Today’s Presentation

I. Development Overview
II. Timeline
III. RNG Market
IV. Challenges
V. Partner Benefits via P3
Development Overview
91st Avenue Waste Water Treatment Facility

- One of the largest WWTP in the US
- Capacity of 200 million gallons per day
- SROG – Sub Regional Operating Group
- Serves Cities of Phoenix, Mesa, Tempe, Glendale & Scottsdale
- 600,000 mmBtu/yr. escalating at 1% per year
  - Anticipated delivery of gas from 91st Ave WWTP
  - Equivalent to 21 commercial blimps/day
  - or 3,750 tanker trucks/day
Development Options

- On-site electrical generation & waste heat recovery
- Generation & sale of electricity to grid
- MBtu gas sales to nearby natural gas end user
- Hbtu gas (or RNG) sales to natural gas market
- One of the only large WWTPs selling Hbtu biogas in the US via P³ (Public Private Partnership)
Preferred Approach: Why RNG?

• Relatively low AZ electrical rates
• Weak AZ REC market
• Low Natural Gas prices
• Positive Experience at SAWS RNG project
• Positive Experience with Kinder Morgan
• Robust RIN Market
• Robust CA LCFS Market
Ownership Structures Contemplated

• Originally 3rd Party ownership
  • Financing challenges

• City/SROG ownership
  • SROG cities not interested
  • Risk of merchant plant

• ASU-ownership
  • 9 month analysis/evaluation
  • Staff supportive
  • Board of Regents hesitant due to other capital project investments

• Public Private Partnership Chosen
  • Ameresco-ownership
Digesters feed for H₂O / H₂S / Siloxanes / CO₂ Removal

**PRODUCT**
- Pressure as needed
- CO₂ = 1-2%
- H₂S < 4 ppm
- H₂O < 7 lb/MM SCF
- Siloxanes < 20 PPB

**TAIL GAS**
- CO₂, H₂S, H₂O
- Siloxanes, VOC’s
- Lost Hydrocarbons

**FEED**
- CH₄
- CO₂
- H₂S
- Siloxanes
- H₂O

**Molecular Gate PSA**

**Compressors**
- 0 psig → 100 psig
- 90 psig
- Product

**Vacuum Pumps**
- 2 psig
Gas Processing Technology – PSA
Pipeline Quality Specifications

Kinder Morgan Natural Gas Pipeline Quality Spec

> 950 Btu/cf
< ¼ grain of H₂S
< 2% CO₂
< 2% N₂
< 0.2% O₂
< 4% of non-hydrocarbons
< 7lbs H₂O vapor/10⁶ cf
< 120° F
> 40° F
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>6/2012</td>
<td>SROG issues RFQ</td>
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<tr>
<td>9/2012</td>
<td>Ameresco submits best &amp; final offer</td>
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<tr>
<td>11/2012</td>
<td>Ameresco notified of project award</td>
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<tr>
<td>4/2013</td>
<td>SROG selects ASU-owned option as preferred approach</td>
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<tr>
<td>3/2014</td>
<td>ASU signs IGA contract with Ameresco</td>
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<tr>
<td>8/2014</td>
<td>Ameresco delivered the Final IGA Report to ASU</td>
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<tr>
<td>12/2014</td>
<td>ASU decides not to move forward with project</td>
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<tr>
<td></td>
<td>Ameresco commits to proceed forward without ASU</td>
</tr>
<tr>
<td>6/2016</td>
<td>City of Phoenix approves project agreements</td>
</tr>
<tr>
<td>3/2017</td>
<td>Ameresco commences construction</td>
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<tr>
<td>2/2019</td>
<td>COD</td>
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“Making Phoenix more sustainable isn’t just the right thing to do, it is also sparks innovation and creates exciting new economic opportunities. By partnering with Ameresco at our new processing plant, Phoenix is taking previously untapped raw biogas generated by wastewater treatment and turning it into a renewable energy source that can be sold. This cutting-edge partnership benefits our regional economy and environment at the same time. Phoenix has set ambitious sustainability and renewable energy goals, and this partnership will help us get there.”

Phoenix Mayor Greg Stanton
February 2, 2017
Where We’ve Been:
Where We’ve Been:

91st Ave pipeline trenching

91st Ave pipeline pressure testing
Where We’ve Been:

91st Ave high pressure pipe

91st Ave pipeline trenching
Where We Are
Where We Are
Kinder Morgan & Technology Selection

- KM Proximity & Capacity
- KM Achievable Quality Standard
- Positive Past Experience w/ KM
- Technology Agnostic
- Proven Operational Record
- PSA Technology & Common Platform

SAWS Kinder Morgan Interconnection
Renewable Natural Gas Market
Renewable Fuel Standard

• Created under the **Energy Policy Act (EPAct) of 2005**

• Established the first renewable fuel volume mandate in the US
  • The first RFS program (RFS1) required 7.5B gallons of renewable fuel to be blended into gasoline by 2012
  • The Energy Independence and Security Act (EISA) of 2007 expanded the RFS program (RFS2)
    • RFS2 includes diesel, in addition to gasoline
    • Increased the required volume to 36B gallons by 2022
    • Established new categories of renewable fuel, w/ set separate, nested requirements
    • Obligated parties to include diesel and gasoline producers (refiners) and importers

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<tr>
<th>Fuel Category</th>
<th>Target under EISA</th>
<th>GHG Reduction</th>
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<tr>
<td>Cellulosic Biofuel</td>
<td>• 16 billion gallons by 2022</td>
<td>60%</td>
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<td>Biomass Based Diesel</td>
<td>• 1 billion gallons by 2012 and beyond</td>
<td>50%</td>
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<tr>
<td>Advanced Biofuel</td>
<td>• 21 billion gallons by 2022, at least 4 billion gallons additional</td>
<td>50%</td>
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<tr>
<td></td>
<td>• Higher tier fuel gallons (CB, BBD) go to meet this tier</td>
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<tr>
<td>Renewable Fuel</td>
<td>• Total of 36 billion gallons by 2022, at least 15 billion additional gallons</td>
<td>20%</td>
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<tr>
<td></td>
<td>• Higher tier fuel gallons (CB, BBD, AB) go to meet this tier</td>
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Historic Pricing for Biomethane

**Biomethane Value, per dth**

- **D3 RIN Value**
- **LCFS Value**
- **Natural Gas Value**

*Natural Gas Value is the Henry Hub natural gas spot market price as reported by US Energy Information Administration*

**LCFS Value was calculated based on an assumed carbon intensity value of 35 gCO2/MJ (ex. wastewater treatment)**
# Current Value of Biomethane

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<tr>
<td>D3</td>
<td>$1.750</td>
<td>$1.880</td>
<td>$1.855</td>
<td>$1.750</td>
<td>$1.890</td>
<td>$1.855</td>
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<tr>
<td>D4</td>
<td>$0.420</td>
<td>$0.525</td>
<td>$0.530</td>
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<tr>
<td>D5</td>
<td>$0.400</td>
<td>$0.500</td>
<td>$0.510</td>
<td>$0.400</td>
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<td>$0.510</td>
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<tr>
<td>D6</td>
<td>$0.190</td>
<td>$0.214</td>
<td>$0.241</td>
<td>$0.190</td>
<td>$0.215</td>
<td>$0.243</td>
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<th>LCFS Credit</th>
<th>Average Price</th>
<th>Closing Value</th>
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<td>$190.50</td>
<td>$190.50</td>
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*Convert RIN (x 11.727) = $21.75*

*Convert LCFS (x 0.035) = $6.67*

*Commodity (SoCalGas) = $2.63*

**TOTAL** $31.05*

*does not include fees (transportation, discounts, marketing gas, etc.)*
Where We’ve Been: **General Challenges**

- Five SROG “Negotiators”, City Councils & City Attorneys
- Pipeline routing & interconnection
  - Wetlands
  - ROW
  - Easements
- Maricopa County Air Permitting
- Palo Verde Nuclear Plant construction window
- Project Financing
- Evolving RNG market
- New Administration
Where We’ve Been: Permitting Challenges

1. ACC: pipeline regulatory

2. Army Corps of Engineers: wetlands permitting

3. Maricopa County: pipeline, site utilities, facility and air permit

4. SRP: irrigation crossings

5. City of Phoenix: AFP building inspections

6. City of Tolleson: 91st Ave. crossing
Where We’ve Been: Pipeline Challenges

1. Army Corps of Engineers 408 permit delay (required contractor de-mob/re-mob)
2. Replacement of pipeline contractor after 408 permit delay
3. Underground interferences not shown on drawings
4. Coordination issues with City MOPO reviews and MOPOs
5. Coordination with SRP on power supply to KM station, including City easements
Where We’ve Been: Site Utilities Challenges

1. Underground interferences not shown on drawings
2. Coordination with multiple engineering teams involved with design & review
3. Added scope due to HAZOP review meetings w/ City
4. Inaccurate information in City Power System Study delayed energizing and re-work
5. Coordination issues with City operations to perform MOPO reviews & MOPOs
6. Potable water line delays due to jurisdictional questions raised by Fire Dept
7. Electrical inspector required Field Certification (UL label) of City switchgear because of new CT’s to City switchgear
Where We’ve Been: Facility Challenges

1. Vendor drawings delayed release of final construction drawings

2. Design changes occurred during construction:
   - Items identified during HAZOP review with City
   - KM pre-verification program for testing gas prior to injection
   - Improve life cycle cost, operability & safety
   - Final vendor information
   - Items identified during review process and/or inspections
Where We’ve Been: Construction Challenges

1. Rework required to VFD cable for large motors
2. Rework required to Bus duct supports
3. Rework required to field pipe welds
4. AFP Stop Work Notice pending completion of special inspections
5. Underground interferences not shown on drawings
6. Contaminated soils encountered on jobsite
7. Security badging delays changing contractors and/or personnel
Partner Benefits
Value Proposition for SROG Members

• Utilization of Wasted Renewable Resource
• WWTP equipment O&M savings
• Royalty payments to SROG cities – millions of dollars estimated over a 20-year term
• Positive PR
• Meeting Sustainability Goals
Value Proposition for SROG Members (continued)

- Site emissions reduced
- Emission reductions of 44,671 tons of CO$_2$/yr. equivalent to

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<th>Annual greenhouse gas emissions from ___ passenger vehicles:</th>
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<tr>
<td>Carbon sequestered annually by ___ acres of pine or fir forests:</td>
<td>87,425</td>
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<tr>
<td>CO$_2$ emissions from burning ___ railcars' worth of coal:</td>
<td>2,009</td>
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<tr>
<td>CO$_2$ emissions from ___ barrels of oil consumed:</td>
<td>894,582</td>
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<tr>
<td>CO$_2$ emissions from ___ gallons of gasoline consumed:</td>
<td>43,662,920</td>
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<td>Heating ___ homes per year:</td>
<td>10,584</td>
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Thank you!