Project Economics for Proposed Wood Energy Installations
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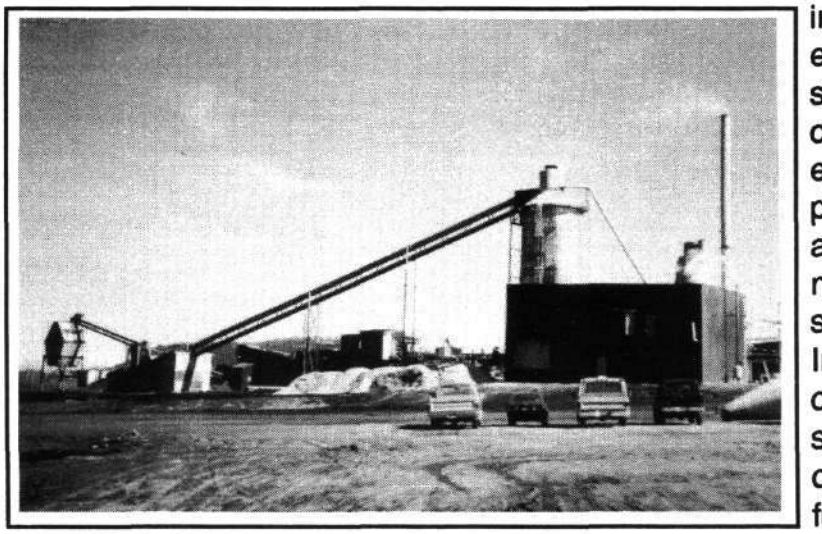
The Michigan Energy Conservation Program (MECP) Wood Energy Demonstration Project was designed to help businesses and organizations throughout the state realize cost and energy savings through the use of wood as an energy source. A direct grant program provided competitive awards to facilities to install and maintain wood energy systems while serving as demonstration sites for other potential wood fuel users.



Requests for proposals outlining Michigan's Wood Energy Demonstration Project were provided to interested organizations throughout the state. All businesses, governmental units, and not-for-profit organizations in Michigan were eligible for the $300,000 grant program. Maximum individual grants were for $75,000. Applicants included primary and secondary forest products producers, schools, agricultural related businesses, and a medical care facility.

Preliminary economic evaluations were performed for all applicants using the Wood Energy Financial Analysis Model (WEFAM) computer program developed by Michigan's Public Service Commission Office of Energy Programs. This report evaluates the results of the economic evaluations.

Applicant Information

All applicants were required to submit detailed information concerning their project plan, including a general problem statement, financial sources, project economics, project budget, and project engineering and design information. Information concerning resource supply (fuel requirements and fuel supply agreements) and organizational structure was also required. Environmental impacts associated with the proposed wood energy systems were

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considered from the standpoint of air quality, reductions in landfill disposal, and incentives for desirable forest management.

The project economics information for the grant applicants was used with the WEFAM computer program. The inputs included current energy system size and energy source, fuel costs, wood fuel moisture content, hours of operation, and initial capital costs (Table 1). A separate economic analysis was conducted for each grant applicant.

Procedures for Wood Energy Economics Computer Analysis

The WEFAM computer program functions as part of a LOTUS 1-2-3 spreadsheet and is a preliminary economic analysis, appropriate for wood energy installations during the initial planning stages. Ten numerical inputs are required to run the program. Information on estimated operating conditions such as wood fuel costs, energy requirements, and capital costs are required (Table 1). Wood fuel cost was assumed to be zero for applicants generating their own wood waste.

Project economics for proposed wood energy systems were based on expected operating conditions (Table 1) and were evaluated over a 20-year planning period. Results of the WEFAM computer analysis were based on the use of wood for fuel and included internal rate of return on investment (IRR,%), project payback period (years), and annual level of energy savings ($). The internal rate of

Table 1

Project Economics Information Required by Applicants for the MECP Wood Energy Demonstration Project

WEFAM[1] Computer Program Input Units

1. Current size of energy system (million BTU/hour)
2. Current energy source and annual usage:
   - natural gas (thousand cubic ft)
   - fuel oil #2 (gallons)
   - fuel oil #6 (gallons)
   - electricity (kilowatt hours)
   - coal (tons)
   - other energy source (million BTU)
3. Current annual fuel cost ($)
4. Moisture content of wood fuel for proposed system (% of dry weight)
5. Estimated cost of wood fuel ($ per ton)
6. Wood energy system operation (hours per day)
7. Wood energy system operation (days per year)
8. Average wage rate for employees ($ per hour)
9. Capital cost of purchasing and installing proposed wood energy system ($)

[1] Wood Energy Financial Analysis Model (WEFAM) (computer program). Office of Energy Programs 1988, Public Service Commission, Michigan Department of Commerce, Lansing, MI.

return and the payback period portions of the program facilitate comparisons of different sized projects.

Project payback is commonly used to evaluate capital spending projects, and in this case represented the time needed for energy savings to repay the initial capital cost of installing a wood energy system. Cash flows were presented on the basis of cumulative and present value amounts for the 20-year planning period. Separately, year one (1) energy savings were determined as a percent of project cost. It was assumed that all wood energy systems would be purchased in full at the time of installation.

TABLE 2

MECP Wood Energy Demonstration Project
Average Wood Energy Capital Investments, Internal Rates of Return, and Payback Periods for Proposed Wood Energy Systems by Organization Type

Organization Type	Average Value: Capital Investment ($)	Internal Rate of Return (%)[1]	Payback Period (years)[2,3]	Number of Projects Evaluated
Primary Forest Products[4]	212,421	25.3	6.8	10
Secondary Forest Products[5]	181,866	19.3	8.8	5
Schools	198,625	12.5	9.3	4
Agricultural Businesses	307,090	8.9	12.0	2
Medical Care Facilities	287,000	19.4	7.0	1

[1] Based on individual values rounded to the nearest 0.1%
[2] Cumulative cash flow method
[3] Based on individual values rounded to the nearest integer
[4] Includes lumber and plywood producers
[5] Includes furniture and specialty products manufacturers

Results and Discussion

The economic analysis indicates considerable variation in internal rate of return (IRR), project payback period, and levels of energy savings among applicants for the MECP Wood Energy Demonstration Project. Differences were apparent among organization types (Table 2) as well as within organizations (Table A1).

Primary forest products organizations (including lumber and plywood producers) had the most favorable project economics of any organization type (Table 2). Project IRR for 10 primary producers averaged 25.3 percent return on investment, corresponding to a payback period of 6.8 years. Secondary forest products, including furniture and specialty products manufacturers, had somewhat lower rates of return (IRR averaged 19.3 percent for 5 applicants).

Schools and agricultural businesses had average IRR values somewhat lower than those for the forest products companies. The relatively high cost of purchasing wood fuel for schools and agricultural businesses contributed to lower calculated IRR values. Most of the forest products applicants would be able to utilize waste residues from manufacturing operations, whereas schools and agricultural businesses would need to purchase fuel from outside sources. Schools averaged 12.5 percent IRR (payback period of 9.3 years) and agricultural businesses averaged 8.9 percent IRR (project payback period of 12.0 years). The medical care facility had an IRR of 19.4 percent and a payback period of 7 years, and was also planning to purchase fuel from outside sources.

The average capital investment for purchasing and installing wood energy systems ranged from $181,866 for secondary forest products companies to $307,090 for agricultural businesses (Table 2). The overall average investment for the 22 proposed wood energy systems was $214,965. Average capital costs for forest products producers and schools showed relatively little variation, ranging from about $182,000 to $212,000 for each wood energy installation. Project economics varied considerably within the organization types.

For primary forest products companies, with a total of 10 applicants, internal rates of return (IRR) varied from less than 8 to about 55 percent (Table A1). A payback period as short as 2 years was realized in one case. Year one energy savings ($) varied greatly and was influenced by the size of the wood energy project. Year one energy savings as a percent of project cost varied from 7 to about 54 percent for primary forest products producers. For secondary forest products producers IRR ranged from 3.8 to almost 37 percent (Table A1). This corresponded to year one energy savings (percent of project cost) for secondary producers of 6.1 to 33.7 percent. The analysis is conservative in that it did not consider any savings resulting from reduced landfill costs.

Results for the four schools showed little variation. Project IRR ranged from 9.4 to 15.9 percent with payback periods ranging from 8 to 11 years Table A1). Year one energy savings (percent of project cost) varied slightly among schools, ranging from 10.5 to 14.7 percent. Fuel purchased from outside sources resulted in lower IRR values for schools in comparison to forest products producers. Year one energy savings ($) varied over a fairly large range and was related to project size as well as energy savings potential.

Conclusions

Many factors may influence the project economics and feasibility of installing wood energy systems for small industrial applications. Operating capacity, capital and maintenance costs for a new system, operating hours, and alternative energy sources and costs all have a direct bearing on economic results. Fuel characteristics such as wood costs, moisture content, and volume of wood required are also important. In this analysis, internal rates of return, payback periods, and levels of energy savings were examined for several different types of proposed wood energy installations.

Many organization types were represented by the applicants for Michigan's Wood Energy Demonstration Project. Included were primary and secondary forest products producers, schools, agricultural related businesses, and a medical care facility. Project economics were generally the most favorable for forest products producers having access to low cost or zero cost fuel such as manufacturing residues. Non-forest products applicants all purchased wood fuel from outside sources, resulting in higher fuel costs and therefore less favorable project economics.

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APPENDIX

TABLE A1

Internal rate of return (IRR), payback period, and year one energy savings for proposed wood energy systems in Michigan. Applicants evaluated as part of the MECP Wood Energy Demonstration Project

Applicant Organization Type	IRR (%)	Payback Period (years)[1]	Year 1 Energy Savings ($)	Energy Savings (% of project cost)
Primary Forest Products[2]	55.0	2	65,700	53.7
	50.9	3	416,039	51.2
	48.0	3	71,550	45.6
	18.3	7	26,280	16.4
	17.5	7	22,338	16.5
	16.0	8	23,850	14.1
	14.8	8	14,310	13.5
	14.5	8	26,280	12.7
	10.8	10	22,896	9.8
	7.5	12	1,490	7.3
Secondary Forest Products[3]	36.8	4	93,015	33.7
	31.8	4	76,283	28.8
	16.9	7	8,160	16.9
	7.0	13	9,930	7.0
	3.8	16	10,931	6.1
Schools	15.9	8	21,721	14.7
	12.3	9	16,309	10.5
	12.2	9	40,185	11.3
	9.4	11	15,390	11.4
Agricultural Businesses	11.7	10	17,378	11.8
	6.1	14	31,461	6.7
Medical Care Facility	19.4	7	58,127	20.3

[1] Based on cumulative cash flow, indicates year in which positive cash flow first occurs
[2] Includes lumber and plywood producers
[3] Includes furniture and specialty products manufacturers