


The Kelly Household's Journey Toward Zero Carbon

CAP Community
Engagement Webinar
March 16, 2023





Four Steps (so far)



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 45) (\$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 almost 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 16,000 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
- 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	\$ 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

- To be estimated after a full year of operation
- Have me back in September
- Natural gas bills down dramatically (just water heating, small amount for fireplace and monthly “Customer Charge” of \$22.88)
- Note natural gas commodity costs have increased dramatically (about 65%) over the last year
- Net Metering contract with Elexicon is complex
- Note “Customer Charge” of approx. \$1 per day



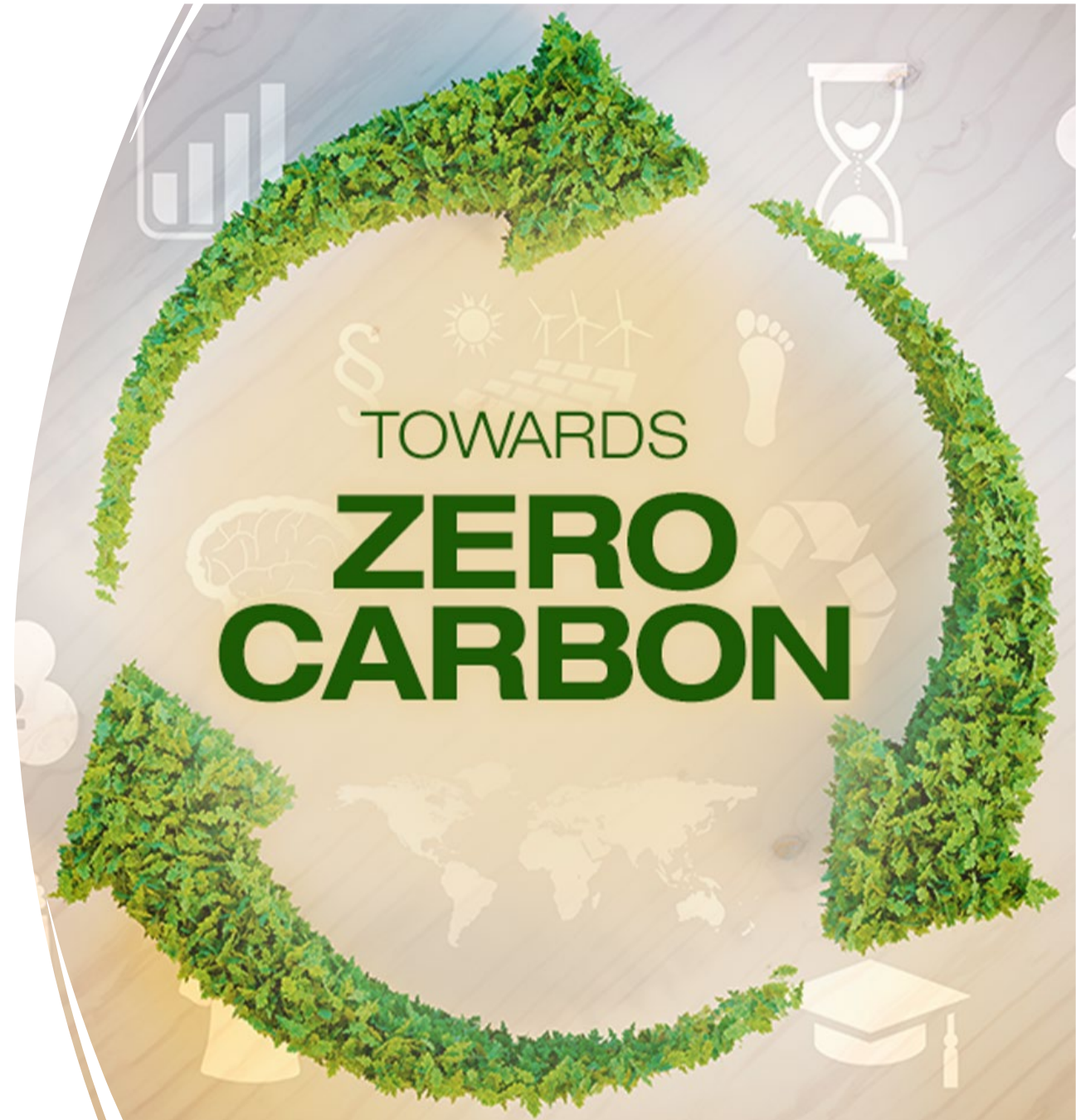
Where Do We Stand on Carbon?

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

Remaining Steps:

- Replace our gas-fired, in-line water heater with an electric alternative
- 2 gas-fired fireplaces ?*
- BBQ ??

Then, **“Goodbye Fuel World!”**



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
- Keep good records (if you are an energy nerd)
- Do it for the carbon reductions; justify it by the economics
- Become a "Carbon Influencer"