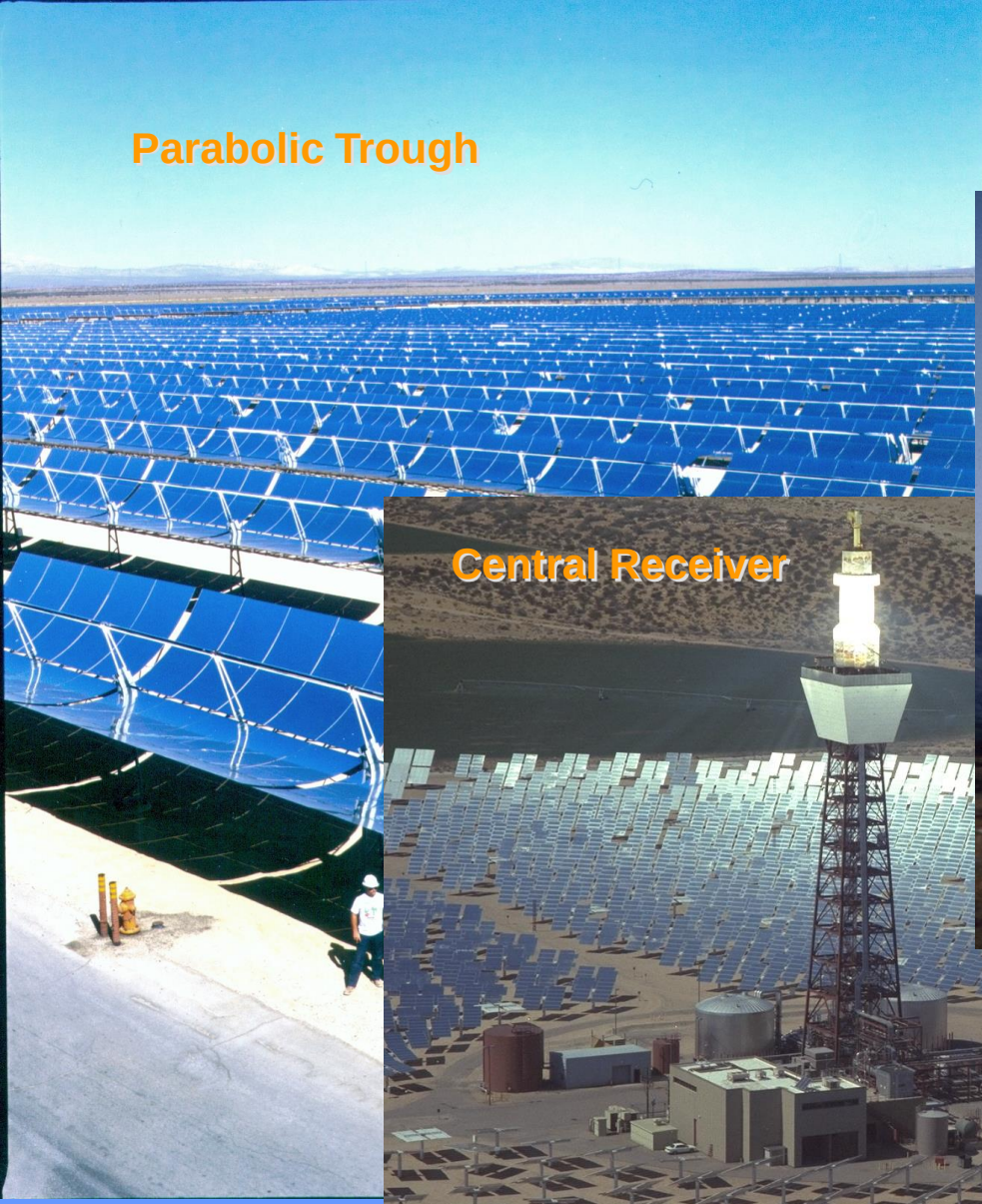
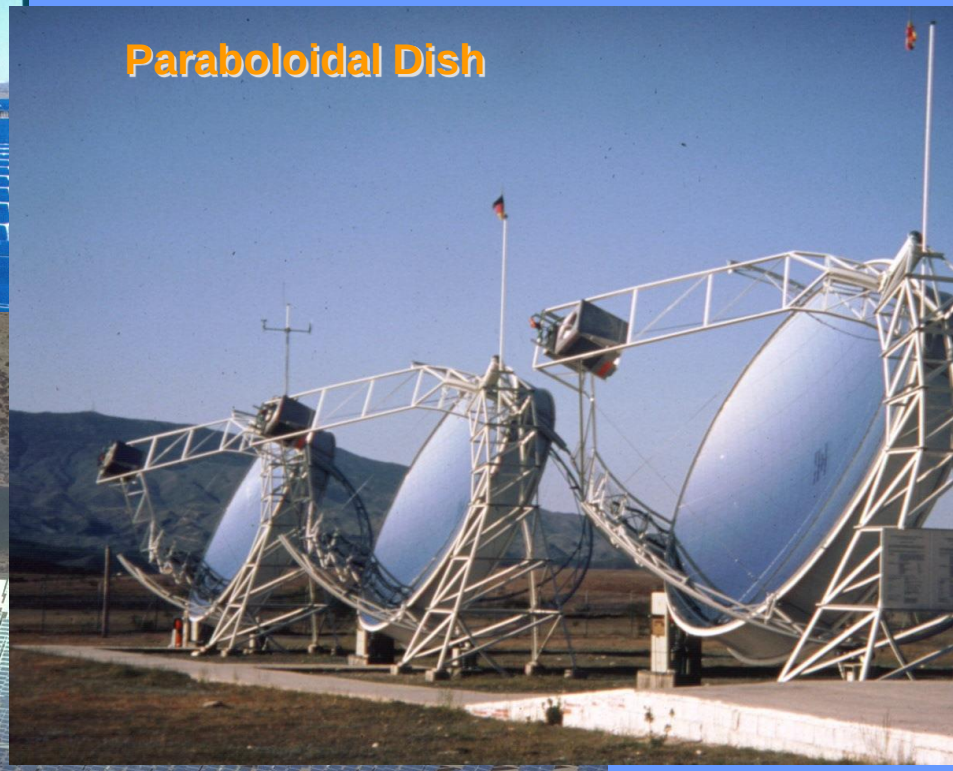
ANU SOLAR THERMAL GROUP ACTIVITIES

Centre for Sustainable Energy Systems
Department of Engineering, ANU
Faculty of Engineering and Information Technology
(http://solar.anu.edu.au)





→ International links via SolarPACES (http://www.solarpaces.org)

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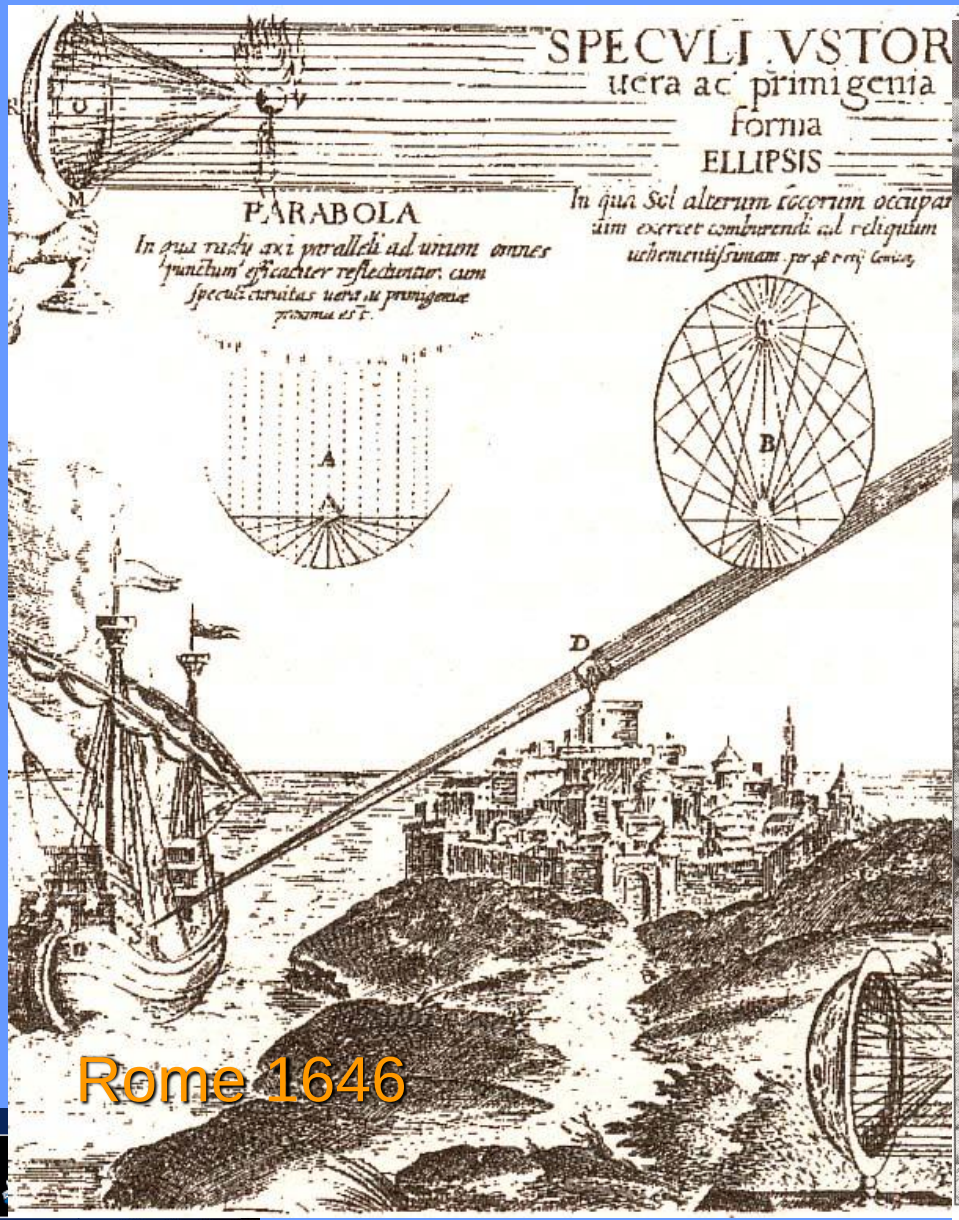
354 MW_e of trough systems in southern California

The latest technology…..



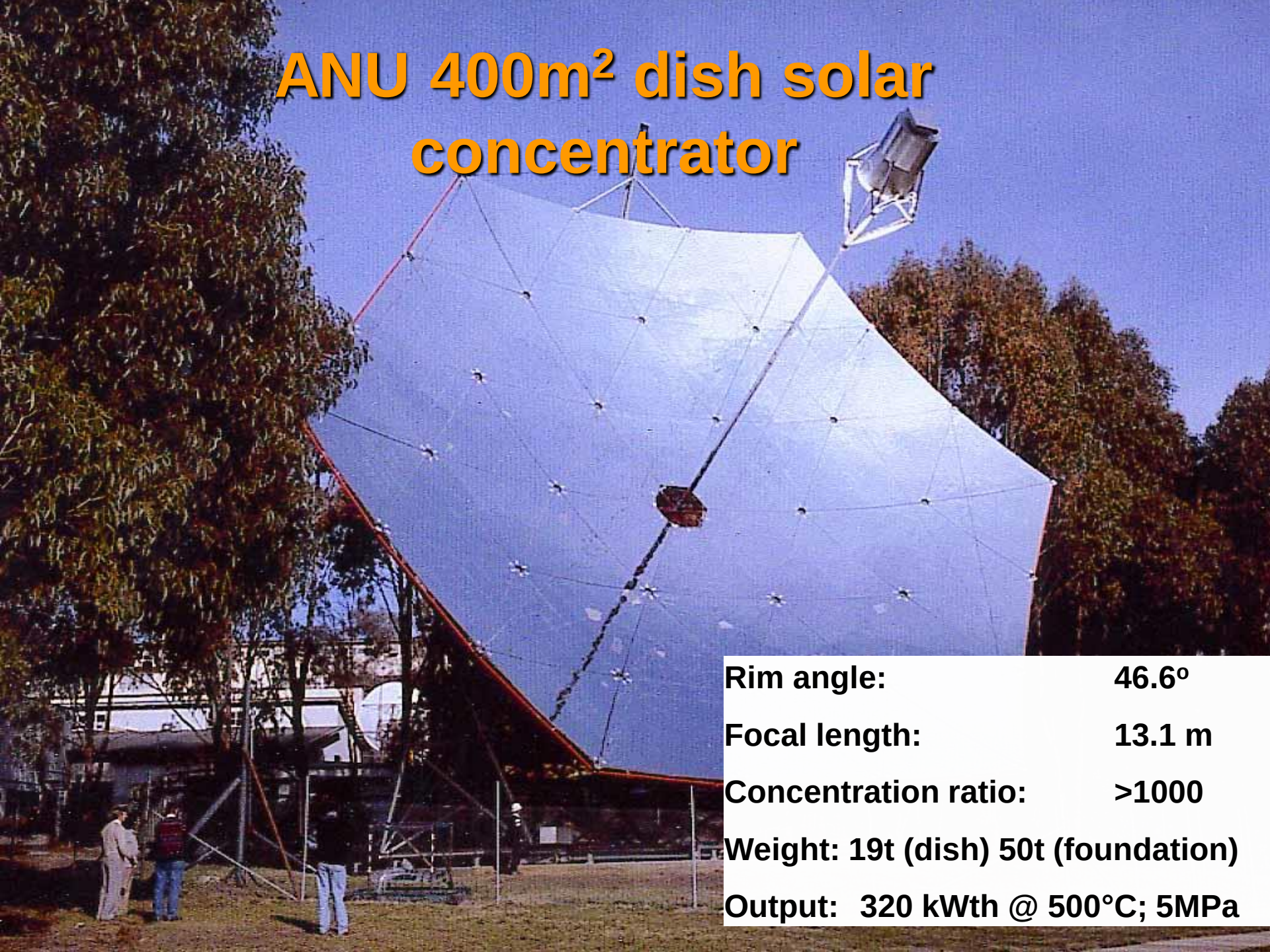
Rome 1646

Athens 2004

Greek actress Thalia Prokopiou, dressed as a high priestess, during a dress rehearsal of the traditional Olympic torch-lighting ceremony in ancient Olympia. **Picture: Reuters**

Our history – White Cliffs 14 dish system

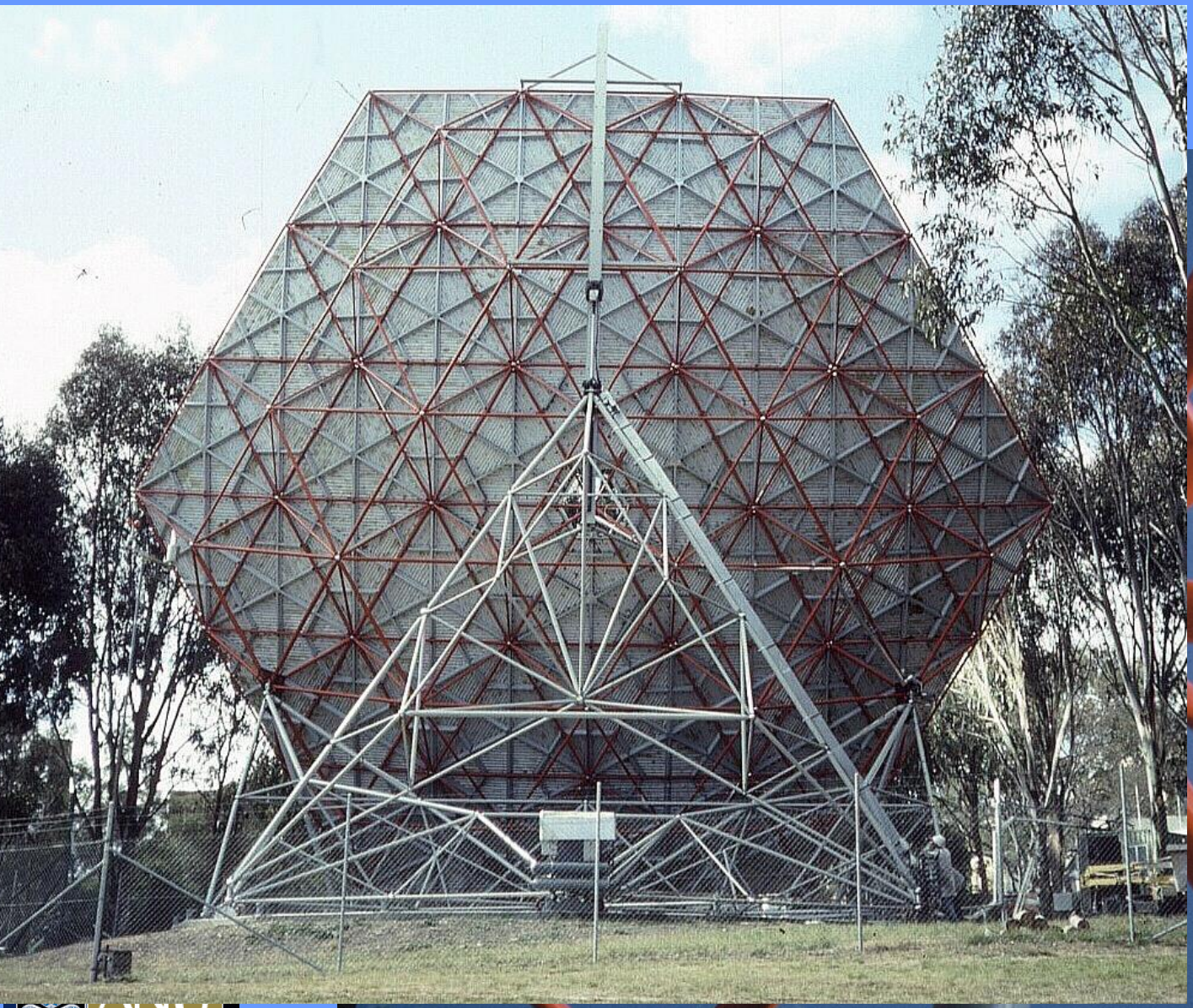
ANU 400m² dish solar concentrator



Rim angle:	**46.6°**
Focal length:	**13.1 m**
Concentration ratio:	**>1000**

Weight: 19t (dish) 50t (foundation)

Output: 320 kWth @ 500°C; 5MPa



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System for BGU, Sde Boquer Israel

Glass on metal mirrors for troughs and dishes

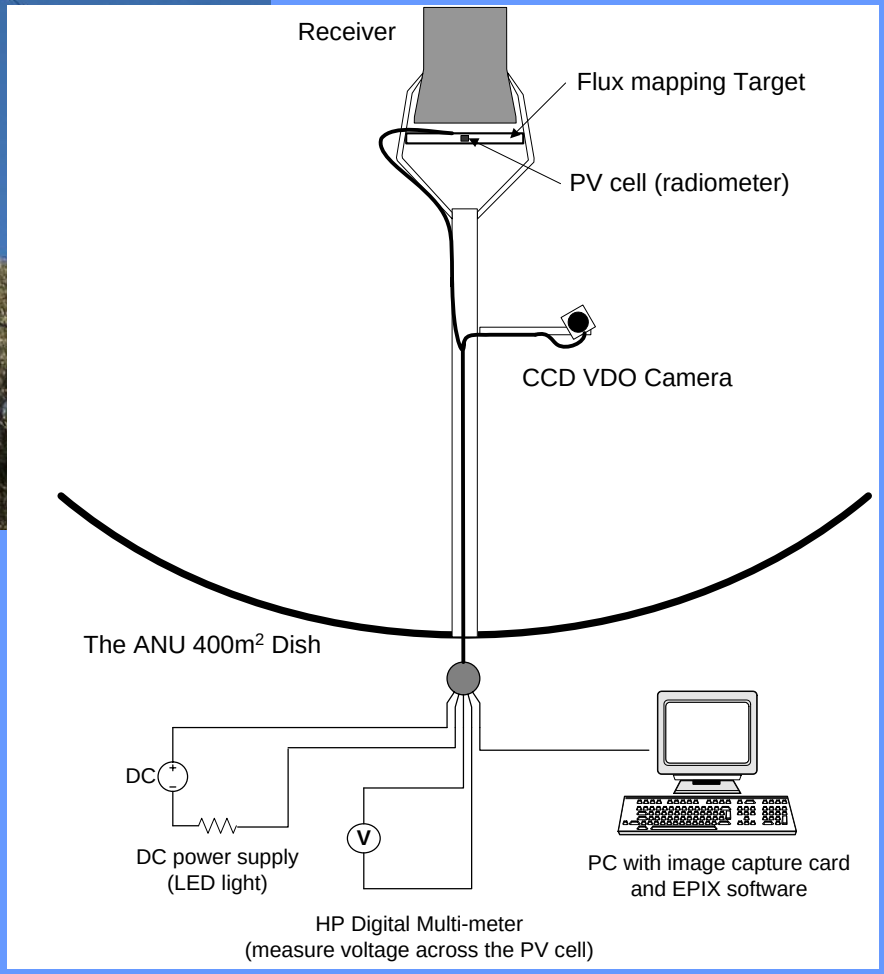
Glass on metal mirrors for troughs and dishes

Glass on metal mirrors for troughs and dishes

Dish mirror panels

- Change from 54 to 216 identical mirror panels
- Design for mass production

Lunar Flux Mapping



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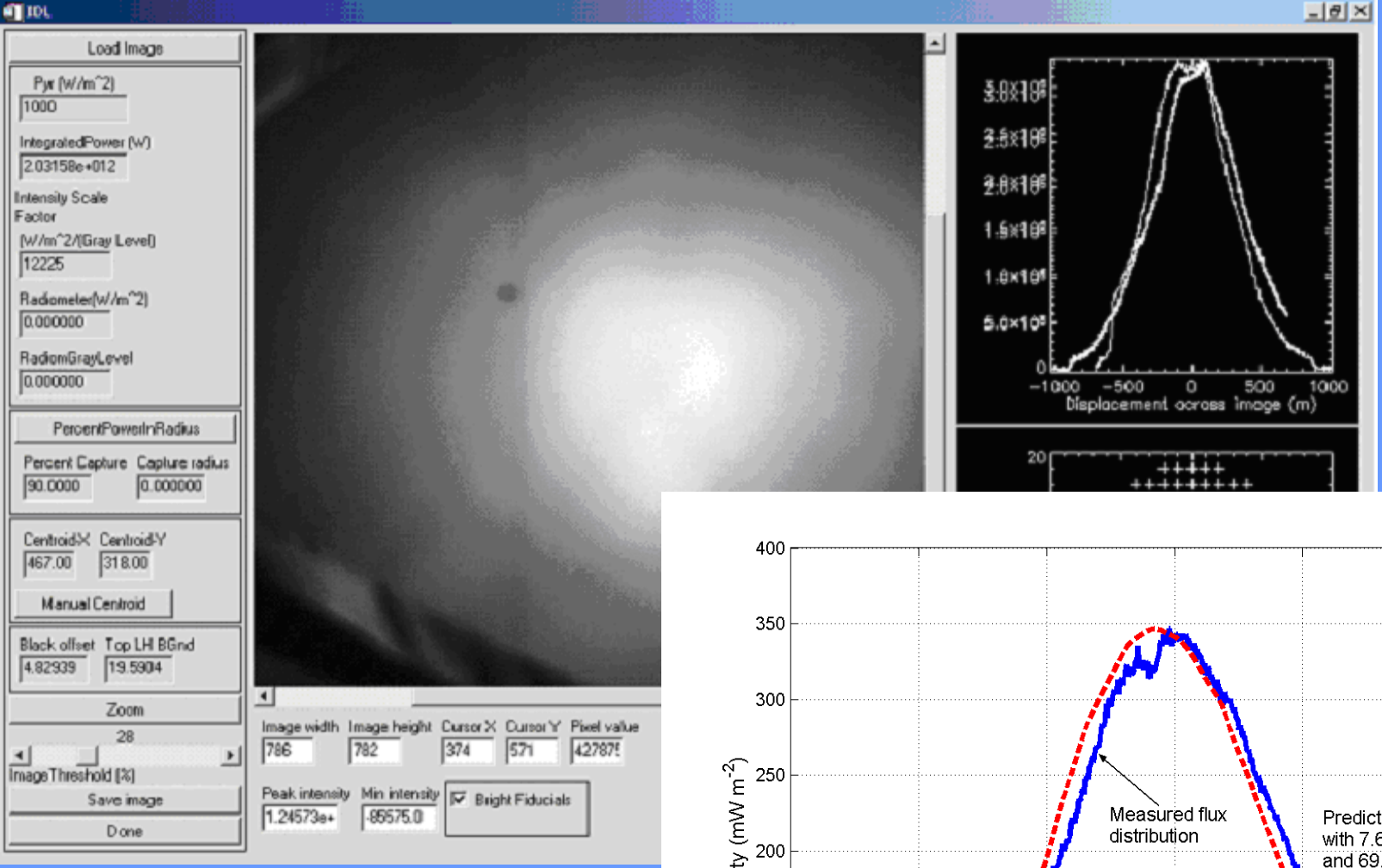

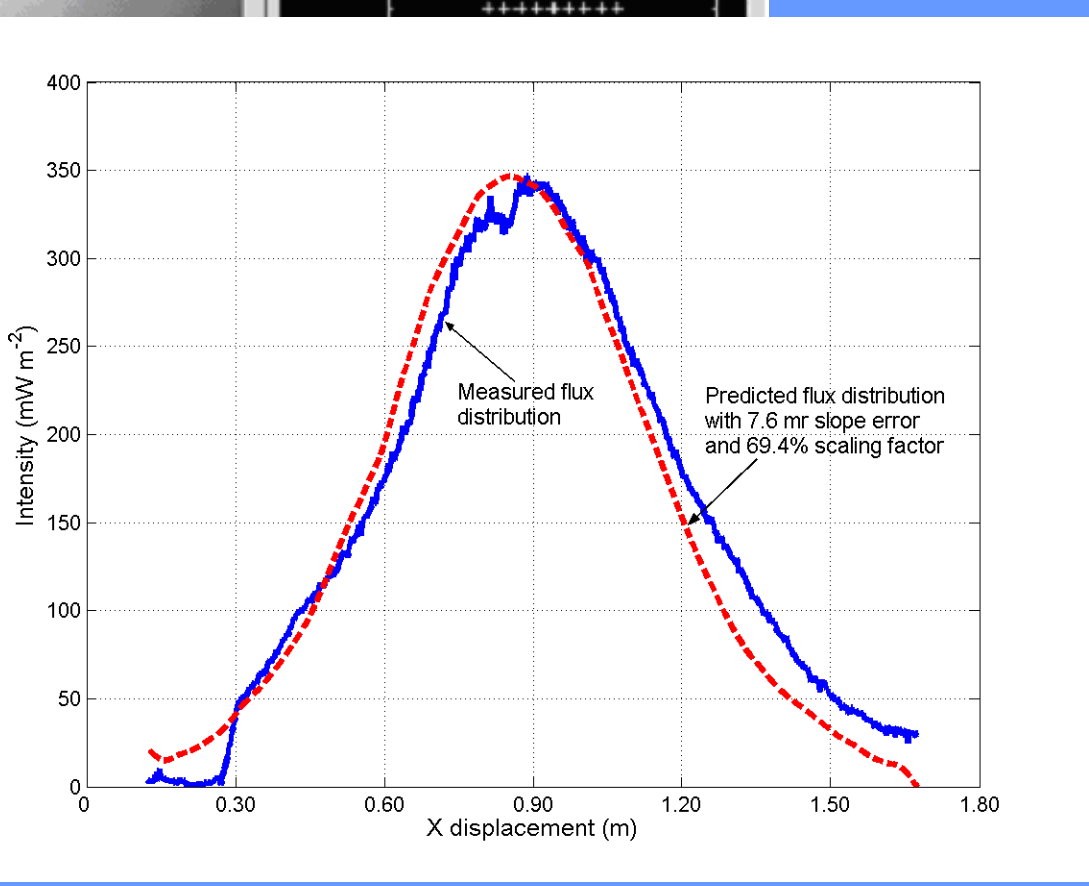

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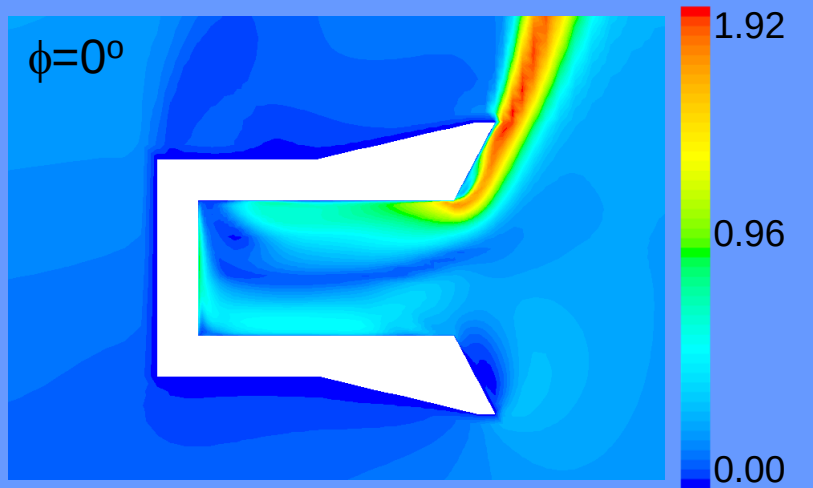
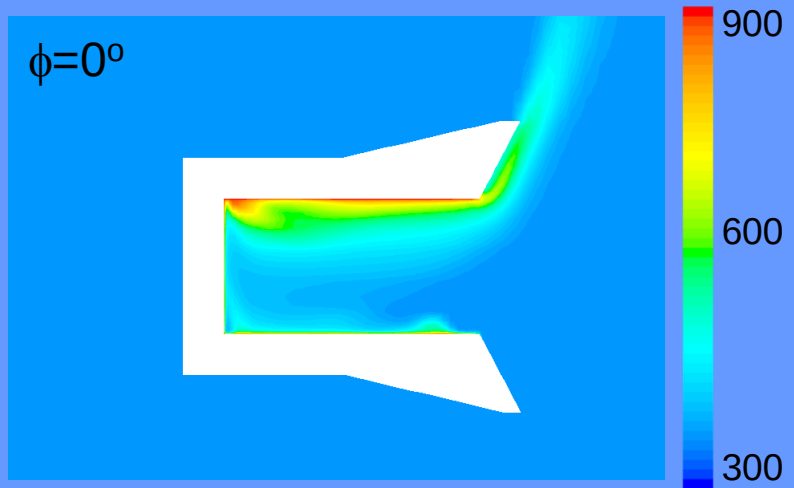
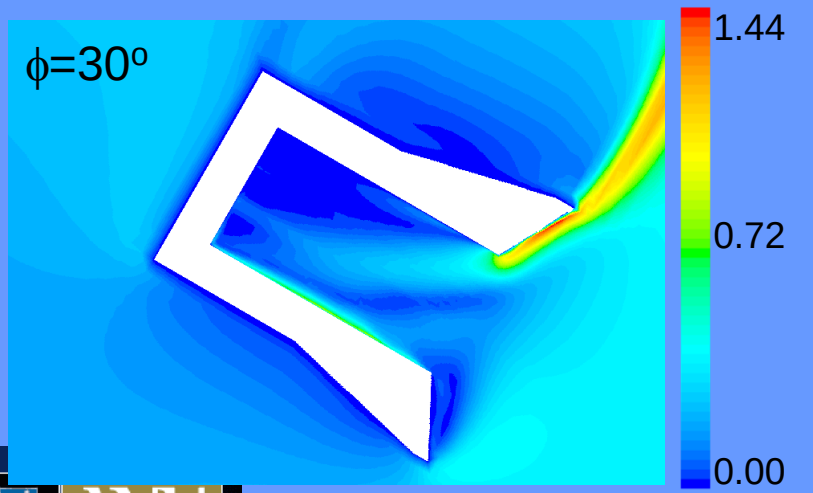
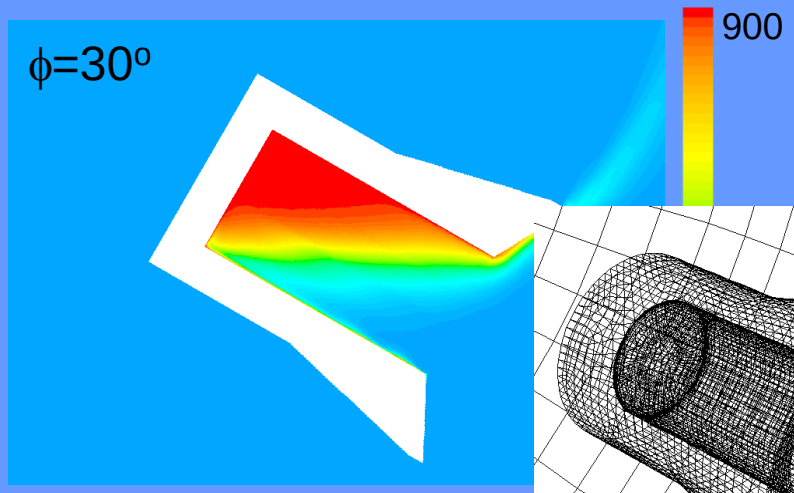
Investigation of Receiver Convection Loss



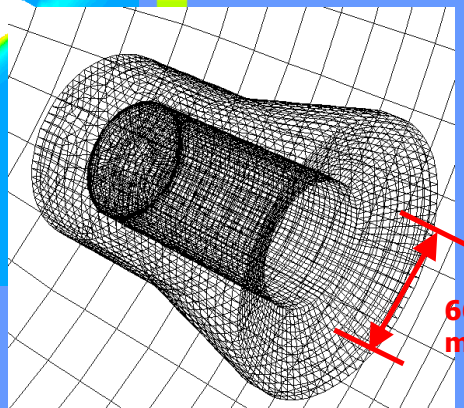






Velocity Magnitude (m/s)

Temperature (K)



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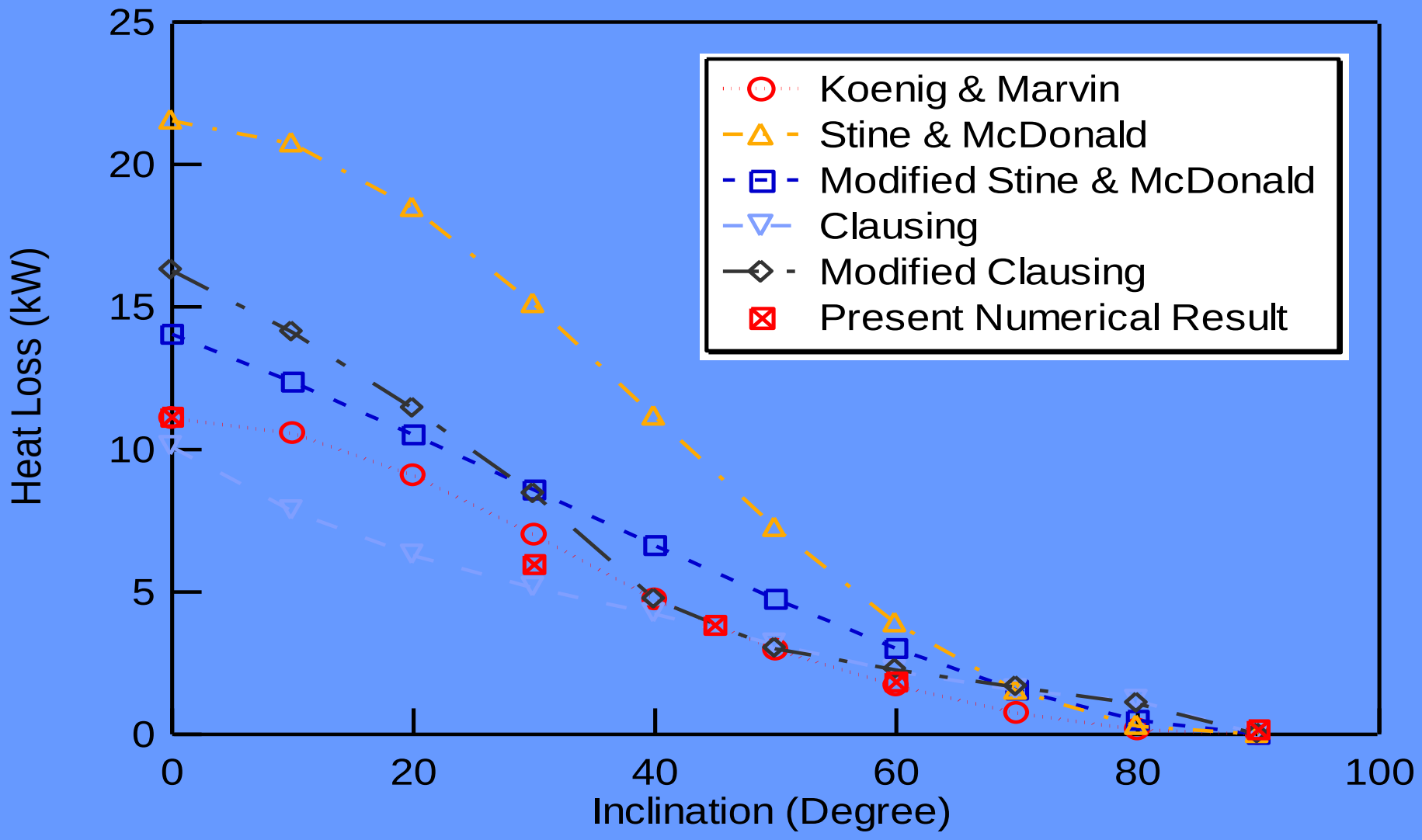

Comparison of natural convection heat loss through the aperture for 400 m^2 dish receiver.

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Transient System Modeling

Weather Data

Ambient Temperature

Incident Radiation

User Input Table

Dish Component

Dish Power

Receiver Aperture Diameter

$Temp_{in}$

$Flowrate_{in}$

$Pressure_{in}$

Receiver Component

Receiver Temp.

Thermal Losses

Useful Thermal Energy

Ambient Temperature

$Temp_{out}$

$Flowrate_{out}$

$Pressure_{out}$

$Temp_{out}$,$Pressure_{out}$,$Flowrate_{out}$

Thermal Losses

Pipe Temp.

Steam Line Component

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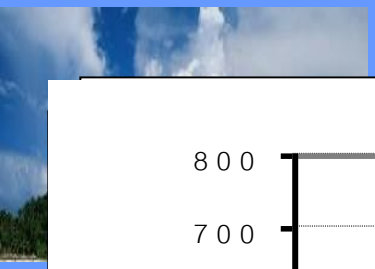
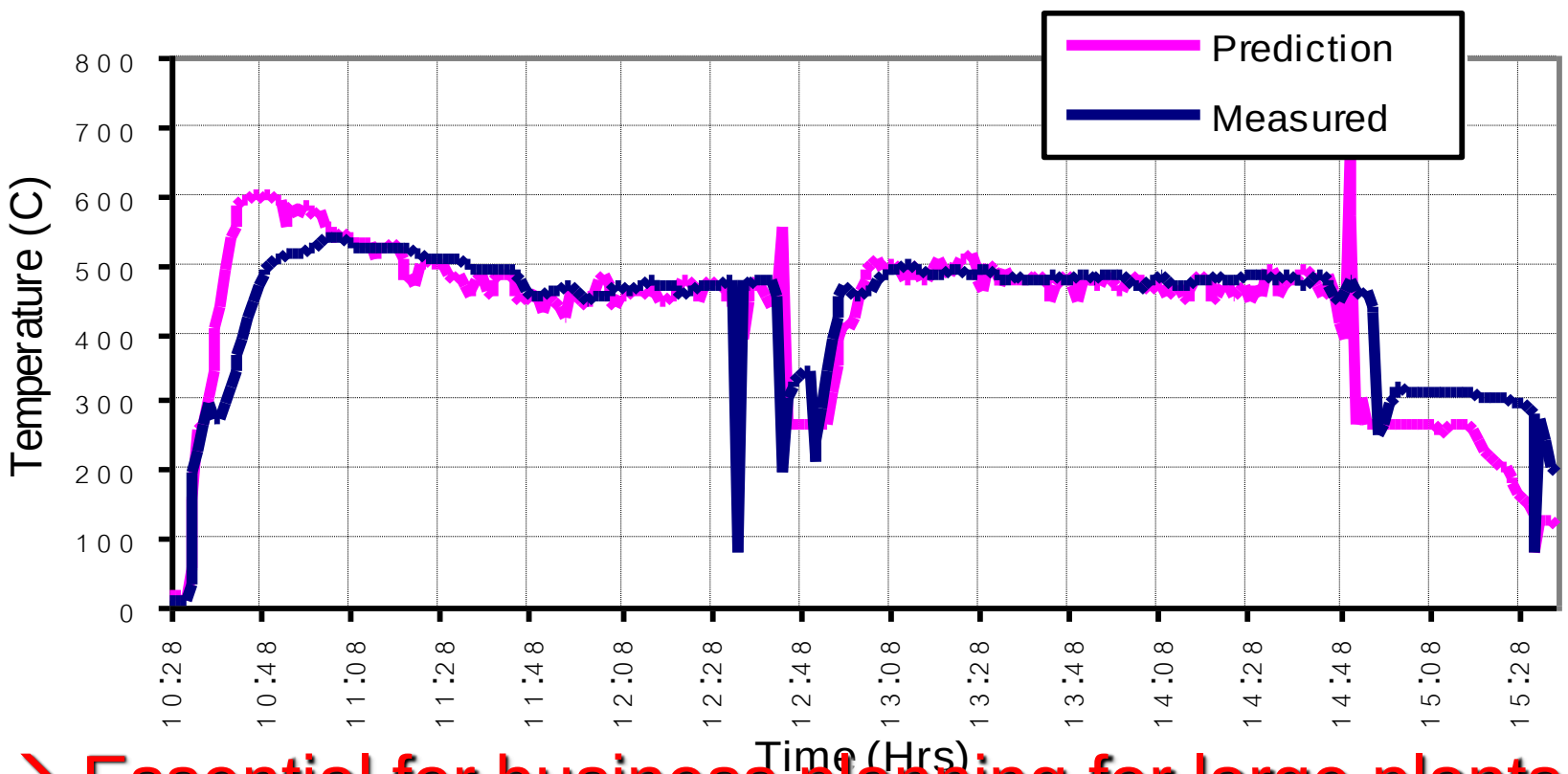
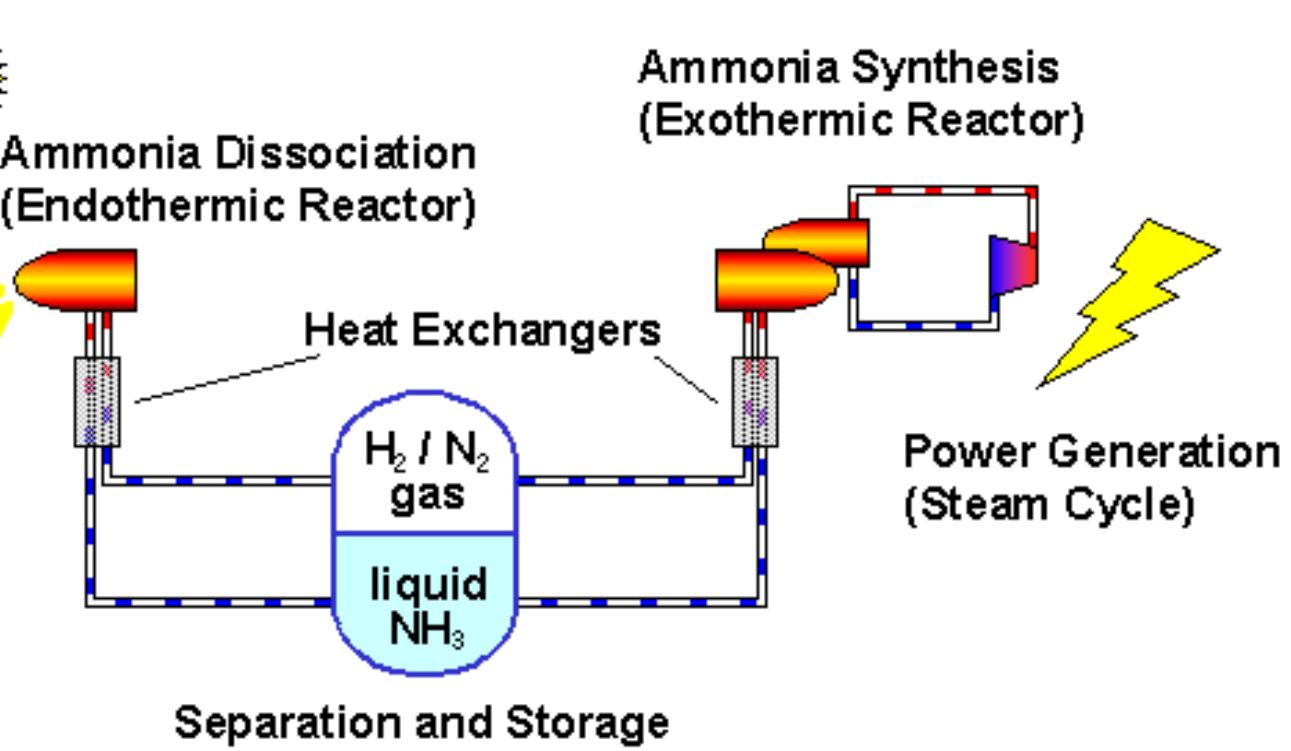
Transient System Modeling





→ Essential for business planning for large plants

Thermochemical Energy Storage



$$NH_3 + 66.8kJ/mol \rightleftharpoons 1/2N_2 + 3/2H_2$$

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.....For 24 Hour Solar Power

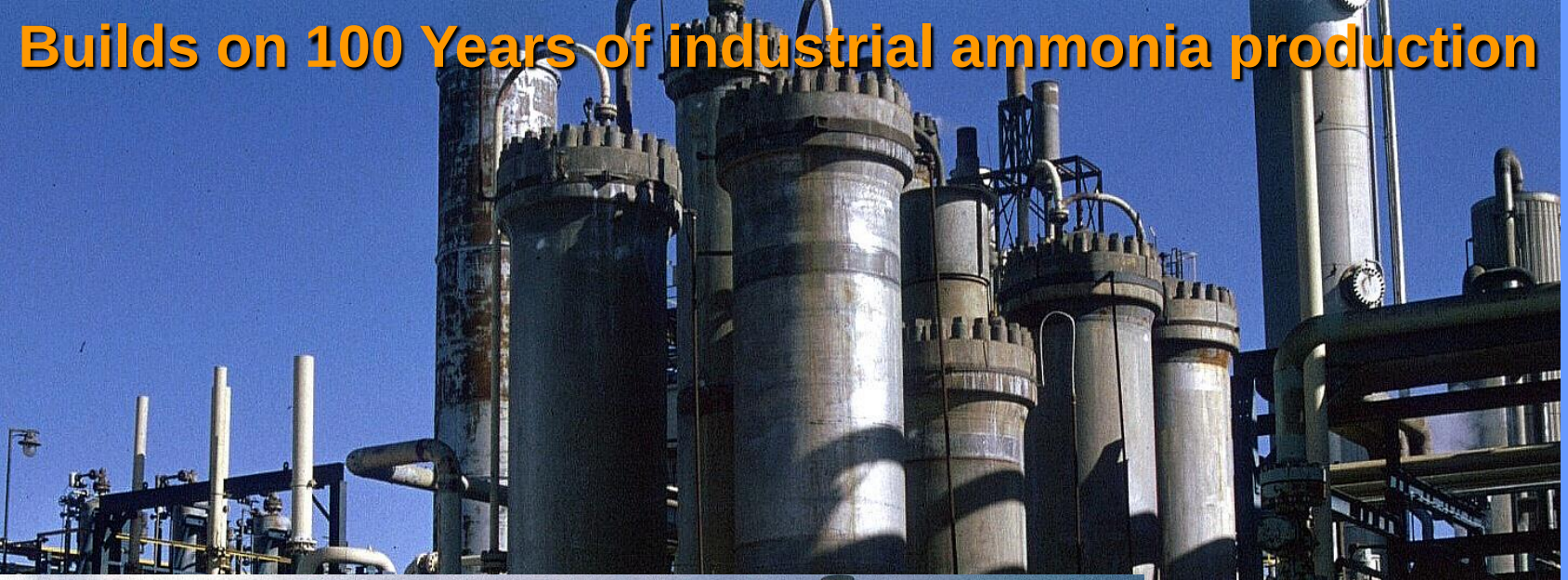
Array of ANU's 400m ^{2} Paraboloidal Solar Collectors

Reactants (NH_{3_l} + H_{2_g} + N_{2_g})
Storage & Transfer Network
(Natural Gas Pipeline)

Ammonia Synthesis Reactor

Rankine Cycle Power Conversion Unit

Builds on 100 Years of industrial ammonia production



Prototype 3m aperture trough tested for ammonia dissociation

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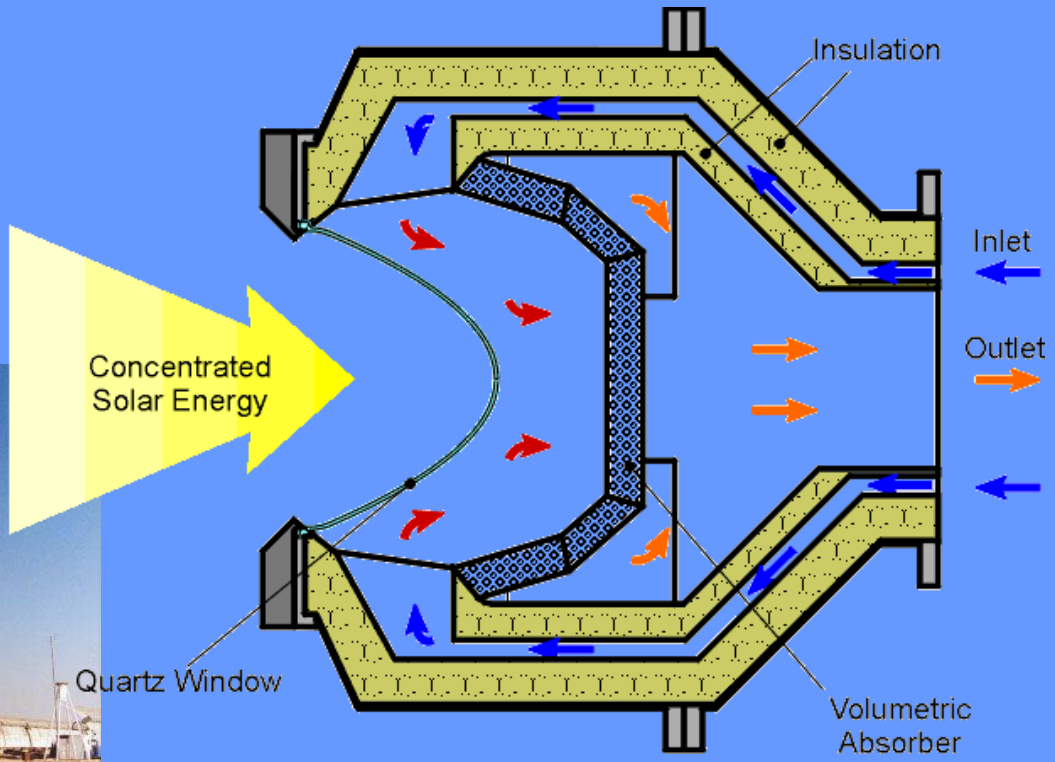
Solar Gas Turbine Study

Collaboration with DLR (GER)

400 m^2 dish at BGU, Israel



DLR's volumetric air receiver, Germany

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Conclusions

- ANU large dish technology offers attractive route to large scale solar thermal power.
- Ongoing R&D leading to performance improvements for dishes and troughs
- Thermochemical storage offers 24 hr operation in the future.
- Dish designs, ammonia system and dish mirrors licenced to Wizard Power

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