

REVIEW OF STATE WASTE TO ENERGY PROGRAMS

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Statement to the Senate Special Committee on Solid and Hazardous Waste
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As requested by the Committee, we have prepared this review of state programs that involve, in one way or another, the conversion of nonhazardous solid wastes to energy. This review consists of three sections. The first section deals with the conversion of biomass wastes to energy; the second section with the conversion of municipal solid waste (MSW) to energy; and the third section summarizes the role of state financing authorities and of tax incentives in promoting the conversion of wastes to energy.

I. CONVERSION OF BIOMASS WASTE TO ENERGY

Biomass waste consists of agricultural and forestry residues. Since 1978-79, a total of \$24.9 million has been appropriated to five state agencies for programs to fund alternative energy projects, including the conversion of biomass wastes to energy. This amount does not include (1) revenue bonds issued by the California Alternative Energy Source Financing Authority or the California Pollution Control Financing Authority, (2) staff support, minor projects and feasibility studies by various state agencies, or (3) support for biomass farming whereby crops or trees are grown specifically for conversion to energy. Table 1 summarizes the amounts appropriated to the state agencies for these programs and the amount encumbered to date for biomass waste-to-energy projects.

Table 1

State Funds Appropriated and Encumbered
for Programs to Convert Biomass Wastes to Energy
(in thousands)

	<u>Amount Appropriated</u>	<u>Amount Encumbered to Date</u>	<u>Difference</u>
California Energy Commission			
SB 771 Agricultural and Forestry Residue Conversion Demonstration Program (Ch 1123/79) ^c	\$10,000	\$8,795	\$1,205
Ethanol Production Demonstration ^c	3,800	889	2,911 ^a
Department of Food and Agriculture			
Ch 733/80 (Agricultural Energy Assistance Loans) ^c	2,000	351	1,649 ^b
Ch 803/80 (Ethanol Fuel Loans) ^c	2,000	1,500	500
California Waste Management Board	2,712	2,412	300
Department of General Services	3,914 ^d	3,914	--
Department of Forestry	<u>478</u>	<u>407</u>	<u>71</u>
Total	\$24,904	\$18,268	\$6,636

- a. Of the \$2,911,000 difference, \$2 million was used to fund a methanol demonstration project, \$511,000 was transferred to the General Fund by the 1983 Budget Act, and \$400,000 was used for feasibility studies for biomass projects that did not use wastes.
- b. \$1,000,000 was transferred to the General Fund by the 1982 Budget Act, \$499,000 was used to fund projects that do not use wastes, and \$150,000 was never disbursed.
- c. Revolving accounts, in which repayments are available for new loans or other financial assistance.
- d. Includes \$600,000 augmentation by the Public Works Board.

Of the total \$24.9 million available, \$18.3 million, or 73 percent, had been encumbered for biomass waste conversion projects as of February 1984. Of the \$6.6 million difference, \$4.4 million has been used for other purposes or transferred to the General Fund and approximately \$2.2 million remains uncommitted and available for future encumbrance. The state programs are discussed in more detail below.

A. CALIFORNIA ENERGY COMMISSION

The California Energy Commission (CEC) has two major programs relating to the recovery of energy from biomass wastes. The SB 771 program funds projects to convert agricultural and forestry residues to energy by direct combustion or by producing fuels. This is still an active program. The Ethanol Demonstration Program funded projects to convert agricultural commodities, primarily wastes, to ethyl alcohol (ethanol). This program has been terminated.

Both programs use purchase buy-back agreements, under which the state purchases and takes title to specific equipment, presumably the most innovative and risky equipment used in the project. If the project attains previously agreed-upon "performance criteria," the project proponent is obligated to "buy back" the equipment from the state at the state's original cost. In the event the performance criteria are not met, the state may negotiate a reduced cost buy-back or even take possession of the equipment for resale. Thus, the state provides assistance to a project by assuming a major part of the project risk. The state does not participate in any profits that are realized.

Senate Bill 771 Program

Senate Bill 771 (Ch 1123/79) established the State Agricultural and Forestry Residue Utilization Account (SAFRUA) in the General Fund and appropriated \$10,500,000 to the account from the General Fund to demonstrate the feasibility of converting agricultural and forestry residues to energy. The legislation directed the CEC to select and fund at least 20 demonstration projects throughout the state. Of the \$10,500,000

provided, \$500,000 was designated to fund the CEC's cost of administering the SB 771 program during the program's first two years.

Projects funded under SB 771 program must use residues as their feedstock and the primary focus of the program is on projects which convert residues directly to energy (in the form of electricity or heat), rather than those that produce fuel, such as ethanol, for sale.

As of February 1984, a total of \$8,795,000 of SB 771 funds has been committed to 18 projects. Private funds totaling \$41,834,000 also have been committed to the projects. The CEC plans to allocate the remaining \$1,205,000 in state funds to an additional 4 to 8 projects by September 1984.

Of the 18 projects to which funds have been committed, 9 involve direct combustion of residues to produce process heat, steam, and/or electricity. The residue feedstocks include orchard prunings, rice hulls and straw, almond shells, wood waste, forest slash, poultry litter, and cotton gin trash. Five projects involve fermentation of manure to generate methane gas for fuel. Four projects involve the development of systems to collect, and prepare biomass wastes for use as a fuel.

Of the 18 projects approved for funding, 10 are in the "shakedown" phase of operation and 4 are under construction. One project, the development of a semi-mobile biomass chipper, has been completed. The remaining three projects are in either the design or contract-negotiating stages.

Although the first state expenditures were made in 1980-81, the commission only recently received its first buy-back payment of \$35,000.

The CEC anticipates receiving \$2.1 million of buy-back payments in 1983-84 and another \$2.0 million in 1984-85. Repayments will be made to the SAFRUA account and are available, when appropriated, to fund additional projects until 1985, when any unobligated SAFRUA funds will revert to the General Fund. Senate Bill 1816 (Maddy) has been introduced to continue the program until December 31, 1990.

The final success of the SB 771 demonstration program will depend on whether the state-aided projects result in a significant number of waste conversion projects that do not require state aid. Information on such projects is not yet available. The CEC has not compiled a list of privately-financed waste conversion projects which are spin-offs of the SB 771 program.

The CEC indicates, however, that during 1983, there were 206 megawatts (MW) of electrical generating capacity in California fueled by biomass. Of this total, 170 MW were forest industry projects that were already in operation prior to the SB 771 program, 17.5 MW were SB 771 projects and the remainder, 18.5 MW, were new biomass conversion projects financed outside the SB 771 program. According to the CEC, an additional 661 MW of installed capacity could result from projects currently under development; including 44 MW from those in the building phase, 162 MW from those in permitting phase, and 455 MW from those in the planning phase.

For comparison, the total electric generating capacity in California is about 46,000 MW at present.

Ethanol Production Demonstration Program

The Ethanol Production Demonstration (EPD) program is part of a larger alternative transportation fuels program established by Ch 161/79 (SB 620), which provided a total of \$10 million from the Transportation Planning and Development Account for development of alternative motor vehicle fuels. Chapter 803, Statutes of 1980, transferred \$3.8 million of the \$10 million to the State Agricultural and Forestry Residue Utilization Account "for the purpose of investigating the practicality and cost effectiveness of alternative motor vehicle fuel, including but not limited to, the production of fuel grade ethanol from agricultural products...."

One project and five feasibility studies have been funded by the EPD program with Ch 803 funds. The feasibility studies involved projects to convert grain, rather than wastes, to ethanol. These projects were found not to be economically feasible. The one funded project, the Raven Distillery, involved the conversion of an existing winery to produce fuel-grade ethanol from cull fruits that would otherwise be disposed of in landfills. The CEC contributed \$888,986 to the project through a buy-back agreement.

The Raven Distillery project was expected to operate commercially by June 1982, at which time the project proponent was to buy back the equipment purchased by the state. The project, however, has not been a commercial success and the CEC has determined that the project has not met the established performance criteria. Consequently, the CEC is attempting to locate a buyer for the state-funded equipment. If none is located, the CEC may have to negotiate a reduced payment with the project owner.

The CEC does not plan to fund any additional ethanol projects because it has determined that large-scale production of fuel-grade ethanol in California is not profitable at present.

In summary, of the \$3.8 million provided to the CEC by Ch 803 for work on alternative fuels, \$889,000 was spent on a project to convert agricultural wastes to ethanol and that project has not succeeded. Of the remaining funds, \$400,000 was used to finance feasibility studies for grain-to-ethanol projects, \$2 million was used for a methanol demonstration project (which does not involve the use of wastes) and \$511,000 was transferred to the General Fund by Control Section 18.50 of the 1983 Budget Act.

B. DEPARTMENT OF FOOD AND AGRICULTURE

The California Department of Food and Agriculture (CDFA) has two loan programs relating to energy recovery from agricultural wastes. One program provides loans for on-farm production of alcohol fuel and the other program provides loans for the use of renewable energy resources.

Ethanol Fuel Loan Program

Chapter 803, Statutes of 1980, created the Ethanol Fuel Revolving Account (EFRA) and transferred \$2 million to it from the \$10 million appropriated for development of alternative fuels by SB 620. The legislation directed the CDFA to provide low interest loans for 40 to 60 small- to medium-sized ethyl alcohol (ethanol) fuel plants throughout the state. These plants were to demonstrate the economic and technical feasibility of ethanol fuel production and to encourage the development of an agriculture-based energy sector in the state. The loans are made for a five-year period at an interest rate of 3 percent and may be used to finance up to 75 percent of the total cost of a project.

To date, the department has made 36 loans totaling \$1.5 million for 31 ethanol fuel projects (some projects have received more than one loan). Fifteen of these 31 projects are designed to use agricultural wastes as their feedstock.

As of January 1, 1984, \$1.2 million of the \$1.5 million had been disbursed to borrowers. Seventeen of the 31 projects financed have been constructed. Not all of the completed projects, however, are currently producing ethanol, and some projects operate only seasonally because of the limited availability of the agricultural feedstocks they use.

As of January 1, 1984, the CDFA had received loan repayments totaling \$188,500. Another \$64,000 in repayments were past due on 11 loans. These 11 loans comprise 31 percent of all the loans and 36 percent of the funds disbursed to date. The department has extended the repayment schedule on four of the loans and has notified the recipients of the remaining seven delinquent loans of the past due status of their accounts.

The primary rationale for the loan program was to demonstrate the practicality of small-scale, farm-based ethanol fuel production and thereby stimulate the development of an agriculture-based energy sector. The department indicates, however, that no more than six privately financed ethanol fuel plants have been constructed as a result of its demonstration loan program. The stabilization of fuel prices and supplies has largely removed the incentive for private investment in the refinement of small-scale ethanol fuel production technology, according to the department.

Because the ethanol fuel loan program has failed to stimulate a nonsubsidized agriculture-based energy sector and because the CDFA does not intend to make any new loans, we recommend eliminating further funding of the ethanol fuel loan program in our Analysis of the 1984-85 Budget Bill.
Agricultural Energy Assistance Program

The Agricultural Energy Assistance (AEA) program, established by Ch 733/80 (AB 3048), was implemented by the CDFA in August 1981. The program offered loans at 6 percent interest for 5- to 10-year terms for the purchase and installation of renewable resource energy equipment in the agricultural sector. Eligible technologies included solar, wind, small

hydroelectric power plants, methane gas from fermentation, and cogeneration.

Of the \$2 million appropriated, \$850,000 was loaned for 15 projects. Another \$150,000 in loans was approved by CDFA but never disbursed. The remaining \$1 million was transferred to the General Fund to help balance the 1981-82 budget.

Six of the 15 projects, totaling \$351,000 in loans, will produce energy from agricultural wastes or residues. Five of the six are in operation at this time. These include a system to collect and chip orchard prunings for direct combustion, a methane digester currently producing 1,000 kwh of electricity per day, two nut driers utilizing orchard prunings as fuel, and a wood chip gasifier. To date, CDFA has received \$134,000 of loan repayments.

C. CALIFORNIA WASTE MANAGEMENT BOARD

Chapter 1161, Statutes of 1977 (SB 650), established a five-year program of state support to local governments and private entities to encourage the development of litter control, recycling, and resource recovery projects. Over the five years of the program, the CWMB allocated approximately \$2.7 million for biomass-related projects. Most of the projects did not directly involve the conversion of biomass to energy but were directed instead at peripheral activities such as determining the feasibility of producing alcohol from rice straw. The \$2.7 million, however, does include two grants totaling \$1,561,000 for projects designed to convert biomass wastes to energy; neither of these projects is successfully operating.

Mobile Pyrolyzer. Since 1978, the board and the U.S. Environmental Protection Agency (EPA) have provided a total of about \$2.2 million (of which \$1,410,000 has been from state funds) for a mobile pyrolyzer. The project was intended to construct and test trailer-mounted equipment that can convert organic material (such as crop wastes) into synthetic fuel.

Field demonstration of the unit was originally to be completed by July 1, 1979. Due to a variety of problems, including cost increases, expenditure freezes, technical difficulties and bankruptcy of the prime contractor, the unit has never been successfully field tested. The board has determined that it is not cost-effective to proceed with further development of the mobile pyrolyzer and has been negotiating with a contractor to perform further tests of the unit at no additional cost to the state. Termination of direct state involvement will save the General

Fund approximately \$300,000. Additional state savings may be realized if the remaining parts of the unit can be sold.

Cotton Gin Waste to Energy. The board has made two grants totaling \$501,352 to the Central Valley Cooperative Gin for a project intended to pyrolyze gin trash to make a combustible gas which in turn would be used to produce electricity and process heat. The board indicates that the project has had technical difficulties, including the melt-down of the heat exchanger, and is not operable at this time.

With the termination of the SB 650 grant program in 1982-83, the CWMB no longer makes grants or loans for waste-to-energy projects. The board's continuing involvement in biomass conversion is now limited to technical assistance provided by one staff person.

D. DEPARTMENT OF GENERAL SERVICES

Since 1978-79, the Department of General Services (DGS) has received \$3.9 million in budget act appropriations and Public Works Board augmentations for construction of a gasification plant adjacent to the central heating and cooling plant in Sacramento. The plant is intended to produce fuel gas by burning tree trimmings, woodchips, and other biomass or solid waste materials.

The plant originally was scheduled for operation in November 1982. Due to a variety of problems, including air pollution difficulties and the lack of a consistent, inexpensive fuel supply, the project is still not in operation.

The project was justified to the Legislature on the basis that, once in operation, the plant would allow the state to reduce its purchase of natural gas by one million therms per year. In order to evaluate the success of the project in meeting that goal, language was included in the 1983 Budget Act providing that, "By March 1, 1984, the Department of General Services shall report to the chairmen of the fiscal committees and the Chairman of the Joint Legislative Budget Committee on the actual costs and savings attributable to the gasification plant." That report has not been received.

E. DEPARTMENT OF FORESTRY

The California Department of Forestry (CDF), through its Wood Energy Program, has been active in several projects involving production of energy from wood waste. Since 1979, the CDF has spent approximately \$656,700 on these projects.

The major completed and ongoing projects include the following:

Wood Densifier. Chapter 1104, Statutes of 1979, created the Renewable Resources Investment Fund and appropriated \$523,700 from it to the CDF "for the development of wood energy demonstration projects to reduce wildland fire hazards and utilize wood wastes for energy production." In 1981-82, \$345,000 of these funds were used to contract with the Papakube Corporation to develop and construct a mobile densifier to convert crushed chaparral and other brush into fuel pellets. The balance of \$178,700 was utilized for support staff and special equipment in the Wood Energy Program.

To date, \$274,000 of the contract amount has been paid to Papakube. Because the densifier has repeatedly failed in CDF field performance tests, the department has terminated its contract with Papakube and is withholding final payment of \$71,000. The department indicates it is currently trying to lease or sell the machine to local agencies that are willing to invest additional funds to overcome operational and design flaws.

Gasifier. In 1980, the California Energy Commission (CEC) provided \$133,000 to the CDF for a five-year project involving the construction of a wood-fired gasifier and its demonstration at a CDF field facility. The CDF subcontracted with the Biomass Corporation of Yuba City for construction of

the gasifier device. Because the department encountered problems in operational testing of the device, it decided to terminate the project in 1982 and transfer the gasifier to the CEC. The Biomass Corporation subsequently has gone out of business and declared bankruptcy. The CEC indicates that the gasifier is now in storage and needs substantial modifications. For this reason, the CEC is attempting to sell the device.

II. CONVERSION OF MUNICIPAL SOLID WASTE TO ENERGY

The second aspect of our review deals with state support for the conversion of municipal solid waste (MSW), which otherwise would be put in landfills, to energy. The California Waste Management Board (CWMB) has been the only state agency significantly involved in the direct funding of MSW projects. Other state agencies that have been/or are potentially involved in determining or regulating the environmental aspects of MSW include: (a) the Air Resources Board in identifying air quality impacts and proposing appropriate control measures, (b) the Department of Health Services and State Water Resources Control Board for regulating the disposal of ash, and (c) the California Energy Commission for siting of any facility with a capacity of 50 megawatts or more.

California Waste Management Board

As with biomass conversion, CWMB's funds for MSW conversion were allocated pursuant to Ch 1161/77 (SB 650). During the five year period from 1978-79 through 1982-83, the board allocated approximately \$4,710,000 from the General Fund to support 15 MSW projects (listed below in Table 2). This amount consisted of \$2.0 million in SB 650 funds specially appropriated by Ch 1011/78 (SB 1855) for the planning and design of large-scale MSW projects and an additional \$2.7 million for 9 other MSW energy projects. In addition to the \$4,710,000 in grants, \$233,000 was allocated by the board for air pollution and ash studies.

Table 2

State Supported Projects to Convert Municipal Solid Waste to Energy
(in thousands)

	<u>Amount Allocated</u>	<u>Amount Encumbered</u>	<u>Difference</u>
A. Large Scale Projects (SB 1855)			
Central Contra Costa Sanitary District	\$438	\$438	--
Humboldt Bay Power/City Garbage of Eureka	380	380	--
County Sanitation Districts of Los Angeles	299	299	--
City and County of San Francisco/Sanitary Fill Company	365	365	--
City of Alameda	177	177	--
San Diego Energy Recovery Project	341	341	--
Subtotal	<u>\$2,000</u>	<u>\$2,000</u>	--
B. Additional Projects			
City of Commerce	\$1,000	--	\$1,000
County of Fresno	22	22	--
Modesto Disposal Service	182	182	--
Stockton Scavenger Association	85	85	--
City of Visalia	18	18	--
North Santa Clara County, JPA	148	148	--
TESCO (Riverside County)	66	66	--
Lassen Community College	570	276	294
West County Agency (Contra Costa County)	619	270	349
Subtotal	<u>\$2,710</u>	<u>\$1,067</u>	<u>\$1,643</u>
Totals	<u><u>\$4,710</u></u>	<u><u>\$3,067</u></u>	<u><u>\$1,643</u></u>

Of the \$4.7 million allocated to MSW projects, \$1.6 million, or 35 percent of the total, remains unencumbered at this time. The CWMB indicates that all of these funds will be encumbered by the end of 1983-84.

Progress on most of the MSW projects has been slow. Of the 15 projects listed in Table 2, only the Lassen Community College project is under construction. Most of the delays have been due to the following problems that generally affect MSW energy conversion projects:

1. Financing. The capital costs of large-scale MSW projects are formidable, ranging from \$100 million for the Humboldt Bay project to over \$180 million for the San Francisco project. In addition, waste-to-energy projects are perceived as high risk ventures by private investors.

2. Environmental Concerns. MSW facilities present major air quality problems. Variations in the composition of waste materials used as fuel cause changes in the pollutants emitted, such as acid gasses, heavy metals, and other hazardous compounds. None of the six SB 1855 projects has yet received the necessary air quality permits.

An additional environmental concern involves the disposal of ash residue left over from the combustion process. Current state regulations classify this ash as a hazardous waste and may require expensive disposal in special landfills.

3. Siting. As with landfills, the siting of MSW projects is controversial and has complicated the development of most MSW projects in California.

III. FINANCING AUTHORITIES AND TAX INCENTIVES

In addition to the direct state support for waste-to-energy conversion projects discussed in the previous two sections, tax-exempt financing for these types of projects is available from two state financing authorities and there are various other state and federal tax incentives for these technologies.

Financing Authorities

The California Pollution Control Financing Authority and the California Alternative Energy Source Financing Authority are authorized to issue revenue bonds. The interest on these bonds is exempt from federal and state income taxes and, therefore, the interest rate on the bonds is lower than the rate on taxable bonds. This reduces the cost of projects financed by revenue bonds. Since debt service on the revenue bonds is secured solely by project revenues or the credit of the project owner, however, bond financing generally is not suitable for projects with significant risk.

California Pollution Control Financing Authority (CPCFA). The CPCFA is a state agency which issues revenue bonds to aid California businesses in acquiring, constructing, or installing pollution control facilities necessary to meet air and water quality standards mandated by government. The CPCFA program is a trust activity that involves no expenditure of state funds. The authority is supported from fees it charges for its services.

Although the CPCFA's efforts are directed toward pollution control facilities, rather than resource recovery facilities per se, the authority plays a major role in the financing plans of existing and prospective resource recovery facilities.

To date a total of \$969,507,000 in bonds have been sold by the CPCFA. Roughly \$58,000,000 of this amount was for 13 projects that involve the recovery of energy from waste. These include (a) \$22,000,000 for the installation of boilers and generators to use wood debris as fuel to generate electricity at two Louisiana Pacific plants, (b) \$10,000,000 for a boiler to use dissolved glue and pulp as fuel to make steam for drying ovens at a Simpson-Lee paper mill, (c) \$9,450,000 for biomass conversion at a Superior Farming food processing plant, and (d) \$4,000,000 for biomass conversion at a Tri-Valley Growers cannery. Both Superior Farming and Tri-Valley Growers also have received funding under the Energy Commission's SB 771 program. In addition, several major MSW energy projects have applied for CPCFA financing.

California Alternative Energy Source Financing Authority (AESFA).

The AESFA is a state agency created by the Legislature to assist California industries in financing facilities that reduce the use of fossil fuels, such as oil and natural gas.

The major restriction on the AESFA's program is imposed by Section 103 of the Internal Revenue Code, which limits each project financed by these revenue bonds, with a few exceptions, to \$1 million. Federal law, however, does allow the authority to provide unlimited financing for MSW projects.

To date, the AESFA has issued bonds totaling \$14,310,000 for five projects. Only one of these issues, for \$3,100,000, involves a waste-to-energy project (producing fuel from wood waste). There are no additional waste-to-energy projects under consideration by the AESFA.

Special Tax Incentives for Waste-to-Energy Projects

There are a variety of special state and federal tax incentives for waste-to-energy projects. These are summarized below:

1. Tax Incentives for Biomass Energy Equipment

- o State Bank and Corporation (B&C) tax law provides for an accelerated depreciation (i.e., faster "write-off") of alternative energy equipment, including biomass equipment (Ch 1328/80, AB 1404). Taxpayers are allowed to depreciate the equipment over 12 or 60 months. This provision applies to equipment installed prior to December 31, 1985.
- o Federal tax law allows a 10 percent energy property credit for biomass equipment (in addition to the general 10 percent investment tax credit). This special credit is effective through December 31, 1985.
- o These state and federal provisions also apply to cogeneration equipment that uses waste as a fuel.

2. Alcohol Fuel Credits

- o State Personal Income Tax (PIT) and B&C law allow a 55 percent credit for the cost of converting vehicles to the use of alcohol fuel. The credit allowed cannot exceed \$1,000 per vehicle. This provision expires on December 31, 1990.
- o Federal law allows a tax credit for alcohol used or produced for fuel purposes. The credit amounts are 50 cents/gallon for alcohol of at least 190 proof and 37.5 cents/gallon for alcohol of at least 150 proof. This provision sunsets January 1, 1993.

3. Sales Tax Exemption for Gasohol

- o Gasohol is partially exempt (3 cents per gallon) from the state sales and use tax. This provision sunsets in 1987.

4. Sales Tax Exemption for Waste Products

- o Waste used for fuel purposes is exempt from the state sales and use tax.
- o The exemption applies to (1) organic products grown expressly for fuel use, and (2) waste by-products from agricultural or forest products, municipal refuse, or manufacturing, and used in an industrial facility as a fuel source in place of oil, natural gas, or coal.
- o This provision sunsets December 31, 1986.