

USF-FESC Energy Research Tasks

- Solar thermal power
- Biomass & Algae to liquid fuels & chemicals
- Thin film PV manufacturing Pilot Line
- Energy efficiency and zero energy buildings
- Secure energy delivery infrastructure
- Carbon capture and sequestration
- Clean water using advanced solar technologies
- Energy Systems Analysis

Demonstration Solar Thermal Power Plant



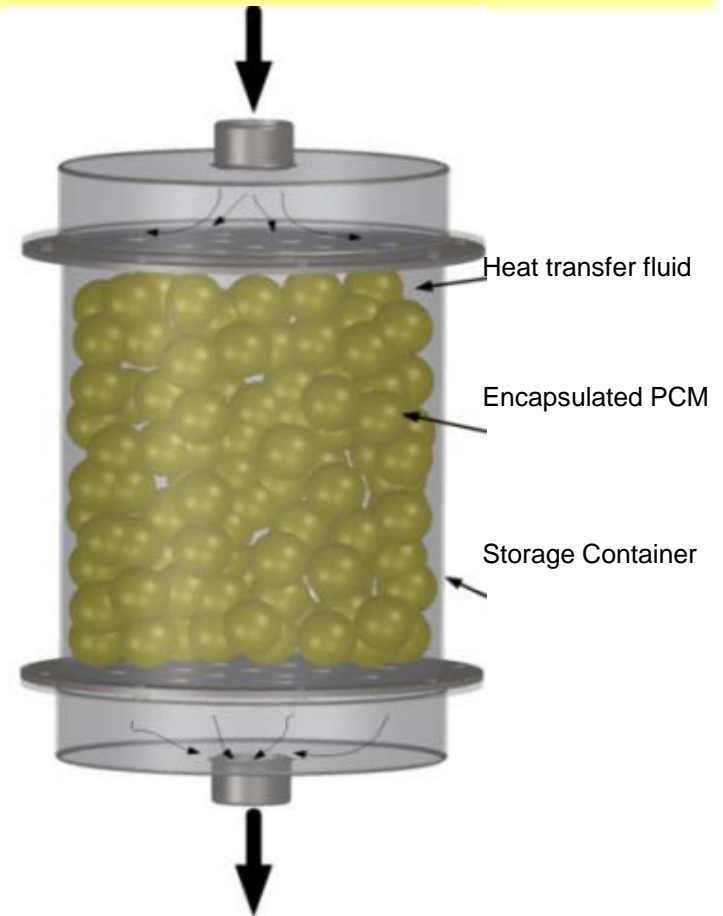
- Serve as a platform to demonstrate technologies developed in the lab
- Facilitate technology transfer to industries
- **Serve as a teaching and training facility for students**
- **Public education**



Energy Storage



- Utility Scale
- Novelty is developing low cost, industrially scalable capsules of PCMs
- Reduce system costs from $\$80/\text{kWh}_{\text{th}}$ at present to $< \$15/\text{kWh}_{\text{th}}$.



Solar Thermal Power

- FESC project resulted in follow on funding
 - ~\$3.5 M for Thermal Energy Storage from USDOE
 - ~\$2.5 M for Thermal Energy Storage from ARP Ae
 - ~\$1 M for Thermal Energy Storage from eON
 - ~\$120 K from Sunborne Energy
- Additional proposals for funding pending and under development

Development of a Low Cost Thermal Energy Storage System Using Phase Change Materials with Enhanced Radiation Heat Transfer

Participating Organizations

Institution



Industrial Partners



Innovative Latent Thermal Energy Storage System for Concentrating Solar Power Plants



Polymer Coated Capsules to 300°C



Metalized Capsules to 450°C after 2000 Cycles (6 yrs eqv.)



Ceramic Coated Capsules to 1000°C



Ceramic Coated Capsule from Kyocera Ind.

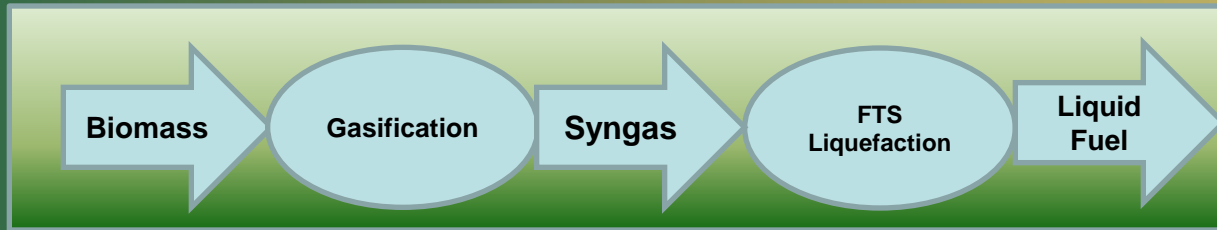
Additional Commercial Application

Storage & transportation of geothermal energy



- Iceland is pioneer in Geothermal Energy
- 90% of heating, hot water and 25% of electricity
- Exporting energy in hot water via ships to other islands and northern Europe
- They will use our PCM Capsules

Biomass to Clean Liquid Fuels

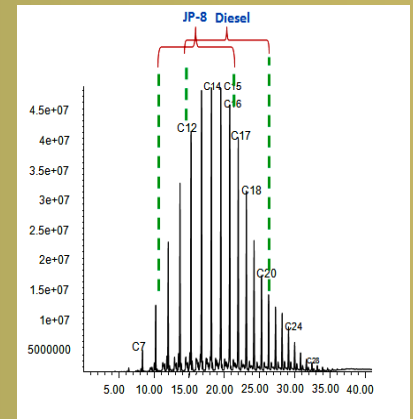
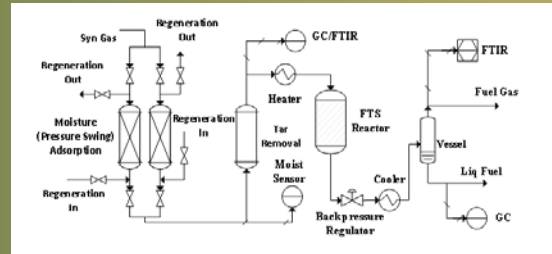
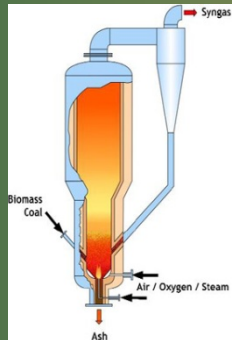


Gasifier

Fischer-Tropsch Synthesis

Diesel, Jet Fuel

Biomass



Major Accomplishments

- Startup company – **Trash2Cash**.
- Won the Megawatts Challenge Competition (\$110K) from DOE
- 2 additional research projects were funded (1 from Hinckley Research Center, 1 from private company)

USF Energy Start-Up Overview

- **Trash2Cash Energy, LLC**
- **New Energy Technologies, Inc.**
- **Dialytics, Inc.**
- **Ultrasonic Technologies, Inc.**
- **MudPower, Inc.**
- **Energy Management Professionals, Corp.**
- **Sunborne Energy**

Solar Energy Education

- The industry growth is creating a critical need for trained professionals in Solar Energy
- There is resurgence of interest among the students and universities in Solar Energy courses
- At USF Clean Energy Research Center we have been teaching Solar Energy courses as a part of the normal engineering degrees
- Added courses of relevance to the industry
- Students being hired by FPL-Nextera, TECO, Algenol and others

THANK YOU