

Welcome to this week's presentation & conversation hosted by the **Canadian Association for the Club of Rome**, a Club dedicated to intelligent debate & action on global issues.

The views and opinions expressed in this presentation are those of the speaker & do not necessarily reflect the views or positions of CACOR.

The Kelly Household's Journey Towards Zero Carbon.

Our speaker today is Brian Kelly, a lifelong environmentalist. He graduated from University of Toronto with a BSc. in Ecology in 1969 and was immediately involved in the founding of Pollution Probe at the University of Toronto. Subsequently, he worked for the Federal Government in energy conservation and renewable energy, as President of Marbek Resource Consultants, as Director of Environment and Sustainable Development at Ontario Hydro, and as an adjunct professor of Business and Sustainability at York University. He concluded his career in 2019 as Manager of Sustainability at the Region of Durham. Today, he continues to advocate for climate action and aspires to be a “carbon influencer.”

DESCRIPTION: This presentation traces the 15-year journey of the Kelly household towards zero carbon emissions, starting with the purchase of a “code-built” house in 2008, its energy retrofit over the years, the purchase of an electric vehicle in 2018 and the recent addition in 2022 of a photovoltaic system and a heat pump system. Data on costs and savings are provided. Next and final steps toward zero carbon and lessons learned along the journey are discussed.

The presentation will be followed by a conversation, questions, & observations from the participants.

CACOR acknowledges that we all benefit from sharing the traditional territories of local Indigenous peoples (First Nations, Métis, & Inuit in Canada) and their descendants.



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The Kelly Household's Journey Toward Zero Carbon

CACOR Webinar

September 27, 2023



Four Steps so
far + one more
to come



New House Retrofit



Electric Vehicle



Photovoltaic System



Heat Pump

Base Case Conditions 2008

House:

- We bought a new house in 2008 (built in 2007)
- 2-storey, detached house, 4 bedrooms with walk-out basement
- 2,460 sq. ft.
- Natural gas furnace (Trane 94% efficient) and natural gas fireplace
- Electric water heater (rental)

Your typical suburban “code-built” house



Vehicle:

- Bought a new 2008 Toyota Prius (parallel hybrid) – about 30% more fuel efficient than a comparable Internal Combustion Engine (ICE) car
- Travelled about 22,000 km annually

Occupants:

- Brian and Ruth Kelly, empty nesters, now 76 and 75, lifelong environmentalists and “Early Adopters” of green technology



Step 1: New House Retrofit

After purchase in Summer of 2008 we added:

- Attic insulation (blown in cellulose insulation, from R32 to R45) (\$583)
- In-line, gas-fired water heater to replace electric HW*
- Heat recovery ventilator
- High-efficiency air conditioner (15 SEER) (\$3,400)
- Finished basement, added wall insulation (from R8 to R20)
- Caulking and weatherstripping to reduce air leakage
- Gas fireplace in basement (infra red)
- Electric lawn mower
- New shingles in 2018, changed from black to light brown/yellow, “high-albedo” shingles
- Waterproof membrane under shingles over *entire* roof and larger eavestroughs
- High-efficiency appliances (esp. refrigerator, clothes washer, dish washer) and lighting (incandescent to CFL to LED)





Step 2: Electric Vehicle

- Replaced previous Toyota Prius (10 years old)
- Took delivery of a Tesla Model 3 on June 6, 2018 (our 48th Anniversary)
- Included long range battery, enhanced autopilot, red colour and premium upgrades
- Total price: \$73,300 + taxes and fees = \$83,169
- Got rebate of \$14,000 from Ontario Government!
- Added a Tesla charger/connector (cost \$715) to our garage at an installation cost of \$1,271 for a total cost of \$1,986
- Received a rebate of \$858 from the Ontario Government!
- Have enjoyed fuel savings and maintenance savings for over 5 years
- **Probably the most impactful step in our decarbonization journey**

Costs and Savings from EV

- Cost of new Tesla Model 3: \$83,169 - \$14,000 in rebate = \$69,169
- Cost of new ICE car: approx. \$45,000 msrp plus taxes & fees = \$51,000*
- Differential approx. \$18,000
- Fuel savings between Gasoline and Electricity about 5:1
- Travel about 17,000 km annually
- Estimated fuel saving (at today's gas costs): \$2,000 per year*
- Maintenance costs: 5-year total maintenance costs for our Tesla M3 = \$400 (including brake maintenance)
- Estimated maintenance savings: \$ 500 per year*
- Total annual savings (gas + maintenance): \$2,500 per year
- **Simple payback period 7 years** (without considering depreciation)



Step 3: Photovoltaic system (PV)

- In late June 2022 added a PV system to our house (after many years of procrastination)
- 9.9 kW system
- 22 panels (450 W each from Canadian Solar)
- Installed by TeraWatt Solar of Markham
- Designed to produce 10,708 kWh per year = 120% of our base annual electricity consumption of 8,902 kWh per year
- Actually produced just over 12,000 kWh in first year
- Net metering contract with Elexicon Energy
- Cost \$20,935 including all permits, installation and taxes





Step 4: Heat Pump

- In July 2022, we had our natural gas furnace and air conditioner (both 14 -15 years old) removed and replaced by a Mitsubishi Zuba high-efficiency, cold-climate heat pump (with a 10kW backup electric resistance heater)
- Probably the top-of-the-line heat pump
- Installed by Infiniti Home Heating and Air Conditioning of Whitby
- Total cost: \$24,747 including installation and taxes
- Replacement cost for new furnace and AC approximately \$10,000
- Net cost of \$14,747
- House seems more comfortable than previously



Costs for Steps 3 and 4

Costs:

• Pre and Post Audit (Windfall Ecology Centre)	\$ 706
• PV System	\$20,935
• Heat Pump	<u>\$24,747</u>
Total	\$46,388

Rebates:

• Federal Greener Homes Program for audit	\$ 600
• Federal Greener Homes Program for retrofit	\$5,000
• Durham Greener Homes Program for retrofit	<u>\$6,481</u>
Total	\$12,081 (26% of costs)

Net Cost: \$34,307



Savings for Steps 3 and 4

- Comparing natural gas and electricity costs for the first year of operation to the previous year, July 1 to June 30

\$ per Year	Base Year	First Year Operation	Saving
Natural Gas	\$1350	\$493	\$857
Electricity	\$1573	\$1538	\$35
Total	\$2923	\$2031	\$892

- Natural gas bills down dramatically (just water heating, small amount for fireplace and monthly “Customer Charge” of \$22.88 plus GST= \$310 annually)
- natural gas commodity costs have increased dramatically (about 65%) over the last year
- Net metering contract with Elexicon is complex but should increase savings in year 2



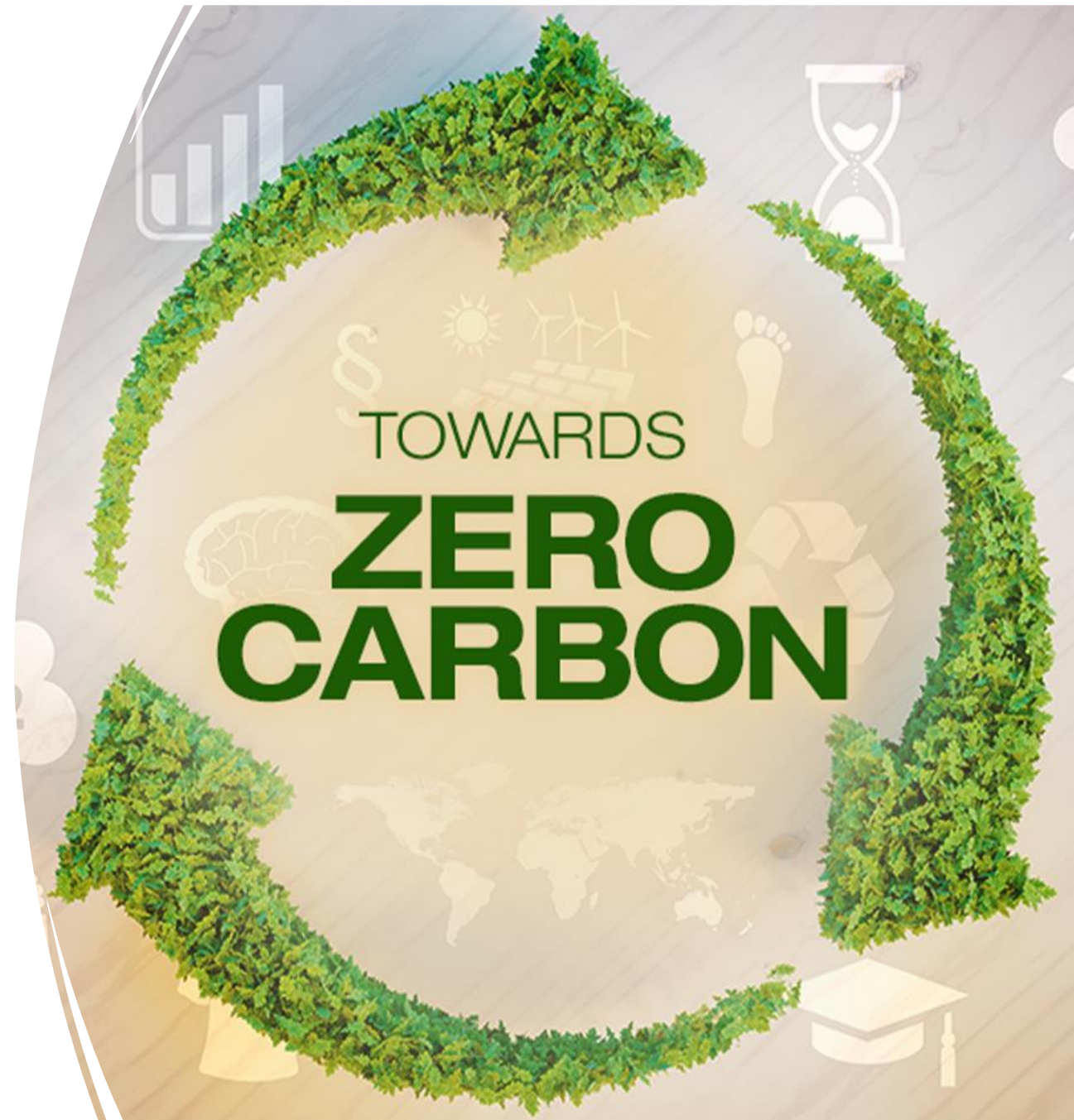
Where Do We Stand on Carbon?

Probably about a **90% emissions reduction in carbon** compared to Base Case

Step 5:

- Replace our gas-fired, in-line water heater with a heat pump water heater (on order for October)
- Disconnect natural gas service
- Convert one fireplace to electric

Then, **“Goodbye Fuel World!”**



Don't Forget the Carbon Fee-bate

- Federal Carbon Pollution Pricing Program in most provinces (PP talk: “The Carbon Tax”)
- Levied on fuels at retail level (at current rate of \$65/tonne) and rebated to all households at a flat rate of \$732 per year for a 2-person household (in Ontario)
- We currently pay \$32 annually (on small amount of natural gas) and receive \$732 annually in quarterly Climate Action Incentive Payments (CAIP)
- Net income of \$700 per year currently
- Will rise each year as rate rises from \$65 to \$170/tonne in 2030
- CAIP becomes Climate Action **Reward** Payment (CARP) for carbon savers

Total Financial Savings

Savings per Year	Currently	After Step 5
Car (est)	\$2,500+	\$2,500+
House (measured)	\$892	\$1,385+
Carbon price	\$700	\$732++
Total	\$4,092	\$4,617++



Lessons Learned

- Include vehicles in your carbon journey; probably half of a household's carbon emissions are from vehicle(s)
- Vehicle decision is relatively easy and quick
- Phase your home retrofits, starting with thermal shell and efficiency upgrades and ending with PV*
- Home retrofits will take time
- Government rebates are important to nudge decisions
- Don't forget climate adaptation measures
- Make optimum use of auditors, advisors and rebate programs
- Choose installers carefully
- Don't forget Carbon Charge savings
- Do it for the carbon reductions; justify it by the economics
- Become a "Carbon Influencer"