Demonstration of μCHP in Light Commercial Hot Water Applications

2016 Building Technologies Office Peer Review

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U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

90% Efficiency
10% Losses
μCHP 70 kW

65% Losses
Grid 60 kW

Boiler/Water Heater 45 kW
7% Losses
60% Efficiency

Electrical 21 kW

Hot Water 42 kW

70 kW
Project Summary

Timeline:
Start date: Oct 1, 2014
Planned end date: September 30, 2017

Key Milestones
1. Identification of Demonstration Sites; 7/1/15
2. EPA Certification; 12/23/15

Budget:
Total Project $ to Date:
- DOE: $143,121
- Cost Share: $143,121

Total Project $:
- DOE: $675,000
- Cost Share: $863,300

Key Partners:
<table>
<thead>
<tr>
<th>Briggs &amp; Stratton</th>
<th>DOE - EERE</th>
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<tbody>
<tr>
<td>YANMAR America</td>
<td>MicroCogen Partners</td>
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<td>ORNL</td>
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Project Outcome:
Provide stakeholders with the information needed to build a sustainable market. Specifically:
1. Verify value proposition of a three year installed cost payback
2. Identify and simplify installation and maintenance
3. Create effective training for installation & maintenance personnel
Purpose and Objectives

Problem Statement:

• Commission eight field demonstration sites across specified target markets and geographic regions in North America to address the following market barriers:
  1. Lack of value proposition – payback longer than product life
  2. Complexity of system/sale – customer, installer, distributor
  3. Complex end market interface – lack of a trained installer base
  4. Lack of States’ regulatory consistency – net metering and feed in tariff

Target Market and Audience:

• Light commercial buildings with high hot water demand: Full service restaurants, hotels & lodging, multifamily housing (75+ units), inpatient healthcare, education, fitness, car washes & Laundromats. More than 370,000 potential buildings in NA in 2012, growing at 1% CAGR\(^1\).

• Geographic regions with favorable µCHP criteria: North-East, Mid-West and CA

• Stakeholders: Distributors, building contractors, building owners, specifying engineers and contracting installers

\(^1\) Micro-CHP: Light Commercial Market Opportunity Analysis in NA, BRG, Sept. 2013
Purpose and Objectives

Impact of Project:
Demonstrate μCHP technology in light commercial buildings.
- Provide independent verification of cost and performance from validated demonstration results.
- Identify and simplify installation and maintenance/service techniques
- Create effective training programs for both installation and service personnel
- Develop an effective technology to market path for μCHP technology

Near-term
Manufacturers and building industry gain a greater understanding of technical and economic merits of μCHP technology and how it can best be used to reduce energy use

Intermediate
Building on technology to market assessments, manufacturers bring μCHP technology market allowing building owners a avenue for adopting μCHP.
Approach

Approach:
• Install 8 μCHP systems in target market segments with high hot water demands.
• ORNL measure and verify the cost and performance of each installation.
• Focus on reducing cost by 1. developing best practices to train personnel and 2. improve product to simplify installation methods.

Key Issues:
• Finalizing installation plans.
• Complete installation

Distinctive Characteristics:
• Turnkey ‘plug and play’ system solution to reduce unnecessary costs
• Develop a “best practices” approach for reducing installation and maintenance costs
• Working closely with gas utilities to solicit feedback on best approach to market
Progress and Accomplishments

Accomplishments:
• Identified demonstration sites
• Obtained EPA emission certification

Market Impact:
• Demonstration systems not yet installed.
• Lab testing demonstrates that target technical performance is achievable and economic merits meet product objectives

Lessons Learned:
• Regulatory requirements and variability from location to location is one of the most significant barriers to entry.
Project Integration and Collaboration

Project Integration:
• Two engine suppliers are each supplying four engines plus controls and providing cost share. One of these (YANMAR) is a leading supplier of \( \mu \)CHP systems in Japan
• There is also direct utility engagement, state/regional agencies, industry trade group outreach

Partners, Subcontractors, and Collaborators:
• YANMAR America/Briggs & Stratton: engine suppliers, engine controls
• Oak Ridge National Lab: field test measurement and verification
• Microcogen Partners: consulting; identification of sites

Communications:
• Webinars describing the project presented to natural gas utilities and utility trade groups
Next Steps and Future Plans

1. Complete the installing planning for all targeted demonstration sites.
2. Complete the installation of all systems
3. California Emissions
Demonstration Sites

- Commercial Laundry
- Hotel
- Fitness Club
- Multifamily Housing
- Assisted Living
- Food Service
Multi-Family, Jamaica, NY

- New Construction
- μCHP ready
- Common DHW and power
- Preheat DHW
Multi-Family, Boiler Room
Resort and Spa, Michigan

- 600 rooms, 5 restaurants, 4 pools
- Kitchen DHW
Resort and Spa, Layout
Resort and Spa, Existing Configuration
Resort, System Configuration

16
Emission Certification

EPA (US except California)
- Engines qualify for EPA certification

CARB
- Nox < 0.07 lb/MW-hr
- CO < 0.10 lb/MW-hr
- VOCs < 0.02 lb/MW-hr
- 1/10 EPA requirements
- Durability requirements
Potential Difficulties – Installation

- Solar
- Poor Access
- Common Venting
- Lack of Space
Potential Regulatory Difficulties—ConEd Brooklyn, NY
Potential Regulatory Difficulties – Net-metering

CHP ELIGIBILITY FOR NET METERING BY STATE

- CHP Eligible
- CHP Not Eligible
REFERENCE SLIDES
**Project Budget**

**Project Budget:** $1,538,300 ($675,000 DOE, $863,300 Cost Share)

**Variances:** Delay in obtaining EPA certification resulted in a 6mo extension to first budget period

**Cost to Date:** $286,242

**Additional Funding:** None.

### Budget History

<table>
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<tr>
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<th>October 1, 2014 – FY 2015 (past)</th>
<th>FY 2016 (current)</th>
<th>FY 2017 – Sep 30, 2017 (planned)</th>
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<tr>
<td>DOE</td>
<td>$188,121</td>
<td>$486,879</td>
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<tr>
<td>Cost-share</td>
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## Project Plan and Schedule

### Project Schedule

<table>
<thead>
<tr>
<th>Project Start: October 1, 2014</th>
<th>Completed Work</th>
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<tr>
<td>Projected End: September 30, 2017</td>
<td>Active Task (in progress work)</td>
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- **Milestone/Deliverable (Originally Planned)**: use for missed milestones
- **Milestone/Deliverable (Actual)**: use when met on time

<table>
<thead>
<tr>
<th>Task</th>
<th>FY2015</th>
<th>FY2016</th>
<th>FY2017</th>
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<tr>
<td></td>
<td>Q1 (Oct-Dec)</td>
<td>Q2 (Jan-Mar)</td>
<td>Q3 (Apr-Jun)</td>
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### Current/Future Work

- **Q1 Milestone: Draft Technology to Market Plan**
- **Q3 Milestone: Site Selection**
- **Q4 Milestone: EPA Certification Go/No-go**
- **Q2 Milestone: Installation**
- **Q1 Milestone: Monitoring**
- **Q2 Milestone: Annual Service**
- **Q4 Milestone: Report**
Questions?