

Urban Biomass Conversion Technologies Deployment in California – An Update

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Overview

- **Conversion technologies (CT's) in a nutshell**
- **Policy Drivers**
- **California Jurisdiction CT Projects**
- **Pilot & Research Projects**
- **Resources**

Feedstocks

MSW *

Green waste

Food waste

Paper

Wood waste

Fats Oil Grease

MRF residuals **

Technologies

A. Digestion

Fermentation

Gasification

Pyrolysis

Hybrid

Products

Electricity

Biogas

Biodiesel

Hydrogen

Heat

Chemicals

Syngas

Compost

* MSW: Municipal Solid Waste

** MRF: Material Recovery Facility

Conversion Technology Drivers

(a partial list)

- 1- **AB 32** - Global Warming Solutions Act of 2006
Anaerobic Digestion measure
- 2- **Renewable Portfolio Standard** - 33% by 2020
- 3- **Low Carbon Fuel Standard:** Deliver automotive energy by 2020 with 10% less greenhouse gases than 2010
- 4- **Renewable Energy Feed in Tariffs**
- 5- **AB 118** - Alternative Fuels Technology Program
- 6- **CIWMB Strategic directives 6.1 & 9.2**

Evaluation of Conversion Technologies for Municipal Waste Management

Jurisdiction Sponsored Evaluations (a partial list)

- City of Los Angeles
- County of Los Angeles
- City & County of Santa Barbara
- Salinas Valley Solid Waste Authority
- Cities of San Jose, Tulare, San Diego & Santa Cruz

City & County of S. Barbara

ANAEROBIC DIGESTION

CA Renewable Technologies - CR&R/Arrow

Ecocorp

THERMAL PROCESSING

AdaptiveNRG (Plasma Gasification)

International Environmental Solutions (Pyrolysis)

Interstate Waste Technologies (Gasification)

Plasco Energy Group (Plasma Gasification)

Tajiguas Partners - WTE/Entech (Gasification)

OTHER TECHNOLOGY

Herhof (Biological Drying/Mechanical Separation/Combustion Off-site)

**For Jurisdictions Conversion Technologies
Evaluation Reports go to:**

[**www.ciwmb.ca.gov/Organics/Conversion/Events**](http://www.ciwmb.ca.gov/Organics/Conversion/Events)

Evaluation of Conversion Technologies for Municipal Waste Management

- **Jurisdiction Sponsored Evaluations** (partial list)
 - City of New York
 - Taunton, Massachusetts
 - Toronto, Ontario, Canada
 - San Lucie Co., FL
 - Delaware Solid Waste Management Authority
 - Connecticut Resources Recovery Authority

Major DOE Biofuels Project Locations

Geographic, Feedstock, and Technology Diversity



Key
Company
Process
Feedstock
(Location)



- ★ Six Commercial-Scale Biorefinery Projects: up to \$385 million.
- ★ Four Small-Scale (10%) Biorefinery Projects: up to \$114 million (first round)
- ★ Three Bioenergy Centers: up to \$405 million
- ★ Four Thermochemical Biofuels Projects: up to \$7.7 million
- ★ Four Improved Enzyme Projects: up to \$33.8 million
- ★ Five Projects for Advanced Ethanol Conversion Organisms: up to \$23 million



Regional Partnerships

South Dakota State Univ., Brookings, SD
Cornell University, Ithaca, NY
Univ. of Tennessee, Knoxville, TN
Oklahoma State Univ., Stillwater, OK
Oregon State Univ., Corvallis, OR

Biomass

US Department of Energy (US DOE) Cellulosic Biorefinery Demonstration Project Awards, 2007-2010

Awarded to	Ethanol Capacity (Million Gallons Year)	Technology	Feedstock (tpd = tons per day)	Location	Award (\$ Million)
Abengoa	11.4 (Cellulosic) 85 (Starch) + Power & Syngas	Enzymatic hydrolysis + Biomass gasification for process energy	700 tpd corn stover, wheat straw, switchgrass, others	Kansas	76
BlueFire Ethanol	19	Concentrated acid hydrolysis (Arkenol process)	700 tpd sorted greenwaste and wood waste from landfill	California	40
POET (Broin)	31 cellulosic 94 starch	Engineered Zymomonas bacteria (Dupont)	842 tpd corn fiber, cobs, stalks	Iowa	80
Range Fuels	40 + 9 methanol	Gasification followed by catalytic syngas upgrading	1,200 tpd wood residues and energy wood	Georgia	76

CIWMB Sponsored Research & Demonstration Projects

- UC Davis Biogas Energy Project
aka Anaerobic Phased Solids Digester
- UC Biofuels LLC, Biomass to Ethanol Project
- Yolo County Landfill. In-Situ AD compost Project
- Phoenix Energy, Los Banos Gasification project
- Anaerobic Digestion Environmental Impact Study

UC Davis Biogas Energy Pilot Project



UC Davis Biogas Energy Pilot Project



Food Leftovers

UC Davis Campus

Restaurants



UC – West Biofuels Biomass to Power & Ethanol pilot project, Woodland, CA

- Dual Bed Gasifier design
- Production Cost Goal:**
Less than \$60 per barrel of
oil equivalent
- Phase I:** Wood chips
- Phase 2:** Post Material
Recovery Facility residuals



Photo: Jacques Franco

UC – West Biofuels Biomass to Power & Ethanol project



Sample Phase II feedstock: Post Material Recovery Facility Residuals

Yolo County Landfill In-Situ AD Compost Pilot Project



Photo: Ramin Yazdani, Yolo Co.

Yolo County Landfill

In-Situ AD Compost Pilot Project



Photo: B. Helmowski

Phoenix Energy LLC., Los Banos Gasifier



Downdraft Gasifier similar to the Los Banos project

Photo: Phoenix Energy LLC

Feedstock:

Almond trimmings, shells & waste wood pallets (4,000 tons/year)

Joint Venture with Parreira Almond Processing Co.

Generating Capacity: 750 Kwh

Power purchase agreement with PG&E in place

Funding: Recycling Marked Development Zones (RMDZ) loan

Loan Info:

www.ciwmb.ca.gov/RMDZ/Loans/

Statewide Environmental Impact Report for Anaerobic Digestion

Purpose: Assess the environmental impacts of siting new and expanding existing anaerobic digestion facilities in California

Will reduce the need for duplicative review of anaerobic digestion facilities and expedite CEQA documentation

Target completion date: June 2010.

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Additional Projects

- **Dixon Ridge Farms Walnut Shell Gasifier, Yolo Co.**
- **CR3 Autoclave Pilot, Crazy Horse Landfill, Monterey Co.**
- **Nexterra Waste Wood Gasifier, Victoria, BC - Canada**
- **Anaerobic Digestion of Food Waste in Waste Water**

Treatment plants

Dixon Ridge Farms Walnut Shell Gasifier, Yolo Co.



**Project Funding: CA Energy
Commission & others**



Autoclave Pilot, Crazy Horse Landfill, Monterey Co.



Photo: Jacques Franco



A Joint project of the
Salinas Valley Solid Waste
Authority, USDA, CR3, HDR
and others

< Photo: USDA

Dockside Green - Nexterra Waste Wood Gasifier, Victoria, BC - Canada



Anaerobic Digestion of Food Waste Water Treatment plants (A partial list)

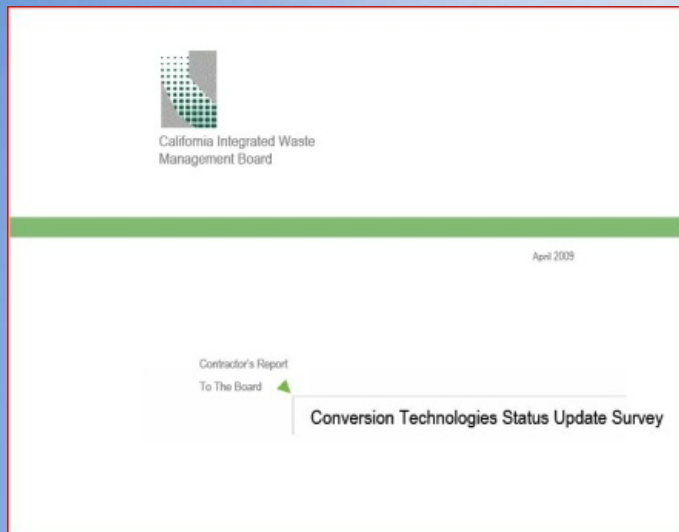
- East Bay Municipal Utility District
- Sacramento Co. Regional WWTP – SMUD
- City of San Rafael – Central Marin Sanitation
- Humboldt Co. Waste Authority
- City of San Jose



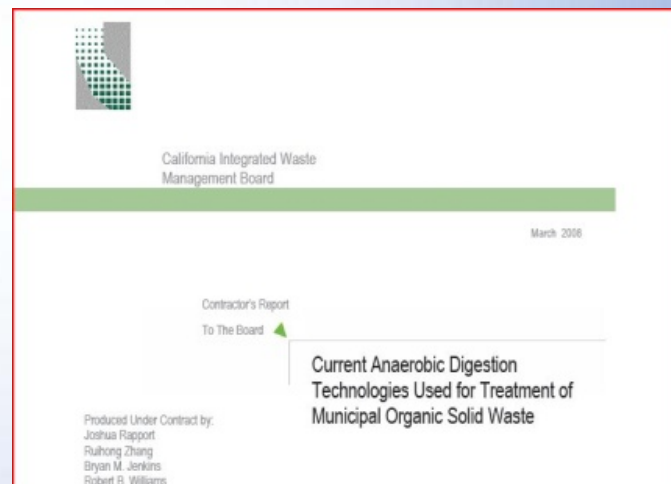
Photo: J. Franco – City of S. Jose WWTP

Recent CIWMB Publications

4/09 - Conversion Technologies Status Survey



3/08 - Current Anaerobic Digestion Technologies Used for MSW organics treatment



www.ciwmb.ca.gov/Organics/Conversion/

Resources

- Board's CT web site:
www.ciwmb.ca.gov/Organics/Conversion/
- CT mailing list: www.ciwmb.ca.gov/Listservs/
- Questions ?

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