



Zero Waste Next Phase: Soothing Climate Change

Organics Recovery grows Green Energy, Jobs and Agriculture

Belo Horizonte, Brasil - May 2014

Kevin Drew, SF Residential Zero Waste Coordinator



SF Environment

Our home. Our city. Our planet.

A Department of the City and County of San Francisco

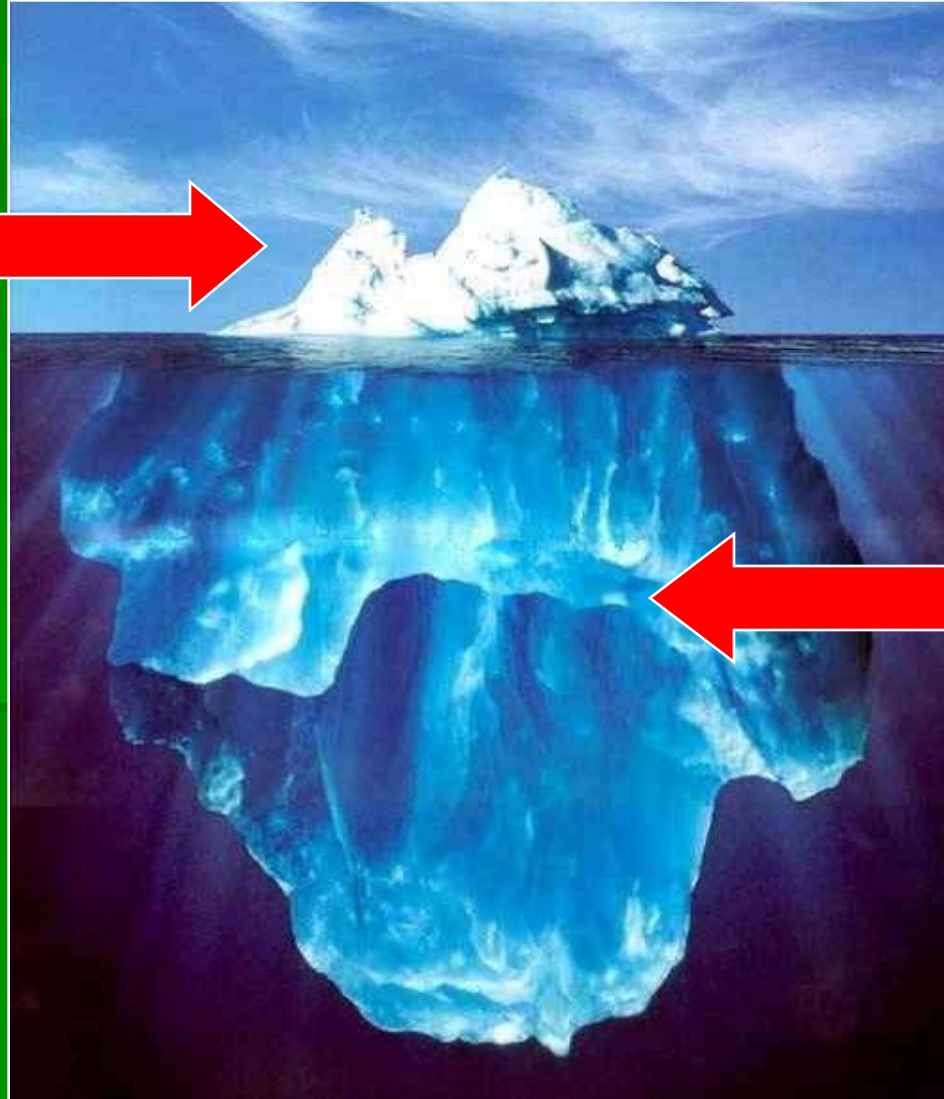
2 Overarching Points

- Upstream processes create 71 times more impact than what ends up in cities
- Comprehensive Zero Waste in our cities can dramatically reduce GHG



Tip of the “Wasteberg” Impact

Municipal waste
tip of the
“wasteberg”



Upstream waste
produced is 70
times greater than
at municipal level

History Matters:

Same local hauler for over 80 years –
Recology Waste Zero



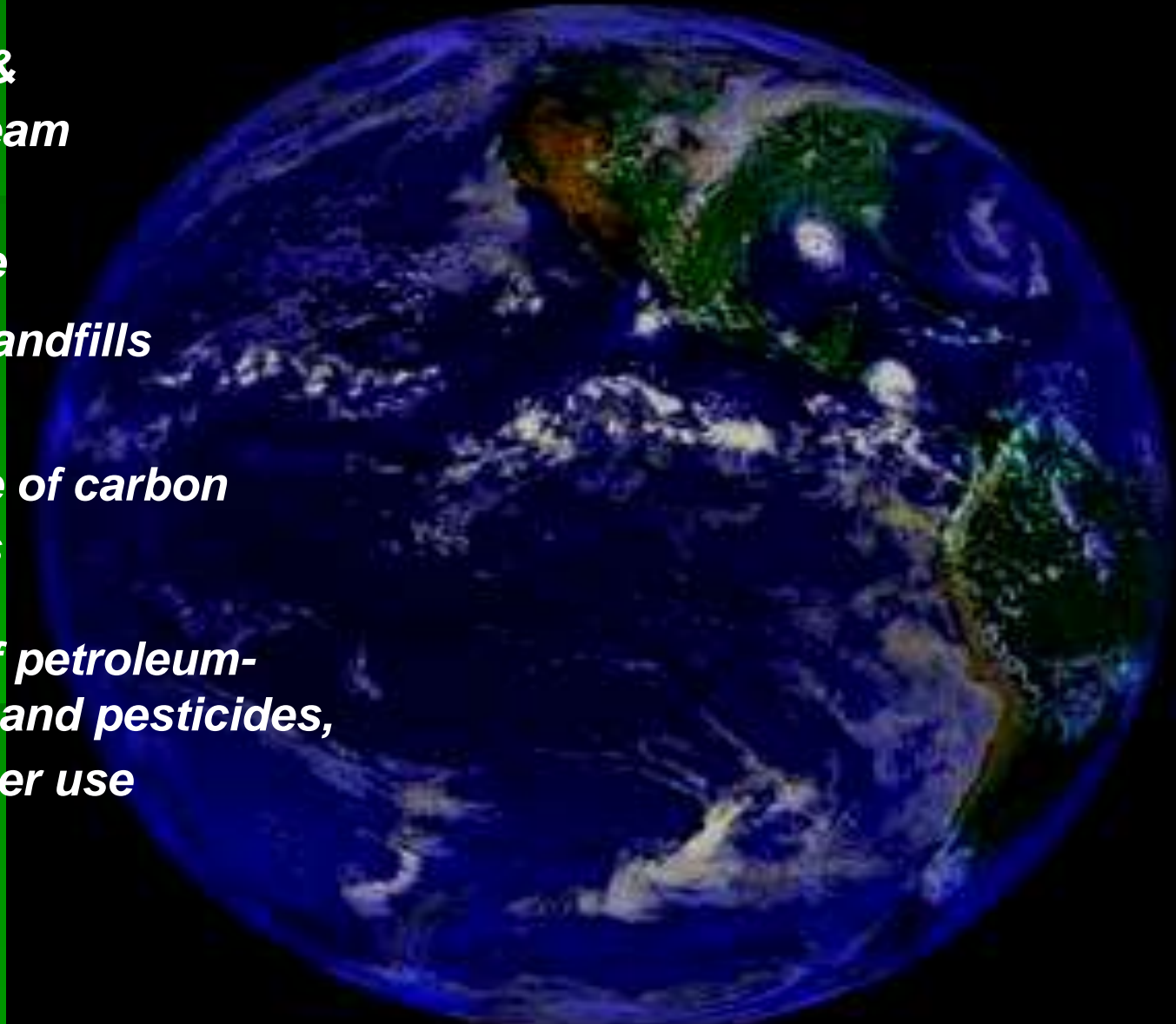
Climate Change and Waste Diversion

Reduces energy & emissions upstream

Reduces methane emissions from landfills

Increases storage of carbon in soil & biomass

Decreases use of petroleum-based fertilizers and pesticides, and reduces water use



Diverting Food and Other Compostables From Landfill Sustains Soils and Closes Organics & Nutrient Loop



Nutrient Rich Compostable Food



We eat food for the calories, the same food create energy and soil amendments

Disposal: lowest in 40 years

Look at organics grow!

Year	Disposal to landfill	Compostables collected	Diversion
2000	872,731	21,072	46%
2005	664,033	85,395	69%
2007	617,883	91,505	72%
2008	560,330	103,749	77%
2009	475,800	>120,000	78%
2010	434,398	>130,000	80%
2015	300,000	>200,000	~85%

Norcal's "Jepsen Prairie Organics" Regional Composting Facility 300 TPD using 15 acres

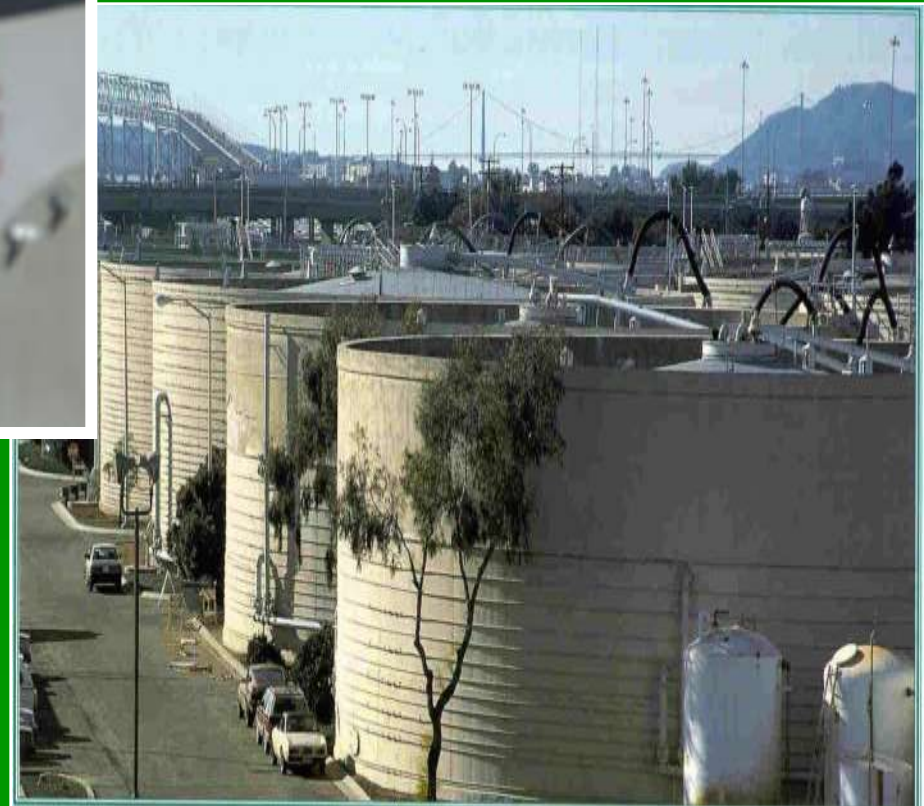


Recology Company Composting Facility allows 600 tpd on 15 acre site

Engineered Compost Systems (ECS)



Food Scrap Digestion to Energy Process



Nutrient Rich Compostable Food



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Renewable Natural Gas: Enough for MUNI and Recology

- 2010 - Organics collected, but not yet digested
- 130,000 tons Organics recovered yields
- 391,213,370 scf natural gas =
- Over 3 Million gallons of vehicle fuel

- 2015 -
- 200,000 tons Organics recovered yields
- 601,865,180 scf natural gas =
- 5 Million gallons of vehicle fuel

Future Zero Waste, Green Energy and Employment Facility



5 Million gallons of fuel from organics, all SF city trucks & buses

Biogas Plant BIGA, Engstingen



BIGA Energie GmbH + Co.KG

Erwin - Rommel - Str. 25

D-72829 Engstingen

Commissioning:	2008
Expansion:	2010
Electrical Output:	900 kW
Digester :	2 x 1,750 m ³
Post-digester:	1 x 1,300 m ³
Substrate:	
Kitchen waste, supermarket waste, expired food	16,000 t/a

Special features

- feedstock processing and elimination of impurities
- earthquake protection in foundation and starter ring
- located in water protection area
- High standard for odor protection

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SF Zero Waste Toolbox

- ❖ Policy
- ❖ Programs
- ❖ Equipment, facilities
- ❖ People
- ❖ Technology

San Francisco's Zero Waste Goals and Policies to Support Them

- ❖ 50% Diversion by 2000 – AB939 State Mandate in 1989
- ❖ In 2003 we adopted a goal of Zero Waste by 2020
- ❖ 75% Landfill Diversion by 2010 SF Goal – at 80% in 2010 including “Highest and Best Use” of Materials and require Consumer and Producer Responsibility (EPR)
- ❖ Construction & demolition ordinance required landfill diversion
- ❖ Banned Plastic Bags and Styrofoam, put a fee on bags
- ❖ Mandatory Recycling and Composting Ordinance and C&D

Three Stream Collection Program for Residents and Businesses



Recyclables & Trash Collected Using Dual Compactors Weekly for Residents



Composting & Recycling Collection Designed For High Diversion



Glass and Plastic
Aluminum and Steel
4%

Recyclable
Paper
21%



Food Scraps
20%



Plant Trimmings
5%

Compostable Paper
& Fiber 10%

Construction and
Demolition Waste
25%



Other
15%



All % numbers by
weight or tons

Material Recovery Facility (MRF) Sited in SF w/ Access to International Markets



Maintain local processing jobs for union waste collection workers



By 2020 - Fuel all Recology & Muni vehicles, create 200+ new green jobs



Environmental stewards from the community for every neighborhood maximize organics collection



Residuals from digestion and yard trimmings create compost used on organic farms and vineyards to build healthy soils



This is soothing to the climate



Thank You

**Kevin Drew
San Francisco
Department of the Environment**

**www.sfenvironment.org
kevin.drew@sfgov.org
415-355-3732**



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Websites and links

www.sfenvironment.org/zerowaste

www.recology.com/compost

www.sfzerowasterates.com/why/

www.stoptrashingtheclimate.org

www.no-burn.org

Things to think about . . .

- ❖ Informal vs Formal
- ❖ Cooperative vs corporate
- ❖ Big vs small –Recology vs WMI
- ❖ Capital, equipment, facilities, people
- ❖ Sole source vs competitively bid
- ❖ Competitively bid vs lowest bid
- ❖ Technology . . . it keeps coming
- ❖ Markets – volatile, complex, critical

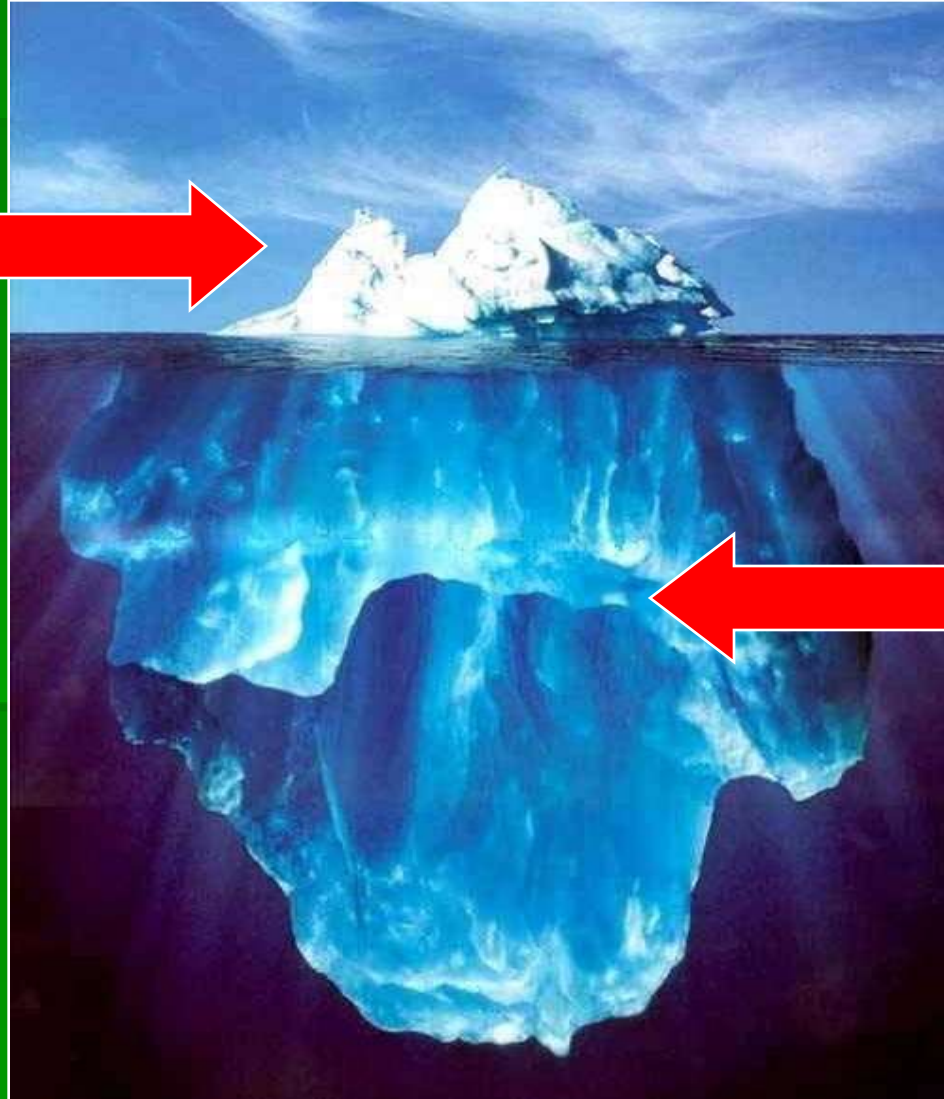
U.S. Biogas Potential and Cost by Vertical



Average US Cost per MW: \$5.74 million¹
Average Cost per Project: \$12.6 million

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A Large City Food Waste Opportunity



- 600 t/d SSO stream of high quality
- 6.4 MW or 4.2 million GGE potential
- City is keen on AD solution
- City interested in CNG
- Hauling cost for composting saved
- Truly green solution that is proven at scale (Nat. Geographic Dec 2012)
- Utility is interested in base load at core demand center
- Adjacent counties could be interested in green solution as well
- Operator sensitive to CapEx and technical risk

Websites and links

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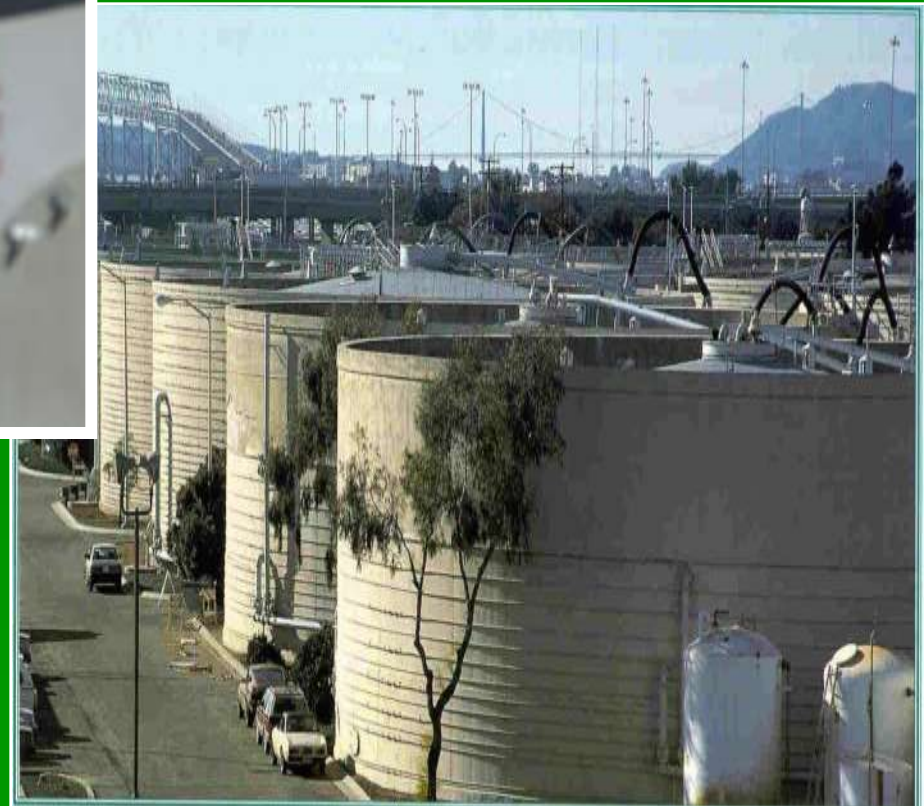


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 - 3,228,044 gallons of vehicle fuel =
 - 200 Recology trucks and 30% MUNI
-
- 2015 -
 - 200,000 tons Organics recovered yields
 - 601,865,180 scf natural gas =
 - 4,966,209 gallons of vehicle fuel =
 - 200 Recology trucks and 60% MUNI

Composting & Recycling Collection Designed For High Diversion



Glass and Plastic
Aluminum and Steel
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Recyclable
Paper
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Food Scraps
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Plant Trimmings
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Construction and
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All % numbers by
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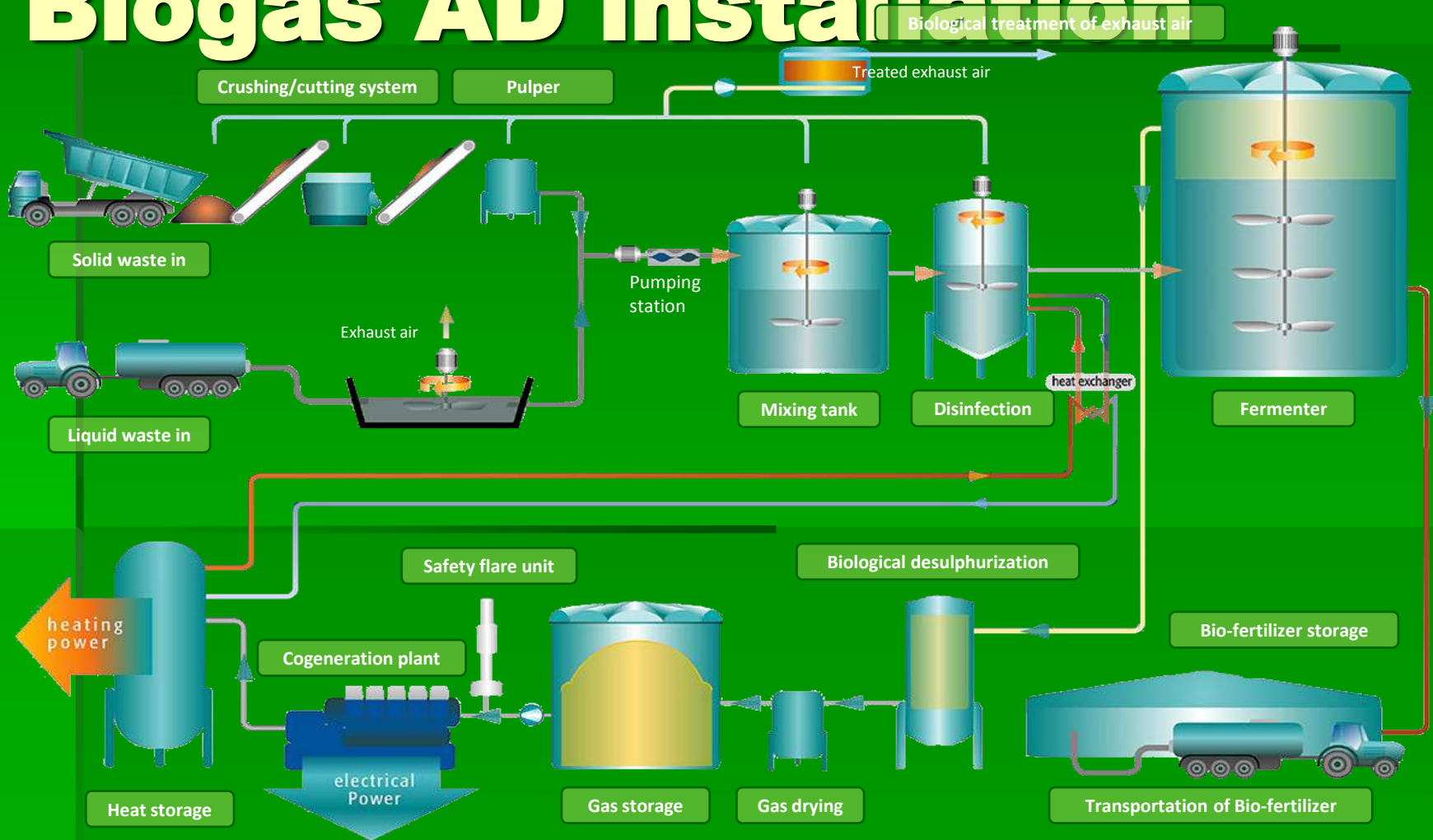
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Typical SSO and MSW Biogas AD installation



Food Waste CapEx & Revenues



Methane Yield

600t FM/d
87.0 m³ CH₄/ t FM

Operations

156,000 t/y

Methane Potential

13,575,523 m³ CH₄/ year

479,362 mmBTU/year

4,204,927 GGE/year

Electric Yield @ 42%

59,004,564 kWh/year

Name Plate @ 95%

6.40 MW

Electric Revenue @ 8.5c/kWh \$ 5,015,388

RNG Revenue @ \$12/mmBTU \$ 5,752,340

CNG Revenue @ \$22/mmBTU \$ 10,545,957

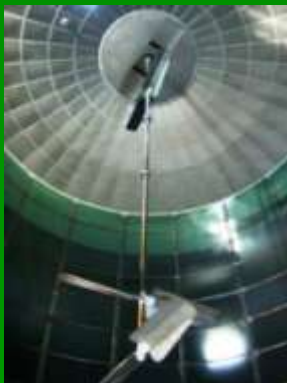
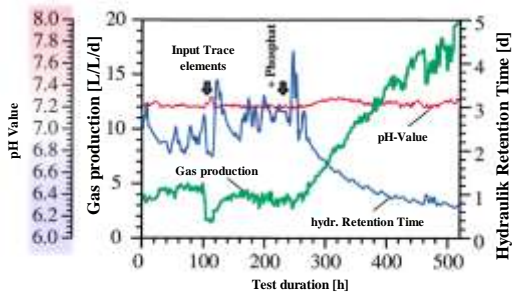
CapEx Est. Electric

\$ 28,800,000

CapEx Est. CNG

\$14

Nutrients and trace elements supplementation



**This is what we
build.**



Biogas Plant Portland, OR – 500 t/d Design Specs



Some Facts on Biogas

- Anaerobic reversal of photosynthesis
- 3,000 year old “technology”
- Base or peak load domestic energy
- GHG negative
- Eliminates Ag/compost odor
- Grid-competitive at \$3/W CapEx
- 7,600 biogas plants in Germany with 3.2 GW and 175,000 Nm³/h Biogas and 41,324 jobs
- Max. FIT in Germany: 16-24 c/kWh
- Bioenergy in Germany is

