

California's Waste Conversion Technologies:

*Ensuring an Environmentally Clean
and Abundant Future*

Converting California's biomass and
plastic wastes into renewable fuel,
green power, and chemical products



California's Challenge

Environmentally Sensitive Waste Disposal



- In 2008, over 40 million tons of post-recycled municipal waste were placed in landfills in California, even though the state now recycles 54% of its wastes. This was two million tons more than were disposed in 1989, when Assembly Bill 939 established the state's recycling program
- Factors such as population and economic growth have effectively offset the benefits of state and local recycling programs.
- In addition, many of the state's recyclables are being sent to China and other Asian countries (where no emissions standards exist) to be converted into products to be sold back to the United States, providing no benefit in terms of jobs or resources for the people of California.
- New landfills are increasingly difficult to site near urban centers. Use of distant landfills increases traffic, pollution, energy use and disposal costs.
- There are no existing markets or beneficial uses for the bulk of post-recycled organic materials currently going to landfills.

These trends are expected to continue.

California's Mandate

Renewable Energy Production



- California's 26 million vehicles are more than 95% dependent upon petroleum. Its 38 million residents use more gasoline and diesel fuel than the 1.3 billion people in China.
- By executive order, Governor Schwarzenegger has mandated that California produce a minimum of 20% of its biofuels in-state by 2010, 40% by 2020 and 75% by 2050. The state's Bioenergy Action Plan establishes biofuel use targets for California equivalent to 1.6 billion gallons of gasoline in 2020, and two billion gallons in 2050.
- In November 2008, the Governor increased the state's Renewable Energy Standard to 33% renewable electrical power by 2020. This will require approximately 1,450 MW of new biomass capacity by 2020.

Waste Recycling in California



The state has made progress over the past 18 years in conserving natural resources and reducing its dependence on landfills. It has:

- Established statewide recycling goals & local planning requirements.
- Developed an extensive recycling and composting infrastructure.
- Increased the removal of hazardous materials from its waste streams.
- Established advanced disposal fees and other manufacturer responsibility measures.

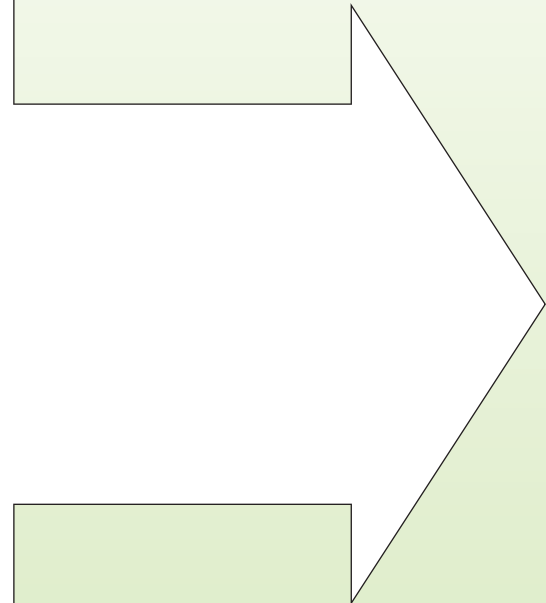
However, using 21st Century technologies, much more can be recycled.

Together with plastics, biomass fractions of the waste stream constitute 75%-85% of the post-recycled materials disposed in CA landfills.

CA's Waste— What's Left after Recycling?

MATERIAL	TONS	%
Paper	8,445,989	21.0
Other Organics	12,166,452	30.2
Plastics	3,809,699	9.5
Construction & Demolition Wastes	8,732,074	21.7
Metal	3,115,357	7.7
Glass	934,926	2.3
Electronics	481,353	1.2
Special Waste	2,034,431	5.1
HHW	73,599	0.2
Mixed Residue	437,448	1.1
TOTALS	40,235,328	100.0

Source: *CA Integrate Waste Management Board, 2004*
(most recent waste characterization study)



Converting Leftover Waste

Conversion Technologies (CTs) refer to a diverse set of new non-combustion thermochemical and biochemical technologies capable of converting biomass and plastic wastes into marketable products.



CTs include:

- Gasification
- Pyrolysis
- Thermal Depolymerization
- Catalytic Cracking
- Hydrolysis/Fermentation

Conversion Technologies are safe

There are 130 CT facilities operating successfully in Europe and Japan. Existing data indicate that they can operate within stringent air quality standards for toxics and other pollutants. CT facilities will be required to meet all CA regulations

What Are CT Products?



Green Power and Heating

Electricity and heating through biomass-derived methane, syngas, steam, and bio-oils.

Renewable Fuels

California ethanol and biodiesel from biomass-derived synthesis gas, sugars and oils; Low sulfur diesel from waste plastics.



Green Chemicals

Non-toxic, degradable bio-chemicals for pesticides, fertilizers, acids, solvents, lubricants, polymers, inks, adhesives, sorbents, and other petroleum replacement products.

California's Goal

Zero Waste

CA has 80 million dry tons of untapped biomass resources that can be disposed in the process of producing electric power, biofuels and chemicals. (There are 1.3 billion tons nationally.)

- CTs can enhance existing glass, metal and plastics recycling by 7-13% through the pre-processing of waste feedstocks or by ejecting inert materials for further recycling when gasifying the organic (carbon-based) portion of a waste stream.
- They can divert from landfills up to 80% of the post-recycled materials they receive and convert them to beneficial use.
- 50% of the available biomass resides in the municipal waste stream, 30% in the agriculture sector and 20% in forestry wastes. CTs can play a central role in developing this critical resource for California.



California's Opportunities

Initiatives to Encourage CT Industry Development



Many states are now providing incentives, including grants and expedited permitting, to encourage the development of bioenergy and bio-based industries. To remain competitive, California must:

- Remove statutory obstacles that equate CTs with disposal and deny eligibility for landfill diversion credit and renewable energy funding.
- Put "beneficial use" on an equal footing with recycling in the state's solid waste hierarchy, and allow jurisdictions to claim full diversion credit under AB 939 for solid waste sent to CT facilities.
- Create a streamlined integrated permitting process for renewable energy projects.
- Implement the recommendations of its Bioenergy Action Plan, a comprehensive bioenergy program for the State that integrates the program objectives and regulatory purviews of its environmental and economic development agencies.

California's Progress toward a Clean, Abundant Future

CIWMB CT Report to the Legislature (2005)

In March 2005, the California Integrated Waste Management Board submitted to the Legislature detailed lifecycle and market assessments of conversion technologies as compared to existing waste management practices. These peer-reviewed studies, completed by University of California and other expert consultants, offered the following conclusions:

- CTs are distinct from landfills and incineration, and can result in substantial benefits for CA, including production of renewable energy, reduced dependency on fossil fuels, and reduction of greenhouse gases.
- On a life-cycle basis, CTs are superior to recycling, composting, landfilling, and transformation in terms of energy balance, NOx emissions and carbon emissions.
- CTs can complement the existing recycling infrastructure and have a positive impact on glass, metals and plastics recycling.
- Using advanced 21st Century environmental controls, CTs can meet the state's stringent emissions and regulatory standards.

The report was delivered four years ago. Nothing has changed. Nothing has been done.

Progress toward Energy Independence

The Governor's Bioenergy Action Plan

In 2006, the Governor's Bioenergy Interagency Working Group issued its Bioenergy Action Plan for the State of California. Its recommendations included the following:

- Establish a broad-based Renewable Fuel Standard (RFS) for CA's transportation sector, targeting the biofuels equivalent to two billion gallons of gasoline by 2020, with a minimum of 40% produced in California.
- Target the development of 1,500 MW of new biopower capacity by 2020 so that biopower will continue to provide a 20% share of in-state renewable electric power. (In November 2008, by Executive Order, the Governor accelerated the RPS, which now calls for 33% of the state's electric energy to come from renewable sources by 2020.)
- Direct the Bioenergy Interagency Working Group to develop an integrated and coordinated plan to create a favorable regulatory environment that enhances opportunities for sustainable in-state bioenergy production, yet maintains the required environmental oversight of the existing utility, transportation fuel, and waste management industries.

Progress toward a Supportive Regulatory Environment

Recommended Legislation

The Bioenergy Action Plan also recommended the following legislative initiatives to enable greater use of the biomass waste that is now being placed in landfills:

- Direct the Integrated Waste Management Board to advocate changes in statute and to develop a regulatory framework for biomass waste conversion facilities that distinguishes them from disposal, and provides clear, expedited permitting pathways for their development.
- Revise the existing statutory definition for transformation and recommend a new definition for conversion technology that facilitates development of environmentally acceptable waste management alternatives. In particular, revise and correct the definitions of *gasification*, *fermentation*, *pyrolysis*, and *manufacturing*.
- Provide diversion credits to local jurisdictions for solid waste processed by these technologies.

The Bioenergy Action Plan was created almost three years ago. Nothing has changed. Nothing has been done. Ask your legislators. Why not?

Financial Incentives for Advanced Biofuels Production

Recommended Programs

The Bioenergy Action Plan further recommended the following financial incentives for advanced biofuels production:

- Establish financial incentives to encourage investment in biopower, biofuels, and bio-products, including tax incentives, loan guarantees, and other financial tools.
- Establish funding mechanisms for bioenergy programs, perhaps to include:
 - Excise taxes on non-renewable motor fuels with proceeds targeted toward biofuels programs.
 - An increase in landfill tipping fees or a small surcharge on trash disposal bills to encourage greater diversion of biomass resources for use in biomass conversion projects.
 - Carbon taxes, consistent with broader state policy on greenhouse gas reductions, recognizing that there are unique considerations for bioenergy relative to other renewable energy resources.
 - Tax credits for biopower and biofuels facilities and delivery infrastructure, including energy production, investment and income tax credits.

Cleaner, Renewable Fuels for California

Why Ethanol?



- Ethanol is an octane enhancer and volume extender for gasoline, reducing dependence on foreign petroleum. It is the only biofuel that can be safely blended with gasoline and has already been integrated into CA's motor fuel distribution network.
- Using waste materials as feedstocks, CTs will take the world beyond the use of food resources in the production of ethanol.
- Ethanol reduces carbon dioxide (CO₂) emissions. When 10% blending is fully implemented by 2010, it will reduce by more than seven million tons the amount of CO₂ CA vehicles create each year.
- 10% ethanol blending will equal 50% of the 2020 goal for non-petroleum fuel use.

California's Progress toward a Clean, Abundant Future

Cleaner, Renewable Fuels for California

Biodiesel Reduces Emissions

- Biodiesel and biodiesel blends reduce particulates and the cancer-causing air toxics that ride on soot particles.
- B20 produces 15% less carbon dioxide (CO₂), and B100 78% less CO₂ than petroleum diesel.
- Biodiesel can be made from oil crops and from local waste fats, greases, and bio-oils.



Emission	B100	B20
Carbon Monoxide	-43.2%	-12.6%
Hydrocarbons	-56.3%	-11.0%
Particulates	-55.4%	-18.0%
Nitrogen oxides	+5.8%	+1.2%
Air toxics	-60%-90%	-12%-20%
Mutagenicity	-80%-90%	-20%

Benefits for Rural California

CTs present new opportunities for farmers and dairy-men, both in the management of wastes and in the development of new industries:



- CTs can mitigate regulatory challenges by turning waste materials, such as agricultural residues and manures, into products, such as distributed energy, ethanol, chemicals, and fertilizers.
- CT “biorefineries” present new fuel and chemical markets for existing crops and residues, and new agribusiness opportunities through the integration of dedicated energy crops.
- Biorefineries and biobased manufacturing provide new avenues for rural economic development.
- CTs help to create a post-petroleum agricultural platform through the use of environmentally benign biochemical alternatives and soil phytoremediation.

Benefits for Wildlife and Urban California

In addition to furthering the State's landfill diversion, air quality, energy, and agricultural goals, this new industrial platform will advance the following:

Forest Health & Wildfire Protection

Coupling forest thinning projects with biomass conversion can create a Statewide wildfire prevention strategy that reduces fire suppression costs and enhances renewable energy supplies.

Water Quality & Watershed Protection

Replacement of petrochemicals with bio-based chemicals and products can reduce harmful releases to waters of the State from agricultural and industrial operations. Preservation of forest integrity also reduces water quality impacts through erosion and runoff.

Urban Revitalization

Clean CT industries can serve as anchor facilities for urban eco-industrial parks.





BioEnergy Producers Association

Clean Technology for Renewable Energy

The BioEnergy Producers Association (BPA) is a coalition of private companies dedicated to the development and commercialization of environmentally preferable industries that produce renewable sources of power, fuels and chemicals from agricultural, forestry and urban biomass, and plastic wastes.

For a copy of a Pocket Guide version of this presentation, or to find out more about BPA, please contact:

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