

Commerce Energy Biogas/PV Mini-Grid  
Renewable Resources Program

***Making Renewables Part of an Affordable and  
Diverse Electric System in California***

**Contract No. 500-00-036**

**Final Program Report: Report Outline**

Project No. 0 Program Administration

*Task 0.6.1 Draft Report Outline*

*Publication Number: (TBD)\_\_\_\_\_*

**Prepared For:**

California Energy Commission  
Public Interest Energy Research Renewable Program  
Ms. Zhiqin Zhang, Commission Project Manager  
Total Contract Amount: \$11,668,572

**Prepared By:**

***Itron***

1104 Main Street, Suite 630  
Vancouver, WA 98660

**Legal Notice**

This report was prepared as a result of work sponsored by the California Energy Commission (Commission). It does not necessarily represent the views of the Commission, its employees, or the State of California. The Commission, the State of California, its employees, contractors, and subcontractors, make no warranty, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the use of this information will not infringe upon privately owned rights. This report has not been approved or disapproved by the Commission nor has the Commission passed upon the accuracy or adequacy of the information in this report.

March 2006

# Table of Contents

---

|   |              |
|---|--------------|
| <b>Legal Notice</b> .....   | <b>L-1</b>   |
| <b>PIER Commerce Energy Program Acknowledgements</b> .....                                  | <b>ACK-1</b> |
| California Energy Commission Staff:.....  | ACK-1        |
| Renewable Program Advisory Committee Members: .....   | ACK-1        |
| Project Technical Advisory Committee Members: [by Project<br>1.1/2.1/2.2/3.1/3.2/3.3] ..... | ACK-1        |
| Commerce Energy Program Team: .....   | ACK-1        |
| Project Host Facility Team Members: .....   | ACK-1        |
| <b>Preface</b> .....  | <b>P-1</b>   |
| <b>Abstract Program Final Report</b> .....  | <b>A-1</b>   |
| Program Purpose & Objectives .....  | A-1          |
| Key Program Outcomes .....  | A-1          |
| Program Conclusions .....   | A-1          |
| <b>Executive Summary</b> .....  | <b>ES-1</b>  |
| ES.1 Program Purpose .....  | ES-1         |
| ES.2 Goals & Objectives .....   | ES-1         |
| ES.3 Key Program Outcomes .....   | ES-1         |
| ES.4 Benefits to California .....   | ES-1         |
| ES.5 Conclusions and Recommendations .....  | ES-1         |
| <b>1 Introduction to the Commerce Energy PIER Renewables Mini-Grid Program</b> .....        | <b>1-1</b>   |
| 1.1 Background and Overview .....   | 1-1          |
| 1.2 Commerce Program Goals and Objectives .....   | 1-1          |
| <i>Program Planning and Analysis</i> .....  | 1-1          |
| <i>Biogas to Energy Projects</i> .....  | 1-1          |
| <i>Building-Applied PV Projects</i> .....   | 1-1          |
| 1.3 Report Organization .....   | 1-1          |
| <b>2 Commerce Energy Renewable Mini-Grid Program Approach</b> .....                         | <b>2-1</b>   |
| 2.1 Program Planning, Analysis and Prioritization of Resource Options.....                  | 2-1          |
| <i>Initial Mini-Grid Study Area</i> .....   | 2-1          |
| <i>Mini-Grid Renewable Resource Determination</i> .....                                     | 2-1          |
| <i>Determination of Electric T&amp;D Boundaries within the Mini-Grid Study Area</i> .....   | 2-1          |
| <i>Renewable Resource Market Potential Assessment</i> .....                                 | 2-1          |
| <i>Economic and Environmental Benefits of Mini-Grid Renewable Resources</i> .....           | 2-1          |
| <i>Estimation of Future Mini-Grid Renewable Resource T&amp;D Public Benefits</i> .....      | 2-1          |
| <i>Identification and Prioritization of Candidate Renewable Generation Facilities</i> ..... | 2-1          |
| 2.2 Development and Implementation of Selected Projects.....                                | 2-1          |
| <i>Biogas to Energy Projects</i> .....  | 2-1          |
| <i>Building-Applied PV Projects</i> .....   | 2-2          |

|   |            |
|---|------------|
| <b>3 Program Outcomes</b> .....   | <b>3-1</b> |
| 3.1 Program Challenges and Market Issues .....  | 3-1        |
| <i>Biogas to Energy Projects</i> .....  | 3-1        |
| <i>Building-Applied PV Projects</i> .....   | 3-1        |
| <i>Chino Basin Mini-Grid Distribution System Assessment</i> .....                           | 3-1        |
| 3.2 Program Results (by Project Area).....  | 3-1        |
| <i>Biogas to Energy Projects</i> .....  | 3-1        |
| <i>Building-Applied PV Projects</i> .....   | 3-1        |
| <i>Chino Basin Mini-Grid Distribution System Assessment</i> .....                           | 3-1        |
| 3.3 Summary of Commerce Energy Program Results .....  | 3-1        |
| <b>4 Conclusions and Recommendations</b> .....  | <b>4-1</b> |
| 4.1 Program Conclusions by Project Area .....   | 4-1        |
| <i>Biogas to Energy Projects</i> .....  | 4-1        |
| <i>Building-Applied PV Projects</i> .....   | 4-1        |
| <i>Chino Basin Mini-Grid Distribution System Assessment</i> .....                           | 4-1        |
| 4.2 Recommendations by Project Area .....   | 4-1        |
| <i>Biogas to Energy Projects</i> .....  | 4-1        |
| <i>Building-Applied PV Projects</i> .....   | 4-1        |
| <i>Chino Basin Mini-Grid Distribution System Assessment</i> .....                           | 4-1        |
| 4.3 Program Benefits to California .....  | 4-1        |
| <i>Existing Benefits Derived from the Commerce Program</i> .....                            | 4-1        |
| <i>Potential Future Program Benefits from Market Dissemination and Transformation</i> ..... | 4-1        |
| 4.4 Summary of Conclusions and Recommendations .....  | 4-1        |
| <b>Endnotes</b> .....   | <b>E-1</b> |
| <b>Glossary</b> .....   | <b>G-1</b> |
| <b>References</b> .....   | <b>R-1</b> |

### List of Figures

Error! No table of figures entries found.

### List of Tables

Error! No table of figures entries found.



## Legal Notice

---

This report was prepared as a result of work sponsored by the California Energy Commission (Energy Commission). It does not necessarily represent the views of the Energy Commission, its employees, or the State of California. The Energy Commission, the State of California, its employees, contractors, and subcontractors, make no warranty, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the use of this information will not infringe upon privately owned rights. This report has not been approved or disapproved by the Energy Commission nor has the Energy Commission passed upon the accuracy or adequacy of the information in this report.

# PIER Commerce Energy Program

## Acknowledgements

---

Commerce Energy on behalf of the Commerce Energy PIER Mini-Grid Program would like to acknowledge and thank the following individuals and/or companies for their support and assistance with this important Program.

### California Energy Commission Staff:

- Ms. Elaine Sisson-Lebrilla, Renewables Program Lead (Acting)
- Ms. Zhiqin Zhang, Energy Commission Project Manager
- Mr. Joseph McCabe
- Mr. Hassan Mohammed
- Mr. Prab Sethi
- Mr. Golam Kibrya
- Mr. George Simons

### Renewable Program Advisory Committee Members:

**Project Technical Advisory Committee Members: [by Project 1.1/2.1/2.2/3.1/3.2/3.3]**

### Commerce Energy Program Team:

### Project Host Facility Team Members:

# Preface

---

The Public Interest Energy Research (PIER) Program supports public interest energy research and development that will help improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

The PIER program, managed by the California Energy Commission (Energy Commission), annually awards up to \$62 million to conduct the most promising public interest energy research by partnering with Research, Development, and Demonstration (RD&D) organizations, including individual, businesses, utilities, and public or private research institutions.

PIER funding efforts are focused on the following six RD&D program areas:

- Buildings End-Use Energy Efficiency
- Industrial/Agricultural/Water End-Use Energy Efficiency
- Renewable Energy
- Environmentally-Preferred Advanced Generation
- Energy-Related Environmental Research
- Strategic Energy Research

What follows is the final report for the PIER Commerce Energy Biogas/PV Mini-Grid Renewable Resources RD&D Program, Contract Number 500-00-036 conducted by the Commerce Energy Team, comprised of Commerce Energy, Itron, Inc., CH<sub>2</sub>MHill, BEW Engineers, Renewable Energy Development Institute (REDI) and Zaininger Engineering, Inc (ZECO). The report is entitled “*Project 0: Task 0.6 Final Program Report*”. This project contributes to the Commerce Energy PIER Renewable Mini-Grid RD&D Program funded in part by the Energy Commission’s PIER Renewables Program element.

For more information on the PIER Program, please visit the Energy Commission’s Web site at: <http://www.energy.ca.gov/research/index.html> or contact the Energy Commission’s Publications Unit at 916-654-5200. Or you may review the PIER Commerce Energy Website at: <http://www.pierminigrd.org>, which was created for this contract, and summarizes each project of the contract.

# **Abstract**

## **Program Final Report**

---

[<250 words – very brief technical version of Executive Summary]

### **Program Purpose& Objectives**

### **Key Program Outcomes**

### **Program Conclusions**

# **Executive Summary**

---

**ES.1 Program Purpose**

**ES.2 Goals & Objectives**

**ES.3 Key Program Outcomes**

**ES.4 Benefits to California**

**ES.5 Conclusions and Recommendations**

# 1

## **Introduction to the Commerce Energy PIER Renewables Mini-Grid Program**

---

### **1.1 Background and Overview**

### **1.2 Commerce Program Goals and Objectives**

*Program Planning and Analysis*

*Biogas to Energy Projects*

*Building-Applied PV Projects*

### **1.3 Report Organization**

# 2

## Commerce Energy Renewable Mini-Grid Program Approach

---

### 2.1 Program Planning, Analysis and Prioritization of Resource Options

*Initial Mini-Grid Study Area*

*Mini-Grid Renewable Resource Determination*

*Determination of Electric T&D Boundaries within the Mini-Grid Study Area*

*Renewable Resource Market Potential Assessment*

*Economic and Environmental Benefits of Mini-Grid Renewable Resources*

*Estimation of Future Mini-Grid Renewable Resource T&D Public Benefits*

*Identification and Prioritization of Candidate Renewable Generation Facilities*

### 2.2 Development and Implementation of Selected Projects

*Biogas to Energy Projects*

***Building-Applied PV Projects***

# 3

## Program Outcomes

---

### 3.1 Program Challenges and Market Issues

*Biogas to Energy Projects*

*Building-Applied PV Projects*

*Chino Basin Mini-Grid Distribution System Assessment*

### 3.2 Program Results (by Project Area)

*Biogas to Energy Projects*

*Building-Applied PV Projects*

*Chino Basin Mini-Grid Distribution System Assessment*

### 3.3 Summary of Commerce Energy Program Results

# 4

## Conclusions and Recommendations

---

### 4.1 Program Conclusions by Project Area

[Address Commercialization Potential – where appropriate]

*Biogas to Energy Projects*

*Building-Applied PV Projects*

*Chino Basin Mini-Grid Distribution System Assessment*

### 4.2 Recommendations by Project Area

*Biogas to Energy Projects*

*Building-Applied PV Projects*

*Chino Basin Mini-Grid Distribution System Assessment*

### 4.3 Program Benefits to California

*Existing Benefits Derived from the Commerce Program*

*Potential Future Program Benefits from Market Dissemination and Transformation*

### 4.4 Summary of Conclusions and Recommendations

## Endnotes

---

The following endnotes/footnotes are contained within this Report.  
(Sections referenced indicated where they appear within the report):

# Glossary

---

The following Acronyms are contained within this Report:

## References

---