



Renewable Biogas: Pipeline Biomethane for California

CEC Low-Emission Vehicle Workshop

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- **Biogas to Biomethane – Flexible, Renewable Fuel**
- **Technology and Economics -- Technology “There”, Economics “On the Cusp”**
- **Our View of “Where We are” – Close of “Study” Phase**
- **What Needed Now – Commercial Demos and Policy Support**

Sempra Energy Utilities Combined Service Areas

- **Southern California Gas**
 - Largest LDC in U.S., 5th globally
 - 20.5 million consumers
 - 5.7 million natural gas meters
 - 20,000 square mile service territory

- **San Diego Gas & Electric**
 - 3.4 million consumers
 - 840,000 natural gas meters
 - 4,100 square mile service territory

- **Combined Service Territory**
 - 13 counties/242 municipalities
 - 23 million consumers/7 million households
 - 2008 Sendout = 1007 Bcf
 - 63,000 miles of pipe
 - 131 billion cubic feet of gas storage capacity



Clean Transportation Program – Multiple Solutions

- There are a number of viable Clean Transportation solutions
- Technology advancement, market development, relative fuel price and duty cycle will dictate
- NGV will play an important role – biogas is particularly important



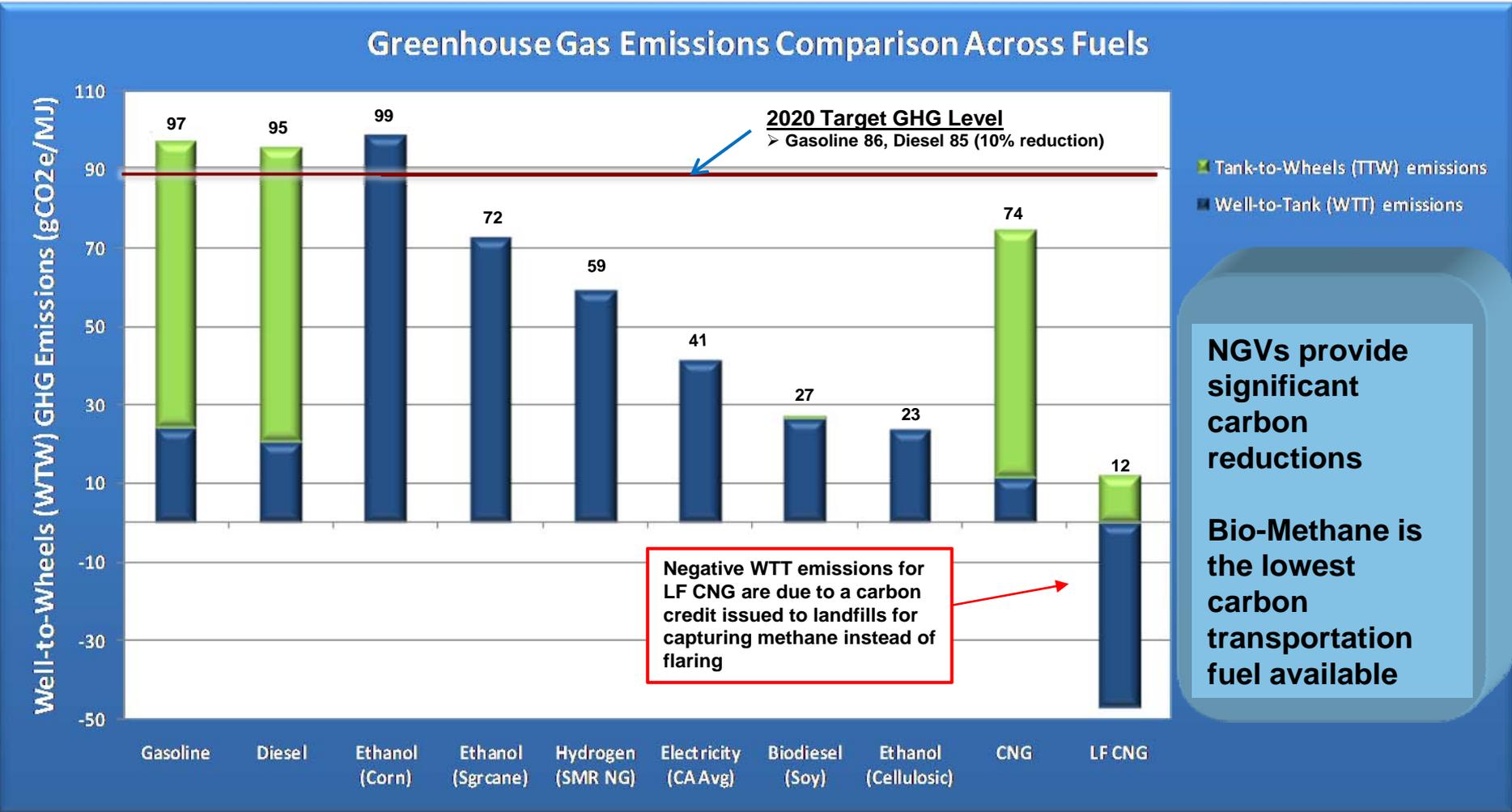
NGV Home Refueler



EV charging portal



Biogas = Lowest GHG Vehicle Fuel Pathway

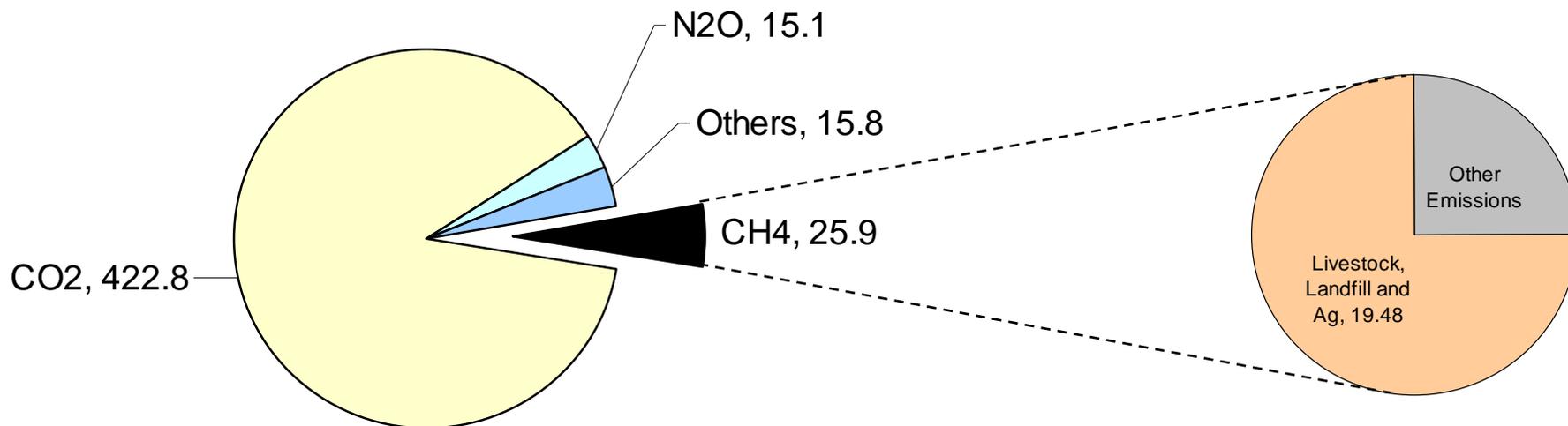


Source: CARB

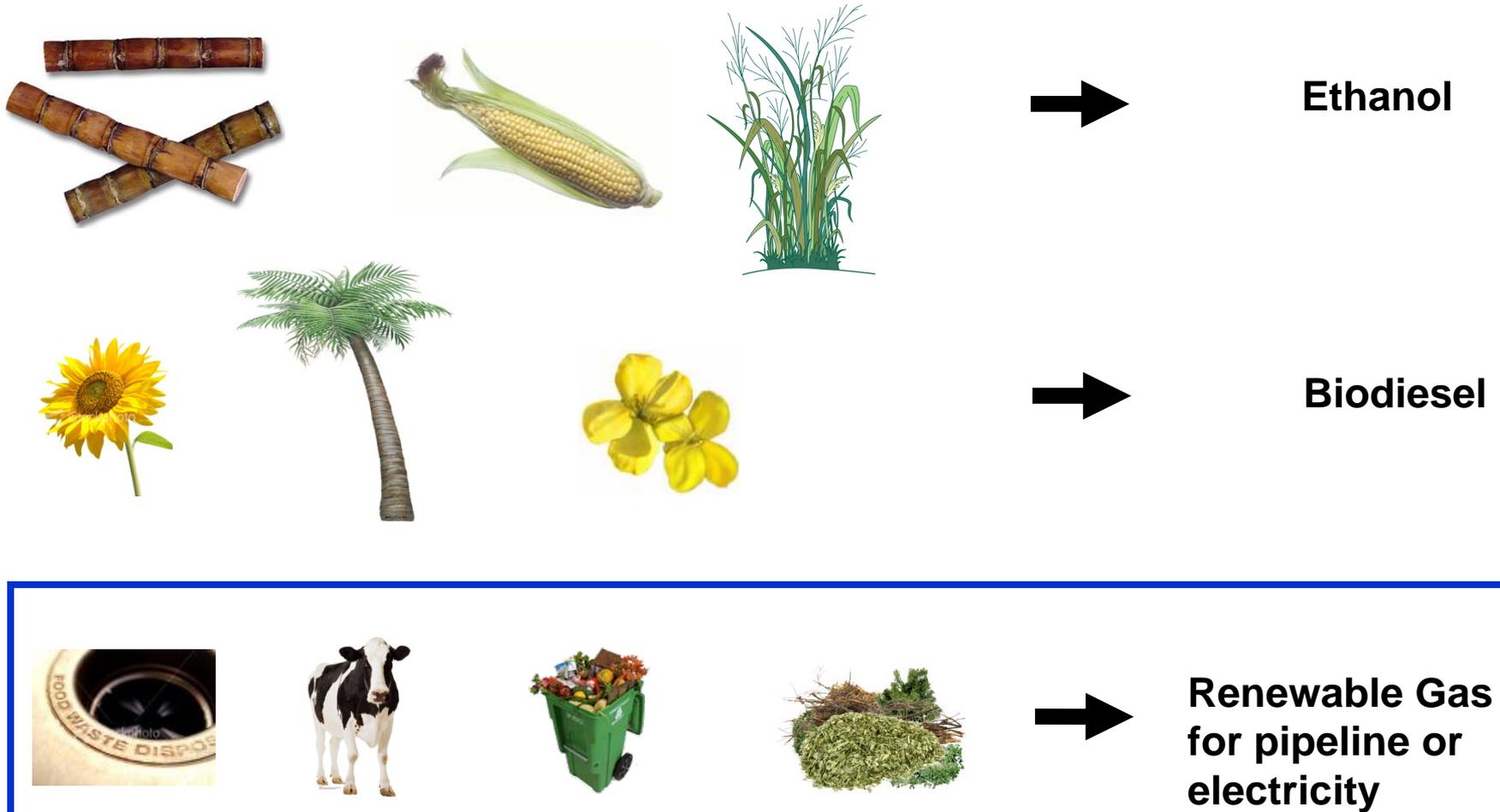
Methane Capture (Waste Streams) Multiplies GHG Benefit

- CH₄ 21x more potent GHG than CO₂ - if not captured or flared it winds up in the atmosphere
- Most atmospheric methane comes from waste streams

CO₂ Equivalent Tons per Year
Methane about 5% of total

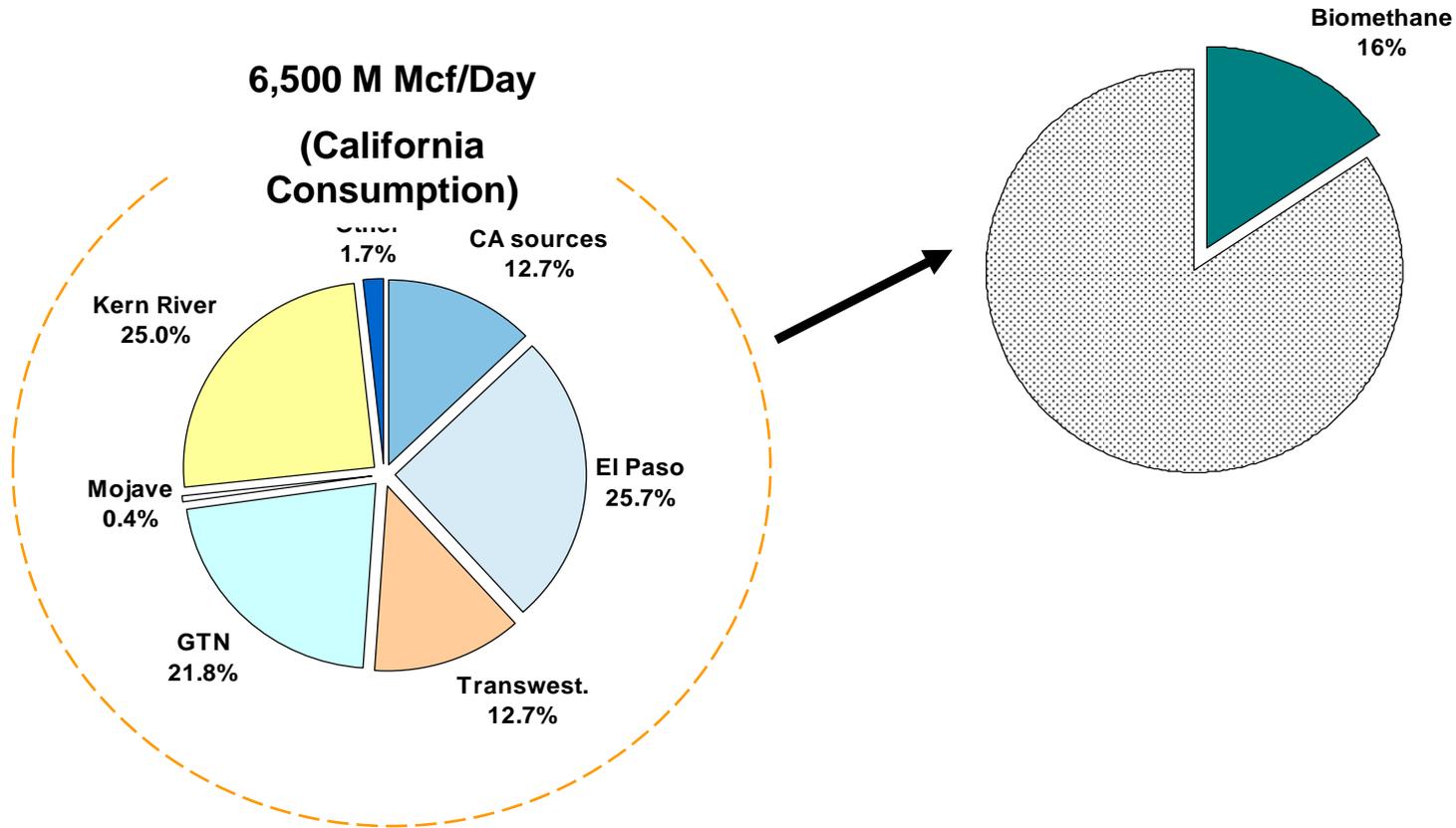


Biogas Comes From a Variety of Waste Streams



- Biomethane is the methane extracted from renewable gas

The Resource Potential is Significant



Source: California Bioenergy Working Group

Future Energy Crops Make Potential Nearly Unlimited



Wastewater or Dedicated Digesters

Processed Algae Crop to Digesters

Biomethane



Generation Block

Power Plants Around the World

Exhaust Gas Feeds Algae



Algae Ponds

Demo Scale

- 1-2 MW (or slipstream)
- ~10 acres

Commercial Scale

- 100's of MW
- 1000's of acres

Our Focus is Pipeline Biomethane – Renewable, Dispatchable, Leverages Infrastructure

- **Renewable**
- **Interchangeable, storable, and dispatchable**
- **Maximizes existing infrastructure**

Requires less new infrastructure than other renewables – limited relative footprint

 - Gas pipelines
 - Gas storage fields
 - Electric power plants
 - Some existing digestion infrastructure
 - Requires new conditioning and additional digestion infrastructure
- **Assignable to highest value use: renewable generation, transportation or end use**

Extensive Feasibility Assessment Over Past 2 Years

- **Gas Quality – Guidelines now available under Rule 30**

- **Conditioning**
 - Technology available
 - Scale sensitive
 - Commercial demo in progress

- **Anaerobic digesters**
 - Large tank digesters a challenge without tipping fee
 - Dairy lagoon digesters more economic (if clustered to 10,000+ cows)

- **Gasification and Methanation -- developmental**

Gas Quality Considerations

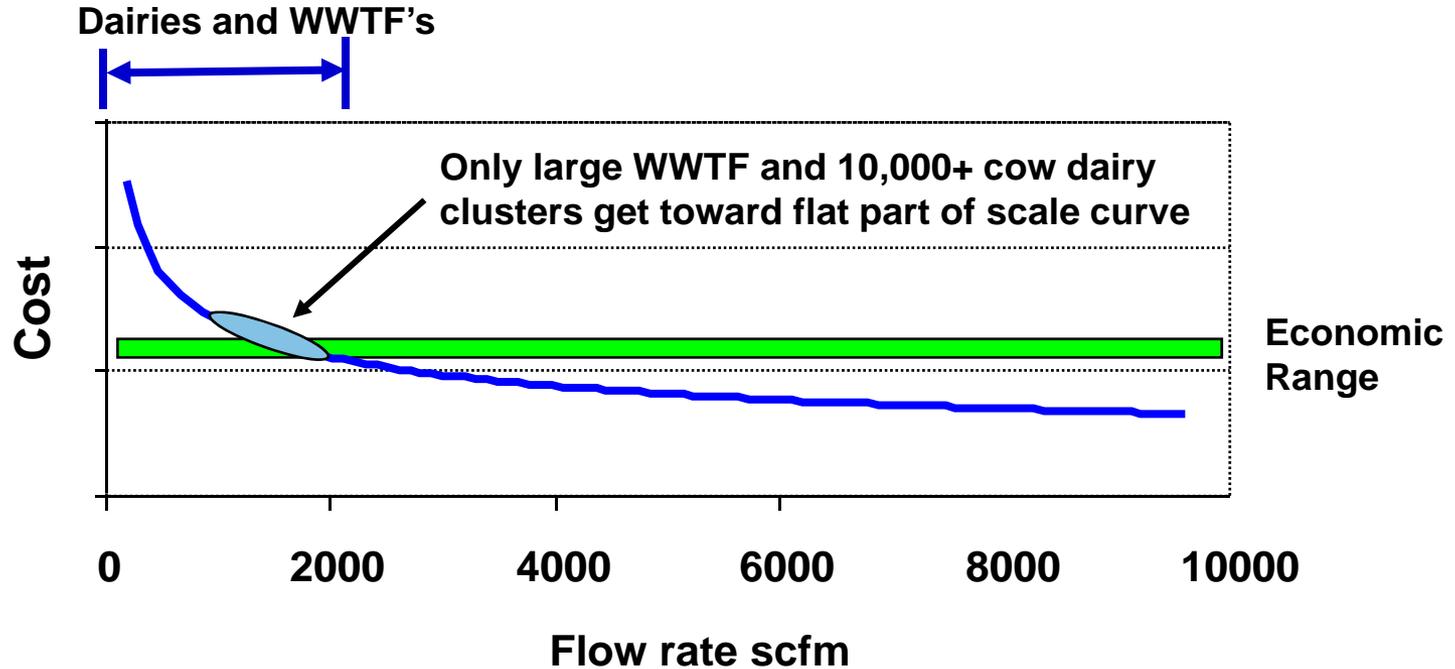
- **SoCalGas has undertaken internal studies and incorporated findings from Gas Technology Institute (GTI) to develop test and monitoring protocols to ensure compliance with existing gas quality standards (our Rule 30)**

Trace Constituents for Biomethane:

- Hydrogen
 - Ammonia
 - Halocarbons
 - Siloxanes
 - Volatile Organic Compounds and SVOC
 - Vinyl Chloride
 - PCBs
 - Pesticides
 - Pharmaceuticals/ Animal care products
 - Mercury, Volatile Metals
 - Formaldehyde, Aldehydes and Ketones
 - Volatile Fatty Acids (VFAs)
 - Biologicals
-
- **Have determined that a number of technologies are capable of processing biogas to pipeline quality including Pressure Swing Adsorption (PSA), membranes, cryogenic distillation and amine scrubbing**
 - **Demonstration will allow refinement of protocols**
 - **Note – Rule 30 prohibits introduction of landfill gas on our system**

Conditioning to Pipeline Quality Can Be Cost Effective at Scale

Illustrative



- Scale economies
- Availability and cost of capital

What it Looks Like -- Conditioning

Pressure Swing Adsorption Example



**Feed
Compression**



**Conditioning
Unit**

**Product
Gas to
Flare**

**(Possibly
pipeline
later)**

**Tail Gas
To Flare**

What it Looks Like – Tank Digester Farm (Germany)



What it Looks Like -- Gasifier



- 1 Crushed Green waste
- 2 Gasification process
- 3 residue
- 4 Syn Gas

Our Policy Perspectives on Renewable Biogas

1. Utilities can play a key role in market development for renewable gas:

- Establish clear **requirements** and processes for interconnection
- Ensure adequate **infrastructure** to accept
- Maintain streamlined **processes** for contracting for gas or power sales
- **Develop and own** renewable gas production facilities within state Electric and Gas Procurement guidelines (such as the California hybrid market structure)

1. In potentially competitive areas, utility projects and services should be pursued on a **competitively neutral basis** that does not interfere with competitive markets
2. Where it supports Commission policy goals, utilities can play a role in **stimulating market development** through incentive programs in areas such as emerging technology development, education and outreach
3. Policies should be even-handed in supporting all cost-effective renewable and low-carbon resources – currently, no **incentives** are in place for pipeline biomethane

What's Needed Now

- **Commercial pilots**
 - **Validate economics**
 - **Provide operating data**
 - **Establish reference projects to support future financing**

- **Policy Support from State (and Possibly Federal) Level**
 - **Siting and permitting / EIR**
 - **Credit and technology risk support (e.g. loan guarantees)**
 - **Even treatment of pipeline biomethane in program qualification (RPS, SGIP, LCFS) and incentives (PTCs and ITCs)**