

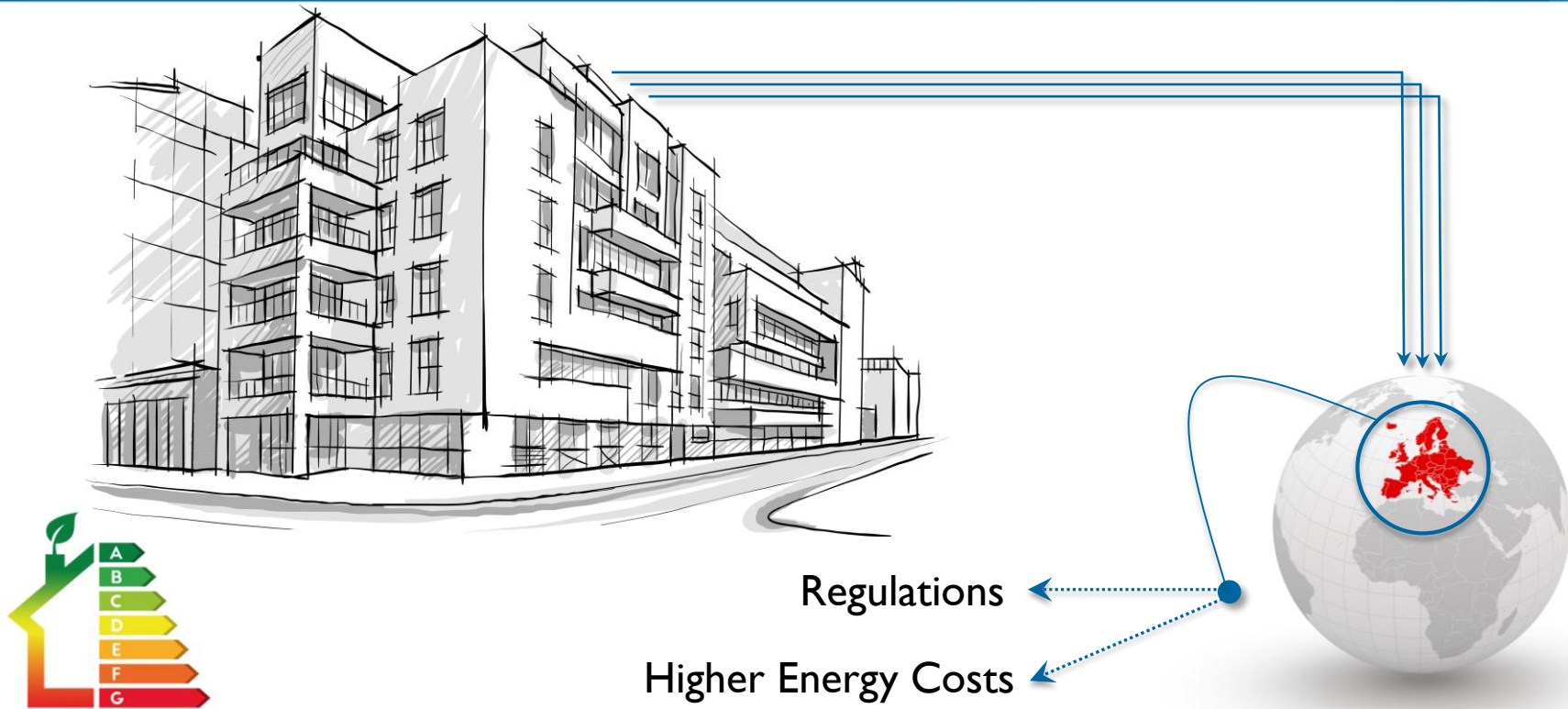


# Low-Energy MURB Design

# MURBs, Energy Efficiency and the Economic Impacts



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# MURBs, Energy Efficiency and the Economic Impacts

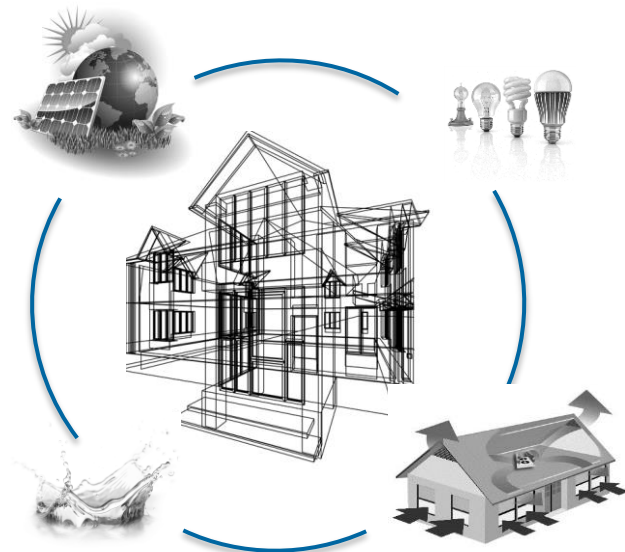


Annual  
Consumption  
120 kWh/m<sup>2</sup>

Space Heating  
15 kWh/m<sup>2</sup>

Energy  
Limits

## Targeting Passive House Levels



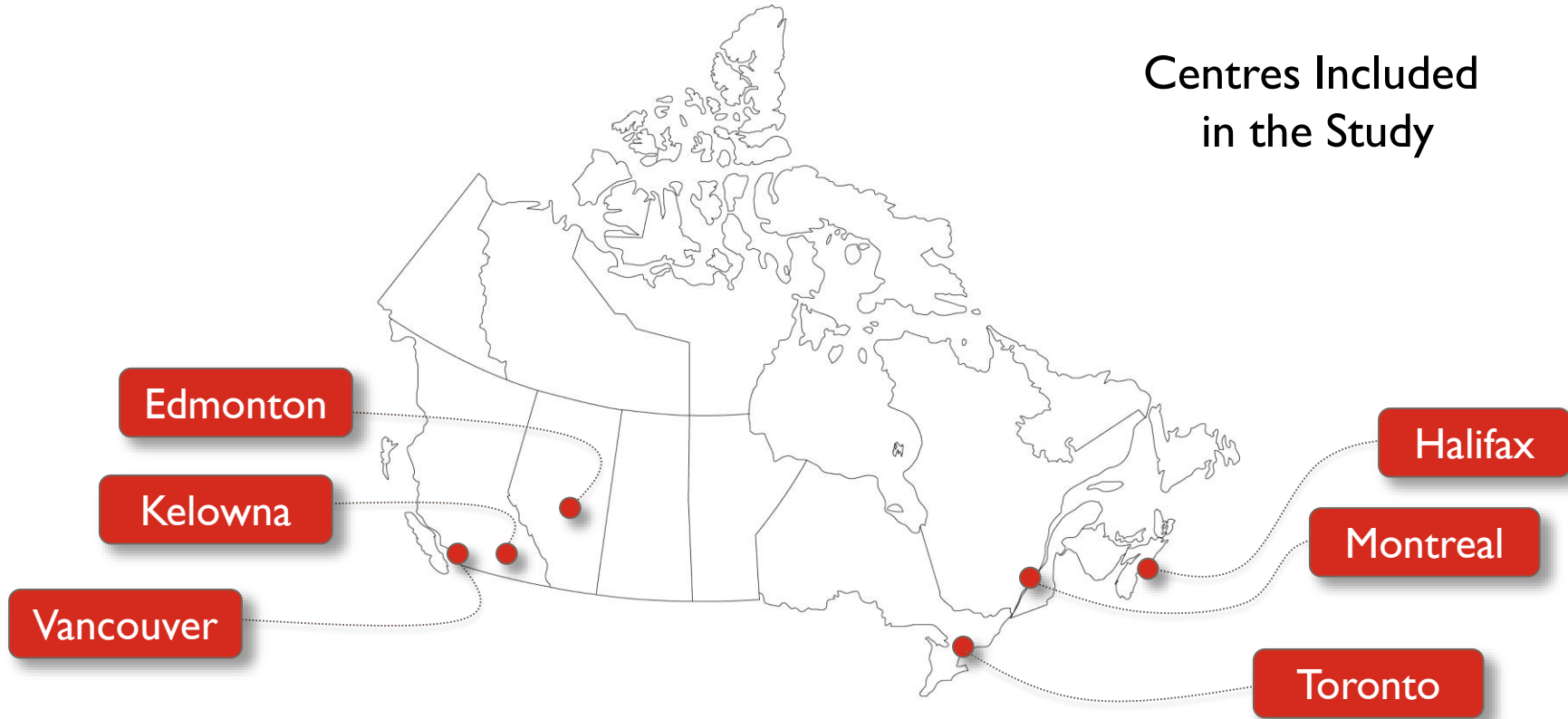
# MURBs, Energy Efficiency and the Economic Impacts

## Economic Impact Low-Energy Design



# MURBs, Energy Efficiency and the Economic Impacts

## Centres Included in the Study



# MURBs, Energy Efficiency and the Economic Impacts



Baseline Model  
for the Study ...



Met or exceeded  
NECB 2011

# MURBs, Energy Efficiency and the Economic Impacts

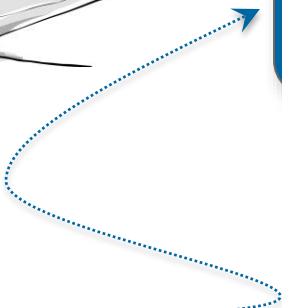


Baseline Model  
for the Study ...



Met or exceeded NECB  
2011

Low-Energy Model  
for the Study ...



Overall Energy  
Consumption



Space Heating  
Load



To Passive House design levels



# Baseline Model

10 Storey  
Steel/  
Concrete

Total Floor  
Area 4,000 m<sup>2</sup>

1,600m<sup>2</sup> below-  
grade parking

Windows  
30-35%  
Gross Wall  
Area

Heating  
Natural gas/hot  
water

Apts. 85%  
of Floor  
Area

50  
Suites

68 m<sup>2</sup> avg.  
living space

Infiltration  
4 Chgs./Hr.

In Suite  
HRVs



# Low-Energy Model

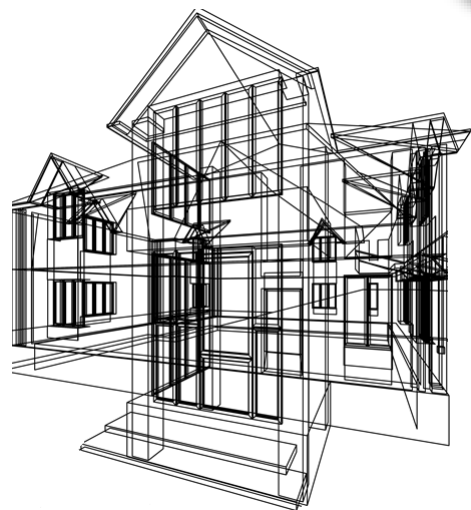
Building  
Envelope

Heat Loss  
Reduction  
Tactics

Market Availability

Practicality

Cost Effectiveness



# Low-Energy Model

## Building Envelope

Heat Loss Reduction Tactics

Market Availability

Practicality

Cost Effectiveness

Maximize Efficiency (Walls)

Significant Insulation

Minimized Linear Losses and Thermal Bridging

# Low-Energy Model

## Building Envelope

### Heat Loss Reduction Tactics

- Market Availability
- Practicality
- Cost Effectiveness

### Maximize Efficiency (Walls)

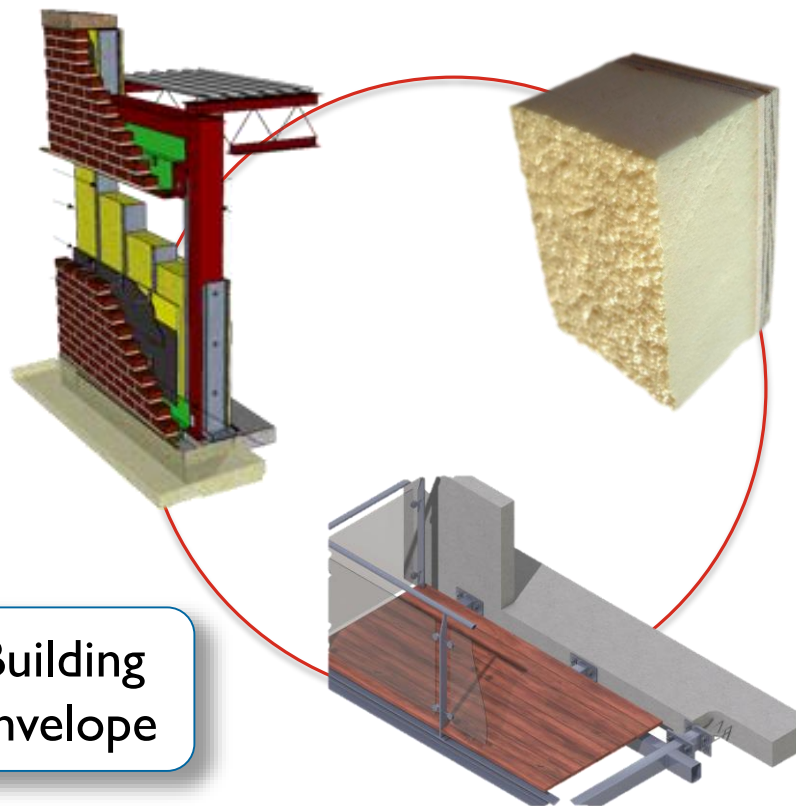
- Significant Insulation
- Minimized Linear Losses and Thermal Bridging

### Thermal Resistance

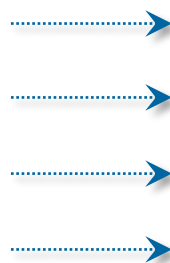
RSI – 4.5 (R-26) to RSI – 5.4 (R-31)

RSI – 5.4 (R-31) in Colder Climates

# Low-Energy Model



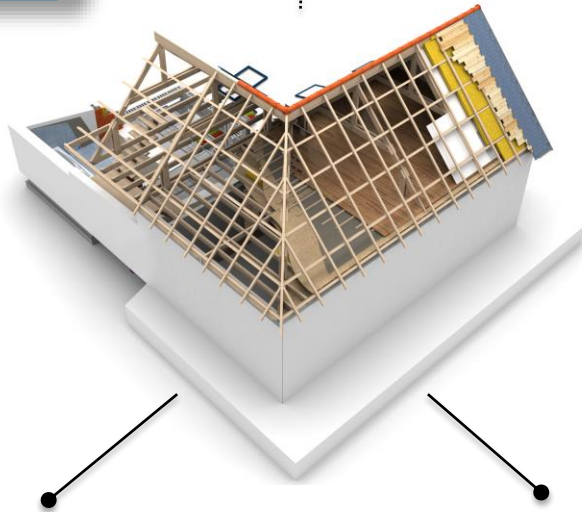
**Building  
Envelope**



High-performing  
envelope  
compared to  
typical market  
practises

# Low-Energy Model

Roof



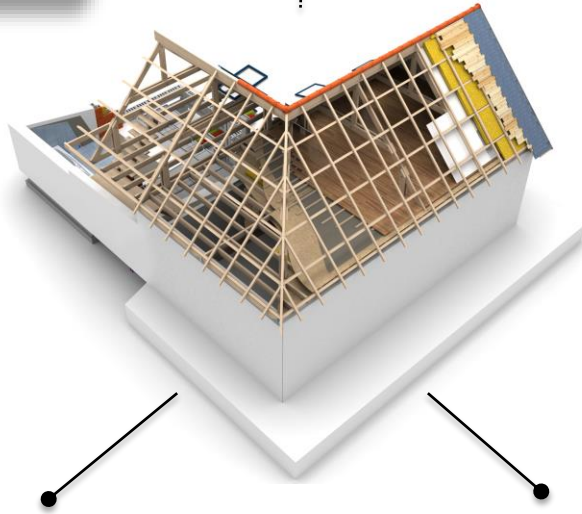
Roof Construction  
Typical concrete or metal deck roof with contiguous rigid insulation.

Colder Climates  
Roof RSI value as high as  
RSI-9.1 (R-52)

Lowest Thermal Resistance (Milder Climate)  
Roof RSI value as high as  
RSI-5.6 (R-32)

# Low-Energy Model

## Roof



Colder Climates  
Roof RSI value as high as  
RSI-9.1 (R-52)

Lowest Thermal Resistance  
Roof RSI value as high as  
RSI-5.6 (R-32)

Note: Adding extra roof insulation did not prove cost-effective if the building was heated using natural gas, but was cost-effective if heated via electricity

# Low-Energy Model



Spray Foam  
Insulation  
below slab

Temperature  
maintained just  
above freezing in  
cold climates

Floor  
above  
Parkade

Note: Increasing insulation thickness  
decreases clearance of the parking garage,  
potentially resulting in higher capital costs if  
additional clearance required.



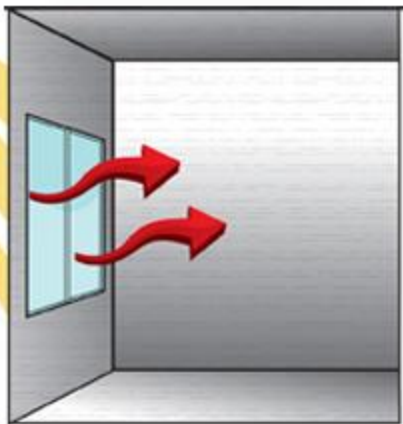
# Low-Energy Model

## Windows

Benefits of Sunlight



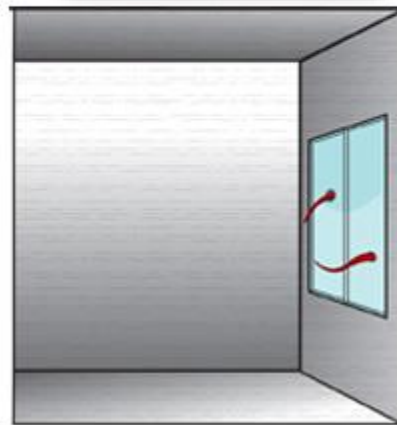
Ability to heat spaces



Offset by



Prime source of heat loss



# Low-Energy Model

Reduction of the  
window area

Investigated to  
determine  
potential  
impact on  
heating loads

Not beneficial when using higher-  
performing windows



# Low-Energy Model



The impact of quadruple-pane windows was investigated

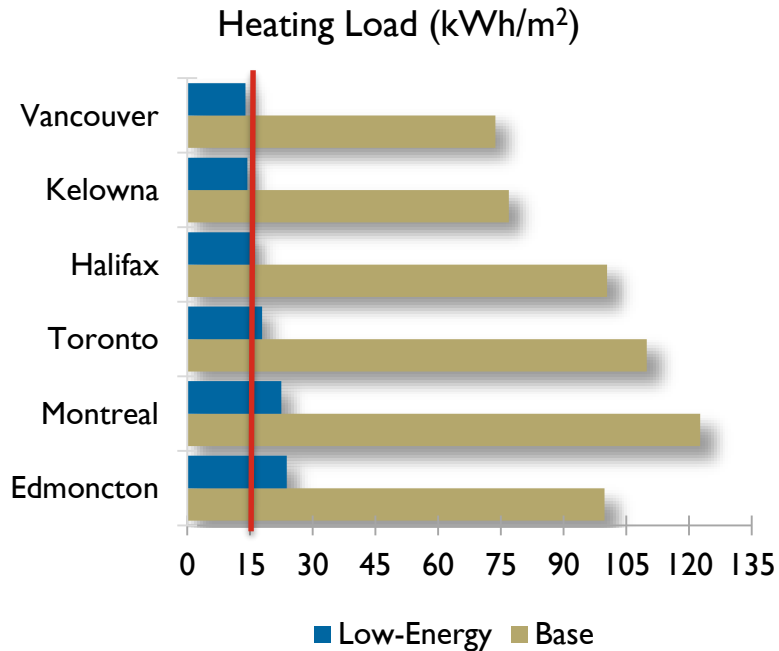
Note

Quadruple-pane windows

Not cost effective compared to triple-paned windows

Significantly reduced heating loads in colder climates

# Low-Energy Model



MURBs in milder climates



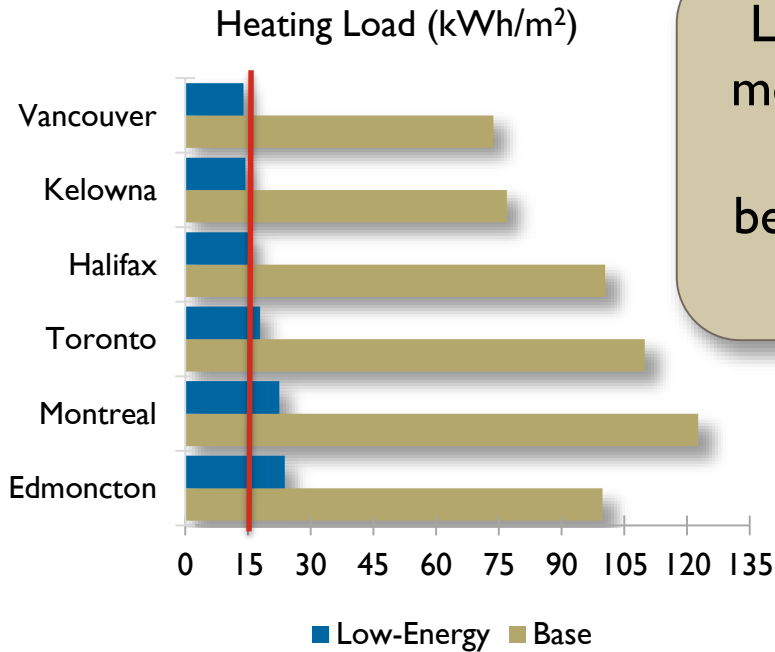
Lower space heating loads



MURBs in colder climates

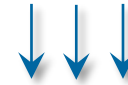


# Low-Energy Model



Low-Energy model savings ranged between 76% and 84%

MURBs in milder climates



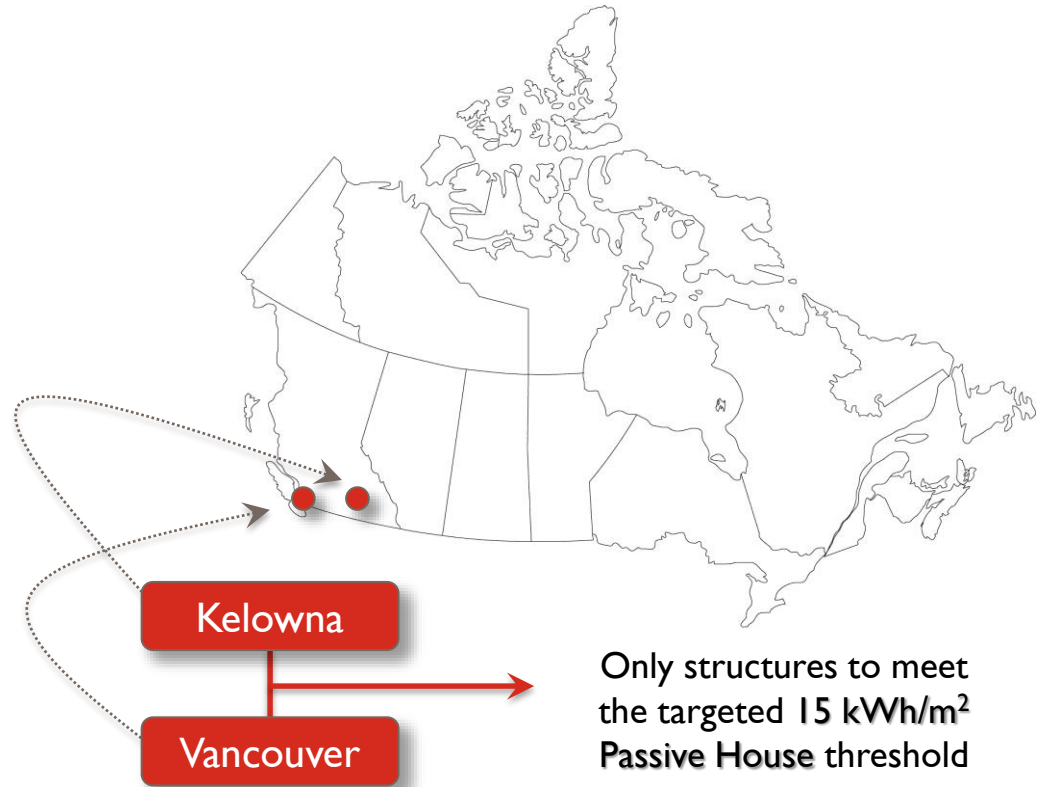
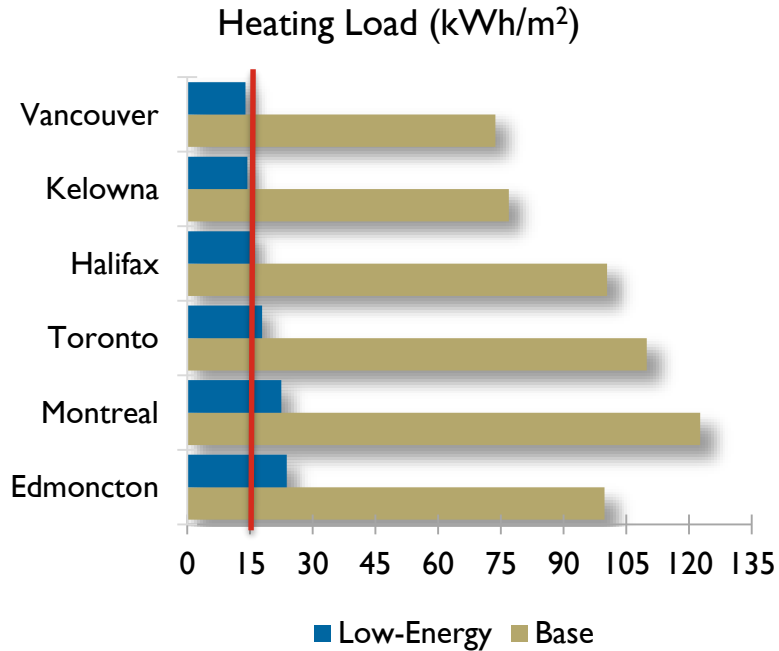
Lower space heating loads



MURBs in colder climates



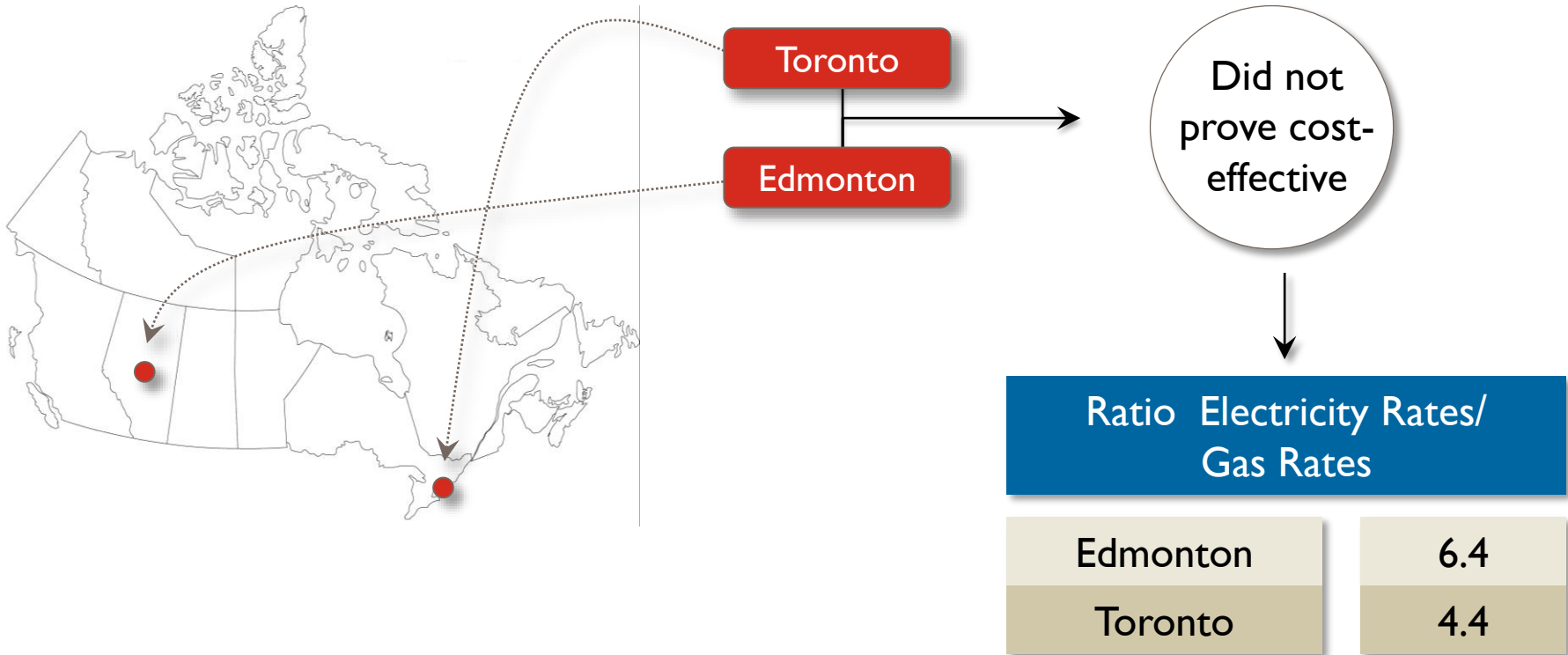
# Low-Energy Model



# Low-Energy Model

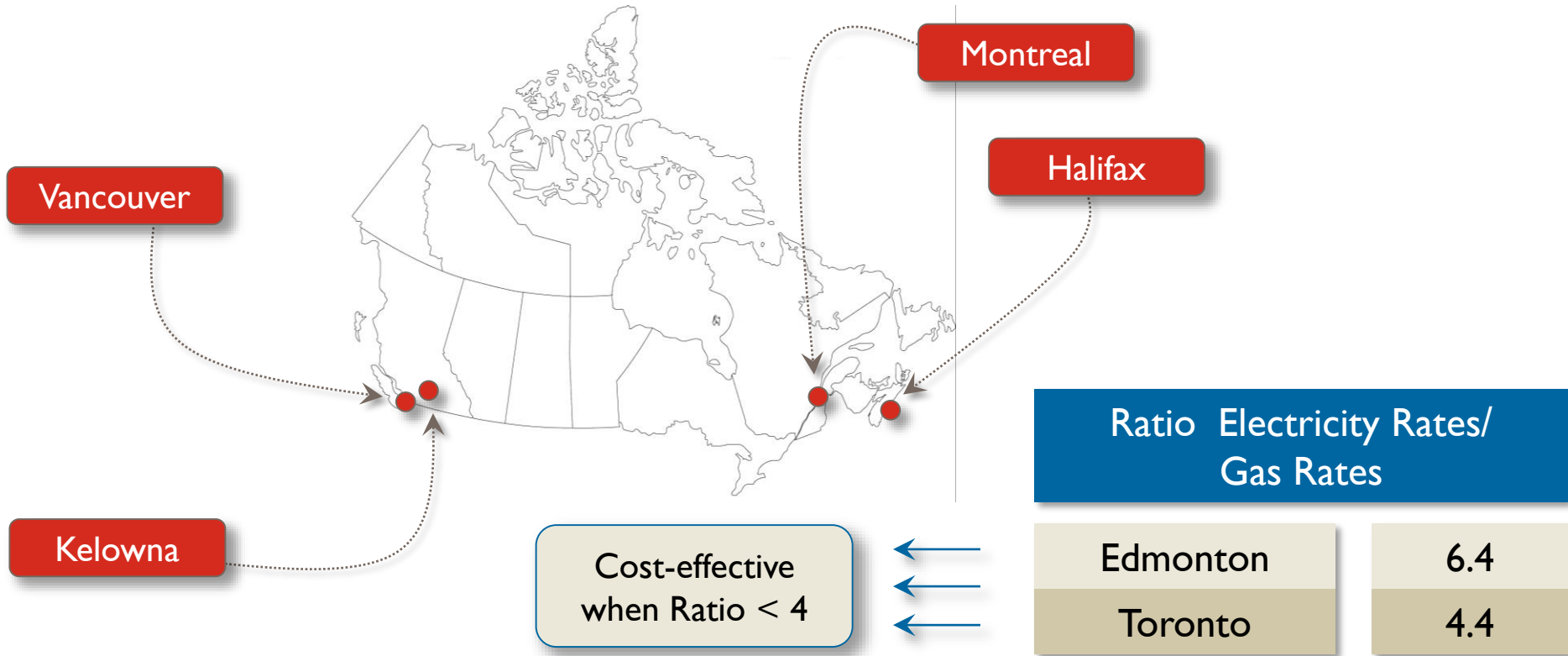
| Location  | Heating Load (kWh/m <sup>2</sup> ) |            | Economic Results |                         |
|-----------|------------------------------------|------------|------------------|-------------------------|
|           | Base                               | Low-energy | Payback Period   | Internal Rate of Return |
| Edmonton  | 99.8                               | 23.8       | > 30 yrs.        | N/A                     |
| Montreal  | 122.7                              | 22.5       | 6.7 yrs.         | 20.3%                   |
| Toronto   | 109.9                              | 17.9       | > 30 yrs.        | 5.5%                    |
| Halifax   | 100.4                              | 15.7       | 8.2 yrs.         | 17.1%                   |
| Kelowna   | 76.9                               | 14.4       | 10.4 yrs.        | 13.2%                   |
| Vancouver | 73.7                               | 13.9       | 11.7 yrs.        | 8.1%                    |

# Low-Energy Model

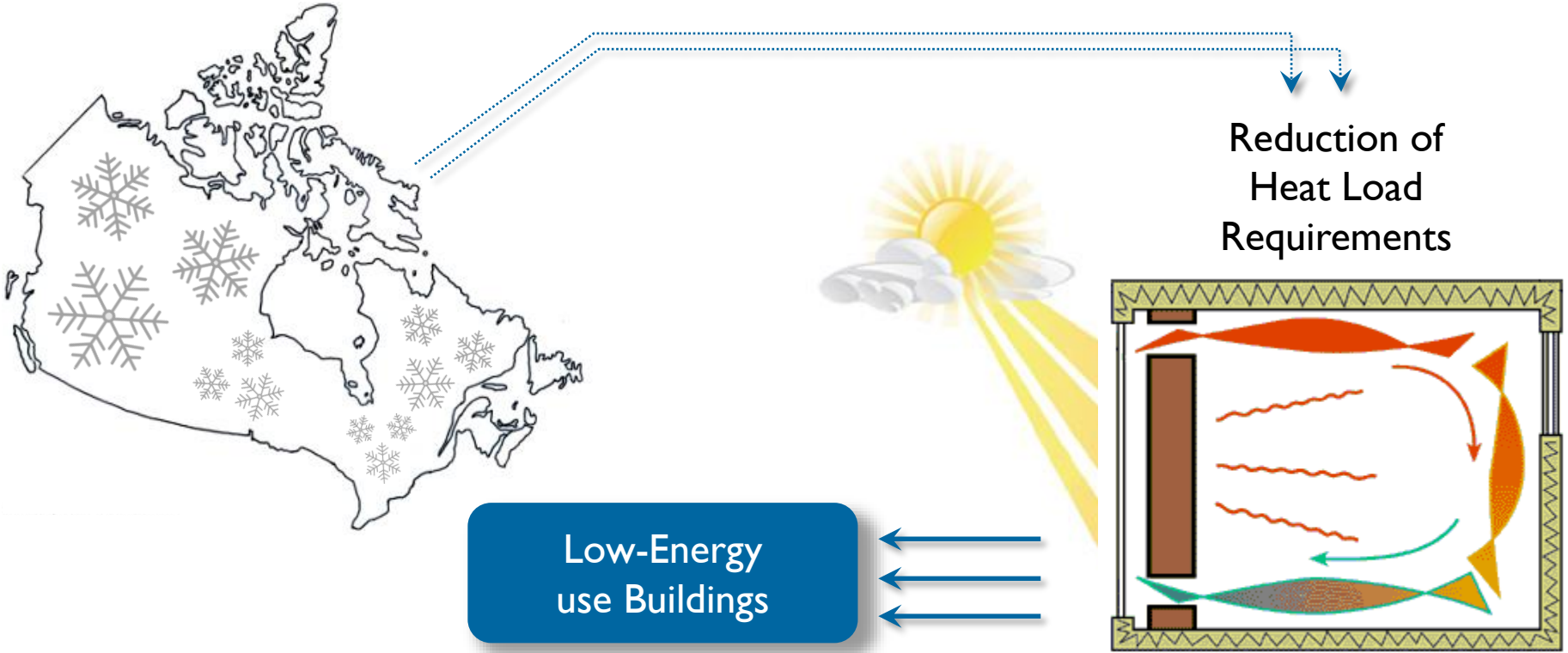




# Low-Energy Model

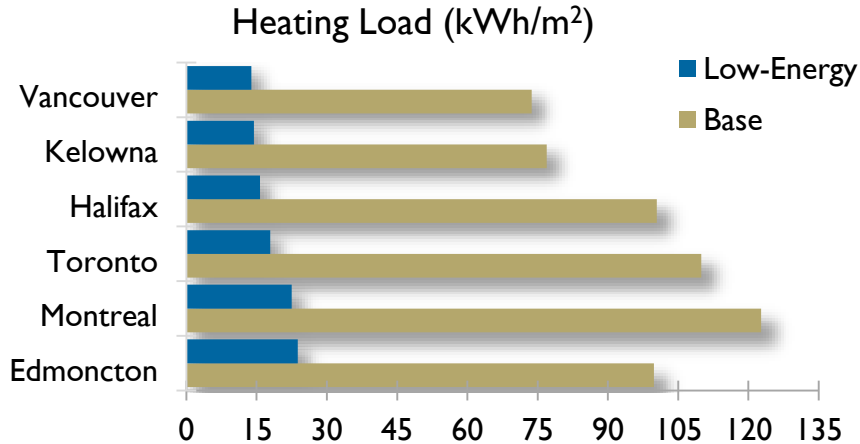
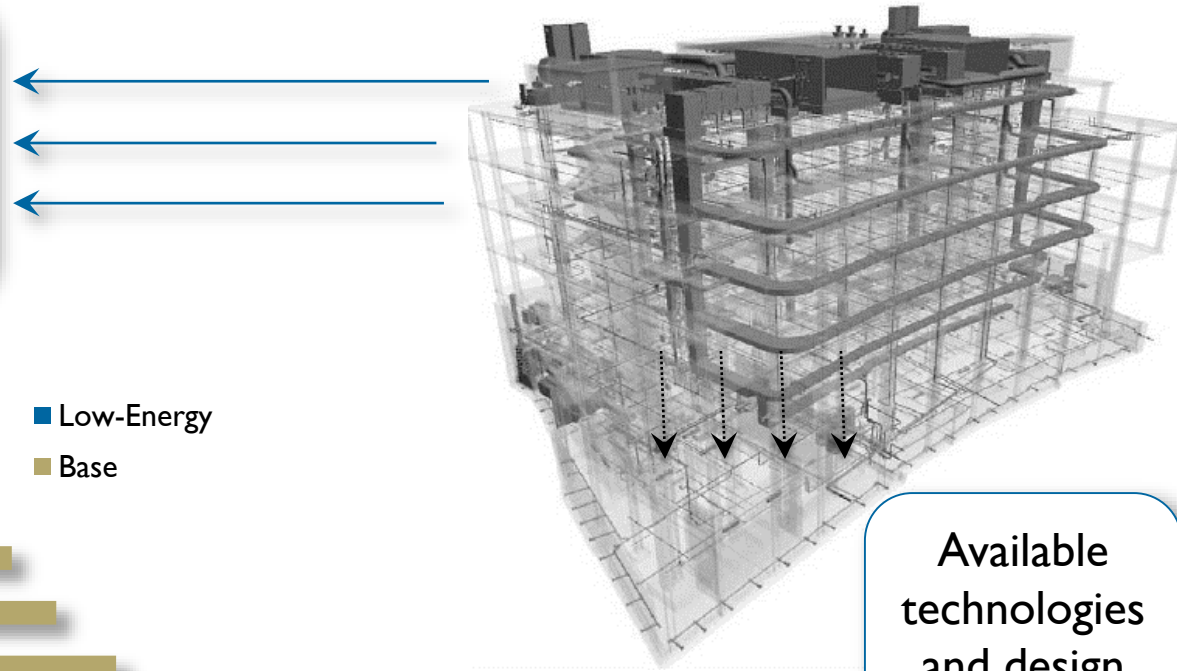


# Conclusions



# Conclusions

Significant Reduction in Space Heating Requirements in Newly Constructed MURBs

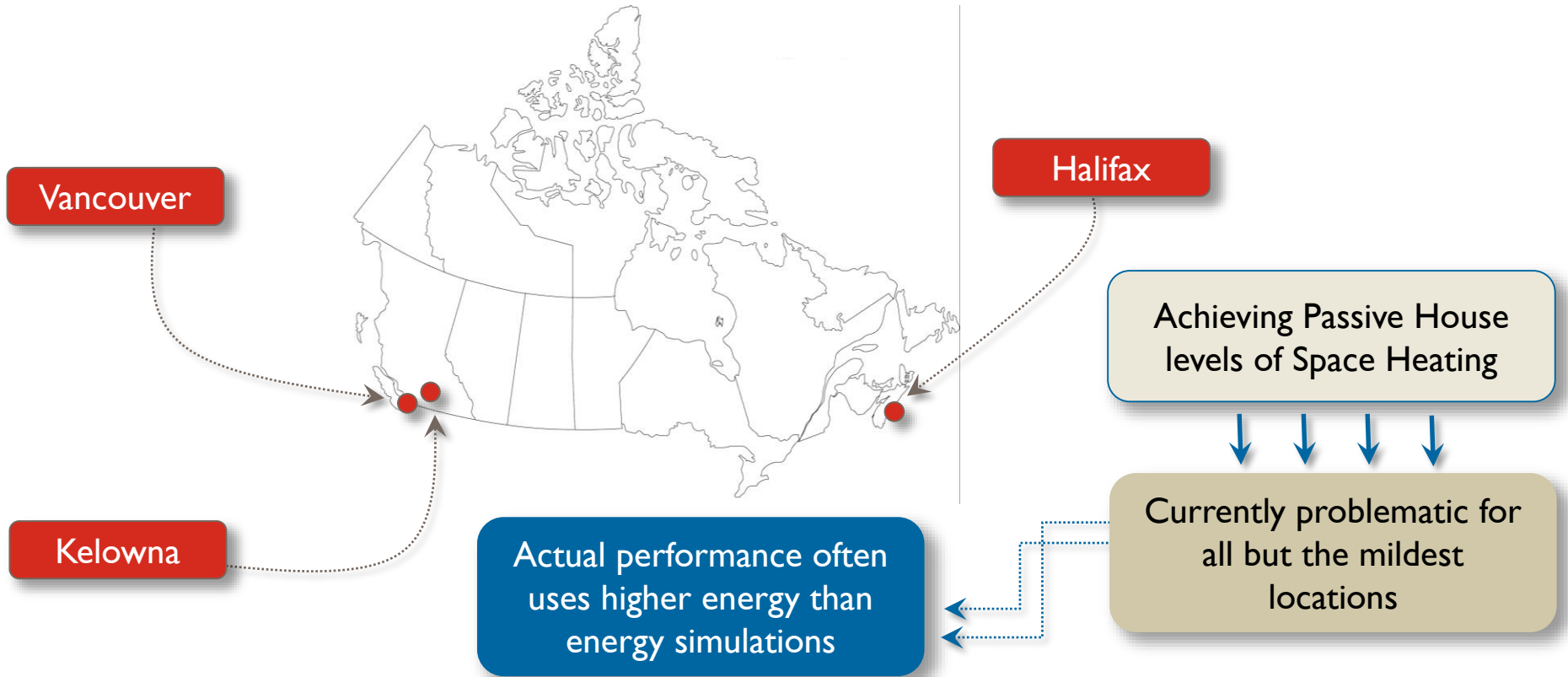


Available technologies and design practises

# Conclusions



# Conclusions





# Thank You

Claude Gautreau

CMHC Knowledge Transfer and Outreach

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