

Beneficial Electrification and Water Heating

ACEEEE Hot Water Forum

**Portland, OR
March 21, 2018**

Robin Roy, Ph.D.
Next Energy US
RRoy@NextEnergyUS.com



Beneficial Electrification: A Key Strategy for Deep Decarbonization

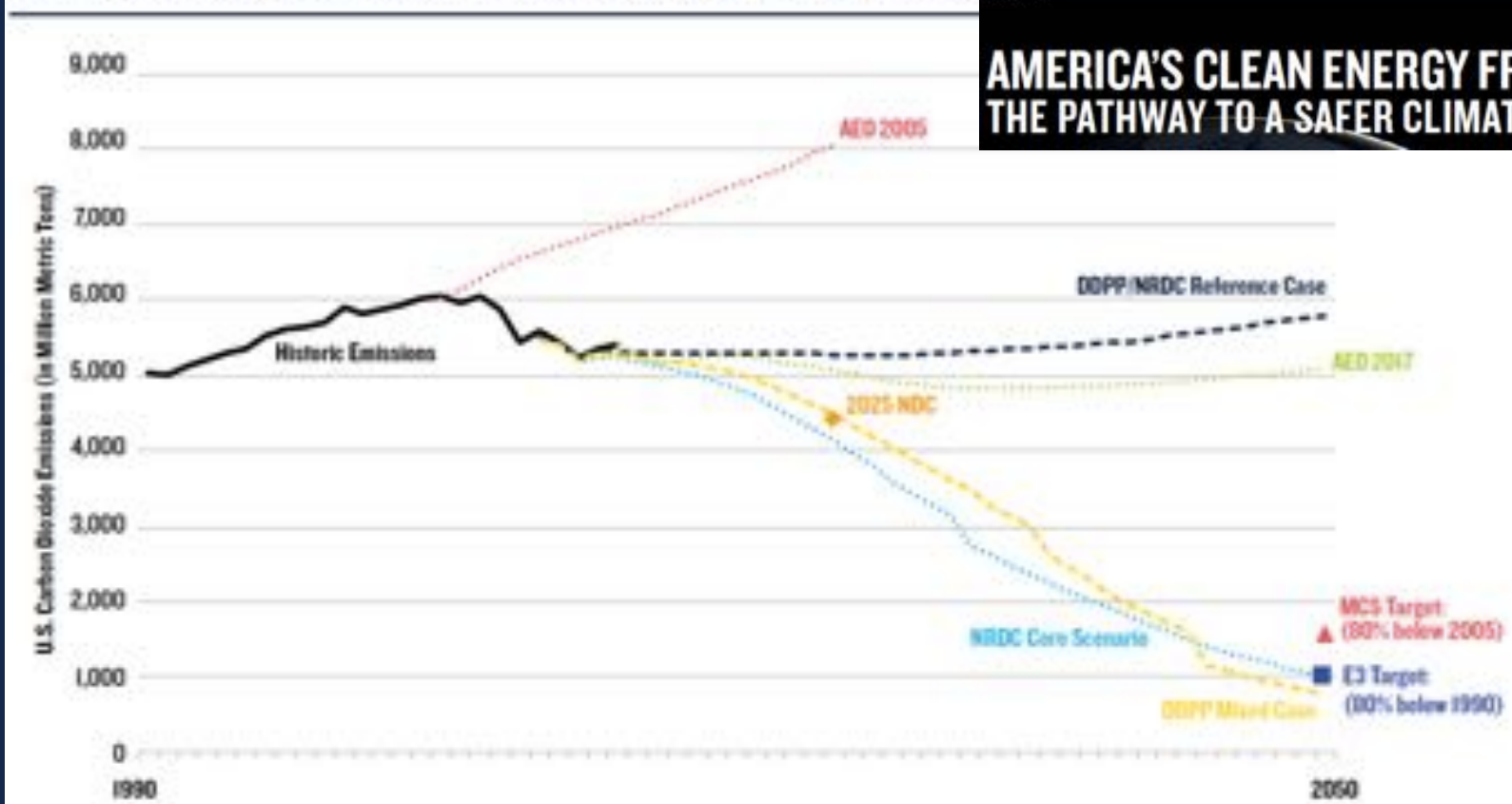


SEPTEMBER 2017
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EXHIBIT 1: TRAJECTORIES OF U.S. CARBON DIOXIDE EMISSIONS FROM 1990 TO 2050 IN DIFFERENT

REPORT

AMERICA'S CLEAN ENERGY FRONTIER: THE PATHWAY TO A SAFER CLIMATE FUTURE





The Electricity Journal

Volume 29, Issue 6, July 2016, Pages 52–58



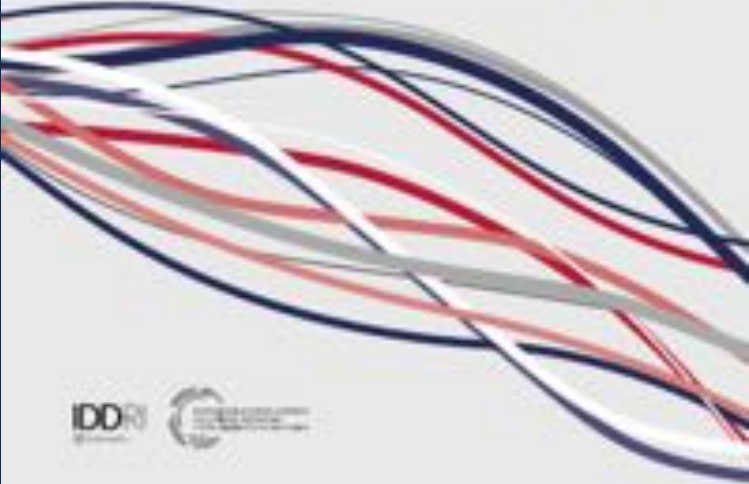

Environmentally beneficial electrification: The dawn of 'emissions efficiency' ☆☆☆




**A BETTER LIFE WITH
A HEALTHY PLANET**
PATHWAYS TO NET-ZERO EMISSIONS
A NEW LENS SCENARIOS SUPPLEMENT

US 2050 Report

pathways to
deep decarbonization
In the United States



IDD 



SCENARIOS FOR MEETING CALIFORNIA'S 2050 CLIMATE GOALS

California's Carbon Challenge Phase II Volume I: Non-Electricity Sectors and Overall Scenario Results

Prepared for: California Energy Commission
Prepared by: University of California, Berkeley and Lawrence Berkeley National Laboratory



SEPTEMBER 2013
CEC-300-YYYY-XXX

Palo Alto Electrification Final Report

November 14, 2014



Submitted To:
CITY OF
PALO ALTO

San Francisco Chronicle

California's next frontier: clean electricity for everything

By David Hochschild and Mark Ferron | May 20, 2016

...we don't get to our GG goal unless we start to supplant gas...with clean electricity as our first fuel."

- CPUC President Picker



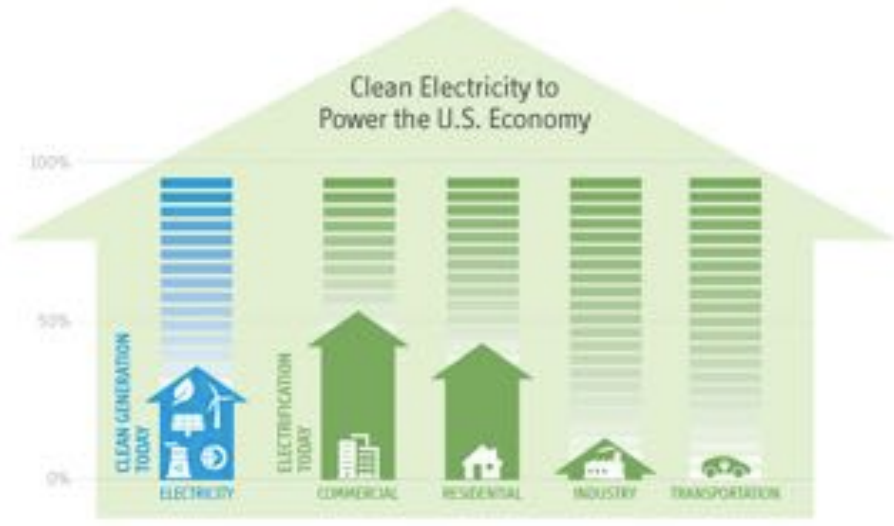


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- Key Activities
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POWER-UP: Potential of Widespread Electrification for Reducing Unwanted Pollution

Through the POWER-UP Study, NREL is leading a research team to explore infrastructure investments needed and implications of a more fully electrified U.S. economy. The study will identify the investments in new generation sources—including renewables and nuclear—needed to support an electrified economy and the implications of those investments for the U.S. economy, environment, and communities.



Powering the Economy with Clean Energy



Electrification

Emerging Opportunities for Utility Growth

PREPARED BY
Jürgen Weira
Ryan Hladik
Michael Hagerly
Will Gorman

January 2017

THE **Brattle** GROUP



EPRI-IEA Workshop on Clean Energy and Electrification

EPRI | ELECTRIC POWER
RESEARCH INSTITUTE



A new electricity era: How to decarbonize energy systems through electrification

An analysis of electrification opportunities in transport, buildings and industry prepared by Climate Policy Initiative and Copenhagen Economics for the Energy Transitions Commission
January 2017

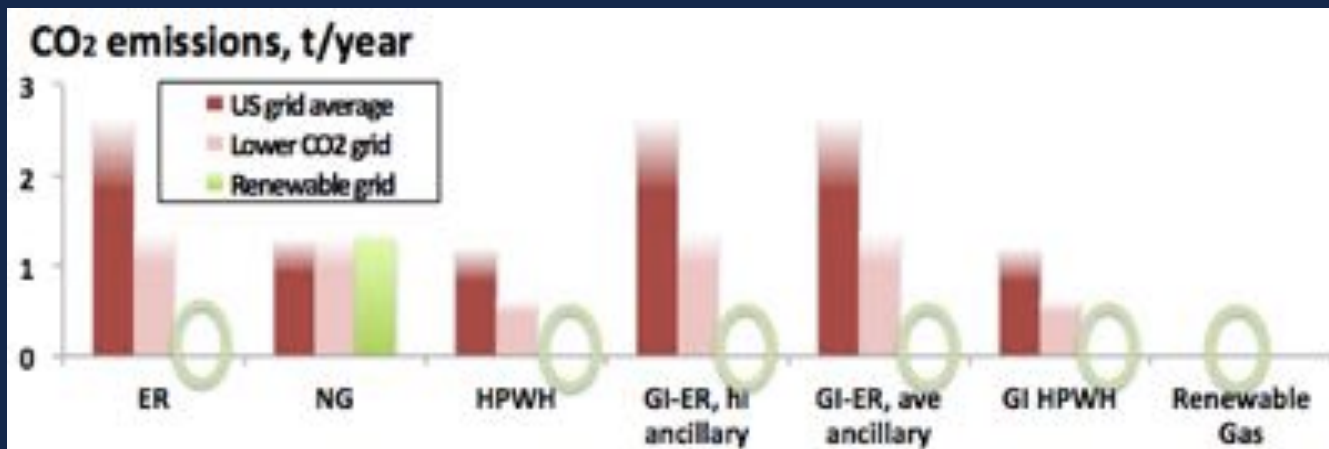
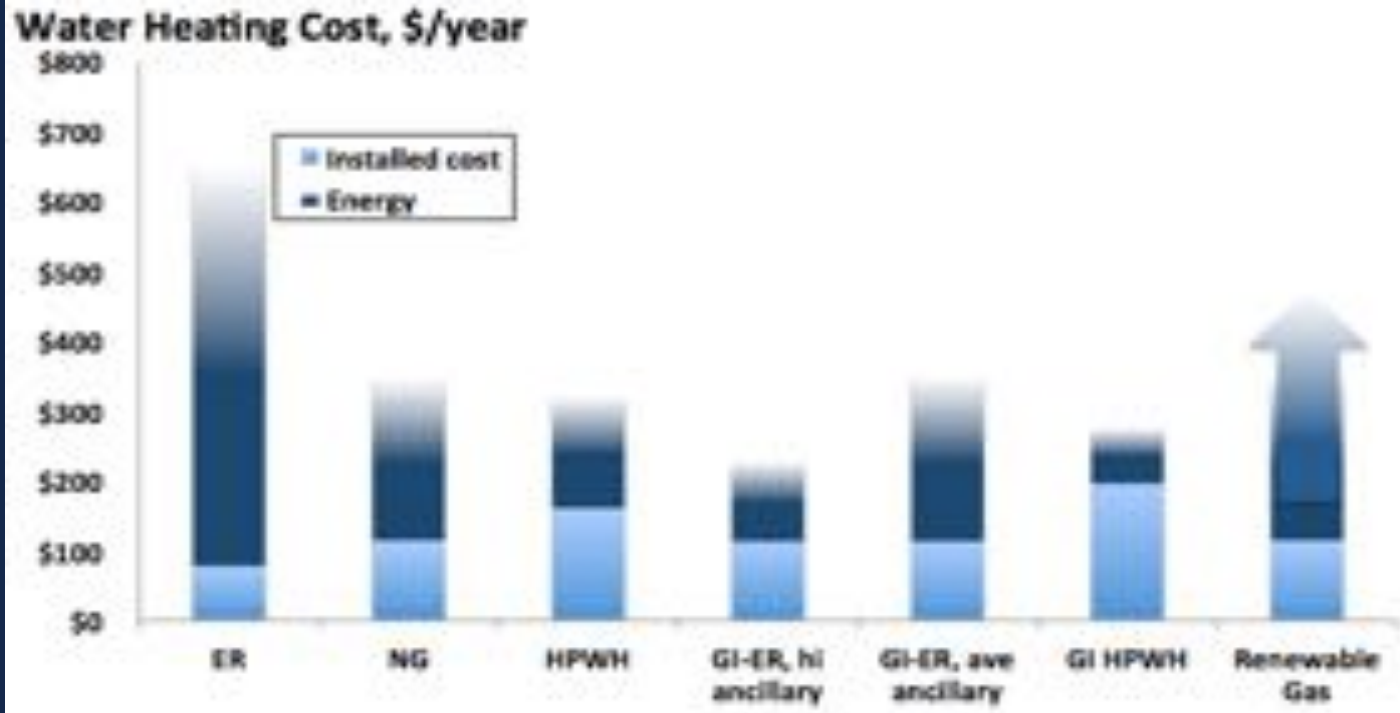


Gas Water Heating: *Historically Cleaner, More Economic*

But...



New Water Heating Technology and Renewable Sources Change the Outlook



Is Beneficial Electrification of Water Heating Inevitable?

Important for deep decarbonization

Renewable gas possibly an alternative

Rapidly emerging economics

New construction and easy retrofit locations

Dynamic electricity pricing and/or DER programs

But...

Consumer, installer, regulator inertia

Building-specific retrofit installation and other issues

Outdated policy & policy inertia



Policy Challenges / Opportunities

Non-cost-reflective pricing & program design

Low / no valuation of carbon pollution

Rate & retail market design, DER program design

Limited dynamic rate design for flexible loads

Difference between marginal/average and future/current

Backward-looking, inappropriate metrics, measurement

Reduce kWh? Or reduce emissions & consumer cost?

Source energy accounting

Restrictions on DER programs for fuel switching

Limits on DERs in wholesale markets

