Commercial Kitchen Hot Water System Design Guide

Final Report

ET22SWE0048

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Disclaimer

Executive Summary

This document presents the final report for the Commercial Kitchen Hot Water System Design Guide project. This project updates a 2022 design guide by including additional information to support decarbonization of commercial kitchen hot water systems. It also separates information into two guides for two different commercial kitchen stakeholders: designers and users. An accompanying PowerPoint and versions in Spanish will also be distributed to the public.

This report provides a summary of the project's objectives, as well as the Team's methods and approach to completing the project. This report includes appendices presenting the final versions of both guides.

Abbreviations and Acronyms

Acronym	Meaning
DHW	Domestic Hot Water
ETCC	Emerging Technologies Coordinating Council
PG&E	Pacific Gas & Electric
SCG	SoCalGas
SDG&E	San Diego Gas & Electric

Table of Contents

List of Figures

1. Introduction

This final report presents a summary of the Commercial Kitchen Hot Water System Design Guide project and final design guides. The primary objective of the project was to use a design guide to demonstrate electrification and energy efficiency opportunities within commercial kitchen domestic hot water (DHW) systems. The remainder of this report presents an overview of the project along with our objectives. It then details our approach and methods used to carry out the project. It concludes by presenting information on how the documents will be distributed to the target audiences. The appendices present the final design guides.

2. Project Overview and Objectives

Water heating for food service applications represents 340 million therms of gas consumption in California, and thus presents a significant opportunity for electrification, as well as efficiency improvements in retrofits and new construction applications. Public-facing design guides specific to improving hot water heating, delivery, and use in commercial kitchens are critical to restaurant operators, system designers, and other relevant audiences. Pacific Gas and Electric (PG&E) first published a design guide to support commercial kitchen DHW system designs in 2010[1] and SoCalGas (SCG) updated the document in 2022.[2]

While the 2022 edition included important energy-efficient advancements, it did not focus on electrification opportunities critical for California to meet decarbonization goals. This project, therefore, addresses this gap in the 2022 design guide by including additional information related to electrification opportunities within commercial kitchen hot water systems. These additions assist commercial kitchen market actors in understanding key considerations in designing and using kitchens in ways that can actualize decarbonization goals.

Due to the numerous additions required, the Project Team became concerned with the potential length of the design guide and the wide variety of information targeting different types of stakeholders. To address this concern, we separated the information into two documents for two unique types of decision makers: commercial kitchen operators and commercial kitchen designers. Separating the information into two guides provides key market actors with specific paths to both design commercial kitchens efficiently and use commercial kitchens as efficiently as possible.

[1] Fisher-Nickel, inc., Pacific Gas and Electric Company. (2010). “Design Guide: Improving Commercial Kitchen Hot Water System Performance.”

[2] Frontier Energy, inc., Pacific Gas and Electric Company, Southern California Gas Company. (2022). “Design Guide: Advanced Water Heating for Foodservice.”

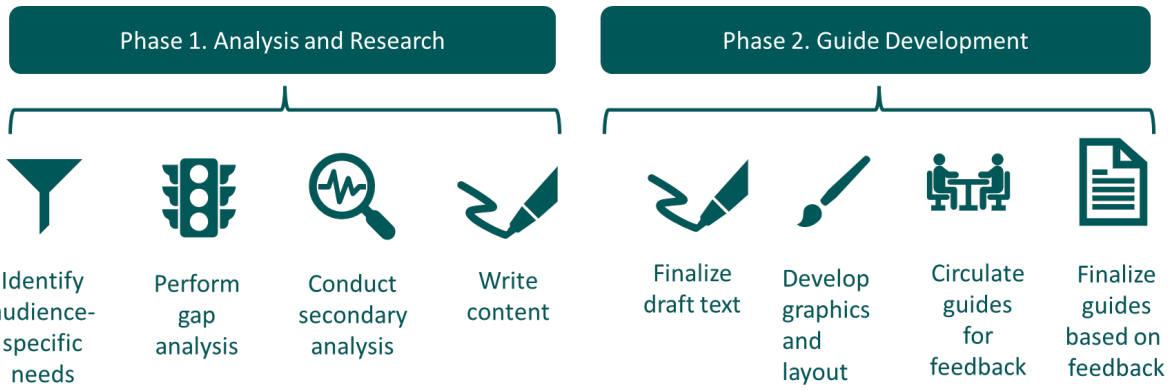
In summary, the Project Team pursued two primary objectives:

1. Update the 2022 guide to incorporate additional advanced hot water system design concepts
2. Separate the information into two different guides: a technical design guide for commercial kitchen designers and an operator's guide for commercial kitchen users

3. Approach and Methodology

To pursue this project, the Project Team developed content for the two guides. Figure 1 shows our overall approach for completing this project. As depicted, we approached this project in two phases. The first phase focused on analysis and research to support the development of the guides. To conduct this work, we first determined the type of information that should be included in each guide. We then performed a gap analysis to understand the additional information needed for each guide. Next, the Project Team conducted secondary research on new information required for each guide. To complete Phase 1 of the project, we drafted preliminary content for each guide.

Figure 1. Guide Development Approach



During the second half of 2023, the Project Team proceeded with Phase 2, which focused on developing the final guides. To do so, we developed a final first draft of each guide, then created accompanying graphics and a graphical layout of the guides. Once completed, we circulated the documents to stakeholders for feedback. To finalize the guides, we incorporated edits from stakeholder feedback. Through the dissemination process, the Project Team will translate the guides into Spanish and develop a slide deck with an accompanying voiceover in both English and Spanish.

As defined in our project plan, the Project Team pursued this approach through three defined tasks. The remainder of this section defines each of these three tasks by presenting the type of information included within each guide and accompanying slide deck.

Task 1: Operator's Guide[3]

[3] The task order for this project refers to this task as the "General Audience Guide."

The Project Team used the 2010[4] and 2022[5] Design Guides as a starting point for building a new commercial kitchen DHW Operator's Guide for users of commercial kitchens. This guide focuses on helping owners and operators of commercial kitchens understand how to operate their hot water systems efficiently and includes information specifically targeting that population. As needed, the operator's guide refers to the technical guide for more detailed considerations for purchasing new equipment and retrofitting kitchen layouts. Specifically, the Project Team included the following information into the operator's guide:

- Considerations when commissioning new equipment
- Operating equipment efficiently
- Maintaining systems, including insulation best practices, spring check valve recommendations, thermal expansion tanks, submetering hot water use, and other ways to catch water leaks
- Specifying new equipment

Task 2: Technical Design Guide

Similar to Task 1, the Project Team used the 2010[4] and 2022[5] Design Guides to develop a more focused technical design guide for designers and installers. This technical guide is intended to help commercial kitchen and DHW system designers create efficient and optimized systems. It is also intended to help contractors and tradespeople ensure that they are knowledgeable about high-quality installation practices and proper system commissioning. Advanced topics for the technical audience include:

- Concept of heat pump 'assist' and energy efficiency benefits versus conventional gas and electric heaters
- A thorough comparison of conventional gas and electric designs, compared to an optimized design
- Electric and gas heat pump types and energy efficiency benefits
- Heat pump incorporation considerations (e.g., ducting, noise, space, weight, and extra storage)
- Single pass electric heat pump-based designs such as the swing tank concept and parallel primary and temperature maintenance systems
- Health department sizing considerations for heat pumps
- Benefits of master mixing valves (e.g., improvements in single-pass reliability when the recirculation return is plumbed to the primary storage tank)
- Additional topics such as: pipe insulation, ECM pumps, and expansion of the design examples

Task 3: Slide Deck Presentation Accompanied by Audio in English and Spanish

To support distribution of the guides to the target audiences, the Project Team also created a slide deck presentation, accompanied by audio in both English and Spanish. This deck is expected to be

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[4] Fisher-Nickel, inc., Pacific Gas and Electric Company. (2010). "Design Guide: Improving Commercial Kitchen Hot Water System Performance."

[5] Frontier Energy, inc., Pacific Gas and Electric Company, Southern California Gas Company. (2022). "Design Guide: Advanced Water Heating for Foodservice."

posted as freely accessible on public-facing websites, including California Energy Wise, Emerging Technologies Coordinating Council (ETCC), and other sites as applicable.

4. Distribution of Guides

The Project Team will distribute these guides to target audiences throughout California by presenting the guides at industry events, as well as posting the guides to the California Energy Wise and ETCC websites for public access.[6] To facilitate distribution to a wider audience, the Project Team has also created Spanish versions of both guides.

This Final Report is accompanied by the Commercial Kitchen Hot Water System Design Guides as separate files in the following formats:

Operators' Design Guide (pdf)
Operators' Design Guide in Spanish (pdf)
Operators' Design Guide PowerPoint with audio (pptx)
Operators' Design Guide PowerPoint with audio in Spanish (pptx)
Operators' Design Guide PowerPoint with audio movie (mp4)
Operators' Design Guide PowerPoint with audio movie in Spanish (mp4)

Technical Design (pdf)
Technical Design in Spanish (pdf)
Technical Design Guide PowerPoint with audio (pptx)
Technical Design Guide PowerPoint with audio in Spanish (pptx)
Technical Design Guide PowerPoint with audio movie (mp4)
Technical Design Guide PowerPoint with audio movie in Spanish (mp4)

[6] Commercial kitchen design guides for the California Energy Wise website are found here: https://caenergywise.com/design-guides/. Commercial kitchen design guides for the Emerging Technologies Coordinating Council website can be found here: https://www.etcc-ca.com/reports/commercial-kitchen-hot-water-system-design-guide.