ASSOCIATION FOR ENERGY AFFORDABILITY INC.

All-Electric Multifamily
Technologies & Techniques

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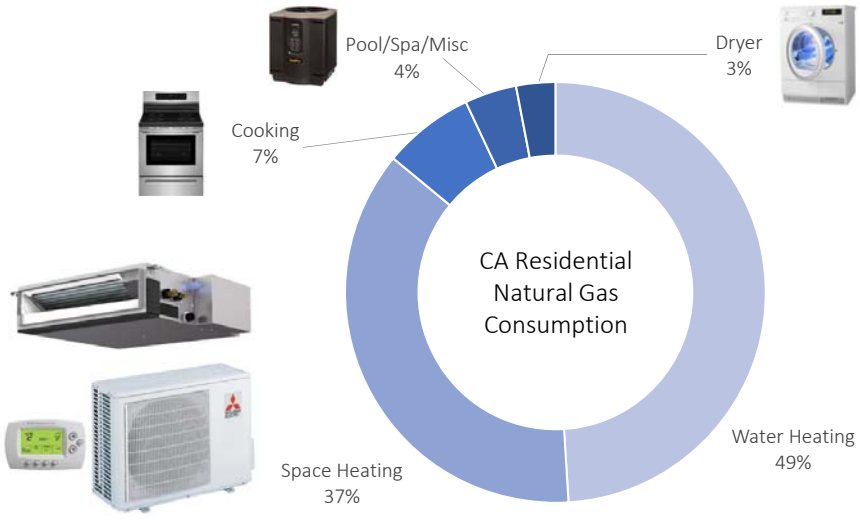
Can you really do it all with electricity?



Source: 2010 California Residential Appliance Saturation Survey

Heat Pump Basics

What is a Heat Pump?

How a Heat Pump Works

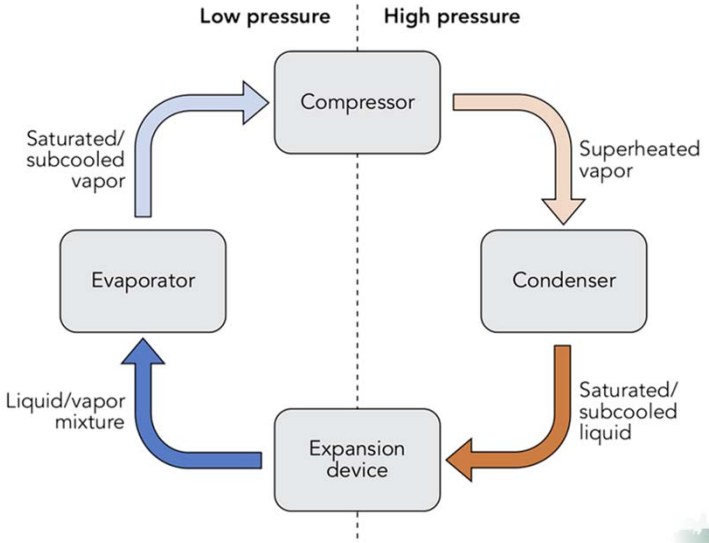
It **moves heat** from one place to another using **refrigerant**.

Just like an air conditioner or refrigerator.

What's so great about heat pumps?

- 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

Refrigerant Cycle



Electric **Water Heating**

Heat Pump Water Heaters - Individual

Split Heat Pump
Water Heater

Combined Heat Pump
Water Heater

Heat Pump Water Heaters - Central

Photo Credit: Colmac

Photo Credit: Nyle


Photo Credit: Nyle

Heat Pump Water Heaters

Key Design Considerations

- Optimal sizing will likely have more storage than gas-based system
  - Engineer should NOT use same sizing parameters as gas hot water system
  - Engage with heat pump manufacturer to obtain sizing recommendations
- Individual systems may be locatable inside a unit with no outside air
  - Always confirm with manufacturer
- Larger or central systems will need access to outside/garage air
  - Many can be ducted if space is tight

HPWH & Title 24 Compliance

- Individual HPWH (one per unit)
  - Easy to model and show compliance; no solar thermal requirement
- Small central HPWH plants w/o recirculation
  - Multiple residential HPWH in parallel serving up to 8 units can be modeled to show compliance
  - Compliance penalty if no solar thermal
- Central HPWH w/ recirculation
  - Currently: have to use complicated modeling workarounds and take compliance penalty for no solar thermal
  - 2020: CEC working on software updates, but no guarantees when these systems will be more straightforward to model for compliance

What about **Solar**?

Solar Photovoltaic (PV) vs. Solar Thermal

Solar PV

Solar Thermal

Solar Photovoltaic (PV) vs. Solar Thermal

Solar PV	Solar Thermal
• No moving parts	• Moving parts (pumps & fluid)
• Can offset 100% of all loads for small buildings	• Can only offset at most 60-70% of hot water load for any building
• PV-only simplifies building – just one renewable system	• PV + thermal complicates building – two renewable systems
• Does not impact heat pump water heating design	• Requires careful integration with heat pump water heating design
• Should be monitored for performance	• Should be monitored for performance
• Limited Energy Code (Title 24) compliance credit	• Often significant Energy Code (Title 24) compliance credit

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Generally, **Solar PV**-only is best approach for all-electric buildings.

Electric **Space Heating**

Space Heating - Heat Pumps

Ducted Heat Pump

Mini-Split Heat Pump
(Ducted or Ductless)

Packaged Terminal
Heat Pump (PTHP)

Space Heating - Heat Pumps

Remember:
With heat pumps, you also get **cooling**!

Ducted Heat Pump

Mini-Split Heat Pump
(Ducted or Ductless)

Packaged Terminal
Heat Pump (PTHP)

Space Heating - Heat Pumps

Variable Refrigerant Flow

Packaged Rooftop Heat Pump

Heat Recovery Chiller

Space Heating – Electric Resistance

Electric Baseboard

Electric Wall Heater (w/ Fan)

Space Heating – Electric Resistance

Key Considerations:

- Electric resistance heating ~3x less efficient than heat pumps.
- Should have very good envelope and ventilation to reduce loads.
- Will incur considerable Energy Code compliance penalty.
- Would require separate cooling system.

Electric **Cooking**

Electric Cooking

Induction

Radiant

Resistance

Electric Cooking

Induction

Radiant

Resistance

Induction: What's so great about it?

- Fastest response time of any heating type (faster than gas!)
- Boils water in ½ the time of any other heating type
- Extremely precise heat control down to very low levels
- Less waste heat = less overheating of kitchen
- No open flames, and only pan gets hot = SAFER

Induction: Yeah, but what about...

Equipment Cost

- Induction currently not cheapest electric ranges
- Prices should come down as adoption accelerates

Frigidaire 30 in. 5.4 cu. ft. Induction Range with Self-Cleaning Oven in Stainless Steel

Model# FFIF3054TS

★★★★☆ (68)

SPECIAL BUY $989.10 ~~$1,099.00~~

Save $109.90 (10%)

Compatible Cookware

- Pots and pans must be ferromagnetic
- Cast-iron and many others with sandwich bottom
- Many affordable options available

Utopia Kitchen Nonstick Frying Pan Set - 3 Piece Induction Bottom - 8...

★★★★½ 199

$26.99

All-Electric Commercial Kitchens

All-Electric Commercial Kitchens

FSTC FOOD SERVICE TECHNOLOGY CENTER
PROMOTING ENERGY EFFICIENCY IN FOODSERVICE

Food Service Technology Center | San Ramon, CA | www.fishnick.com

- FREE all-electric kitchen consulting
- Full kitchen lab where people can try out different equipment
- Help accessing rebates for efficient electric cooking appliances
- PG&E-funded

Electric **Laundry** (Dryers)

Residential Clothes Dryers

Heat Pump Dryer

Electric Resistance Dryer

Combo Washer + Resistance Dryer

Commercial Clothes Dryers

Electric Resistance Dryer

Electric Heat Pump Dryer

(Not yet available in US)

Electric **Transportation**

Electric Vehicle Charging

- The EV revolution is here, and new buildings need to be ready for it.
- Many state and local requirements for EV charging.
- Consider sizing electrical service and infrastructure for all-EV future to reduce service upgrade costs down the road.

Electric **Storage**

What About Battery Storage?

- Battery storage systems are available and cost-effective for many building types, particularly when combined with solar PV.
- Batteries can improve resiliency by powering critical systems during a utility outage.
- Storage can also reduce peak electrical charges.
- May not work for all project types, but worth investigating.

Electric **Pools & Spas**

Heat Pump Pool Heaters

Electric **Infrastructure**

Just (More) Electricity

- All-electric buildings **eliminate gas costs**: main extensions, meters, interconnection fees, and in-building infrastructure.
- With all systems powered by electricity, projects may need **larger electrical service**.
- Consult with electrical engineer **early-on** and ensure they know that project will be all-electric.
- Engage with **electric utility** as early as possible to reduce potential service or interconnection issues

The All-Electric Future is Here

- Many jurisdictions have passed or are considering **policies that favor all-electric**.
- City of Berkeley already passed an ordinance to completely **phase out gas in new construction**.
- Starting now in CA, any **new gas infrastructure will be a stranded asset** before it is paid off.
- As building electrification accelerates, fewer and fewer gas customers will share burden of fixed system costs, **increasing gas rates** considerably.