What's cooking? Design of a Retrofit Ready Induction Stove

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Project Overview

Our Client

Redwood Energy is an electrification company based out of Eureka, CA. They own and operate several multi-family zero-net-energy housing complexes that provide clean, affordable living spaces for many disadvantaged communities and low-income renters.

Project Significance

This design project is focused on extending the benefits of electrification to renters and non-homeowners both within Redwood Energy's housing developments and in external communities. The goal is to design a retrofit ready induction stove that eliminates the need for a time intensive and costly cooktop conversion.

Project Team Objectives

The primary objective for the project team is to analyze cooking session data taken from a multifamily housing community owned by Redwood energy (Atascadero housing complex) and determine if 1800W induction cooktop is sufficient for most household use, and how these capabilities are affected by number of occupants and cooking duration

Design Specifications:

- 9" & 7" induction coil, 1800W, load balancing.
- 5" induction coil. 900W, load balancing
- Compatible with a 120V wall outlet (no wiring upgrade needed)
- 1800W maximum for total power draw

Data Analysis Methodology

Table 2. Cooking efficiency results measured according to EPRI test procedure

	Large Vessel		Small Vessel	
	Half Power	Full Power	Half Power	Full Power
Induction Cooker A	74.9%	77.6%	76.5%	77.4%
Induction Cooker B	75.7%	77.2%	75.6%	75.1%
Electric Coil	81.6%	83.4%	48.2%	41.5%
Natural Gas	41.7%*	35.2%*	-	30.2%*

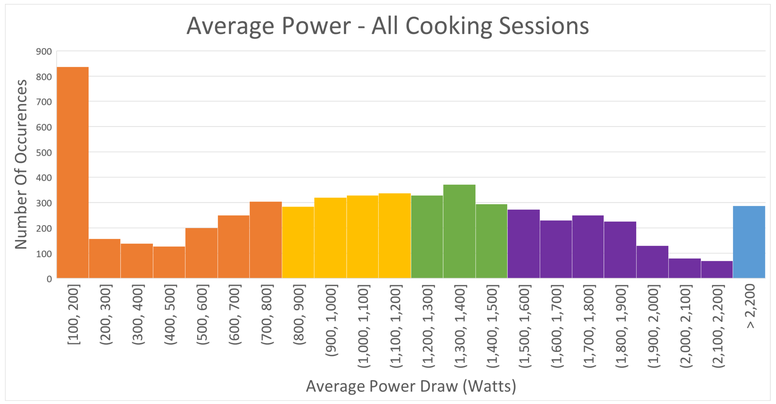
*Natural gas range tested at 50° F (10° C).

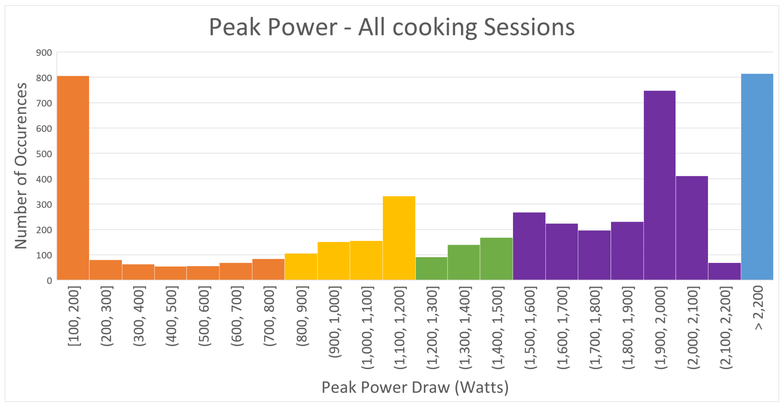
Assumptions

- Cooking session data from November to December (2019, pre-COVID) chosen to represent all sessions
- Lowest setting on electric cooktop is **100 W (used as minimum cutoff value)**
- Any cooking sessions that drew more than **3000W and longer than 20 minutes** is assumed to include oven operation (excluded)
- Only data for **1-6 occupant** apartments was considered

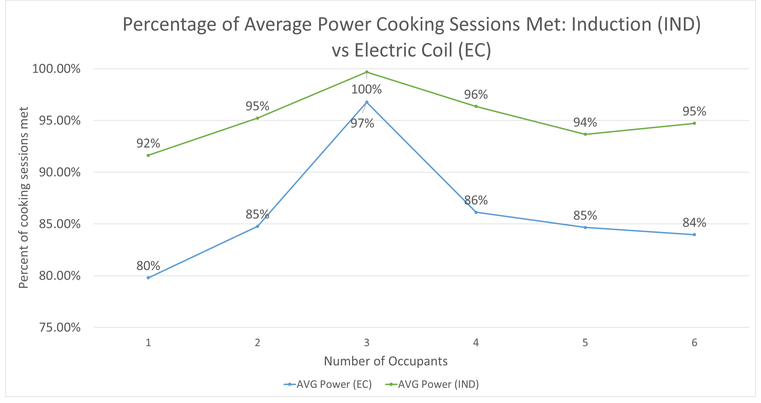
Cooktop Efficiency

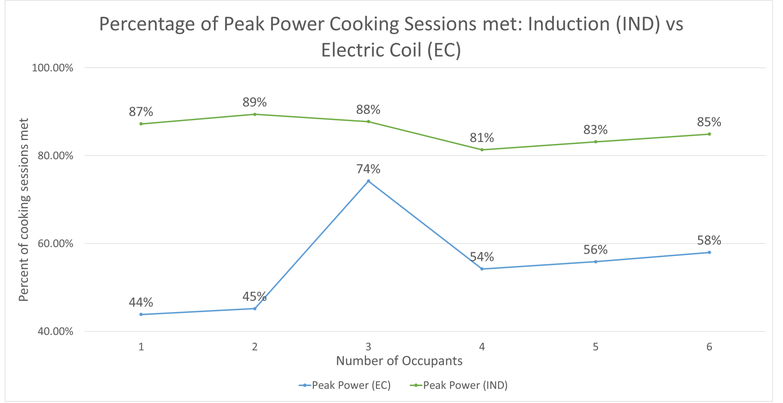
Induction stove efficiency = **78% (Induction Stove A average at full power)**
Electric stove efficiency = **62% (Electric Coil range average at full power)**





Electric Coil Burner Size (W)	Induction Stove equivalent (W)	Peak Power Cooking Sessions Covered by Burner	Average Power Cooking Sessions Covered by Burner
750	600	22%	32%
1100	900	31%	51%
1450	1200	43%	71%
2200	1800	85%	95%





Key Findings

- A **16%** improvement in efficiency yields a **19%** savings in energy (Wh)
- Approximately **85%** of cooking sessions peak power usage is covered by an induction stove
- Approximately **95%** of cooking sessions' average power draw is covered by an induction stove
- As occupancy increases, power draw increases
- **67%** of all cooking sessions fall between 1 and 20 minutes
- **15%** of cooking sessions draw between 100 and 200 Watts

Sweeney, Micah, et al. *Induction Cooking Technology Design and Assessment*. Electric Power Research Institute (EPRI), 2014
BAKER, R.C., et al. "Electrical Energy Used and Time Consumed When Cooking Foods by Various Home Methods: Eggs." *Poultry Science*, vol. 59, no. 3, 1980, pp. 545–549., https://doi.org/10.3382/ps.0590545.