Partners in Project Green

A Program of Toronto and Region Conservation Authority

GreenBiz Caledon:

Best Practices in Energy Management & Low Carbon Transportation

June 7th, 2022

8:30am to 10:00am

We respectfully acknowledge that we are situated on the Traditional Territories and Treaty Lands, in particular those of the Mississaugas of the Credit First Nation, as well as the Anishinaabe of the Williams Treaty First Nations, the Huron Wendat, the Haudenosaunee, and the Metis Nation.

As stewards of land and water resources within the Greater Toronto Region, Toronto and Region Conservation Authority appreciates and respects the history and diversity of the land and is grateful to have the opportunity to work and meet on this territory.

Additional Resources

- yrnature.ca/acknowledging_land
- edgeofthebush.ca
- native-land.ca
- Text 1-855-917-5263 with your City and Province to learn whose traditional territory you're on
  (standard text messaging rates may apply)

Agenda

- Introduction to GreenBiz
- Energy Efficiency Workshop
  - Energy Management Challenge/Benefits
  - The Seven Steps
  - Finding Opportunities for Energy Savings
  - Low Carbon Transportation
- Question & Answer Period

GreenBiz Caledon

Introduction

GreenBiz Resource Hub & Workshops

- **Free resources & support** to help businesses reduce their **carbon footprint, green their operations, and save on their bottom line**
- **Resource Hub** launching in June with tools, checklists, videos and more
- **Expert-led workshop series** provided throughout the year with practical steps for taking action
- Attend all four workshops for a chance at the **grand prize draw!**

GreenBiz Caledon

Register for the next workshop today!
https://partnersinprojectgreen.com/greenbiz-resource-hub/

Brought to you by:

TOWN OF CALEDON

Partners in Project Green
A Program of Toronto and Region Conservation Authority

Workshop Series

GreenBiz Caledon

Water Efficiency

May 31, 2022

- Best practice in conserving water
- Low impact development for stormwater management

Energy Management

June 7, 2022

- Energy savings, carbon reduction, habits of efficient companies
- Low carbon transportation

Waste Reduction

September, 2022

- Waste reduction strategies
- Waste audit tools and best practices

Employee Engagement

October, 2022

- Best practice in engaging employees
- Drive workplace sustainability actions

Resource Hub

- Free action-oriented videos, tools, and materials
- Share with your team and drive action at your company

https://partnersinprojectgreen.com/greenbiz-resource-hub/#GreenBiz-Hub

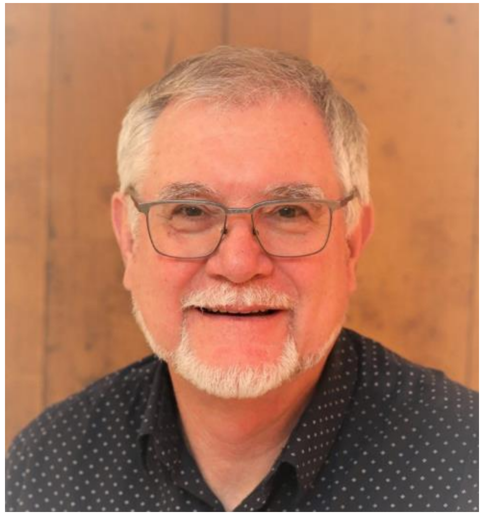
Putting Sustainability to Practice

- Access to **tools, guides, videos, and resources**
- **Develop** internal **knowledge** and **capacity**
- **Identify opportunities** cost **savings** and improving your environmental **impact**
- **Network and collaborate** with like-minded businesses
- Learn how to **access additional government incentives**
- Entry in the **Grand Prize Draw**

Incentives, Support, & Resources

- Save on Energy business programs
  - Retrofit, Small Business Program
- Enbridge Gas business programs
  - Equipment upgrades, new construction, retrofits and custom projects, audits and site assessments
- Local programs & resources
  - Caledon Financial Improvement Programs
  - Sustainable Transportation

Today’s Speakers



Stephen Dixon, B.Sc., M.A.Sc

Stephen Dixon, has for over 40 years, provided energy management services to a diverse range of industrial, commercial, institutional and utility organizations. Broadly recognized as a leader in energy management training, his focus is simple; to empower all that he works with to use energy more effectively by developing individual skills, organizational best practices and providing tools for energy management.

Gil Amdurski, Technical Coordinator, STEP

Gil Amdurski is a skilled consultant and researcher, with experience in renewable energy, sustainable technologies and energy auditing. He has a wide range of expertise in measurement and verification, test & monitoring equipment, energy monitoring & conservation, data analysis, and Energy Management Information Systems, among others.

Energy Efficiency Workshop

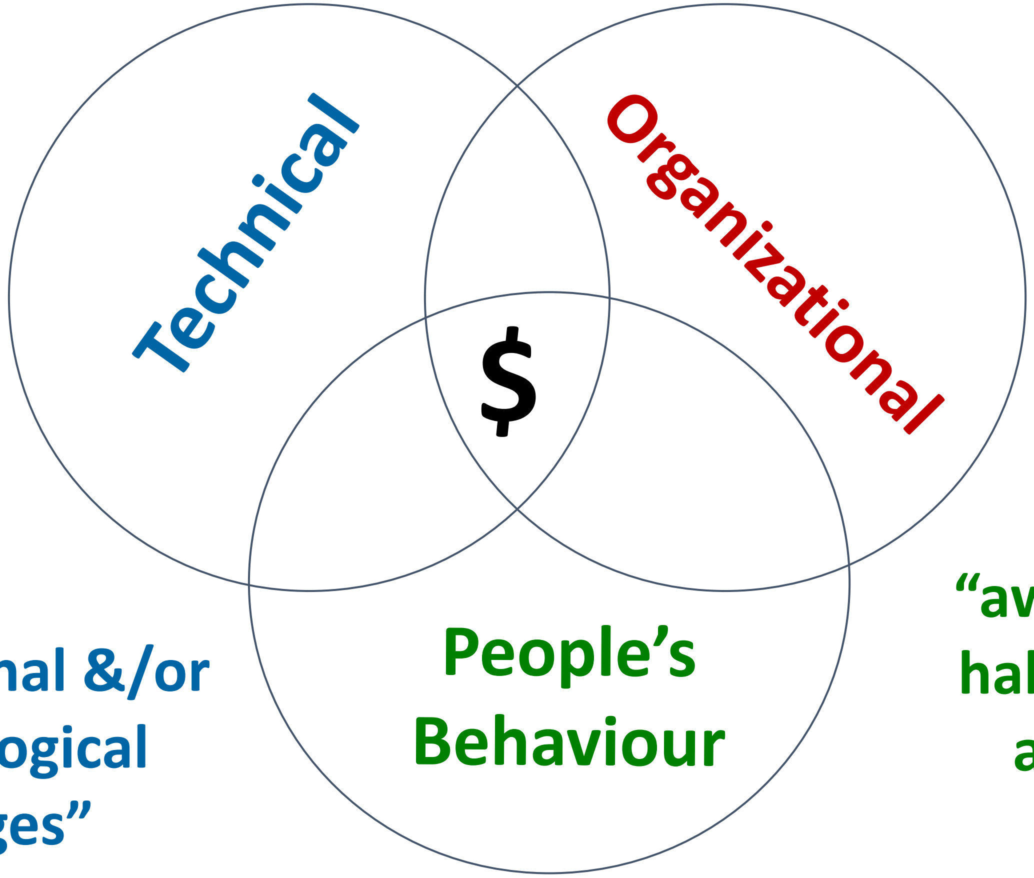
Energy Management Challenges/ Benefits

Bold Energy Facts

- Up to 30% energy reduction possible with 1.5 – 3.5 year paybacks
- Operational & behavioural changes could yield 10-20% savings.

The Dimensions of Energy Management

"working together to build an energy managing culture "



"operational &/or technological changes"

"awareness, better habits, procedures and feedback"

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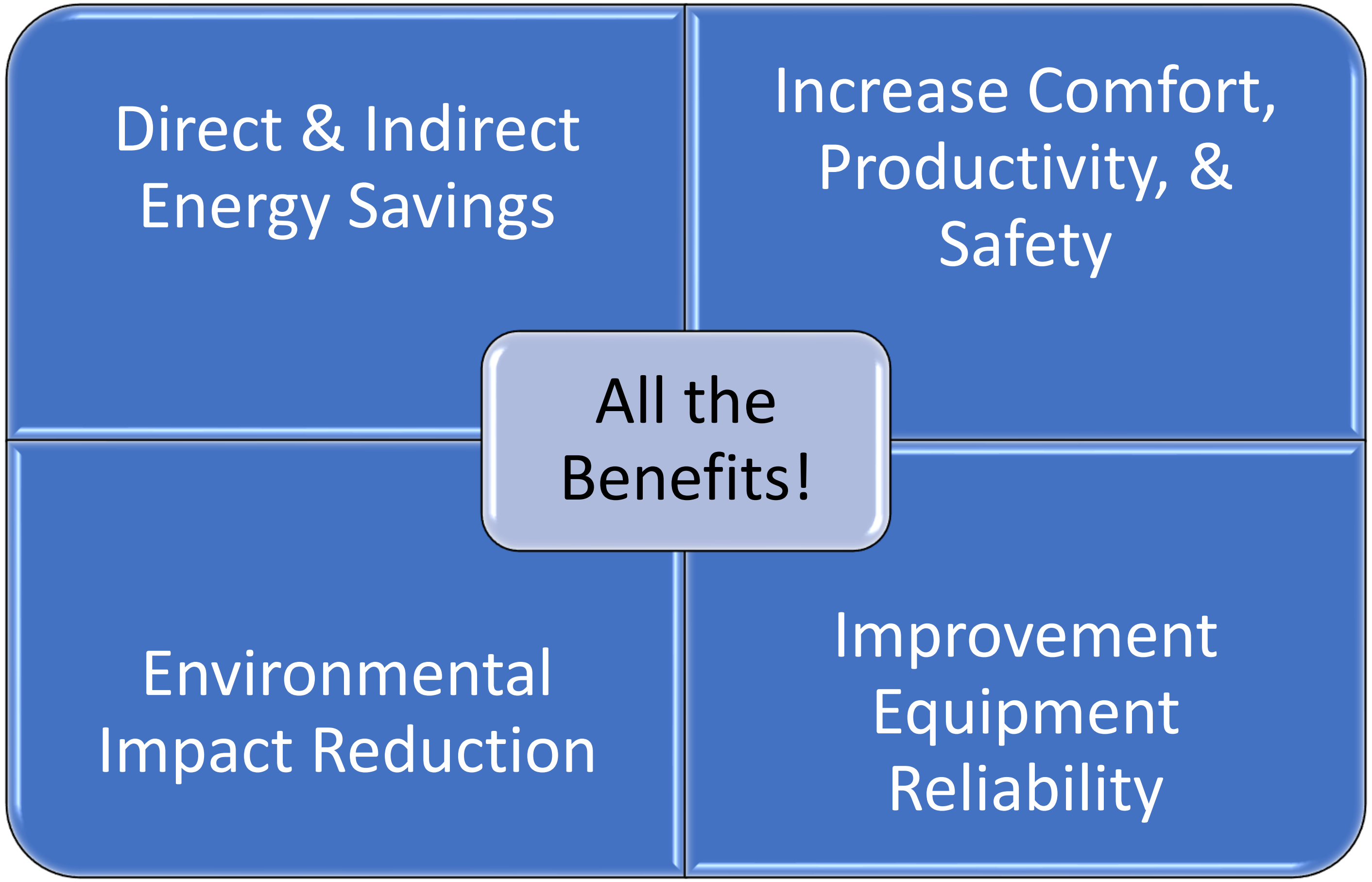
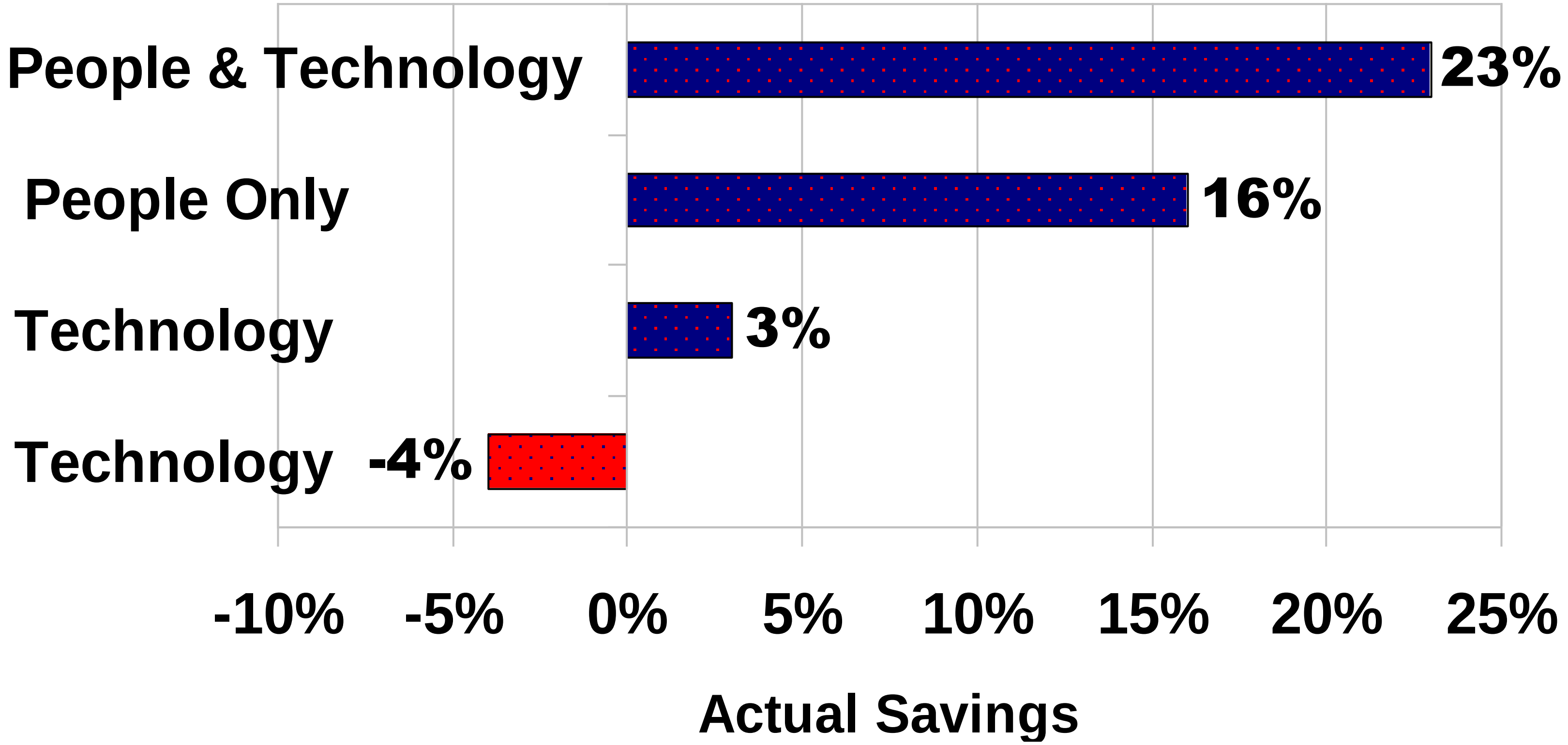
All of the Energy Management Benefits



Finally, ~~What~~ Creates Savings?

Who



Source: Good Practice Guide 84 Managing and Motivating Staff to Save Energy

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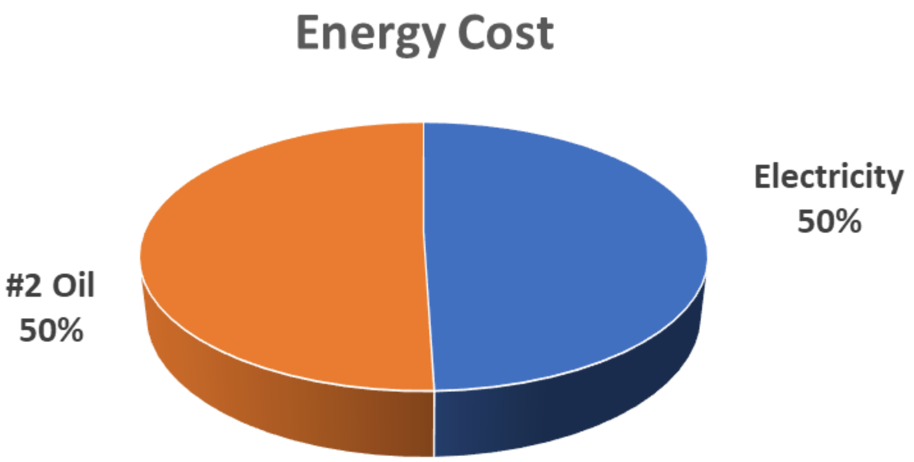
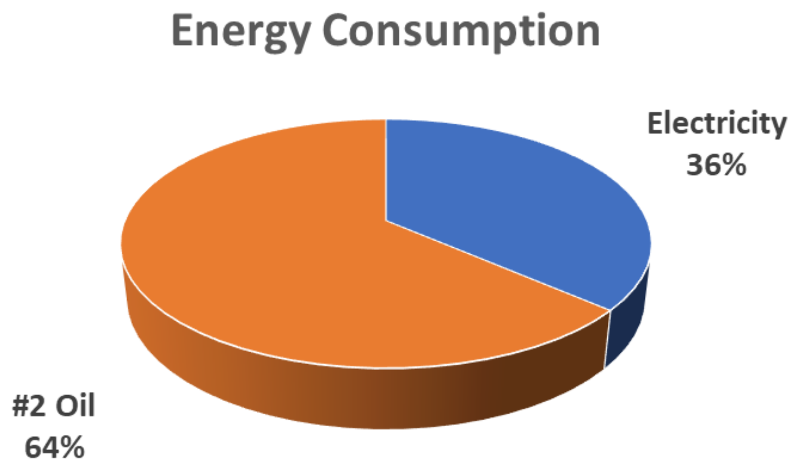
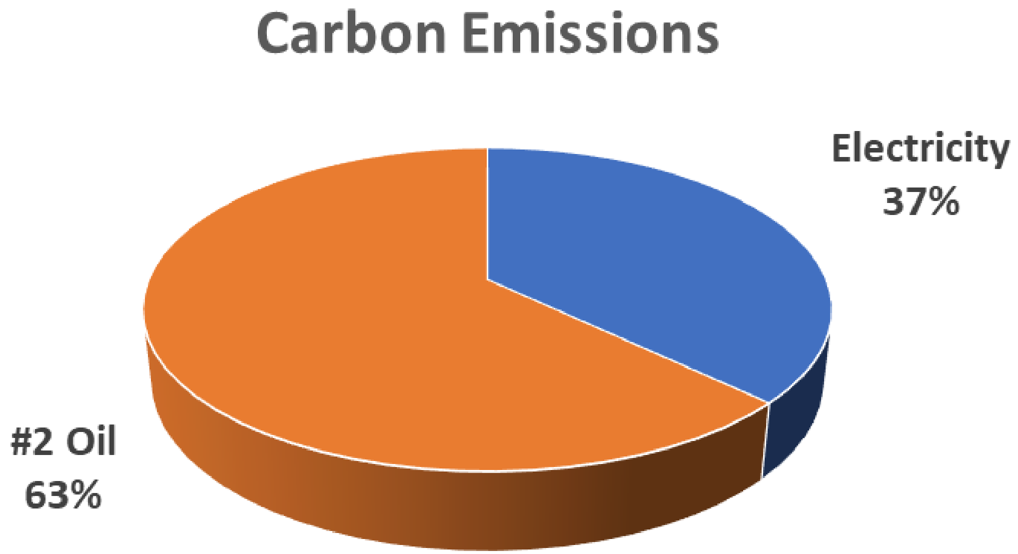
Cost , Energy & Carbon

(Medium Size Office Building in PEI)







The Seven Steps to Understanding & Reducing Energy Consumption

1. Understand Consumption Price & Cost
2. Compare Yourself to Benchmarks
3. Understand When Your Building Uses Energy
4. Understand Where Your Building Uses Energy
5. Eliminate Energy Waste
6. Improve Efficiency
7. Optimize Energy Supply

The Seven Steps

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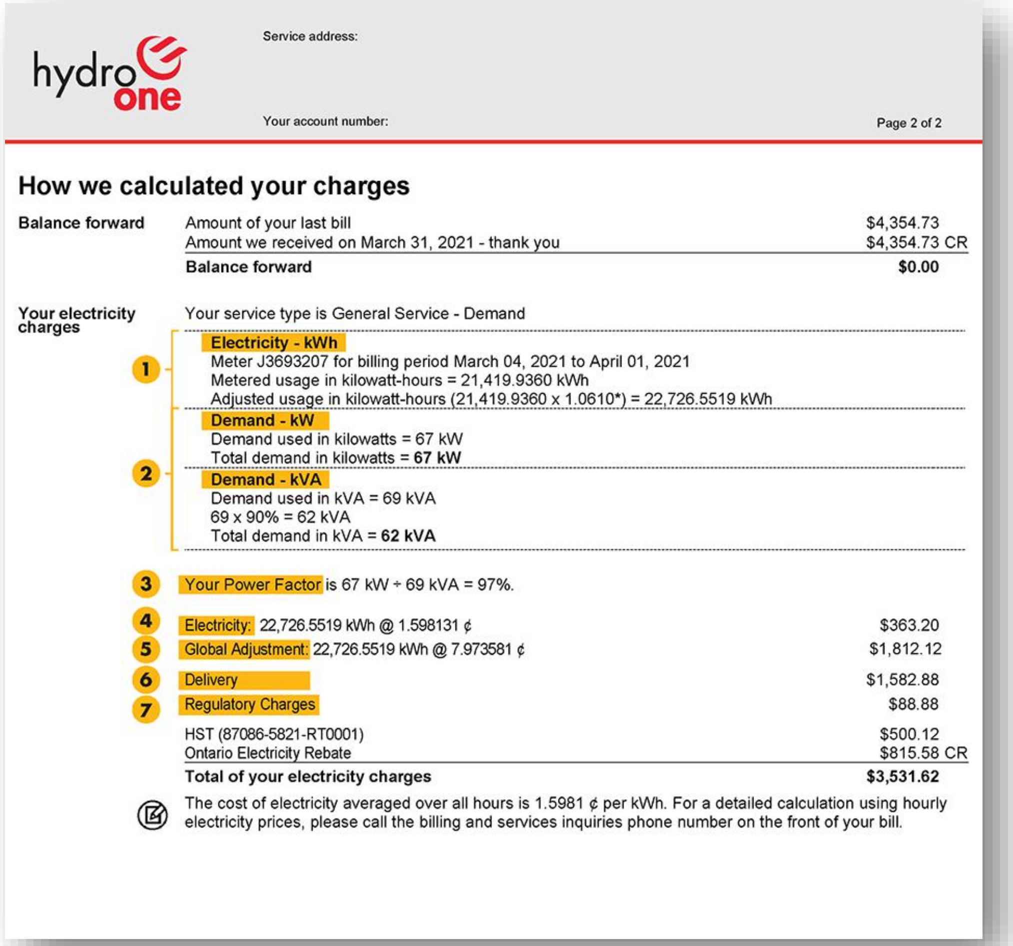
1. Understand Consumption Price & Cost

Example – Electricity

- January '05
  250,000 kWh … $19,670
- February '05
  250,015 kWh … $20,032

- Energy Up 0.01%
- Cost Up 1.8% ???
- >$24 per kWh



hydro one

Service address:

Your account number:

Page 2 of 2

How we calculated your charges

Balance forward	Amount of your last bill	$4,354.73
	Amount we received on March 31, 2021 - thank you	$4,354.73 CR
	Balance forward	**$0.00**

Your electricity charges

Your service type is General Service - Demand

1 **Electricity - kWh**
Meter J3693207 for billing period March 04, 2021 to April 01, 2021
Metered usage in kilowatt-hours = 21,419.9360 kWh
Adjusted usage in kilowatt-hours (21,419.9360 x 1.0610*) = 22,726.5519 kWh

2 **Demand - kW**
Demand used in kilowatts = 67 kW
Total demand in kilowatts = **67 kW**

Demand - kVA
Demand used in kVA = 69 kVA
69 x 90% = 62 kVA
Total demand in kVA = **62 kVA**

3 Your Power Factor is 67 kW ÷ 69 kVA = 97%.

4	Electricity: 22,726.5519 kWh @ 1.598131 ¢	$363.20
5	Global Adjustment: 22,726.5519 kWh @ 7.973581 ¢	$1,812.12
6	Delivery	$1,582.88
7	Regulatory Charges	$88.88
	HST (87086-5821-RT0001)	$500.12
	Ontario Electricity Rebate	$815.58 CR
	Total of your electricity charges	**$3,531.62**

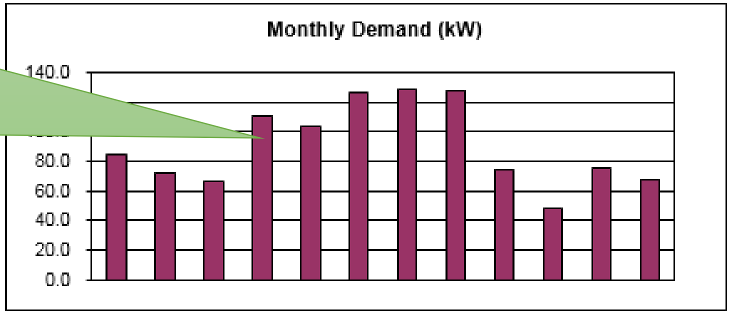
The cost of electricity averaged over all hours is 1.5981 ¢ per kWh. For a detailed calculation using hourly electricity prices, please call the billing and services inquiries phone number on the front of your bill.

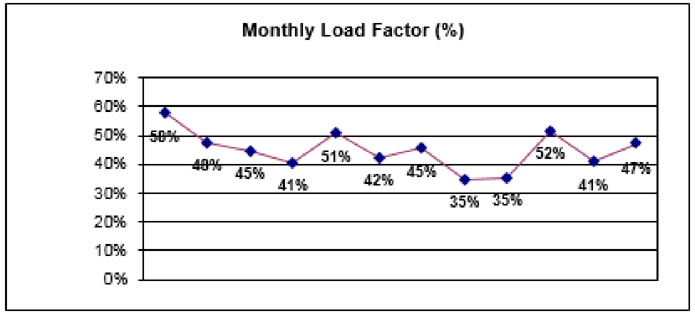
A Simple Historical Analysis Spreadsheet

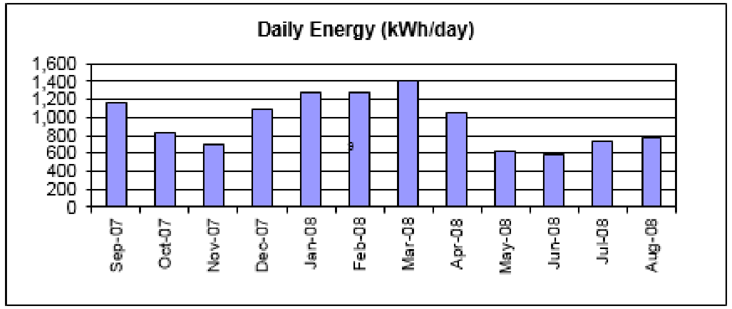
Electricity Consumption Data Location: Sample Facility

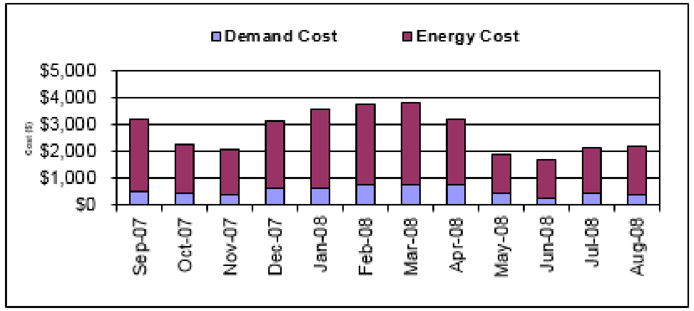
Billing Date	Metered kVA	Metered kW	Power Factor	Billed kW	Energy kWh	Days	Daily kWh	Load Factor	Demand Cost	Energy Cost	Adjust (+/-)	Sub Total	Total Cost
1-Sep-07	0.0	84.0		84.0	36,053	31	1,163	58%	$500	$2,704	$0	$3,204	$3,396
1-Oct-07	0.0	72.0		72.0	24,707	30	824	48%	$428	$1,853	$0	$2,281	$2,418
1-Nov-07	0.0	66.0		66.0	21,934	31	708	45%	$393	$1,645	$0	$2,038	$2,160
1-Dec-07	0.0	111.0		111.0	32,523	30	1,084	41%	$660	$2,439	$0	$3,100	$3,286
1-Jan-08	0.0	104.0		104.0	39,330	31	1,269	51%	$619	$2,950	$0	$3,569	$3,783
1-Feb-08	0.0	126.0		126.0	39,835	31	1,285	42%	$750	$2,988	$0	$3,737	$3,962
1-Mar-08	0.0	129.0		129.0	40,843	29	1,408	45%	$768	$3,063	$0	$3,831	$4,061
1-Apr-08	0.0	127.0		127.0	32,775	31	1,057	35%	$756	$2,458	$0	$3,214	$3,407
1-May-08	0.0	74.0		74.0	18,909	30	630	35%	$440	$1,418	$0	$1,858	$1,970
1-Jun-08	0.0	48.0		48.0	18,404	31	594	52%	$286	$1,380	$0	$1,666	$1,766
1-Jul-08	0.0	75.0		75.0	22,157	30	739	41%	$446	$1,662	$0	$2,108	$2,235
1-Aug-08	0.0	68.0		68.0	23,699	31	764	47%	$405	$1,777	$0	$2,182	$2,313
Totals/Max	**0.0**	**129.0**		**129.0**	**351,169**	**366**			**$6,450**	**$26,338**	**$0**	**$32,787**	**$34,755**

Tracking the bill uncovers increased demand charges due to service/testing of A/C systems (1 month = **1% of annual bill**)





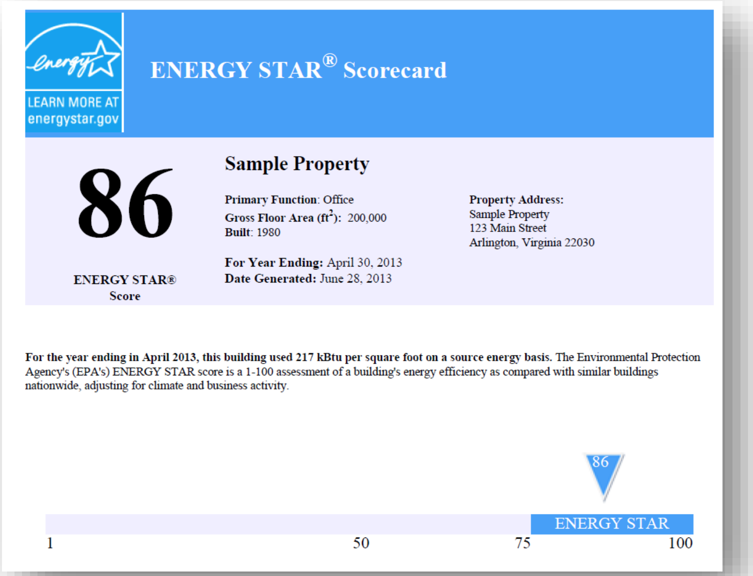




Step 2: Compare Yourself

- Externally
  - Benchmarking
  - Associations
- Internally
  - Compare buildings in your portfolio
  - Monitoring
- Energy Utilization Index (EUI)
  - **ekWh/ft²/year**

ENERGY STAR®
PortfolioManager™


LEARN MORE AT energystar.gov

ENERGY STAR® Scorecard

86

ENERGY STAR® Score

Sample Property

Primary Function: Office
Gross Floor Area (ft^2): 200,000
Built: 1980

Property Address:
Sample Property
123 Main Street
Arlington, Virginia 22030

For Year Ending: April 30, 2013
Date Generated: June 28, 2013

For the year ending in April 2013, this building used 217 kBtu per square foot on a source energy basis. The Environmental Protection Agency's (EPA's) ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Finding Savings with Benchmarking

Simple benchmarking identifies a project to reduce **electricity usage by 25%**

Activity: Building Energy Benchmarking

This facility is a four storey building with a basement and mechanical penthouse. The total floor area is assumed to be 5700 sq feet. Two key intensity ratios can be calculated based upon the 1994 historical data.

1. Demand Intensity

Typical peak demand intensity (in 1994) for an office building is:	4 – 10 watts/ ft^2
This building demands 380 kW over 5,700ft^2 for:	6.7 watts/ ft^2.

2. Electrical Energy Intensity

Typical energy intensity (in 1994) for an office building is:	14 to 26 kWh/ ft^2
This building used 1,743,120 kWh in 1994, for:	30.6 kWh/ ft^2

3. Fuel (Natural Gas) Energy Intensity

Typical fuel energy intensity (in 1994) for an office building is:	12 to 24 kWh/ ft^2
This building used 961,448 kWh in 1994, for: (92, 447 m^3 at 10.4 kWh/m^3)	16.9 kWh/ ft^2

4. Overall Energy Intensity 39.7 kWh/ ft^2

5. Other Benchmarks

BOMA BEST™ 2014 Average:	27.4 kWh/m^2
REALpac 2013 Average:	27.4 kWh/m^2

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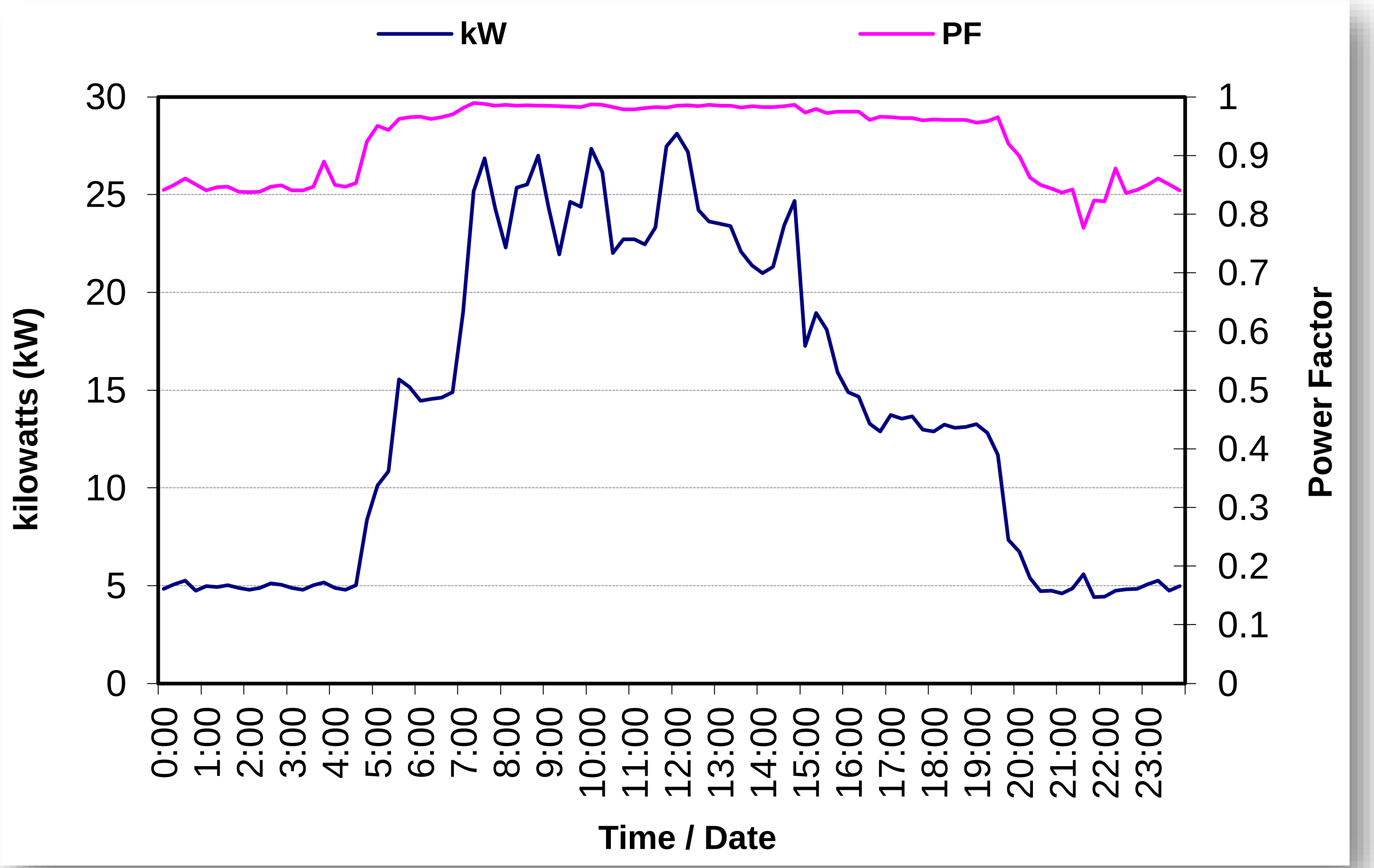
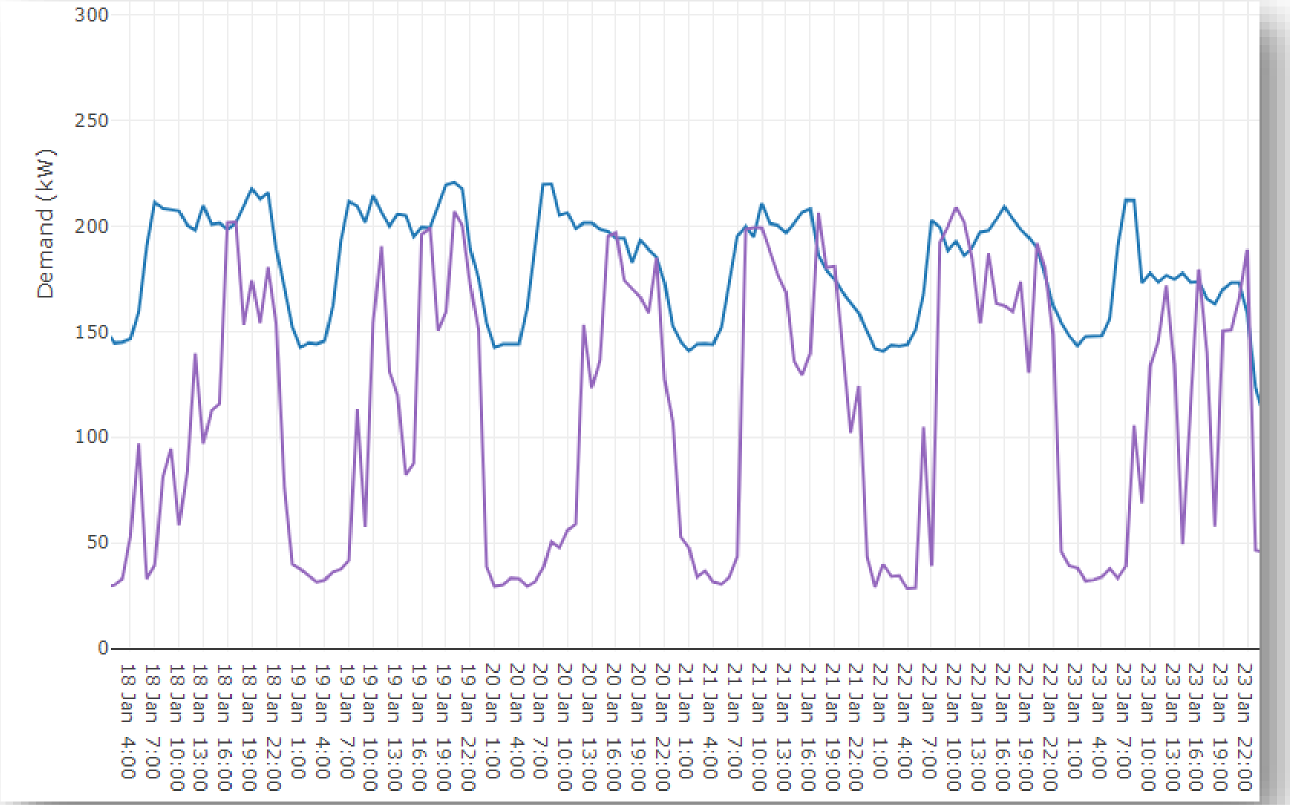
Step 3: Understand When A Facility Uses Energy

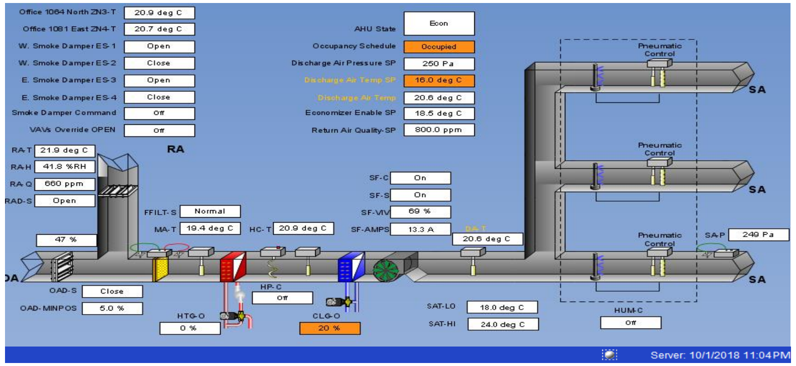


What We Found: Facility Staff Operator Spots Similar Facility – Different Baseload!



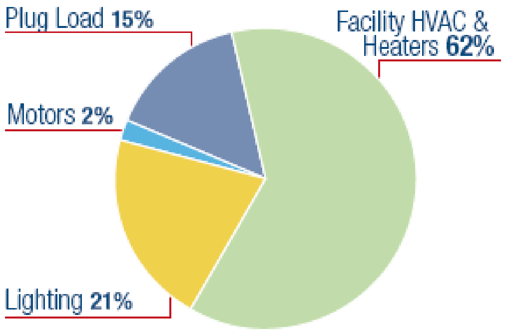
Building Automation System Schedule Overrides

> $20,000/yr



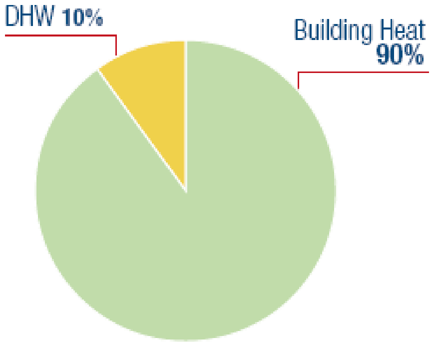
Step 4: Understand Where A Facility Uses Energy

Electricity Breakdown



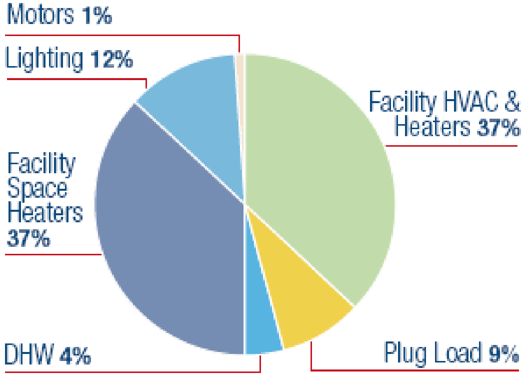
2007 Prorated Annual Consumption:
783,273 kWh

Thermal Breakdown



2007 Prorated Annual Consumption:
60,606 m³ (622,429 ekWh)

Total Energy Breakdown



2007 Prorated Annual Consumption:
1,405,702 ekWh

HVAC = Heating , Ventilation and Air Conditioning DHW = Domestic Hot Water Heating

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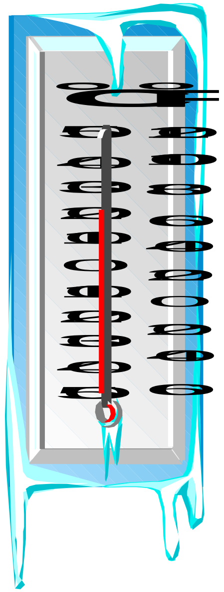
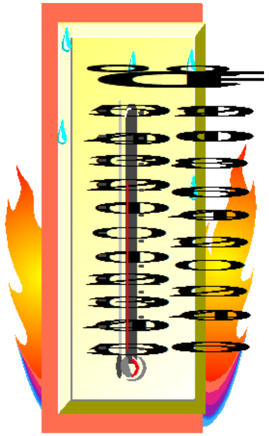
Steps 5, 6 & 7 – Identify the Opportunity

1. Understand Consumption Price & Cost
2. Compare Yourself to Benchmarks
3. Understand When Your Building Uses Energy
4. Understand Where Your Building Uses Energy
5. Eliminate Energy Waste
6. Improve Efficiency
7. Optimize Energy Supply

Establish a Valid Need

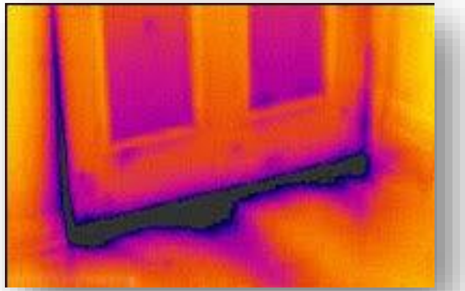
- Heat/cool
- Air power
- Fluid flow
- Ventilation
- Illumination



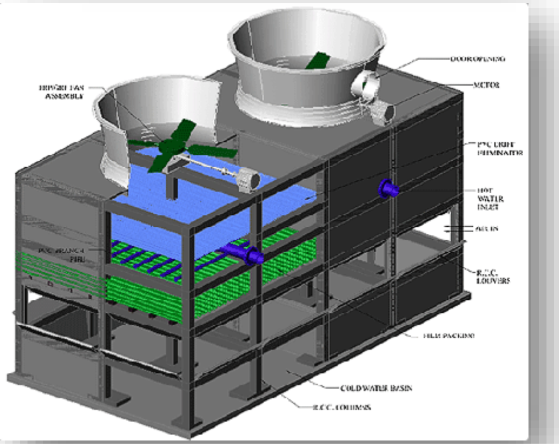


Current Facility Requirement

5. Eliminate Energy Waste
“Match the Need – Right Size”



- Turn it off
  - Lights, fans, pumps
  - Leaky building envelope
  - Phantom loads
- Turn it down
  - Temperature
  - Water
  - Air flow
- Control it
  - Exhaust / ventilation
  - Lighting time & levels



Which Uses More Energy….
Clocks or Cooking?

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What We Found: Parallel Pumps

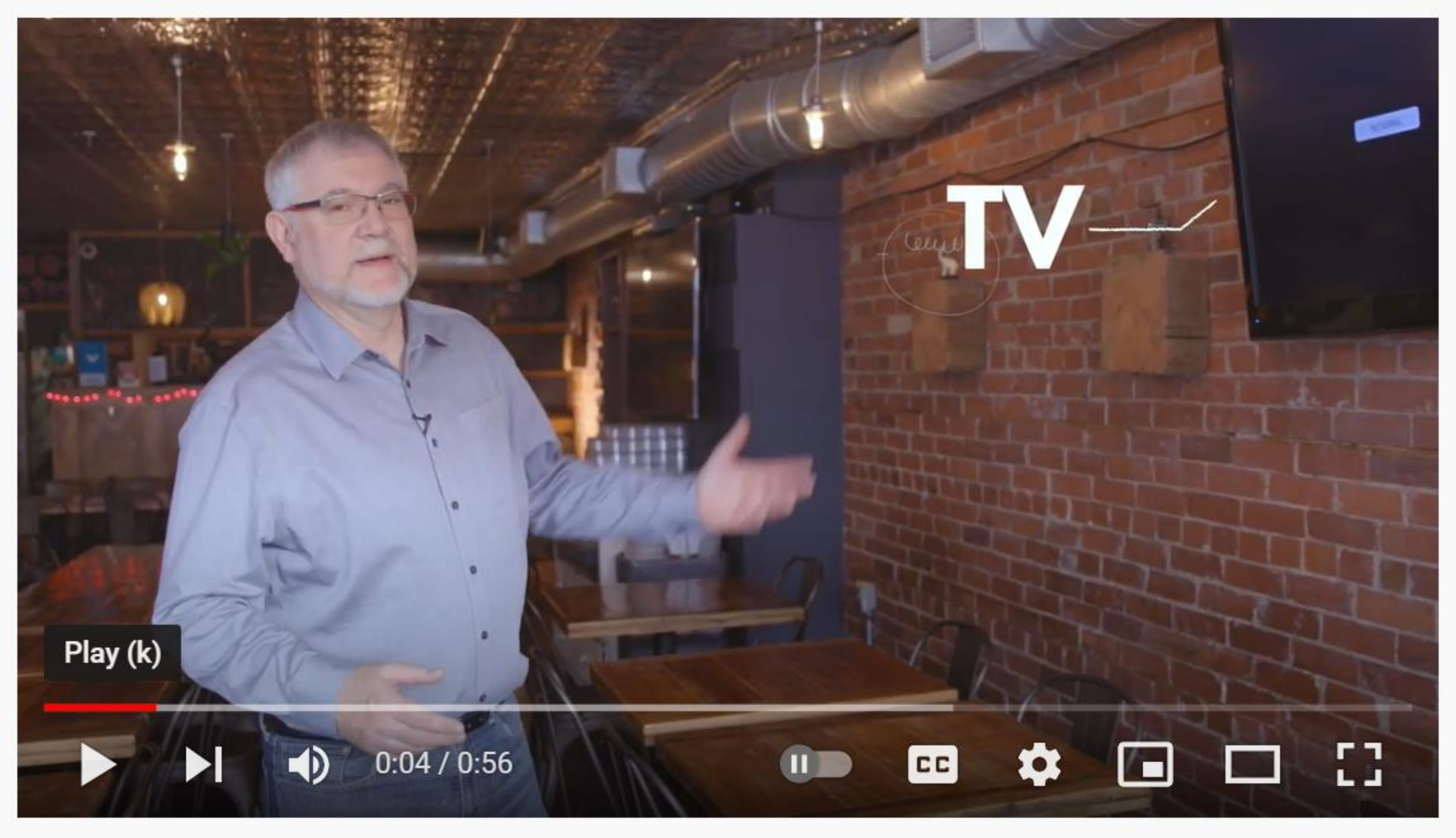
- Two pumps in parallel
- Both with VFDs
  - One at 20%
  - Other at 87%
- One was a backup
  - “deep” override on
- Shut down slower pump
- Savings of $2,900/yr
- No cost

Reduce Compressed Air Leaks

- Metering of compressors and ultrasonic leak testing revealed 200 scfm = 50 HP
- Where: piping connections, control valves, drains.
- Savings : 343,000 kWh per year
- Savings : $30,870 per year
- Payback: < 1 year.

https://www.caasafety.com.au/products/ultrasonic-leak-detector/

Let’s Take a Quick Walk



https://www.youtube.com/watch?v=yeT3pNUorXM

Step 6: Maximize Efficiency

- Maintenance
  - Filters and lubrication
  - Clean heat exchangers, pipes, ducts and coils
- Combustion Equipment
  - Regular tune-ups
  - New controls
- Optimize compressors, pumps and fans
  - Sequence multiple devices
  - Operate at most efficient point.
  - Variable speed drives
- More efficient equipment
  - Lighting
    - Lamps &/or re-design
  - Compressors & Chillers

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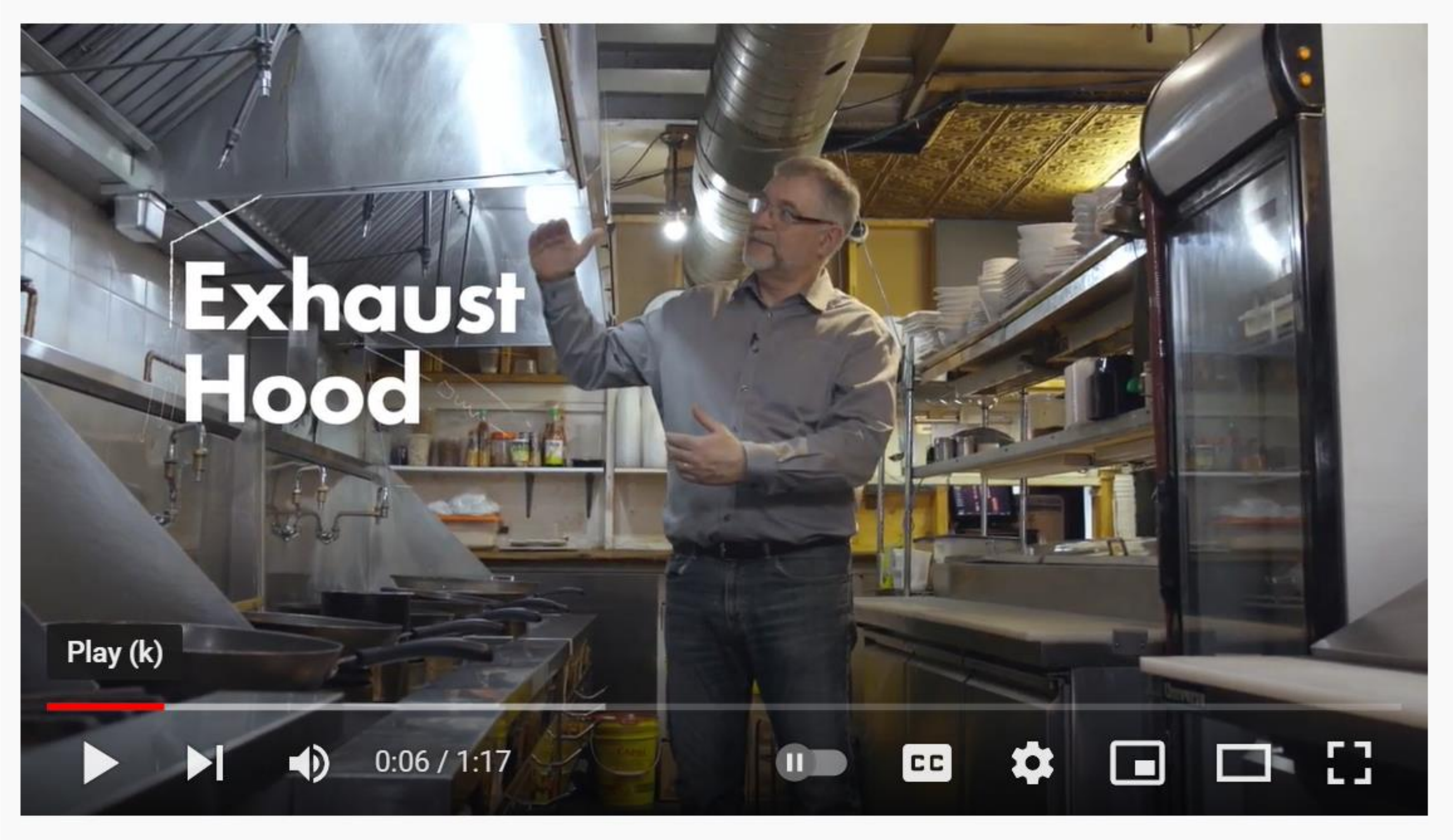
Improve Compressed Air System Control

- Incorporate larger receiver capacity, variable speed compressor, and controls.
- Variable speed compressor could be an alternative to rebuild 2 existing compressors .
- Savings : $8,200 per year.
- Payback: 1-2 years depending options.

Proper Roof Top Unit Economizer Operation

- Air-side "free cooling" can become inefficient or cost you if your economizer is not working properly or is not controlled optimally.
- For many rooftop units, economizer can be somewhat "forgotten" due to location.
- Without an economizer, cooling consumption can increase by more than 50%.

A Heating Ventilation & A/C (HVAC) Walkthrough



https://www.youtube.com/watch?v=hTsvnqQzT5Q

A Refrigeration Walkthrough

https://www.youtube.com/watch?v=t2rDBxJWOmg

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Waste & Efficiency…

Match the Need

Reducing waste is as simple as turning it off!

Action	Lower Cost (operational)	Higher Cost (technological)
Eliminate Waste	**1.** Manual control	**2.** Automatic control
Maximize Efficiency	**3.** Operating conditions	**4.** Efficient equipment

Reduce Losses

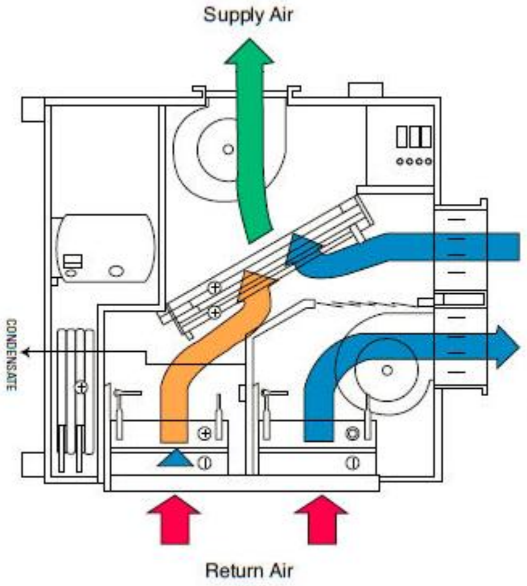
Efficiency is a result of good maintenance

Back to the 7th & Final Step!

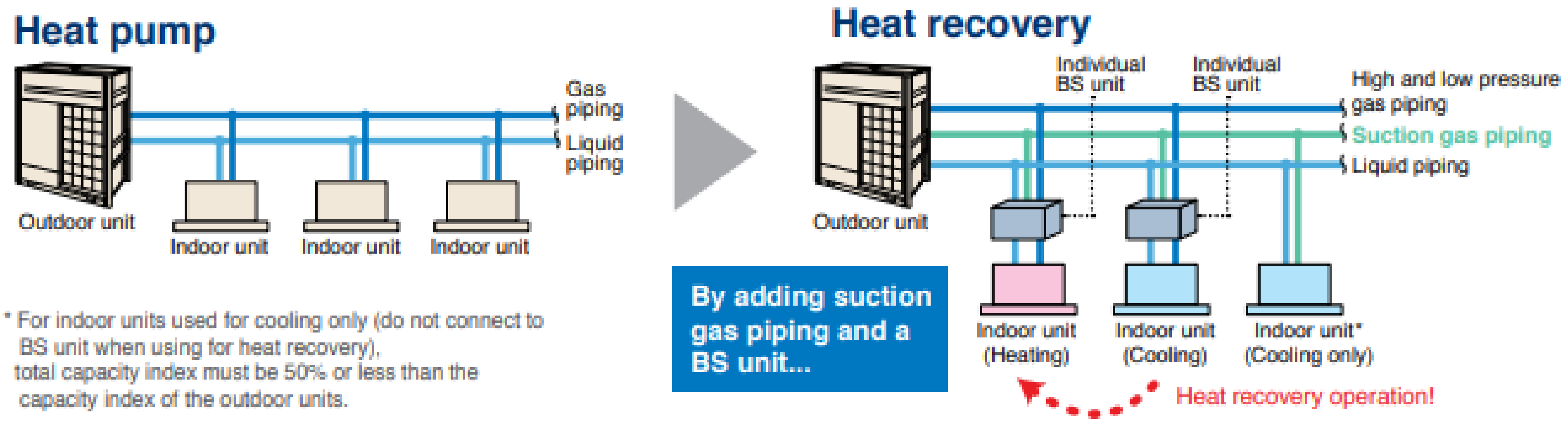
1. Understand Consumption Price & Cost
2. Compare Yourself to Benchmarks
3. Understand When Your Building Uses Energy
4. Understand Where Your Building Uses Energy
5. Eliminate Energy Waste
6. Improve Efficiency
7. Optimize Energy Supply

7: Optimize Supply:
After reducing waste & increasing efficiency

- Heat Recovery
  - Look at water and air streams
- Heat pumps
  - Air & ground source
- Renewable energy
  - Photovoltaic
  - Solar air, hot water
  - Wind power
- Supply contracts



Heat Pumps & Heat Recovery



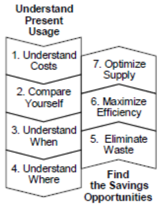
https://www.daikin.com.au/sites/default/files/PCVAU1706-Daikin_VRV_General_Brochure-LR.pdf

Energy Assessment Results

Energy Profile & Savings Opportunity Assessment

for

A Sample Hotel



March 2009

The Facility

The Hotel is an 86 room hotel serving the Some City area. This year round hotel is heated and cooled electrically primarily with through the wall heating and air conditioning units.

Domestic hot water for guest rooms and the laundry is heated by natural gas, which also provides heats for the dryers in the laundry.

Exterior lighting is provided by high pressure sodium wall packs and incandescent pot lamps in the lobby entry canopy.

Interior lighting is provided by a mix of incandescent lamps in ceiling pot fixtures and fluorescent wall sconces in hallways.

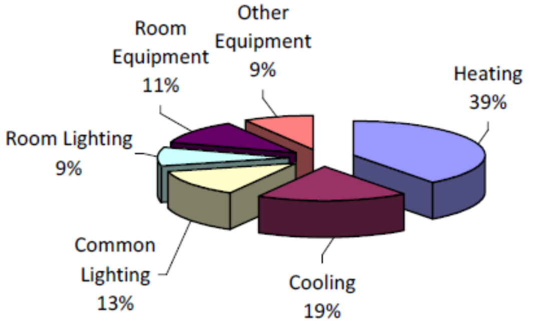
While the energy consumption of this hotel does not include that of the attached restaurant, there are ice, cold beverage and snack vending machines throughout the facility.

The walls and roof of this building are reasonably well insulated while windows are double glazed or double thermo-pane unit.

Each guest room features an array of incandescent ceiling and desk/table lighting, a small refrigerator, microwave oven, small coffee maker and an exhaust fan in the bathroom operated from the light switch.

Typical of this type of hotel, each of the lower … large sliding … various

Breakdown of Electricity Consumption



Summary of Findings

The following table summarizes the current level of energy consumption costs, greenhouse gas emissions and the savings opportunities that have been identified in this facility:

Energy Analysis and Opportunity Summary for Sample Hotel

	Electricity Consumption		Natural Gas Consumption		Total Energy Use		Benchmark	CO2 Emissions	Esimated Cost	Simple Payback	IRR	Savings to Investment Ratio
	kWh	$	m3	$	GJ	$	GJ/m2	kg	$	yrs	%	
Current Situation	**351,169**	**$34,755**	**22,439**	**$10,334**	**2,093**	**$45,089**	**0.63**	**117,647**				
A Comparable Facility							0.70					
Energy Management Opportunties												
Building Envelope												
Reduce Air Leakage on Sliding Doors	33,000	$2,475			119	$2,475		7,260	$2,000	0.8	132.7%	11.7
Hot Water												
Utilize low-flow shower heads			3,060	$1,225	115	$1,225		5,508	$650	0.5	200.0%	17.9
Replace washing machine			1,500	$600	58	$600		2,700	$1,800	3.0	36.4%	3.2
Equipment												
Room refigerator temperature control	4,000	$300			14	$300		880	$100	0.3	316.0%	28.5
Occupancy control on vending machines	2,000	$150			7	$150		440	$300	2.0	55.0%	4.7
Lighting												
Room lamps from Incadescent to CFL	12,000	$1,300			43	$1,300		2,640	$3,250	2.5	44.0%	3.8
Hall pots from Inc. to induction	5,000	$425			18	$425		1,100	$650	1.5	71.5%	6.2
Canopy lamps from Inc. to Induction	3,000	$225			11	$225		660	$450	2.0	55.0%	4.7
Heat Recovery												
Install heat recovery on laundry dryers.			4,900	$1,960	183	$1,960		8,820	$8,000	4.1	25.6%	2.3
Savings for Selected Actions	59,000	$4,875	9,460	$3,785	568	$8,660	0.17	30,008	$17,200	**2.0**	**55.4%**	**4.8**
as a % of Current Situation	17%	14%	42%	37%	27%	19%	27%	26%				
Proposed Situation With All Oppoortunities Implemented	**292,169**	**29,880**	**12,979**	**6,549**	**1,525**	**36,429**	**0.46**	**87,639**				

Note 1: figures provided are annual totals

Note 2: IRR and SIR based upon 45 inlfation, 5% discount rate and 10 yr project life

ESO #3: Replace Washing Machine with New Low Water Model

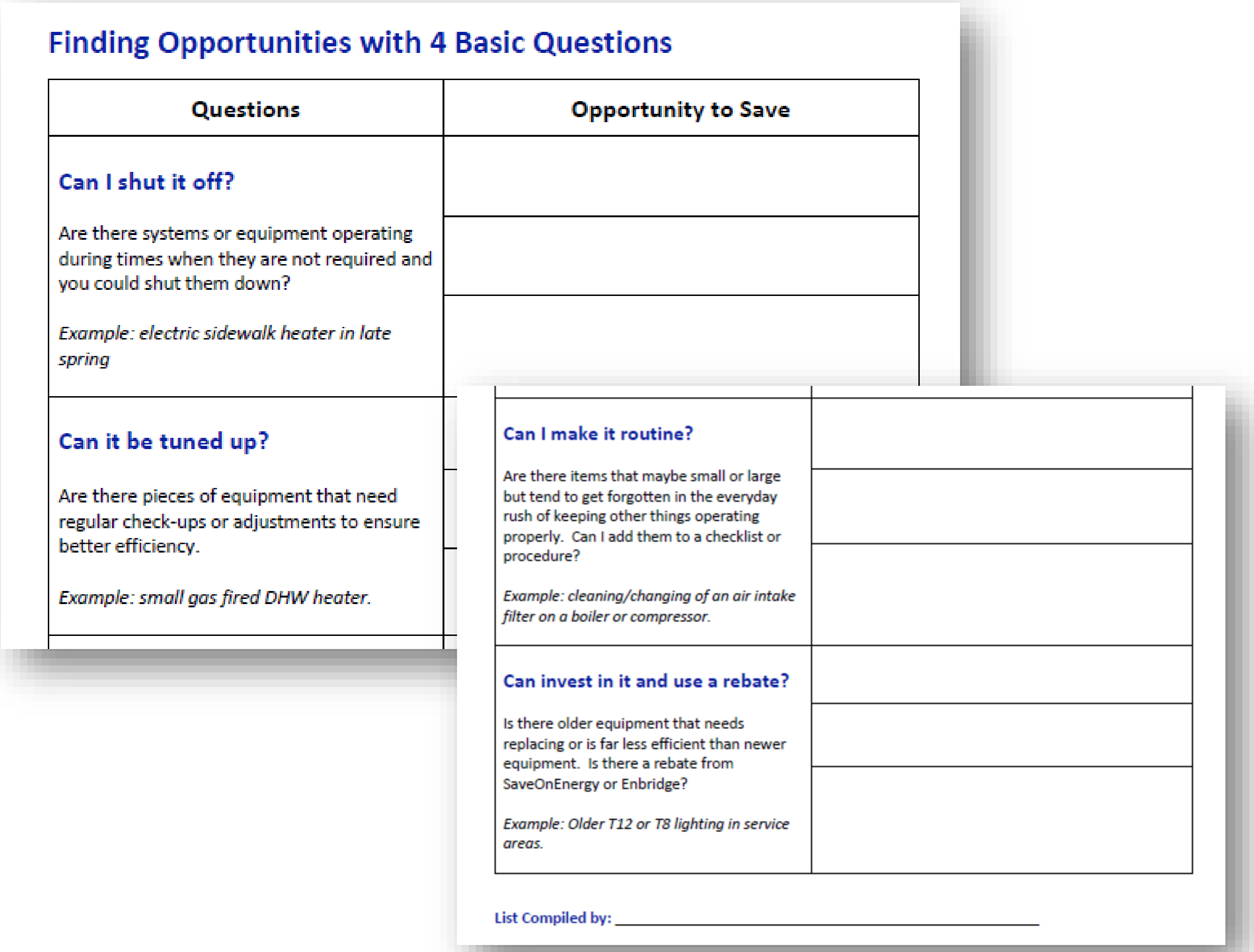
At the time of the site assessment it was reported that the washer currently in use is aging and will leak a considerable amount of water per load - estimated to be 3-5 gallons. New washers today could reduce the routine consumption of water by as much as 50%, and would eliminate the leaking water. As in the previous measure, there will be additional water cost savings to the energy savings estimated below.

Savings Summary	KWh	Gas M³	$ Saved
Direct Saving	0	1,500	
Indirect Cooling Savings	0		
Indirect Heating Cost	0		
Net Savings	0	1,500	$600
Estimated Cost		$1,800	
Payback, IRR & SIR	3.0 yrs	36.4%	3.2

knowenergy ...powered by TdS Dixon Inc.

After an Energy Walkthrough – Take Action

- Can you shut if off?
  - Or turn it down, or control it better
- Can you tune it up?
- Can you make it routine?
  - Find better practices
- Can you make an investment in it?
  - A lot of incentives/rebates are available



Finding Opportunities with 4 Basic Questions

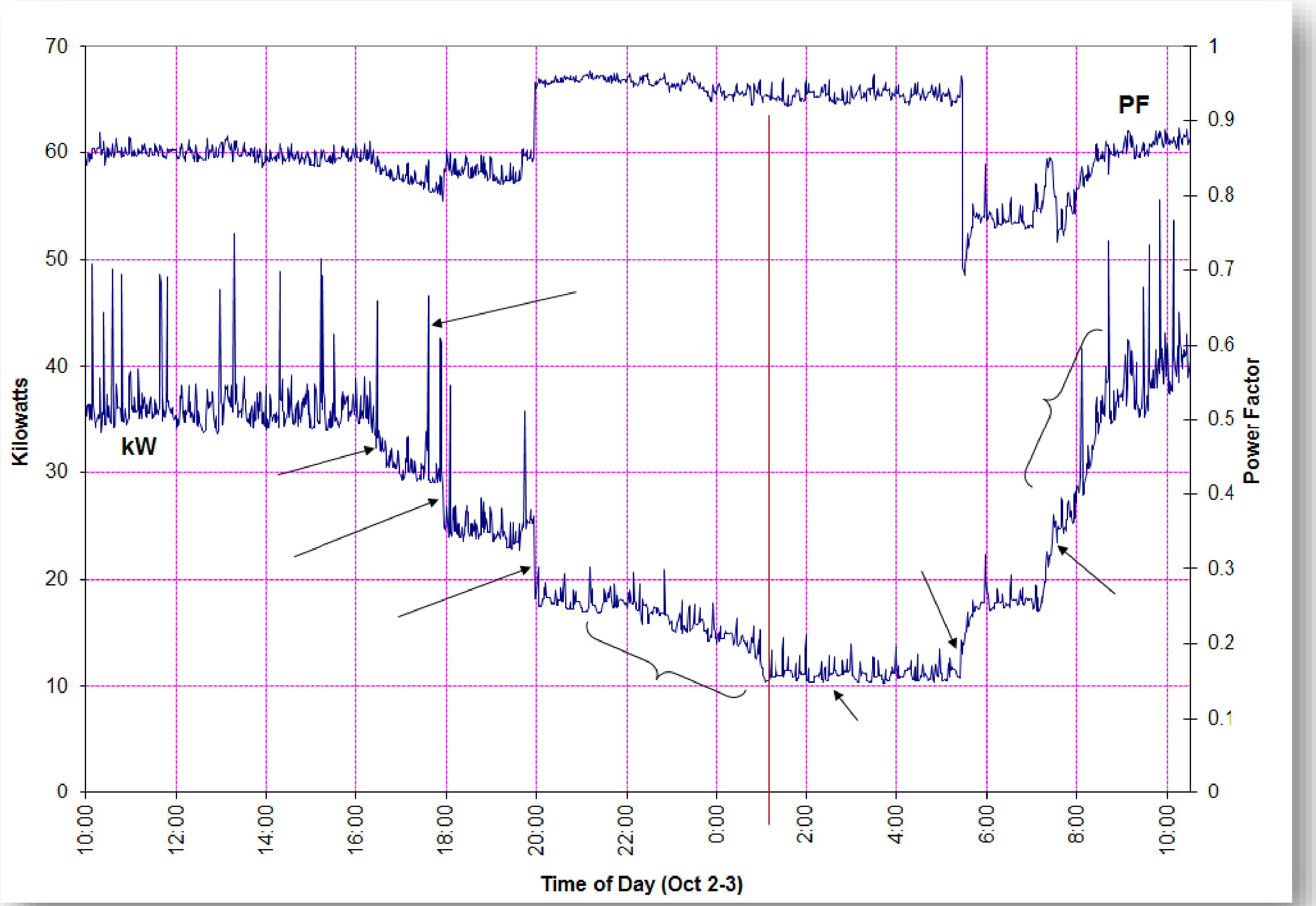
Questions	Opportunity to Save
Can I shut it off? Are there systems or equipment operating during times when they are not required and you could shut them down? *Example: electric sidewalk heater in late spring*	
Can it be tuned up? Are there pieces of equipment that need regular check-ups or adjustments to ensure better efficiency. *Example: small gas fired DHW heater.*	

Can I make it routine? Are there items that maybe small or large but tend to get forgotten in the everyday rush of keeping other things operating properly. Can I add them to a checklist or procedure? *Example: cleaning/changing of an air intake filter on a boiler or compressor.*	
Can invest in it and use a rebate? Is there older equipment that needs replacing or is far less efficient than newer equipment. Is there a rebate from SaveOnEnergy or Enbridge? *Example: Older T12 or T8 lighting in service areas.*	

List Compiled by: ______________________

Finding Opportunities for Energy Savings

Finding Savings in an Office Demand Profile



Using kW & PF Information

- + kW - PF
  - Motor load on
- + kW + PF
  - Lighting load on
- - kW - PF
  - Lighting load off
- - kW + PF
  - Motor load off

Profile Data Available from Utility Interval Data Portals

(check with your Utility/Local Distribution Company)

https://www.hydroone.com/business-services/commercial-industrial-generators-and-ldcs/commercial-industrial-customers/interval-data-portal

The Help Desk for Workshop

Stephen Dixon

sdixon@knowenergy.com

Low Carbon Transportation

Sustainable Technologies
EVALUATION PROGRAM
Supported by Toronto and Region Conservation Authority

- Non-profit
- Collaborative
- Research

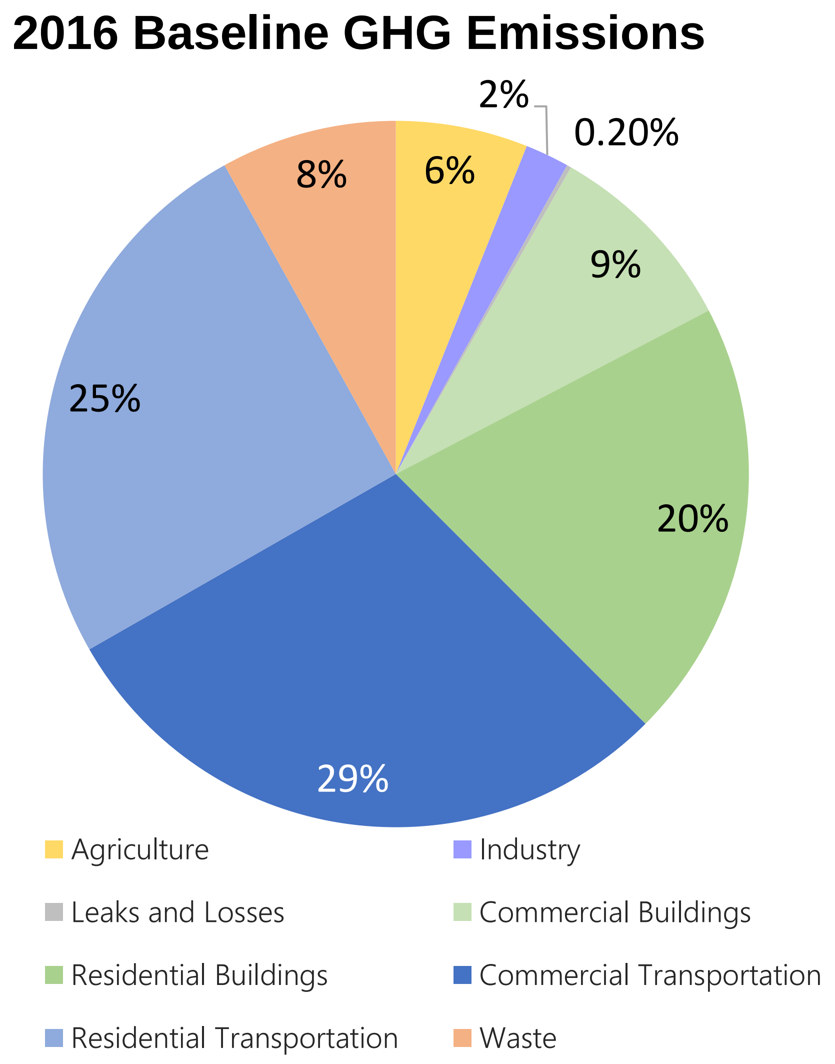
- Pilots
- M & V
- Clean Tech

- Buildings
- Renewables
- Smart-grid

www.sustainabletechnologies.ca

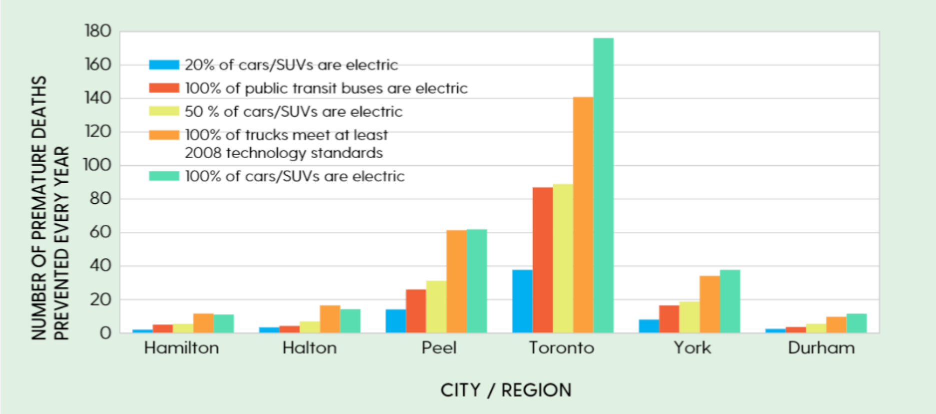
The context

- Over 50% of Caledon's GHG emissions from transportation
- Commercial transportation highest



The transition to EVs and Public Health

- GHG emissions and climate change are not the benefits of a transition to Evs
- Air quality
- Hydrocarbon pollutants
- Carbon monoxide dangers
- Oil spills
- dangers of transporting fuels



Death toll in Lac-Megantic disaster now at 47

By Staff · The Canadian Press
Posted July 19, 2013 4:17 pm · Updated July 19, 2013 4:19 pm

Authorities have established a number of people they believe have been killed in the Lac-Megantic train disaster. THE CANADIAN PRESS/Ryan Remiorz

The full cost of an EV and an equivalent gas car
if gasoline averages $2/L

ELECTRIC

GAS

2022 Chevrolet Bolt

Retail price: **$38,198**
Battery range: 416 kilometres
Eligible for rebates: yes

Total ownership cost: $45,509

2022 Toyota Corolla Hatchback

Retail price: **$21,450**

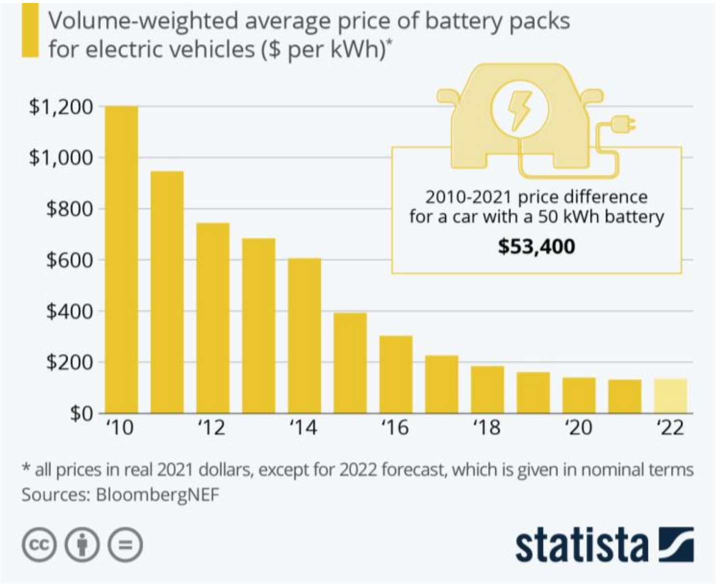
Total ownership cost: $67,380

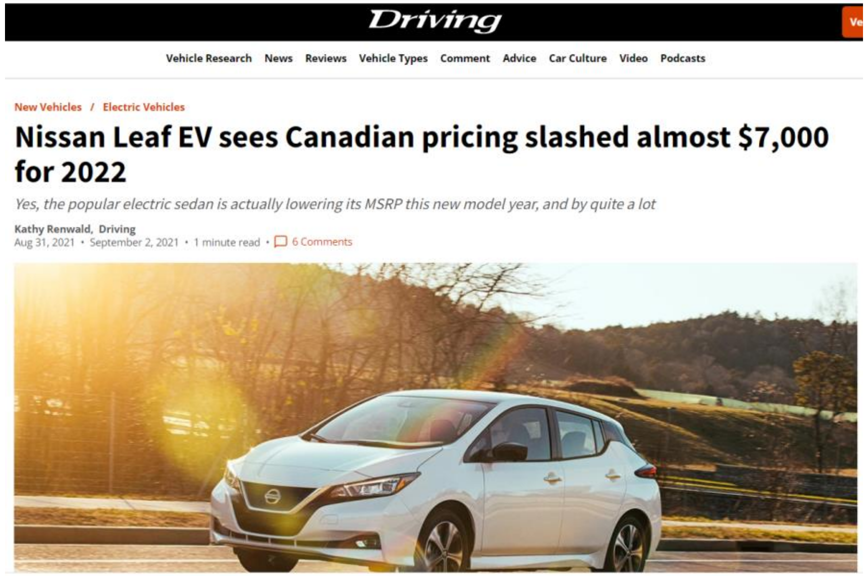
$ **48%** more expensive for the gas vehicle

Cost of car (depreciation) | Fuel | Maintenance and repairs | Taxes, insurance, and other costs

EV capital costs

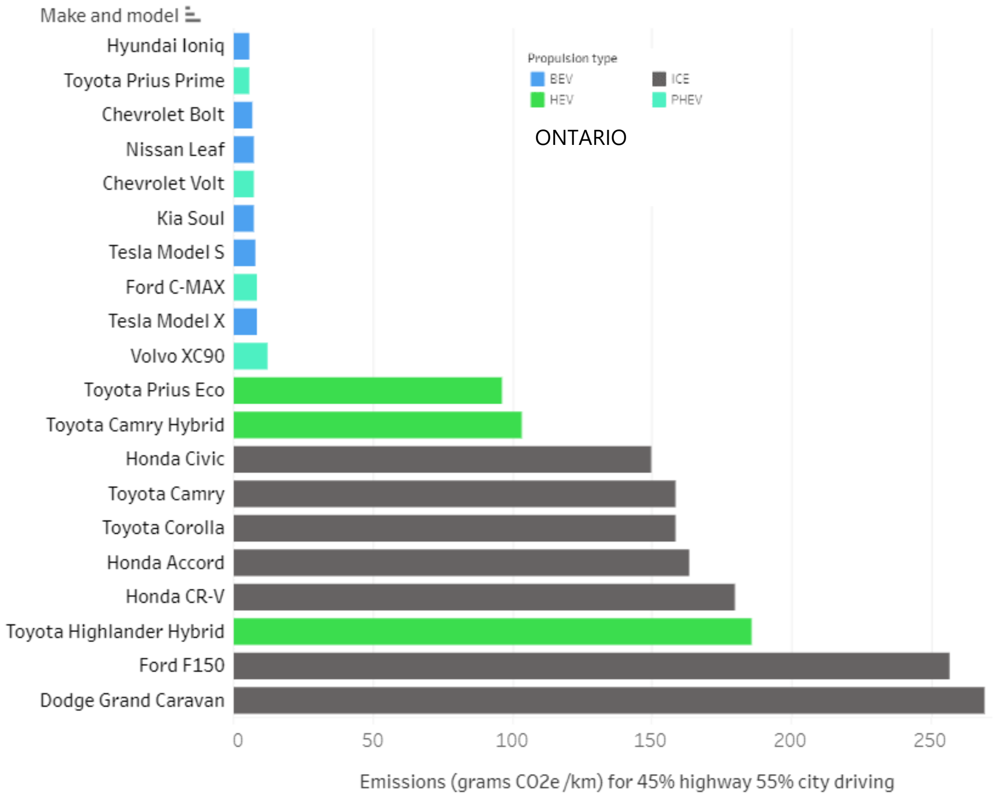
- Year after year, EVs are becoming cheaper
- More competitive manufacturing
- Price parody is estimate 2024-2026; though some estimate sooner



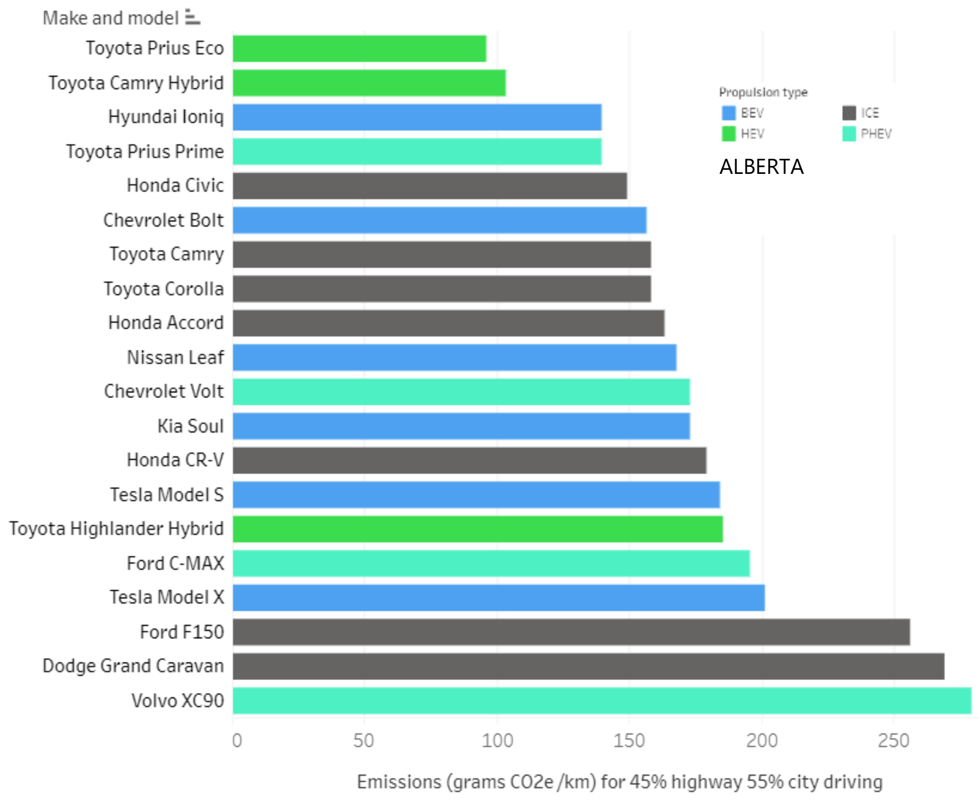


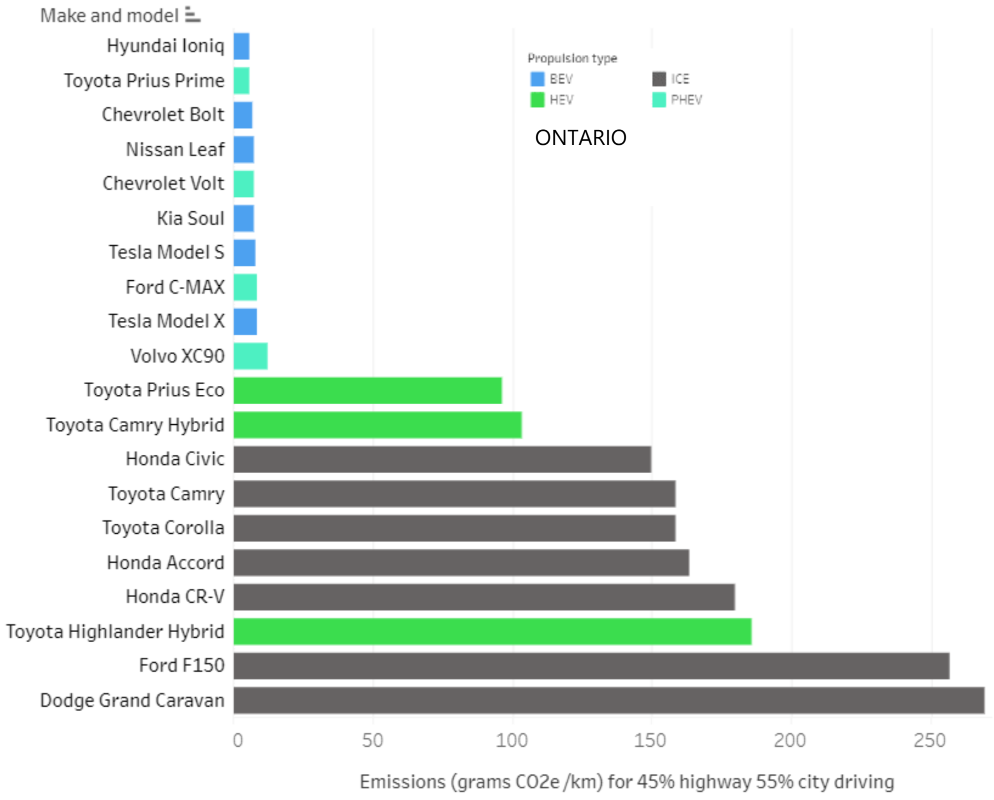
EV Emissions

- Operating emissions are very low
- Ontario at advantage with low carbon electricity

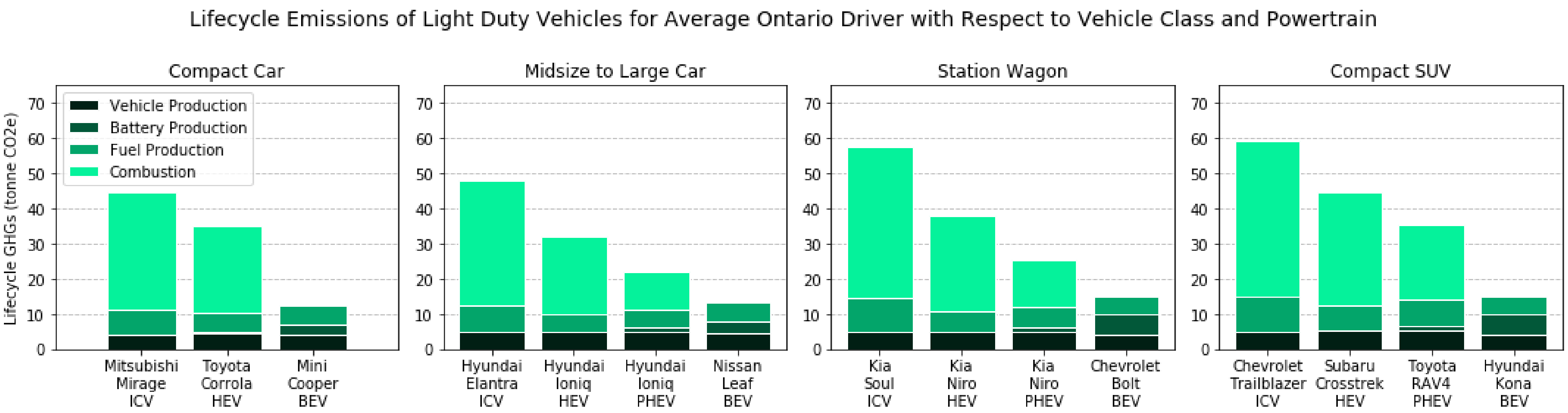


EV Emissions





EV Emissions - Lifecycle



Data retrieved from Carboncounter 2021 Tool. Accessed online March 2021: www.carboncounter.com

- Battery production does create emission
- Majority of emission in Fuel production and consumption

Medium and Heavy Duty Vehicles

- There are many large auto manufacturers entering this stream
- Small manufacturers exist
- Have been operating for some time.
- Wide variety of electric vehicles

Medium Duty, Vans, Delivery vehicles. Class 2/3

- 68 kWh Lithium-ion battery
- targeted range of 203 km
- $63,570 CAD

Medium Duty, Vans, Delivery vehicles. Class 2/3

Vehicle type	Mfr.	Vehicle model	Max GVWR (kg)	Battery capacity (kWh)	Range (km)	Availability in Canada
Cargo van	GM	EV600	4,536	-	402	2022
Cargo van	Ford	Transit EV	3,800	67	203	2022
Cargo van	Lightning	Transit Cargo Van	4,699	86 / 105	225 / 275	Available
Cargo van	SEA Electric	Ford Transit Cargo Van	4,699	88	304	Available
Cargo van	Adomani	All Electric High-Top Cargo Van	6,400	106.2	200	Available
Cargo van	Green Power	EV Star Cargo	6,499	118	240	Available
Step van	Motiv	EPIC E-450 Step Van	6,577	106 / 127	160	Available
Step van	Motiv	EPIC F-59 Step Van	9,979	127	144	Available
Step van	Lightning	Ford F-59	8,845 / 9,980	128 / 160 / 192	175 / 225 / 270	Available
Step van	SEA Electric	Ford F-59	8,156	138	320	Available
Step van	Workhorse	C1000	5,670	70	160	Available
Step van	Workhorse	C650	5,670	70	160	Available

EV Models for urban deliveries.

Class 4-8

- Electric Shunt Trucks/yard spotter/terminal tractor
  - Excellent choice for electrification
  - Lack of emissions due to idling in busy yards
  - Small battery due to low milage
  - Lots of manufacturers

NFI
Kalmar T2e

Ruan
Orange EV T Series

Ryder Logistics
LoneStar SV S22

Class 4-8

Case Study:

- Orange EV – Boathouse Farms
- Less down time
- Diesel = $3.9/hr
- Electric = $0.98/hr
- Diesel fuel $15,750yr
- Electricity $1,575/yr

Class 4-8

- There are numerous manufacturers of Medium/heavy duty already on the market
- Lion
- E-lightning
- International
- Peterbilt

LIGHTNING eMOTORS

Lightning Electric Vehicles

FLEETS POWERED BY LIGHTNING

Lightning eMotors designs, manufactures and installs high-quality battery-electric drivetrains for popular medium- and heavy-duty commercial vehicles. Whether you need a passenger shuttle or a food truck, we have the vehicle for you.

Transit 350HD passenger shuttle and cargo van

This popular and versatile Class 3 van gives a refined and quiet ride with great range and reliability.

- Battery capacity options: 43 kWh, 86 kWh
- Typical ranges*: 60 miles, 120 miles
- Level 2 AC and DC Fast Charge (J1772 CCS-1 Combo)
- Buy America compliant. Ford eQVM. CARB certified.

E-450 shuttle and cutaway

A mainstay of the shuttle industry, the E-450 is a trusted platform that's even better as a fully electric vehicle.

- Battery capacity options: 86 kWh, 129 kWh
- Typical ranges*: 80 miles, 110 miles
- Level 2 AC and DC Fast Charge (J1772 CCS-1 Combo)
- Buy America compliant. Ford eQVM. CARB certified.

F-53 / F-59 delivery van and food truck

From delivering packages to serving food, the F-59 is a familiar sight on the streets. The electric range easily covers delivery and food truck routes.

- Battery capacity options: 96 kWh, 128 kWh
- Typical ranges*: 80 miles, 110 miles
- Level 2 AC and DC Fast Charge (J1772 CCS-1 Combo)
- Ford eQVM. CARB certified.

F-550 bus and truck

Filling the space between shuttles and transit buses, the electric F-550 bus produces no emissions and gives a quiet ride.

- Battery capacity options: 128 kWh, 160 kWh
- Typical ranges*: To be confirmed
- Level 2 AC and DC Fast Charge (J1772 CCS-1 Combo)
- Ford eQVM.

GM 6500XD Low Cab Forward Class 6 truck

The electric GM 6500XD is ideal for logistics and large package delivery, and eliminates the pollution and noise of the equivalent diesel vehicle.

- Battery capacity options: 96 kWh, 128 kWh, 160 kWh, 192 kWh
- Typical ranges*: 66 miles, 88 miles, 110 miles, 130 miles
- DC Fast Charge (J1772 CCS-1 Combo)
- CARB certified.

* All-electric range can vary depending on route or drive cycle, environmental conditions, vehicle or equipment configurations, and driver behavior.

LION8

Technical Specifications

WEIGHT & DIMENSIONS

Cabin Length - BBC	79 in.
Cabin Height	107 in.
Wheelbase	195 in.
Gross Vehicle Weight Rating (GVWR)	Up to 60,000 lb

ELECTRIC POWERTRAIN

Top Speed	65 mph
Maximum Power	350 kW • 470 HP
Maximum Torque	3,400 Nm • 2,500 ft-lb
Range	Up to 170 miles
Battery Capacity	Up to 252 kWh
Motor & Inverter	SUMO HD 800 VDC 9 phases Dana TM4
Transmission	Direct drive No transmission
Level III – Charging Time	Minimum 2 hours

CHASSIS

Front Axle	Up to 20,000 lb
Rear Axle	Up to 40,000 lb
Suspension	Air suspension • Hendrickson
Braking	Air disc brakes • Bendix

Multiple range offerings available

All-Electric Class 8 Straight Truck

LION ELECTRIC

thelionelectric.com

Semi

- Freightliner e-Cascadia
- Volvo, 6 models
- Daimler eM2
- Mercedes-Benz eActros

Semi - Tesla

Acceleration 0-100 km/h with 36k kg	25 sec
Speed up a 5% Grade	100+ km/h
Kilometer Range	475 or 800 kilometers
Powertrain	4 Independent Motors on Rear Axles
Energy Consumption	Less than 125 kWh per 100 kilometers
Expected Base Price *(475 kilometer range)*	$190,000
Expected Base Price *(800 kilometer range)*	$230,000
Base Reservation	$26,000

Charging Infrastructure (EVSE)

Type	Description	Approximate unit cost[8,9]
Level 1 AC	Plugging in directly to a standard wall outlet (110 to 120 V). This is the slowest speed of charging.	$790 to $1,080
Level 2 AC	An EV charger that uses a 208 to 240 V system. Charges at a faster speed than Level 1 charging.[10]	$1,240 to $4,150
Direct current fast charger (DCFC)	An EV charger that uses a 400 to 1,000 V system, offering the fastest charging speeds.[11]	$37,690 to $185,770

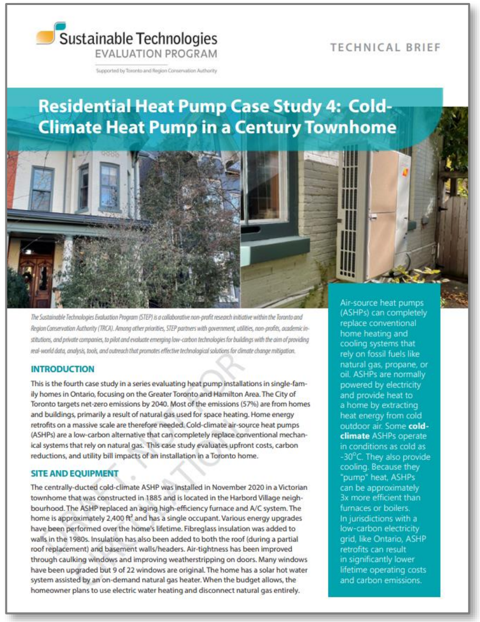
- Plan ahead, plan ahead… Plan ahead
- Engage the local distribution company
- Identify need for transformer or grid upgrades
- Highly recommend* consider smart-charging

Who can help you

- NGO’s and private organizations
- Plug N’ Drive
- Funding available:
  - Zero Emission Vehicle Infrastructure Program (ZEVIP)
  - Federal tax write-off
  - Accelerated Investment Incentive
  - iZEV Program
  - Not yet released: $547.5 million, for medium- and heavy-duty

Sustainable Technologies
EVALUATION PROGRAM
Supported by Toronto and Region Conservation Authority

- Living Labs @ Kortright and TRCA buildings provide a friendly environment for vetting/testing prior to further deployment
- Open houses, group tours, meeting space, professional training, event space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Residential Heat Pump Case Study 4: Cold-Climate Heat Pump in a Century Townhome
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SITE AND EQUIPMENT


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Heating & Cooling
Case Study: Ductless Heat Pump Retrofits in an Ontario Rowhouse Complex
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Gas Absorption Heat Pumps: Carbon, Energy and Cost Reductions for Heating Applications in a Cold Climate
INTRODUCTION
TECHNOLOGY

Sustainable Technologies EVALUATION PROGRAM

Thanks!
Questions?

Gil Amdurski
Gil.Amdurski@trca.ca

For more information:
sustainabletechnologies.ca

Thank you. Any questions?

Matt Brunette, Program Manager, Energy Performance
Partners in Project Green
Matt.brunette@trca.ca