

# **Technical Support for Integrated Community Energy Solutions**

## ***Task 2 Outline and Approach Development of Cost Benefit Information and Business Case for Integrated Community Energy Solutions***

***Report #3***

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## Development of Cost Benefit Information and Business Case for Integrated Community Energy Solutions

The deliverable of this task is a report on the business case for various approaches available for Integrated Community Energy Solutions, with a primary focus on district energy, microgrids, and CHP. This report provides an outline of the final report. There will be four major elements in the final report:

- Overview of Clean Energy Technology Options -- Overview of key clean technology options, including a description, graphic illustrations, and example cases from the US and internationally.
- Costs and Benefits -- Generalized overview of the costs and benefit of the clean energy options, including: capital costs, operating costs and total costs; power-related benefits; energy efficiency benefits; and environment benefits.
- Implementation Challenges – Description of major challenges that can constrain the implementation of integrated community energy systems.
- Ownership and Operation Models – Description of the advantages and disadvantages of different community energy system ownership and operation models.

## Overview of Clean Energy Technology Options

### Facilities

Gas Boilers

Biomass Boilers

### Heat and Power

Gas Engines

Gas Turbines

Steam Turbine Rankine Cycle

## **Organic Rankine Cycle**

### **Thermal and Waste Heat**

**Solar Thermal**

**Ground Source Heat Pumps**

**Industrial Waste Heat Recovery**

**Electric Centrifugal Chillers**

**Absorption Chillers**

### **Energy Storage**

**Chilled Water Storage**

**Hot Water Storage**

## **Costs and Benefits**

### **for Generalized System**

**Introduction**

**Loads**

*Peak*

*Annual*

*Peak*

*Annual*

*Peak*

*Annual*

**Key System Parameters**

-  
*Heating*

*Cooling*

*Power*

System  
*Piping Technology*

*Distribution System Length*

*Annual Distribution Efficiency*

Interface  
*Type*

*Average Size*

**Operating Costs**

Gas

## **of Technology Options**

### **Introduction**

### **Capital Costs**

#### Facilities

*Gas Boilers*

*Biomass Boilers*

#### Heat and Power

*Gas Engines*

*Gas Turbines*

*Steam Turbine Rankine Cycle*

*Organic Rankine Cycle*

#### Thermal and Waste Heat

*Solar Thermal*

*Ground Source Heat Pumps*

*Industrial Waste Heat Recovery*

*Electric Centrifugal Chillers*

*Absorption Chillers*

#### Energy Storage

*Chilled Water Storage*

*Hot Water Storage*



## **Operating Costs**

### Facilities

*Gas Boilers*

*Biomass Boilers*

### Heat and Power

*Gas Engines*

*Gas Turbines*

*Steam Turbine Rankine Cycle*

*Organic Rankine Cycle*

### Thermal and Waste Heat

*Solar Thermal*

*Ground Source Heat Pumps*

*Industrial Waste Heat Recovery*

*Electric Centrifugal Chillers*

*Absorption Chillers*

### Systems

### Interface Systems

## **Total Annual Costs**

of Capital

Production Technologies

*Boiler Facilities*

Boilers

Boilers

*Combined Heat and Power*

Engines

Turbines

Turbine Rankine Cycle

Rankine Cycle

*Renewable Thermal and Waste Heat*

Thermal

Source Heat Pumps

Waste Heat Recovery

*Chillers*

Centrifugal Chillers

Chillers

Integrated System Configurations

*Scenario 1*

*Scenario 2*

*Scenario 3*

## **Grid Benefits**

**Peak Power Demand Reduction**

**Power Grid Support**

**Reliability and Power Quality Benefits For Mission-Critical Facilities**

## **and Environmental Benefits**

**Power Grid Characteristics**

Rate

Gas Emissions

**Primary Energy Consumption Comparisons with Business As Usual**

Energy Technologies

Integrated Community Energy System Scenarios

**Greenhouse Gas Emission Comparisons with Business As Usual**

Energy Technologies

Integrated Community Energy System Scenarios

**Air Pollution Emission Comparisons with Business As Usual**

Energy Technologies

Integrated Community Energy System Scenarios

## **Implementation Challenges**

### **Buy-In**

### **Roles and Structure for Financing, Ownership and Operation**

### **Project Development**

### **Securing the Initial Customer Base**

### **Design for Both Near Term and Long Term**

### **Construction**

## **Ownership and Operation Models**

Risk Management

Public Sector Strengths

Private Sector Strengths

### **Options**

Municipal Utility Company

Special-Purpose Municipal Entity

Private Non-Profit Corporation

**Private For-Profit Corporation**

**Public-Private Partnership**

**Options**

**Debt**

Exempt Revenue Bonds

Bonds

Financing

-interest Federal Loan

**Private Equity**

**Grants**