

Electrification of buildings in context

To minimize climate change impacts, we need to reduce GHG emissions by 80% by 2050 (below 1990)

80/50 Decarbonization Framework





Buildings \approx 2nd largest source of GHGs in CA (including emissions from gas + electricity use)



Source: <u>www.arb.ca.gov/cc/inventory/data/data.htm</u> (1) For a 2% leakage rate and 20-year GWP

- Combustion emissions ≈ all instate power plants
- Not including fugitive methane
 ≈ 60% combustion GHG impacts¹



Electricity use still the majority of GHG emissions from buildings, but as the grid gets cleaner, natural gas becoming a major contributor



- Jones C., Kammen D., "Bay Area Consumption-Based Greenhouse Gas Emissions Inventory", Jan. 2016, <u>http://www.baaqmd.gov/research-and-data/emission-inventory/consumption-based-ghg-emissions-inventory</u>
- Note including emissions from methane and other high global warming potential gases



Heat pump technology can electrify over 90% of thermal end uses



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Heat pumps 101

Extracts, concentrates, and moves (or "pumps") heat from surrounding air into tank or building

Like a fridge or A/C in reverse









Hybrid heat pumps

Many heat pumps are "hybrids", they have both a heat pump, and a backup resistive element for:

- high demand periods
- very cold periods

Like plug-in hybrid cars (e.g. Chevy Volt)

But new technologies can work down to -20F in heat pump only mode







Heat pumps value benefits: Much more than GHGs!





Water heater CO2 emissions

As CA grid gets cleaner, HPWH offer pathway to near zero-GHG hot water



1) Not including fugitive methane emissions, which may roughly double GHG emissions from gas 2) With 45%-efficient combined cycle gas plant as long-run marginal resource

Grid-interactive heat pump water heaters can help deep integration of renewable energy



NRDC et. al. study in-progress to quantify the load shifting capacity and value of HPWH, report planned June 2018



Barriers: What's hindering adoption?



In-storeSupply-chain



Technology

Installation cost reduction

Equipment: capital costInstallation: circuit, panel

• Operation: rate design

Controls

Costs

Cold temperature performance

Regulatory

- CEC: Building code compliance
- CPUC: incentives, rates...
- ARB: Scoping Plan



Policy Roadmap

Accelerate the transition of the building sector to clean energy





Theory of Change







Key policy opportunities

 Local Gov't, Air Districts Public education Workforce development Clean heating rebates Bulk buy programs 	UtilitiesPilot programsIncentive programsElectrification-friendly rates	 CPUC Incentive programs Electrification-friendly rates San Joaquin Valley
CEC	CARB	Legislation
 Building Code IEPR SB 350 Double EE Savings AB 758 Existing Building 	 Scoping Plan Cap and trade funding Leakage emissions Health impacts of fossil fuel 	 GHG targets in buildings Remove regulatory barriers Allocate funding Assess leakage emissions



Building Decarbonization Policy Action Supporters (as of 4/6/2018)



And the following organizations: Beyond Efficiency; Design Avenues; EHDD; Guttman Blaevoet; Integral; Interface Engineers; Leddy Mayton Stacy Brown and Green Architects; Menlo Spark; Mogavero Architects; Point Energy Innovations; Redwood Energy; SEA; Siegel & Strain Architects





Thank you!

Contact info: Pierre Delforge pdelforge@nrdc.org

