



CSP 2.0

*The solar disruptor -
Twice as efficient and half the
cost of traditional CSP*

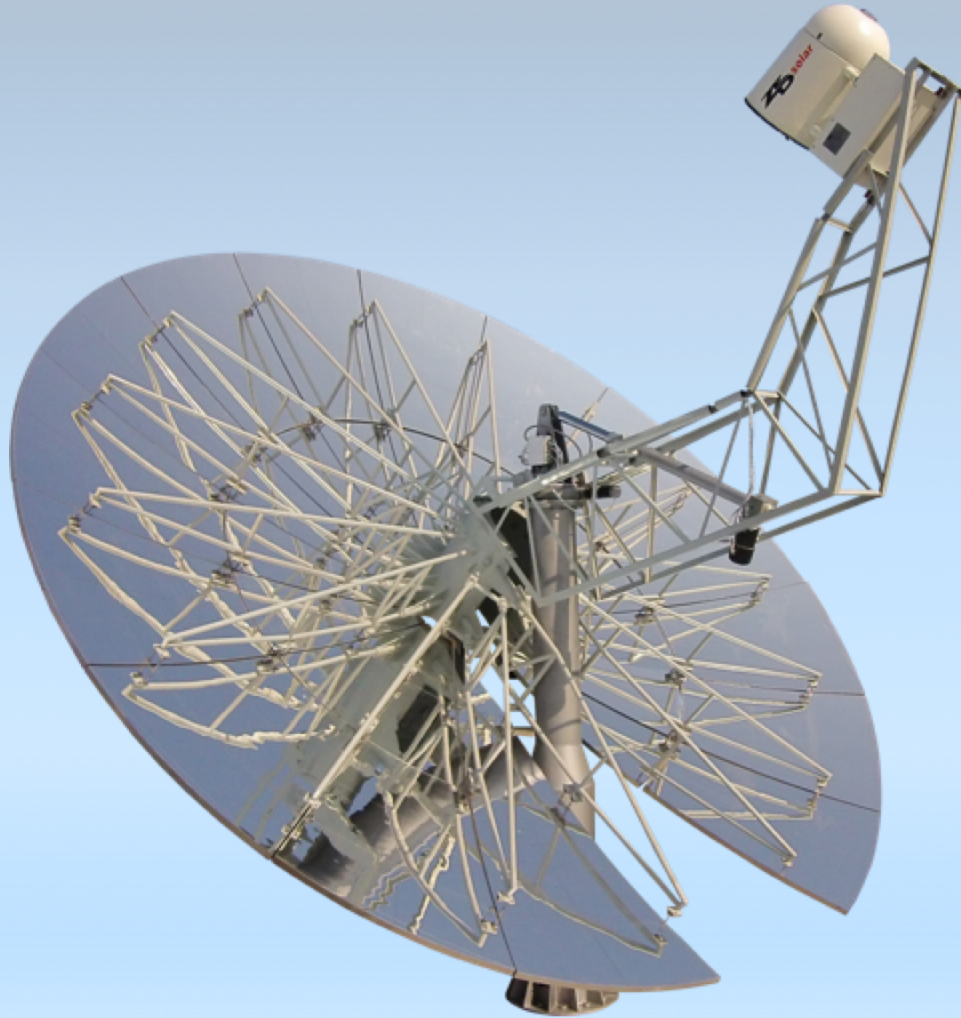
ZEDsolar

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The future of solar thermal energy



Applications; Direct Steam Generation

- **Industrial Process Steam**
- **Solar Thermal Enhanced Oil Recovery**
- **Desalination**
- **Power generation with thermal storage**

7 Reasons why CSP 2.0 is the real disruptor in solar thermal power

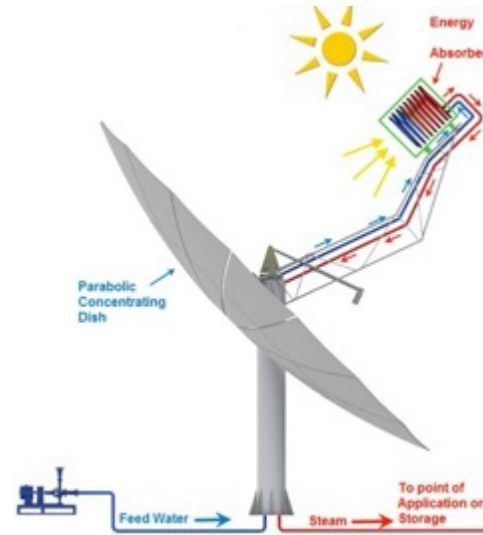


1. It provides the required steam quality at an **ultra high net solar to thermal conversion efficiency of 88%** - Solar steam costs are **fully competitive with gas-fired systems**
2. The system was designed for and has proven itself in **harsh environments**
3. The **modular and decentralized** system increases **robustness** and reduces construction & commissioning times
4. An Inbuilt & **automated self cleaning** system keeps the mirrors clean and O&M costs down
5. Flexible deployment possible through a **semi-mobile design**
6. **In-country** value creation

CSP 2.0 - Solar dish & thermal receiver

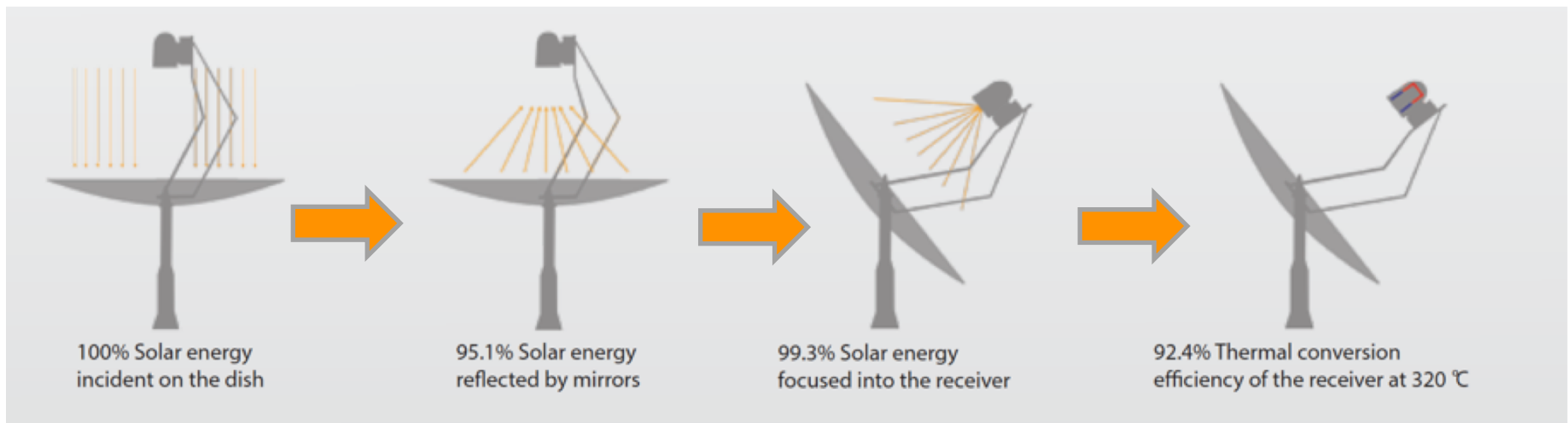


- The patented concentrator was designed to achieve high optical performance while being low cost to produce and fast to install & commission on-site.
- Bespoke cavity type receiver achieves almost flat efficiency curve at all temperatures.

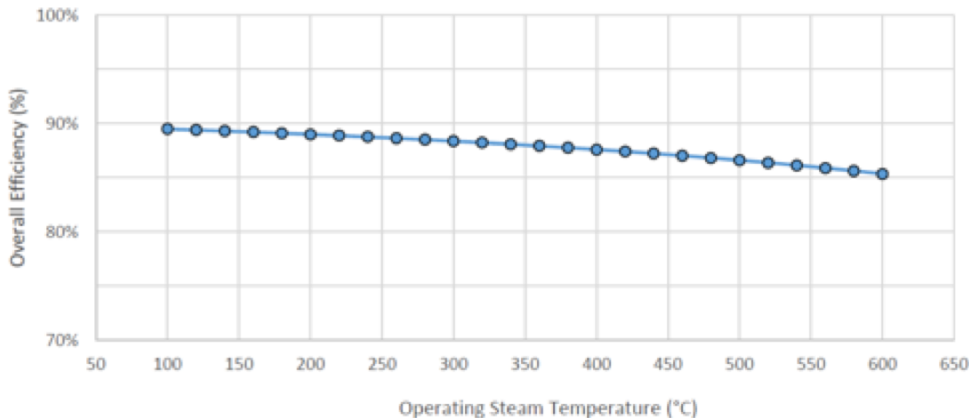


- Precise sun tracking system combined with dual axis drives follows the sun the whole day
- Steam can be generated between 100° and 800° Celsius

How we achieve 88% net solar to steam conversion efficiency

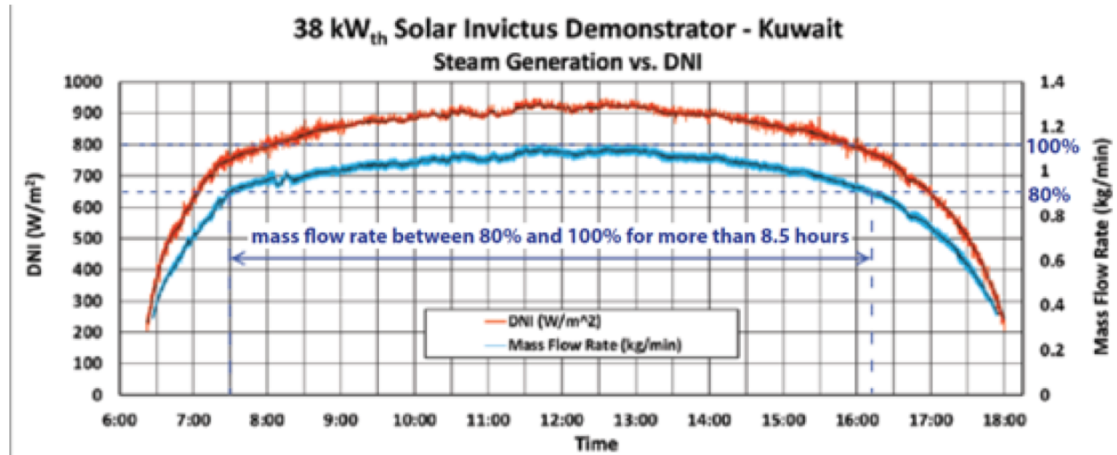


Efficient and useable energy output



- Ultra-high net solar to thermal efficiency of 88% enables a smaller solar field to produce the same output yielding two big advantages; significantly lower Capex and and project life-long O&M savings.

- Energy output is smooth and near rated capacity for almost the entire day, allowing easy integration.

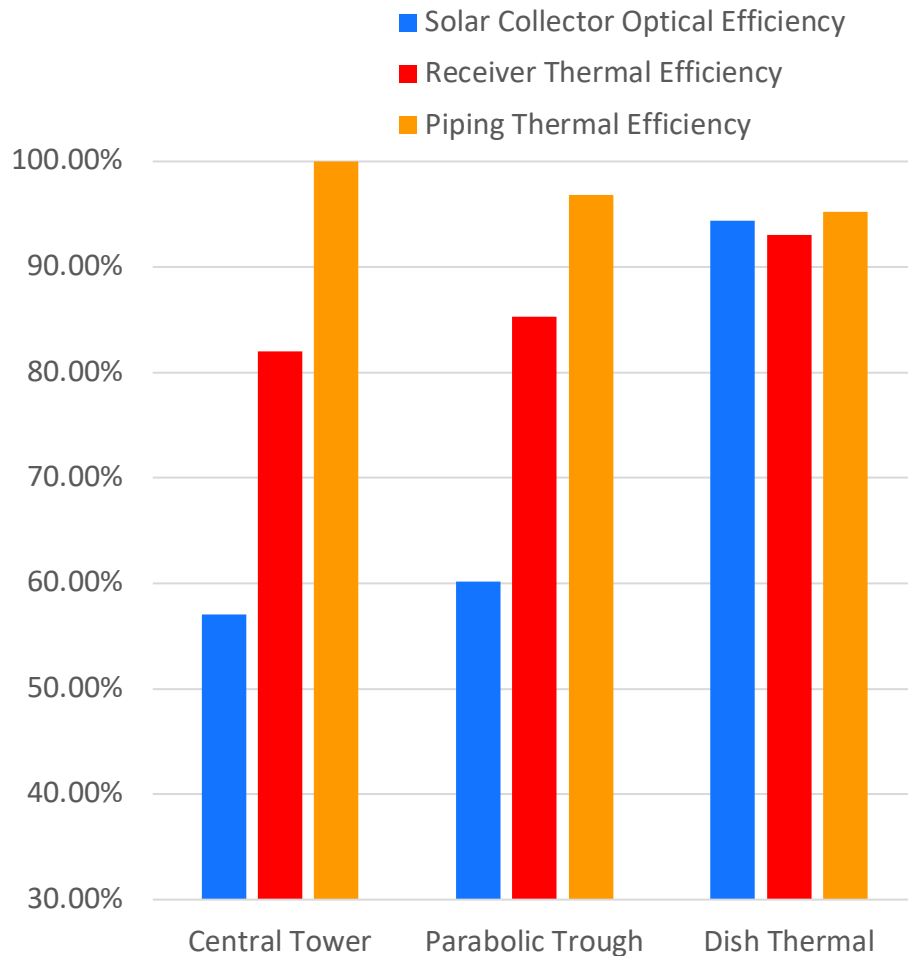


Efficiency graph source: [U. Jamil and W. Ali: Performance Tests and Efficiency Analysis of Solar Invictus 53S – A Parabolic Dish Solar Collector for Direct Steam Generation. Paper for SolarPACES Conference 2015.]

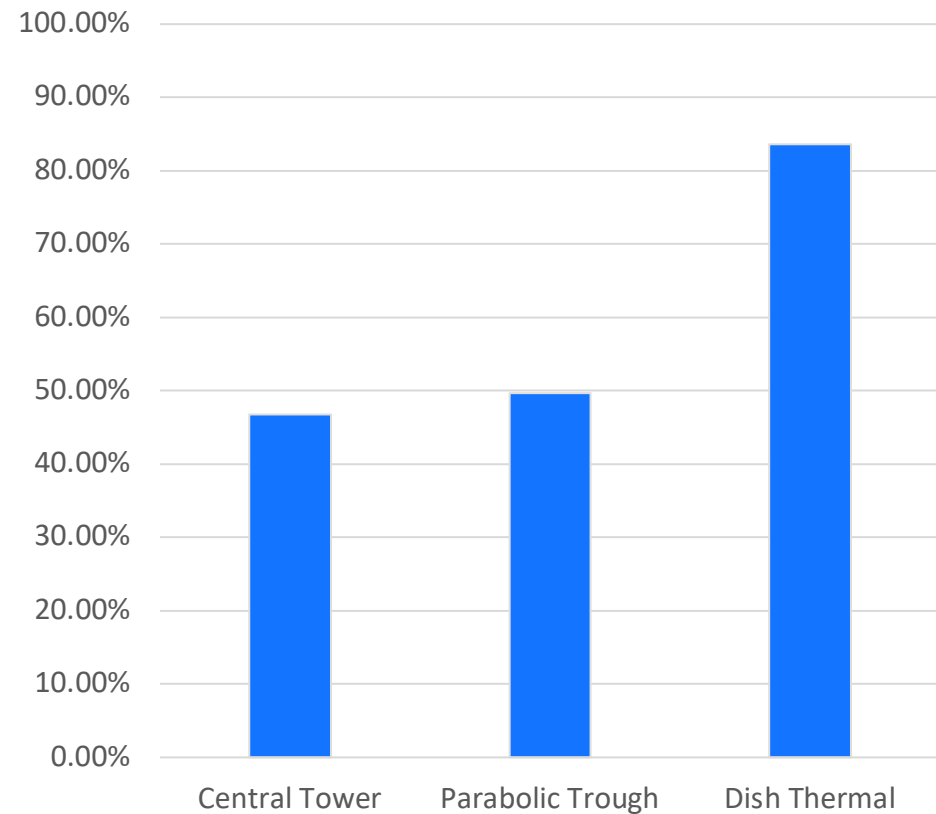
Efficiency comparison; 2.0 versus legacy



Annual Average Efficiency Breakdown



Overall net annual average solar field efficiency



2.0 compared to legacy CSP technology



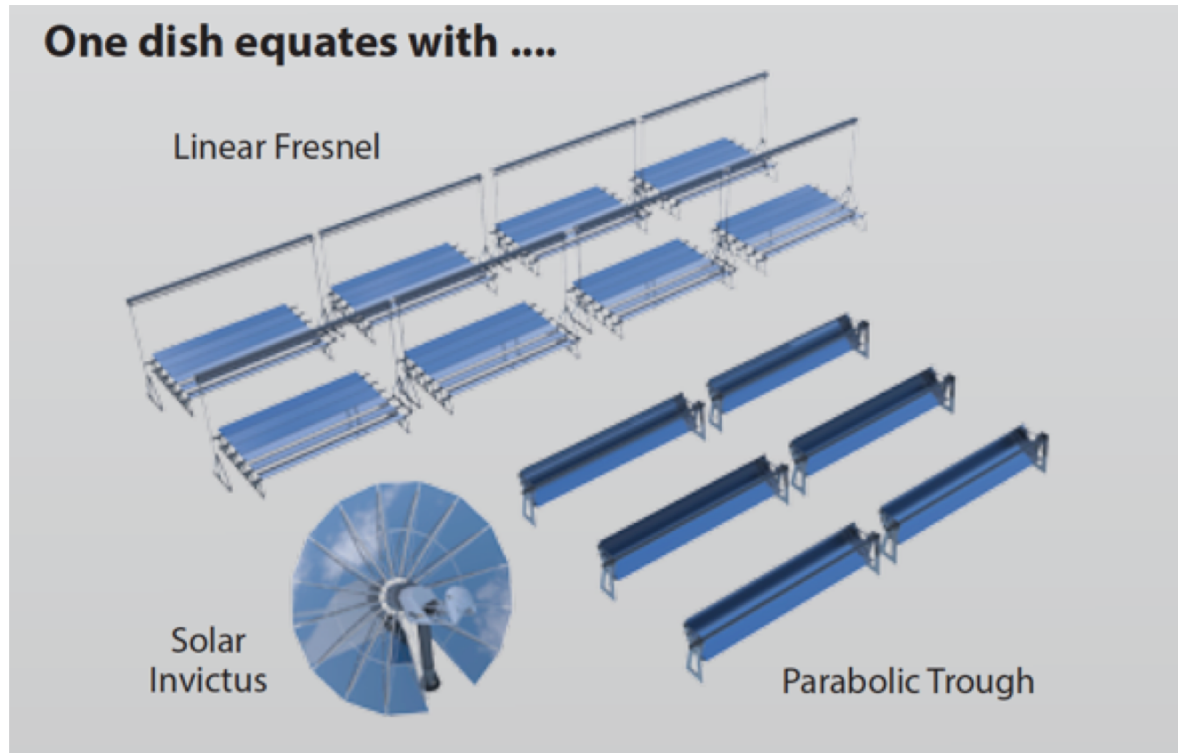
Comparison for a solar park size of 500 tons of steam generation per day capacity

MIRROR AREA

- **Solar Invictus** **71,700 sqm**
- Parabolic Trough 162,000 sqm
- Linear Fresnel 206,900 sqm

TOTAL LAND REQUIRMENT

- **Solar Invictus** **214,800 sqm**
- Linear Fresnel 328,300 sqm
- Parabolic Trough 372,600 sqm



Solar park technology, proven performance in harsh environments



Major areas of overall ZED Solar system

- Concentrator & Receiver (energy absorber)
- Automated cleaning system
- Park level integration and control system for flow and steam regulation
- Steam quality control system
- Sun-tracking system
- Alignment technology
- Production know how
- Field installation know how and methods

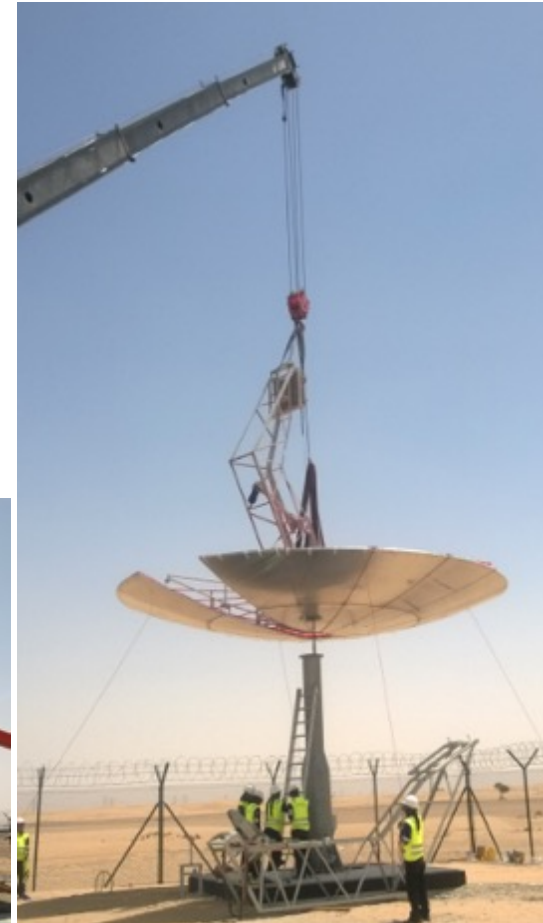
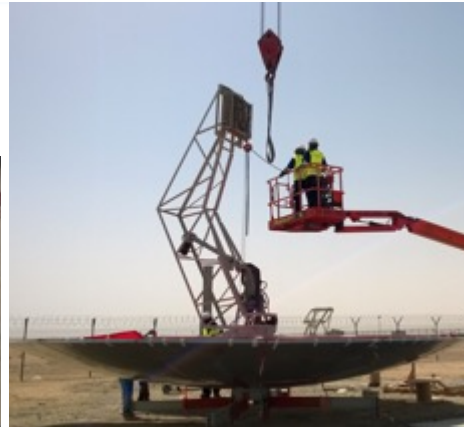
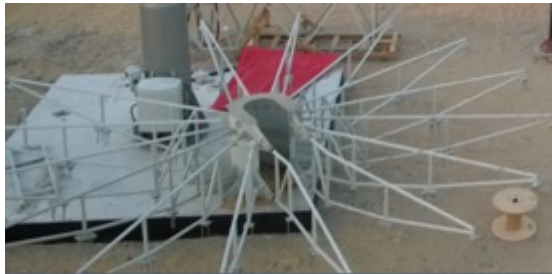
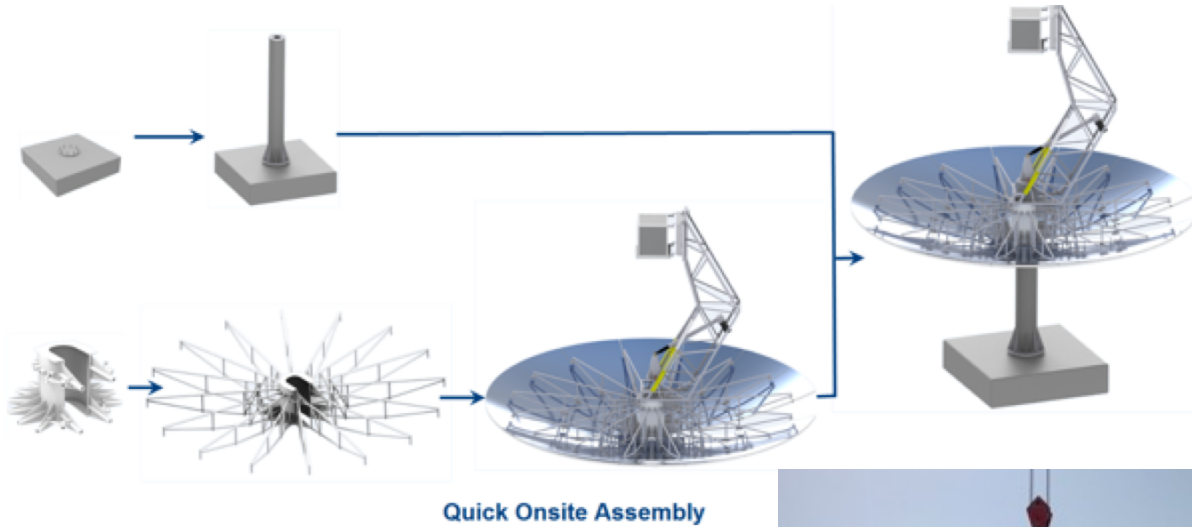


Sandstorm, Dubai, 2014



Winter deep-freeze, Sweden, 2012

Simple installation & commissioning



Lahore demo site; 2 dishes, Steam & Power



Kuwait; Steam



Dubai pilot project; 10 dishes, Power



Awards, recognition and publications



- Finalists for Platts Global Energy Awards 2016 “Breakthrough Solution of the Year”, New York City, USA
- Finalist for “CSP Technology Innovation for MENA 2016”, Dubai, UAE
- Winner of “CSP Technology and Supplier Award 2015”, Seville, Spain
- Finalist for "Most Innovative Green Technology" Kuwait Sustainable Energy Conference 2015, Kuwait City, Kuwait

Technical papers presented at SolarPACES 2015, 2016 & 2017 and published by American Institute of Physics.



We've launched a AED 500 Mn. Research Fund for Clean Energy&Dubai Green Fund with AED100 bn clean energy investments



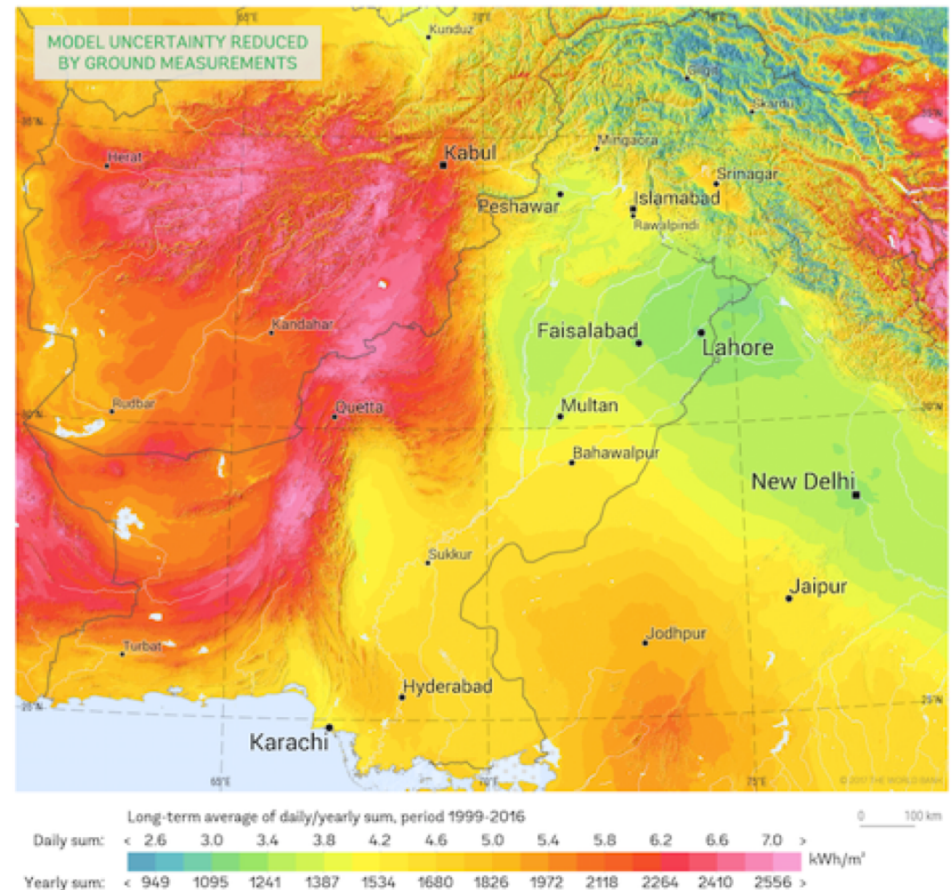
HH Sheikh Mohammed, Ruler of Dubai

Solar steam vs. Dirty steam



Factors to be considered: High Cost of alternative fuel sources vs. variable DNI

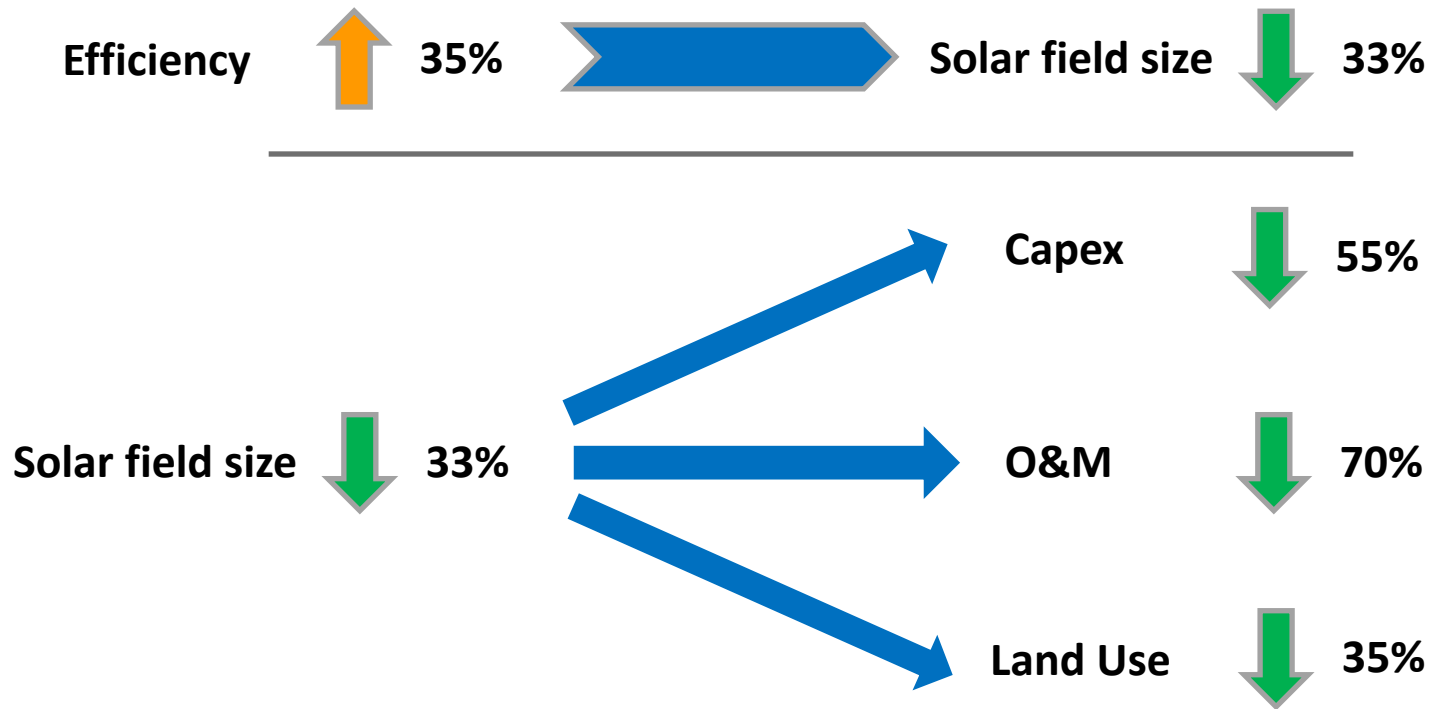
- **LNG 9.3 USD/mmbtu**
- **Furnace oil 0.6 USD/litre**
- **Diesel 0.89 USD/litre**



Why ZED Solar over legacy CSP?



Our competitive advantages over legacy CSP technologies: 88% net solar to thermal conversion efficiency





4B *solar*