Heat Pumps in Seattle

Multifamily

Seattle City Light

Lighting Design Lab

June 10, 2021

Cooling “food for thought”

- 90 degree day in May – the future is hot!
  - The value of cooling cannot be understated
  - Cooling will be essential for future resiliency
- How do you select the type of cooling?
  - BYOC (Bring your own cooling) could see an energy increase of 100s of kWh / unit / year
  - Lifetime energy savings of a heat pump / VRF are significant
- Ductless heat pumps common option for low-rise apartments
  - People are doing this on their own because of code tradeoffs, value of cooling is significant
  - Only a handful of projects applied for City Light incentives in the last year

We are here to help to make efficient cooling the norm

Before we Begin…

During the Webinar

- Attendees will be muted
- Please use the chat feature in the control panel to submit questions to LDL staff
- The presenter will pause to address questions periodically.
- Please participate in the online polls.

Following the Webinar

- Please take the short survey
- A recording and the slide deck will be posted on LDL's webpage
- Reach out to LightingDesignLab@seattle.gov with comments or questions.

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LEED E&A TAG member

Sustainable Mechanical Engineering

Energy Modeling and Auditing

130+ LEED Projects

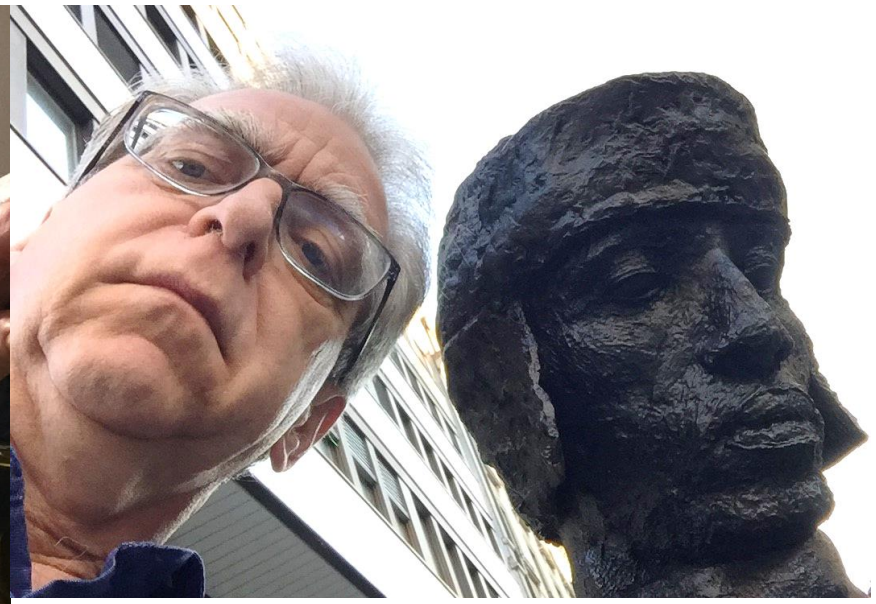
2 Certified Living Buildings

9 current projects targeting Net Zero

Code Nerd

Duane Jonlin, FAIA

- 30 years as technical architect
- 9 years as Energy Code guy
- 4th generation Seattleite



We got this.

It's not *whether* we're going to do this, it's *how*

Washington state:
70% less building energy use by 2030

- Zero-carbon buildings
- Gov says move faster

Washington state:
45% reduction in GHG emissions by 2030

- 95% reduction by 2050

Seattle: Carbon-neutral building & vehicle operations by 2050

- …or sooner with Green New Deal?

Dwelling Unit electric system options

Electric Resistance	Baseboard heaters, wall-mounted fan coil units, cove heaters
Ductless mini-split heat pump	Outdoor heat pump unit for each unit in garden or on roof, indoor unit on wall
VRF (variable refrigerant flow)	One rooftop heat pump can serve 50 or more units, refrigerant lines **(VRV?)**
Double duct heat pump	Unit mounts on interior wall, with two 6” ducts through the wall.
PTHP (constant volume)	Packaged Terminal Heat Pump. Typical in budget motels
VTHP (constant volume)	Vertical Terminal Heat Pump. Through wall heat pump, located in closet at exterior wall.
VRP (inverter driven)	Variable Refrigerant Package. Through wall heat pump, located in closet at exterior wall.
Air-to-water heat pump	Outdoor heat pump feeds hydronic flow to radiators, radiant floor loop, or fan coils.

ELECTRIC RESISTANCE

Use for small loads, special conditions and apartments

SYSTEM Baseboard heaters, wall-mounted fan coil units, cove heaters, radiant floor & ceiling panels.

ISSUES Poor efficiency compared with heat pumps (COP of 1.0 vs. COP of 3.0). Large electric service size required for building, increases utility peak loads.

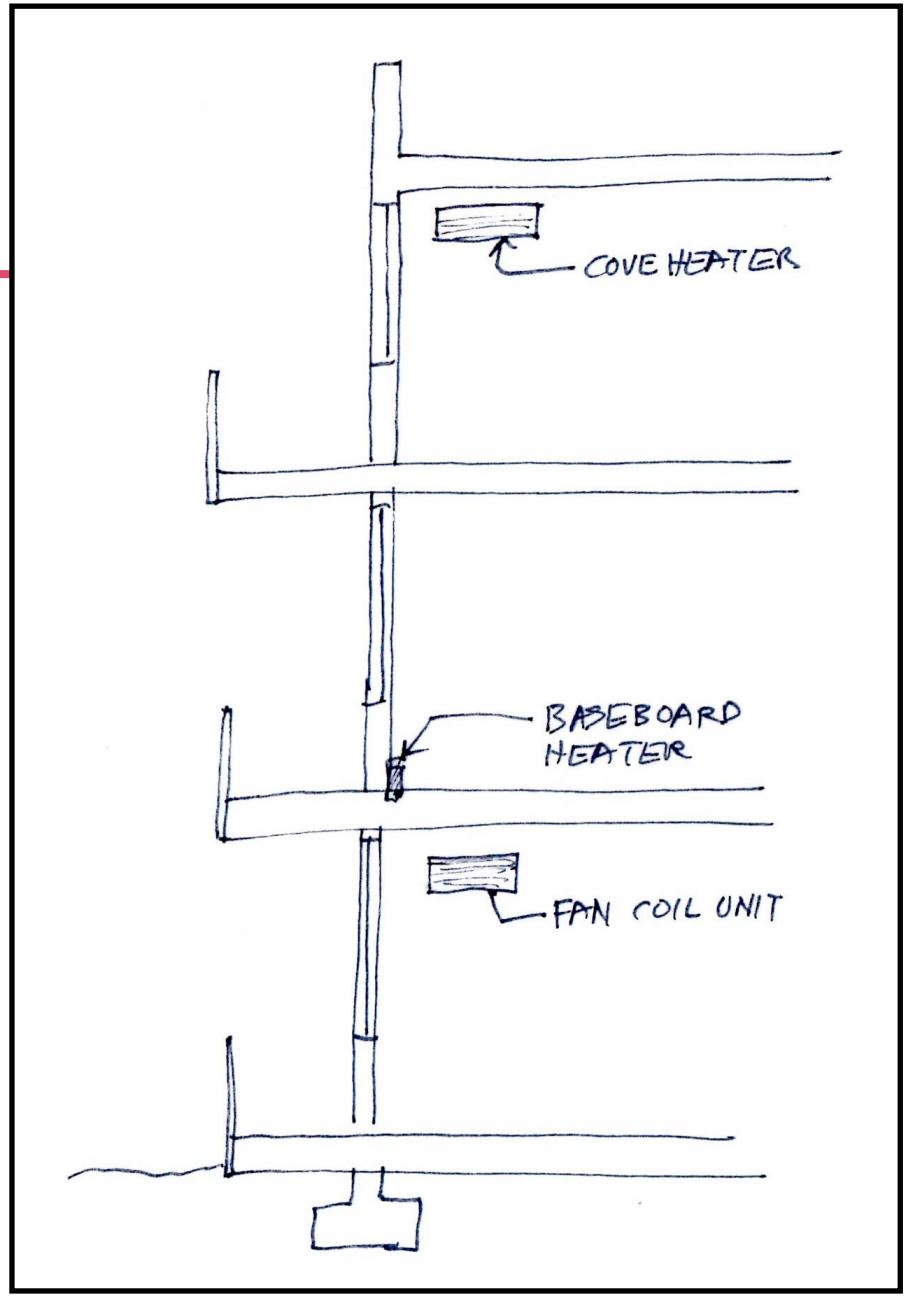
TYPICAL SIZING 500W – 1000W per room

TYPICAL PERFORMANCE COP 1.0

ANNUAL HEATING COST $210-$500/Apartment

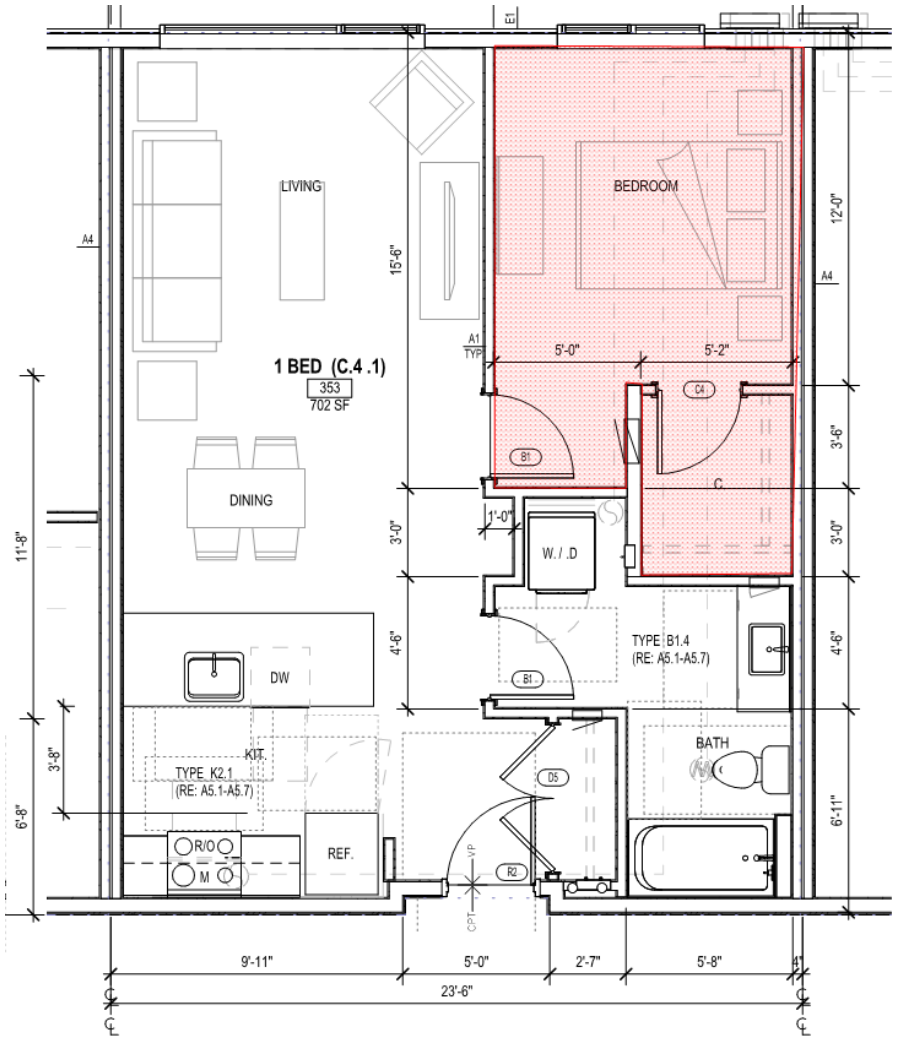
INSTALLED SYSTEM COST $2,500—$3,000 per apartment

CODE REQUIREMENTS Seattle: Limited to 750W per room in multifamily, 1000W for corner room



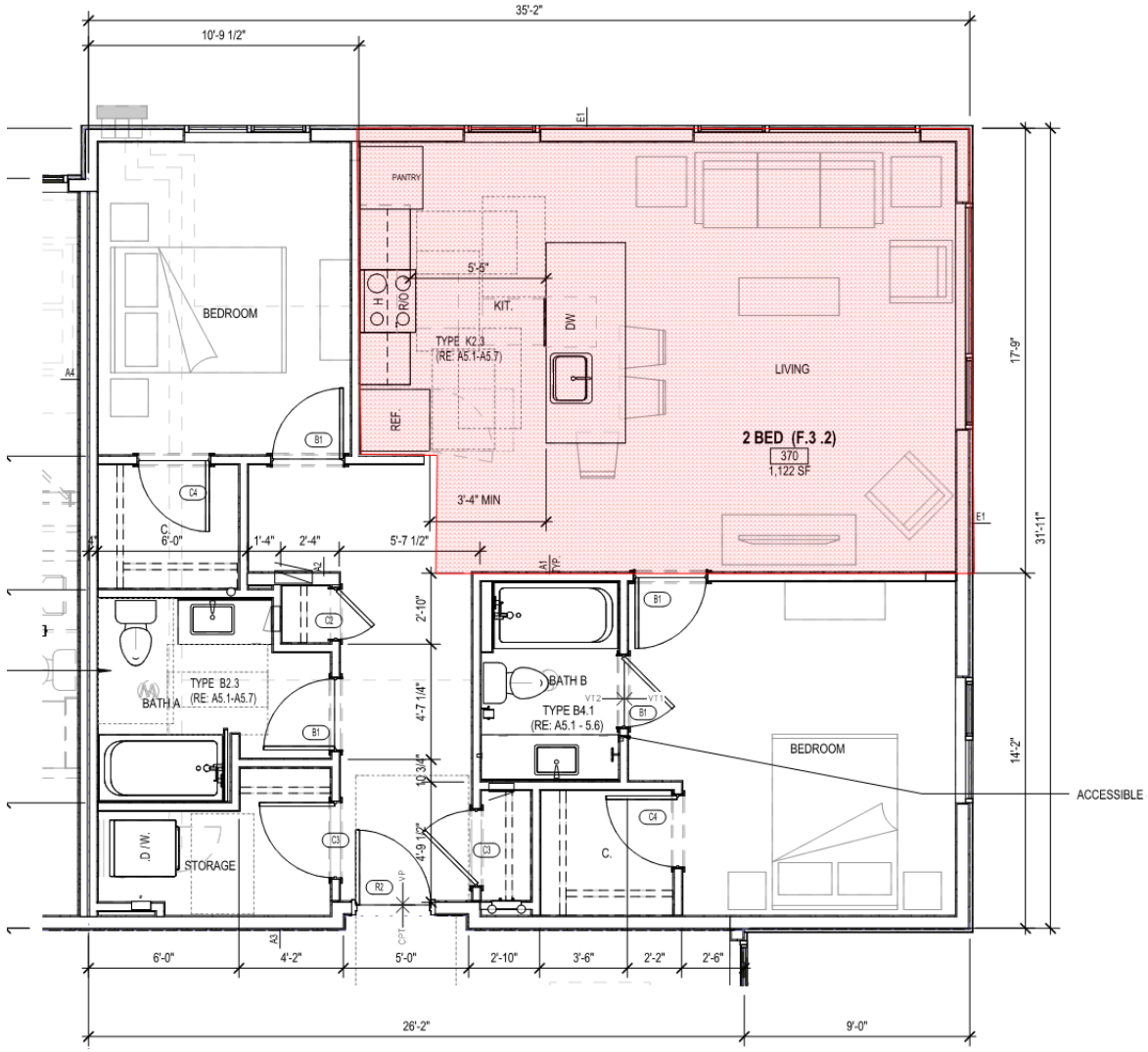
Electric Resistance Case Studies

- Typical Bedroom **<750W**.
- One large (6'x7') sliding glass door (40% glazing).
  - Wood-Framed Construction with punched windows
    - **Heat Requirement ≈ 400W**
  - Steel-Framed Construction with unitized glazing
    - **Heat Requirement ≈ 475W**
- Takeaway: Large glazing percentages still possible for small rooms with approximately 10-12 feet of exterior wall



Electric Resistance Case Studies

- **24’x18’ Corner living room**
- 35% glazing
- Wood-Framed Construction with punched windows
  - **Heat Requirement ≈ 1000W**
- Steel-Framed Construction with unitized glazing
  - **Heat Requirement ≈ 1200W**
  - **Use U-0.30 glazing to get down to 1kW**
- Takeaway: It may be challenging to meet loads in corner units due primarily to higher enclosure areas. Close review required
- These are small capacities!



If you ~~build~~ *Cool* it, they will ~~come~~ *use the cooling*

Annual Cooling, Dehumidification, and Enthalpy Design Conditions

Hottest month	Hottest month DB range	Cooling DB/MCWB						Evaporation WB/MCDB						MCWS/PCWD to 0.4% DB	
		0.4%		1%		2%		0.4%		1%		2%			
		DB	MCWB	DB	MCWB	DB	MCWB	WB	MCDB	WB	MCDB	WB	MCDB	MCWS	PCWD
7	*8*	*9a*	*9b*	*9c*	*9d*	*9e*	*9f*	*10a*	*10b*	*10c*	*10d*	*10e*	*10f*	*11a*	*11b*
8	**18.2**	**84.9**	**65.2**	**81.2**	**63.7**	**77.6**	**62.3**	**66.5**	**82.5**	**64.7**	**78.9**	**63.1**	**75.8**	**9.7**	**0**

DUCTLESS MINI-SPLIT HEAT PUMP

Good system, need to locate outdoor unit for each apartment

SYSTEM One outdoor unit for each apartment, in garden, on roof, or on deck. Also provides cooling.

ISSUES Refrigerant lines limited to 50 feet, so hard to use if taller than 6 stories. Roof area – figure 25 sq ft per unit.

TYPICAL DIM'S Indoor unit 32" x 12" x 9" Outdoor 30" x 30" x 12"

TYPICAL CAPACITY SIZING 9 to 24 kBTH, ¾-2 tons nominal

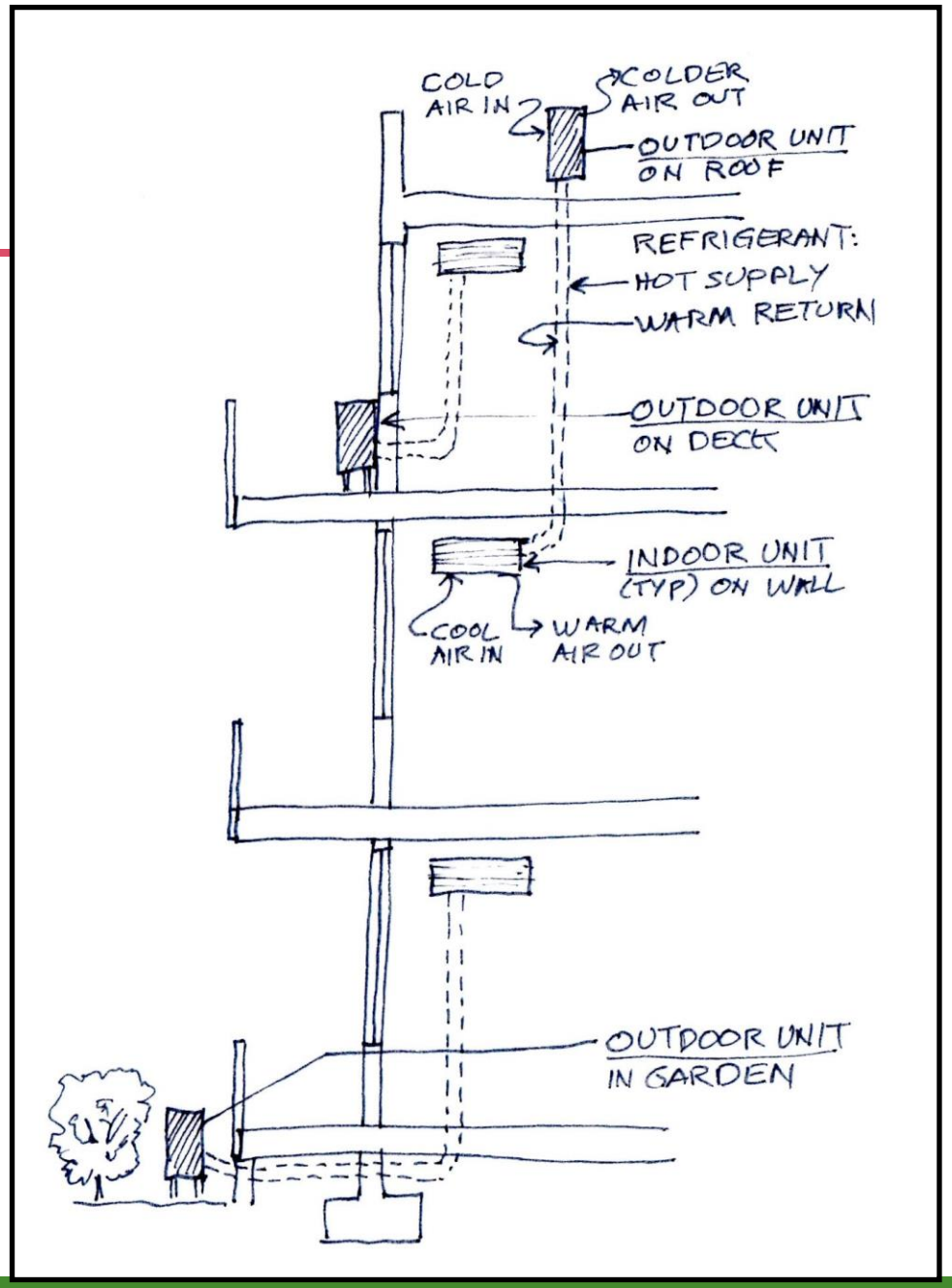
TYPICAL PERFORMANCE SEER 21, HSPF 12 (up to 30)

ANNUAL HEATING COST $60-$250

INSTALLED SYSTEM COST $8,000—$10,000 per apartment

REFRIGERANT Typically R-410a, leakage risk from site-installed connections

CONDENSATE Gravity or pump to sink tailpiece



VRF—VARIABLE REFRIGERANT FLOW

SYSTEM One rooftop outdoor unit can serve 50+ indoor units.

ISSUES Fairly expensive option. Proprietary metering and billing.

DIMENSIONS Indoor unit 30” x 12” x 9” Outdoor 36”W x 30” x 22”

TYPICAL SIZING 9 to 24 kBTH, ¾-2 tons nominal

TYPICAL PERFORMANCE EER 12-14, COP 3.6-4.0

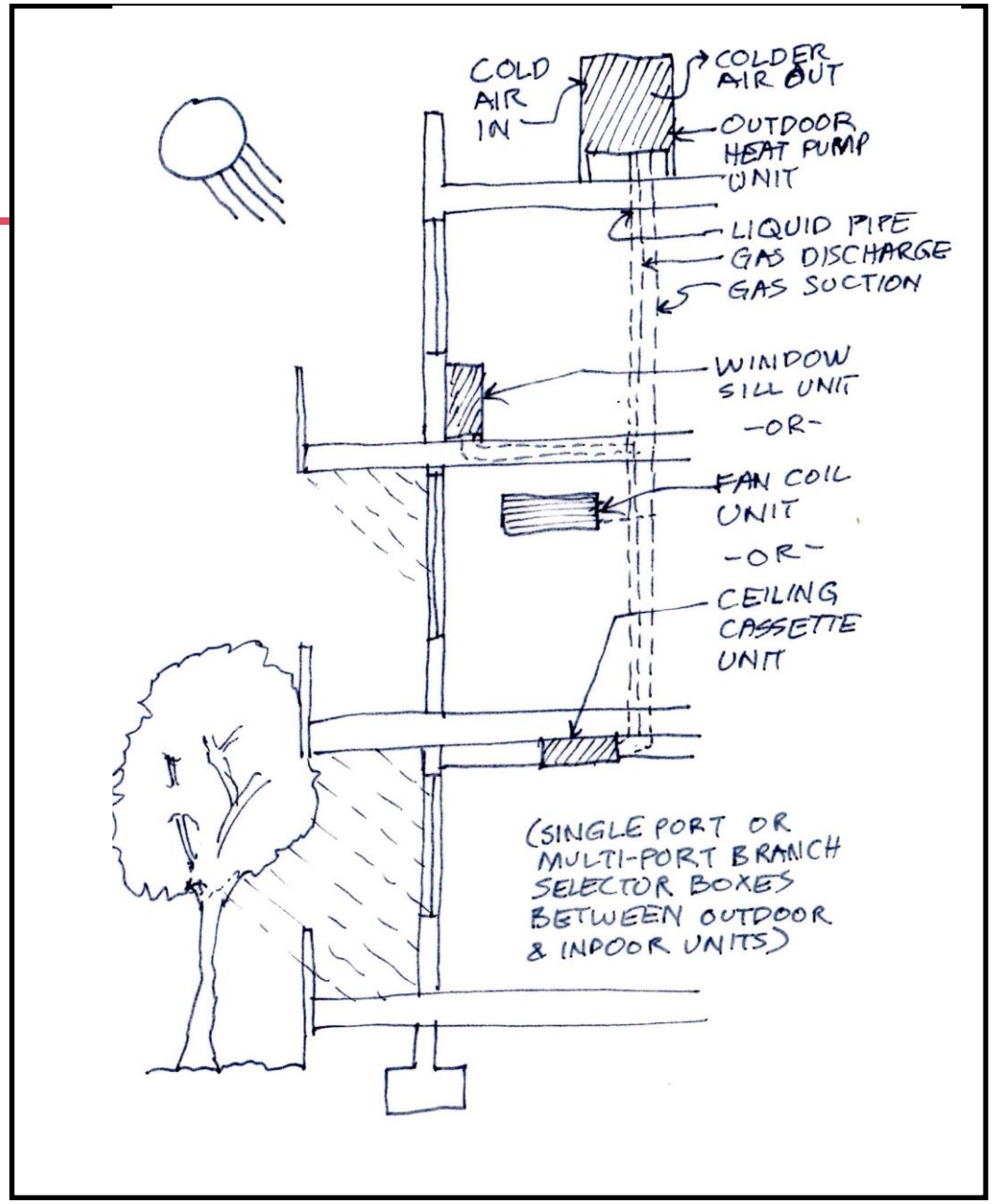
ANNUAL HEATING COST $80-$250

INSTALLED SYSTEM COST $19,000—$20,000 per apartment

REFRIGERANT Typically R-410a, very large refrigerant volume in building with hundreds of field joints creating leak potential.

CONDENSATE Gravity or pump to sink tailpiece.

CODE REQUIREMENTS Seattle only: Auxiliary electric resistance heat locked out below 32°F, compressor heating operates to 17°F.



DOUBLE-DUCT HEAT PUMP

Good lower-cost solution, but not yet in US market (?)

SYSTEM Unit mounts on interior wall, two 6-inch ducts through the wall.

ISSUES Not yet available in US, but expected this summer. Small capacity

DIMENSIONS 40” W x 22” W x 6” D

TYPICAL SIZING 9 to 12 kBTH, ¾-1 tons nominal

TYPICAL PERFORMANCE EER 11, COP 3.3

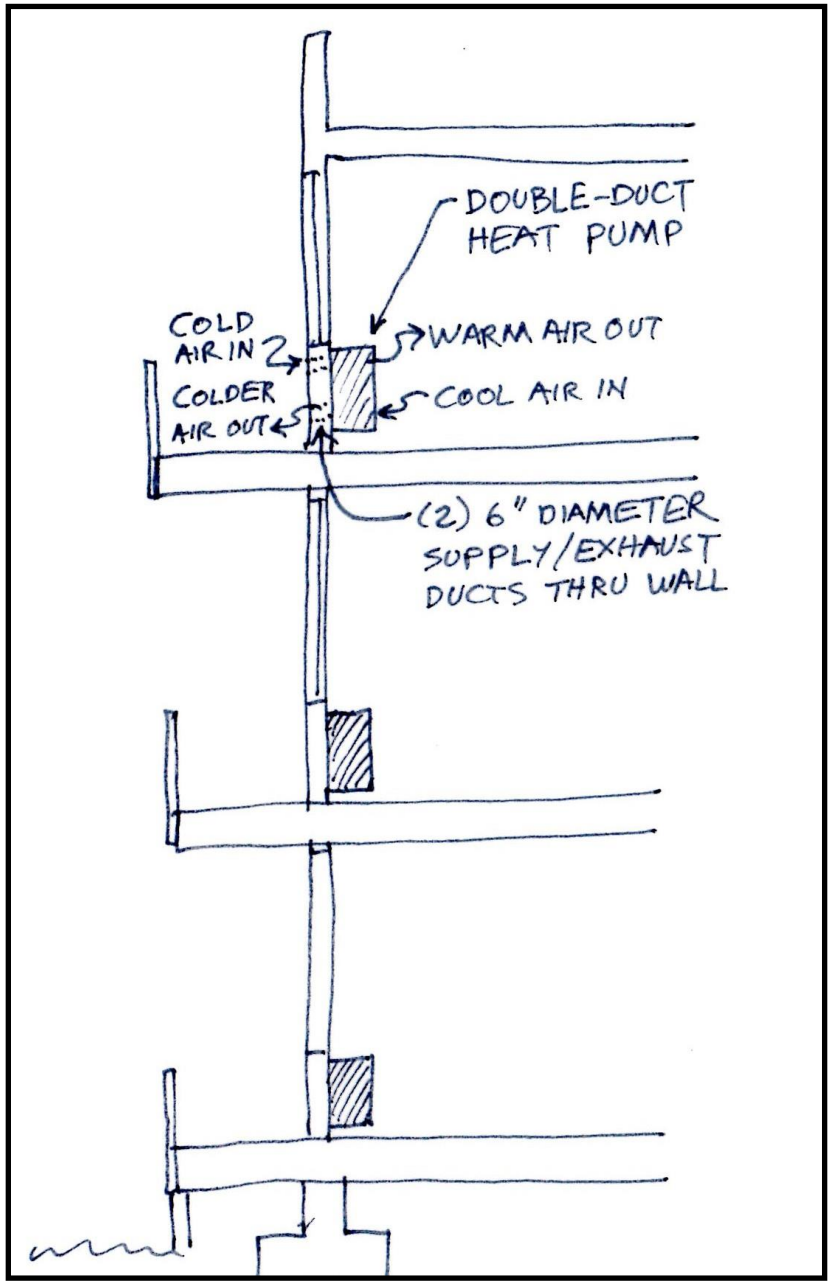
ANNUAL HEATING COST $80-$250

INSTALLED SYSTEM COST $6,000—$7,000 per apartment

REFRIGERANT R-410a, all refrigerant contained in equipment.

CONDENSATE Gravity drained through exterior or party wall – need access to air gap at bottom.

CODE REQUIREMENTS Auxiliary electric resistance heat locked out below 32°F, compressor heating operates down to 17°F.



PTHP—PACKAGED TERMINAL HEAT PUMP

Cheap, noisy and low-performing, creates big insulation gap

SYSTEM **C**onstant-volume heat pump fitting in a sleeve through the wall. Typical in budget motels due to low cost and easy service.

ISSUES Poor efficiency, heat pump switches to electric resistance below 45F. Very poor insulation and air leakage. **Noisy**. Large electric service size required for building. Limited capacity.

DIMENSIONS 42” W x 16” H x 20” deep (incl wall)

TYPICAL CAPACITY SIZING 7 to 14 kBTH, 1/2-1 1/4 tons nominal

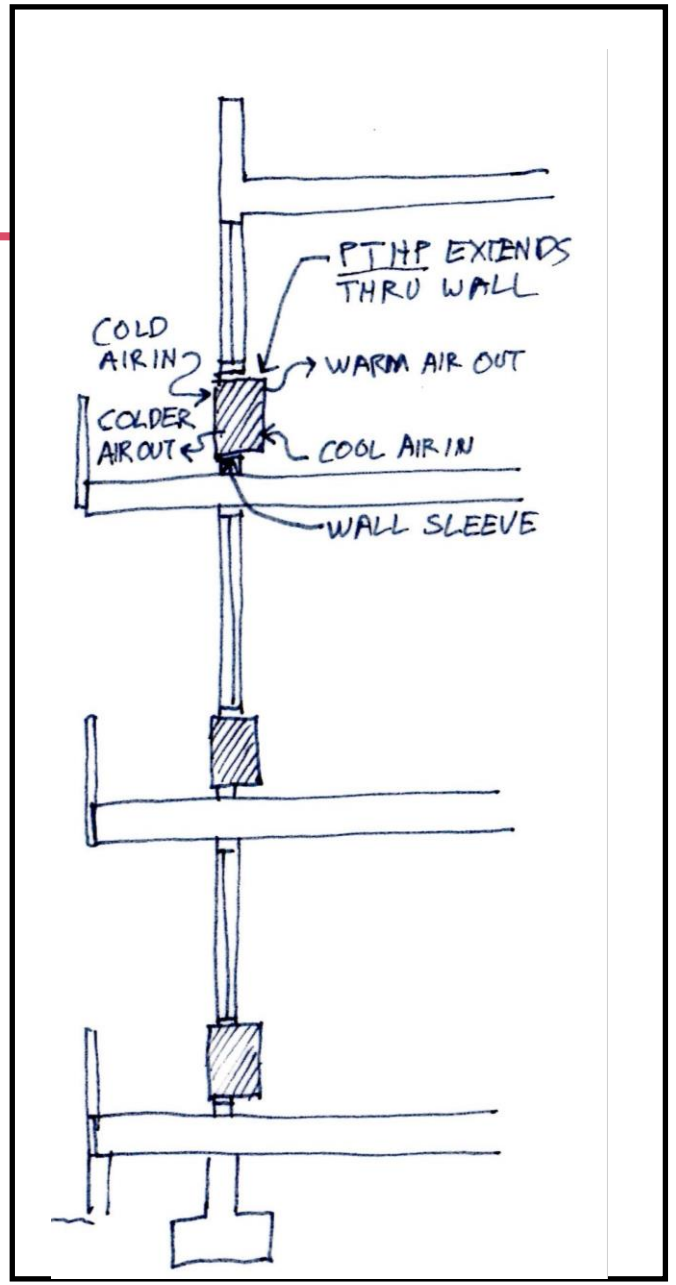
TYPICAL PERFORMANCE COP = 1.0 below 45°F

ANNUAL HEATING COST $90-$300

INSTALLED SYSTEM COST $3,000—$3,500 per apt

REFRIGERANT Typically R-410a

CONDENSATE Gravity drained through common condensate drain in wall.



VERTICAL TERMINAL HEAT PUMP

Requires large closet in each apartment

SYSTEM Essentially a PTHP standing on end, located in closet at exterior wall. Constant volume (or 2– or 3-speed fan). Can be ducted to more than one room.

ISSUES Large footprint required in leasable space. Poor efficiency, more expensive than PTHP. Requires exterior wall sleeve. **Noisy.**

DIMENSIONS 22” x 25” x 52” high, minimum 3” clearance, in separate closet.

TYPICAL CAPACITY SIZING 9 to 24 kBTH, ¾-2 tons nominal

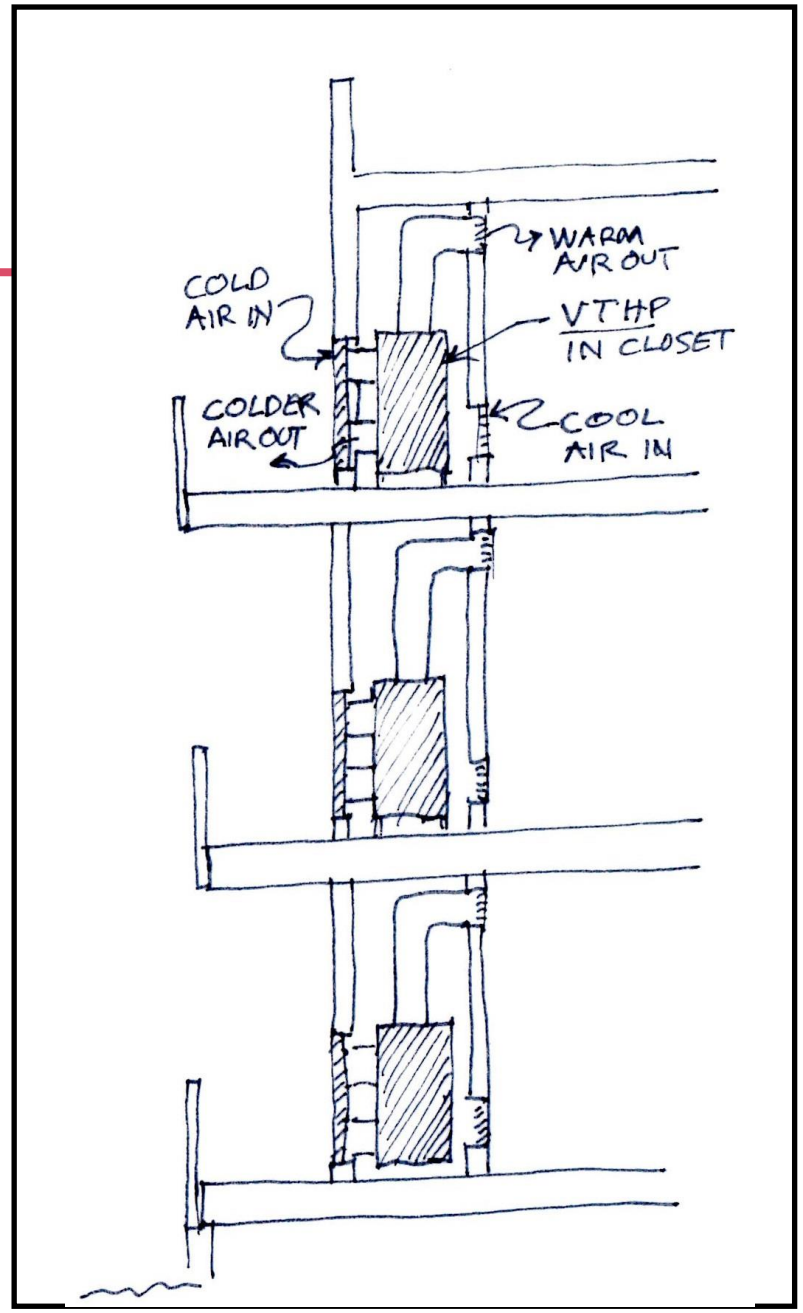
TYPICAL PERFORMANCE SEER 15.5-20, EER 11-13, HSPF 8.5-10, COP 3.1-3.4

ANNUAL HEATING COST $90-$300

INSTALLED SYSTEM COST $10,000—$11,000 per apartment

REFRIGERANT R-410a.

CONDENSATE Drain pan is provided.



VARIABLE REFRIGERANT PACKAGE (VRP)

High-performing VTHP, but requires large closet in each apartment

SYSTEM Premium version of VTHP, through-wall unit with inverter driven compressors, located in closet. Can also provide ventilation.

ISSUES Large footprint required in leasable space. **Noisy.**

DIMENSIONS 22” x 25” x 52” high, in separate closet

TYPICAL SIZING 9 to 24 kBTH, ¾-2 tons nominal

TYPICAL PERFORMANCE SEER 15.5-20, EER 11-13, HSPF 8.5-10, COP 3.1-3.4

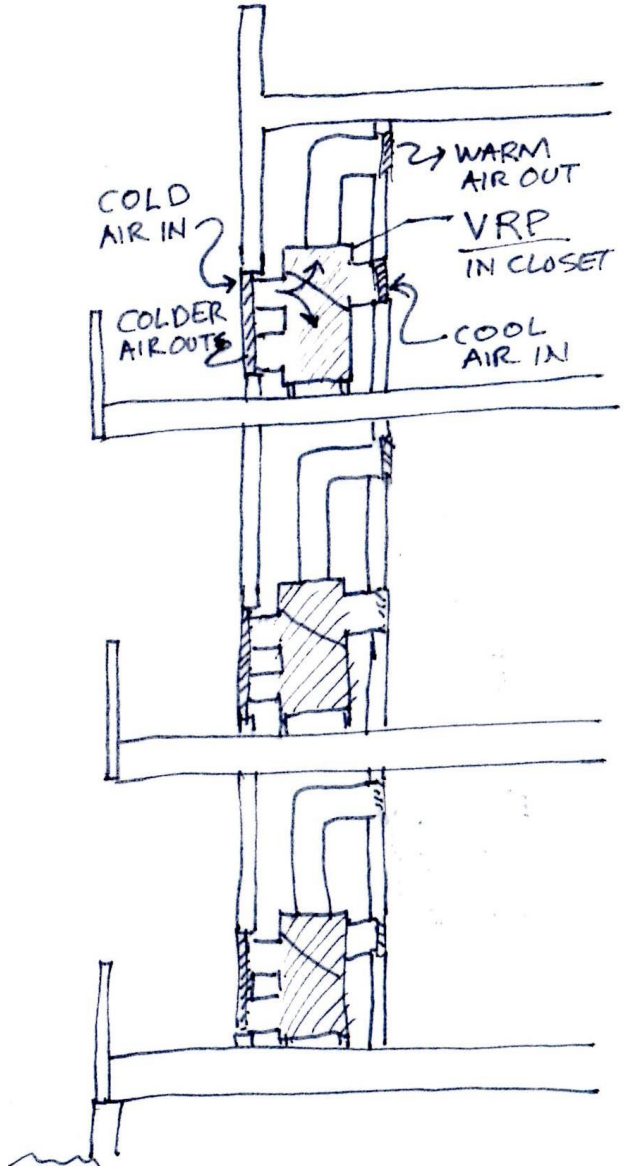
ANNUAL HEATING COST $60-$250

INSTALLED SYSTEM COST $11,000—$12,000 per apartment

REFRIGERANT R-410a, all refrigerant contained within factory equipment.

CONDENSATE Requires floor drain in mechanical closet for condensate.

CODE REQUIREMENTS Auxiliary electric resistance heat locked out below 32°F, compressor heating operates down to 17°F.



AIR TO WATER HEAT PUMP

Hydronic system allows radiant floor/ceiling. Expensive

SYSTEM Outdoor heat pump feeds hydronic flow to radiators, radiant floor loop, or fan coils. Can be a switchover system (heat or cool), or a 2-pipe system that allows heat to be extracted or inserted into the loop, or a 4-pipe system allowing heating and cooling to different units 24/7. Heat recovery units available. Water circulates at 120°F..

ISSUES Fairly expensive due to piping costs. Unfamiliar to most contractors. BTU meter needed at each apartment for metering ($$$)

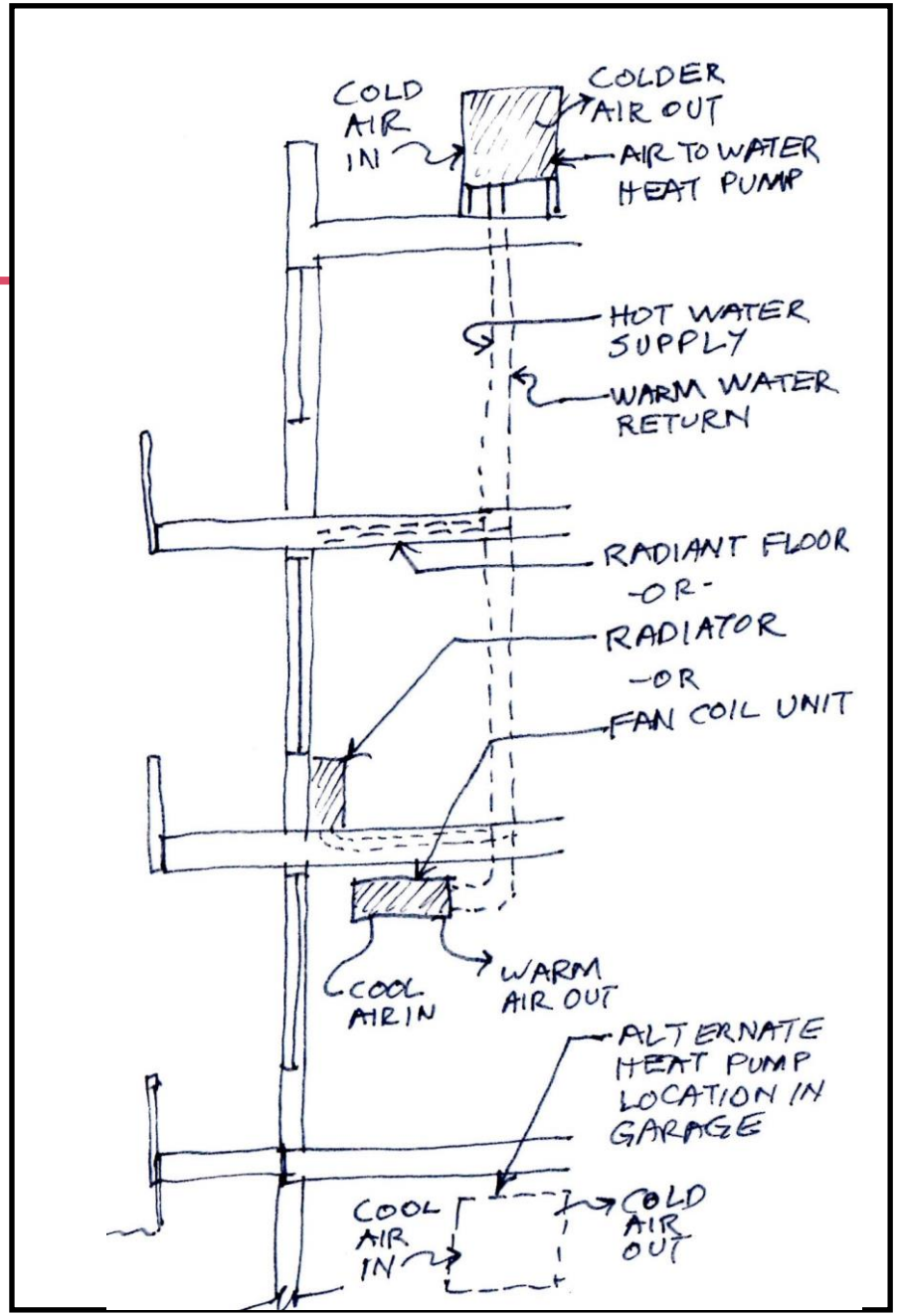
TYPICAL CAPACITY SIZING Unlimited, most units 9 to 24 kBTH

TYPICAL PERFORMANCE EER 9.0-11, COP 3.0-3.4

ANNUAL HEATING COST $60-$250

INSTALLED SYSTEM COST $18,000—$20,000 per apartment

REFRIGERANT Typically R-410a. R-32 units are starting to appear on the market. Circulating fluid is water.



AWHP WITH WSHP

Water Source Heat Pump Loop

SYSTEM Outdoor air to water heat pump feeds medium temperature 50 – 90F water to indoor water source heat pumps, two pipe system. Similar to ground source heat pump, but with heat pump chiller.

ISSUES Fairly expensive due to piping costs. Less familiar to most contractors. BTU meter needed at each apartment for metering ($$$)

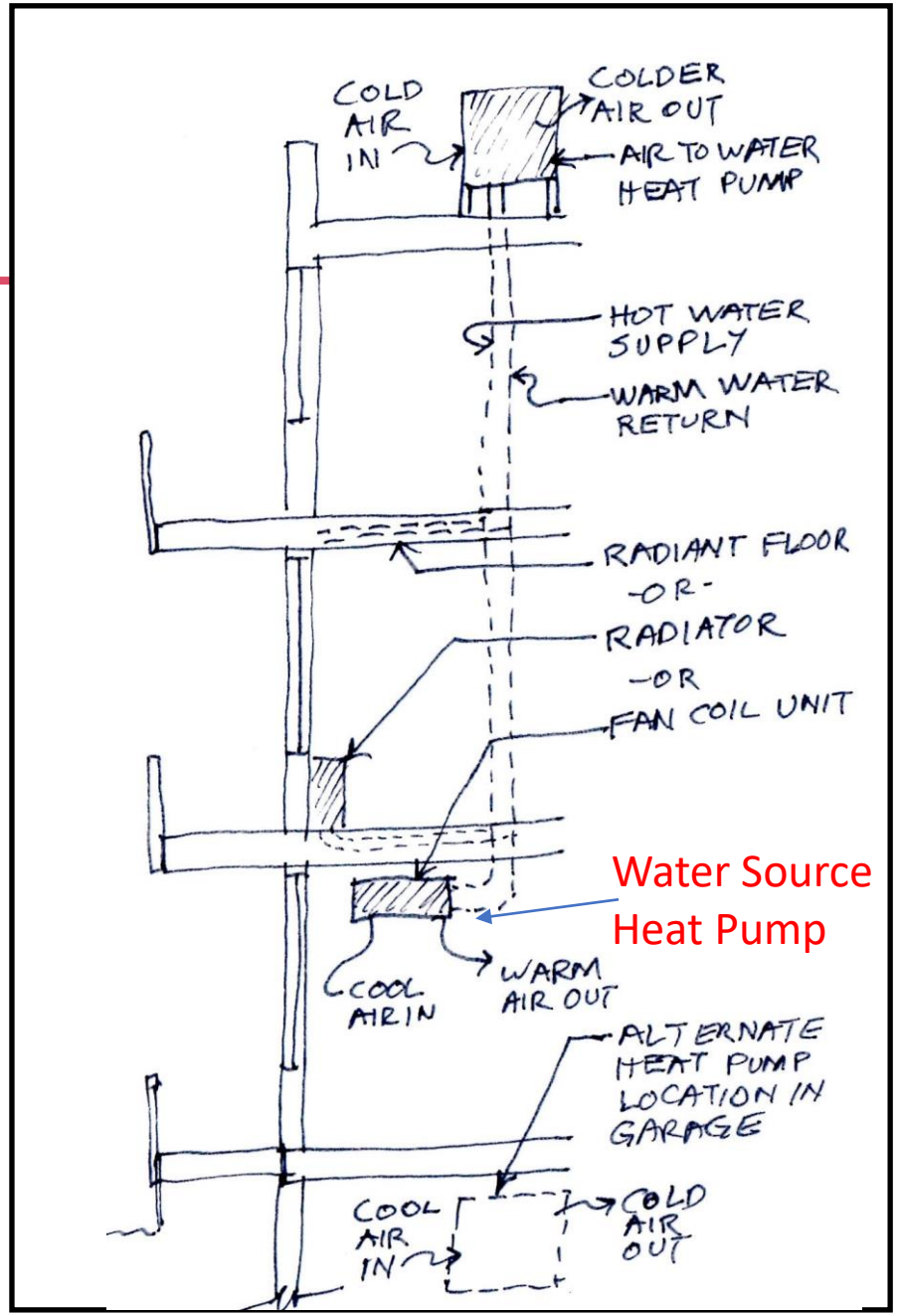
TYPICAL CAPACITY SIZING Unlimited, most units 9 to 60 kBTH

TYPICAL PERFORMANCE EER 15-19, COP 3.5-5, reduced with AWHP

ANNUAL HEATING COST $90-$300

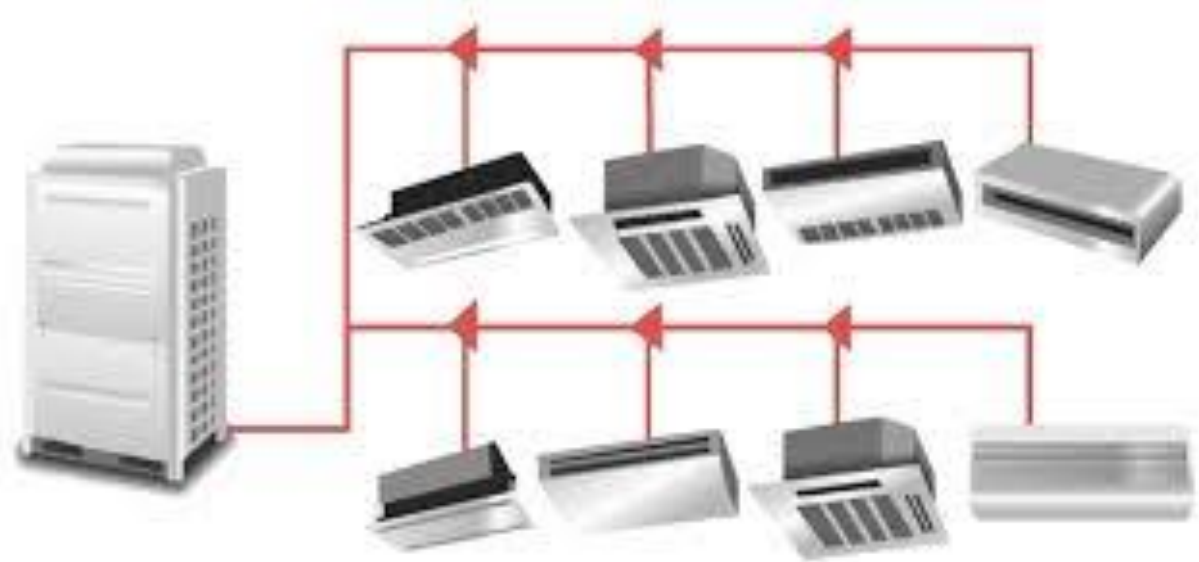
INSTALLED SYSTEM COST $18,000—$22,000 per apartment

REFRIGERANT Typically R-410a and indoor water source heat pump, with very small volumes. R-32 units are starting to appear on the market. Circulating fluid is hydronic.



Heat Pump Layout

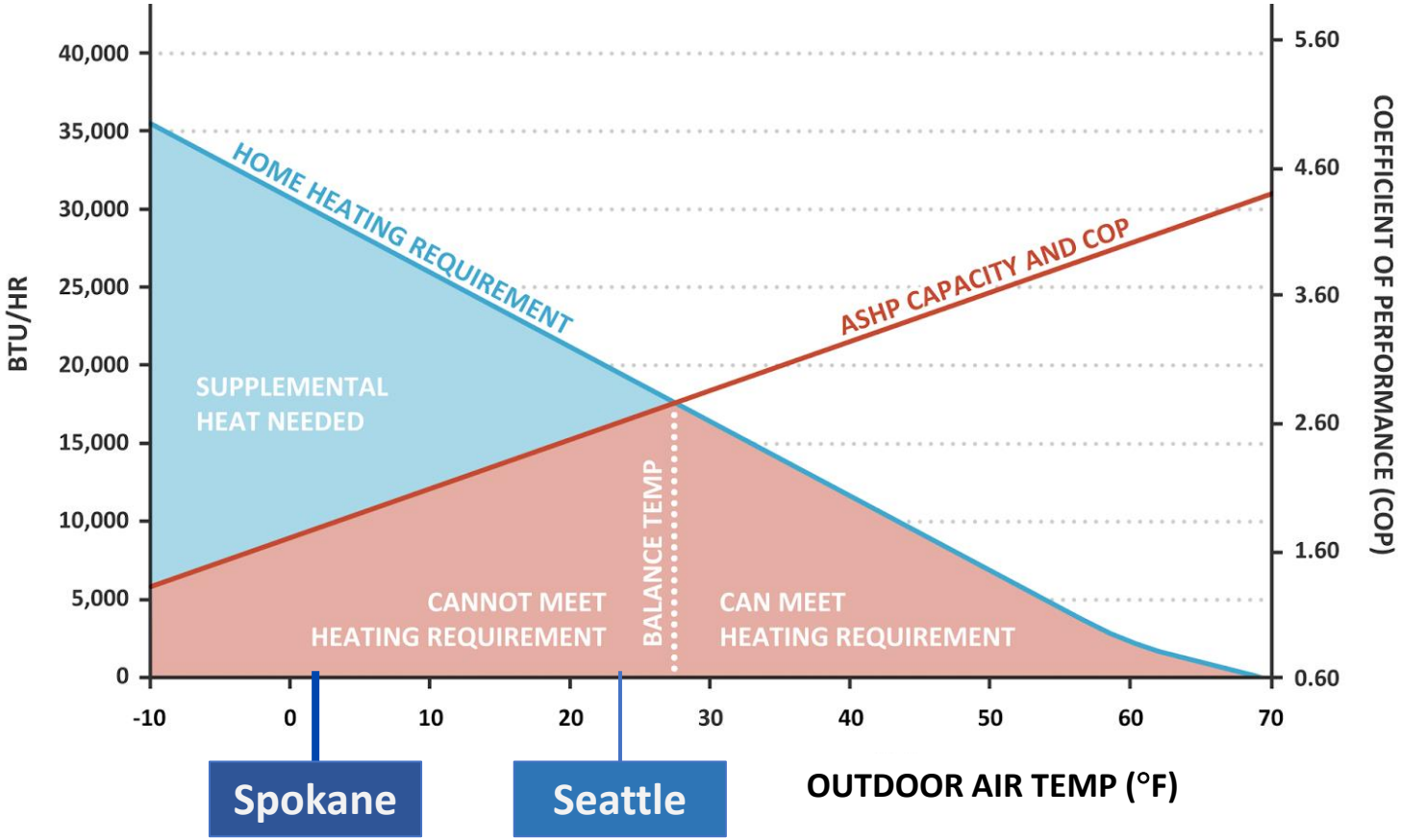
Heat Pump Layout, variable speed



Engineering View, Limitations

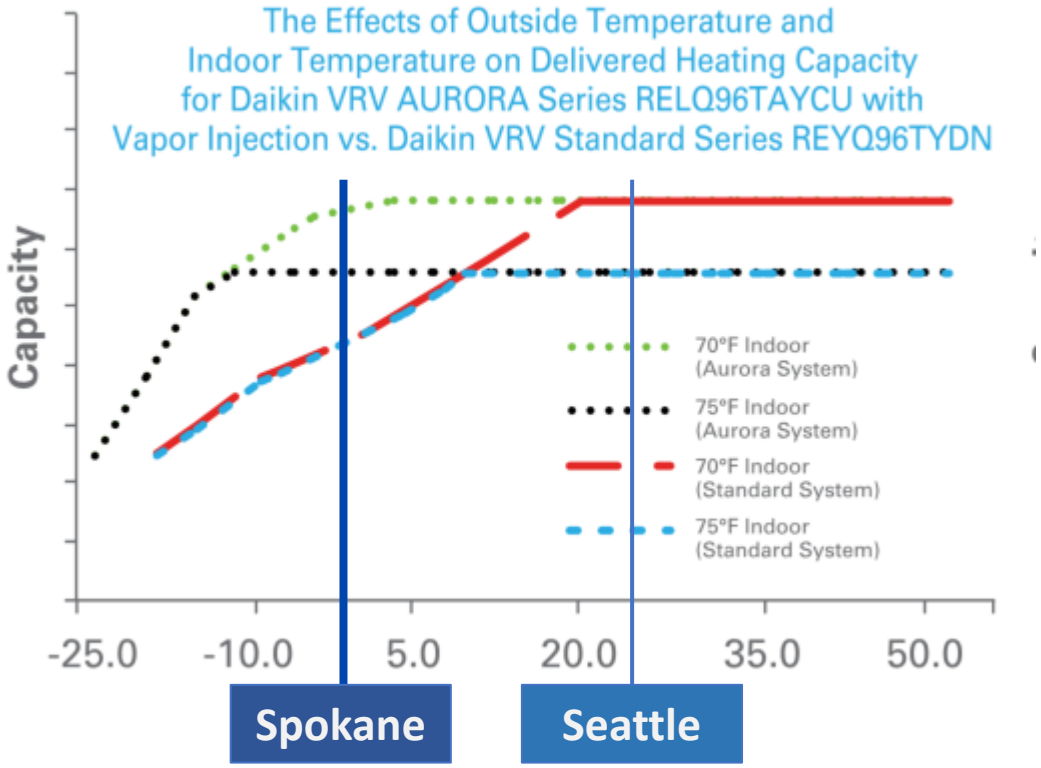
Heat Pump Performance, Cold Temp Impacts (cheap version)

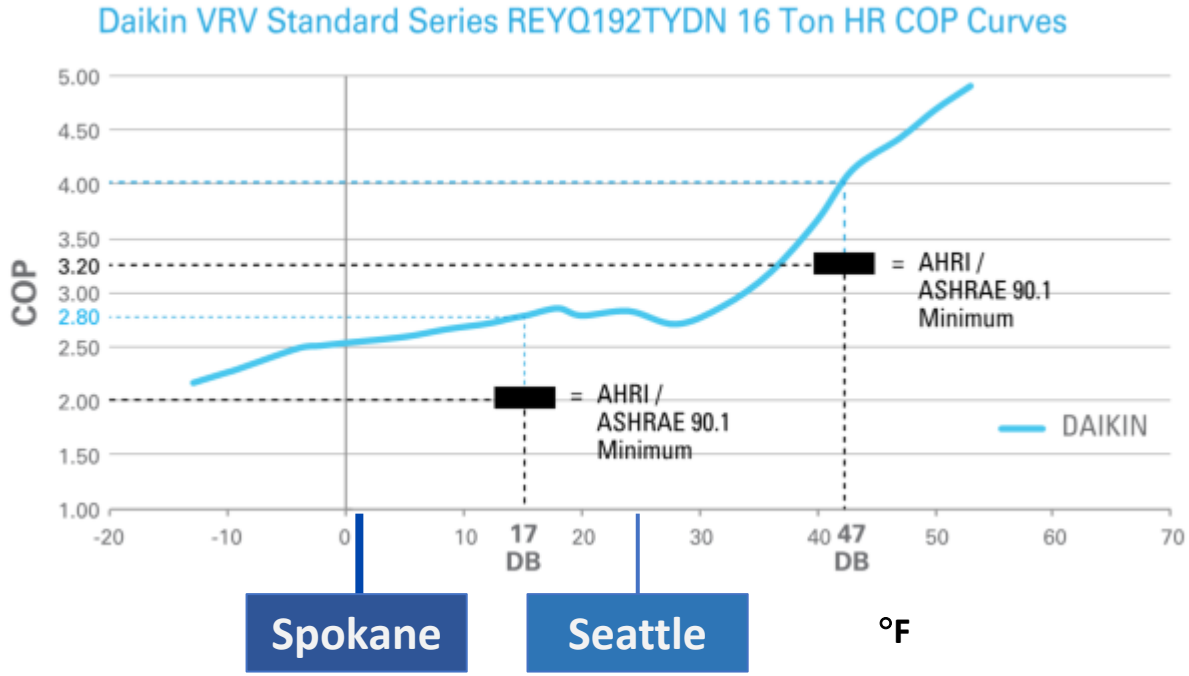
Performance of typical 2-ton air-source heat pump



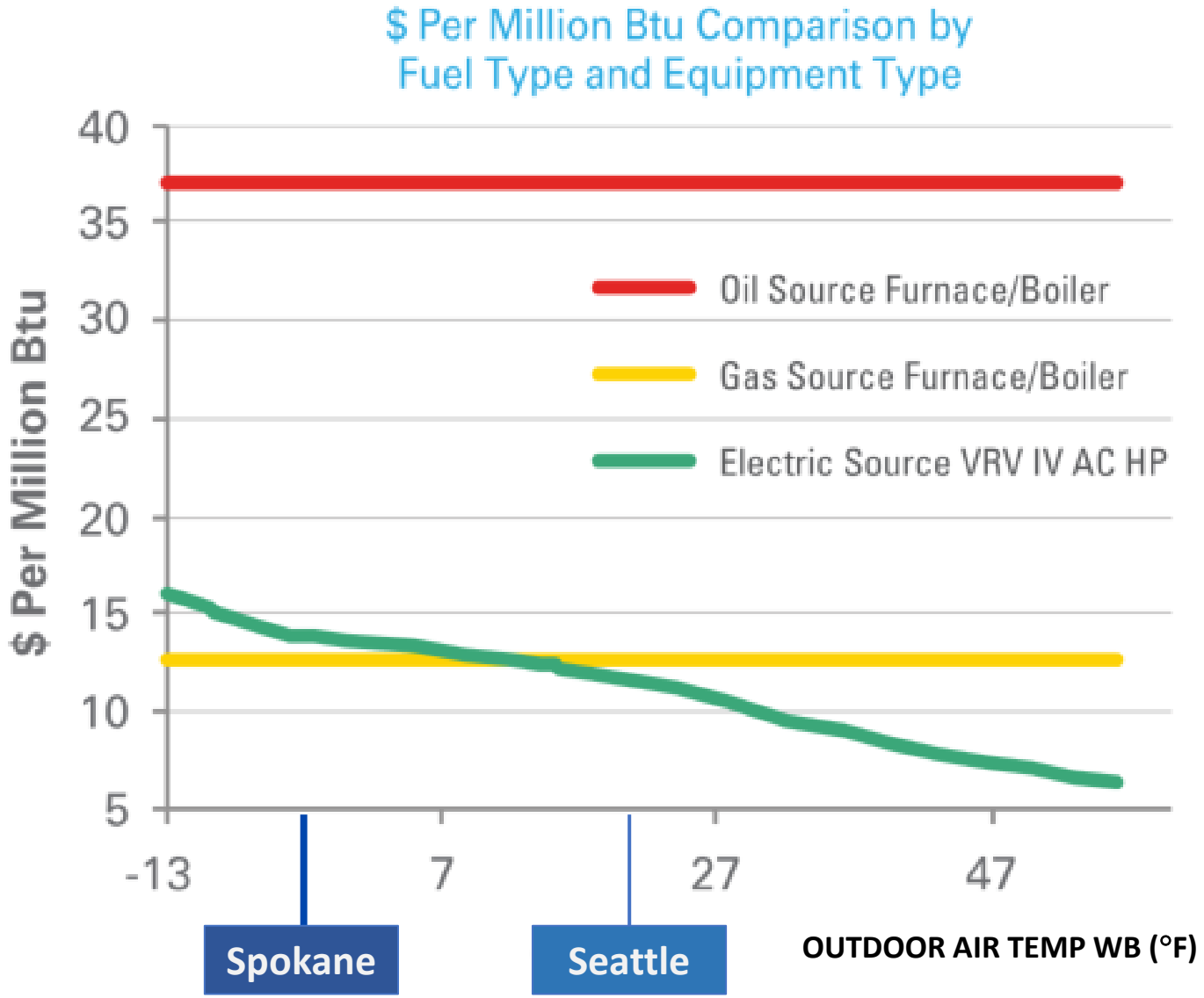
Engineering View, Less Limitations

Variable Speed Version





Engineering View, Cost



Seattle Department of Construction & Inspections

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

TSPR = (annual) $\frac{\text{Heating + Cooling Loads}}{\text{Carbon Emissions}}$

TSPR: Total System Performance Ratio

Office, Retail, Library, Education

Seattle adds multifamily and medical office

TSPR evaluates HVAC efficiency by comparing:

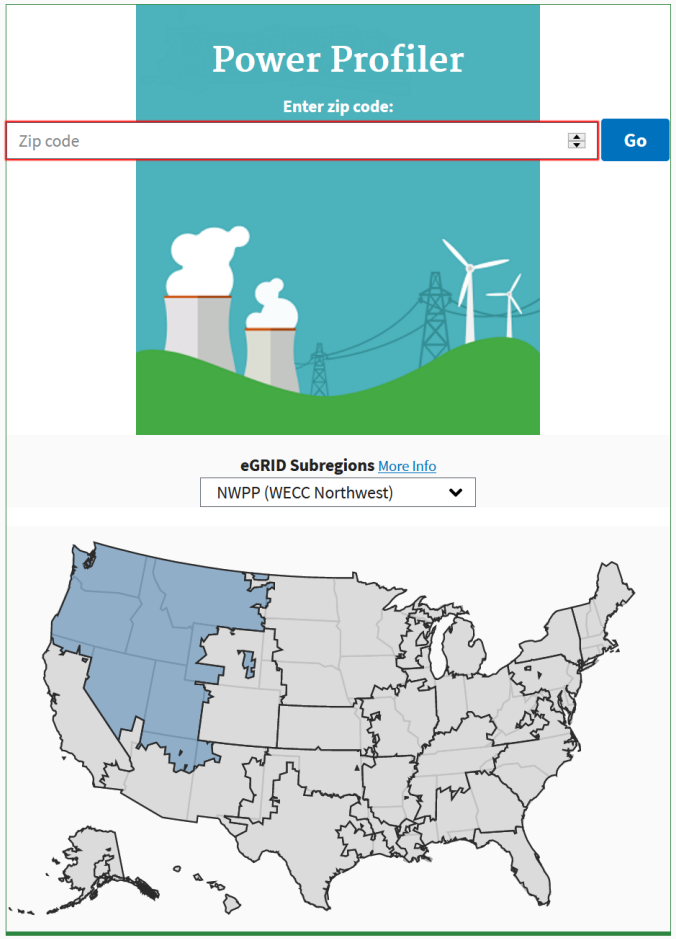
- required annual heating & cooling, to
- carbon emissions due to heating & cooling

Free online calculation tool from PNNL

Engineering View, CO2

How clean is the electricity you use?

Electricity is produced by many different sources of energy, including, but not limited to, wind, solar, nuclear, and fossil fuels. The type and amount of emissions produced depend on how electricity is generated in your region. Type in your zip code (or select a region) to view your power profile. More Info

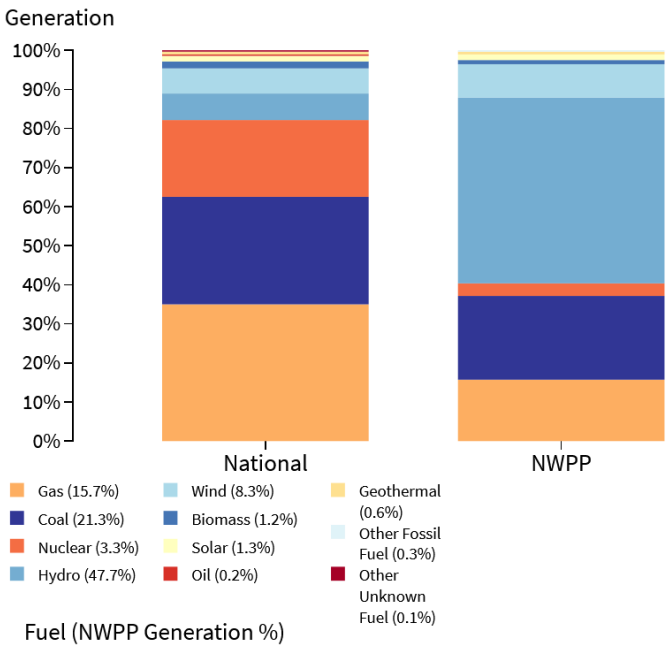


NWPP Emission Rates

CO_2	SO_2	NO_X
639.0	0.4	0.6
(lbs/MWh)	(lbs/MWh)	(lbs/MWh)

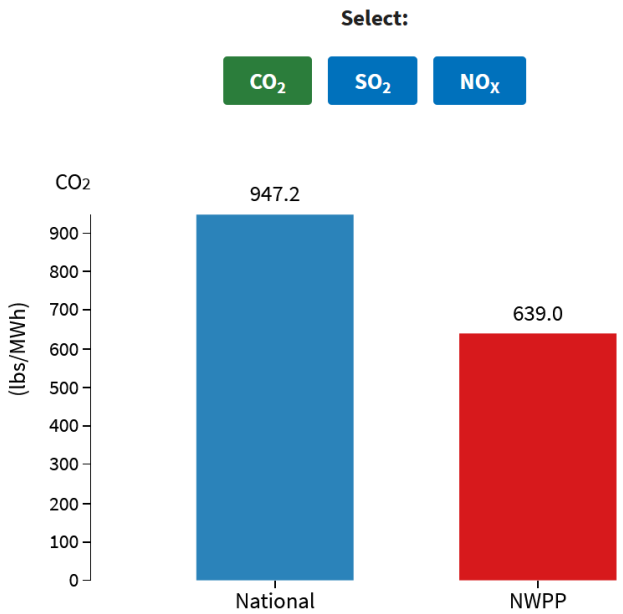
Fuel Mix

This chart compares fuel mix (%) of sources used to generate electricity in the selected eGRID subregion to the national fuel mix (%).



Emission Rates

This chart compares the average emission rates (lbs/MWh) in the selected eGRID subregion to the national average emission rates (lbs/MWh) for carbon dioxide (CO_2), sulfur dioxide (SO_2), and nitrogen oxide (NO_X).

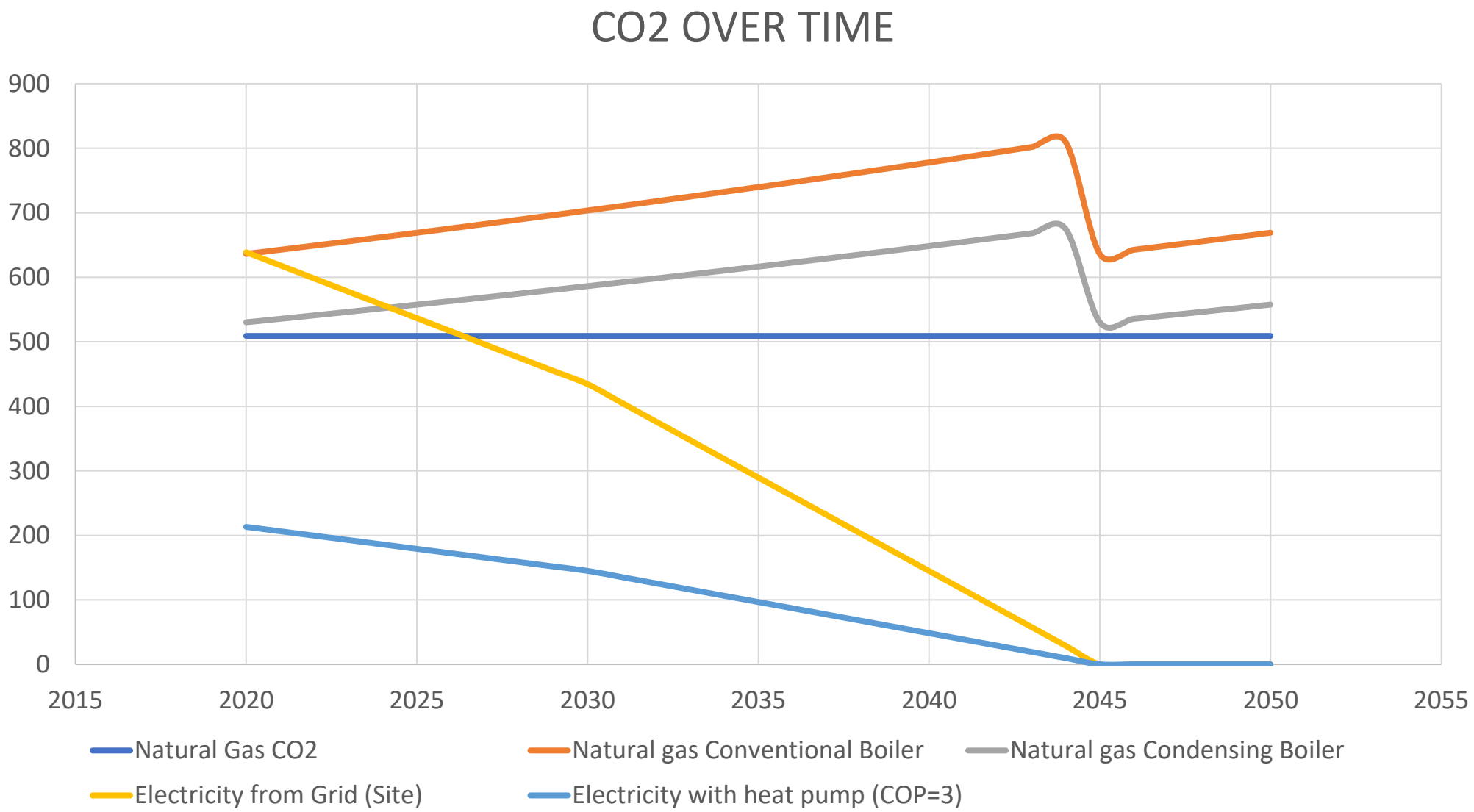


eGRID

Engineering View, Future CO2

Washington Senate Bill 5116 (2019-2020) established goals of carbon neutrality in 2030 and carbon-free by 2045

Engineering View, Future CO2



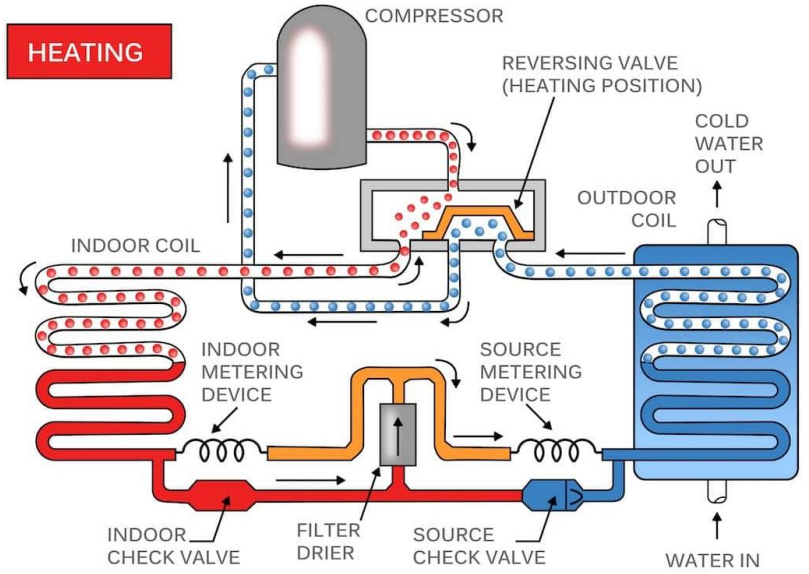
Seattle: Space heating (for common areas)

No electric resistance or fossil fuel combustion for space heating

- Usually means “use heat pumps”

Exceptions allow electric resistance heat for:

1. Permits applied for prior to 1/1/2022
2. **Dwelling units**: Max **750 W** per room
   - **1000 W** for corner room
3. Other space types: Max 2.5 W/sf total installed heating (The “Passive House” rule)
4. Heat pump auxiliary heat in cold weather
5. etc.…



Heat pumps squeeze warmth out of cold air

No electric resistance or gas heat (Seattle)

Airside systems we can use

No electric resistance or gas heat (Seattle)

Waterside systems we can use

Additional Efficiency Package Options

(aka choose your own adventure)

Previously

Select Two, aka “Choose Your Own Adventure”

Now

6 credits for Washington

8 credits for Seattle, based on occupancy

If DOAS is required, no additional points

Code Section	Commercial Building Occupancy					
	Group R-1	Group R-2	Group B	Group E	Group M	All Other
	Additional Efficiency Credits					
1. More efficient HVAC performance in accordance with Section C406.2	2.0	3.0	3.0	2.0	1.0	2.0
2. Reduced lighting power: Option 1 in accordance with Section C406.3.1	1.0	1.0	2.0	2.0	3.0	2.0
3. Reduced lighting power: Option 2 in accordance with Section C406.3.2[a]	2.0	3.0	4.0	4.0	6.0	4.0
4. Enhanced lighting controls in accordance with Section C406.4	NA	NA	1.0	1.0	1.0	1.0
5. On-site supply of renewable energy in accordance with C406.5	3.0	3.0	3.0	3.0	3.0	3.0
6. Dedicated outdoor air system in accordance with Section C406.6[b]	4.0	4.0	4.0	NA	NA	4.0
7. High performance dedicated outdoor air system in accordance with Section C406.7	4.0	4.0	4.0	4.0	4.0	4.0
8. High-efficiency service water heating in accordance with Sections C406.8.1 and C406.8.2	4.0	5.0	NA	NA	NA	8.0
9. High performance service water heating in multi-family buildings in accordance with Section C406.9	7.0	8.0	NA	NA	NA	NA
10. Enhanced envelope performance in accordance with Section C406.10[c]	3.0	6.0	3.0	3.0	3.0	4.0
11. Reduced air infiltration in accordance with Section C406.11[c]	1.0	2.0	1.0	1.0	1.0	1.0
12. Enhanced commercial kitchen equipment in accordance with Section C406.12	5.0	NA	NA	NA	5.0	5.0 (A-2 Only)

Table C406.1 Efficiency Package Credits

Key

Most cost effective

2nd most cost effective

C406.2 Engineering Notes

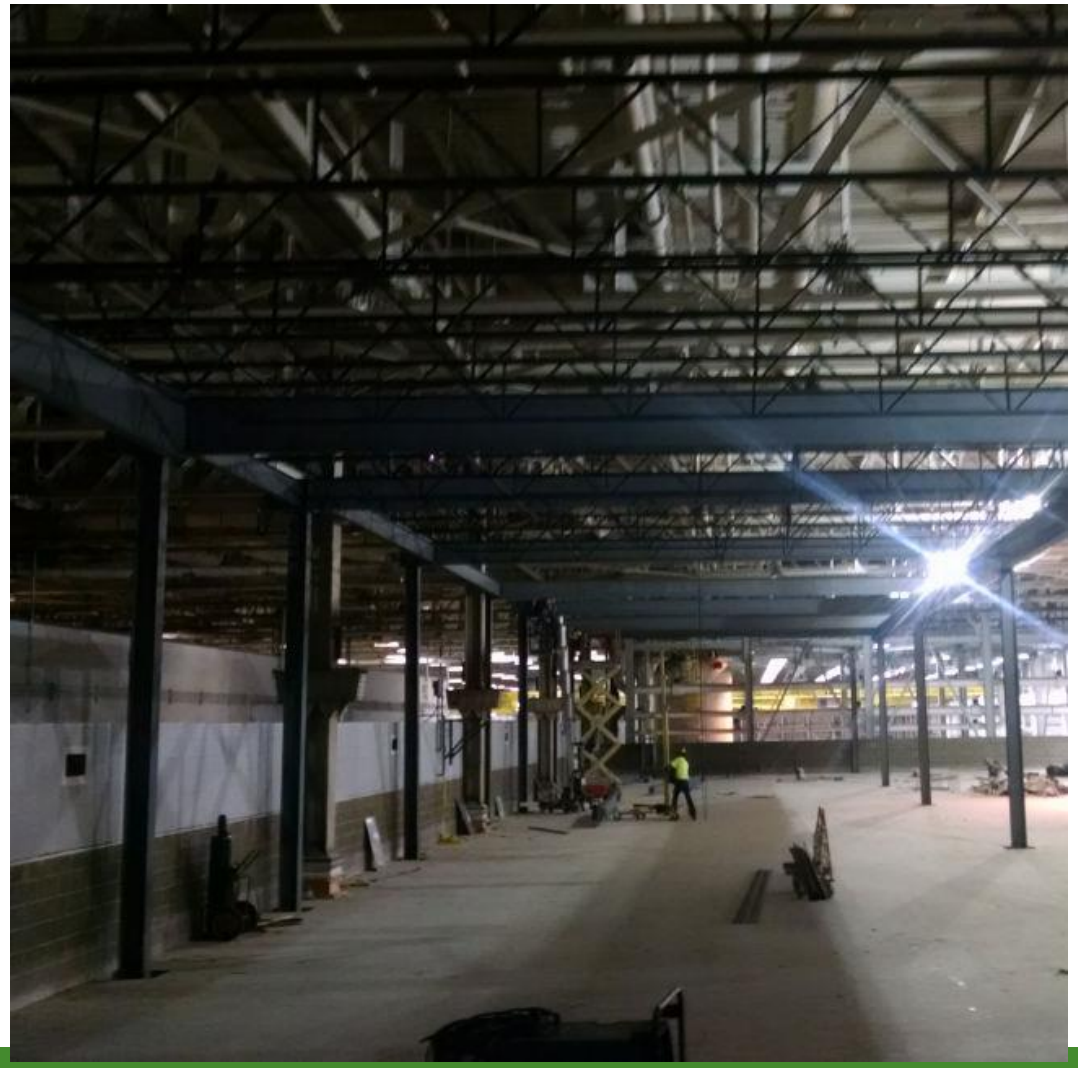
C406.8 and C406.9 Engineering Notes

8. High-efficiency service water heating in accordance with Sections C406.8.1 and C406.8.2	4.0 NA for R-1 & R-2 after 1/1/2022	5.0 NA for R-1 & R-2 after 1/1/2022
9. High performance service water heating in ((~~multi-family~~)) R-1 and R-2 buildings in accordance with Section C406.9	7.0 prior to 1/1/2022 5.0 after 1/1/2022	8.0 prior to 1/1/2022 5.0 after 1/1/2022

Alterations C503

General principles:

- Existing (untouched) can remain as-is
- Service and repairs OK
- New equipment and new systems must meet code
- Seattle “Substantial Alterations” Whole *building* meets code
  - With a small break for UA *or* BPF
- … same with change of occupancy, change of space conditioning



Replacement heating equipment

- New HVAC work must comply with all of C403
- New central heating must be heat pump
- Distributed fan coils not affected
- **Exception**: One (only) failing boiler or furnace can be replaced like for like. **Not** for planned replacements or part of a larger project

Substantial Alterations: a sticky situation

HFC refrigerant phaseout – HB 1112 & HB 1050

- Cutoff dates for equipment using HFCs
  - Supermarket & warehouse refrigeration 2020
  - Chillers 2024, Heat pumps 2025, VRF 2026
  - Equipment mfr date, not permit date
- R-410, R134…going, going, gone!
- R-32 approved, but no equipment yet
- CO2 systems already viable for HPWH

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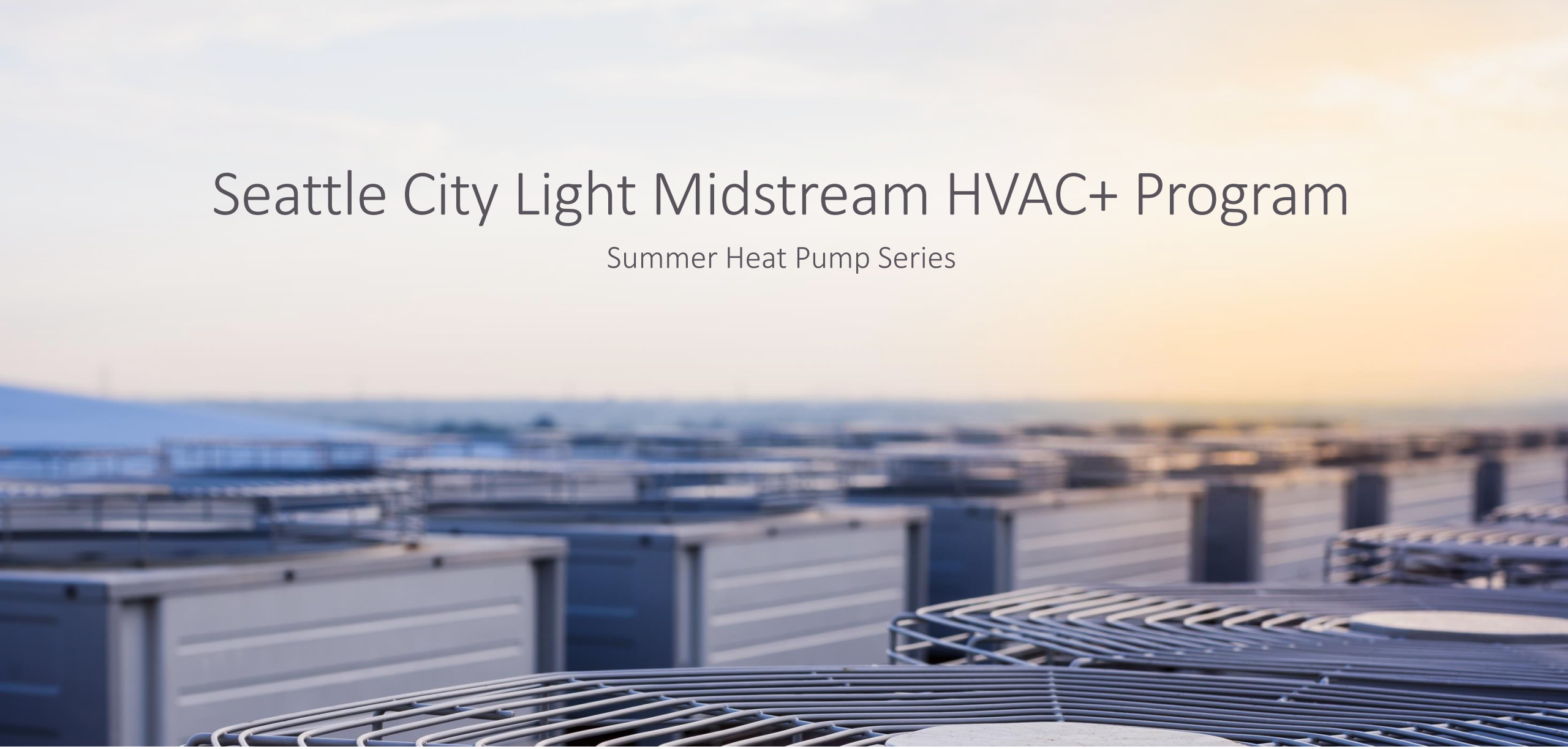
Seattle City Light Midstream HVAC+ Program

Summer Heat Pump Series



Energy Solutions

Seattle City Light

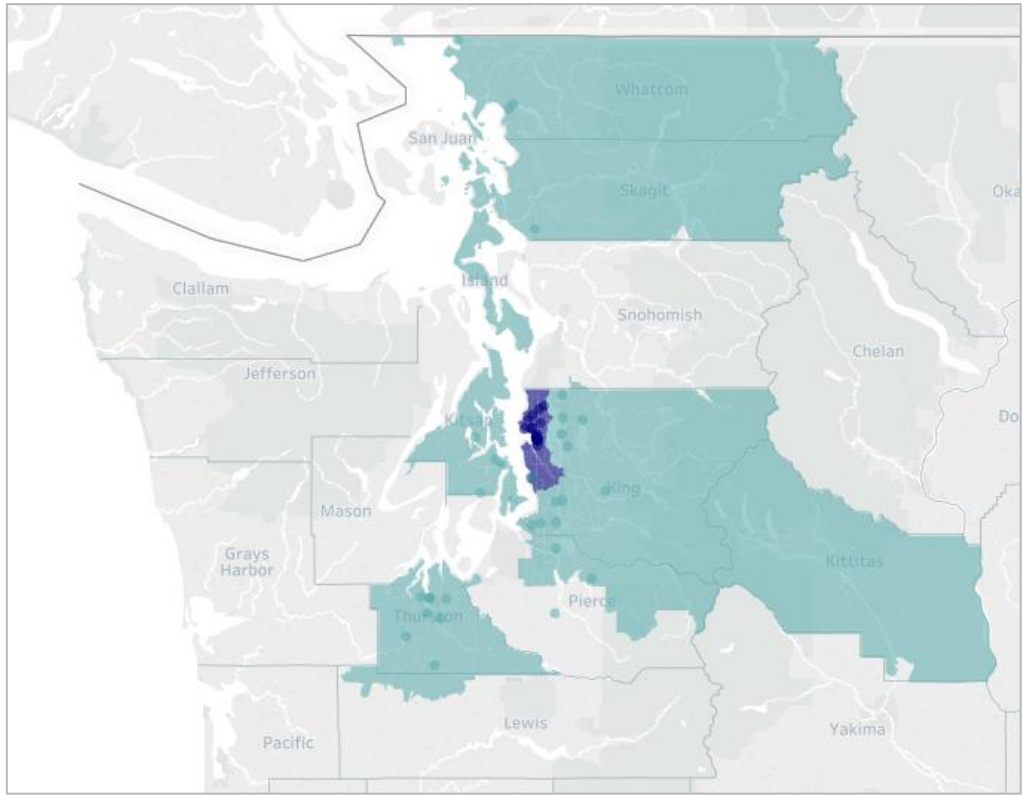
Program Overview

Midstream HVAC and HPWH Program Overview

- Administered by City Light and Puget Sound Energy
  - Energy Solutions, the program implementer, provides support and guidance for program participants
- Contractor incentives available through enrolled distributors
  - Contractors are encouraged to pass incentives through to customers
- Includes heat pumps < 5.4 tons, hybrid heat pump water heaters, and ECM circulator pumps
- Includes residential and commercial installations

Program Goals

- Promote the stocking and upselling of high efficiency equipment
- Reduce energy use and carbon emissions through optimal HVAC design



Qualifying program territory (approx.)

Seattle City Light

Puget Sound Energy

Participating in the Program

Steps to Participate

1. Check if your distributor is enrolled, or identify an enrolled distributor
2. Purchase equipment for a qualifying installation through your distributor
3. Share requested customer information with your distributor*
4. Receive rebate

* You do not need to apply for rebates directly! Distributors will complete application information.

Your Distributor Will Need:

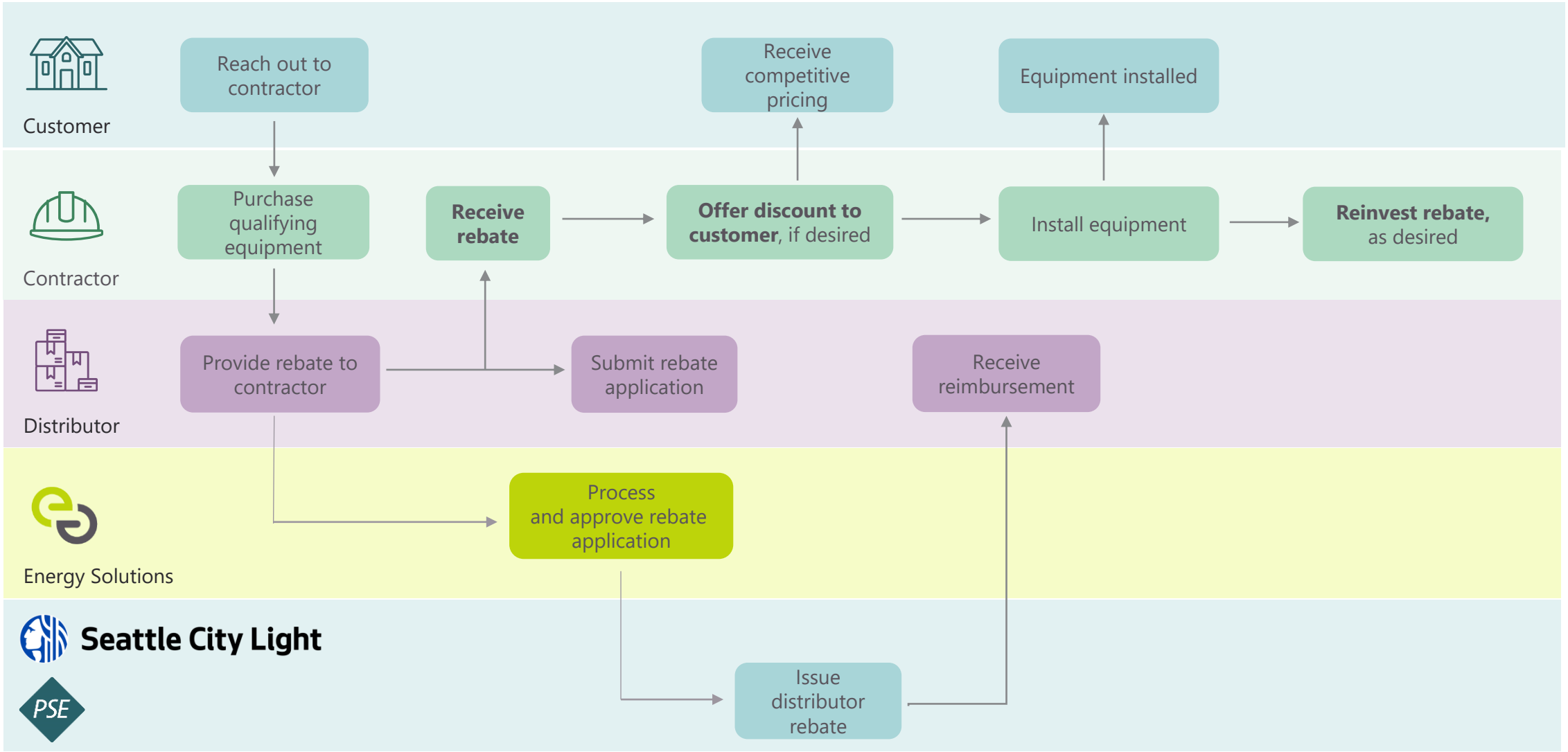
- Installation address
  - Suite/unit number(s) if applicable
- Building type
  - Examples: single family, office, laboratory
- Project type
  - New construction or retrofit
- Estimated installation date

Participating Distributors

"These kinds of programs are great because they help us stock more efficient equipment and give us incentive to get the units into customers' hands."
-Ken Porter, AirReps

"This is one of the most successful rebate programs PSE or SCL has ever had."
- Mark Stearns, Gensco

Program Process



Eligible Installations

Heat Pumps

- Mini- or multi-split heat pumps < 5.4 tons
- Traditional heat pumps < 5.4 tons
- $300-$600 available for heat pumps
- Limit 1 heat pump per residence

Hybrid Heat Pump Water Heaters

- $500 rebate per hybrid HPWH
- Limit 1 hybrid HPWH per residence

ECM Circulator Pumps

- $100 - $400 rebate per pump
- No installation limit

Incentives

Commercial and Residential Air-Cooled Heat Pumps (under 5.4 tons)

Unit Type	Size Category	Tier	SEER		HSPF	Contractor Rebate ($/unit)
Mini- or multi- split heat pump	< 65 kBtuh (<5.4 tons)	1	16.0	and	9.5	$400
		2	16.0	and	11.0	$600
Traditional heat pump	< 65 kBtuh (<5.4 tons)	1	15.0	and	9.0	$300
		2	15.0	and	10.0	$500

Commercial and Residential Hybrid Heat Pump Water Heaters

Unit Type	Size Category	UEF/COP	Contractor Rebate ($/unit)
Hybrid Heat Pump Water Heater	≤ 200 gallon storage	3.0	$500

Commercial ECM Circulator Pumps

Unit Type	Subcategory	Size Category	Contractor Rebate ($/unit)
ECM Circulator Pump	Hydronic Heating	≤ 1/6 hp	$100
		>1/6 and ≤ 3/4 hp	$200
		>3/4 and ≤ 3.5 hp	$400
ECM Circulator Pump	Service Hot Water	≤ 1/6 hp	$100
		>1/6 and ≤ 3/4 hp	$200
		>3/4 and ≤ 3.5 hp	$400

Residential ECM Circulator Pumps

Unit Type	Subcategory	Size Category	Contractor Rebate ($/unit)
ECM Circulator Pump	Hydronic Heating	Any Pump Size	$100
ECM Circulator Pump	Service Hot Water	Any Pump Size	$100

Multifamily and Large Commercial Solutions

Access to High-Efficiency Solutions

- City Light and Puget Sound Energy are working with the supply chain to improve access to high-performance, high-efficiency equipment for commercial and industrial customers
- Contact your distributor to determine the availability of high-efficiency equipment and understand installation options

Multifamily, Commercial, and Industrial Options

- City Light encourages you to work with your distributor to identify high-efficiency options for large commercial and multifamily installations, including:
  - Variable refrigerant flow (VRF)
  - Water source heat pumps
  - Heat pumps (split and packaged)
  - Air conditioners (split and packaged)
- City Light is also supporting efforts to increase sales and stocking of efficient FEI-rated fans and PEI-rated pumps

Contact Us

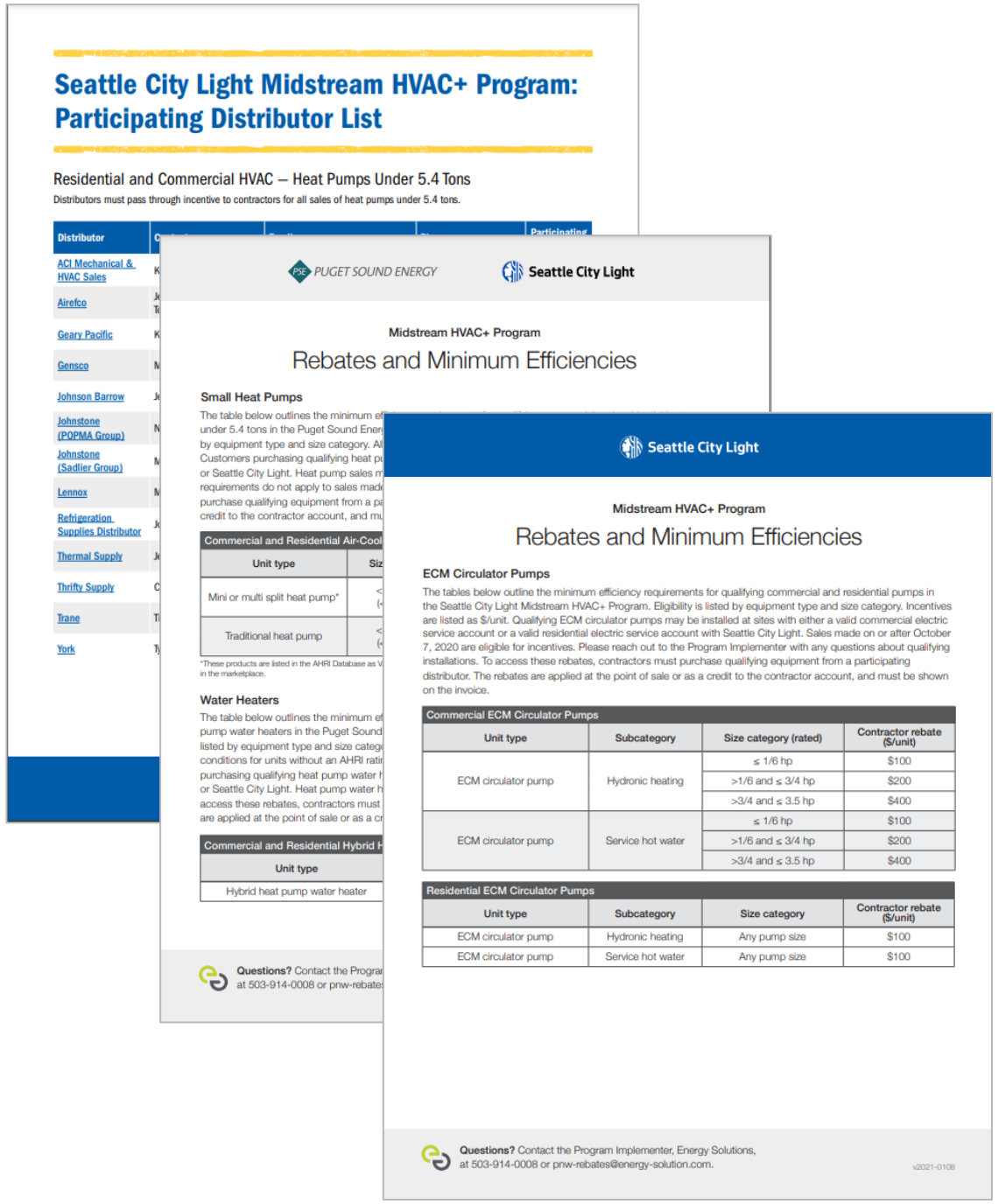
- Email: pnw-rebates@energy-solution.com
- Hotline: (503) 914-0008

Energy Solutions is happy to assist you!

Resources

Additional resources are available through:

- Your participating distributor
- Energy Solutions
- Seattle City Light, at http://www.seattle.gov/city-light/residential-services/home-energy-solutions



Seattle City Light Midstream HVAC+ Program: Participating Distributor List

Residential and Commercial HVAC – Heat Pumps Under 5.4 Tons

Distributors must pass through incentive to contractors for all sales of heat pumps under 5.4 tons.

Distributor	Participating
ACI Mechanical & HVAC Sales	
Airefco	
Geary Pacific	
Gensco	
Johnson Barrow	
Johnstone (POPMA Group)	
Johnstone (Sadlier Group)	
Lennox	
Refrigeration Supplies Distributor	
Thermal Supply	
Thrifty Supply	
Trane	
York	

PUGET SOUND ENERGY Seattle City Light

Midstream HVAC+ Program

Rebates and Minimum Efficiencies

Small Heat Pumps

Commercial and Residential Air-Cool

Unit type	Siz
Mini or multi split heat pump*	
Traditional heat pump	

Water Heaters

Commercial and Residential Hybrid H

Unit type
Hybrid heat pump water heater

Seattle City Light

Midstream HVAC+ Program

Rebates and Minimum Efficiencies

ECM Circulator Pumps

The tables below outline the minimum efficiency requirements for qualifying commercial and residential pumps in the Seattle City Light Midstream HVAC+ Program. Eligibility is listed by equipment type and size category. Incentives are listed as $/unit. Qualifying ECM circulator pumps may be installed at sites with either a valid commercial electric service account or a valid residential electric service account with Seattle City Light. Sales made on or after October 7, 2020 are eligible for incentives. Please reach out to the Program Implementer with any questions about qualifying installations. To access these rebates, contractors must purchase qualifying equipment from a participating distributor. The rebates are applied at the point of sale or as a credit to the contractor account, and must be shown on the invoice.

Commercial ECM Circulator Pumps

Unit type	Subcategory	Size category (rated)	Contractor rebate ($/unit)
ECM circulator pump	Hydronic heating	≤ 1/6 hp	$100
		>1/6 and ≤ 3/4 hp	$200
		>3/4 and ≤ 3.5 hp	$400
ECM circulator pump	Service hot water	≤ 1/6 hp	$100
		>1/6 and ≤ 3/4 hp	$200
		>3/4 and ≤ 3.5 hp	$400

Residential ECM Circulator Pumps

Unit type	Subcategory	Size category	Contractor rebate ($/unit)
ECM circulator pump	Hydronic heating	Any pump size	$100
ECM circulator pump	Service hot water	Any pump size	$100

Questions? Contact the Program Implementer, Energy Solutions, at 503-914-0008 or pnw-rebates@energy-solution.com.

v2021-0108

Upcoming LDL Online Events

LDL Course	Delivery Date	Time
Code Compliance: Heating Multifamily Units in Seattle	June 10th	10am – Noon
Code Compliance: Heat Pump Space Heating For Commercial and Institutional Buildings	June 15th	10am – Noon
Code Compliance: Heat Pump Water Heating in Seattle	June 22nd	10am - Noon

Today's slide deck and previous online courses can be found on our website

Click – Call – Connect

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  - Duane.Jonlin@seattle.gov
- Armando Berdiel Chavez, M.Eng., LC.
  - 206-475-2722
  - armando.berdiel@seattle.gov

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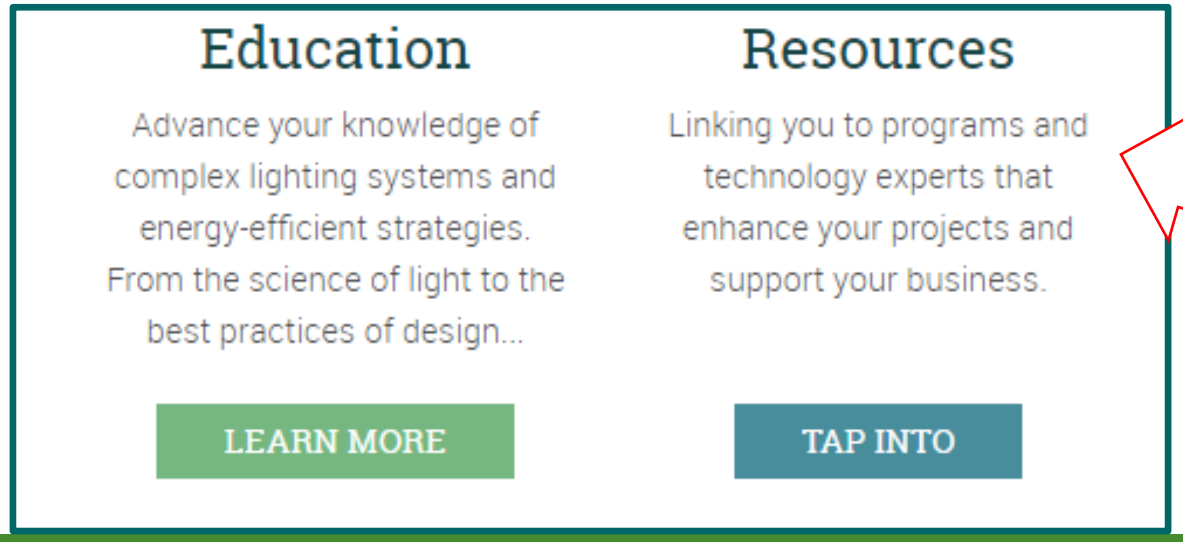

OR

Email Us

lightingdesignlab@seattle.gov

Todays slide deck will be posted here!

Please take the online survey once you exit the webinar

We'll *SEE* you on the next call… ☺