



MulK Enpar

Renewable Energy

TOTAL CSP SOLUTIONS

Design ♦ Manufacturing ♦ Fabrication
Installation ♦ Operation ♦ Maintenance

ELECTRIC POWER - PROCESS STEAM - AIR CONDITION



MULK ENPAR RENEWABLE ENERGY - SOLAR THERMAL SYSTEM
A BREAK THROUGH IN CSP TECHNOLOGY
LOW COST & HIGH EFFICIENCY



MULK ENPAR R.E SOLAR THERMAL SYSTEM - PROFILE

Solar Trough systems use parabolic shaped reflectors to focus the sun's energy at 3-4 times its normal intensity on the receiver pipe. Solar parabolic trough technology remains the most mature and bankable concentrating solar power (CSP) technology available today within the field of CSP industry.

MULK ENPAR R.E solar thermal system is a revolution in trough technology that brings together modern advances in manufacturing and technology with a focus on enhancing efficiency and reducing cost.

MULK ENPAR R.E system uses deep parabolic solar trough with light weight Alubond U.S.A solar collector mirror leading to higher efficiency, cost effective maintenance, substructure savings, proven tracking system and best warranty terms.

DEMO PLANT OPERATING (PLC Screen)

Full Size Commercial Trough - Sharjah, U.A.E

Demo Plant - Sharjah, U.A.E

Mulk Solar Collector Demo Field

- CONSTRUCT BY ONE LOOP IN SOLAR TROUGH
- AREA: 500 SQ. MT
- PARABOLIC COLLECTORS AND MAKE UP
- METAL MIRROR: ALUBOND SOLAR COLLECTOR MIRROR
- SUB STRUCTURE: ALUMINIUM
- SUPPORTING POST: STEEL
- FOUNDATION: CONCRETE
- RECEIVER TUBE: EVALUATED GLASS & METAL TUBE BY MUNK
- HEATING FLUID: SOLAR TROUGH OIL

One Loop - 1 Solar Trough

TYPE: PL-1007

- SOLAR TROUGH: 500 SQ. METERS
- TRACKING MOTOR: 5000 WATT
- TRACKING FLUID: SOLAR TROUGH OIL
- RECEIVER TUBE: 100MM

PERFORMANCE DATA:

- INPUT TEMP: 300°C
- OUTPUT TEMP: 320°C
- APERTURE AREA: 500 SQ. METERS
- HEATING CAPACITY: 1000 KW
- SOLAR RADIATION: 1000 KW
- ALUBOND: 1000 KW

ALUBOND U.S.A SOLAR COLLECTOR MIRROR - LIGHT-WEIGHT METALLIC MIRROR

The Alubond Solar Collector Mirror (ASCM) is a light weight composite metallic mirror with high total solar reflectance is invented, designed, developed in U.S.A by Mulk Enpar R.E's Khurram Khan Nawab and patented in U.S.A and Worldwide. ASCM is a result of pioneering research in metal composite technology with a special innovative and patented coating. American Building Technologies Inc (ABTI) brings this innovation to CSP, CPV and BMPV (Booster Mirror PV) systems that are superior to the conventional glass mirrors technology being currently used which is heavy, expensive and highly breakable.



Khurram Khan Nawab

Khurram Khan Nawabs other patents in the filed of green energy are:

Alubond PV Booster Mirror.
Receiver Tube ' Helios"
Solar PV Plat Form.
Solar Hydro electric Power system.
PBB Green power system.

ASCM Advantages:

- Highly durable exterior grade core.
- Features phenomenal flatness
- Low maintenance.
- Mirror - Hydrophilic Principle (Self Cleaning Property)
- Easier handling, packaging and shipping
- Concentration full range UV, visible, NIR and IR (380 μm to 2400 μm)
- Light weight
- Retains its shape
- Mirror are mass produced
- Unbreakable Mirrors

CONCENTRATED LINEAR FRESNEL REFLECTOR SYSTEM (CLFR)

Dilip apte of Mulk Enpar R.E. has design, developed and patented a unique Concentrated Linear Fresnel Reflector System (CLFR) for low heat operation used for process steam & Air Conditioning.

- Low cost & high efficiency in its class.
- Unique Tracking system
- BOM consists of commonly available parts
- Highly scalable
- Low wind resistance
- Easy to install & to maintain



MULK ENPAR R.E SYSTEM Vs CONVENTIONAL TROUGH TECHNOLOGY

The MULK ENPAR R.E Solar Trough System's salient improvements from the Conventional Trough Technology include:

SOLAR COLLECTOR MIRRORS

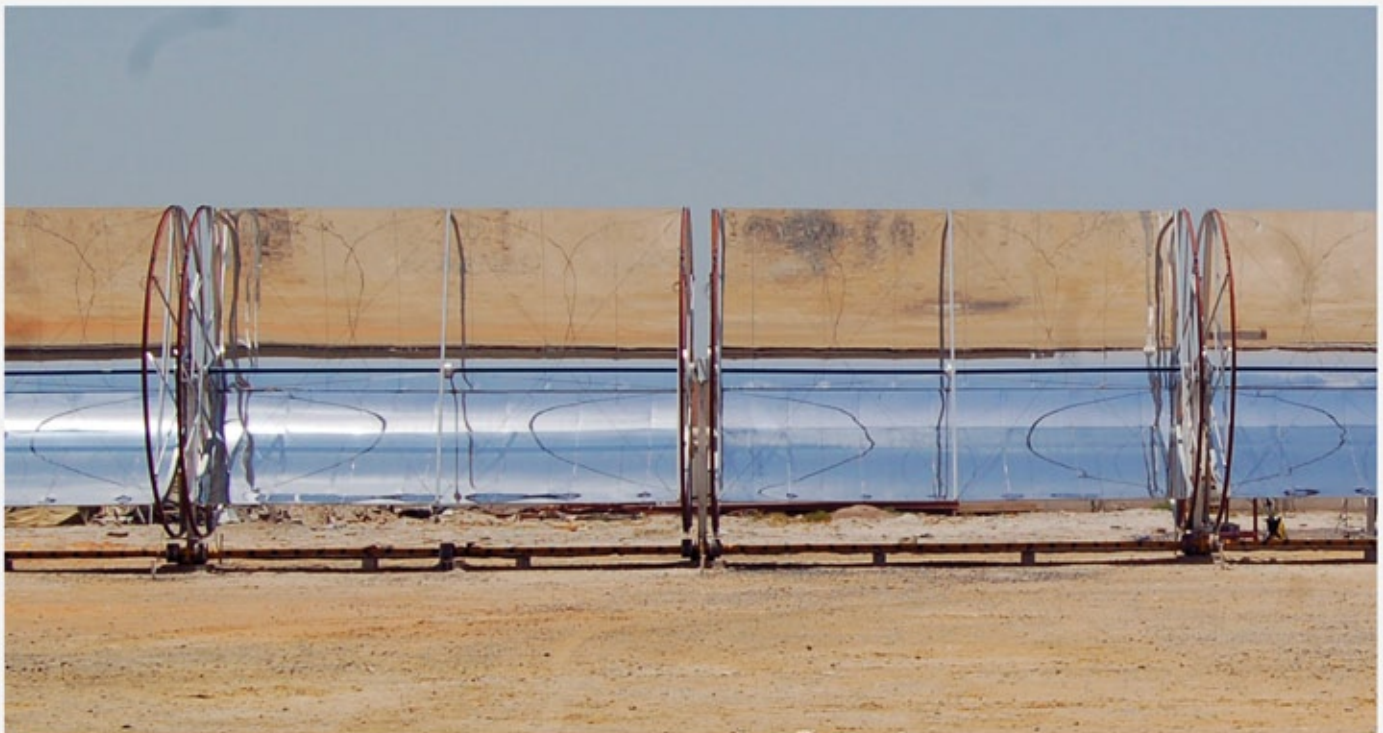
Conventional CSP systems

Heavy and expensive mirrors - 10 kg/sqm.

- Difficult to retain deep parabolic shape
- Requires extensive support frame.



MULK ENPAR R.E Solar system (MESS)



- Uses light weight Alubond Solar Collector Mirrors (ASCM) - 3 kg/sqm.
- ASCM mirror retains deep parabolic shape with ease.
- Requires simple substructure support frame.
- Savings of 200% in weight.

MULK ENPAR R.E SYSTEMS Vs CONVENTIONAL TROUGH TECHNOLOGY

SUBSTRUCTURE FRAME

Conventional CSP systems



- Conventional mirrors systems require complex support frames to hold the mirrors and the high trough structure.

MULK ENPAR R.E Solar system (MESS)



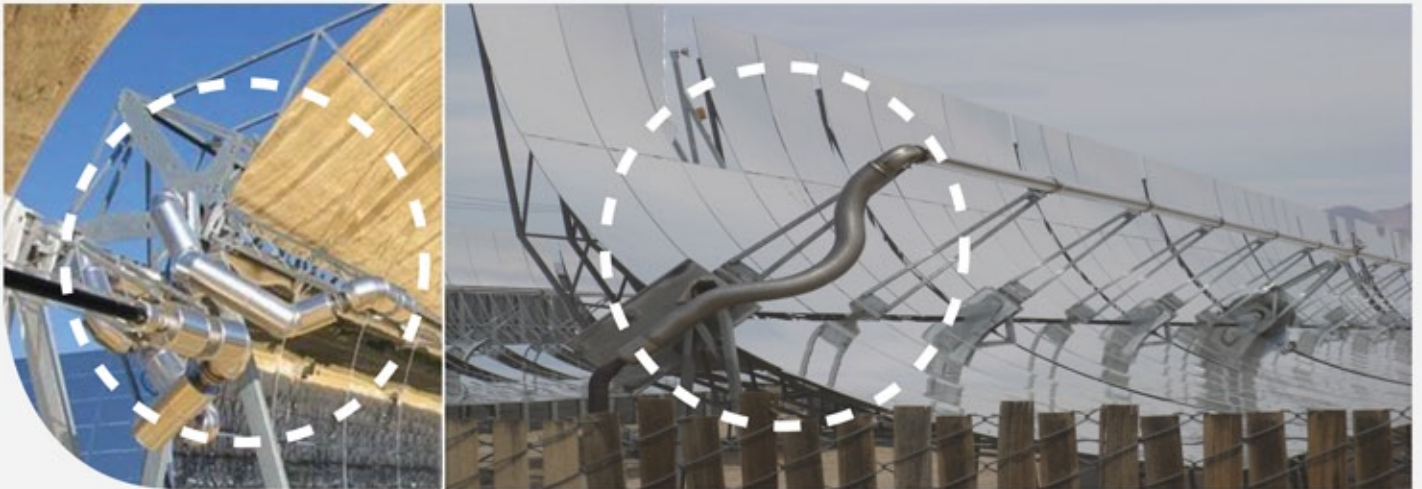
- MULK ENPAR R.E System uses ASCM that is lightweight and holds its deep parabolic shape requiring less than 1/4th of the conventional substructure.
- This leads to substantial substructure savings.

MULK ENPAR R.E SYSTEM Vs CONVENTIONAL TROUGH TECHNOLOGY

SOLAR RECEIVER TUBE AND SWIVEL JOINTS

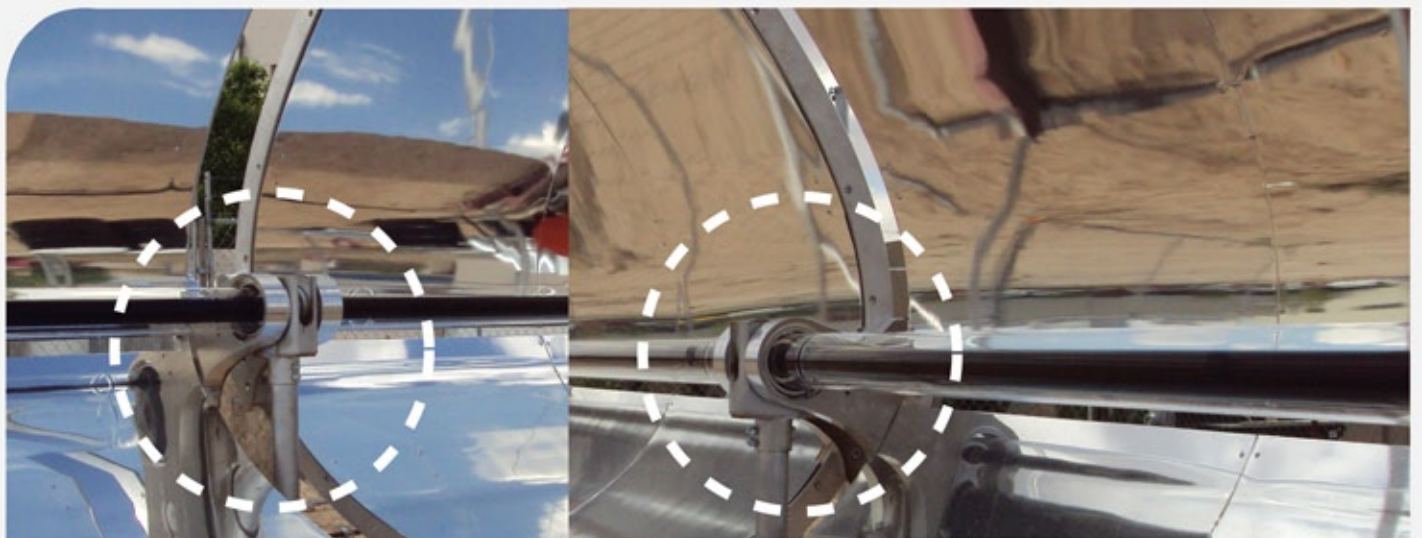
Conventional CSP systems

- Movement of receiver tube and parabolic troughs, degree off centre error is noticed.
- Entire trough including the solar receiver is rotated using complex hydraulics.
- This requires thousands of expensive swivel joints which require high maintenance.



MULK ENPAR R.E Solar system (MESS)

- Solar receiver tube is fixed at the bed of the concave.
- A row of 9 troughs can be moved using a small motor of 0.33 HP / 246 Watts.
- System is capable of reaching temperatures over 400 ° c and a steam pressure of over 60 bar.



MULK ENPAR R.E SYSTEM Vs CONVENTIONAL TROUGH TECHNOLOGY

INSTALLATION PROCESS

The MULK R.E Solar system can be preassembled at site and brought to site for installation.

LAND

▶ Conventional CSP systems

- Land required 3.5 to 4 acres per MW.

▶ MULK ENPAR R.E Solar system (MESS)

- Due to low height and reduced shadow effect
Land required 3 acres per MW

TRACKING & ROTATION

▶ Conventional CSP systems

- Tracks from below using hydraulics and heavy motors
- Large motor required to move standard troughs.

▶ MULK ENPAR R.E Solar system (MESS)

- Uses Archimedes principle.
- Sub Array of 9 troughs moved using a small motor.

MULK ENPAR R.E OVERHEAD TRACKING SYSTEM

Archimedes said “ Give me lever and a place to stand and I will move the world ”

Mulk Enpar R.E uses the Archimedes lever principle that anything that can be moved from above will need less torque.



ABTI Tracking Circuit



Gear Motor



Drum, Pipe & cable



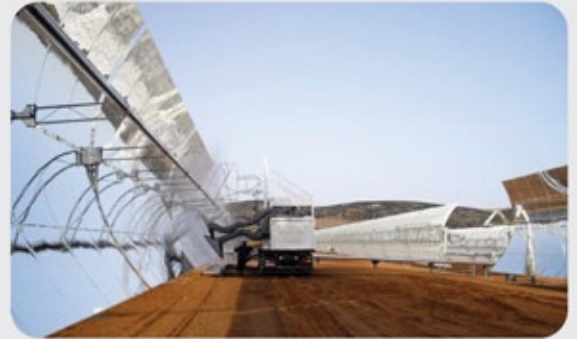
Tracking Big Wheel

MULK ENPAR R.E SYSTEMS Vs CONVENTIONAL TROUGH TECHNOLOGY

MAINTENANCE AND CLEANING

Mulk Enpar Solar system (MESS) advantages:

- Regular and constant velocity
- Adjustable water pressure & flow rate
- Mechanical Cleaning with Rotation brush
- Water recycling (Recovery Filtration and Reuse)
- Drying with high flow rate of air
- Remote Radio controlled panel
- CCTV cameras
- Ability to work in adverse conditions
- Low water consumption
- Cleaning of the top and bottom of the parabola same time
- Simultaneous cleaning of receiver tube
- Elimination of Swivel joints greatly reduces the complexity of Maintenance operations and breakdown time.



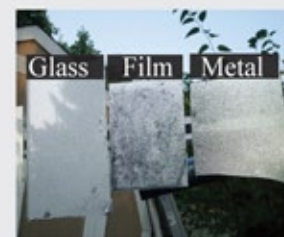
HYDROPHILIC EFFECT

Alubond Solar Collector Mirror have special innovative coating which uses Hydrophilic Principle in which the physical property of a molecule repels from a mass of water. This was observed when water was placed on the Alubond Solar Collector Mirror, water did not form droplets but instead fully wets the mirrors to have self cleaning effects.



Alubond
Solar Collector Mirror water flows

To study the effect of this aspect on solar system performance, samples were mounted on a rack outside on a clear night. The next morning, observations were made. As shown in the picture, Alubond Solar Collector Mirror hydrophilic samples appeared to be visually clear.



Conventional
Glass / Film / Metal Mirror
Water form clouds

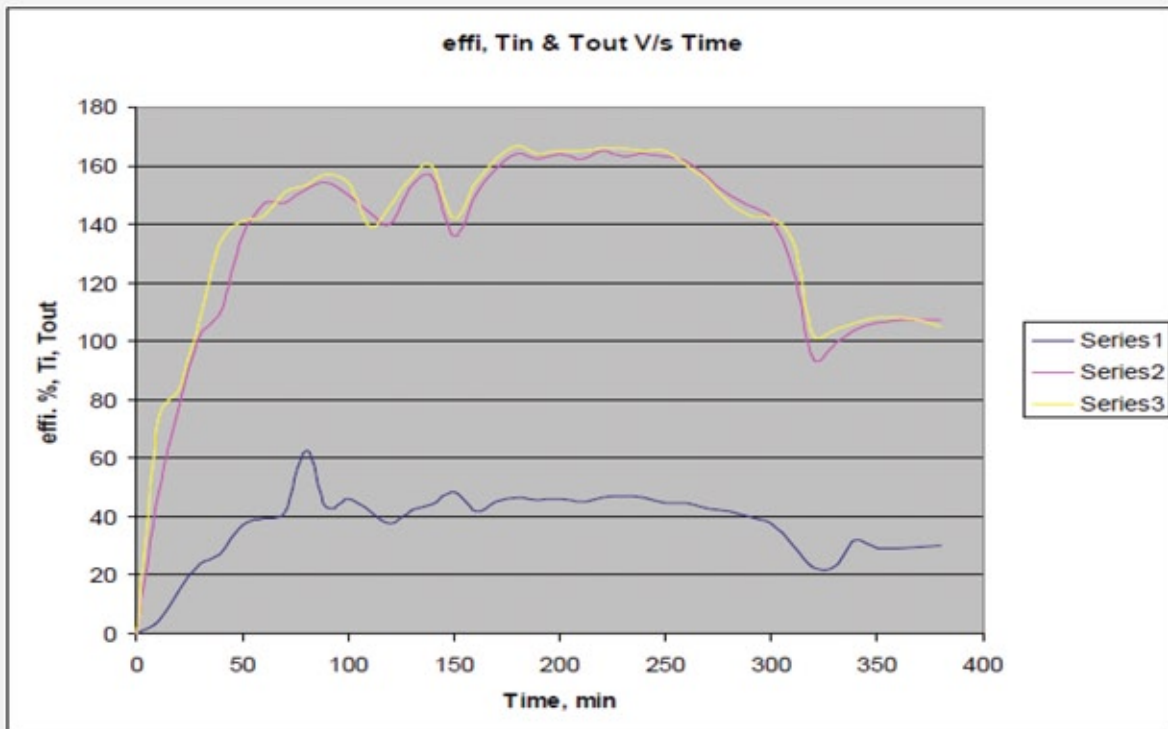
CONCENTRATED LINEAR FRESNEL REFLECTOR SYSTEM (CFLR)

Our Distributed Mirror Concentrator (DMC) uses Alubond Solar Collector Mirror which is curved to focus sun's Energy at 30-60 times the solar intensity on a specially designed receiver pipes & its distinct advantages

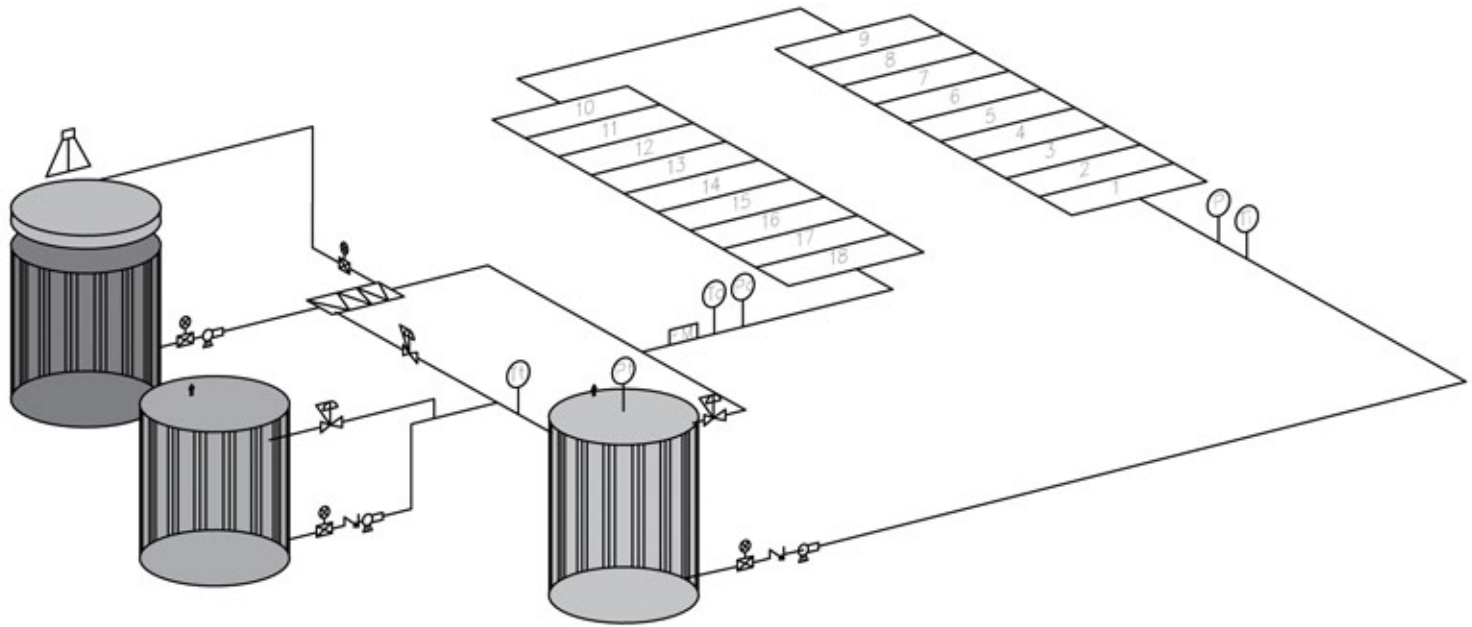
- Maintenance is easy
- Tracking is low power
- Very high land area coverage for collector area

Applications of CFLR

- Solar Air conditioning
- Process Steam



MULK ENPAR R.E ONE LOOP SYSTEM OPERATING AT HAMRIYAH FREEZONE, SHARJAH, U.A.E



COMPARISON - CONVENTIONAL MIRROR SYSTEM Vs MULK ENPAR R.E SYSTEM

SYSTEM COMPONENT	CONVENTIONAL MIRROR SYSTEM	MULK ENPAR R.E SYSTEM	ADVANTAGE
Reflector panel	Heavy Glass Mirrors	3 mm Composite Metallic Mirror (ASCM)	Lighter by 200%
Sub frame	Heavy space frame	Light weight tubular	
Rotation system	On hydraulics from below	From the top by tracking big wheel, drum & cables	High Efficiency
Tracking system	One large motor for every 6 troughs	Small gear motor 1/3 hp for 9 troughs	
Solar receiver tube	Moving with swivel joints	Fixed without swivel joints	
Hydraulics	Required	None	
Swivel joints	Two for every trough	None	
Height	Need height due to hydraulics	Low height	
Space between troughs	Large space due to greater height	Low space due to low height	
Land	Minimum 4 acres	Minimum 3 acres	
On site installation time 25 MW	16 to 18 months	12 to 14 months	
Maintenance	Intensive	Minimal	
Weight of entire system	Heavy	Light weight	Low Cost
Water Recovery- Washing	less than 60%	More than 80%	
Reflectivity	Approx 93%	Choice of 91% and 95 %	Higher Reflectivity
Exterior warranty	20 to 25 years	20 to 25 years	Best Warranty Terms



PLC system
Fully Automatic system

Moving system

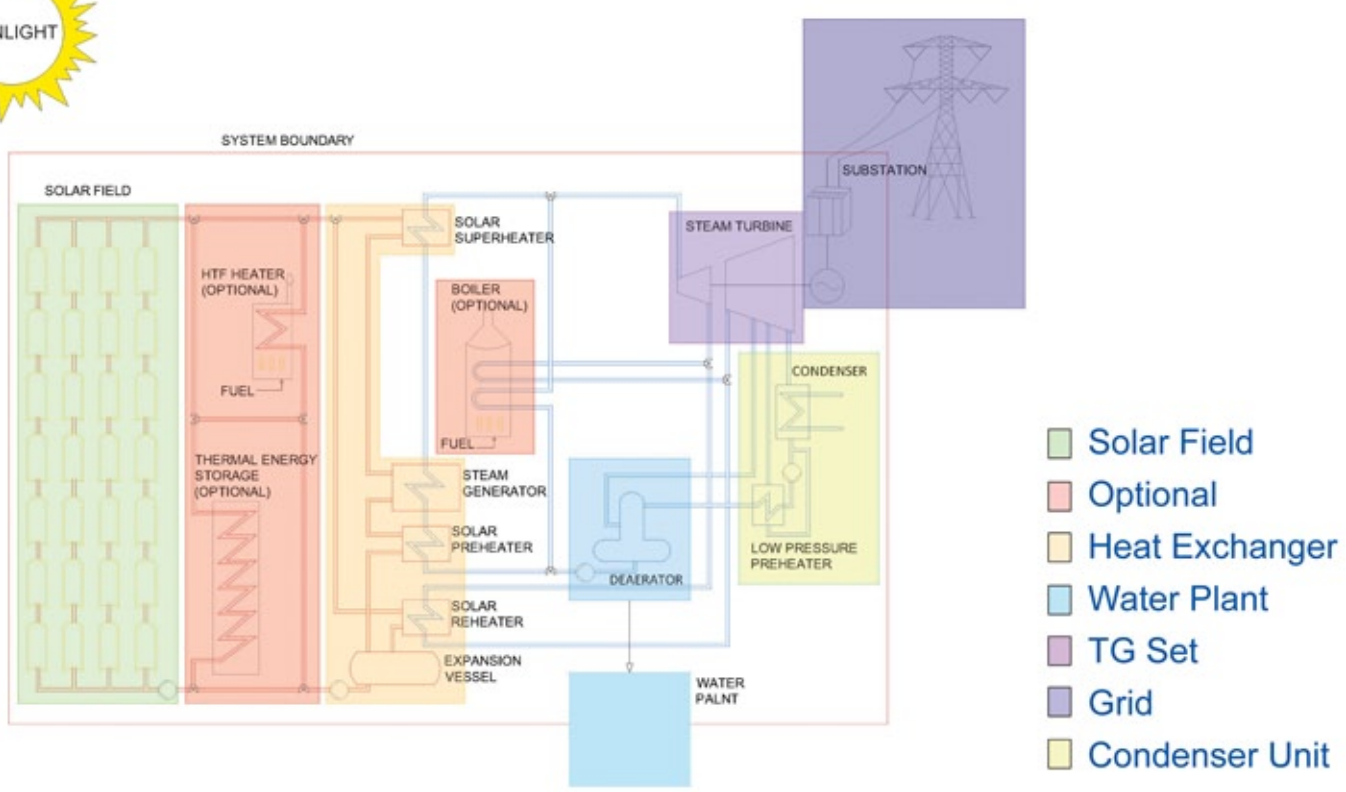
Control Room

Pump, Tank & Valves

Tracking Drum
Cables

Tracking Pipe
1/3 HP gear motor.

MULK ENPAR R.E SOLAR THERMAL SYSTEM - SCHEMATIC DIAGRAM



All information, Photos, Drawings, Data, Graphs is the Copyright of Mulk ENPAR RE
Technology Patented in USA & Worldwide



Mulk Enpar

Renewable Energy

A BREAKTHROUGH IN CSP TECHNOLOGY
LOW COST & HIGH EFFICIENCY



Mulk ENPAR Renewable Energy

Post Box No. 50879

Hamriya Freezone, Sharjah

United Arab Emirates

Tel : +971-6- 5262202

Fax : +971-6-5262203

csp@mulkre.com

www.mulkre.com