

Understanding and Improving Solar Thermal Water Heating Effectiveness for California Households



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California Energy Commission

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Overview

- Problem and research needs
- California SWH policy goals and results to date
- Research Approach
- Research Design and hoped-for new knowledge
- Partners and team
- Next steps

Problem and Research Needs

- Climate change
- Carbon reduction
- Displacing natural gas
- Considering all sources of emissions and forms of demand
- Residential SWH is an established policy approach
- But: A need to assess actual benefits of SWH
 - real world adoption
 - real world performance: both *technology* and *behavior*
 - real world benefits

Significant Solar Hot Water Investments

- \$350M incentives authorized 2010-2018
- Senate Bill (SB) 1 (2006)
 - \$100M incentives for solar thermal technologies displacing electricity
- Assembly Bill (AB) 1470 (2007)
 - \$250M for 200,000 SWH systems to displace natural gas
- SWH Pilot Program (2007-2009)
 - market test & measured cost-effective savings
- CPUC approves CSI-Thermal through utilities (2010)
 - evaluation begins summer 2015

CSI – Thermal: Facts & Figures

- Existing SWH saturation: < 1% of SF units in CA
- Goal: 200,000 SWH systems by 2017
- Typical rebate: \approx \$3500
- Number of installations to date: 1,578
- Statewide contractor network: 506
- Number of contractors actually installing: 158
- Number of contractors installing 10+ systems: 30
- Numbers of installs for the top ten most successful contractors: 405, 100, 87, 84, 59, 58, 46, 43, 43, 39

Installs by the Top 30 Contractors: Finding *Hot/Cold Spots* in the Market

North Coast	12
Bay Area	41
Sacramento	209
San Joaquin Valley	272
Santa Barbara	91
Los Angeles	567
San Diego	87

total 1279

(81% of all installs)

Research Approach

- Market focused (both supply & demand sides considered: more than just a “barriers” and “adoption” problem)
- Theory-based (thinking about technologies AND people)
 - Diffusion of Innovation (weak, descriptive)
 - Institutional / Organizational Fields (competition, regulations)
 - Social Practices (social shaping of tech, social uses of tech)
 - Socio-technical Transitions (changes in tech systems over time)
- Empirical
 - data on SWH use and performance *in situ*
 - comparisons of markets
 - field data: consumer and installer interviews; experts

Research Design 1

- Landscape analysis & conceptual development
- Develop industry map
- Scope SWH markets elsewhere
- Inventory SWH technologies, costs & design options
- Depth interviews with experts (across sectors)
- Problem-solving workshops to explore novel solutions



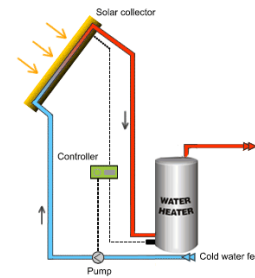
Research Design 2

- Assemble existing system and performance data
- Engage with homeowners and contractors
- Collect field data (surveys and interviews)
- Analysis
 - validation of GHG *emissions reduction* benefits
 - *technical* and *behavioral* factors affecting system performance
 - opportunities for improving SWH *adoption* and *performance*
 - *niche* opportunities (locales, consumer segments, situations)
 - estimate statewide, utility and regional *scaled-up potentials*



Hoped-for New Knowledge

- Understand the landscape of SWH manufacturing and distribution
 - structure and function of SWH markets, changes over time, opportunities for private sector and policy actors
 - espec. the dynamics of codes and regulations
- Understand homeowners & interactions with installers and SWH systems
 - motivations, values, purchasing choices
 - DHW behavior and needs
 - adoption process: SWH buying, selling
 - SWH in action: practices and operations
 - end-user experiences, understandings and assessments
 - DIY, grassroots and community programs



Partners

Partners	Contributions
Southern California Gas company	Co-funding, data access, tech expertise
California Solar Energy Industry Association (CALSEIA)	Contractor & manufacturer contacts, technical expertise
Northern California Solar Energy Association (NorCal Solar)	Contractor & manufacturer contacts, technical expertise
Cool Davis	SWH user contact, community process expertise
City of Davis	Climate Action Plan implementation
International Association of Plumbing and Mechanical Officials (IAPMO)	Expertise in SWH tech alternatives
BKi (home performance programs)	Contractor contact, home performance markets
Zero Energy Contractors (leading CSI-Thermal installer)	SWH user contact, supply chain expertise
Aztec Solar (leading CSI-Thermal installer)	SWH user contact, supply chain expertise
California Center for Sustainable Energy	CSI-Thermal program operator, contractor contacts, data
California Public Utilities Commission	Data from evaluations and CSI-Thermal field testing
Individual Plumbers, Smaller Solar Contractors, and Advocates	Hands-on expertise

Research Team

Team Member	Affiliations and Expertise
Kristin Heinemeier	Principal Investigator, UC Davis Energy Efficiency Center (EEC) Mechanical engineering, homeowner-contractor interactions
Nicole Biggart	Professor Emeritus, Dean (ret.), and Director (ret.) UCD EEC Sociology of organizations and markets
Loren Lutzenhiser	Professor PSU / Affiliated Faculty UCD EEC Sociology, energy consumers and consumption
Mithra Moezzi	Principal, Ghoulem Research, San Rafael, CA Anthropology, statistics, energy analysis
Jim Lutz	Staff Scientist (ret.) LBNL, Berkeley CA Hot Water Guru extraordinaire
Hal Wilhite	Professor U Oslo, Berkeley CA Anthropology, energy consumers and consumption
Aaron Ingle	Consultant, Ghoulem Research Solar adoption, technology modeling, demand GHG forecasting

What's next?

- ① Contracting (nearly completed)
- ② Detailed planning
- ③ Organizing Technical Advisory Committee
- ④ Data collection and analysis
- ⑤ Report results

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We welcome your insights and ideas...

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