The Most Sustainable Ways to Heat and Cool Your Home

OSU Green Home Workshop 5-16-17

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Heating and Cooling Our Homes Takes Energy

Credit: Pixabay
What kind of energy?

Fossil

Renewable

Flickr
Renewable = Electric
Go Renewable Today For Almost Nothing. Google PUCO. Select your supplier.
Go Renewable Today For Almost Nothing.
Select 76-100% renewable content. Switch.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Rate Type</th>
<th>Renewable Content</th>
<th>Intro. Price</th>
<th>Term Length</th>
<th>Early Term. Fee</th>
<th>Monthly Fee</th>
<th>Promo. Offers</th>
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<tbody>
<tr>
<td>AEP Energy Inc</td>
<td>Fixed</td>
<td>100%</td>
<td>No</td>
<td>12 mo.</td>
<td>$10</td>
<td>$0</td>
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<td>No</td>
<td>12 mo.</td>
<td>$0</td>
<td>$0</td>
<td>No</td>
</tr>
</tbody>
</table>
All Electric = Heat Pumps

Heat pumps are air conditioners that can heat as well as cool.

Never buy an air conditioner again. Only heat pumps.
Heat Pumps

Moving heat.

Not making heat.
Making Heat
Moving Heat

Cold air contains heat!
Making Heat

Moving Heat

= 2x to 5x the energy of
Conclusion:

Heat Pumps Rock!

Moving heat.

Not making heat.
Two Options

Ground Source
aka Geothermal

Air Source
New Development: Efficiencies are getting much closer.

Ground Source aka Geothermal

Air Source
Ground Source

Pros
- More efficient*
- No outdoor unit, less noise

Cons
- $ = 2x-3x air source
- Tax credit expired
- Not enough $ for other upgrades
- Few qualified techs
- Digging required for some repairs
- Energy Savings???
Air Source

Pros
- Amazing comfort
- Much less $
- Higher end is quiet
- Easier to get service

Cons
- Performance declines on cold days
- Outdoor Unit
Ground Source Example
Uncomfortable Home, No $ left
Conclusion:
Ground source may be worth considering for very large homes and commercial buildings, but not for smaller homes.
Air Source: Two Options

Mini Split

Standard Split
Mini Split

Inside

Outside
Mini Split

Pros

● No ductwork required
● Good for large open spaces
● Good cold weather performance

Cons

● Poor filtration
● No fresh air capability
● Not a good whole house option
● Not a good replacement option
Standard Split: Two Options

Heat Pump Only

Hybrid: Heat Pump On Top of Furnace
Standard Split: Heat Pump Only

Inside
Heat pump looks like furnace

Outside
Heat pump is on legs to stay above snow
What Happens On Really Cold Days?

Backup Heat

- Like the element in an electric oven
- Can be staged with HP
- All electric
- Only a few days per year if designed well
- You won’t freeze!
Heat Pump Only

Pros
- No fossil fuels with renewable electricity
- Replace current HVAC
- Fabulous comfort
- Healthy Home
  - Good filtration
  - Fresh air
  - Dehumidification

Cons
- Requires design
  - Blower door test
  - Load calculation
- May require Home Performance project
- Good installation
  - Thoughtful installer
  - Good thermostat
Standard Split: Hybrid

Inside

Heat pump on top of furnace instead of AC

Furnace

Outside

Same outdoor unit
Hybrid System

Pros
- Fewer fossil fuels
- Replace current AC
- Good comfort
- Healthy Home
  - Good filtration
  - Fresh air
  - Dehumidification

Cons
- Still uses fossil fuels
- May require furnace replacement anyway
- Gas backup can’t stage with heat pump the way grid heat can.
Don’t Heat Pumps Cost More?
A Tale of Two Similar Houses

Furnace

Heat Pump Only
Don’t Heat Pumps Cost More?
A Tale of Two Similar Houses

- Built 1915
- 1800 square feet
- 1 occupant
- Foamed walkup attic
- 1960 cfm50 leakage

- Built 1918
- 1700 square feet
- 1 occupant
- Foamed walkup attic
- 1860 cfm50 leakage
Don’t Heat Pumps Cost More?

A Tale of Two Houses

Cost to Operate
12/15 - 12/16
$1813.62
$151/mo
Don’t Heat Pumps Cost More?

A Tale of Two Houses

Cost to Operate
12/15 - 12/16
$1813.62
($151/mo)

Cost to Operate
12/15 - 12/16
$1730.00
($144/mo)
What about a mild winter?

A Tale of Two Houses

Cost to Operate
4/16 - 4/17 (Mild Winter)
$1706.59
($142/mo)
Don’t Heat Pumps Cost More?
A Tale of Two Houses

This is with natural gas at record low prices.
Conclusion:
Air source heat pumps aren’t necessarily more expensive to run than gas furnaces.
Energy Price Volatility?

AS INDUSTRY SCALES, PRICES FALL

Blended Average Solar PV Price ($/watt)

Solar PV Installations (MWdc)


$9.00 $8.00 $7.00 $6.00 $5.00 $4.00 $3.00 $2.00 $1.00

SOLAR PV INSTALLATIONS SOLAR PV PRICES

Solar Tribune
Energy Price Volatility?

![Average Retail Fuel Prices in the U.S.](image)

Source: Clean Cities Alternative Fuel Price Reports

NGV America
Energy Prices?

Will electricity costs go down while fossil fuel costs go up?
If heat pumps make sense today, what about when electricity is cheaper?
Energy Prices?

When you buy a furnace, you are making a 15-20 year commitment to fossil fuels. Are you sure that’s wise?

*I could be completely wrong here, too...
Here’s my future bet: Heat Pump Only
Most Sustainable Way to Heat and Cool Your Home:
Heat Pump Only
But.
It requires design.
The Home Performance Project

Before Foam w/ Heat Pump
Leaky: 4610 cfm50
24,289 kWh/yr

After Foam w/ Heat Pump
Tight: 1860 cfm50
12,161 kWh/yr
The Home Performance Project

50% less usage after air sealing!
(To be fair, it was a harsh winter vs. a mild one.)
Conclusion:
Design and air sealing are critical for optimum HVAC performance.
Work with a Home Performance Specialist.
Best Paths to **Heat and Cool** Your Home Sustainably

First, switch electric suppliers to a 100% renewable one. Google PUCO.
Best Paths to **Heat** and **Cool** Your Home Sustainably

**Home Performance Process**

- List Problems
- Develop Budget
- Diagnose Problems (Energy Audit)
- Develop Plan (Including Load Calculations)
- Fix House
- Install Heat Pump or Hybrid
- Tweak to Perfection
Best Paths to Heat and Cool Your Home Sustainably

Heat Pumps

Ground Source
Air Source

Mini Split
Standard Split

Hybrid
Heat Pump Only
Best Paths to Heat and Cool Your Home Sustainably

Hybrid
- Keep furnace, replace AC with heat pump
- Can do to any home with forced air
- Still uses fossil fuels
- 15-20 year commitment to fossil fuels

Heat Pump Only
- Most sustainable option
- Requires design if you want certainty of low operating costs
- Home Performance project is likely required
  - Air sealing
  - Insulation
  - HVAC design/install
Best Paths to **Heat** and **Cool**
Your Home Sustainably

Don’t forget to design for a Healthy Home/Good Indoor Air Quality

- Fresh Air
- Filtered Air
- Humidity Controlled Air
Want to know more? See our case studies

1915 Case Study

1918 House of the Future Case Study
Want to know more?

Get our free HVAC guide.
The Most Sustainable Ways to **Heat** and **Cool** Your Home

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