

### Matchmaking Support for DOE's Industrial Technology Validation (ITV) Pilot

*This is an overview of the technologies that are seeking industrial host sites to jointly apply to the ITV Pilot.*

#### Thermal Energy Storage

##### 1. XPanel Integrated Energy Recovery Ventilator System

An integrated system that combines Energy Recovery Ventilators (ERVs), solar collectors, and Thermal Energy Storage (TES) technologies to be installed as a single system in facilities to reduce energy, GHG emissions and associated costs, with few alterations to existing HVAC components. The energy exchange panels recover energy from the building's exhaust air stream at high efficiencies. To further improve performance, the panels absorb solar energy during the winter months. Additionally, the incorporation of phase change materials (PCM) to the device will allow for the collected solar energy to be stored for later usage.

**Application:** This system can be installed at a facility as an add-on to an existing HVAC system to reduce energy use.

##### 2. HEATER for PV Energy Collection and Long Duration Energy Storage

Heat Exchanger and Particle Thermal Energy Reservoir (HEATER) is a flexible zero-carbon energy platform that uses solar PV to charge using an electric air heater and blower and store energy in Thermal Energy Storage (TES) media. Once stored, the heated air can be discharged over a long duration to co-generate heat and power. HEATER uses low-cost and highly stable particles (sand, recycled ceramic, high purity ceramic, rocks) as storage medium options depending on project requirements. The particle TES system can be designed with a large storage temperature difference, thereby increasing the energy density, and can provide a uniform TES solution using particle-based TES in vertical silos with a small footprint. This system can be integrated with renewable resources (electric or thermal) to supply 24/7 or per demand heat and power.

**Application:** Can be integrated with renewable resources to supply 24/7 process heat and power.

#### Renewable Energy/Energy Storage

##### 3. Criterion Energy Partners' Industrial DirectConnect Geothermal Energy Technology

Criterion Energy Partners' Industrial DirectConnect is intended to provide geothermal-based decarbonization CHP solutions for the chemical and industrial manufacturing facilities. The technology will enable the application of heat from geothermal sources to preheat and potentially replace fossil fuel from the boiler systems thereby reducing GHG emissions and associated operating costs. The technology will be co-located with the manufacturer that will use the energy directly from a geothermal installation.

**Application:** This technology can integrate into manufacturing processes to provide clean, efficient energy/heat for use at the site level and is appropriate for any facility with a boiler and heat requirements.

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#### **4. CSP Thermal Solar with an Opportunity for ORC Electrical Generation**

A modular concentrating solar-thermal power (CSP) technology for agricultural, industrial or commercial use that utilizes solar concentrators for generating thermal heat and potentially electricity from an ORC. This technology can effectively reduce the amount of fossil fuels which are otherwise typically needed for these applications. Potential applications include industries that require thermal heat like food processing, mold injection plastic, grain drying.

Application: Can be used for processes that require thermal energy.

#### **5. Solar Thermal Technology Harvesting UV (Ultraviolet) Rays**

The technology is an evacuated tube solar thermal product where the heat is delivered through a closed hydronic loop to a heat exchanger. The collectors are sized to become the primary heat source during the day to cut energy usage and carbon emissions. Applications include retrofitting existing boilers and water heaters regardless of their current energy source (electric, natural gas, propane).

Application: Can be retrofitted onto existing boilers and water heaters.

### **Electric Process Heating**

#### **6. DirectConnect Medium Voltage Heat**

DirectConnect provides medium voltage electric process heating systems to address large heating demands in industrial and commercial industries. Typical process heating applications include in-line circulation systems, heat transfer packages, and steam boilers for use as fuel gas heaters, steam superheaters, hydrocarbon vaporizers, hot oil systems, power-to-heat and thermal energy storage applications. This technology allows electric heaters to be powered directly from power sources rated up to 7.2kV without the use of step down transformers. The operation at higher voltage provides a significant reduction in amperage which reduces electrical infrastructure requirements and improves operational efficiencies due to reduced heat dissipation through power switching components and fewer I<sup>2</sup>R losses.

Application: Medium voltage heating systems can be used for large process heating and steam generation applications, including district heating, and other large heat duty applications in heavy industrial sectors such as power generation, oil and gas, petrochemical, and chemical processing.

### **Waste Heat Recovery**

#### **7. Hydrogen Technologies, LLC Zero-Emission Industrial/Commercial Hydrogen Boiler**

The proposed technology is a zero-emission hydrogen boiler to catalyze a natural reaction between hydrogen and oxygen, creating H<sub>2</sub>O and ultraviolet energy. Inside the boiler's combustion chamber, this energy is harnessed to create hot water and/or steam, or can employ a turbine to create Combined Heat and Power (CHP). Technology may be applicable for any industrial facility looking to replace their hydrocarbon-fueled boilers with a hydrogen-fueled one.

Application: Any industrial facility looking to replace its boiler.

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## Carbon Capture

### 8. Captis-Aire Advanced Pollution Control Technology

This project will demonstrate the scale-up of a novel Fluidized Bed Concentrator (FBC) that uses a flowable bead shaped activated carbon (BAC) to clean the air from a variety of industrial processes by capturing pollutants from the air. This technology intends to control pollutants initially from wood drying processes used for making liquid or solid biofuels from wood, oriented strand board (OSB), plywood, lumber, etc.

Application: Intended for use in wood drying processes.

### 9. Gas Catcher

A compact device to capture methane and other hydrocarbon gases from oil wells, resulting in reduced methane released to the atmosphere. This captured methane can be used for fuel, flared, sold, or used for enhanced recovery. Typically, the volume of gas is not sufficient to maintain the burning of a flare. The proposed device, by recovering additional gas, can increase the volume enough to run an engine or be properly flared. Additionally, the reduction of gas in the flow line can reduce surges of liquid into the oil/water separator, resulting in better separation which reduces waste and increases saleable oil.

Application: Oil/gas facilities with wellhead and tank battery.

## Gas Separation

### 10. Osmoses, Inc. Osmosis-Gas Separation Membranes

Osmoses developed polymer membranes with high rates of permeability and selectivity compared to existing membranes in the market to separate gases, thereby enabling efficient oxygen production, nitrogen enrichment, hydrogen generation, CO<sub>2</sub> capture, and biogas production. This compact, module-based membrane system can be tested alongside an existing gas separation system through slip stream configuration to evaluate its effectiveness and performance.

Application: Can be embedded in a gas separation system to carry out the target separation.

## Water Purification

### 11. Max-IR Labs Energy Efficiency at Wastewater Treatment Plants through Aeration Process Monitoring

Max-IR Labs developed a sensor for monitoring the levels of nitrogen-based components in wastewater, such as nitrate, nitrite, and ammonia. Implementation of the Max-IR sensor into feedback control-based systems at municipal wastewater treatment plants (WWTP) can help conserve over 20% of energy by reducing excess aeration.

Application: Intended for use in wastewater treatment plants.

### 12. Bio-Electro Water/Wastewater Electrons Dispersion and Filtration (EDF) Solution to Treat Urban Wastewater

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A chemical-based water desalination, decontamination, and disinfection solution to reduce radioactive content and other wastewater pollutants, including disinfection of pathogens to levels set by the drinking water requirements. EDF offers a high efficiency, low-cost, sustainable, non-allergenic, and small footprint electrochemical catalysis solution.

**Application:** Intended for use in wastewater treatment plants, industrial wastewater reclamation and decontamination, urban stormwater and tertiary sewer water treatment, mining, pharmaceutical manufacturing, reclamation, and desalination of brackish groundwater.

## Smart Manufacturing

### 13. OTAware-Edge Based System to Address O&M Issues

OTAware-Edge's distributed edge computing-based AI/ML platform is designed for reducing operations & maintenance costs in manufacturing plants. The platform alerts technicians to problems as soon as they happen and gives them the information they need to resolve the issue rapidly, reducing time-to-fix. The platform operates with no connection to the cloud; all information is kept on-device, improving the system performance while minimizing cybersecurity concerns.

**Application:** Can be integrated with existing manufacturing data systems.

### 14. PLC-Easy Software Solution

PLC-Easy is a software module that can be programmed to monitor and optimize energy as part of the process control capabilities. This simplified PLC software architecture comes with packaged routines and functionality that can be incorporated into existing processes and systems faster compared to existing traditional systems. It empowers people with very little programming skills to convert their process knowledge into process control software. It is intended for application in dairy, potable and wastewater treatment, chemical, power generation/distribution, pharmaceutical and other process-based industries.

**Application:** Intended for many industries including dairy, potable and wastewater treatment, chemical industry, power generation/distribution, pharmaceutical etc.

For more information, visit

<https://betterbuildingssolutioncenter.energy.gov/better-plants/industrial-technology-validation-pilot>

If you have questions or want to work with one of these vendors, email us at:

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