Renewable Energy in Oil and Gas – Oman Perspective

Dr. Syham Bentouati – NAFAS International LLC

Regional capacity building workshop on "Water - Energy Nexus Operational Toolkit: Renewable Energy"

Beirut– 11 July 2017

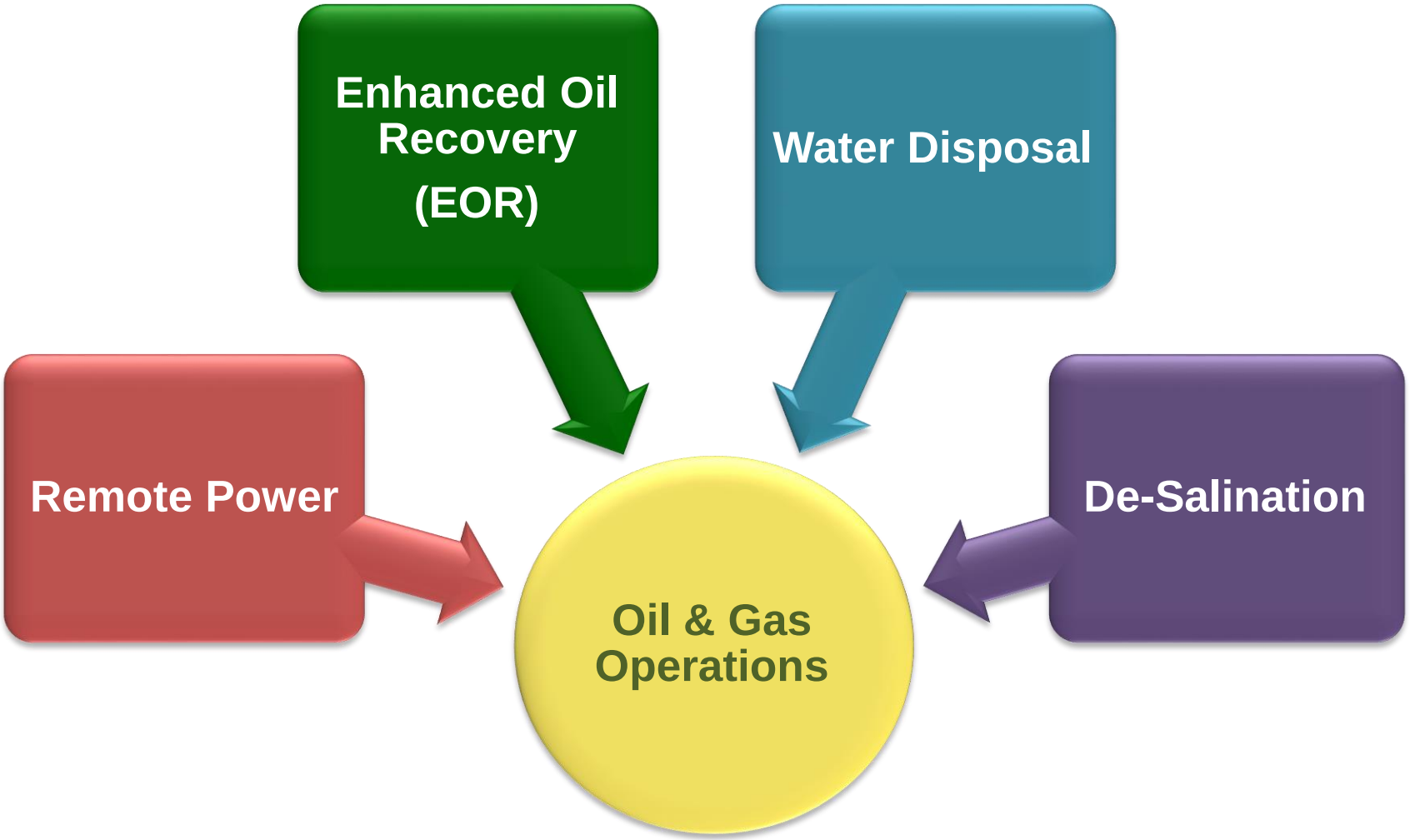
United Nations Development Account Project on Developing the Capacity of ESCWA Member Countries to address the Water and Energy Nexus for Achieving Sustainable Development Goals

NAFAS

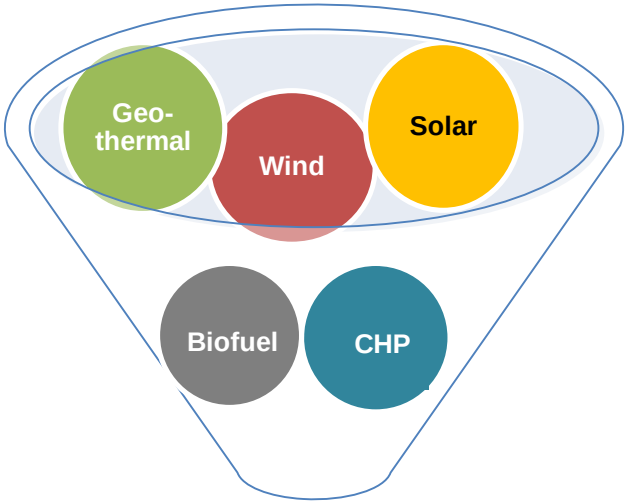
DISCLAIMER

The information presented in the following slides is curtesy of Petroleum Development Oman (PDO) and GlassPoint Solar. It is available in the public domain.

Renewable Energy in Oil and Gas – Short Term

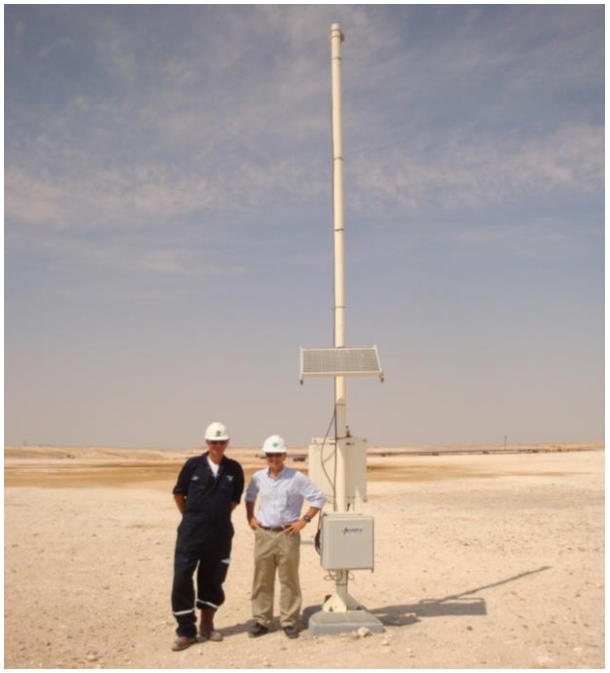


Renewable Energy in Oil and Gas – Future?



Energy for Oil and Gas

Well Surveillance & Communications



Well and reservoir surveillance

- Water injection and Gas lift wells
- Purpose: monitor pressure, flow, temperature and perform some controls
- Each unit output 50-80 W

Seismic Operations

Seismic Geophones

- Each unit output: 40 to 80 W

Street Lamps

Street Lamps

- Each unit output: 40 W

Structural Monitoring

Micro-Seismic Data (mini-earthquakes):

- For wellhead amplifiers, digitisers and radio transmissions
- Each unit output 30-100 W
- Works 24/7 - battery storage

Surface Deformation Data (detailed position):

- Since 2003
- Power for GPS system
- Each unit output ~50 W
- Works 24/7 - battery storage

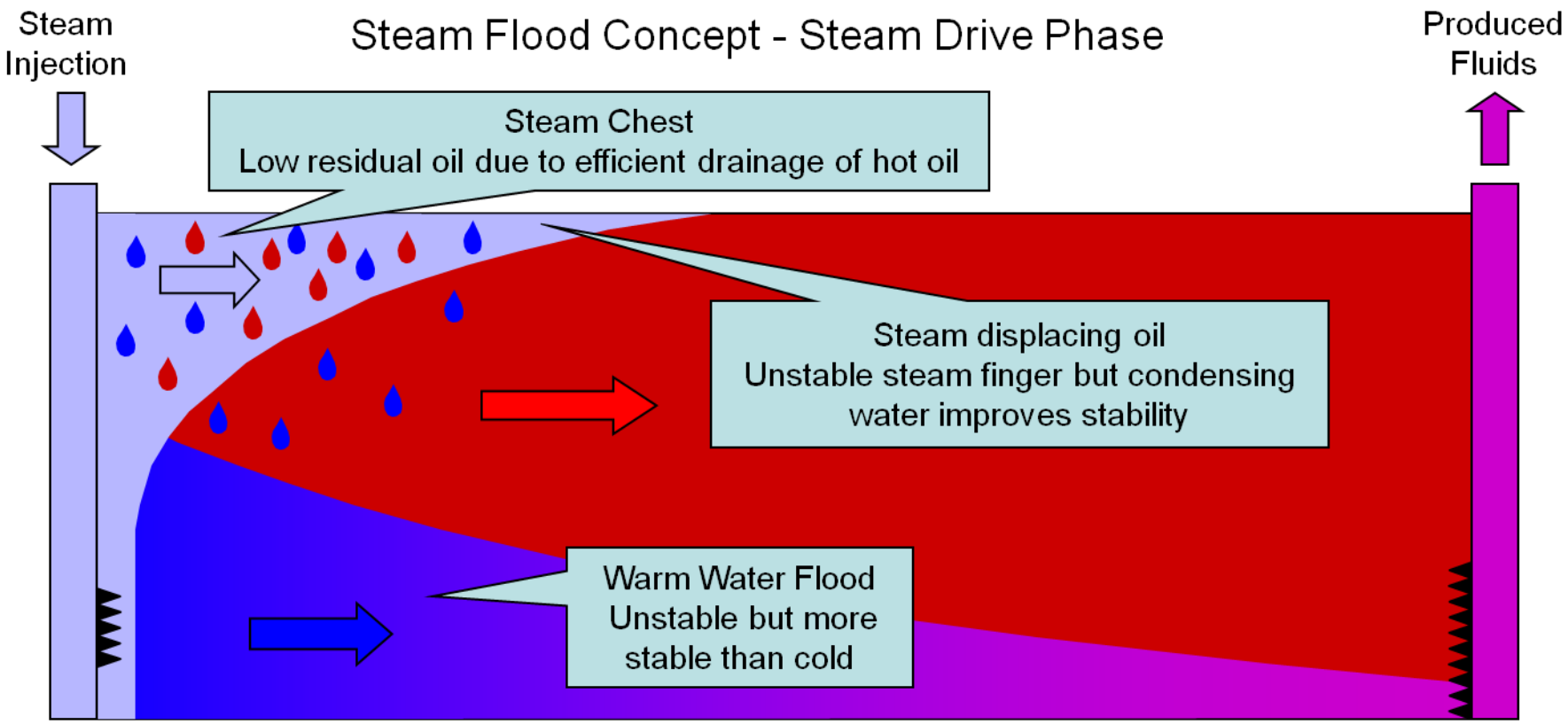
Large Scale Power Generation

- As the cost of solar energy has fallen significantly, large scale power plants (multi-MW or even GW) are now serious options
- It is important to select the right technology for the application as well as the right location. The latter is not easy given that most land in any concession area is potential location for drilling/production-related facilities

Solar Energy for Water Disposal – Solar Ponds

Evaporation and salt harvesting

Enhanced Oil Recovery (EOR)



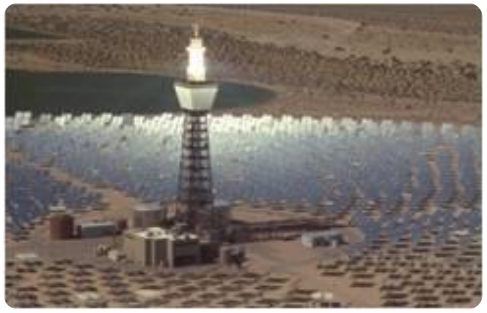
- Increasing oil temperatures enormously reduces viscosity
- Steam injection introduces pressure gradient, provides heat, and takes up volume
- Fluids of different densities, therefore gravity drainage process operate

Selecting the Right Solar Technology for EOR

✓

Parabolic Troughs

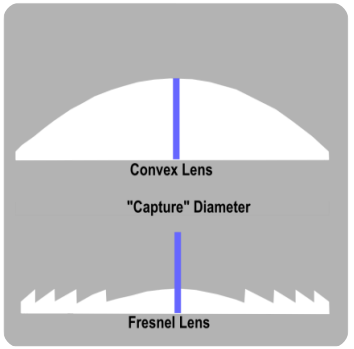
Linear Fresnel



Solar Towers

X

Photo Voltaics

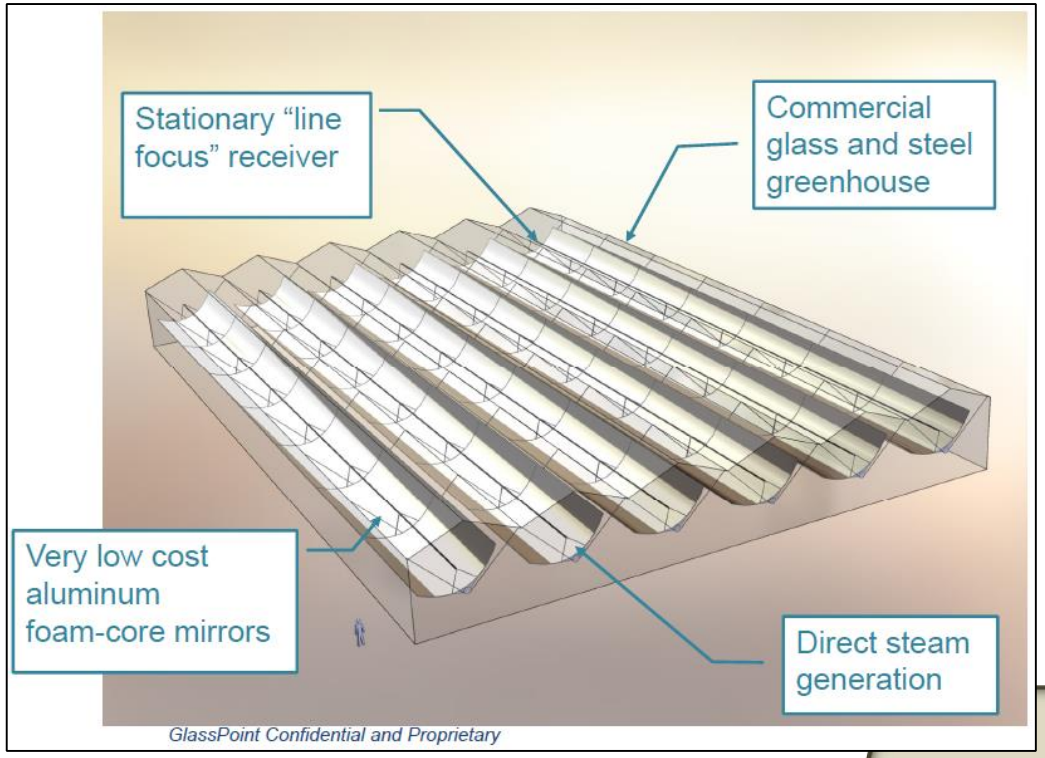


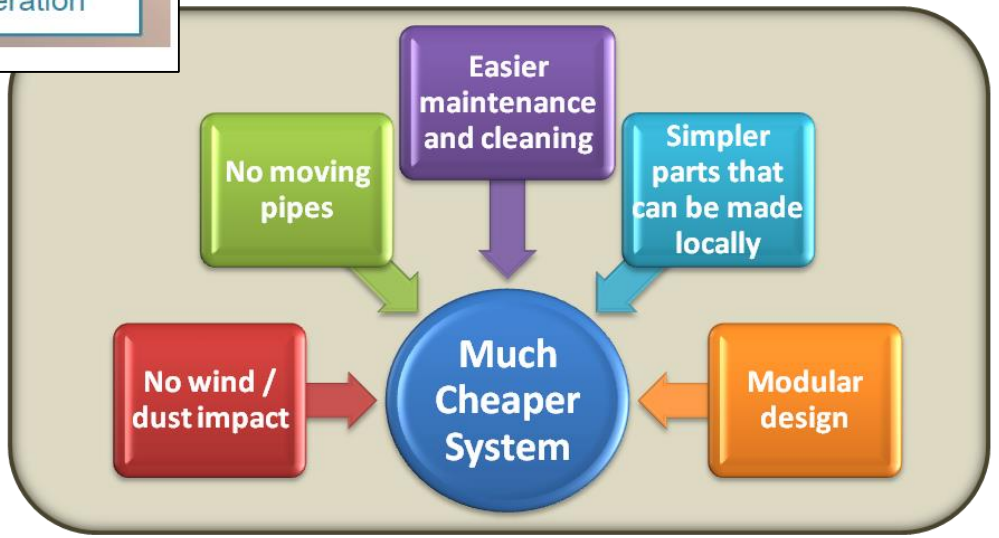
Lenses

Solar Dishes

Solar Ponds

The Selected Technology

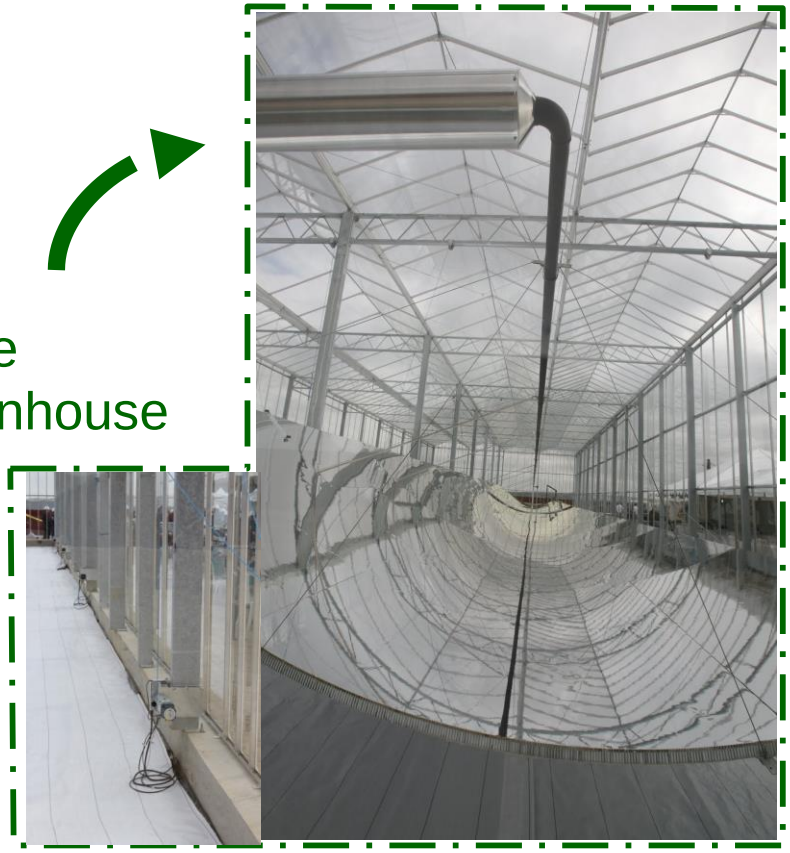




Components / Footprint

Outside Greenhouse

Inside Greenhouse

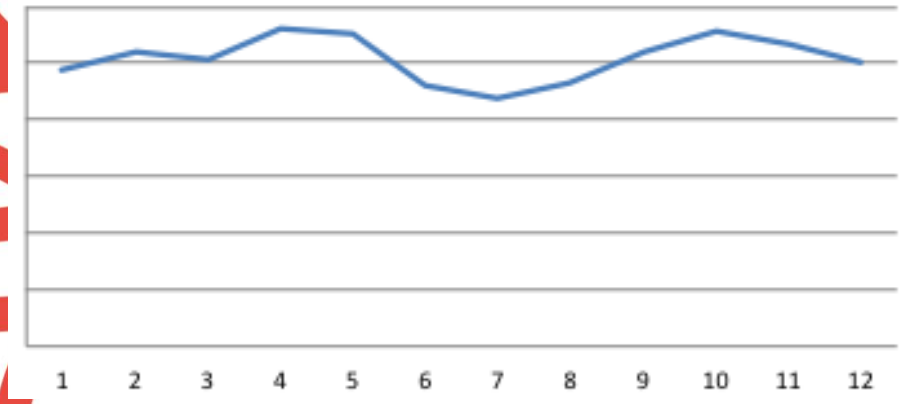


Flow rate (t/d)	Footprint (acres)	Football pitches*
50	4 (16,200 m2)	2
5,000	400 (1.62 km2)	200
10,000	800 (3.24 km2)	400

* Max football size is: 110 x 75 = 8250 m2

Within less than one year, the pilot had produced over 13,000 tons of steam, saving almost 1 million m^3 of natural gas, ~ 1800 tons of CO_2

Solar Steam Generation Pilot – Learnings



Sunshine Almost All Year Long

Dust, Humidity, Sand

Solar Steam Generation Pilot – Learnings

- Water Tank: reduce start up and shutdown losses and save water
- Temperatures inside glasshouse reached over 80 ^{o}C! New sealing system design required for hot desert environment
- Impact of bad weather / sandstorm much less than on conventional solar technologies

- Water quality excursions effect on meters
- Mitigate power loss impacts
- Mitigate daily thermal stresses on the steam system

Post Pilot Success – Miraah

ENERGY PRODUCTION
1,021 MW thermal (1 GW)

DAILY STEAM OUTPUT
6,000 tons

TOTAL PROJECT AREA
3 km^2 or 741 acres

TECHNOLOGY
GlassPoint enclosed trough

NUMBER OF GLASSHOUSES
36

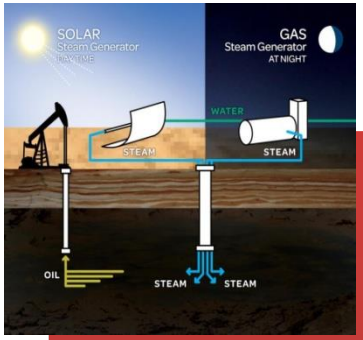
CONSTRUCTION START
2015

FIRST STEAM
2017

GAS SAVINGS
5.6 trillion Btus per year

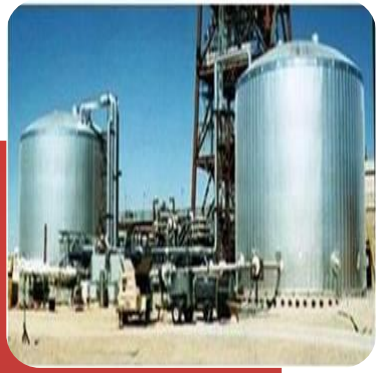
CO_2 EMISSIONS SAVED
300,000 tons per year

24-Hour Sunshine?



Supplement

- Extended Operation
- Combine with Conventional System
- Integrity / Reliability
- Expensive
- Mature option



Store

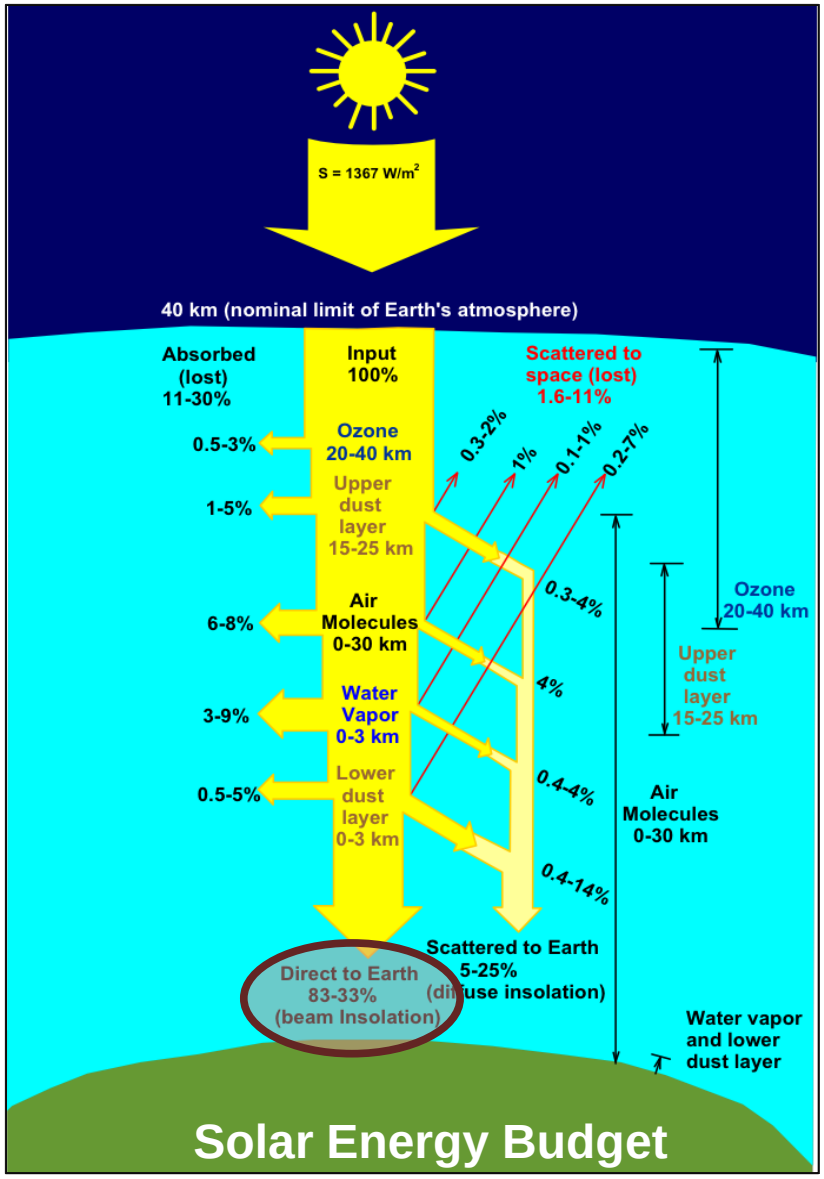
- Molten Salt
- Concrete Storage
- Latent Heat / Phase Shift Material
- Very expensive
- Many options still not fully proven
- Possible HSE issues

Tel: +968 99626621 (Oman)

+971 568264773 (UAE)

Email: syham@nafasinternational.com

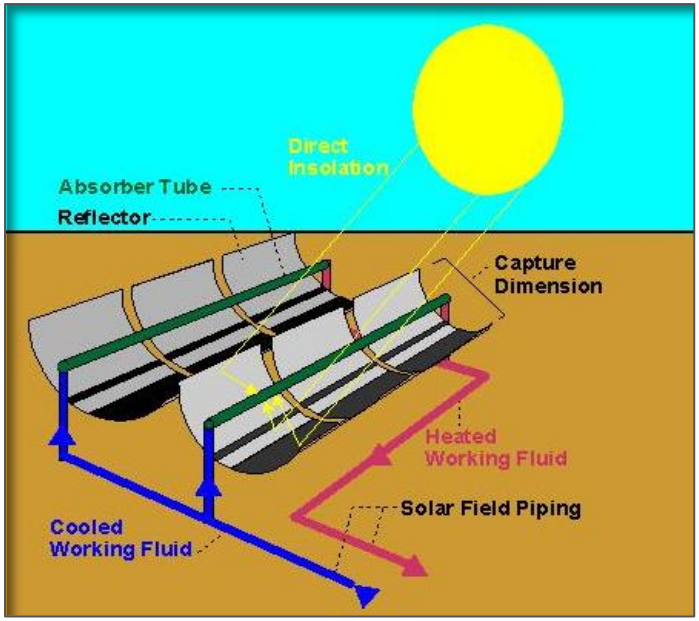
Solar Energy – Back to Basics

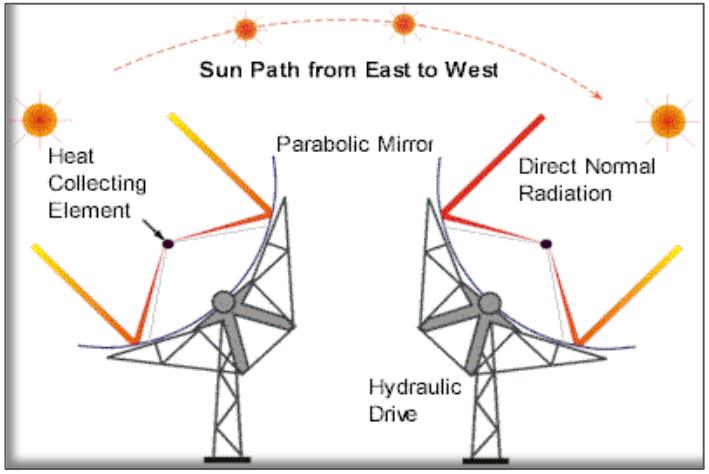


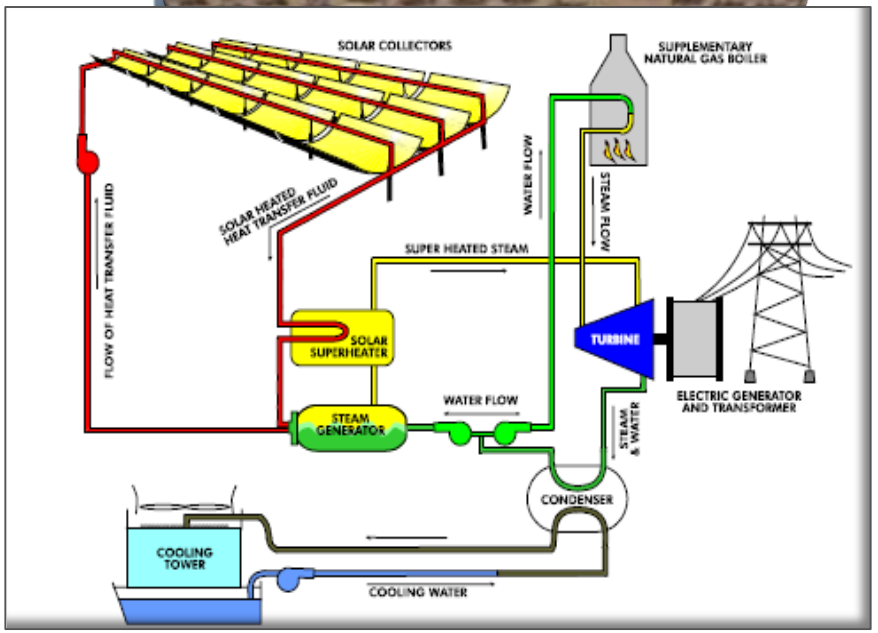
NOT ALL RADIATION EMITTED BY THE SUN REACHES EARTH

NOT ALL RADIATION THAT REACHES EARTH IS USEFUL

Solar Energy – How Does it Work?







Concentrated Solar Power (CSP)

Solar Energy – How Does it Work?

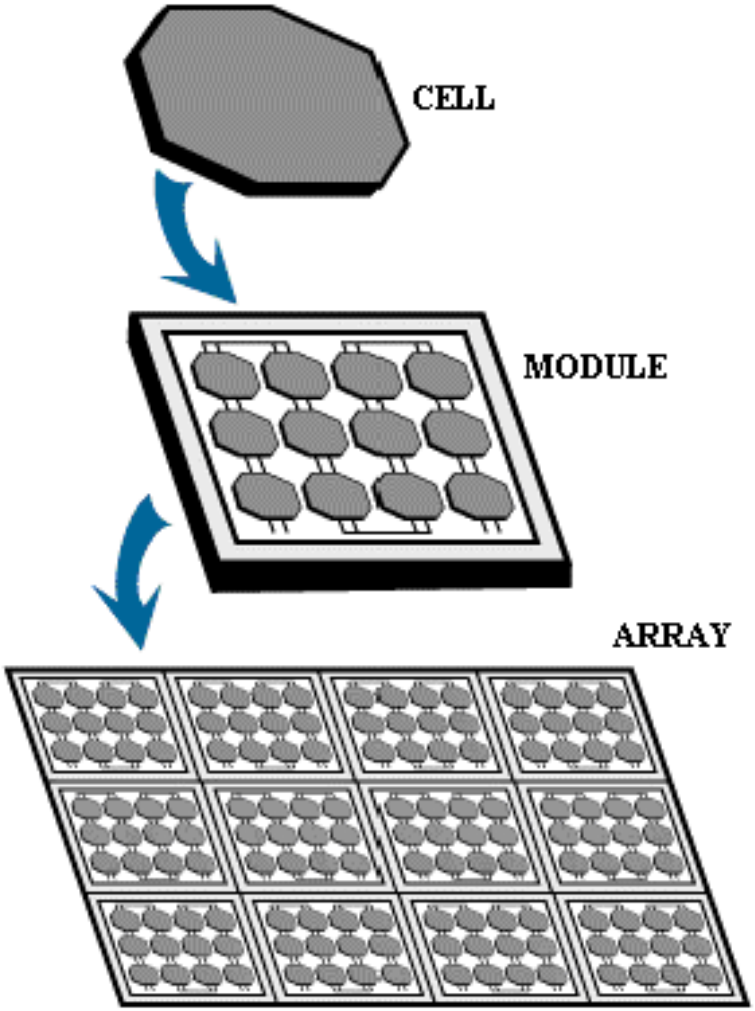


Photo Voltaics (PVs)