SMUD Biomass Program for Renewable Energy

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Leader in Renewable Energy

- Successful Solar Energy Program
  - Almost 10 MW of Photovoltaic (PV)
  - Utility scale & distributed at over 900 customer sites
- "Leftovers to Lights" Program
  - *Convert local wastes and residues to renewable energy while improving the environment and providing local economic benefits*

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SMUD Core and Key Values

- Board Policy Direction (Core Values)
  - Environmental Protection
  - Competitive Rates
  - Reliability
  - Customer Relations
  - Local Control

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SMUD Core and Key Values

- Board Policy Direction (Key Values)
  - Local Benefits
  - Renewable Portfolio Standard (RPS)
  - Clean Distributed Generation
  - Research and Development
  - Economic Development

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Renewable Portfolio Standard (RPS)

12% renewables by 2006

23% renewables by 2011

includes 3% Greenergy

*Renewables are non-large-hydro renewable energy resources

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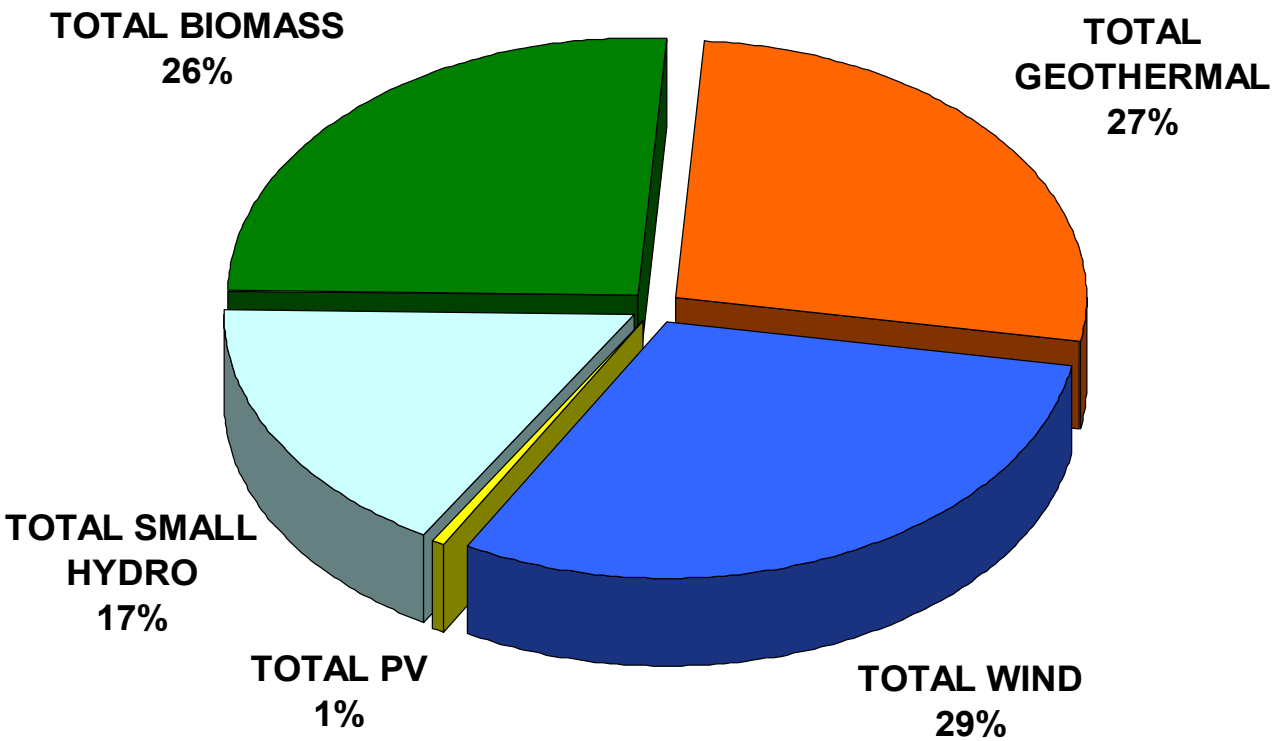
SMUD Renewables by 2006



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Developing Local Biomass

- Benefits of Local Biomass Projects
  - Relatively low cost renewable energy
  - Reduce air emissions
  - Reduce groundwater contamination
  - Mature technologies
  - Distributed energy
  - High capacity factor
  - Sustainable fuel supply
  - Serves other waste disposal purposes

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Program Structure

- Assessment & Evaluation of Resources
  - Biomass Fuels Inventory
- Research, Development and Demonstration
  - Technology improvements and demonstration
- Policy Development
  - Establish Biomass Net Metering Rate
  - Biomass Interconnection Policy
  - Input to State and local agency policies on conversion technologies or waste management policies

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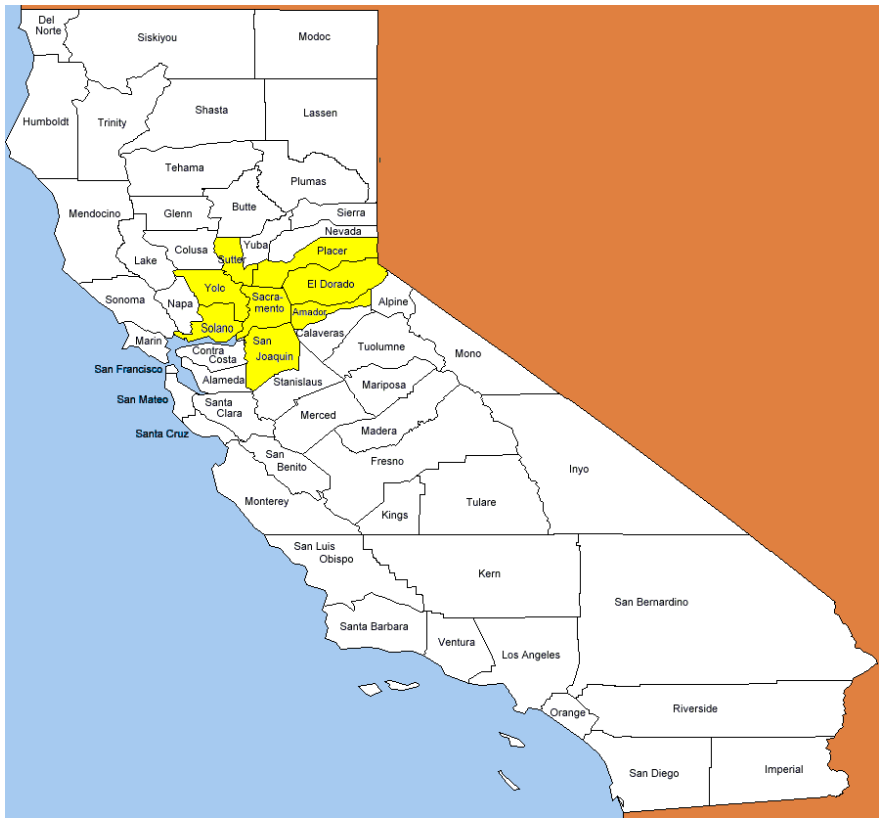
Biomass Fuels Inventory



- Sacramento and 7 contiguous counties
  - Sacramento
  - Yolo
  - Solano
  - Sutter
  - Placer
  - El Dorado
  - Amador
  - San Joaquin

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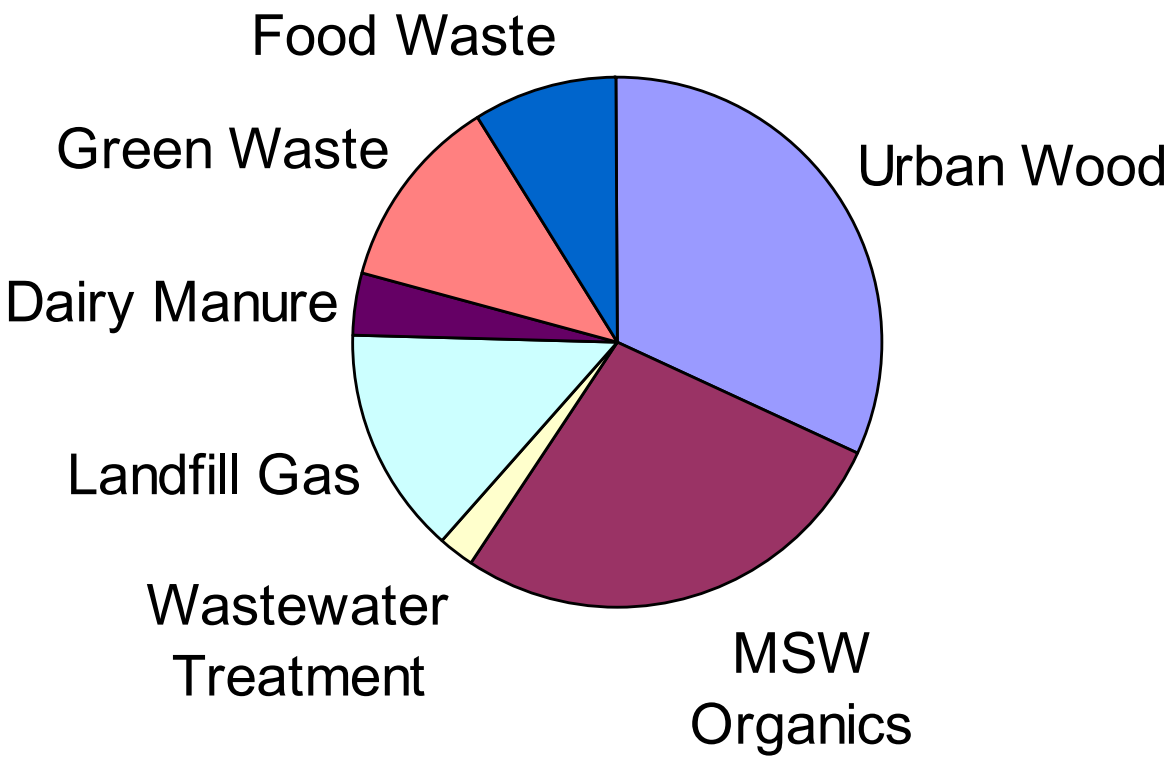
Remaining Technical Potential



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Pilot Dairy Digester Program

Covered Lagoon Digester

Complete Mix Digester

Engine Generator

- SMUD provides 13% incentive for dairy digesters to augment USDA funding, plus net metering and expedited interconnection

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Environmental Benefits – Reduction of VOCs and Greenhouse Gases

Location of Dairy	Number of Animals	*Total VOC Reduction (Lbs/Year)	**Methane Reduction (Tons/Year)	CO2 Equivalent (Ton/Year)
Elk Grove	1,435	*8,565*	534	11,738
Galt #1	1,100	6,426	172	3,776
Galt #2	1,020	6,075	204	4,489
TOTAL	**3,555**	**21,066**	**910**	**20,003**

*Based on SMAQMD Title V Emissions estimate; *VOC reduction from the dairy planning addition of food waste, is based on manure only.*

**Assuming the biogas produced contains 60% methane

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SMUD Biomass Policies

- Policy Development
  - SMUD Biomass Net Metering Rate adopted March 2005 provides net metering at retail for customers who generate up to their own energy needs
  - Biomass Hybrid Net Metering / Power Purchase approved for dairies that produce surplus energy
  - Adopted Biomass Interconnection Agreement in which SMUD acquires Renewable Energy Credits

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Research and Development

- Research and development projects:
  - Side by side test of low NOx engine
  - Community digester feasibility study
  - Testing co-digestion of commercial food waste
  - Demonstrating emission controls on small dairy
  - Demonstration of advanced technologies

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Conversion Technologies R&D

- MSW Conversion Feasibility Study (PIER)
  - Assess feasibility of converting municipal solid wastes to energy, reducing impact of 1.5 million tons/year in Sacramento
    - 46% of waste is organic fraction, paper & cardboard
  - What are the economic 'tipping points' that would make conversion feasible
  - What are the environmental benefits
  - What is the energy balance

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Assess Multiple Inputs

- Compare Anaerobic Digestion, Gasification, Pyrolysis
  - Include in analysis of emissions and energy balance
    - Transportation
    - Preprocessing
    - Conversion technology
    - Disposal of residue
    - Wastewater cleanup
    - Parasitic losses
    - Net energy
  - Include consideration of stakeholder interests
    - Environmental justice
    - Regulators
    - Citizens groups
    - Utility
    - Waste management agency
    - Waste management company
    - Economic impacts

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Strong Partnerships

- BLT Enterprises
  - Actively investigating conversion technologies for demonstration plant in Sacramento
  - Committed to finding superior resource management options
  - Engagement of waste management company is most critical part of project
- City of Sacramento
  - Agreed to adopt Urban Environmental Accords on Earthday, which includes waste reduction and renewable energy goals

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Goal: Stop Transporting our Trash

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Conversion Technologies at Transfer Stations

- Benefits our community:
  - Reduce trucking pollution
  - Reduce traffic congestion
  - Increase recycling
  - Produce renewable energy

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Green Waste to Energy Potential

- City of Sacramento is called the **City of Trees**
  - Sacramento collects 287,000 tons/year of Green Waste
  - County of Sacramento planning a 100,000 ton/year composting site for operation in 2008
  - Anaerobic Digestion is one option for the site

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AD Technology Examples

OWS - Dranco

Valorga

APS - Onsite Power
at UC Davis

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Anaerobic Digestion of Green Waste

- AD is a Viable Alternative
  - Produces high quality compost
    - Little or no odor
    - Smaller space requirement

  - Produces renewable energy supplanting fossil fuels
  - Reduces ammonia and volatile organic compounds (VOCs) normally released from aerobic composting
  - Mature technology – 85 facilities in Europe
  - SMUD would encourage a fully integrated facility

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Green Waste Feasibility Study Results

- Economic feasibility study by RIS International
  - Can produce 6 MW or 50,000 MW-hrs/year
  - Tipping fees of $45/ton needed for 50,000/ton/yr facility
- Ways to reduce costs of Anaerobic Digestion:
  - Co-locate with another facility, e.g. MRF or landfill,
  - Co-digest with food waste and non-recyclable paper waste
- Cost of aerobic composting is expected to rise
  - Air quality standards will require more costly technologies (Aerated Static Pile, Ag-Bag, In-Vessel Composting)

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Food Waste

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Food Waste Collection Options Study

- Opportunity
  - Removing organics from landfills can reduce groundwater contamination and fugitive methane emissions
  - Commercial or residential source separated food waste collection programs demonstrated in 25 other cities (SF, LA)
  - A few cities operating programs applicable to Sacramento
  - Food waste can be processed in digesters on-site at food processors, centralized plants, or wastewater treatment plants
  - UC Davis studying impacts of co-digestion with manure or green waste

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Turning Leftovers to Lights

- Emerging technologies for converting solid waste to energy meets SMUD's goals of environmental protection and renewable energy
- Significant benefits to our community are possible
- Requires significant effort, coordination, communication

Convert Local Wastes and Residues to Energy
While Improving the Environment
and Providing Local Economic Benefits

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