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Building Retrofits for SMES

Part 1: Where To Start

2020

What is EnviroCentre?

EnviroCentre:
Your local environmental non-profit

Our mission is to provide people, communities, and organizations in Ottawa with practical solutions to lighten their environmental impact in lasting ways.

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Our work focuses on four main areas

Green Homes

Active Transportation

Green Lifestyles

Green Business

Energy Services

- Home and MURB Energy Audits
- Business Energy Analysis and Audits
- Business carbon accounting (through Carbon 613)
- Green Audits

Carbon 613:
EnviroCentre's program for businesses

- Membership based program for Ottawa businesses
- Access to events, resources, discounts
- Comprehensive tools for Carbon analysis and target setting
- Local network of businesses committed to climate action

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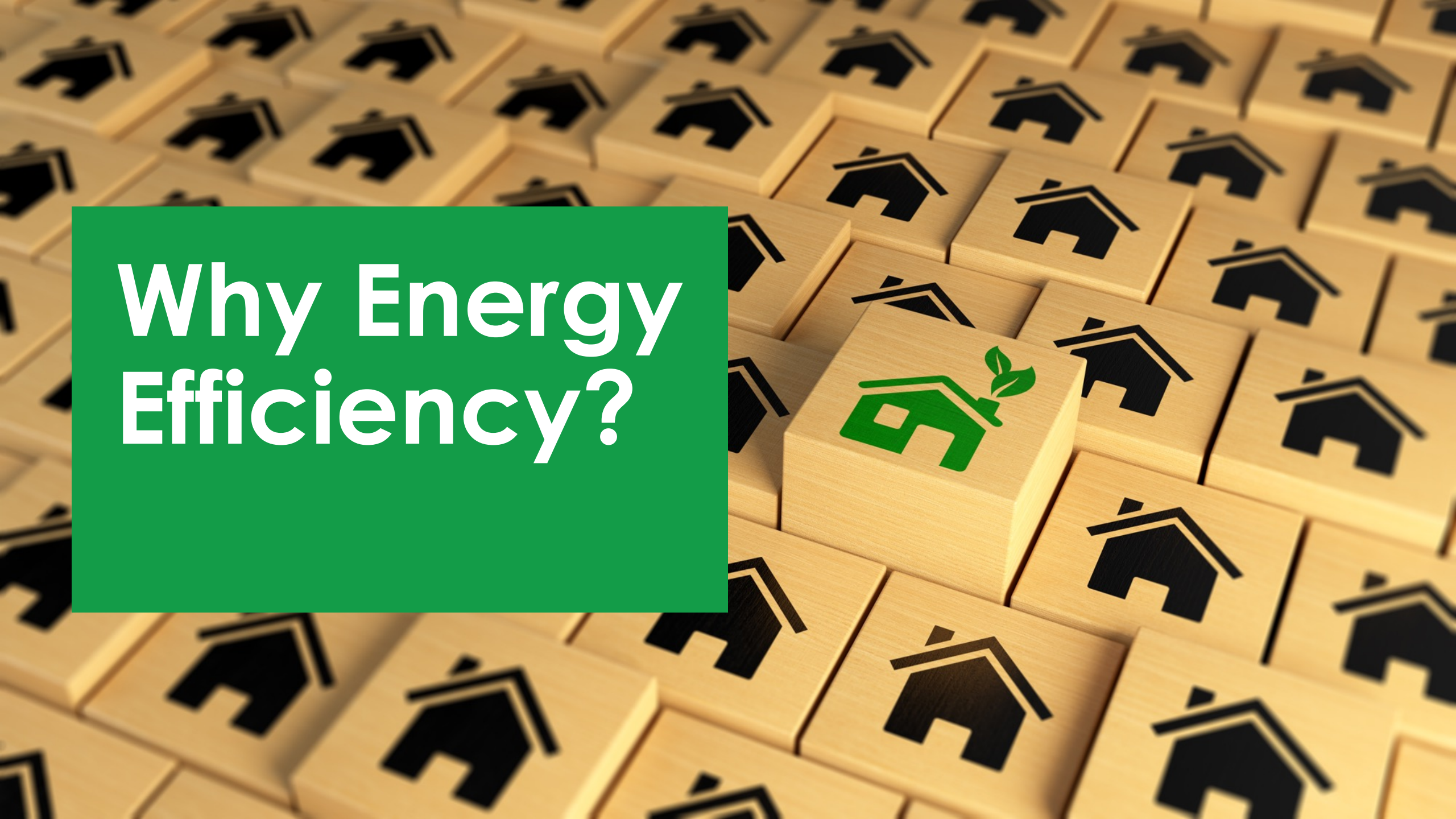
Who I am

- Greg Furlong, Senior Energy Analyst
- Energy Advisor – NRCan, CHBA Net Zero, ENERGY STAR etc.
- Certified Energy Manager (AEE)
- Over 100 MURBs assessed plus a dozen commercial audits
- More than 700 private homes since 2003
- Co-founder of a successful retail business in Toronto

Our goals today

1. Understand energy and carbon trends for small businesses
2. Understand the specific benefits of energy retrofits
3. Success stories


Why Energy Efficiency?

Energy Efficiency

- Average building wastes 30% of its energy!
- Energy savings: less waste
- Smaller equipment and infrastructure needs
- Lower peaks of energy use
- $ Savings
- Less CO_2 production
- Lower pollution – cleaner air

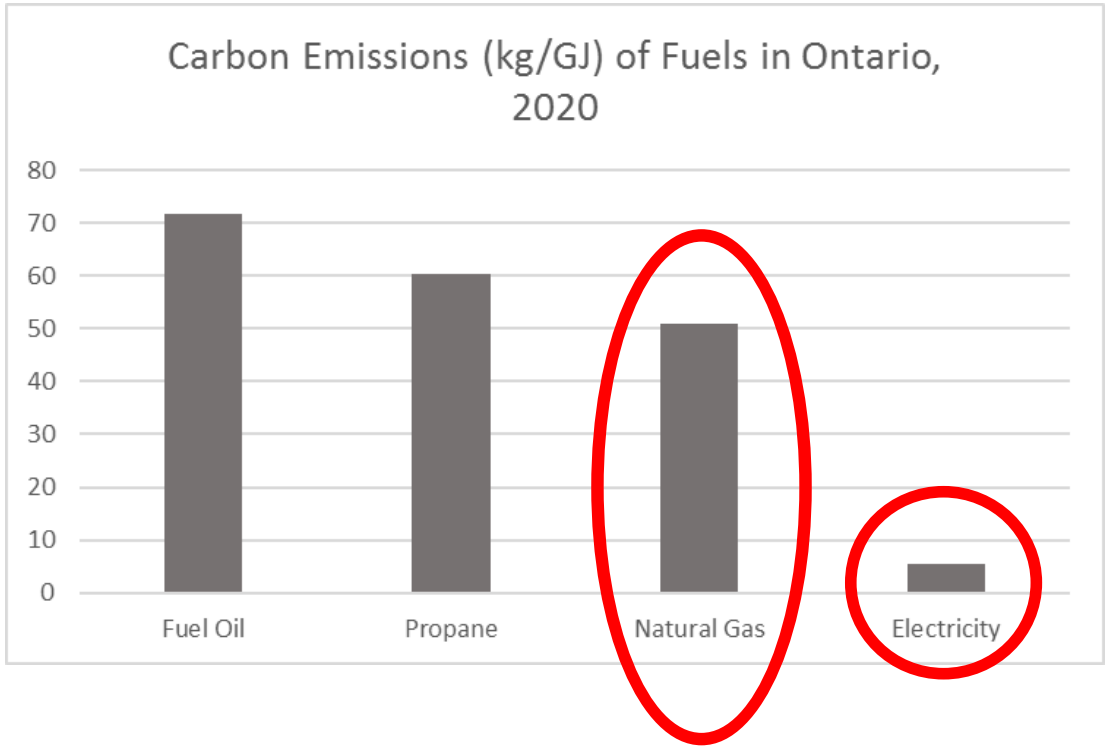
Energy efficiency & economic gains

- Commercial efficiency rising about **2.5%** per year – about $420 million in savings.
- But … energy use still rising **1.8%** ear (more enterprises and activities).
- National carbon output rising at the same rate.
- Easiest way to drop carbon while maintaining growth: reduce combustion, switch to cleaner, efficient energy sources - **stop burning things!**

Carbon content

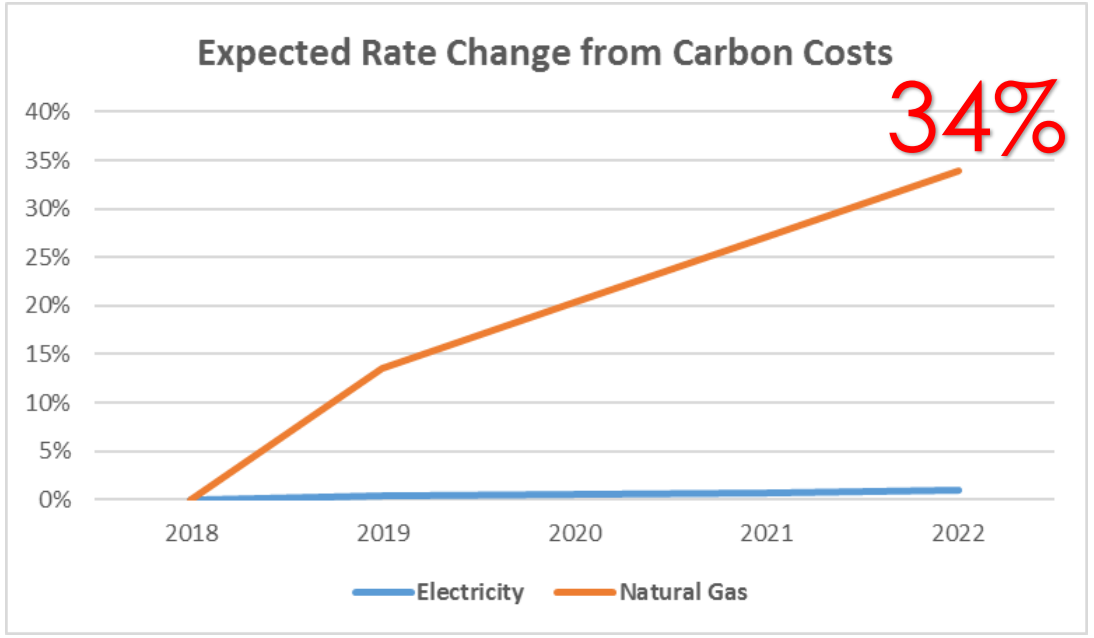
- Amount varies a lot for the same amount of energy

- Natural Gas: 10 times the carbon of Electricity in Ontario



Carbon pricing and energy efficiency

- Carbon Pricing is here: EU began in 2005, now at 30 € ($44) per tonne of CO2
- Canada introduced $20/t in 2019, but rising to $50 by 2022
- Cost of electricity only rising 1%, but gas will go up 34% by 2022
- Efficiency will lower your carbon fees - especially if you fuel switch to electricity

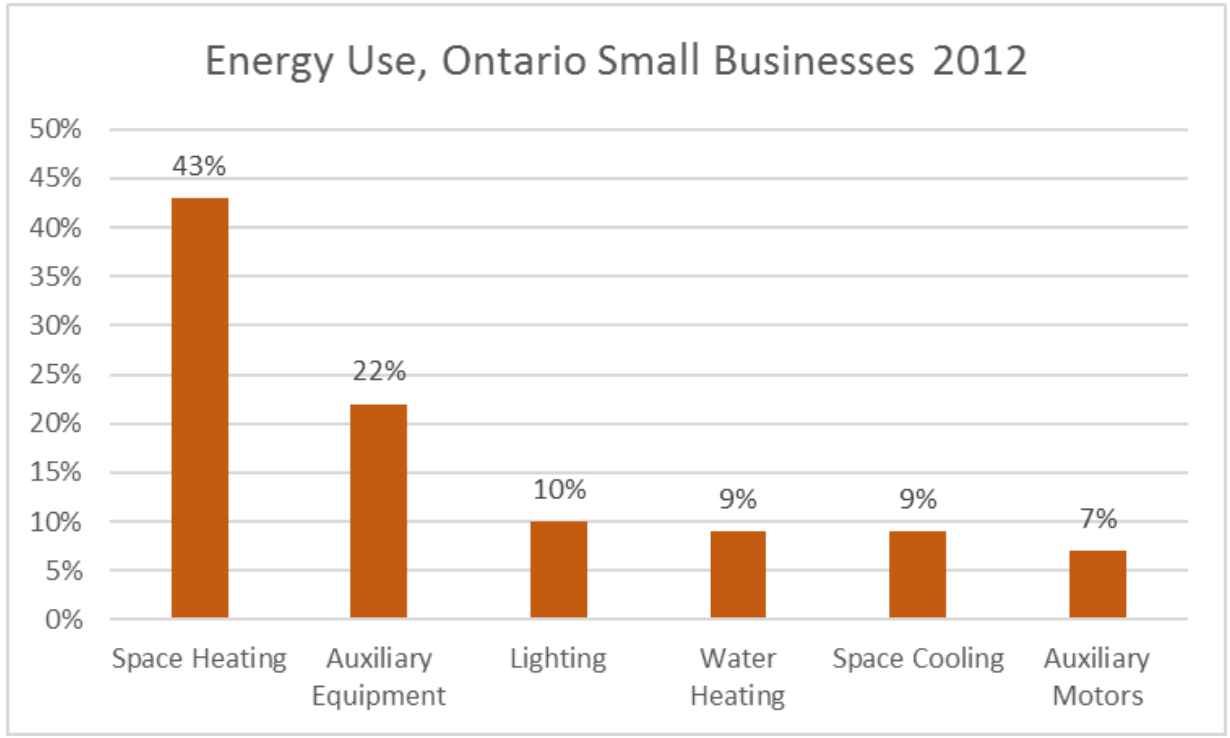


Net Zero targets: the changing world

- Net Zero energy means
  consumption = generation onsite
- Net Zero carbon is the same, but with carbon offsets
- Feds currently aiming at 30% below 2005 levels by 2030
- Feds and City of Ottawa: Net Zero carbon by 2050
- City of Copenhagen: Net Zero carbon by 2025

Energy efficiency and my business

- Half of small Canadian businesses are in Ontario
- Breakdown shows heating/cooling account for more than 50%
- Auxiliary Equipment (22%) such as:
  - refrigeration
  - cooking
  - machinery
  - computers
  - office equipment etc.
- Note lighting: only 10%



energy savings

=

operating cost savings

What You Can Do: a High-Level Overview

Upgrades with Impact

- **Envelope: Airsealing and Insulation**
  - ✓ Lower heating load
  - ✓ Lower carbon footprint
  - ✓ Lower operating costs
- **HVAC upgrades can also have big impact, but**
  - ✓ Look at $ AND carbon savings
  - ✓ Avoid committing to combustion

Lighting retrofits

Source: Lightenco

- The answer is LEDs!
- Lighting retrofits can lower your operating costs
- But:
  - Small energy/carbon savings (Lighting only 10% of total)
  - Heating load will go up
  - **If you heat with Natural Gas, carbon costs and footprint also rise!**

Towards Net Zero

- **Solar Energy:** Assess your rooftop for solar production (~30 kWh/sq.ft. annually in Ottawa)
- **Energy Audit:** will identify
  - ✓ upgrades
  - ✓ sizing
  - ✓ costs and benefits
- **Create your plan** to lower energy use to match your solar production

Efficiency

Benefits to Your Business

Utility Rates

Natural Gas

Rate 6:

- 35 ¢/m^3
- $985 / year fixed cost

Electricity

Demand less than 50 kW:

- 14 ¢/kWh (mid-peak)
- $270 / year fixed

Demand of 50 to 1500 kW:

- Wholesale market rates for kWh
- $11.30 / kW demand
- Demand can cost more than consumption
- $2712 / year fixed

Significant, low risk ROI

Building envelope improvements

- 20% savings on a $15k heating bill is $3k per year:
  - ✓ NPV = $26k at 3% over 10 years,
  - ✓ Plus added property value

- 60% savings earns $9k:
  - ✓ NPV = $77k
- However, much higher capital costs!

Significant, low risk ROI

Equipment:

- Reduce carbon costs and footprint by 70-90%:
  - ✓ Replace AC with Heat Pump technology
  - ✓ Same operating costs
  - ✓ Small incremental costs
  - ✓ Includes cooling

- Solar panels:
  - ✓ 2,000 sq.ft. in Ottawa produces 40,000 kWh yearly ($5.6k value)
  - ✓ NPV = $48k
  - ✓ no moving parts
  - ✓ 25-year warrantee

More comfort for clients, employees & tenants

- More uniform heat and air conditioning
- Less air movement
- Better ventilation
- Better humidity control
- Fewer complaints!

Reduced maintenance

- Smaller equipment requirements
- With heat pumps, fewer pieces of equipment to maintain
- Less ice buildup – less roof damage

Reduced CO_2 emissions

- Electricity upgrades like lighting have a small impact (<5% reduction)
- Upgrading to similar HVAC equipment has medium impact (5-30%)
- Envelope upgrades have medium impact (5-40%)
- Upgrading to Heat Pumps has big impact (50-95%)
- Carbon pricing means added $ value on emissions reductions

Marketing advantages

IKEA: "*No method is more effective than the good example*" – Ingvar Kamprad

- *Save money and the planet, without leaving your home*
- *Top tips for sustainable living*

MEC: Public statements on sustainability including Carbon Footprint

- Named Canada's most trusted brand by the Gustavson Brand Trust Index
- Selected as one of Canada's top employers and greenest employers by MediaCorp

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Incentives and Support

Prescriptive or Performance Incentives:

- Hydro Ottawa: SaveONEnergy
- Enbridge: Smart Savings

Financial Support for Industry:

- NRCan: ISO 50001 Standard

Federal Tax Provision for Clean Energy Equipment:

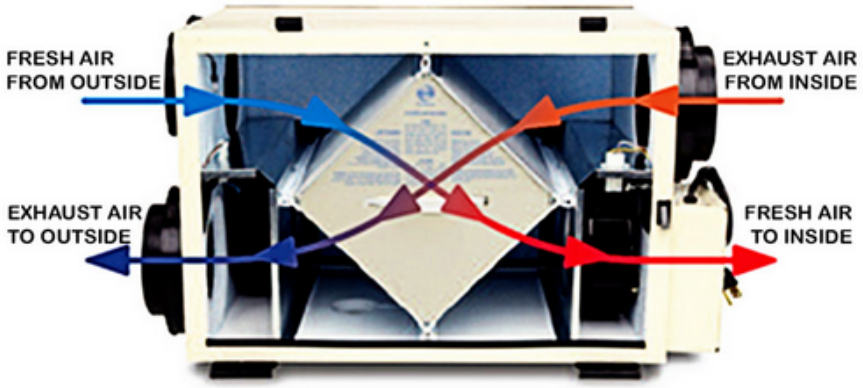
- Classes 43.1 and 43.2 of Schedule II

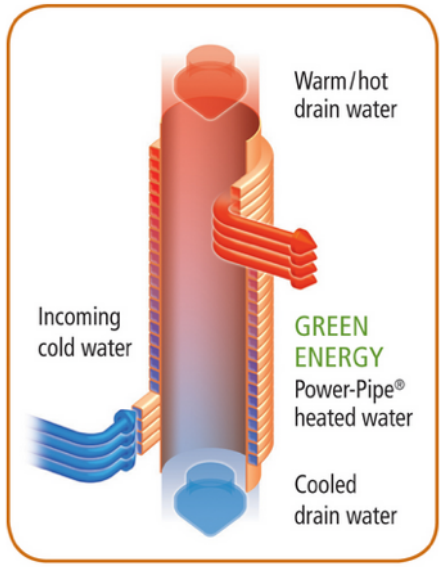
The Technology

Insulation

- Very poor conductor of heat, due to trapped air
- Installed between inside and outside
- Not necessarily airtight
  - ✓ Loose: fibrous stuffing is packed or blown.
  - ✓ Batts: fibrous blankets are fitted.
  - ✓ Boards: sheets of stiff material are fastened.
  - ✓ Foam: liquid foam is sprayed, then hardens.
- Boards and foam can also be airtight

Heat Exchangers



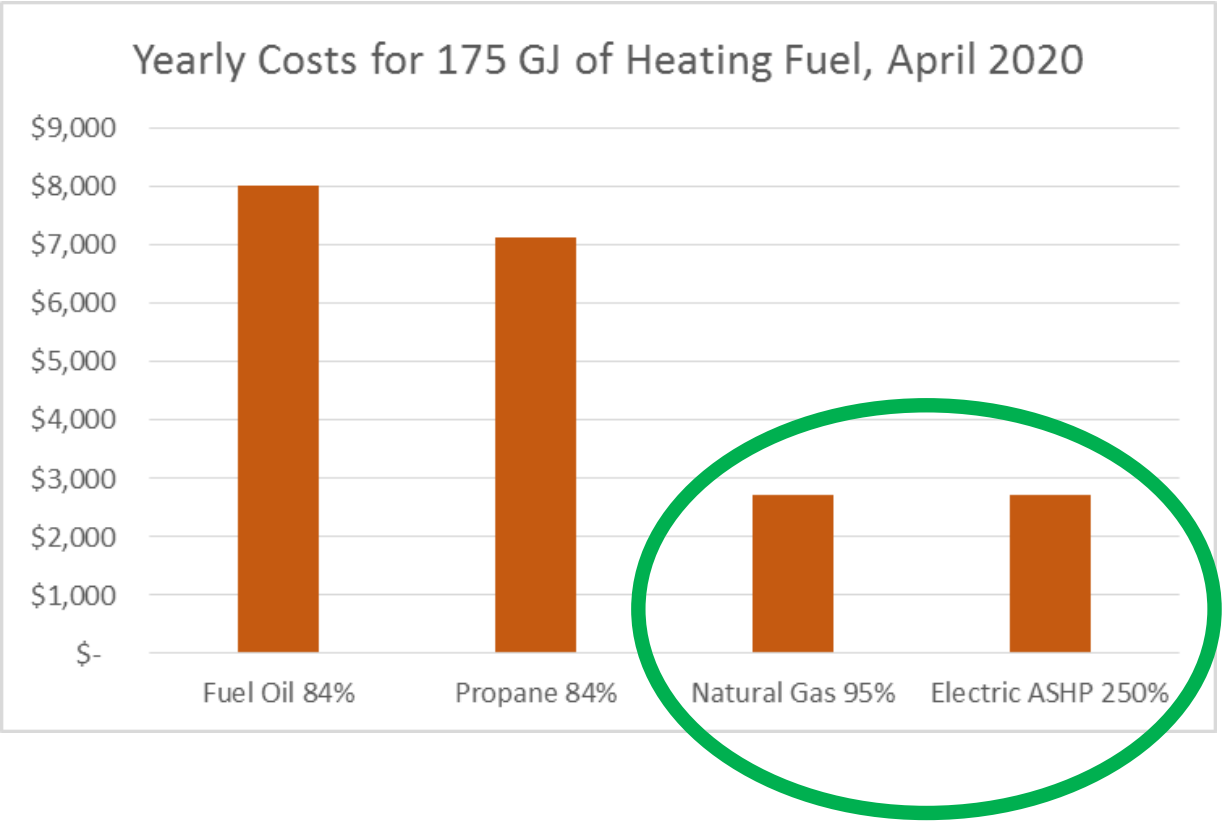


- Transfer heat energy from one flow to another flow
- The flows do not touch one another
- Are the basis of HRV, ERV and DWHR
- Also used in furnaces, boilers and automobiles (radiators)
- HRV/ERV takes heat from exhaust to fresh air (75%)
- DWHR unit: heat from drain to DHW inlet water (60%)

Heat Pump

- "Pumps" energy from one place to another
- Provides both heating and cooling
- 50% energy, 95% less CO2 than natural gas
- Operating costs now similar
- Now effective in colder climates like Ottawa
- Air-source (ASHP): COP of 1.5 to 3.5, cost ~$10K
- Ground or water source (GSHP, WSHP): COP of 3 to 5.5, but cost ~$25K

Electric Heat: Myth Busting



Is Electric Heating Inefficient?

- At least 100% (baseboards, etc)
- Heat Pumps: 200-400%

Is Electric Heat More Expensive than Natural Gas?

- Closing your Rate 6 gas account?
- Resistance heat costs more if over $1300 per year
- Heat pumps: If over $2700 per year

First Steps

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Where am I? *Benchmarking*

It's Canada's only standard benchmarking tool based on national, statistically valid data

Carbon 613 by envirocentre

More than just $: "Bookkeeping" that allows decisions based on the whole consumption picture

Data and analysis that accounts for

- kWh of Electricity
- m^3 of Natural Gas
- Litres of Oil
- m^3 of water
- Tonnes of CO_2

DIY, or help is available:

- **ENERGY STAR Portfolio Manager**
- Join **Carbon 613**
- Energy Audit – see next slide

Energy Audit

Typical Commercial Audit (ASHRAE Level 2) looks at:

- Benchmarking (from bills) your energy and water consumption
- HVAC
- Building envelope
- Process equipment
- Utility and cost analysis
- Identifies upgrades, costs and benefits

Finding an evaluator

- **Office, retail, restaurant or workshop:** Energy Auditor or Energy Manager (Consulting Engineers, Utility Companies, Envari)

- **Rental properties:** Registered Energy Advisor (NRCan Service Organizations like EnviroCentre)

What do I get out of this process?

- Expert analysis of your current situation
- Expert recommendations
- Benefits and costs of upgrades
- Clear path to getting work done
- Guide to available incentives

Incentives – Utility Based

Independent Electricity Systems Operator (**IESO**: Hydro Ottawa or Hydro One)

- **SaveONEnergy Retrofit program**: Electricity savings only

Enbridge (Continuing Gas users only)

- **Smart Savings** for commercial buildings
- **Home Efficiency Rebate** for residential properties (non-MURB)

Incentives – Federal

Financial Support for Industry: NRCan: **ISO 50001 Standard**

- Energy Management Systems Standard
- Participating companies have improved energy performance by 10%
- Assistance up to 50% of eligible project costs

Federal Tax Provision for Clean Energy Equipment:

- Classes 43.1 and 43.2 of Schedule II
- **Fully expense your solar energy system and heat recovery equipment**
- CCA rate of 100%
- Abolishment of the first-year rule

If you Rent, Lease or Share

Influence Your Workplace

- Reduce energy use through behaviour
- Some small upgrades have big impact
- Join Carbon 613 for ongoing support

Influence Your Landlord

- Landlord's utility share may motivate
- Improvements add value
- Better tenant retention
- Discuss renos during lease negotiations
- Tell them about these workshops!

Building a Plan

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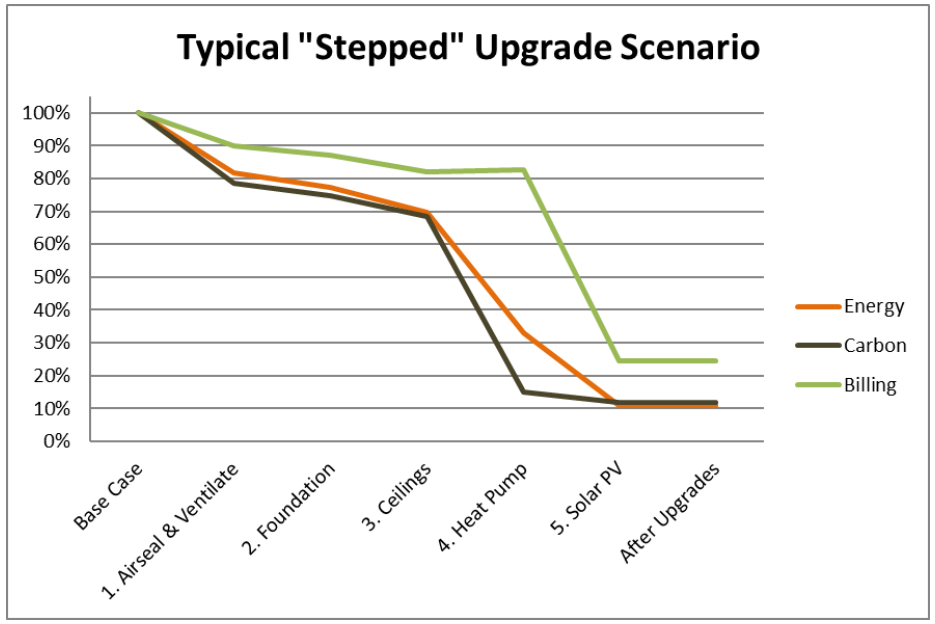
What do I want?

- Determine your upgrade goals
- Include efficiency and carbon upgrades
- Accept advice from impartial experts
- Work within your business plan and budget

Who builds the efficiency plan?

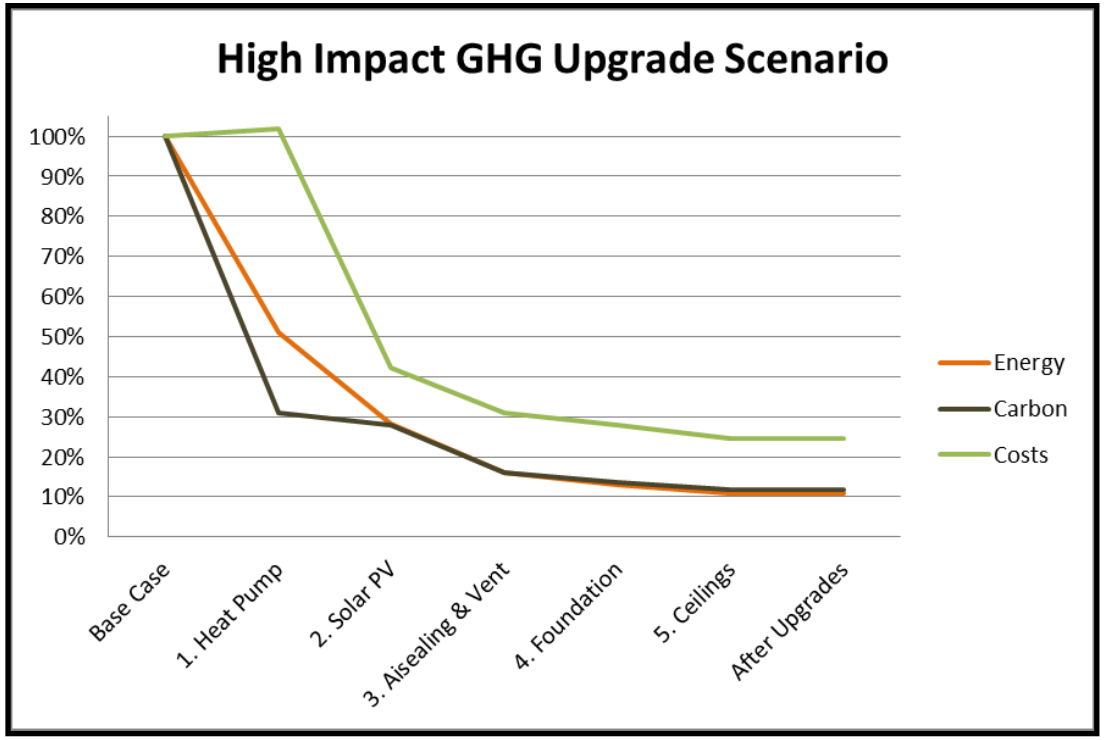
- The energy auditor, working with the needs of the business
- Can assist with
  - ✓ Sourcing contractors
  - ✓ Applying for incentives

Stepped plan



1. Best for ensuring cashflow on a tight budget
2. Implement the cost-effective upgrades first
3. Use savings to finance further upgrades
4. Use incremental costs if equipment is due for replacement anyway

High Impact GHG plan



1. Front-loaded costs, but greater savings in all respects
2. Implement the equipment upgrades first: Solar PV, Heat Pumps
3. Renovate building to match design capacity of equipment
4. Same capital costs for both approaches

Finding the right Contractors

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Choosing Contractors

- Find contractors you can trust and are comfortable with:
    - Ask lots of questions
    - Talk with previous customers
    - Visit past or current projects
- Have a detailed written contract
- Don't expect problem-free upgrades – hidden situations

Contractors: Advice from CHBA

- ✓Know what you want
- ✓Have a realistic budget
- ✓Plan for the long term – sequencing avoids having to redo
- ✓Protect yourself with a written agreement
- ✓Don't compromise on quality
- ✓Don't choose contractor on price alone
- ✓Beware direct sales

Green tools & certifications

Energy tools and certifications

Natural Resources Canada (NRCan): Data analysis software and modelling tools

HOT2000, RETScreen, CAN-Quest, Heat Pump Pre-Screening Tool etc.

These and other tools are available for free download at this site:

https://www.nrcan.gc.ca/maps-tools-publications/tools/modelling-tools/7417

Canadian Green Building Council (CaGBC):

Zero Carbon Building Standard and LEED

https://www.cagbc.org/CAGBC/Zero_Carbon/The_CaGBC_Zero_Carbon_Building_Program.aspx

PASSIVEHOUSE CANADA

Passive House and EnerPHit – PHI

https://www.passivehousecanada.com/about-passive-house/

Canadian Home Builders' Association

Net Zero Home Labelling

https://www.chba.ca/CHBA/HousingCanada/Net_Zero_Energy_Program/NZE_Qualified_Homes/CHBA/Housing_in_Canada/Net_Zero_Energy_Program/NZE_Qualified_Homes.aspx?hkey=6dfe0bb7-cd34-4395-9052-64219fe31a99

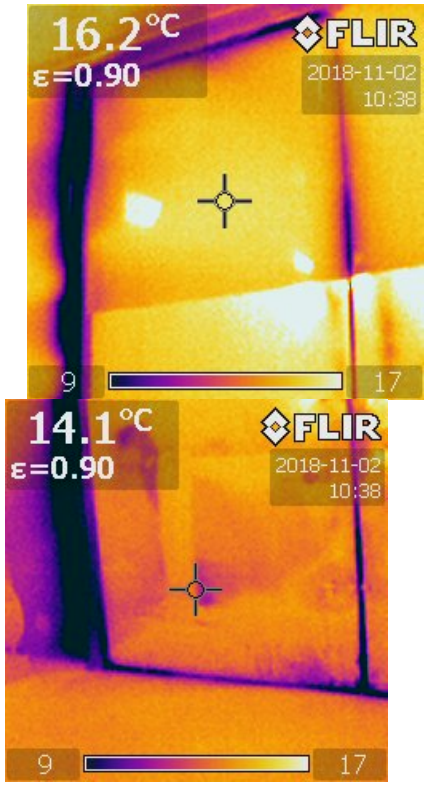
Easy Energy Efficiency Upgrades

Poorly insulated ceilings

Could reduce your heating by 10%

- **Attics:**
  - ✓ Airseal first, based on blower / IR testing.
  - ✓ Insulate: blown cellulose is very economical.
- **Flat roofs or cathedral ceilings:**
  - ✓ Custom approach based on the situation.
- **Added benefits:**
  - ✓ reduced leaks, smaller icicles, lower maintenance costs.

Uncontrolled air leakage



Reductions of 10% or more:

- Air Leakage Testing will tell you where and how much (e.g. EnviroCentre)
- Airseal gaps, cracks and openings
- Weatherstrip doors and windows
- Added benefits:
  - ✓ comfort, humidity control, health and safety (garages)

Any equipment producing heat or cold

Lots of energy use
=
Lots of opportunities for savings

- Furnaces or Boilers: Upgrade
- Air conditioners: Upgrade to heat pumps
- Makeup air: Use energy recovered from exhaust air to preheat
- Water heaters: Upgrade to point-of-use, add heat recovery for showers
- Refrigerators and freezers: Upgrade
- Dryers and Ovens: Upgrade, add heat recovery

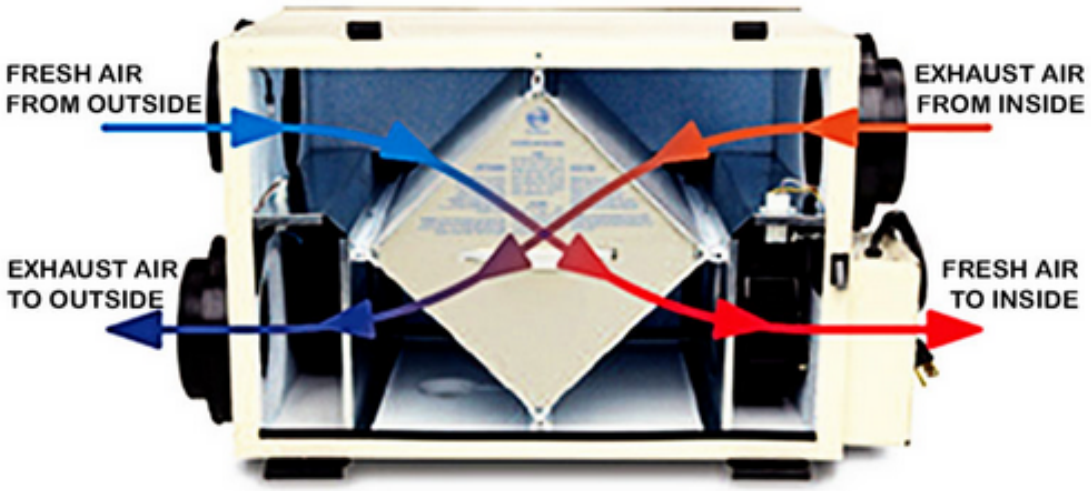
Idling or redundant equipment

Turn off, turn down or use timers:

- Phantom loads: transformers, idling office equipment
- Motors that run continuously
- HVAC systems after office hours
- Electric heaters for unused spaces
- Cabinet heaters for entryways (4000 W +)

For cost savings only: shift use to off-peak hours

Heat recovery from exhaust air



HRV or ERV - Fresh Air Machines recapture up to 75% of energy from exhaust

- **Heat Recovery Ventilator:** fresh air preheated for free
- **ERV:** preheated air with humidity regulation
- Low electrical consumption, but need regular cleaning maintenance
- Commercial and residential models available

Heat recovery from drainwater

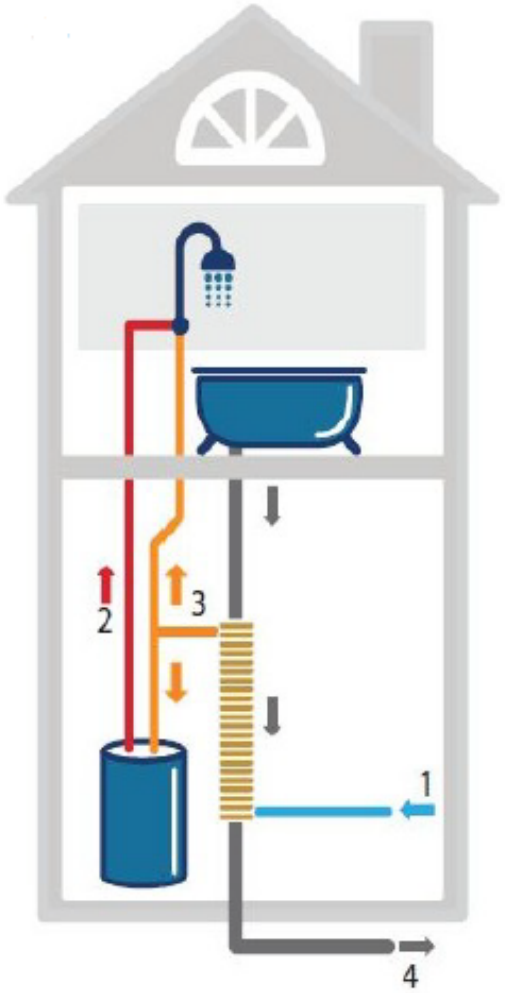


Image: ThermoDrain

DWHR – Hot water energy booster recaptures up to 60% of energy from drainwater (mainly showers)

- Drain Water Heat Recovery units have no moving parts, no maintenance
- Water coming into the water heater is preheated for free!
- Installed by plumber

Deeper Energy Efficiency Upgrades

Deep Retrofits
(more details in Part 2)

Empty wall cavities:
- Filling with cellulose saves up to 20% on heating

Exterior Wall Insulation:
- Board Insulation under new cladding also saves up to 20%, but more expensive

Foundation:
- Savings up to 20% for interior or exterior insulation. Can be cost-effective, but requires expert advice.

Windows:
- Upgrading is not usually cost-effective for energy (<10% savings), but increased property values

Solar Energy:
- Big capital cost, but high returns
- Net metering can offset your entire electricity usage each year
- Site assessment is necessary

Business Retrofit Examples

IKEA: global target is Net Zero by 2030

Image: IKEA

- Commitment to energy conservation including the supply network
- Solar panels on every roof
- Summertime peak reductions for electricity

Humber College NX Building: Retrofit to Zero Carbon

Image: CaGBC

- 70% less energy
- First retrofit project to achieve ZCB-Design certification from CaGBC
- Guided by Humber College's 20-year Integrated Energy Master Plan

Robert O. Pickard Environmental Centre: Cogeneration

Image: CBC

- Wastewater treatment plant
- 50% cogeneration from wastewater methane since 1998 (5 MW annually)
- Will be100% cogeneration by 2024 – just announced

OakWood Design Centre: Low Energy Retrofits

Image: Oakwood

- OakWood specializes in home renos
- Retrofits planned to achieve complete energy self-sufficiency
- PV is now installed

Want to go deeper?

Don’t Miss Part 2: from Plan to Project

- How to reach Net Zero
- More Details on Upgrades
- More about Benefits and Costs
- Available Incentives
- Getting Support

Discover other workshops in the *Let’s Talk Green Economy* series
www.envirocentre.ca/letstalk

Thank You!

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