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Voluntary certification scheme for zero carbon energy certificates—Specification for certification of biomass thermal energy

零碳能源证书自愿核证体系 生物质热能核证规范

(English Translation)

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Contents

Foreword

CAPID is in charge of this English translation. In case of any doubt about the contents of English translation, the Chinese original shall be considered authoritative.

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Introduction

The "14th Five-Year Plan" for Renewable Energy Development explicitly proposes the establishment of a sound mechanism for green energy consumption and the establishment of a system for the evaluation, certification, and labelling of green energy consumption. At present, China's verification and issuance of green power certificates and voluntary subscription system is basically established, but a proper mechanism for the non-electric utilization of renewable energy is not available, and the way of realizing environmental rights and interests is still absent. For example, a corresponding verification and certificate trading system has not yet been formed for green thermal energy, green gas and green liquid fuels, making it difficult to manifest the environmental rights and interests of the energy.

In order to implement the national carbon peaking and carbon neutrality strategy, promote the high-quality development of China's renewable energy, and create a diversified mechanism for realizing the environmental rights and interests of renewable energy, the Biomass Energy Industry Promotion Association, CAPID organized enterprises and experts to formulate the series standards for the "Voluntary Certification Scheme for Zero Carbon Energy Certificates" which is aimed at establishing a mechanism for the certification and consumption of non-electricity renewable energy, and further reflecting the environmental rights and interests of renewable energy.

As the guiding document, the Voluntary Certification Scheme for Zero Carbon Energy Certificates - General Rules establishes the structure of the certification system, clarifies the responsibilities of all relevant parties, and standardizes the whole life cycle from certification to cancellation of the certificates, so as to guarantee the environmental rights and interests of the Zero Carbon Energy Certificates.

A series of standards of Voluntary Certification Scheme for Zero Carbon Energy Certificates - Certification Code are formulated for specific renewable energy utilization, covering all areas of non-electricity utilization of renewable energy, providing normative guidance for the certification of different types of renewable energy projects, aiming to ensure compliance, voluntariness, uniqueness, transparency, accuracy, conservatism, etc.

This document provides the necessary references for the certification of zero-carbon energy certificates in the field of biomass thermal energy in terms of the accounting content, the accounting boundary, the accounting steps and methods, the sources of accounting data and quality management, the verification procedures, and the certification procedures, which covers the key links in the certification of zero-carbon energy certificates in the field of biomass thermal energy, to regulate the certification work, to safeguard the quality of the certification, and to provide guidance and references for the participation of the relevant parties.

Voluntary certification scheme for zero carbon energy certificates—Specification for certification of biomass thermal energy

1 Scope

This document specifies the accounting content, accounting boundary, accounting steps and methods, accounting data sources, accounting quality management, verification procedures, and certification procedures for certification of zero-carbon energy certificates for biomass thermal energy.
This document is applicable to the accounting, verification and certification of Zero Carbon Energy Certificates for biomass thermal energy.

2 Normative references

The contents of the following documents constitute indispensable provisions of this document by means of normative references in the text. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 2589 *General rules for calculation of the comprehensive energy consumption*

GB 17167 *General principle for equipping and managing of the measuring instrument of energy in organization of energy using*

GB/T 30727 *Determination of calorific value for solid biofuels*

GB/T 32224 *Heat meters*

GB/T 34060 *Steam heat calculation method*

GB/T 35211 *Measurement of nature gas calorific value—Continuous combustion*

CJ/T 313 Sampling and analysis methods for domestic waste

T/CAPID 006 *Voluntary certification scheme for zero carbon energy certificates—general rules*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in GB/T 30366-2013 and the following apply.

3.1

Biomass

All organic matters formed directly or indirectly by the use of photosynthesis in green plants, including plants, animals and micro-organisms excluding fossil fuels, as well as organic matter produced by the excretion and metabolism of these living organisms. Biomass can be categorized into agricultural biomass, forestry biomass, municipal solid waste, and animal waste.

NOTE: Rewirte GB/T 30366—2013, Definition 2.1.

3.2

Biomass thermal energy

Thermal energy generated from the use of biomass as a fuel for heating.

3.3

Biomass heating project

Project that utilizes biomass thermal energy to provide heat externally.

Note: They mainly include agricultural and forestry biomass combined heat and power (CHP) projects, waste incineration CHP projects, and biomass-based clean heat supply projects.

3.4

Percent of zero carbon energy

The percentage of zero-carbon energy with respect to the total energy in the main production system before production, within the accounting boundary.

Note: In this document, it equals the percentage of zero carbon energy in the total amount of energy produced or supplied.

4 Accounting content and boundaries

4.1 Accounting content

Total zero carbon energy produced or supplied in the energy activities of its production system that shall be accounted for and reported by the subject of application for certification through the certification platform.

4.2 Accounting boundary

4.2.1 The subject of application for certification shall identify the accounting boundaries and the timeframe involved in zero carbon energy certificates, as well as the target recipients of the work.

4.2.2 The subject of application for certification shall take as its boundary an enterprise legal person or a self-accounting unit treated as a legal person to account for and report the amount of zero-carbon energy generated or supplied by its production system. Production system includes the main production system, auxiliary system and accessorial system directly serving for the production; auxiliary system including dynamical system, power supply, water supply, laboratory, mechanic, warehouse, transportation, etc., and the accessorial system including the production commanding system (factory) as well as the departments and facilities serving for the production in the factory area (such as workers' cafeteria, workshop bathroom, health care station, etc.).

4.2.3 The determination of the accounting boundary should take reference to the facilities and business scope of the subject of application for certification and their production process flow, which shall include energies in the raw material transportation and the energy production (heat production and supply), as shown in Figure 1. For instance, fossil energy used in the transportation of raw materials, raw material energy, fossil energy,

purchased electricity, and reused energy in production systems for heat production and supply.

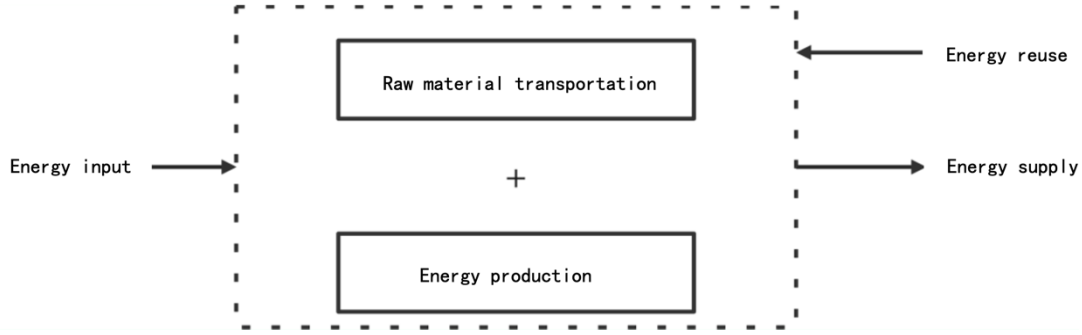

Figure 1 Schematic diagram of the accounting boundary

5 Accounting steps and methods

5.1 Accounting steps

The workflow of accounting and reporting for the subject of application for certification includes the following steps:

a) Identify the accounting boundaries and collect data on activities on each phase;

b) Calculate the amount of energy from raw materials, energy from fossil energy, consumption of purchased electricity, reuse of energy among others at each phase within the accounting boundary;

c) Summarize and account for the zero-carbon energy produced and supplied by the subject of application for certification and other related information;

d) Formulate the accounting report.

5.2 Accounting method

The amount of zero-carbon energy that the subject of application for certification is applying to certifyQ_z, is calculated with equation (1):

$$Q_z = RATIO_Z \times Q_{jc} - Q_{ys} - Q_s - Q_{jj} - Q_{hy} \quad \cdots\cdots\cdots\cdots (1)$$

where:

Q_z--Zero carbon energy amount, i.e. certified energy amount, the energy corresponding to the issued zero carbon energy certificate, in gigajoules (GJ);

$RATIO_Z$-- Percentage of energy directly used for heat production in the energy production phase, i.e. percent of zero-carbon energy, %;

Q_{jc}--The total amount of thermal energy supplied outside by the subject of application for certification that is monitored online by the certification platform, in gigajoules (GJ);

Q_{ys}-- Energy from fossil energy sources used during the transportation of raw materials, in gigajoules (GJ);

Q_s-- Energy contained in the water used directly for thermal energy production in the energy production phase, in gigajoules (GJ);

Q_{jj}-- Energy indirectly used for heat production in the energy production phase, in gigajoules (GJ);

Q_{hy}-- Energy reused in the production system in the energy production phase, in gigajoules (GJ).

Note: Sections 5.3 and 5.4 indicate accounting for energy input and energy reuse, while sections 5.5 and 5.6 concern accounting for energy output.

5.3 Energy in the transportation of raw materials

The total fossil energy in the raw material transportation is calculated according to equation (2), based on the fossil energy consumption and the corresponding calorific value:

$$Q_{ys} = \sum q_i \times m_i \times 10^{-3} \quad \cdots\cdots\cdots\cdots\cdots\cdots (2)$$

where:

q_i-- Dry basis low level calorific value of the Type i fossil energy source, in kilojoules per kilogram (kJ/kg);

m_i-- Mass of the Type i fossil energy source, in tons (t);

10^{-3}--Unit conversion factor, dimensionless;

i--Type i of fossil energy.

Note: The dry basis low level calorific value of fossil energy can be measured with reference to Annex A, GB/T 2589-2020 or through corresponding standards.

5.4 Energy in the energy production phase

5.4.1 Energy directly used for heat production

The energy directly used in the energy production phase for heat production, i.e. the energy in the main production system, is calculated according to equation (3):

$$Q_{zj} = Q_{yl} + Q_{zj,hs} \quad \cdots\cdots\cdots\cdots\cdots\cdots (3)$$

where:

Q_{zj}-- Total energy directly used for heat production in the energy production phase, in gigajoules (GJ);

Q_{yl}-- Total energy of biomass raw materials directly used for heat production in the energy production phase, in gigajoules (GJ);

$Q_{zj,hs}$-- Total fossil energy directly used for heat production in the energy production phase, in gigajoules (GJ);

5.4.1.1 Total energy of biomass raw materials directly used for heat production

The total energy Q_{yl} of the biomass raw material directly used for thermal energy production in the energy production phase is calculated according to equation (4):

$$Q_{yl} = q_{yl} \times m_{yl} \times 10^{-3} \quad \cdots\cdots\cdots\cdots\cdots\cdots (4)$$

where:

q_{yl}-- Dry basis low level calorific value of biomass raw material, in kilojoules per kilogram (kJ/kg);

m_{yl}-- Mass of biomass raw material, in tons (t);

10^{-3}--Unit conversion factor, dimensionless.

Note: The biomass raw material shall be measured for dry basis low level calorific valueq_{yl} in accordance with the relevant standards. The calorific value of solid biomass fuel shall be measured according to GB/T 30727, the calorific value of domestic garbage shall be measured according to CJ/T313, and the calorific value of biogas shall be measured according to GB/T 35211.

In the case of biomass raw materials containing a fossil carbon component, the main biomass raw materials shall be recorded and preserved in advance, to analyze and calculate the percentage of fossil carbon and non-fossil carbon components in the main biomass raw materials, for separate energy calculations.

Among them, the energy of fossil carbon in biomass feedstock $Q_{yl,hs}$ is calculated according to equation (5).

$$Q_{yl,hs} = Q_{yl} \times FCC \times FFC \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (5)$$

where:

$Q_{yl,hs}$--Energy of fossil carbon contained in biomass raw material, in gigajoules (GJ);

FCC-- Percentage of total carbon content in biomass raw material, %;

FFC-- Percentage of fossil carbon to total carbon content in biomass raw material, %.

5.4.1.2 Total fossil energy directly used for heat production

The total amount of fossil energy used directly for heat production in the energy production phase $Q_{zj,hs}$ shall be calculated according to equation (2) on the basis of the amount of fossil energy used for auxiliary combustion in the main production system and their corresponding calorific values.

5.4.1.3 Energy contained in water used directly for thermal energy production

The energy contained in the water used directly for heat production at the energy production phase Q_s shall be calculated in accordance with GB/T 32224.

5.4.2 Energy indirectly used for heat production

The energy indirectly used for heat production in the energy production phase Q_{jj} is calculated according to equation (6):

$$Q_{jj} = Q_{jj,hs} + Q_{yd} \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (6)$$

where:

$Q_{jj,hs}$-- Total fossil energy indirectly used for heat production in the energy production phase, in gigajoules (GJ);

Q_{yd}-- Total electricity indirectly used for heat production in the energy production phase, in gigajoules (GJ);

Note: If all electricity used within the accounting boundary is green power, Q_{yd} =0, otherwise it shall be discounted accordingly.

5.4.2.1 Total fossil energy indirectly used for heat production

The total amount of fossil energy used indirectly for heat production in the energy production phase $Q_{jj,hs}$ shall be calculated according to equation (2) on the basis of the amount of fossil energy used in the auxiliary and accessorial production system and their corresponding calorific values.

5.4.2.2 Total electricity consumption indirectly used for heat production

The total electricity consumption indirectly used for heat production in the energy production phase Q_{yd} shall be accounted for on the basis of meter access data for off-grid electricity within the accounting boundary.

In case of electricity consumption within the factory for other purposes, the source of electricity should be identified; for example, if the energy source is fossil energy this electricity consumption shall be accounted for as fossil energy, but if it is from renewable energy sources, it could not be accounted for.

5.4.3 Total energy reused

The energy reuse involved in this document is mainly based on water reuse, and other forms of energy usage, if any, shall be validated accordingly.
The total energy reused in the energy production phaseQ_{hy} shall be calculated based on GB/T 32224.

5.5 Percent of zero-carbon energy

The percentage of zero-carbon energy $RATIO_z$ is calculated according to equation (7):

$$RATIO_z = \frac{Q_{yl} - Q_{yl,hs}}{Q_{zj}} \quad \cdots\cdots\cdots\cdots\cdots\cdots (7)$$

5.6 Total thermal energy supplied outside

The total thermal energy supplied outside Q_{jc}, all be calculated according to the corresponding criteria based on the form of thermal energy supplied outside. Steam shall be calculated according to GB/T 34060 and hot water shall be calculated according to GB/T 32224.

6 Sources of accounting data and quality control

6.1 Sources of accounting data

6.1.1 Sequence of accounting data acquisition

The monitoring equipment shall meet the requirements of national standards, local standards and industry standards, and the instrumentation shall be properly calibrated on a regular basis to ensure the accuracy of the verification data. The data acquisition priorities for the accounting of Zero Carbon Energy Certificates are shown in Table 1:

Table 1 Data acquisition priority

Data types	Description	Priority
Raw data	Data obtained from monitoring and measurement by the certification platform	Highest
	Data obtained from direct instrumental measurement by the subject of application for certification	High
Secondary data	Data obtained by converting raw data	Medium
Alternative data	Data from similar processes or activities	Low

6.1.2 Frequency of accounting data acquisition

The accounting data, except those monitored in real time by the certification platform, shall be acquired at the frequency specified in the monitoring plan of the subject of application for certification. The monitoring plan shall conform to the national and local laws as well as regulations, policies, standards, and the platform management rules.

6.2 Accounting quality management

The subject of application for certification shall reinforce the management of data quality in the Zero Carbon Energy Certificates, including, but not limited to:

a) Establish rules for the accounting and reporting of zero-carbon energy certificates for biomass thermal energy in enterprises, including the responsible organization and personnel, workflow and content, work cycle and time nodes, etc.; a dedicated staff

member is assigned to be responsible for the accounting and reporting of zero-carbon energy certificates in enterprises;

b) Classify the accounting data of zero carbon energy certificates according to their priority, with a list of the accounting data of zero carbon energy certificates of enterprises, which provides corresponding requirements for the acquisition of accounting data of different classes;

c) Evaluate the existing monitoring conditions in accordance with GB 17167, to constantly improve their monitoring capacity, and formulate corresponding monitoring plans to collect activity data; regularly maintain the measuring instruments, testing equipment and online monitoring instruments, with clear records;

d) Establish an internal review system for Zero Carbon Energy Certificate reports, regularly cross-check production activity data to identify potential risks of data errors and propose appropriate solutions.

e) Establish a sound data record system for Zero Carbon Energy Certificates, including information such as data source, time of data acquisition and relevant responsible persons.

7 Verification

7.1 Verification principles

7.1.1 Objective and independent

The verification organization shall maintain its independence from the certified project activity, remain objective throughout the verification activity without bias or conflict of interest.

7.1.2 Fair and just

The findings, conclusions and reports of the verification organization in its verification activities shall be true and accurate. The report shall include unresolved differences of opinion, in addition to significant obstacles during the certification.

7.1.3 Honest and trustworthy

The verification organization shall exercise a high degree of responsibility to ensure the integrity and confidentiality of the verification.

7.1.4 Professional

The verification organization shall possess the necessary professional skills for verification, able to exercise professional judgment in accordance with the importance of the task and the specific requirements of the client.

7.2 Verification Process

7.2.1 Verification process

The process of verification of zero carbon energy certificates carried out by the verification organization consists of three phases, as shown in Figure 2.

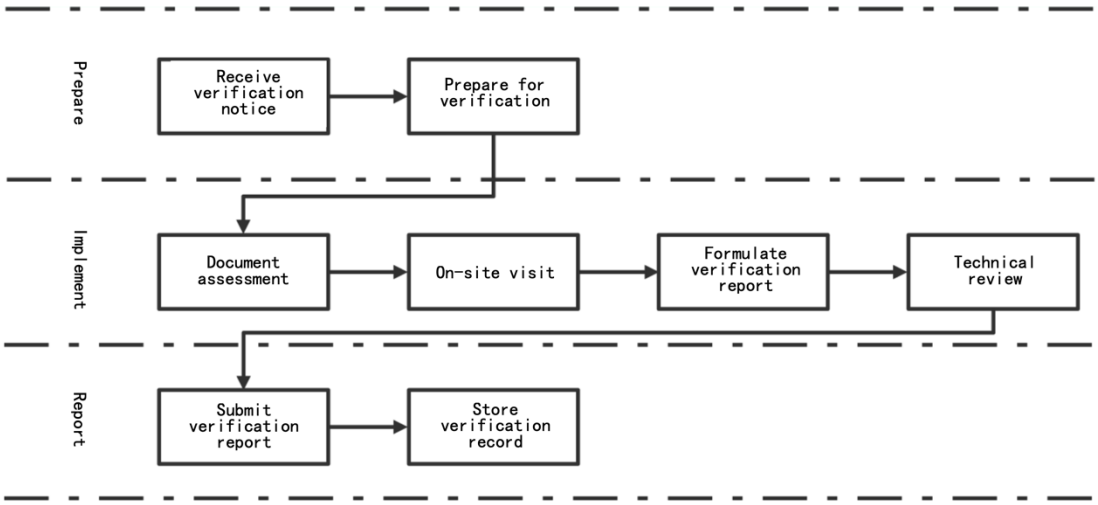

Figure 2 Verification process

7.2.2 Preparation

Upon receipt of the notification from the certification platform, the verification organization shall establish a verification team with professional skills in accordance with the project status, as well as the field of expertise and technical competence of the verifier, to prepare for the verification in advance.

7.2.3 Implementation of verification

The verification organization shall act in accordance with the corresponding certification standards and requirements and perform effective on-site visits after determination of the rationality of the materials to be verified, confirmation of the focus of the on-site visit and formulation of the on-site visit plan. The verification organization shall prepare a verification report based on the on-site findings and conduct a technical review to ensure that the verification report is truthful, objective and logically clear.

7.2.4 Reporting

After the technical review, the verification organization shall submit the verification report and other supporting relevant materials to the certification platform. The verification body shall keep all written and electronic documents in the verification process in a secure and confidential manner for at least 10 years.

7.3 Verification content

The verification organization shall conduct verification in accordance with the rules and relevant requirements of the certification platform to confirm the uniqueness of the involved zero-carbon energy certificates, the correctness of the accounting results, and validate the production facilities, the configuration of the measurement equipment and the operation of the monitoring system, and the implementation of the monitoring plan, etc.

8 Certification

The certification of Zero Carbon Energy Certificates shall be conducted in accordance with T/CAPID 006 and related regulations.

Annex A

(Normative)

Energy conversion and reference value

Due to the variety of non-electric renewable energy sources, the conversion between different energy sources should take reference to the relevant provisions of GB/T 2589-2020, with the energy unit unified as gigajoule (GJ). If the energy is not in joules, it is converted to gigajoules by means of a standard coal quantity.

Note 1: 1 kgce = 29307.6 kJ = 0.0293076 GJ = 7000 kcal

Note 2: 1 kW·h = 3600000 J = 0.0036 GJ

Table A.1 Standard coal conversion factors for energy sources (for reference)

Energy	Average low calorific value	Coefficient of conversion to standard coal
Raw coal	20934 kJ/kg (5000 kcal/kg)	0.7143 kgce/kg
Cleaned coal	26377 kJ/kg (6300 kcal/kg)	0.9000 kgce/kg
Middling	8374 kJ/kg (2000 kcal/kg)	0.2857 kgce/kg
Coal sludge	8374 kJ/kg~12560 kJ/kg (2000 kcal/kg～3000 kcal/kg)	0.2857 kgce/kg ~0.4286 kgce/kg
coal gangue (as energy)	8374 kJ/kg (2000 kcal/kg)	0.2857 kgce/kg
Coke (DryQuenching)	28470 kJ/kg (6800 kcal/kg)	0.9714 kgce/kg
Coal tar	33494 kJ/kg (8000 kcal/kg)	1.1429 kgce/kg
Crude oil	41868 kJ/kg (10000 kcal/kg)	1.4286 kgce/kg
Fuel oil	41868 kJ/kg (10000 kcal/kg)	1.4286 kgce/kg
Gasoline	43124 kJ/kg (10300 kcal/kg)	1.4714 kgce/kg
Kerosene	43124 kJ/kg (10300 kcal/kg)	1.4714 kgce/kg
Diesel oil	42705 kJ/kg (10200 kcal/kg)	1.4571 kgce/kg
Natural gas	32238 kJ/m^3~38979 kJ/m^3 (7700 kcal/m^3～9310 kcal/m^3)	1.1000 kgce/m^3 ~1.3300 kgce/m^3
Liquified natural gas	51498 kJ/kg (12300 kcal/kg)	1.7572 kgce/kg
Liquefied petroleum gas	50242 kJ/kg (12000 kcal/kg)	1.7143 kgce/kg
Refinery dry gas	46055 kJ/kg (11000 kcal/kg)	1.5714 kgce/kg
Coke oven gas	16747 kJ/m^3~18003 kJ/m^3 (4000 kcal/m^3~4300 kcal/m^3)	0.5714 kgce/m^3 ~0.6143 kgce/m^3
Blast furnace gas	3768 kJ/m^3 (900 kcal/m^3)	0.1286 kgce/m^3
Producer gas	5234 kJ/m^3 (1250 kcal/m^3)	0.1786 kgce/m^3
Residue fluid catalytic cracking gas	19259 kJ/m^3 (4600 kcal/m^3)	0.6571 kgce/m^3
Catalytic pyrolysis gas	35588 kJ/m^3 (8500 kcal/m^3)	1.2143 kgce/m^3
Coke gas	16329 kJ/m^3 (3900 kcal/m^3)	0.5571 kgce/m^3
Pressure gasified gas	15072 kJ/m^3 (3600 kcal/m^3)	0.5143 kgce/m^3
Water gas	10467 kJ/m^3 (2500 kcal/m^3)	0.3571 kgce/m^3
Crude benzene	41868 kJ/kg (10000 kcal/kg)	1.4286 kgce/kg
Methanol (as fuel)	19913 kJ/kg (4756 kcal/kg)	0 6704 kgce/kg
Ethanol (as fuel)	26800 kJ/kg (6401 kcal/kg)	0.9144 kgce/kg
Hydrogen (as fuel, density of 0.082kg/m^3)	9756 kJ/m^3 (2330 kcal/m^3)	0.3329 kgce/m^3
Biogas	20934 kJ/m^3~24283 kJ/m^3 (5000kcal/m^3~5800kcal/m^3)	0.7143 kgce/m^3 ~0.8286 kgce/m^3

Annex B

(Informative)

Schematic diagram of energy accounting for biomass heating project in different phases

A schematic diagram of the energy accounting for each phase of the biomass heating project is shown in Figure B.1.

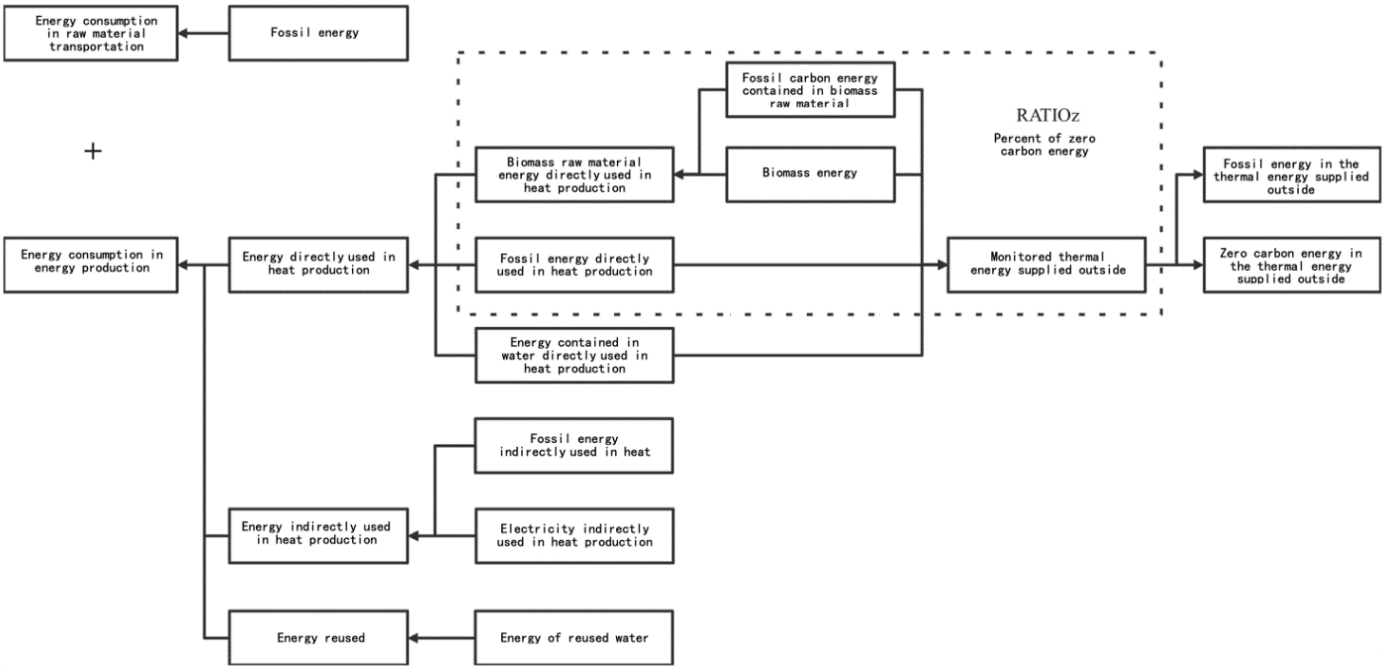

Figure B.1 Schematic diagram of energy accounting for the energy production phase

Annex C

(Informative)

Accounting form for Zero Carbon Energy Certificate for Biomass Thermal Energy

C.1 Energy in the transportation of raw materials (Q_{ys})

Energy in the transportation of raw materialsQ_{ys}
GJ
A

C.2 Energy directly used for heat production during the energy production phase (Q_{zj})

Total energy of biomass raw materials directly used for heat productionQ_{yl}	Total fossil energy directly used for heat production$Q_{zj,hs}$	Energy contained in water used directly for thermal energy productionQ_s	Energy directly used for heat productionQ_{zj}
GJ	GJ	GJ	GJ
B1	B2	B3	B=B1+B2

C.3 Energy indirectly used for heat production in the energy production phase (Q_{jj})

$Q_{jj,hs}$	Q_{yd}	Energy indirectly used for heat production Q_{jj}
GJ	GJ	GJ
C1	C2	C=C1+C2

C.4 Energy reused in the energy production phase (Q_{hy})

Total energy reused Q_{hy}
GJ
D

C.5 Percent of zero-carbon energy ($RATIO_z$)

Fossil carbon energy contained in biomass raw materials directly used for thermal energy production $Q_{yl,hs}$	Percent of zero-carbon energy $RATIO_z$
GJ	/
E1	E= (B1-E1) /B

C.6 Total thermal energy supplied outside

Total thermal energy supplied outside Q_{jc}
GJ
F

C.7 Zero-carbon energy accounted for (Q_{zj})

Total thermal energy supplied outside Q_{jc}	Percent of zero-carbon energy$RATIO_z$	Energy contained in water used directly for thermal energy productionQ_s	Energy indirectly used for heat production in the energy production phase Q_{jj}	Energy production phase reused energyQ_{hy}	Energy in the acquisition and transportation of raw materials Q_{ys}	Zero-carbon energy accounted for Q_z
GJ	GJ	GJ	GJ	GJ	GJ	GJ
F	E	B3	C	D	A	G= F×E-B3-C-D-A

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