

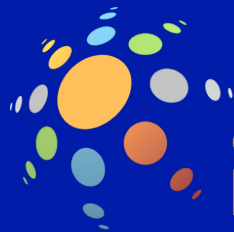
# ***Research and Development***

## ***Solar Energy***

***S.A.M. Said***

Center of Research Excellence in Renewable Energy (CoRE-RE)

***King Fahd Univ. of Petroleum & Minerals***



Center of Research Excellence in  
Renewable Energy

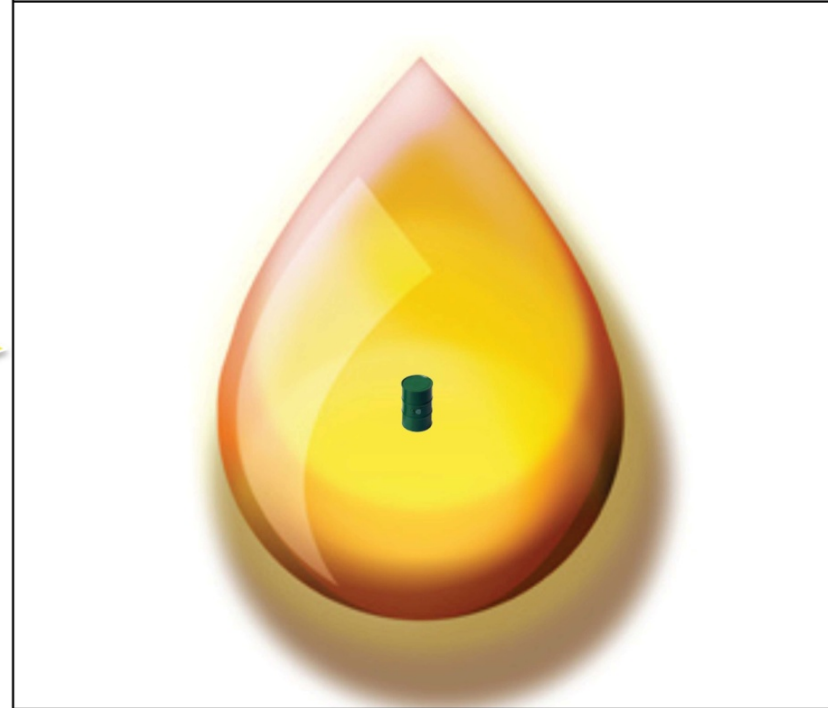


## Why Solar?

KSA Solar Resource  
8 **billion** boe/day.



KSA Petro Export  
8 **million** boe/day.



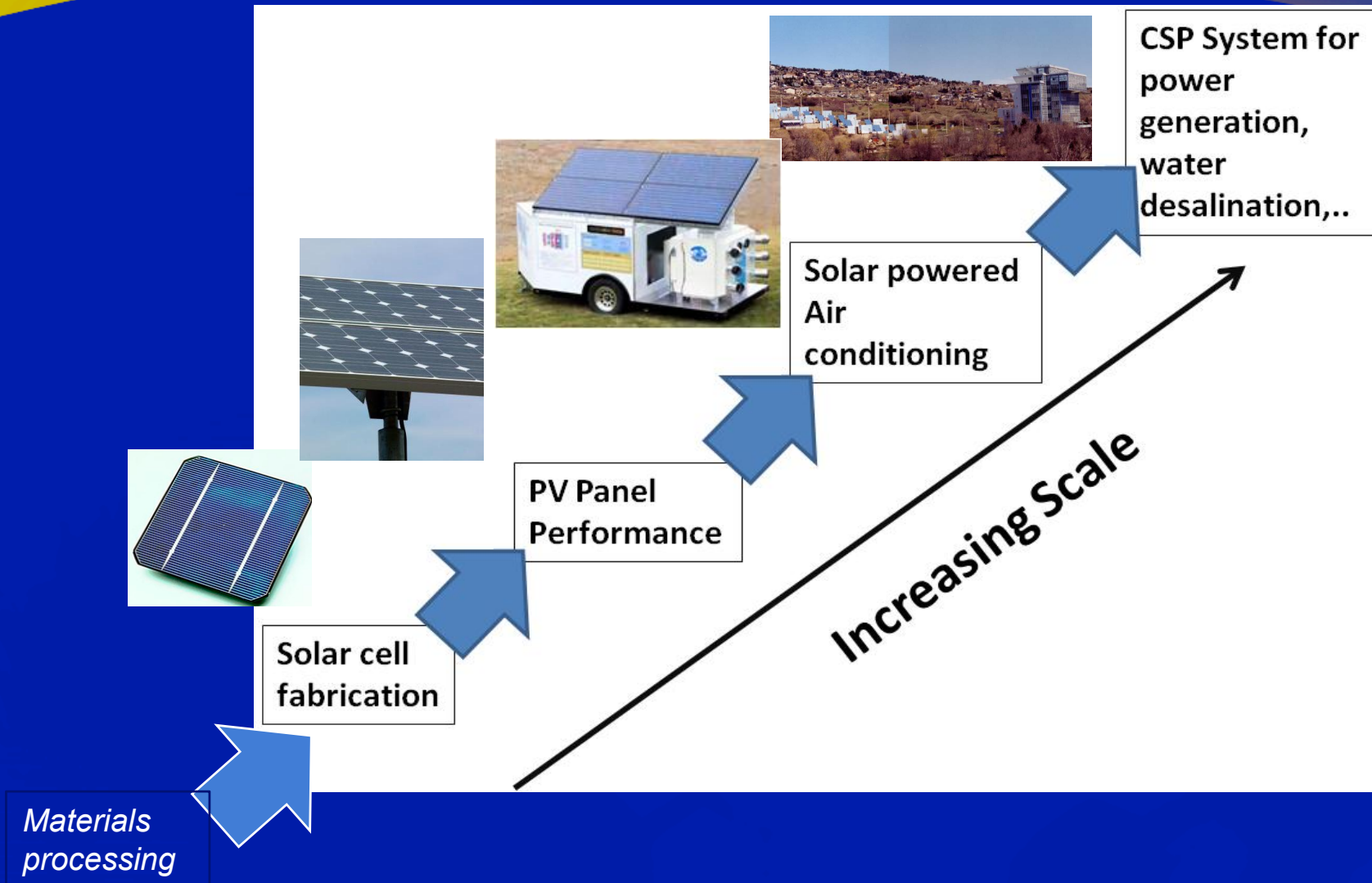
# *Vision*

*To be the national Research hub that contributes to the advances of research and commercialization of Solar energy technologies in the KSA.*

# Objectives

1. *Build Research Capacity*
2. *Conduct research and development*
3. *Promote Solar energy technologies and application in the KSA*
4. *Promote economic development through advancement and commercialization of renewable energy technologies*
5. *Promote educational opportunities in the field of Solar energy*

# SOLAR RESEARCH CONTINUM



# Quest for Excellence

## Research Thrust

Solar PV: Enhancing Cell Efficiencies

Solar Thermal: Applications in cooling, heating, desalination

Concentrated Solar Power CSP, PV and CPV



## How?

Current Capabilities at KFUPM

Building Research Capacity

Int. and National Collaborations

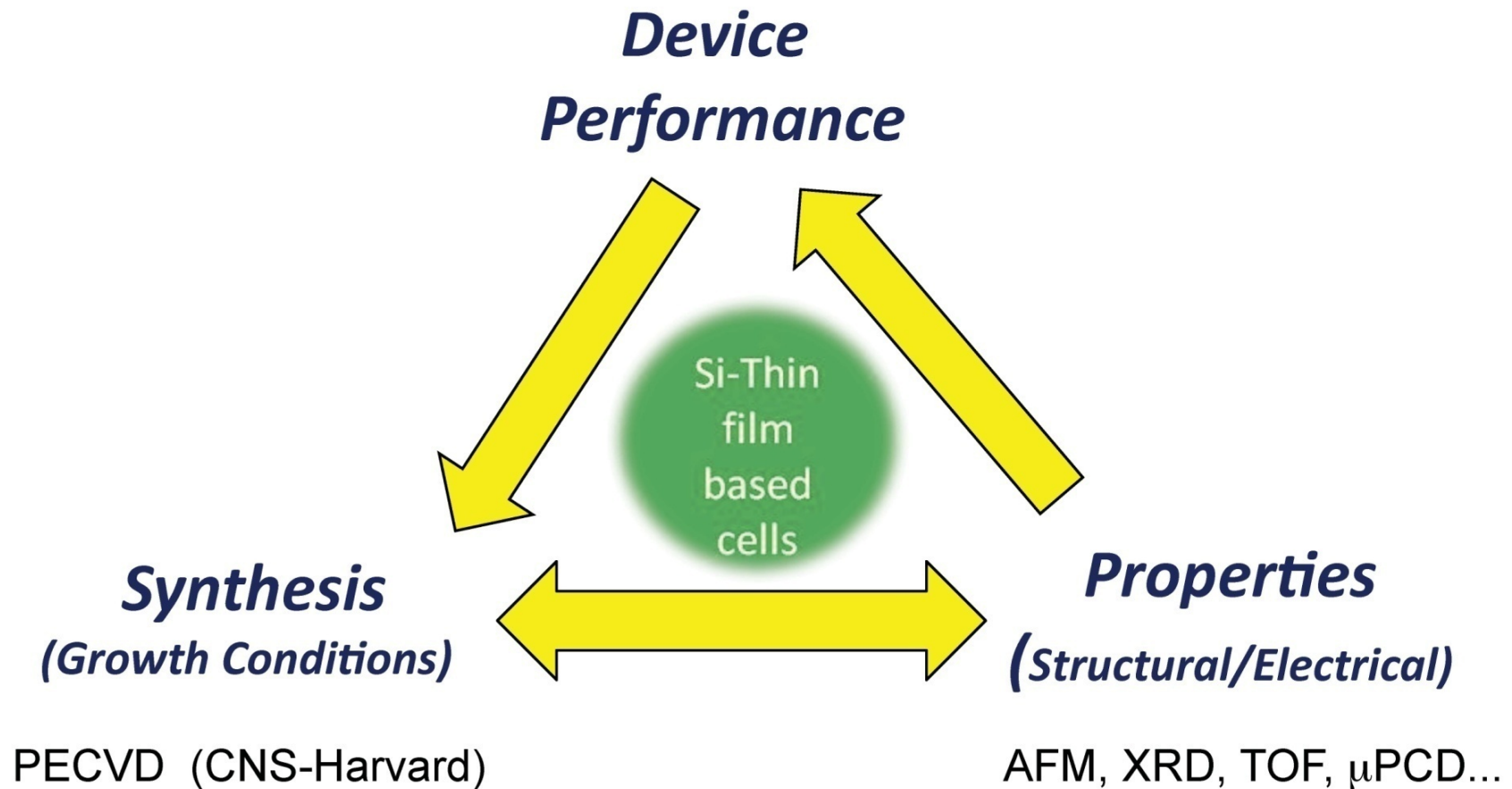
Simulation Capabilities/MIT Test Facility

# *Solar Photovoltaic*

*1. PV Cell Performance*

*2. PV Module Reliability and Performance*

*3. Power Generation*



*Establish a PV Laboratory*



*Leverage MIT-KFUPM Collaboration Program*



# Facilities

## Synthesis: PECVD



Plasma Enhanced  
Chemical Deposition (PECVD)

Bought-To be installed

## Characterization Tools

### Ellipsometer

Installed and Operational  
June 2010



### Hall Effect System

Installed and Operational,  
July 2010



### Microwave Photoconductive decay

Installed and Operational, July 2010

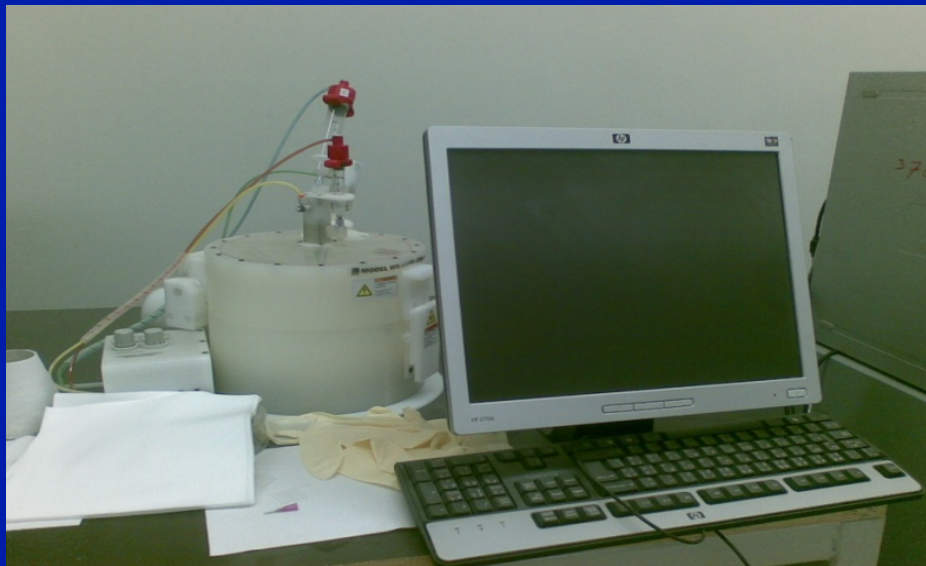
# Solar Cell Laboratory



**ELECTRO-SPINNING**



**SEMICONDUCTOR CHARACTERIZATION**



**SPIN COATER**



**PROFILER**

# Solar PV Cell & Module Laboratory



**LASER SOURCE**



**SUN SIMULATOR**



**OPTICAL TABLE**



**WEATHERING STATION**

# *PV Module Test Field*





## Module and array performance characterization



### Weathering Effect:

- Temperature
- Dust
- Corrosion
- Moisture

### Module durability:

- Mechanical Properties
- Adhesion Properties
- ...

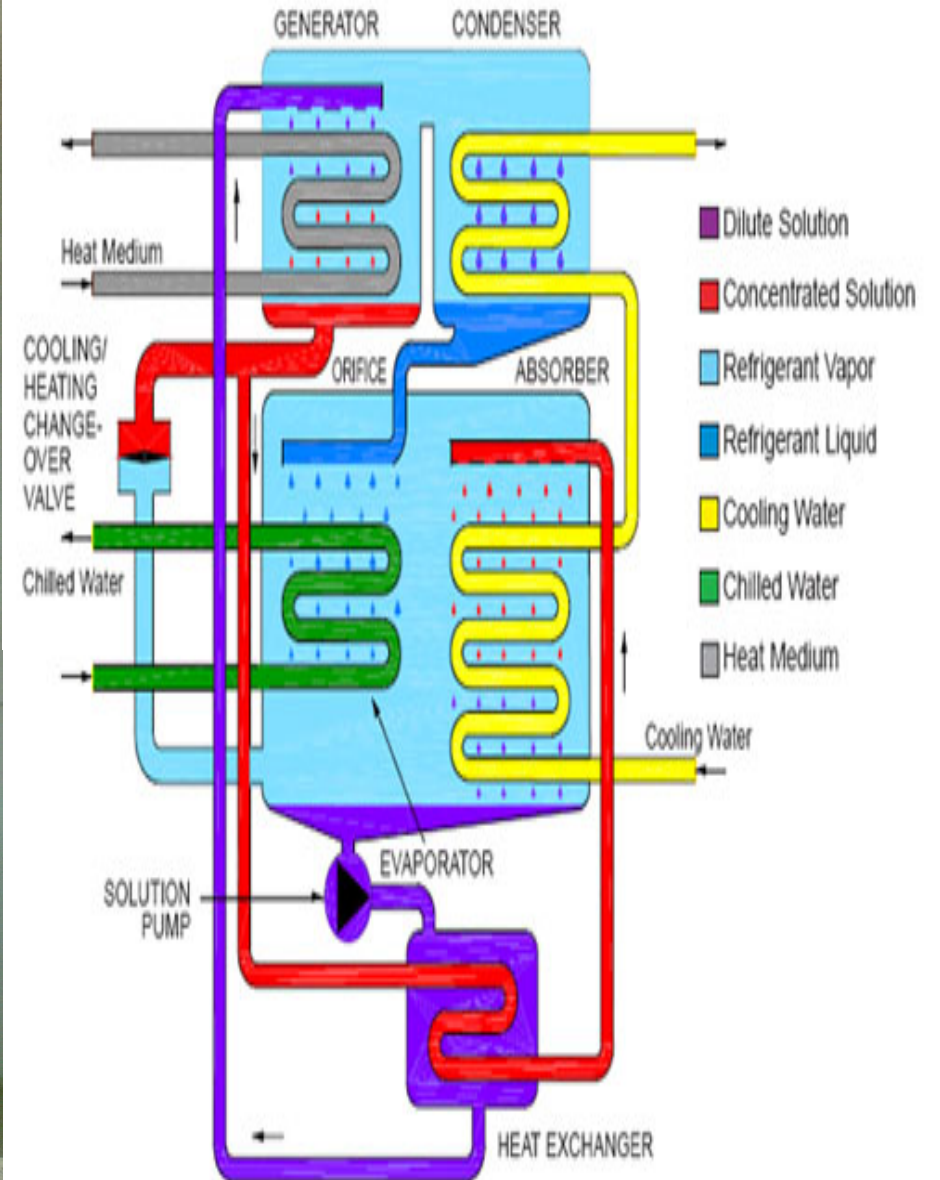
# *Solar Thermal*

1. *Heating and Cooling*
2. *Desalination*
3. *Power Generation (CSP)*
4. *Dust Mitigation*

# SOLAR COOLING LAB



**ICE STORAGE**

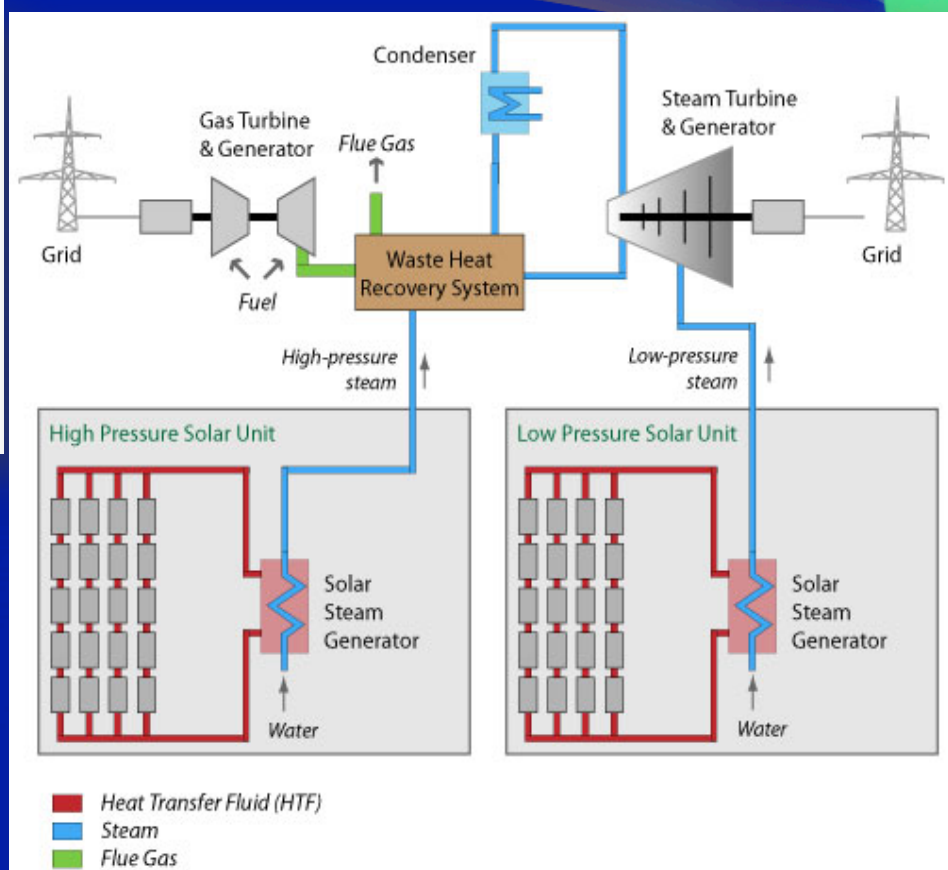
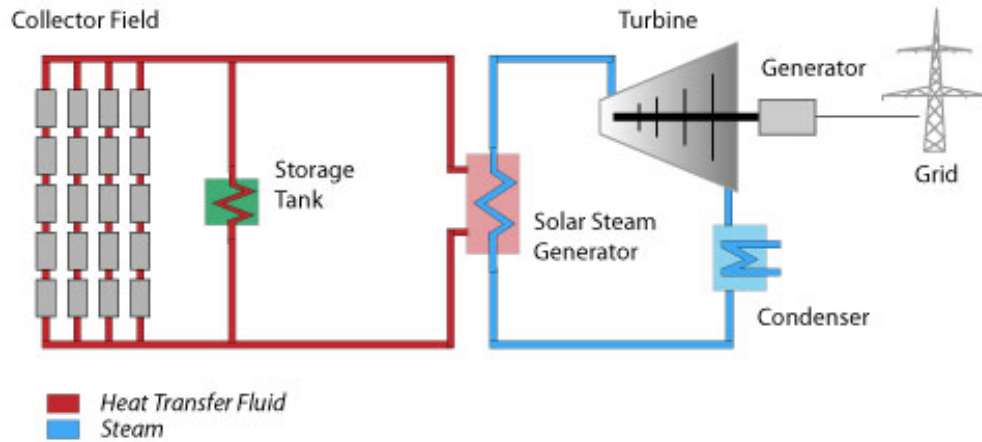


# CSP Cycles Under Study

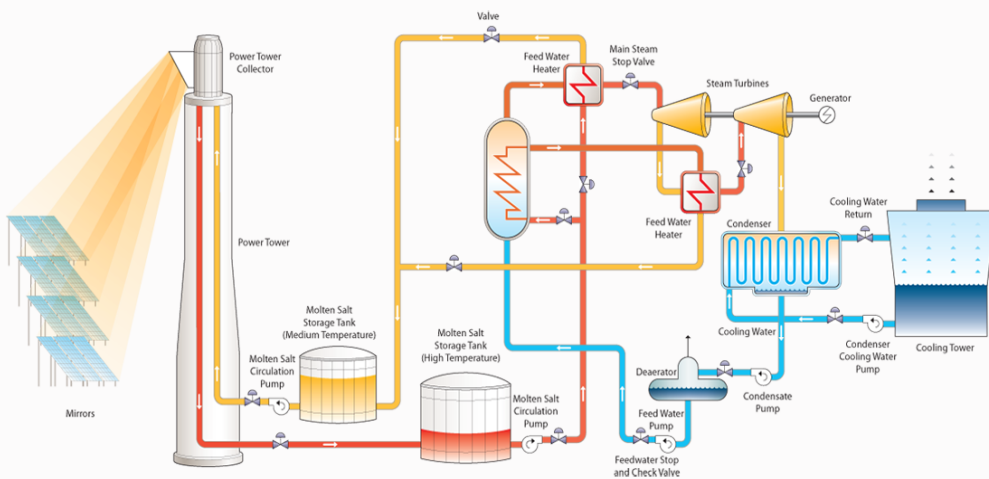


Solar Energy with Steam Turbine

Integrated Post Gas Turbine And Steam Turbine



Integrated Solar With Gas Turbine And Combined Cycle System





# *CSP-Objectives*



- *Size, analyze and optimize a hybrid cycle for different integration configuration with different percentage of solar share under Saudi Arabia weather conditions.*
- *Install a Pilot Plant for testing.*

# ***Collaborations***

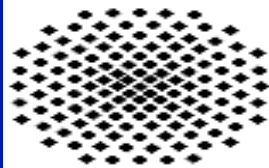


Massachusetts Institute of Technology



**Fraunhofer**

ISE



**University of Stuttgart**

Germany

# Potential Collaborations



- 1.** *University of Tokyo – Japan*
- 2.** *UCB – USA*
- 3.** *Stanford University-USA*
- 4.** *Siemens*
- 5.** *Du Pont - Europe*

# ***Messages from CoRE-RE***



- 1. Solar PV and CSP are Real in the Future and Now***
- 2. Investment in Policy and R&D – Both Priorities.***
- 3. Increase Research Capacity- Funding***

# ***Concluding Remarks***



- 1. Investing on the path to sustainable development became a MUST.***
- 2. Regional enthusiasm for Solar energy options.***
- 3. The drive towards Solar energy in KSA should not be regarded as being a luxury but rather a must.***
- 4. Solar is Ideal for KSA***



***Thank you***