# Chinese Solar Cooling Conference 2015

## Large Scale Solar AC System Project

China Singyes Solar Technologies Holding Ltd.

Green Building Research Center

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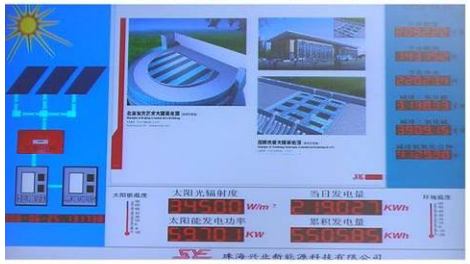



# 1、Brief introduction of Singyes Solar

# 1. 1 Singyes Solar-Leading a low carbon economy in china

- Founded in 1990;  listed in HK stock market  in 2009
- More than 2000 engineers, corporation income >5 billion in 2014

SINGYES SOLAR

**China low carbon products supplier**

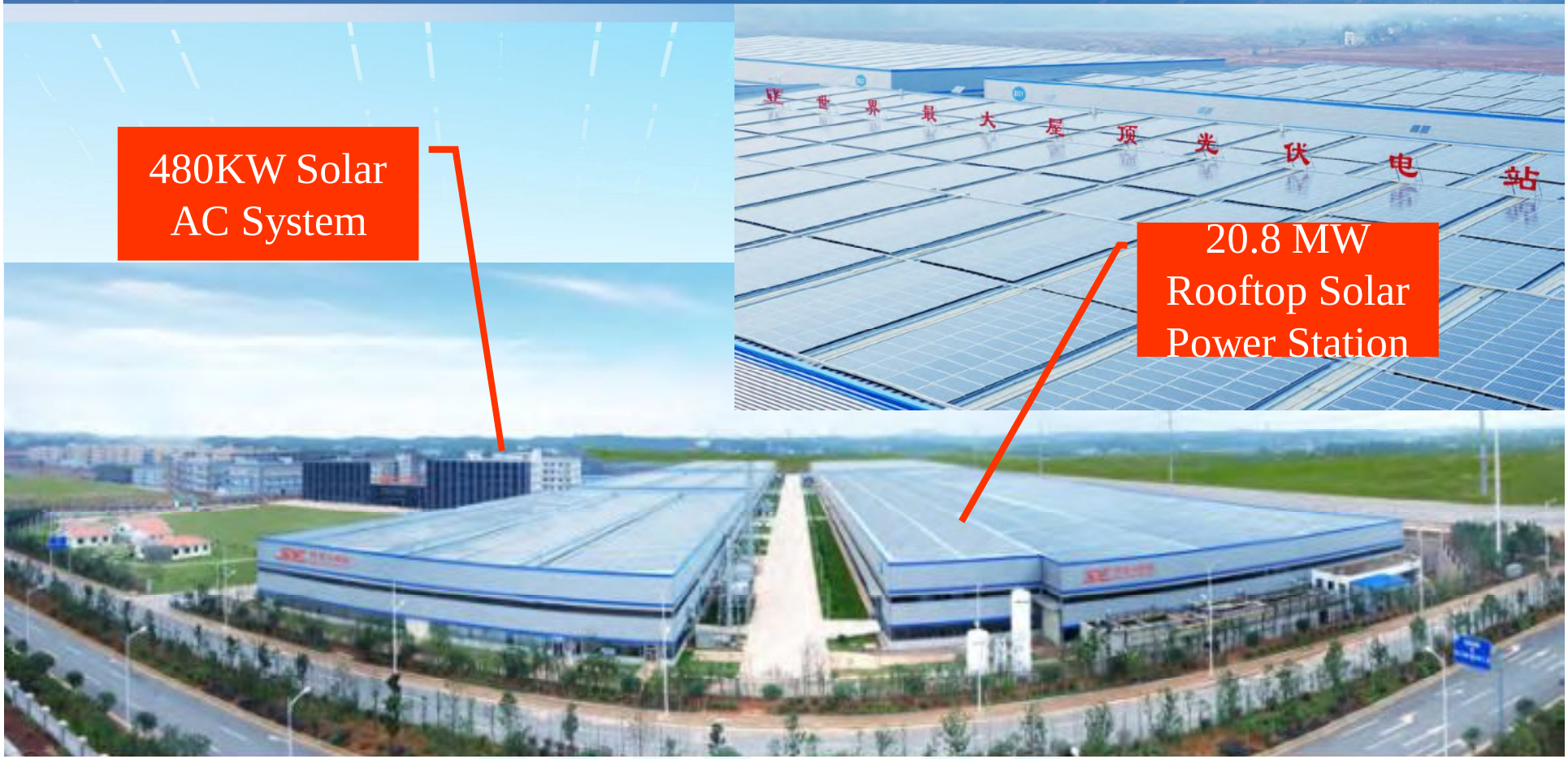
**Green building technology**

**Renewable energy products**

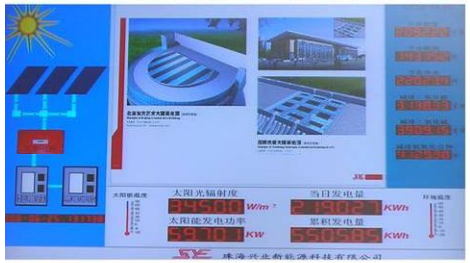
**New material products**

**Low carbon industry**

# 1.2 Singyes Solar Manufactory Plant in Hunan




**The world's largest rooftop solar power station（20.8 MW）& 480KW Solar AC System built in Singyes Hunan Plant in 2012.**




# 2 .Working Principle of Singyes Solar AC System

# 2.1 Project overview

Location: Xiangtan ·Hunan.

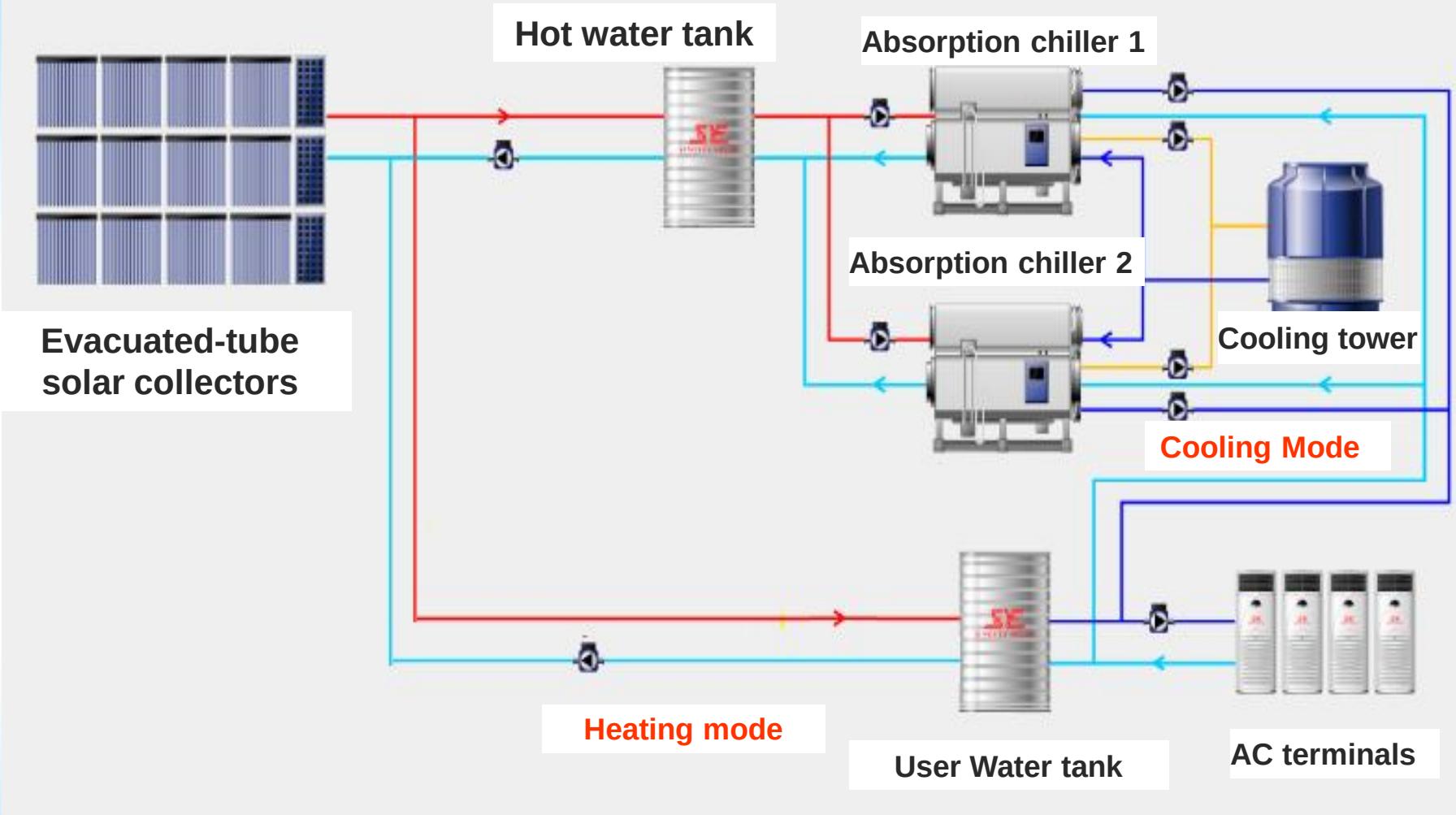
Average annual temp. is about 17℃

Average annual solar radiation : 4030 MJ/m$^2$.

Detail information of solar AC system :

| Type | AC Area | Cooling load | Heating load | Hot water |
|---|---|---|---|---|
| Exhibition Hall | 4,700㎡ | 480kW | 390kW | / |
| Office Rooms | | | | / |
| Restaurants | | | | / |
| Dormitory | / | / | / | 30T/day |

# 2.2 Singyes Solar AC System's Working Principle



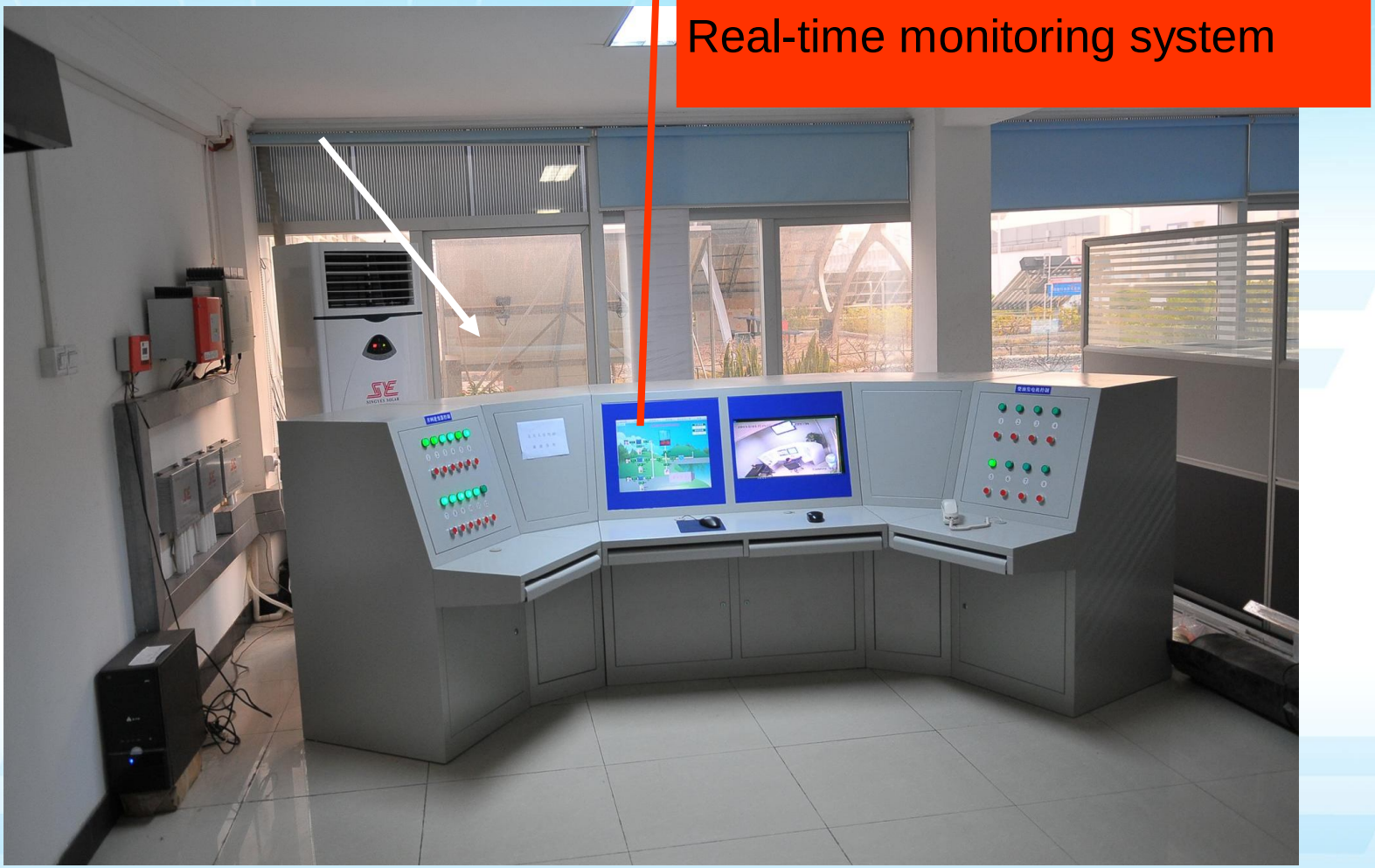
# 2.3 Components of Singyes Solar AC System:
## ① Heat pipe evacuated-tube solar collectors

| Specifications of the solar collectors | | Number |
|---|---|---|
| Working temperature | 50~90℃ | 256 |
| Installation area | 1,600㎡ | |

# 2.3 Components of Singyes Solar AC System:
## ② Two LiBr Absorption chillers

| Cooling Capacity of Absorption Chiller | | Auxiliary energy |
|---|---|---|
| Libr Absorption chiller 1 | 230kW | Natural gas |
| Libr Absorption chiller 2 | 250kW | |


# 2.3 Components of Singyes Solar AC System:
## ③ Monitoring and control devices

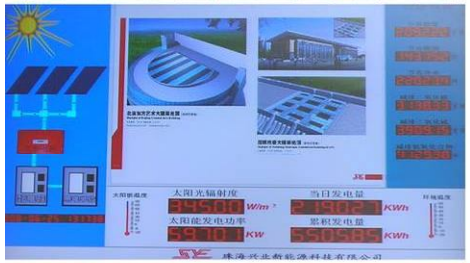


# 2.3 Components of Singyes Solar AC System:
## ④ Air terminal modules

Embedded fan coils in exhibition hall

Embedded fan coils in restaurants

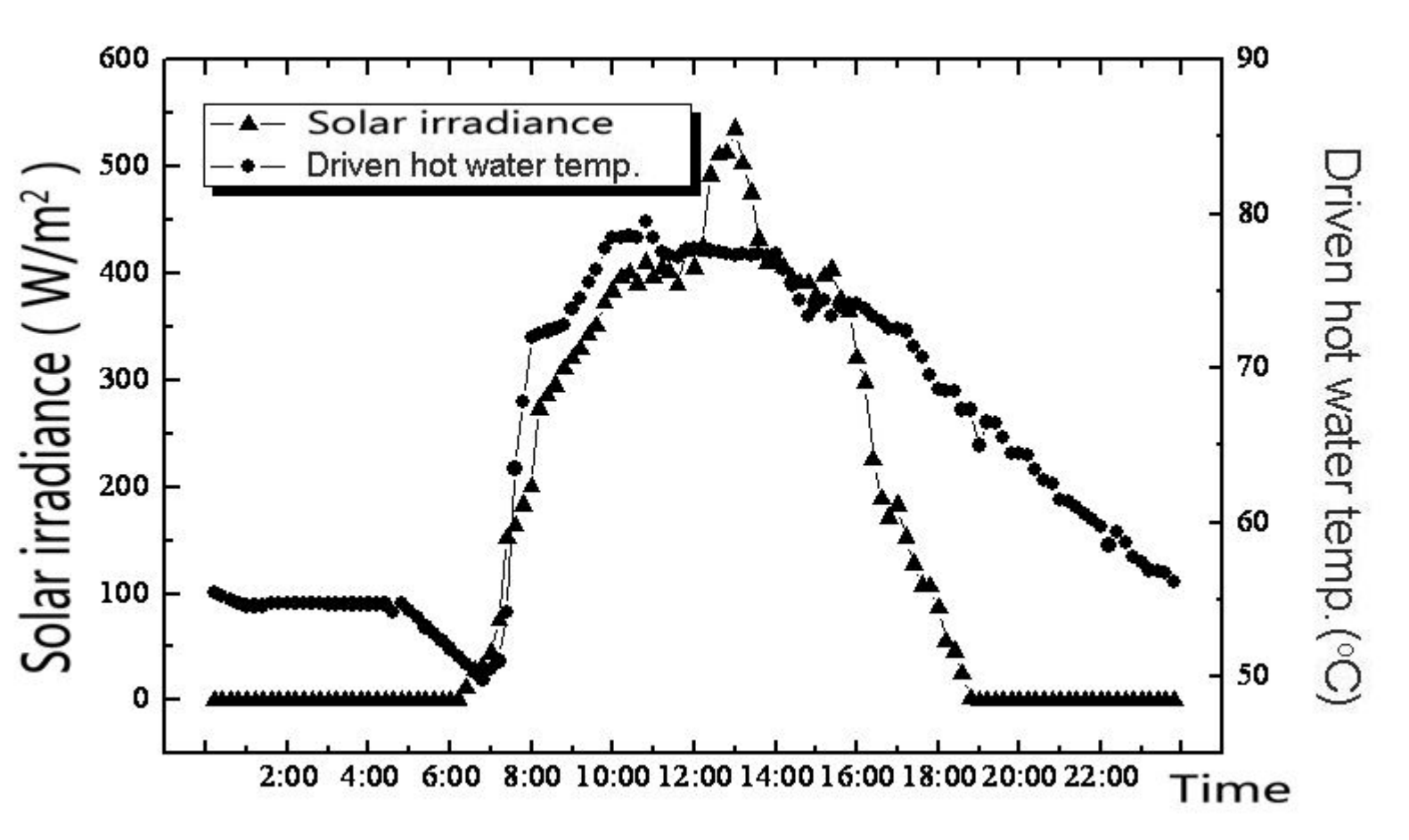
Air terminals in the office




# 3. Performance of Singyes Solar AC System

# 3.1 Performance Data Analysis:

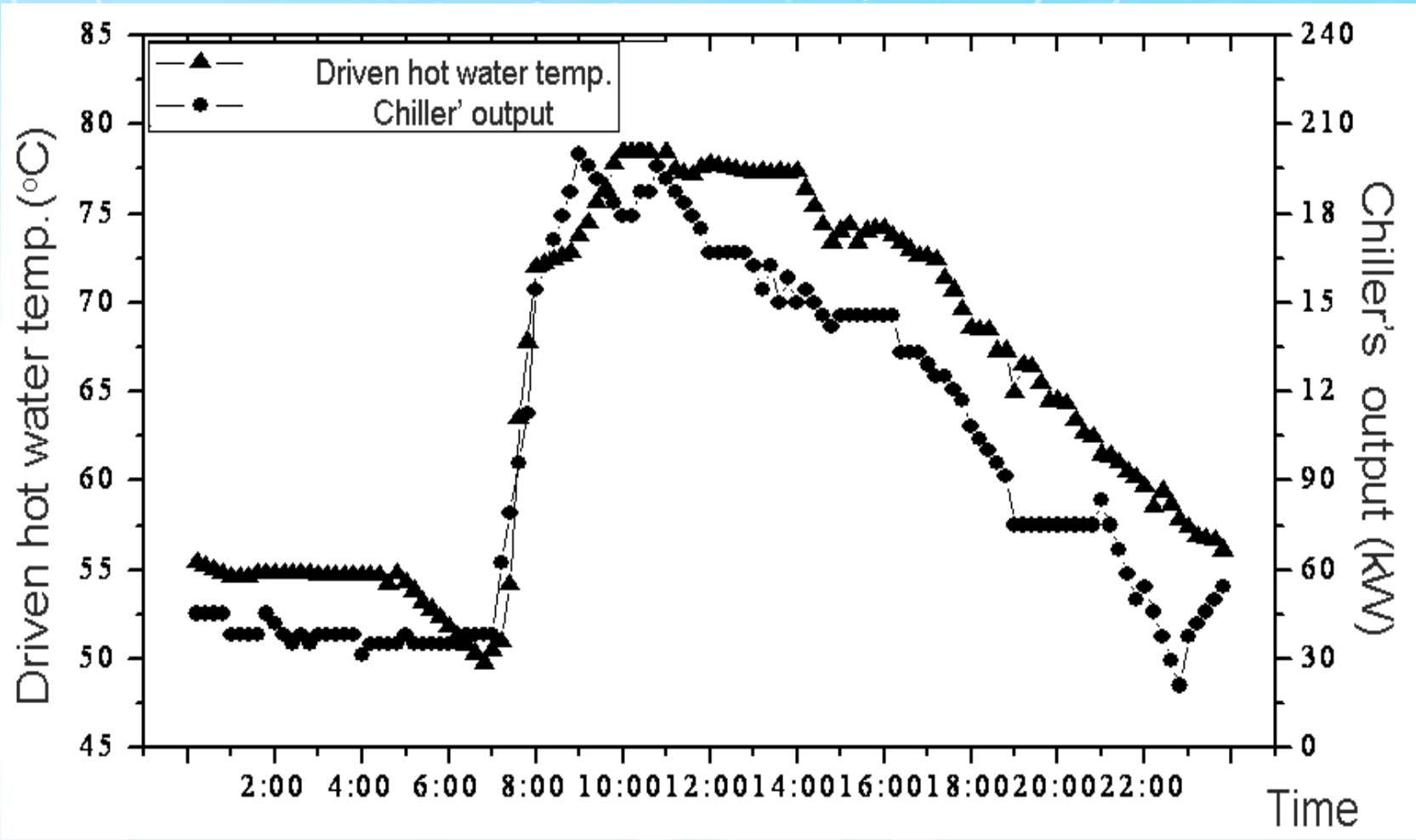
## (1) Solar Irradiance VS. Driven Hot Water Temp.




Temperature of driven hot water is directly proportional to solar irradiance with delay

# 3.1 Performance Data Analysis:

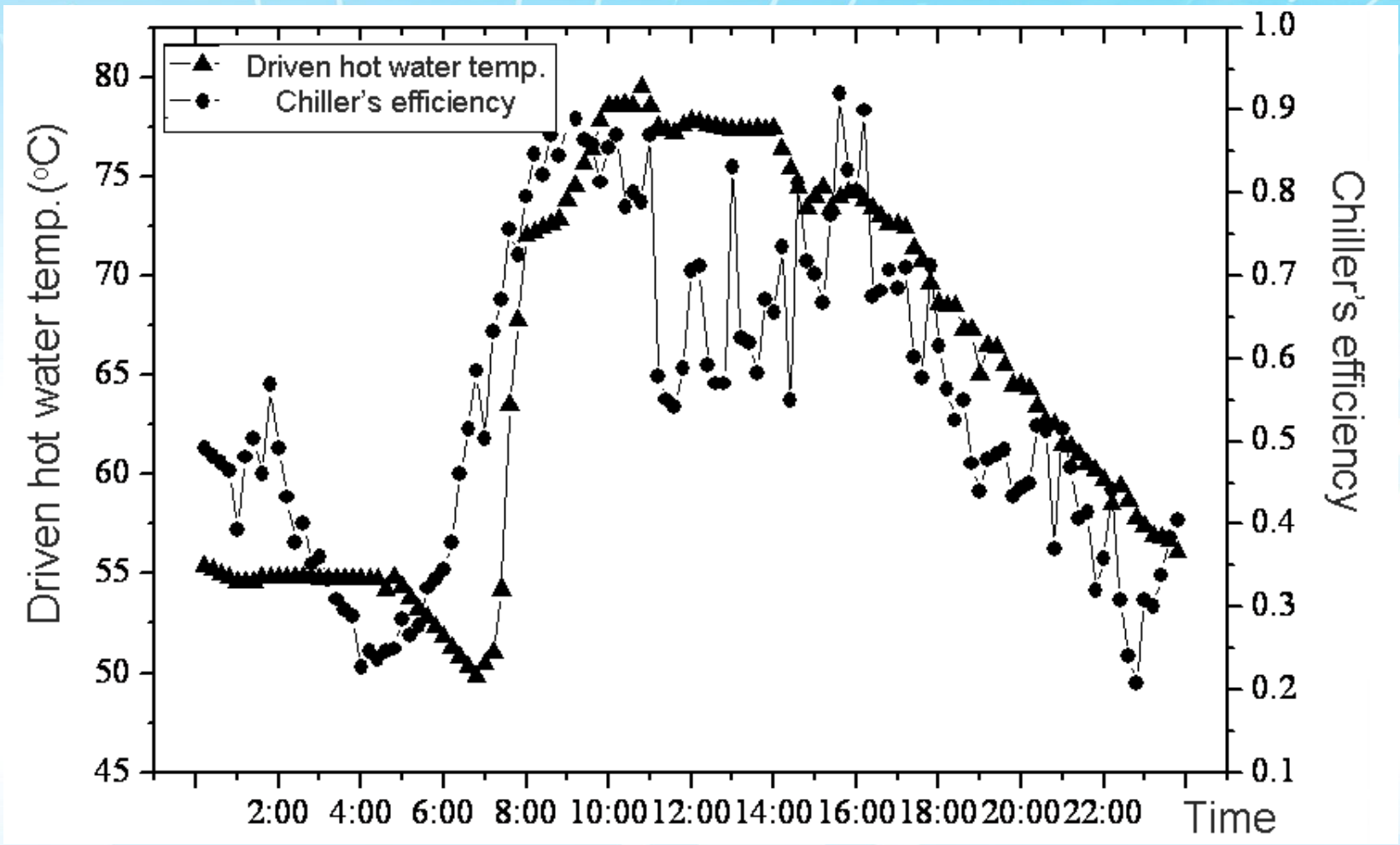
## (2) Chiller's Cooling Output VS. Driven Hot Water Temp.




**The chiller's output increased dramatically when the driven hot water temp. > 70℃.**

# 3.1 Performance Data Analysis:

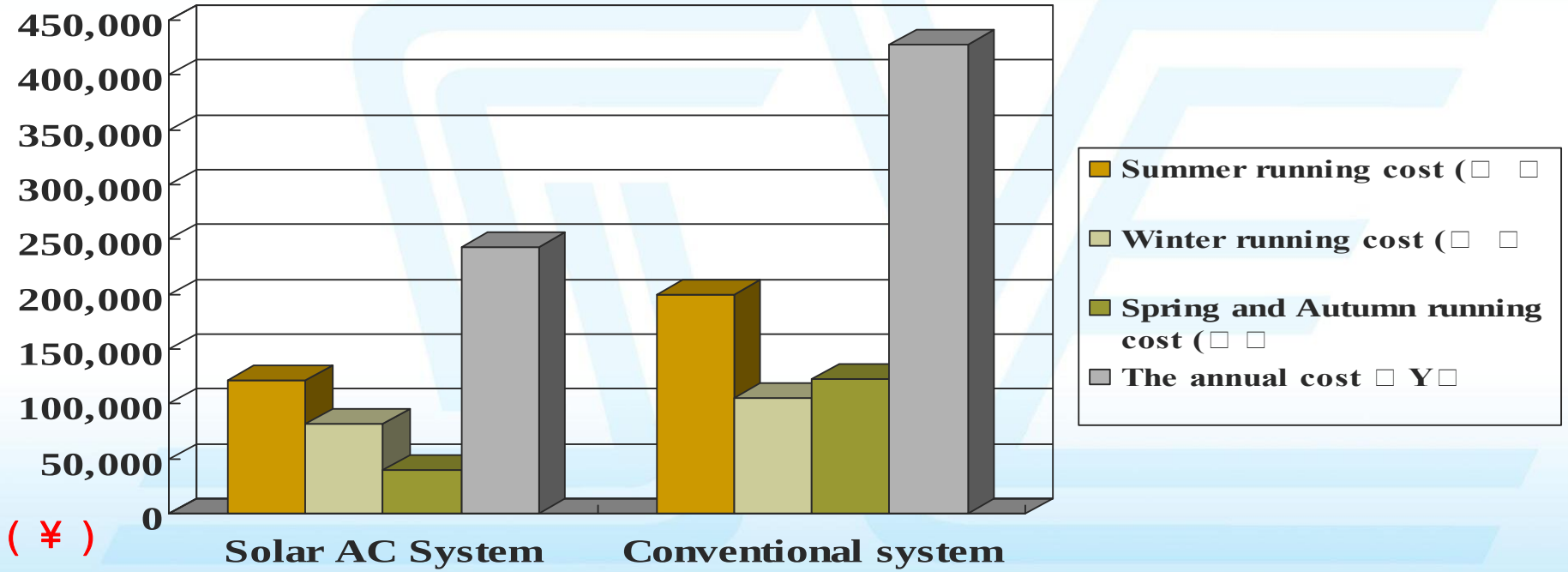
## (3) Chiller's Efficiency VS. Driven Hot Water Temp.




The average efficiency of the chiller is about 0.6 in the typical summer day

# 3.2 Singyes Solar AC System Running Cost （Compared with the conventional system）

| Seasons \Running cost (￥) | Singyes Solar AC system | Conventional system | Cost Saving |
|---|---|---|---|
| **Summer**(150 days) ：480 kw cooling load | 121,300 | 199,400 | 78,100 |
| **Winter**(120 days) ： 390 kW heating load | 82,200 | 105,700 | 23,500 |
| **Spring and Autumn** (90 days) ：hot water 30T/day | 40,000 | 122,500 | 82,500 |
| **Annual cost** | 243,500 | 427,600 | 184,100 |



# 3.3 Performance Conclusions

- **Chiller efficiency** (driven hot water temp )

The chiller have a higher efficiency when driven hot water temp. >70 ℃.

- **Effective factor** (solar radiation ) :

Building a larger hot water storage tank may decrease the effective factor of solar radiation, which can make the system working more stable.

- **Auxiliary energy** (natural gas):

Increasing the solar collectors' area may decrease the gas consumption and the running cost.

# 3.4 Advantages of the Solar AC System

## Environmental friendly:

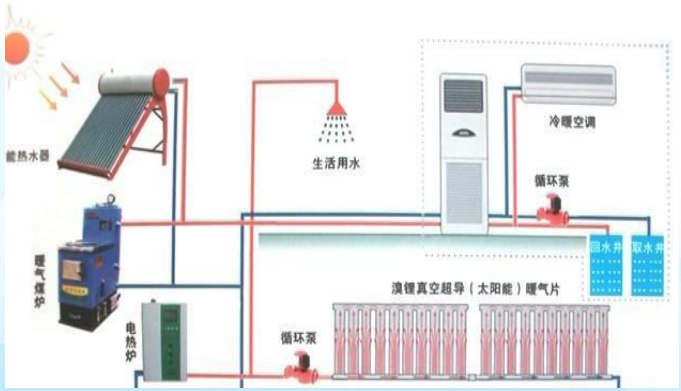
**Non-freon system, decrease the Greenhouse effect**

## Low running cost :

**Can supply heating in winter , supply cooling in summer, supply the hot water in the other seasons by mostly using the solar energy.**

## Good seasonal adaptability:

**Cooling and heating capacity of the system is directly proportional to the solar radiation**



# 3.5 Limitations for promotion of the Solar AC System

- High initial investment :

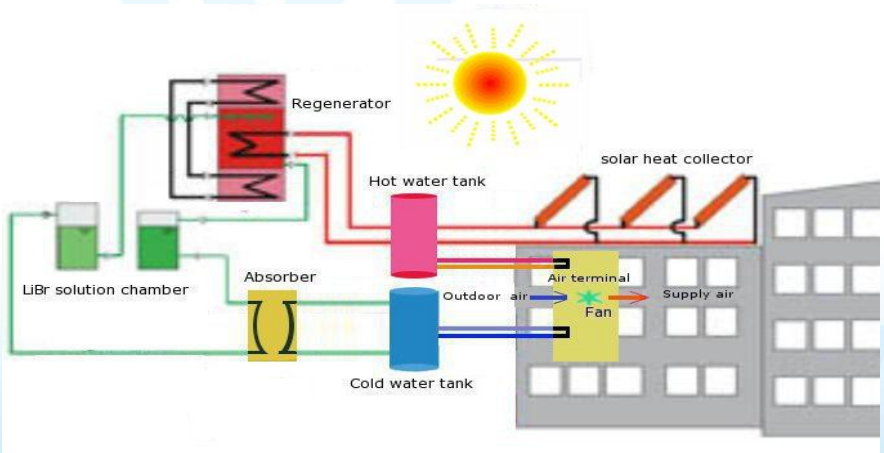
  long payback period

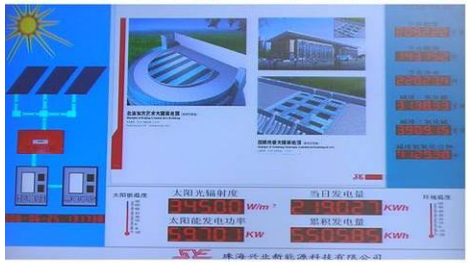
- Limited building installation areas for the solar collectors:

  higher running cost

- Low absorption chiller's running efficiency :

  can not fulfill the user's cooling and heating load

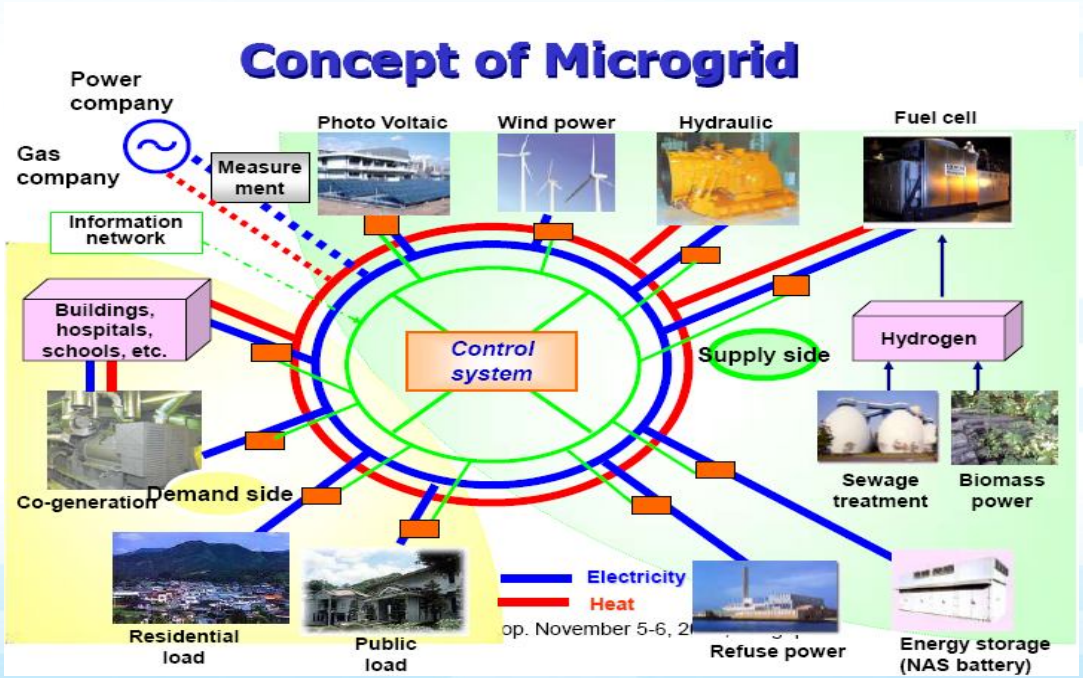





# 4. Prospects for Solar AC Development

# Prospects for the Solar AC System Development

- High efficiency solar collectors;
- High efficiency chillers in low driven temperature;
- Low cost phase change material for energy storage.



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SINGYES SOLAR

# The End
# Thank you ！