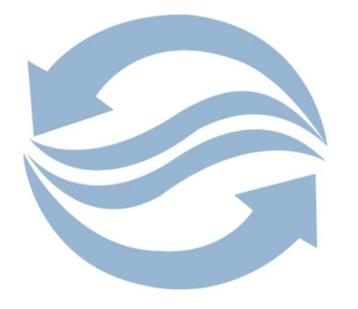
FACING CLIMATE CHANGE

March 1, 2017, Toronto
Freight Day VI Symposium
Dianne Saxe





Overview

- 1: Who is the ECO?
- 2. Why I'm so passionate about climate change
- 3. Freight matters



1: Who is the ECO?



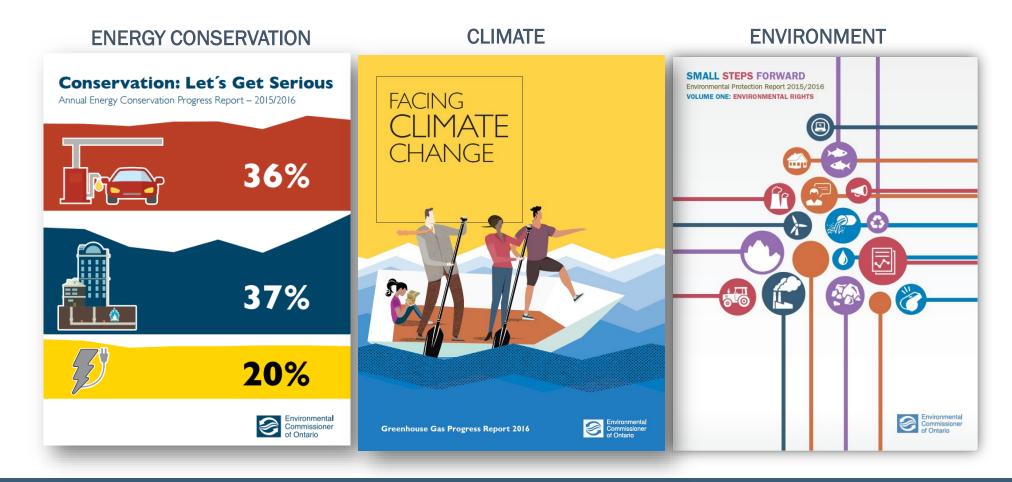
Who is the ECO?

- Impartial, independent
- Guardian of the Environmental Bill of Rights
- Watchdog on:
 - Greenhouse gas emissions in Ontario
 - Energy conservation
 - Environmental protection
- Driven by what I have learned in the last year





Really Good Reports

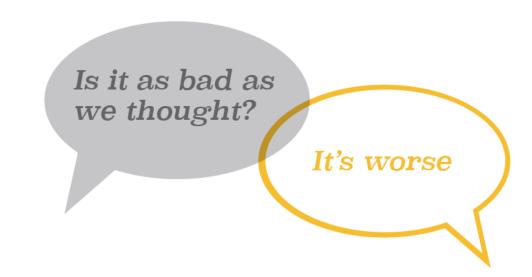




Find Them Here







2: Why I'm so passionate about climate change



Your colleagues may know

- 97% of climate scientists agree:
- Climate change is:
 - Human-caused
 - Serious
 - Caused mostly by greenhouse gases in the atmosphere that keep solar heat from escaping
 - Primary GHG is CO2 from fossil fuels
 - Real



But do they know?

- Climate change is:
 - Here now and moving fast (last 12 months are "off the charts")
 - \$Trillions financial opportunity and threat
 - Immense impact on environment and people
 - Huge implications for Ontario infrastructure and economy
- We're running out of time

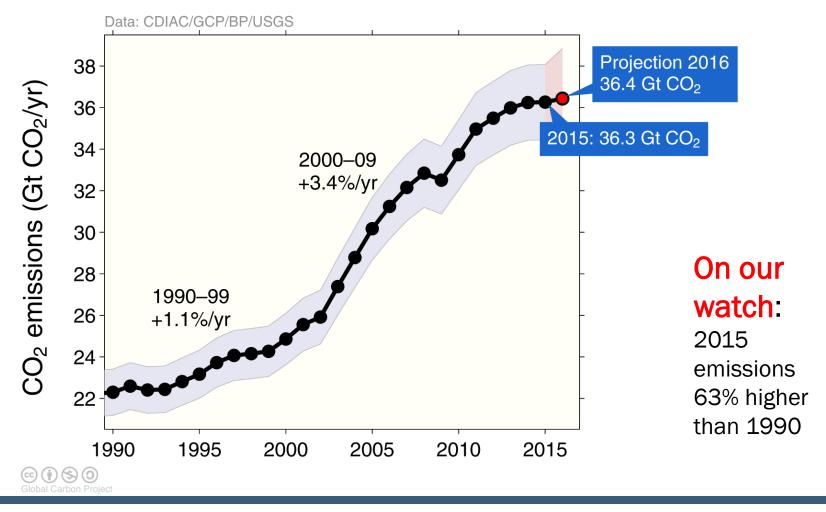


Young people won't have what we had





Highest ever CO₂ emissions





Source: Global Carbon Project, Carbon Budget 2016

Where does the CO_2 go? (2006-2015)



34.1 GtCO₂/yr **91%**

16.4 GtCO₂/yr **44%**



Sources = Sinks



9% 3.5 GtCO₂/yr

31% 11.6 GtCO₂/yr



26% 9.7 GtCO₂/yr





Highest Air CO₂ in (Human) History

Humans until 1750 180 - 280

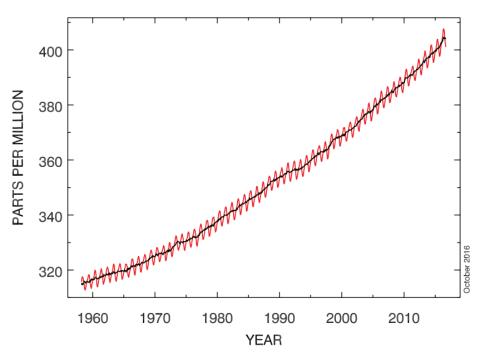
1750278

1860280

1988350

• 2016 406 ppm

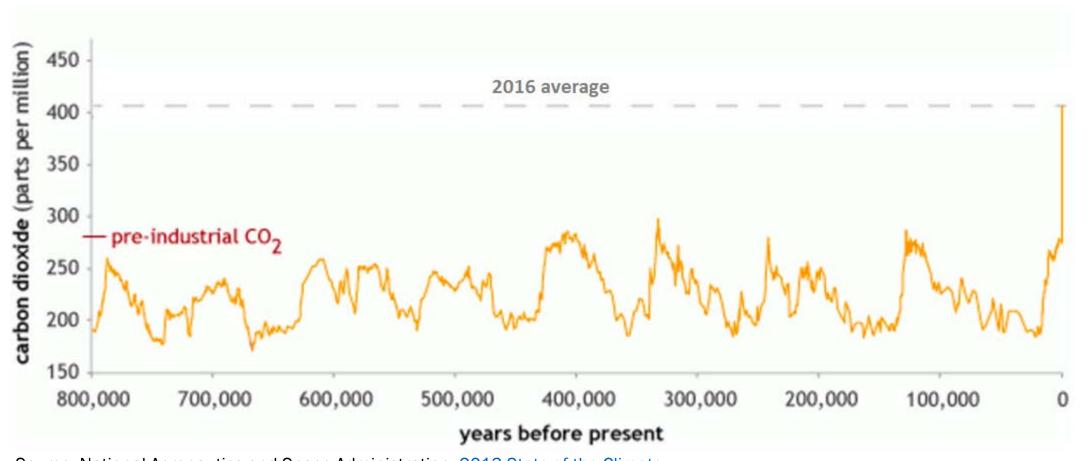
- Now permanently above 400 ppm
- Trapping extra heat



Source: National Oceanic and Atmospheric Administration, Trends in Atmospheric Carbon Dioxide at Mauna Loa Observatory (full record), 2016.



Yes Virginia, there is a CO₂ hockey stick

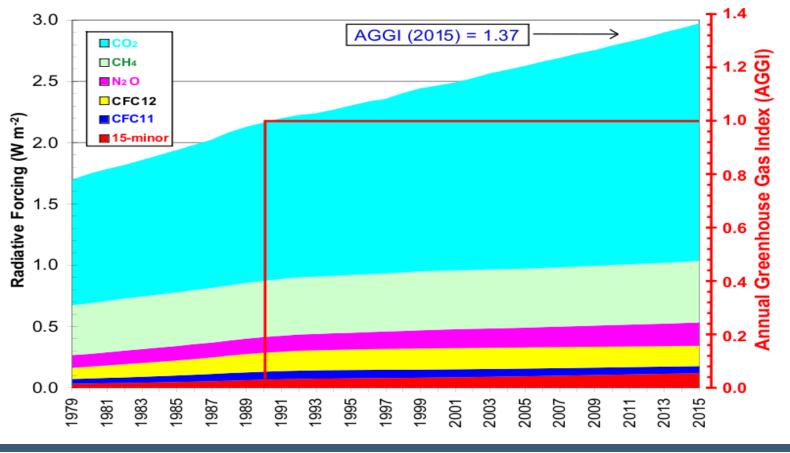


Source: National Aeronautics and Space Administration, <u>2013 State of the Climate:</u> <u>Carbon dioxide tops 400 ppm</u>



Not just CO₂

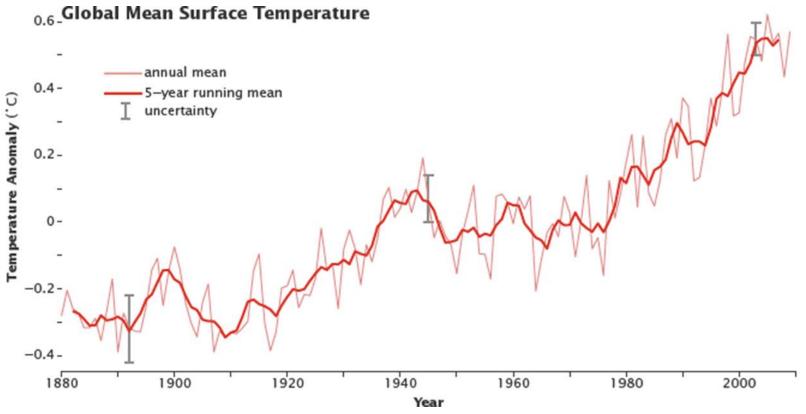
- ~50% more heat than CO₂ alone
- Methane
- Nitrous oxide
- Refrigerants





Source: National Oceanic and Atmospheric Administration, The NOAA Annual Greenhouse Gas Index (AGGI), 2016.

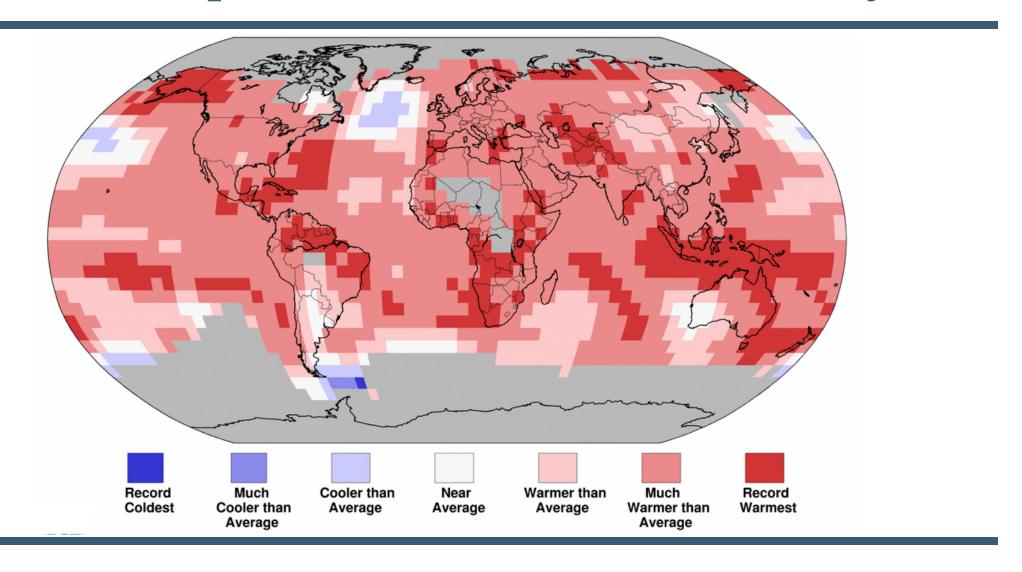
Only 1% of the Heat in the Air



Source: National Aeronautics and Space Administration, Earth Observatory: 2010 Features – Global Warming, 2010.

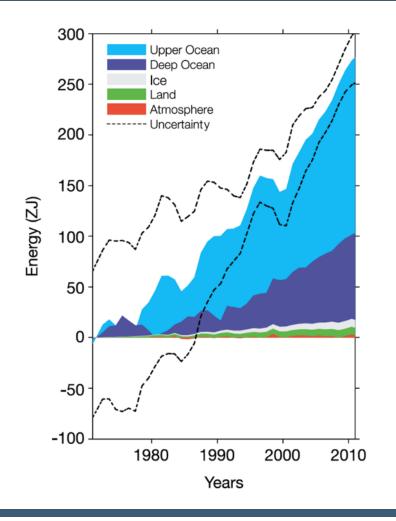


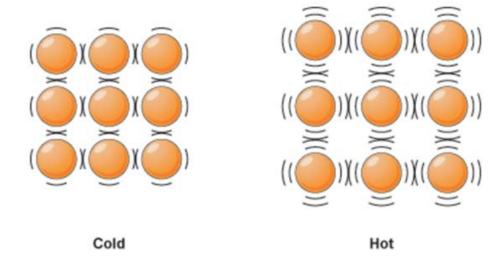
Highest temperatures in human history





93% of the Extra Heat is in Oceans, Lakes





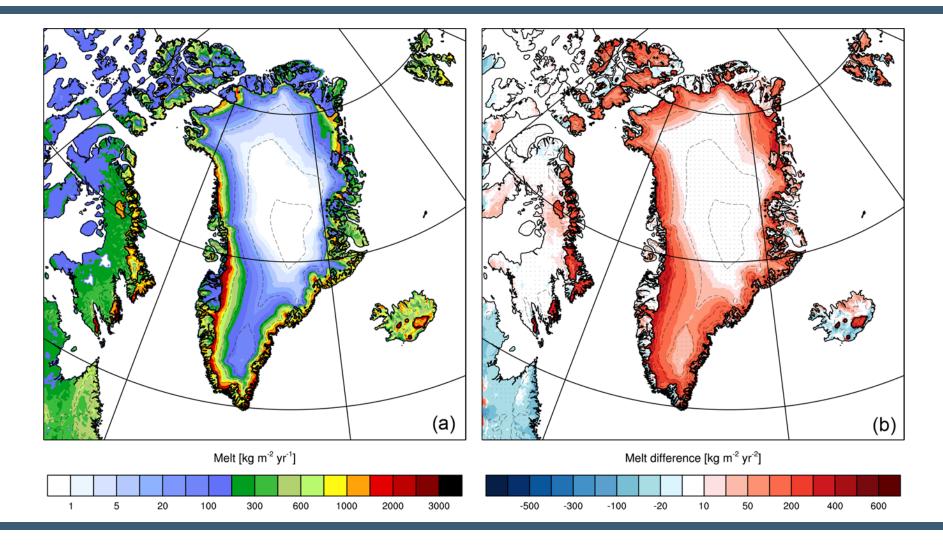
Warmer water takes up more space

Source: BBC, Behaviour of matter: Expansion and contraction, 2014.

Source: Intergovernmental Panel on Climate Change, Chapter 3: Observations: Oceans in Climate Change 2013: The Physical Science Basis (contribution of Working Group 1 to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change), 2013.



4% of the Heat to Ice



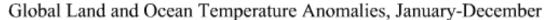


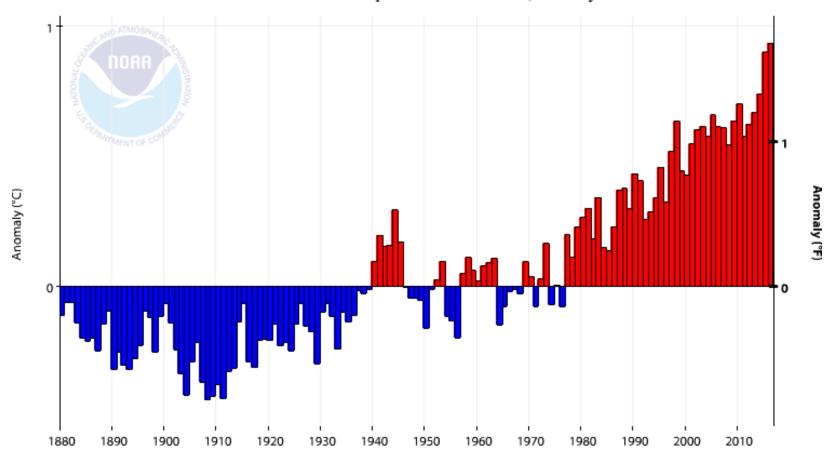
Higher Sea Levels, Wilder Storms





20th Century "Normal" is Gone

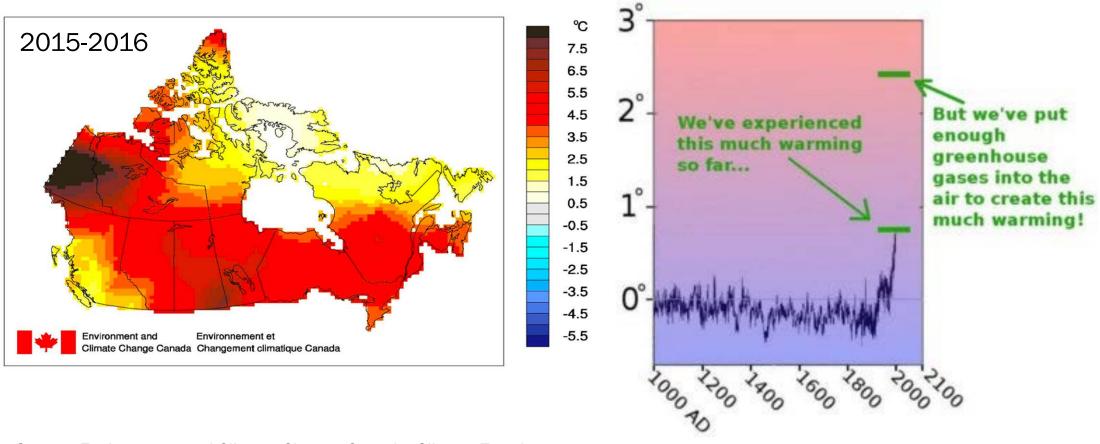


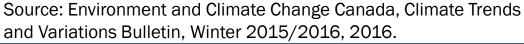


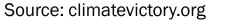


ZJ

More already locked in







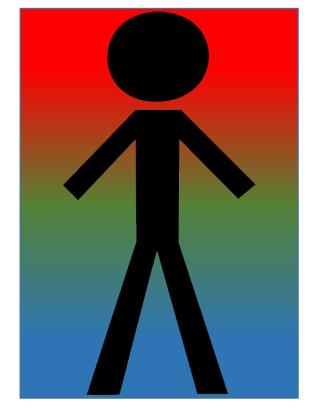


"Global Warming"?

- ≠ Everywhere always warmer
- Higher average temperatures
 - But unevenly distributed
 - Disruption of natural cycles
- More damaging, more unpleasant extremes



TOO HOT!

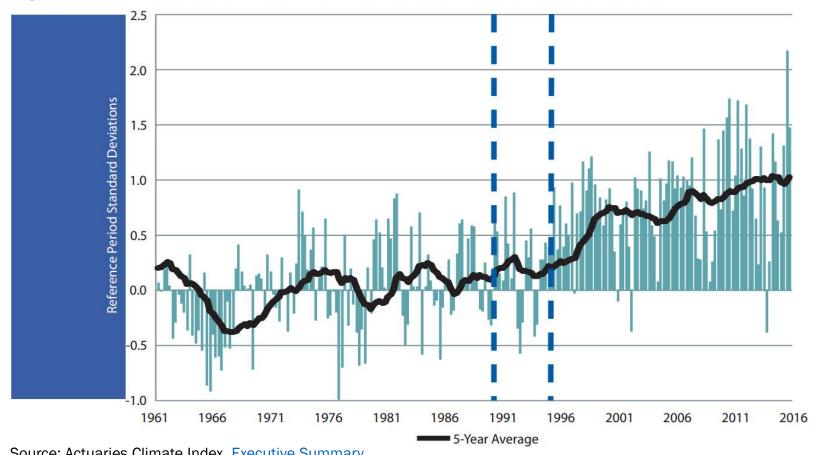


TOO COLD!



Extreme events have tripled

Figure 3. The Actuaries Climate Index for Canada and the United States.



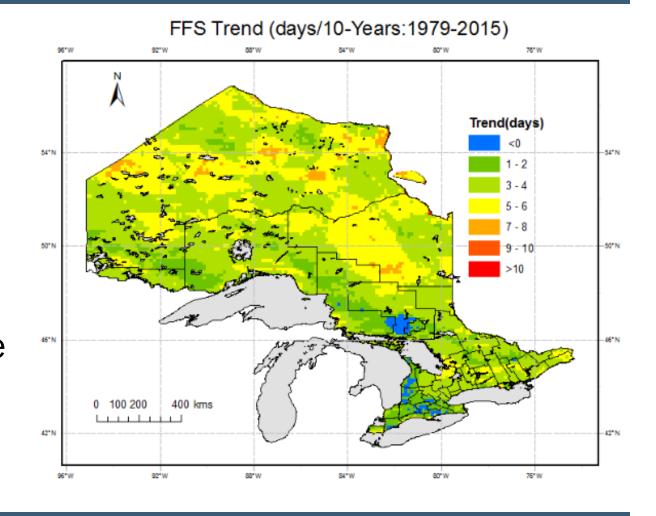
Source: Actuaries Climate Index, Executive Summary



Ontario Warming Faster Than Average

 Ontario frost-free season increasing by 1-13 days each decade

- Warming differs by region
- Extremes hurting agriculture





Ontario: When, not if

- Milder winters
 - Ice roads, winter sports, snow cover
- Wetter springs, faster melts
- Hotter, drier summers

- Storms, floods, droughts
- Forest fire
- Invasive species





Case Study: Rideau Canal Skateway

- World's largest skating rink
- Economically and culturally important – nearly a million visitors/ year
- Becoming unreliable
- Open only 18 days in 2016





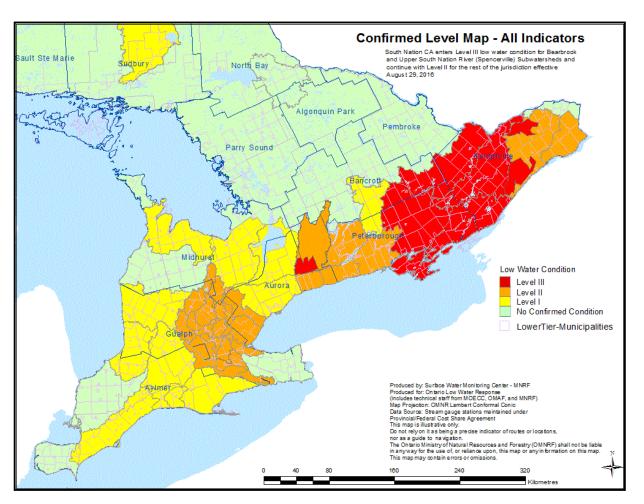
Case Study: Lake Simcoe Ice Fishing

- Regional economic and social/ cultural importance.
- Since 1989, ice cover has decreased by one day each year
- Could disappear entirely within 50 years





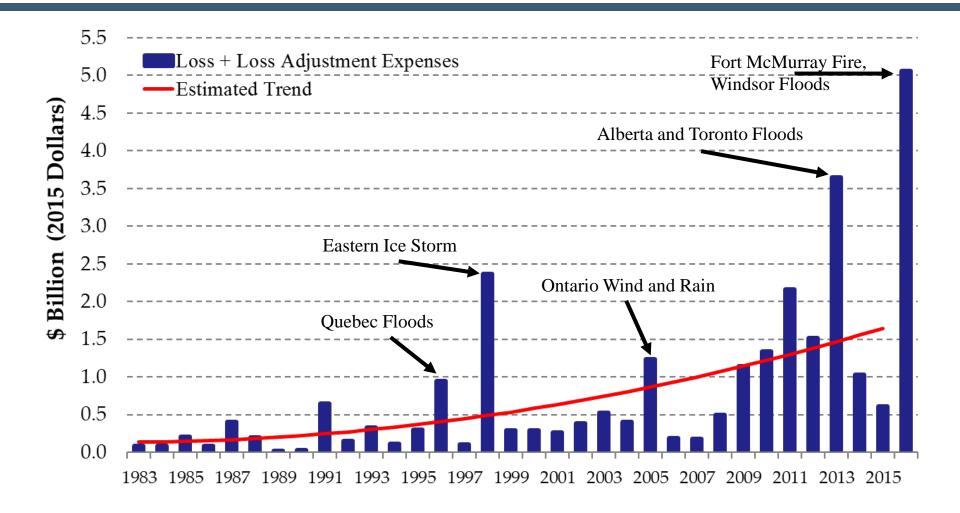
2016 Drought



Conditions as of July 31, 2016



Catastrophic Insured Losses - Canada





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Ontario: When, not if

• Health impacts, e.g. more:

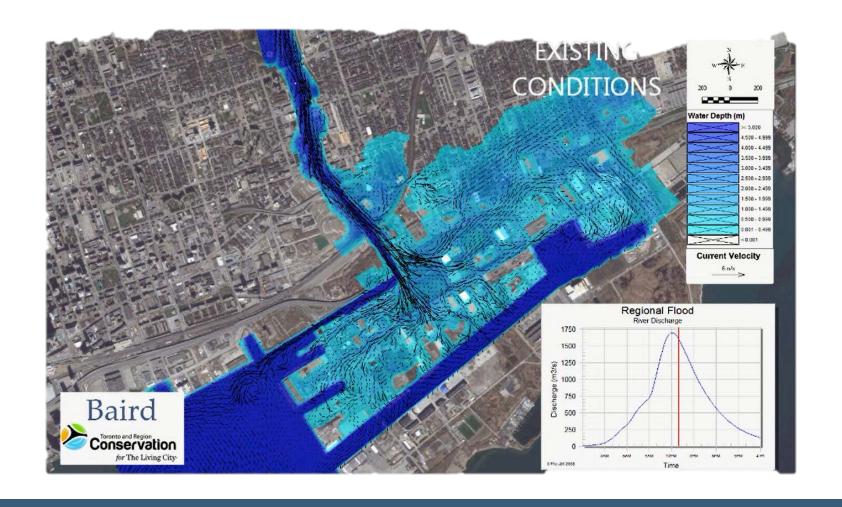
- Infectious diseases
- Extreme weather events
- Extreme heat
- Poor air quality
- Water stress





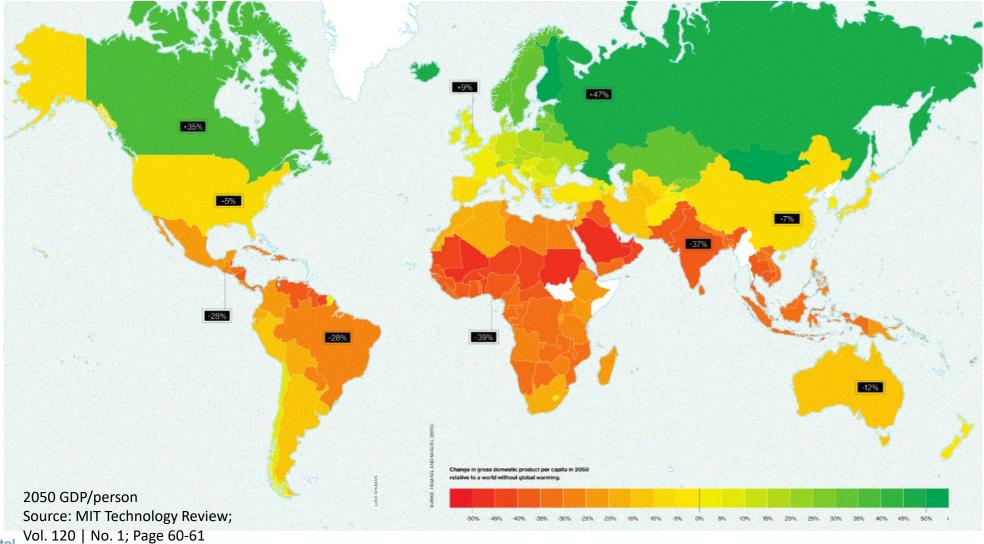


Toronto 100 year flood



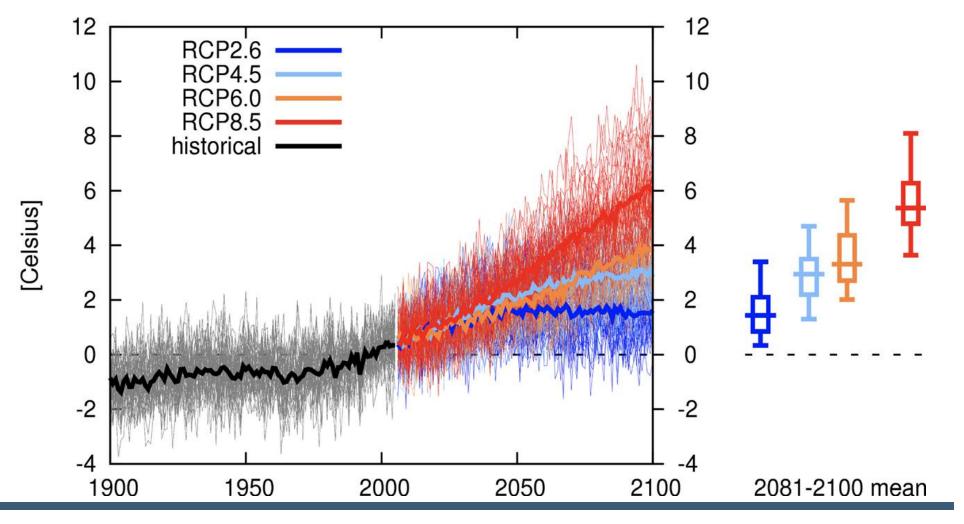


We are the lucky



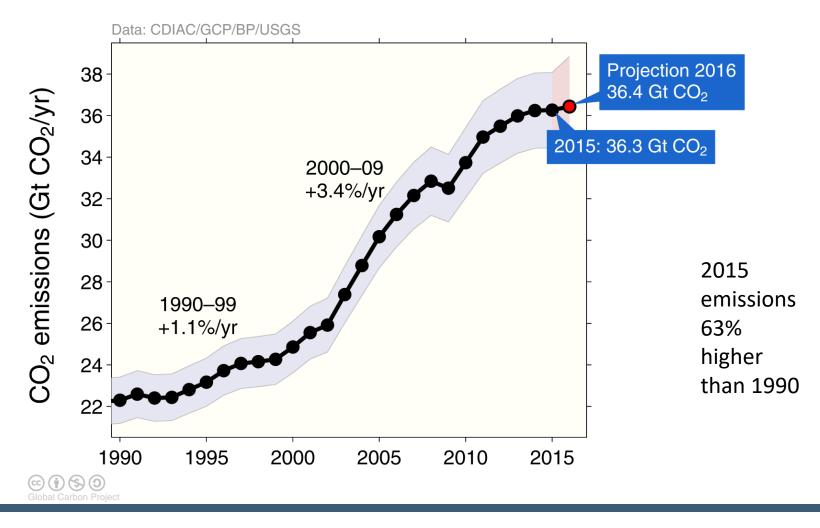


How Much Worse? Depends on Emissions





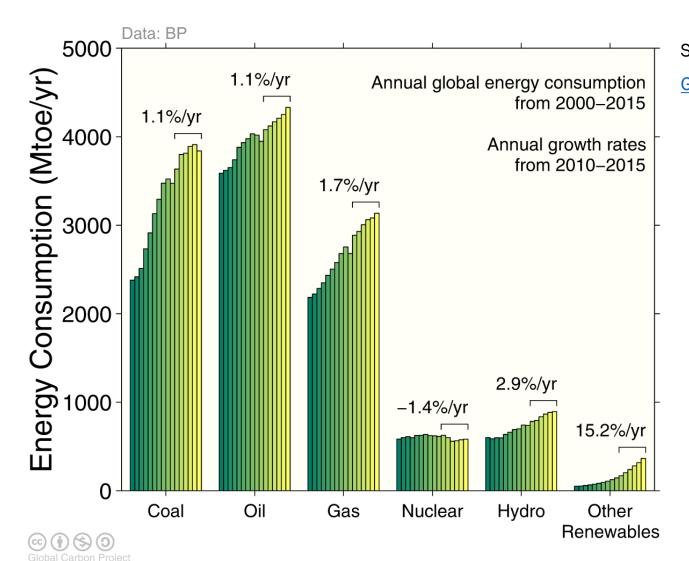
Because emissions skyrocketed





Source: Global Carbon Project

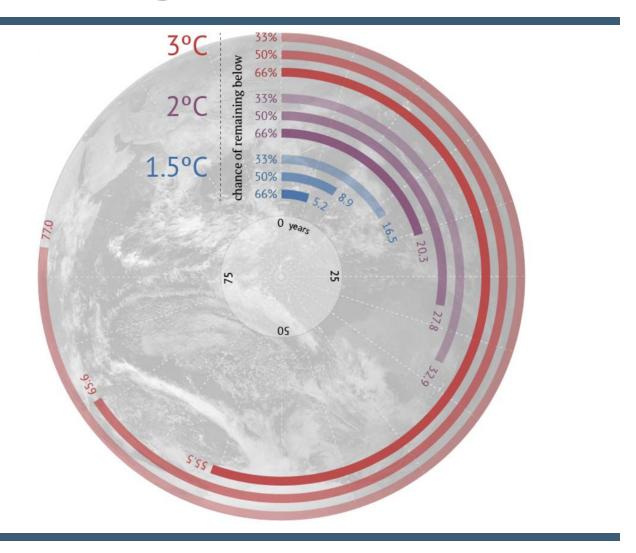
And are still growing



Source: <u>BP 2016</u>; <u>Jackson et al 2015</u>; Global Carbon Budget 2016

Carbon budget running out

If we want a 2/3 chance of staying <2°C, most of proven fossil fuel reserves can not be burned





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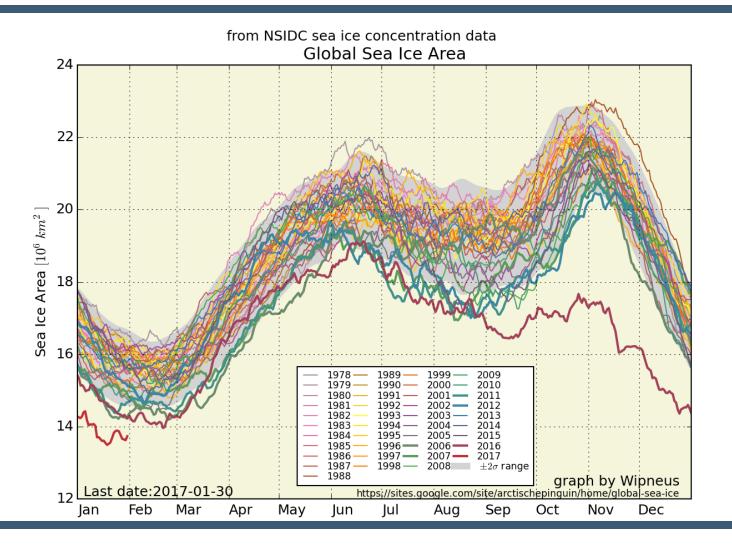
What else have we unleashed?

- Permafrost
- Soil carbon loss
- Forest die-back
- Ocean current changes
- Loss of sea ice

What would a tipping point look like?



Global Sea Ice



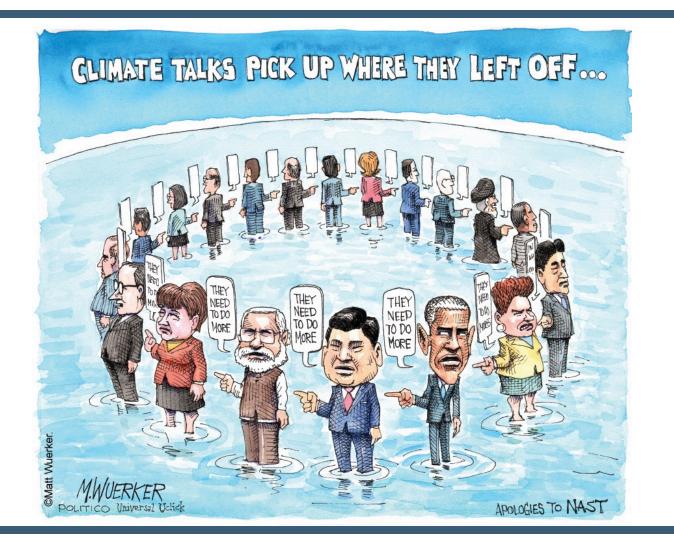


Is it too late?

- We are in for big changes
- There is still a little time to have an impact on what's coming
- Our choices, right now, matter



Do Ontario emissions matter?

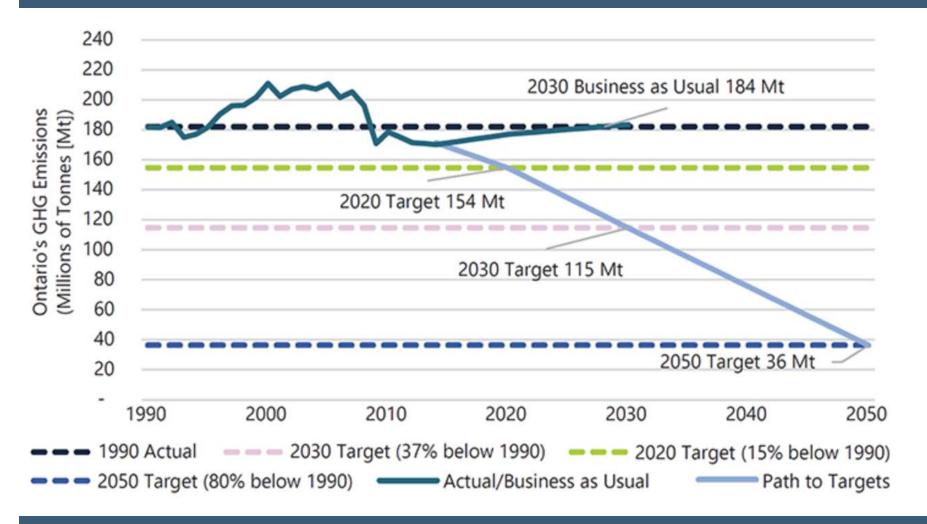




3: Freight matters



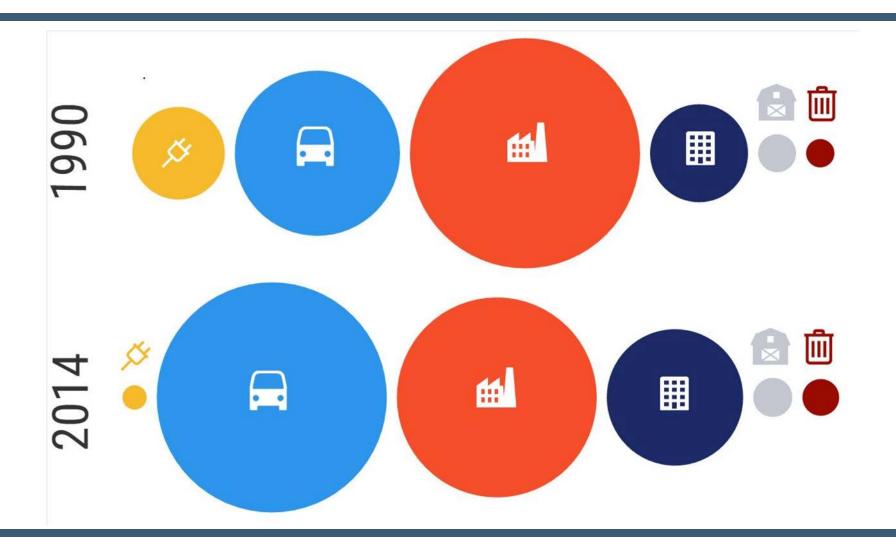
Ontario's journey to a low carbon economy



And a new climate

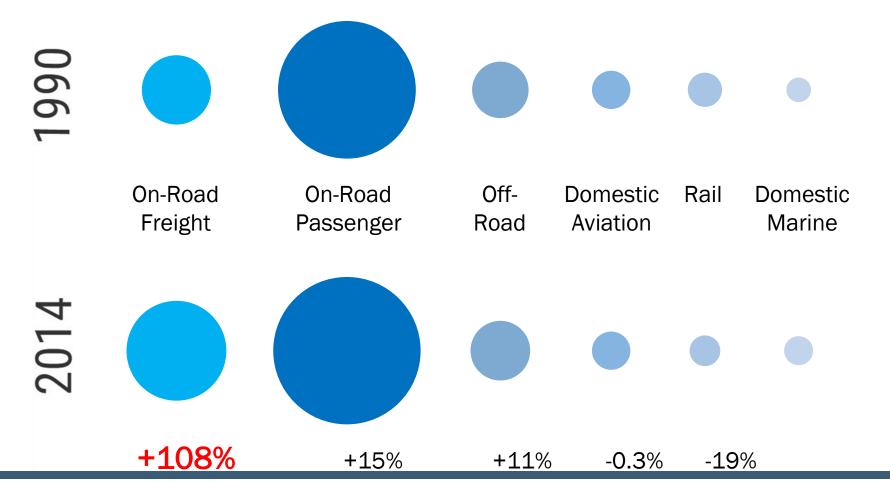


Ontario: Where are we now?





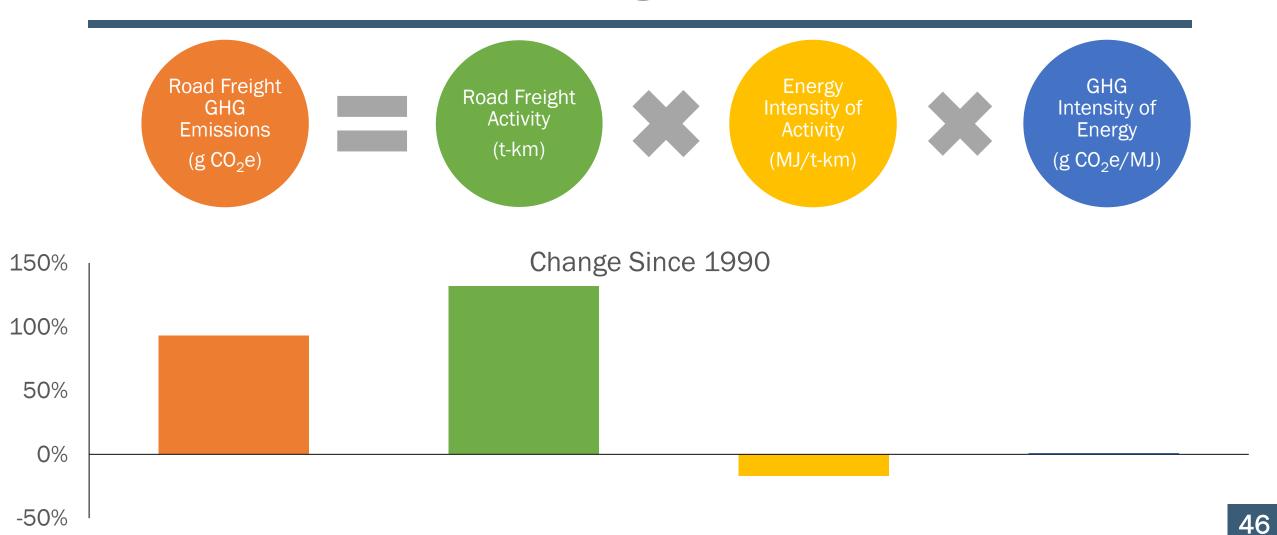
Transportation Since 1990





45

Ontario On-road Freight GHG Emissions



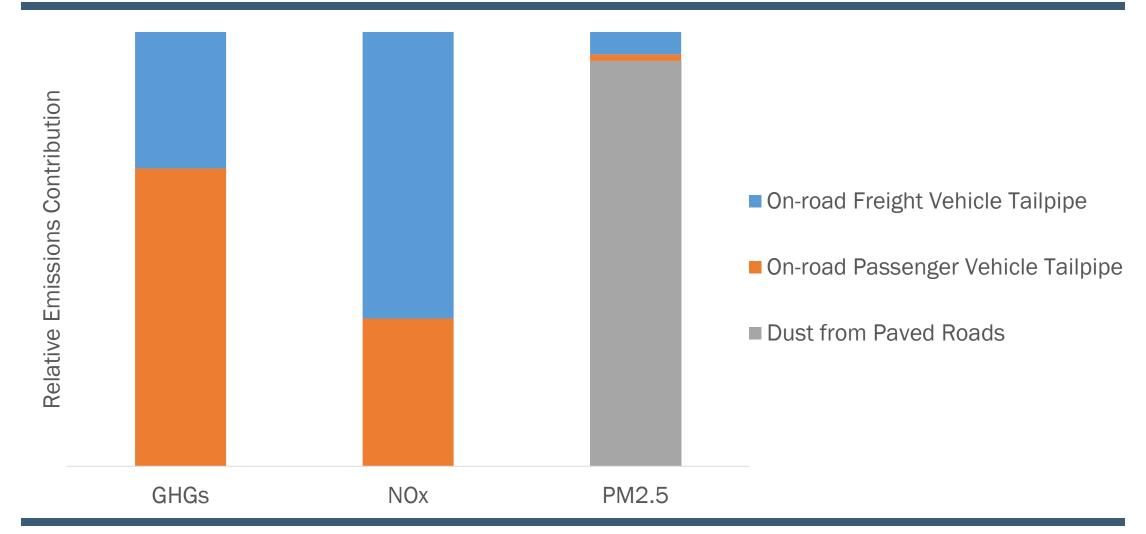


Ontario On-road Freight Fuel Mix



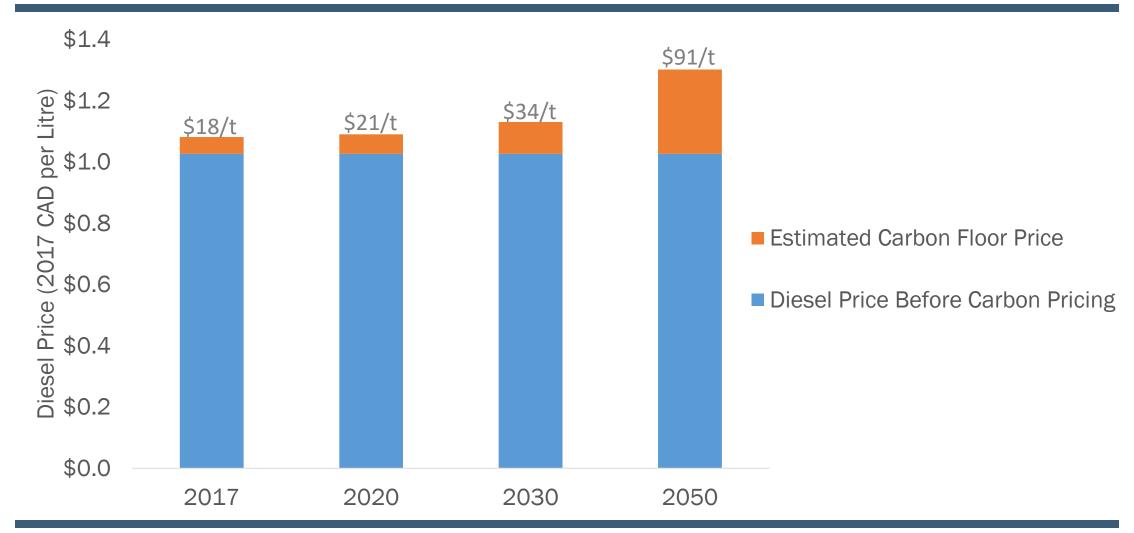


Air Pollution and Health





Is cap and trade the solution?

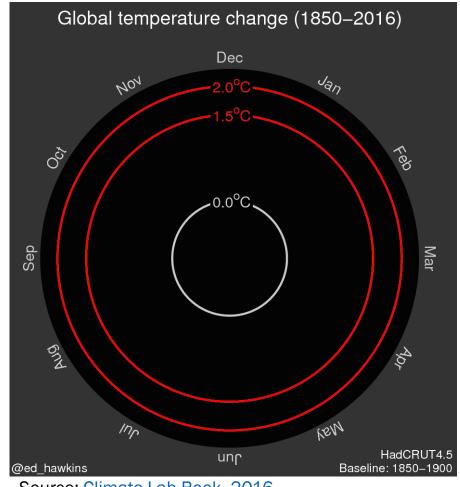




What will it take?

- Time to put an urgent climate lens on:
 - Procurement
 - Funding
 - Regulations
 - Incentives
 - Policies
 - Permitting
 - Planning....

Climate changes everything



Source: Climate Lab Book, 2016

