Renewable Natural Gas: Current Trends and Opportunities
Prepared for: Center Point Energy
May 23, 2017
Agenda

1. Introduction
2. The Biogas Opportunity
3. RFS 101
4. Closing Comments
Creating Sustainable Solutions For The World

Audit
- RFS and LCFS
- QAP
- Custom Audit Protocol
- Engineering Reviews
- Carbon Intensity Verification

Compliance
- Eco-RIN Management
- RIN Academy

Consulting
- Compliance Strategy
- Pathway Petitions
- Sustainability Programs
- RFS, LCFS & CFP Registration

360 Biogas Solution
- Regulatory Advocacy
- Technology Integration
- Efficient Producer
- GREET Modeling

Biomass Mapping
- Waste Shed Studies
- Feasibility Studies
- Feedstock Agreements

Utility Negotiations
- Q-RIN
- Offtake Consulting

SUSTAINABLE SOLUTIONS

Audit
- Over 150 Biofuel Plants
- In 20 Countries

1.7 Billion Gallons of Biofuel Capacity Under Management

50 Producers Have Enrolled in RIN Compliance Program

Why EcoEngineers?

EcoEngineers
People Driven Solutions

Assisted Registration & Preparation for Over 60 LCFS Pathway Projects

3.6 Billion RINS Transacted in 2016

9.9 Million RINS Processed Each Day
on Our Automated Platform

One of the First USEPA Recognized RIN Quality Assurance Programs
Pioneering work that is building out the biogas industry

- Economic Impact Analyses
- Biomass Asset Mapping
- Wasteshed Analysis
- Substrate Analysis & BMP
- Feedstock Agreements
- Financial Analysis and ROI
- Biogas & Waster-Energy Nexus
- Pipeline Injection Agreements
- Technology Selection
- Off-Take Options
- Compliance Training & Education
- RFS, LCFS, CFP Compliance
02 The Biogas Opportunity
Methane From Biogas is Renewable Natural Gas (RNG)

Anaerobic Digester

- Slurry & Manure
- Food & Amenity Waste
- Crops & Residues

Biogas

- Power
- Gas Grid
- Transport Fuel
- Heat

Digestate
Evolution of Biogas Uses

Raw to moderately upgraded

Pipeline quality
### Carbon Credits Add Significant Value To RNG

One MMBTU of Pipeline Quality Biogas Produced in the Midwest and Used for Transportation in California

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of Gas</td>
<td>$3.00</td>
<td>9%</td>
</tr>
<tr>
<td>Value of Federal Credits (RINs)</td>
<td>$22.20</td>
<td>69%</td>
</tr>
<tr>
<td>Value of California Credits (LCFS)</td>
<td>$6.85</td>
<td>21%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$32.05</td>
<td>100%</td>
</tr>
</tbody>
</table>

**RFS**

![RFS Graph](image)

**CAP & TRADE**

![CAP & TRADE Graph](image)

**LCFS**

![LCFS Graph](image)
The Process

1. Landfill
   - Wastewater Plant
   - Waste Digester
   - Facilities must be registered with the regulators - EPA, CARB, etc.

2. Project Owner
   - Owns one or more RNG upgrading and injection facilities
   - Facility injects purified RNG into utility pipeline

3. Physical Pathway from Production to Use
   - Gas is co-mingled with pipeline gas. Project owner sells the physical gas to gas marketer, utility or local end user. Pipeline is paid for transport. Environmental aspects are separated.
   - Gas is extracted anywhere on the grid for use as CNG.

4. Contractual Pathway for Environmental Aspects
   - Project Owner holds multiple contractual pathways for CNG end use for generation and trade of environmental aspects
   - CNG End User
The Renewable Fuel Standard
The Renewable Fuel Standard (RFS)

The RFS requires the blending of Renewable Fuels with the nation’s motor vehicle fuel supply.

Origins in EISA and RFS1 (2005-07)

RFS 2 promulgated in July 2010

Four renewable fuel categories

36 billion gallon goal for 2022
<table>
<thead>
<tr>
<th>Fuel Category</th>
<th>Fuel</th>
<th>GHG Reduction Requirement</th>
<th>RIN Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulosic Biofuels</td>
<td><strong>Renewable CNG/LNG</strong>, cellulosic ethanol, cellulosic naphtha, cellulosic diesel, etc.</td>
<td>60%</td>
<td>D3 / D7</td>
</tr>
<tr>
<td>Biomass-based Diesel</td>
<td>Biodiesel, renewable diesel, etc.</td>
<td>50%</td>
<td>D4</td>
</tr>
<tr>
<td>Advanced Biofuels</td>
<td><strong>Renewable CNG/LNG</strong>, sugarcane ethanol, renewable heating oil, etc.</td>
<td>50%</td>
<td>D5</td>
</tr>
<tr>
<td>Renewable Fuel</td>
<td>Corn ethanol, etc.</td>
<td>20% or less</td>
<td>D6</td>
</tr>
</tbody>
</table>
Renewable Volume Obligations (RVO’s) set by the EPA create demand for clean fuel credits called RINS.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cellulosic Fuels D3/D7</th>
<th>Biomass-based Diesel D4</th>
<th>Advanced Biofuels D5</th>
<th>Renewable Fuel D6</th>
<th>Total Renewable Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0.033</td>
<td>1.63</td>
<td>2.67</td>
<td>13.61</td>
<td>16.28</td>
</tr>
<tr>
<td>2015</td>
<td>0.123</td>
<td>1.73</td>
<td>2.88</td>
<td>14.05</td>
<td>16.93</td>
</tr>
<tr>
<td>2016</td>
<td>0.230</td>
<td>1.90</td>
<td>3.61</td>
<td>14.50</td>
<td>18.11</td>
</tr>
<tr>
<td>2017</td>
<td>0.311</td>
<td>2.00</td>
<td>4.28</td>
<td>15.00</td>
<td>19.28</td>
</tr>
<tr>
<td>2018</td>
<td>tbd</td>
<td>2.10</td>
<td>11</td>
<td>15.00</td>
<td>26.00</td>
</tr>
<tr>
<td>2019</td>
<td>tbd</td>
<td>tbd</td>
<td>13</td>
<td>15.00</td>
<td>28.00</td>
</tr>
<tr>
<td>2020</td>
<td>tbd</td>
<td>tbd</td>
<td>15</td>
<td>15.00</td>
<td>30.00</td>
</tr>
<tr>
<td>2021</td>
<td>tbd</td>
<td>tbd</td>
<td>18</td>
<td>15.00</td>
<td>33.00</td>
</tr>
<tr>
<td>2022</td>
<td>tbd</td>
<td>tbd</td>
<td>21</td>
<td>15.00</td>
<td>36.00</td>
</tr>
<tr>
<td>Year</td>
<td>Cellulosic Fuels D3/D7</td>
<td>Biomass-based Diesel D4</td>
<td>Advanced Biofuels D5</td>
<td>Renewable Fuel D6</td>
<td>Total Renewable Fuel</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>2014</td>
<td>0.033</td>
<td>1.63</td>
<td>2.67</td>
<td>13.61</td>
<td>16.28</td>
</tr>
<tr>
<td>2015</td>
<td>0.123</td>
<td>1.73</td>
<td>2.88</td>
<td>14.05</td>
<td>16.93</td>
</tr>
<tr>
<td>2016</td>
<td>0.230</td>
<td>1.90</td>
<td>3.61</td>
<td>14.50</td>
<td>18.11</td>
</tr>
<tr>
<td>2017</td>
<td>0.311</td>
<td>2.00</td>
<td>4.28</td>
<td>15.00</td>
<td>19.28</td>
</tr>
<tr>
<td>2018</td>
<td>tbd</td>
<td>2.10</td>
<td>11</td>
<td>15.00</td>
<td>26.00</td>
</tr>
<tr>
<td>2019</td>
<td>tbd</td>
<td>tbd</td>
<td>13</td>
<td>15.00</td>
<td>28.00</td>
</tr>
<tr>
<td>2020</td>
<td>tbd</td>
<td>tbd</td>
<td>15</td>
<td>15.00</td>
<td>30.00</td>
</tr>
<tr>
<td>2021</td>
<td>tbd</td>
<td>tbd</td>
<td>18</td>
<td>15.00</td>
<td>33.00</td>
</tr>
<tr>
<td>2022</td>
<td>tbd</td>
<td>tbd</td>
<td>21</td>
<td>15.00</td>
<td>36.00</td>
</tr>
</tbody>
</table>

The opportunity for biogas and other advanced fuels
A RIN is Proof That Biofuels Were Used in Transportation

- A tradable environmental attribute
- Proof of compliance
- Attached to fuel at production/import
- Strict rules of separation/trading
RIN Values Can Be Volatile

RIN Values are Driven by Regulatory Uncertainty, Supply-Demand Fundamentals and Perceptions of Quality

D3, D4, D5, and D6 RIN Prices March 2, 2015 - March 23, 2017

D3 Price Range
Petroleum Refiners & Importers Required To Prove Compliance

An Obligated Party (OP) must acquire RINs to prove biofuel blending obligations were fulfilled.

An OP is:

- A refiner that produces gasoline or diesel fuel within the 48 contiguous states or Hawaii during a compliance period.
- An importer that imports gasoline or diesel fuel into the 48 contiguous states or Hawaii during a compliance period.
- A party that simply blends renewable fuel into gasoline or diesel fuel is not an obligated party.
How to Enter the Market

**Planning**
Fuel Pathway and feedstock
Establish physical and contractual pathways for RNG from to end use

**RFS Registration**
Engineering Review
Regulatory review and approval

**QAP (3rd Party Monitoring)**
QAP protocol submitted
Review of production records
Review of CNG metering records
Site visits

**RIN Generation**
Ongoing reporting – Daily, Quarterly and Annual – to regulators
04 Closing Comments
**Consumer Demand**

- 69% of HN millennials place greater worth in putting their money toward companies that show a high level of corporate social responsibility.

- Companies with renewable energy or sustainability targets in 2016:
  - 71% of Fortune 100
  - 43% of Fortune 500
  - 22 companies with commitments to power all of their operations with renewable energy

**Profit**

- Environmental credits compress payback period and make investments in sustainability profitable.
We Create Sustainable Solutions for the World

1. We will give you the tools and confidence to navigate the New Energy Economy
   – Conduct a comprehensive economic, technical and regulatory review of RNG opportunities
   – Develop strategy and facility plan to execute on selected projects
   – Measure and mitigate your carbon footprint

2. Our training and support make compliance with clean fuel regulations easy

3. We can connect you to carbon credit and fuel markets
Future of Fueling
Connect with us:
ecoengineers.us