

Energy and Architecture in China

LI Yunjiang

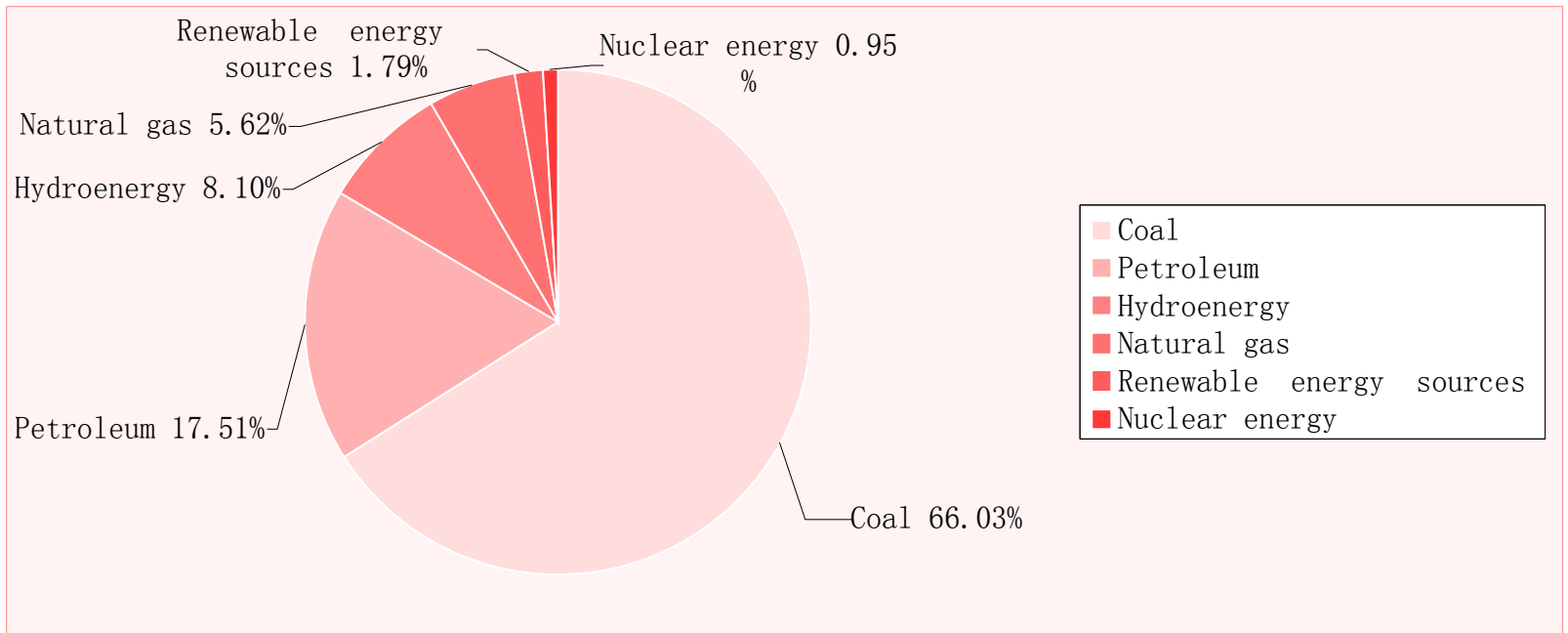
Dept. of Architecture and Urban Planning
China Three Gorges University

content

- + Primary Energy in China
- + Green Building in China
- + Some Actual Projects

Primary energy in China

+ Consumption structure of primary energy in 2014



Renewable energy

Solar energy

Wind energy

Hydroenergy

Biomass energy

China energy market in 2014

Despite growth of energy consumption and manufacture slow down recently, China still remains the world's largest energy consumer, manufacturer and net importer.

+2.6%

Growth of China's energy consumption

+0.1%

Change of China's coal consumption

+15.7%

Growth of China's hydro production

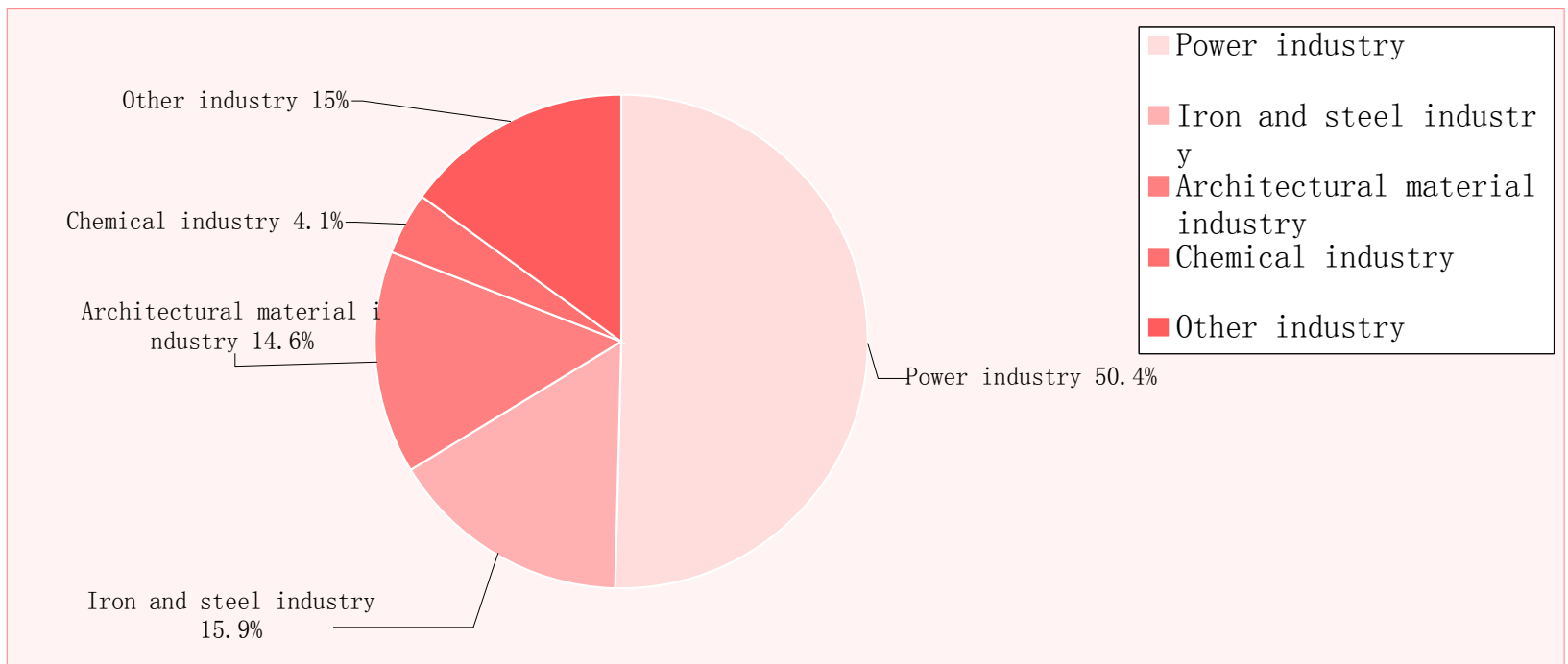
-2.6%

Decrease of China's coal production

- China's energy consumption grew by 2.6% in 2014. This was less than half the ten-year average growth rate of 6.6% and the slowest annual rate of growth since 1998.
- China remained the world's largest energy consumer and accounted for 23% of global energy consumption and 61% of net global energy growth.
- China's energy mix continues to evolve. While coal remains the dominant energy, accounting for 66% of China's energy consumption, this was the lowest share on record and down from recent highs of 74% in the mid-2000s.
- Renewable energy grew 15.1% over the year. Chinese renewable energy now accounts for 16.7% of the global total, up from 1.2% just ten years ago. Nuclear power grew 13.2%, more than doubling production over the last seven years.

Coal

+ Industrial energy consumption of coal



Coal



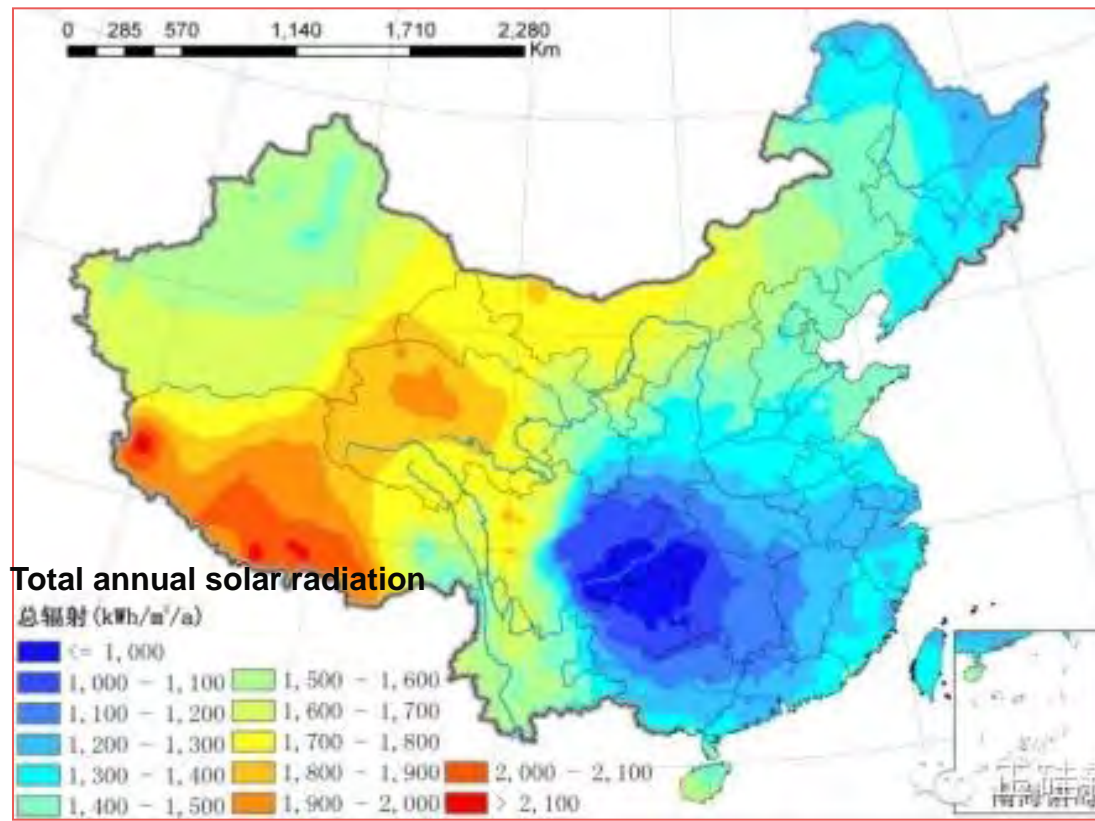
Current Beijing, China



London, UK 1950

Solar energy

+ Distribution of solar energy resources



Solar energy

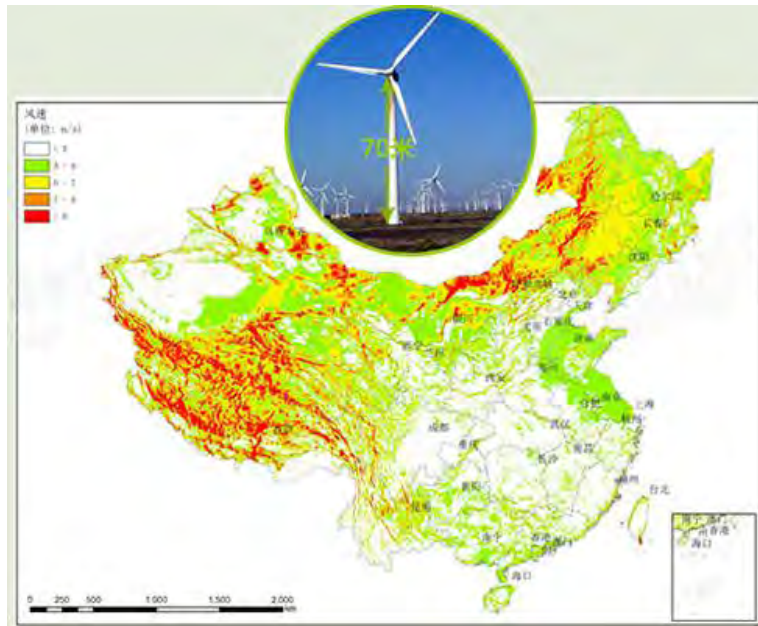


Rikeze Solar Power Station, Tibet （日喀则太阳能电站）

Wind energy

+ Wind energy resource in the height of 70m

In general, it has the potential for wind energy development on condition that annual average wind speed is above 5 m/s and annual average wind power density is above 150 W/m^2 .



Wind energy



Dabancheng Wind Power Station, Xinjiang (达坂城风力发电站, 亚洲最大)

Hydroenergy

+ Distribution of hydroenergy resource

The result of general investigation of water resource in China shows that the potential hydropower resource is 0.68 billion kW, which account for 1/6 of the total quantity in the world.



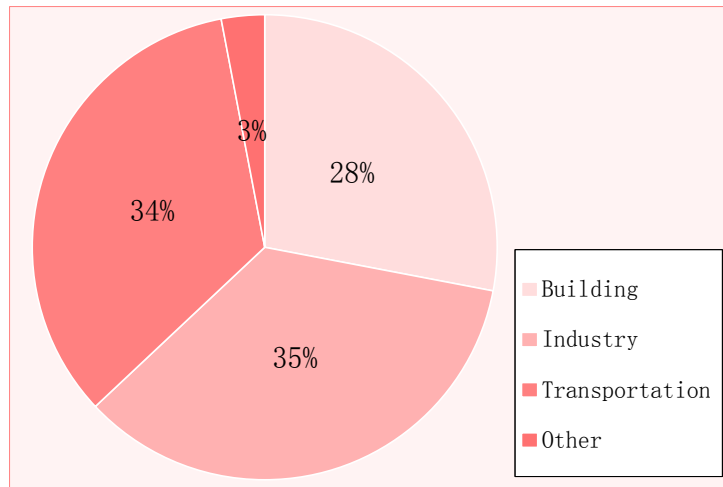
Hydroenergy



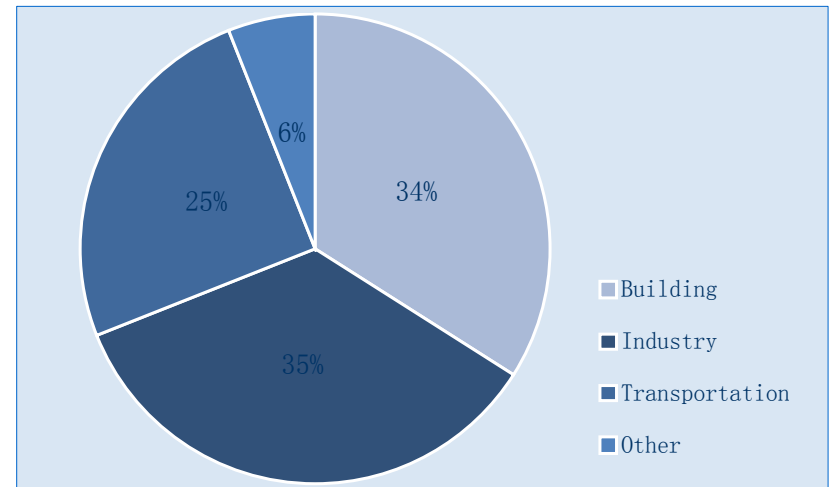
China Three Gorges Dam (三峡大坝, 当今世界最大的水利发电工程)

Building energy consumption

Construction is one of the main fields of energy consumption in China. According to statistics of MOHURD, energy consumption in building accounts for around 30% of those in the total society. 95% of the existing buildings in China are high energy consumption ones, which have a big gap compare to the advanced level in the world.



Distribution of energy consumption in China



Distribution of energy consumption in US

Building thermal partitions

Building thermal partitions map of China

中国建筑热工设计分区图

GB 50176-93



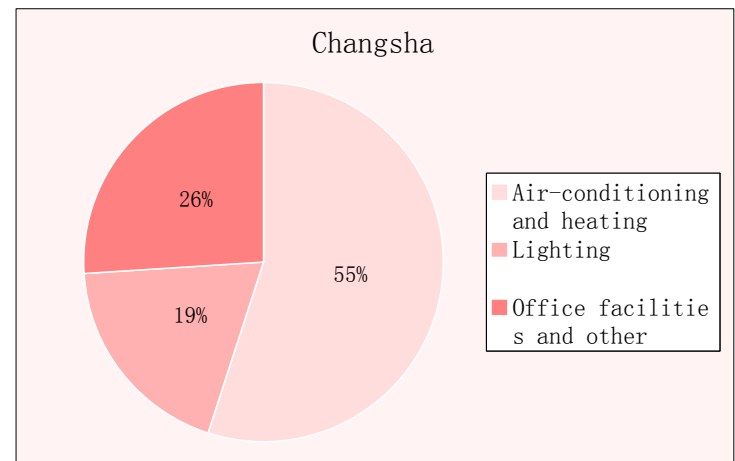
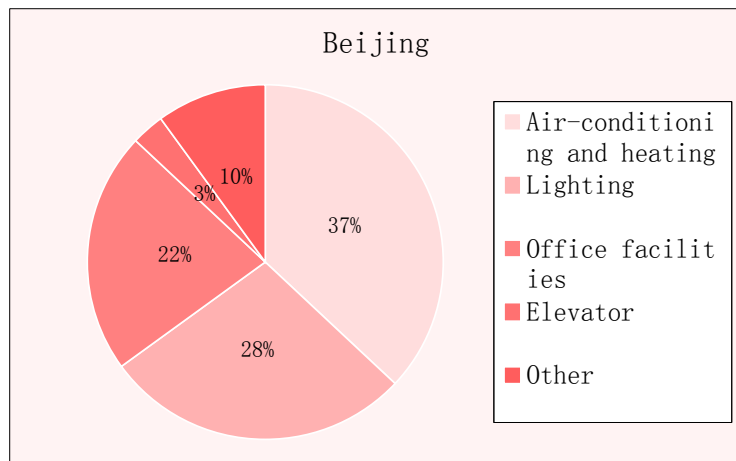
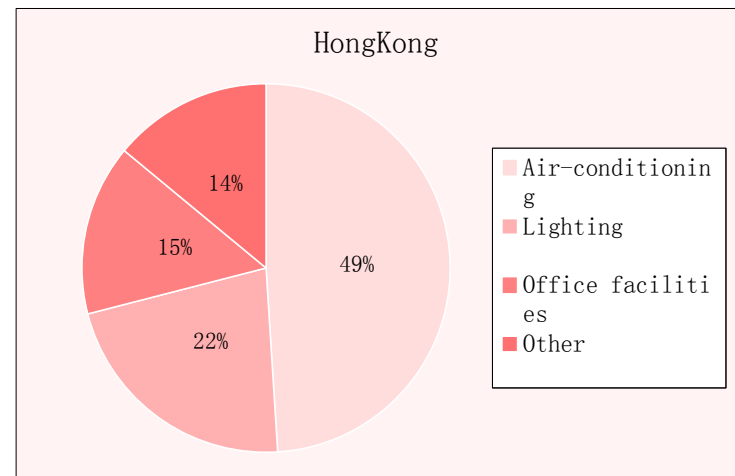
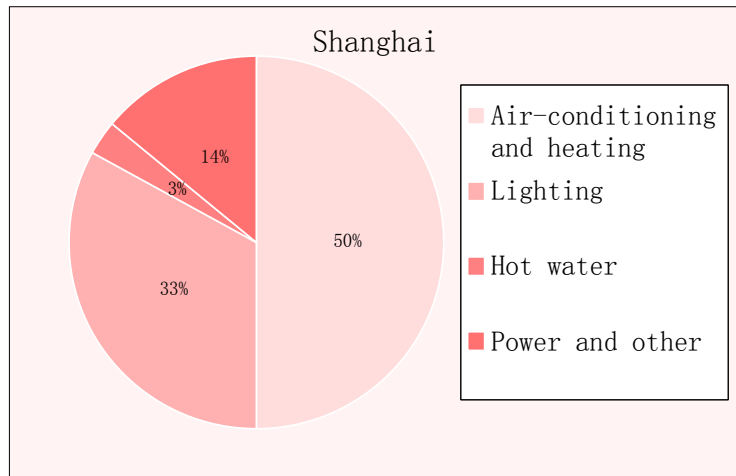
Building thermal partitions

Heating and Cooling System in China

- In general, central heating systems are applied for heating/cooling in the public buildings in north part of the Yellow River(north China). Boilers are used to heat up residential houses in winter, and split-type air conditioners are used to cool down the houses in summer in these areas.
- In hot summer and cold winter zone, central air conditioners are widely used for heating/cooling in some public buildings, like hospitals, office buildings and hotels, etc. Split-type air conditioners are very popular in residential buildings for heating/cooling at all seasons.
- In subtropical zone, as it is warm all year, the buildings have cooling system but without heating system in most cases.

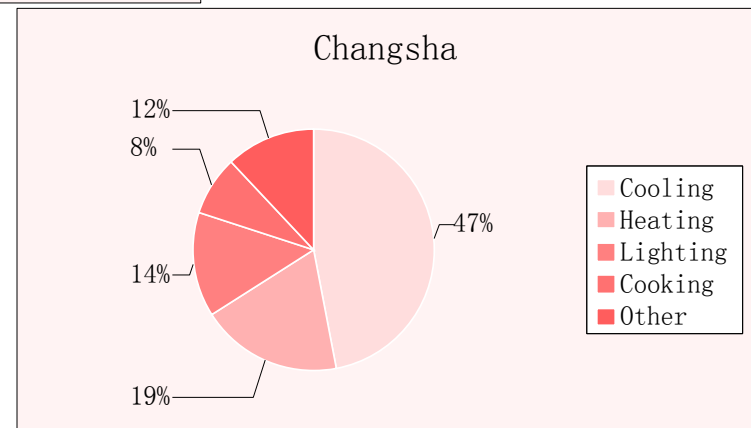
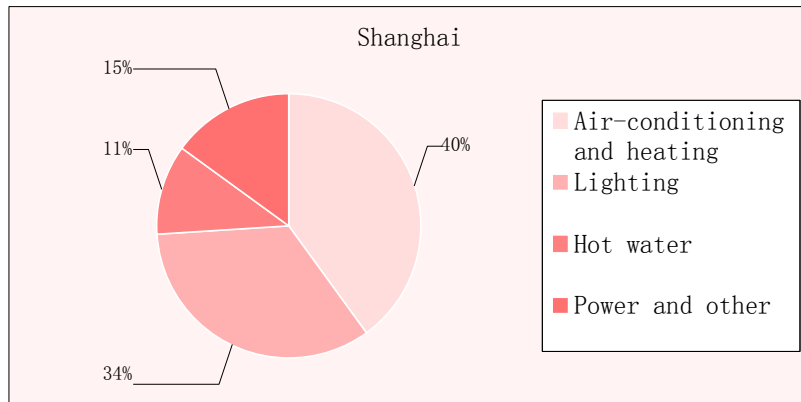
Public building energy consumption

+ Breakdown of office building energy consumption in some cities



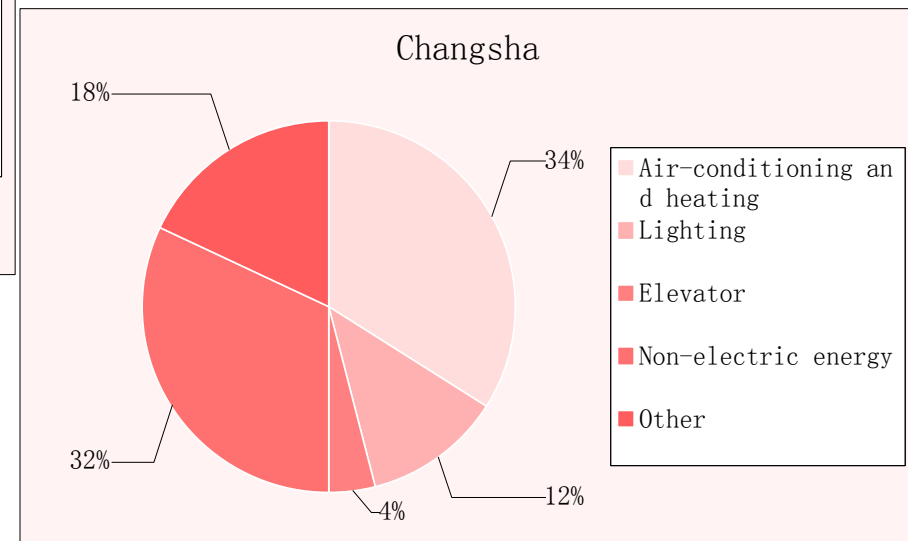
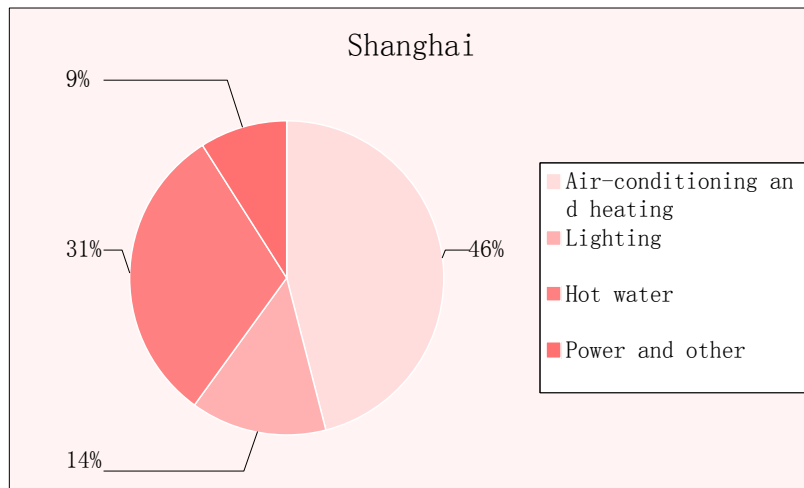
Public building energy consumption

+ Energy consumption composition of office buildings



Public building energy consumption

+ Energy consumption breakdown of hotel buildings



China Energy Strategy

+ **Development and goals of energy conservation planning**

After the Eleventh Five-year Plan(2006-2010), China puts energy Conservation and emission reduction into KPI for the local governments and Enterprise leaders and takes a series of policy actions.

+ **During the Twelfth Five-Year Plan(2011-2015):**

- Carbon emission of unit GDP reduced by 17%;
- Energy consumption of unit GDP reduced by 16%;
- The proportion of non-fossil energy raise to 11.4%;
- Emissions of sulfur dioxide and COD declined by 8%;
- Emissions of ammonia nitrogen and nitrogen oxide declined by 10%.

+ **Task of the 13th Five Year Plan(2016-2020):**

- Carbon emission of unit GDP in 2020 reduced by 40% ~ 45% compare to that in 2005

China Energy Strategy

The highlights of the Eighteen Session of the Fifth Plenary Session of NPC (National People's Congress) (will be held late this month)

- **Intelligent Energy**
- **Energy Shortage Supporting**
- **New Energy**
- **Environment Protection Transaction**

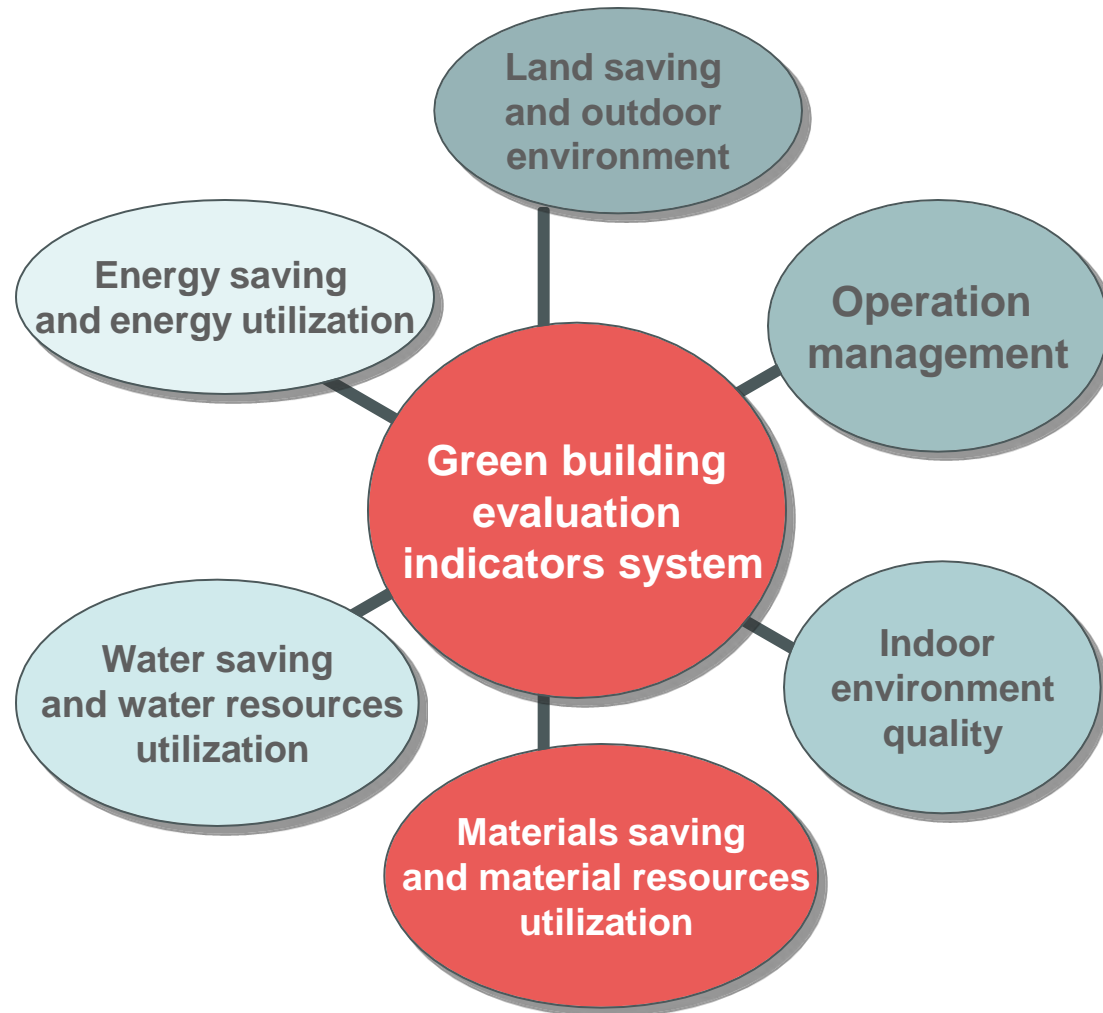
The green building in China

+ Application of green building

- In 2006, *Evaluation Standard for Green Buildings GB/T 50378-2006* was issued by Chinese Government
- In 2014, *Assessment standard for green building GB/T 50378-2014* was issued based on the previous version.



The green building in China



The green building in China

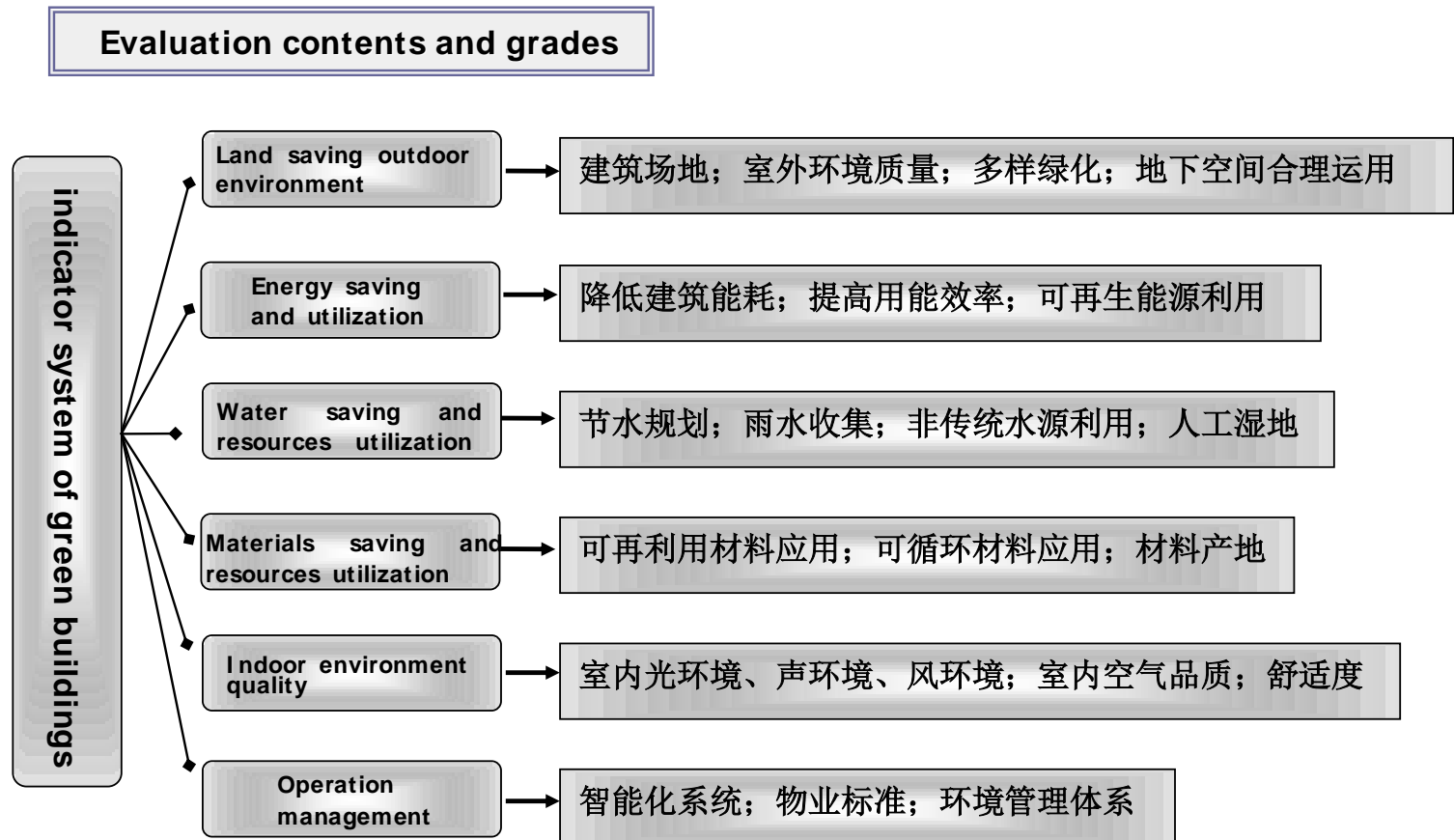
Items required for green building rating

rating	general options (40) (residential buildings)						prior options (9)
	Land saving and outdoor environment (8)	(6)	Water saving and water resources utilization (6)	Materials saving and resources Utilization (7)	Indoor environment quality (6)	Operation management (7)	
★	4	2	3	3	2	4	--
★★	5	3	4	4	3	5	3
★★★	6	4	5	5	4	6	5

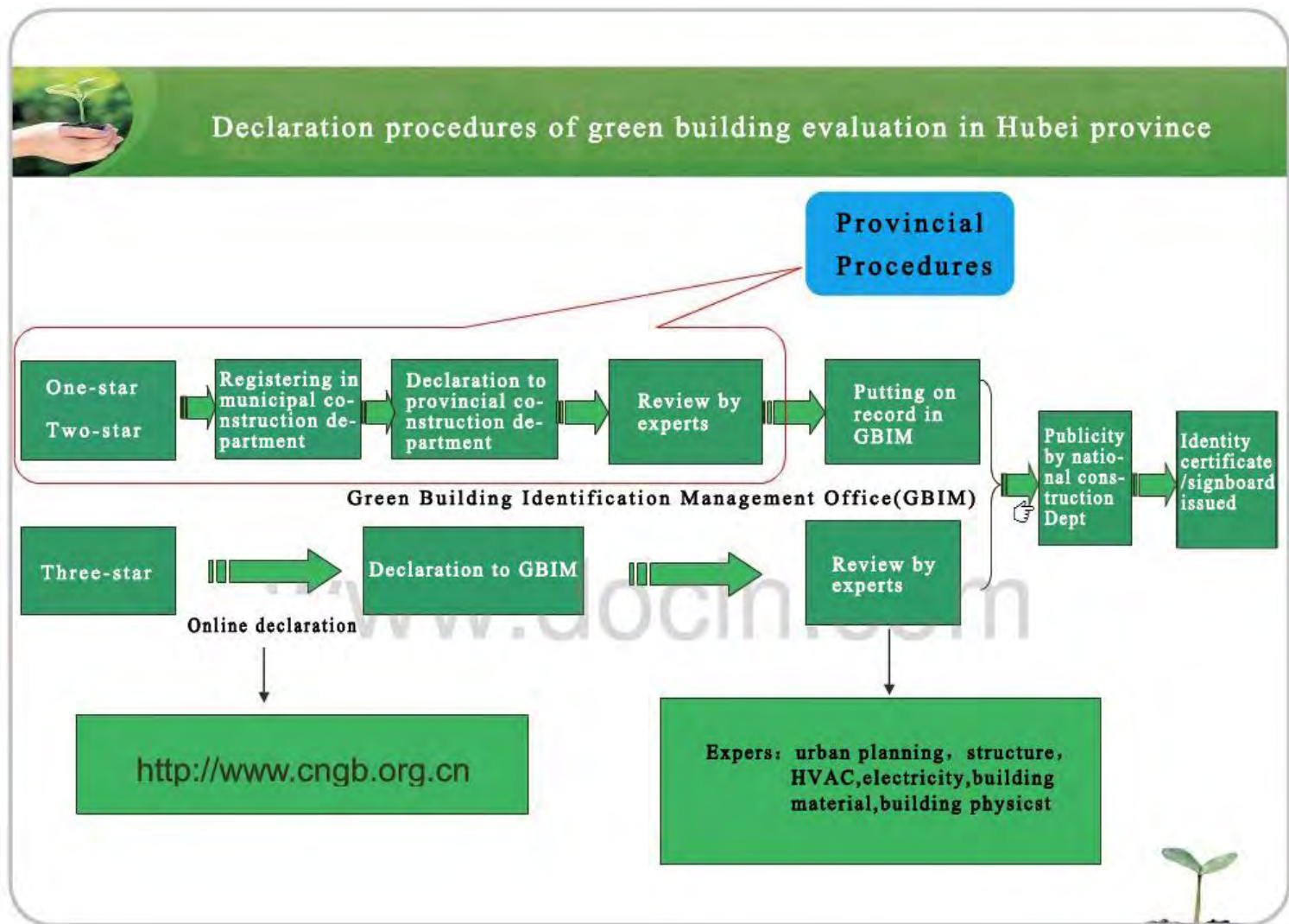
rating	general options (40) (public buildings)						prior options (14)
	Land saving and outdoor environment (6)	Energy saving and energy utilization (10)	Water saving and water resources utilization (6)	Materials saving and resources utilization (8)	Indoor environment quality (6)	Operation management (7)	
★	3	4	3	5	3	4	--
★★	4	6	4	6	4	5	6
★★★	5	8	5	7	5	6	10

The green building in China

Indicator system of green buildings



The green building in China



The green building in China

Awards standards for green building in the 2012 (floor area) :

Rating	Awards
★★	¥45 /m ²
★★★	¥ 80 /m ²

The green building in China

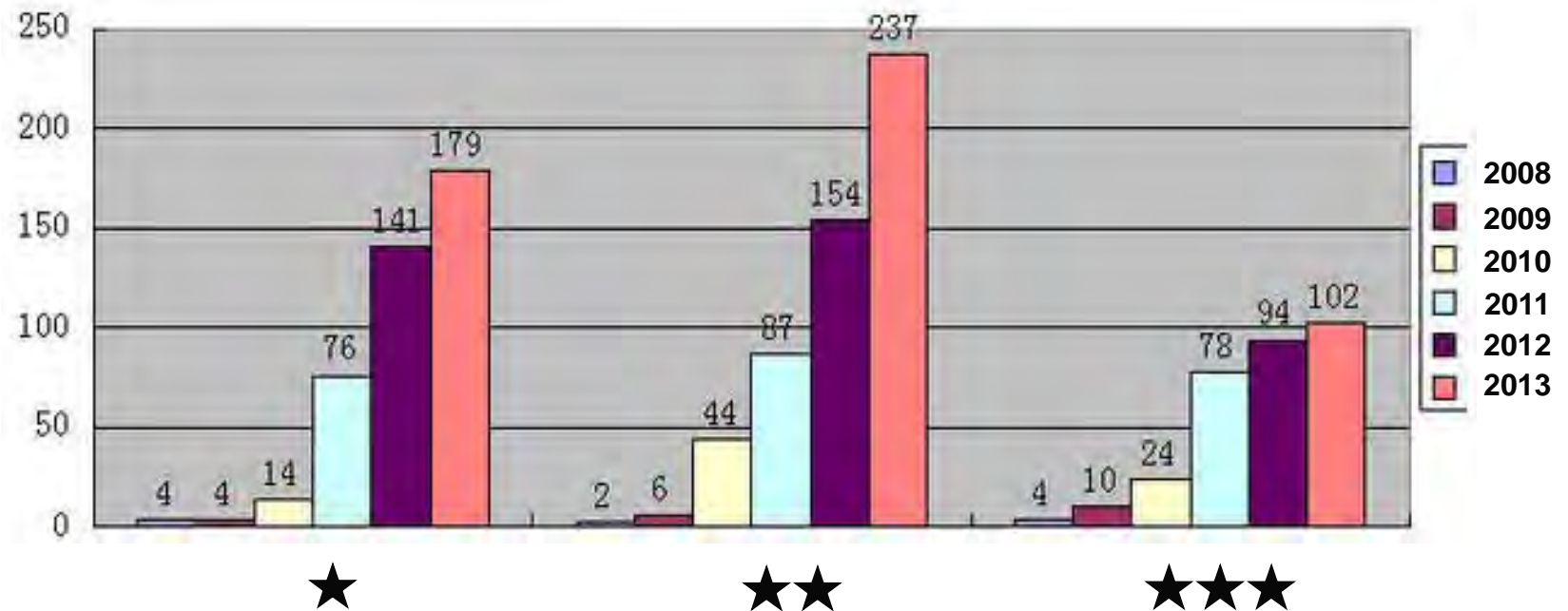


certificate for
Green building design



certificate for
Green building operation

The green building in China



Identified projects of green building

Some Actual Projects

★ ★ Shenzhen No.10 Senior School (new campus)



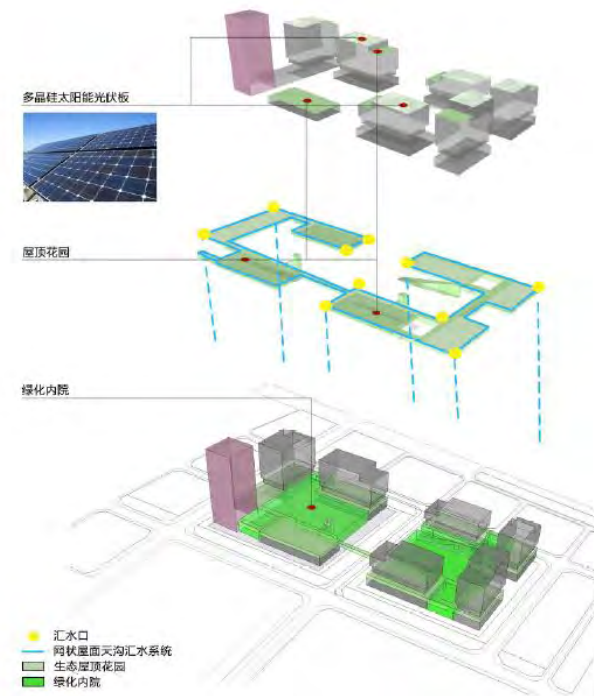
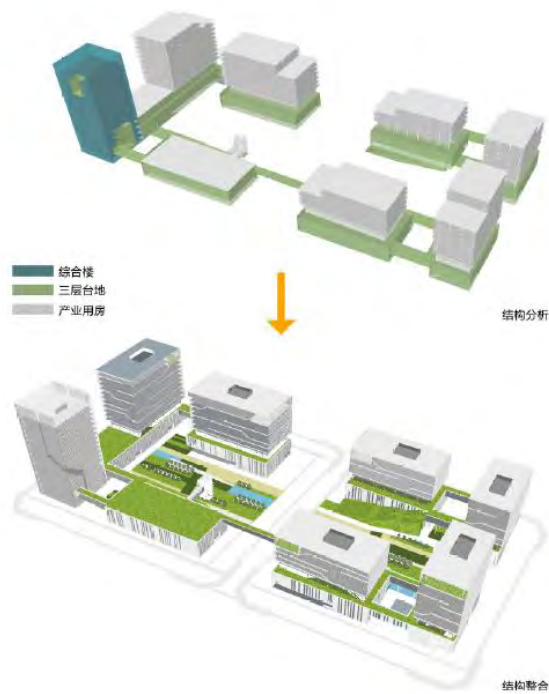
Some Actual Projects

★ Shenzhen optoelectronics incubator industrial park)



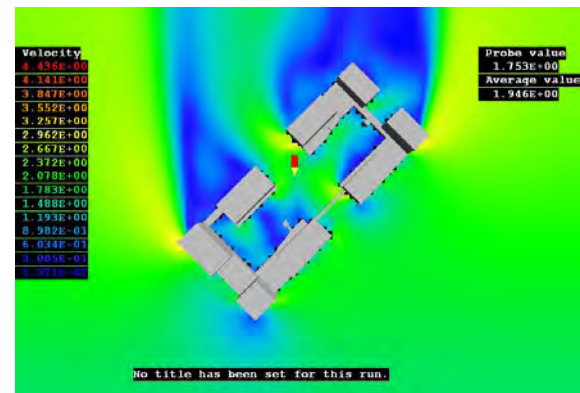
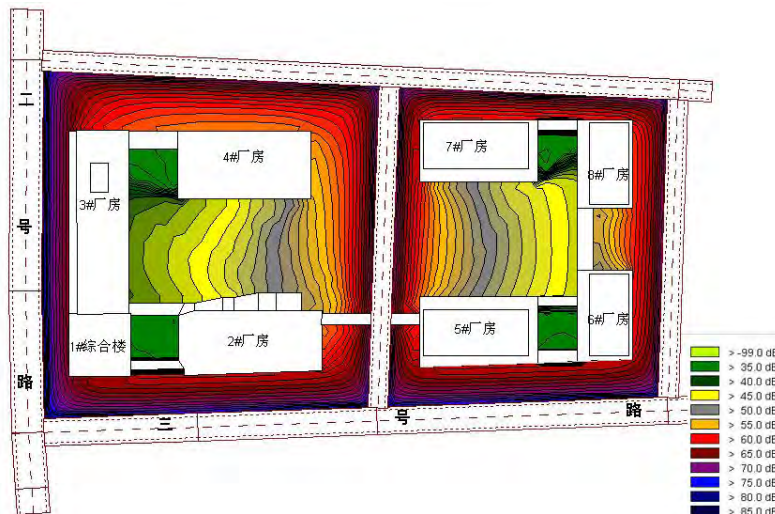
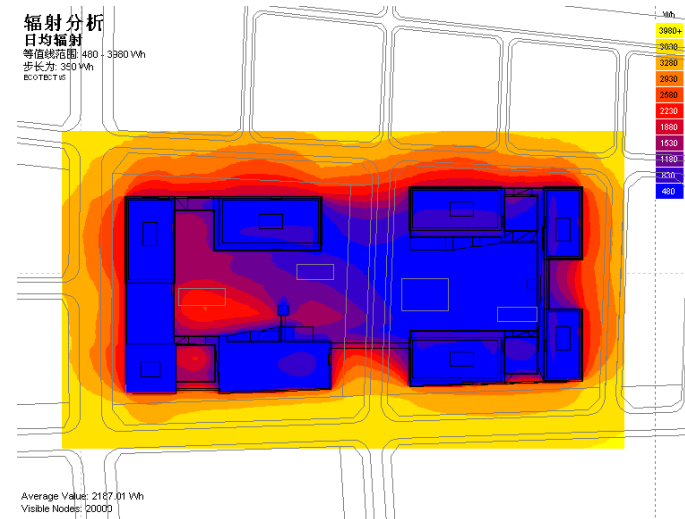
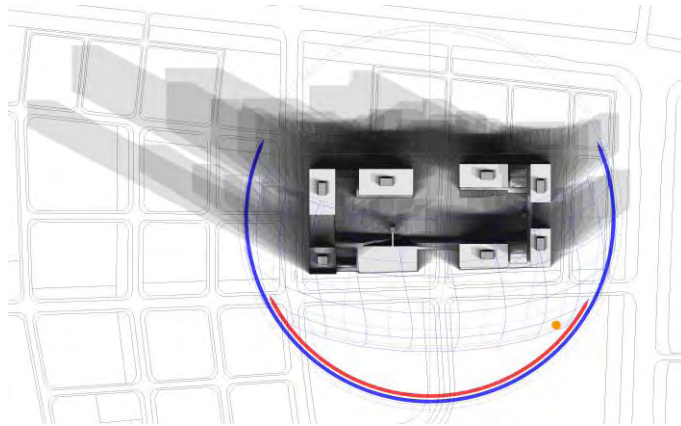
Some Actual Projects

★ Shenzhen optoelectronics incubator industrial park)



Some Actual Projects

★ Shenzhen optoelectronics incubator industrial park)



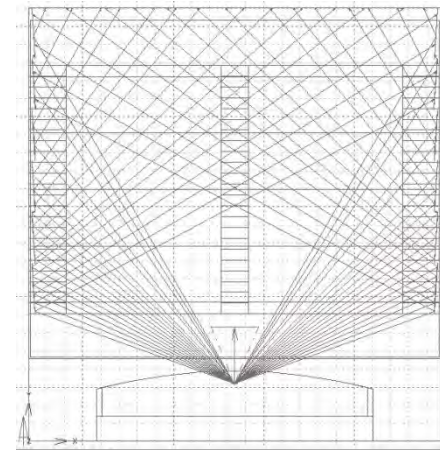
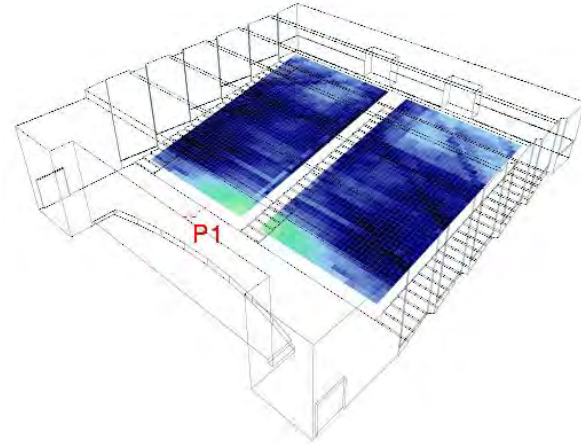
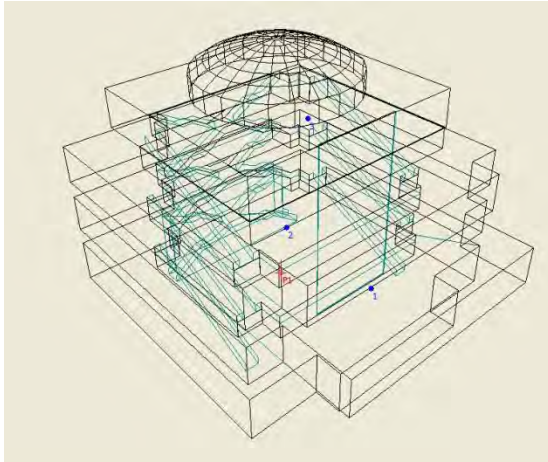
Some Actual Projects



★ ★ Yichang Museum



Some Actual Projects



★ ★ Yichang Museum

Vielen Dank für die Aufmerksamkeit

Thank you for your attention

非常感谢你的耐心