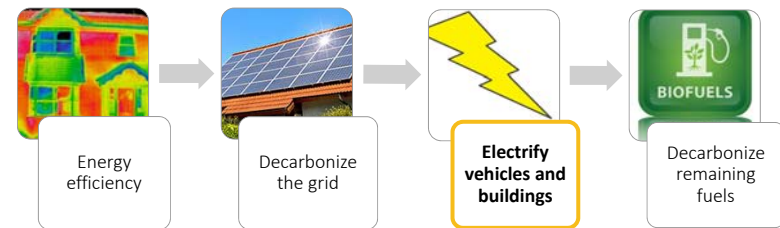


Zero-Carbon All-Electric Buildings

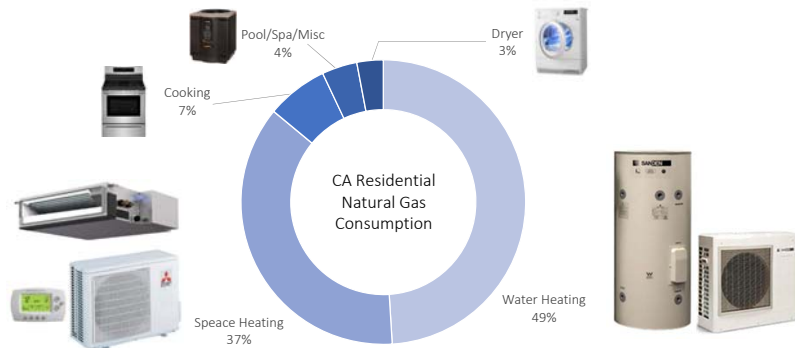
How to do it

Nick Young
April 24, 2019

We Must Electrify



How to Do It



What's so great about heat pumps?

- Are hyper-efficient (4-5x equivalent gas products)
- Enable Zero Emissions Buildings via carbon-free renewable energy
- Can utilize on-site solar and act as a thermal battery
- Improve air quality – no local emissions
- Improve safety – no gas lines in building

How do we heat water?

Gas (80-97% Efficient)

- In-Unit or Central
- Boiler, Tank Type, Tankless



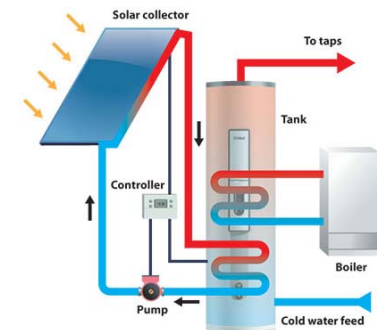
Electric Resistance – 98-99% Efficient

- In-Unit
- Tank Type, Tankless
- Rarely meets energy code



Solar Thermal

- Preheats water going to central DHW system
- Large tanks of preheated water act as thermal storage
- Requires engaged O&M to deliver long-term savings



Source: <http://greenfieldenergy.com/wp-content/uploads/2015/07/Solar-Thermal-System-Diagram.pdf>

Electric Heat Pumps – 300-500% Efficient

- In-Unit or Central
- **Most efficient** way to heat water with electricity



How a Heat Pump Works

It **moves heat** from one place to another using **refrigerant**.

Just like an air conditioner or refrigerator.

How a Heat Pump Works



Meeting CA Energy Code w/ All-Electric

- Currently **very difficult** because Title 24 Energy Code favors gas over electricity
- Energy metric used for code compliance – TDV – is not well-aligned with carbon emissions.
- How we're getting projects to comply under current limitations
 - Cumbersome workarounds w/ compliance penalties
 - Improving other systems to make up for electric penalty in code compliance model
- City of Berkeley talking to CEC about fast-tracking improved code-compliance options for all-electric buildings