

Making Connections

Straight Talk About Electricity in Ontario

Webinar with the Commissioner:
Dr. Dianne Saxe (April 17, 2018)

Environmental
Commissioner
of Ontario



Commissaire à
l'environnement
de l'Ontario



The Environmental Commissioner of Ontario

The ECO is the province's environmental watchdog.

Appointed by an all-party committee, the ECO is an independent officer of the [Ontario Legislature](#) tasked with:

- Promoting and providing advice and assistance about the *Environmental Bill of Rights, 1993 (EBR)*;
- Reporting on the implementation of, and compliance with, the *EBR*; and
- Reporting on Ontario's progress reducing greenhouse gas emissions and improving energy conservation and efficiency.

What is this report about?

Ontario's electricity system from 2005→2030

PAST: Ontario's transition to a low-carbon electricity system
impacts on health, the environment, and costs

FUTURE: Critical steps for Ontario to meet our GHG targets

19 FAQs in 5 sections:



Ontario's Transition to a Low-Carbon Electricity System, 1 – 4



Impact on our Electricity System, 5 - 7



Impact on Electricity Prices, 8 - 9



Impact on the Environment, 10 - 12



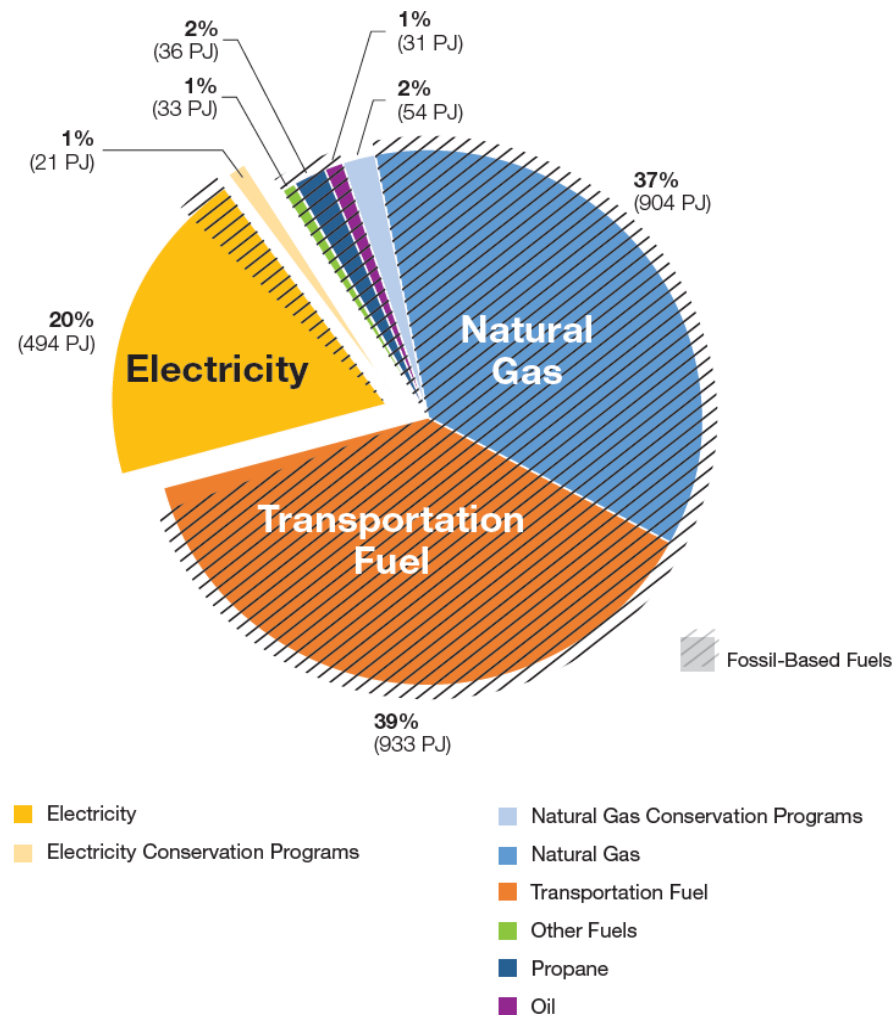
Ontario's Electricity Future, 13 - 19



Q1 What is this report about?

Q2 How does Ontario make decisions about its sources of electricity?

Electricity key to Ontario's low carbon energy future



Ontario's transition to low-carbon electricity

2005:

- Unreliable
- Low investment
- High pollution (air and GHG)
- High indebtedness

Today:

- Reliable (then some)
- Infrastructure upgrades and innovation
- 96% carbon-emission free
- Higher unit cost of electricity
- Cleaner air, better public health

Ontario's electricity decision making

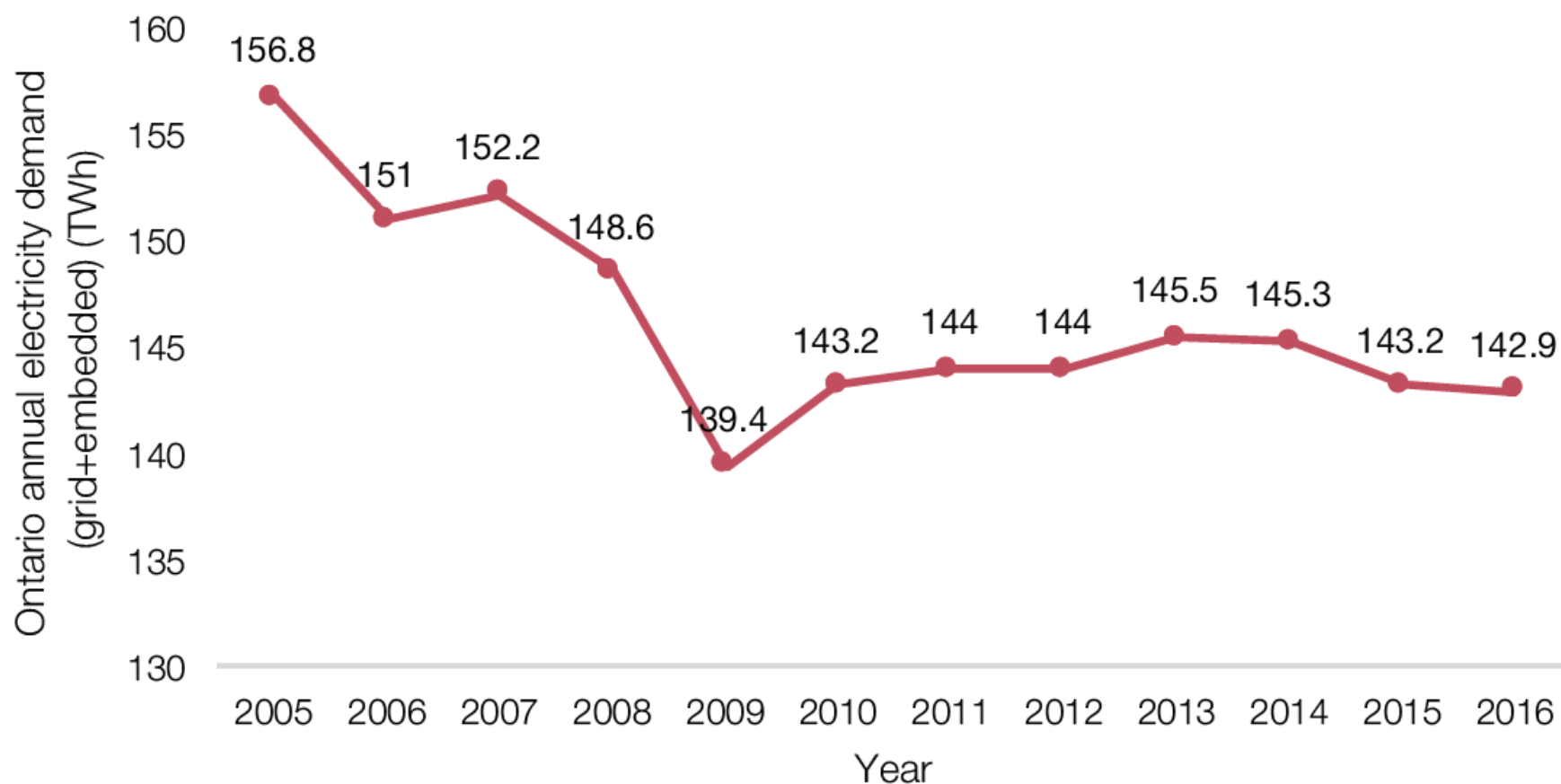


- 3 decades of policy instability, politicization
 - Hard path? Soft path?
 - Government control v markets?
- Wholesale market INEFFECTIVE in adding new generation
 - Crisis/ Task Force in 2003
- Decisions driven by Ministry of Energy
- Long-Term Energy Plan: mostly electricity
- Key decisions outside the LTEP process



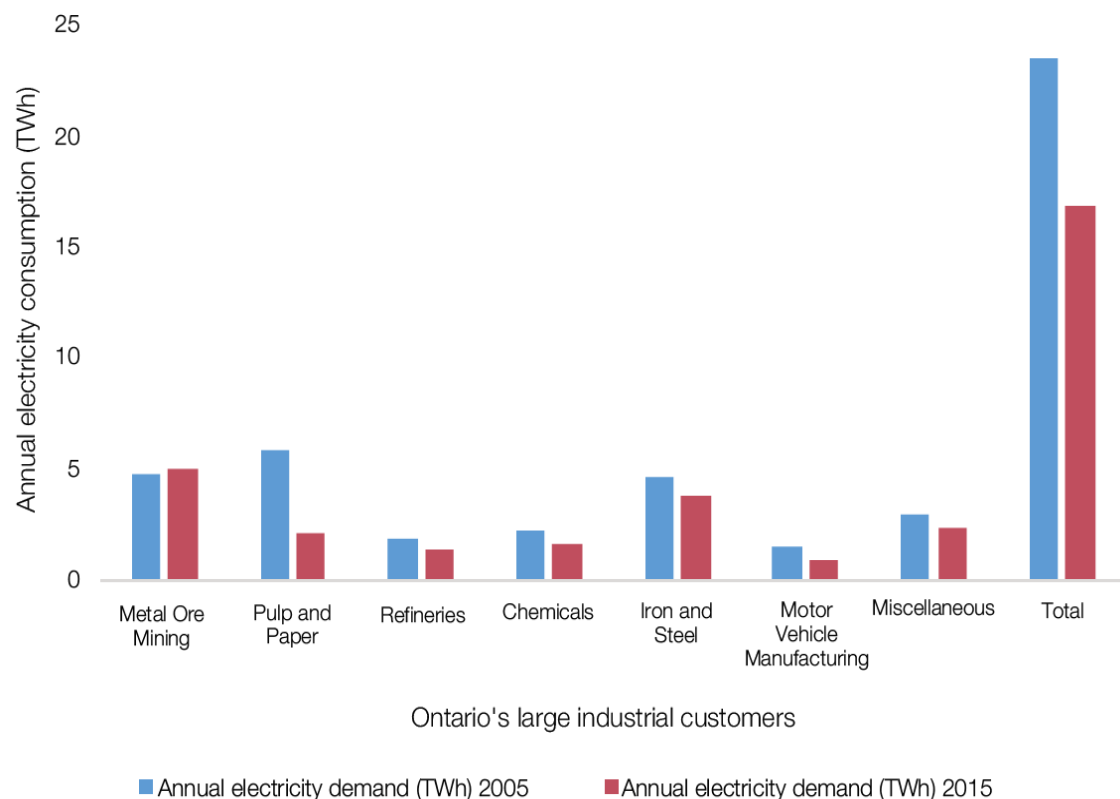
- Q3** How and why has Ontario electricity demand changed?
- Q4** Where does our electricity come from and how has the supply mix changed?

Ontario's changing electricity demand (2005-2016)



Demand largely flat...
(not what was expected in 2003 - 2005)

Less industrial demand, conservation at home

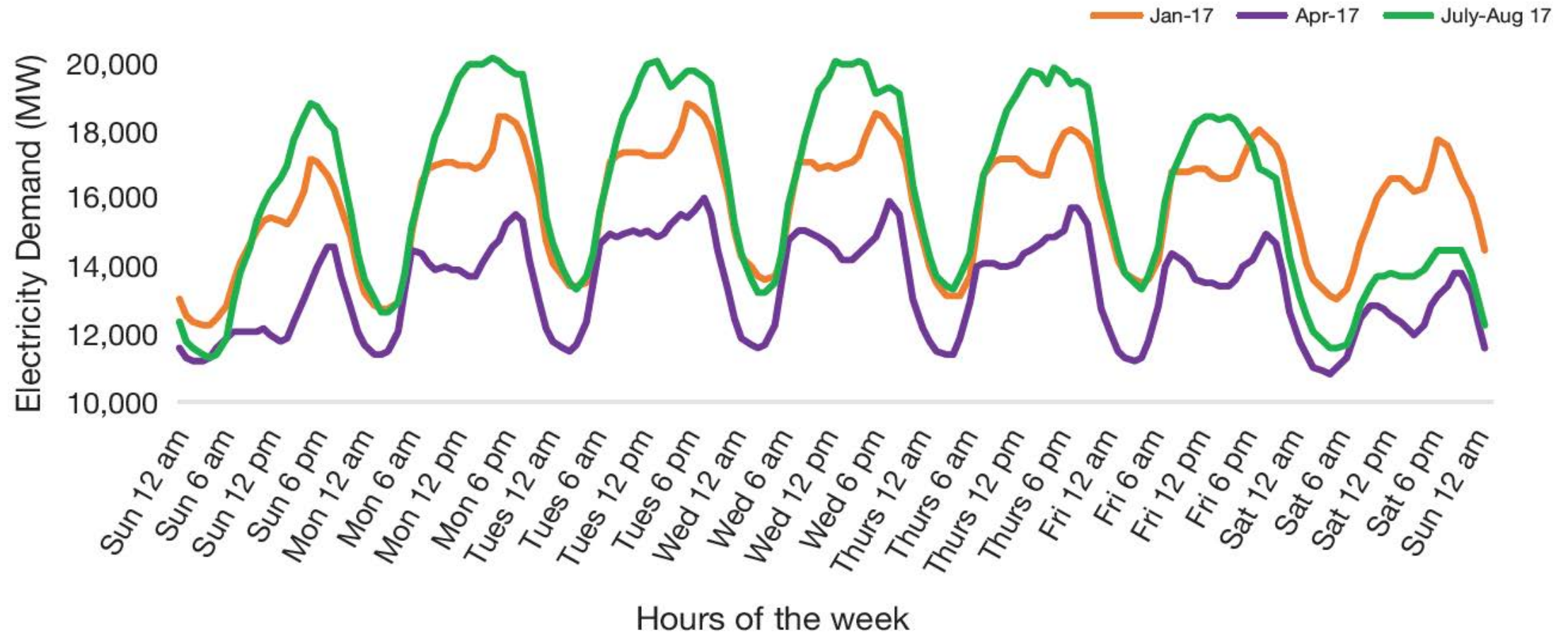


Annual industrial consumption

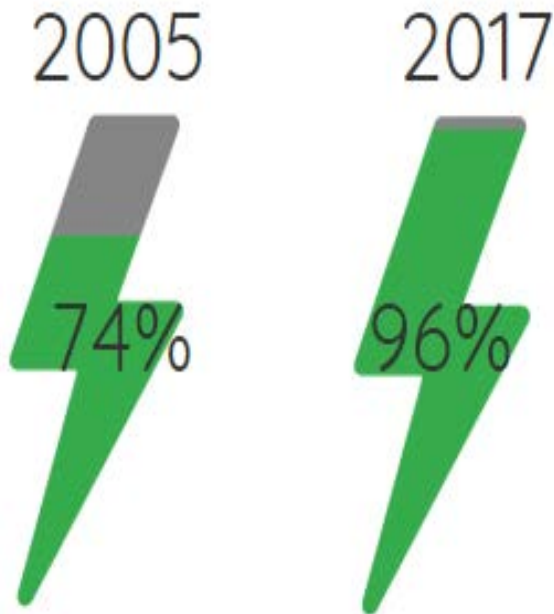


Monthly residential consumption

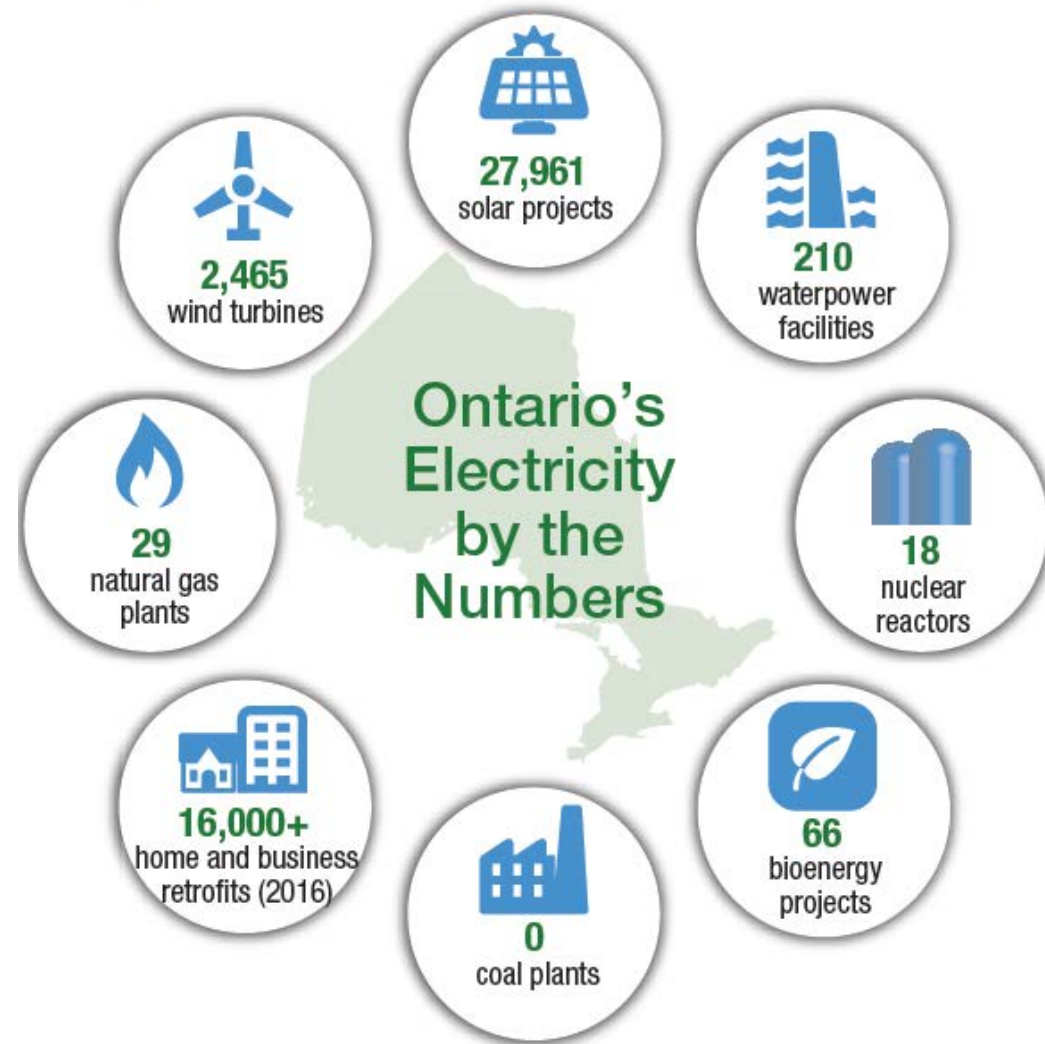
Huge demand swings - daily, weekly, seasonally



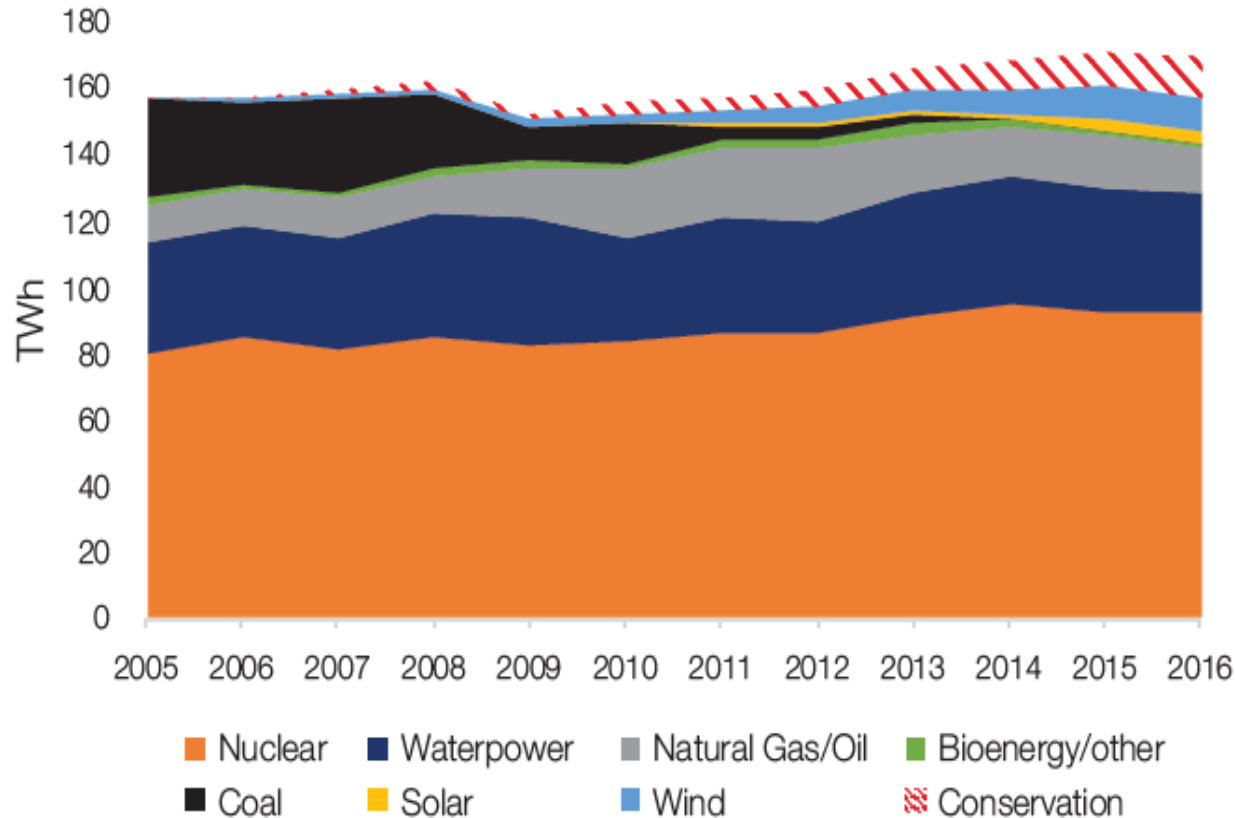
Cleaner, more diverse supply



Ontario's electricity system went from 74% low-carbon generation in 2005 to 96% low-carbon generation in 2017.

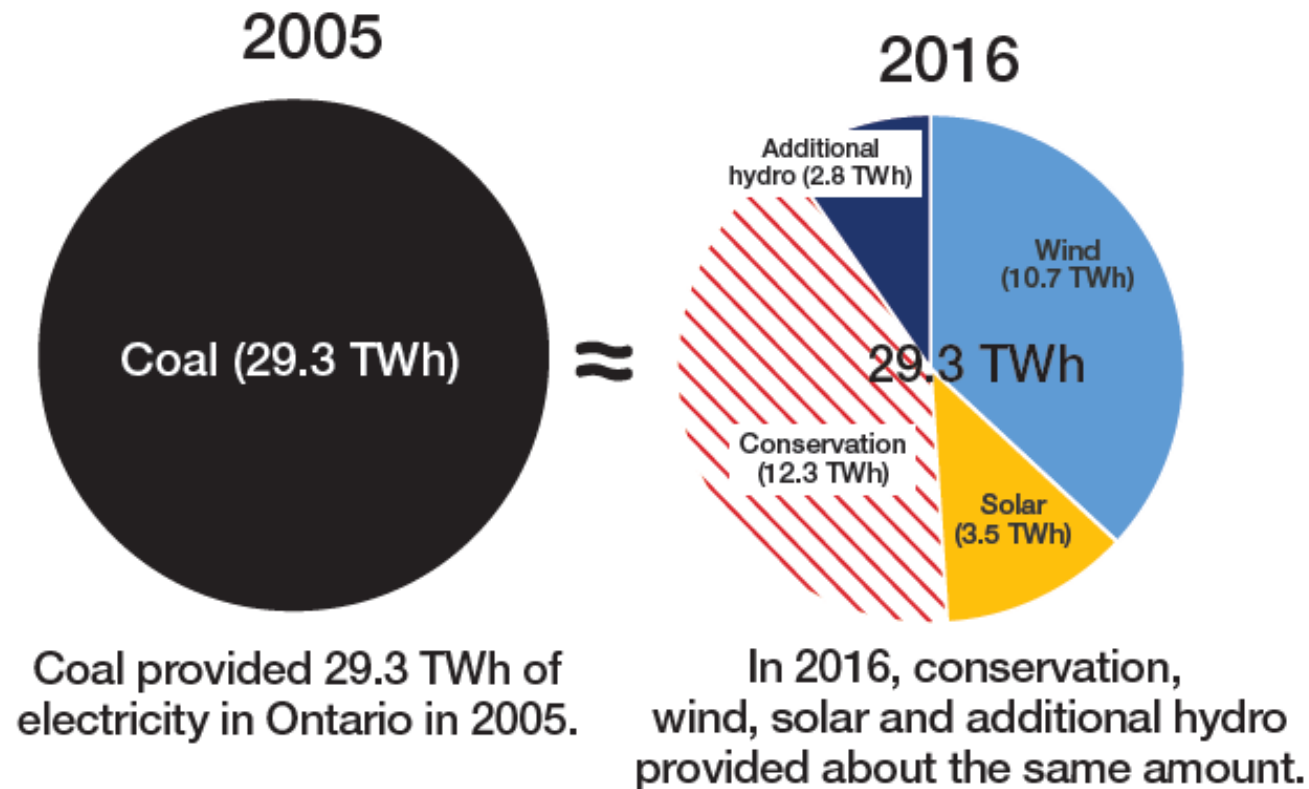


But a less dispatchable supply mix



- $\approx 19\% \rightarrow 0\%$ coal generation
- $0\% \rightarrow \approx 10\%$ wind and solar
 - More embedded generation
- $\approx 60\%$ generation from nuclear
- Conservation has avoided ≈ 12 TWh ($\approx 9\%$ of demand)

What replaced coal?



but not as dispatchable

Which source of power is best?

- Each has advantages and disadvantages, e.g. natural gas prices

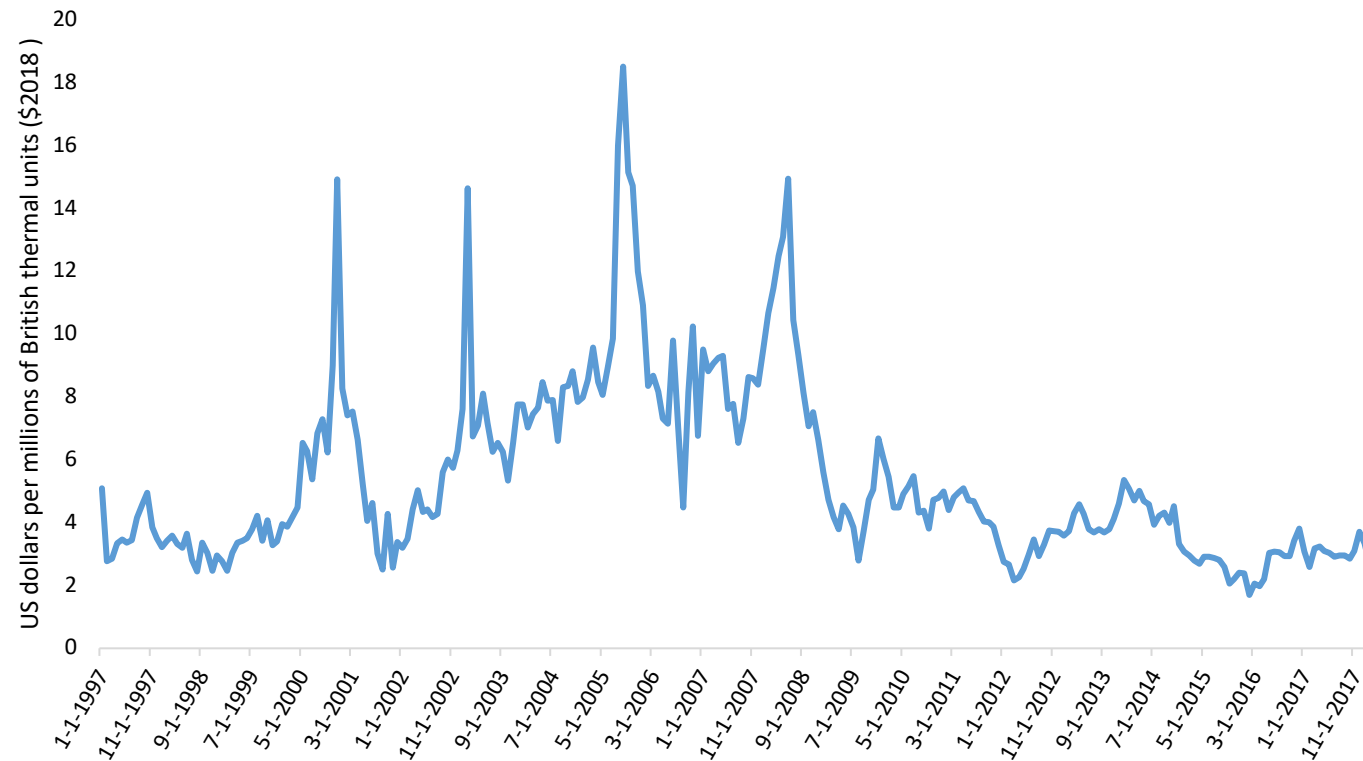
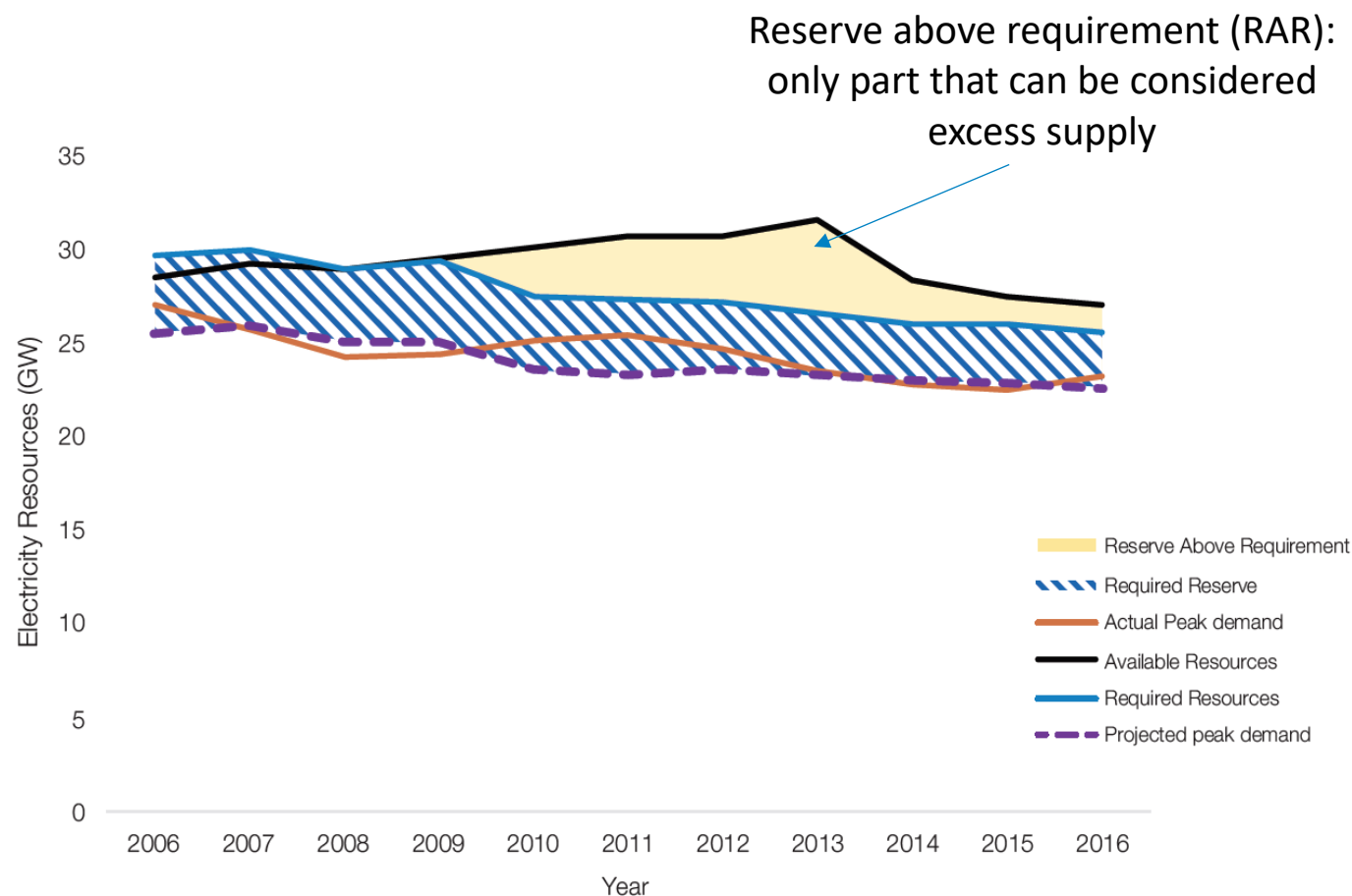


Figure 4.4. Henry Hub natural gas price (US \$2018 real dollars, 1997-2018).



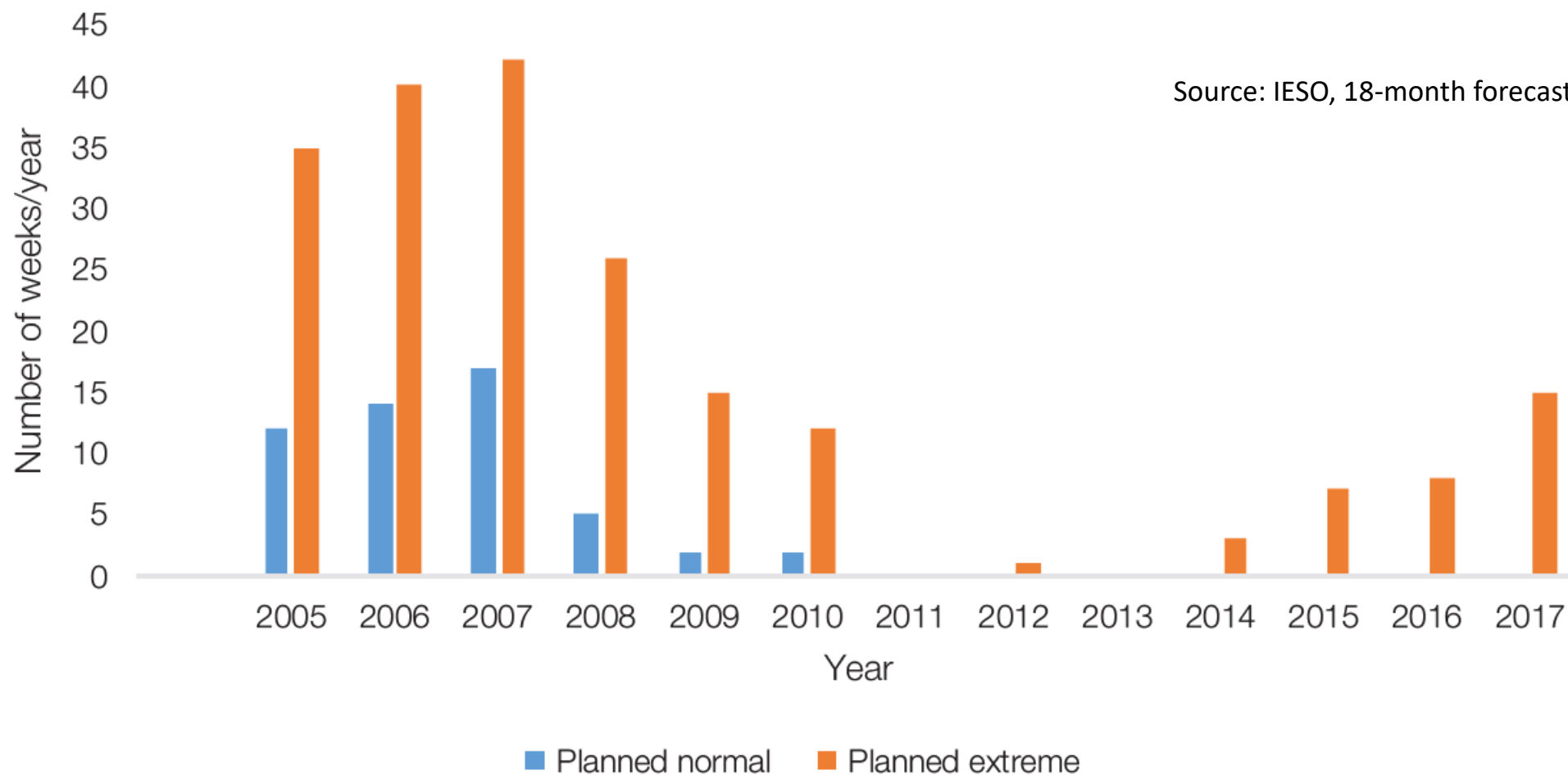
Q5 Has Ontario's electricity system become more reliable and able to meet peak demand?

Improved reliability



1. Transnational obligations to maintain greater reliability after 2003
 2. Provide power during highest demand ("peak")
 3. Increased variable renewable generation
- System oversized by ~18%

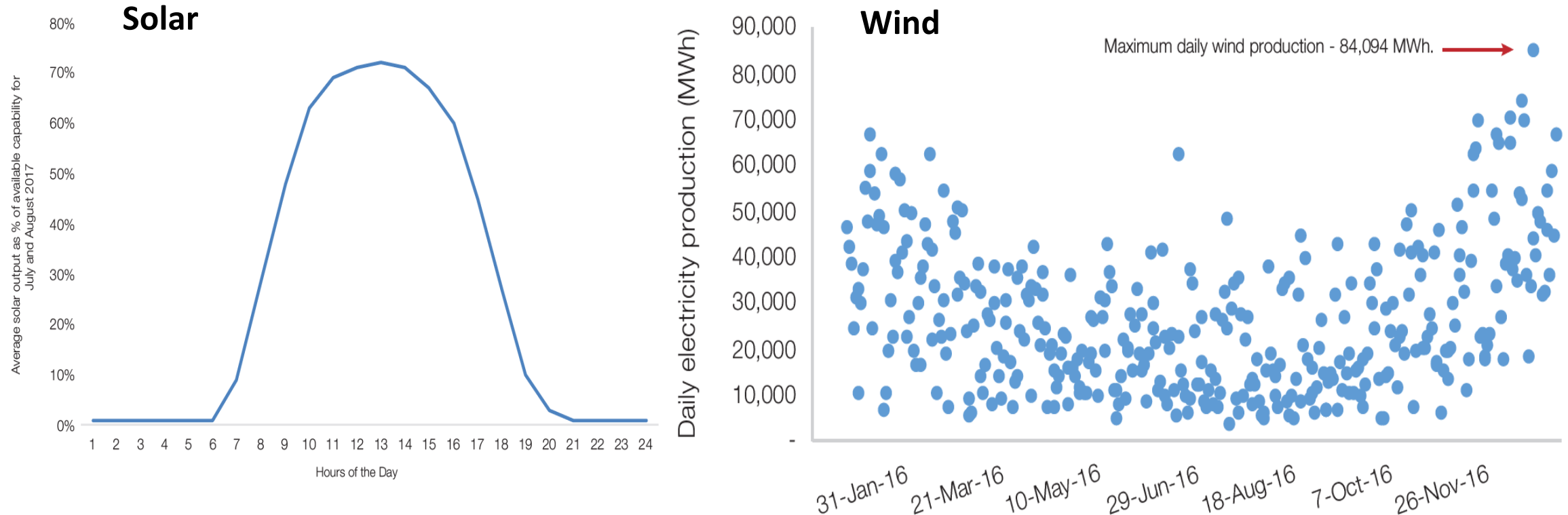
Enough, but not too much





- Q6** How does Ontario deal with the variability of wind and solar electricity output?
- Q7** Why does Ontario export and curtail so much electricity?

More solar & wind = more variability



- Wind & solar have variable output (benefits & challenges)
- Several mechanisms to manage variability (e.g., storage, pricing)

Learning from other jurisdictions

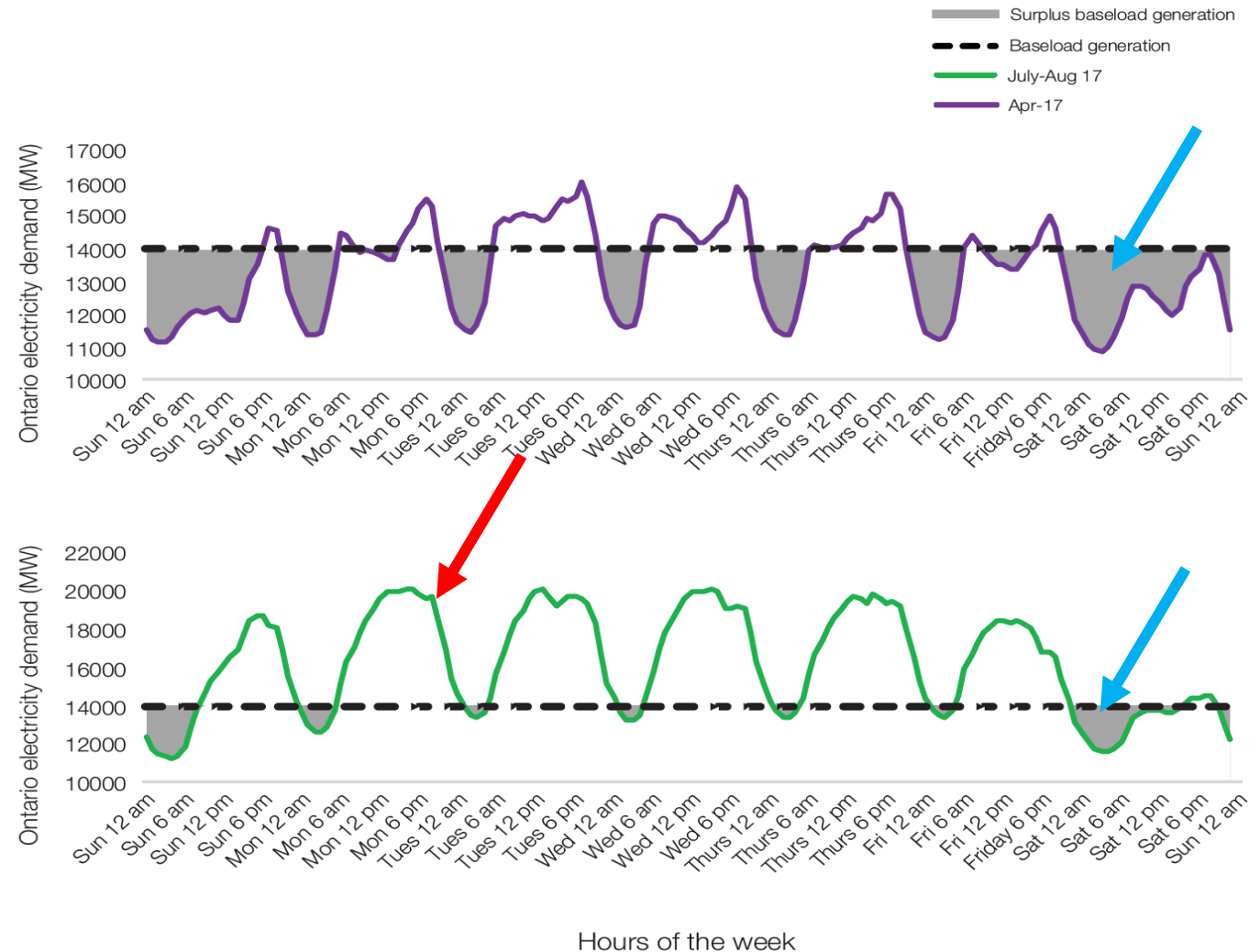
Country	Solar (%)	Wind (%)	Solar +Wind (%)
Denmark	2	42	44
Ireland	0	20	20
Spain	3	20	23
Germany	6	12	18
United Kingdom	3	11	14
Italy	8	6	14
Ontario	2	7	9

Solar and wind role often hidden



Do we have too much electricity?

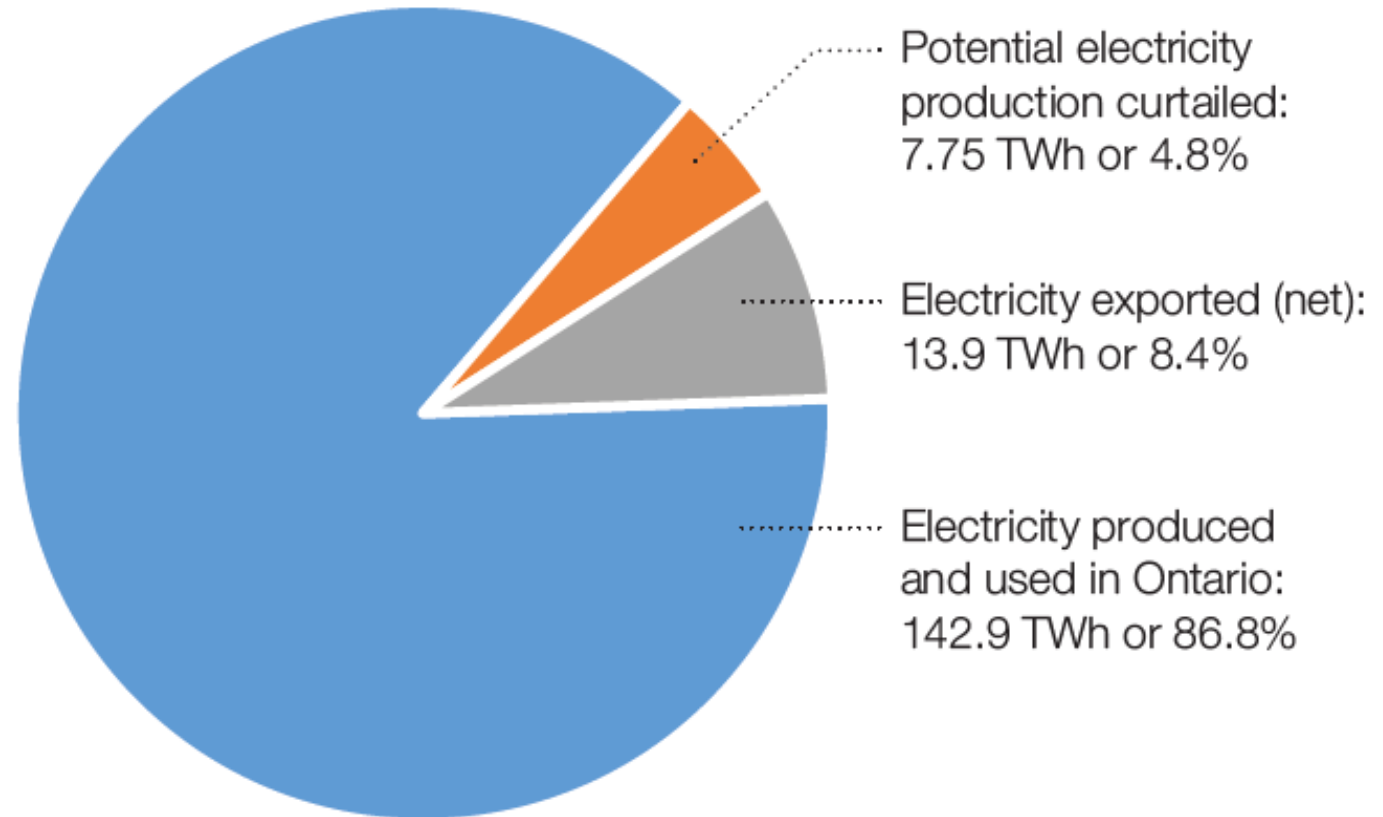
- Sometimes:
 - Overnight, weekends, especially during spring, fall
- But not always:
 - Ontario has just enough during periods of critical peak demand (late aft of hot summer days)



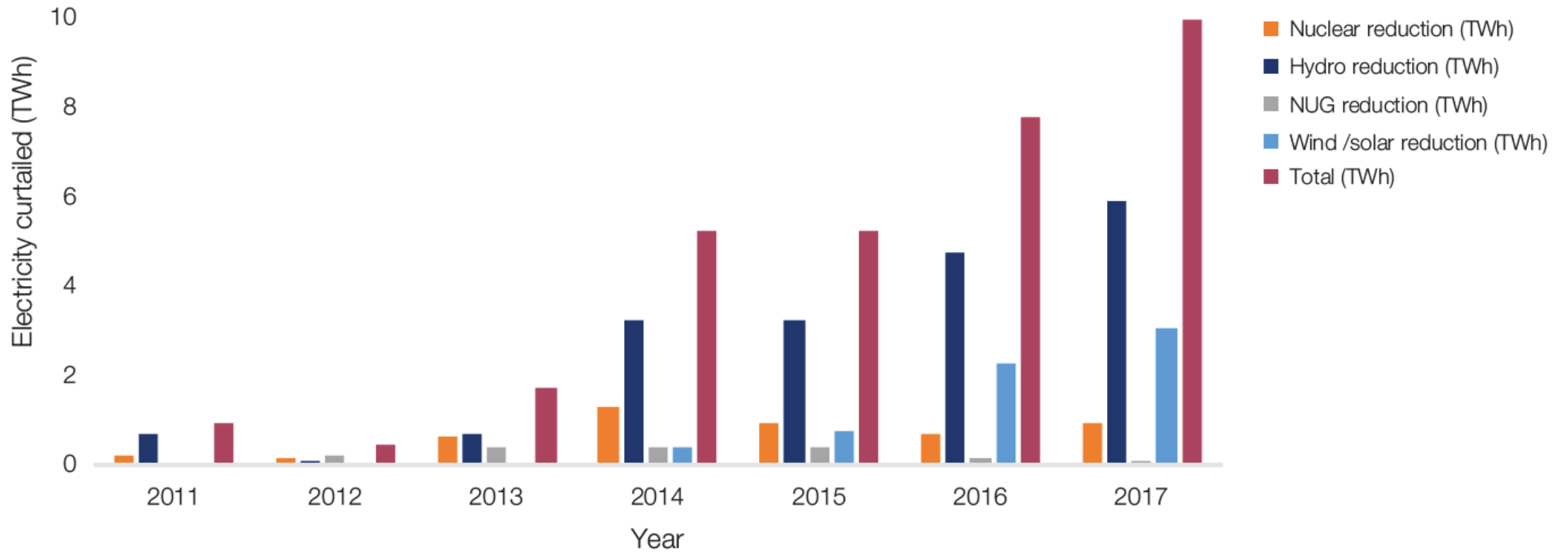
Exporting and curtailing electricity

2016: Ontario
exported or curtailed
13% of electricity
(especially wind and
water)

**Ontario could take
better advantage of
this clean electricity**



What we curtail

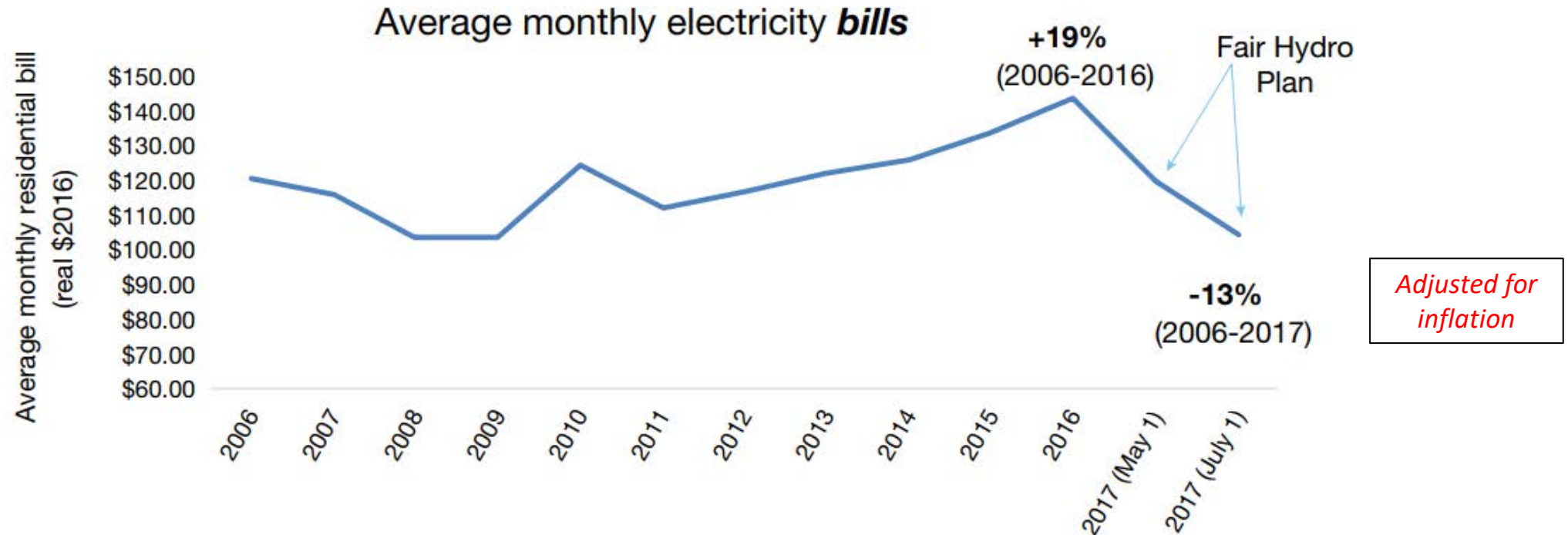




Q8 How high are Ontario electricity prices?

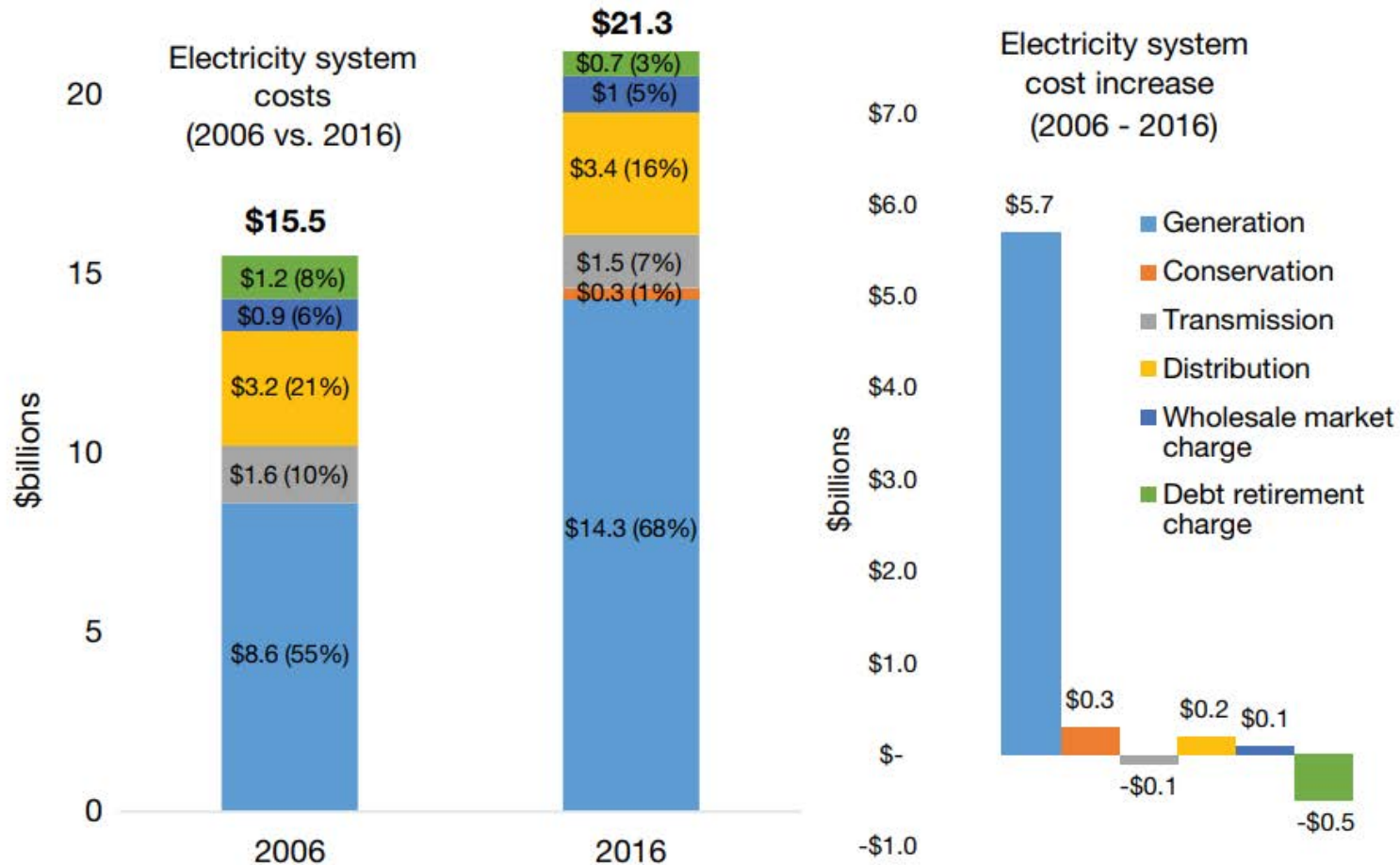
Q9 What do higher electricity costs pay for?

How high are Ontario electricity bills?



- Average **unit cost of electricity service** has increased (45% from 2006-2016)
- But, average residential **electricity bills** have decreased, because:
 1. Average consumption has decreased 13%
 2. Only 80% of system costs paid by current customers (e.g., Fair Hydro Plan)

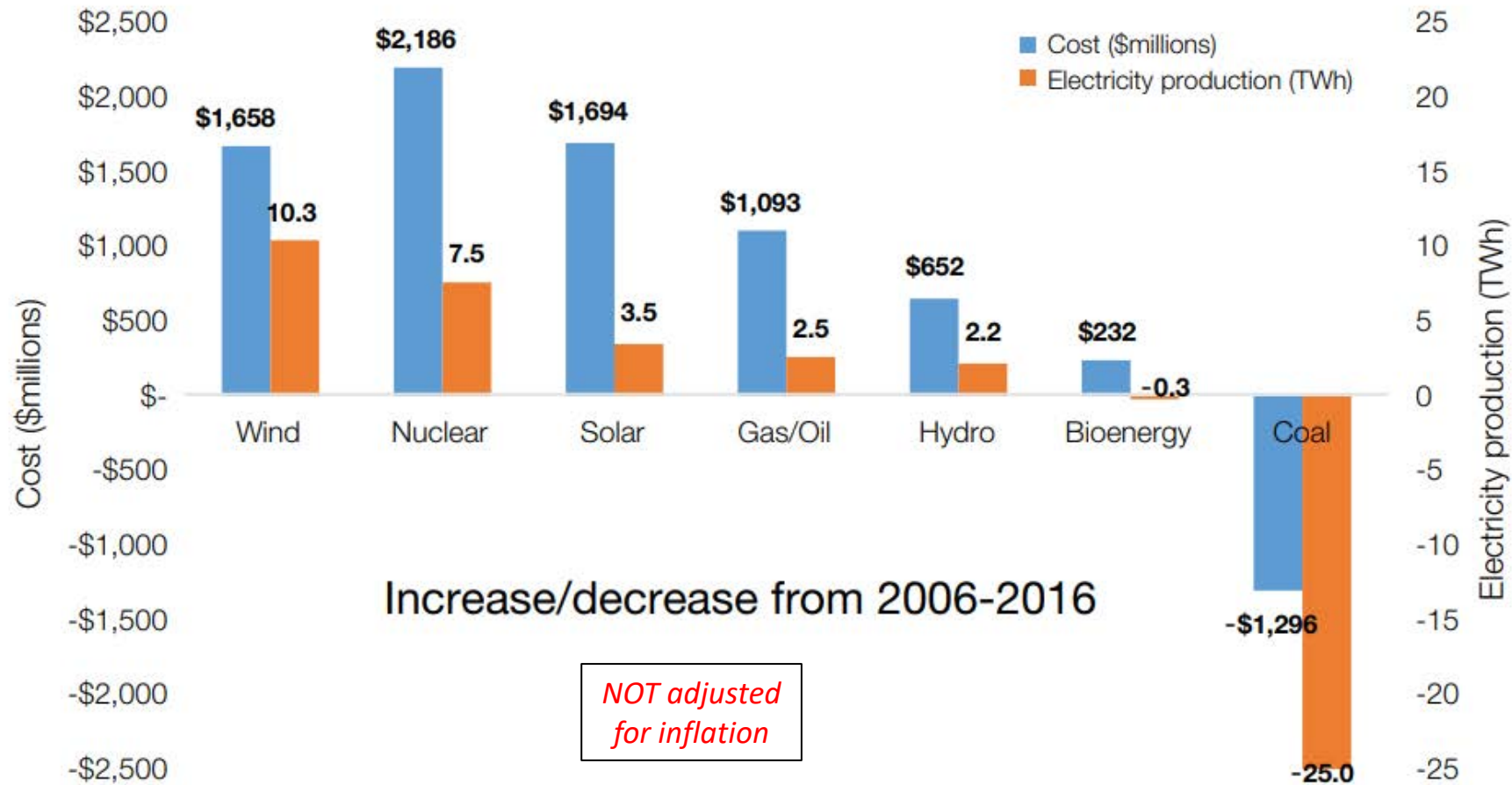
What do higher electricity costs pay for?



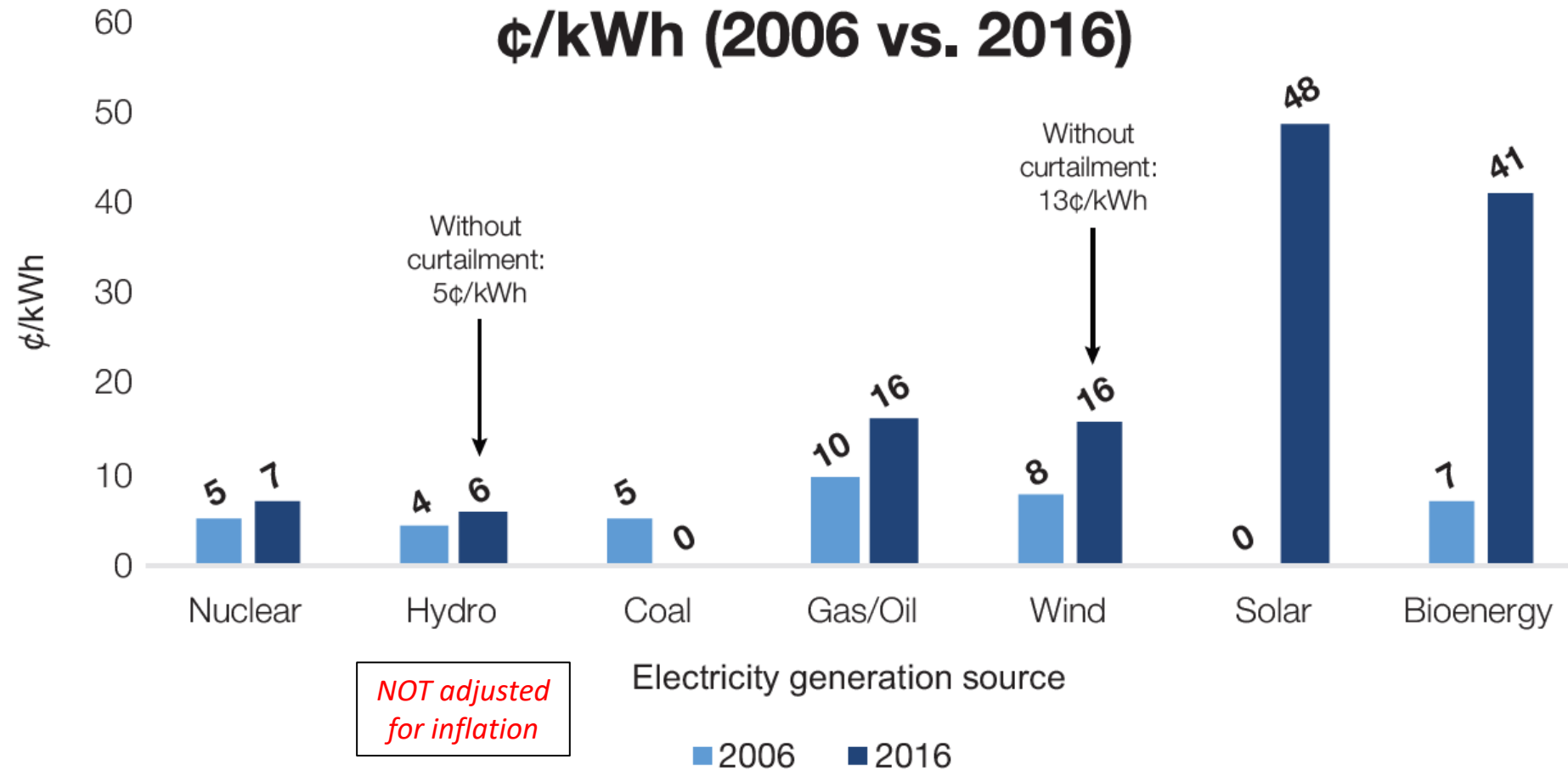
- Total system cost increase: 37%
- 98% of increase: Generation
- Transmission & distribution costs stable
- Increased cost → cleaner and more reliable supply

Adjusted for inflation

Changes in costs and production (2006-2016)



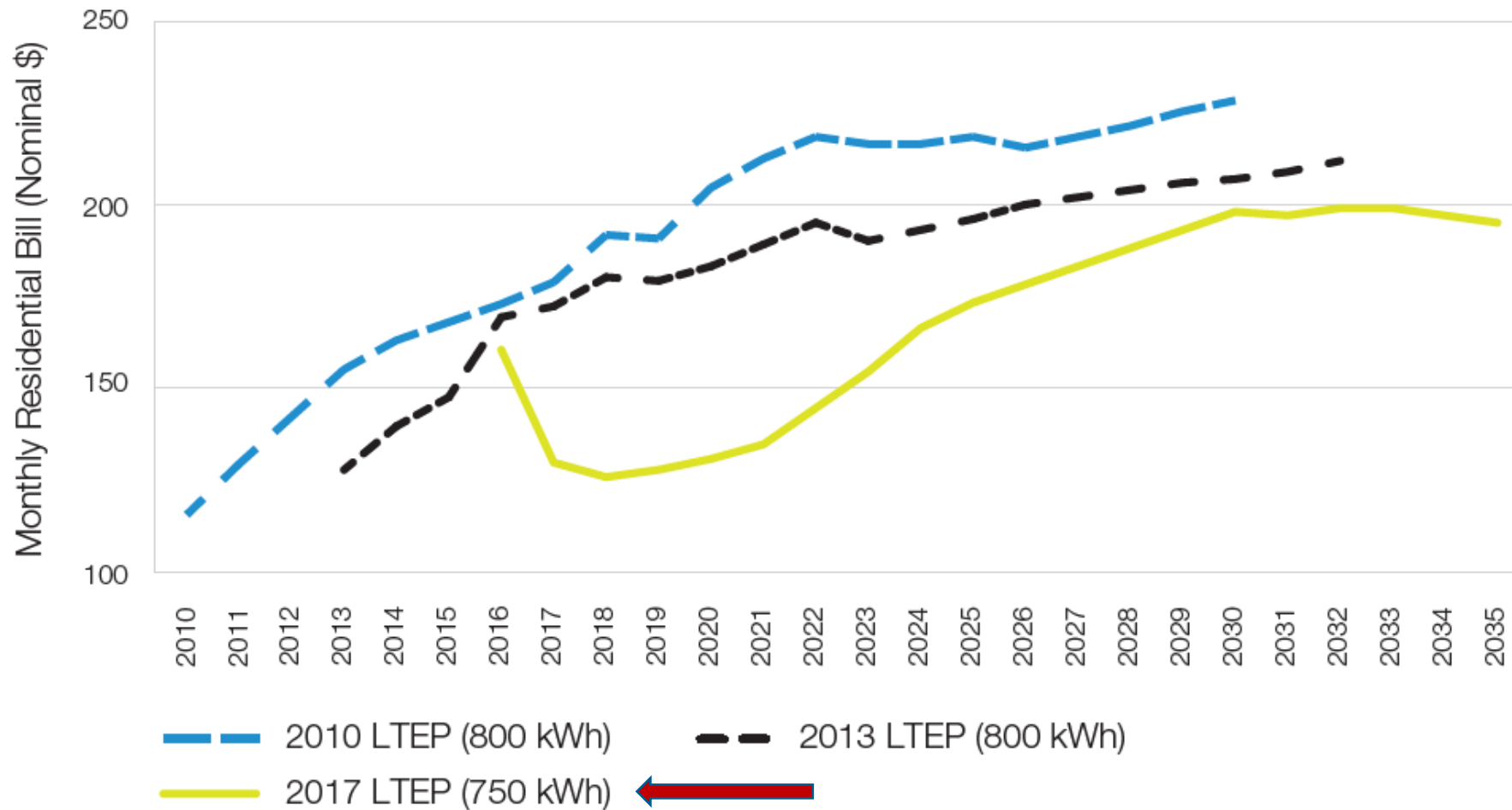
Unit costs (not the whole story)



How much of your bill?

- How much of a \$125 monthly bill is for:
 - Gas plant relocation? ~25 cents
 - Ontario Hydro stranded debt? Was ~ \$6, now \$0
 - Sale of Hydro One? \$0
- Selling surplus power to the US? Saves about \$1.40

Where are rates going?



16% pay much higher than average electricity bills

≈\$210

- Avg. monthly Ontario energy bill in 2017
 - ≈ \$90 for natural gas
 - ≈ \$124 for electricity

≈ \$320

- Avg. monthly electricity bill for homes heated with electric baseboard heaters

→ Energy poverty is a major concern for some households.

→ More focus needed on low-income and First Nations energy conservation programs

What should Ontario do for people unduly affected?

- Financial support for energy poverty (7%)
- Focussed conservation / efficiency for electrically heated homes
 - Especially baseboards



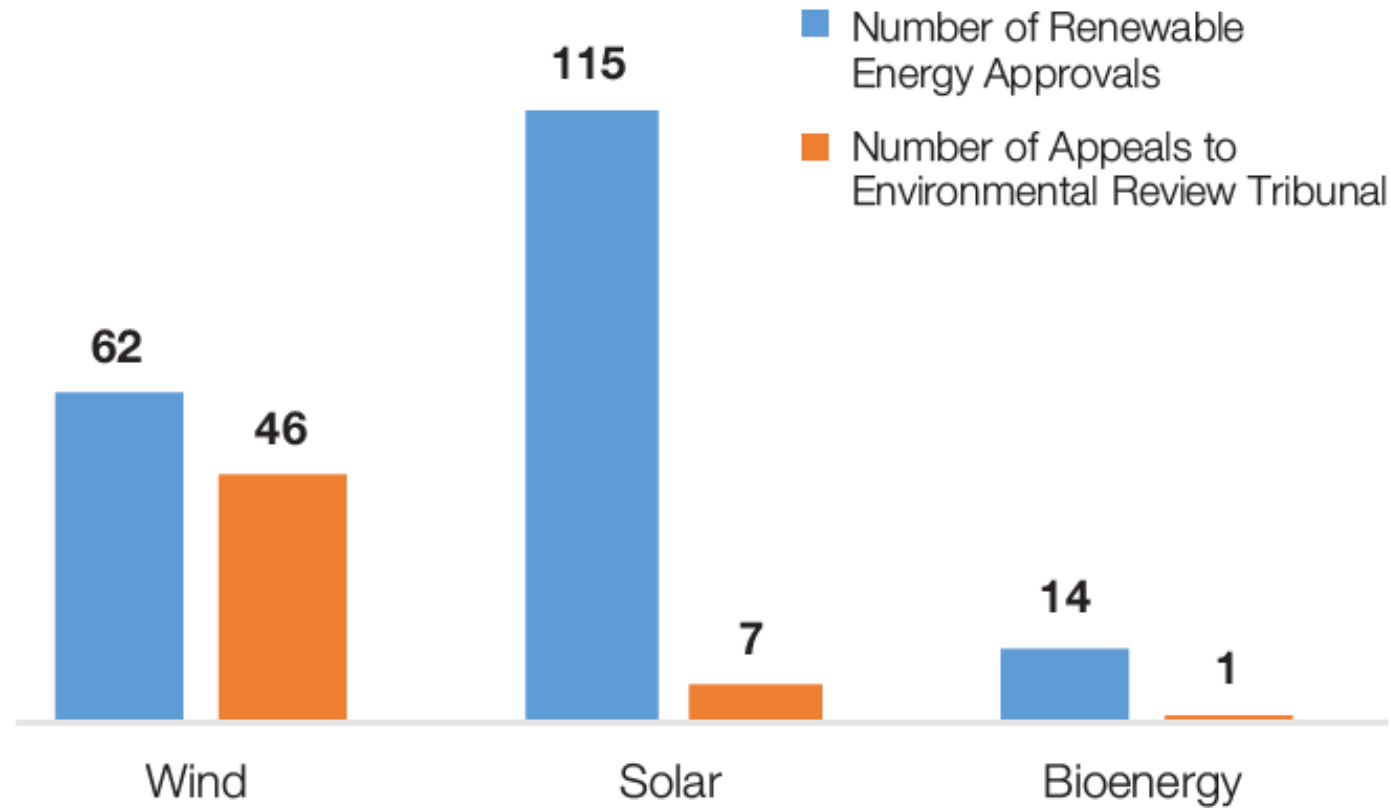
- Q10** What are the environmental impacts of Ontario's electricity sources?
- Q11** How much have the coal phase-out, renewable electricity, and conservation reduced greenhouse gas emissions?
- Q12** How much did the coal shutdown reduce pollution?

Environmental impacts of generation

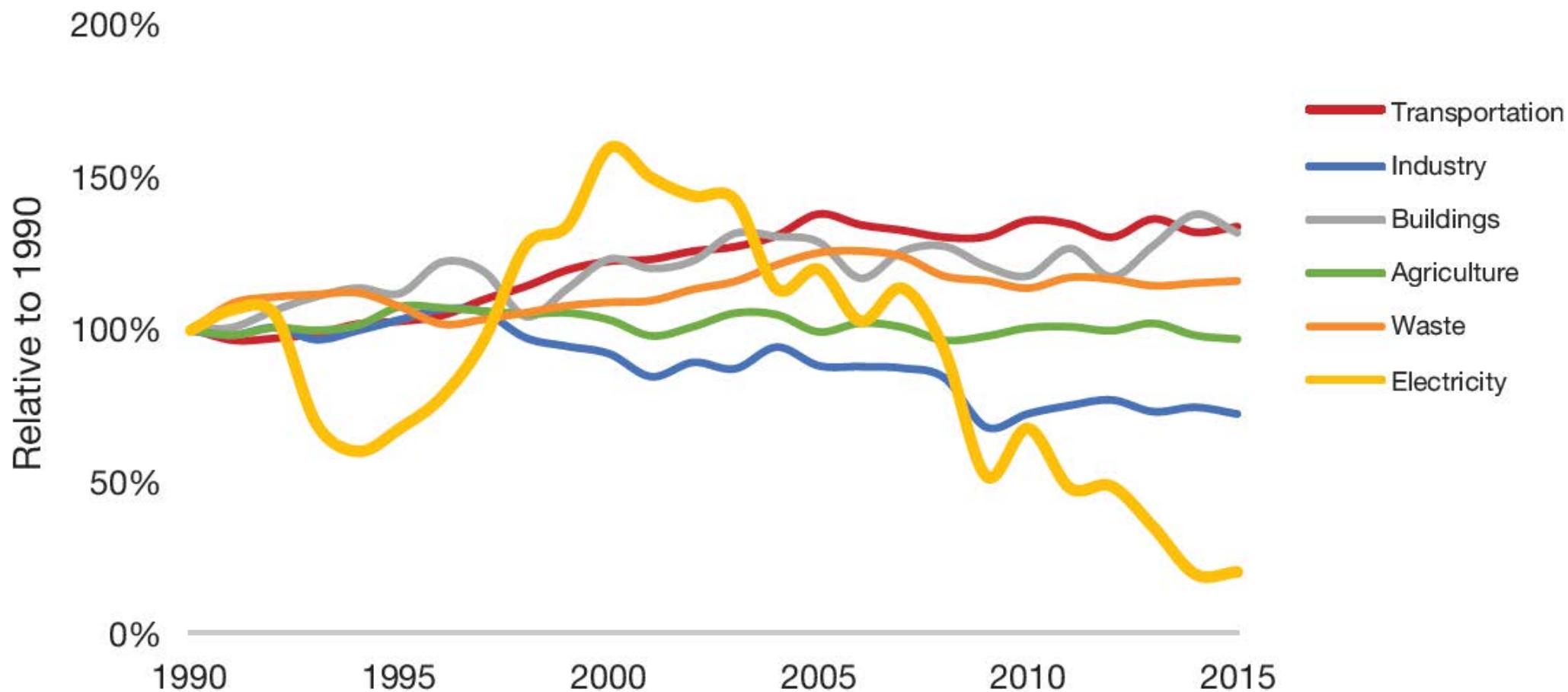


Other than conservation, every source of electricity has environmental impacts (e.g., bat and bird kills from wind turbines, nuclear waste, etc.).

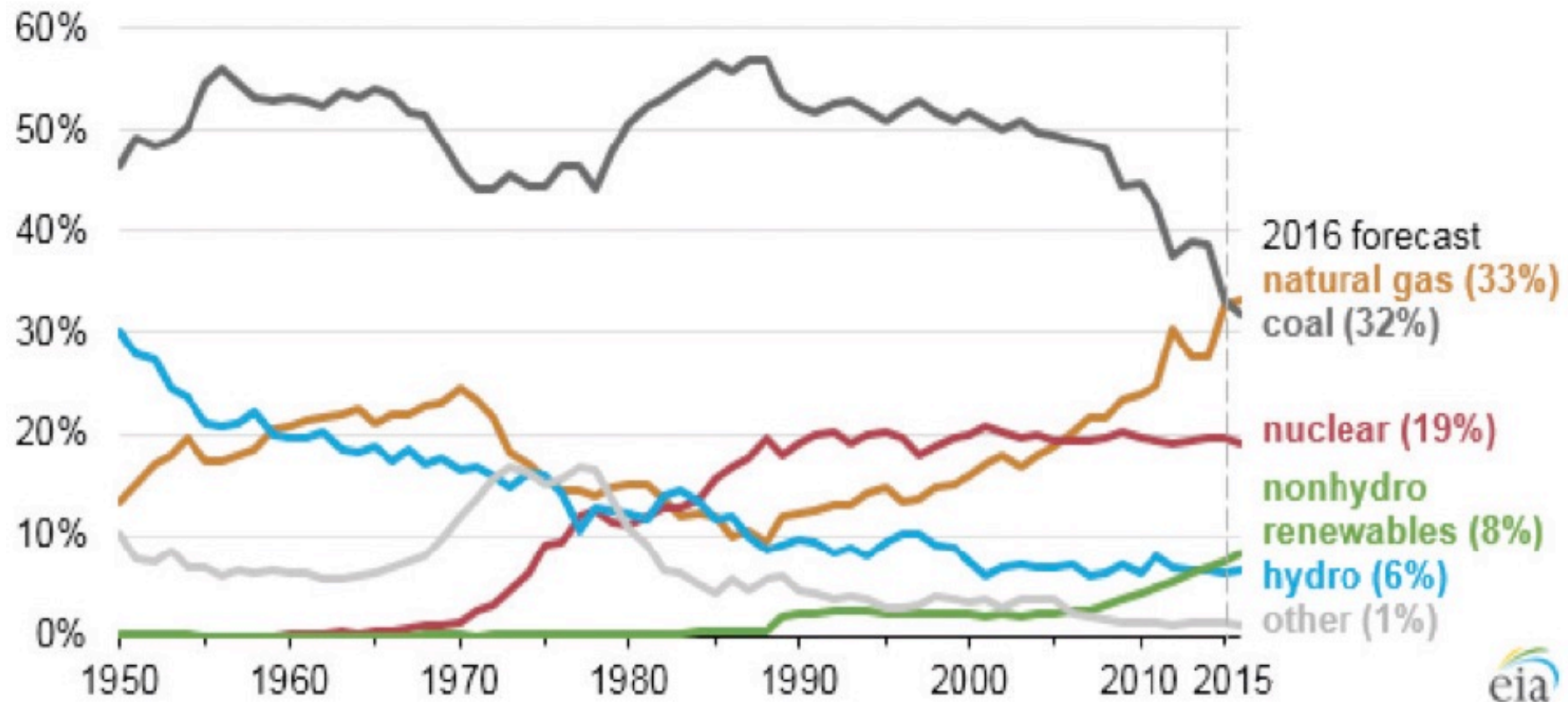
Some control by Environmental Review Tribunal



GHG reductions from clean electricity generation



Coal down in the US too



Impact of coal shutdowns

- 53 smog days in 2005
- 0 smog days in 2014
- Reduction in electricity sector air emissions:
 - 82% reduction in nitrogen oxides
 - 99% reduction in sulphur dioxide
 - 86% reduction in fine particulate matter
 - 100% reduction in mercury
- In 2000, air pollution (from all sources) resulted in 45,000 emergency room visits; 1,900 premature deaths in Ontario

Clean air matters

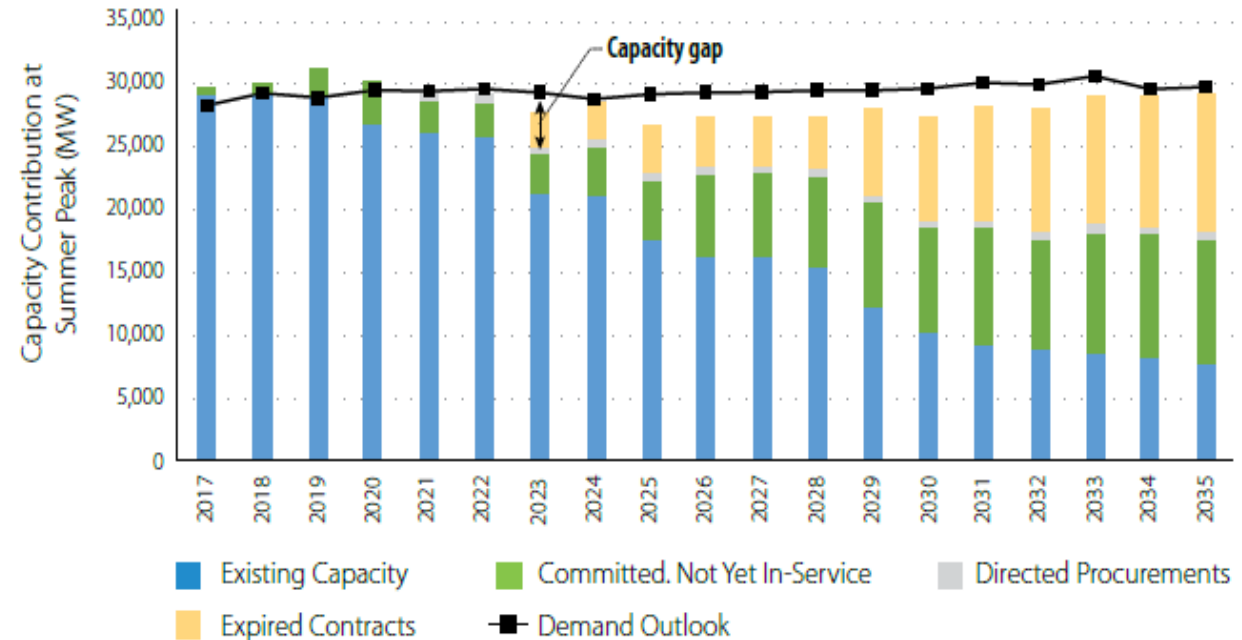
- Enormous health, environmental and economic benefits from cleaner air
- RGGI: \$5.7 billion (US) in health benefits over three years from reduced coal use
 - 39,000 to 47,000 fewer lost days at work
 - 300 to 830 lives saved
 - 8,200 to 9,990 fewer asthma attacks
- Recent research
 - Less crime, less depression

Q13 What does the Long-Term Energy Plan propose for Ontario's electricity future?

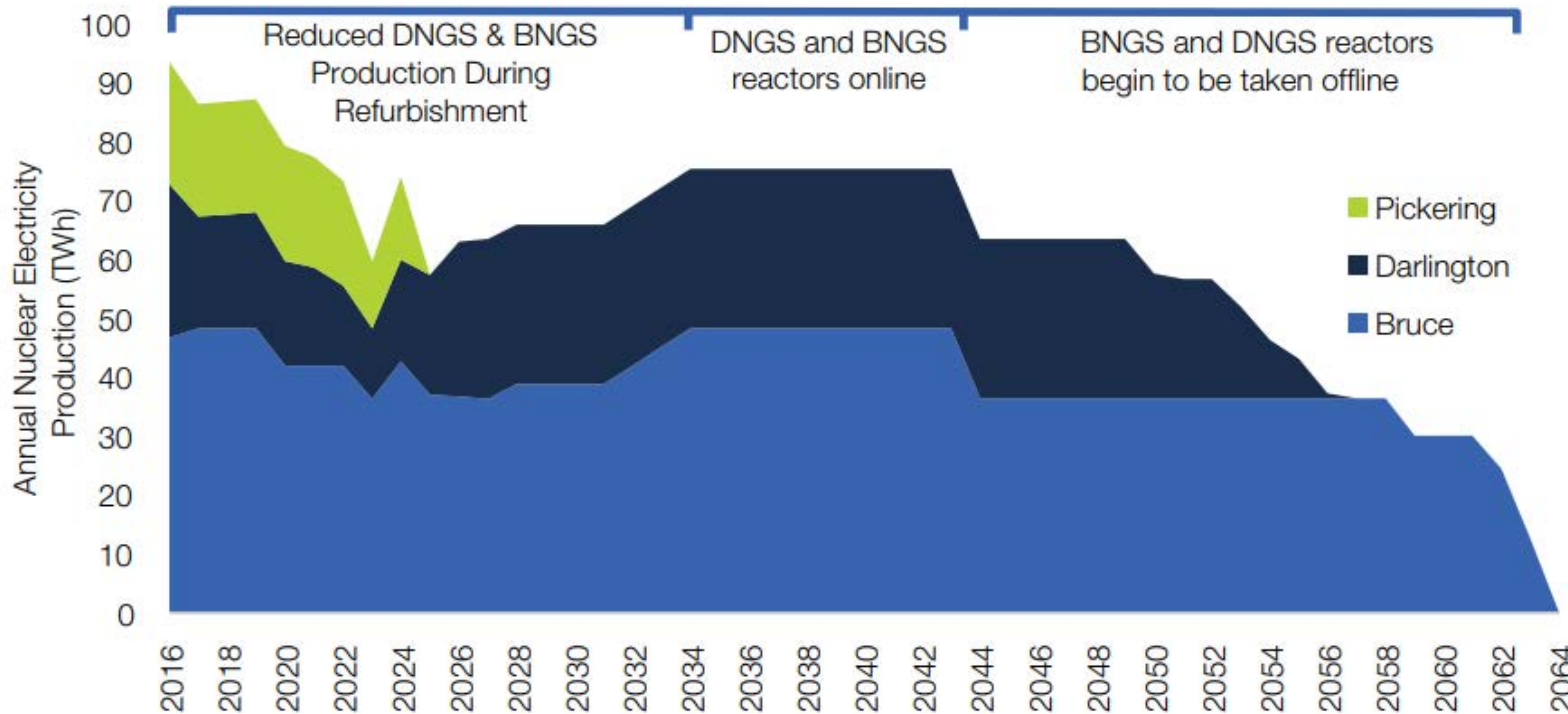
Q14 What are the consequences of the Long-Term Energy Plan's commitment to nuclear power?

Ontario's 2017 Long-Term Energy Plan

- Focus only on electricity
 - not planning the entire energy system (i.e., transportation fuels, natural gas, etc.)
- Assumes flat demand through 2035
 - Predicts little need for new supply, and stable costs
 - BUT climate targets could mean about 35% more electricity demand by 2030!



Planned nuclear generation



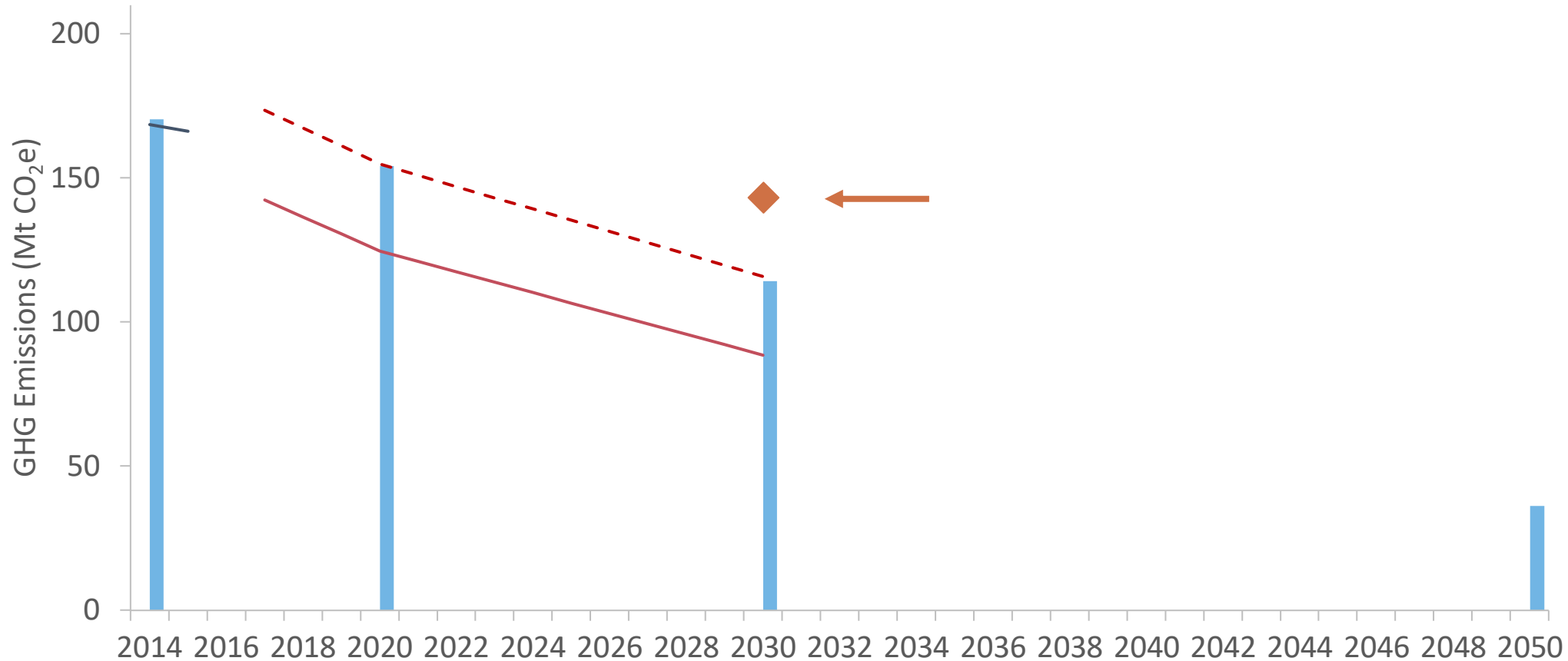
- FAO: Large amount of low-carbon electricity at reasonable cost, based on current alternatives
 - But alternatives are improving
- Ongoing and long-term environmental concerns
- Should keep door open for alternatives to later refurbishments
- Plan to extend Pickering should be reviewed



Q15 How much of Ontario's energy system must be electrified to meet Ontario's greenhouse gas limits?

Q16 How can Ontario make full use of clean off-peak electricity and prevent it from going to waste?

LTEP not consistent with climate law



Ontario's climate change law

$$\begin{array}{rcl} 88.5 \text{ Mt} & \dashrightarrow & \text{2030 cap on GHG allowances} \\ -22 \text{ Mt} & \dashrightarrow & \text{assumed to stay constant from industrial} \\ & & \text{processes \& product use} \\ \hline \approx 66.5 \text{ Mt} & \dashrightarrow & \text{2030 max GHG allowances for fossil fuel} \\ & & \text{(plus up to 7 Mt of offset credits)} \end{array}$$



How to cut fossil fuel emissions this much by 2030???

How much electrification is required?

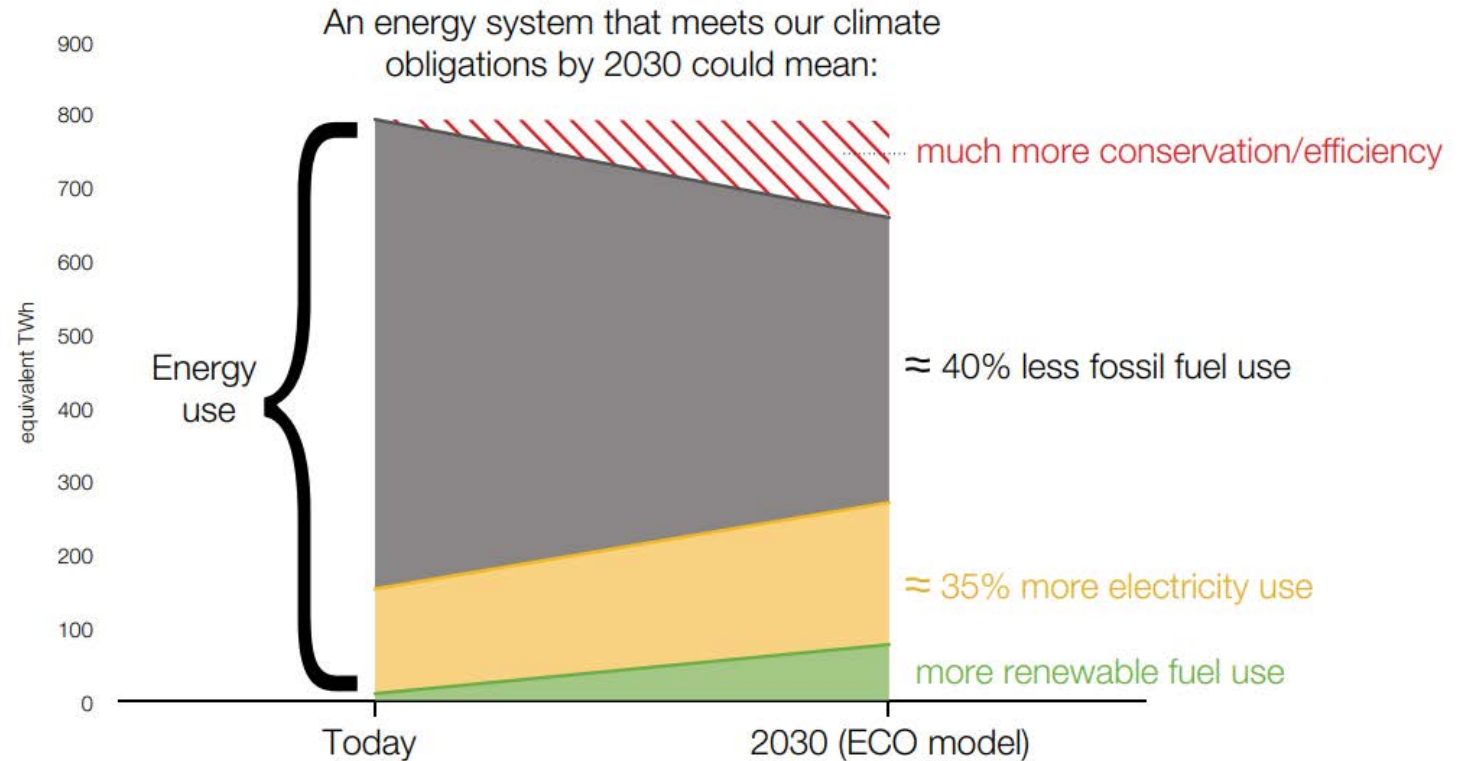
Major electrification opportunities:

1. EVs

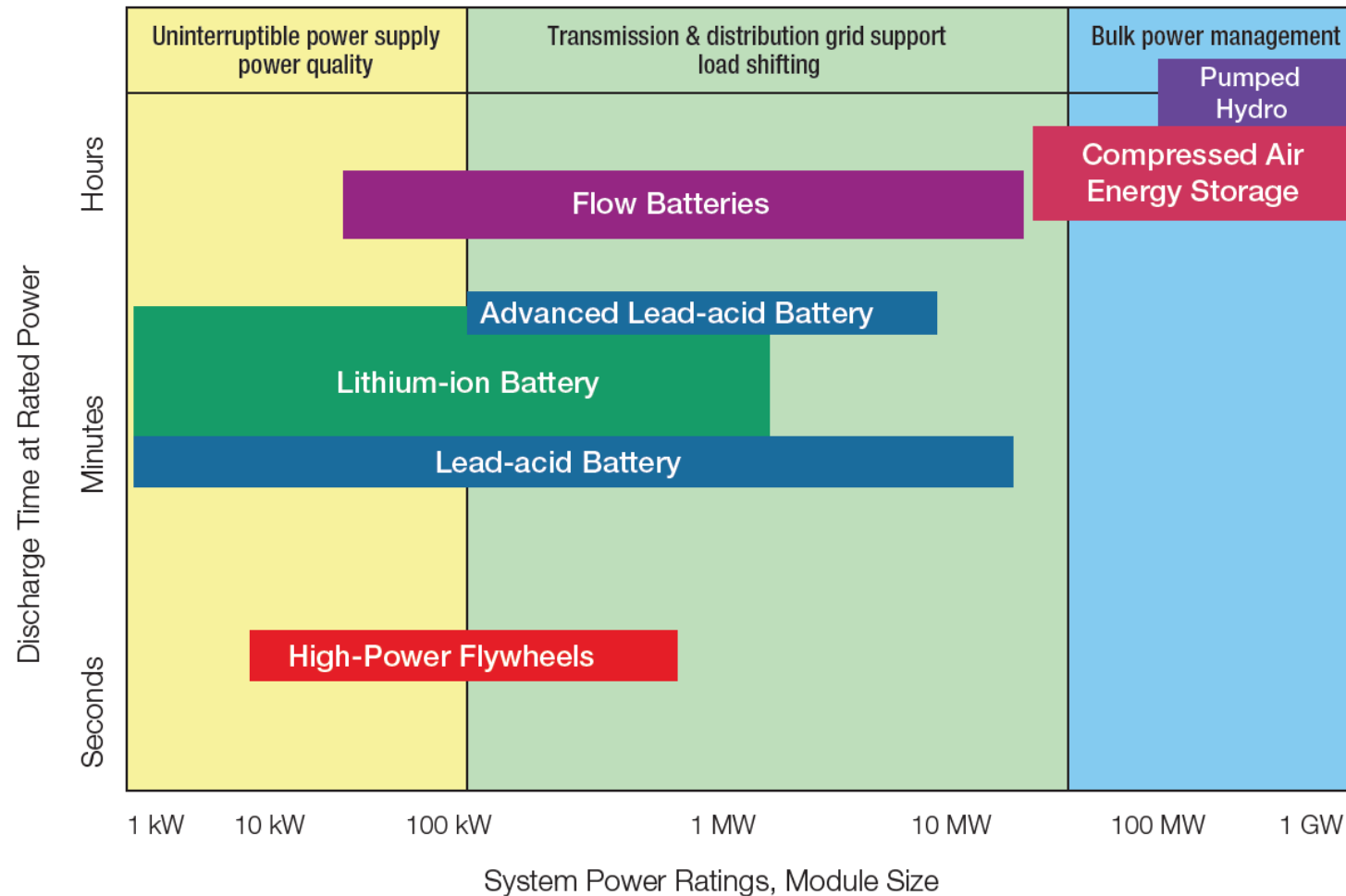
- much more than currently planned (i.e., 2.4 million by 2035)

2. Space & water heating

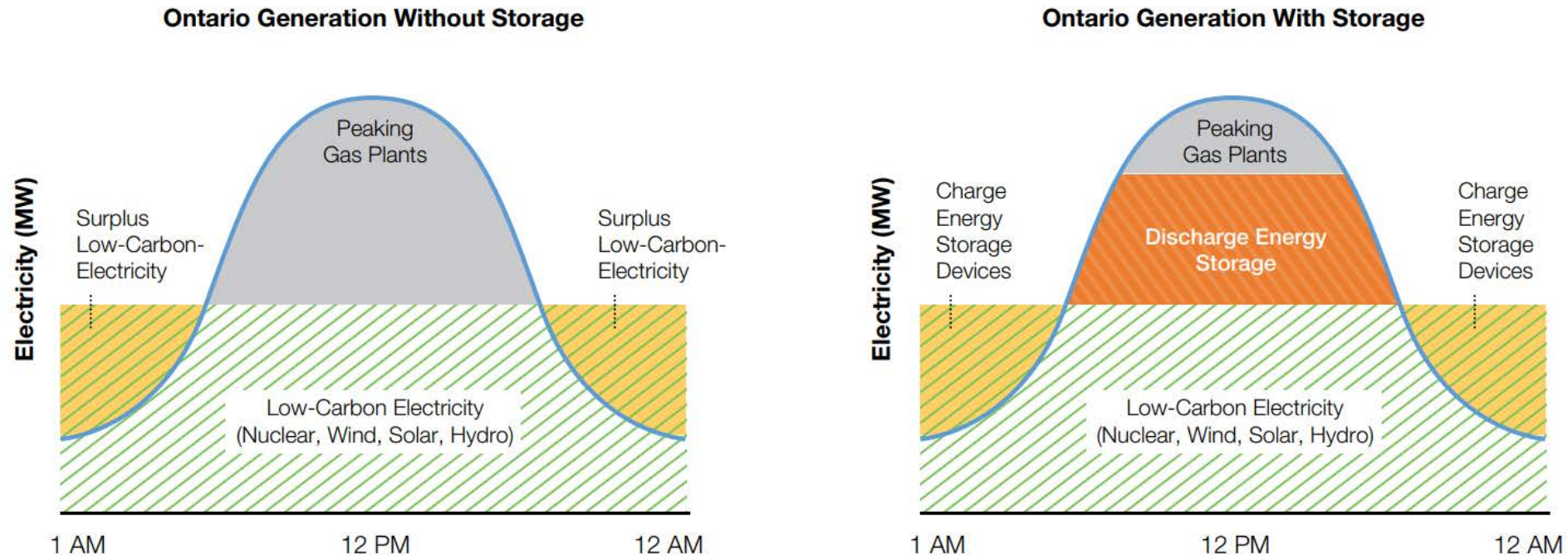
- currently no financial incentives to switch from NG heaters to electric heat pumps



Not just more supply, e.g. storage



More storage, less curtailment, less gas



Opportunities:

- Store and return to grid when needed
- Store and power electric vehicles
- Convert to other energy forms
- Use pricing tools to encourage consumption

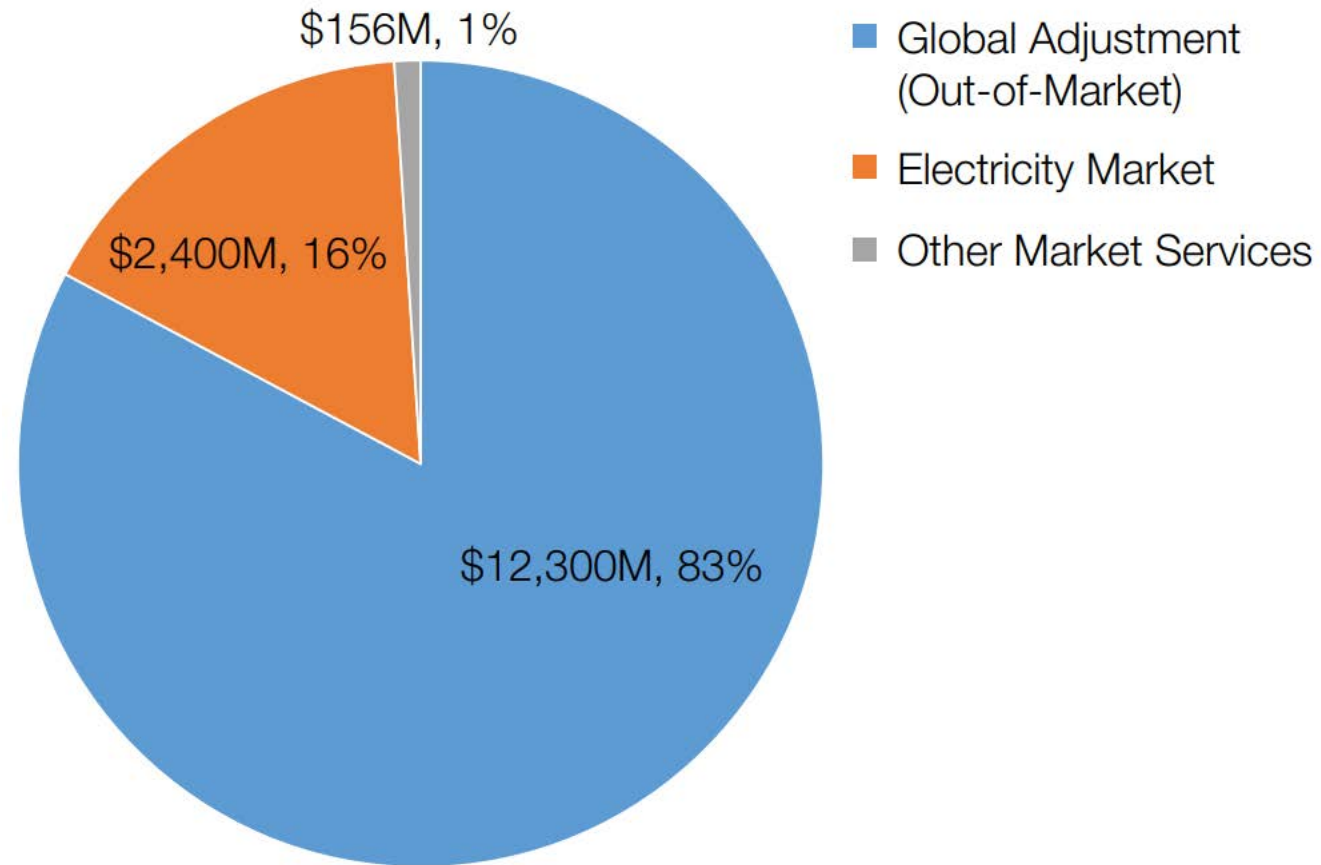
Barriers:

- Regulatory framework
- Role of LDCs?
- Technology performance and cost



- Q17** What impact will Ontario's electricity market redesign have on the cost and greenhouse gas emissions of our electricity system?
- Q18** What impact will net metering have on the future of renewable electricity in Ontario?
- Q19** What is the value of conservation?

Everyone hates the Global Adjustment

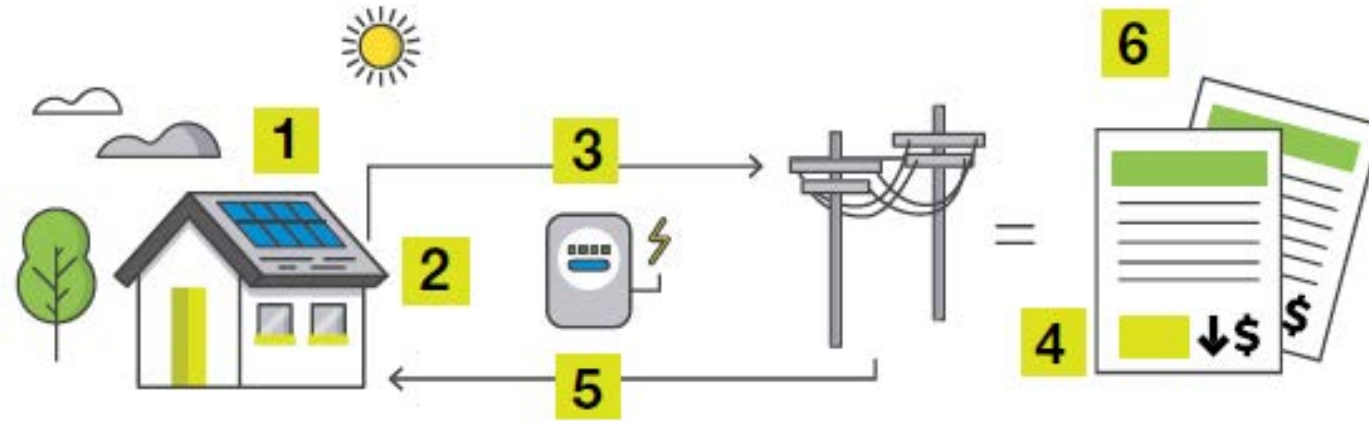


Ontario's Market Renewal

- Vision: all revenue from a competitive market for electricity services, no long-term contracts
- But,
 - Will developers accept investment risks?
 - How will low-carbon resources be incented?
 - It didn't work last time

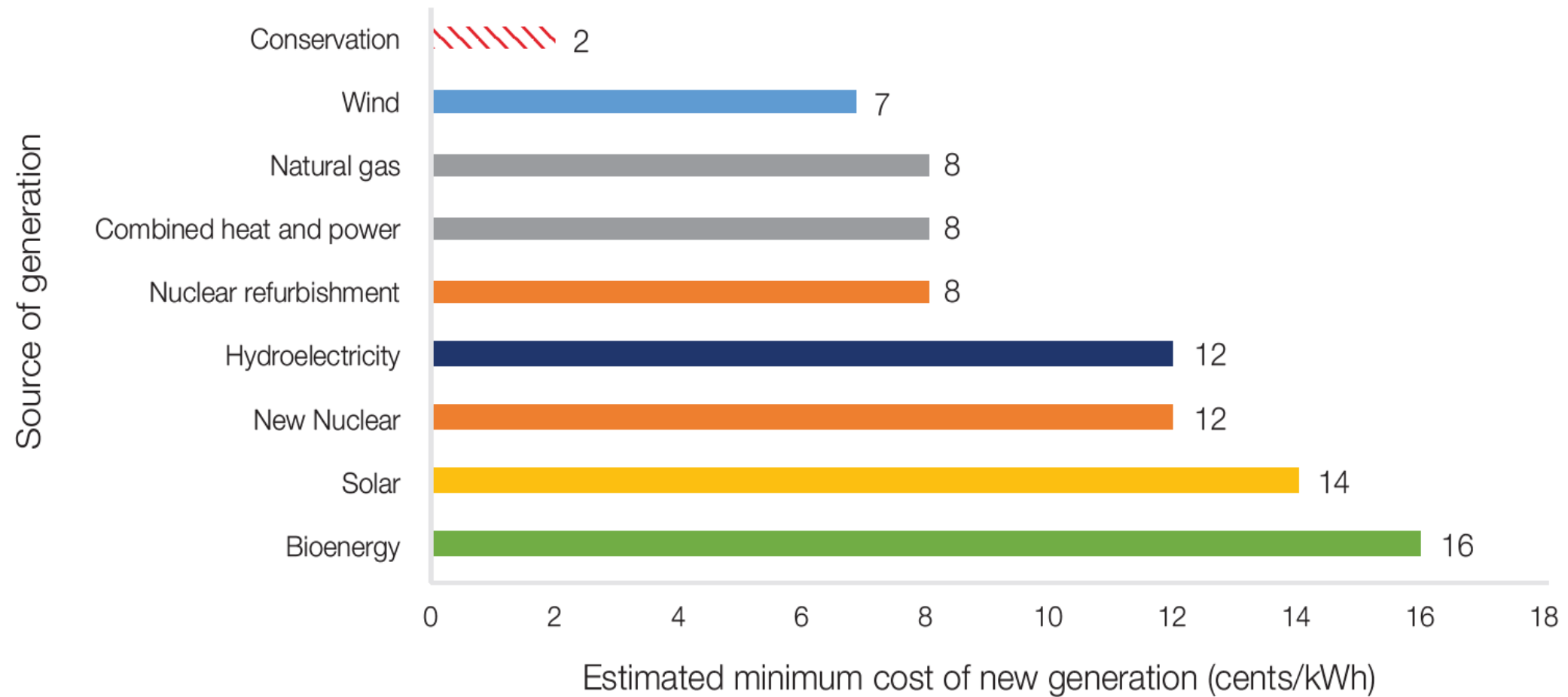


Net metering and the future of renewable energy?



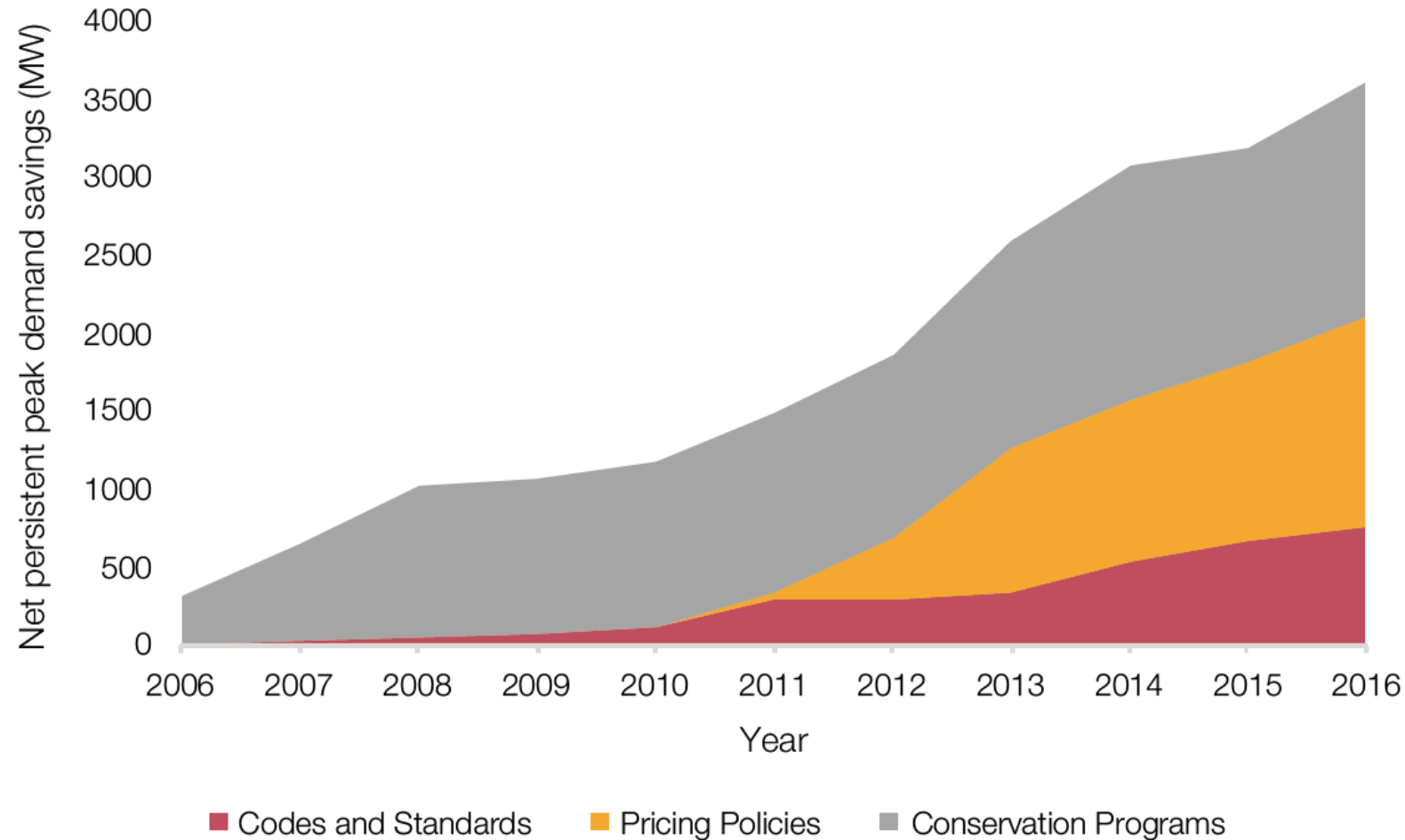
- No one can make money, just reduce own bill
- Less customer uptake, will hurt renewable energy industry
- Higher value of solar at peak not recognized

Conservation the lowest cost generation



Ontario needs much more conservation if we are to meet climate targets.

Pay now, benefit later



Thank you!

Questions?

