



中國建築科學研究院
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Building Energy-Efficiency Evaluation & Labeling Technologies in China

China Academy of Building Research
Building Environment and Energy Efficiency

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1 Background

1.1 Function of Building Energy-efficiency Labeling

- Show the building energy-consumption and enhance market transparency.
- Promote building energy-saving, reflect the differences between different buildings , promote the development of high-energy saving buildings.
- Manage and supervise the developers
- Serve as the basis of the economic incentive policies for building energy-saving

1.2 References for Building Energy-efficiency Labels

- Europe Union
 - Denmark : Building Energy-consumption Labeling System .
 - Germany : Conformity Certificate of the Building Energy
 - Russia : Energy Passport of the Buildings
 - The UK and other countries
- USA
 - The Building label of “Energy Star”
 - LEED Green Building Certification System
- Japan
 - CASBEE system

1.3 Technical Basis for the Energy - efficiency Evaluation

Our country has basically developed the building energy-saving technology standard system . There are relevant technology standard for public and civil buildings in different climate areas .

Design-- energy-saving testing and inspection – Acceptance

Some building research institutions in China have a number of professionals technicians who are able to carry out energy-saving inspection and the required equipments and instruments for building energy-efficiency inspection as well as capability of carry out building energy-efficiency evaluation.

2 Building Energy-efficiency Evaluation & Labeling Methods

“Technical Guideline for Civil Building Energy-efficiency Evaluation & Labeling”(trial) was issued in June 2008.

—— Compiled with the joint efforts of China Academy of Building Research which serves as the main unit and other relevant units .

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2.1 Compilation Principles

(1) Relying on the existing standard of building energy-saving.

- *Design standard for energy efficiency of Civil building energy-saving*(**JGJ26-95**)
- *Design standard for energy efficiency of residential building in hot summer and cold winter zone .* (**JGJ131-2001**)
- *Design standard for energy efficiency of residential building in hot summer and warm winter zone .* (**JGJ75-2003**)
- *Design standard for energy efficiency of public buildings.*(**GB50189-2005**)
- *Code for acceptance of energy efficient building construction* (**GB50411-2007**)
- *Standard for Energy Efficiency Test of Residential Buildings* (**JGJ/T132-2009**)
- *Standard for energy efficiency test of public building.* (**JGJ/T 177-2009**)

2.1 Compilation Principles

(2) Integration of Qualitative and Quantitative Evaluation

- Document examination -- qualitative evaluation
- Calculate the energy-saving rate with simulation software and do the performance test— quantitative evaluation

2.2 Basically Rules

- Labeling shall be done on the basis of the building energy-efficiency evaluation results. Labeling for residential buildings and public buildings shall be done separately.
- Labeling shall be done for each **single building**, including the pipes and cooling/heating source equipments connected with each building.
- Comprehensive evaluation shall be done by taking into consideration the calculate, analyzed and measured results for the building energy consumption and on the basis of reviewing the relevant documents and the performance test report for the components and parts and on the basis to spot checking.

2.2 Basic Rules

- Evaluation Indexes
 - **Basic items:** The basic items refer to the energy-consumption of the heating , air conditioning and lighting systems per unit area of the buildings calculated or measured in the line with the requirements and methods in the existing national building energy-efficiency design stands.
 - **Stipulated items :** The stipulated items refer to the times that the building envelops and the HVAC system must meet in line with the requirements of the current national building energy-conservation design standards, except the basic items.
 - **Optional items :** Optional items refer to the energy-using systems and the process technologies that are above the current national building energy-conservation standards.

2.2 Basic Rules

- The table is divided into **five grades**:

Basic items	Stipulated items	Grade	Optional items
Meet the energy-conservation design standard and The energy-saving rate is <65%	All meet the relevant requirements	★	Another star shall be added if the score is above 60 (with 100 as the highest score)
$65\% \leq \text{energy-saving rate} < 75\%$	All meet the relevant requirements	★★	
$75\% \leq \text{energy-saving rate} < 85\%$	All meet the relevant requirements	★★★	
energy-saving rate $\geq 85\%$	All meet the relevant requirements	★★★★	
energy-saving rate $\geq 85\%$	All meet the relevant requirements	★★★★★	The score exceeds 60

2.2 Basic Rules

- The labeling process is divided into two stages: first, labeling of the theoretical values of building energy-efficiency and the second, labeling of the measured values of building energy-efficiency.
 - Labeling of the theoretical value of the building energy-efficiency: this shall be done after the buildings pass the completion acceptance; the validity period lasts **one year**.
 - Labeling of the measured value of the building energy efficiency: uninterrupted field measurement lasting at least one year shall be made to measure the actual building energy-efficiency. Then rectify the theoretical value of the building energy-efficiency in accordance with the measured results and provide the result of the measured building energy-efficiency labeling. The labeling of the measured value has a validity period of **five years**.

2.3 Theoretical Value of Building Energy-efficiency

(1) **Basic items** – the calculated of building energy-saving rate

- Residential buildings : The energy-saving rate calculating the annual energy consumption of the HVAC system per unit area of the building.
- Public buildings : The energy-saving rate obtained by calculating the annual energy consumption of the HVAC and lighting system per unit area of the building.
- Evaluating methods : simulation assessment and performance test
 - ✓ Should meet the national existing standards of building energy-saving
 - ✓ Completion materials and test reports

2.3 Theoretical Value of Building Energy-efficiency

(2) Stipulated Items

- Air tightness of the external windows.
- Heat preservation measures for the thermal bridge
- Methods and materials for sealing the door and window openings
- Forms and energy-efficiency of cooling and Heating source
- Electricity consumption to transferred heat quantity ratio of the circulating water pump
- Energy-efficiency ratio of air conditioning chilled/heated water system
- Power consumption per unit air volume of the fan
- Hydraulic balance measures
- Room temperature regulating facility
- Heat metering device
- Monitor and control system
- Lighting power density

●Evaluating methods :

Simulation assessment, performance test.

2.3 Theoretical Value of Building Energy-efficiency

(3) Optional items

Optional items		Residential building	Public building
Percentage of the renewable energy source out of the energy consumption of the HVAC system and the domestic hot water supply of a building(%)	<20	5 scores	5 scores
	20~50	15 scores	15 scores
	50~70	35 scores	35 scores
	>70	55 scores	55 scores
Natural ventilation and natural lighting		20 scores	5 scores
Energy recovery system (equipment)		15 scores	5 scores
Other new energy-saving methods		10 scores	15 scores
Thermal and cooling storage system		/	5 scores
Waste heat utilization		/	10 scores
Regulation of the all fresh air ratio or variable fresh air ratio of the air conditioning system		/	5 scores
Regulation of the variable water volume or variable air volume of the air conditioning system		/	5 scores
Building automation system		/	5 scores
Management system for energy consumption		/	5 scores

2.4 Measured Value of Building Energy-efficiency

(1) Basic Items

- The total energy consumption per unit area
- Heating energy consumption per unit area
- Cooling energy consumption of the air conditioning system per unit area

The basic items of the measured energy-efficiency value should write in the labeling certification.

2.4 Measured Value of Building Energy-efficiency

(2) **Stipulated Items**--all meet the relevant requirements

- The indoor average temperature
- The actual operating efficiency of boiler
- The heat-loss rate of outdoor pipe network
- Electricity consumption to transferred heat quantity ratio of the central heating system

The evaluation shall be in line with the
Standard for Energy Efficiency Test of Residential Buildings.(JGJ/T132-2009)

2.4 Measured Value of Building Energy-efficiency

(2) Stipulated Items--all meet the relevant requirements

- Indoor average temperature and humidity
- Performance evaluation of heating, air-condition and water system
- Coefficient of performance of the unit
- The consistency of return water temperature in water system
- The temperature drop between supplied water and return water
- Pump efficiency
- Energy-efficiency coefficient of cooling resource system
- Performance of air system
- Power consumption per unit air volume of the fan
- Fresh air volume
- Degree of balance of the constant air volume system

The evaluation shall be in line with the
Standard for Energy Efficiency Test of Public Buildings.(JGJ/T177)

2.4 Measured Value of Building Energy-efficiency

(3) **Optional Items**– Evaluation of the practical application

effect report

- Renewable energy resources
- Ice storage and thermal storage technology
- Heat recovery system
- Waste heat utilization
- All fresh air or variable fresh air technology
- Energy-saving technology of VAV or VWV
- Other new energy-saving methods

The labeling grade for theoretical value of building energy-efficiency shall be rectified according to the results of the evaluation of the optional items to serve as the labeling grade for the measured value of building energy-efficiency.

2.5 Evaluating methods

Evaluation of the theoretical value:

- **Simulation Evaluation**— calculation the basic items
 - The function and algorithm of the building energy-consumption computing & analysis software shall be in line with the requirements in the relevant building energy-conservation design standards.
 - Document examination
 - The legality, integrality and timeliness of the documents.
- **Field Inspection**
 - design compliance inspection and field review
- **Performance Test**
 - Capability checking method should meet the current national standard
 - Those items with test report issued by the qualified test institutions require no repeated test.

2.5 Evaluating methods

Evaluation of the measured value

- **Statistical analysis**

Mainly used in the annual energy consumption evaluation .

- **Field performance test**

This is mainly applicable to the evaluation of the stipulated items. Field test method shall be in line with the requirements of current national energy-efficiency test standards.

- **Report evaluation**

This is mainly used to evaluate the optional items. Report evaluation takes the measured values and the energy-conservation effects as its main basis.

3 Main Problems in Evaluation

(1) The consistency problem of energy-saving rate result .

- Calculation of annual energy consumption ——Basic requirements of the software.
- Data sources – as-built drawing, test report.
- Prescribed conditions for the unified computing ——reference building and system settings as well as the energy conversion method.
- Unifying the energy consumption's calculation method of heating & air-condition systems.

3 Main Problems in Evaluation

(2) The stipulated and optional items are not sufficiently tested and evaluated.

- Lack of test & evaluation basis.
- The evaluation methods need to be defined in a more detailed manner.
- Grade division of the renewable energy source and discrimination of the calculation methods.

3 Main Problems in Evaluation

(3) Grade division principles

Energy-saving rate shall serve as the grade division standard——it is hard to be implemented in southern areas.

(4) The relationship between the theoretical value labeling and measured value labeling

- Existing method: revise the measured values of the stipulated items(HVAC energy-efficiency) and the optional items on the basis of the theoretical labeling.
It is beneficial to the popularization of the measured value labeling; large gap between the energy-consumption values of the theoretical value labeling and measured value labeling may cause misunderstanding.
- Separately labeling: theoretical value labeling serves as the completion labeling and the measured value labeling as the operation labeling ——lack of relevant standards.

4 The Next Step

- By summing up experience from the pilot work of building energy-efficiency evaluation & labeling and on the basis of modifying and improving the “*Technical Guideline for Civil Building Energy-efficiency Evaluation & Labeling*”, complete the compilation of the “*Technical Standard for Building Energy-efficiency Evaluation & Labeling*”(which is included into the plan for formulation & modification of the state engineering construction standard in 2009; on November 17, 2009, the first working conference after the establishment of the drafting group was held.)

4 The Next Step

Key points in compilation of the “Technical Standard for Building Energy-efficiency Labeling”

(1) Grade division of the theoretical value labeling.

The grade of the theoretical value labeling shall be determined by taking the current national energy-saving design standards as the benchmark and on the basis of the increased relative energy-saving rate. The items with the same increased energy-saving rate shall have the same labeling grade.

4 The Next Step

Key points in compilation of the “Technical Standard for Building Energy-efficiency Labeling”

(2) Make clear the method for calculating the energy-saving rate of the basic items

- Set up the calculation conditions for the labeled building and the reference buildings.
- Setting and the method for calculating the energy consumption of the HVAC system of the residential buildings and the reference buildings in different climatic regions.
- Method for calculating the energy consumption of different HVAC system.

4 The Next Step

Key points in compilation of the “Technical Standard for Building Energy-efficiency Labeling”

(3) The methods for evaluating the stipulated and optional items are defined in a more detailed manner; the necessary requirements are made clear; and the operability of the evaluation is enhanced.

(4) The application & scoring standard for the renewable energy source is modified; the scoring items in the optional items are regulated.

4 The Next Step

- Problems need further solutions:

- Evaluation method for measured value
 - Take the theoretical value as the basis? Evaluate separately? What is the evaluation cost?
- The evaluation methods and indexes are constantly improving.
- Strengthen the technical training for the personnel who participate in the evaluation.
- Give wide publicity to the building energy-efficiency labeling so as to enhance the awareness of the public.



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谢谢
THANKS

