Renewable Natural Gas

California Climate Action Planning Conference
Southern California Gas Company

- Largest natural gas distribution utility in US
- Service territory of 20,000 square miles
- Serving 20.9 million consumers through 5.8 million meters in more than 500 communities
- Workforce of 8,500 employees
CA Climate Change Policy: Make Room for “Near-Zero” End Uses and Low Carbon Gas

- California focused on electrifying end uses and “de-carbonizing” electricity
  - Electrify transportation
  - Electrify energy end uses
  - De-carbonize generation

- SoCalGas focused on “near-zero” end use technology and exploring “de-carbonizing” the pipeline
  - Near-zero NGV’s
  - Near-zero gas technology
  - New methane and hydrogen feedstocks/blends
De-carbonizing the pipeline

1. Biogas
   - Landfills
   - Diverted Landfill
   - Waste Water Treatment Plants
   - Dairy Digester

2. Power-to-Gas
   Excess renewable energy converted into synthetic natural gas for storage
What is Biogas?

1. Photosynthesis
2. Food crops
3. Animal/Organic Waste
4. Farm Waste
5. Food Waste and Waste Water

- City Landfill
- Anaerobic Digester
- Biogas Conditioning
- Biogas
- On-site Vehicle Fueling
- Pipeline
- On-site Electric Generation or other heat use

CO2 From Biogas Combustion
Biomethane Market: Differences Between Biogas & Renewable Natural Gas (RNG)

Gas Composition and Heating Value

<table>
<thead>
<tr>
<th></th>
<th>Biogas</th>
<th>“Conditioned” Biogas</th>
<th>RNG*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH4</td>
<td>62.0%</td>
<td>62.0%</td>
<td>98.5%</td>
</tr>
<tr>
<td>CO2</td>
<td>37.6%</td>
<td>37.6%</td>
<td>0.8%</td>
</tr>
<tr>
<td>O2, H2, N2, Others</td>
<td>0.4%</td>
<td>0.4%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Heating Value (btu/scf)</td>
<td>625</td>
<td>625</td>
<td>990+</td>
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Two of the Key Trace Constituents

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<tbody>
<tr>
<td>H2S</td>
<td>300 ppm</td>
<td>1 ppm</td>
<td>1 ppm</td>
</tr>
<tr>
<td>Siloxanes</td>
<td>4,000 ppb</td>
<td>70 ppb</td>
<td>Non-detectable</td>
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</table>

*Gas composition and trace constituent limits will/may differ by utility
CARB’s Low Carbon Fuel Standard

- State determined carbon intensity scores for wastewater, landfill, and dairy gas lower than electricity
HARRF Information

- Wastewater treatment facility located in Escondido, CA
- Average Daily Flow ~ 15.6 MGD
- Biogas was being flared prior to start of demonstration project
- Biogas Production ~ 95 million cubic feet per year
- Biogas contains enough energy to supply ~1,200 homes
Gills Onions Waste to Energy

» First food processing facility in the world to convert 100% of their daily onion waste into renewable energy and cattle feed

» Advanced Energy Recovery System (AERS) began in 2009

» Extracts juice from onion peels → fed into high-rate anaerobic reactor → produces methane-rich biogas → feeds 2 300-kW fuel cells
Biogas Conditioning Tariff

- **Summary**: The BCS Tariff is a new utility tariff that allows SoCalGas to design, install, own, operate & maintain biogas conditioning/upgrading equipment on or adjacent to the customers premise
  - SoCalGas will not own the biogas entering or the upgraded biogas leaving the biogas conditioning/upgrading facility
  - For pipeline injection, customer must pay for all costs associated with the interconnection facilities

- **What is included in SoCalGas’ turnkey solution?**
  - 100% of the upfront capital
  - Biogas conditioning/upgrading facilities design
  - Equipment and construction RFP
  - Vendor selection and management
  - Project/construction management
  - Facility operation and ongoing maintenance
  - Contract management
Power-to-Gas

*Projects are being developed in which surplus electricity is used to power electrolysers that will split water into its component parts, with the hydrogen being directly injected into natural gas pipelines for storage.*

*The concept has become known as “Power to Gas” or P2G*
De-Carbonizing the Pipeline:
Electrolysis of Excess Renewable Electricity
(Power-to-Gas)
Hydrogenics Plant (Stuttgart, Germany)
Power-to-Gas Example

- Nearby renewable energy powers an electrolyzer to produce H₂ from water
- Uses CO₂ from biogas plant
- Produces methane, which is injected into pipeline
SoCalGas/National Renewable Energy Laboratory Project

Objective:
• Enable higher penetrations of renewable energy generation using the natural gas pipeline system for energy storage

The project has two primary elements:
• Electrolyzer/methanation hardware characterization and testing in a full-up grid-simulation environment
• Modeling of P2G economics based on value provided to the grid in various operating scenarios

Deliverables:
Design, build, install, test and demonstrate systems for
• Electrolysis
• Methanation

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<tr>
<th>P2G Solar Energy Storage RD&amp;D</th>
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<tr>
<td>Collaboration Partners</td>
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<tr>
<td>Location</td>
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<td>Start Date</td>
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<td>Planned End Date</td>
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<td>Budget</td>
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<td>Co-funding</td>
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SoCalGas/UC Irvine Project

Purpose:
Develop a deep understanding of the physical, chemical and energy dynamic attributes of H2 blending necessary to achieve commercial P2G deployments for storage and distribution of excess wind and solar energy
• This is logical next step from SoCalGas/NREL that focuses on P2G grid integration

Deliverables:
Design, build, install and test systems for:
• PV and electrolysis integration
• H2 blending and pipeline injection
Determine impacts of H2 injection on natural gas system components
### Massive Energy Storage

- Hydrogen energy can successfully store energy
- Where can we storage the gas?
  - Why not use the natural gas infrastructure?
- Southern California Gas Company Storage
  - Alison Canyon (2,435,262,000 m³)
  - Honor Rancho (685,271,400 m³)
  - La Goleta (608,815,500 m³)
  - Playa del Rey (67,960,800 m³)
THANK YOU

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