REWIRING AMERICA

Electrify Everything in Your Neighborhood

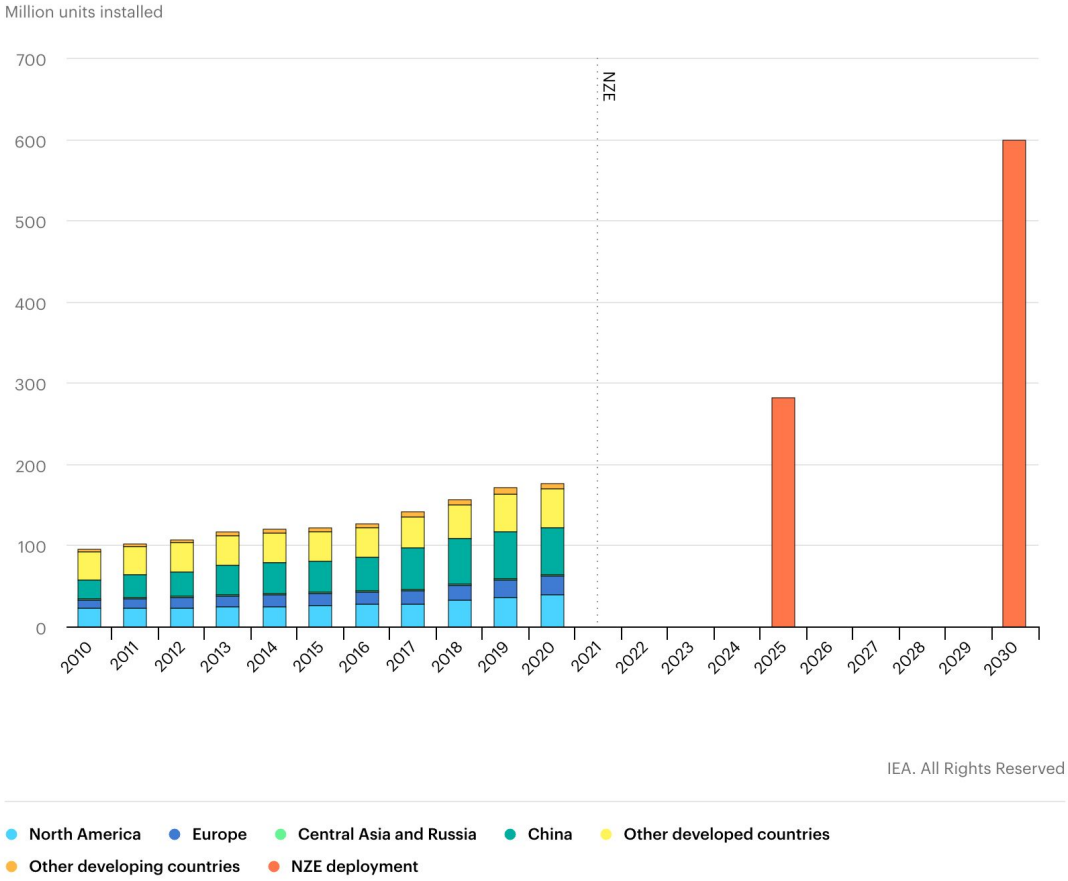
Joel Rosenberg
joel@rewiringamerica.org

“A solution to the climate crisis is finally surfacing, and I hope everybody hears this:

- Clean your electric grid, because electricity has the potential to be fully renewable.
- Electrify vehicles as the #1 emitters in the nation.
- Drastically reduce fossil fuel use in homes and buildings.”

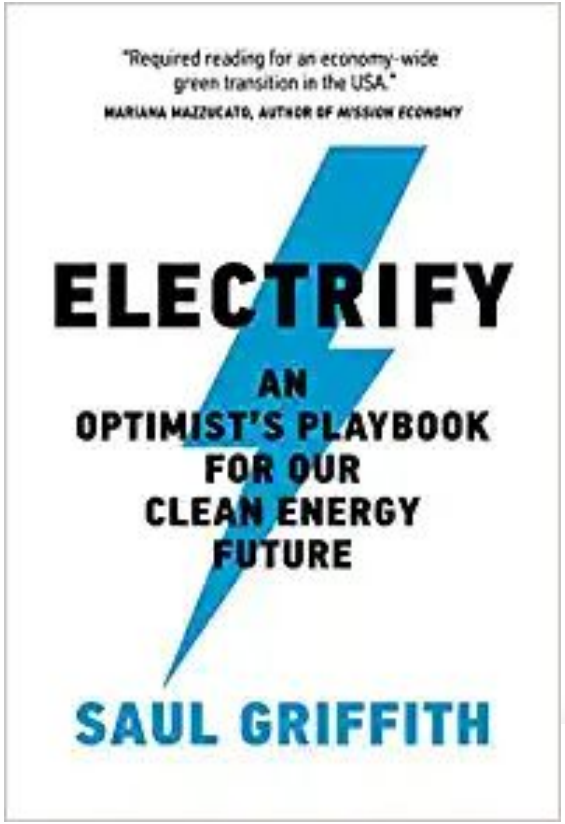
— Will Vicent, California Energy Commission

IEA’s global heat pump installs and targets for 1.5°C



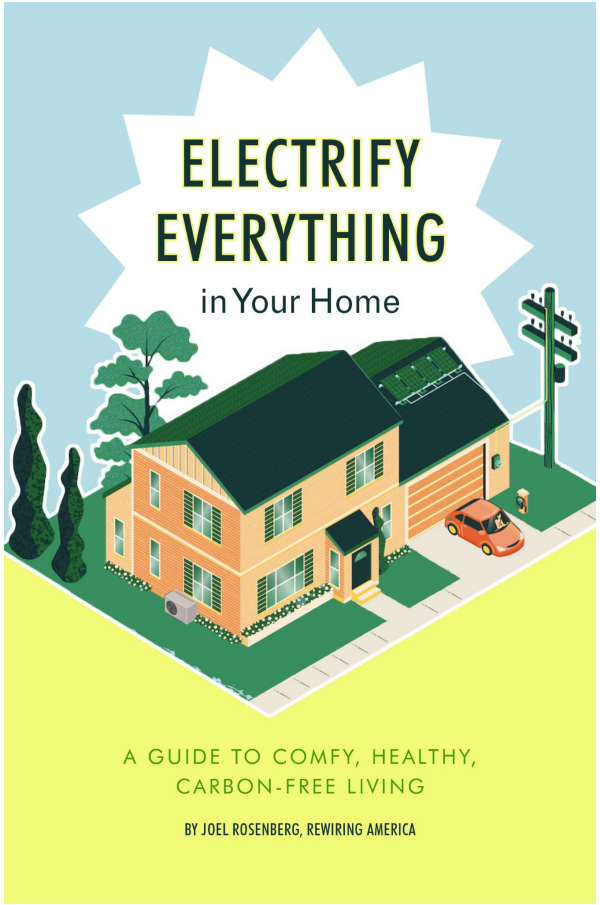
https://www.iea.org/data-and-statistics/charts/installed-heat-pump-stock-by-region-and-global-net-zero-scenario-deployment-2010-2030

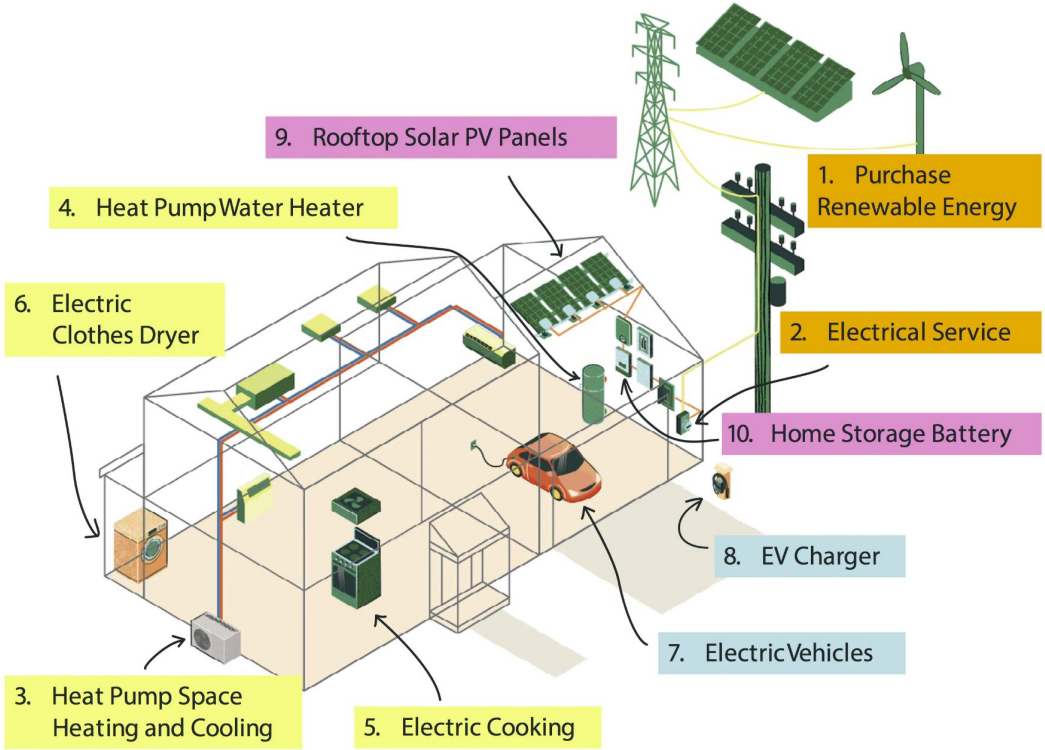
January 2021, Saul had co-founded Rewiring America, and was writing Electrify, which came out in October



https://www.rewiringamerica.org/electrify-the-book

FREE guide — “How to make a plan & be a good client to contractors”





https://www.rewiringamerica.org/electrify-home-guide

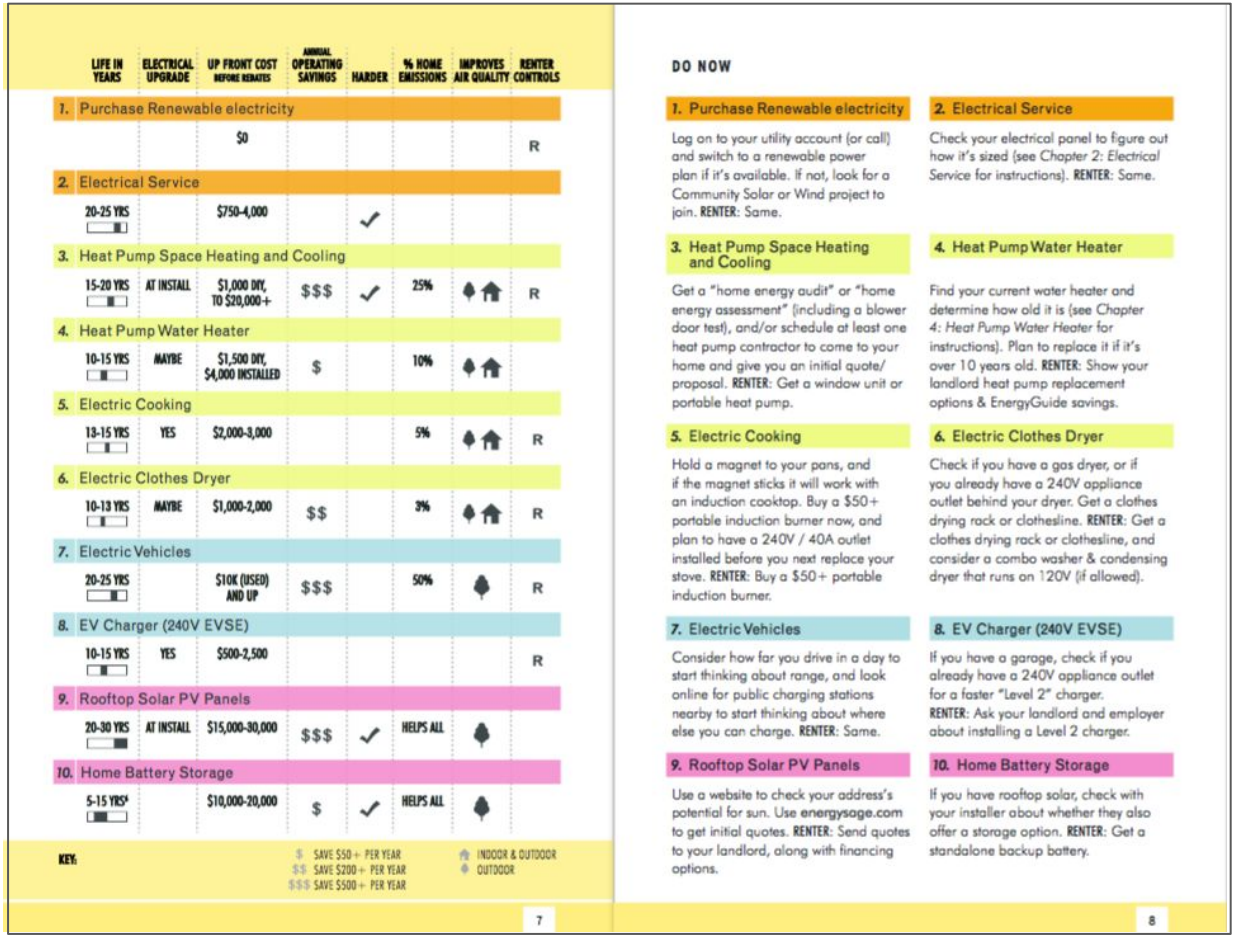
Quick reference & “Do Now” chart

Utility

Heating

EV

Solar + Storage



	LIFE IN YEARS	ELECTRICAL UPGRADE	UP FRONT COST BEFORE REBATES	ANNUAL OPERATING SAVINGS	HARDER	% HOME EMISSIONS	IMPROVES AIR QUALITY	RENTER CONTROLS
1. Purchase Renewable electricity			$0					R
2. Electrical Service	20-25 YRS		$750-4,000		✓			
3. Heat Pump Space Heating and Cooling	15-20 YRS	AT INSTALL	$1,000 DIY, TO $20,000+	$$$	✓	25%		R
4. Heat Pump Water Heater	10-15 YRS	MAYBE	$1,500 DIY, $4,000 INSTALLED	$		10%		
5. Electric Cooking	13-15 YRS	YES	$2,000-3,000			5%		R
6. Electric Clothes Dryer	10-13 YRS	MAYBE	$1,000-2,000	$$		3%		R
7. Electric Vehicles	20-25 YRS		$10K (USED) AND UP	$$$		50%		R
8. EV Charger (240V EVSE)	10-15 YRS	YES	$500-2,500					R
9. Rooftop Solar PV Panels	20-30 YRS	AT INSTALL	$15,000-30,000	$$$	✓	HELPS ALL		
10. Home Battery Storage	5-15 YRS[9]		$10,000-20,000	$	✓	HELPS ALL		

KEY:

$ SAVE $50+ PER YEAR
$$ SAVE $200+ PER YEAR
$$$ SAVE $500+ PER YEAR

INDOOR & OUTDOOR
OUTDOOR

7

DO NOW

1. Purchase Renewable electricity

Log on to your utility account (or call) and switch to a renewable power plan if it's available. If not, look for a Community Solar or Wind project to join. **RENTER**: Same.

2. Electrical Service

Check your electrical panel to figure out how it's sized (see *Chapter 2: Electrical Service* for instructions). **RENTER**: Same.

3. Heat Pump Space Heating and Cooling

Get a "home energy audit" or "home energy assessment" (including a blower door test), and/or schedule at least one heat pump contractor to come to your home and give you an initial quote/proposal. **RENTER**: Get a window unit or portable heat pump.

4. Heat Pump Water Heater

Find your current water heater and determine how old it is (see *Chapter 4: Heat Pump Water Heater* for instructions). Plan to replace it if it's over 10 years old. **RENTER**: Show your landlord heat pump replacement options & EnergyGuide savings.

5. Electric Cooking

Hold a magnet to your pans, and if the magnet sticks it will work with an induction cooktop. Buy a $50+ portable induction burner now, and plan to have a 240V / 40A outlet installed before you next replace your stove. **RENTER**: Buy a $50+ portable induction burner.

6. Electric Clothes Dryer

Check if you have a gas dryer, or if you already have a 240V appliance outlet behind your dryer. Get a clothes drying rack or clothesline. **RENTER**: Get a clothes drying rack or clothesline, and consider a combo washer & condensing dryer that runs on 120V (if allowed).

7. Electric Vehicles

Consider how far you drive in a day to start thinking about range, and look online for public charging stations nearby to start thinking about where else you can charge. **RENTER**: Same.

8. EV Charger (240V EVSE)

If you have a garage, check if you already have a 240V appliance outlet for a faster "Level 2" charger. **RENTER**: Ask your landlord and employer about installing a Level 2 charger.

9. Rooftop Solar PV Panels

Use a website to check your address's potential for sun. Use **energysage.com** to get initial quotes. **RENTER**: Send quotes to your landlord, along with financing options.

10. Home Battery Storage

If you have rooftop solar, check with your installer about whether they also offer a storage option. **RENTER**: Get a standalone backup battery.

8

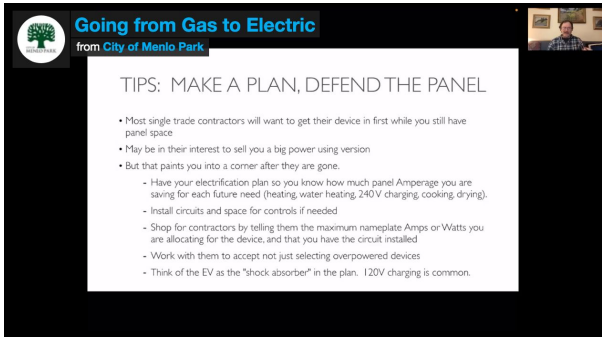
Redwood Energy's Retrofit Guide

https://redwoodenergy.net/research

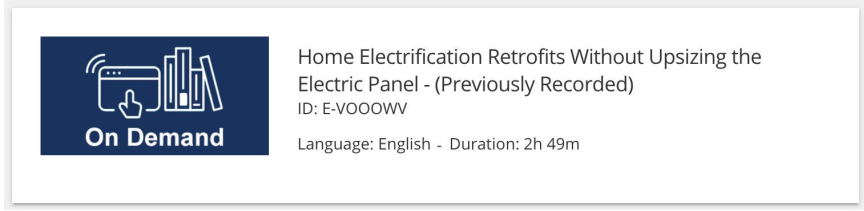
Redwood Energy's Retrofit Guide

https://redwoodenergy.net/research

Menlo Park's "Going from Gas to Electric"

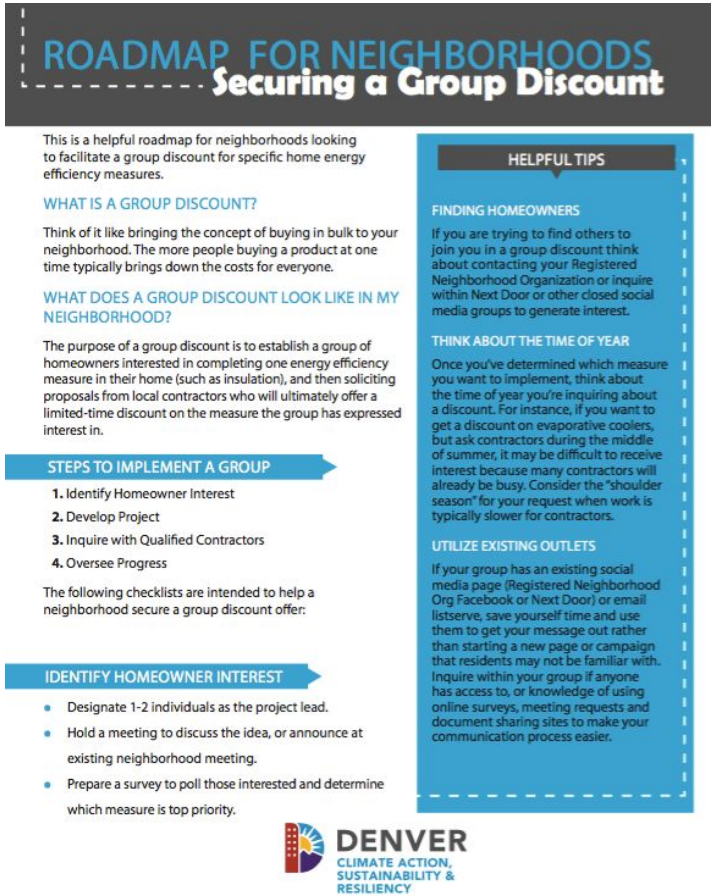


https://vimeo.com/channels/menloparklibrary/652117978



https://pge.docebosaas.com/learn/course/external/view/elearning/1206/home-electrification-retrofits-without-upsizing-the-electric-panel-previously-recorded

Denver's Group Discounts (!)



ROADMAP FOR NEIGHBORHOODS
Securing a Group Discount

This is a helpful roadmap for neighborhoods looking to facilitate a group discount for specific home energy efficiency measures.

WHAT IS A GROUP DISCOUNT?

Think of it like bringing the concept of buying in bulk to your neighborhood. The more people buying a product at one time typically brings down the costs for everyone.

WHAT DOES A GROUP DISCOUNT LOOK LIKE IN MY NEIGHBORHOOD?

The purpose of a group discount is to establish a group of homeowners interested in completing one energy efficiency measure in their home (such as insulation), and then soliciting proposals from local contractors who will ultimately offer a limited-time discount on the measure the group has expressed interest in.

STEPS TO IMPLEMENT A GROUP

1. Identify Homeowner Interest
2. Develop Project
3. Inquire with Qualified Contractors
4. Oversee Progress

The following checklists are intended to help a neighborhood secure a group discount offer:

IDENTIFY HOMEOWNER INTEREST

- Designate 1-2 individuals as the project lead.
- Hold a meeting to discuss the idea, or announce at existing neighborhood meeting.
- Prepare a survey to poll those interested and determine which measure is top priority.

HELPFUL TIPS

FINDING HOMEOWNERS

If you are trying to find others to join you in a group discount think about contacting your Registered Neighborhood Organization or inquire within Next Door or other closed social media groups to generate interest.

THINK ABOUT THE TIME OF YEAR

Once you've determined which measure you want to implement, think about the time of year you're inquiring about a discount. For instance, if you want to get a discount on evaporative coolers, but ask contractors during the middle of summer, it may be difficult to receive interest because many contractors will already be busy. Consider the "shoulder season" for your request when work is typically slower for contractors.

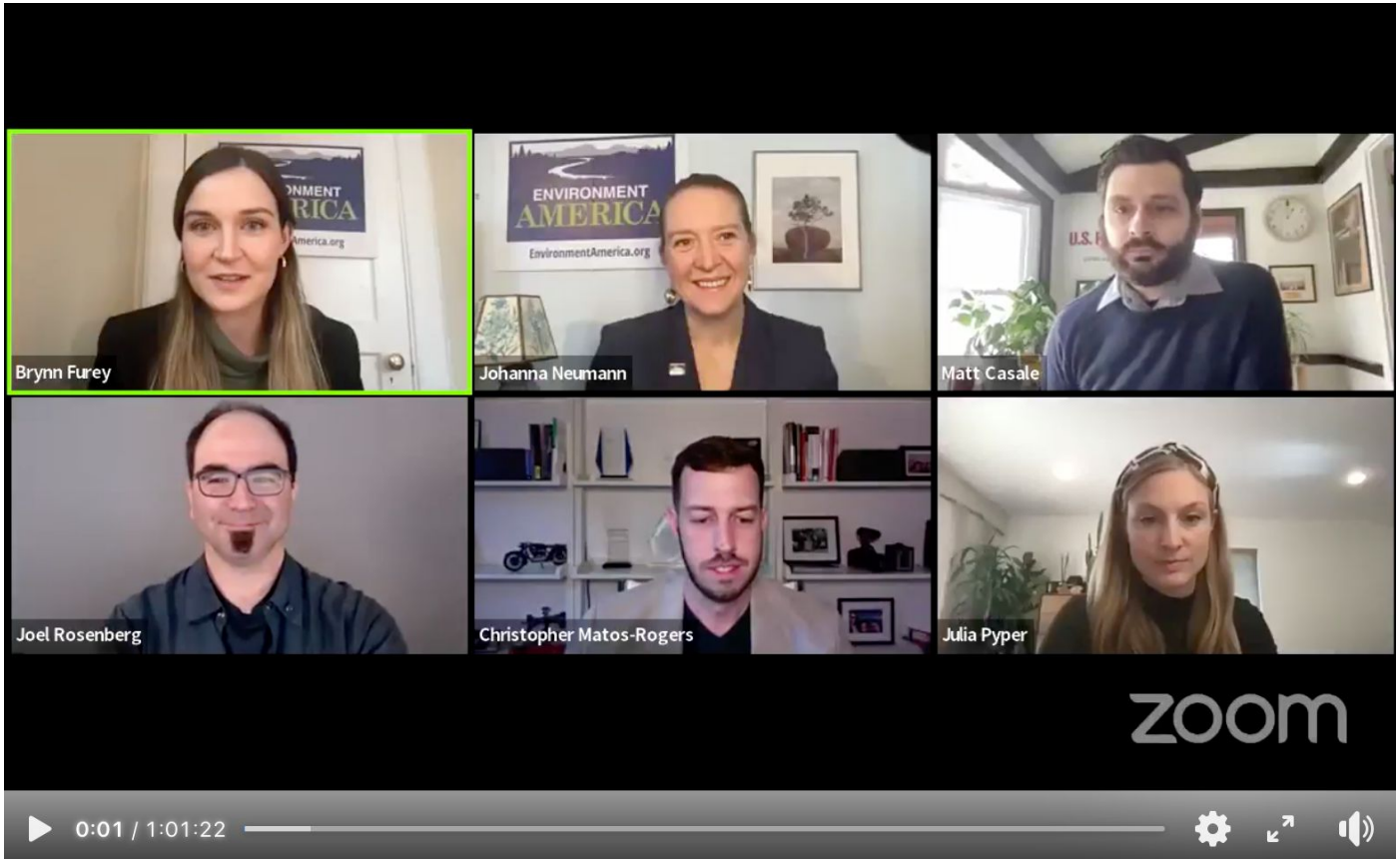
UTILIZE EXISTING OUTLETS

If your group has an existing social media page (Registered Neighborhood Org Facebook or Next Door) or email listserve, save yourself time and use them to get your message out rather than starting a new page or campaign that residents may not be familiar with. Inquire within your group if anyone has access to, or knowledge of using online surveys, meeting requests and document sharing sites to make your communication process easier.

DENVER
CLIMATE ACTION, SUSTAINABILITY & RESILIENCY

https://www.denvergov.org/content/dam/denvergov/Portals/779/documents/residential-energy/NeighborhoodRoadmap.pdf

How to make your home a clean energy home



https://www.facebook.com/100064511481841/videos/1059278301322440

Why electrify?

- You're going to have to replace all your appliances in the next 5-20 years anyway, so make a plan!
- We can't get to zero emissions unless we stop burning fossil fuels — electrification is the only path to zero.
- If you can afford it now, you will help build the market and drive down the cost for others.
- Many appliances will be cheaper to operate — think "total cost of ownership," not upfront cost.
- Electric appliances are now BETTER, so it's not a sacrifice, it's an improvement.
    - It's comfier — heat pumps are like a shower, instead of a bucket of water.
    - It's healthier — no explosive & toxic methane gas in, no carbon monoxide and NOx out.
    - It's carbon-free (or will be as the grid is cleaned up)

Why electrify as a community? ("Rewiring Communities")

- Share the research, recommendations, and benefits (e.g. consolidate rebates)
- Some people can go first, report back learnings, show off improvements
    - See https://www.eastbaygreenhome.com)
- Potential cost savings through buying teams (reduce contractor "soft costs")
    - Great job! https://www.portlandmaine.gov/2763/Electrify
- Could stock items not normally stocked by contractors (e.g. 240V, 15A HPWHs)
- Encourage each other to actually do it, and serve as a model for other communities!

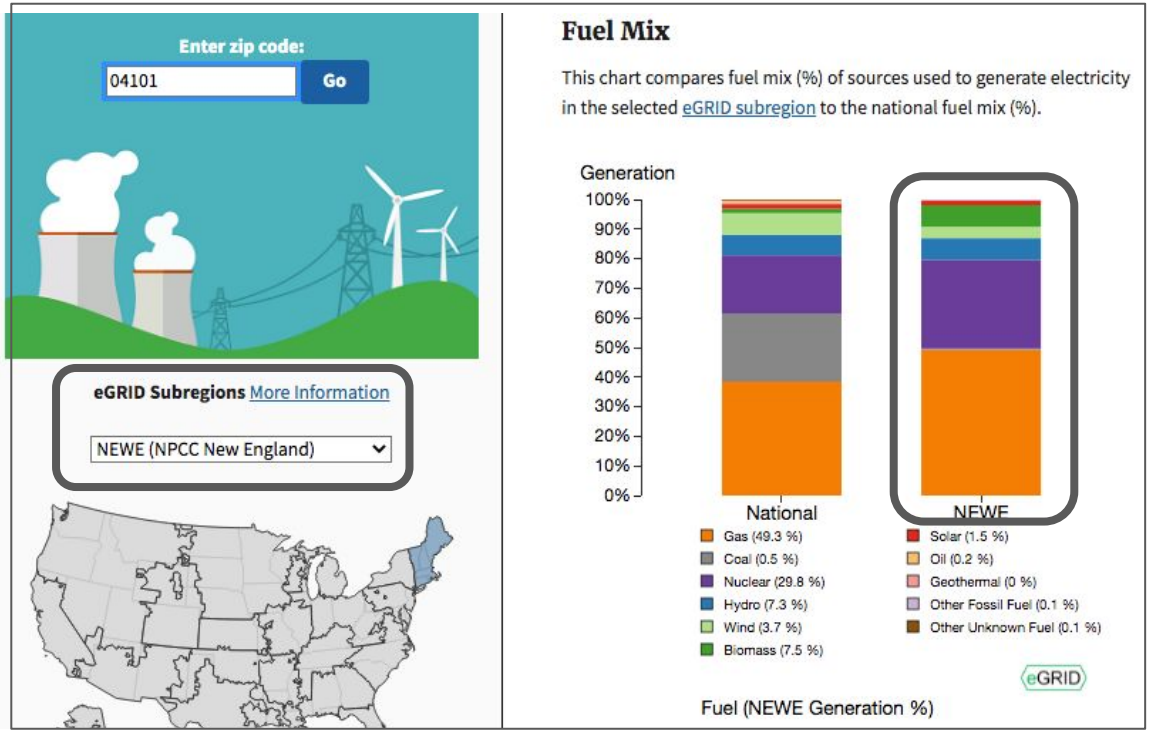
1 Purchase Renewable Energy

NPCC New England
(subregion of
Northeast Power Coordinating Council)

? % renewable

? % fossil

1 Purchase Renewable Energy



NPCC New England
(subregion of
Northeast Power Coordinating Council)

Solar (1.5%)
Biomass (7.5)
Wind (3.7%)
Hydro (7.3%)
Nuclear (29.8)

50% renewable

Gas (49.3%)

50% fossil

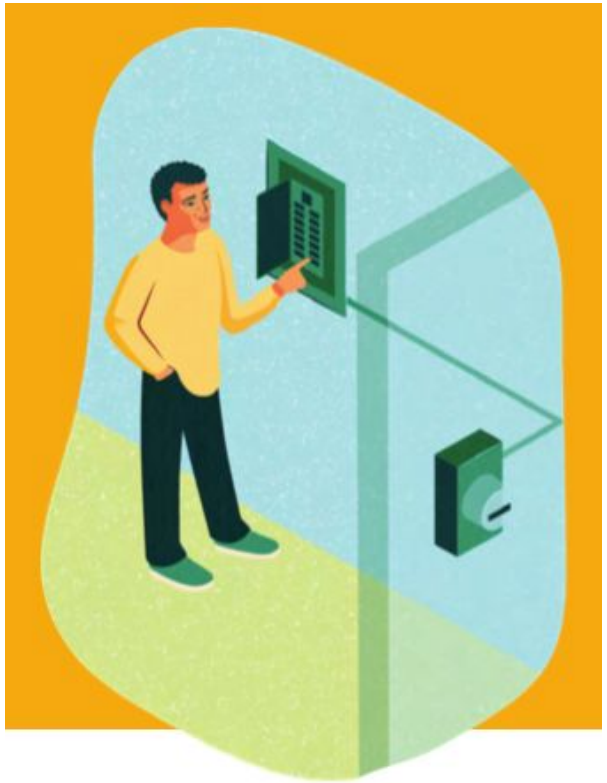
https://www.epa.gov/egrid/power-profiler#/NEWE

1 Purchase Renewable Energy

- Choose renewable plan
- Help neighbors switch
- Document steps & summarize options to make it easier?

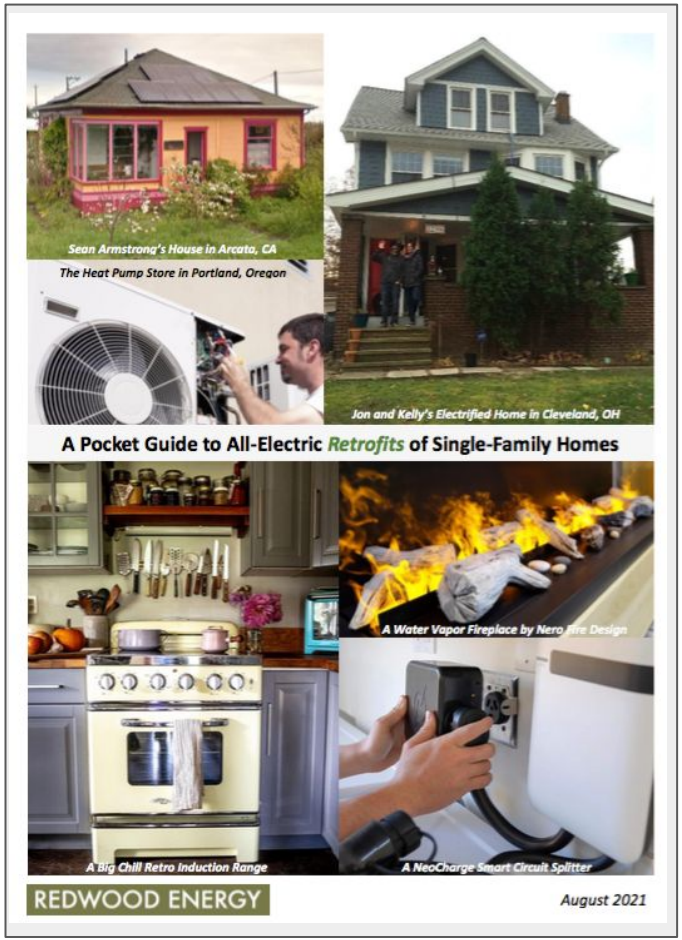
Nate Adams's Ohio how-to, with screenshots:
http://energysmartohio.com/all-electric/4-steps-buy-clean-renewable-electricity-price-dirty-electricity/

2 Electrical Service



- Probably need at least 100A
- Can work out electrification plans for similar homes based on panel sizes
- “Defend the panel,” but also prepare to upgrade if necessary
  - Panel itself
  - Utility service into home

2 Electrical Service



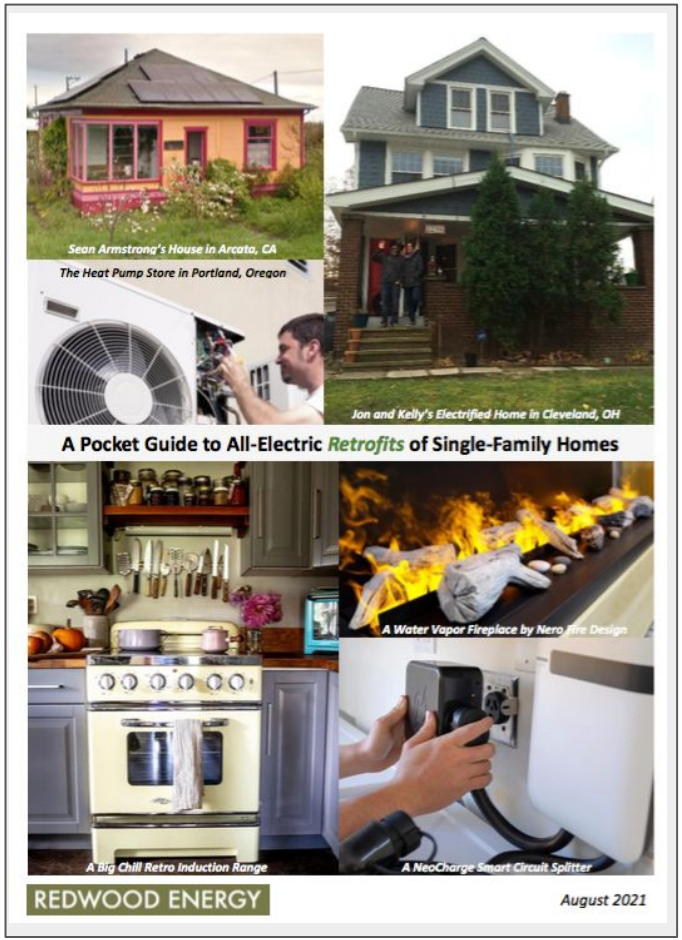
All Electric 100 Amp Home (3,000 square feet)

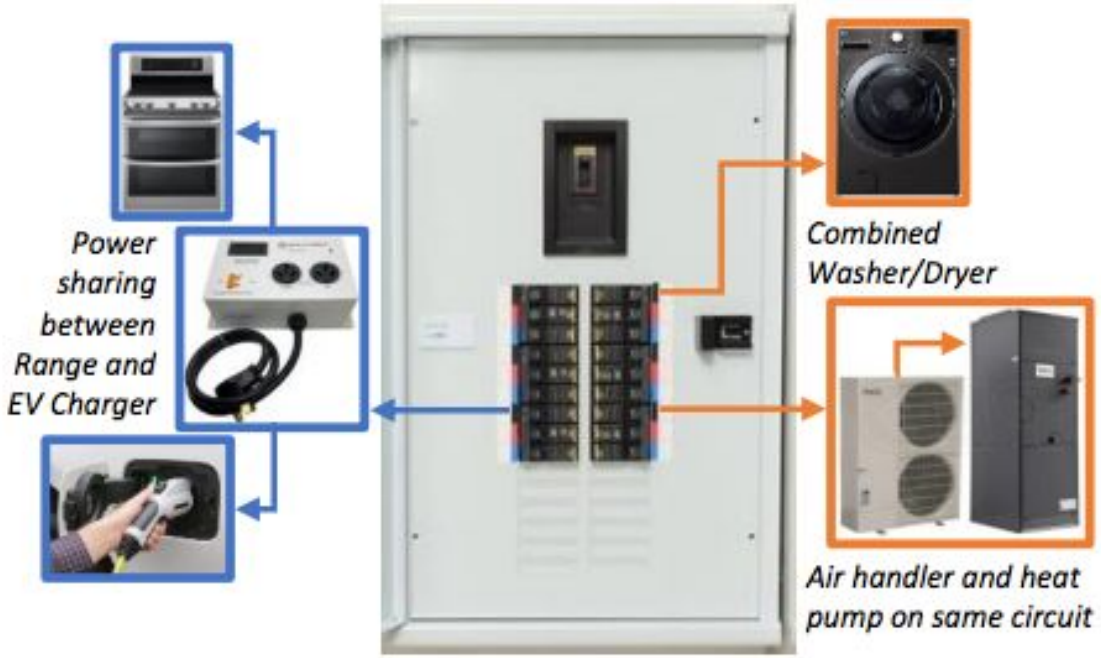
Two "automatic sharing" circuits, ductless mini split heat pump, resistance dryer, high power heat pump water heater

Device Volts	Device Amps	100 Amp Panel		Device Amps	Device Volts
120	12	Lights/Plug 15	15 Lights/Plug	12	120
120	12	Lights/Plug 15	15 Lights/Plug	12	120
120	14	Lights/Plug 20	20 Lights/Plug	14	120
120	10	Garbage Disposal 20	20 Kitchen Outlets	15	120
120	12	Dishwasher 20	20 Kitchen Outlets	15	120
120	7	Refrigerator 20	20 Clothes Washer	15	120
240	20	Ductless Heat Pump 30	30 Automatic Circuit Sharing	24	240
					Resistance Dryer
					Heat Pump Water Heater
240	16	Solar Input 20	50 Automatic Circuit Sharing	40	240
					Range (cooktop+ oven)
					EV Charger

https://redwoodenergy.net/research

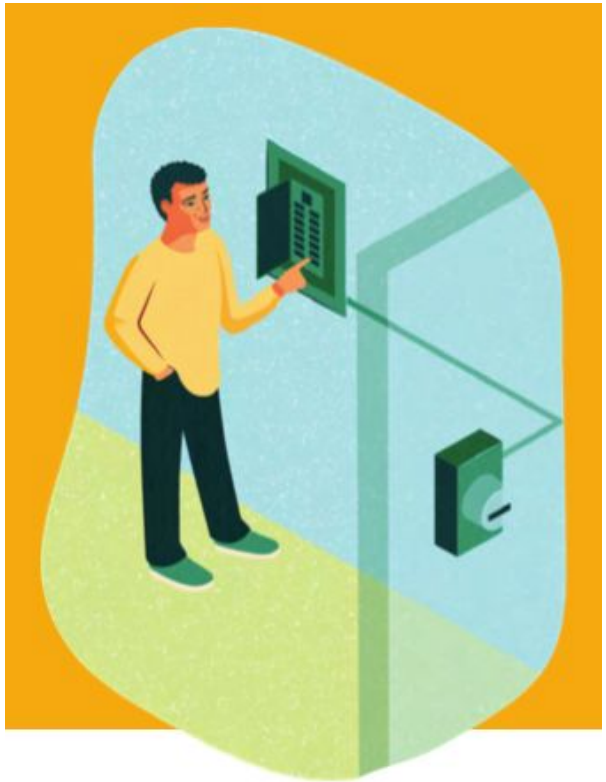
2 Electrical Service





https://redwoodenergy.net/research

2 Electrical Service

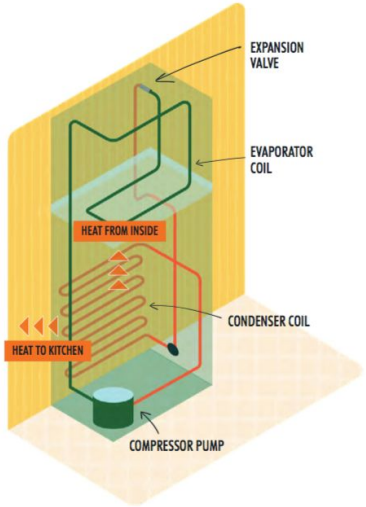


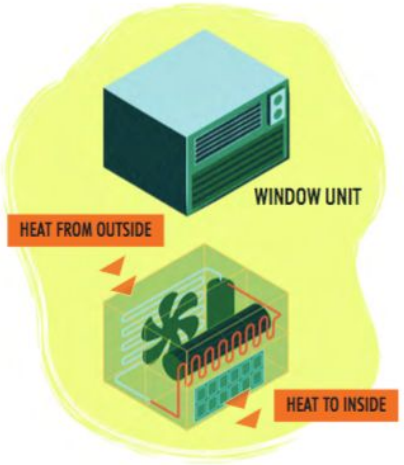
Computer-controlled panels can help

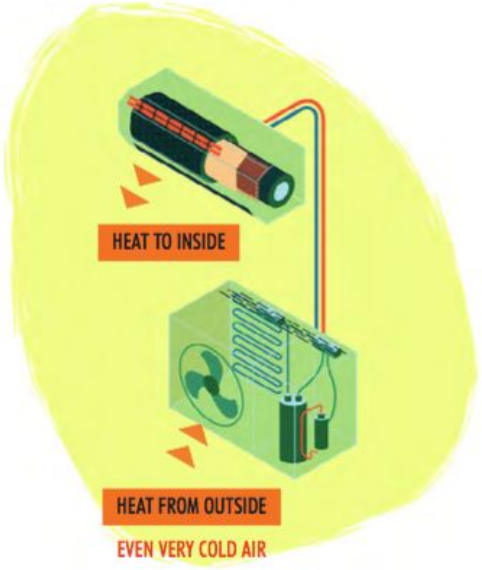
https://www.span.io/

3 Heat Pump Space Heating & Cooling

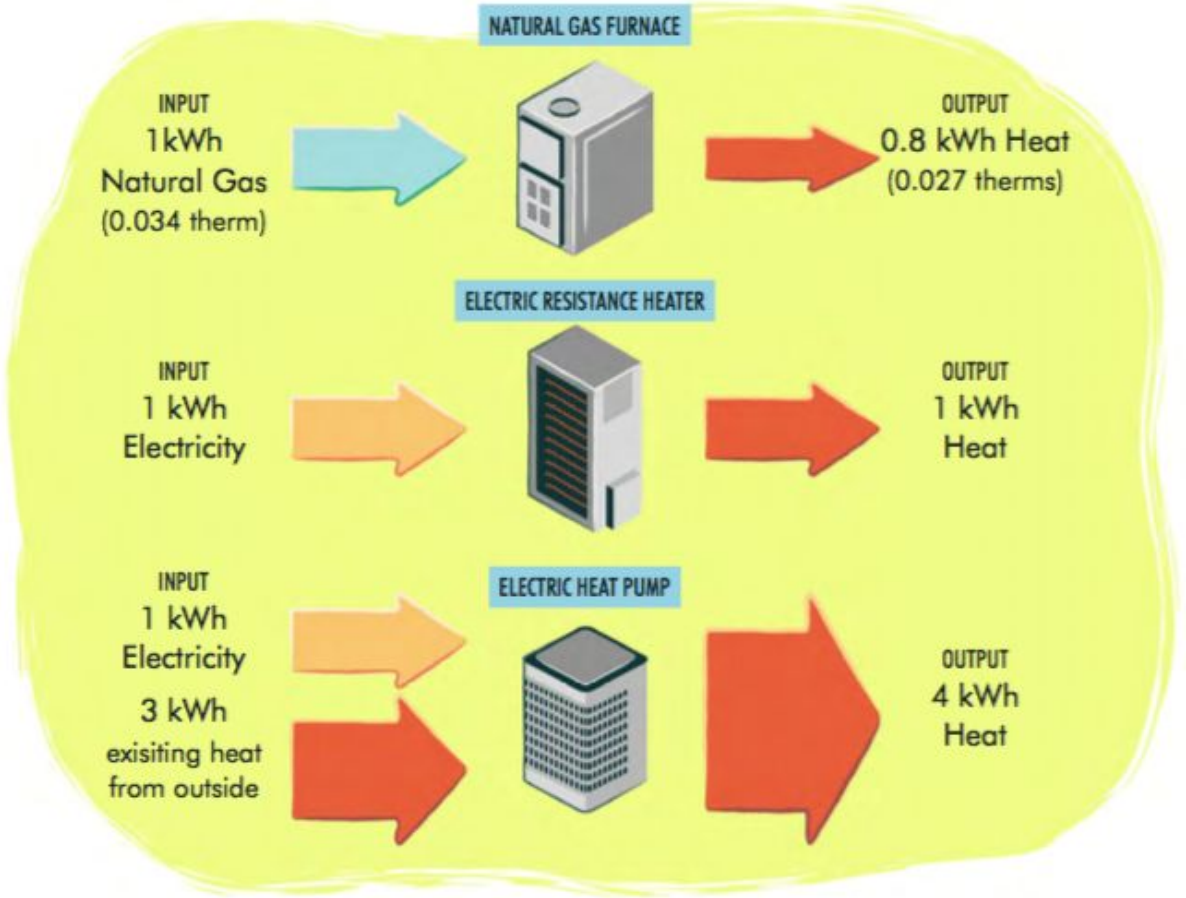
- Probably the hardest thing in the whole guide (but easier if you have AC)
- Basically an AC (or fridge) that can reverse to heat







3 Heat Pump Space Heating & Cooling



80%

100%

400% (!!!)

(700% in Japan!)

3 Heat Pump Space Heating & Cooling

- Ideally first thing to do is an “energy audit” to reduce the heating/cooling needs.
- Could do a few audits per home type.
- Could get community IR cameras for DIY weatherization projects (library lending?)

https://mygreenmontgomery.org/project/camera/
https://montgomerycountymd.gov/library/resources/files/services/thermal-camera-borrowing-guide.pdf

3 Heat Pump Space Heating & Cooling

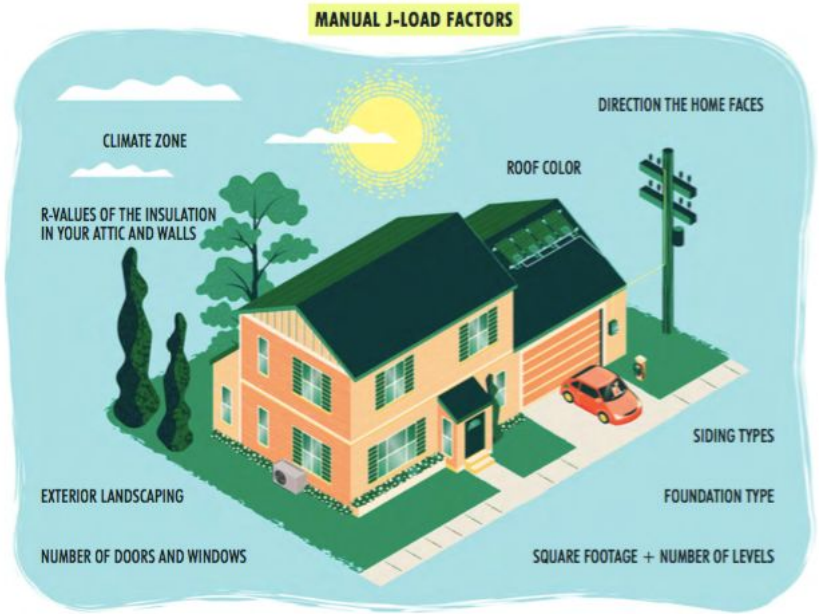
- Next find contractors who install inverter heat pumps. Screen by asking during call:

1. *Are you going to do a Manual J?*
2. *Will it include room-by-room airflow?*
3. *What types of inverter heating systems do you sell?*

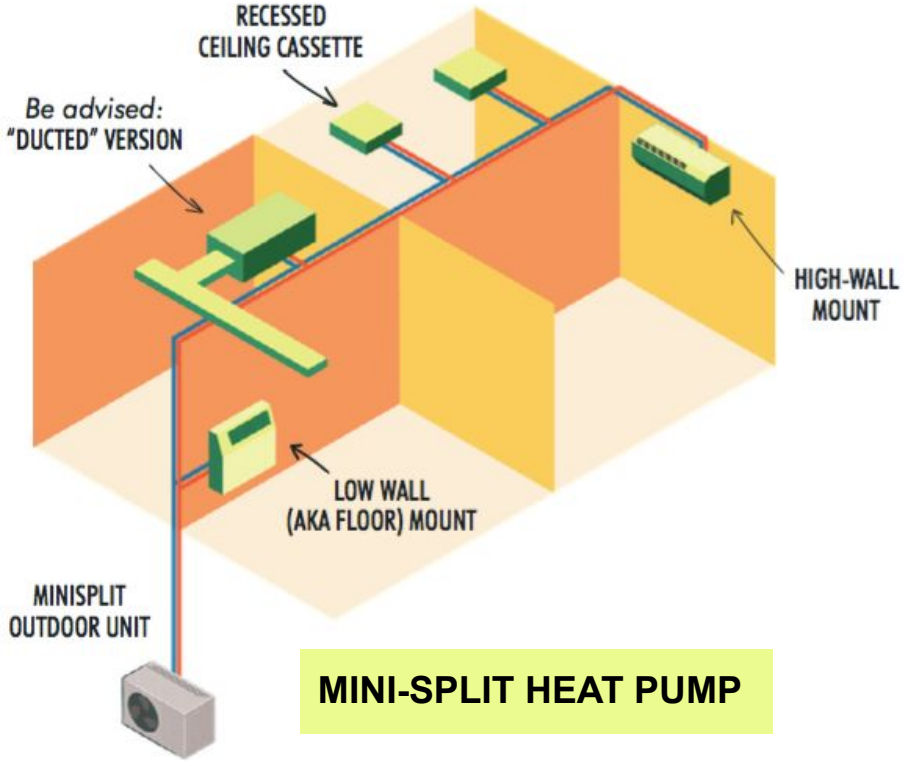
   If they can't answer, call the next one!

- Can probably use similar equipment for similar homes

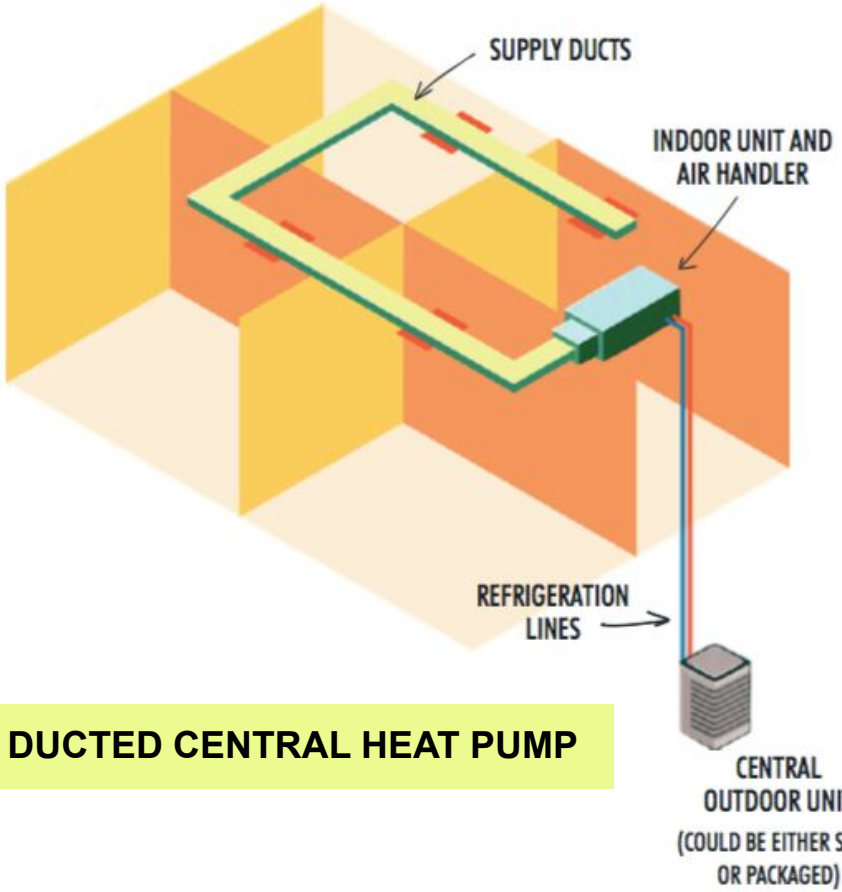
  (e.g. Menlo Park's Mitsubishi 3-ton inverter driven heat pump HVAC system w/central air handler)



3 Heat Pump Space Heating & Cooling

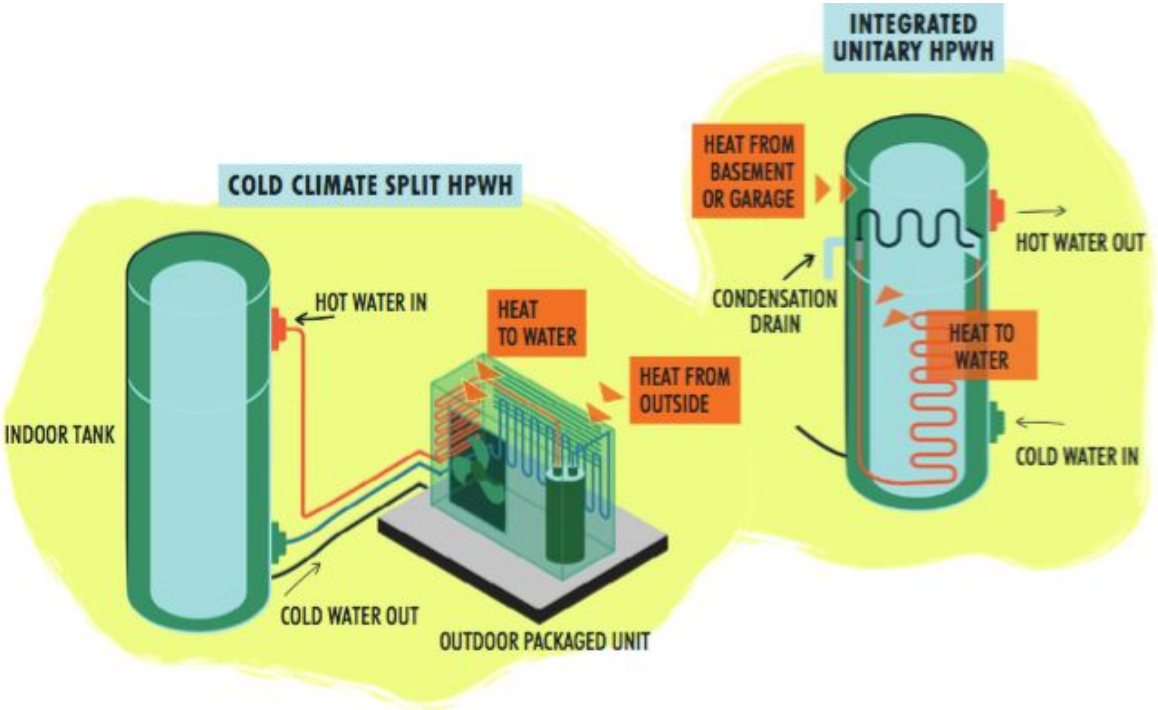


MINI-SPLIT HEAT PUMP



DUCTED CENTRAL HEAT PUMP

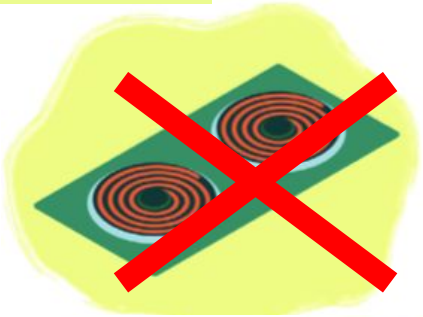
4 Heat Pump Water Heater

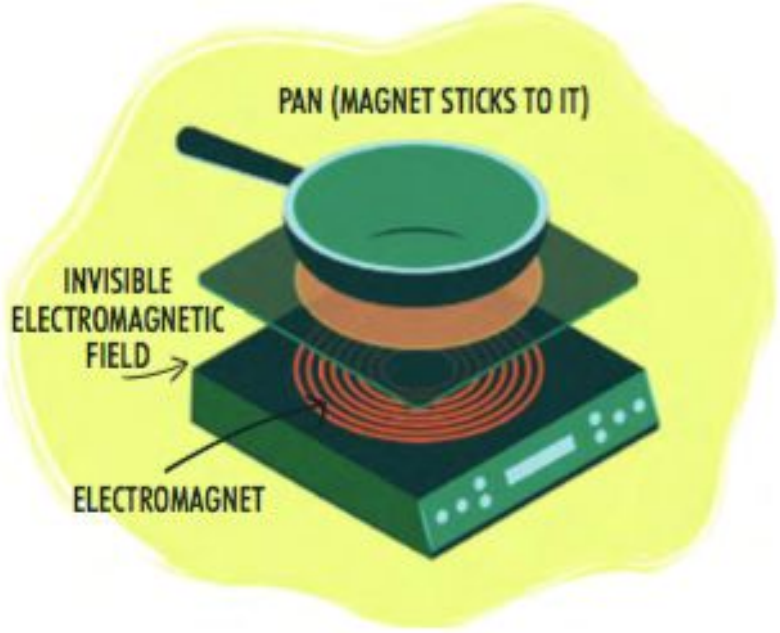


- "Unitary" HPWH
- 240V 15A (avoid 30A)
- 120V coming
- Community burnout stockpile?
  - Five 15A, 80 gallon special orders

- Split HPWH for cold climate
  - Uses CO_2 — better refrigerant
  - More expensive

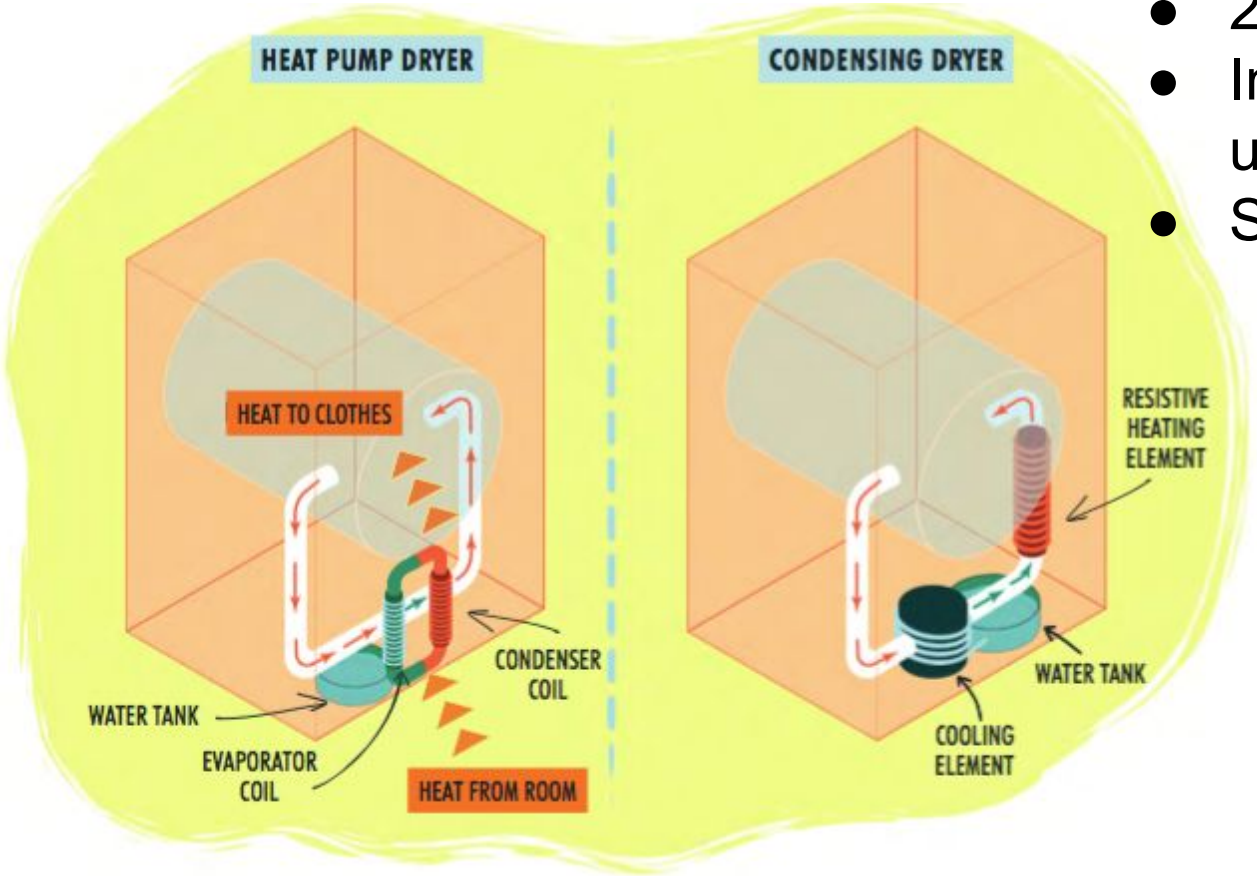
5 Electric Cooking





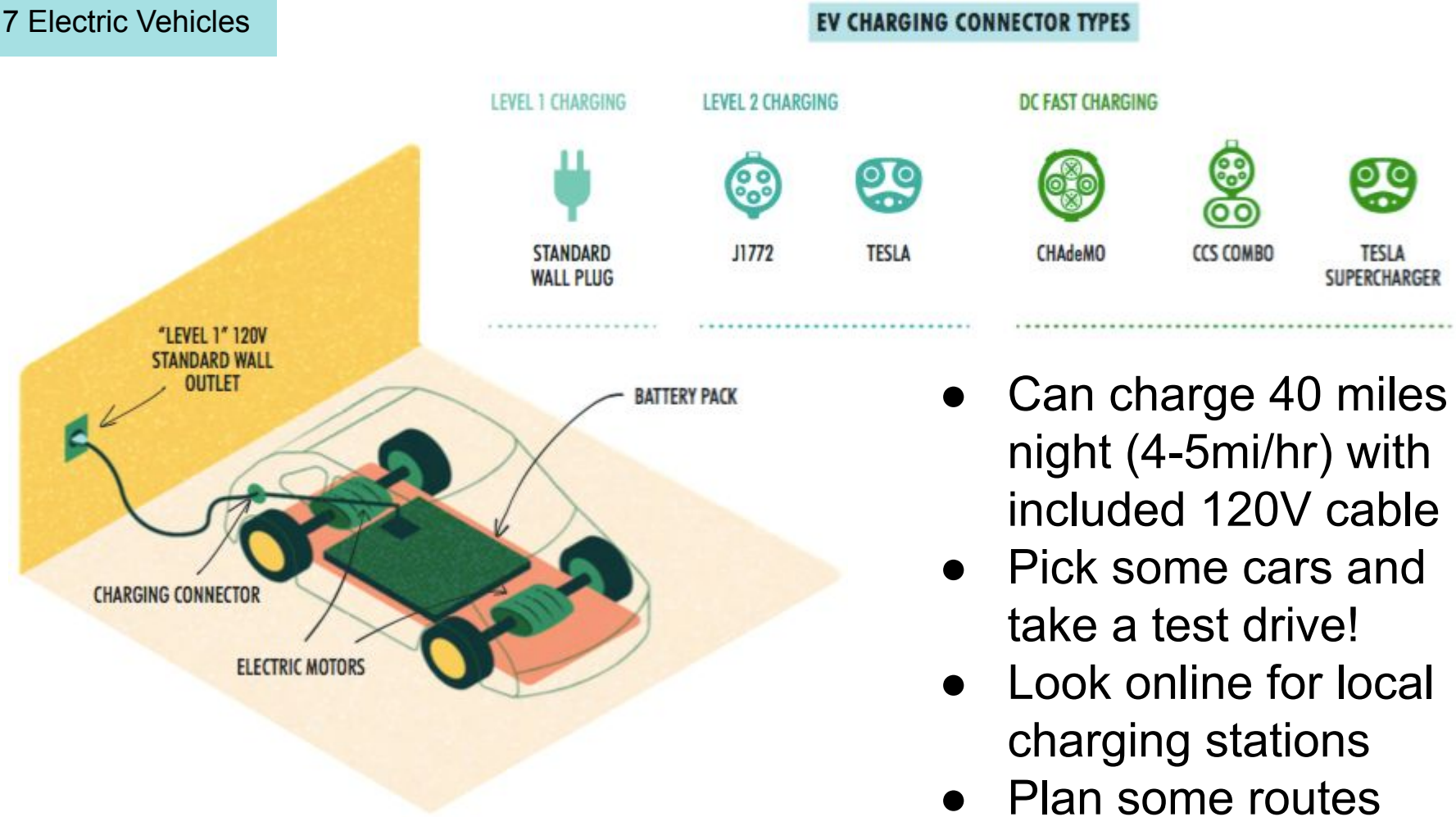
- Induction — not your grandma's electric coils
- Uses electromagnet, not resistance
  - Test pans with magnets
- Get a $50-100 portable 120V to try and show off to friends
- Always use your fume hood — especially with gas
- Other electric ok, just not as nice

6 Electric Clothes Dryer



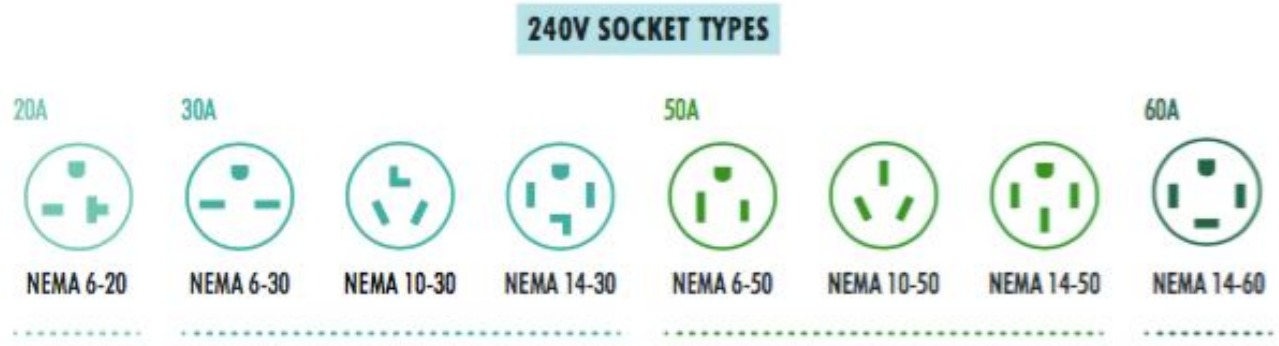
- Ventless
  - No hole in wall
- 240V or 120V
- Integrated washer/dryer units
- Still better to hang dry

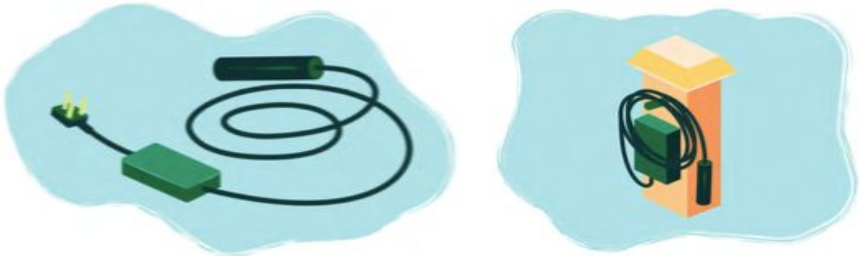
7 Electric Vehicles



- Can charge 40 miles a night (4-5mi/hr) with included 120V cable
- Pick some cars and take a test drive!
- Look online for local charging stations
- Plan some routes

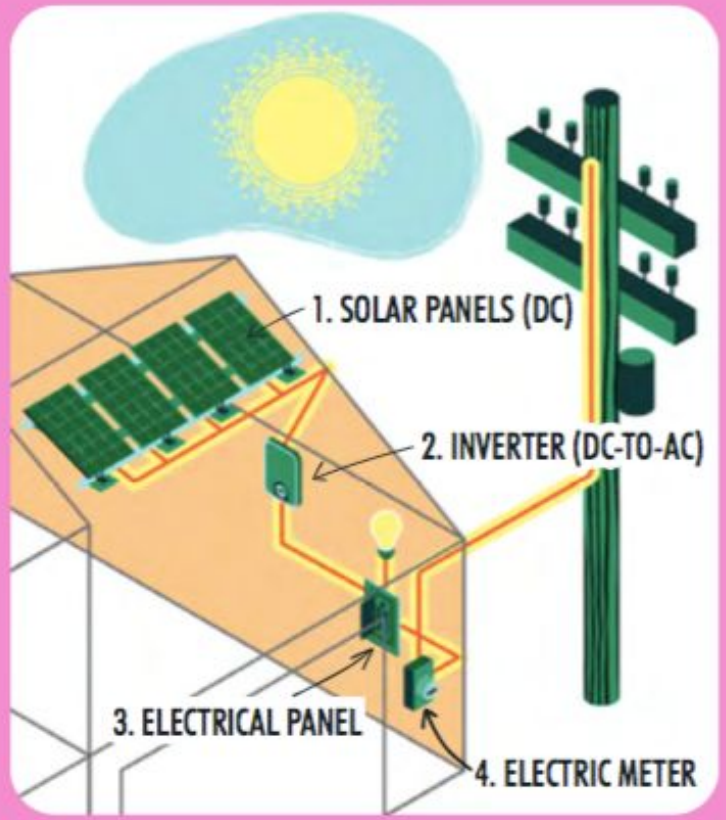
8 EV Charger (240V EVSE)





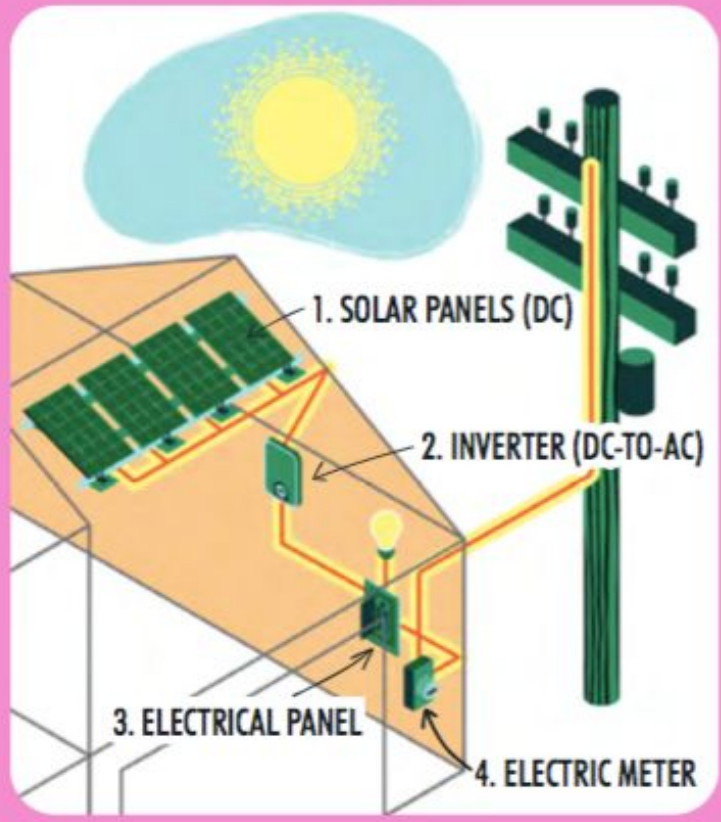
- Can charge 200+ miles a night (15-30 mi/hr)
- Can be indoor or outdoor, wired or portable
- Look for adjustable amps

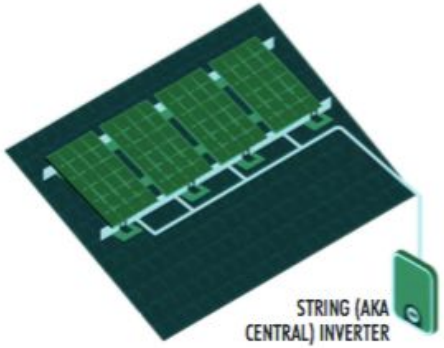
9 Rooftop Solar PV Panels

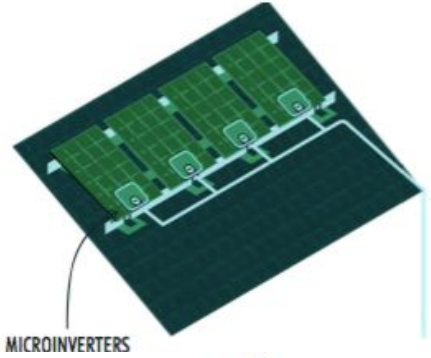


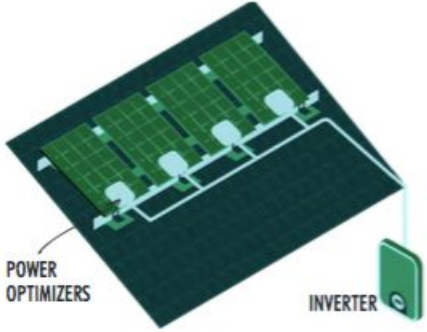
- Get system size estimates and quick quotes at energysage.com
- Include battery quotes — solar won’t work by itself in grid outage

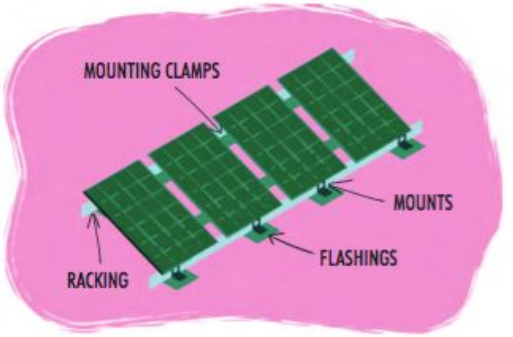
9 Rooftop Solar PV Panels



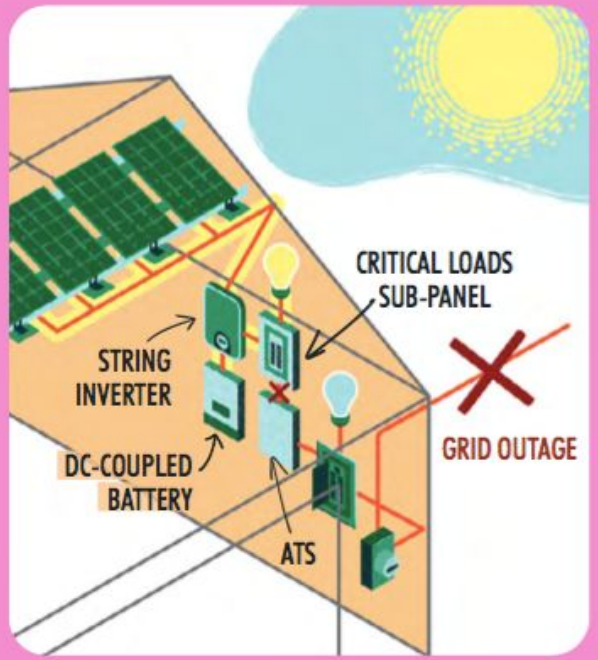


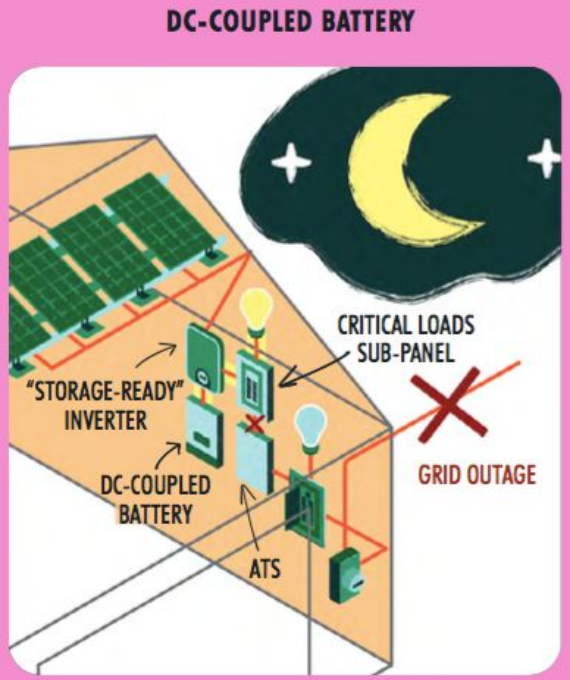


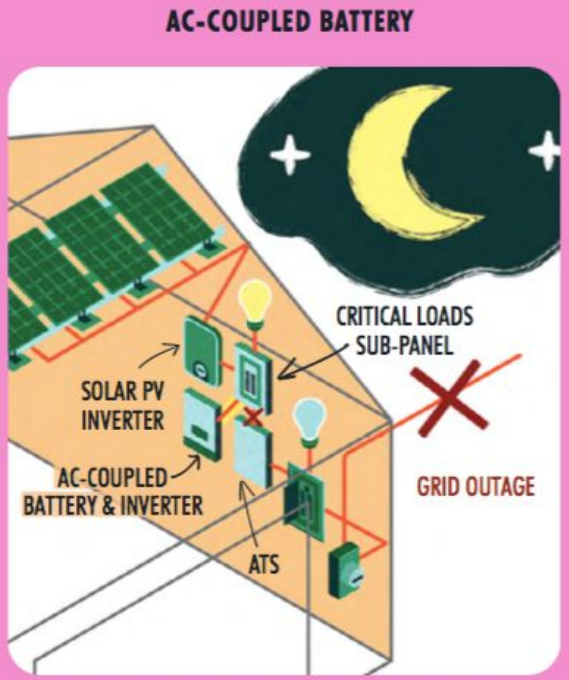




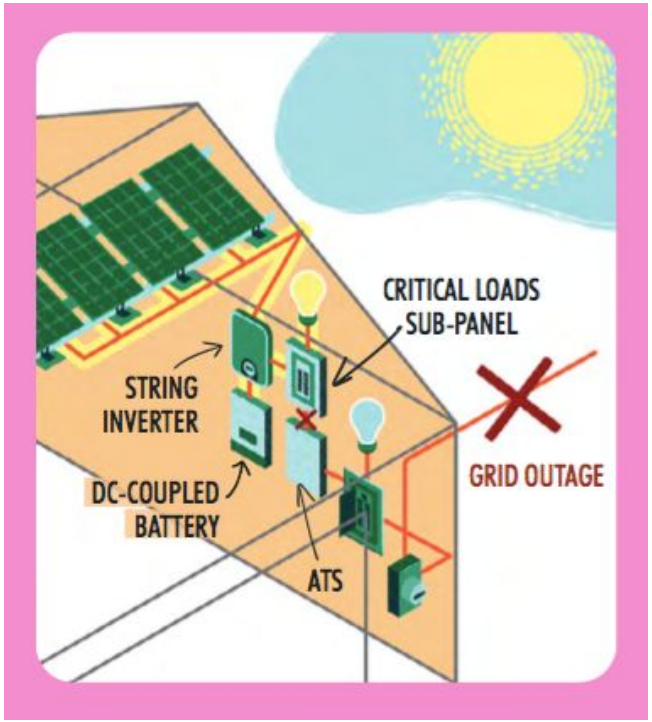
10 Home Battery Storage

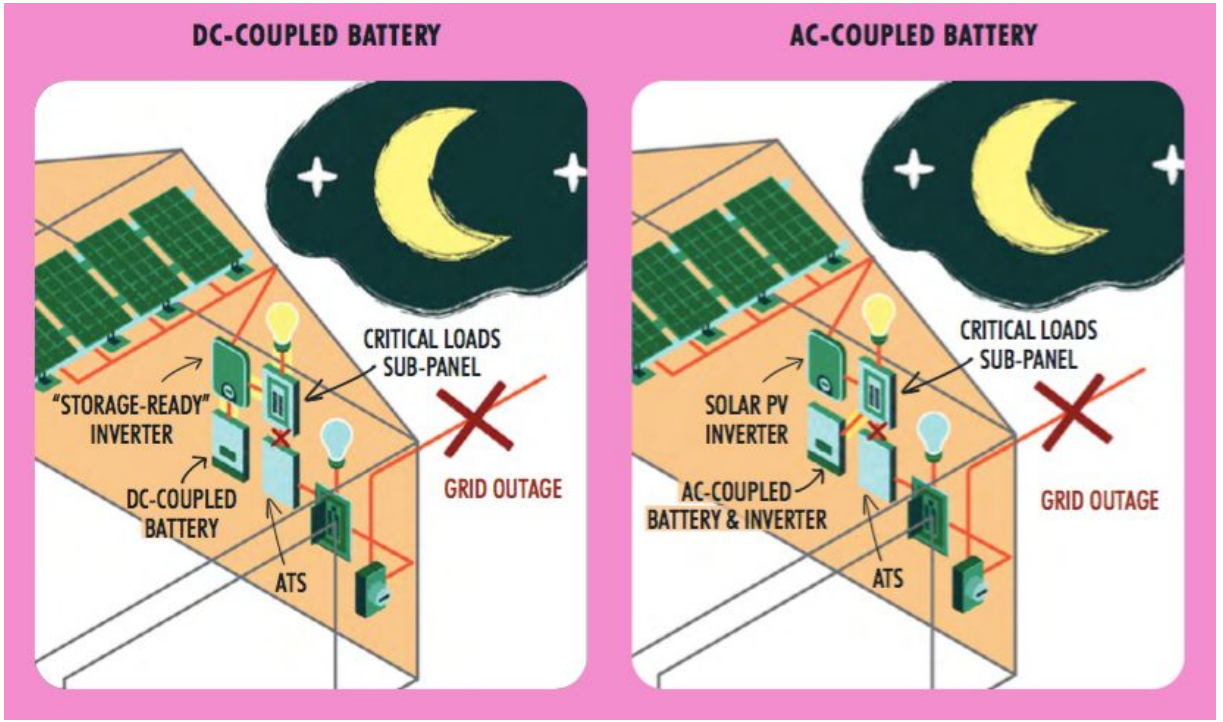






10 Home Battery Storage

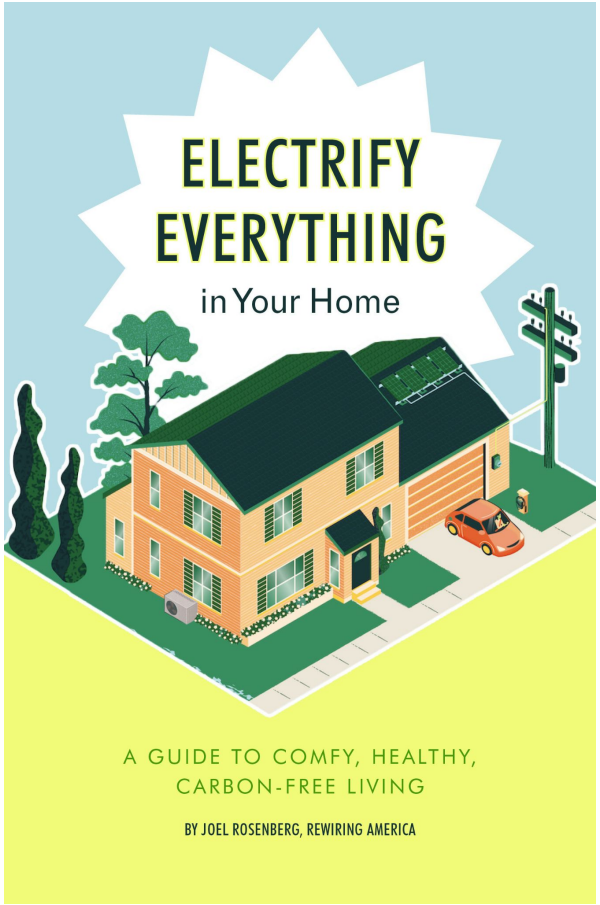




- Consider a battery now if you can afford it, but soon your EV might be able to also be your home battery.

https://cleantechnica.com/2022/02/02/sunrun-v2g-charger-works-with-ford-f-150-lightning-to-power-your-home/

Summary



- Read the FREE guide
- Make a plan!
- Work together as a community to make it easy for everyone to electrify
  - Buying teams & economies of scale
  - Recommend contractors
  - Aggregate demand
- Reduce emissions, increase resiliency
- Document and share!

My next (current) project:
Electrify Everything in Your Schools

SEE_Sustainability - Dr Matt Sawyer
@SEESustainabil1

I am thinking of replacing my electric car with a petrol car and have some questions.
1. I have heard that petrol cars can not refuel at home while you sleep? How often do you have to refill elsewhere? Is this several times a year? Will there be a solution for refueling at home?
2. Which parts will I need service on and how often? The car salesman mentioned a box with gears in it. What is this and will I receive a warning with an indicator when I need to change gear?
3. Can I accelerate and brake with one pedal as I do today with my electric car?
4. Do I get fuel back when I slow down or drive downhill? I assume so, but need to ask to be sure.
5. The car I test drove seemed to have a delay from the time I pressed the accelerator pedal until it began to accelerate. Is that normal in petrol cars?
6. We currently pay about 1.2p per mile to drive our electric car. I have heard that petrol can cost up to 10 times as much so I reckon we will lose some money in the beginning. We drive about 20,000 miles a year. Let's hope more people will start using petrol so prices go down.
7. Is it true that petrol is flammable? Should I empty the tank and store the petrol somewhere else while the car is in the garage?
8. Is there an automatic system to prevent gasoline from catching fire or exploding in an accident. What does this cost?
9. I understand that the main ingredient in petrol is oil. Is it true that the extraction and refining of oil causes environmental problems as well as conflicts and major wars that over the last 100 years have cost millions of lives? Is there a solution to these problems?
I may have more questions later, but these are the most important ones to me at the moment. Thank you in advance for your reply.

https://twitter.com/SEESustainabil1/status/1415756524790722561

Luc Vanhoorickx
@Libomaluc

https://twitter.com/Libomaluc/status/1416709534782005249

[thanks @SEESustainabil1 for inspiration:] I am thinking of replacing my heat pump at home with a natural gas heating system and have some questions.
1/ Do I have to put an ugly chimney on the house like in the middle ages, or is natural gas smoke safe to leave inside the house?
2/ I've heard modern condensing burner systems have an efficiency of 98%, some even advertise > 100%! How do I get gas back when my heating system goes over 100%? I'd like to know as my heat pump has an efficiency of 400%, so I would like to recup as much gas as possible.
3/ From where does the natural gas come from? Is it some place in nature closeby, or from faraway states that we then become dependent on? I assume transport is relatively light, or is it through pipelines cutting through our landscapes or through heavy trucks that clog highways?
4/ Is it true that there's major infrastructure works to bring gas pipeline under the ground into our house? The salesman mentioned that if they cannot break open the street for months, I can also install a tank in my garden but not too close to the house. Will we be safe?
5/ Is it true that natural gas can be explosive? Should I build a protective wall around the burner so that side of the house is protected? What maintenance is needed and is it true that every year I have to pay to get an official safety testing certificate?
6/ Can I also use the system in summer in an inverted manner to cool down my house as I do today with our heat pump?
7/ The model house we visited had a 'thermostat' that automatically controlled the house so it flicks on the heating in the morning after it turned cold at night. Is there a way to keep the temperature in the house constantly perfect like we have with our heat pump now?
8/ We currently pay about 700 euros a year for our heat pump. I have heard that gas is heavily subsidized atm but it is still more expensive. Let's hope more people will start using natural gas and states will subsidize even more so prices go down.