Advanced Solar Thermal and Natural Gas

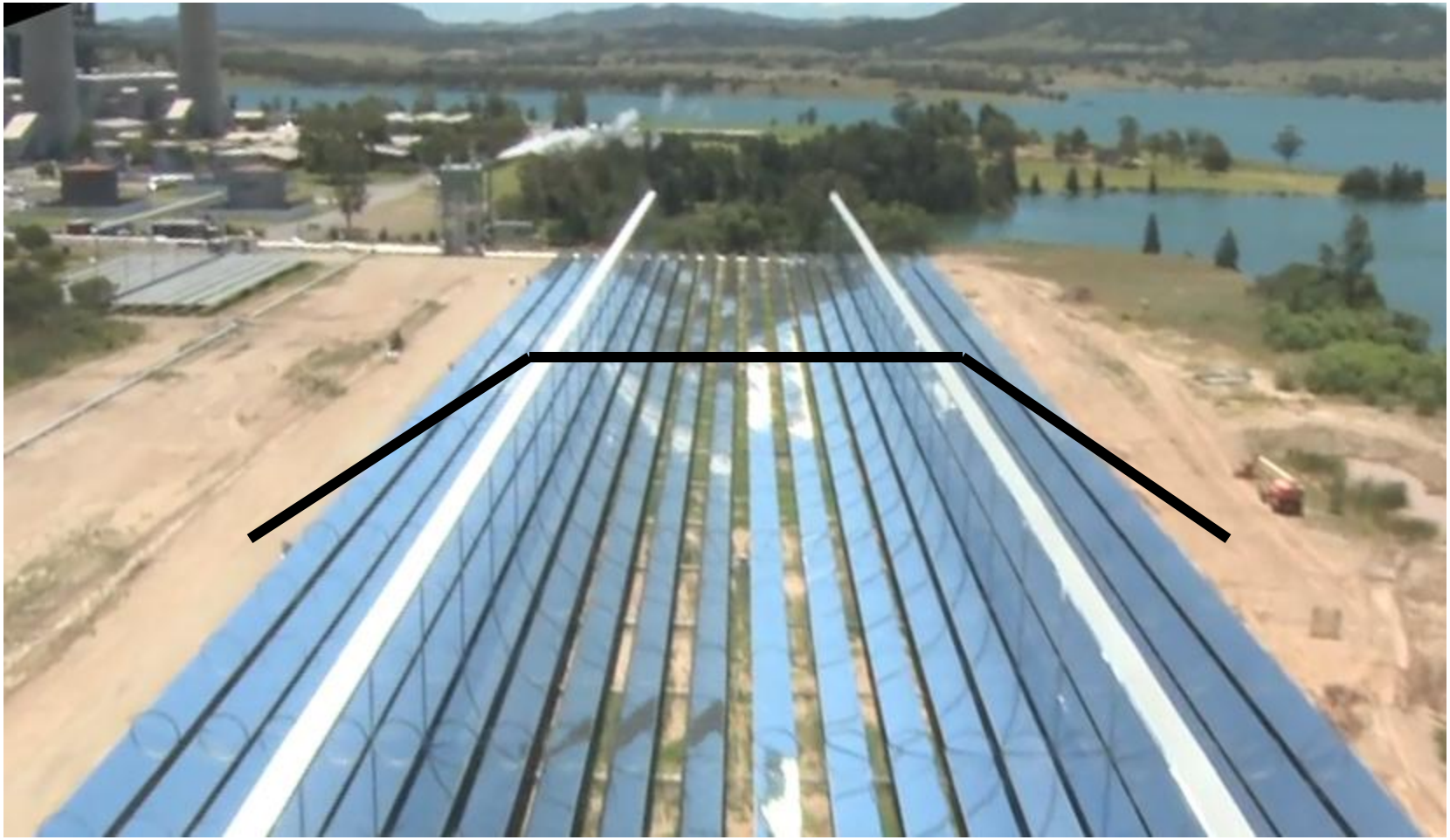
Peter Le Lievre

"Natural Gas and Southern California's Renewable Energy Future"

CHROMASUN

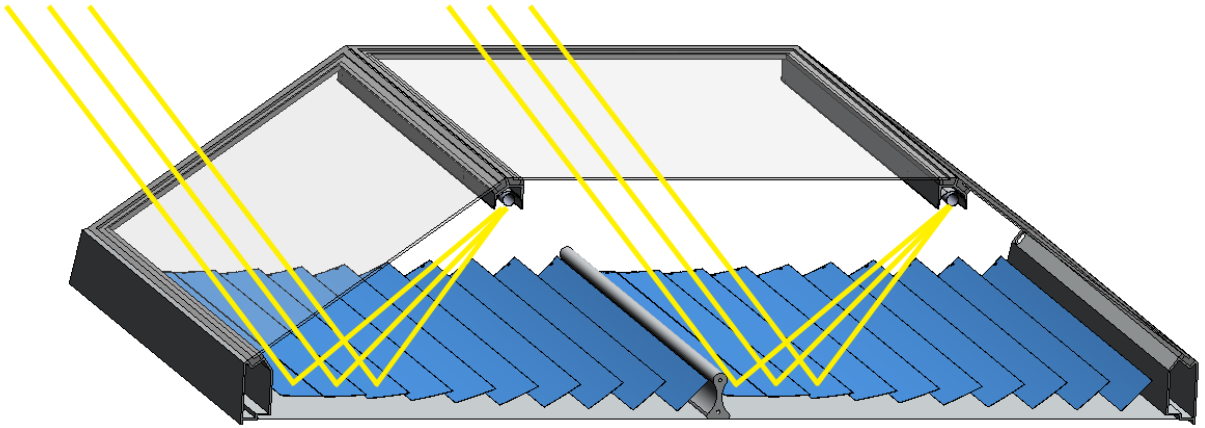
Chromasun Background

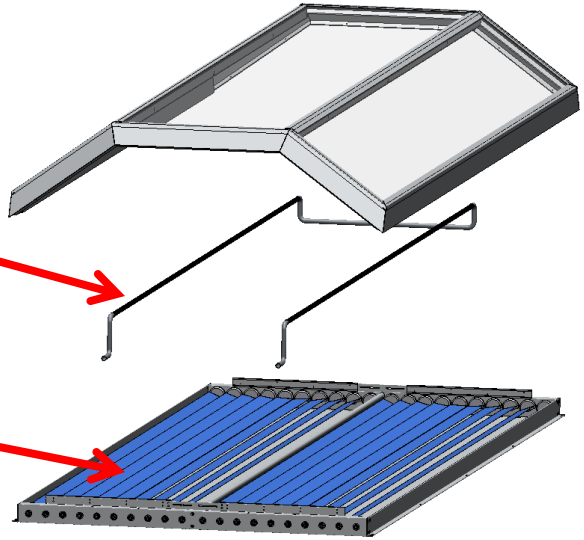
2008 Chromasun Formed




Micro-Concentrator (MCT)
And made it 100X smaller!

MCT Exploded View





Receiver Pipe
(SS 304 A213 Tube)

Parallel Mirrors

Chromasun's Global Testing Partners

Santa Clara University

Southern California Gas

Pacific Energy Testing

GE - Bangalore

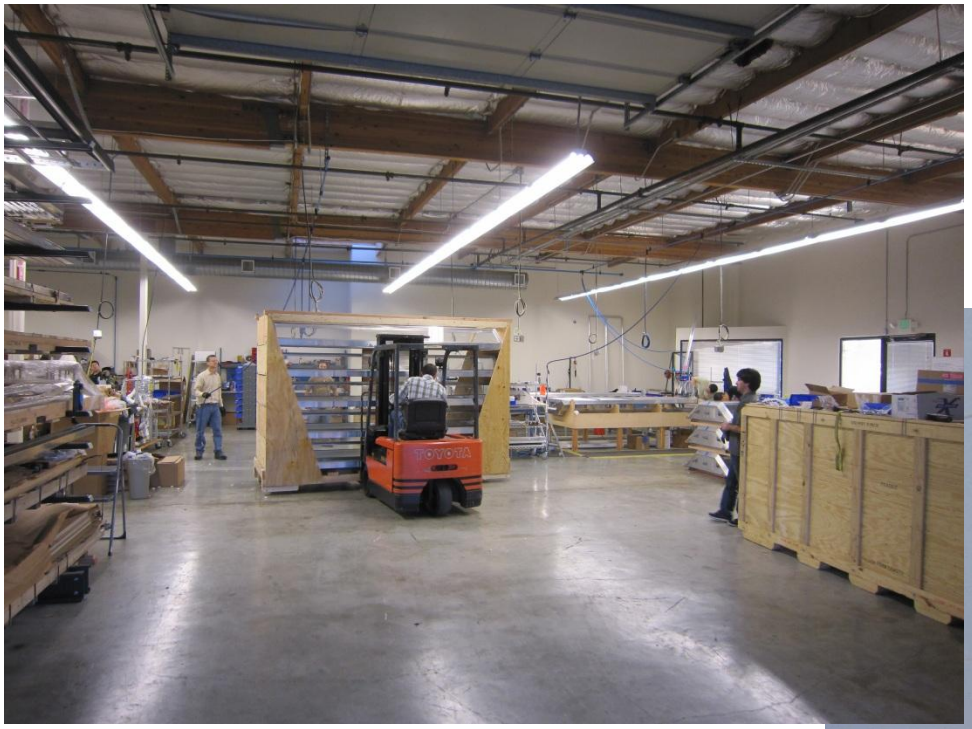
Australian National University

GE - Munich

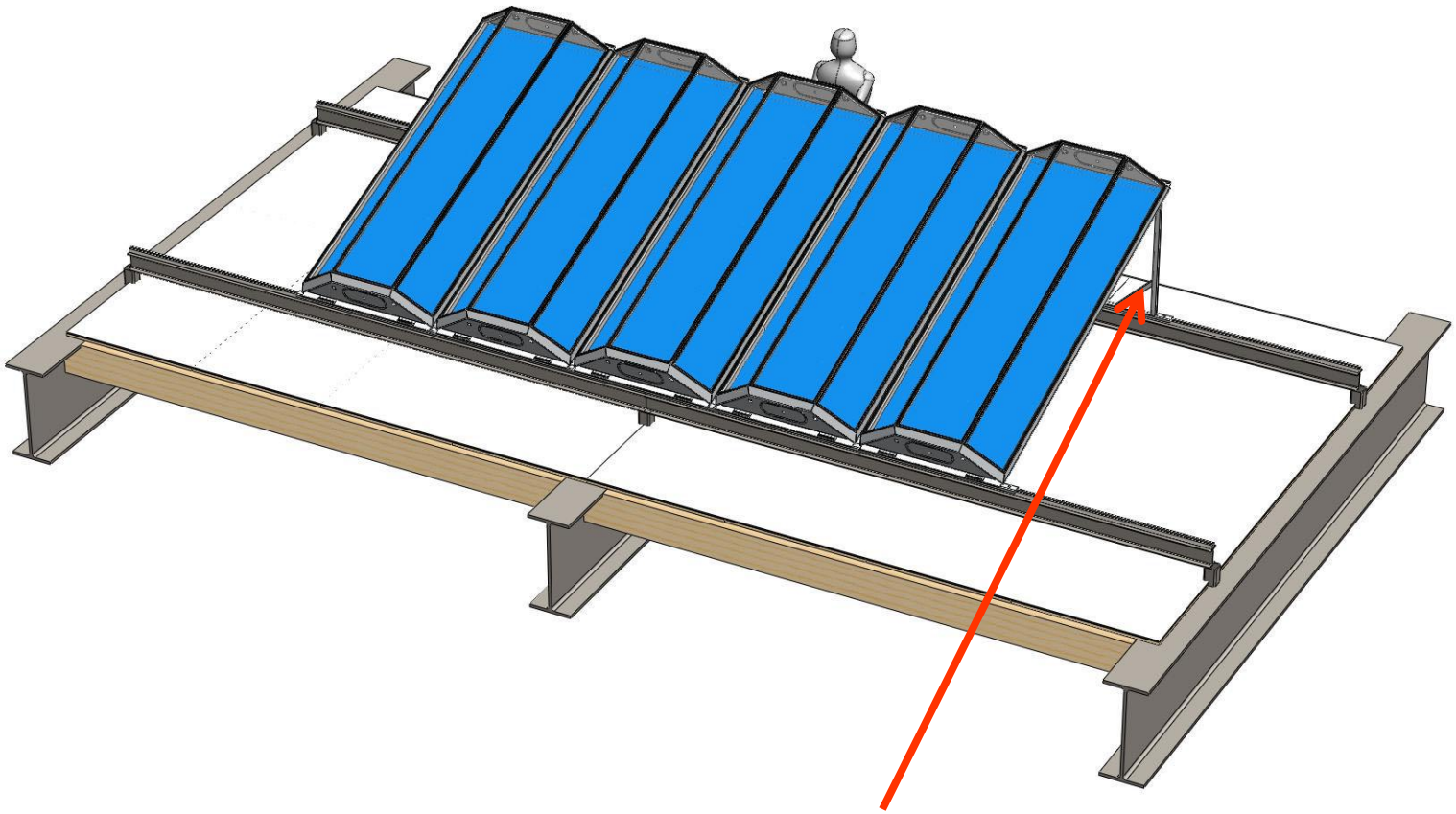
Chromasun MCT – Highest temperature rated panel

- Certified to OG-100 Standard 600 Exposure tested at 179ºC (354ºF)
- Highest temperature rated solar collector in the USA

Chromasun 40MW annum San Jose facility



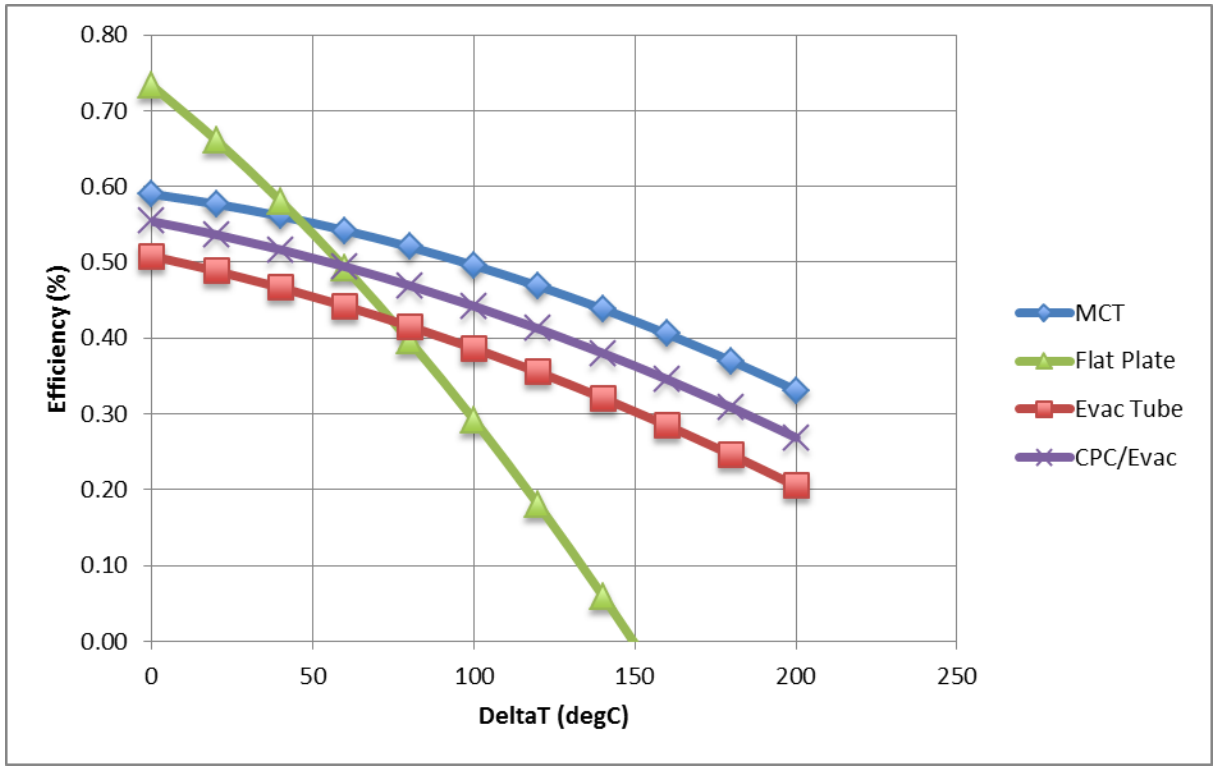
Chromasun MCT – Simple Installation



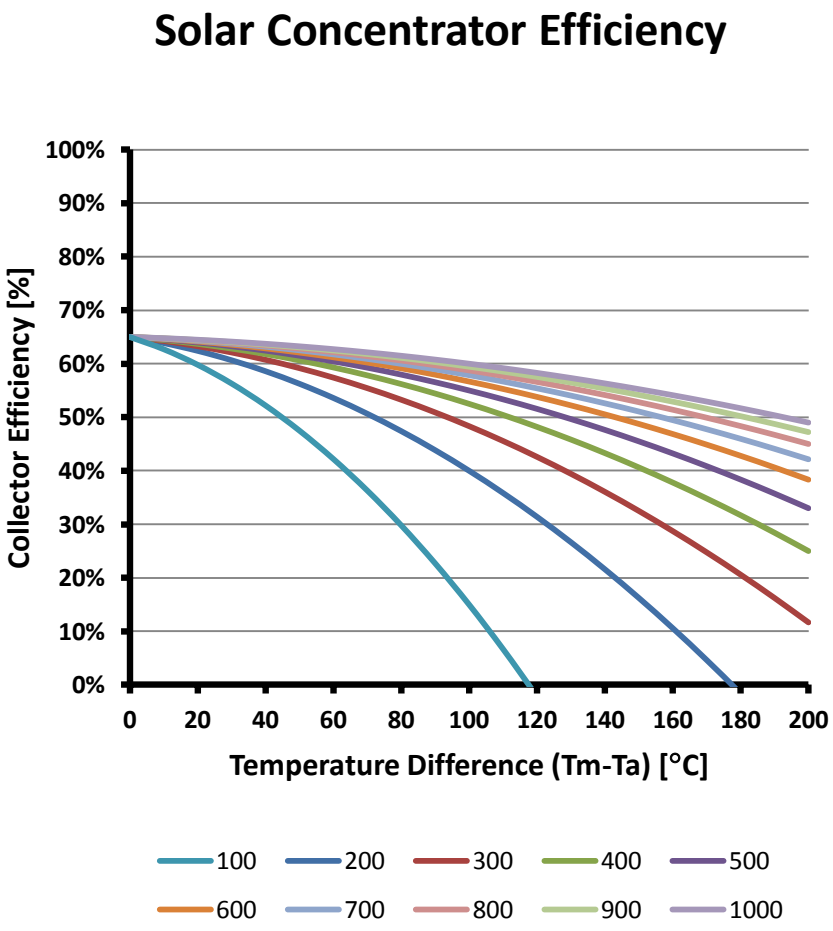
MCT is self-supporting and has an integrated stand.
Technology can be deployed quickly and into remote areas

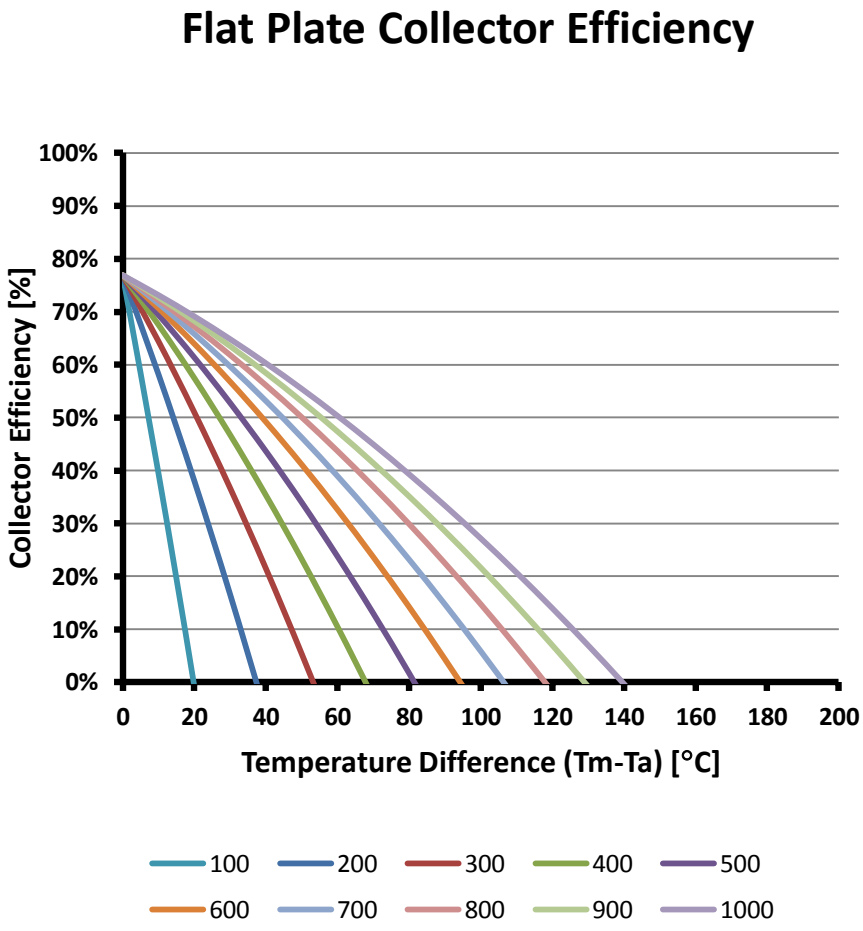
Chromasun MCT – Simple Installation

Chromasun MCT – Advantages of concentration



Chromasun MCT – Advantages of Concentration

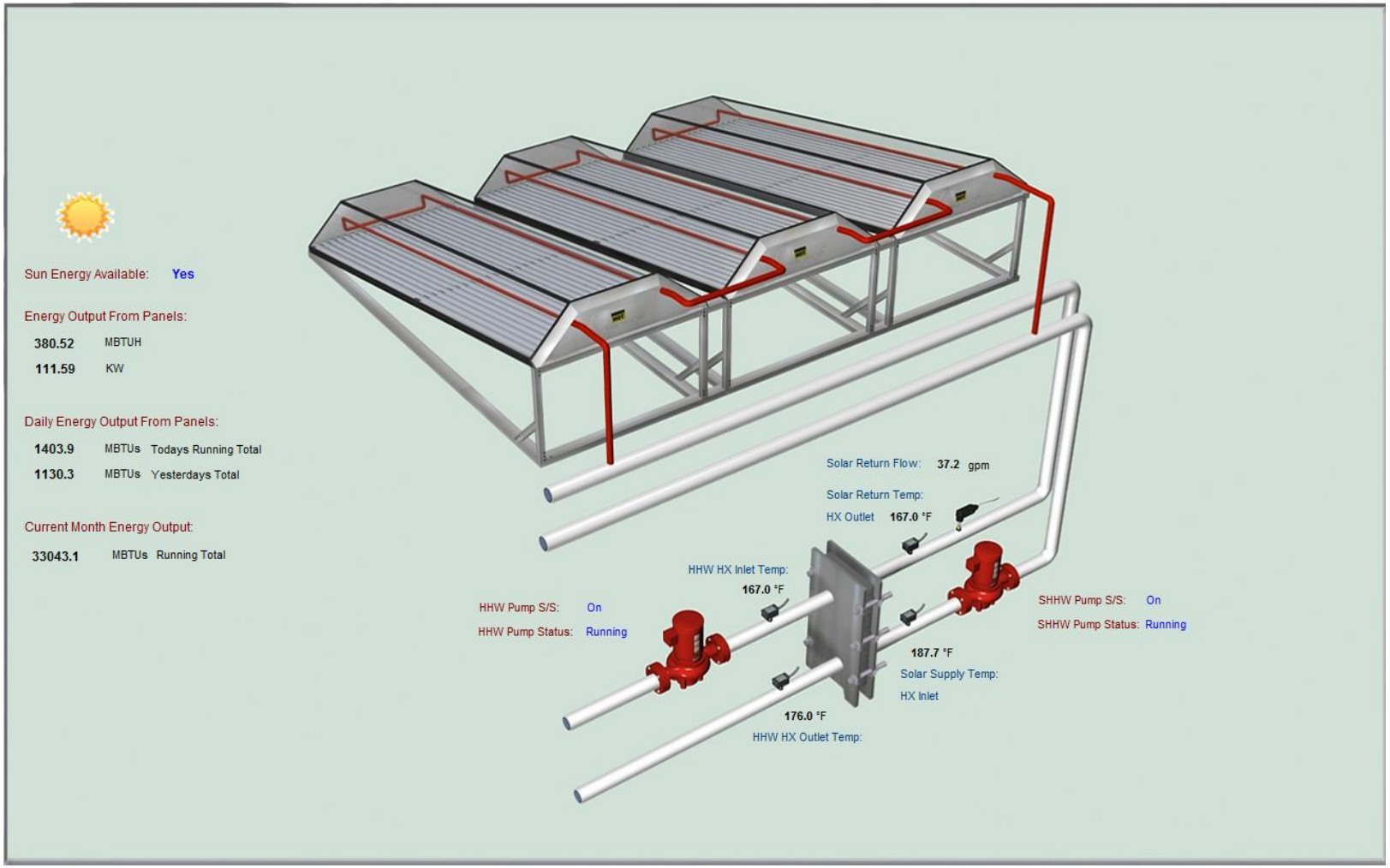




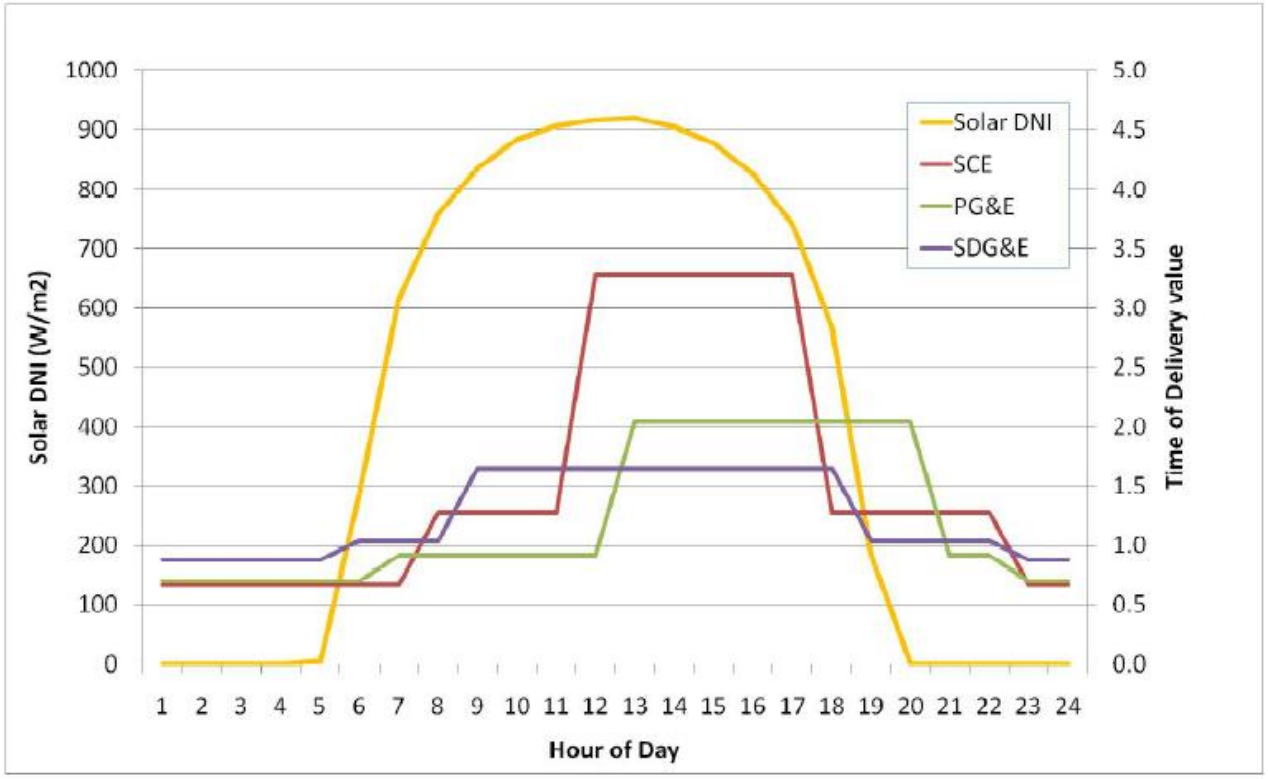
Santa Clara University Benson Showcase Project

MCT Use: Boiler Feedwater Preheat (gas supplementation)

BTU - Energy Metering

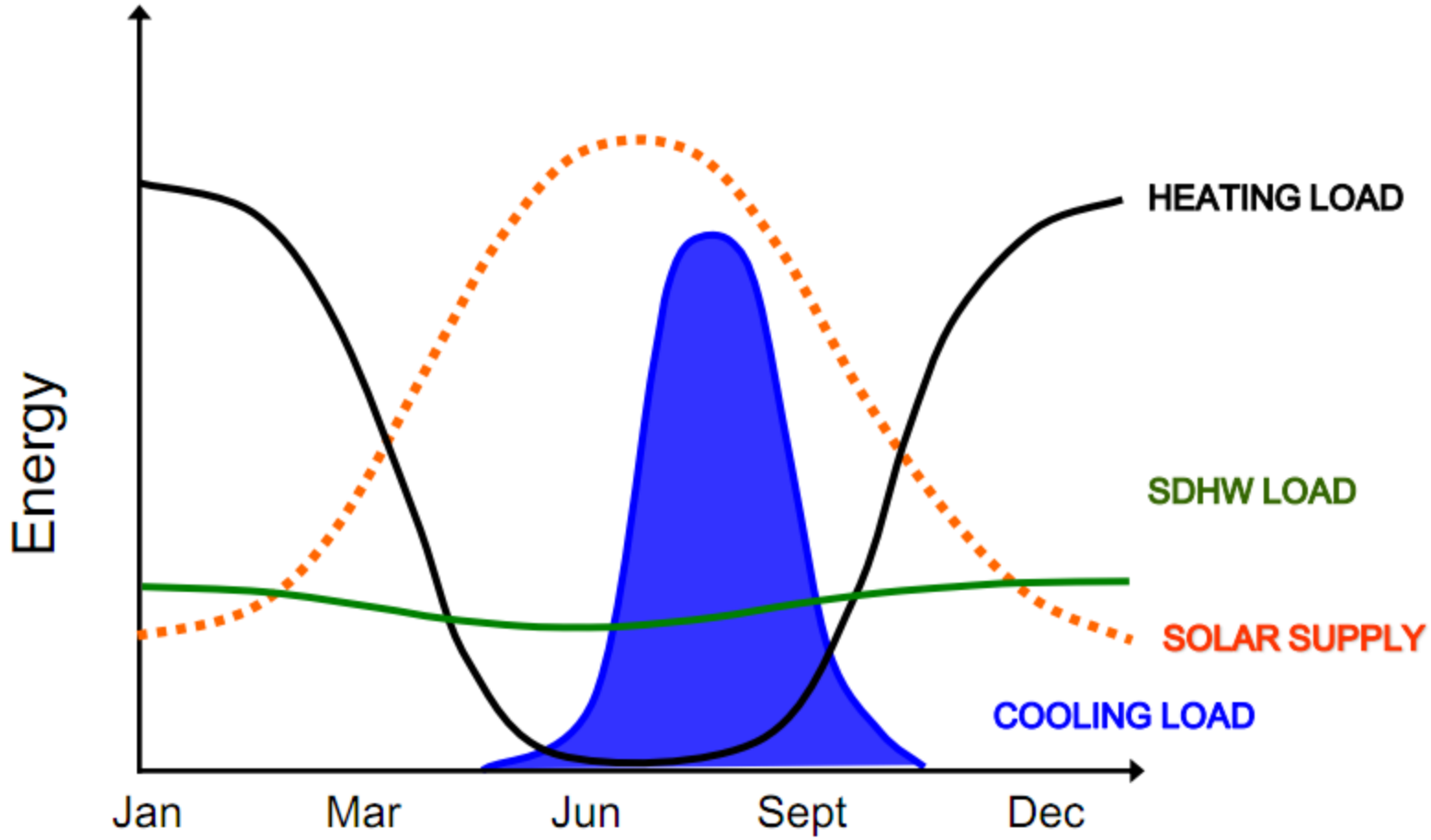


Opportunity: Grid Peaking correlates with Solar Resource



There is strong correlation between when electricity is peaking and the solar resource. Utilities value the energy greater during these times

MCT Use - Solar Cooling Load Correlation



HHW, CHW and CW with Solar Thermal Panels/Natural Gas

Sunlight

MCT Panels

1 @ 175° C

HHW

and/or

Natural Gas

Cool Building

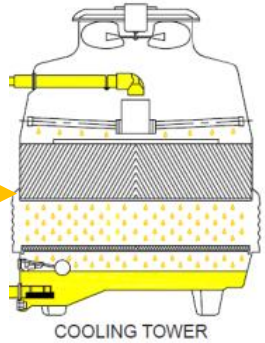
1.35 @ 7° C

CHW

DE Multi-Fire Absorption Chiller

2.35 @ 30° C

CW



Heat Rejection

Opportunity: Low gas prices and high peaking power prices

Gas Fired Chiller Comparison with Electric Chiller		
Gas Fired Thermal Chiller		
Chiller COP	1.35	
Gas Price	$0.85	therm
CHW Price	**$6.30**	MMBTU
Electric Chiller		
Chiller COP	4.00	
Electricity Price	$0.13	kWh
CHW Price	**$9.52**	MMBTU
Difference	**66.12%**	

HHW, CHW and DHW with Solar Thermal Panels/Natural Gas

Sunlight

MCT Panels

1 @ 115° C

HHW

and/or

Natural Gas

Cool Building

0.6 @ 7° C

CHW

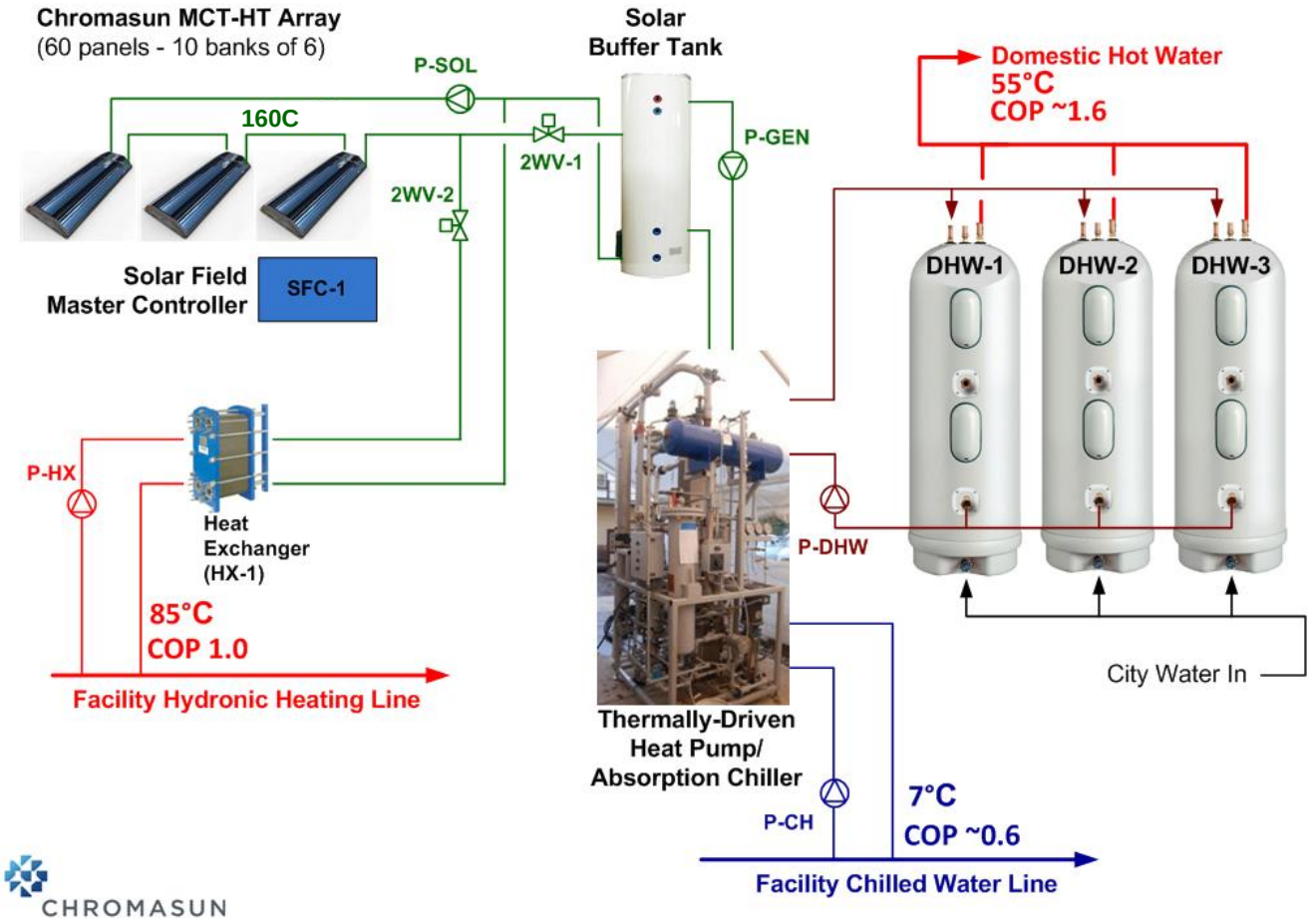
NH3 Multi-Fire Absorption Chiller

1.6 @ 54° C

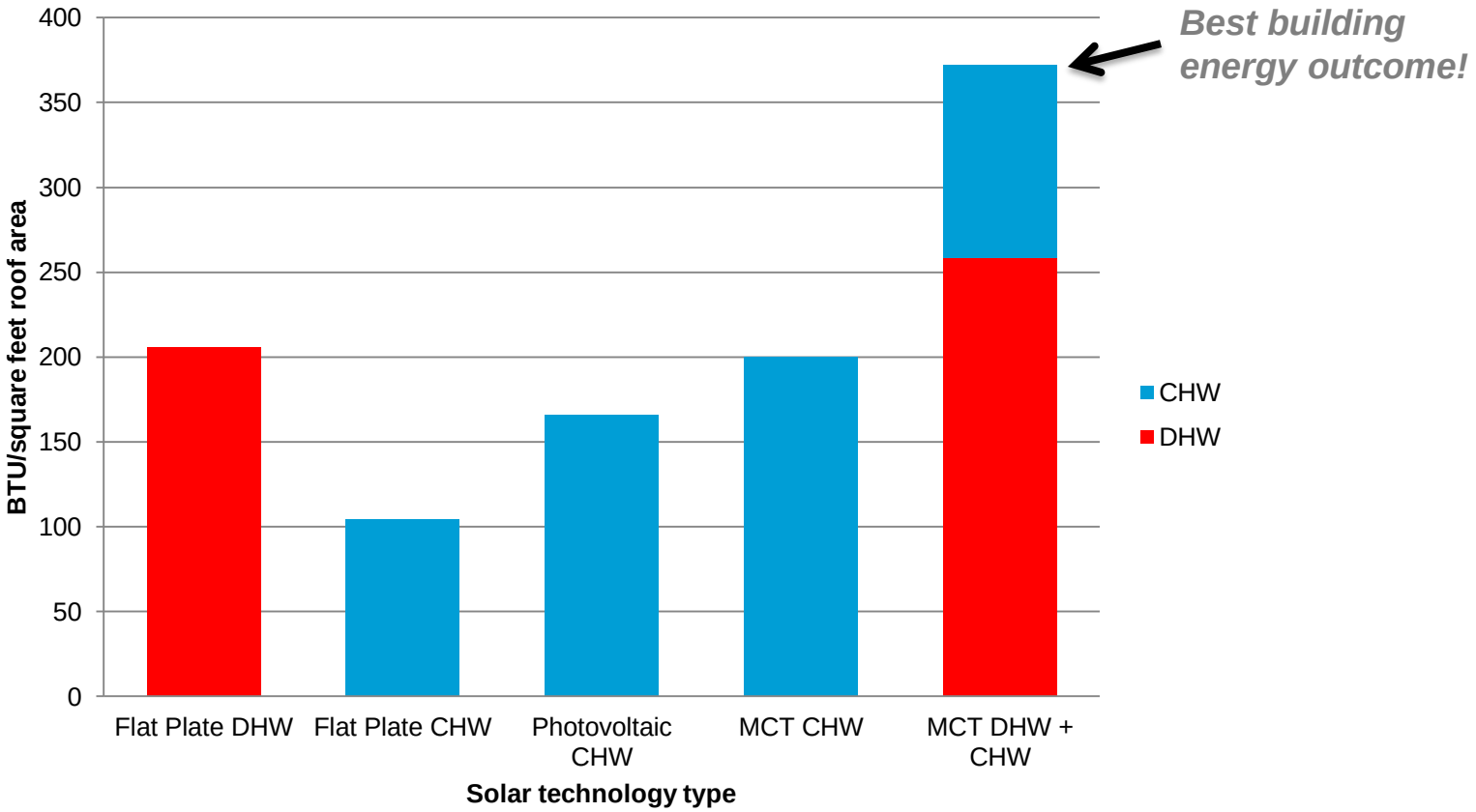
DHW

Hot Water

Phase 2: Benson Center Design



Rooftop solar energy yields for the building



1000W/global, 850W/DNI solar resource

Summary

- Chromasun MCT is an example a new generation of urban solar technologies
- High temperature solar thermal provides best building energy outcomes.
- Thermal heat pumps offer spectacular performance efficiencies
- Natural gas is the perfect supplement to these systems.
- With current state and federal policy settings, Chromasun MCT is cost effective.

THANK YOU

CHROMASUN

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