

# Chromasun Micro-Concentrator

ACEEE Hot Water Forum

Andrew Tanner



CHROMASUN

# Solar Experience

- **Andrew Tanner:** VP Engineering at Chromasun





Source: Macquarie Generation [http://www.ausramediroom.com/download/LiddelSolarThermal\\_17Nov09\\_MPEG-4-1280x720.mp4.zip](http://www.ausramediroom.com/download/LiddelSolarThermal_17Nov09_MPEG-4-1280x720.mp4.zip)



# 2007 – Liddell Power Station – 15MW



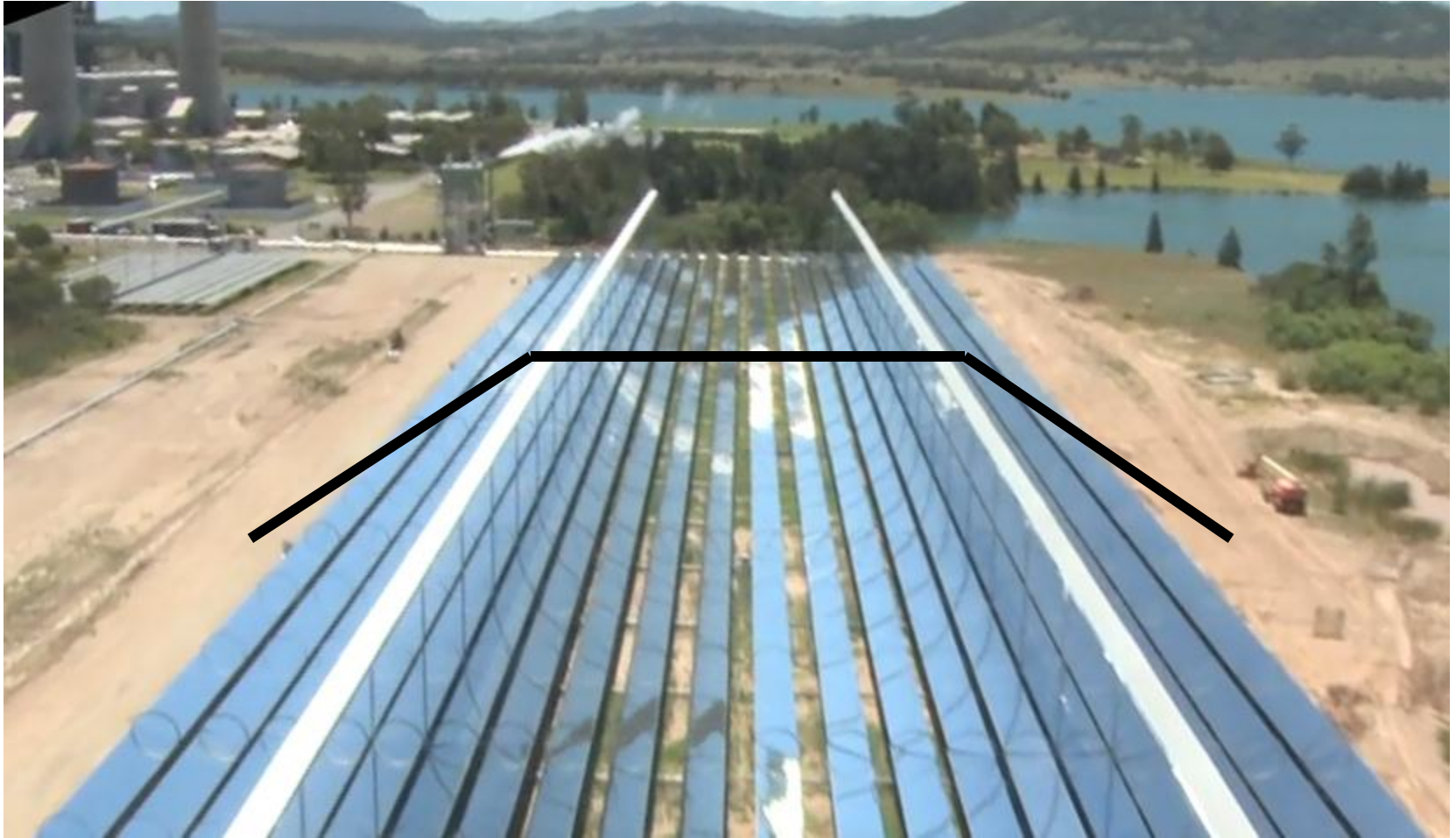
2002 – Prototyping first Ausra reflector



2007- Commissioning the world's largest hybrid solar/coal-fired power station



# 2008 Chromasun Formed





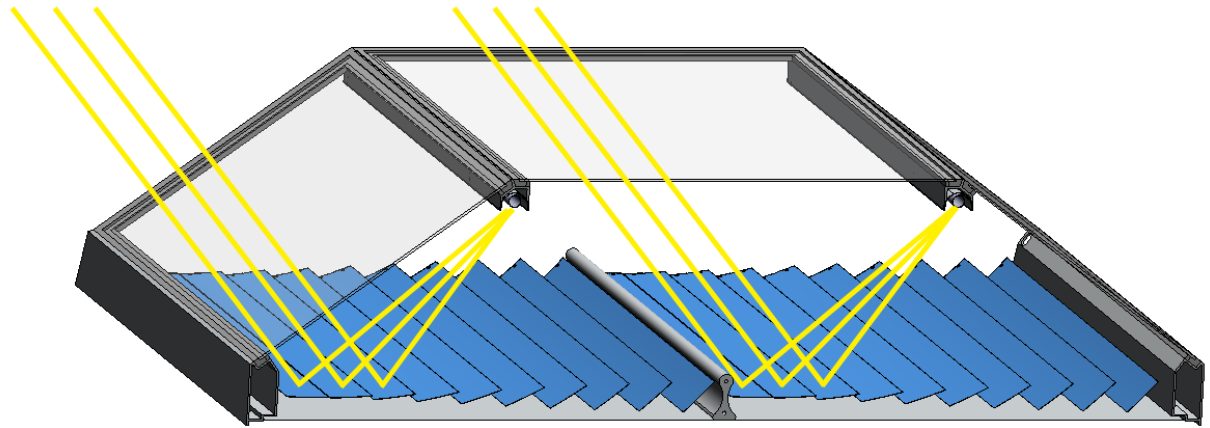
Micro-Concentrator (MCT)



And made it 100X smaller!

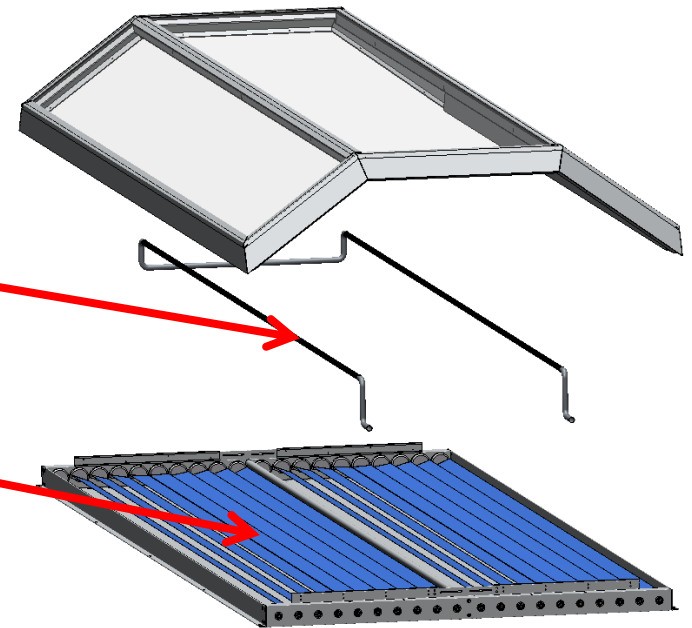


# MCT Exploded View

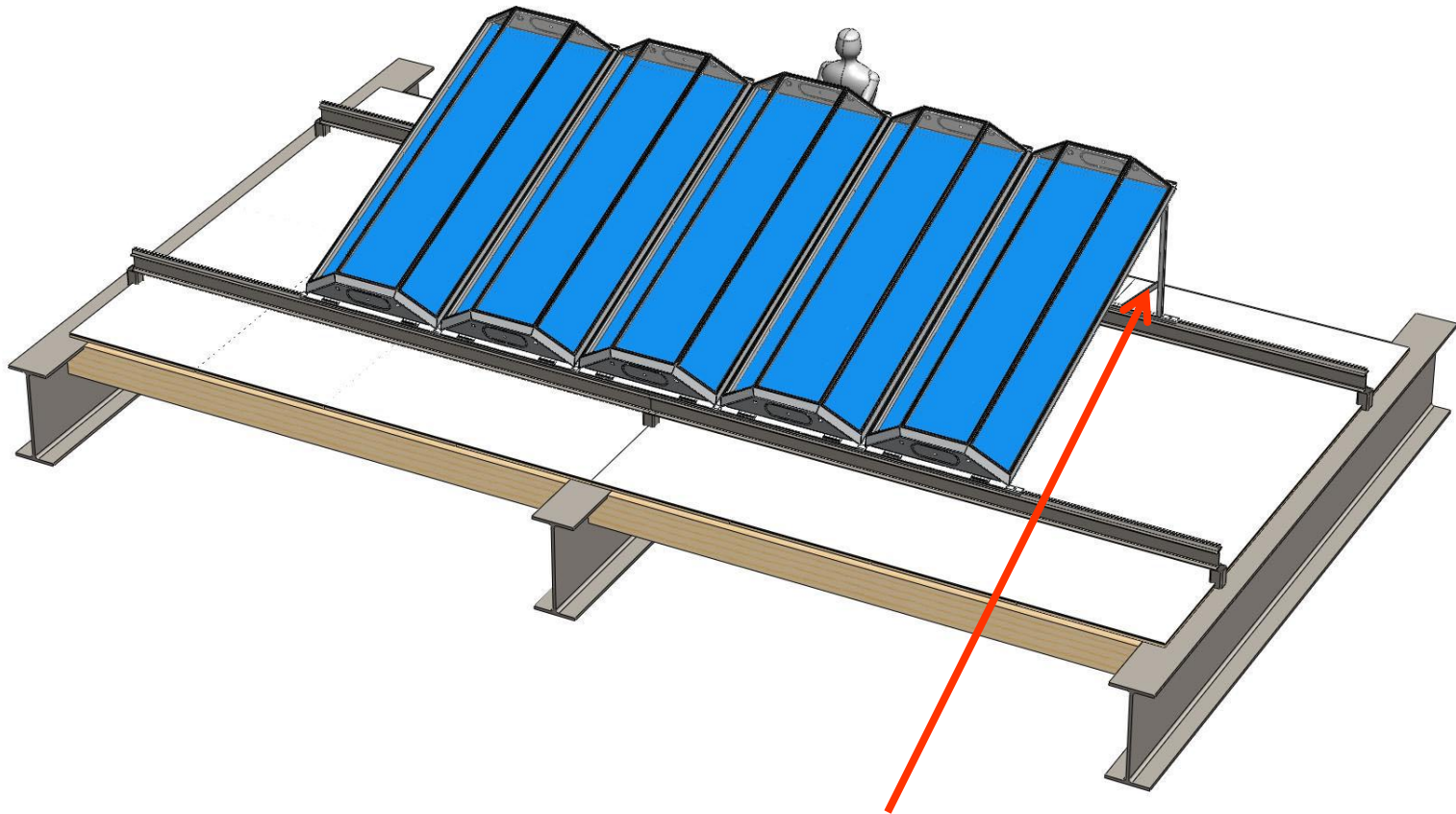


Receiver Pipe  
(SS 304 A213 Tube)

Parallel Mirrors



# Chromasun MCT – Simple Installation

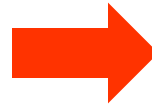


MCT is self-supporting and has an integrated stand.  
Technology can be deployed quickly and into remote areas





# Chromasun MCT – Simple Installation

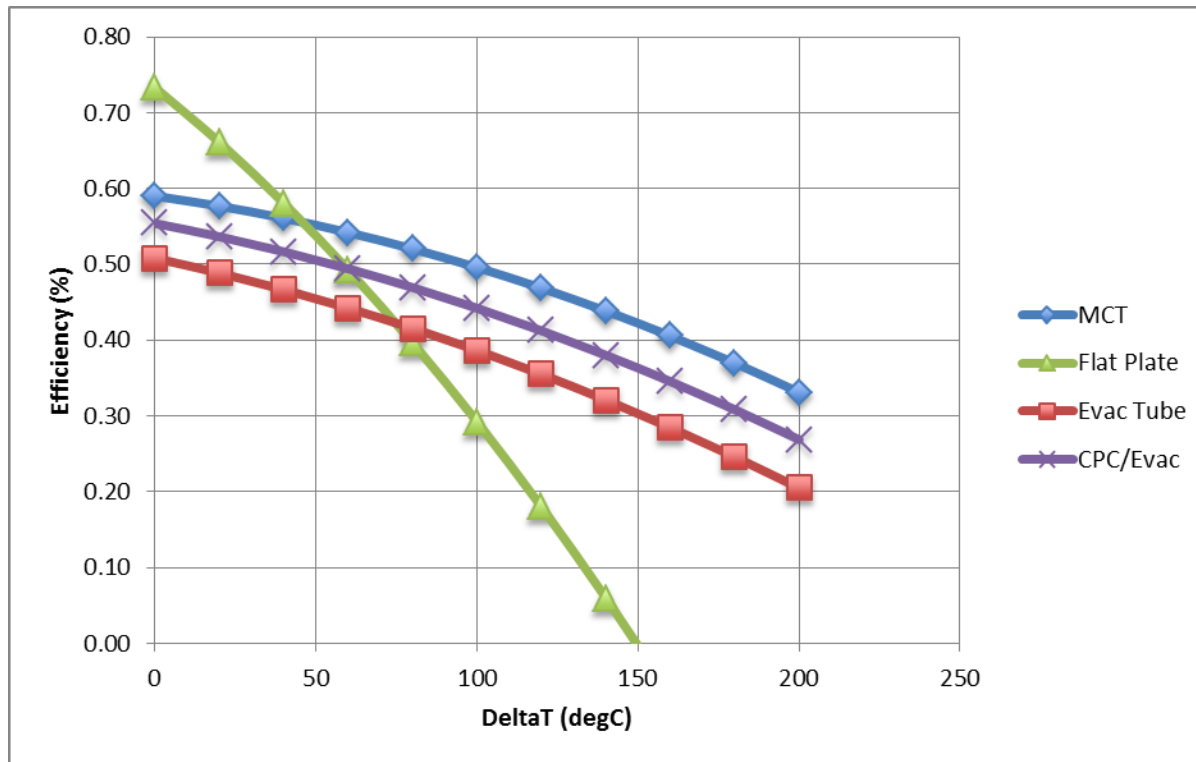






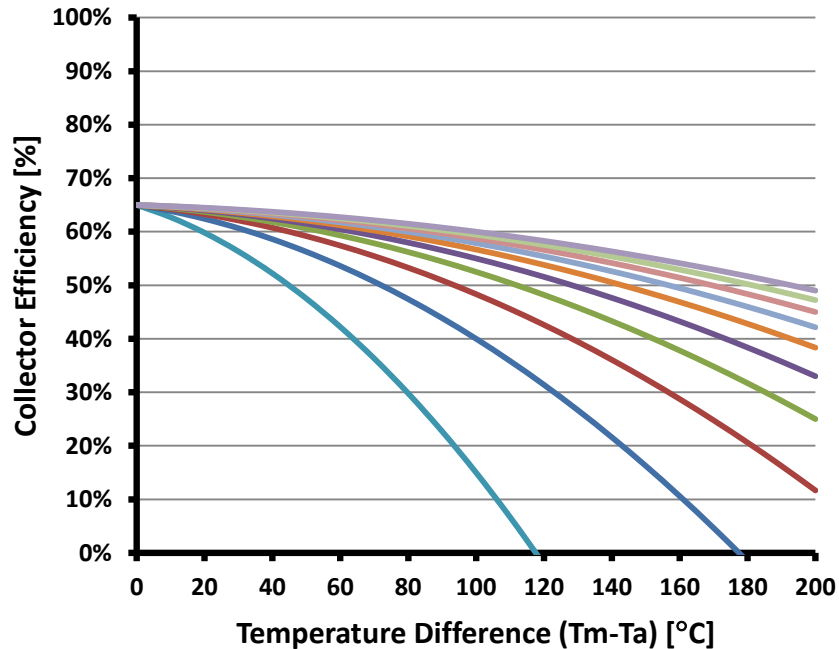
# Competitive Analysis

## Gross Aperture Efficiency at 1000W Global/850W DNI



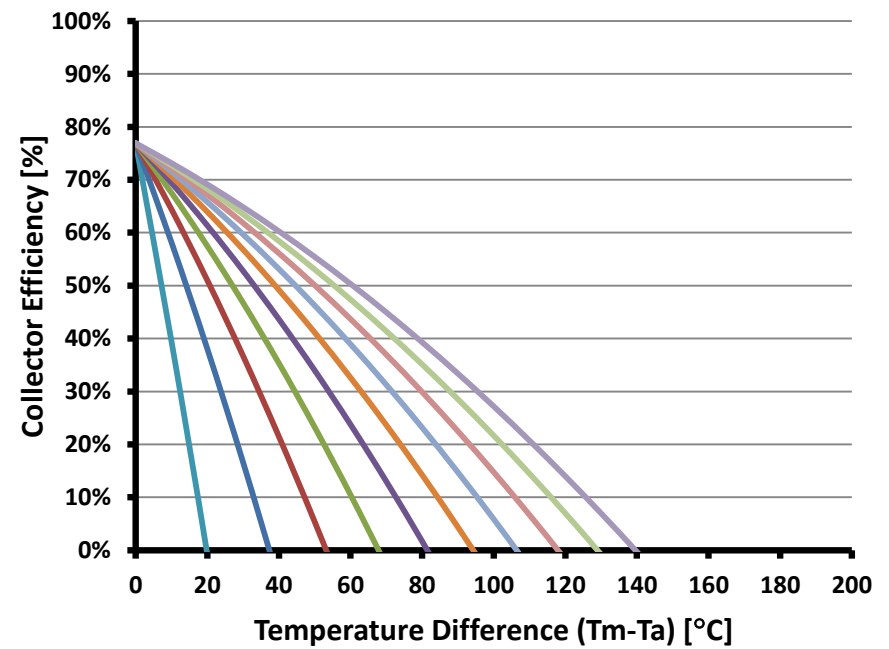
# MCT vs Flat Plates

## Solar Concentrator Efficiency



100 200 300 400 500  
600 700 800 900 1000

## Flat Plate Collector Efficiency



100 200 300 400 500  
600 700 800 900 1000





# Santa Clara University Showcase Project



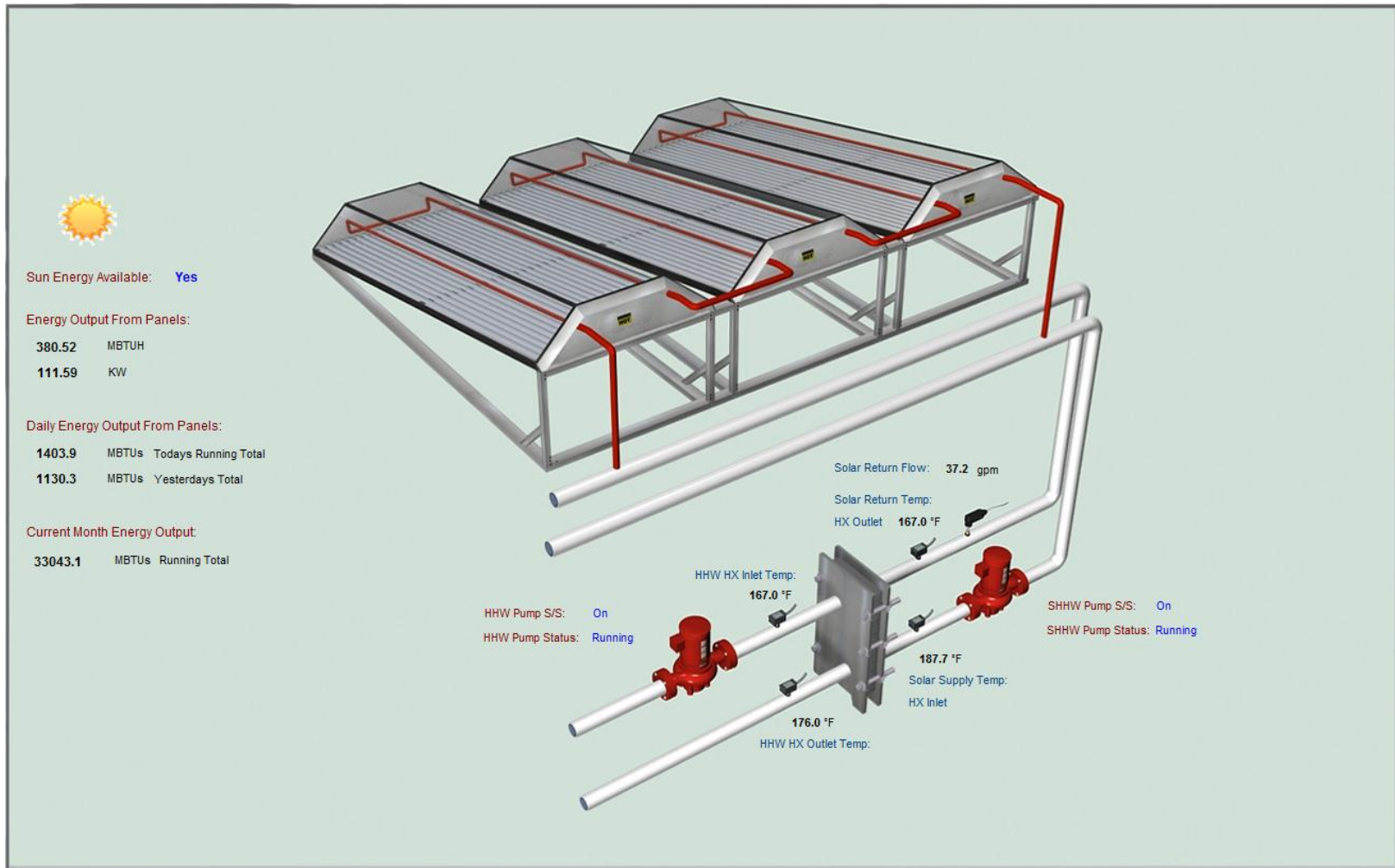


## Monitoring Equipment

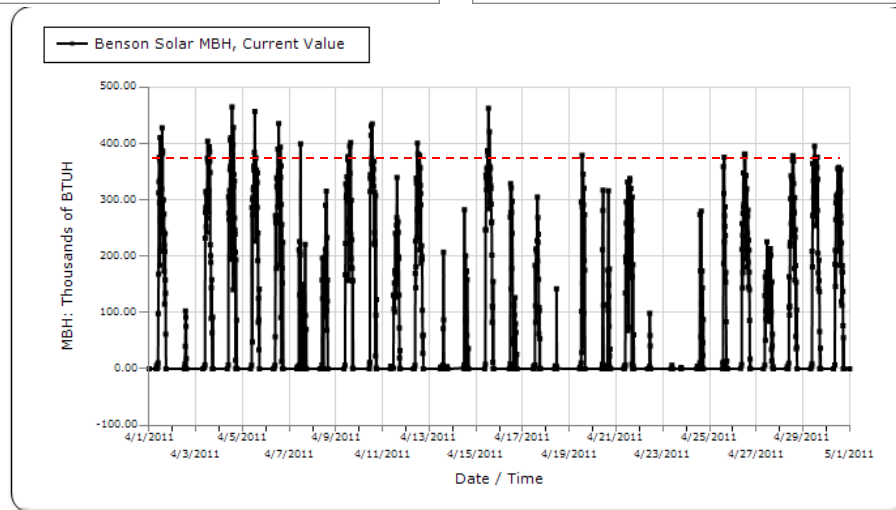
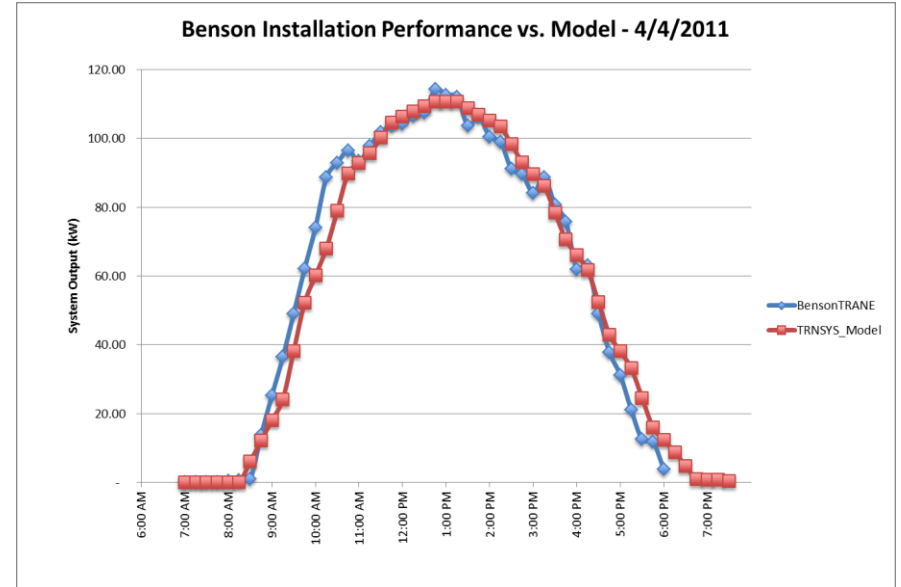
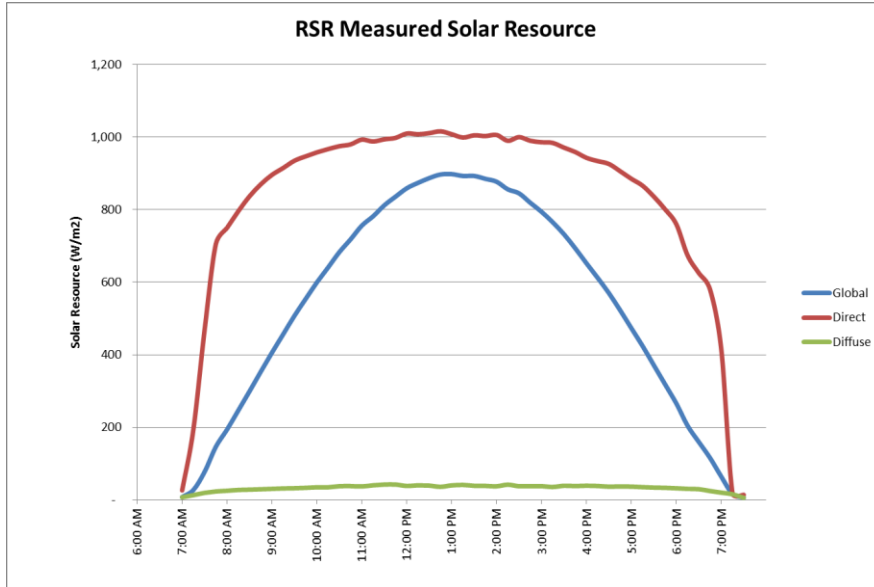




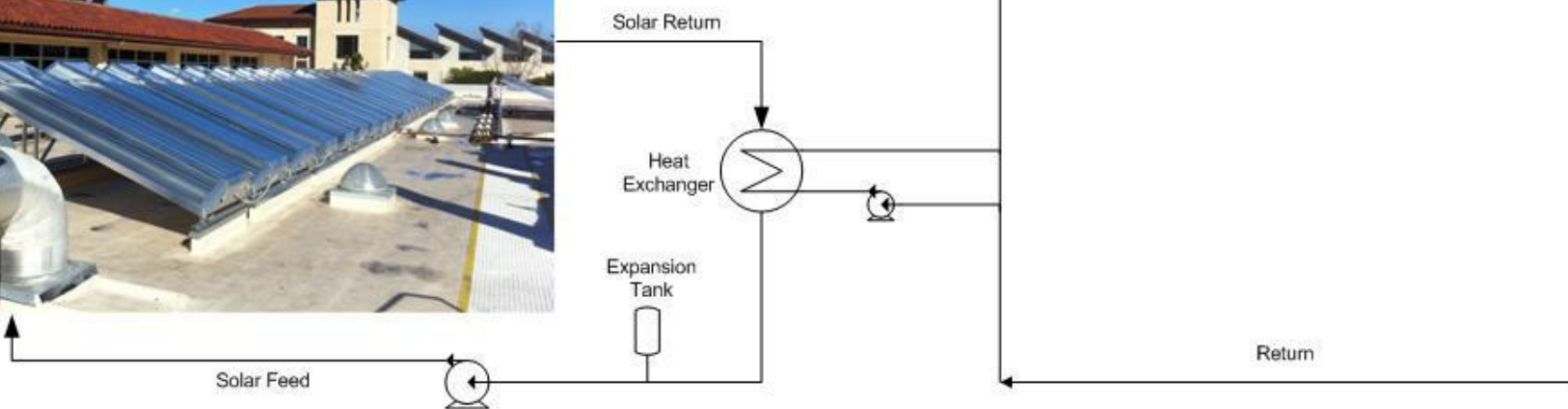
# SCU Energy Metering



# SCU Performance

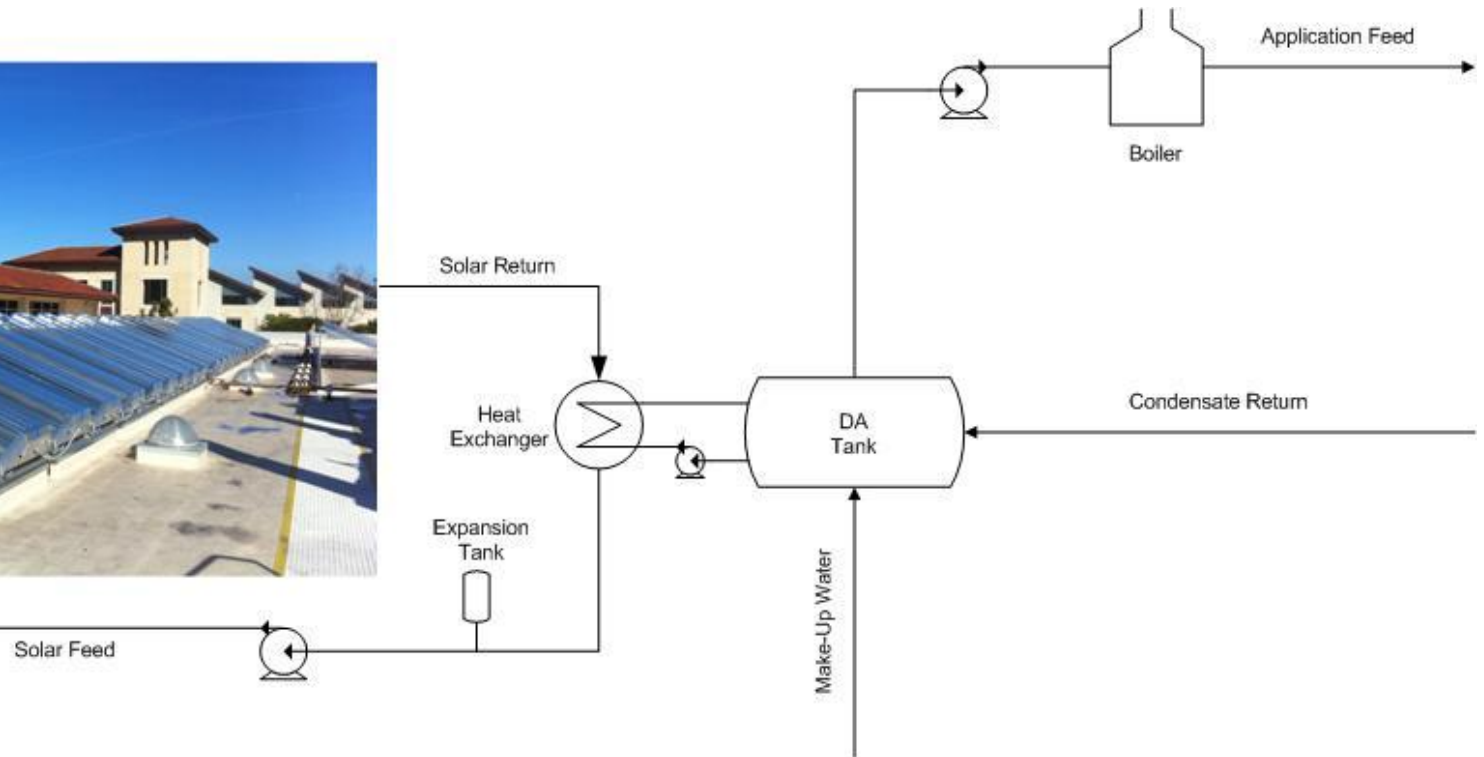


# SCU Benson System Schematic

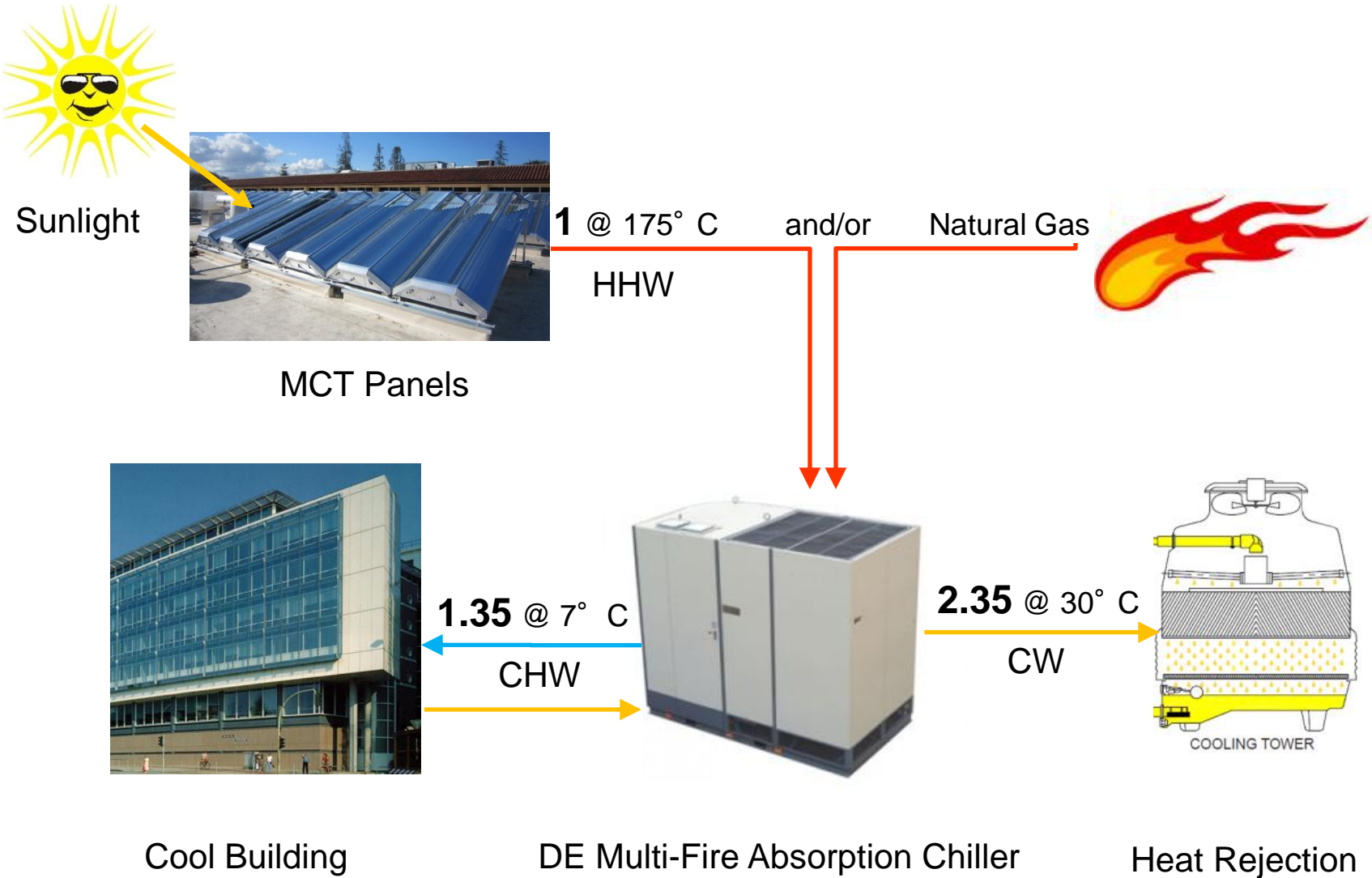




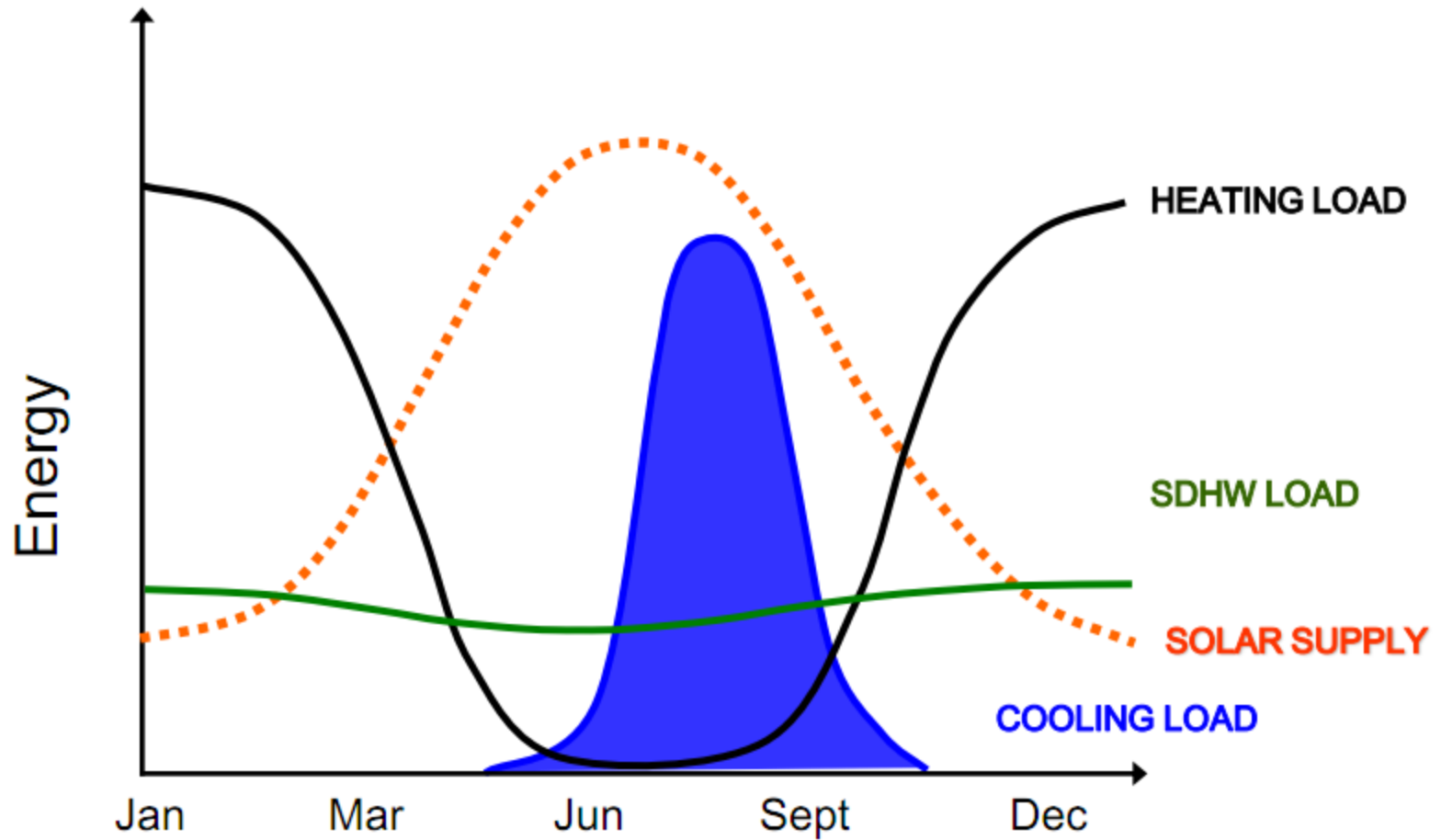
# Industrial Process Heat Applications



# HHW, CHW and CW with Solar Thermal Panels

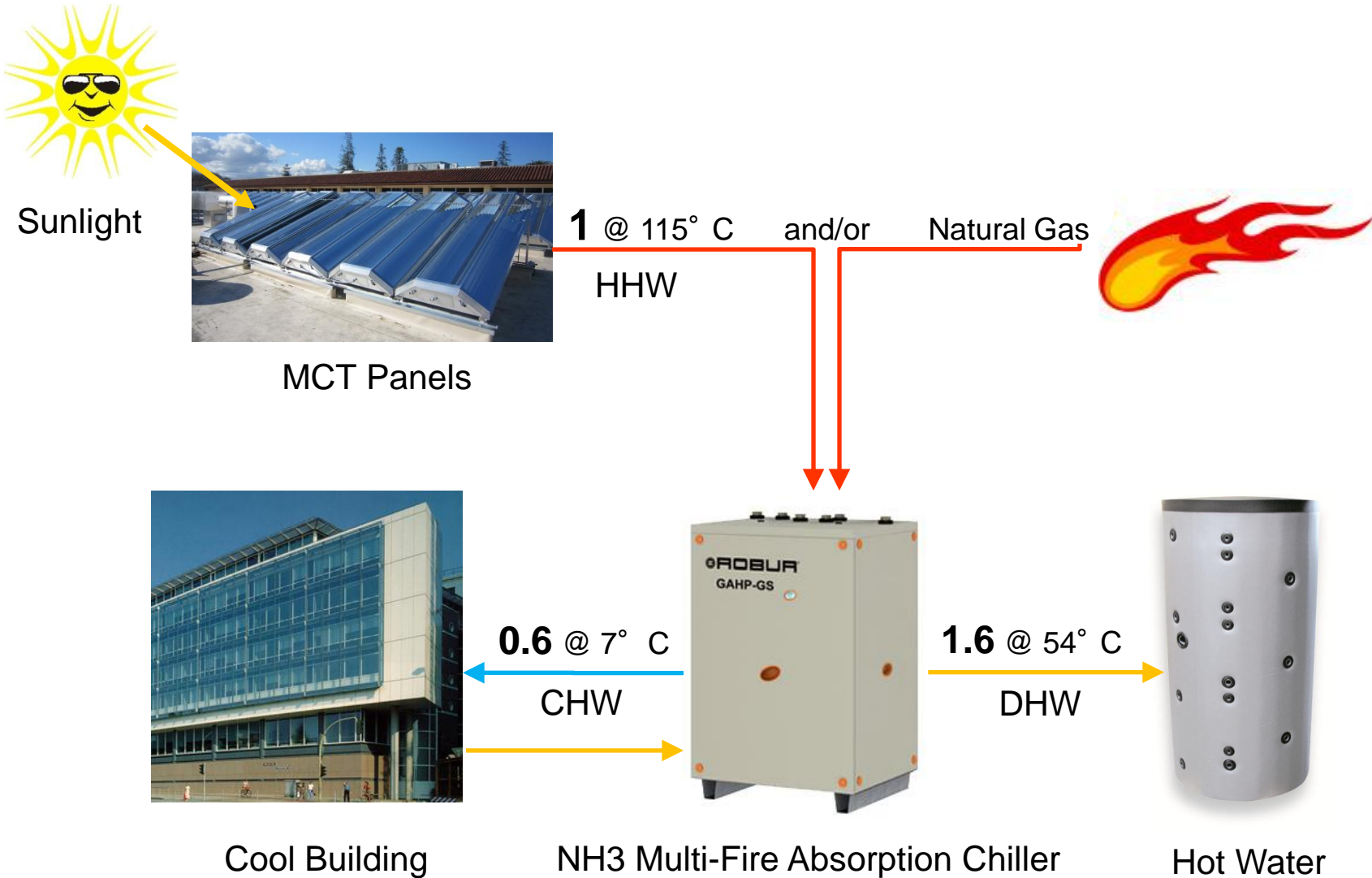


# Solar Cooling Load Correlation

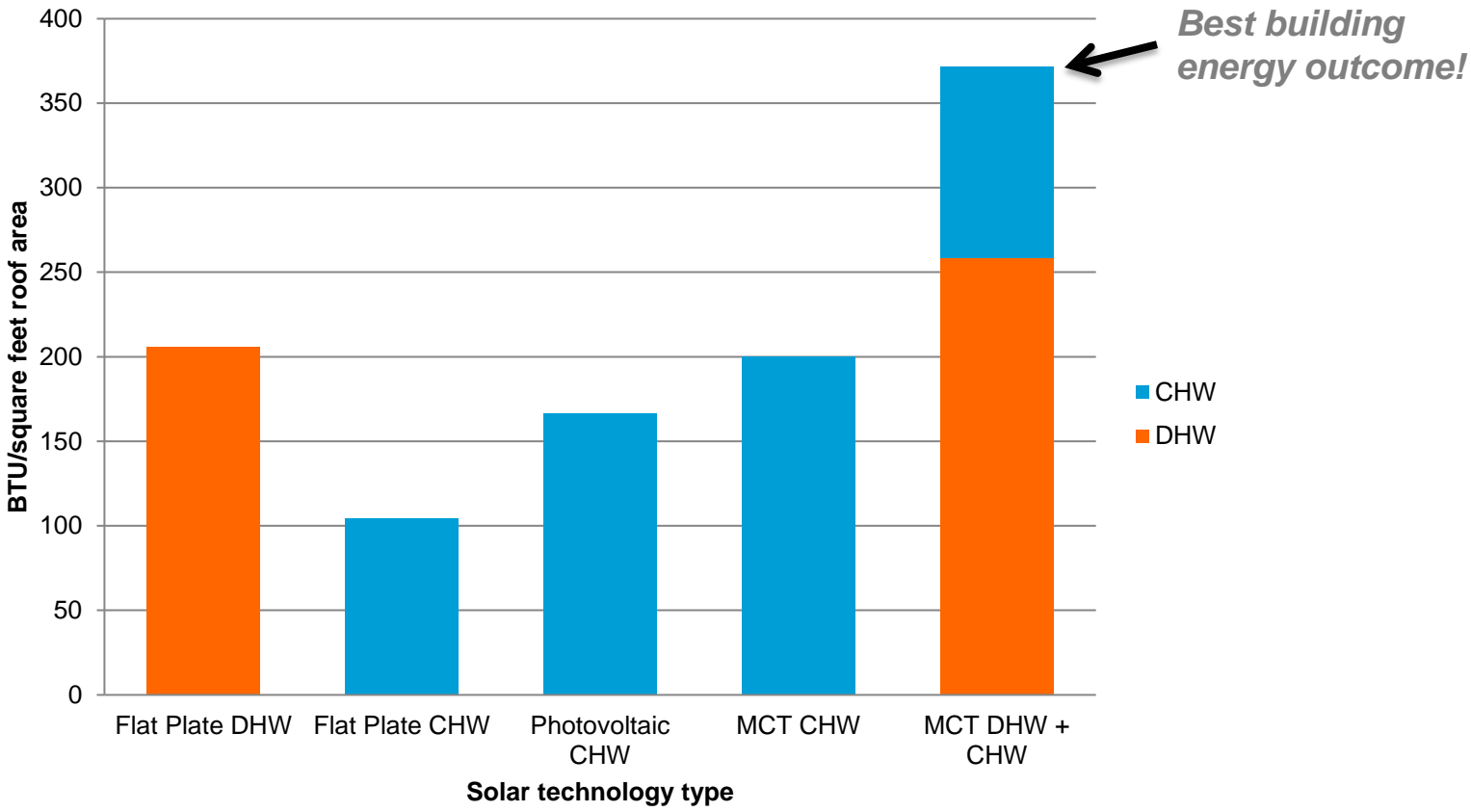




# HHW, CHW and DHW with Solar Thermal Panels



# Rooftop solar energy yields for the building



1000W/global, 850W/DNI solar resource



# Opportunity Summary

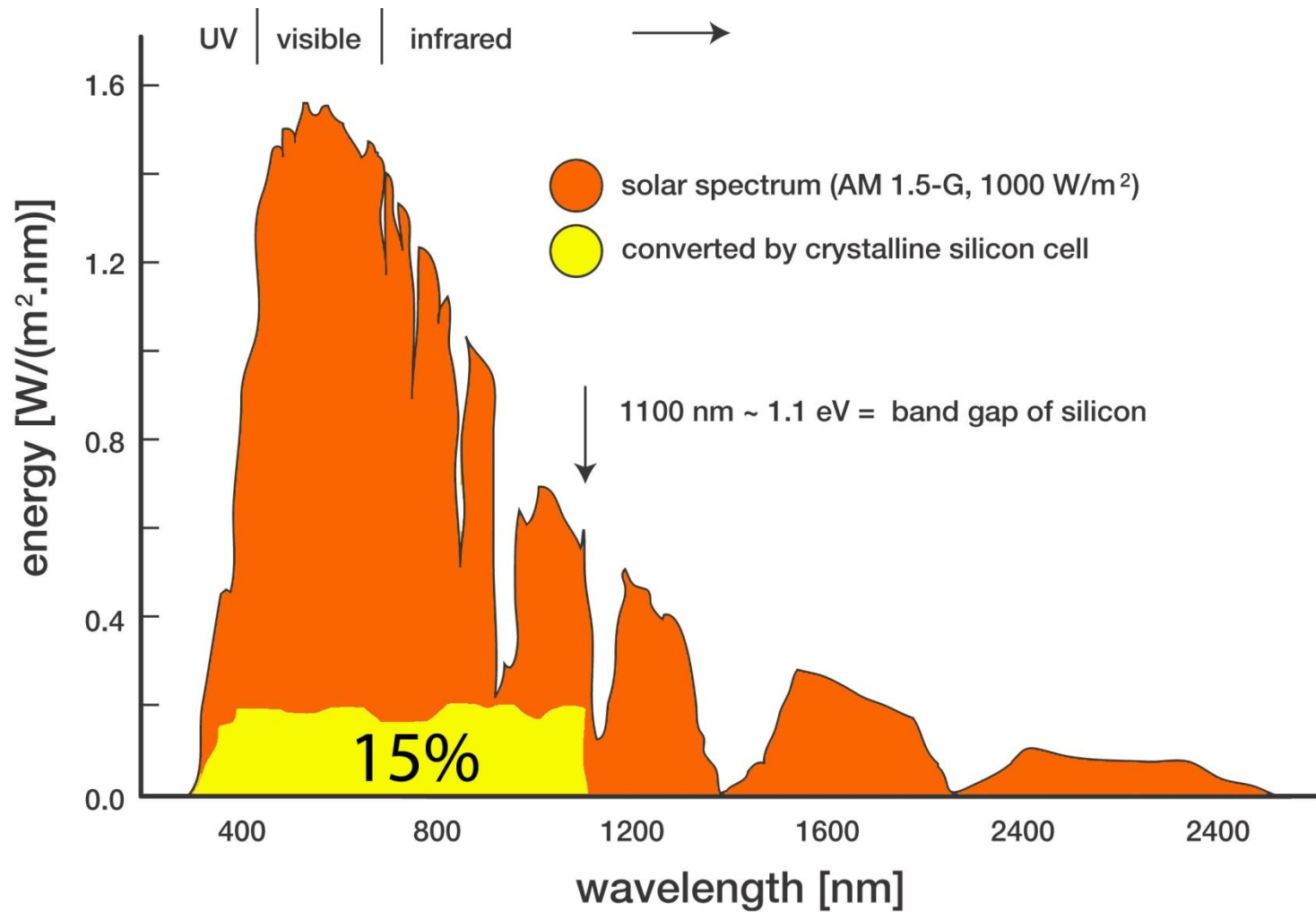
- Three market segments identified for Chromasun MCT product

Segment A	Segment B	Segment C
<b>Process Heat Applications</b>	<b>Solar Heat Pump Applications</b>	<b>Hybrid Applications</b>
<ul style="list-style-type: none"><li>• Hot Water</li><li>• Heating Hot Water</li><li>• Steam</li></ul>	<ul style="list-style-type: none"><li>• Chilled Water</li><li>• Hot Water</li></ul>	<ul style="list-style-type: none"><li>• Electricity</li><li>• Hot Water</li></ul>
<b>Large market</b>	<b>Undeveloped market</b>	<b>Unknown market</b>
<b>Existing Solar Channel Partners</b>	<b>Inexperienced Channel Partners</b>	<b>Existing Solar Channel Partners</b>

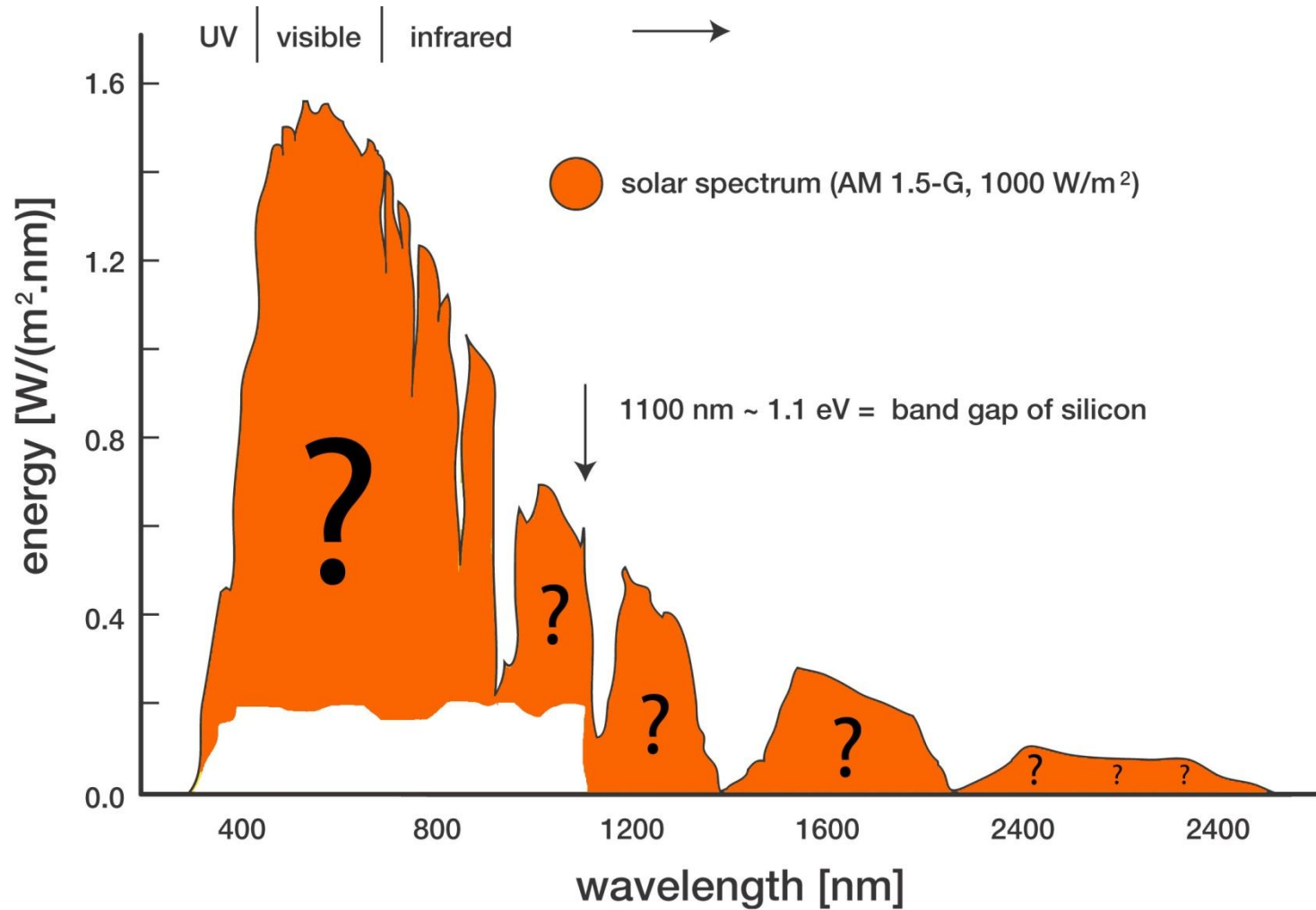




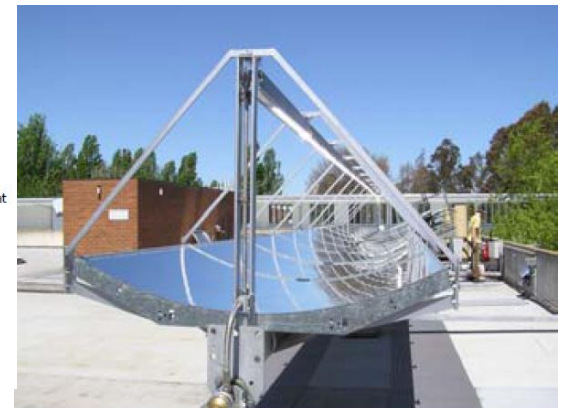
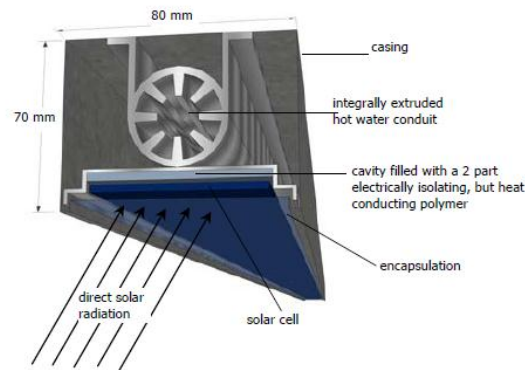
# AM 1.5 Solar Spectrum – PV Capture



# AM 1.5 Solar Spectrum - Unharnessed



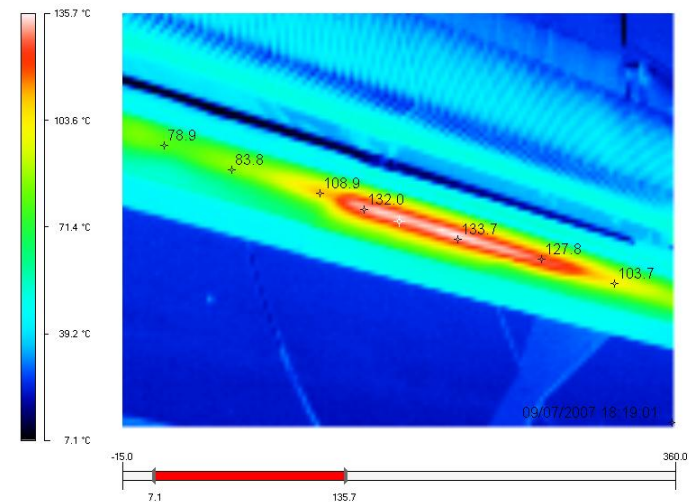
# Australian National University – CHAPS (2004)



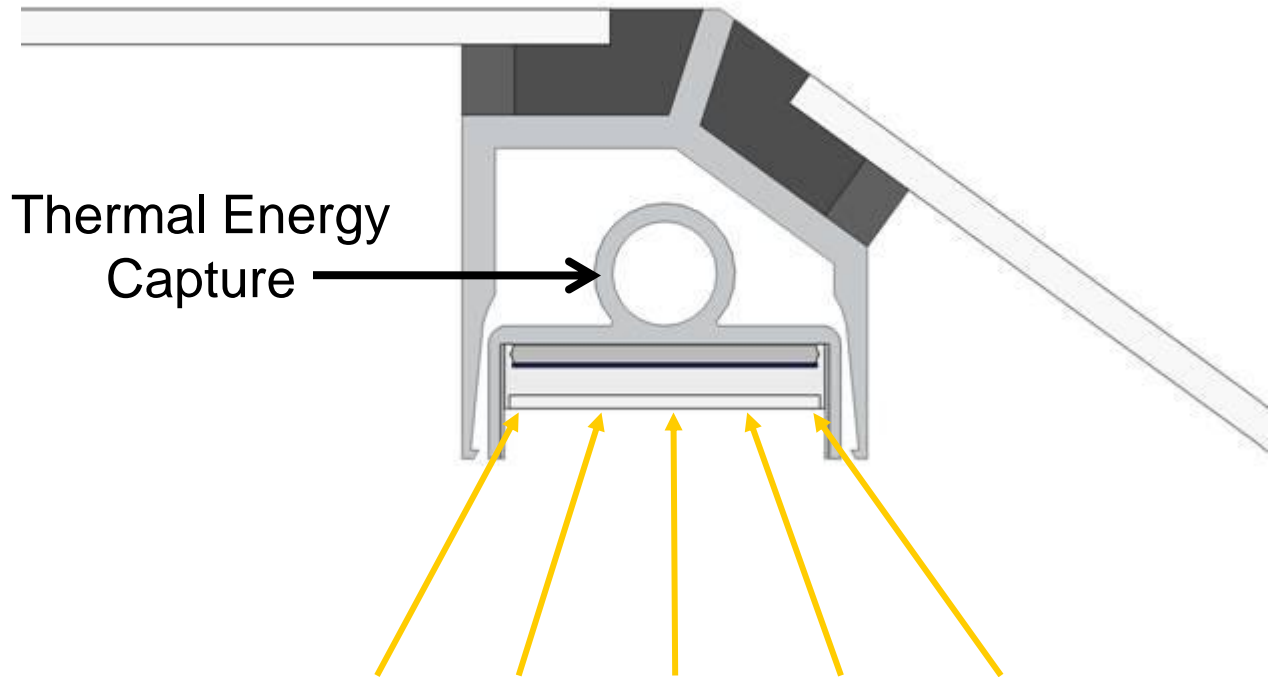
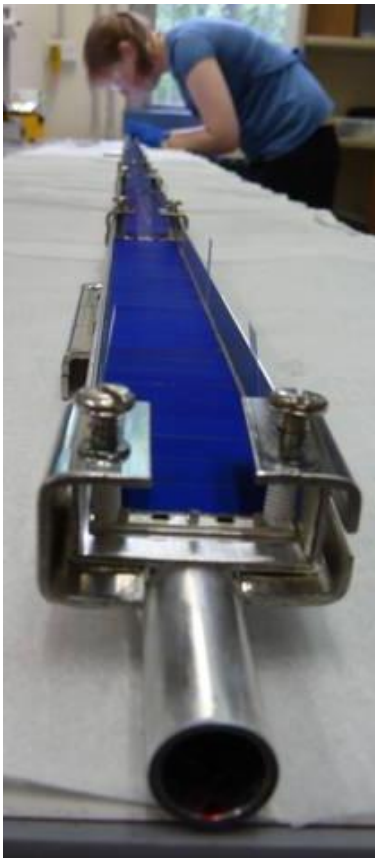


# Euclides II

IDEOCONTE Project test sites:  
Ferrara (Italy), Stuttgart  
(Germany) and Madrid (Spain)



## Concentrating PV receiver option for Electrical and Thermal Output (<math><90^{\circ}\text{C}</math>)

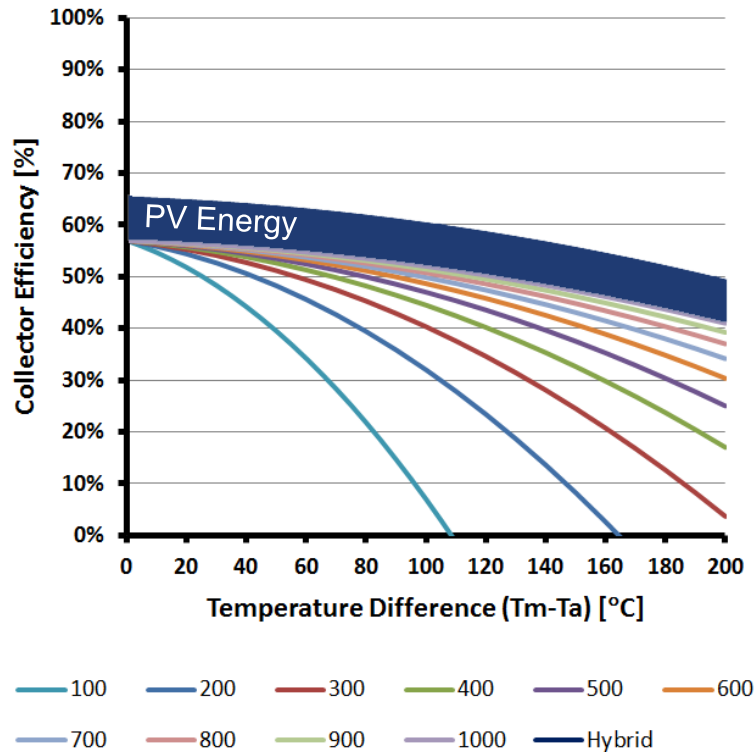


15% PV + 50% Thermal = 65% Total Yield  
Diffuse Light is available for Day-lighting

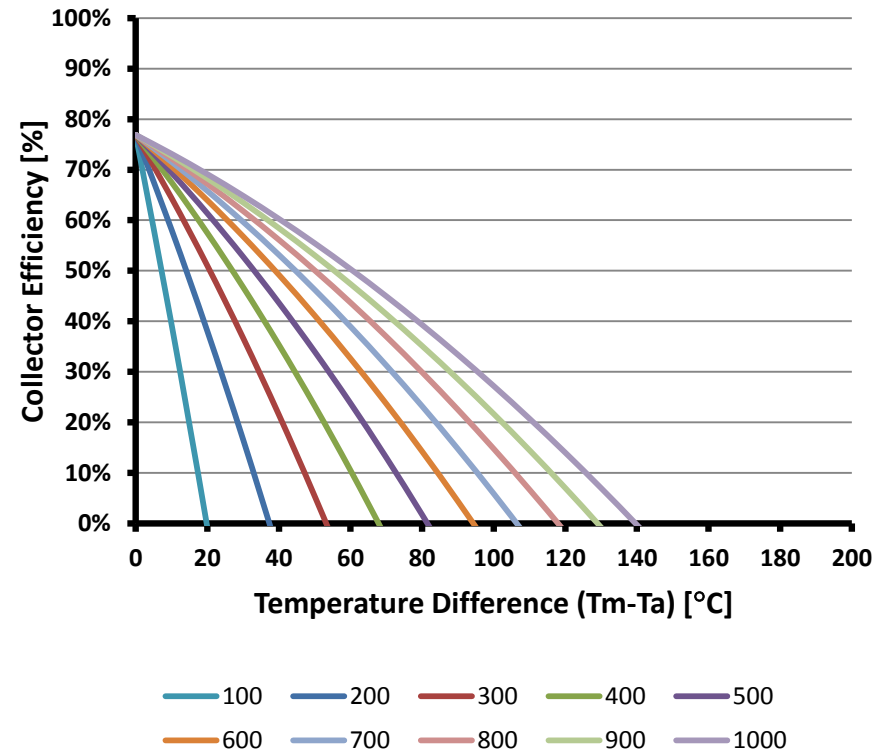


# MCT-Hybrid Efficiency

## Solar Concentrator Efficiency



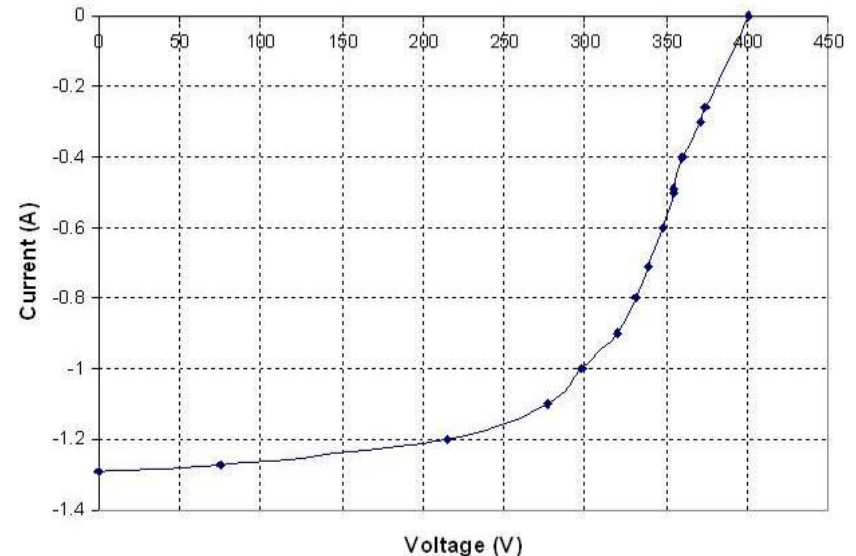
## Flat Plate Collector Efficiency



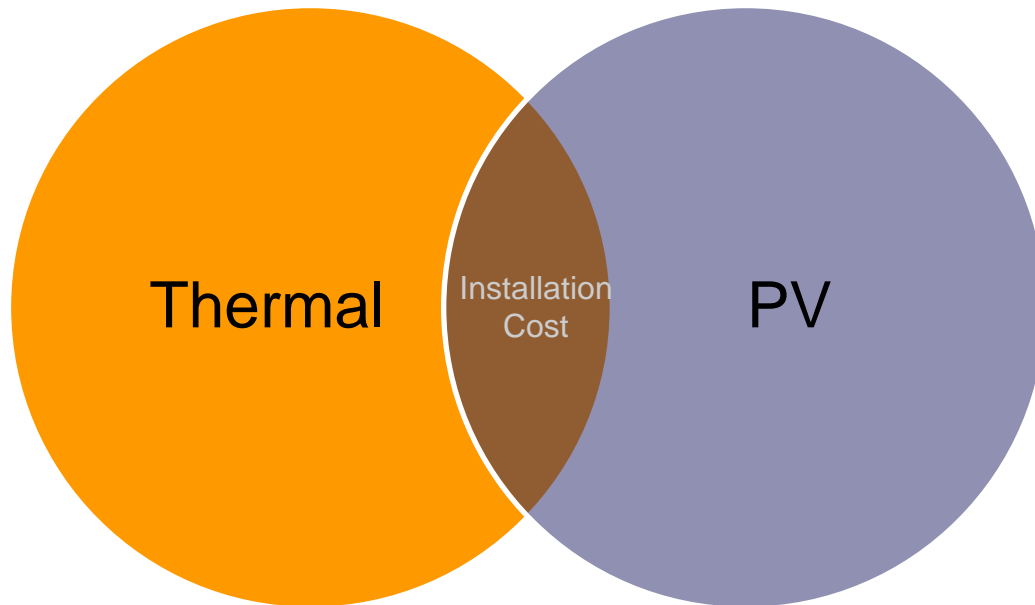


# MCT-Hybrid Initial results

- Electrical output 305 W
- Thermal output 1580 W
- >65% Solar Harvest
- High Voltage / Low Current design minimized losses and increases inversion efficiency
- Shipping in 2012
- Won \$3.2M Grant in conjunction with the CSIRO, ANU and UNSW to develop high temperature hybrid (150°C/300°F)



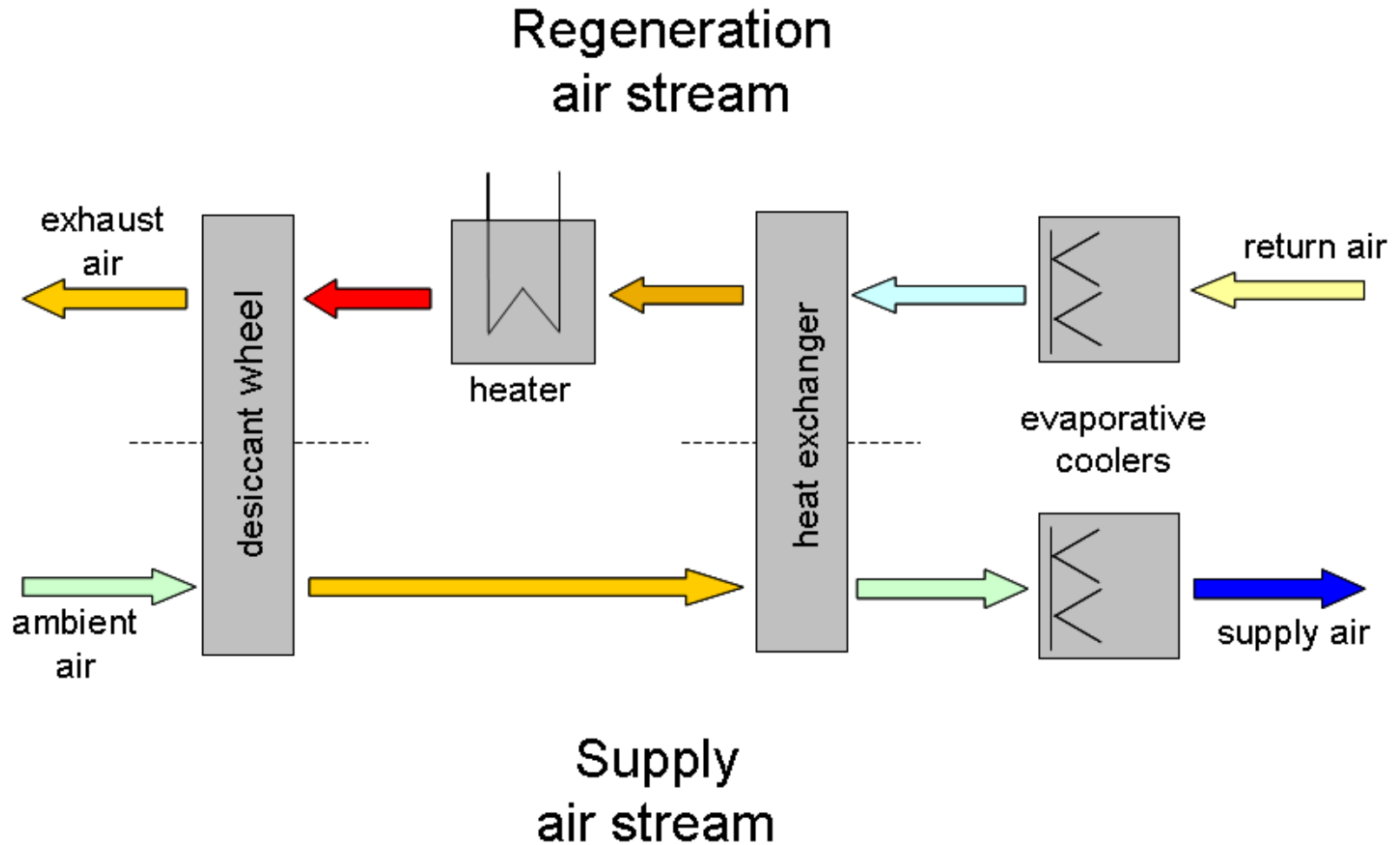
# Shared Integration Cost



Technology cost is only 50% of the total system cost so coupling the installation of PV and Thermal together reduces the total installed cost (\$/W) and ultimately LCOE



# Low Temperature Solar Cooling

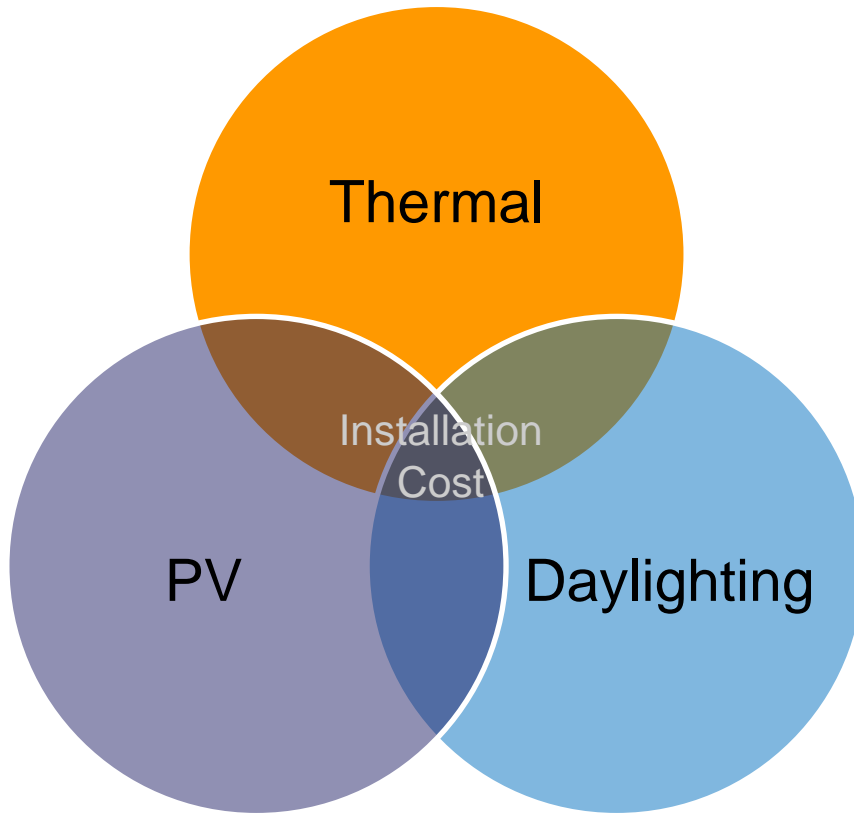




# Day-lighting MCT



# Shared Integration Cost



Integration cost could further be shared with the installation cost allocated for day-lighting





# Chromasun's Global Approach to Testing



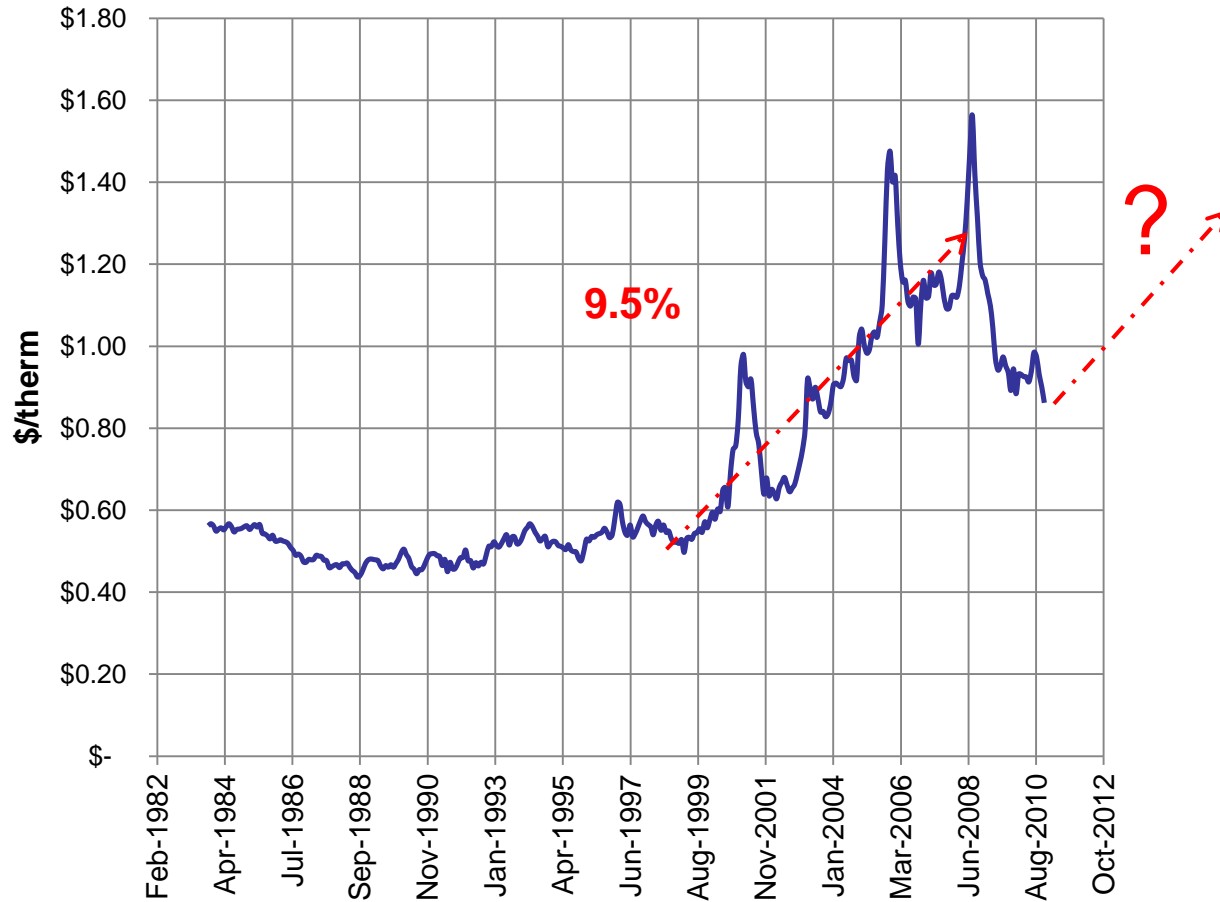




- Tested to Standard 600 for Solar Concentrators
- Exposure tested at 179°C (354°F) which makes it the highest temperature rated solar collector in the USA



## Historical Natural Gas Price



- 30% Federal ITC
- 100% Bonus Depreciation
- CSI Thermal Rebate



# Chromasun 10MW / Annum San Jose facility



# MCT Summary

- Chromasun MCT is based on existing CSP technology and over a decade of experience in large-scale solar
- 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 a 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
- Aperture efficiency will reach 75% by the end of 2011
- Hybrid MCT to be showcased in Q4 2011 (Funding round in Q3/Q4)
- Project financing available through Chromasun





*THANK YOU*



CHROMASUN

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