DISTINGUISHING THE FEATURES OF JAPANESE BIOMASS TOWN PROJECTS AND IDENTYFYING ITS DIRECTION

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The present paper aims at identifying the direction of Japanese biomass town by analyzing the 97 plans specified by the Ministry of Agriculture, Forestry and Fisheries as those on the Biomass Nippon Strategy. Information related to objectives, features, and the environmental performances from those plans are analyzed by means of statistical methods. The waste related biomass use is expected to increase in 12.5%, while the unused biomass recovery in 22.2%. The main sectors engaged are livestock (96% of the projects), forestry (95%), and agriculture (94%). Concerning the recovery aspects, the promising recovery options are judged to be esterification into biodiesel fuels (50% of the cases), methane fermentation or gasification (20-30%), in addition to the traditional composting (97%). The waste-related biomass amount will be reduced in 0.39 ton/per capita/year, while the biomass use will be increased in 0.54 ton/per capita/year.

Key Words : *biomass, renewable energy, biomass town, biomass recovery options*

1. INTRODUCTION

Modern societies most pressing energy needs include: ensuring access to energy supply, reducing green house gases (GHG) emission and providing universal access to modern forms of energy[1)]. Dependence on fossil fuel sources alone has many risks including supply disruptions and soaring prices. The energy sector is the main contributor to GHG emissions. Stabilizing the concentrations of GHG gases at a level that would avoid human-induced changes on the earth climate is perhaps one of the biggest challenges we must face[2)]. Another key issue is the provision of modern forms of energy to developing countries. In fact the Millennium Assessment asserts that providing energy to the poor is indispensable to meet the human development goals of the United Nations Millennium Declaration[3)].

In order to overcome the energy challenges mentioned before, it is necessary to promote new and renewable energy sources in addition to increased energy efficiency of the current systems. Biomass energy plays a central role in this task. Since biomass energy is carbon-neutral, it contributes to combating global warming. Biomass energy systems also increase the resilience of societies in terms of energy security because of the variety of biomass imputs (agriculture and forest residues, energy crops and organi wastes), as well as the availability of different energy conversion technologies and energy outputs[4)].

The Japanese government considers the use of biomass, particularly as a source of renewable energy, to be a key element in the achievement of its CO_2 emission reduction commitments under the Kyoto Protocol.

In this sense the Japanese government has enacted legal incentives for public utilities and private companies to invest in biomass technologies. For example, the Renewables Portfolios Standard (RPS) Law requires energy suppliers to utilize renewable energies to supply customers. In 2002, the RPS Law was amended to include biomass sources. The marketable opportunities for biomass technologies have also been strengthened by the wide acceptance of the 2002 Biomass Nippon Strategy (BNS).

The strategy envisions a future where biomass would be widely used as a renewable source of energy and in the production of biomass-plastics hybrids. To strenghten its commitment to the RPS and BNS, the Japanese government supports an increase in biomass electric power generation in more than 50% from 218,000 kilowatts (kW) in 2002 to 330,000 kW in 2010[5].

Three general types of biomass are relevant for the supply of Japanese biomass market. The first is biomass from waste sources. Approximately 305 million tons on a wet basis (56 million tons on a dry basis) are produced from these sources, the equivalent of 930 petajoules (PJ) of energy produced[6]. While these sources are the most abundant type, they are inefficient for use in energy production because of high moisture content. However, food waste and wood-based construction waste are easily collectable and transportable, making them economically feasible for use in energy or other production processes.

The second type is unused biomass sources that result from harvesting raw materials. Approximately 16 million tons on a wet basis (12 million on a dry basis) are produced annually, which have an energy equivalency of 210 PJ[6]. While these sources offer significant potential as efficient feedstock for biomass technologies, the transportation costs makes them unfeasible for large-scale recovery uses[7]. They do offer some potential use for small-scale recycling and energy production uses.

Energy crops are the third type of biomass being considered by the Government of Japan. These are agricultural crops grown specifically to be used as feedstock for biomass-to-energy production, and already some commercial applications have been developed in Europe, the United States, Brazil and Canada[8]. By 2020, annual production of energy crops is predicted to be approximately 19 million tons on a wet basis (12 million tons on a dry basis), or 210 PJ, annually[6].

Within the aims of the BNS it is considered the development of 500 biomass towns by the year 2020. The municipalities around the country are publicly invited to propose their biomass use strategy to apply for 'biomass town" designation. Entries are examined for conformity to standards set by the Biomass Japan Comprehensive Strategy Promotion Council, established by the Cabinet Office and six other concerned Ministries, including the Ministry of Agriculture, Forestry and Fisheries (MAFF). Once conformity is established, the information is shared among the Ministries that can help establish an environment for the biomass town to promote active participation by local citizens, a main catalyst for further development[9]. The Council also posts the information on a Biomass Information Headquarters website, to introduce the ways the town creates and uses biomass, helping promote networking among people engaged in biomass production and utilization all over Japan. As for June 2007, there are 97 biomass towns approved[10].

However, there is no study about those biomass towns projects approved yet. This paper identifies the characterics and directions of the biomass town projects approved so far, in order to assess the benefits it will bring as they will be executed.

2. METHODOLOGICAL FRAMEWORK

(1) Goals of the study

The goal of the present study is to distinguish the features of Japanese biomass town projects and to identify its direction.

(2) Data source

The main data source is the database of the Biomass Information Headquarters[10]. Data not available in some plans about geographical and socioeconomic aspects were completed from information of each municipality or city.

(3) Description of the system

The system involves the 97 biomass town plans approved so far, as for June 2007, in Japan. **Fig. 1** shows the framework of the biomass town projects characterization. The geographical and socioeconomic features of the municipalities that execute the biomass town are identified. Then the biomass town plan itself is characterized by means of statistical analysis of the data available related to aims of the biomass town, key projects or measures considered, and relationship to other projects. Each biomass town is analyzed by the biomass source type considered (waste-related biomass, unused

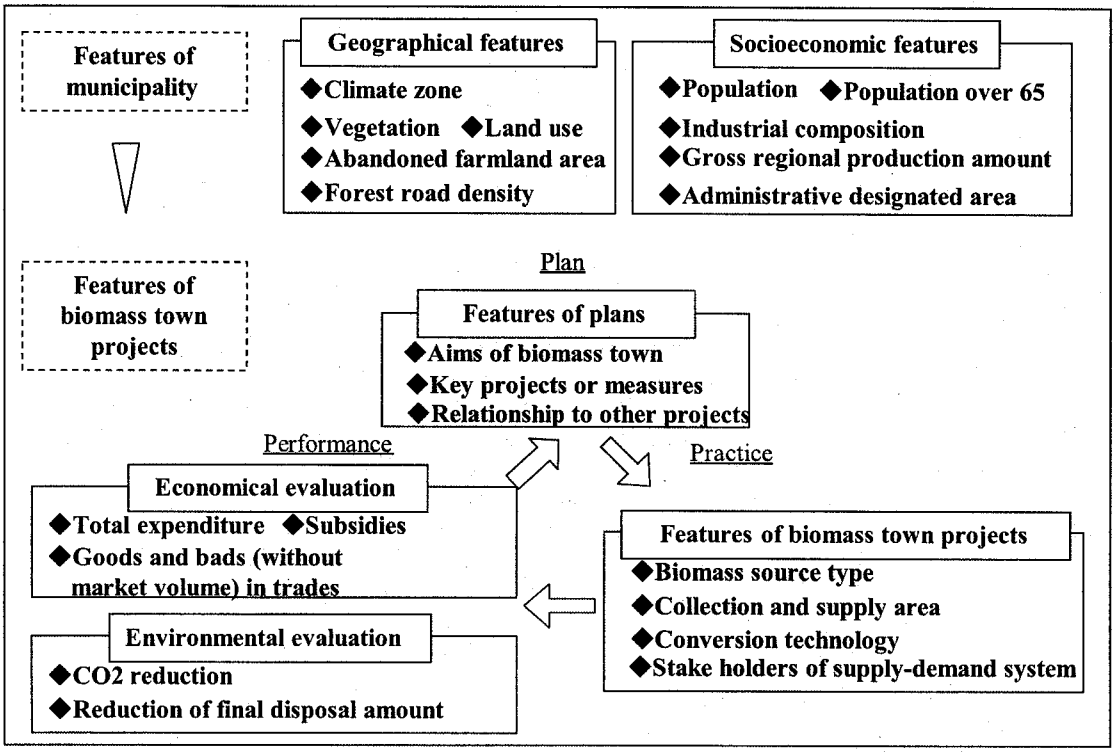

Fig. 1 Framework for biomass town projects characterization

biomass, and energy crops), the collection and supply area, and conversion technology. Also the environmental impact is appraised based on the amount of biomass used increased and the reduction of waste-related biomass.

Since the information collected for this study is limited to the data provided on the approved biomass town projects, this paper should be considered as a preliminary study of the biomass town projects in Japan. Following chapters were revised taking this limitation into account.

3. PRELIMINARY RESULTS

In the present study, the preliminary results of the whole research are presented.

(1) Geographical and socioeconomic features

Table 1 shows the distribution of biomass towns in Japan. The areas with the higher number of biomass town projects approved are Tohoku (18), Kyushu (18), Kanto (16), and Hokkaido (15).

The population of the municipalities involved ranges from 798 for the case of Izumi town in Fukui Prefecture, to 421,000 for the case of Toyama city in Toyama Prefecture. The average population is 42781 people.

Table 1 Distribution of biomass towns in Japan per region (June 2007).

Region	Number of biomass towns
Hokkaido	15
Tohoku	18
Kanto	16
Hokuriku	11
Tokai	2
Kansai	7
Chugoku	5
Shikoku	5
Kyushu	18
Total	97

From the data available of 17 biomass towns, the population over 65 ranged from 17% of the population for the case of Kosai city in Shizuoka Prefecture to 47.2% for Hayakawa town in Yamanashi Prefecture.

The area of the municipalities ranges from 18.43 km2 for the case of Oki town in Fukuoka Prefecture to 1320 km^2 for the case of Betsukai town in Hokkaido. The average area is 322.55 km^2.

The population density ranges from 2.2 person/km^2 for the case of Ono city in Fukui Prefecture to 1602 person/km^2 for the case of Miura city in Kanagawa Prefecture.

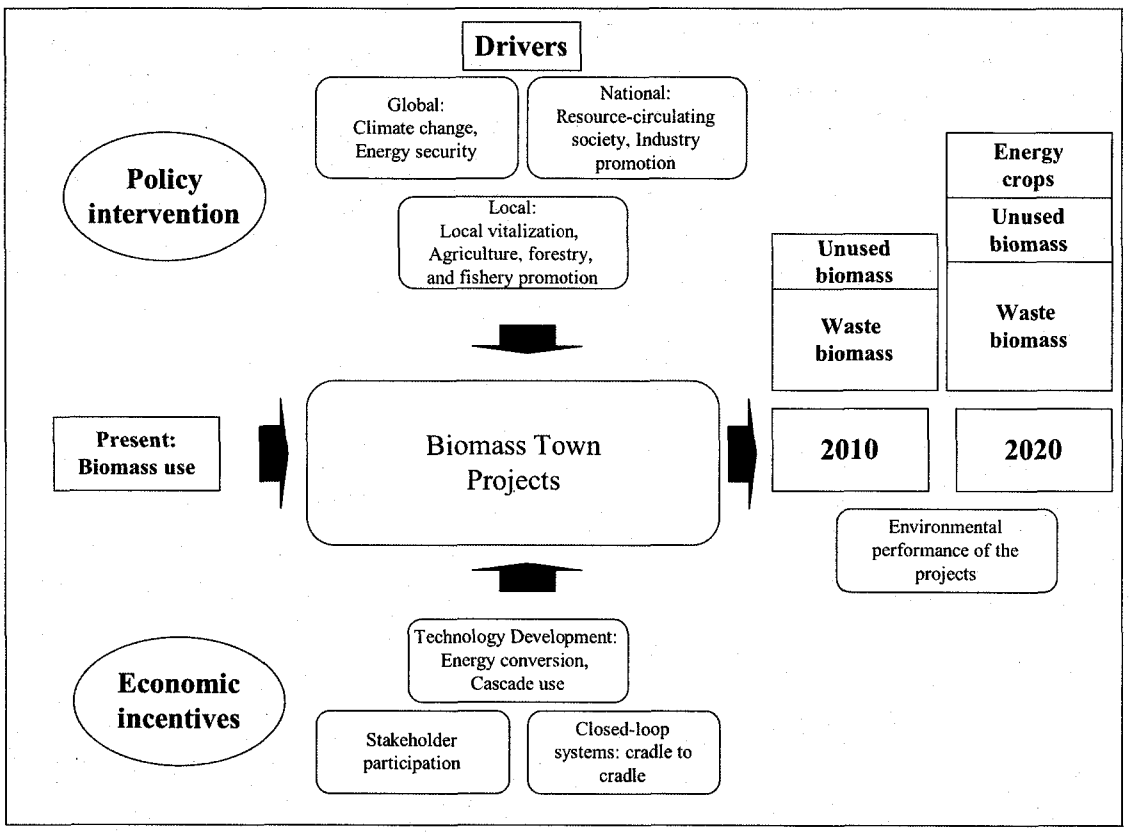

Fig. 2 Evaluation components for biomass town

(2) Features of biomass town projects

The main sectors involved in the biomass town projects are livestock (96% of the projects), forestry (95%), agriculture (94%), household (87%), sewage service (69%), and food-processing industry (48%).

Concerning the recovery aspects, the promising recovery options are judged to be esterification into biodiesel fuels (50% of the cases), methane fermentation (29%), and gasification (21%), in addition to the traditional composting (97%), direct combustion (48%) and palletizing (40%).

Table 2 shows a compilation of the existing, current use and objectives of the 97 biomass town projects, divided by type of biomass resource.

The waste-related biomass use will be increased from current 82% to 94.8%, while the unused biomass use ratio will be increased from curret 39% to 55.1%. In terms of data percapita, The contribution of energy crops is low compared to the other two biomass sources type. In terms of data per capita, the waste-related biomass amount will be reduced in 0.39 ton/percapita/year, while the total biomass use will be increased in 0.54 ton/per capita/year.

Table 2 Current use and objectives of biomass town projects.

Type	Existing	Current		Objective	
	10^3ton/y	10^3ton/y	%	10^3ton/y	%
Waste biomass	12886	10593	82.2	12213	94.8
Unused biomass	2762	909	32.9	1521	55.1
Energy crops	2	0.02	1.3	1.2	62.0
Total	15650	11502	73.5	13735	87.8

4. EVALUATION SYSTEM

Fig. 2 shows the evaluation components for biomass towns. The evaluation considers the main driving forces from global, national and local perspectives. At the same time, it takes into account the trends in technology development, the stakeholders interrelation, and the cycling oriented approach. For the environmental performance it assumes that by 2010 the unused biomass will be recovered in addition to waste-related biomass, and by 2020 the energy crops will be introduced.

5. CONCLUSIONS

This paper aimed to distinguish the features of Japanese biomass town projects and to identify its direction. The 97 biomass towns approved so far were studied. The main sectors involved in the biomass town projects are livestock (96% of the projects), forestry (95%), and agriculture (94%).

The promising recovery options are judged to be esterification into biodiesel fuels (50% of the cases), methane fermentation (29%), and gasification (21%), in addition to the traditional composting (97%).

The initial results show that important efforts are being made to increase the utilization of waste-related and unused biomass to levels around 95% and 55% of the amount generated, respectively.

Further environmental performance evaluation, and economical analysis are necessary to identify the benefits that the execution of these biomass towns projects may carry out.

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