



C. S. T. P.

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(CONCENTRATED SOLAR THERMAL POWER)

BY

SOLTHERM ENERGY SOLUTIONS (P)LTD.

UTTAR PRADESH (INDIA)

www.soltherm.in

Background.....



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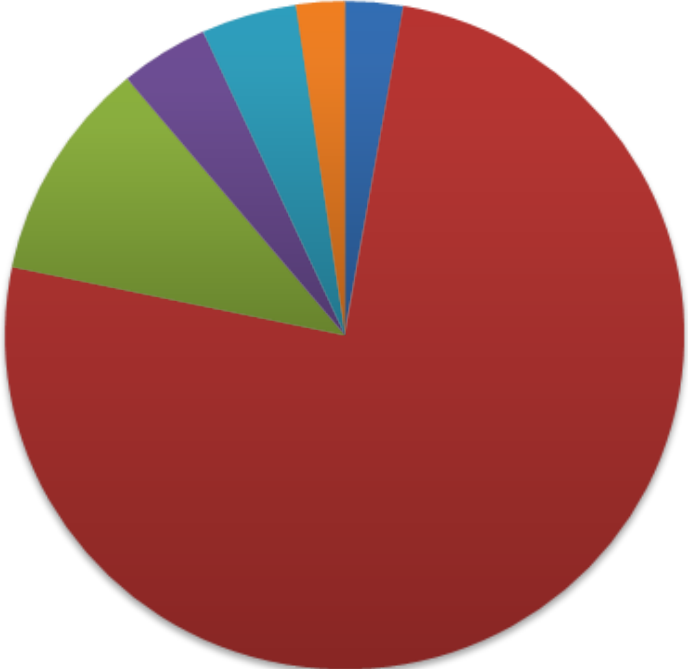
.....Need

- We need “Energy” to perform any task, whether it be a living organism or an Industrial Setup.
- Electricity has been proved to be so convenient and accustomed form of energy, to be used for almost every walk of life that we can not even envisage any task without Electric Power.
- India has been an energy starved country so far, there is still a huge gap in demand and supply. The rate of per capita energy consumption is far lower in India than that of world’s average.
- More than 65% of our energy needs are fulfilled by Coal Fired Power Plants. Burning coal causes various direct or indirect environmental consequences.
- More over the cost of energy is also striking high beyond the reach of common people.
- Thus we are in immense need of a sustainable, dependable, cost effective & environment-friendly solution for our ever increasing energy needs.
- The presents technology is the right answer to the situation we have entered into.

India Power Mix 2020 (Courtesy EIA)

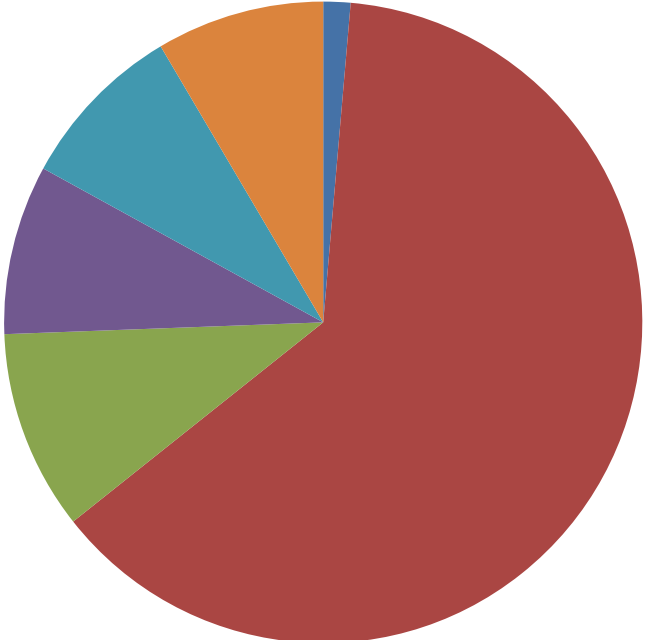


Annual Generation Mix (14,51,000 MU)



- Nuclear (40,000 MU)
- Hydro (155,000 MU)
- Wind (66,000 MU)
- Fossil Fuel (1,096,000 MU)
- Solar (61,000 MU)
- Biomass (33,000 MU)

Installed Capacity Mix (4,57,300 MW)



- Nuclear (6,300 MW)
- Hydro (46,000 MW)
- Wind (39,000 MW)
- Fossil Fuel (288,000 MW)
- Solar (39,000 MW)
- Biomass (39,000 MW)

India Power Mix 2020 (Courtesy EIA)



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Annual Generation Against Installed Capacity

Resource	Installed Capacity (MW)	Annual Generation MU	Annual Generation (MU/MW)
Nuclear Power	6,300	40,000	6.35
Fossil Fuel Plants	288,000	1,096,000	3.80
Hydro Power Plants	46,000	155,000	3.36
Solar Power Plants	39,000	61,000	1.56
Wind Power Plant	39,000	66,000	1.69
Biomass Power Plants	39,000	33,000	0.85
TOTAL	4,57,300	1,451,000	3.17
Typical CSTP Plant	1.00	7.5	7.5

Sustainable Development? (Options)



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- Sustainable development is nothing but making a balance in what we consume and what we produce, if we are not compelled to use some reserve resource and Production matches the consumption, then we can say we are in a sustainable state.
- In Power Sector we are dependent mostly on Coal based Power Stations where we use coal reserves but we can not produce it, so this is not a sustainable system.
- For total replacement of Coal Fired Power Stations, we may be required to install about 3,00,000 MW such Solar Power Station with storage.
- Therefore, if we envisage develop a sustainable power generation by CSTP We may need about 18,000 Km² Land Area in Suitable Region to sustain 3,00,000 MW Generation.
- Alternatively on the other hand, if we envisage develop a sustainable power generation by growing biomass, and run Coal/Biomass based Power Plant. In that case the total required land area engaged with C₄ Plantation, has to be more than 9,00,000 Km² to sustain 3,00,000 MW Generation.

Solution (The Way Ahead)



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- Here at SOLTHERM ENERGY SOLUTIONS PVT. LTD. We are offering the Cost effective, Eco-friendly CSTP system, that is one point solution of all your needs of Power, Heating & Air-conditioning.
- The present CSTP system uses solar heat to produce required Power using Concentrating Solar Power Technology.
- With adequate provision of Thermal Storage, the power plant runs round the clock to ensure regular power supply hence grid independent operation is made possible.
- Process Steam/ Heat can also be made available as and when required.
- The Exhaust Heat of CSTP Plant may be used to produce desired Heating/ Cooling as and when required.
- The system runs on solar power only to produce required power, therefore there is Zero Cost of Fuel and Zero Emission as well.

Why CSTP?



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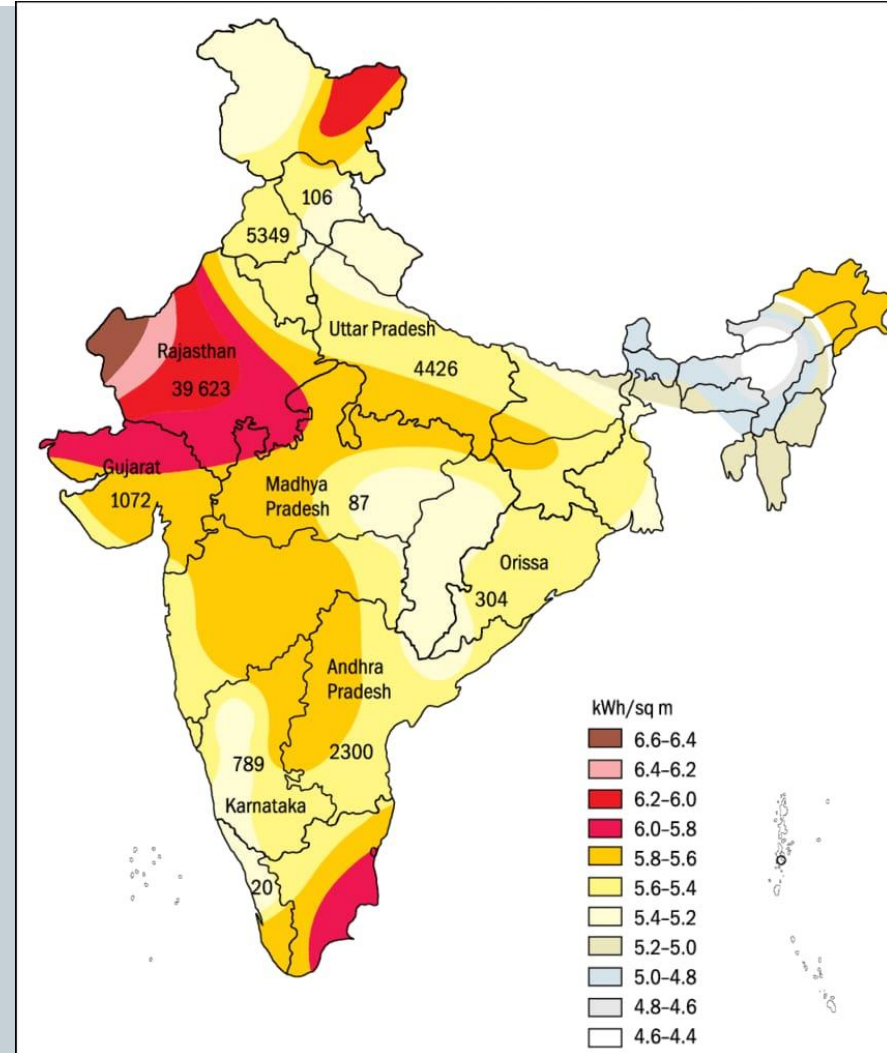
- ❖ As we know “Sun is the ultimate source of energy on Earth”.
- ❖ Green Plants converts only <2% of solar energy into Bio-mass that could be used as Food/ Fuel source by various organism or industries.
- ❖ Solar PV Plants converts about 15-18% of Solar Energy into electricity by direct conversion, more over it can supply power 5-8 hours/day.
- ❖ A typical CSTP Project can convert 22-28% of solar energy into electricity, thereby reducing specific land requirement, more over round the clock power supply is made available by means of adequate thermal storage.
- ❖ Thermal Storage is much more cost effective, durable, reliable, than that of electrical storage, especially on large scale storage.
- ❖ Sustainable and dependable system of power generation that have potential to play base load provider & substitute coal fired Thermal Power Plants.

The Solar Resource & Power Need



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- India being situated in tropical region receives good enough solar resource.
- As we can see in the MNRE provided solar resource map of INDIA, whole of the Country does not receives good enough Solar Irradiation what may be optimal for a CSTP Project.
- Even then we have most of the regions, which receives >5.6 KWh/M² DNI where this kind project can be developed as well.
- The Country presently has a total Installed Capacity about 3,29,000 MW.
- For a typical 100 MW CSTP Project about 1500 Acre land is required. That could generate about 720.00 MU Electricity each year.



The Technology



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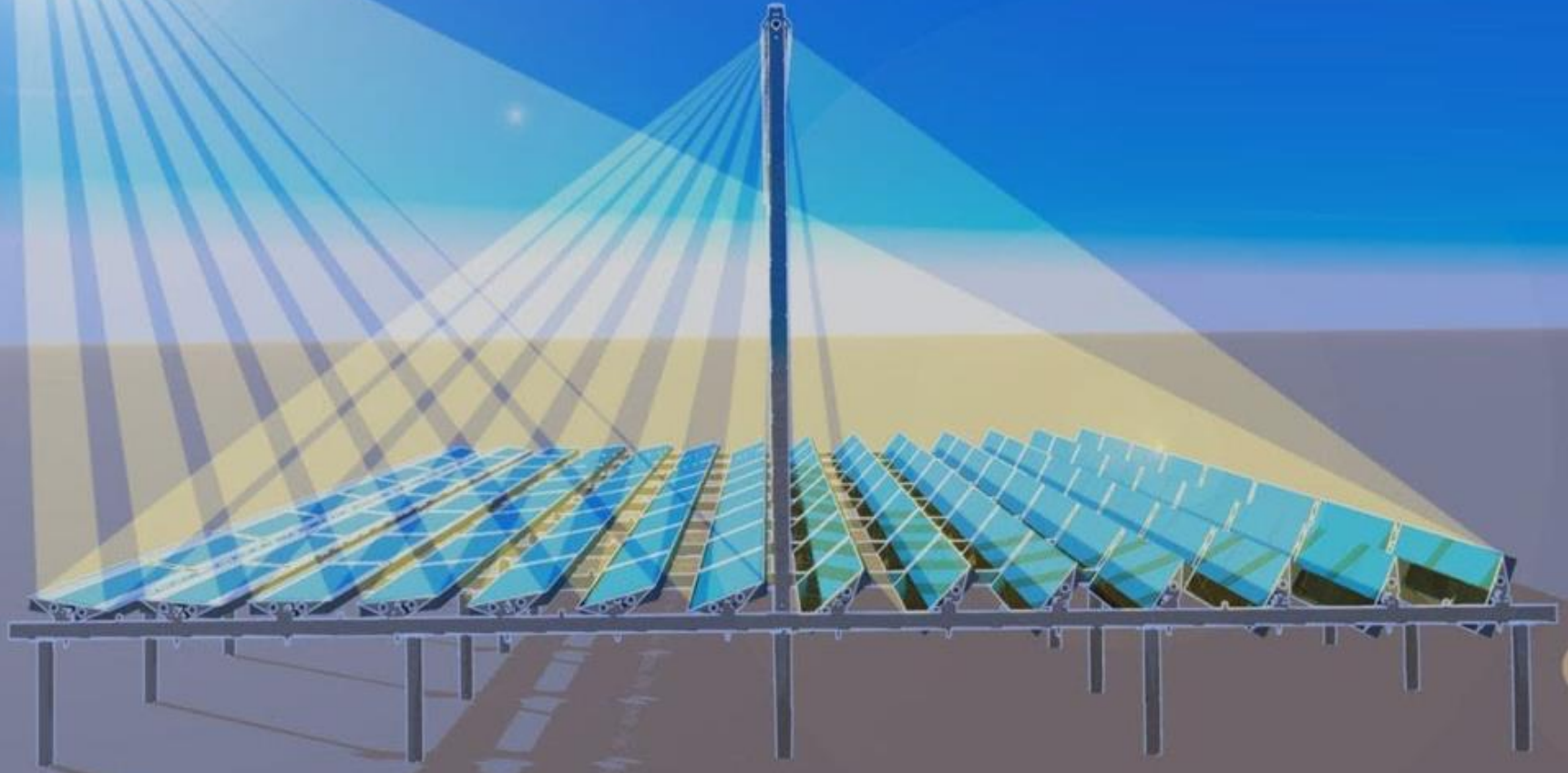
1. Solar irradiation is concentrated on a centrally located receiver tube thereby attaining high temperature to Produce super heated steam.
2. The super heated steam is used to run a Rankin Cycle based turbine to produced required Power.
3. The Technology is contrary to the Solar Photo Voltaic Technology which Directly Convert Radiant energy into Electricity (DC Power)
4. Round the clock operation is made possible by adequate “Thermal Storage” of solar heat for overnight operation of the Plant.
5. Super Critical Operation of the Plant ensures even higher thermodynamic efficiency of the plant, thereby reducing specific cost of generation.

Concentrating Solar Irradiation...



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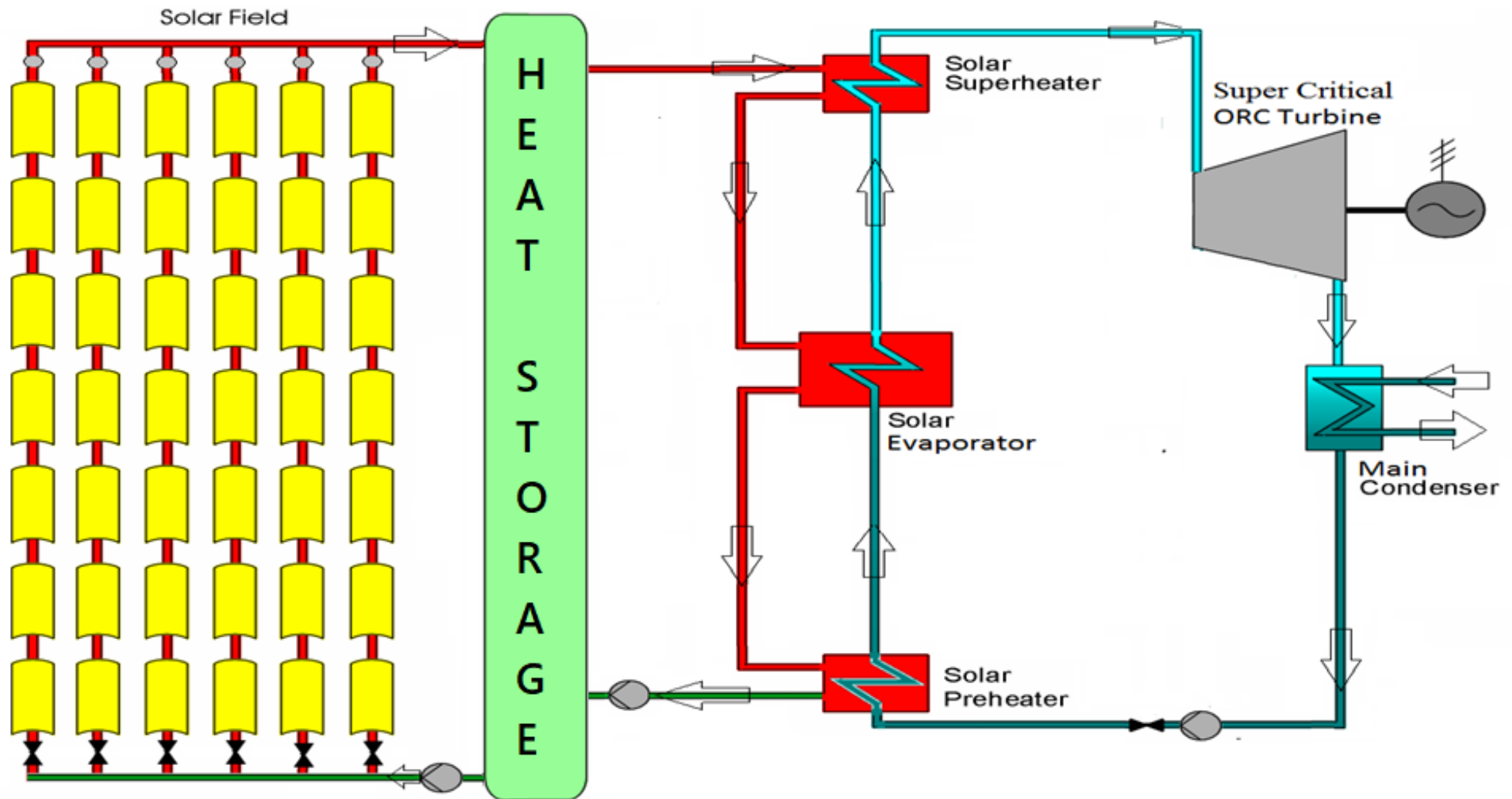
Concentration of sun rays onto the receiver



Schematic Process Flow Diagram



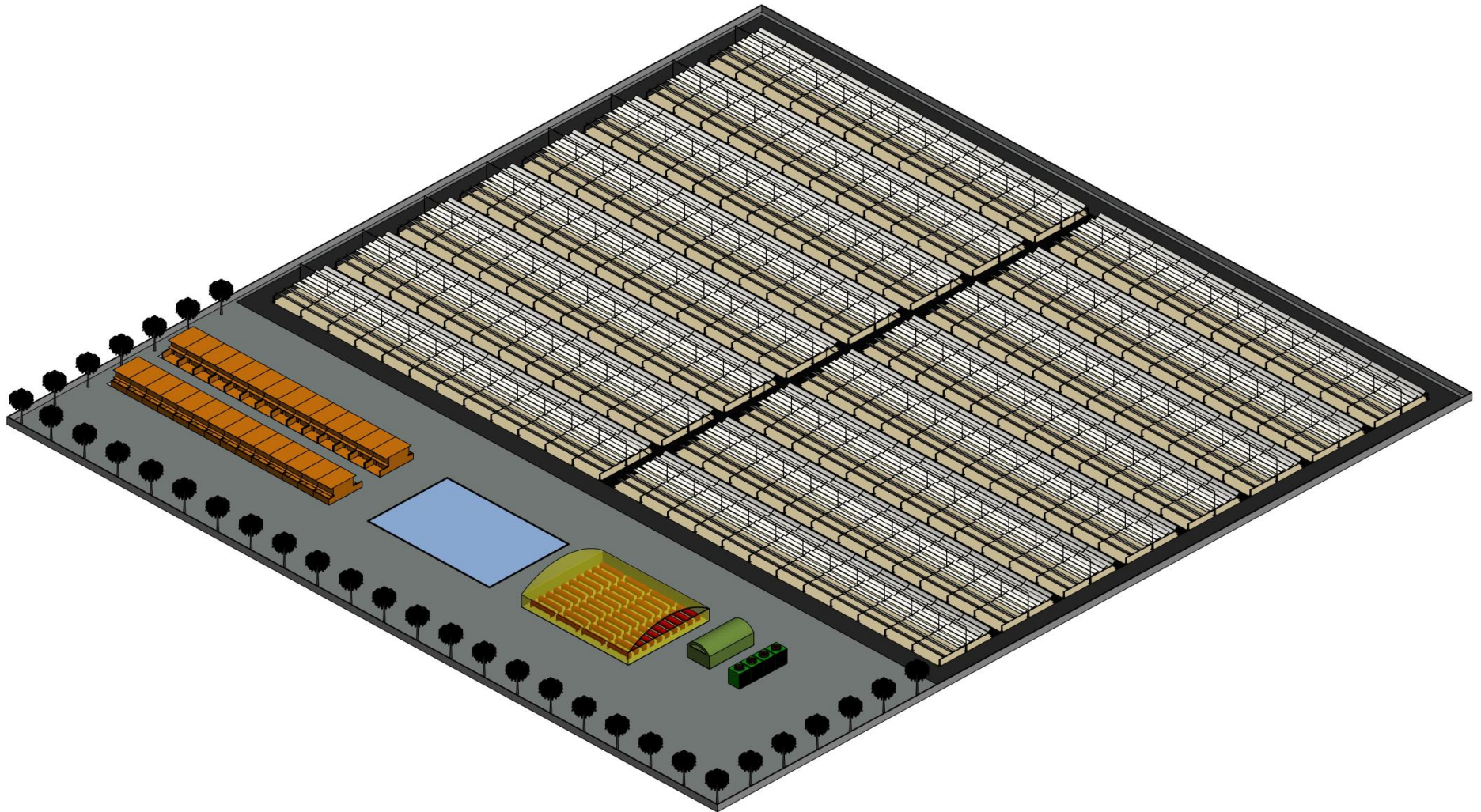
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Schematic Plant Setup



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Key Advantages of CSTP



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- Reduced Specific Cost of Generation of Solar Power.
- Round the clock operation, with adequate Thermal Storage.
- Achieved Plant Load Factor (PLF) 80-100%.
- Can Sustain Jerk Load as against SPV Technology.
- Reduced Specific Land Requirement for Solar Power Generation.
- Cost competitive to Coal Fired Thermal Power Plants.
- Can play as base Load Supply as Like Coal Fired Thermal Power Plants.
- A typical One MW CSTP Plant can save >5000 Ton Coal/Year, and **prevent more than 18,000 Ton CO₂ Each Year.**

Comparison: (SPV without Storage)

SPV v/s CSTP



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Description	SPV Project	CSTP Project
➤ Plant's net Electrical Capacity	1 MW	1 MW
➤ Designed Plant Load factor (PLF)	20-22%	80-100%
➤ Daily Operating Hours	6-8 Hours	24 Hours
➤ Daily Electricity Produced	4500-5000 KW.h	22,000-24000 KW.h
➤ Annual Average net Electricity Produced	1350-1500 MW.h	6600-7200 MW.h
➤ Land Area Required	10,000-12000 M ²	60,000-62,000 M ²
➤ Active Service Life	25-30 Years	25-30 Years
➤ Estimated Cost of Installation	INR-4.0~4.5 Crore	INR-20.0~22.0 Crore
➤ Average Gestation Period	4-6 Months	10-12 Months
➤ Specific Cost of Installation	INR-30/KW.h/Year	INR-35/KW.h/Year

Comparison: (SPV with Storage)

SPV v/s CSTP



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Description	SPV Project	CSTP Project
➤ Plant's net Electrical Capacity	1 MW	1 MW
➤ Designed Plant Load factor (PLF)	100%	100%
➤ Grid Feeding	24 Hour	24 Hours
➤ Daily Electricity Produced	24,000 KW.h	24000 KW.h
➤ Energy Storage (Type)	Electrical	Thermal
➤ Land Area Required	70,000-75,000 M ²	60,000-62,000 M ²
➤ Storage Replacement	3-5 Years	N/A
➤ Estimated Cost of Installation	INR-34.0~35.0 Crore	INR-20.0~22.0 Crore
➤ Cost of Battery Replacement	INR-2.0 Crore/Year	N/A
➤ Specific Cost of Installation	INR-60/KW.h/Year	INR-35/KW.h/Year

Present & Potential Usage...



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- Dependable Power Supply to Industrial Commercial or Residential Consumers.
- Feeding Charging Stations to Power Electric Mobility.
- Green Hydrogen Generation that may be used in various industrial or energy application.
- Green Ammonia production to sustain Fertilizer Industry & eliminate dependency upon fossil reserves.



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THANKING YOU

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