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Cooling Systems for Strata Owners

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RDH Building Science – Who we are

- People with a passion for making buildings better
- We do this by providing services that include:
  - Climate resilience evaluation and planning
  - Energy and carbon analysis
  - Architectural and engineering design of renewals
  - Project and construction management
  - Depreciation Reports
  - Building Enclosure Condition Assessments
  - Warranty Reviews
  - Research, testing, investigation
- 22 staff in Victoria and Courtenay

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Learning Objectives

- To understand the implications of adding heat pump(s) to your building
  - What to consider as an Owner
  - What to consider as a Strata Corporation

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Outline

- Why cooling?
- How does your building get hot?
- Why a heat pump?
- What is a heat pump?
- Considerations for stratas
- How a heat pump fits within other strategies/renewals
- Planning for future climate and policy changes

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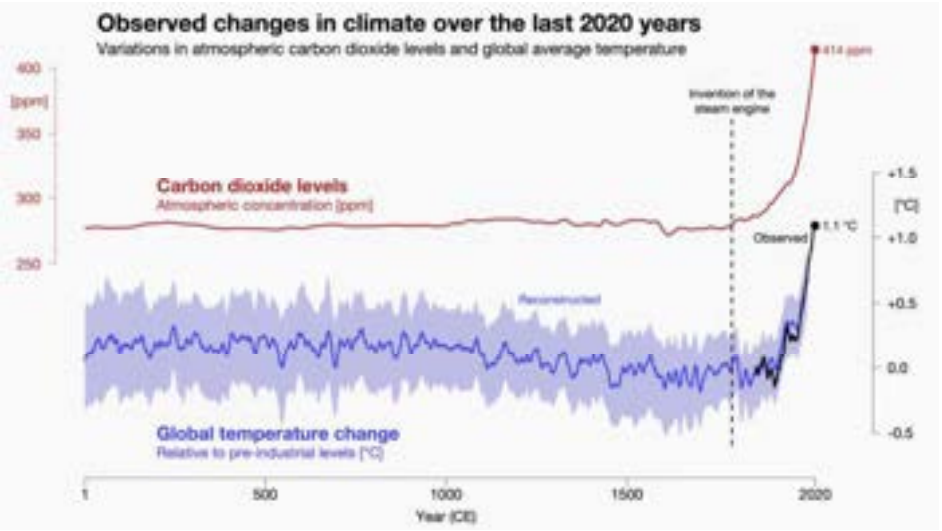
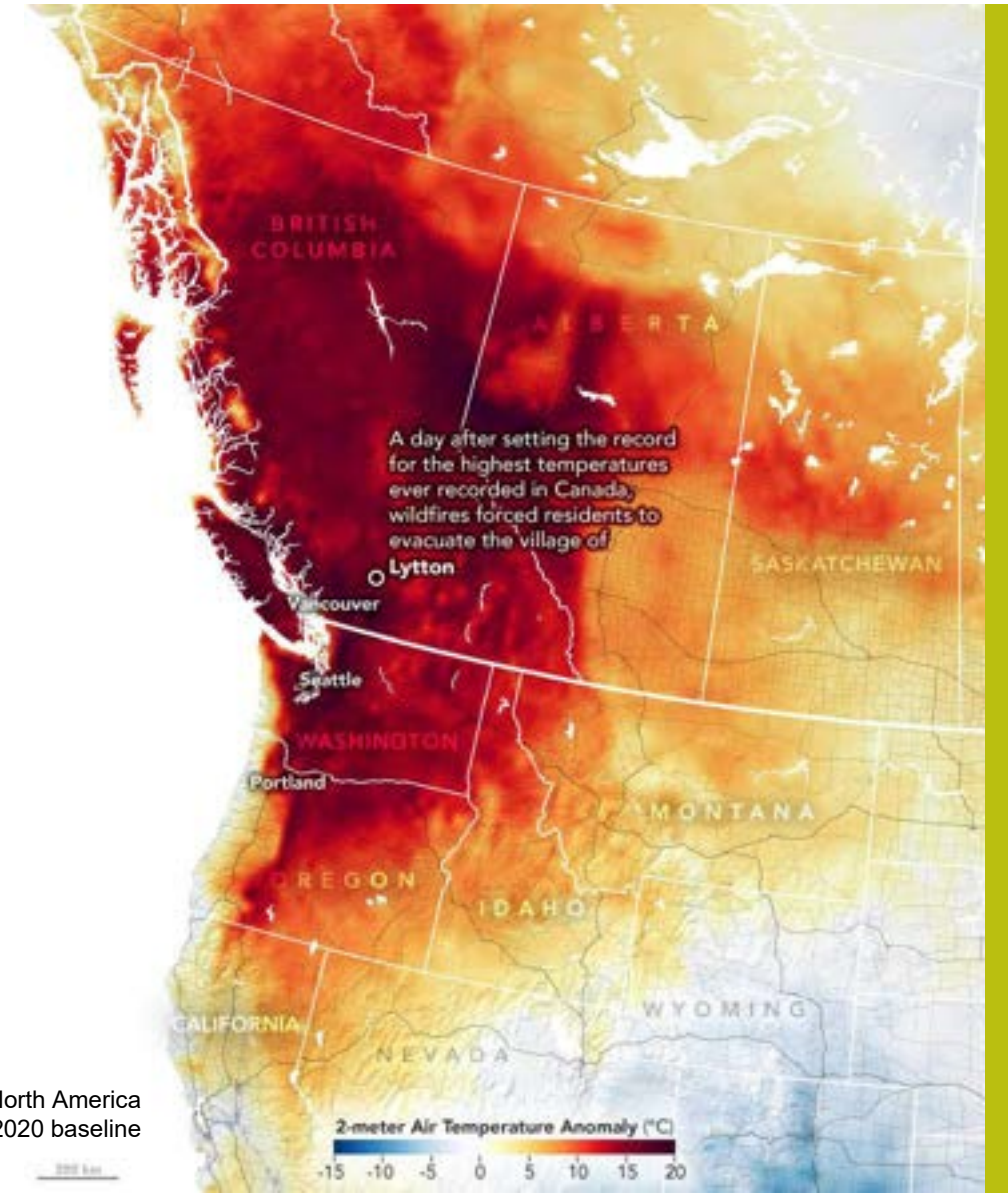
Why are people asking for cooling?

→ It's getting hot!

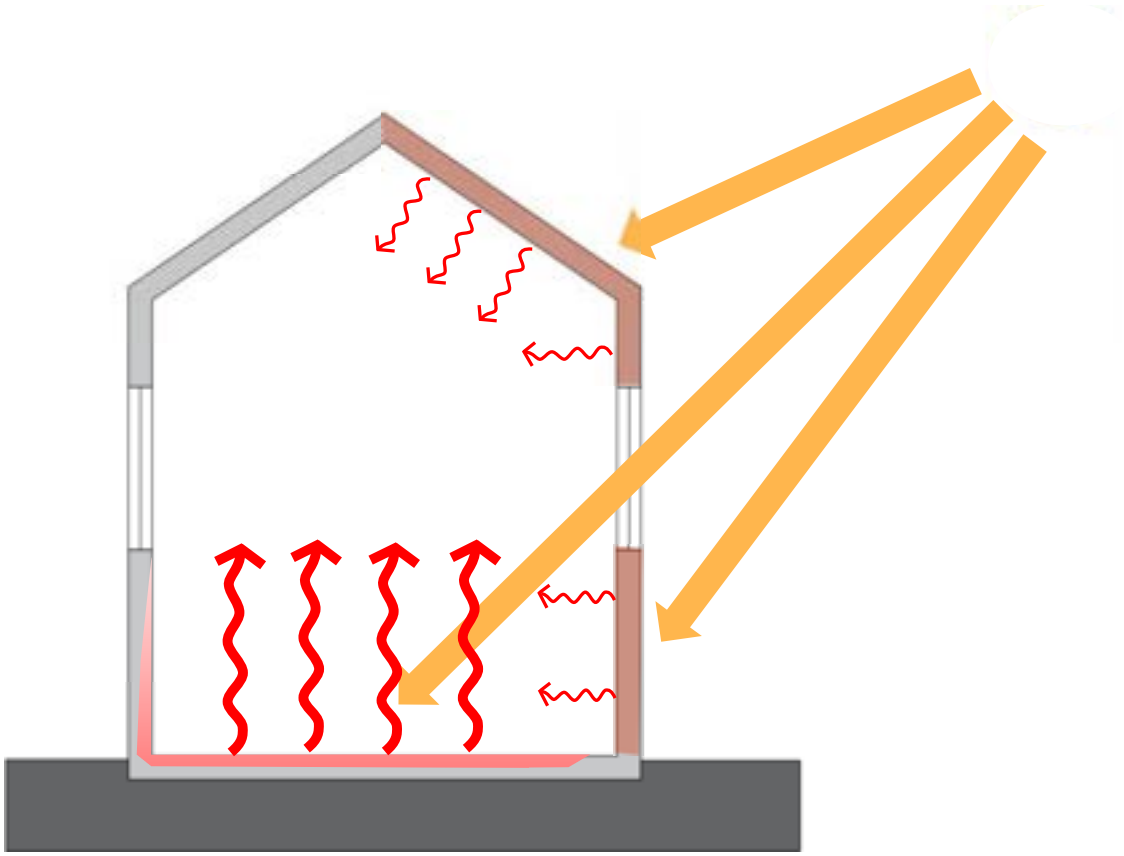
→ Most residents on the island don't have it





Map: Air temperature anomalies across North America on June 29, 2021, compared to 2014–2020 baseline

How does your Building get hot?



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Why a Heat Pump?

- Heat pumps (can be) an efficient way to provide cooling – and heating
- Lots of incentives being promoted

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CleanBC Plan to reduce emissions:

"By 2030, all new buildings will be zero carbon, and all new space and water heating equipment will meet the highest standards for efficiency."

~ Clean BC (p.16)

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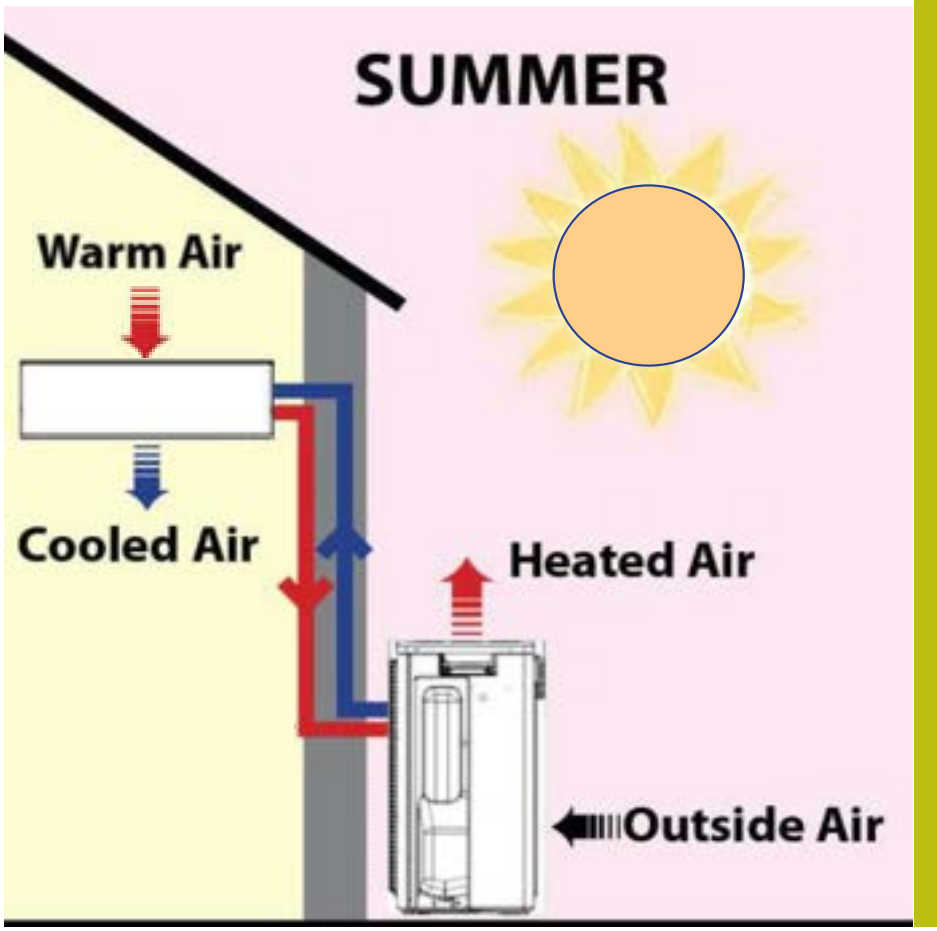
How does a Heat Pump Work?

SUMMER

Refrigerant absorbs heat from outdoor air and transfers it to the indoor air

1 unit in = 3 units out (COP = 3)



How does a Heat Pump Work?

	Air-to-air	**Air-to-water**
Air Source:		
	Water-to-air	**Water-to-water**
Water Source:		

In-Suite Heat Pump Options - Window mounted A/C

- Cheap up front increased electricity costs
- Peak load/capacity issues?
- Reduces air tightness and therefore overall thermal performance
- No heating

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In-Suite Heat Pump Options - Portable A/C Units

- Cheap up front increased electricity costs
- Peak load/capacity issues?
- Reduces air tightness and therefore overall thermal performance
- No heating

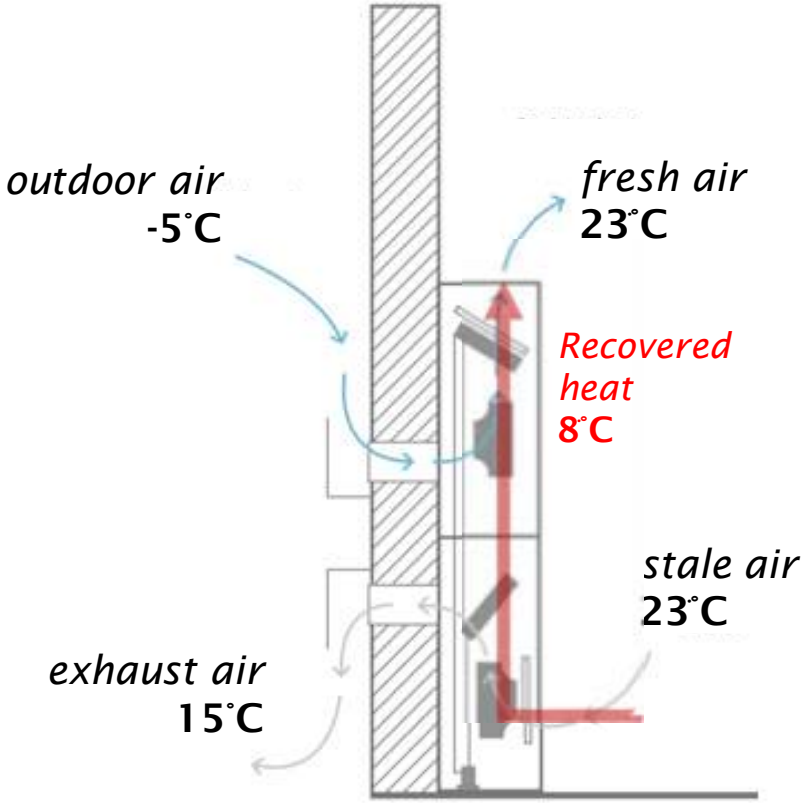
In-Suite Heat Pump Options - Mini-Split

DELUXE WALL-MOUNTED INDOOR UNIT

The MSZ-FS Deluxe Wall-mounted Indoor Unit features a 3D i-see Sensor® and offers dual vane operation. The 3D i-see Sensor scans the room, measuring temperature and occupant location. Indirect or Direct airflow settings divert supply air away from or toward room occupants. The unit's interior air duct/vane, coil, and fan features Dual Barrier Coating, which maintains efficiency by keeping the inside clean. The MSZ-FS offers triple filtration, a backlit hand controller, and other premium features.

Capacities: 6,000 to 18,000 BTU/H
Sound: as low as 20 dB(A)
SEER: up to 33.1
HSPF: up to 13.5
COP: up to 4.68
ENERGY STAR®: Yes

In-Suite Heat Pump Options – New Unitary Products



Temperature Deltas

with HRV
20˚C

without HRV
28˚C

Note:
greater delta =
more energy consumption

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Central Air-to-air heat pump examples

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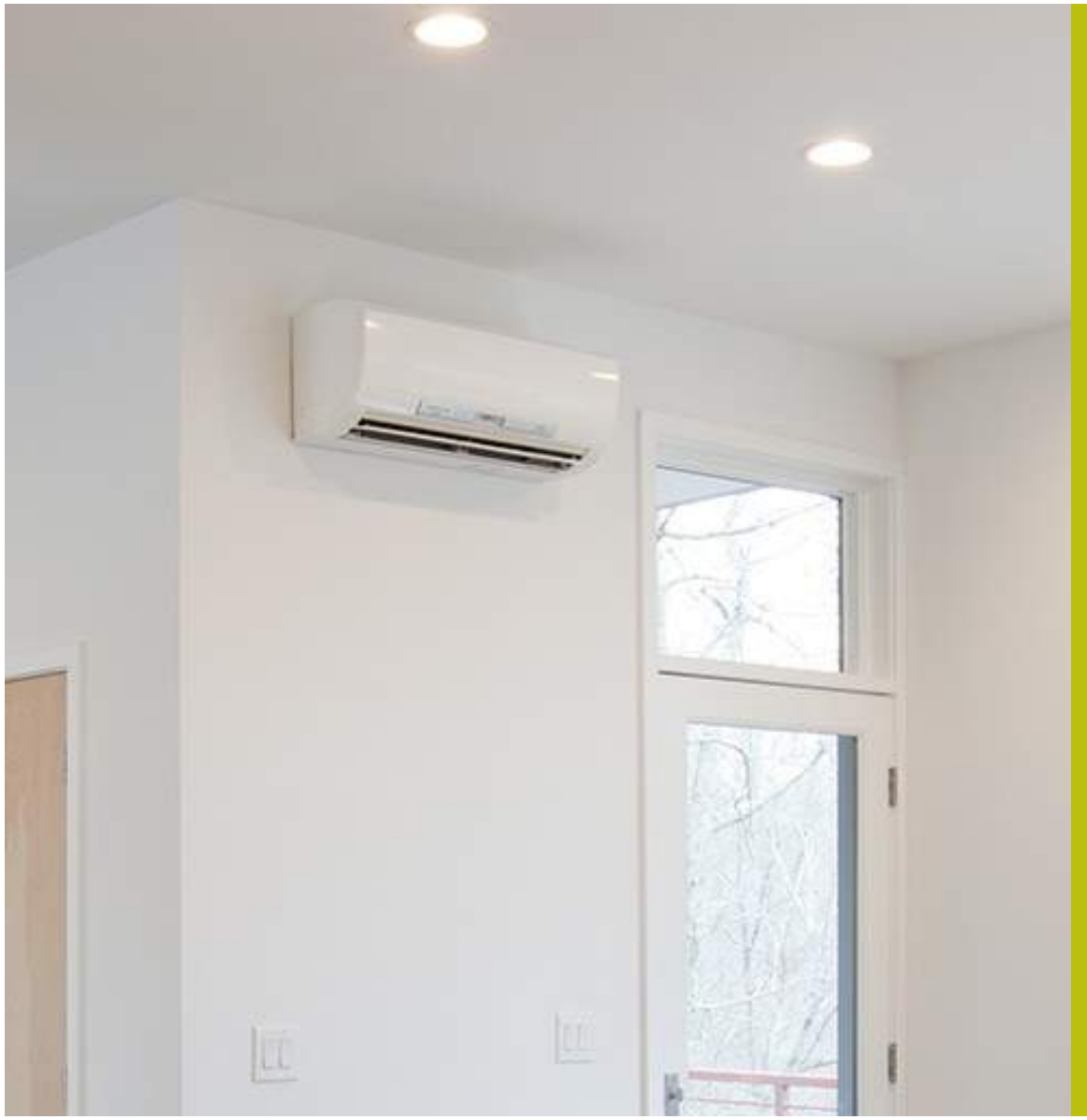
Indoor Unit Examples



Things for Strata Councils to Consider – Details

- Maintaining Performance of Common Assets
  - Properly detailed wall penetrations for refrigerant lines (air tightness, water penetration, R-value)
  - Protection of balcony membranes
- Adequate Existing Structural Support for Heat Pump Equipment?
- Building Code
  - Proximity of units to guardrails can create climbing hazard
- Aesthetic Considerations
  - Consistent location of exterior units throughout building?
  - Same kind of unit throughout?
  - Locations of electrical, refrigerant, condensate lines?

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Things for Strata Councils to Consider – Details

- Capacity of electrical service – can it handle additional loads?
  - Starting from electric heating vs gas heating?
  - Consider heat pump options (higher efficiency unit = no elec upgrade?)
- Energy Performance
  - Variation by outdoor temperature
  - Impact on utility costs
- Acoustic considerations
  - dB standard?
  - Proximity to neighbouring unit windows?

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Heat Pump Performance – Key Performance Metrics

Coefficient of Performance

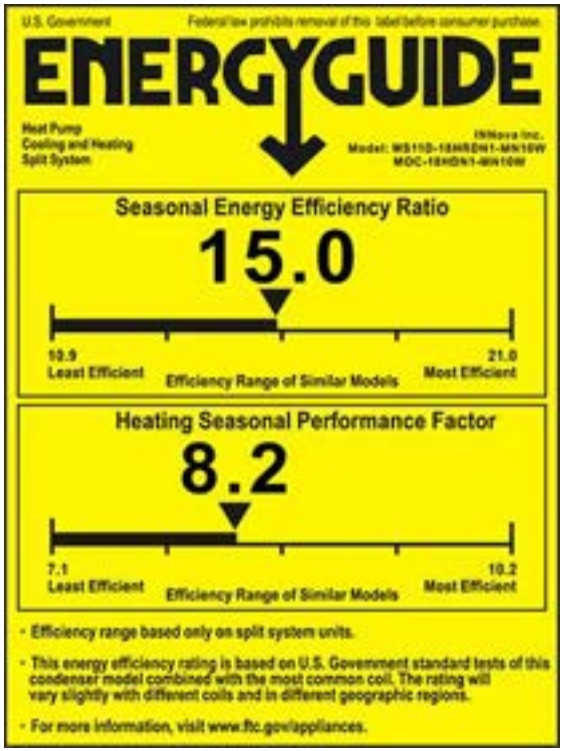
→ $COP = \frac{heat\ delivered\ to\ or\ removed\ from\ indoor\ environment\ (W)}{power\ consumed\ by\ the\ heat\ pump\ (W)}$

Seasonal Energy Efficiency Ratio

→ $SEER = \frac{total\ cooling\ energy\ removed\ over\ a\ season\ (BTU)}{input\ electrical\ energy\ during\ the\ cooling\ season\ (Wh)}$

Heating Seasonal Performance Factor

→ $HSPF = \frac{total\ heating\ energy\ delivered\ over\ a\ season\ (BTU)}{input\ electrical\ energy\ during\ the\ heating\ season\ (Wh)}$



Heat Pump Performance - Resources

- Air-Conditioning, Heating, and Refrigeration Institute: https://www.ahridirectory.org/
- BC Hydro/FortisBC qualified product listing (for incentives): https://betterhomesbc.ca/faqs/how-do-i-find-eligible-heat-pump-models/
- Consortium of Energy Efficiency (CEE) Directory – subset of AHRI with minimum efficiency requirements: http://www.ceedirectory.org/ - Tiers (1, 2, 3) of efficiency (Energy Star min. or better)
- North East Energy Partnership (NEEP) – more tailored to cold climate heat pump/colder climate applications; includes design guidance + includes min. performance specs - ccASHP Specification & Product List | Northeast Energy Efficiency Partnerships (neep.org)

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Heat Pump Performance – Resources – Sound Data

	9RLS3H Heat Pump	12RLS3H Heat Pump	15RLS3H Heat Pump
Nominal Cooling *BTU/h*	9,000	12,000	14,500
Min.~Max. Cooling *BTU/h*	3,100~12,000	3,100~13,600	3,100~18,400
Nominal Heating *BTU/h*	12,000	16,000	18,000
Min.~Max. Heating *BTU/h*	3,100~22,000	3,100~22,100	3,100~23,900
HSPF *BTU/hW*	14.0	13.8	13.3
SEER *BTU/hW*	33.0	29.3	25.3
EER *Clg/Htg*	18.0	15.2	13.9
Clg. Operating Range °F(°C)	14~115 (-10~46)	14~115 (-10~46)	14~115 (-10~46)
Htg. Operating Range °F(°C)	-15~75 (-26~24)	-15~75 (-26~24)	-15~75 (-26~24)
Moisture Removal *Pt./h(l/h)*	2.6 (1.2)	2.7 (1.3)	4.0 (1.9)
Voltage/Frequency/Phase	208-230/60/1	208-230/60/1	208-230/60/1
MAX.CRT.BKR *(A)*	15	15	20
Air Circ. *C.F.M. (m/h)*: Hi	489 (830)	489 (830)	489 (830)
Medium	400 (680)	400 (680)	459 (780)
Low	341 (580)	341 (580)	371 (630)
Quiet	224 (380)	224 (380)	Clg 259 (440) Htg 294 (500)
Noise Level *dB(A) Clg/Htg*: Hi	42/41	42/41	45/45

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Things for Strata Councils to Consider - Big Picture

- The interrelationship of individual building assets/systems in optimizing occupant comfort and building performance
  - Comfort/Performance targets
  - Planning for asset replacements to meet targets
  - Consideration of passive cooling measures
- Timing:
  - Any enclosure work coming up?
  - Need for air handling upgrades?
  - Why does timing matter?
- Cost/Funding
  - Appropriate CRF funding
  - Need for Special Assessments?
  - Need Owner understanding and buy-in
- Legal considerations (future webinar)

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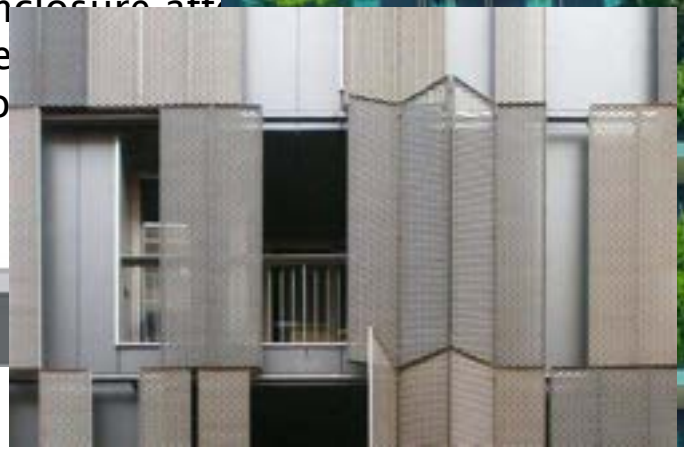
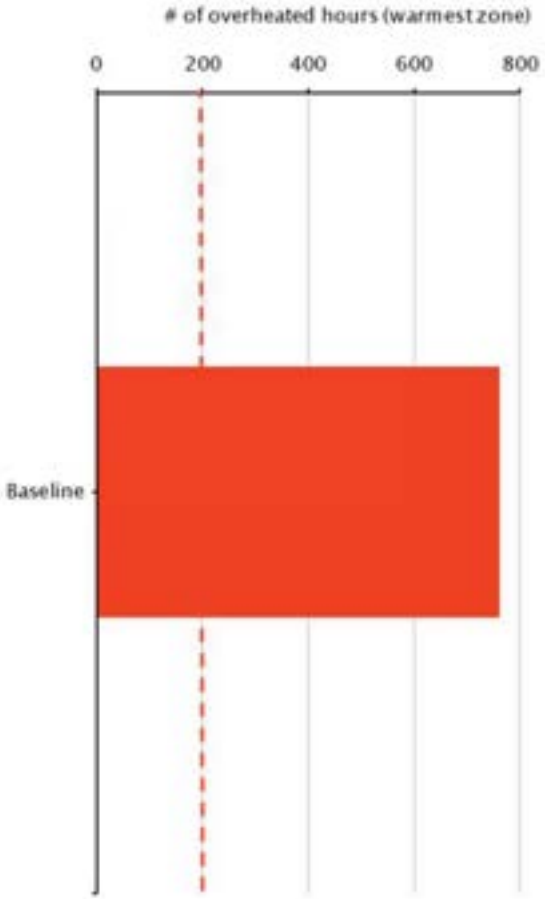
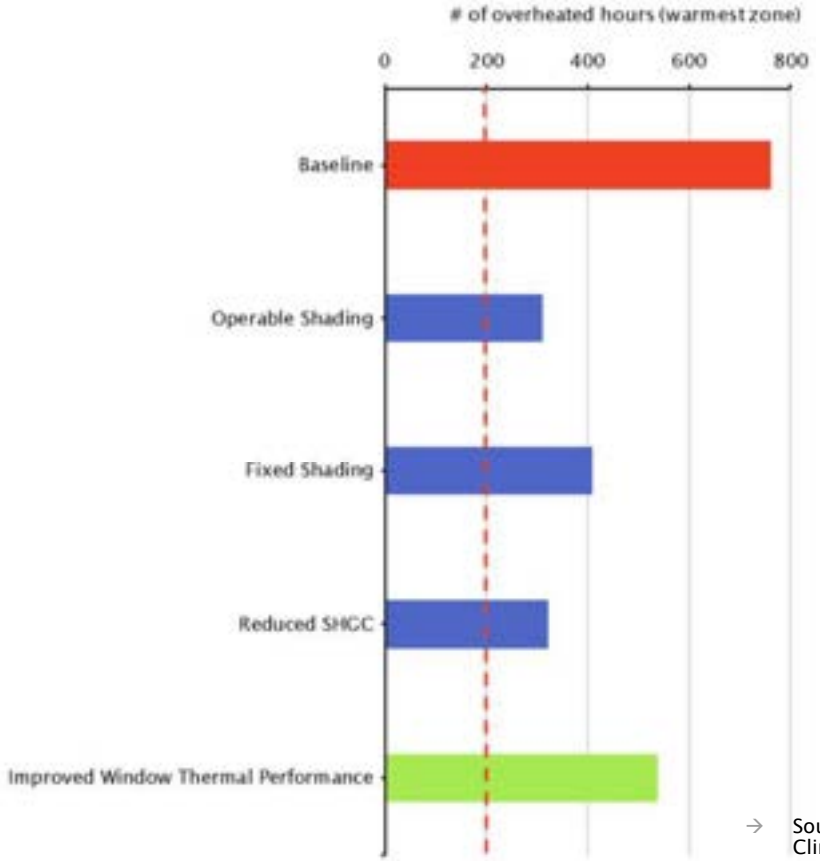
Keeping your Building Cool



Reduce the Need for Cooling





→ Source: UBC Designing Climate Resilient Buildings Study

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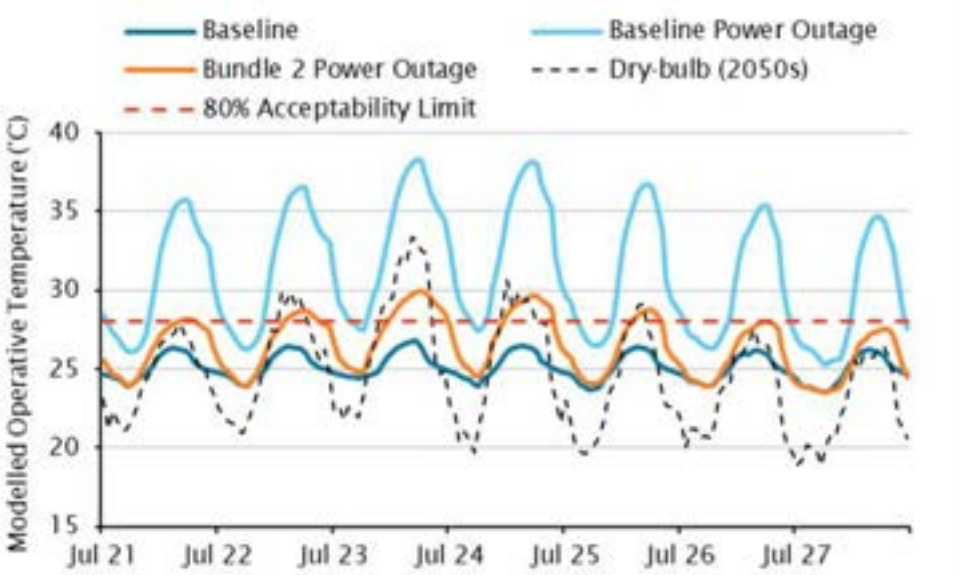
Benefits of Passive Solar Control

→ Power outage (high rise new)



2050s scenario: one bundle was analyzed for the high-rise new building:

- Bundle 2: operable exterior shading + reduced SHGC

Source: UBC Designing Climate Resilient Buildings Study

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A Plan

- Climate adaptation and future proofing is more than the installation of heat pumps
- Consider the whole building
  - Complaints about being stuffy?
  - What about wildfire smoke events?
  - Drafty in winter? Condensation on windows?
  - Is the heating system due for renewal?
  - How resilient is the building to power outage?
- Asset maintenance, repairs, and renewals are inevitable – Make the most of it
  - Work done now may be in place for decades
  - Will it perform in changing climate conditions?

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A Plan

- Adaptation to changing climate as part of asset planning
  - Will asset perform adequately in climate conditions throughout its service life (e.g., windows designed to withstand higher wind loads and more severe rain events during their 35-45 year life span)
  - Will new assets work together to contribute to overall future building performance
  - Where is the most adaptation/mitigation "bang for the buck"
- Consider changing codes, & changing expectations about comfort
- Consider how things get built
  - What is the most effective way of scheduling your building assets' replacement and renewals – *which projects when?*
  - Minimize disruption to owners
- Have a plan for the future that you can build towards

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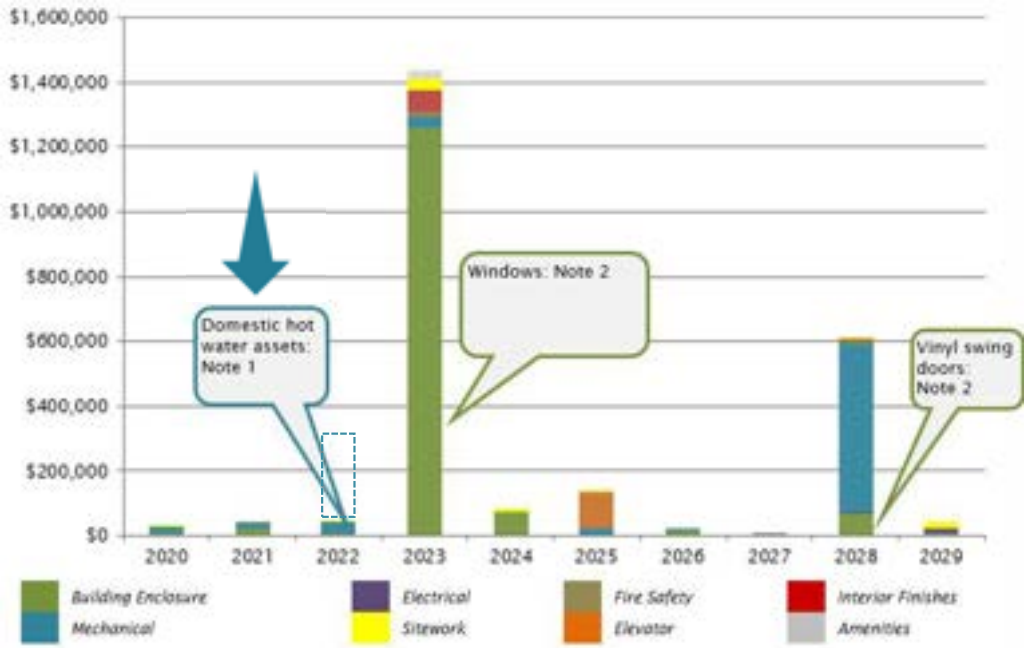
Capital Asset Planning

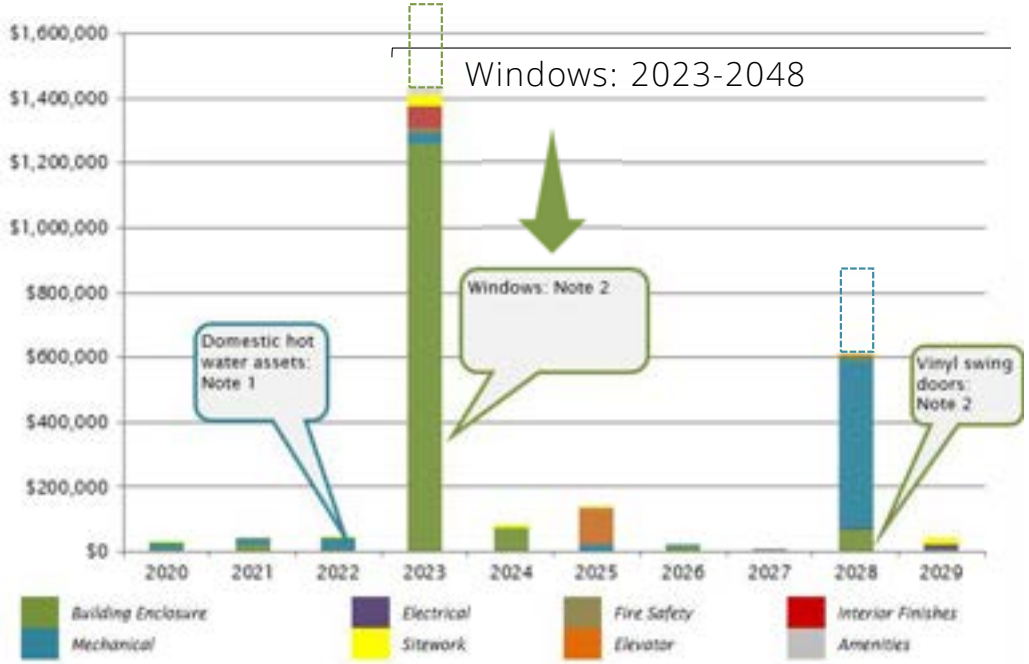


Capital plan accounting for

- Upcoming codes

"DHW equipment to be replaced with "min 100% efficient" equipment by 2030

Capital Asset Planning

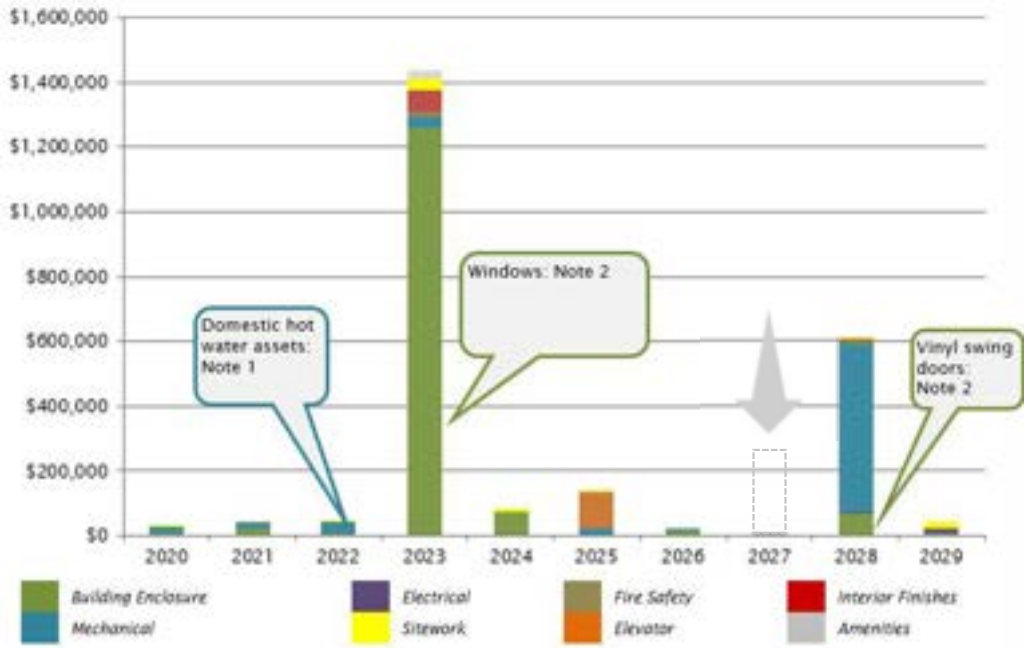


Capital plan accounting for

- Upcoming codes
- Adaptation: Replacement

Replacement to cope with predicted climate (2040-50) (e.g., triple glazing, lower SHGC)"

Capital Asset Planning



Capital Plan accounting for

- Upcoming codes
- Adaptation: Replacement
- Adaptation: New

"Need for additional measures not yet incorporated for climate adaptation (e.g., introduction of shading, cooling)"

Summary/Key Takeaways

- The demand for cooling will increase as the climate warms
- Need for well considered guidelines for
  - For ensure common property not compromised
  - Consistency, transparency, and fairness
- Mechanical cooling is but one element of a broader approach to climate adaptation
- Consider passive means of controlling heat gain to reduce need for mechanical cooling
- Integrate climate adaptation into long term maintenance and renewals
- Consider the whole building and asset/building system relationships
- Develop a plan!

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Discussion + Questions

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