Reject waste streams will be minimised or reduced to zero, thus protecting the environment.

Interactions between water, energy and food systems;



INDIA-H<sub>2</sub>O concept for piloting water recycling and Water Energy Food Nexus at a village level

Grant No: DBT/IN/EU-WR/40/AM/2018

Project value: 42 Cr

PDP share: 5.07 Cr

Partners involved: 21

Manpower sanctioned: 1 PA + 1 SRF + 2 JRF + 3 FW

Project duration: June 2019 - June 2024

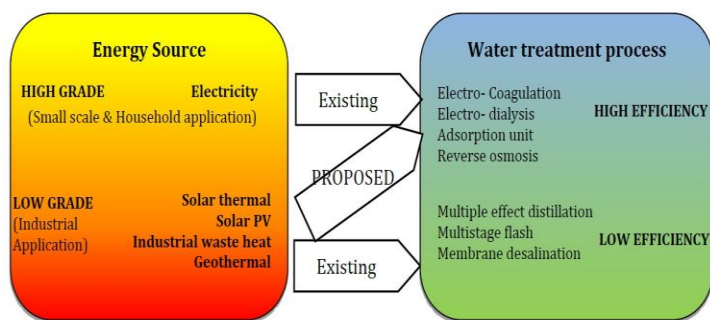
Project Website: <https://www.india-h2o.eu/>



## LOW-COST RENEWABLE ENERGY DRIVEN (LC-RED) WATER TREATMENT SOLUTIONS CENTRE

Funded by: Department of Science & Technology, New Delhi

In the leadership of Pandit Deendayal Energy University (PDEU), the consortium includes G B Pant University (GBPU), Uttarakhand; Banasthali University (BU), Rajasthan and Central University of Gujarat (CUG). The consortium partners bring multi-disciplinary expertise ranging from renewable energy driven efficient water treatment systems supported through biological, bacterial and biotechnological pre-treatment approach to address truly global challenge of scarcity of clean and drinking water. The aim of project is to provide practical & innovative solutions to address the shortfall of freshwater supply which is one of the most pressing problems affecting India and several other global regions. The project also aims to explore water saving schemes, recycling measures and industrial wastewater treatment.



Grant No: DST/TM/WTI/ WIC/2K17/124

Project value: 5.3 Cr

PDP share: 3.7138 Cr

Partners involved: 4

Manpower sanctioned: 1 PC + 2 JRF + 3 FW

Project duration: Jan 2019 - Jan 2024

Project Website: <https://lc-red.wixsite.com/lcred>



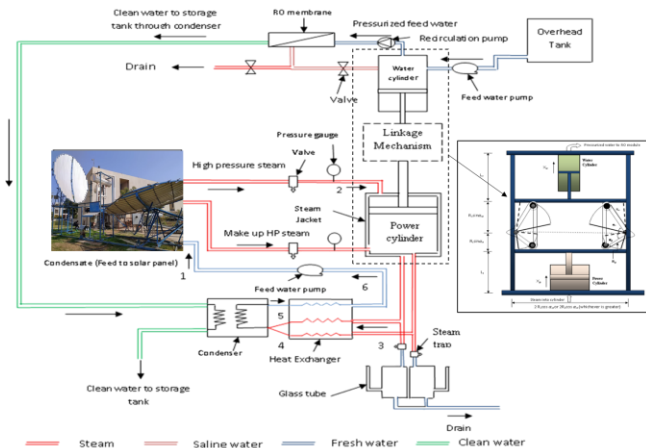
# About Projects



## SOLAR POWERED HIGH RECOVERY DESALINATION (SPHRD) TO PROVIDE CLEAN WATER

Funded by: Department of Science & Technology, New Delhi

This overall aims of the project is to provide an high recovery solar powered RO desalination. A steam-Rankine cycle has been designed to drive mechanically a batch-RO system that achieves high recovery, without the high energy penalty typically incurred in a continuous-RO system. The steam may be generated by solar panels, biomass boilers, or as an industrial by-product. A novel mechanical arrangement has been designed for low cost, an a steam-jacketed arrangement has been designed for isothermal expansion and improved thermodynamic efficiency.



Grant No: DST/ TM/ WTI/ 2K15/ 219

Project value: 63 lakh

Partners involved: 1

Manpower sanctioned: 1 JRF

Project duration: April 2016 - September 2019



## PILOT FOR MASTERS IN CIRCULAR ECONOMY

Funded by: British Council, United Kingdom

Climate change issues are the major threat to humankind. Although all countries are making efforts to reduce GHG emissions that include offering courses in the universities related to sustainability, there is a lack of transnational education (TNE) opportunities for young people on the topic of climate change from multi-stakeholders and cross-disciplinary perspectives. The main aim is to design and develop plan for a of transnational education (TNE) program by engaging Aston University, Pandit Deendayal Energy University, IIT Kharagapur, Gandhi Institute of Technology and Management, and K J Somaiya Institute of Management. The programme structure will follow the objectives of United Nations' Sustainable Development Goals (SDGs). The modules for TNE programme entitled 'Circular economy to combat climate change challenges through water, energy and food nexus: Technology and business solutions' will be designed to address each of the SDGs.



Grant No: 877775303

Project value: 89,905 £

PDP share: 11,105 £

Partners involved: 6

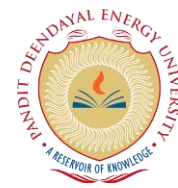
Manpower sanctioned: 3 Students

Project duration: December 2021 - December 2022

# About Organisation

## PANDIT DEENDAYAL ENERGY UNIVERSITY

Formerly Pandit Deendayal Petroleum University (PDPU)



Pandit Deendayal Energy University (PDEU) formerly known as Pandit Deendayal Petroleum University (PDPU) was established by Gujarat Energy Research Management Institute (GERMI) as a Private University through the State Act with a vision "To emerge as a world class Institution of Excellence in Energy Education, Research and Innovation which will prepare and sensitize the youth and ultimately the society for radical yet sustainable societal transformation". This objective is being addressed through a number of specialized and well-planned undergraduate, postgraduate programs and intense research initiatives in the domain of science, technology, management and humanities. PDEU has been promoted by Government and Industry to create a world class University to cater the need for trained and specialized human resource with special focus on energy sector. PDEU is under top 100 universities in the country (NIRF ranking - Univ-73, Engg-68, Mgt-66) and ranks 2nd in GSIRF rankings. It is NAAC accredited, with "A" grade and CGPA of 3.39 out of 4 point scale. It is also ISO 14001:2015 and ISO 9001:2015 certified. PDEU is the only private college in Gujarat to get the autonomous status by the University Grant Commission (UGC) in 2018 among other 60 better performing central, state and private universities in country. At present University has several research projects sponsored by various organizations and Industries. Governments of India, Ministry of Science and Technology, Department of Scientific and Industrial Research have accorded recognition to PDEU, Gandhinagar as Scientific and Industrial Research Organization (SIRO). The university aims to get the status of "Institute of Eminence (IoE)" and to achieve status of world Class University in near future.



## PEOPLE AT CoE

### DR. ANURAG MUDGAL

Department of Mechanical Engineering

### DR. VIVEK K. PATEL

Department of Mechanical Engineering

### DR. JATIN PATEL

Department of Mechanical Engineering

### DR. MANISH SINHA

Department of Chemical Engineering

### DR. VARSHA MUDGAL

Project Co-Ordinator, LC-RED Project

### MR. MILAN RANINGA

Water Project Staff

### MR. DIPAK ANKOLIYA

Water Project Staff

### MR. DHAVAL PATEL

Water Project Staff



# PDEU

PANDIT DEENDAYAL ENERGY UNIVERSITY

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[www.pdpu.ac.in](http://www.pdpu.ac.in)  
[Water@pdpu.ac.in](mailto:Water@pdpu.ac.in)

## ASSOCIATE PROJECTS

### INDIA H<sub>2</sub>O



[www.india-h2o.eu](http://www.india-h2o.eu)

### LC-RED



[www.lc-red.wixsite.com/lcred](http://www.lc-red.wixsite.com/lcred)

### SPHRD



### GOING GLOBAL

