

Title of Proposed Initiative

Using Advanced Social Sciences to Ensure ZNE Technology Success

California Energy Commission

DOCKETED

12-EPIC-01

TN 72535

FEB 13 2014

Investment Areas

- ✓ Applied Research and Development
- Technology Demonstration and Deployment
- ✓ Market Facilitation

Electricity System Value Chain (Check only one):

- Grid operations/market design
- Generation
- Transmission
- Distribution
- ✓ Demand-side management

Issues and Barriers:

California has successfully developed regulatory and funding processes to promote clean energy technologies and strategies, including ZNE houses and commercial buildings. As do government and societies elsewhere, the state now faces challenges in getting these technologies and strategies to be adopted, to deliver the expected environmental benefits, and to evolve as part of a truly more sustainable economy. This evolution cannot happen without accounting for actual adoption, use, and performance. To circumvent potential failures and undesirable unintended consequences, serious attention to people must be integrated into research and policy portfolios, transcending the ability of markets alone to provide this guidance. The remainder of this questionnaire illustrates the need for human dimensions research alongside any promoted technology or strategy, using the example of ZNE-design home construction.

One of California's "big bold energy efficiency strategies" calls for all new residential construction to be Zero Net Energy (ZNE) by 2020. This strategy requires that the building industry, technology designers, energy suppliers, potential home buyers, and occupants all align around a major new construction paradigm. ZNE building performance can be potentially assured, enhanced, degraded, or defeated by the behaviors of the people in these homes and commercial buildings. In addition, those behaviors are shaped and constrained by the networks of people outside of the buildings—market actors, institutions, and regulations that strongly influence the design and even operation of buildings. The implications for large-scale implementation of ZNE home and communities are clear. Careful design and intelligent on-site generation, storage and grid connections can go a long way toward ZNE. But, as for nearly any clean energy technology, the crucial remainder that "gets us over the top" is behavioral.

Initiative Description and Purpose

If ZNE buildings are to successfully fulfill their policy intent, understanding the role of people in designing, selling, buying, operating, and modifying buildings is crucial. Current government-supported efforts to develop ZNE homes recognize that builders and buyers are needed, and that what occupants do matters, but basically assume that market mechanisms and demand-oriented technologies such as energy use feedback will deliver enough. However, it is crucial to track what happens after adoption, both to actual energy use and occupant satisfaction within these houses, as well as to construction paradigms overall (e.g., locking out alternative technology trajectories, climate change adaptation and disaster resilience). By applying social sciences methods, including on-site observation, interviews, integrated data collection, and critical analysis, researchers can highlight unrecognized snags and

barriers to well-functioning ZNE homes and markets, and help all parties develop methods to circumvent problems and develop technologies and policies that work long-term.

Stakeholders

Stakeholders include all Californians and especially future home buyers, the home construction industry, and the renewable energy industry. Californians in general would potentially benefit from future pollution and resource use reductions and supply reliability. The research is expected to be of interest not only to the California Energy Commission, but also to the California Solar Initiative, the CPUC, the Department of Energy and national laboratories, the U.S. Environmental Protection Agency, as well as governments elsewhere in the world who are facing similar problems in promoting and evaluating low-energy homes and other green technology.

Background and the State-of-the-Art

Recent California ZNE roadmaps and technical analyses, and ongoing action plans and market analyses, provide a launching pad for developing and integrating more critical social scientific analysis of residential ZNE performance and adoption. A great deal of work on residential energy use feedback has been conducted, for example, but this work reveals that feedback is very unlikely to get people to manage plug loads in “optimal ways,” and rather that a different way of thinking about the problem is required. Furthermore, studies underscore that generation can offset the energy use of any home, but this leaves open important questions about the cost-effectiveness of this technology as well as its relative environmental sustainability. Efforts to develop well-functioning low-energy dwellings in Europe and Canada have already provided a number of insights. Similar research adapted to California climate, lifestyles, and buildings will be critical to success.

Justification

If California’s residential ZNE strategy meets its target, the entire set of new homes built in 2020 and later will be ZNE-design. If the role of people in creating and operating these dwellings is not properly attended, there is severe risk that publicly funded efforts to develop ZNE will fail to deliver the anticipated combination of energy savings and comfortable homes.

Ratepayer Benefits

- ✓ **Promote greater reliability**
- ✓ **Potential energy and cost savings**
 - Increased safety
- ✓ **Societal benefits**
- ✓ **Environmental benefits - specify**
 - ✓ **GHG emissions mitigation/adaptation in the electricity sector at the lowest possible cost**
 - Low emission vehicles/transportation
 - Waste reduction
- ✓ **Economic development**

Harmonizing ZNE technology development with the human dimensions of household decision-making and household energy use potentially secures all of the promised benefits of ZNE housing, which otherwise risk being missed or circumvented if people are considered solely as market actors.

Public Utilities Code Sections 740.1 and 8360:

This work does not duplicate existing work, supports conservation, and supports the development of new resources and processes, including supply technologies (§740.1). It also supports Deployment and integration of cost-effective distributed resources and generation, as well as development and incorporation of cost-effective demand response, demand-side resources, and energy-efficient resources (§8360).