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***Sacramento Municipal Utility District's  
“Leftovers to Lights” Program***

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***EPA Region 9  
Byproducts Beneficial Use Summit***

**November 29-30, 2006  
San Francisco, California**

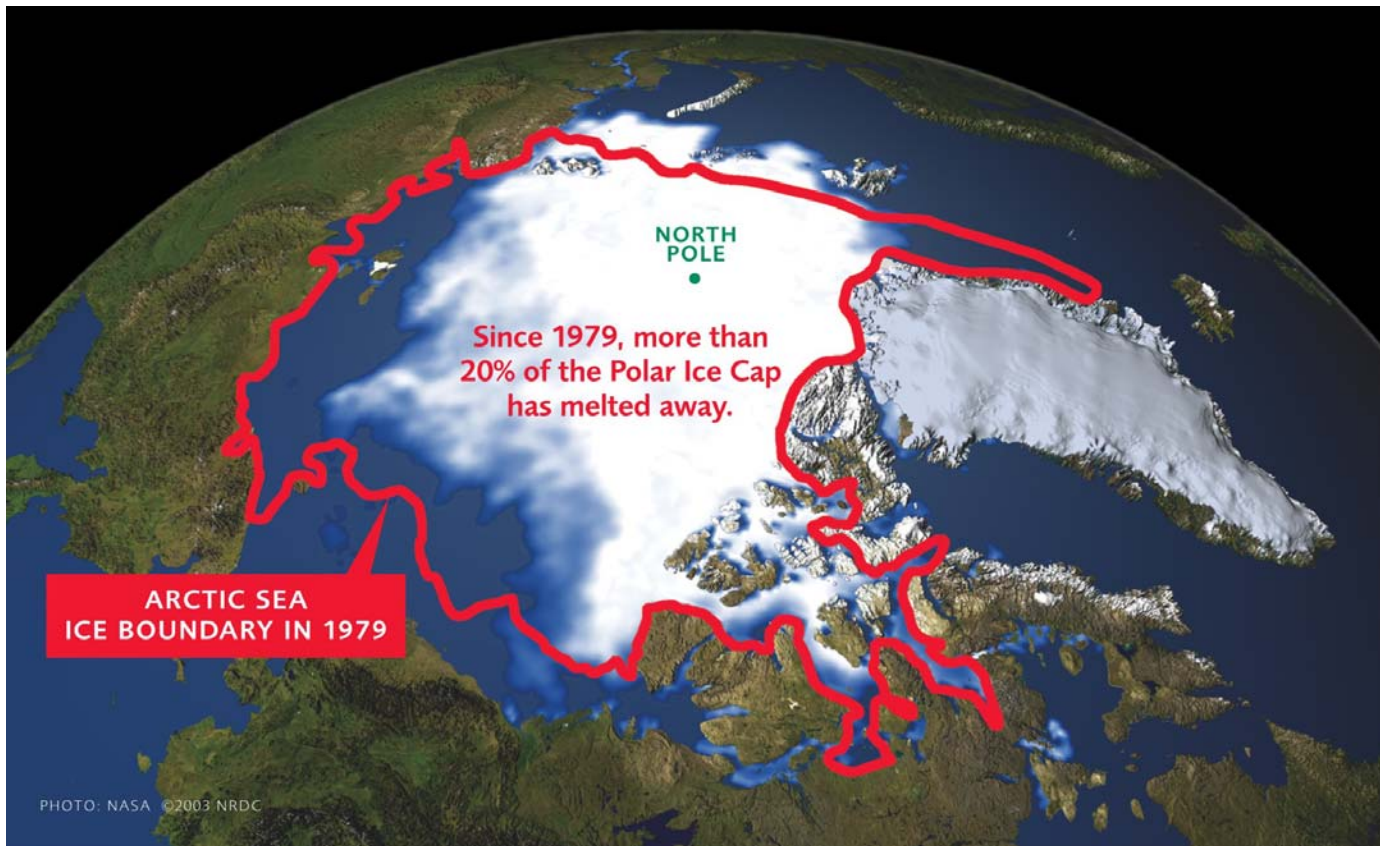
# What is SMUD ???

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- SMUD is a not-for-profit municipal electric utility
- Serves Sacramento County – 1.5 million people
- Aggressive Goals and Policies
  - Renewable Energy Goals = 23% by 2011
    - Purchase power and partner with energy providers
    - Biomass Interconnection and Net Metering Rate
  - Research and Development policy for emerging technologies
  - Environmental protection & economic development policies

# Greenhouse Gas Reduction Goals

Climate change affects our ability to generate hydropower when we need it by reducing snow load and leading to earlier melt



# SMUD's Biomass Program

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- ***“Convert untapped problem wastes and residues to renewable energy while providing local environmental and economic benefits”***
- Food waste, green waste, MSW, forest waste, agricultural waste, animal wastes, etc.
- Many methods for turning foodwaste to energy:
  - anaerobic digestion or thermal ‘conversion technologies’,
  - collection of source separated or comingled waste,
  - collection of solid or liquid?

# Leftovers to Lights Working Group Formed

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- Formed Leftovers to Lights Working Group to bring all stakeholders together to develop consensus on implementing local projects – launched July 2006
- Working Group composed of regulators, municipalities, businesses, environmentalists, researchers, and other stakeholders
- A collaborative effort to evaluate the strengths / challenges of five different approaches to diverting food waste to energy

# Strengths of Approach

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- Reduced cost of disposal
- Highest level of diversion possible
- Renewable energy generation potential
- Reduced transportation impacts (emissions, congestion)
- Marketable byproducts
- Reduced environmental impacts; air, soil, and water
- Commercially available technology
- Available expertise, examples
- Ability to site, permit

# Challenges to Approach

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- New technology may cost more than business as usual
- No free lunch – may be some environmental impacts (air, water) requiring mitigation
- Methods of preprocessing of waste need developed
- Permitting is new ground: air, water, solid waste
- Marketing of byproducts is new ground
- New technologies must be financed with little track record

# Approaches to Diverting Food Waste into Energy

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- Digested in a wastewater treatment plant
- Mixed with green waste in a compost digester
- Onsite at a food processing facility
- Co-digested in a dairy manure digester
- Pre-processed in autoclave system (steam hydrolysis) co-mingled with MSW

# Wastewater Treatment Plant Digester



East Bay MUD

# Compost in a High Solids APS Digester



# Compost in High Solids Digester



Organic Waste Systems - Dranco

# Anaerobic Digestion of Green Waste

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- AD is a Viable Alternative

- Facilities are easier to site:

- Little or no odor or emissions
- Smaller space requirement



- Technology is mature - 87 full scale facilities operating

- Produces renewable energy supplanting fossil fuels

- Composts in 30 days – 15 in-vessel and 15 out

- Cost is \$45 to \$50 / ton for co-located processing

- Reduces ammonia and volatile organic compounds (VOCs) normally released from aerobic composting

# Environmental Benefits of AD

- Reduction of Ammonia and VOC emissions

**Sacramento Emissions Forecast Comparison**

	NH <sub>3</sub> Rate [lbs/ton GW]	VOC Rate [lbs/ton GW]	(260,000 [tons GW/year])	
			NH <sub>3</sub> [tons/year]	VOC [tons/year]
Aerobic Composting*	0.85	3.84	111	500
Anaerobic Digestion	0.03	0.15	4.4	20

\* rates taken from SCAQMD Assessment for PR1133

# Food Waste Lagoon Digester



Valley Fig Producers Cooperative in Fresno

# Codigestion in Dairy Manure Digester

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RCM Digesters, Inc.  
Matlink Dairy  
Clymer, NY  
900 Cows & Organics

Complete Mix Digester  
Biogas since Nov. 2001  
135kW Generator  
100,000 cu. ft. Per Day



# High Pressure Steam Hydrolysis



CR3, CSG, RCR, WWI

# Co-digestion in Wastewater Treatment Plant (WWTP)

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## ● Benefits of Approach

- Excess capacity exists at regional WWTP
- Feasibility of co-digestion with grease trap waste and liquid food waste is well established
- Existing infrastructure and anaerobic digestion professionals already on site
- Biogas is already used at SMUD cogeneration facility
- Economic feasibility study in progress



# Co-digestion in Dairy Digester

## ● Benefits of Approach

- Co-digestion is well established in Europe and several states in U.S.
- Increased biogas production can make farmer-owned digesters more economically viable
- Additional nutrients in food waste can be used by crops when kept to agronomic loading rates
- Research in progress to quantify environmental impacts by Conestoga Rovers, UC Davis, and Woods End Research Laboratories

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# Managing Nutrients from Codigestion

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- UC Davis Biological / Agricultural Engineering Department tested codigestion of manure and food waste from several sources
- Input results in Complete Nutrient Management Plan using Dairy Planning Tool (DPT) v 3.0
- DPT looks at salt loading on soils, calculates number of cows, and sets standard based on Total Dissolved Solids (TDS) from manure
- Management of food waste additions based on salt is more feasible and relevant than TDS

# UC Davis Food Waste Survey

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- Goal to identify volume and types of their organic waste resources in and adjacent to Sacramento
- UC Davis researchers surveyed local food waste generators: businesses, industries, & institutions
- 45 businesses and institutions participated; 21 in SMUD's service territory
- Estimated 4.7 MW of potential generation of combined waste streams from all surveyed companies

# UC Davis Food Waste Survey

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- Survey provided preliminary technical feasibilities:
  - Only one local company could build an anaerobic digester dedicated to its own waste stream
  - Two companies could host a centralized anaerobic digesters and potentially bring in wastes from other companies, if permitted
- Source separated “solid food waste” is 70% water
- Majority of waste (4/5) found to be high moisture

# Low Moisture Streams

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	Dry matter (ton/year)	Electrical Power (kWe)
5 Fruit and vegetable	8,484	484
1 Winery	6,480	369
1 Cannery soup	686	39
1 Bakery	645	29
2 Meat	43	2
Grain and fiber		
1 processing	29	1
<b>Total</b>	<b>16,368</b>	<b>925</b>


# High Moisture Streams

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		Dry matter (ton/year)	Electrical Power (kWe)
4	Meat	13,263	1,114
6	Wineries	12,642	1,061
4	Tomato canneries	7,773	653
	Fruit and vegetables		
7	distribution	802	67
4	Fruit canneries	632	53
2	Schools and Prisons	309	26
2	Health care	67	6
3	Hotel	31	3
	<b>Total</b>	<b>35,518</b>	<b>2,982</b>

# Wastewater Streams

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	<b>BOD<sub>5</sub></b> <b>(ton/year)</b>	<b>Electrical</b> <b>Power</b> <b>(kWe)</b>
<b>3 Tomato Canneries</b>	<b>3,167</b>	<b>357.2</b>
<b>1 Milk Processor</b>	<b>1,318</b>	<b>148.6</b>
<b>2 Fruit canneries</b>	<b>1,195</b>	<b>134.7</b>
<b>1 Cannery soup</b>	<b>1,038</b>	<b>117.1</b>
<b>3 Vineyards</b>	<b>575</b>	<b>64.9</b>
<b>1 Meat</b>	<b>43</b>	<b>4.8</b>
<b>Total</b>	<b>7,336</b>	<b>827</b>

# An Opportunity to Collect as Liquid Waste



Grinding food waste onsite into a slurry that is stored in an odor-free underground tank for collection as a liquid



# Efficient Liquid Collection System



Reduced collection frequency  
= less cost and less trucking



# 5:1 Size Reduction from Grinding

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# Benefits of On-site Food Grinder

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- No odor and vermin, in-ground fiberglass tank is cool and ventilated
- Reduces volume to 1/5 compared to solid waste bins
- Reduces frequency of collection from every 3 days to twice a month = less truck traffic
- Collection is easy using pump truck, no interruption to store personnel
- Small in-store footprint
- Can handle any type of waste, fruit, vegetables, meats, grease
- This example is the Organic Resource Recovery System (ORRS) patented system at [www.nationalchallenge.com](http://www.nationalchallenge.com)

# Thinking Outside of the Bin

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- The waste bin, that is...
- SMUD plans to test new concepts in waste collection, such as 'liquified' organics
- Current regulations are based on collecting solid waste co-mingled with putrescibles for landfill disposal – this needs to expand
- High cost of fuel and impacts of global warming compels us to start 'thinking outside of the bin'



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# Questions?



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