

# TOP TEN 2018

## CHINA'S ENERGY EFFICIENCY TECHNOLOGIES FOR THE CHINA BUILDING SECTOR

The National Development and Reform Commission of China (NDRC) guided the China Quality Certification Center (CQC) to develop a China TOP TENS Best Energy-Efficient Technologies list to highlight energy savings technologies for China's buildings sector. The technologies represent good value for money, are innovative, reliable and widely available. This list covers a broad range of building technologies including both commercial and residential. The technologies represent top level in China that are innovative, sustainable reliable.

Each technology has been weighted using a structured methodology to determine its energy saving potential, technical and financial characteristics, as well as co-benefit characteristics.

### How to use the list

Energy consumers, program administrators, developers, designers, and policy makers can use this list to consider the benefits of these technologies, while producers of these technologies can use this list and underlying research to promote their products in the global marketplace.

China will partner with other countries that also investigated buildings technologies, including Japan and U.S. Getting exposure to the Chinese audiences, for example, can be beneficial for Chinese producers to implement the practices in general, as China is one of the largest buildings markets in the world.

### Top Tens Task Group

The Top Tens Task Group was established in 2013 and is managed through the International Partnership for Energy Efficiency Cooperation (IPEEC). China, co-leading with Australia, is together with members including Canada, France, Japan, South Korea, and the United States. The objective of the task group is to improve energy efficiency globally through better exchange of information about technologies and practices. Members of the task group are developing domestic and international Top Tens lists, with related case studies, to provide practical information for technology users.

These will have broad international relevance and provide a range of comparative case studies in different national contexts.



# TOP TEN 2018

## CHINA'S ENERGY EFFICIENCY TECHNOLOGIES FOR THE CHINA BUILDING SECTOR

These are the technologies that have demonstrated leading energy efficiencies across China buildings sector and are innovative or provide other sustainability benefits. The score given is out of 100 possible points.

- 1**  
Score: 87.7  
**Intelligent Heating Network Monitoring and Operation Optimization Technology**  
Establishing an intelligent operation management platform, combining technologies of climate compensation...read more.
- 2**  
Score: 87.3  
**Centrifuge Technology with Independent Temperature and Humidity Control**  
Air conditioning system with independent temperature and humidity control uses two independent systems...read more.
- 3**  
Score: 84.0  
**Insulation Treatment Technology of Prefabricated and Direct Buried Thermal Insulation Pipe**  
The cyclopentane foaming process and the automatic spraying technology of polyurethane foaming agent are used...read more.
- 4**  
Score: 83.5  
**Integrated Low-NOx Combustion and Condensation Technology Based on New Heat Exchanger Structure**  
The al heat transfer structure of 316L stainless steel can effectively resist condensation corrosion, making the flue...read more.
- 5**  
Score: 82.0  
**Skid-mounted Heat Transfer Station Technology Based on Complete Welded High-Efficiency Heat Exchanger**  
With the complete-welded high-efficiency heat exch...read more.
- 6**  
Score: 76.6  
**Energy-saving Synthetic Resin Curtain Wall Decoration System**  
With synthetic resin as the main adhesive material, use a variety of additives to produce putty and a variety of coatings...read more.
- 7**  
Score: 76.6  
**Modular Central Air Conditioning Energy Saving Technology Based on Variable Flow Control of Cooling Towers**  
By using the variable flow technology of cooling tower, efficiently utilize heat exchange Plug load control...read more
- 8**  
Score: 76.3  
**Channel Heat Transfer Technology of Wastewater Source Heat Pump System**  
Design of single flow channel, large cross-section, non-contact structure is used on the...read more.
- 9**  
Score: 73.4  
**CO<sub>2</sub> Air Source Heat pump Heating Technology**  
CO<sub>2</sub> air source heat pump has the characteristics of high water temperature, strong adaptability to the outdoor temperature in cold areas, and has a high...read more.



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# CHINA BUILDINGS SECTOR'S BEST AVAILABLE TECHNOLOGIES



**SCORE 87.7**

## **Intelligent Heating Network Monitoring and Operation Optimization Technology**

Establishing an intelligent operation management platform, combining technologies of climate compensation, cell and time division, and optimization operation of multiple heat source networking, to realize functions such as dynamic load forecasting, whole network scheduling, operation trend analysis, and energy consumption analysis of heating systems, and to realize intelligent centralized monitoring and remote scheduling in the heating process.

### **Sectors and end-use applications**

Building, Heating/Cooling

### **Score and weighting**

<b>Indicator</b>	<b>Score</b>
1. Energy saving potential	
1.1 Level of energy efficiency	<b>14/15</b>
1.2 Technical potential &	
1.3 Maximum adoption potential	<b>17/20</b>
2. Technical practicality	
2.1 Advanced nature	
2.2 Innovative nature	<b>8/10</b>
2.2 Reliability	<b>9/10</b>
3. Economic characteristics:	
3.1 Internal rate of return	<b>22.3/25</b>
3.2 Payback period	<b>8.7/10</b>
4. Social characteristics	
4.1 Co-benefits	<b>8.7/10</b>
<b>TOTAL</b>	<b>87.7/100</b>

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# CHINA BUILDINGS SECTOR'S BEST AVAILABLE TECHNOLOGIES



## SCORE 87.3

### Centrifuge Technology with Independent Temperature and Humidity Control

Air conditioning system with independent temperature and humidity control uses two independent systems to control and adjust indoor air temperature and humidity respectively.

#### Sectors and end-use applications

Building, heating and cooling systems' Energy efficiency of public buildings, residential buildings, etc

#### Score and weighting

Indicator	Score
1. Energy saving potential	
1.1 Level of energy efficiency	<b>13.3/15</b>
1.2 Technical potential &	
1.3 Maximum adoption potential	<b>18.3/20</b>
2. Technical practicality	
2.1 Advanced nature	
2.2 Innovative nature	<b>9/10</b>
2.2 Reliability	<b>8.7/10</b>
3. Economic characteristics:	
3.1 Internal rate of return	<b>21/25</b>
3.2 Payback period	<b>8.7/10</b>
4. Social characteristics	
4.1 Co-benefits	<b>8.3/10</b>
<b>TOTAL</b>	<b>87.3/100</b>

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# CHINA BUILDINGS SECTOR'S BEST AVAILABLE TECHNOLOGIES

**3**

**SCORE 84**

## **Insulation Treatment Technology of Prefabricated and Direct Buried Thermal Insulation Pipe**

The cyclopentane foaming process and the automatic spraying technology of polyurethane foaming agent are used to form a heat preservation structure outside the pipeline. And the external protection pipe is cooled and shaped through the heat winding technology to realize close adhesion of the working steel pipe, polyurethane insulation layer, and high-density polyethylene outer protection pipe, which forms a 'Three in One' insulation structure, in order to enhance the insulation effect and extend the life cycle time of the pipeline.

### **Sectors and end-use applications**

Building, Urban Central heating and Specific area's cooling etc.

### **Score and weighting**

<b>Indicator</b>	<b>Score</b>
1. Energy saving potential	
1.1 Level of energy efficiency	<b>13.3/15</b>
1.2 Technical potential &	
1.3 Maximum adoption potential	<b>16.3/20</b>
2. Technical practicality	
2.1 Advanced nature	
2.2 Innovative nature	<b>7.7/10</b>
2.2 Reliability	<b>8.7/10</b>
3. Economic characteristics:	
3.1 Internal rate of return	<b>21.7/25</b>
3.2 Payback period	<b>8.3/10</b>
4. Social characteristics	
4.1 Co-benefits	<b>8/10</b>
<b>TOTAL</b>	<b>84/100</b>

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# CHINA BUILDINGS SECTOR'S BEST AVAILABLE TECHNOLOGIES



SCORE 83.5

## Integrated Low-NO<sub>x</sub> Combustion and Condensation Technology Based on New Heat Exchanger Structure

The all heat transfer structure of 316L stainless steel can effectively resist condensation corrosion, making the flue gas in the heat exchange process to generate rotation, diversion and convergence, and then increase the heat transfer efficiency. Because the condensing boiler can greatly recover the sensible heat and latent heat in the flue gas, the thermal efficiency is higher than that of the traditional gas boiler, and the maximum thermal efficiency of the boiler can reach 109%.

### Sectors and end-use applications

Building, Civil heating, industrial heating

### Score and weighting

Indicator	Score
1. Energy saving potential	
1.1 Level of energy efficiency	<b>13.3/15</b>
1.2 Technical potential &	
1.3 Maximum adoption potential	<b>16.3/20</b>
2. Technical practicality	
2.1 Advanced nature	
2.2 Innovative nature	<b>8.3/10</b>
2.2 Reliability	<b>8/10</b>
3. Economic characteristics:	
3.1 Internal rate of return	<b>22/25</b>
3.2 Payback period	<b>7.3/10</b>
4. Social characteristics	
4.1 Co-benefits	<b>8.3/10</b>
<b>TOTAL</b>	<b>83.5/100</b>

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# CHINA BUILDINGS SECTOR'S BEST AVAILABLE TECHNOLOGIES

**5**

**SCORE 82**

## **Skid-mounted Heat Transfer Station Technology Based on Complete Welded High Efficiency Heat Exchanger**

With the complete-welded high-efficiency heat exchanger as the core technology, this technology integrates the intelligent electrical control equipment and intelligent operation monitoring equipment to achieve efficient heat exchange of the heat exchange stations. The technology has the advantages of high heat transfer efficiency, small resistance of the pipe network, on-demand heating, automatic water treatment, intelligent control, unattended operation, and cleansing-free maintenance, which can achieve energy cascade utilization.

### **Sectors and end-use applications**

Building, heating

### **Score and weighting**

<b>Indicator</b>	<b>Score</b>
1. Energy saving potential	
1.1 Level of energy efficiency	<b>13.7/15</b>
1.2 Technical potential &	
1.3 Maximum adoption potential	<b>13.7/20</b>
2. Technical practicality	
2.1 Advanced nature	
2.2 Innovative nature	<b>7.3/10</b>
2.2 Reliability	<b>8.3/10</b>
3. Economic characteristics:	
3.1 Internal rate of return	<b>22/25</b>
3.2 Payback period	<b>8/10</b>
4. Social characteristics	
4.1 Co-benefits	<b>9/10</b>
<b>TOTAL</b>	<b>82/100</b>

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# CHINA BUILDINGS SECTOR'S BEST AVAILABLE TECHNOLOGIES

6

(tied)  
SCORE 76.6

## Energy-saving Synthetic Resin Curtain Wall Decoration System

With synthetic resin as the main adhesive material, use a variety of additives to produce putty and a variety of coatings, which are layered pasted on the building wall, replacing the traditional aluminum-plastic plate curtain wall, to save energy-consumption in terms of production, construction, and utilization.

### Sectors and end-use applications

Building, building wall decoration

### Score and weighting

Indicator	Score
1. Energy saving potential	
1.1 Level of energy efficiency	12.3/15
1.2 Technical potential &	
1.3 Maximum adoption potential	11.3/20
2. Technical practicality	
2.1 Advanced nature	
2.2 Innovative nature	8/10
2.2 Reliability	8/10
3. Economic characteristics:	
3.1 Internal rate of return	20.7/25
3.2 Payback period	8/10
4. Social characteristics	
4.1 Co-benefits	8.3/10
<b>TOTAL</b>	<b>76.6/100</b>

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# CHINA BUILDINGS SECTOR'S BEST AVAILABLE TECHNOLOGIES

7

(tied)  
SCORE 76.6

## Modular Central Air Conditioning Energy Saving Technology Based on Variable Flow Control of Cooling Towers

By using the variable flow technology of cooling tower, efficiently utilize heat exchange area of the cooling tower, increase the cooling efficiency, reduce the cooling water flow requirement, and decrease the energy consumption of the main engine and the cooling water pump; Double variable flow technology is adopted, use primary pump system to realize the main engine running in fixed flow mode and terminal-end running in variable flow energy-saving mode, so as to reduce the energy consumption of the chilled water pump. The traditional way that all signals collection of temperature, pressure, and flow rate are centralized processed by a host computer, and then distribute orders to drive the relevant equipment respectively, which is replaced with a new mode that the relevant equipment will collect signals independently and directly drive its running, realize modularization.

### Sectors and end-use applications

Building, using Central Air Conditioning System with Water-Cooling Unit in building and Industry area.

### Score and weighting

Indicator	Score
1. Energy saving potential	
1.1 Level of energy efficiency	11.3/15
1.2 Technical potential &	
1.3 Maximum adoption potential	13/20
2. Technical practicality	
2.1 Advanced nature	
2.2 Innovative nature	8/10
2.2 Reliability	8/10
3. Economic characteristics:	
3.1 Internal rate of return	20.3/25
3.2 Payback period	8.3/10
4. Social characteristics	
4.1 Co-benefits	7.7/10
<b>TOTAL</b>	<b>76.6/100</b>

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# CHINA BUILDINGS SECTOR'S BEST AVAILABLE TECHNOLOGIES



SCORE 76.6

## Channel Heat Transfer Technology of Wastewater Source Heat Pump System

Design of single flow channel, large cross-section, non-contact structure is used on the sewage side of this technology, with excellent anti-blocking, anti-scaling performance; a compact, small cross-section, multi-fulcrum, multi-parallel and tandem structure is used on the clean water side to ensure anti-pressure and anti-deflection capacity of the heat exchange equipment. The COP of the heat pump system using this technology can reach 3.5-4.5, and the energy-saving benefit is significant.

### Sectors and end-use applications

Building, building heating

### Score and weighting

Indicator	Score
1. Energy saving potential	
1.1 Level of energy efficiency	12.7/15
1.2 Technical potential &	
1.3 Maximum adoption potential	11.7/20
2. Technical practicality	
2.1 Advanced nature	
2.2 Innovative nature	7.7/10
2.2 Reliability	7.3/10
3. Economic characteristics:	
3.1 Internal rate of return	21.3/25
3.2 Payback period	7.3/10
4. Social characteristics	
4.1 Co-benefits	8.3/10
<b>TOTAL</b>	<b>76.3/100</b>

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# CHINA BUILDINGS SECTOR'S BEST AVAILABLE TECHNOLOGIES



SCORE 73.4

## CO<sub>2</sub> Air Source Heat pump Heating Technology

CO<sub>2</sub> air source heat pump has the characteristics of high water temperature, strong adaptability to the outdoor temperature in cold areas, and has a high heating coefficient under the condition of large temperature difference between water supply and return. Compared with the traditional Freon heat pump, the CO<sub>2</sub> heat pump can reach a water temperature above 70°C. The water supply temperature can meet the needs of traditional radiators. Therefore, it is not necessary to retrofit old residential district over the pipelines and building internal systems.

### Sectors and end-use applications

Building, centralized, distributed heating and domestic hot water

### Score and weighting

Indicator	Score
1. Energy saving potential	
1.1 Level of energy efficiency	<b>10.3/15</b>
1.2 Technical potential &	
1.3 Maximum adoption potential	<b>13/20</b>
2. Technical practicality	
2.1 Advanced nature	
2.2 Innovative nature	<b>8/10</b>
2.2 Reliability	<b>7/10</b>
3. Economic characteristics:	
3.1 Internal rate of return	<b>19.7/25</b>
3.2 Payback period	<b>7.7/10</b>
4. Social characteristics	
4.1 Co-benefits	<b>7.7/10</b>
<b>TOTAL</b>	<b>73.4/100</b>

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