



PPL Electric Utilities

The presentation will begin shortly!

WHY ARE HEAT PUMPS SO GOOD?



Hap Haven
PPL Pilot Manager

WHY ARE HEAT PUMPS SO GOOD

Thank you for coming today!

- 90 second summary of today's topic.
- **HEAT PUMP TECHNOLOGIES**– Which one is right for you?
 - What is the PPL Residential Energy Retrofit program? Incentives?
 - Q and A at the end – please type into the box
 - No need to take notes – we'll send you the PDF

90 SEC REVIEW – WHAT

What is a Heat Pump?

- It's a mechanical system that moves heat from one place to another place.
- It does not make heat. It moves heat!

**SIMILAR TECHNOLOGY,
DIFFERENT PURPOSE,
DIFFERENT NAMES**

What is the Refrigeration Cycle?

- This is the original “heat pump” with a different objective.
- It's a mechanical system that removes heat from one place and dumps it in another place.
- It does not make “coolness”. It just removes heat!

90 SEC REVIEW – HISTORY

The science has been around forever. Technology keeps improving.

REFRIGERATION

The goal is REMOVE heat

Refrigerators

- 1657 – Invented. Latin meaning “make cold”
- 1834 – Commercially available
- 1927 – Residentially available \$6 - \$12K

Freezers

- 1857 - Named for metal ice cream makers
- 1923 - Frigidaire introduces 1st standalone unit

Air Conditioners

- 1911 – Name coined for technology to make textile mills more comfortable
- 1931 - standalone unit \$10 to \$50,000
- 1950s – widely adopted after WW2
- 1970s – Central air installs began rising

HEAT PUMPS

The goal is ADD heat

Heat pumps

- 1840s – Name for extracting salt from salt water. (heat the water so it evaporates)
- 1948 - 1st residential centrally ducted
- 1962 – 1st residential mini-split

✓ **House heaters**
Moves heat 2 directions

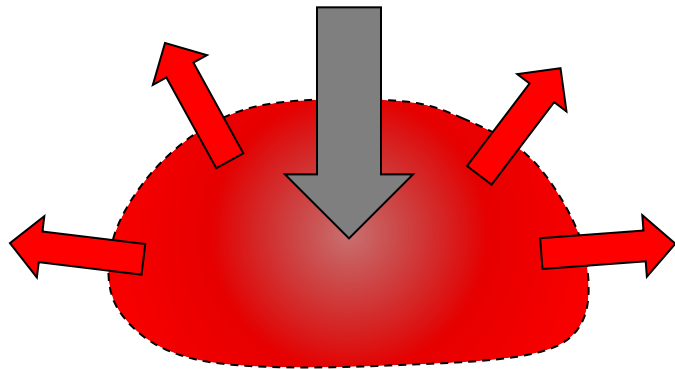
✓ **Water heaters**
✓ **Clothes dryers**

90 SEC REVIEW – HOW

Science - Heat naturally moves from hot to cold

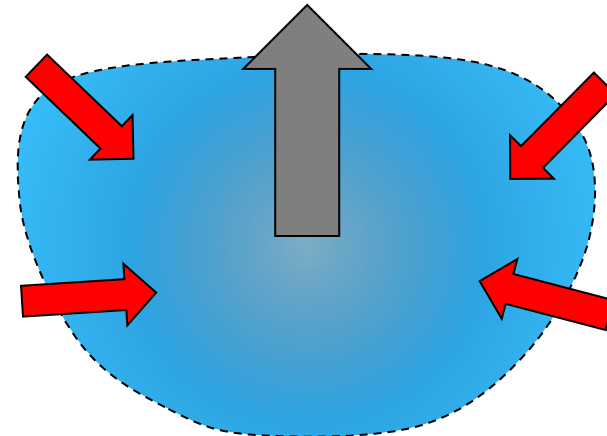
Engineering – Use a mechanical system to control this phenomenon by compressing and expanding a refrigerant.

COMPRESSION



High pressure heats-up the gas to a hot fluid, and releases heat

EXPANSION



Low pressure cools-down the liquid to become gas, and absorbs heat

WHY ARE HEAT PUMPS SO GOOD?

Modern Heat Pumps are a Game Changer

- Most efficient dryer (Adds heat to clothes)
- Most efficient water heater (Adds heat to water)
- Most efficient heaters (Adds heat to house and removes heat from house)
- Used world-wide for more than 30 years

Always look for the **ENERGY STAR®** logo and energy information

MOST EFFICIENT CLOTHES DRYERS?

- **Gas dryers**

- Greater upfront purchase price and requires gas connection
- Heats up faster and hotter so drying times are shorter
- Potential Carbon Monoxide safety issues

- **Electric dryers**

- Cheaper up-front cost but costs 50 to 100% more to run
- Requires 240-volt electric connection

- **Heat Pump Dryers**

- Doesn't need venting (uses condensation for drying)
- No combustion safety issues
- May cost double other dryers but the Home Upgrades rebate program can level the playing field. (30-50% of cost depending on income as a rebate - not available in PA yet)
- Doesn't need vent to outside, but a drain is recommended.
- Extra important to maintain filters

This Old House video <https://www.youtube.com/watch?v=DeN-h6opueM>



Heat Pump Dryers
Cost up to 40% less to run than gas dryers.
Cost up to 70% less to run than electric dryers

Photo courtesy of Blomberg

MOST EFFICIENT WATER HEATER?

- **Gas water heater – 70 to 90% efficient**
 - Lasts ~8 to 12 years
 - Requires burners and chimney/flue safety checks
 - Tankless / instantaneous units need cleaning every year
 - Potential Carbon Monoxide issues in less efficient units
 - Needs make-up air for combustion
- **Electric water heater – 100% efficient**
 - Lasts ~8 to 12 years
 - No combustion safety issues
 - Can be installed in closets and just about anywhere
- **HPWH – 300% efficient**
 - Lasts ~10 to 15 years
 - No combustion safety issues
 - May cost double the gas water heater but incentives and tax credits level the playing field (30% of project cost up to \$2,000 - federal tax credit)
 - Can't be installed everywhere – usually installed in basement
 - Will cool down the space where it's located but will also dehumidify that space. Can be vented to the outdoors.



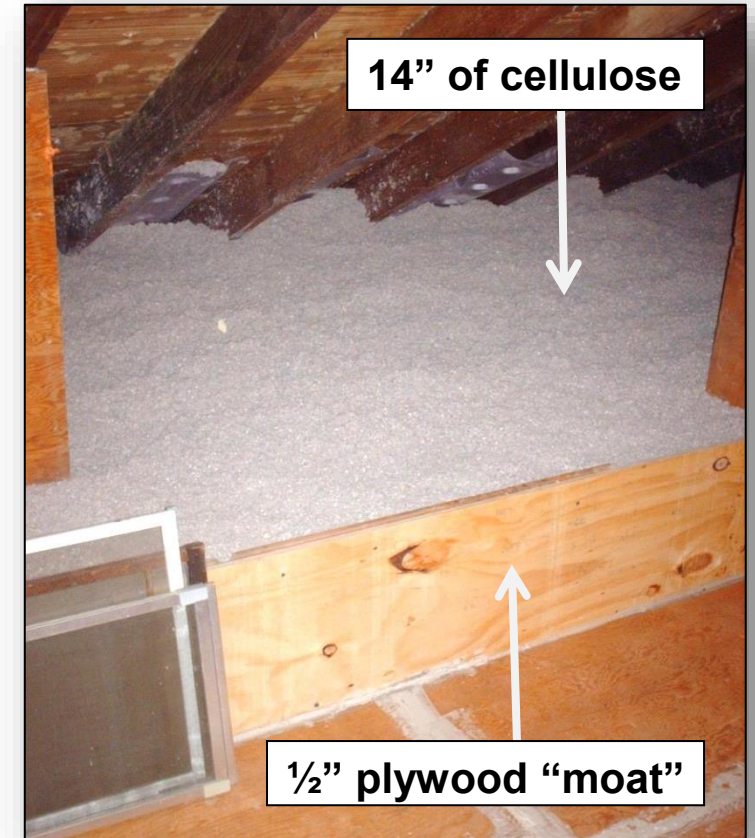
**Heat Pump
water heaters**
use up to 50% less
electricity!

HEAT PUMPS ARE AMAZING, BUT

They can't solve all your comfort problems

Your heating/cooling system needs to work with the structural system to provide comfort at a reasonable cost.

Your house shell only performs well if it is **AIR SEALED** before it's **INSULATED**



HEAT PUMPS ARE AMAZING, BUT

Poorly designed distribution systems are a common problem.

Your heating ducts and pipes only perform best if they are in the **conditioned space**. (Not in the attic or crawlspace)

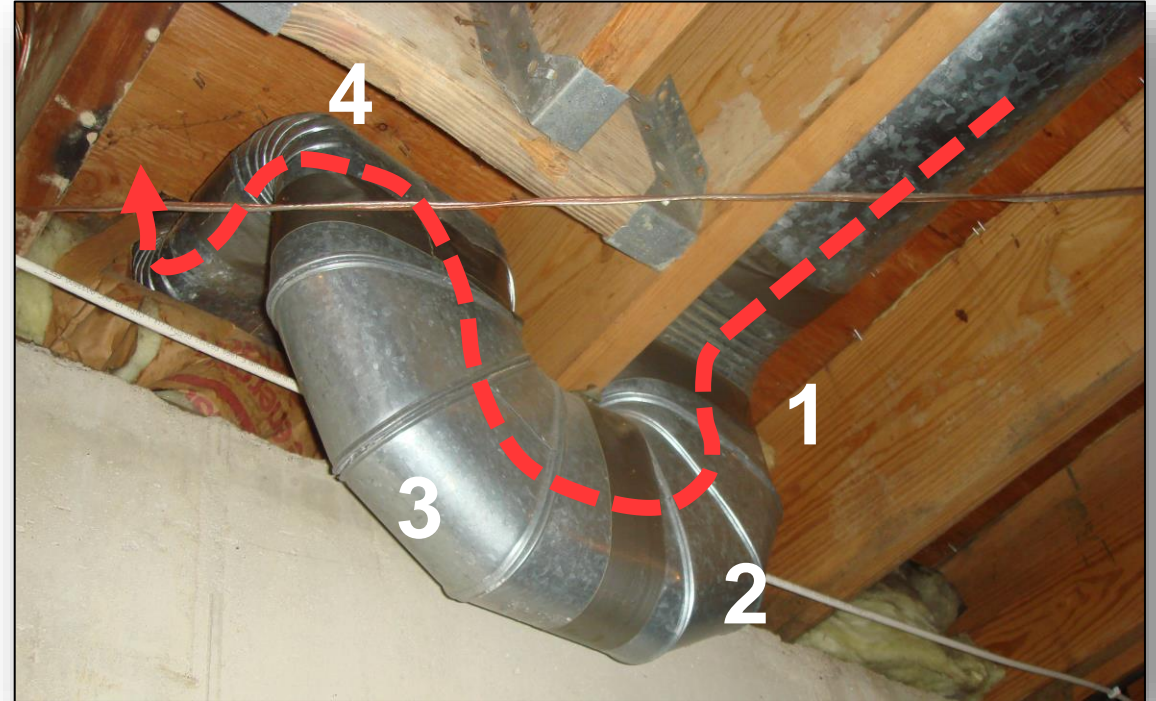
Ducts need to be designed to carry the right amount of conditioned air to each room.

Total Effective Length

Is part of the duct design process to calculate friction/cfm and volume.

Each 90° Elbow = EL of 30'

30 x 4 = 120' Extra feet of duct run.



HEAT PUMP COMFORT SOLUTIONS

How can Heat Pumps solve you comfort problems?

Single Zone mini-splits

Air Source Heat Pump
(Ducted or ductless mini-split)

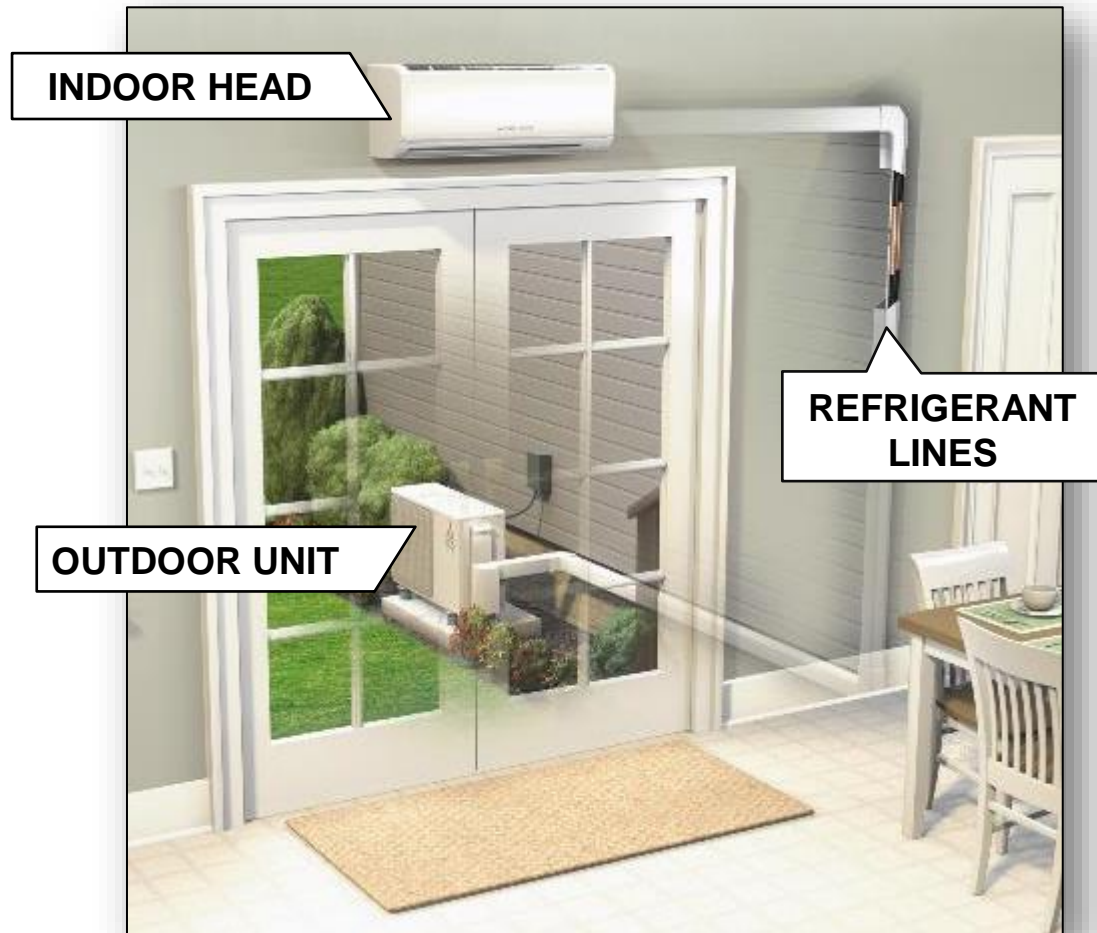


Illustration courtesy of Mitsubishi Electric

HEAT PUMP COMFORT SOLUTIONS

Multi-Zone mini-splits

Lots of “radiator” options

Ceiling



Floor



Low/Mid Wall



Illustration courtesy of Chriltrix

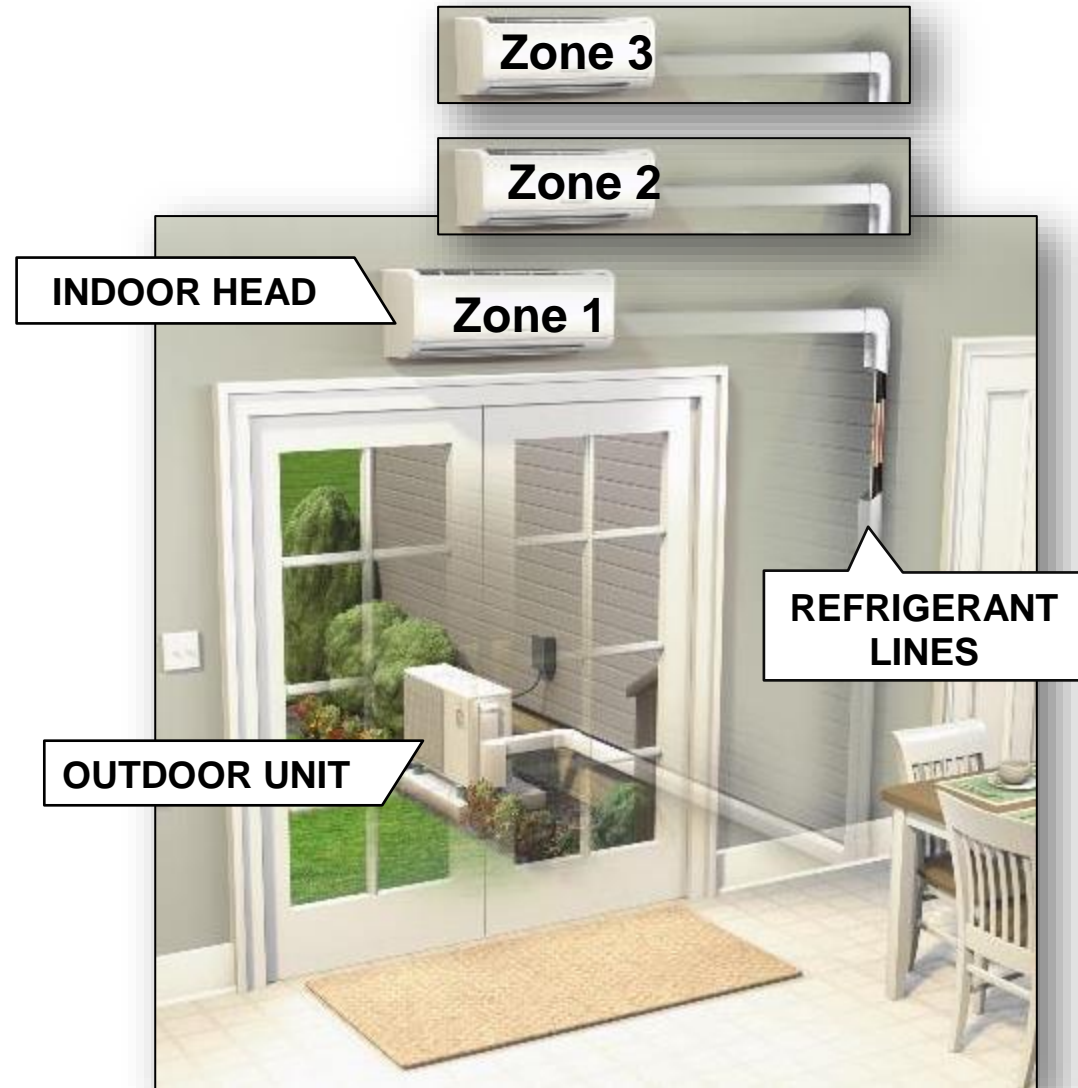


Illustration courtesy of Mitsubishi Electric

EXAMPLE: AFTERNOON SUN

Sun heats up the living room

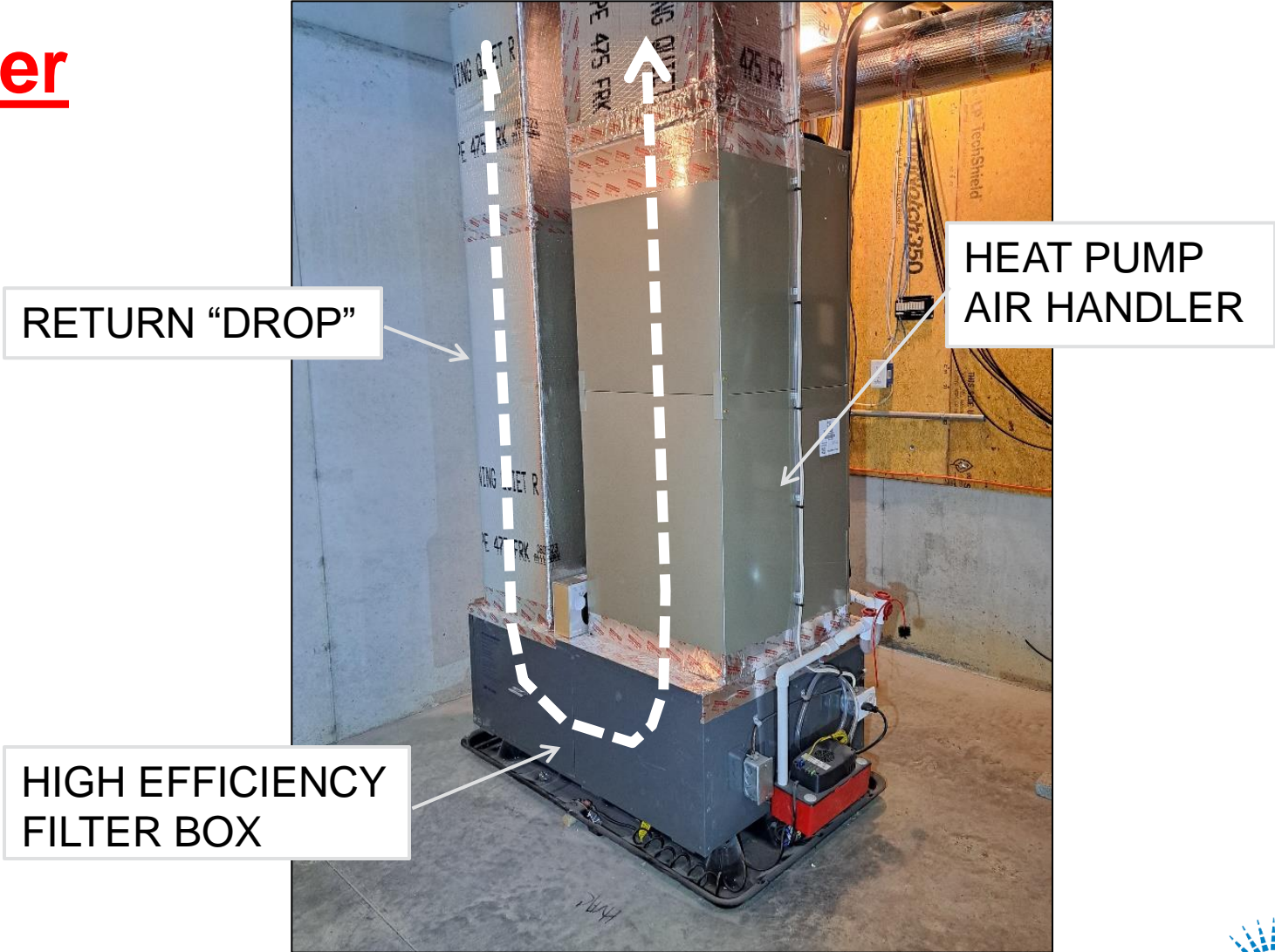
- Install single zone mini-split for the living room
- Add a second zone for the main bedroom



HEAT PUMPS FOR DUCTED HOMES

Standard Air Handler

Air Source Heat Pump designed for a fully ducted system



CUTTING EDGE HEAT PUMPS

Air to Water Heat Pumps

Has a sealed condenser and evaporator outside in one unit (Mono Block). Huge environmental benefits - No refrigerant circulating to house and highest efficiencies available.

Cascade Heat Pumps

Multiple heat pumps in series – able to achieve temps high enough to use in existing cast iron radiators.

AIR DELIVERED
BY DUCTS

AIR HANDLER
INSIDE

EVAPORATOR
AND
COMPRESSOR
TOGETHER ON
PAD OUTSIDE



WATER



Illustration courtesy of Chiltrix

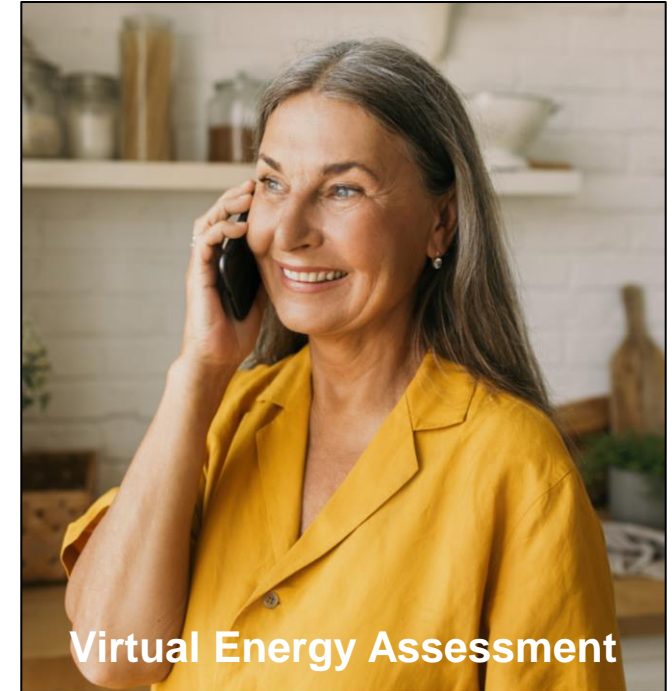
1ST STEP TO GETTING ANSWERS

VIRTUAL ENERGY ASSESSMENT

Your choice – a voice or video call with an Energy Advisor
Free for electric heating or central air customers and
comes with a free energy savings kit mailed to your home
Call 877-486-9204 to schedule

IN-HOME ENERGY AUDIT

\$350 rebate for electric heating and central AC customers
\$200 rebate for electric heating or central AC customers
Check with your auditor if the assessment is free before you
schedule an appointment.



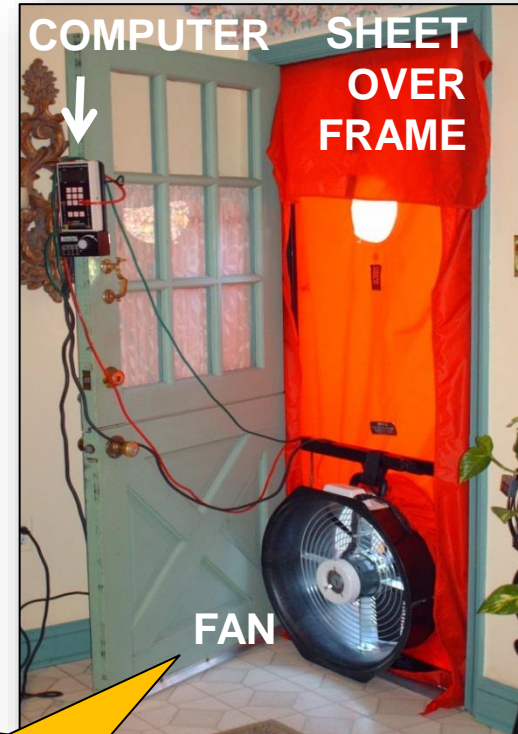
IN-HOME ENERGY AUDITING

An in-home energy audit isn't about typical problems:

- Broken heaters or air conditioning
- Kitchens over vented crawlspaces

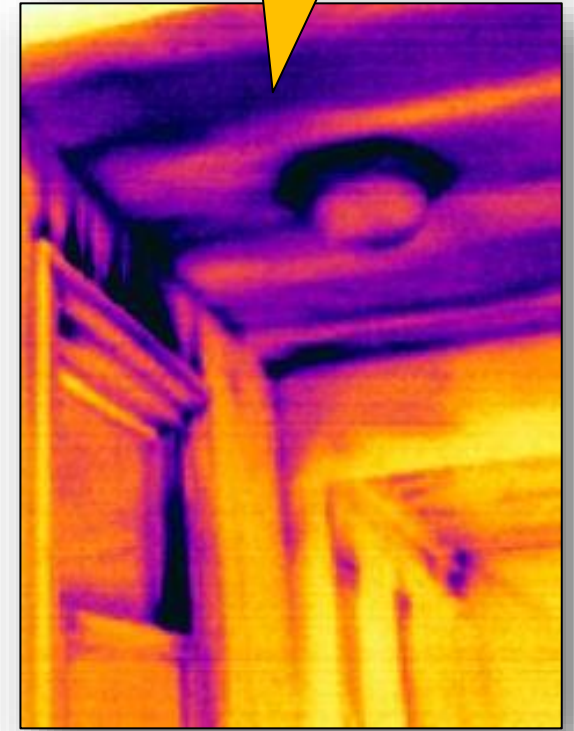


No problem here



Blower Door set-up

Infrared shows you the problem



PPL ENERGY EFFICIENT HOME REBATES

<https://www.pplelectric.com/rebates>

Single Weatherization Upgrades	Rebate	Notes	SHELL SYSTEM
Attic Insulation (electric heat)	\$500	75% of cost up to a max of \$500	
Attic Insulation (central A/C, non-electric heat)	\$200	75% of cost up to a max of \$200	
Basement Wall Insulation (electric heat)	\$500	75% of cost up to a max of \$500	
Basement Wall Insulation (central A/C, non-electric heat)	\$200	75% of cost up to a max of \$200	
Air Sealing	\$200	Air infiltration reduction (@ CFM50) x \$0.25 up to a max of \$200	
Single Efficient Equipment Upgrades	Rebate	Notes	MECHANICAL SYSTEM
Smart Thermostat (self-install)	\$50	ENERGY STAR® certified	
Smart Thermostat (professional install)	\$100	ENERGY STAR certified. Must be installed by a PPL Electric Utilities qualified contractor.	
→ Heat Pump Water Heater	\$400	Universal Energy Factor (UEF) ≥ 3.3	
→ Air Source Heat Pump	\$350	≥ 15.2 HSPF2, ≥ 11.7 EER2, ≥ 7.8 HSPF2	
→ Air Source Heat Pump	\$450	≥ 16.3 SEER2, ≥ 12.9 EER2, ≥ 8.2 HSPF2	
→ Ductless Mini-Split Heat Pump	\$400 (per outdoor unit)	≥ 15.2 SEER2, ≥ 11.7 EER2, ≥ 7.8 HSPF2	
Central Air Conditioner	\$200	≥ 15.2 SEER2, ≥ 12 EER2	
Central Air Conditioner	\$300	≥ 16.3 SEER2, ≥ 12.9 EER2	

Make sure you follow the specs. for minimum efficiencies.

PPL BONUS REBATES

Comprehensive Retrofit Bonus 1 (\$250)

(2 major treatments installed within 12 months) (1 weatherization upgrade + 1 other major upgrade)

Comprehensive Retrofit Bonus 2 (+\$100 or \$350 total)

(3 major treatments installed within 12 months) (Bonus Tier 1 + 1 or more additional major upgrades)

Deep Energy Retrofit Bonus (\$500)

(3 major treatments installed at the same time)

(In-Home audit + 3 treatments with at least 1 shell and 1 mechanical treatments)

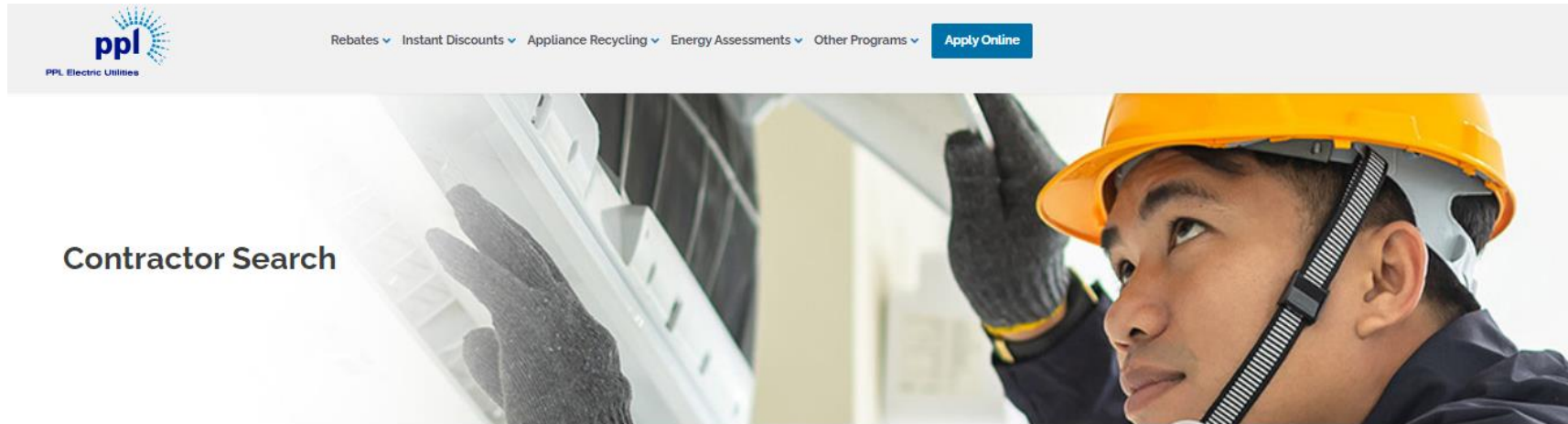
(Cannot be used with Bonus 1 or 2)

DER Bonus webpage: <https://www.pplelectric.com/retrofitpilot>

CONTRACTORS

Log onto the PPL Electric Utilities website for more program information or to identify a Trade Ally you'd like to hire.

<https://www.pplelectricsavings.com//ppl/homeequipment/contractor/>



The Trade Allies below are qualified to provide In-home Energy Audits and the Deep Energy Retrofit Bonus.

**Advanced Efficiency Worx
Energy Services Group
MT Weatherization**

support@aeworxpa.com
info@energysvc.com
ACastles@tennygroup.com

BUNDLE YOUR SAVINGS

Final Note: Don't forget to bundle your savings.

You may qualify for federal tax credit is a maximum of \$3,200 per year from two different “buckets”. Up to \$1,200 home improvements and up to \$2,000 for higher performance mechanical improvements.

<https://www.EnergyStar.gov/about/federal-tax-credits>

Example: Heat Pump Water Heater

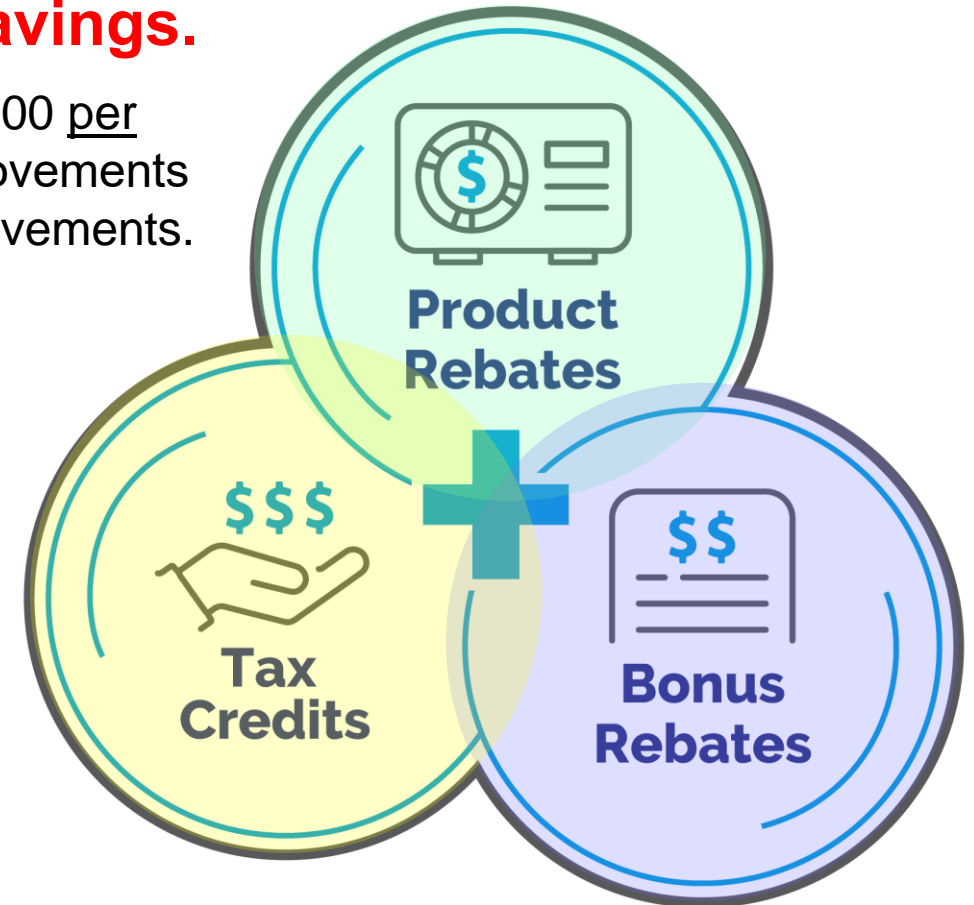
(30% up to \$2,000 for federal tax credit)

(\$400 – PPL rebate)

If you purchase a \$2,000 unit and paid \$500 to install it, your project cost is \$2,500

$30\% \times \$2,500 = \750 federal tax credit.

$\$2,500 - \$750 - \$400 = \$1,350$ adjusted project cost.



HEAT PUMP SUMMARY

There are Heat Pumps to solve most problems

- Most efficient dryer
- Most efficient water heater
- Most efficient Heaters
- Used world-wide for more than 30 years

Heat Pumps (HPs) don't make heat – they move heat

- HPs use a refrigerant to move heat
- Refrigerators, freezers and air conditioners REmove heat
- Heat pumps can reverse the flow of refrigerant and move heat two ways

QUESTIONS and COMMENTS ?

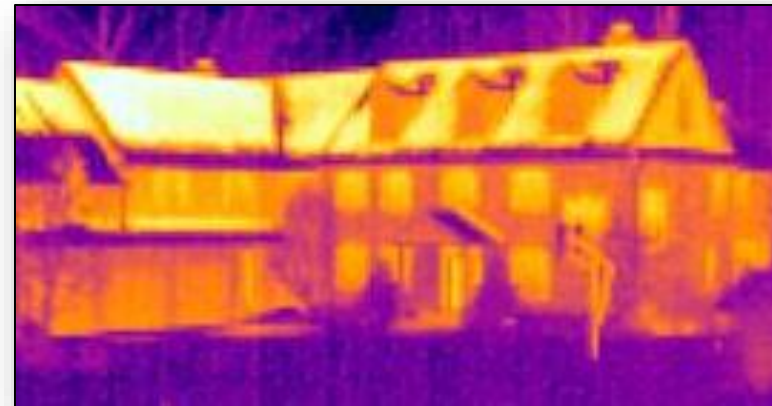
Please type them into the questions box





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Thank you for coming today



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