Solar Thermal Powered Drum Drying of California Specialty Crops

Project Background

- Use of drum drying to remove water content from California specialty crop pomaces and purées.
- Provide heating power needed for drying from innovative solar thermal collectors.
- Identify the feasibility of adapting solar thermal energy for use with existing drum drying technologies.

Drum Drying

- Consist of one or more rotating steel cylinders.
- Traditionally powered by steam condensing on the inside surface.
- Highly versatile in the ability to adjust surface temperature, rotation speed, and application thickness.
- Ideal for agricultural and food processing where there is a solid/liquid combined byproduct or waste stream.

Types of Drum Dryers

- Top Fed Double Drum
- Top Fed Single Drum
- Bottom Fed Double Drum
- Bottom Fed Single Drum

Solar Integration of a Drum Dryer

- Drum dryer to be operated using mineral oil heat transfer fluid rather than steam.
- Heating power to be provided by and XCPC array connected to a double drum dryer via a heat exchanger.

The External Compound Parabolic Concentrator (XCPC)

- Evacuated tubes with concentrating reflectors
- Medium temperature range
- (100°C ≤ T ≤ 300°C)
- High solar to thermal efficiency
- Non-Tracking
- Low cost and low maintenance

Solar Resource

- California has an abundant solar resource.
- Average direct normal irradiance of 5.0-6.0 kW/m²
day.
- Sunlight to heat conversion generally more efficient than sunlight to electricity.
- Concentrating solar irradiation can improve heating power.
- Solar thermal is a well established industry.

Table 1 - Characterization of drum surface temperatures for various set point oil temperatures

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