

## **DST-PDEU TECHNOLOGY ENABLING CENTRE**

Theme: **"Technology Enabling Centre: Energy, Health & Water"**

DST sanction order no.: **DST/TDT/TEC/2022/153**

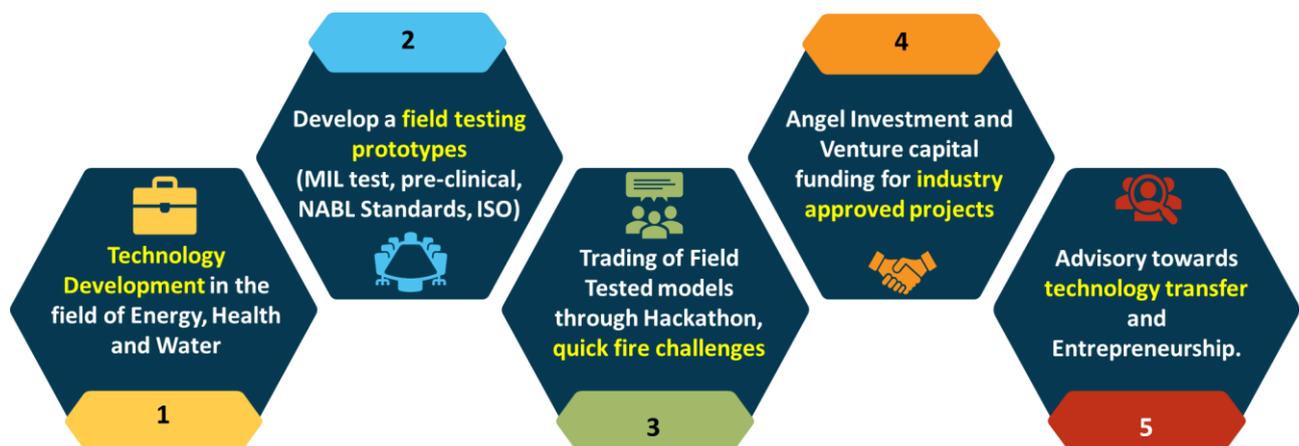
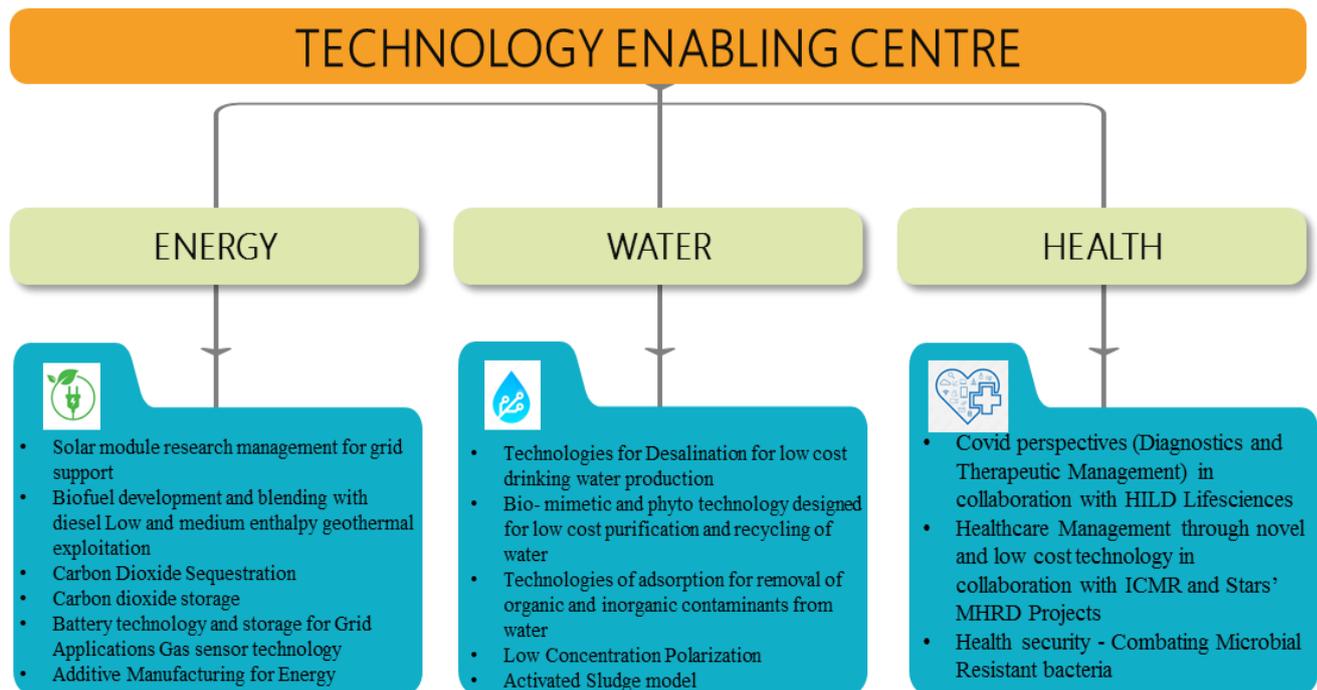
### **What is Technology Enabling Centre (TEC)?**

In the recent times, a rapid expansion is witnessed both in S&T and R&D outputs of the country in terms of publications, IP, research translation and technology commercialization etc. These outcomes play a key role in developing country's economy as well as its financial status as evidenced by various rankings and performance matrices. The roots of this rapid expansion lies within the Academia that is the prime resource for innovation and intervention of new knowledge with a scope to model or translate the outcome into output. The kinetics of implementation at institutional level and mechanisms of technology transfer to commercial scale are the missing links between academia and industries. Thus the filling of this gap or the missing link is the prime requirement for visualising research output of any country. Henceforth, TEC would play this vital role by providing an adherence surface where the technology invented can be idealised, prototyped, validated, scaled up, transferred and finally commercialised on real ground basis. The skill of technology know how transfer would be better optimized at academia and industrial levels with the help of this initiative by DST in the form of TEC.

### **Aims and Objectives of TEC**

The objective of TEC will be to create an Ecosystem for Technology Development in the Universities and provide a platform to network researchers with other institutes, National laboratories and industry. The focus of Centres will be on providing an enabling eco system, process and support system.

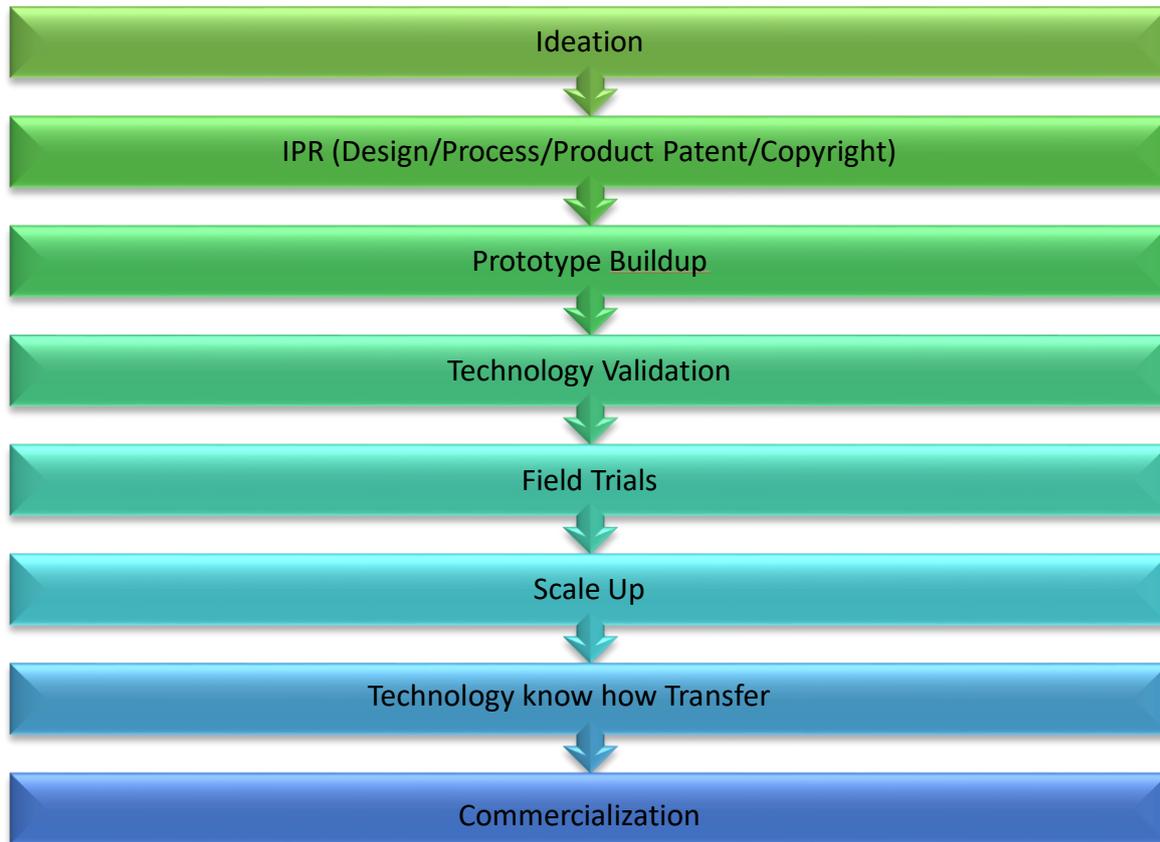
Establishing TEC at Pandit Deendyal Energy University will be stepping stone in field of innovation.



### **Basis of establishment of TEC at PDEU**

Pandit Deendayal Energy University's 100 acre campus located in Gandhinagar, offers multiple courses ranging from engineering, arts and management along with maximum exposure and opportunities to its students through various national and International exchange programs with Best Universities worldwide.

Technology Enabling Centre at PDEU was established on 20<sup>th</sup> March'2023 with an aim to support researchers to conceptualise new technologies and collaborate with industries and other universities to bring them out in academic market for development in field. The Technology Enabling Centre will enable on Technology Development, Technology Deployment and Technology Diffusion in the field of Energy, Health and Water. Centre will develop a field testing prototypes (MIL test, pre-clinical, NABL Standards, ISO) and observe the market perspective for developing a business model.



### Highlights of PDEU

Global energy mix is shifting from fossil fuels to renewable energy in accordance to COP 27 and climate resilience proposed in G20 presidency. In accordance to the same PDEU got transformed to PDEU (Petroleum to Energy) in 2020 and are researching on six renewable sectors (Solar Energy, Wind Energy, Hydrogen Energy, Geothermal, Hydrogen and Bioenergy). The objective is to contribute to the net zero intention of India by 2050 as a part of Circular Economy. PDEU is augmenting ML and AI in all its efforts. PDEU is starting 45 MW solar production line, generated 50 KW of electricity from geothermal, produced 100 litre of Biofuel, demonstrated 5 KW rooftop wind turbine, 100 KWh vanadium battery storage. Augmented research on Additive manufacturing and state of the art Apple lab (in pipe line) will impact materials associated with stated goals that are going to be operational over the next few years. PDEU has published/granted 139 patents and fulfilled Sustainable Development Goals of UNESCO (Goals 6,7,9,13).

### Centres at PDEU

- International Automobile Centre of Excellence
- SIEMENS Centre of Excellence
- Centre for Biofuel and Bioenergy Studies
- Solar Research and Development Centre
- Centre of Excellence for Geothermal Energy (CEGE)



- Drilling & Simulation Centre
- Water Treatment and Management Centre

ENERGY	WATER	HEALTH
<p>It aims to acquire green energy through hybridisation of renewable energy resources and reduce carbon footprint.</p>	<p>It aims to explore low cost technology for groundwater exploration and prevent water wastage by recycling, desalinating and treatment of water acquired from drilled wells.</p>	<p>It aims achieve proper health care management through latest low cost technology and health security by Combating microbial Resistant bacteria.</p>
<ul style="list-style-type: none"><li>• Solar module research Management for grid support.</li><li>• Natural Gas Sector Technologies.</li><li>• Carbon dioxide sequestration and storage.</li><li>• Battery Technology and storage for grid Application</li><li>• Advanced technologies for grid support using solar/wind/ geothermal and hybridization of the renewable energy.</li></ul>	<ul style="list-style-type: none"><li>• Device low cost tools for groundwater exploration</li><li>• Technologies of adsorption for removal of organic and inorganic contaminants from water</li><li>• Low Concentration Polarization</li><li>• Desalination of water</li><li>• Treatment of produced water from drilled wells</li><li>• Activated Sludge model</li><li>• Water Recycling</li></ul>	<ul style="list-style-type: none"><li>• Diagnostics and Therapeutic Management.</li><li>• Healthcare management through novel and low cost technology</li><li>• Health Security – Combating microbial Resistant bacteria</li></ul>

### TEC at work



## Team at TEC@PDEU

**Mentor: Prof. Dr. S. Sundar Manoharan,**

Director General, PDEU

**PI: Prof. Anirbid Sircar**

Director, SoET, PDEU.

**Co-PI: Prof. Surendra Singh Kachwaha**

Professor, SoT, PDEU

Mr. Abhinav Kapadia

CFO, PDEU

### DST Nominated Members for TEC-PDEU

- **2 TEC Members/Coordinators(Nominated by DST)-One from Phase I and one from Phase II**

**Dr. Indrani Karunasagar**

TEC Coordinator, NITTE University

**Dr. Raja P Pappu**

TEC Coordinator, GITAM University

- **TEC-EAG Member/Expert**

**Prof. K Balasubramaniam**

IIT Madras

- **Representative from Program Division DST**

**Dr. Anita Aggarwal**

**Dr. Krishna Kanth Pulicherla**

### Research staff

Research Associate-I

Research Associate-II

Senior Research Fellow

Junior Research Fellow

**Partner Institutes:**

**Dr. Hirok Choudhuri**

Associate Professor  
Dept. of Physics, NIT Durgapur, West Bengal

**Dr. Shibani Khanra Jha**

Assistant Professor  
Dept. of Civil Engineering, BITS Pilani, Rajasthan

**Dr. Mandira Agarwal**

Distinguished Professor  
University of Petroleum and Energy Studies, Dehradun

**Dr. Kriti Yadav**

Assistant professor,  
Department of Geology, Patna University

**Dr. Sumit Mishra**

Associate Professor,  
Department of Chemistry  
Birla Institute of Technology, Mesra, Jharkhand

**Prof. Samuel Raj**

Dean of Academic Affairs & Registrar  
Director of centre for Drug Design & Development  
SRM University Sonipat, Haryana

**Prof. Pallavi Sharma**

Dean I/C, School of Nanoscience,  
Central University of Gujarat, Sector 30, Gandhinagar.



## **Industry Association/Industry Expert**

**Dr. Alok Das**

VP and Business Development Head

Suzlon Energy Limited

Ahmedabad, Gujarat

**Mr. Pratik Patel**

Project Engineer

Balief Corporation, GIDC Naroda Ahmedabad, Gujarat

**Dr. Manjul Joshipura**

Senior Vice President, Innovation & New Products

Cadila Pharmaceuticals Ltd.

**Mr. Ravi Kumar**

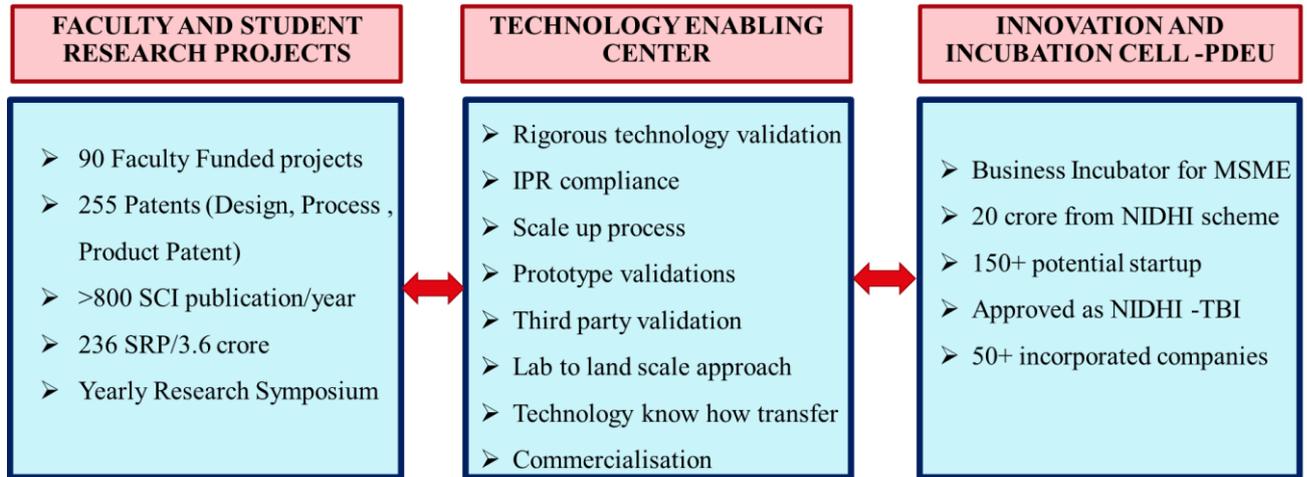
Director General-OEC

ONGC Energy Centre, SCOPE Minar, Laxmi Nagar, Delhi

## **List of Design/Process/Product Patents**

<https://www.pdpu.ac.in/orsp.html>

## Unique Proposition of DST-TEC@PDEU



### Contact:

Prof. Anirbid Sircar

Director and Professor, SoET

PDEU, Gandhinagar

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## TECHNOLOGY ENABLING CENTRE (TEC)

### TEMPORARY SPEED BREAKER WITH UNDER CABLE TUNNEL

Patent Application No  
202121053582

#### INVENTOR NAME

1. PDEU  
2. P. Jayakumar

Theme: Energy

➤ The titled "Speed breaker bump with power cable transfer tunnel" designed to be installed on the important junction of the road as temporary speed breaker is used to regulate the speed of the moving vehicle while the cavity provided under the bumping blocks is used to pass the electric power cable from one side of the road to the another side of the road.

➤ The passing of under way electric cable is used to transfer the electric current from the available side to another side for utilizing the electric load used for construction or other maintenance works.

➤ The dual purpose of the bumping blocks of serving as speed breaker as well as the under cavity cable transfer is compactly designed.



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## TECHNOLOGY ENABLING CENTRE (TEC)

### SOLAR OPERATED DUST BIN SEGREGATOR

Patent Application No  
202121053579

INVENTOR NAME

1. PDEU  
2. P. Jayakumar

Theme: Energy

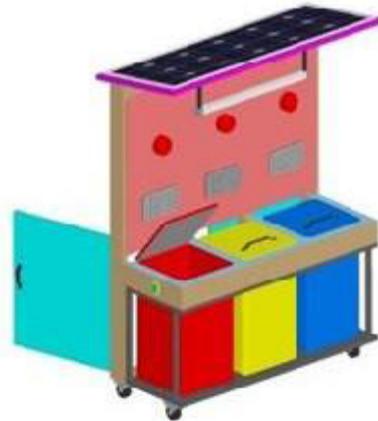
➤ The main objective of this project is to design of SOLAR OPERATED DUST BIN SEGREGATOR which will help keeping our environment clean and ecofriendly.

➤ The three varieties of garbage viz e-waste, plastic waste and paper waste have to be segregated and dumped into the garbage bin. It is usually done manually and segregated wastage should be dumped in separate bins.

➤ But if human error poses the problem then the waste with exact category may be dumped in wrong garbage bins which cause hardship while disposing at the garbage dumping yard which may further be processed to either recycle or to become ashes.

➤ The novel design concept is to design the dust bin which allows only the corresponding waste is allowed to be dumped in the bin with exact category.

➤ The visually impaired person is directed through voice message to put the waste, depends on the category at the appropriate garbage container which are coded and distinguished with various colors.



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## TECHNOLOGY ENABLING CENTRE (TEC)

### IONIC LIQUID SUPPORTED MEMBRANE FOR ENHANCED CO<sub>2</sub> SEPARATION

Patent Application No  
202221029658

#### INVENTOR NAME

1. PDEU
2. Ms. Tushar Vilas Patil
3. Dr. Swapnil Dharaskar
4. Dr. Manish Kumar Sinha
5. Dr. Surendra Sasikumar Jampa

Theme: Energy

- The titled invention “Ionic Liquid Supported Membrane for Enhanced CO<sub>2</sub> Separation” discloses the invention is related to the efficient gas separation process for a binary gas mixture (CO<sub>2</sub>/CH<sub>4</sub>). The world’s growing population necessitates the use of natural resources for energy, contributing significantly to global climate change. Carbon dioxide (CO<sub>2</sub>) is one of the most critical components of the global greenhouse gas phenomenon.
- Many researchers have been working on CO<sub>2</sub> capture and storage technologies as CO<sub>2</sub> emission has been extended in recent years. Technologies such as absorption, adsorption, chemical looping/ catalytic conversion, and membrane separations are extensively investigated and well-known for carbon capture and storage (CCS). Membrane separation offers an often-better CO<sub>2</sub> capture performance than other approaches.
- The membrane separation technique for CO<sub>2</sub> capture and sequestration has been the most popular among academics over the last two decades since it does not need considerable energy consumption for processing and does not require paying exorbitant chemical prices.
- In this work, supported ionic liquid membranes are synthesized, and a gas separation study is conducted for binary gas mixture (CO<sub>2</sub>/CH<sub>4</sub>). Phosphonium based ionic liquid is used for the fabrication of membranes. The Pebax-1657 with Trihexyl tetradecyl phosphonium bromide [THTDP][Br] concentrations 5%, 10%, 20% (wt.%, based on polymer) were prepared for gas separation study.
- The interactions of CO<sub>2</sub> and CH<sub>4</sub> with the ionic liquid were also predicted using density functional theory (DFT) calculations. The gas separation results show that selectivity for the binary gas mixture (CO<sub>2</sub>/CH<sub>4</sub>) is 22.28 Barrer. Membrane with 20 wt.% concentration (based on polymer) IL shows higher permeability and CO<sub>2</sub>/CH<sub>4</sub> selectivity.

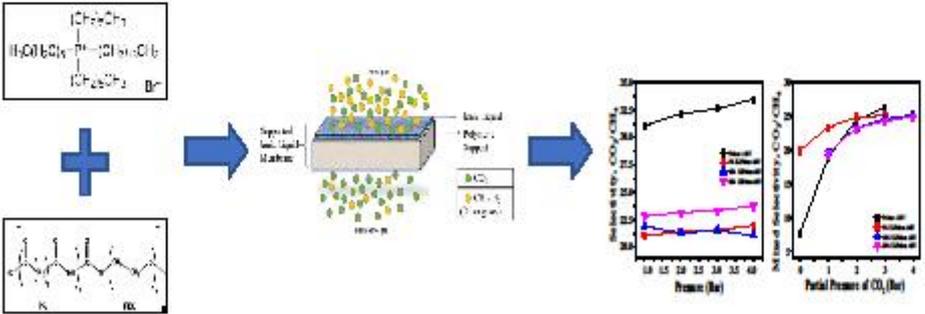
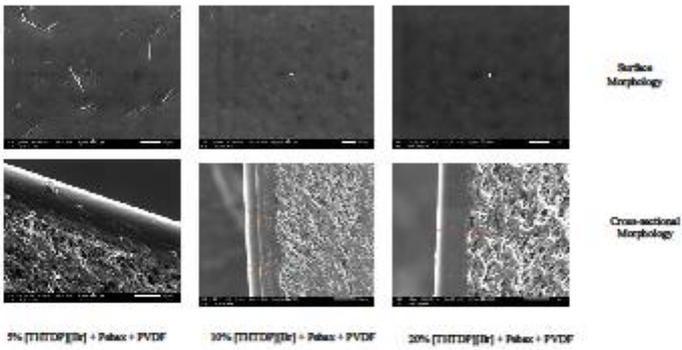
**TECHNOLOGY ENABLING CENTRE (TEC)**

**IONIC LIQUID SUPPORTED MEMBRANE FOR ENHANCED CO<sub>2</sub> SEPARATION**

Patent Application No  
202221029658

- INVENTOR NAME**
1. PDEU
  2. Ms. Tushar Vilas Patil
  3. Dr. Swapnil Dharaskar
  4. Dr. Manish Kumar Sinha
  5. Dr. Surendra Sasikumar Jampa

**Theme: Energy**



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## TECHNOLOGY ENABLING CENTRE (TEC)

### AUTOMATIC SOLAR PANEL CLEANER WITH STREET LIGHT

Patent Application No  
202121053580

#### INVENTOR NAME

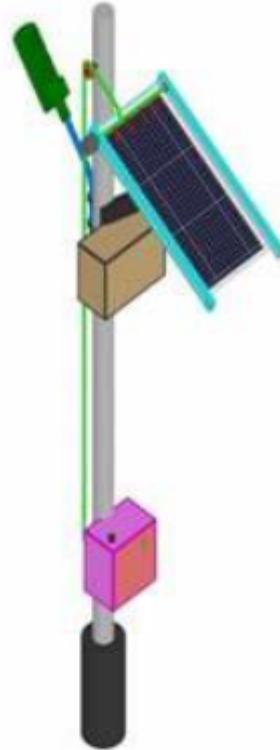
1. PDEU
2. Dr. Anirbid Sircar
3. Abhishek Nair
4. Krishna Solanki

Theme: Energy

➤ The titled "Automatic Solar Panel Cleaner With Street Light" is designed on integral mast which holds the LED street light powered with solar panel illuminates the surroundings with cool whitelight powered by battery back up.

➤ The solar panel is fixed with cleaning device which is programmed to clean up the surface of the solar panel with water jet spraying to remove dust or other particles every day after sunset.

➤ The pre programmed scheduled timings to execute the cleansing process is done by spraying the water jet on the surface of the panel and the LED street light is programmed to glow only in the dark and off after the sunrise automatically.



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## TECHNOLOGY ENABLING CENTRE (TEC)

### MILK PASTEURIZATION USING LOW ENTHALPY GEOTHERMAL WATER

Patent Application No  
202221029659

#### INVENTOR NAME

1. PDEU
2. Dr. Kirti Yadav
3. Dr. Anirbid Sircar
4. Namrata Bist
5. Jaya Kumar

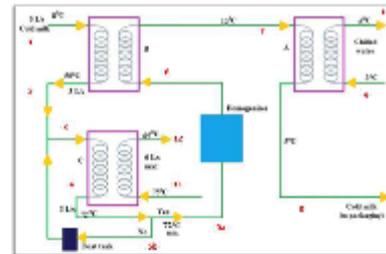
Theme: Energy

>The titled invention "Milk Pasteurization using low enthalpy geothermal water" discloses the process of using geothermal energy to pasteurize the milk. Geothermal energy is one of the cleanest source of renewable energy. In recent times geothermal industries are more focused towards the other utilizations of geothermal energy rather than the electricity generation.

>The direct utilization of geothermal water includes balneology, honey processing, desalination of water, food dryer, etc. Milk pasteurization through geothermal water is one of such practice.

> This invention talks about stages of milk processing and the main categories of heat treatment utilized in dairy processing. It will describe about a milk pasteurization system which utilizes the residual discharge of geothermal water (75-80°C). The water gets discharged from a Space Heating and Cooling plant which is used for combined heating and cooling purpose using low enthalpy geothermal water.

> The inlet temperature of milk will be around 8°C which will be pasteurized by geothermal water of 75-80°C and will be packed at 5°C after the homogenization and cooling.



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## TECHNOLOGY ENABLING CENTRE (TEC)

### Nano Hydro Fiber Scaffold (Nano HIFI)

Patent Application No  
202121053519

#### INVENTOR NAME

1. PDEU
2. Dr. S. Sundar Manoharn
3. Dr. P.S. Pradeep
4. Dr. D. Sivaraman
5. Mr. Darshan N Ladva

#### Theme: Health

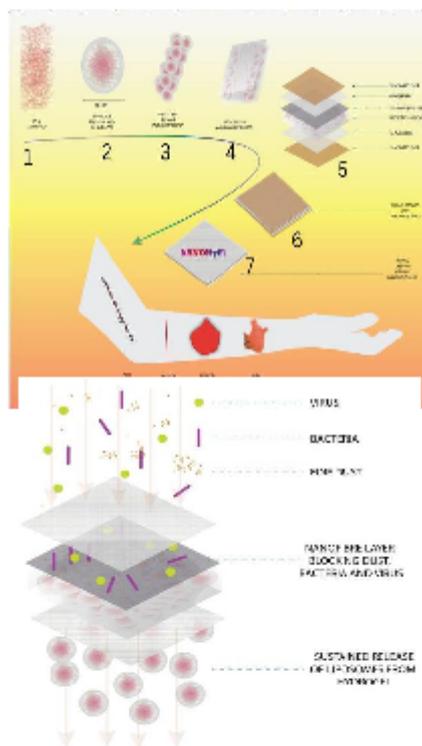
>The titled "NANO FIBER SCAFFOLD (NANO HIFI)" discloses about the wound healing using bio degradable scaffold which is essential to repair the skin after injury. The engineering of several nanoparticles to target the bacteria makes them a powerful candidate to encapsulated drugs for rapid wound healing process.

>Several resources contribute to the generation of nanoparticles ranging from 20 to 500 nm. Encapsulating the antibiotics or drugs into liposome would be highly efficient for wound care management.

>Hydrogel loaded antibiotics mimics the texture of tissues and deliver the antibiotics at the target sites.

>Gellan gum hydrogels have several unique properties such as higher biodegradability, increased water retaining capacity, lesser toxicity and clear gelling ability makes them a multifunctional candidate to be used to load various antibiotics and can be made as a wound dressing materials.

>Polyvinyl alcohol based liposomal hydrofiber was developed to restrict the entry of foreign pathogens and release the liposome loaded antibiotics to the wound site.



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## TECHNOLOGY ENABLING CENTRE (TEC)

### NANO OLEUM - AN HYBRID SECONDARY DRESSING PAD

Patent Application No  
202221072465

#### INVENTOR NAME

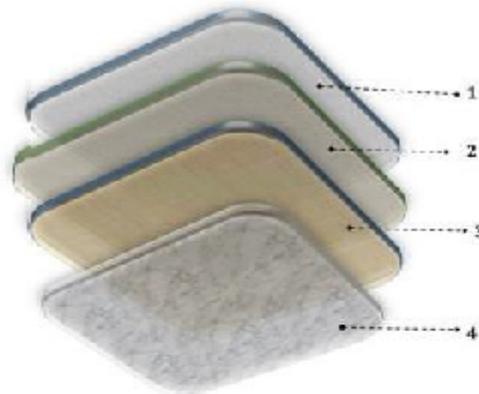
1. PDEU
2. Dr. S. Sundar Manoharan
3. Mr. Darshan N Ladva
4. Dr. P. S. Pradeep
5. Dr. D. Sivaraman
6. Dr. Sam Scudder
7. Miss. Grishma Kantibhai Chitroda

Theme: Health

>The present invention relate to a bilayered secondary dressing pad comprising an ultrafine fibrous framework administered or laden with a combination of polymers, polysaccharides, fatty acids, glycoproteins and glycolipids.

>The dressing pad scaffolds produced from the current technologies of electrospinning and phase separation are either lack of 3D oriented fibrous structure or too compact to be penetrated by cells.

>The hybrid external dressing pad with the advantage of an ultrafine polymeric scaffold may exert additional protection to the underlying primary dressing bandages and also absorbs wound exudates, render anti-microbial property, and prevents the entry of pathogen from the external environment.



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## TECHNOLOGY ENABLING CENTRE (TEC)

### EBACTIN GEL - MOLDABLE HYDROCOLLOID FOR SKIN WOUND

Patent Application No  
202221072468

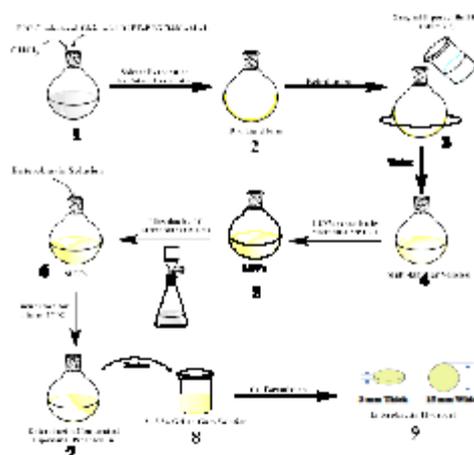
#### INVENTOR NAME

1. PDEU
2. Dr. S. Sundar Manoharan
3. Dr. D. Sivaraman
4. Dr. P. S. Pradeep
5. Dr. Sam Scudder
6. Mr. Darshan N Ladva

Theme: Health

>Siderophore mediated drug delivery approach has received considerable attention as an emerging and promising strategy for treating severe infections.

>The proposed formulation was designed to explore the state-of-the-art regarding the use of novel liposomal-Enterobactin mediated antibiotic therapy in the development of enhancing the action of antibiotic for the treatment of skin diseases with the emphasis on overcoming MDR E.coli infections.



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**TECHNOLOGY ENABLING CENTRE (TEC)**

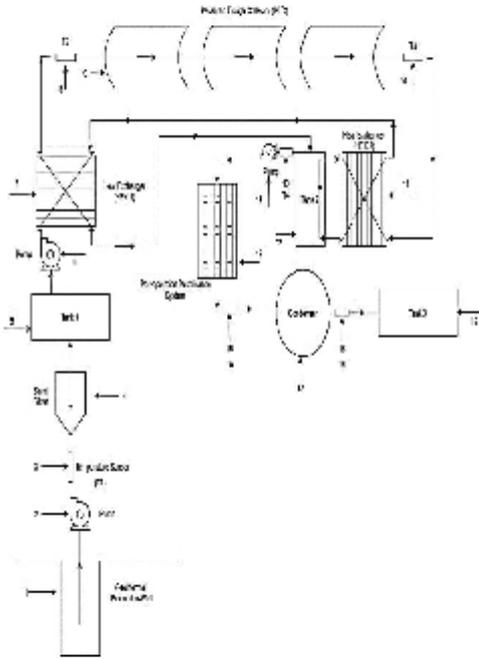
**SOLAR GEOTHERMAL PERVAPORATION DESALINATION SYSTEM**

Patent Application No  
202221072471

**INVENTOR NAME**  
 1. PDEU  
 2. Dr. Namrata Bist  
 3. Dr. Anirbid Sircar  
 4. Dr. Kriti Yadav

**Theme: Water**

>The present invention showcases the desalination of geothermal water by hybridizing solar thermal and pervaporation systems. The system comprises a sand filter to separate unwanted particles, where tank1 and tank2 are utilized for storing geothermal fluid for the remaining application process. Heat Exchangers (HEX 1 and HEX 2) are used to exchange heat between thermic fluid and geofluid. Temperature sensors display input and output temperature of the solar collector, pervaporation desalination system, condenser, and tank 3. Solar thermal collectors such as parabolic trough and evacuated tube collectors are determined for temperature elevation, and the pervaporation process is carried out in desalinating geofluid. Lastly, the desalinated water is condensed and transferred to tank 3 for drinking purposes.



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## TECHNOLOGY ENABLING CENTRE (TEC)

### THERMAL INSULATED HOT WATER STORAGE TANK

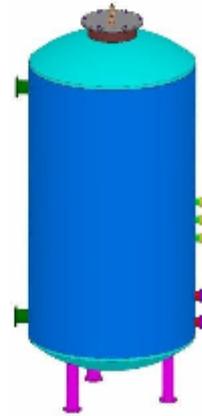
Design Patent Application No  
337090-002

#### INVENTOR NAME

1. PDEU
2. Prof. Anirbid Sircar,
3. Dr. Kriti Yadav,
4. Mrs. Namrata Bist,

Theme: Water

- In industrial water storage system hot water is required for cleaning or processing with chemicals.
- The water storage tank is designed to heat up the water up to the required temperature and to maintain it automatically.
- The thermally insulated lining inside the cylinder prevents the heat loss from the stored hot water
- Maintains the heat of the water up to 24 hours
- Hence power consumption is very less.
- The hot water storage tank has the inlet ,outlet and drain facility to utilize the water for industrial use.



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## TECHNOLOGY ENABLING CENTRE (TEC)

### VERTICAL MULTI-EFFECT DISTILLATION (MED) PLANT FOR WATER DISTILLATION

Design Patent Application No  
338366-001

#### INVENTOR NAME

1. Pandit Deendayal Energy University,
2. Mr Rahul Deharkar, Assistant Professor,
3. Dr. Anurag Mudgal, Associate Professor,
4. Dr Vivek Patel, Assistant Professor,

Theme: Water

>Expulsion of broken-down salts and poisonous chemicals in water, particularly dissolved impurities at a number of parts per million (ppm) levels is one of the foremost troublesome issues.

>There are a few strategies utilized for water filtration.

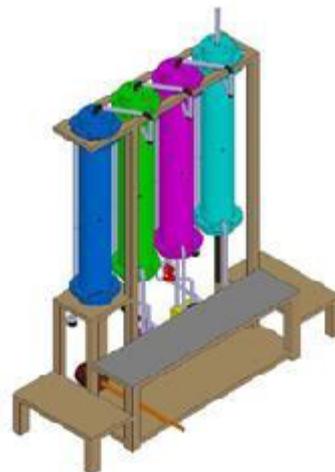
>The choice of the method depends primarily on the level of nourish water saltiness, source of vitality with sort of contaminants present and available energy source.

>Distillation is an age ancient strategy which can evacuate all sorts of broken up debasements from sullied water.

>In different impact refining (MED) idle warm of steam is reused a few times to deliver numerous units of distilled water with one unit of essential steam input.

>This is often as of now being utilized in huge capacity plants for treating ocean water. But the challenge lies in planning a framework for energy efficient and cost-effective small-scale operations that can treat a few cubic meters of water per day, particularly appropriate for rustic communities where the accessible water is brackish.

>A small-scale vertical fluted tube MED unit with an extendable number of impacts has been outlined and designed for optimum yield in terms of add up to distillate delivered.



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## TECHNOLOGY ENABLING CENTRE (TEC)

### HANDY WATER BOTTLE WITH FLUORIDE FILTER

Design Patent Application No  
342145-001

#### INVENTOR NAME

1. Pandit Deendayal Energy University,  
2. Dr. Swapnil Dharaskar,

Theme: Water

> Water purification has become a major concern to the people around the globe. Filtration process has become a necessary solution for water treatment which can make water suitable for human consumption or domestic use, because of the steady decline of water quality caused by environmental pollution and industrial processes.

> In this design a new type of potable handy bottle filter is presented, aimed for people to be used while travelling.

> These bottle filters are low cost comprised of a (tested) nano particle which can remove 97.5 % fluoride removal efficiency.

> The apparatus may be configured such that water is first passed through a top storage container designed to receive water. Then the water is followed by nano filtration membrane, activated carbon, micro filter ceramic, trimetals nano particles, micro filter ceramic, activated carbon and nano filtration.

> These layers were packed and kept in the upper part of the bottle. These packets of filter can be washed and can be reused.

> The water will pass through these filters and can be consumed by human beings.

> The main advantages of these filter it is of low cost than other cartilage which is used in the houses, can be taken anywhere, and can drink from nearby lakes and rivers without any worry while travelling.



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## TECHNOLOGY ENABLING CENTRE (TEC)

### NANO-TECHNOLOGY BASED WATER DE-SCALING EQUIPMENT

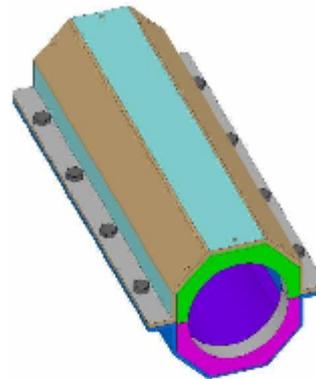
Design Patent Application No  
338360-004

#### INVENTOR NAME

1. PDEU
2. C. Baheerathan,
3. B. Karunya,
4. B. Raman Kishore,
5. Dr. S. Sundar Manoharan,

Theme: Water

- BRK systems de scaler is an eco-friendly water treatment system that protects piping system and appliances against scale deposits and rust.
- The central hub is designed with round hollow structure while the outer ring surface is designed with split octagonal shape with the insulated foam
- The split type outer hub is fastened with the pipe line and the de scaling process is done inside the pipeline.
- The De scaler Technology is based on the principle of physical water treatment. Special Device change the crystallization process of the liquid calcium.
- This way the hard scale loses its adhesive power. This changes in the molecular structure of the water by converting High sized, Low Energy Molecules to Low sized, High Energy Molecules.



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