Shanghai Construction Standard

Evaluation Standard of Energy Efficiency for Existing Building

DG/TJ 08-2036-2008

Developed by Shanghai Real Estate Science Research Institute
Approved by Shanghai Construction and Transportation Commission
Implementation Date: July 1, 2008

Content

1. General Rules

1.0.1 This standard is developed for regularization of Shanghai existing civil building energy performance evaluation.

1.0.2 This standard is available to building energy efficiency performance of all existing buildings and existing building energy retrofitting projects.

1.0.3 The building energy evaluation in the standard addresses to building envelop thermal performance, HVAC system, lighting system and renewable energy utilization.

1.0.4 Building energy efficiency evaluation of existing buildings, existing building energy retrofitting projects shall not only comply with the standard, but also comply with other concerned national and Shanghai building codes.

2. Terms

2.0.1 **Existing civil buildings**. Built and occupied residential buildings and commercial buildings

2.0.2 **Energy efficiency of existing buildings**. Efficiency of building energy use, it comprehensively represent building envelope thermal performance, HVAC system, lighting system and renewable energy utilization.

2.0.3 **Retrofit for energy efficiency**: To reduce building operation energy use by certain approaches of envelope improve and mechanical systems improve, while keeping building indoor environment and comfort.

2.0.4 **Reference building for energy efficiency**: Comparing to evaluated building, assuming a virtual building which is same with design building in shape, size, orientation, inner shaping and operation condition, and its energy factors are from current building energy efficiency design standards.

2.0.5 **Energy efficiency index**: an index of building energy use efficiency, which is number over zero to represent difference of design building and reference building.

2.0.6 **Energy rating grade**: to show building energy performance level, here are 10 level. The grade of “V level of incompliance” is the lowest energy performance, grade of “5★” is highest efficiency level.

2.0.7 **Grad of renewable energy sources utilization**, To present renewable utilization scope in building, to classify grad of renewable energy use in building based on percentage of renewable energy in total building energy use.

3. Basic Rules

3.1 general principles

3.1.1 Single residential building and commercial building should be the object of energy efficiency evaluation.

3.1.2 Basis information concerning the evaluation on existing residential should cover information collection, field sampling and inspection and calculation of energy use of buildings.

3.1.3 The evaluation should adopt the tools recognized by the industry, and be in line with the requirement stipulated in Article 5.3 in this Standard.

3.1.4 The same evaluation measures and tools should be applied to the energy efficiency evaluation on existing residential buildings before and after the retrofit

3.1.5 The evaluation on residential buildings should be undertaken by a third-party, and this evaluation agency should be held accountable for the accuracy and truthfulness of the evaluation report it delivers, and be obliged to keep secret.

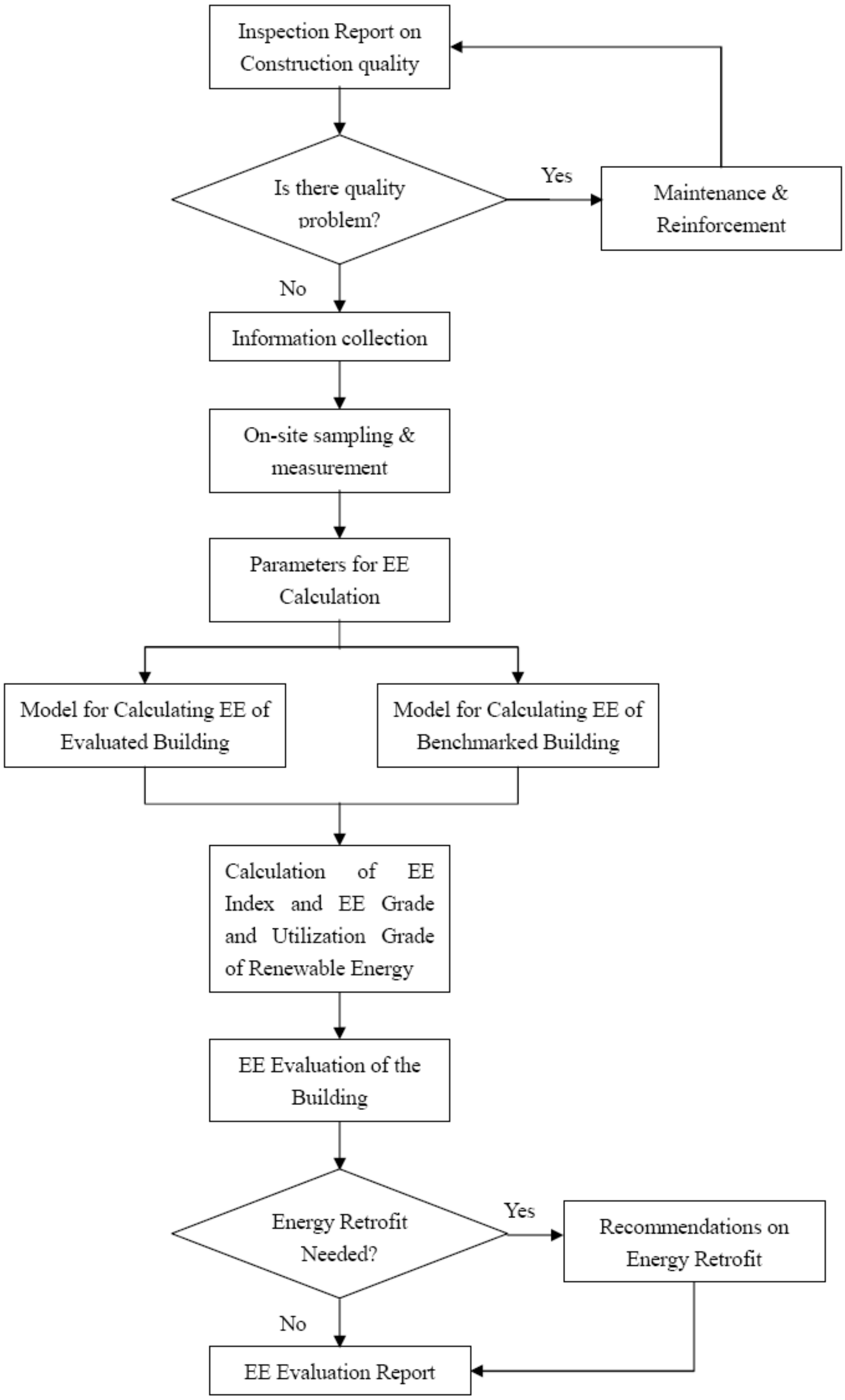
3.1.6 The evaluator should receive professional training recognized by the industry, be capable of evaluating energy efficiency and writing reports, and obtain relevant qualifications.

3.2 Procedure of energy efficiency evaluation

3.2.1 The process for existing residential buildings should follow the rules set in Chart 3.2.1-1, and the evaluation on existing residential buildings after the retrofit should follow the rules set in Chart 3.2.1-2.

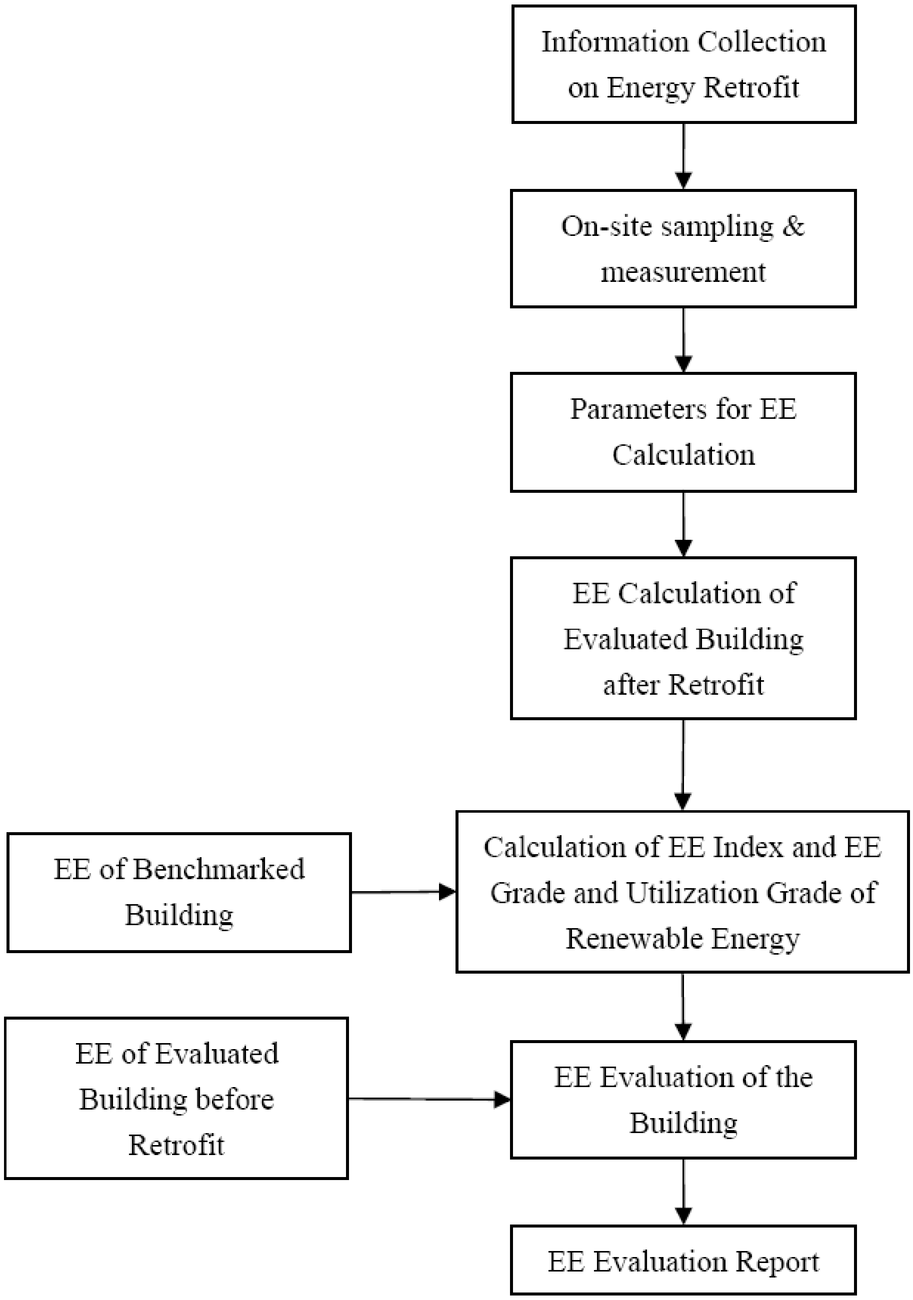
3.2.2 The existing residential buildings subject to evaluation should pose no security and quality problems, and no evaluation should be conducted when the report on quality inspection verify security and qualify problems.

3.2.3 When the evaluated buildings need to go through energy efficiency retrofit, the evaluation agency should present suggestions.



Energy Efficiency (EE) Evaluation Process of Existing Civil Buildings

Chart 3.2.1-1 Energy Efficiency Evaluation Process of Existing Civil Buildings



Energy Efficiency (EE) Evaluation Process of Existing Civil Buildings after Retrofit

Chart 3.2.1-2 Energy Efficiency Evaluation Process of Existing Civil Buildings after Retrofitting

4 Building Energy Efficiency Performance Evaluation Basis

4.1 General rules

4.1.1 The basis for evaluation on existing residential buildings should incorporate basic info of the building and parameters of energy use calculation. The parameters include the ones for thermal performance of building envelop and performance of energy using facilities. Each type of parameters contains both basic parameter and additional ones. Basic parameter refers to the one that is a must for calculating energy consumption; additional parameter refers to the one that is a extra help for gaining more accurate result when conditions permit.

4.1.2 Each parameter should be confirmed based on field survey and data derived from on-spot sampling and inspection. Parameters not suitable for on-spot inspection can be reached through checking relevant documents and historical data.

4.1.3 In evaluating the retrofitted residential buildings, the selection of parameter should be consistent with the one before the retrofitted, moreover, to obtain each parameter, the same testing conditions and inspection methods should be adopted with the same usage or running conditions and targeted at the same inspection spot or facility.

4.2 Basic information

4.2.1 When the party who entrust the evaluation agency to evaluate the energy efficiency, it should provide the following documents:

1. Documents on approving the building when it is completed, or relevant documents and files;
2. Report on quality inspection of the building
3. Report on the inspection of thermal performance in each part of the building envelop presented by relevant inspection agency;
4. Report on the inspection of performance and efficiency of heating, air-conditioning and lighting facilities presented by relevant inspection agency
5. Documents on the performance of other related building parts and facilities;
6. Description of renewable energy using

4.2.2 When energy efficiency evaluation apply on energy retrofitted building, applicator shall submit following documents:

1. Building quality inspection/testing reports;
2. Energy retrofitting plan and drawings;
3. Installation drawings and project acceptance files after retrofitted;
4. Test reports of insulation and window/doors energy performance by qualified test body;
5. Efficiency performance report of renovated or replaced equipments by qualified inspection organization;
6. Other materials and equipments data;
7. Statement of renewable energy use in the project.

4.3 Parameter of the thermal performance of envelope structure

4.3.1 The basic parameter of the thermal performance of envelop should incorporate the following items:

1. Heat transfer coefficient of roof
1. Average heat transfer coefficient of outer walls of all directions
2. Heat transfer coefficient and air-tightness of outer windows (including transparent and non-transparent wall)
3. Heat transfer coefficient and air-tightness of outer doors
4. Types, heat conduction co-efficient and thickness of insulation materials
5. Insulation defects of envelop structure

4.3.2 Additional parameters of thermal performance of envelop can include the following items:

1. Insulation performance of roof and outer walls in summer (the maximum temperature of inner surface at natural ventilation in the summer);
2. Heat transfer coefficient of party wall
3. Heat transfer coefficient of floor
4. Heat transfer coefficient of ground floor built on stilts
5. Shading condition of outer windows

4.4 Parameter of energy-using facilities' performance

4.4.1 The basic parameter of energy-using equipments performance:

1, The equipments apparent quality, integrity and operation conditions;

2, Types of heating and cooling sources of air conditioner, capacity, performance function or energy efficiency ratio

3, Total capacity of water system in air-conditioner, temperature of supplying and return water

4, Power of air-conditioning unit, wind volume, cooling volume

5, Power of fan-coil, design of volume of wind prevented, waste pressure

6, Power and air flow of exhaust fans

7, Power, flow and head of water pump

8, Types of lights, power intensity

4.4.2 Additional parameters of energy-using equipments may include:

1, Power and efficiency of cooling tower

2, Load curve of each part in air conditioning system

3, Power, flow capacity and cooling volume of fresh air unit

5 Methodology of evaluation

5.1 evaluation index

5.1.1 Building energy efficiency index

The index with efficiency benchmark is 100, the index with no net energy input is 0, this serves as the gauge of index ratio of building being evaluated, each equal part represent the 1% difference value of building being evaluated against benchmark building, the index for building being evaluated should be calculated according to formula 5.1.1

$$\text{Energy Efficiency Index} = 100 + \frac{\text{Evaluated Building Energy Use} - \text{Reference Building Energy Use}}{\text{Reference Building Energy Use}} \times 100\%$$

5.1.2 grade of energy efficiency

For buildings whose index is below 100 (meeting the efficiency standard), each 10 equal parts is a grade, from “1*grade” to 5*grade”, and 5* represents the highest efficiency, for buildings whose index is higher than 100 (failing to meet the standard”), 25 equal parts are translated into one grade, from substandard grade I to substandard grade V, and V is the lowest. The grade should be divided according to table 5.1.2

Table 5.1.2　Classification of Building Energy Efficiency Grades

Building Energy Efficiency Level	**Energy Efficiency Index (EEI) Categories**
non EEB V	EEI < 200
non EEB IV	175 < EEI ≤ 200
non EEB III	150 < EEI ≤ 175
non EEB II	125 < EEI ≤ 150
non EEB I	100 < EEI ≤ 125
★	90 < EEI ≤ 100
★★	80 < EEI ≤ 90
★★★	70 < EEI ≤ 80
★★★★	60 < EEI ≤ 70
★★★★★	0 < EEI ≤ 60

Note: EEB means “Energy Efficiency Building”

5.1.3 grade of renewable energy usage

The usage should be evaluated based on the rate of renewable energy utilization in the building being evaluated. Based on the ratio between the usage amount of renewable energy utilization and the total regular energy consumption, the grade is divided into 1* to 4*, the buildings that do not use renewable energy will not be given a grade. The grade will be divided according to table 5.1.3

Table 5.1.3　Classification of Renewable Energy Use Grades

Grade of Renewable Energy Use	**Scope of Renewable Energy Use (%)**
☆	0 < Renewable Energy Use ≤ 25
☆☆	25 < Renewable Energy Use ≤ 50
☆☆☆	50 < Renewable Energy Use ≤ 75
☆☆☆☆	75 < Renewable Energy Use

5.2. Evaluation norm

5.2.1 The evaluation should include efficiency index, grade, and grade for renewable energy utilization

5.2.2 When the efficiency index is higher than 100, the grade fails to reach 1*, the building should be retrofitted

5.2.3 The retrofitted building's index should not exceed 100, grade should not be lower than 1*. If the index and grade fail to meet the requirement, then the renewable energy utilization grade should be increased. When the grade of the building reached 1* prior to retrofit, the grade should be promoted after retrofit.

5.3 evaluation tools

5.3.1 The energy use calculation of the tool should follow chapter four, and be based on the basic information of the building and the energy use parameter

5.3.2 Should adopt the data of a typical meteorological year and calculate the energy use of the building being evaluated and benchmark building

5.3.3 The conditions of energy use calculation of building being evaluated should be set by giving priority to the actual use condition of the building. When the above mentioned demand can not be met, the residential buildings can refer to chapter 5 of the national standard "energy efficiency design standard for residential buildings in areas where the summer is hot and cold in winter Zone" (JGJ134), and the commercials can refer to appendix B of national standard "design standard of energy efficiency of commercial building" (GB50189)

5.3.4 The energy use calculation of the tools should include the following functions:

1, Input and setup of building geometry model and energy use calculation parameter

2, Setup and revision of building operation schedule in workdays and vacation days

3, Setup and revision of each performance curve of mechanical equipments;

4, Simulation of operation and control measures of each type of air conditioning system

5, Cooling and heating load calculation around the year

6, Calculation of yearly 8760 hours energy use of heating, air-conditioning, and lighting;

7, All the models and calculation measures should be stable and consistent

5.4 Requirement of Reference building

5.4.1 Energy calculation of efficiency reference building and evaluated building should adopt same building energy evaluation tool.

5.4.2 Basic information of reference building shape, size, orientation, indoor space and function, operation schedule should same to evaluated building.

5.4.3 Thermal parameters of envelope shall comply to relevant values of national standard "Energy Efficiency Design Standard of Residential Building for Hot in Summer and Cold in Winter Zone" (JGJ134), Commercial buildings refer to relevant values of national standard "Building Energy Efficiency Design Standard of Public Building "(GB50189).

5.4.4 Parameters of HVAC system. If residential building uses separate air conditioner, its COP refers to the values of national standard "Energy Efficiency Standard of Residential Building for Hot in Summer and Cold in Winter Zone" (JGJ134); for central air conditioning system in residential building and commercial building, its heating and cooling parameter should refer to relevant values of national standard "Energy Efficiency Standard of Public Building" (GB50189)

5.4.5 Lighting power density of reference building should comply to relevant values in chapter 6.1 of national standard “Building Lighting Design Standard” (GB50034).

5.5 Evaluation Report

5.5.1 Evaluating organization should submit complete energy efficiency evaluation report after evaluation to existing civil building.

5.5.2 Existing civil building energy efficiency evaluation report should include below information:

1. Basic building information and energy calculation parameters of evaluated building and reference building;
2. Energy use indexes of evaluated building and reference building;
3. Energy efficiency evaluation conclusion;
4. Suggestion of energy innovation (only for energy innovation requirement);
5. Evaluation tool and its version;
6. Reference codes, standards and information list;
7. Evaluator signature and evaluation seal.

5.5.3 Building energy efficiency evaluation report surrendered by evaluation organization must have uniform format. Appendix A gives a report template.

Appendix A. Template of evaluation report of existing building energy efficiency

(neglected translation)

Table A Template of energy efficiency evaluation report for existing civil building

<table>
<tr><td colspan="4">Project name:</td><td>Site location</td></tr>
<tr><td colspan="4">Area(m2)/floors:</td><td>Building Type</td></tr>
<tr><td colspan="4">Energy Retrofitted ☐Yes / ☐No</td><td>Evaluation tool/version:</td></tr>
<tr><td colspan="5">Building Energy Use Calculation Parameters</td></tr>
<tr><td rowspan="15">Thermal parameters of envelop</td><td colspan="3"></td><td>Evaluating Building / Reference Building</td></tr>
<tr><td colspan="3">Heat Transfer Coefficient W/(m2.k)</td><td></td></tr>
<tr><td colspan="2" rowspan="4">Average K value of Outer Wall</td><td>East</td><td></td></tr>
<tr><td>South</td><td></td></tr>
<tr><td>West</td><td></td></tr>
<tr><td>North</td><td></td></tr>
<tr><td colspan="3">K value of outer windows W/(m2.k)</td><td></td></tr>
<tr><td colspan="3">K value of outer doors W/(m2.k)</td><td></td></tr>
<tr><td rowspan="3">Insulation</td><td colspan="2">Type</td><td></td></tr>
<tr><td colspan="2">Thickness</td><td></td></tr>
<tr><td colspan="2">Heat Conduction Coefficient W/(m.k)</td><td></td></tr>
<tr><td colspan="3">Disfigurement in insulation</td><td></td></tr>
<tr><td colspan="3">Heat insulation performance</td><td></td></tr>
<tr><td colspan="3">K value of partition W/(m2.k)</td><td></td></tr>
<tr><td colspan="3">K value of floor W/(m2.k)</td><td></td></tr>
<tr><td></td><td colspan="3">K value of over raised floor W/(m2.k)</td><td></td></tr>
<tr><td></td><td colspan="3">shading</td><td></td></tr>
</table>

Continued Table A

<table>
<tr><td colspan="6">Calculation factors of Energy Use</td></tr>
<tr><td rowspan="12">Energy Using Equipments factor</td><td rowspan="2">Heating Sources</td><td>type</td><td>number</td><td>capacity</td><td>COP or EER</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Cooling sources</td><td>type</td><td>number</td><td>capacity</td><td>COP or EER</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Water system of Air Conditioning</td><td colspan="2">Total Flow (m3/h)</td><td colspan="2">Temperature of Supply water and return water (°C)</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td rowspan="2">Air conditioner unit</td><td>number</td><td>Power (kW)</td><td>Air flow (m3/h)</td><td>Cool capacity (kW)</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Fan Coil unit</td><td>Power(kW)</td><td>Design flow (m3/h)</td><td colspan="2">Remain pressure (Pa)</td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
</table>

	Exhaust Fan	Number	Power(kw)	Flow(m3/h)	
	Water pump	Number	Power(kw)	Flow(m3/h)	Head (m)
	Lighting	Fixture type		LPD (W/m2)	
	Cooling tower	Number	Power(kw)	Efficiency (%)	
	Fresh Air unit	Number	Power(kw)	Flow(m3/h)	Cool (kw)
Renewable Energy Adoption	Type		Use		Scope

Continued Table A

Energy Use Index			
	Evaluated Building	Reference Building	
Heat energy use per SQM(kwh/m2)			
Cool Energy use per sqm (kwh/m2)			
Lighting energy use per sqm (kwh/m2)			
Total (khw/m2)			
Evaluation Conclusion			
Energy Efficiency Index		Energy efficiency grade	
Renewable Energy Use rate		Renewable Energy use grade	
Evaluation Result			
Energy Renovation Suggestion			
Reference Codes:			
Reference Materials list			
Evaluator (signature) Evaluation organization chief (signature): Evaluation organization (seal): DD/MM/YY			

Explanation of the standard vocabularies

1. For more accurate implementation of the standard, here are narratives of stringent scope of requirement vocabularies:

a. Must to comply. Positive word use “must”; negative word use “prohibit”.

b. Required to comply in normal. Positive word uses “shall” or “should”, negative word use “shall not” or “not”

c. Allow offset, but should be priority complied in normal condition. Positive word use “shall” or “appropriate”, negative word use “shall not” or “inappropriate”

2. Other standards mentioned in clauses that need to follow. Statements are drafted as “shall comply……standard” or “shall refer to…….”.

Reference codes/standards and Technical Adoptions

A. Following standards are for reference during the standard development:

1.《夏热冬冷地区居住建筑节能设计标准》JGJ134-2001
   "Energy Efficiency Design Standard for Residential Building of Hot in Summer and Cold in Winter" JGJ 134-2001
2.《公共建筑节能设计标准》GB 50189-2005
   "Energy Efficiency Design Standard for Public Buildings" GB 50189-2005
3.《居住建筑节能检验标准》JGJ132-2001
   "Energy Efficiency Inspection Standard of Residential Buildings" JGJ 132-2001
4.《公共建筑节能评估标准》DBJ/T01-100-2005、
   "Building Energy Efficiency Performance Evaluation Standard" DBJ/T 01-100-2005
5.《住宅建筑节能检测评估标准》DG/TJ 08-19801-2004
   "Energy Efficiency Inspection and Evaluation Standard of Residential Building" DG/TJ 08-19801-2004
6.《既有建筑节能改造技术规程》DG/TJ08-2010-2006
   "Technical Regulation of Energy Retrofitting for Existing Building" DG/TJ08-2010-2006
7.《建筑照明设计标准》GB50034-2004
   "Building Lighting Design Standard" GB 50034-2004

B. Details of technical Adoptions in the standard

1. Clause 3.1 "General Rule" and clause 3.2 "Energy performance evaluation process" made reference to Chapter 3 of "Technical Regulation of Energy Retrofitting for Existing Building" DG/TJ08-2010-2006, as follow:

"Technical Regulation of Energy Retrofitting for Existing Building" DG/TJ08-2010-2006

Chapter 3 Basic Rule

3.1 Inspection and Evaluation

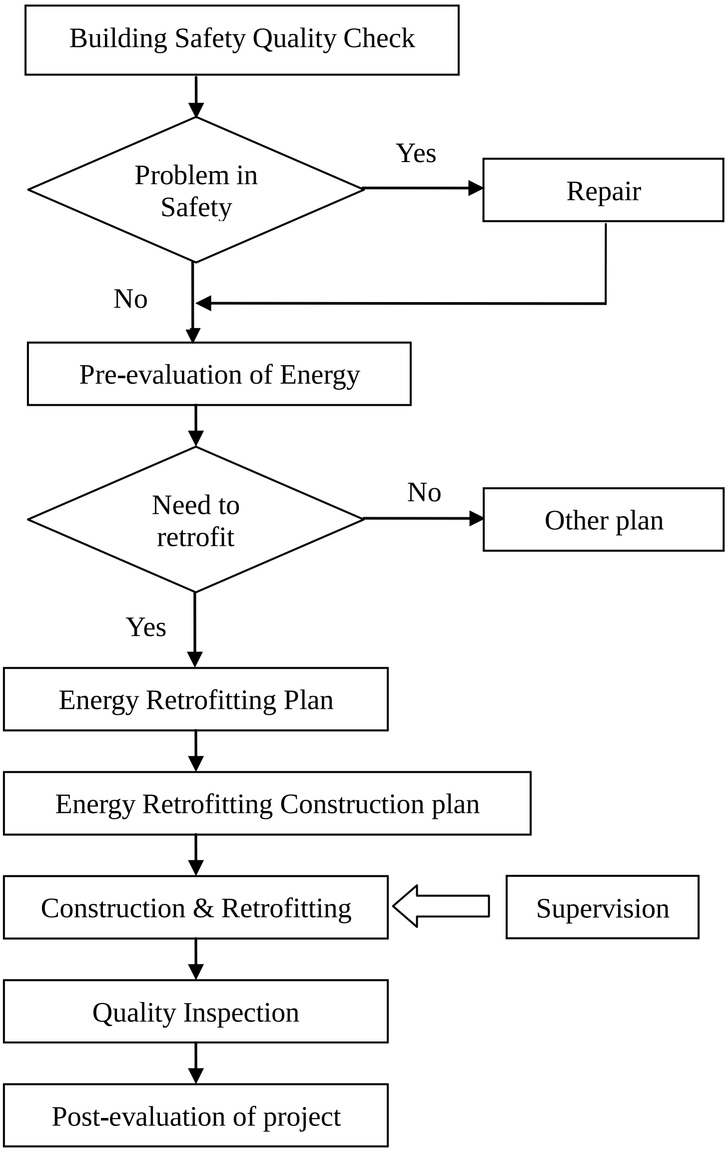
3.2.1 Energy performance evaluation should be taken before and after existing building energy retrofitting. Evaluation should includes envelop thermal performance and energy using equipments inspection and assessment. Pre-evaluation should be as design basis of energy retrofitting plan, Post-evaluation should be as basis of verification and acceptance for energy retrofitting project.

3.2.2 Information of pre-evaluation and post-evaluation should be consistent. Operation condition of energy inspection for pre-evaluation and post-evaluation should be consistent, testing method should be same.

3.2.3. Pre-evaluation and post-evaluation of energy retrofitting should be based on testing data of envelop thermal performance and energy using equipments. For the cases that site testing can't be taken, evaluation data can be calculated based on historical data and relevant data.

3.3 Process of building energy retrofitting

Process chart…..



3. 4 Indoor Environment Design factor

3. 4. 1 Indoor thermal environment design parameters of existing residential buildings should comply table 3.4.1

Table 3. 4. 1 Indoor thermal environment design parameter of existing residential building

factor	Winter	Summer
Temperature (℃)	18	26
Air change rate(/h)	1. 0	1. 0

3. 4. 2 Indoor thermal environment design parameters of existing public buildings should comply table 3.4.1

Table 3. 4. 1 Indoor thermal environment design parameter of existing public building

factor		Winter	Summer
Temperature (℃)	Normal room	20	26

	Lobby	18	Indoor and outdoor temperature difference ≤10
Air velocity (v)(m/s)		0. 10≤v≤0. 20	0. 15≤v≤0. 30
RH(%)		30~60	40~65

2. Clause 5.3.3 refer to Chapter 5 of "Energy Efficiency Design Standard for Residential Building of Hot in Summer and Cold in Winter" JGJ 134-2001, and appendix B of "Energy Efficiency Design Standard for Public Building" GB 50189-2005, details are as follow:

Chapter 5 of "Energy Efficiency Design Standard for Residential Building of Hot in Summer and Cold in Winter" JGJ 134-2001

Chapter 5 Building Integrative Energy Efficiency Index

5.0.2 Building integrative energy efficiency index in the standard adopts building heating use, cooling use index, and yearly power use for heating and cooling.

5.0.3 Building integrative energy efficiency index should be calculated with dynamic calculation method.

5.0.4 Calculation condition of building integrative energy efficiency index are as :

1. Calculation temperature of living room, winter is 18C; summer is 26ºC.
2. Weather data takes typical meteorological year.
3. During heating and cooling season, air exchange rate take 1.0 /h.
4. If take home use air heat pump air conditioner for heating in winter and cooling in summer, cooling COP is 2.3, heating COP is 1.9.
5. Indoor heat gain by lighting take 0.014kwh/m2. other heat sources takes 4.3w/m2 as heat density.
6. Building area and volume calculation is taken method in appendix B.

5.0.5 Calculated yearly total power use for heating and cooling should not be more than total yearly power value for heating and cooling according to different heating degree day and cooling degree day in table 5.0.5

Table 5.0.5 Limited value of building integrative energy efficiency index

HDD18 (ºC.d)	Heating use index qh (W/m2)	Yearly Power for heating Eh (kwh/m2)	CDD26 (ºC.d)	Cooling use index qc (w/m2)	Yearly power use for cooling Ec (kwh/m2)
800	10.1	11.1	25	18.4	13.7
900	10.9	13.4	50	19.9	15.6
1000	11.7	15.6	75	21.3	17.4
1100	12.5	17.8	100	22.8	19.3
1200	13.4	20.1	125	24.3	21.2
1300	14.2	22.3	150	25.8	23.0
1400	15.0	24.5	175	27.3	24.9

1500	15.8	26.7	200	28.8	26.8
1600	16.6	29.0	225	30.3	28.6
1700	17.5	31.2	250	31.8	30.5
1800	18.3	33.4	275	33.3	32.4
1900	19.1	35.7	300	34.8	34.2
2000	19.9	37.9	--	--	--
2100	20.7	40.1	--	--	--
2200	21.6	42.4	--	--	--
2300	22.4	44.6	--	--	--
2400	23.2	46.8	--	--	--
2500	24.0	49.0	--	--	--

Appendix B of "Energy Efficiency Design Standard for Public Building" GB 50189-2005

Appendix B Envelop Thermal Performance Trade-off Calculation

B.0.1 Assuming base building and design building use dul-pipe fan coil unit for heating and cooling, water circle in both model are same.

B.0.2 HVAC working schedule of base building and design building are same. If working schedule can not find from design plan, assume fan coil system working whole year.

B.0.3 Base building and design building are same in HVAC system hour use each day. If day working hour is not clear in design plan, day working hour can be assumed as follow schedule.

Table B.0.3 Hour working schedule of fan coil system

Type		Working schedule
Office	Work day	7:00 --- 18:00
	Holiday	---
Hotel	Whole year	1:00 --- 24:00
Shopping	Whole year	8:00 --- 21:00

B.0.4 Base building and design building should be same in indoor temperature set. If temperature set is not clear in design plan. Take values in table B.0.4 to set indoor temperature.

Table B.0.4 Indoor temperature set for HVAC system

			Hour																							
Type			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Office	Work day	Cooling	37	37	37	37	37	37	28	26	26	26	26	26	26	26	26	26	26	26	37	37	37	37	37	37
		Heating	12	12	12	12	12	12	18	20	20	20	20	20	20	20	20	20	20	20	12	12	12	12	12	12
	Holiday	Cooling	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37
		Heating	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Hotel	yearly	Cooling	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
		Heating	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Shopping	yearly	Cooling	37	37	37	37	37	37	37	28	25	25	25	25	25	25	25	25	25	25	25	25	37	37	37	37
		Heating	12	12	12	12	12	12	12	16	18	18	18	18	18	18	18	18	18	18	18	18	12	12	12	12

B.0.5 Indoor LPD of base building and design building should be same. But if LPD can not be clear in design plan. Value of LPD in below tables should be as reference.

Table B.0.5- Value of lighting power density (W/m^2)

Building Type	Room	LPD (W/m^2)
Office	Normal office	11
	Senior office / Design	18
	Conference	11
	Corridor	5
	other	11
Hotel	Guest room	15
	Dinner	13
	Meeting/Multi-function	18
	Corridor	5
	Lobby	15
Shopping	Normal	12
	High level	19

Table B.0.5-2 Lighting on/off schedule %

		Hour																							
Type		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Office	Work day	0	0	0	0	0	0	10	50	95	95	95	80	80	95	95	95	95	30	30	0	0	0	0	0
	Holiday	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hotel	Yearly	10	10	10	10	10	10	30	30	30	30	30	30	30	30	50	50	60	90	90	90	90	80	10	10
Shopping	Yearly	10	10	10	10	10	10	10	50	60	60	60	60	60	60	60	60	80	90	100	100	100	10	10	10

B.0.6 Occupancy density of base building and design building should be same. If it can not be clear in design plan. Occupancy design should take table B.0.6-1 as reference. Occupancy schedule should be take Table B.0.6-2 as reference.

Table B.0.6-1 Area occupancy of various rooms (m^2/p)

Building Type	Room	Average occupancy density (m^2/p)
Office	Normal office	4
	Senior office	8
	Conference	2.5
	Corridor	50
	other	20
Hotel	Normal room	15
	Senior room	30
	Conference/Multi-function	2.5
	Corridor	50
	Other	20
Shopping	Normal	3
	High level	4

Table B.0.6-2 Space occupancy schedule (%)

		Hour																							
Type		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Office	Work day	0	0	0	0	0	0	10	50	95	95	95	80	80	95	95	95	95	30	30	0	0	0	0	0
	Holiday	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hotel	Yearly	70	70	70	70	70	70	70	70	50	50	50	50	50	50	50	50	50	50	70	70	70	70	70	70
Shopping	Yearly	0	0	0	0	0	0	0	20	50	80	80	80	80	80	80	80	80	80	80	70	50	0	0	0

3. Clause 5.4.4 refer to Chapter 4 of "Energy Efficiency Design Standard for Residential Building of Hot in Summer and Cold in Winter" JGJ 134-2001, and Chapter 4 of "Energy Efficiency Design Standard for Public Building" GB

50189-2005, details are as follow:

Chapter 4 of "Energy Efficiency Design Standard for Residential Building of Hot in Summer and Cold in Winter" JGJ 134-2001

Chapter 4 Building and thermal design parameters

4.0.3 Shape coefficient of strip shape building shall not more than 0.35, shape coefficient of point shape building shall not more than 0.40.

4.0.4 Outer window size (including transparent part of balcony door) shall not be too big. Their heat transfer coefficient shall be taken as table 4.0.4 at various orientation, window/wall area ratios.

Table 4.0.4 K value of outer window at various orientation, window/wall area ratio

Orientation	Outdoor Condition	Outer window K value (w/(m2.K))				
		Window/wall area ratio 0.25	Window/wall area ratio >0.25 and ≤0.30	Window/wall area ratio >0.30 and ≤0.35	Window/ wall area ratio >0.35 and ≤0.45	Window/wall area ratio >0.45 and ≤0.50
North (range: 60° east and 60° to west)	Monthly average temperature in coldest winter > 5℃	4.7	4.7	3.2	2.5	--
	Monthly average temperature in coldest winter ≤ 5ºC	4.7	3.2	3.2	2.5	--
East and West (range: 30° to north and 60° to south)	No shading	4.7	3.2	--	--	--
	Shading (solar penetration is less than 20%	4.7	3.2	3.2	2.5	2.5
South (range: 30° to west and 30° to east		4.7	4.7	3.2	2.5	2.5

4.0.8 Heat transfer and heat inertia parameters of envelop shall meet table 4.0.8. Cold bridge effect should be taken account into outer wall heat transfer coefficient, taking average heat transfer coefficient. Calculation method refer to appendix A.

Table 4.0.8 Each part heat transfer coefficient of envelop (K) and heat inertia index (D)

Roof	Wall	Window (including transparent part of balcony door	Partition wall and floor	Raised base floor under which allow air flow	Home door
K ≤ 1.0 D ≥ 3.0	K ≤ 1.5 D ≥ 3.0	Value of table 4.0.4	K ≤ 2.0	K ≤ 1.5	K ≤ 3.0
K ≤ 0.8 D ≥ 2.5	K ≤ 1.0 D ≥ 2.5				

Chapter 4 of "Energy Efficiency Design Standard for Public Building" GB 50189-2005

Chapter 4 Building thermal design parameters

Table 4.2.2-4 Value of envelop heat transfer coefficient (K) and shading coefficient (SC)

Component in envelop		K W/(m²·K)	
roof		≤ 0.70	
Outer wall (including opaque glass curtain)		≤ 1.0	
Bottom floor that contacting outdoor air		≤ 1.0	
		K W/(m²·K)	SC
Single orientation outer window (including transparent glass curtain)	Window/wall ratio≤0.2	≤ 4.7	—
	0.2< Window/wall ratio ≤0.3	≤ 3.5	≤ 0.55/—
	0.3< Window/wall ratio≤0.4	≤ 3.0	≤ 0.50/0.60
	0.4< Window/wall ratio≤0.5	≤ 2.8	≤ 0.45/0.55
	0.5< Window/wall ratio≤0.7	≤ 2.5	≤ 0.40/0.50
Transparent part of roof		≤3.0	≤0.40
Note: when there is outer shading device, SC=glass SC X SC of outer shading device; if no out shading device, SC = glaze SC			

表 4.2.2-6 Heat Resistance of basement wall (R)

Climate zone	Envelop part	R (m²·K)/W
Hot in Summer and Cold in winter	Ground	≥ 1.2
	Basement Wall (contacting soil)	≥ 1.2

4.2.6 Opaque part of roof should not more 20% in area of total roof area. If it can't be meet. Trade-off calculation should be taken according to clause 4.3.

4. Clause 5.4.5, Lighting power density refer to chapter 6.1 of national standard "Building lighting design standard" (GB50034).

"Building lighting design standard" (GB 50034-2004)

Chapter 6.1 Value of lighting power density

6.1.1 Lighting power density of each household shall not more than the value in table 6.1.1. If space luminance value is higher or lower than luminance value in the table. Lighting power density should be proportionally adjusted.

Table 6.1.1 Lighting power density of in house of residential building

Room or space	Lighting power density (W/m²)		Corresponding luminance (lx)
	Current	In future	
Living	7	6	100
Bed			75
Dining			150
Kitchen			100
Bath			100

6.1.2 Lighting power density of office shall not more than the value in table 6.1.1. If space luminance value is higher or lower than luminance value in the table. Lighting power density should be proportionally adjusted.

Table 6.1.2 Lighting power density of office

Room or space	Lighting power density (W/m^2)		Corresponding luminance (lx)
	Current	future	
Ordinary office	11	9	300
Senior office/design space	18	15	500
Conference	11	9	300
Business space	13	11	300
Documentation/copy/printing	11	9	300
Files space	8	7	200

6.1.3 Lighting power density of shopping building shall not more than the value in table 6.1.1. If space luminance value is higher or lower than luminance value in the table. Lighting power density should be proportionally adjusted.

Table 6.1.3 Lighting power density of shopping building

Room or space	Lighting power density (W/m^2)		Corresponding luminance (lx)
	Current	future	
Ordinary sale space	12	10	300
High grade sale space	19	16	500
Normal super market	13	11	300
High grad super market	20	17	300

6.1.4 Lighting power density of hotel room shall not more than the value in table 6.1.1. If space luminance value is higher or lower than luminance value in the table. Lighting power density should be proportionally adjusted.

Table 6.1.4 Lighting power density of hotel building

Room or space	Lighting power density (W/m^2)		Corresponding luminance (lx)
	Current	future	
Guest room	15	13	—
Chinese dinner room	13	111	200
Multi-function space	18	15	300
Corridor	5	14	50
Lobby	15	13	300