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**EMCORE Corporation Background**
Emcore is a world-recognized supplier of optical components into the broadband and telecommunications market, and Multi Junction solar cells and panels into the Satellite Power market. Emcore is a publicly traded company on the Nasdaq exchange under the symbol of EMKR. Emcore has numerous manufacturing and design centers globally and is headquartered in Albuquerque, NM, U.S.A. Additional information regarding EMCORE can be found on the web at www.emcore.com

**EMCORE SOLAR POWER**

EMCORE is a world-recognized supplier of optical components into the broadband and telecommunications market, and Multi-Junction photovoltaic technology for the satellite market. The company, founded in 1984, is respected for its product manufacturing capabilities, with over 20 years of continuous operations, $100M of facilities and equipment, more than 750 employees and with 2007 annual revenues of over $170M USD. EMCORE is uniquely positioned as a vertically integrated supplier of Concentrator Photovoltaic (CPV) systems. EMCORE began producing Multi-Junction (MJ) solar cells for the satellite industry in 1998 and began producing CPV solar cells for high-concentration systems (up to 1,000X) in terrestrial applications in 2004. EMCORE's MJ solar cells have performed flawlessly in satellite applications without a single incidence of solar cell failure recorded over eight years of continuous operation. The same high-quality cell technology is being translated to our terrestrial products. Our vertical integration provides a cost advantage and allows a competitive advantage at the system level, in our ability to optimize the performance between the cell and system. For more than twenty years, EMCORE designed, developed, and manufactured large-scale metal organic chemical vapor deposition (MOCVD) systems for the manufacture of solar cells, LEDs, laser diodes, RF transistors, and high power semiconductors among other applications. This experience in large-scale capital equipment development, combined with state-of-the art solar cell technology, provides a foundation for EMCORE Solar Power, one of four divisions within EMCORE today. EMCORE Solar Power produces high-efficiency CPV array systems and is positioned as a turnkey system provider for utility-scale and large commercial solar power generation facilities.

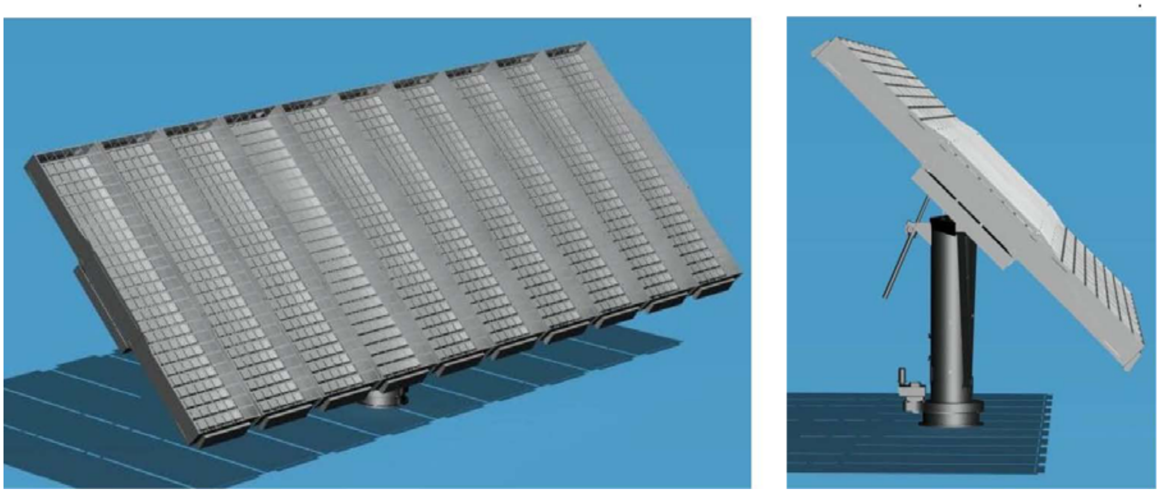


**Figure 1**: Graphical representation of the EMCORE 25KW CPV array

**CONCENTRATOR PHOTOVOLTAIC TECHNOLOGY**
**Background**

An evaluation of the markets for CPV technology and traditional silicone photovoltaics reveal significant cost advantages for CPV. The silicon cell industry is a mature, commoditized, industry with little room for cost reductions. The industry experienced silicon shortages in 2006 causing price increases. Costs are expected to return to a 10% year-over-year reduction, but they will have to come from higher-volume economies as the price for silicon will remain fairly stable and there is little room for higher cell efficiencies. CPV Cost reductions have been dramatic due to both the rapid development of high-volume production and higher cell efficiencies. Material cost for CPV cells is kept low due to the extremely small size of the cells. Currently 36% efficient CPV cells are being manufactured, almost twice the efficiency of silicon cells, and the technology for efficiency increases, up to 45% by 2010, are already known. The combination of lower material usage, much higher cell efficiencies and high-volume production will allow for rapid cost reductions for CPV technologies as seen in Figure 2.

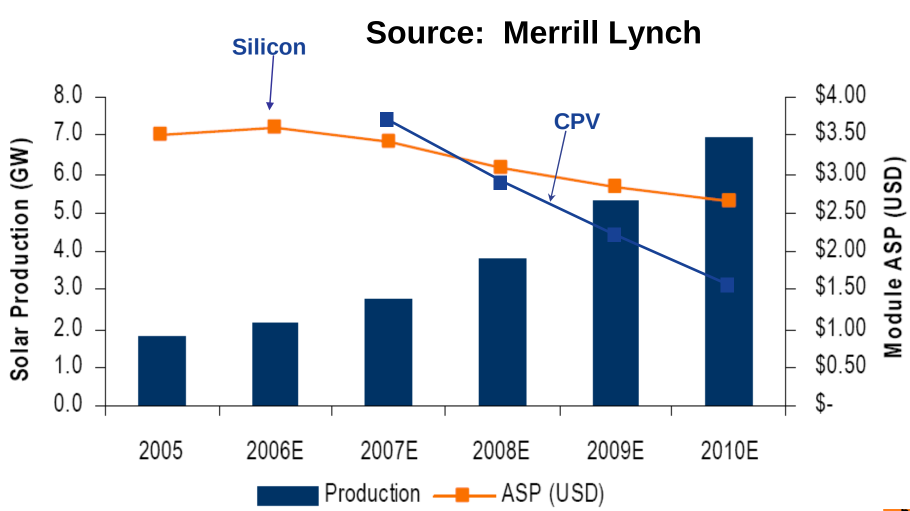
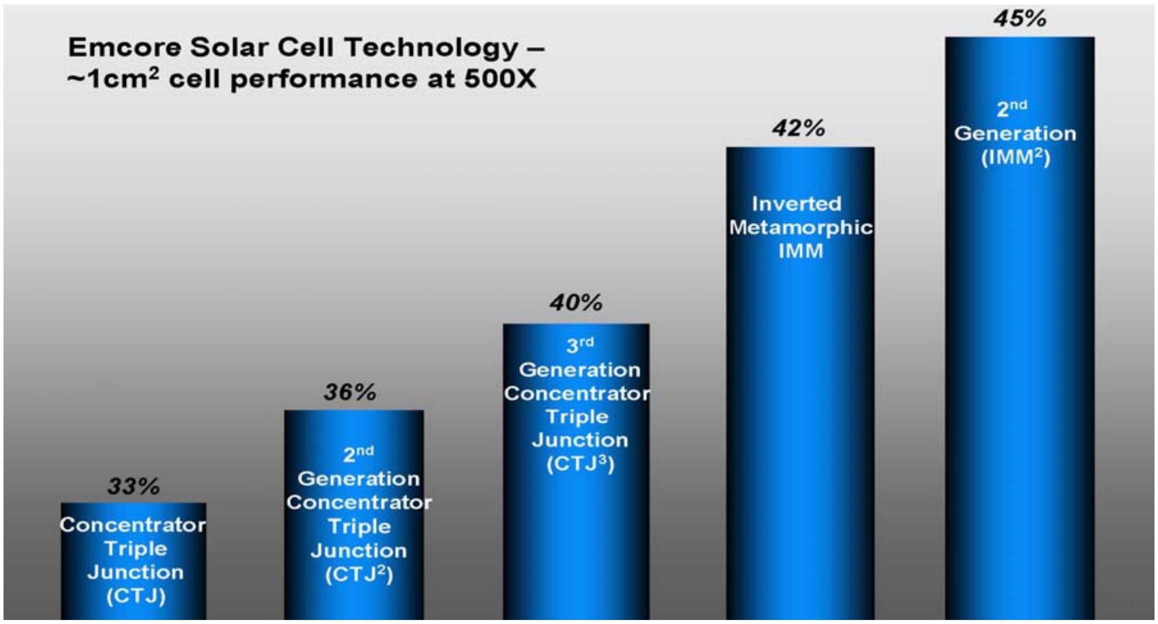



**Figure 2**: CPV vs. Silicon ASP over time

The efficiency roadmap for EMCORE's terrestrial solar products is shown in Figure 3. This ability to increase cell efficiency through advanced, MJ solar cell design is a key driver for reducing the cost of CPV systems. As the efficiency of the solar cells increases, the cost of the entire CPV system decreases proportionately. EMCORE's captive cell production and development capability allows us to optimize the performance of cell and system concurrently to take the best advantage of these efficiency improvements.




**2005-2006** **2007** **2008** **2009** **2010**

**Figure 3**: EMCORE efficiency road map

**EMCORE'S 25kW CPV Array**
**System Specifications**

Performance specifications for EMCORE's 25kW CPV array are shown in Table 1 below. To understand how the system performs at various conditions, we specify performance at three different test conditions. Standard Test Conditions (STC) are used throughout the solar photovoltaic industry to compare products under equivalent conditions. For STC, the system is specified with a solar temperature of 25C – no information about ambient temperature is defined for this standard. EMCORE specifies system performance at Standard Operating Conditions (SOC), which defines that ambient temperature to be 20C. Under SOC, our system produces 25.0kW. PVUSA test conditions offer a third way to specify system performance. The PVUSA test conditions call for 850W/m2 of Direct Normal Incident (DNI) radiation for CPV systems, and 1000W/m2 for flat plate systems. The difference in the irradiance specification accounts for the difference in operation of the systems. CPV systems respond to DNI while typical flat plate systems respond to both DNI as well as diffuse irradiance.

| Parameter | Standard Test Conditions | Standard Operating Conditions | PVUSA |
|---|---|---|---|
| **Peak Power Output (kWDC)** | 25.5 | 25.0 | 21.5 |
| **DNI (W / m2)** | 1000 | 1000 | 850 |
| **Cell Temperature ($^{o}$C)** | 25 | 60 | 60 |
| **Ambient Temperature ($^{o}$C)** | n / a | 20 | 20 |
| **Wind Speed (m / s)** | n / a | 3 | 1 |
| **Ipp (A)** | 53.2 | 56.3 | 47.8 |
| **Vpp (V)** | 480 | 444 | 449 |
| **Isc (A)** | 59.2 | 62.2 | 52.9 |
| **Voc (V)** | 552 | 514 | 520 |

**Table 1**: EMCORE 25KW CPV array system specifications

**System Configuration**

The EMCORE 25kW CPV array (patent pending) is designed to deliver 25 kW peak DC power for unattended operation in either grid-tied or off-grid applications. The array is configured with ten (10) modular 2.5 kW sub-arrays, each containing 182 MJ solar cell receivers. A reliable structure provides safe operation in all conditions, and an extremely accurate 2-axis tracking element maintains focus on the sun, allowing for maximum power output. The array was designed for ease of assembly, installation and maintenance. The system is designed for 520X geometric concentration, using Fresnel optics and a secondary optical reflector.

**Array Mechanical Information**

- Total Width: 1814 cm.
- Total Height: 740 cm.
- Total Collecting Area: 95 m2.
- Total Weight: 8620 kg.
- Designed to withstand 40.3 m / s winds.
- Decentralized 2-axis tracking
- EMCORE proprietary control system with continuous data and state-of-health monitoring for remote fault detection and maximization of power production
- Designed for efficient assembly and installation
- Unique aspect ratio for minimum shadow-free land use. Packing density approximately 2.3 ha / MW without shadowing adjacent arrays (sun-angle 15°above the horizon)

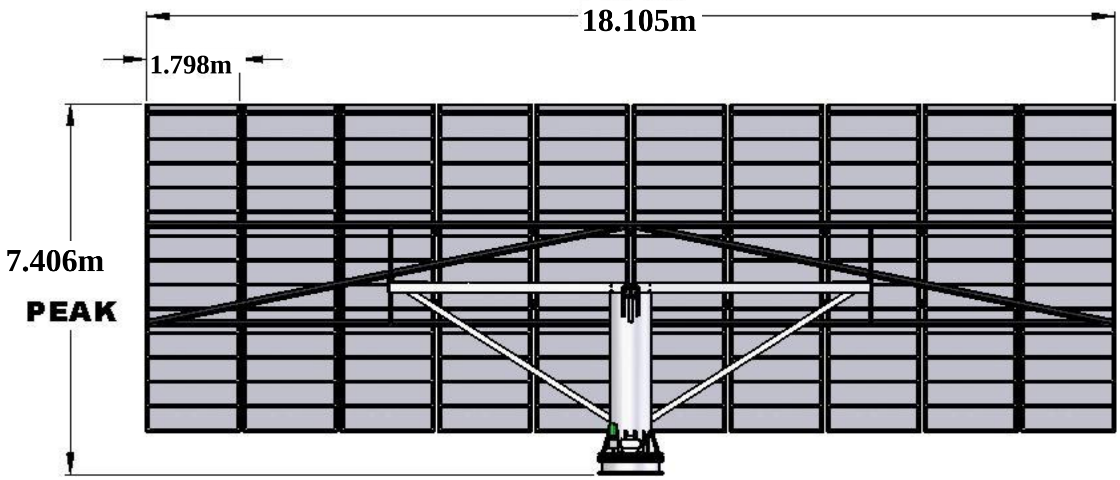



**Figure 4**: EMCORE 25KW CPV array dimensions

**Tracking Structure Design**

The tracking structure is of pedestal design, with the sub-arrays attached across the tracking structure. Structure performance against the following stresses has been validated:

- Support of deadweight of the array structure
- Overturning moments due to deadweight
- 40.2 m/s winds on both sides of the array
- 40.2 m/s wind on one side of the array and 24.6 m/s wind on the other 5
- 40.2 m/s wind on upper half of array and 65mph wind on the lower
- 30.48cm of snow at 33% density of water

The system analysis indicates that all components of the system exceed yield strength by at least a factor of 2X over all of these conditions. The tracking structure maintains system alignment to the sun within ±0.5 degrees. Individual trackers in an installation are not interconnected to each other; this prevents a system wide failure in the event of a single controller fault.

**Tracking Controls**

The tracking control system uses variable frequency AC Motor controllers. The motors and controllers are wired with positional encoder and reference sensors with positional resolution of 0.01 degrees. The tracking control does not use stop/start operation; rather the motors operate continually during the day and have a tracking accuracy of better than 0.02 degrees in operation. The operating principle for tracking the sun is a hybrid: motor control is close loop using the motor's encoders for feedback, position control is open loop using an accurate sun position algorithm. Adjustments to the position algorithm can be automated and is thus using current, voltage or power measurement of the solar array. The system can be configured to automatically perform this position adjustment on a regular schedule, or when it detects the power production of the array has decreased below the performance of other arrays.

**Sub-Array Details**
Each 25kW CPV array is comprised of ten 2,500 W sub-arrays connected in parallel. Each sub-array contains the following components: receiver assemblies, Fresnel lens parquets, electrical wiring, air vents, and sun shields.

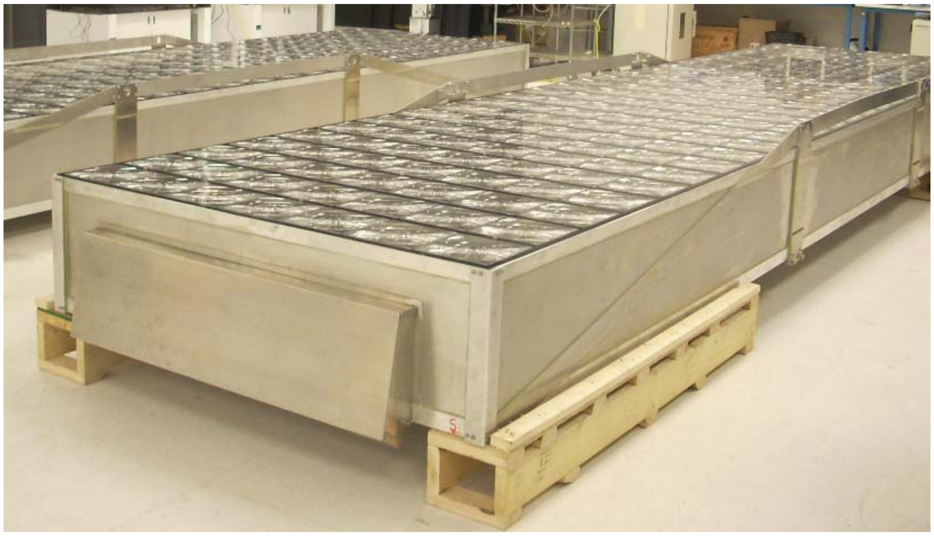


**Figure 5:** Actual photo of completed EMCORE 2.5KW sub-array

**Optical System**
EMCORE's CPV system uses an acrylic Fresnel lens to concentrate the solar flux to 520 times the normal irradiance of the sun. Use of concentrated light increases the performance of the MJ solar cells. A secondary optical element is used to increase the acceptance angle of the optical system. The acceptance angle, which is defined as the angular miss pointing that causes the system output to degrade to 90% of its peak, is +/-1 degree. The secondary optical element also aids in homogenizing the flux at the solar cell. Maintaining uniform illumination on the cell also helps improve system efficiency.

**Receiver Assembly**
The receiver assembly includes the solar cell in its package, connections and leads to the package, the secondary optical element, and a plate that these components mount to. The solar cell package provides the thermal, electrical and optical interface to the solar cell. The package is optimized for thermal conduction to the receiver plate and for voltage stand-off to eliminate the possibility of arcing. In addition, the electrical interconnections from the cell to the input and output leads are designed to limit any series resistance in the system.

**III-V Multi Junction Solar Cells**

EMCORE is 1 of only 2 volume manufactures of III-V Multi Junction Solar Cells in the world. EMCORE has reached cell efficiencies of 39% under 1000X concentration. Efficiencies for EMCORE's terrestrical solar cells are approximately 36% for volume production. The key to the high conversion efficiencies for III-V MJ solar cells is the ability of these cells to capture a much larger portion of the solar spectrum compared to silicon flat plate technologies. Our MJ cells consist of three separate solar cells combined in series monolithically. Each of these cells, or junctions, is formed with materials that capture different portions of the solar spectrum. This broadens the overall collection efficiency compared to silicon solar cells. The selection of appropriate materials and junction thicknesses allow for optimization of the cell efficiency and response to the solar spectrum.

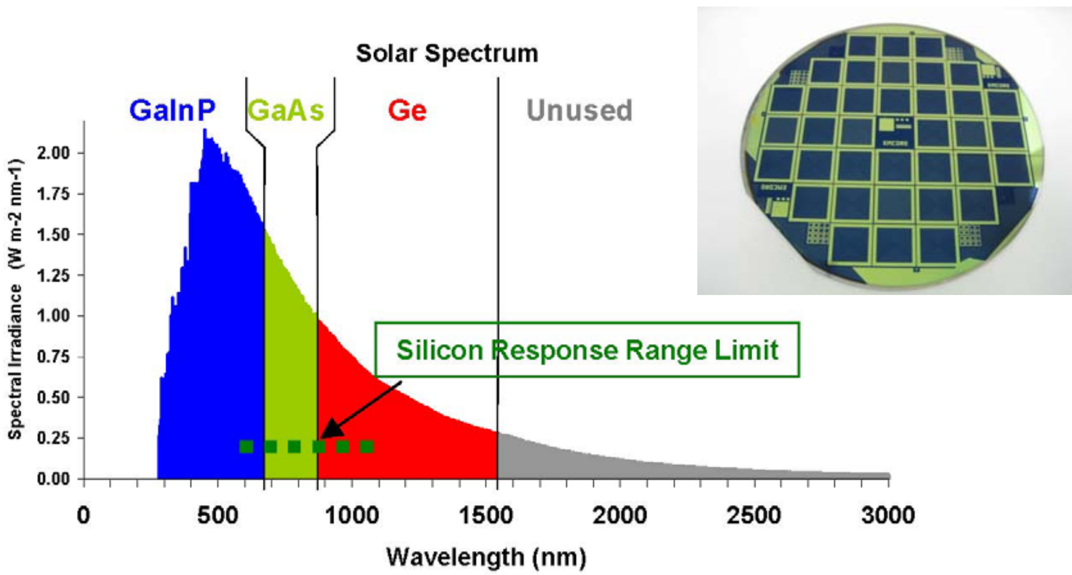



**Figure 6: Left**-Graphical representation of the solar spectrum and the wavelength captured by the EMCORE III-V Triple-Junction solar cells
**Right**: Triple-junction wafer with EMCORE concentrator cells

**SYSTEM INSTALLATION**

EMCORE's 25kW CPV Array is optimized for ease of installation. The first installation requirement is preparing foundations for the system. The foundation design is dependent on the soil type at the site, but typically consists of reinforced concrete set below the frost line. Three-inch diameter bolts extend above ground level. These bolts will be used to mount the rest of the structure. The array installation sequence is shown in the Table 2. Each tower installation requires a crew of approximately 5 people for one day.

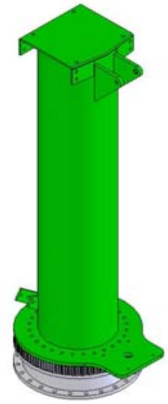
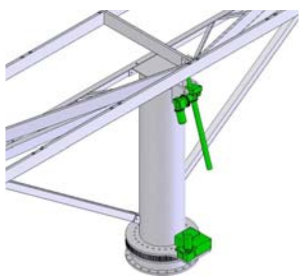
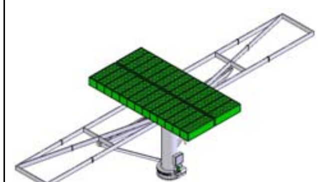
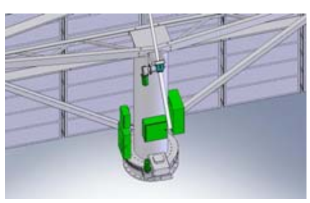
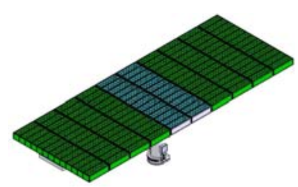
| | | | |
|---|---|---|---|
| Step 1: Install and Level the Azimuth Bearing to the Foundation |  | Step 2: Bolt and Plumb the Main Pedestal to Azimuth Bearing |  |
| Step 3: Attach the Support Truss to Main Pedestal |  | Step 4: Bolt Subarray Bed to the Support Truss |  |
| Step 5: Install the Elevation Screw and Motors to the Structure |  | Step 6: Bolt Subarrays to the Structure, Connect Wires to Combiner Box. |  |
| Step 7: Connect Subarray Cables to Sensor Interconnect Box, Connect Motors and AC Power to Drive Box, Connect DC Disconnect Output to AC Inverter |  | Step 8: Validate Planar Alignment<br><br>Step 9: Initiate Sun Tracking Process |  |

**Table 2.** Installation sequence for EMCORE's 25kW CPV Array

# SOLAR FIELD DETAILS

## Field Layout

The aspect ratio of EMCORE's 25kW CPV Array is optimized to provide minimal land use. The 3:1 aspect ratio (width to height), allows us to achieve a packing density of approximately 5.5acres/MW (2.3ha/MW) assuming a flat or appropriately sloping installation site. This packing density provides shadow-free operation when the sun is above 15$^{o}$ above the horizon. A representative 1MWac field layout is shown in Figure 12. Spacing in the east-west direction is approximately 28.8m. Spacing in the north-south direction is 22.0m.

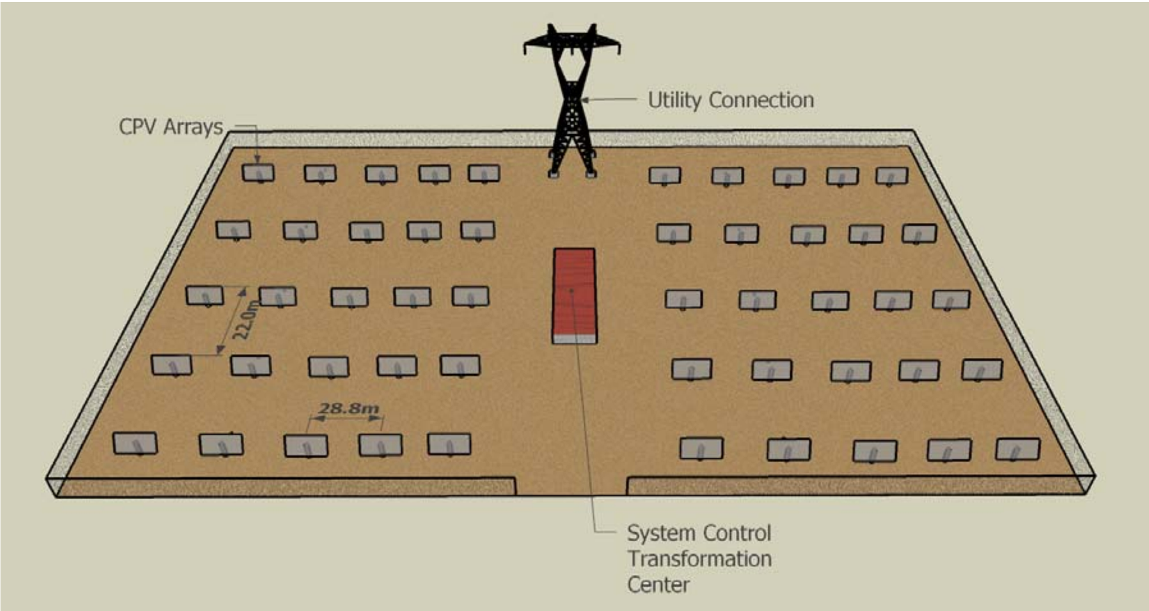



**Figure 7**: Graphical representation of 1MW field layout

## Field Control and Monitoring

The EMCORE Solar Field Control System is an integrated, distributed system containing various parts: Main Database and Messaging Servers, Tracking Software, Inverter Data Acquisition Software, Weather and Irradiance Monitoring Software, Current/Voltage Sensors and Operators Terminals. Each solar field contains a wireless network. Technicians will use portable computers to control, adjust or monitor the state of the trackers, inverters and sensors while working in the solar field. The system is fully integrated with various weather sensors so it can be configured to safe stow during high winds, rain, hail, snow. Stowing occurs when sustained wind speeds exceed 11.2 m/s. The system selects its stow position based on wind direction.

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