

Reframed Tech Series

Heat pumps & deep retrofits



#Reframed

May 27, 2020

PEMBINA
institute

Leading Canada's transition to clean energy

The Pembina Institute is a non-profit think-tank that advances a prosperous clean energy future for Canada through credible policy solutions.



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Reframed Tech Series

Moderator

Betsy Agar

Senior analyst, Pembina Institute

Agenda

1. Introductions
2. Presentations
3. Q&A
4. Upcoming opportunity

Note to attendees

This webinar is being recorded.
The video will be published
online and shared with all
registrants.

Introducing the Reframed Initiative

The Reframed Initiative is working with designers, builders, owners, financiers, and policy-makers to scale up deep retrofits.

Together, we can address the housing crunch and climate emergency.

LEARN MORE: pembina.org/reframed

Deep retrofits are:

- **Healthy:** cleaner air, improved comfort
- **Resilient:** ready for extreme weather and earthquakes
- **Low-carbon:** use renewable energy and carbon smart materials

Let's scale up solutions that:

- Keep rent affordable
- Minimize disruption to tenants
- Return value to owners and investors

New primer

DOWNLOAD:

pembina.org/pub/heat-pump-retrofits

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Heat pumps and deep retrofits

Deep retrofits aim to drive down carbon pollution and energy consumption in existing homes and buildings. This requires a profound shift in how we heat and cool buildings — and heat pumps can play a major role.

Heat pumps are used for space conditioning as well as domestic hot water. They are highly efficient, because they move heat from one space to another (e.g. indoors to outdoors) rather than convert it from other forms of energy.

Heat pumps capture heat from the air, water, or ground (i.e. geoechange) through a refrigeration process. This process is better known for providing air conditioning in summer. In addition to space cooling, heat pumps work in reverse to provide space heating in winter. They can work with hydronic heating systems or forced-air central-heating systems, or can provide direct heat through ductless "mini-split" systems.

How efficient are heat pumps?

Combustion heating systems (e.g. gas furnaces) convert fuel into heat and lose energy in the process. In contrast, heat pumps move energy from the outside of the home to the inside (or vice-versa). Heat pumps available in Canada typically have a coefficient of performance (COP) between three and five; for every unit of input energy, heat pumps provide three to five units of heat energy. Heat pumps using carbon dioxide as a refrigerant reach COPs greater than five but are not commonly available yet in Canada.

The efficiency of air-source heat pumps is directly affected by:

- Equipment quality and maintenance
- Type of refrigerant
- Installation quality
- Seasonal ambient temperatures

Air-source heat pumps that are designed specifically for cold climates are eliminating the need for backup heating systems, even in North America's coldest regions. The efficiency of ground-source heat pumps is not affected by ambient temperatures.



Heat pumps can provide both heating and cooling.

Municipal action on heat pumps

The City of Vancouver, B.C., has taken several measures that support the adoption of heat pumps, including:

- Setting greenhouse gas emissions limits for different building types in its building bylaws
- Streamlining the application process and reducing the cost of low-risk heat pump permits
- Topping up provincial (CleanBC) and utility (BC Hydro) rebates
- Spreading awareness of the benefits of heat pumps
- Developing a database of homes and their energy performance to help owners make informed upgrades to their heating systems
- Assessing local skill gaps to determine the capacity building needed to meet rising demand



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Panellist

Jordan Fisher

President, FRESCo Building
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Principal and sales engineer,
Olympic International





Panellist

Don Curry

Managing partner, Alterna Mechanical



Panellist

Thomas Barr

Chief innovation officer, Alterna Mechanical



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Heat Pumps and Deep Retrofits

May 27, 2020

Jordan Fisher

www.frescoltd.com





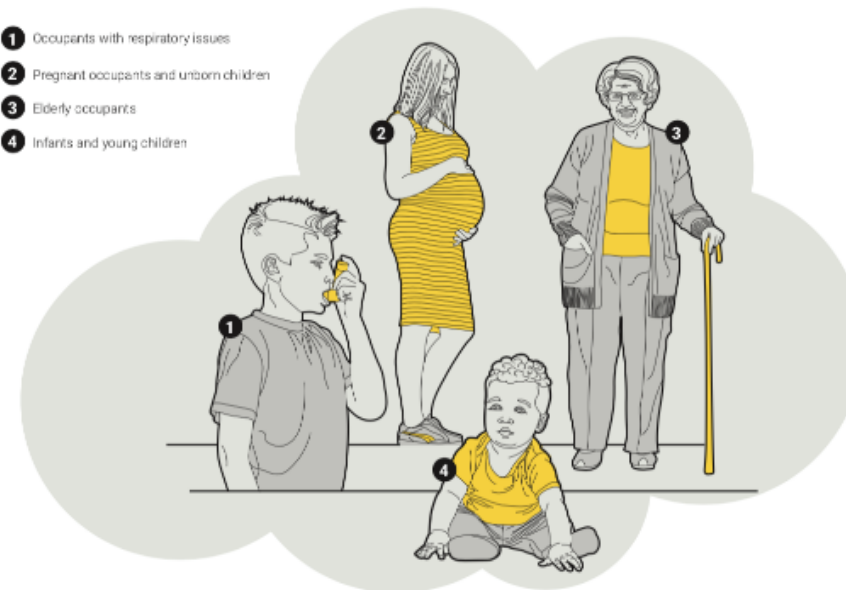
Heat Pump Context

- **Air Source Heat Pumps**
- Ground Source Heat Pumps
- Gas-driven Heat Pumps



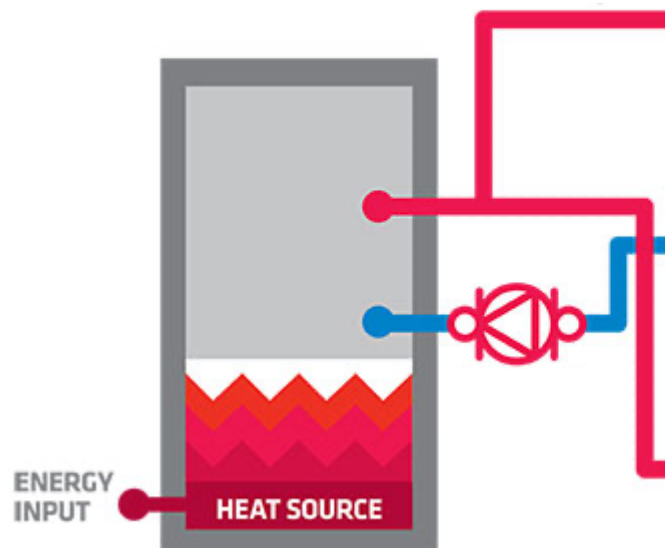
Why Heat Pumps?

- 1 Occupants with respiratory issues
- 2 Pregnant occupants and unborn children
- 3 Elderly occupants
- 4 Infants and young children





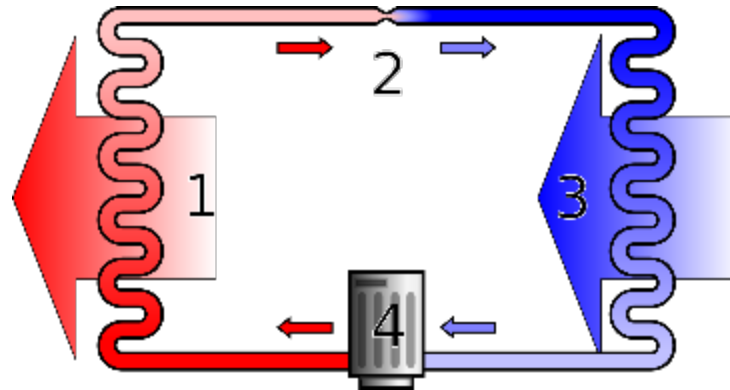
Traditional Heating Technology



- Heat created from burning fuels (gas, oil, wood)
- Electric resistance
- 60% to 95% efficiency



What are Heat Pumps?



- Deliver heat by MOVING heat instead of BURNING something to create it
- Same basic technology as refrigerators, conventional A/C systems



Multi-Family Context

1. Townhouse (ground oriented)
2. Older apartment-style
3. Newer apartment-style
4. High performance



Multi-Family Context Townhouse





Multi-Family Context Apartment Style - Older





Multi-Family Context Apartment Style - Newer



RN Series





Multi-Family Context New High-Performance





Common Issues

- Sizing
- Cost of gas v. electricity
- Incentives
- Integration - whole-building strategy
- Legal – e.g. who pays for heat
- Fully electric v. hybrid
- Refrigerants GWP



Common Issues

- “Nitty gritty” - e.g.
 - Electrical service
 - Structural
 - Permits
 - Logistics
 - Coordination
 - Rate structures (e.g. demand charges)



THANK YOU!

*For technical questions, please contact us
and we'd be happy to answer any questions
you may have.*

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HEAT PUMPS & DEEP RETROFITS

Jay Jagpal

Principal, Engineering sales



Olympic
International

WHO WE ARE...



We are the largest HVAC solutions provider in the Multi family, and Commercial Construction Market for British Columbia. Over 55 years in the Market.



We are committed to bringing the world's leading sustainable technologies to the BC market.



We have contributed our expertise all levels of government, and policy makers on product applications that will reduce GHG emissions.



WE PROUDLY SUPPLY THESE MANUFACTURER'S PRODUCTS



RETROFITS — WHERE DO WE START?

Critical information to gather:

Sizing of existing equipment (what is the capacity of the boiler?)

Data of actual usage, and capacities of heating

- what is the loading of the boiler(s) during winter?
- what is the DHW usage?

Existing on site electrical infrastructure?



CURRENT MARKET PRODUCT SOLUTIONS IN SUITE — THRU THE WALL



Continuous heating down to 5F (-15C)



CURRENT MARKET PRODUCT SOLUTIONS -SPLIT SYSTEMS & VRF



VRV AURORA™ Heat Recovery

- » VRF Industry's first air cooled system that delivers heating down to -22°F (-30°C) as standard



Cold climate ready (Continuous operation down to -13°F (-25°C))

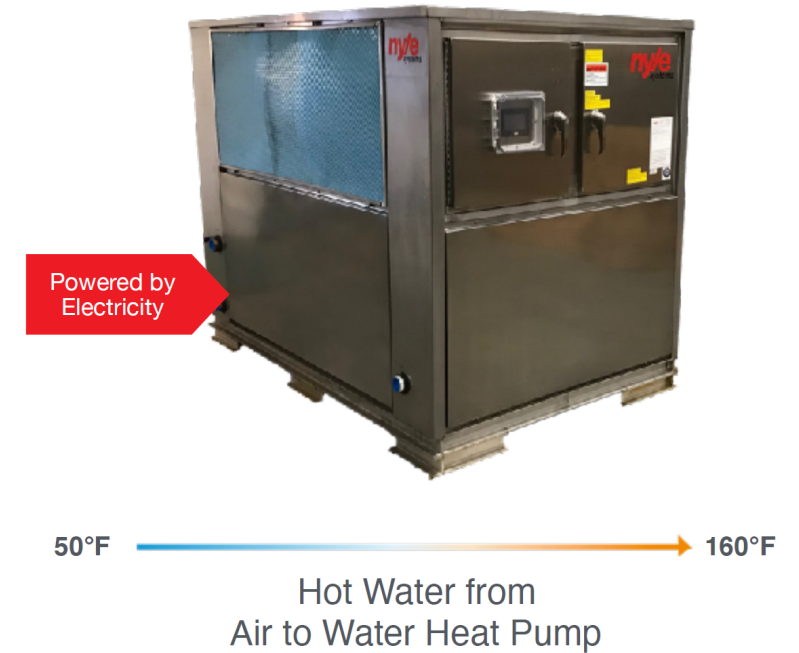
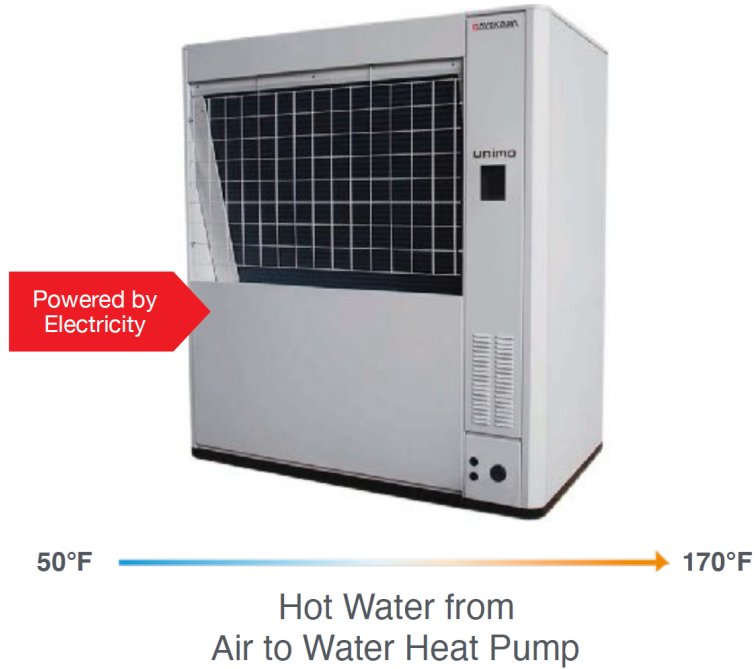
CURRENT MARKET PRODUCT SOLUTIONS -PACKAGED ROOFTOP UNITS



CURRENT MARKET PRODUCT SOLUTIONS -CENTRAL PLANT INCLUDING DHW



CURRENT MARKET PRODUCT SOLUTIONS -CENTRAL PLANT WITH SEPARATE DHW



SUCCESS BRINGING GLOBAL PRODUCTS TO BC MARKET



jaga
CLIMATE
DESIGNERS

AERMEC



LESSONS LEARNED BRINGING GLOBAL PRODUCTS TO BC MARKET

- Partnership with Manufacture is Critical
- Innovation based on Market Conditions
- Safety Certification
- Electrical Certification
- National Plumbing Standards



LOCAL INSTALLATION & LESSONS LEARNED

- Vancouver City Hall Retrofit Installation



Aermec ASHP installed at City Hall



LIFE CYCLE OF THE EQUIPMENT

Best Practices for Maintenance

Refrigerant Leakage Rates

Scheduled replacement of components



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ALTERNA

Heat Pumps & Deep Retrofits A Contractor's Perspective



Prepared By: Don Curry & Thomas Barr
Prepared For: Pembina Institute – Webinar Series – Heat Pumps & D.E.R.
Date: 2020-05-27

Topics For Discussion



1. Process Vs. Technology
2. Process – Conventional Vs. Integrated
3. Sundance – Lessons Learned

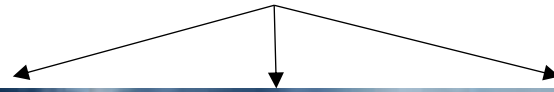


1. Process Vs. Technology



Conventional Approach

Inputs

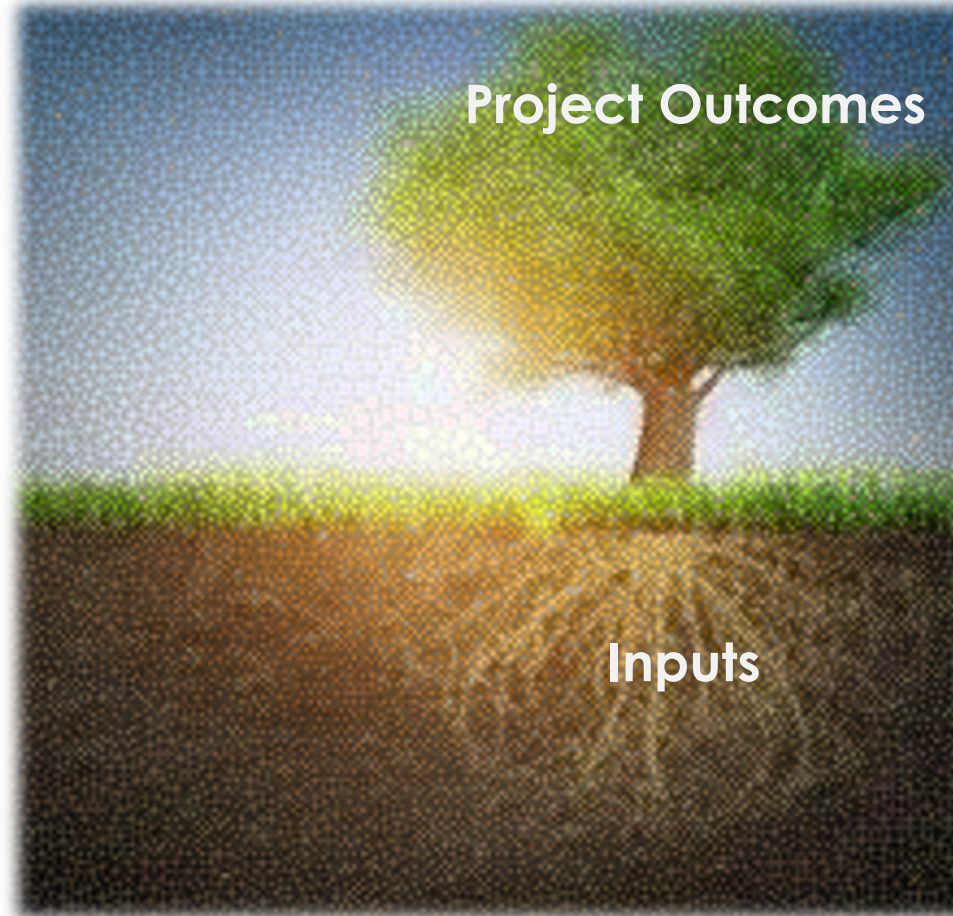


Project Outcomes

1. Process Vs. Technology



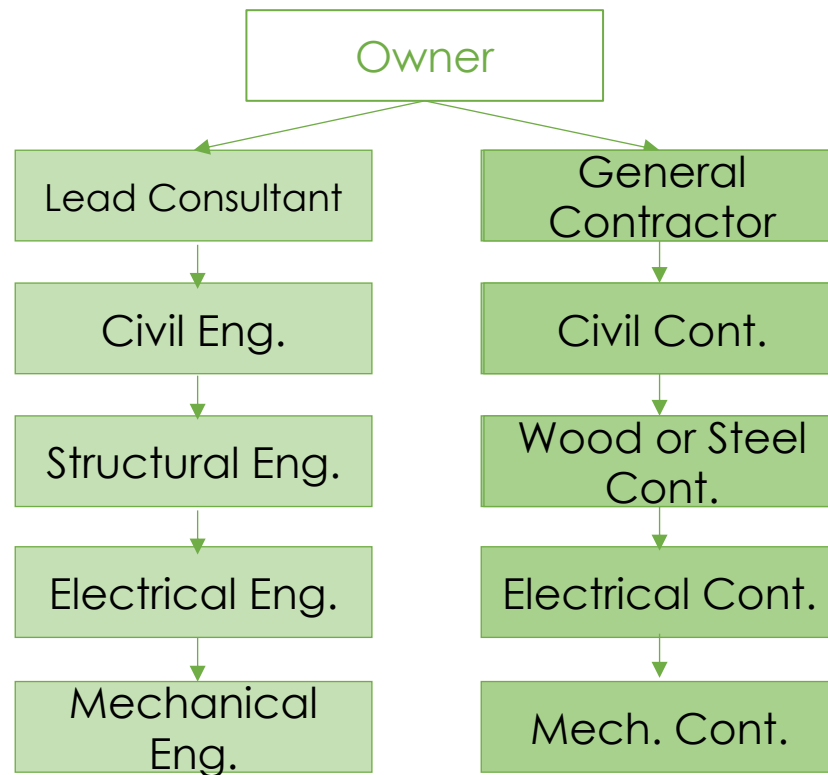
Integrated Approach



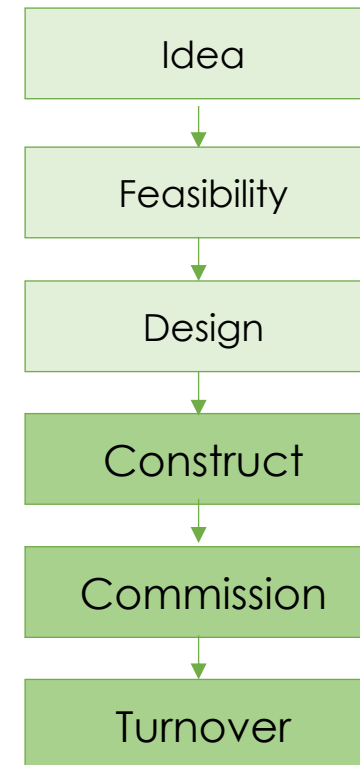
2. Conventional Project Delivery



Project Partner Format



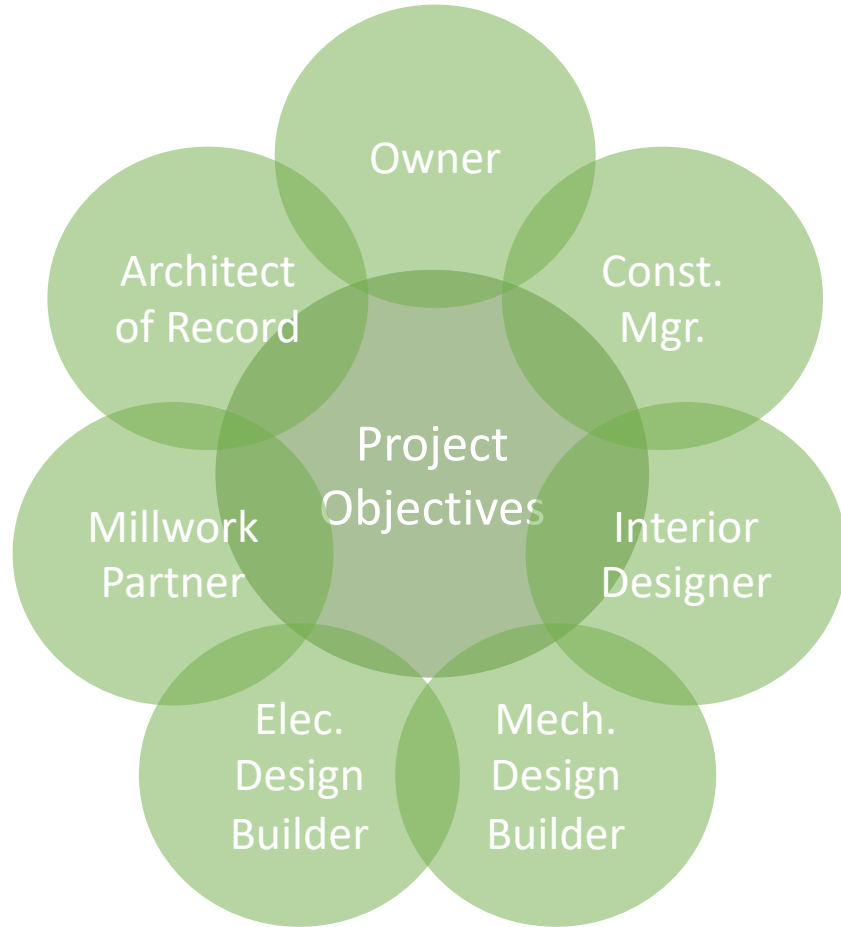
Process Flow



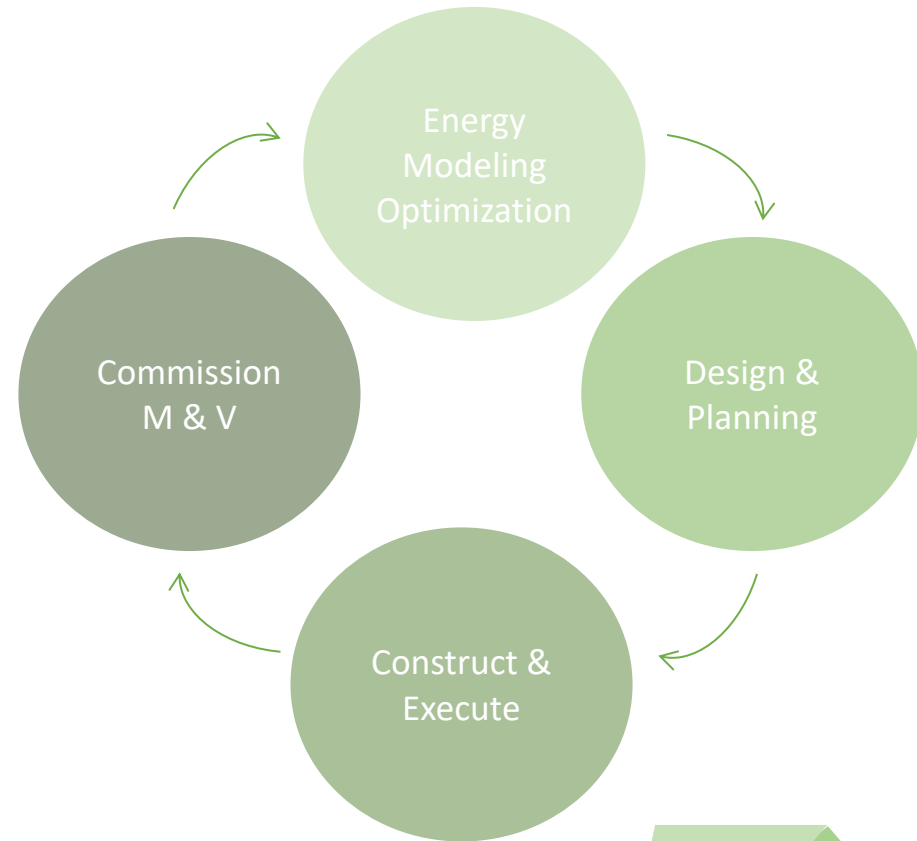
2. Integrated Project Delivery



Project Partner Format



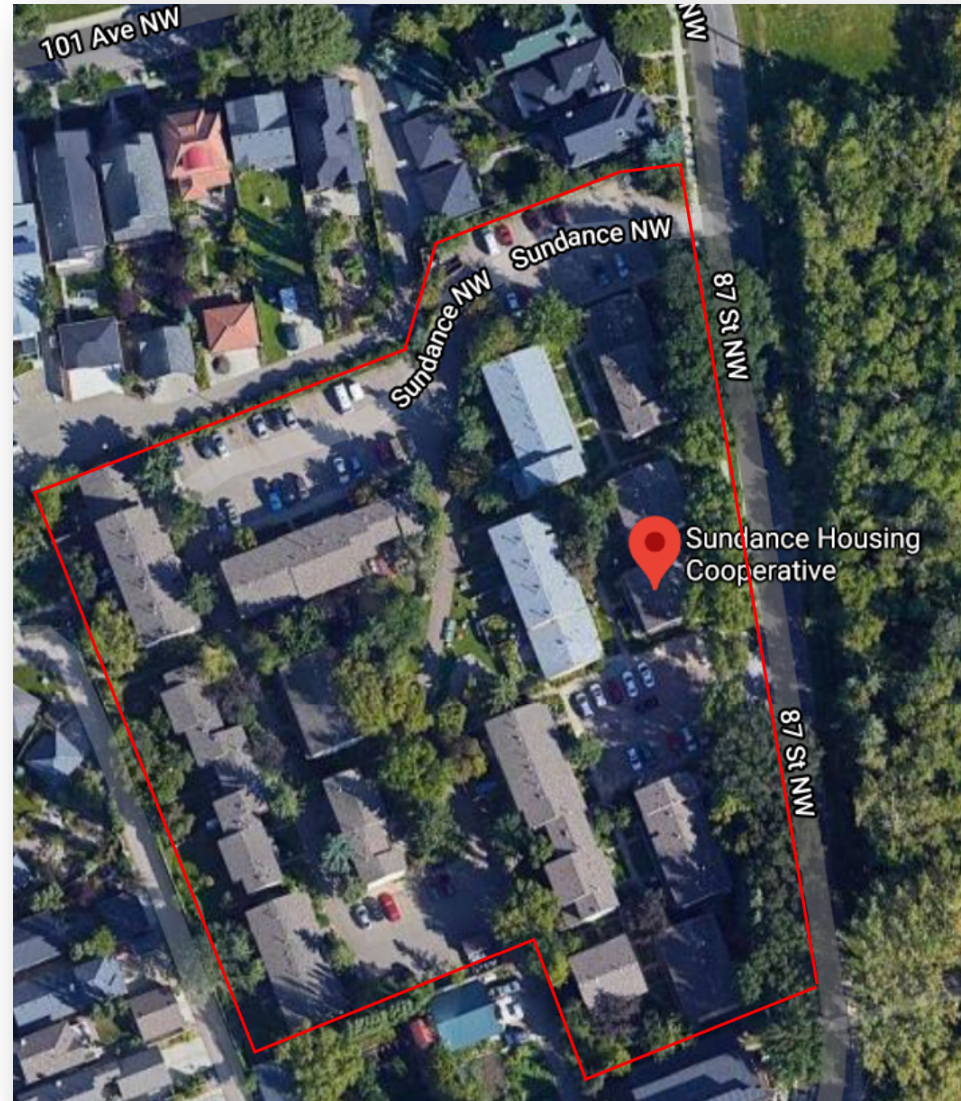
Process Flow



3. Sundance – Project Delivery



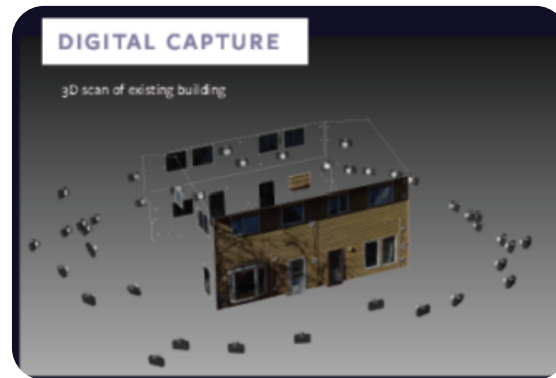
Canada's Largest
Residential Deep Energy
Retrofit - Sundance



3. Sundance – Project Delivery



1.



2..



3.



4.



5.

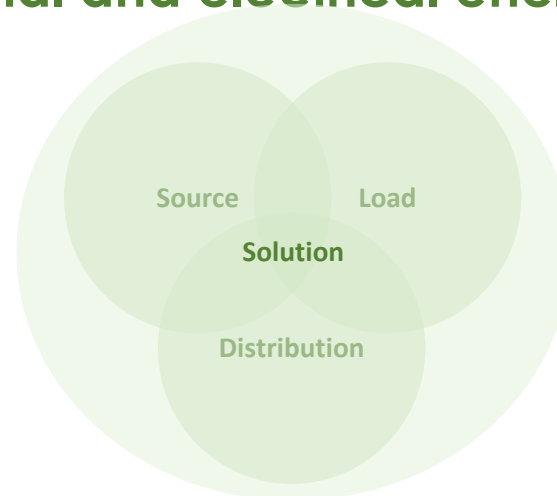


3. Sundance – Project Delivery



Critical Components to Any Design

- Source:** Where does our energy come from to heat, cool, & energize our building?
- Load:** What is our current energy demand and how can we minimize it?
- Distribution** How do we get thermal and electrical energy from source to load as efficiently as possible?



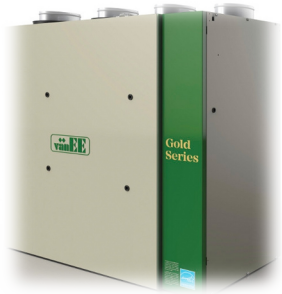
3. Sundance – Mechanical Systems



1. Space Conditioning – Daikin SkyAir System



2. Fresh Air Ventilation – VanEE G2400H



3. Domestic Hot Water – RHEEM Performance Platinum – 50 Gallon



3. Sundance – Lessons Learned



3.1 Outdoor Equipment Placement



3. Sundance – Lessons Learned



3.1 Outdoor Equipment Placement – Things to AVOID



3. Sundance – Lessons Learned



3.2 indoor Equipment Placement



3. Sundance – Lessons Learned



3.3 Existing Distribution

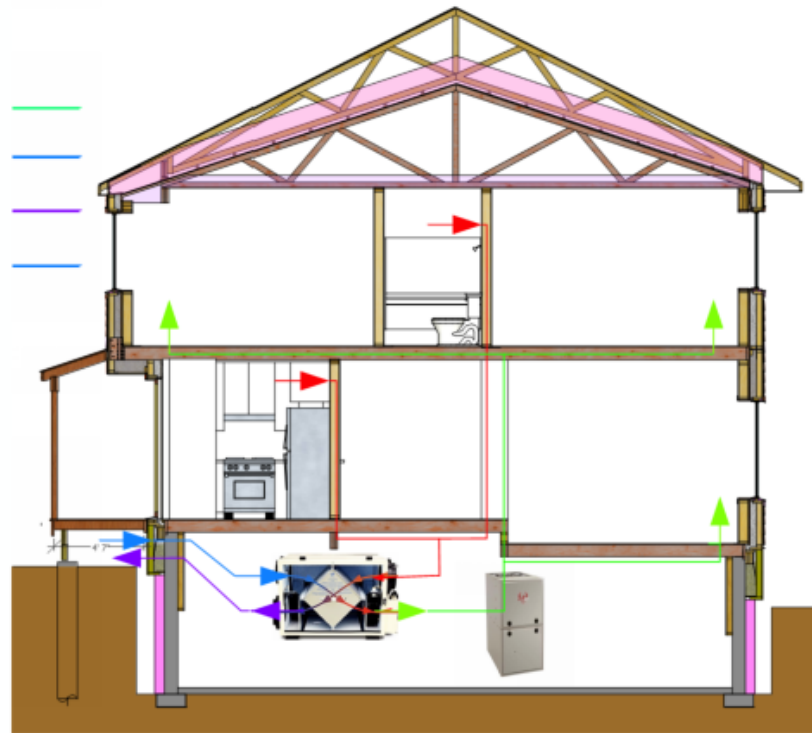
HRV (Heat Recovery Ventilator)

Warmed Fresh Air to Rooms

Stale Air from Kitchen, Bath

Cold Fresh Air to HRV

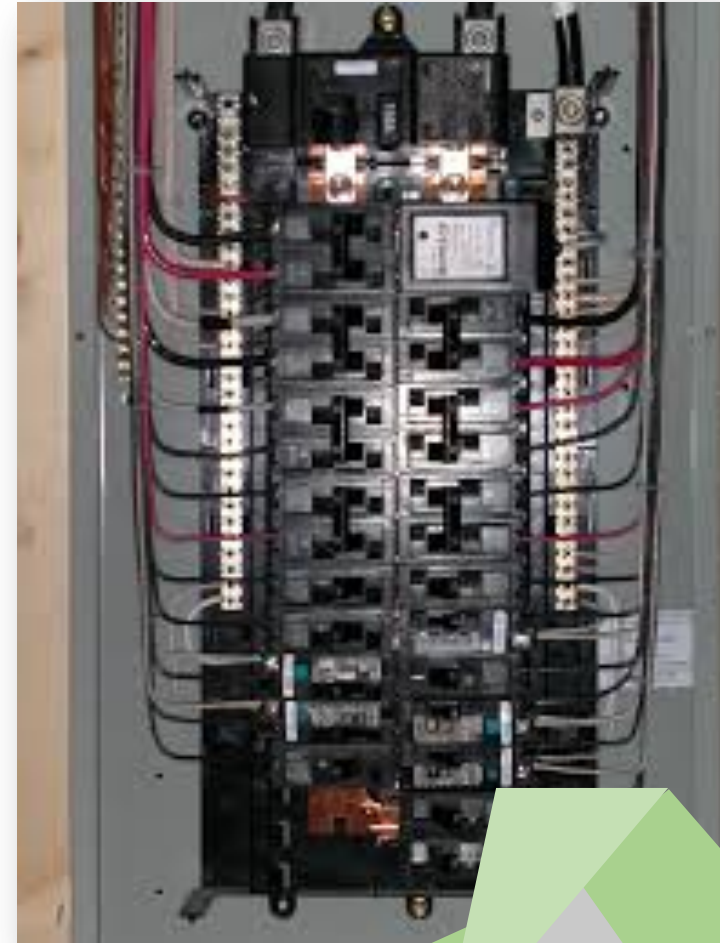
Cooled Stale Air from HRV



3. Sundance – Lessons Learned



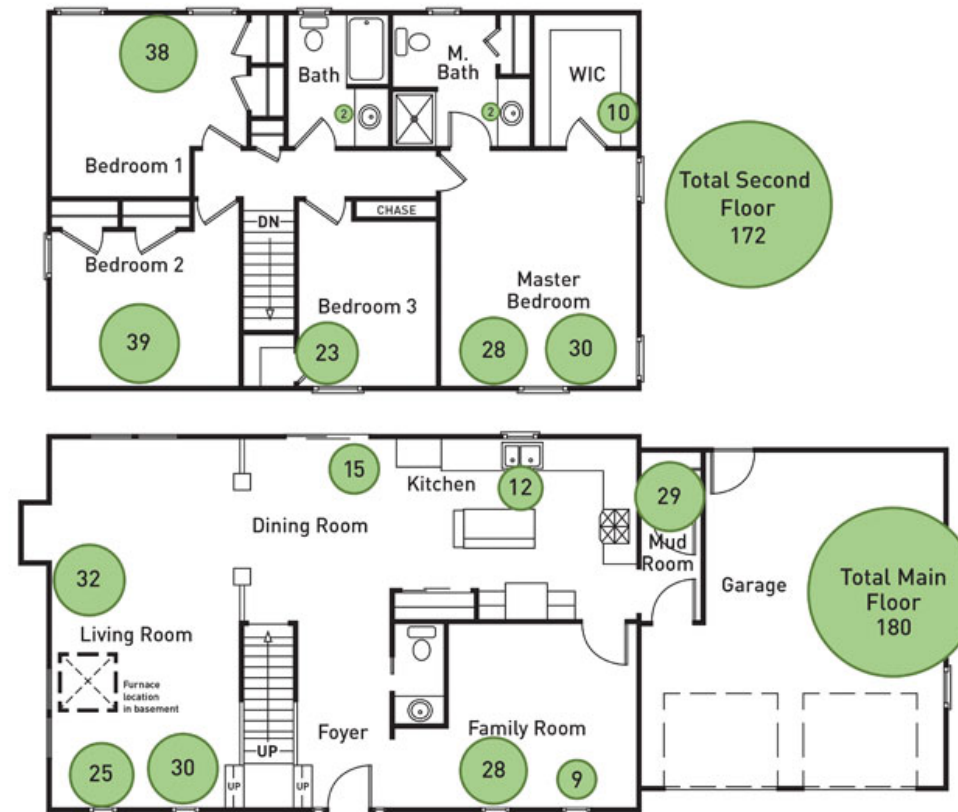
3.5 Electrical Requirements



3. Sundance – Lessons Learned



3.6 Commissioning



3. Sundance – Lessons Learned



3.7 – Contractor Wish List

1. Equipment needs to be smaller – Both Physically & In Capacity
2. Equipment needs to be combined – In one location
 - Heating
 - Cooling
 - HRV
 - Domestic Hot Water
3. Equipment could be more aesthetically pleasing
4. Project Partnerships – All Industry Sectors beating the same drum
 - Universal design guide / standard for Deep Energy Retrofits
5. Creation of a consistent training program



Thank you for your time!

Please contact us directly for any further information.

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CONSTRUCTION

CODE &
PERMITTING

3/0
Energy Conservation
& Smart
Retrofit Coupling

Poll

3/0
Seeing examples
that work abroad

3/0
Recognition that
the current model
isn't working at
the political
level. Young
people are young

GOALS

What:

Net-zero Carbon retrofits delivered
at scale across Canada driving carbon
neutrality in the residential market
by 2050.

W: Engage & coordinate the market
as an industrialized turnkey
retrofit process

Questions

Upcoming Reframed Lab

- Request for proposals expected in summer 2020
- Multi-disciplinary teams will design solutions for low-rise residential buildings in B.C.'s Lower Mainland or Victoria area
- Six-month exploration lab with support from climate, energy, and health experts

REGISTER YOUR INTEREST: pembina.org/reframed

Integrated design teams

- Architects
- Building science, electrical, mechanical, and structural engineers
- Contractors, builders, and retrofitters
- Manufacturers, fabricators, and suppliers
- Modeling and data capture specialists
- Monitoring and control equipment specialists

REGISTER YOUR INTEREST: pembina.org/reframed

Solutions of particular interest

- Prefabricated exterior wall and roof panels
- High-efficiency and low-carbon mechanical systems
- Roofing solutions that integrate on-site renewable electricity
- Storage and/or renewable thermal generation
- Seismic upgrades
- Climate adaptation measures
- System controls and performance monitoring

REGISTER YOUR INTEREST: pembina.org/reframed

Reframed Tech Series



Climate resilience & deep retrofits

June 10, 2020



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