Statewide Energy Efficiency Forum

Biomethane @ PG&E

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Gas Operations

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Serves nearly 16 million people throughout a 70,000 square-mile service area

Operates approximately 6,700 miles of gas transmission pipeline and ~ 42,800 miles of gas distribution pipeline

4.4 million natural gas customer accounts

Delivers approximately 1 trillion cubic feet (Tcf)/year (2.8 billion cubic feet (Bcf)/day, and 5.0 Bcf/day peak)

Approximately 105 Bcf of gas storage

Gas System Operations – Safe and reliable operations of Transmission and Distribution 24x7
California Greenhouse Gas Reduction Goals and Historic Emissions

Million metric tons CO$_2$e

- **AB 32** requires California to return to 1990 levels by 2020
- **SB 32** requires California to reach 40% below 1990 levels by 2030
- **Executive Order S-3-05 (2005)** requires 80% below 1990 levels by 2050
Renewable Natural Gas

1. Organic waste
2. Anaerobic digestion
3. Biogas
4. Purification
5. Biomethane

- Cows and grass field
- Pipe and tank system
- Industrial cleaning facility
What is biomethane?

Biogas is *not* Biomethane

Biogas MUST be treated to meet pipeline quality specifications in PG&E’s gas Rule 21 as approved by the CPUC and *before* it can be transported through the utility pipeline system.
Protecting Pipeline Integrity

Ammonia       Biologicals    Hydrogen
Mercury       Siloxanes

Corrosion, Brittleness, Rupture
Protecting Our Health

- Arsenic
- p-Dicholorobenzene
- n-Nitroso-di-n-propylamine
- Vinyl Chloride
- Antimony
- Copper
- Hydrogen Sulfide
- Lead
- Methacrolein
- Toulene

Exposure to Toxins, Cancer
## Pipeline Interconnection

<table>
<thead>
<tr>
<th>Key Factors</th>
<th>Details</th>
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<tbody>
<tr>
<td><strong>LOCATION</strong></td>
<td>Location of a biomethane plant relative to existing gas lines plus environmental complexities</td>
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<tr>
<td><strong>CAPACITY</strong></td>
<td>Whether existing natural gas lines have the capacity to receive biomethane amounts produced by developers.</td>
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<td><strong>PRESSURE</strong></td>
<td>Pipeline pressure at site of potential injection point.</td>
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<tr>
<td><strong>DEMAND</strong></td>
<td>Whether gas demand (volume and load profile) downstream of the point of injection is sufficient to match supply.</td>
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Pipeline Interconnection Process

1. Developer Intake
2. Initial Feasibility
3. Design Scope
4. Prelim. Estimate
5. Project Execution
INITIAL FEASIBILITY STUDY

1. **Developer Intake:** First PG&E contact and project interconnection request form

2. **Initial Feasibility:** System Planning determines injection location

<table>
<thead>
<tr>
<th>CURRENT TIMEFRAME</th>
<th>CURRENT AVERAGE DEVELOPER COST</th>
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<tbody>
<tr>
<td>~3 Weeks</td>
<td>No cost</td>
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DESIGN SCOPE & PRELIMINARY ESTIMATE

3. **Design Scope**: High level site, route, land and permitting assessment

4. **Preliminary Estimate**: High level project cost analysis

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<th>CURRENT TIMEFRAME</th>
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<td>~20 Weeks</td>
<td>$50K</td>
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CONTRACT & EXECUTION

5. Project Execution: Formal project design and construction

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<tr>
<th>CURRENT TIMEFRAME</th>
<th>CURRENT AVERAGE DEVELOPER COST</th>
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<tr>
<td>12-24 Months</td>
<td>$2-6M</td>
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The source and volume of the gas will dictate exactly what type of monitoring equipment is required.
Public Supply Capacity Absorption Map

- Online mapping tool to allow project location screening by Developers
- Pipeline segments color coded based on absorption volume potential
Trucked Biomethane

Raw Biogas  Biomethane  BioCNG  Biomethane  BioCNG

Producer Owns & Operates  PG&E Owns & Operates  PG&E or 3rd Party CNG Station
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Heavy Duty Transportation

- Lower emissions
- Comparable range to diesel
- Proven technology
- Compatible with existing trucks
Hydrogen / Power-to-Gas

- Store renewable energy in the form of hydrogen or methane
- Cost effective when electric prices are low – overgeneration
- Enables greater renewable penetration
Contact PG&E

Biomethane information:
pge.com/biomethane

Biomethane Interconnection Questions?
Email: biomethane@pge.com