Chromasun Micro-Concentrator
What is Solar Thermal?
Solar Hot Water Heating

- Solar Hot Water heating uses the heat of the sun to generate hot water
- Flat panels like the ones shown to the right can efficiently generate temperatures of 120°F but beyond that they lose efficiency rapidly
What is **Concentrating Solar Thermal**?
Concentrating solar thermal uses reflectors to actively track the sun and concentrate the heat onto an absorber pipe.

The reduced surface area of the absorber pipe means that these types of collectors are still efficient at temperatures over 200F.
Why Chromasun?
Solar Experience

- Peter Le Lievre (CEO) and Andrew Tanner (VP of Engineering) were founding engineers at Ausra, now Areva Renewables. Between 2002 and 2008 built Australia’s largest solar thermal power plant and designed Germany’s largest. They have applied this knowledge to design and build the Chromasun MCT.
Objective: miniaturize the known linear Fresnel optic that they pioneered with Ausra and make it into a building friendly product

200X Reduction in size!
The MCT is fixed on the rooftop like a regular panel however 20 parallel mirrors internally track the sun to provide 20X concentration onto a stainless steel receiver pipe.

**Diagram:**
- **Receiver Pipe** (SS 304 A213 Tube)
- **Parallel Mirrors**
Best in Class Solar Collector

Highest temperature rated solar collector in the USA
(179ºC /354ºF)

Solar Collector Comparison
(Global = 1000W/m², DNI = 850W/m²)
Why is the MCT the superior concentrator?

- Easy to install
- Closed loop plug-and-play approach to tracking
- No external moving parts
- Reduced wind-loadings
- Reduced roof loadings (<5lb/sqft)
- Aesthetically stunning
- Easy to clean

vs

- External tracking mechanisms
- Dependent on algorithms to track
- Reflective surface is prone to abrasive damage over time
- Catches the dirt and hard to clean
- Lower roof packing density due to shading
- Complex roof loadings
How does the MCT install?
MCT is self-supporting and has an integrated stand that has seismic and structural sign-off to hurricane loadings
Chromasun MCT – Simple Installation

The picking points and integrated racking makes installation on the rooftop simple and efficient.
Where have they deployed the technology before?
Santa Clara University Showcase Project
Simple plate exchanger takes the 200F heat from the MCT’s and delivers it to the building loop.
Solar Monitoring Equipment was installed so that output could be modeled.
SCU BTU Energy Metering

BTU Metering was installed so that output could be measured.

- Sun Energy Available: Yes
- Energy Output From Panels:
  - 380.52 MBTUH
  - 111.50 KW
- Daily Energy Output From Panels:
  - 1403.9 MBTUH Today's Running Total
  - 1136.3 MBTUH Yesterday's Total
- Current Month Energy Output:
  - 33843.1 MBTU Running Total

- HHW Pump Status: On
- HHW Pump Status: Running
- Solar Return Flow: 37.2 gpm
- Solar Return Temp: 167.0 °F
- HX Inlet Temp: 167.0 °F
- Solar Supply Temp: 187.7 °F
- HX Outlet Temp: 176.0 °F
- HHW HX Inlet Temp: 167.0 °F
- HHW HX Outlet Temp: 176.0 °F
SCU Performance

- Monitoring equipment enables comparison of metered data with modeled data
- For this project measured and modeled have aligned perfectly!
What if I have a steam requirement?
Industrial Process Heat Applications
Solution for baseload cooling?
Cooling with MCT’s and a Double Effect Absorption Chiller

Sunlight → MCT Panels → 1.35 @ 7°C / 44°F → CHW

1 @ 175°C / 350°F and/or Natural Gas → HHW

2.35 @ 30°C / 85°F → CW

Cool Building → DE Multi-Fire Absorption Chiller → Heat Rejection
An MCT array in conjunction with a two-stage absorption chiller is best in class for rooftop area utilization
Solution for baseload domestic hot water &cooling?
Solar Heating & Cooling with MCT Panels

The MCT’s unique ability to efficiently deliver thermal energy over 200°F makes it ideal for integration with absorption chillers / heat pumps.

1.6 times as much heat out!!
This “Solar Cooling” design gets the Federal 30% rebate (including the aux boiler!)

- CSI State Rebate on Solar and Energy Efficiency rebate on the boiler skid
- Chromasun can finance the entire system and attain a payback through both solar and the 150% efficient boiler
Example Chiller at Poultry Farm in CA

Compact Skid!
The Chromasun MCT with the heat pump therefore delivers more energy for a rooftop area than any other solar technology.
What if I have a high latent/dehumidification load?
Traditional Cooling

“cause that’s how we’ve always done it”

Over-chilling by electrical vapor compression

Humidity removal by condensation

SENSIBLE + LATENT

Temp

65°F/18°C

44°F/7°C

“Summer” Boiler
Latent Heat Removal with Desiccants

Humidity removal by desiccant (solid or liquid) that can then be regenerated by solar thermal.

Significantly reduced net chilling by electrical vapor compression and no lover over-chilling.

65°F / 18°C
How are these projects financed?
2011 – The year for Solar Thermal!!

• In 2011, the following incentives are available to offset the cost
  – 30% Federal Investment Tax Credit as a **GRANT**
  – 100% Bonus Depreciation at the end of Year 1 **WORTH 30%**
  – California Solar Initiative Thermal Rebate is at Tier 1 and **WORTH APPROX 20%**

• In 2012, the incentives reduce to the following
  – 30% Federal Investment Tax Credit as a **TAX CREDIT**
  – 50% Bonus Depreciation at the end of Year 1 **WORTH 15%**
  – California Solar Initiative Thermal Rebate will likely drop to Tier 2 and **WORTH APPROX 10%**
Project Financing

- Chromasun is able to fully finance projects as:
  - Finance Lease
  - Thermal Power Purchasing Agreement

- Finance Lease
  - Fixed Monthly Rate
  - Performance Guarantees

- Thermal PPA
  - Thermal Energy is metered and charged to the customer at a rate below what it costs to produce it from gas (nominally 10%). I.e. Always saving!
  - 10, 15 or 20yr terms
  - O&M remains responsibility of Chromasun
Where do they manufacture?
Chromasun 10MW / Annum San Jose facility

Chromasun MCT are made in the USA
MCT Summary

- Chromasun MCT is based on existing CSP technology and over a decade of experience in large-scale solar
- Highest Temperature rated SRCC collector in the US
- Concentrating the sun’s energy enables the MCT to consistently deliver up to 220°C (440°F) on the rooftop
- MCT has no externally moving parts, reducing O&M
- Unlike other concentrating technologies, cleaning is limited to flat glass (automated cleaning system in development)
- MCT can be turned on or off which provides safe operation
- MCT is a durable, industrial grade product with sturdy installation method
- The delivery of higher grade heat enables compatibility with absorption chillers and thermally driven heat pumps
- Project financing available through Chromasun
THANK YOU

Andrew Tanner
+1 650 644 9177
andrew@chromasun.com