Feasibility Study of Woody Biomass (Thinning Residue) Energy Businesses

Background

There are great expectations to utilize energy obtained from thinned tree waste. However, there is no study or report available on the estimated total volume of thinning residue, which reflects the current state of the forestry industry, considering such issues as an aging workforce or recession in the industry. It is possible to conduct such a study to obtain accurate results, of the estimated total volume of thinning residue, using Geographic Information System (GIS). In addition, there are virtually no newly established businesses taking advantage of tree waste as a fuel. It is being discussed to substitute woody biomass for the fuel used in existing public baths etc., but no thorough research has yet been made on the feasibility of businesses based on such a substituted energy source.

Objectives

The objectives of the project were to estimate, using GIS, the total volume of thinning residue reflecting the current state of the forestry industry, calculate the maximum cost for installing new equipment to use woody biomass in existing facilities, and propose an overall, optimal scheme to utilize thinned tree waste.

Principal Results

We conducted a case study in the Minami district, of Gifu prefecture, in Japan. The Minami district may be considered a typical mountainous area in Japan, where there is a great demand for regional economic development.

1. Estimated production of thinning residue based on the thinning plan for the Minami district:

Based on the district's thinning plan (2005-2008) and interviews with persons in charge of the thinning, the production of tree waste was estimated (Refer to Figure 1). Results showed that, in years with large production, approximately 1,500 m^3 of tree waste was produced, and in years with small production, approximately 880 m^3 of tree waste was produced, while the estimated total volume of tree waste produced all over the Minami district (including inaccessible areas) was 22,000 m^3 per annum (calculated based on a simple formula using tree age). Further calculating, 880 - 1,500 m^3 per annum was equivalent to 2.4 - 4.1 m^3 (or 1.0 - 1.7 ton) produced per day. Thus, we found that the production of thinned tree waste according to the district's plan was very low.

2. Estimation of maximum cost for building new facilities:

Based on our survey and interviews with officials from the Minami district and neighboring areas, a public bath and a heated swimming pool were found to be suitable for using woody biomass. Criteria for evaluating the suitability included closeness to biomass sources, sufficient capacity, sustained demands for biomass energy, and existing requirements not only for electricity but for heat.

The maximum cost was then calculated by substituting equipment such as a woody biomass boiler (or gasification cogeneration) in place of the existing oil boilers at both the public bath and swimming pool, assuming a depreciation period of 15 years and governmental financial support of 50 percent. As a result, the maximum cost for installing a woody biomass boiler was approximately 50,000,000 JPY under the assumption that the public bath owner covered 30 percent of the difference between oil / electricity cost and biomass cost, and that the oil boilers in the public bath were found to be interchangeable with woody biomass boilers (see table 1).

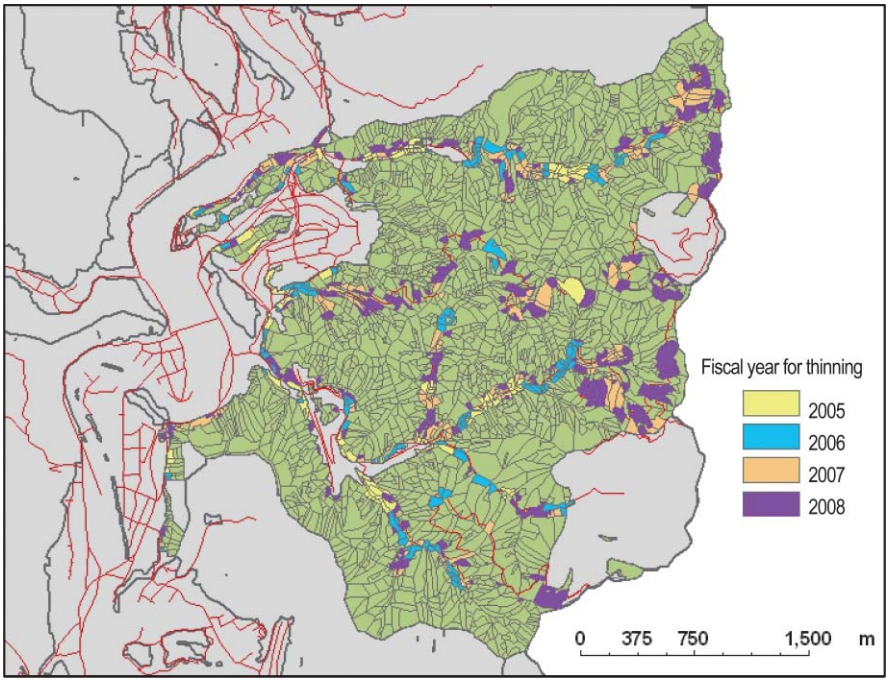
The installation of biomass boilers instead of oil boilers has the merit of utilizing natural resources in Japanese mountainous areas and developing regional economies. When using biomass energy, it is important to consider not only large-scaled use of the energy but also small or medium scale use such as substituting the energy for existing oil boilers as based on the estimate of available local natural resources.

Future Developments

A more detailed estimate must be conducted taking into account loan interest rate, property tax, cases without government financial support, and the market price of thinned thinning residue.

Main Researcher: Masanao Iuchi, Dr.,
Research Engineer, Socio-Economic Research Center

Reference: M. Iuchi, 2006, "Profitability evaluation of biomass energy project using thinning residue" CRIEPI Report Y05021



Legend: Red lines represent roads. Thinning targets are shown in different colors based on how thinning would be carried out during the fiscal year. Thinning areas become wider taking into account road lengths and elevation slope.

Fig.1 Per annum thinning targets based on the thinning plan of Gifu's Minami District

Table 1 Feasibility of woody biomass businesses

Facilities	Public bath	Heated swimming pool
Assumption	・Woody biomass boiler ・Satisfy all requirements for heat.	・Gasification cogeneration ・Plan its scale in accordance with requirements for heat. ・93 percent of total energy demands will be covered with electricity obtained from biomass.
Output	Heat: 1,585MJ/h	Electricity: 207kW Heat: 4,648MJ/h
Consumed thinning residue	2.9m^3 /day	8.6m^3 /day
Required volume of thinning residue	896m^3 /year	2,657m^3 /year
Maximum installation cost*	50,562,000 JPY	119,934,000 JPY

* assuming a depreciation period of 15 years, government financial support of 50 percent, and use of the extra available amount (the difference between oil / electricity cost and biomass management cost; 30 percent for installation and 10 percent for overhead costs)