Make Solar Energy Greener in buildings

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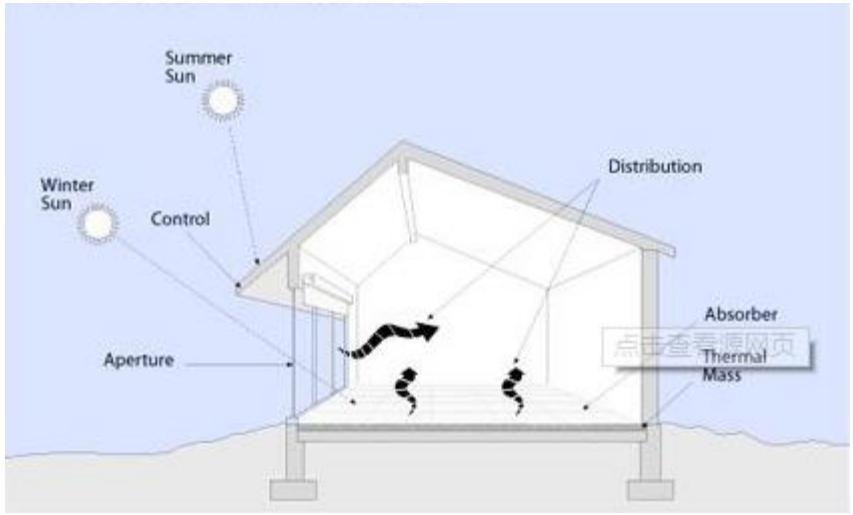
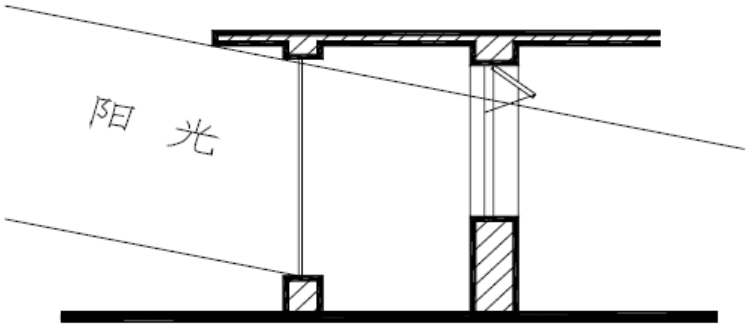
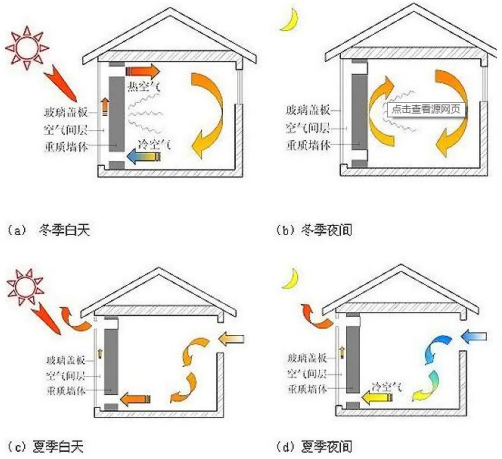
Sept. 28, 2020

0. Solar applications in buildings (passive)

- **natural lighting and passive thermal techniques**

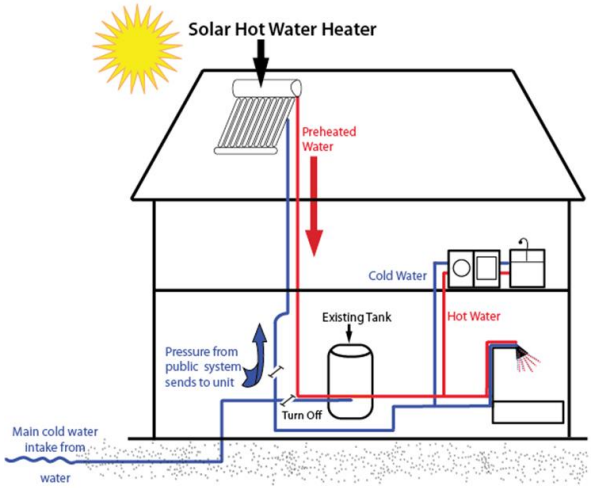






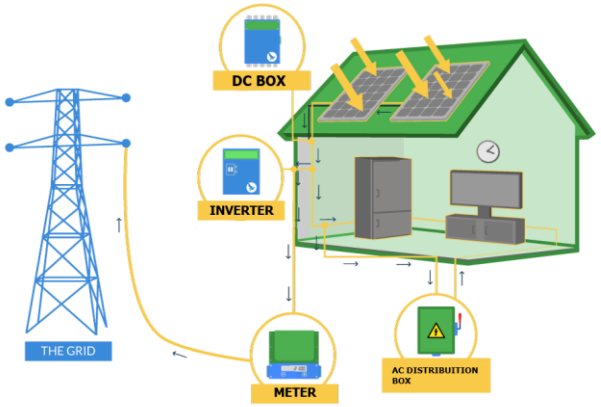
0. Solar applications in buildings (active)

- **Solar domestic hot water**



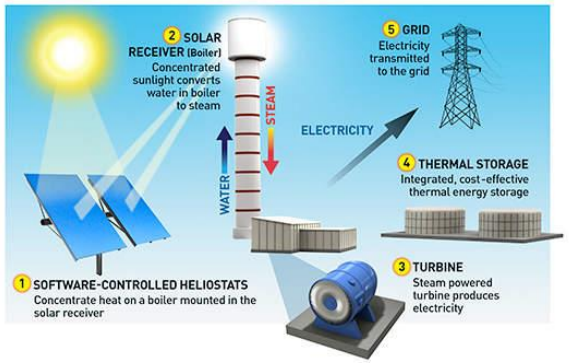
- New installations in 2019: **31.3GW$_{th}$** (72.8% in China)
- Global total: **479GW$_{th}$** (69% in China)

- **Solar PV**



- New installations in 2019: **114.9GW** (26.2% in China)
- Global total: **627GW** (32.6% in China)

- **others**

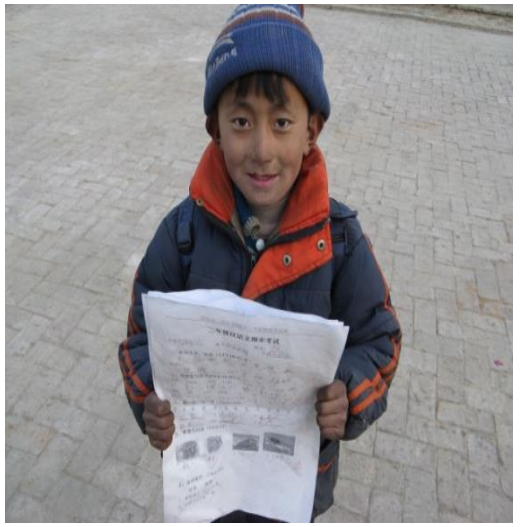


- Solar refrigeration,
- solar thermal power plant
- Solar thermal heating
- Etc.

Back to Jan, 2009

Qinghai

- Solar PV and lighting 5W, supported by WB program



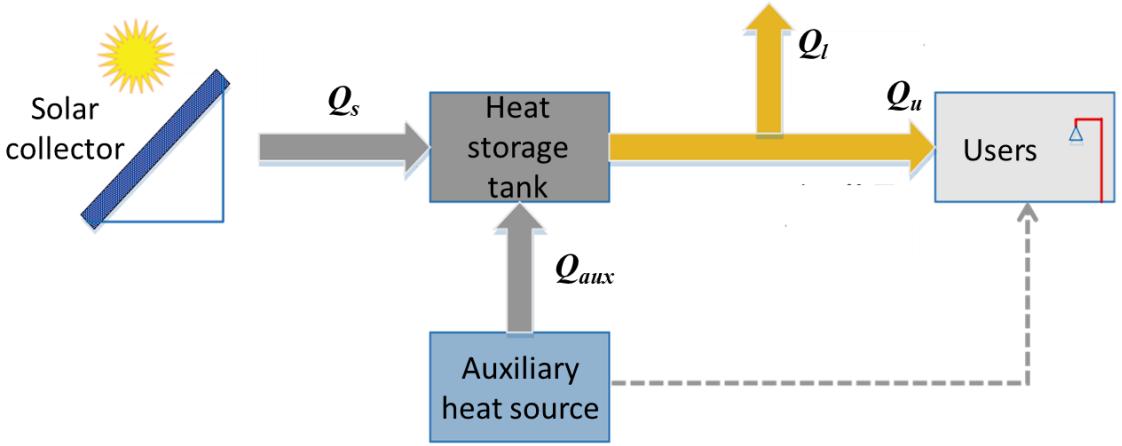
- The boy's Score: 100

To use renewables efficiently is more important than to install it.

How many points can we score?

1. Solar domestic hot water

- **Focus on the real effect not only the installation capacity**



From： Solar fraction: Q_s/Q_u

To：

Solar energy efficiency: $(Q_s - Q_l)/Q_s$

Solar energy contribution rate: $(Q_s - Q_l)/Q_u$

System heat loss ratio: Q_l/Q_u

Case	City	Solar fraction	Solar energy efficiency	Solar energy contribution rate	System heat loss ration
1	Beijing	100%	6.2%	18%	2.72
2	Chifeng	89%	21%	19%	0.70
3	Tianjin	79.1%	32%	25%	0.54
4	Yinchuan	60%	24.56%	33.92%	1.04
5	Ningxia	60%	50%	38%	0.38
6	Shenzhen	40%	-17.62%	-4.98%	0.33
7	Beijing	90%	-11.77%	-11.72%	1.11
8	Beijing	90%	25%	81%	2.40
9	Beijing	100%	32%	28%	0.73
10	Shanghai	100%	56%	69%	0.48

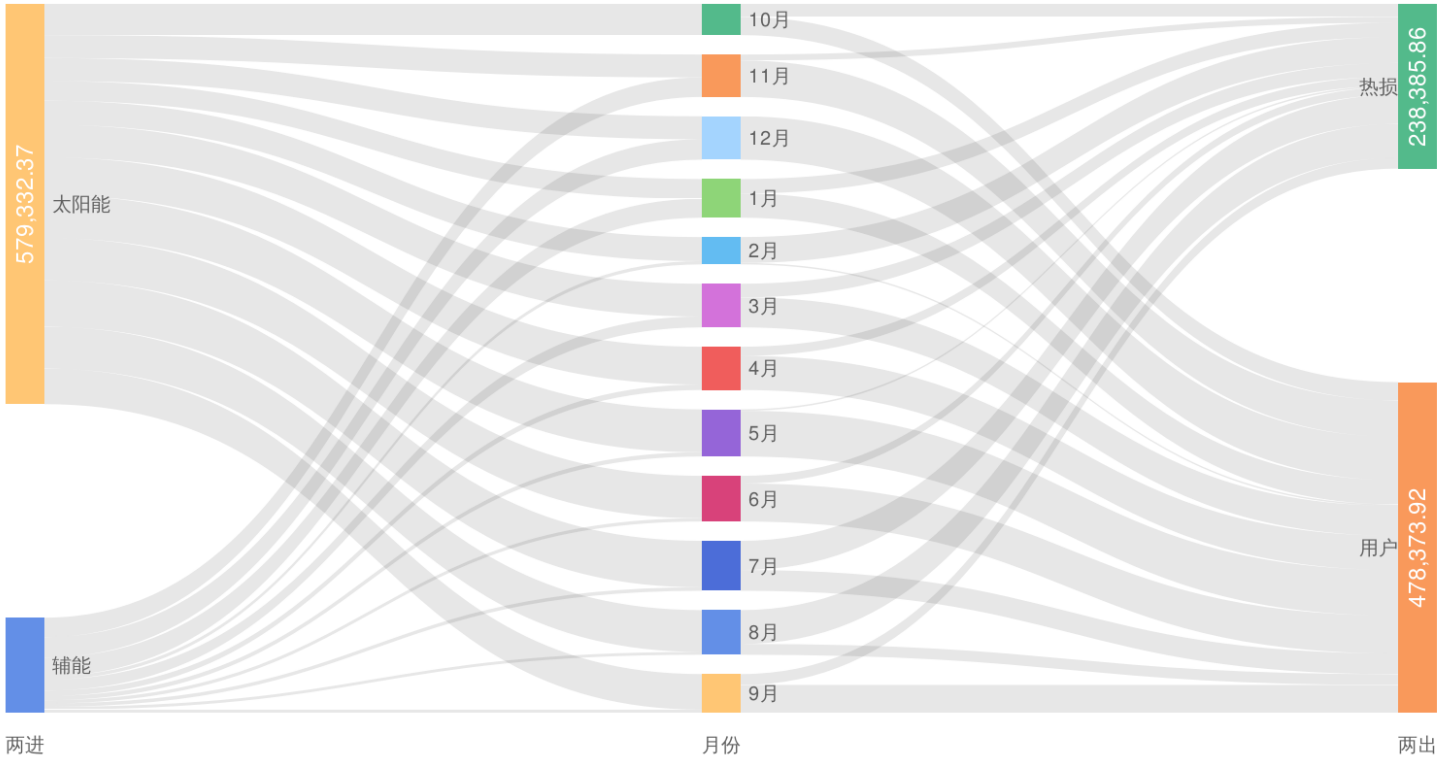
1. Solar heat-domestic hot water

- **Focus on the real effect not only the installation capacity**

Case 10

- A dormitory building in Shanghai
- 6 floors and 12 bathrooms
- Solar collector area: 230m^2
- Hot water supply from 15:00-23:30

Solar energy efficiency: 56%
Solar energy contribution rate: 69%
System heat loss ratio: 0.48



1. Solar heat-domestic hot water

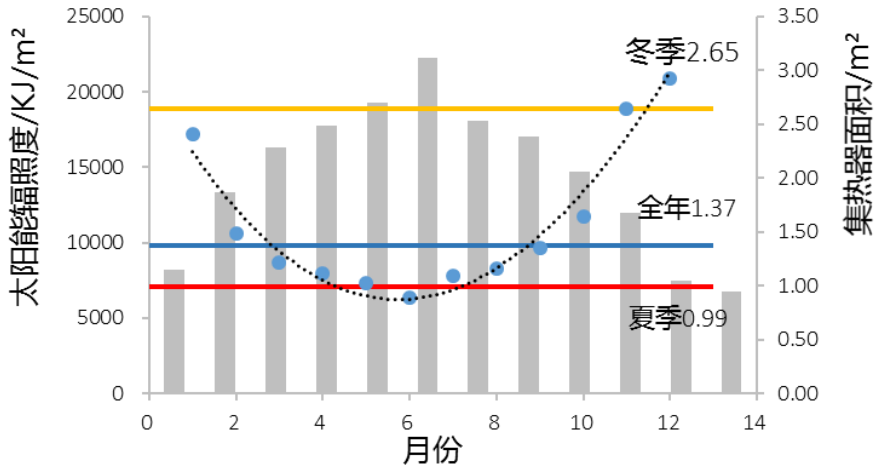
- **Focus on the real effect not only the installation capacity**

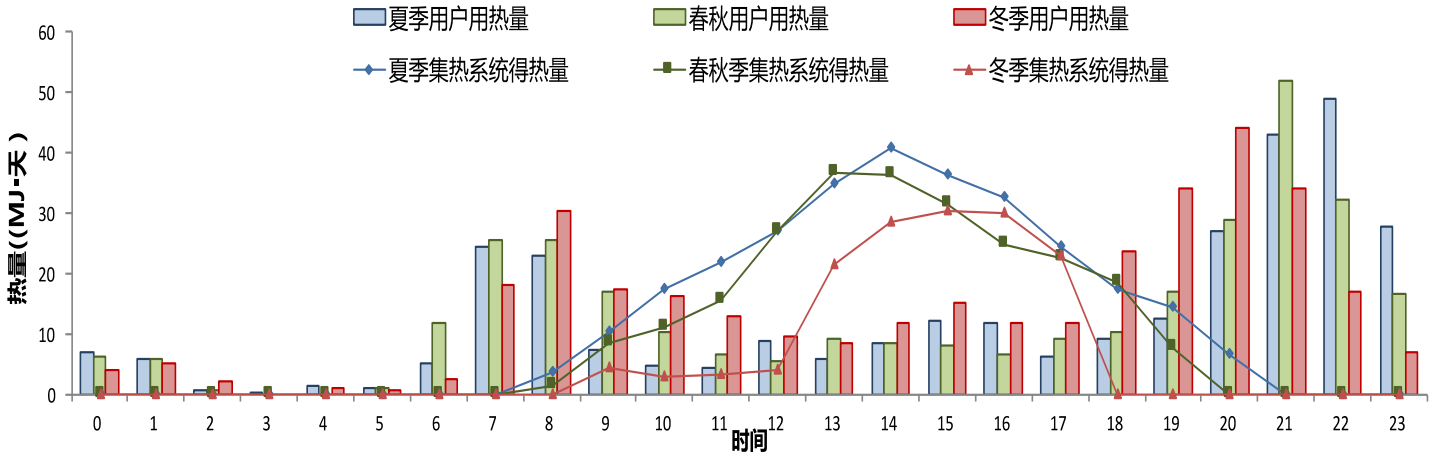
Features:

- Timing mismatch
- Heat loss is more than we imagined

Pathway:

- Collect-transmit-storage-consumer
- Control auxiliary heat
- Operation strategy related with the OB

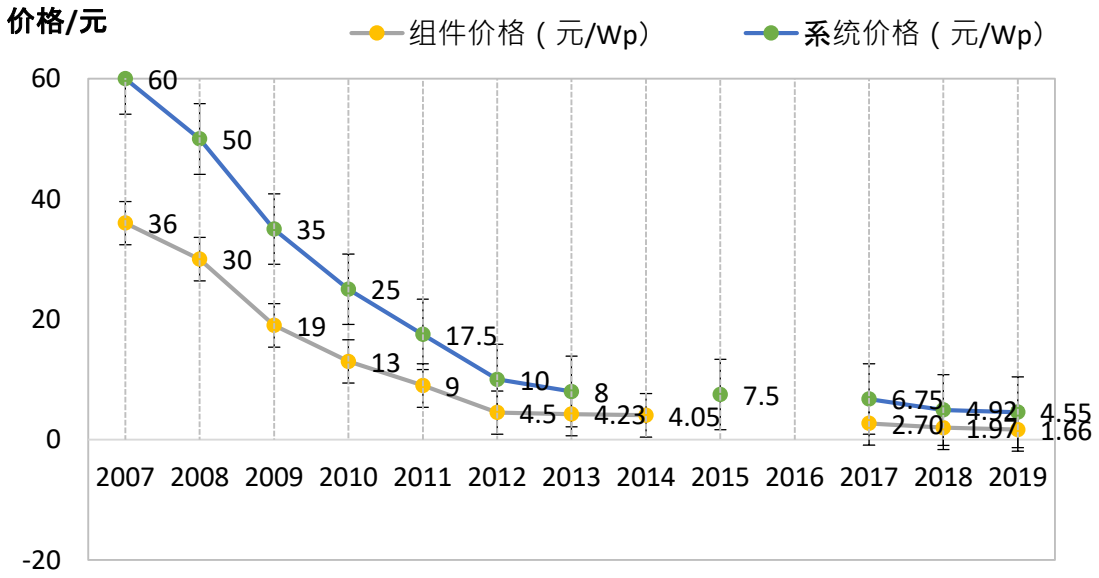


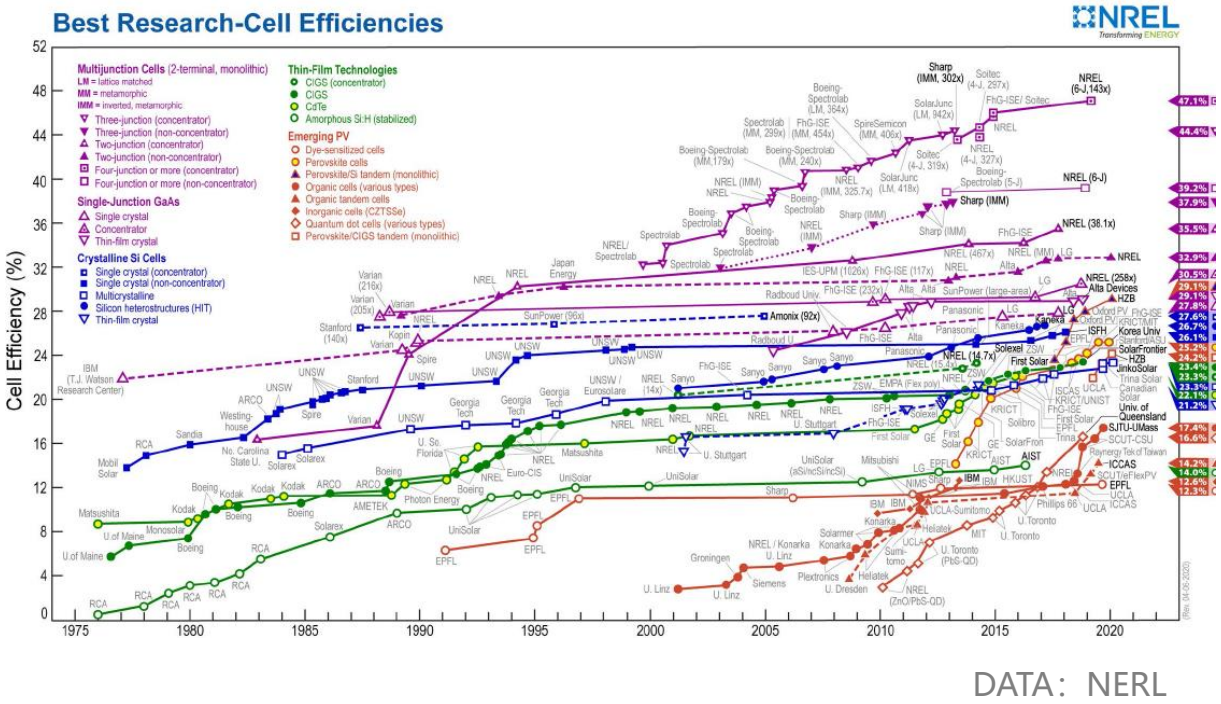


2. Distributed Solar PV

- **Cost-effectiveness is excellent, PV Spring is coming**

Cost is becoming lower and lower





DATA：NERL

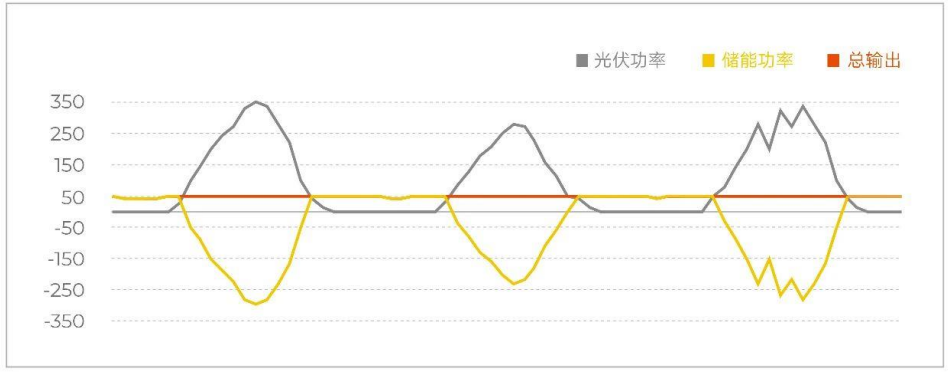
Efficiency is improving dramatically

2. Distributed Solar PV

- **It is time emphasize the distributed solar PV**

solar power station

- No more land
- cost
- Unstable-how to connect with grid
- Electricity abandon



PV power Capacity : inverter capacity= 7:1

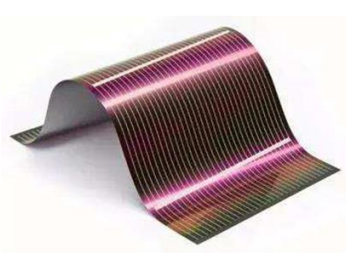
Distributed solar PV in buildings

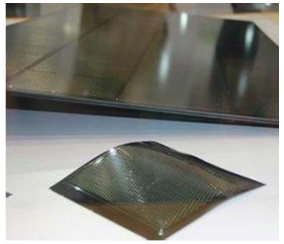
- integration
- Strategy for rural and urban
- DSPV tech as a building energy system

2. Distributed Solar PV

- **Balancing the integration and the efficiency**

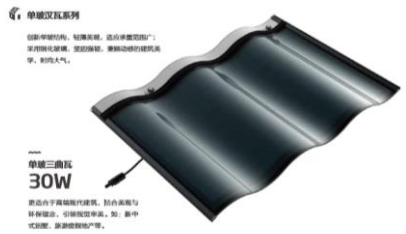
PERC/PERT（roof and non-transparent facade）**+ CdTe and CIGS**（transparent facade）





铜铟镓硒(CIGS)薄膜电池板

碲化镉(CdTe)薄膜电池板



CASE inChina

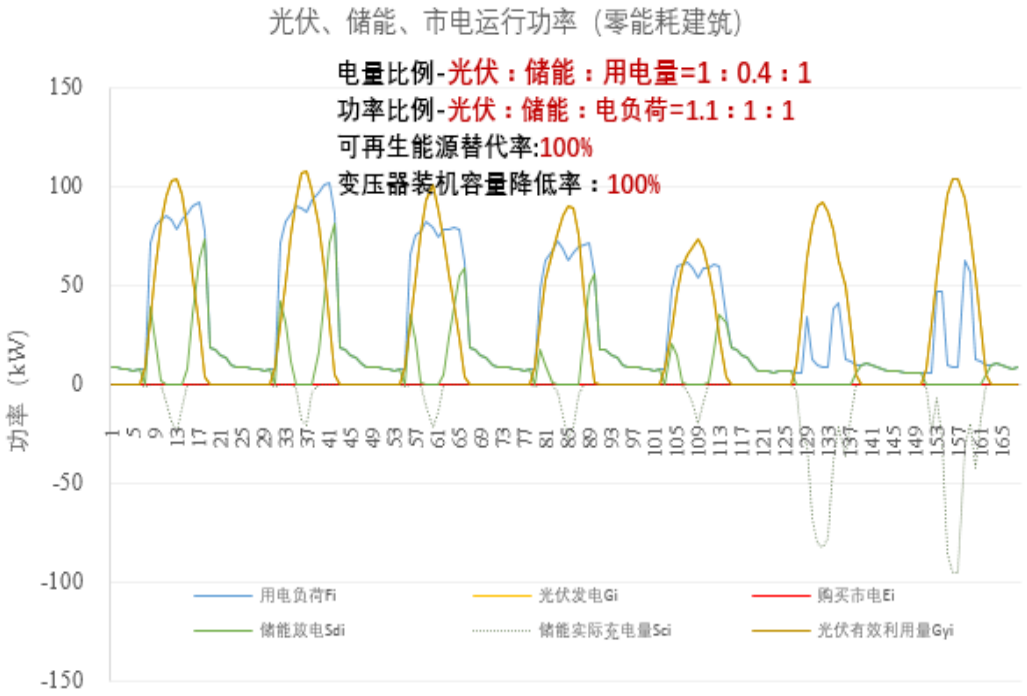
Building： 60billion m2

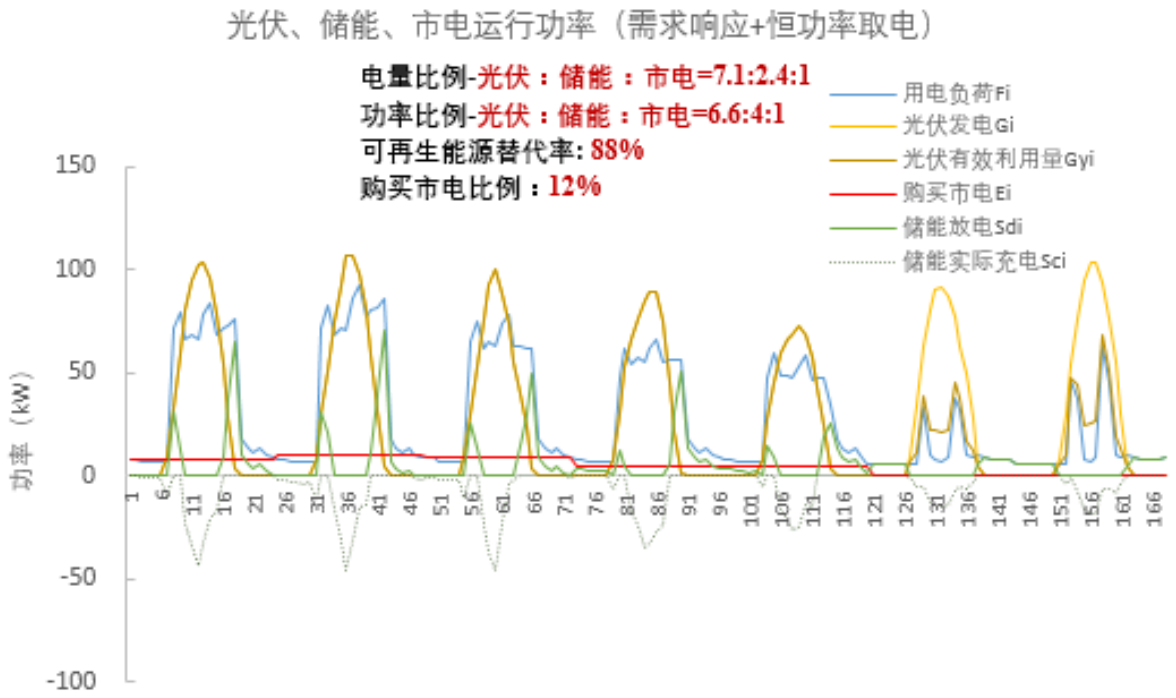
Roof：6 billion m2

DSPV：1200 GW

2. Distributed Solar PV

- **If electricity produced by DSPV is more than what we consumed, we are ZEB?**

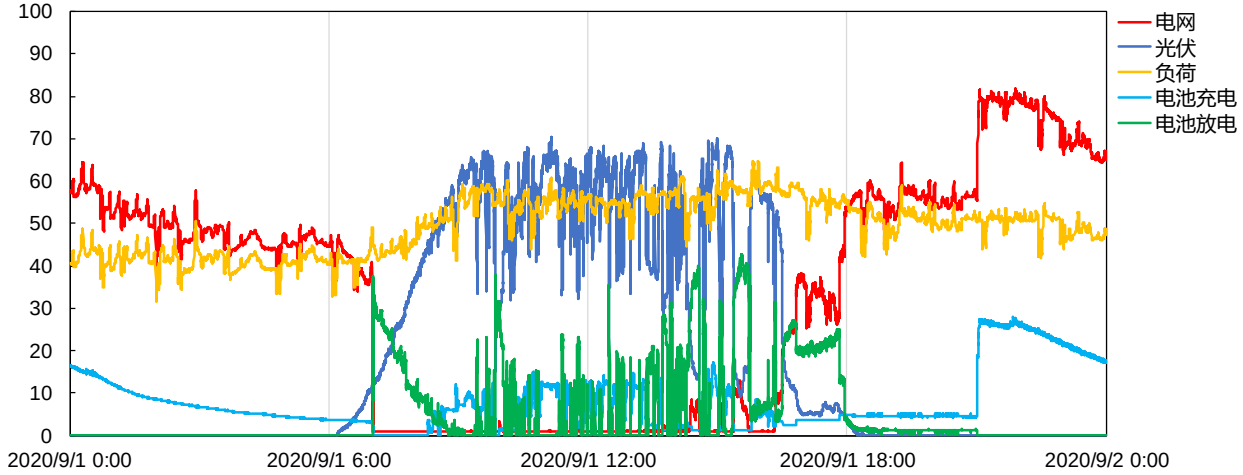




2. Distributed Solar PV

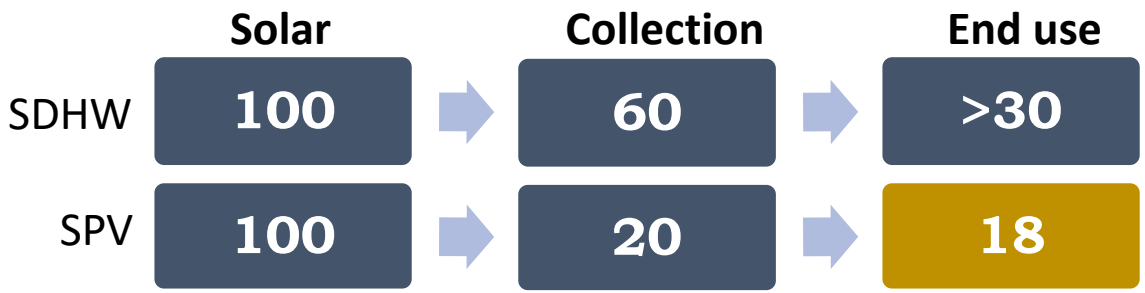
Pathway： DSPV tech as a building energy system

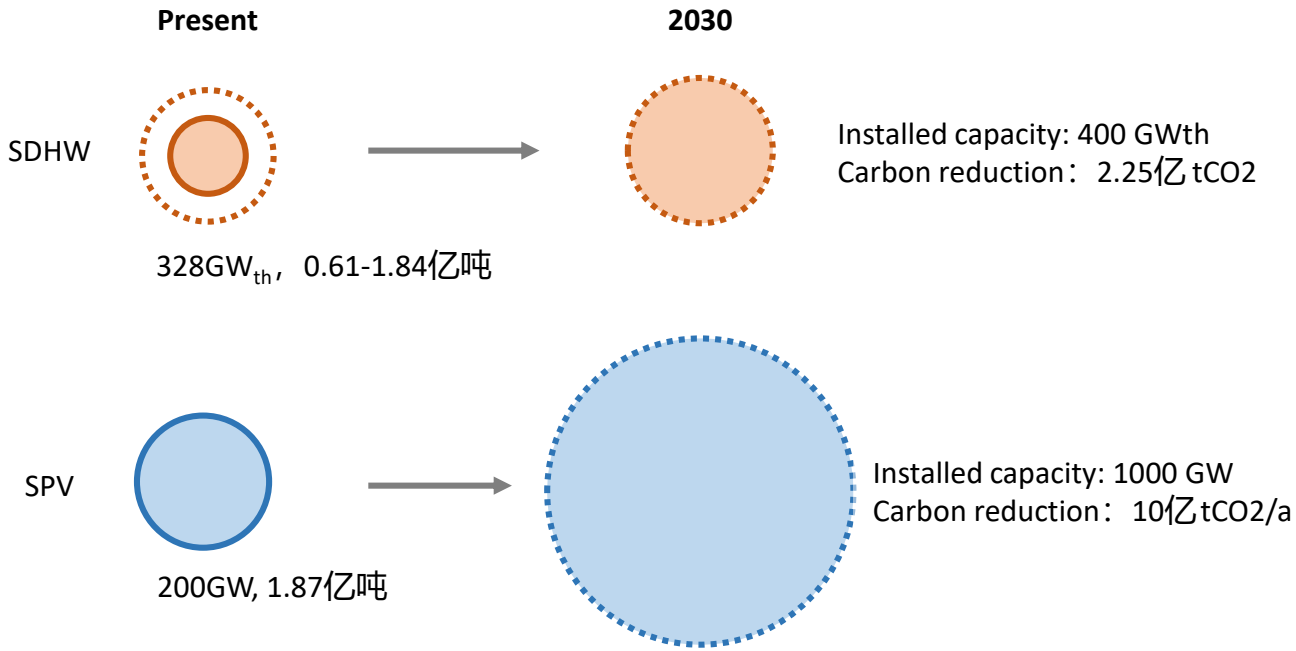
- Different from SDHW: ~~Collect-transmit-storage-consumer~~
- Load Flexibility
- LVDC
- Energy storage
- Grid-interactive



3. Future：From Solar energy to solar enabling
从太阳能到太阳 能

- **Carbon reduction potential**





One for all was yesterday, all for all is the future.

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