



State of Minnesota

# State of MN: Public Buildings Enhanced Energy Efficiency Program (PBEEEP)

## Program Overview

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### Presenters:

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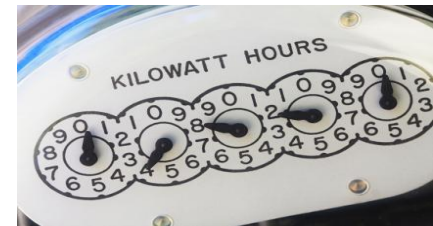
**PBEEEP**  
State Government



# Agenda – PBEEEP All-Agency Overview

## ▶ Presentation Contents:

- ▶ PBEEEP Introduction
- ▶ Overview of Program
- ▶ Program Framework
  - ▶ Application
  - ▶ Screen Phase
  - ▶ Investigate Phase
  - ▶ Implement Phase
  - ▶ Verify Phase
- ▶ On-going Support
- ▶ Program Release
  - ▶ Availability and Participation Details
- ▶ Case Study



# Why participate in PBEEEP?

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**PBEEEP** = Quality Assurance (QA)  
*State Government*

**QA = \$ Saved**

# PBEEEP Introduction

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- ▶ **Legislative Background – State Energy Improvement Financing Program**
  - ▶ Minn. Stat §16B.321 – 16B.322 enacted in 2008 to address two fundamental constraints to reducing energy consumption in state buildings:
    - ▶ Access to expert technical assessment to identify measures to reduce energy consumption
    - ▶ Access to financing to implement recommended measures
  - ▶ Economic feasibility is determined by ability to pay back financing out of savings realized by energy improvement project
  - ▶ Admin authorized to develop and administer energy improvement financing program
  - ▶ \$1M of Petroleum Violation Escrow Funds transferred to Admin to develop program and provide technical services

# PBEEEP Introduction

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## ▶ **Qualified Energy Improvement Project**

- ▶ Project and financing agreement approved by head of agency that operates or manages the state building to be improved;
- ▶ The project is technically and economically feasible;
- ▶ The State agency that operates or manages the state building has made adequate provision for the operation and maintenance of the planned improvements;
- ▶ If an energy efficiency improvement, the project is calculated to result in a positive cash flow in each year of the financing agreement is in effect;
- ▶ The project proposer has fully explored the use of conservation investment plan opportunities;
- ▶ If a renewable energy improvement, the project is calculated to reduce use of fossil-fuel energy; and,
- ▶ If a geothermal energy improvement, the project is calculated to produce savings in terms of non-geothermal energy and costs.

# PBEEEP Definitions



## People and Organizations

- ▶ Program:
    - ▶ Center for Energy and Environment (CEE)
  - ▶ Provider:
    - ▶ PBEEEP Qualified Contractor
  - ▶ State
    - ▶ Dept. of Administration/ RECS
  - ▶ Agency:
    - ▶ State Agency
- PBEEEP development and program administrator
- Contractors/consultants that complete and manage PBEEEP projects
- Project site/building owner

# PBEEEP Definitions



## Technical Terminology

- ▶ ReCommissioning and/or RetroCommissioning(RCx)
  - ▶ Repair to, or optimization of, building operations (schedules, procedures), equipment, facilities, or systems to primarily enhance energy efficiency.
  - ▶ RCx generally focuses on major building systems (building envelope, HVAC, and controls), targeting quick payback and often, relatively quick turnaround, energy conservation opportunities
  
- ▶ Retrofit
  - ▶ Replacement of or upgrade to existing equipment, tools, or systems with the primary intent of enhancing energy efficiency

# Program Overview - Background

## ▶ Enhance MN Public Building Energy Efficiency through Retro- Commissioning and Retrofit

### ▶ Purpose:

- ▶ Reduce Energy Use
- ▶ Reduce Operating Costs
- ▶ Reduce Green House Gas (GHG)Emissions
- ▶ Create/Retain Jobs
- ▶ Promote Renewable, Alternative Energy Sources



# Program Overview - Background

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## ▶ Program Development

- ▶ CEE & PECl: partnered for the development of the Program under contract with the State
- ▶ CEE has extensive experience in the ReCommissioning/Retrofit Industry

## ▶ Development Outcomes:

- ▶ Delivery of all technical standards and guidelines
- ▶ Delivery of the 4-phase project framework and application process

# Program Overview – Technical Standards and Guidelines



- ▶ **Project-Level:**
  - ▶ Screening Guidelines
  - ▶ Investigation Guidelines
    - ▶ Findings Workbook Tool
  - ▶ Implementation Guidelines
  - ▶ Monitoring and Verification Guidelines
- ▶ **Program-Level:**
  - ▶ Provider Performance Guidelines
  - ▶ Program Evaluation Process

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# Program Framework: PBEEEP Project Process

**Apply**

**P1:  
Screen**

**P2:  
Investigate**

**P3:  
Implement**

**P4:  
Verify**

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# Program Framework: PBEEEP Project Process

**Apply**

**P1:  
Screen**

**P2:  
Investigate**

**P3:  
Implement**

**P4:  
Verify**

# Program Framework: Apply

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- 1) Application is available at [www.PBEEEP.org](http://www.PBEEEP.org)
- 2) Agency submits application to Program via web (preferred) or Fax/Mail/ E-mail ([PBEEEPapplication@mncee.org](mailto:PBEEEPapplication@mncee.org))
- 3) Program notifies agency of status and queue

**Project is ready for SCREEN PHASE**



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# Program Framework: PBEEEP Project Process

Apply

**P1:  
Screen**

**P2:  
Investigate**

**P3:  
Implement**

**P4:  
Verify**

# Program Framework: Screen

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- 1) State/Program develop RFP using ***Application***
- 2) Provider performs screening per Guidelines
- 3) Provider submits ***Screening Form***
- 4) Program scores and ranks potential projects based on ***Screening Forms***

**Project is ready for INVESTIGATE PHASE**



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# Program Framework: PBEEEP Project Process

Apply

**P1:  
Screen**

**P2:  
Investigate**

**P3:  
Implement**

**P4:  
Verify**

# Program Framework: Investigate

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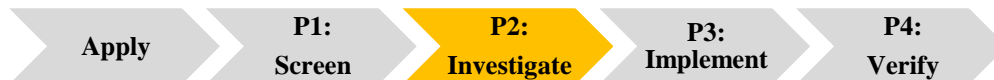
- 1) State/Program develop RFP using **Screening Form**
- 2) Investigation kick-off with key stakeholders
- 3) Provider completes investigation per Guidelines
  - Mid-Point Formal Review by Program
  - Final Formal Review by Program

# Program Framework: Investigate (cont.)

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- 4) Provider presents results of investigation
- 5) Agency determines measures for implementation with support from the Program (as needed)
- 6) Provider delivers final ***Investigation Report***

**Project is ready for IMPLEMENT PHASE**



# Program Deliverable –Investigation Report

## RCx Investigation Report Outline

The Program provides a template for the *RCx Investigation Report* and includes the following elements:

1. Program Cover (provided), customize for the facility
2. Table of Contents (provided, update as necessary)
3. Report Contents (see Outline below)

The RCx Provider should consider the following outline as the minimum content required and include any additional information gathered during the RCx investigation process that they feel may assist the Owner in selecting and implementing the retrofit and operational improvement measures.

### Introduction

Introduces the Report to the Owner with information about the RCx Provider and Company/Building involved in the project.

### 1.0 Project Overview

Copy and Paste from *Findings Workbook*, “Project Overview” worksheet.

### 2.0 Measures Selected for Implementation

An overview, recommendations for implementation, and evidence of proper implementation are outlined for each measure selected by the Owner. This section can include pictures, graphs and tables to support the data collected through investigation. An example of this section is provided in the following pages.

### 3.0 Next Steps

Description of the next steps in the Program for the Owner to anticipate, including the date they are expected to implement the selected measures.

**Appendix A: Investigation Summary Table (copied from the *Findings Workbook*)**

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# Program Framework: PBEEEP Project Process

Apply

**P1:  
Screen**

**P2:  
Investigate**

**P3:  
Implement**

**P4:  
Verify**

# Program Framework: Implement

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- 1) State/Program develop RFP using ***Investigation Report***
- 2) Implementation kick-off with key stakeholders
- 3) Provider manages implementation per Guidelines
  - Mid-Point Formal Review by Program
  - Final Formal by Program

**Project is ready for VERIFY PHASE**



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# Program Framework: PBEEEP Project Process

Apply

**P1:**  
Screen

**P2:**  
Investigate

**P3:**  
Implement

**P4:**  
Verify

# Program Framework: Verify

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- 1) Provider organizes *Verification Planning Meeting*
- 2) Provider completes verification per Guidelines
- 3) Provider submits ***Implementation Report***
- 4) Provider delivers approved hand-off plan, which includes training plan and documents

**Project COMPLETE**



# On-going Program Support

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- 1) Assistance and Technical Services in the event of problems:
  - 1) Mechanical functions
  - 2) Energy consumption
  - 3) Comfort
  - 4) Deficient Energy Savings
  - 5) Other
- 2) On-going energy consumption monitoring support

# Program Overview – Project Funding

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- ▶ **Financing High-Lights:**
  - ▶ Lease-purchase agreement
  - ▶ Financing is repaid through implemented measure savings
  - ▶ Financing includes administration and agency support costs
  - ▶ Agencies will be required to certify sufficient resources for debt service payments

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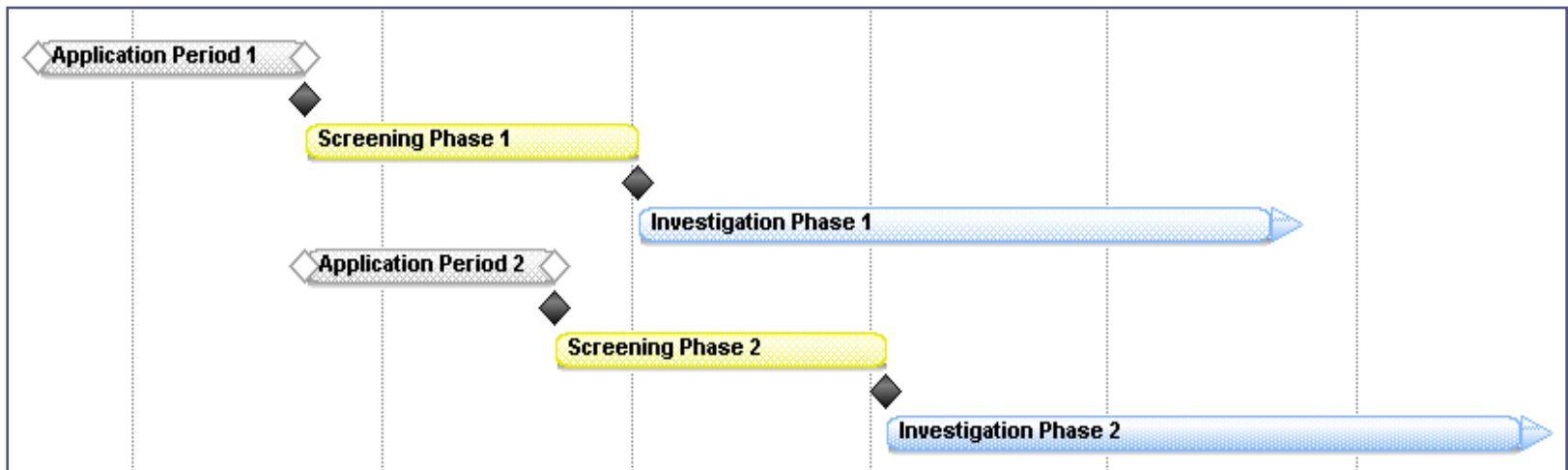
# Program Release: Availability Details

## ▶ Eligible Projects

- ▶ Any project with the objective of improving the efficiency of energy-consuming equipment (chillers, motors, boilers, etc) and/or equipment that affects energy consumption (building envelope, etc.)

## ▶ High-Level Schedule:

- ▶ August/September –
  - ▶ Manual Complete
  - ▶ Master Qualified Providers Trained
  - ▶ Application Period 1
- ▶ September/October –
  - ▶ Screen 1
  - ▶ Application Period 2
  - ▶ Screen Group 2
  - ▶ Investigation Phase 1
- ▶ On-going
  - ▶ Implementation Phases Kick-Off
  - ▶ Projects cycle continues



# Program Release: **Why participate in PBEEEP?**

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- ▶ Utilize the PBEEEP framework: built in quality assurance
- ▶ Monitoring/Verification an integrated component
- ▶ Focused on opportunities with RetroCommissioning/ Retrofit
- ▶ Opportunities for cost sharing / Comprehensive funding mechanisms
  
- ▶ **Simple participation process**

# Program Release: Participation

- ▶ **Application:**
  - ▶ Available at: [www.pbееep.org](http://www.pbееep.org)
  - ▶ Submit to Program:
    - ▶ Program Application Form
    - ▶ Utility Authorization Form
    - ▶ Dept. Of Admin/RECS PIF
  - ▶ Questions? contact [PBEEEPapplication@mncee.org](mailto:PBEEEPapplication@mncee.org)

3.0 Energy Usage					
	Electric	Natural Gas			
3.1 Utility Provider					
3.2 Estimated Annual Usage (last 12 mo)	kWh	Therms			
3.3 Estimated Annual Cost (last 12 mo)	\$	\$			
3.4 Peak Summer Demand	kW				
3.5 Number of Meters (total)					
3.6 Is there on-site generation?					
<input type="checkbox"/> No <input type="checkbox"/> Yes    If yes, source?					
3.7 Has utility data been for building/site been entered into a benchmarking application:					
<input type="checkbox"/> No		<input type="checkbox"/> Yes, please provide additional information:		<input type="checkbox"/> B3 data base, please provide Username/Password for log-in: <input type="checkbox"/> Portfolio Manager (PM) data base, please provide Username/Password for log-in	
4.0 Building Overview					
4.1 Primary Use(s) (check all that apply):	Medical <input type="checkbox"/>	Conference <input type="checkbox"/>	Office <input type="checkbox"/>	Lodging <input type="checkbox"/>	Other, specify:
4.2 Building Square Footage (gross)					
4.3 % Occupancy:					
4.4 Year Constructed:					
4.5 Total Annual Hours of Operation:					
5.0 HVAC System Overview					

# Case Study:

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- ▶ Typical office building.
  - ▶ 59,000 sq. ft
  - ▶ Single Constant volume air handler for entire building
  - ▶ 225 ton centrifugal chiller
  - ▶ Hot water perimeter radiation
  - ▶ Hot water also used in 150 terminal boxes for reheat
  
- ▶ Recommissioning effort was driven by core principles outlined in PBEEEP

# Case Study:

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- ▶ No serious problems in the building, but...
  - ▶ Higher than expected energy use when compared to similar buildings.
  - ▶ Some typical comfort complaints from occupants.
  - ▶ Pressurization problem during operation.

# Case Study:

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- ▶ Total supply air flow was determined to be greater than needed.
- ▶ Measured at 1.0 cfm/sq. ft. Reduced to 0.8 cfm/sq. ft.
  - ▶ Installed a Variable Frequency Drive (VFD)

Electrical Demand (kW)	Electrical Energy (kWh)	District Heat Demand (kW)	District Heat Energy (mWh)	Total Annual Savings (\$)
24.8	75,365	31.8	108.0	\$7,147

# Case Study:

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- ▶ With the installation of the VFD, an additional mode of operation was able to be implemented to increase savings during extended hours.
- ▶ An additional 10% reduction in flow after the hours of 5:30 p.m. was programmed into the automation system.

Electrical Demand (kW)	Electrical Energy (kWh)	District Heat Demand (kW)	District Heat Energy (mWh)	Total Annual Savings (\$)
	47,056			\$1,435

# Case Study:

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- ▶ Return fan was incorrectly controlling building static pressure.
  - ▶ Over pressurization during economizing
    - ▶ Installed a Variable Frequency Drive (VFD)
    - ▶ Installed new motor to match actual load.

Electrical Demand (kW)	Electrical Energy (kWh)	District Heat Demand (kW)	District Heat Energy (mWh)	Total Annual Savings (\$)
6.9	31,050			\$1,489

# Case Study:

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- ▶ Chilled water flow was found to be over pumped.
  - ▶ Design flow rate on chiller is 450 gpm. Measured flow between 680 gpm and 800 gpm.
    - ▶ Installed a correctly sized pump.

Electrical Demand (kW)	Electrical Energy (kWh)	District Heat Demand (kW)	District Heat Energy (mWh)	Total Annual Savings (\$)
5.8	11,566			\$544

# Case Study:

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- ▶ Hot water reheat was constant volume.
  - ▶ Convert to variable volume flow with differential setpoint.
    - ▶ Installed a VFD installed
    - ▶ Installed a new motor compatible with VFD

Electrical Demand (kW)	Electrical Energy (kWh)	District Heat Demand (kW)	District Heat Energy (mWh)	Total Annual Savings (\$)
	20,072			\$612

# Case Study:

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## ► Financial information

<b>Opportunity</b>	<b>Annual Savings</b>	<b>Gross cost of opportunity</b>	<b>Simple Payback</b>	<b>Utility Rebate</b>	<b>Simple Payback after rebate</b>
Reduction in supply fan volume	\$8,582	\$9,701	1.1 yrs	\$4,960	0.55 yrs
Return air flow correction	\$1,489	\$8,803	5.3 yrs	\$1,380	4.9 yrs
New chilled water pump	\$544	\$5,552	10.2 yrs	\$1,160	8.1 yrs
Reheat pump control	\$612	\$3,256	5.3 yrs	\$0	5.3 yrs
<b>Total Package</b>	<b>\$11,227</b>	<b>\$27,312</b>	<b>2.4 yrs</b>	<b>\$7,500</b>	<b>1.7 yrs</b>

# Program Release – Program Information

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- ▶ Program Administration Organization:

Center for Energy and Environment (CEE)

212 3<sup>rd</sup> Ave North, Suite 560 | Mpls, MN 55401

- ▶ Mark Hancock, CEE Program Director / 612/335- 5861
- ▶ Christie Traczyk, CEE Program Manager / 612/335-2651
- ▶ Chris Plum, CEE Program Manager / 612/335-5825

- ▶ For additional information or to contact the program:

[www.PBEEEP.org](http://www.PBEEEP.org)

[PBEEEPapplication@mncee.org](mailto:PBEEEPapplication@mncee.org)

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