# COMPANY PROFILE
# 2023

24 Clean Energy Co., LTD.

# HISTORY

## 24 CLEAN ENERGY CO., LTD

was established in December 2014 with the aim to provide alternative power to Thailand which was at this time struck by flooding and with the aim to implement solutions which help to reduce the dependency on fossil fuels.

The founders had the idea that an alternative power supply independent from the power grids would ease emergency situations by giving people the possibility to communicate with beloved ones while charging of mobiles was impossible with the normal power grids due to the flooding. Solar panels have the huge benefit that they do not rely on fossil fuels which are also sparse in emergency situations.

Further more, antennas, emergency communication, hospital equipment and other emergency relive tools could be run with solar power as well.

After the situation returned to normal the second stage of our business concept started – the implementation of solar power plants.

## VISION

Clean Energy will prevail only if it is not just an ideal. It has to be a solution which works under the pressure of economic competition and can rely on its advantages such as independency from outer fuel resources once installed.

## MISSION

Providing the best service and products to our international and domestic clients

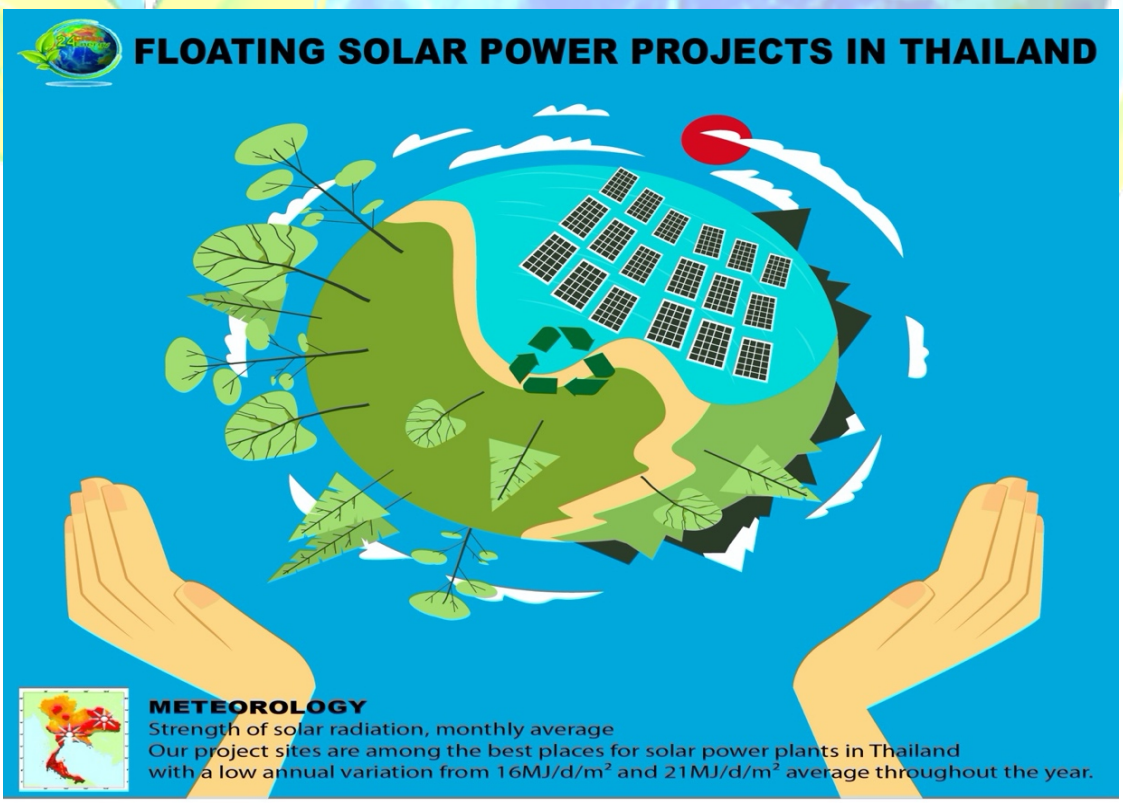
## VALUES

- Honest and straight to the point
- Scientific methodology and constant learning
- Social responsibility
- Transparent and international working standards

## STRATEGY

The implementation of proven and approved technology, the consequent use of scientific data and attention to the details in each area of our business make our project almost fail-safe.

# ORGANIZATION CHART


# PRODUCTS AND SERVICES

Represented by the three arrows in our logo we are active in our three main departments – Projects, Consulting, Trading

Projects expertise in the following fields:

**Floating Solar Farm**
Solar Farm (PV + Thermal)
Solar rooftops
Wind Turbine
Biomass, Biogas
Construction
EV Charging Station

Trade in the following areas:

**Floating Solar Farm solutions**
Solar Rooftops
Solar Hybrid Air conditioner
Solar Pumps
Solar Mobile Phone chargers
Portable Solar solutions
Solar street lighting systems
LED lighting solutions
EV Charging Station
Special requests

**Consulting Services**

**For foreign investors**
Find suitable products and projects in Thailand and the ASEAN countries
Manage and implement projects on their behalf

**For domestic investors**
Find the suitable business partners and technology providers
Planning and management of projects

## CORPORATE RESPONSIBILITY AND AFFILIATES:

Our company has evaluated and keeps observing the following aspects which affect directly and indirectly the implementation of our current and future projects:

Political situation
Technical feasibility
Geological and meteorological survey
Social and economical development
Legal and financial regulations regarding land ownership
Legal, social and financial aspects related to our project

# Floating Solar Farm or FPV (Floating photovoltaic)

Refers to solar panels on a structure that floats in water, typically an artificial basin or lake.

**Technology features**

There are several reasons for this development:

This technology has been growing rapidly in the renewable energy market since 2017.

No land occupancy: the main advantage of floating PV plants is that they do not take up any land, except the limited surfaces necessary for electric cabinet and grid connections. Their price is comparable with land-based plants, but they provide a good way to avoid land consumption.

**Installation and decommissioning:**

floating PV plants are more compact than land-based plants, their management is simpler and their construction and decommissioning straightforward. The main point is that no fixed structures exist like the foundations used for a land-based plant so their installation can be totally reversible.

**Water saving and water quality:**

the partial coverage of basins can reduce the water evaporation. This result depends on climate conditions and on the percentage of the covered surface. In arid climates such as parts of India this is an important advantage since about 30% of the evaporation of the covered surface is saved. This may be greater in Australia, and is a very useful feature if the basin is used for irrigation purposes.

**Cooling:**

cooling the floating structure is simple. Natural cooling can be increased by a water layer on the PV modules or by submerging them, the so-called SP2 (Submerged Photovoltaic Solar Panel). In these cases, the global PV modules efficiency rises thanks to the absence of thermal drift, with a gain in energy harvesting up to 8-10%.

**Tracking:**

a large floating platform can be easily turned and can perform a vertical tracking: this can be done without wasting energy and without the need for a complex mechanical apparatus as in land-based PV plants. Equipping a floating PV plant with a tracking system costs little extra while the energy gain can range from 15 to 25%.

**Storage opportunity:**

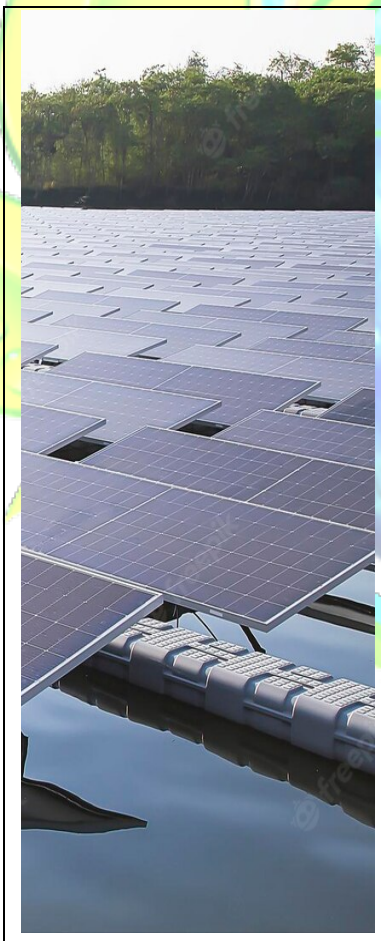
the presence of water naturally suggests using gravity energy storage mainly in the coupling with hydroelectric basins. However other possibilities have been explored and in particular compressed-air energy storage systems have been suggested.

**Environment control:**

algal blooms, a serious problem in industrialized countries, may be reduced. The partial coverage of the basins and the reduction of light on biological fouling just below the surface, together with active systems can solve this problem. This is only a part of the more general problem of managing a water basin generated by industrial activities or polluted by them.

**Efficiency improvement:**

Many studies claim that solar panels over water are more efficient. The energy gain reported range from 5 to 15%.



**Advantages of floating solar**

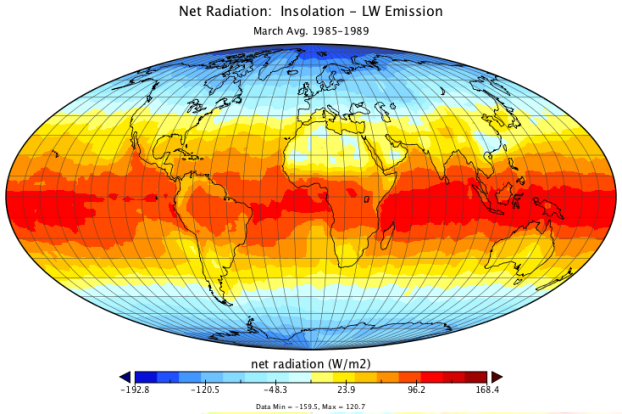
1. No land required the cost compared to laying on the land is similar and without wasting land in vain.
2. Installation and demolition: Floating PV plants are more compact than land-based ones, easier to operate and manage, and construction and demolition are easy. There are no fixed structures like land-based foundations.
3. The quality of the water will improve. Reduces evaporation by up to 8 0 % because the solar panel is covered.
4. Floating structure makes the cooling mechanism work better. can increase the efficiency of solar cell up to 8 - 10%
5. The solar panel can be adjusted to receive sunlight easily.
6. More efficient than other installations

A rooftop solar power system, or rooftop PV system, is a photovoltaic (PV) system that has its electricity-generating solar panels mounted on the rooftop of a residential or commercial building or structure. The various components of such a system include photovoltaic modules, mounting systems, cables, solar inverters and other electrical accessories.

Rooftop mounted systems are small compared to utility-scale solar ground-mounted photovoltaic power stations with capacities in the megawatt range, hence being a form of distributed generation. Most rooftop PV stations are Grid-connected photovoltaic power systems. Rooftop PV systems on residential buildings typically feature a capacity of about 5 to 20 kilowatts (kW), while those mounted on commercial buildings often reach 100 kilowatts to 1 Megawatt (MW). Very large roofs can house industrial scale PV systems in the range of 1-10 Megawatts.

# SOLAR TECHNOLOGY

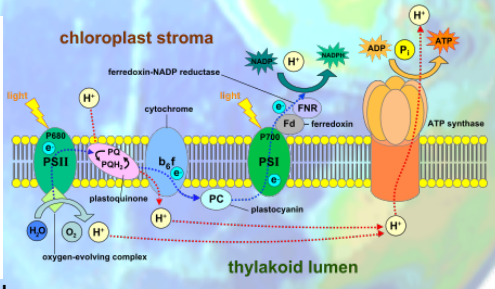
In just 40 minutes enough energy reaches our planet from the sun to cover the entire need for energy of all human kind for an entire year.




The problem which researchers worldwide are working on is:
How can we harvest and convert this energy into usable electrical energy?
This leads to several different approaches:

1) **Indirect approach**

Plants use solar light to transform $H_2O + CO_2$ to $CH_2O + O_2$, storing the energy rom the photons in form of chemical energy in the $CH_2O$ compound which is then used to produce starch and sugar. Interestingly the oxygen released in the process comes from the water ($H_2O$) and not from the carbon dioxide ($CO_2$), contrary to common belief.

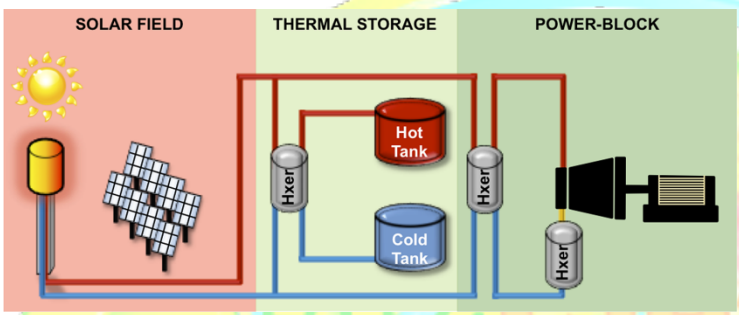



These energy-rich organic compounds can then be used as source of energy, for example by burning the organic compounds in Biomass-power plants. Since the $CO_2$ that is released in the process was earlier absorbed from the air, this solution has a neutral $CO_2$-balance.

## 2) Direct approach

### a) Solar Thermal power generation

In this installation, mirrors are used to collect the heat from the solar radiation through focussing. This heat is then used to power evaporate water and power a steam-turbine which generates electrical power.




First installations show that through the addition of a molten-salt storage tank, heat can be stored for times without solar irradiation, thus allowing the plant to produce solar energy around the clock.

### b) Photovoltaic power generation

In this technology, an incoming photon dislocates an electron from a target-atom. This generates an electrical potential which the target atom needs to compensate, therefore inducing an electrical current. This is the most direct photon-to-electricity approach.

#### I) Generation 1 Photovoltaics

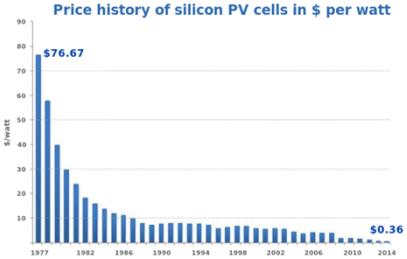
Known since the late 19th century, photovoltaic elements began to become increasingly popular during the space-race in the 1960's and first customer applications with solar power became available in the late 1970's but for a long time remained too expensive for utility scale application.

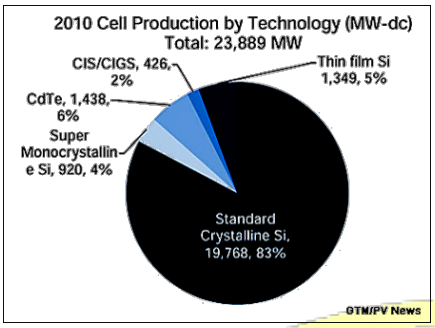
Vanguard1 Satellite, with solar power

One of the first solar powered calculators

Test of a 6% efficient solar panel, 1959

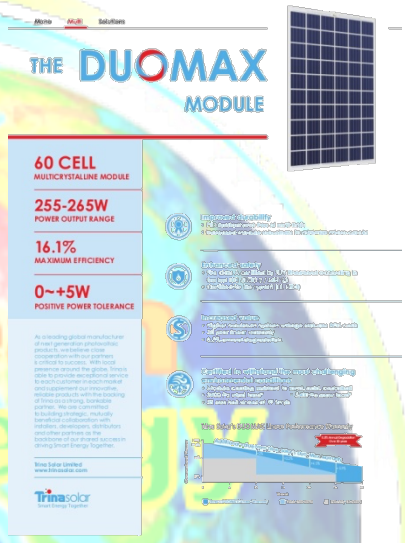
Further development and research together with an increasing demand however lead to the rapid decline of the prices per installed watt by about factor 200.
This effect was further increased by the government-subventionned, mass production of solar panels in China.






This first generation of solar cells include most of today's silicone waver based solar panels, including polycrystalline, mono-crystalline and amorphous Silicone panels. Until today, this technology is the undisputed market leader with over 80% of all solar watts installed.

In the laboratory, the first Silicon-based solar cells have been researched to reach a current maximum efficiency of 26.3% - not far from the theoretical maximum efficiency of 32%. This will be the barrier for Silicon based solar panels since it is one of the material properties as it can be calculated with the Shockley-Queisser limits. This means no matter how much research is done, silicon based solar cells will never break the 32%-mark.

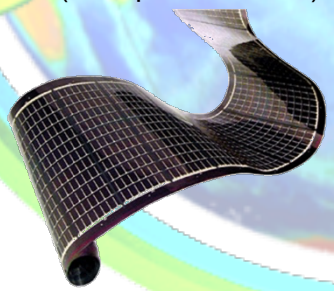



Current commercially available solar panels are still far from this point however with average efficiencies of about 15%-18%

**II) Generation 2 Photovoltaics**

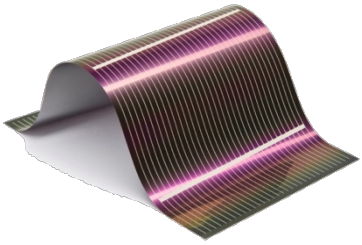
This category is made up mainly of so-called thin-film solar panels where as there are:

- a-Si (amorphous Silicon)



- CdTe (Cadmium Telluride)

- CIGS (Copper-Indium-Gallium-Selenide)



Historically, Thin Film Solar panels used to be less efficient than Si-based panels, but this gap is closing rapidly with modern thin film panels providing efficiencies of 17%. Together with the cheaper production methods – one of the main advantages of Thin Film technology, and with the reduced weight load, this technology is very promising and holds currently 20% of the market share.

Each of these types have however their own disadvantages which demand for solution:

a- A-Si type: generally the amorphous Silicone type Thin Film panels are less efficient than it's rivalling technologies.

b- CdTe type Thin Film solar panels received some critics due to the high toxidity of the Cadmium used in the cells. Often the public opinion preffers non-toxic materials.

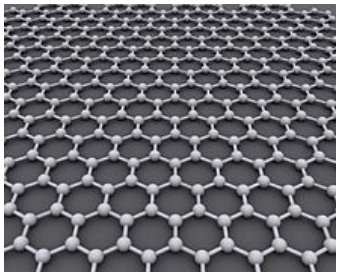
c- The CIGS type Thin Film solar panels are still used only in a few special applications since the required Indium makes the panels extremely costly.

**An outlook to the future – Generation 3 Solar panels**

There are currently heavy efforts in research and development to bring a new, 3rd generation solar panels to the market. So far there are 2 very promising approaches which are beein researched:

1) Perovskite based Solar cells – A Calcium-Titanium-Oxide mineral

2) Graphene based Solar cells – An allotrope or Carbon



Both elements are present in abundance and both are non-toxic which eliminates two critical barriers from the 2nd generation of Solar Cells.

Under lab conditions, researchers are calculating efficiencies of 40% to 60% - far beyond the reach of Silicon based solar cells due to their Shockley-Queisser limits at 32% as discussed above.

Perovskite solar cell being researched at Oxford university

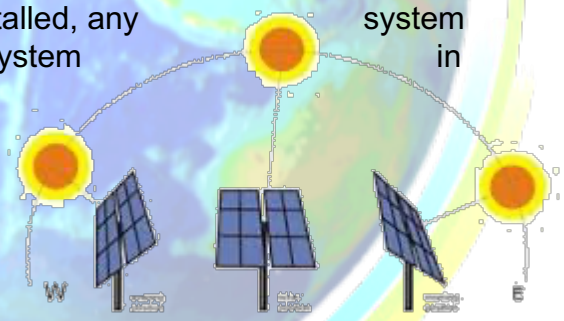
However – while Graphene is indeed a very interesting material – it is near transparent, highly conductive, stronger than steel – it has also it's limits to readily absorb photon-energy. This is one of the tasks that researchers around the globe are working on.

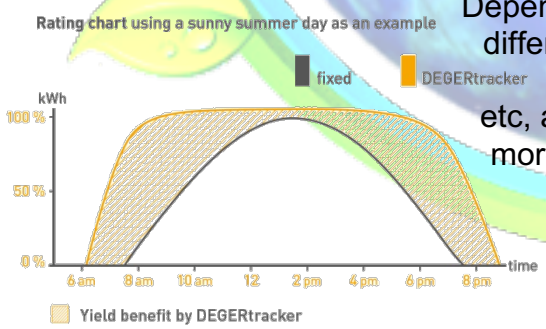
While silicon absorbs the photons from a very narrow bandwidth of light, researchers are further investigating ways to absorb the photons from the full light spectrum. This is achieved by modifying the band gap of the material which is controlled by the Halide concentration in the material – or simple put, scientists are able to control the color of the light absorbed through the composition of the material.

While all these technologies have promising onsets, there are still a few problems to be solved and therefore 3rd generation solar panels will be commercially available only in a few years from now.

**Tracking**

No matter which generation of solar panels are installed, any system receives an efficiency boost from a solar tracking system in which the solar panels are constantly aligned perpendicular to the sun, as opposed to fix installed systems where the sun passes over it in the course of a day at various angles.

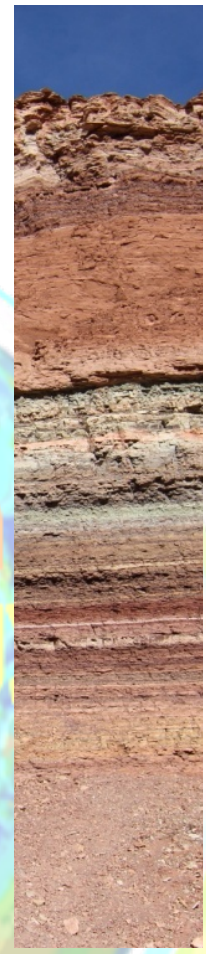



Depending in different variables such as location, technology, season etc, a tracking system will generate 10% to 40% more

Solar tracking systems that follow the sun over the course of the day are called intra-day tracking systems and can be single axis tracking systems

## “GREEN ENERGY” - FROM AN IDEALIST DREAM TO A PRACTICAL SOLUTION



No one can deny these days that there is a climate change and that it affects each and every one of us. Be it directly through natural hazards which occur at increased frequency or through economic crisis triggered by flooding, tsunamis and similar events.
While a look into the geologic stratigraphy (the science describing the layered deposit of sediments) shows us that our planet was constantly changing ever since the beginning, it cannot be a bad idea to do our part in order not to accelerate it more and more by release of trapped CO2. While it may not be the end of the world, it may be for mankind. After all, first there was only CO2, and oxygen was generated as a “waste product” of photosynthesis over billions of years. It can’t harm to help to protect this precious gas which is the base of all what we classify as “higher life forms”.

What helps to do this is that modern solar cells are producing more energy in their lifetime and help to conserve more CO2 than it takes to produce them. This has long been a hindrance for any idealism driven project. Further, the initial investment has been on a continuous decline over the past decade so that we are now at a point where solar power generation starts to make real sense – both from idealist as well as from economical view.

Let’s take this chance and start to let the dream come true.

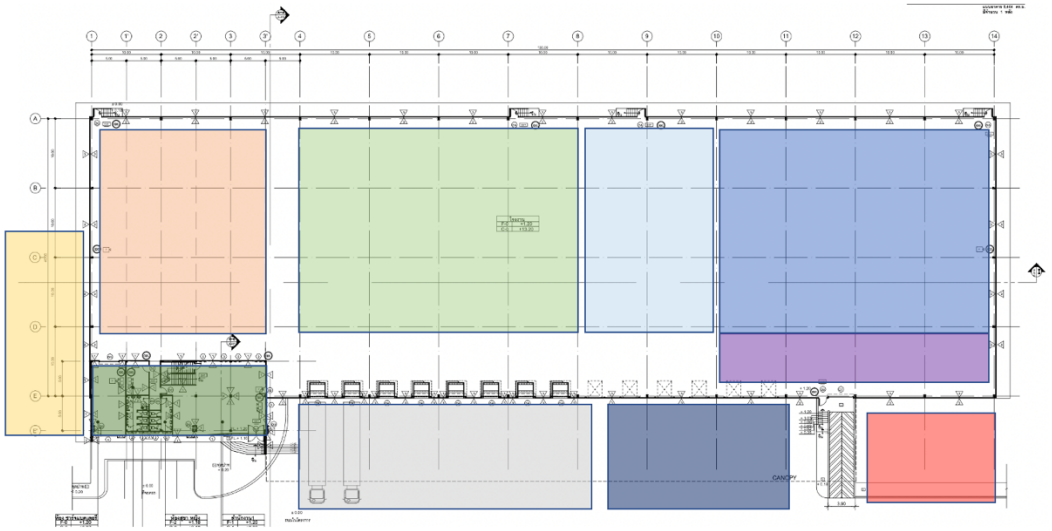
## EV Charging Station

A charging station, also called an EV charger, electric vehicle supply equipment (EVSE) or simply charger is a piece of equipment that supplies electrical power for charging plug-in electric vehicles (including hybrids, neighborhood electric vehicles, trucks, buses, and others).

Although batteries can only be charged with DC power, most electric vehicles have an onboard AC-to-DC converter that allows them to be plugged into a standard household AC electrical receptacle. Inexpensive low-power public charging stations will also provide AC power, known as "AC charging stations". To facilitate higher power charging, which requires much larger AC-to-DC converters, the converter is built into the charging station instead of the vehicle, and the station supplies already-converted DC power directly to the vehicle, bypassing the vehicle's onboard converter. These are known as "DC charging stations". Most fully electric car models can accept both AC and DC power.

Charging stations provide connectors that conform to a variety of standards. DC charging stations are commonly equipped with multiple connectors to be able to supply a wide variety of vehicles.

Public charging stations are typically found street-side or at retail shopping centers, government facilities, and other parking areas.

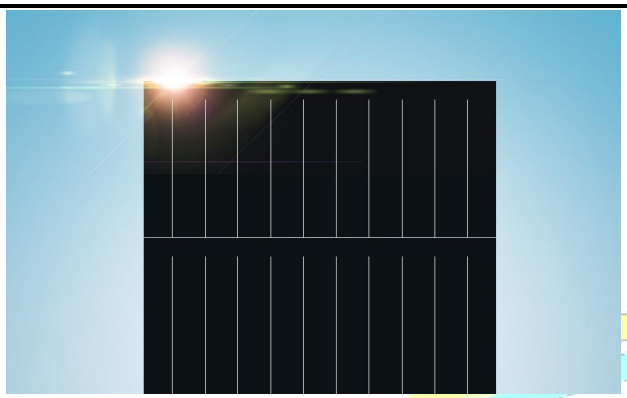



## โครงการการตลาดด้านระบบโซล่าเซลล์

ตัวอย่าง สินค้ากลุ่ม Solar panel 670W / one panel (เสนอขายกับทางลูกค้าทางฝั่ง CANADA)

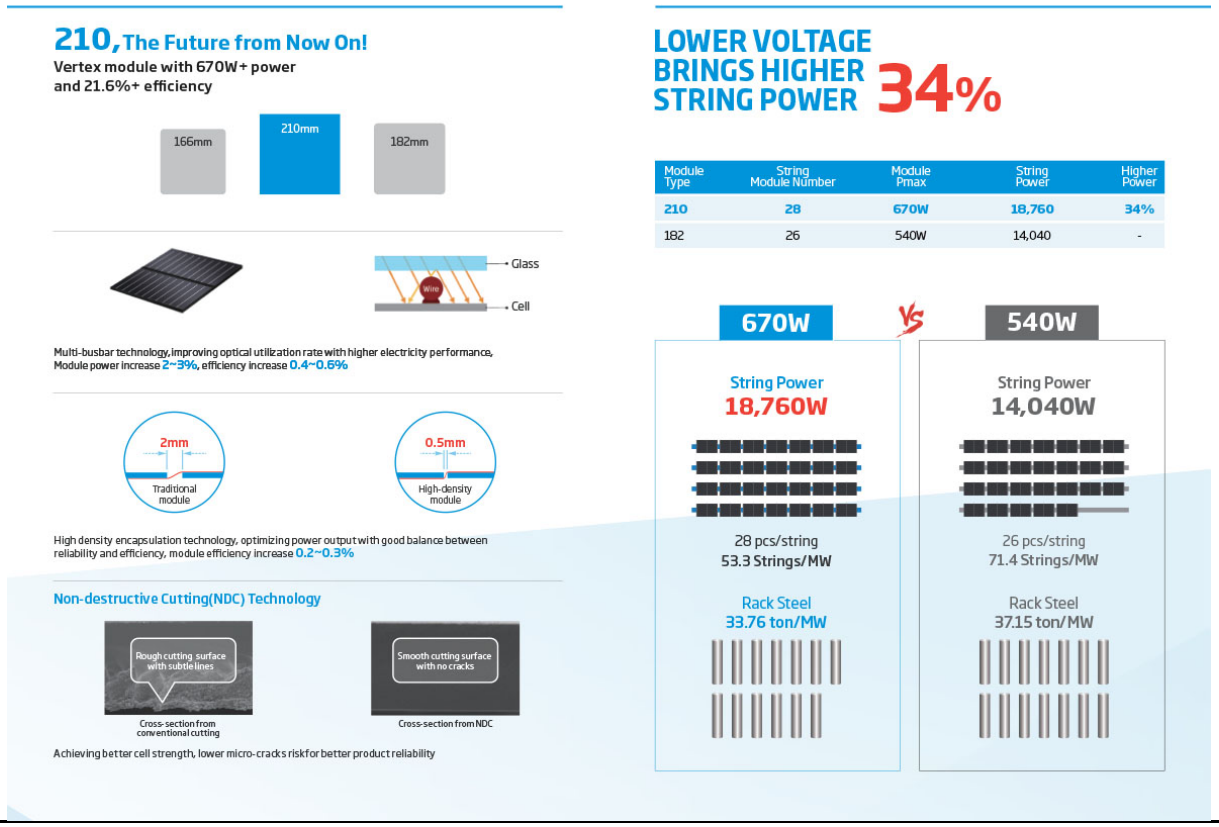

**670W Ultra-high Power with 21.6% High Efficiency**

Based on the 210mm large-size silicon wafer and monocrystalline PERC cell, the Vertex comes with several innovative design features allowing high power output up to 670W. Excellent temperature coefficient and low irradiation performance brings the greater power. Furthermore, benefit from square mono cells and high-density encapsulation technology, the efficiency of Vertex can reach up to 21.6%.



## Power Output of a Single Module String by More Than 34%

Based on the aim of improving the system efficiency and reducing the balance-of-system costs, Trina Solar's research and development team has introduced an innovative design of low-voltage and higher module string power output. Typicallly, Trina can interconnect 28 Vertex modules into a string. Compared with other reference module, a single module string can achieve up to a 34% power increase, 0.012-0.014 BOS reduction, 1.2%-1.5% LCOE reduction, indicating an innovative technological breakthrough and ushering in a new era of 600W+.



# HIGHER STRING POWER BRINGS LOWER COST

## CUSTOMER VALUE OF 670W VERTEX MODULES

**Case study**
Location: Minnesota
Project Capacity: 100MW
Inverter: String Inverter
Capacity ratio: 1.2
Fixed Tilt

-15% Racks

-17% Foundation

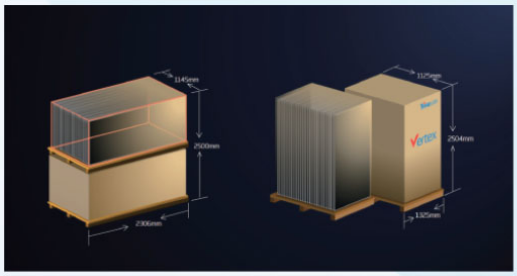
-11% Cable

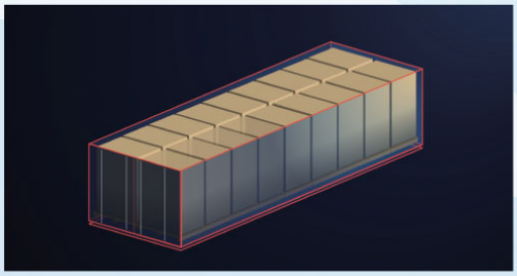
-7% installation

| | Module Type Power | Reference module 540W | Vertex 670W |
|---|---|---|---|
| BOS($/W) | Racks | BL | -0.0035 |
| | Foundation | BL | -0.0015 |
| | Cable | BL | -0.0027 |
| | installation | BL | -0.0053 |
| | Sum | BL | -0.013 |
| LCOE | | | ~-1.2% |

*Source: Authority expert.

## Logistic cost reduce 12% per container

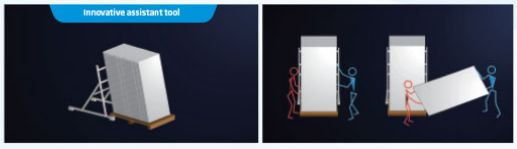




| Category | Module Power | Piece per Pallet | Pallet NO. per Container | Power per Container |
|---|---|---|---|---|
| Other Module | 540W | 31 | 20 | 334,800W |
| Vertex Module | 670W | 31 | 18 | 373,860W |

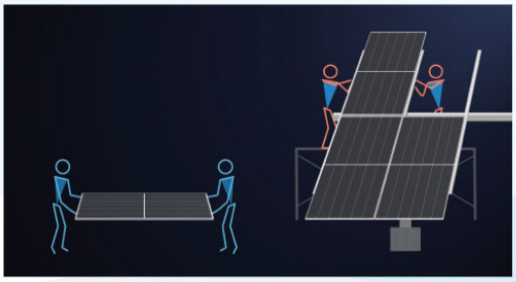
+390,60W (+12%)

## Easy for unpacking and prevent module from falling down




## Manual handling

4 crews/group, same staffing as traditional installation

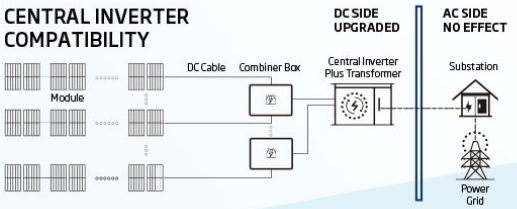


-24%
Module installation Quantity
Installation cost reduction 5-7%

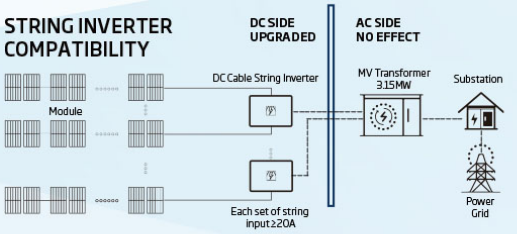
# ECOSYSTEM IS COMPLETELY IN PLACE

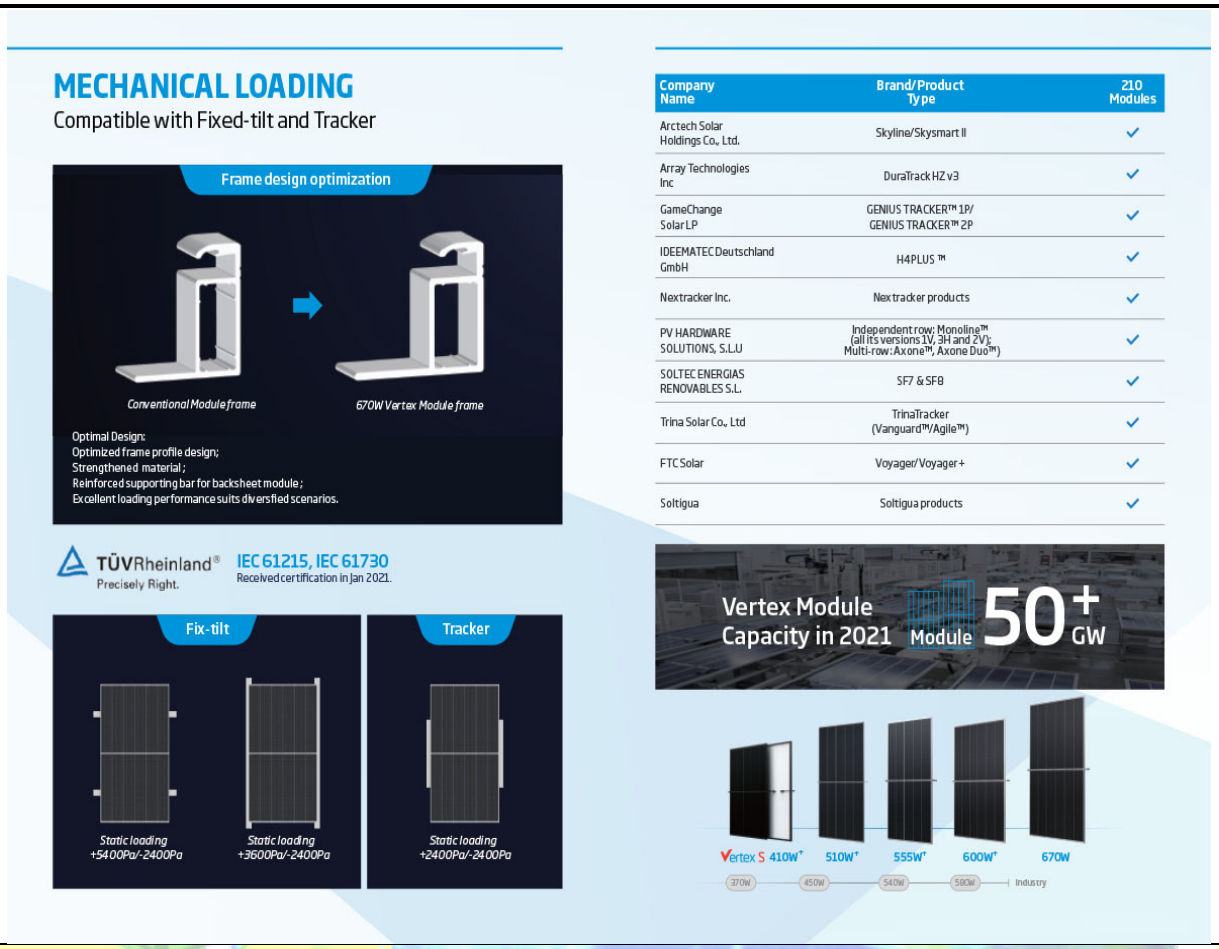
| TYPE | | BRAND | MODEL |
|---|---|---|---|
| INVERTER | Central | SUNGROW | 1600/2500/3125KW |
| | String | SUNGROW | SG225HX/SG250HX |
| | | HUAWEI | SUN2000-196KTL-H0/SUN2000-196KTL-H3 |
| | | SMA | Sunny Tripower 150-20 |
| | | SINENG | SP-225-H/SP-250K-H |
| COMBINER BOX | | LongMax, Bentek, ConnectPV Shoals, SolarBOS | 1500V High Current |
| CABLE | | 4MM²/6MM² | |

## CENTRAL INVERTER COMPATIBILITY




## STRING INVERTER COMPATIBILITY






## บ้านพลังงานสะอาด 24 Clean Energy of House


24 CLEAN ENERGY CO.,LTD.
THANK YOU