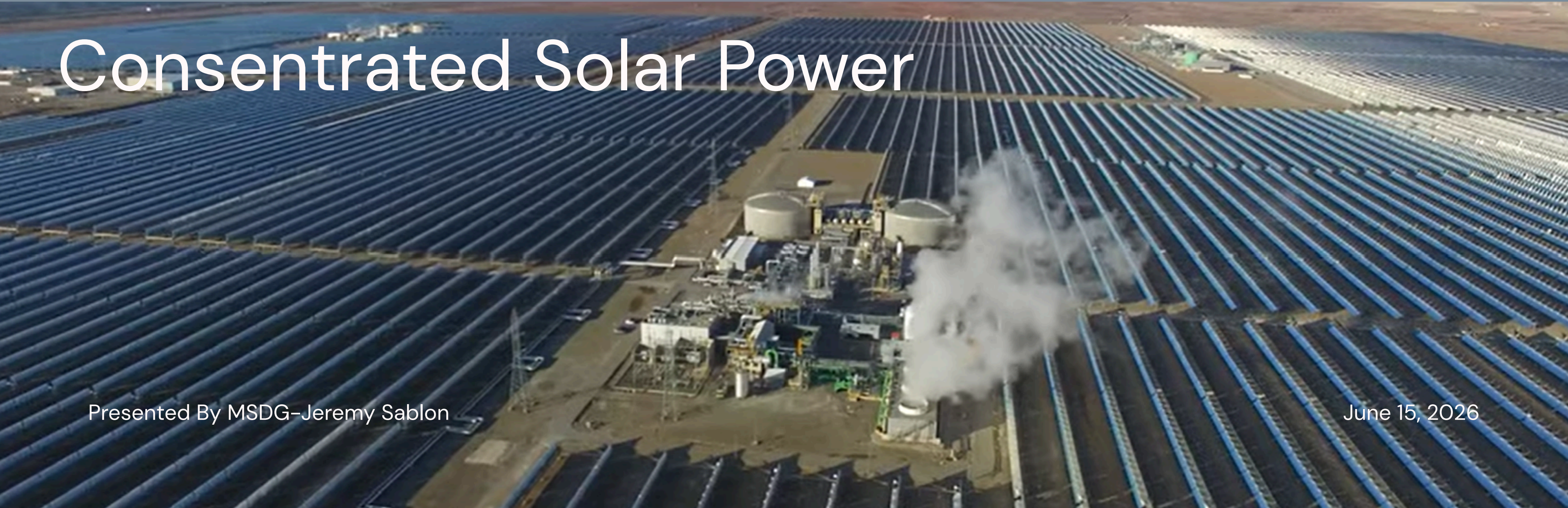


CSP

Concentrated Solar Power

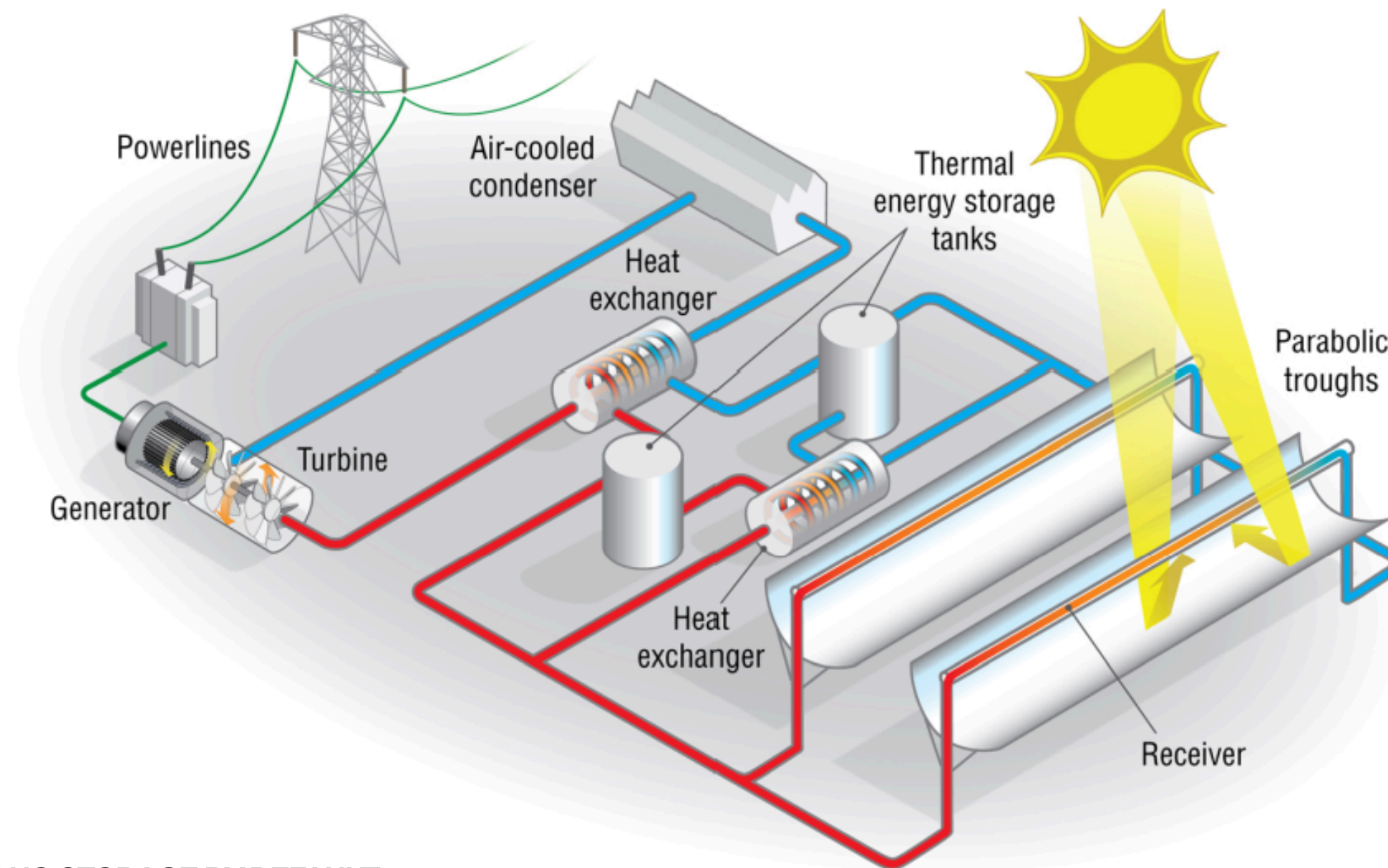
Presented By MSDG-Jeremy Sablon

June 15, 2026



WHAT IS CSP?

CSP (Concentrated Solar Power) is a renewable thermal power technology that uses reflective mirrors to concentrate direct solar radiation into high-temperature heat, and converts thermal energy into electricity via traditional steam turbine power cycles.



CORE DIFFERENCE FROM PV

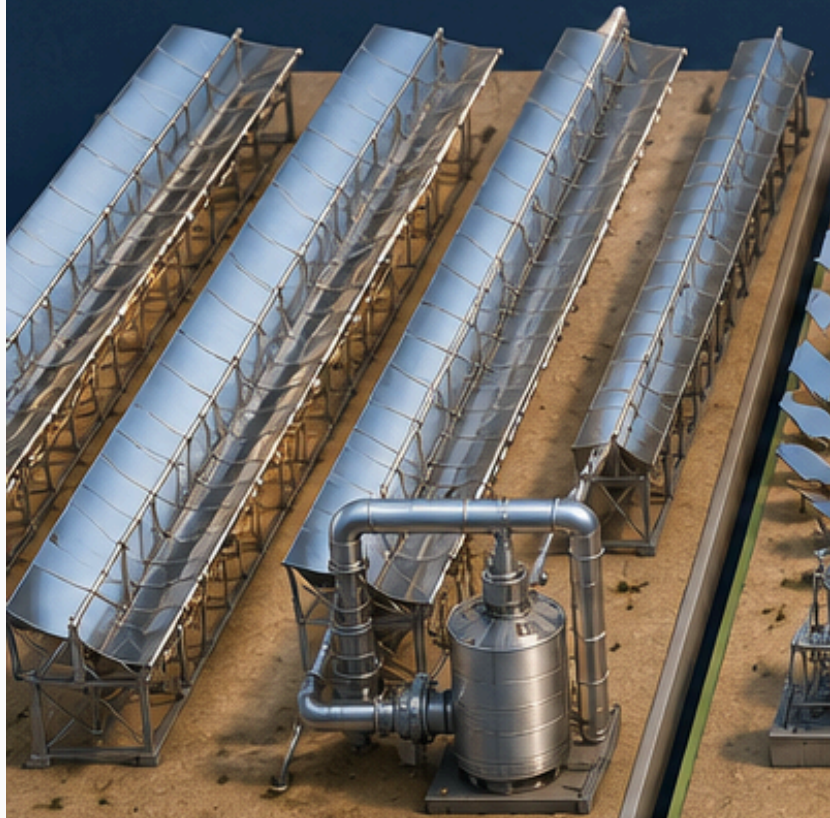
PV: LIGHT → → → ELECTRICITY (INTERMITTENT, NO STORAGE BY DEFAULT)

CSP: LIGHT → HEAT → ELECTRICITY (DISPATCHABLE, SUPPORT STABLE POWER SUPPLY WITH THERMAL STORAGE)

Four Mainstream CSP Technologies

1

Parabolic Trough Technology



Uses parabolic-shaped mirrors to focus sunlight onto a receiver tube. The heat transfer fluid heated in the tube is used to generate steam and produce electricity.

2

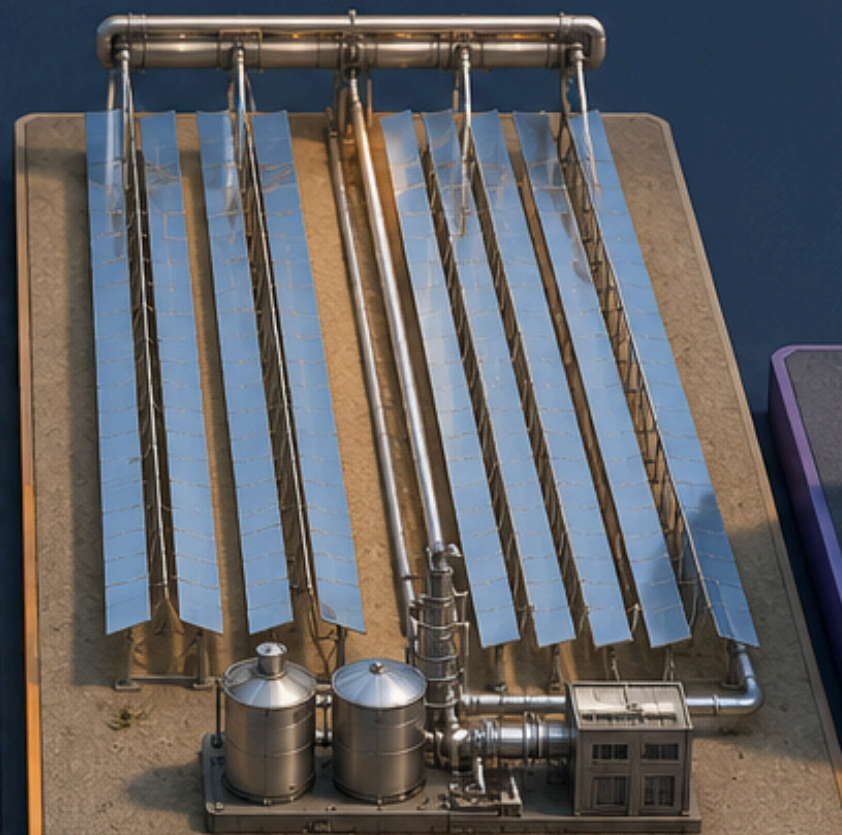
Solar Tower Technology



Uses a field of heliostats (mirrors) to focus sunlight onto a receiver at the top of a tower. The heat absorbed is used to generate steam and produce electricity.

3

Linear Fresnel Technology



Uses long, flat or slightly curved mirrors to focus sunlight onto a fixed elevated receiver. The heat transfer fluid is used to generate steam and produce electricity.

4

Dish Stirling Technology



Uses a parabolic dish to focus sunlight onto a receiver/engine (Stirling engine) that converts heat directly into electricity.

PARABOLIC TROUGH TECHNOLOGY



Core Principle

Utilizes long, curved parabolic mirrors to focus direct sunlight onto a receiver tube along the focal line. Inside the tube, a heat transfer fluid (HTF), typically synthetic oil, is heated to temperatures up to 390°C, which is then used to generate steam for power production.

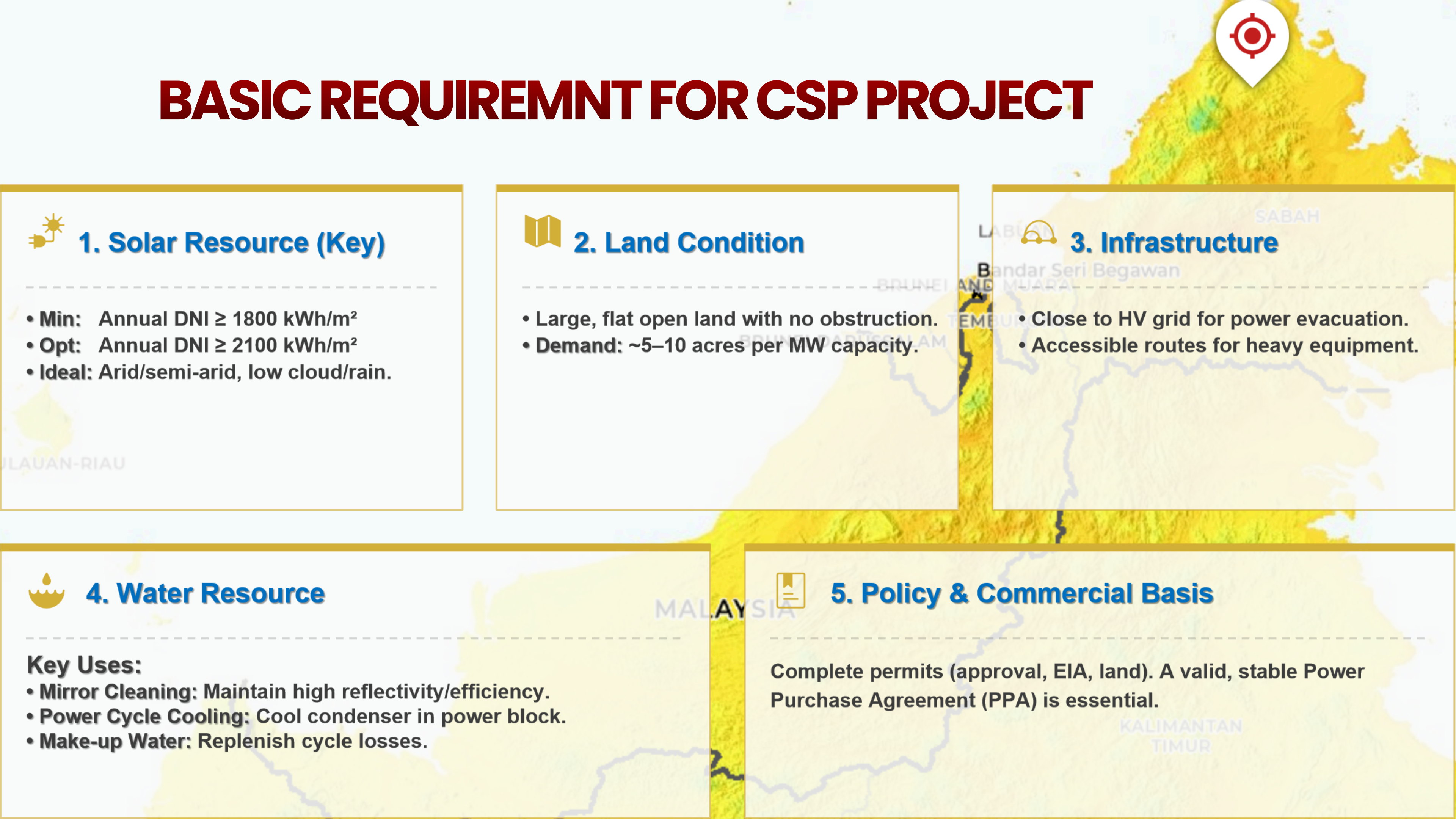
Key Components

Parabolic Mirrors & Receiver

Tube: Highly reflective glass troughs focus light onto an evacuated glass-metal absorber tube, minimizing heat loss to the environment.

HTF & Tracking System: Synthetic oil transfers heat to the power block; a single-axis tracker aligns troughs east-west to maximize solar capture.

Advantages: Most mature technology with a proven track record, established supply chains, and lower investment risk for developers.



BASIC REQUIREMENT FOR CSP PROJECT



1. Solar Resource (Key)

- **Min:** Annual DNI ≥ 1800 kWh/m²
- **Opt:** Annual DNI ≥ 2100 kWh/m²
- **Ideal:** Arid/semi-arid, low cloud/rain.



2. Land Condition

- Large, flat open land with no obstruction.
- **Demand:** ~5–10 acres per MW capacity.



3. Infrastructure

- Close to HV grid for power evacuation.
- Accessible routes for heavy equipment.



4. Water Resource

Key Uses:

- **Mirror Cleaning:** Maintain high reflectivity/efficiency.
- **Power Cycle Cooling:** Cool condenser in power block.
- **Make-up Water:** Replenish cycle losses.



5. Policy & Commercial Basis

Complete permits (approval, EIA, land). A valid, stable Power Purchase Agreement (PPA) is essential.

An aerial photograph of a large Concentrated Solar Power (CSP) plant. The image shows long, parallel rows of solar collectors (heliostats) reflecting sunlight. In the center, there are several industrial buildings, including a large multi-story structure and smaller auxiliary buildings. A parking lot with several vehicles is visible in the foreground. The text "CSP" and "5 CORE SYSTEMS" is overlaid in large, bold, red letters.

CSP

5 CORE SYSTEMS

SOLAR FIELD SYSTEM



Function

The primary energy collection system of the CSP plant, capturing and concentrating solar radiation to convert it into thermal energy, which is critical for power generation stability.



Reflective Mirror Arrays

Large fields of mirrors (heliostats, parabolic troughs, or Fresnel reflectors) that track the sun's movement to focus sunlight onto receivers.



Sun Tracking System

Precision drives and control systems that ensure optimal alignment with the sun, maximizing the amount of solar energy captured.



Heat Transfer Fluid (HTF) Pipeline Network

Pipes that circulate the heat transfer fluid to and from the receivers, transporting thermal energy for storage or power generation.

RECEIVER & THERMAL ENERGY STORAGE (TES) SYSTEM



Receiver System

TRX SOLAR RECEIVER TUBE



Function:

The key heat absorption device. It absorbs the concentrated solar energy and transfers this heat to the heat transfer fluid (HTF), heating it to high temperatures (e.g., 565°C for molten salt).



Thermal Energy Storage (TES)

The core advantage of CSP, enabling dispatchable power generation. Typically adopts a molten salt heat storage mode with two large tanks for hot and cold salt.



Dispatchable Power

Excess solar heat is stored in the hot tank. When needed, hot salt generates steam for power production, allowing for **24-hour stable power supply**.

POWER BLOCK SYSTEM



Function: The thermal-to-electric conversion unit of the plant.



Steam Generator

Uses the hot HTF to produce high-pressure, high-temperature steam.



Steam Turbine

Driven by the steam, converting thermal energy into mechanical rotational energy.



Generator

Converts the mechanical energy from the turbine into electrical energy.



Cooling System

Condenses the exhaust steam back into water for reuse.

BALANCE OF PLANT (BOP) AUXILIARY SYSTEM

Function: All supporting systems essential for the plant's operation.



Composition:

- **Electric Power Distribution:** Transforms and distributes generated electricity to the grid.
- **Water Treatment Plant:** Provides clean water for cooling and mirror cleaning.
- **SCADA:** The central automatic control system that monitors and operates the entire plant.
- **Civil Engineering:** Includes buildings, roads, foundations, etc.
- **Auxiliary Supporting Facilities:** Fire protection systems, maintenance workshops, etc.

CORE ADVANTAGES OF CSP

- **DISPATCHABLE RENEWABLE POWER:**
SOLVE SOLAR INTERMITTENCY PROBLEM
- **LONG ENERGY STORAGE TIME:**
6–12 HOURS FULL-LOAD STORAGE
- **HIGH GRID STABILITY:**
SUITABLE FOR BASE LOAD & PEAK LOAD REGULATION
- **LONG SERVICE LIFE:**
25–30 YEARS OPERATION PERIOD

- CSP is a high-value renewable power technology with heat storage capability. Basic requirements of CSP project requires sufficient solar resources, qualified land & infrastructure, and complete legal & commercial conditions. The whole plant is composed of solar field, receiver, thermal storage, power block and BOP systems, which jointly realize stable, continuous and grid-friendly solar power generation.



THANK YOU

