NET Power

Truly Clean, Cheaper Energy

December 4, 2017
The Allam Cycle advantage

 электроэнергия из природного газа, синтез-газа и низкобТУ топлива

 Обход конкурентоспособен с традиционными углеводородными электростанциями

 Снимает или устраняет значительное количество углерода и неуглеродных атмосферных выбросов без дополнительных затрат

 Вода не требуется (с небольшим снижением эффективности)

 Можем использовать дешевые топлива, такие как азот, кислый газ, суррогатный газ, ассоциированный газ и производимый газ

 Также производит важные газы, включая N₂, O₂ и Аргон
The Allam Cycle is simple
The Allam Cycle is being commercialized today

• Developing the natural gas-fueled Allam Cycle
• Collaboration between 8 Rivers, Exelon, CB&I and Toshiba
• Building a 50MWth demonstration plant in La Porte, TX.

8RIVERS ENERGY

• Developing the coal-fueled Allam Cycle
• Supported by a North Dakota-based consortium (EERC, Lignite Energy Council, Basin Electric, ALLETE, NETL)
• Focused on developing the coal-specific Allam Cycle components
The Allam Cycle is low cost

1. LCOE calculated using EPRI methodology
2. Assumes natural gas at $2.85/MMBTU and coal at $1.73/MMBTU
3. Every move of $1 in natural gas moves LCOE $6
Allam Cycle CO₂ can improve EOR economics

Current EOR Lifting Costs in the US

2. Assumes 1.5 bbl/ton from EOR, fuel costs of $2.5/MMBtu gas and $1.5/MMBtu coal, and net of $40/MWh for power from the capture plant.
NET Power’s Development Program
Overview of NET Power Commercialization Schedule

Demonstration-scale Timeline

- Allam Cycle IP Filed
- NET Power 4-way agreement signed
- Demo combustor testing
- Demo prep-FEED est. complete
- $140M investment for demo program
- Demo turbine ordered
- Combustor testing complete
- Start demo engineering
- 99% engineering complete
- Complete demo construction
- Complete demo testing

Commercial-scale Timeline

- Validation of commercial design
- Complete conceptual design
- Commercial prep-FEED est. complete
- Internal est. update based on learnings
- Pre-FEED Phase 1: revised design complete
- Pre-FEED Phase 2: Cost update complete
- Detailed design complete
- Basic design (FEED) complete
- Target online date

- Process data
- Controls/simulator
- Turbine performance
- HX design life

Timeline:
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020
- 2021
- 2022
Demo Plant Main Equipment and Overhead Layout
Demo Plant Main Equipment and Overhead Layout
Plant commissioning is now underway

• **50MWth natural gas plant**
  - Scaled down from 500 MWth pre-FEED design to ensure scalability
  - Includes all core equipment
  - Grid connected

• **Commissioning underway**
  - First CO$_2$ fill in October
  - Test combustor shipped
  - Now commissioning major equipment and auxiliaries
  - System simulator coming online

• **2018 operation planned in 2 phases**
  - Combustion testing – Feb 2018
  - Full load operation – July 2018
First commercial project is under development

- **Revised 300MWe pre-FEED design underway**
  - Detailed, bottom-up estimate based on procured equipment and material take-offs
- **Vetting partners for Plant #1**
  - Power generation, oil & gas, and other companies engaged in plant development
  - Includes 11 of the 14 largest utilities in the US
  - Major and independent oil & gas firms involved for CO₂-EOR and power purposes
  - Several sites have been purchased by customers
- **Moving towards delivery of first commercial plant in 2021**
  - Seeking to issue a notice to proceed following successful demonstration plant operation in 2018

**NET Power Commercial Natural Gas Plant**

<table>
<thead>
<tr>
<th></th>
<th>305MWe</th>
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<tbody>
<tr>
<td><strong>Electric Output</strong></td>
<td></td>
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<tr>
<td><strong>CO₂ Output</strong></td>
<td></td>
</tr>
<tr>
<td>• 890,000 ton/year</td>
<td></td>
</tr>
<tr>
<td>• 44 million scf/day</td>
<td></td>
</tr>
<tr>
<td>• 120 bar pressure</td>
<td></td>
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<tr>
<td><strong>N₂ Output</strong></td>
<td>4 MM ton/year</td>
</tr>
<tr>
<td><strong>Argon Output</strong></td>
<td>70,000 ton/year</td>
</tr>
<tr>
<td><strong>Site Area</strong></td>
<td>11 acres</td>
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Thank You

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The Allam Cycle natural gas power system
NET Power is much smaller and simpler than previous attempts to achieve carbon capture

- Bulks have been a significant driver of cost, NET Power solves this problem:

  - In addition, NET Power’s footprint per MW is ¼ of that needed for IGCC