CACOR's Pathways Study

Canada's greenhouse gases

How to set targets and then hit them

Use a technologically coherent simulation model

Governments must "close the gap between rhetoric and reality".

What is required is "nothing short of a total transformation of the energy systems that underpin" our economies.

Fatih Birol, Executive Director, International Energy Agency

- This CACOR study provides a way of connecting rhetoric and reality, addressing the entire system.
  - ❖ It is an approach that must be adopted by the Government of Canada if it is to succeed in setting achievable targets and then actually hit them.

By Pathway is meant the sequence of actions needed to transform an energy system from its present state to a desired state at a given time in the future.

- This study shows how physically and technologically coherent pathways may be designed.

- Every jurisdiction responsible for energy policy needs to develop its own feasible pathway and put in place the programs to follow it.

- Circumstances change, sometimes quickly, for example,
  - Development of technologies more rapid than expected;
  - Failure of a policy tool to deliver what was expected.

- Progress along a pathway must be monitored regularly and adjustments made to policy and programs as necessary.

Governments, as Bill Gates puts it, have been *tilting at windmills*.

- The weakness of the approach of the Canadian government is that its thinking is rooted principally in <u>just one discipline</u>:
  - economics.
- It needs to take a much broader, multidisciplinary approach:
  - to understand that the entire socioeconomic system must follow
    - ❖ physically and technologically coherent pathways.

Acknowledgements

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a think tank and registered Canadian charity.

- Seventeen members made personal donations to this project.

- The research was conducted by Bastiaan Straatman, *whatIf? Technologies*

- The research was guided by a Pathways Team of members: Art Hunter, Catherine Smith, David Dougherty, David Pollock, Gordon Kubanek, John Hollins, Nigel Weir, Robert Hoffman, and Ted Manning.

    - ❖ The Team adopted an aggressive approach.

- The Storyline and the Messages have been composed by the authors and editor of the report: Robert Hoffman, John Hollins and Catherine Smith.

Storyline, 1
from CACOR's Pathways Study

- Canadian policy has repeatedly failed to meet Canada's commitments to reduced GHG emissions and is on track to continue to do so.

- Canadian policy is based on the illusion that targets for reductions in greenhouse gas emissions can be met primarily by incentivizing citizens and businesses to take the actions needed and that such actions can be financed by private investors and commercial lenders.

Storyline, 2

- A new approach is needed, one that engages all stakeholders in understanding and committing to biophysically and technologically coherent pathways with detailed milestones to allow progress to be monitored and policies and programs adapted as need be.

- Canada will continue to fail to meet its commitments if it persists in producing more oil from sand and more gas by fracking. It simply does not add up.

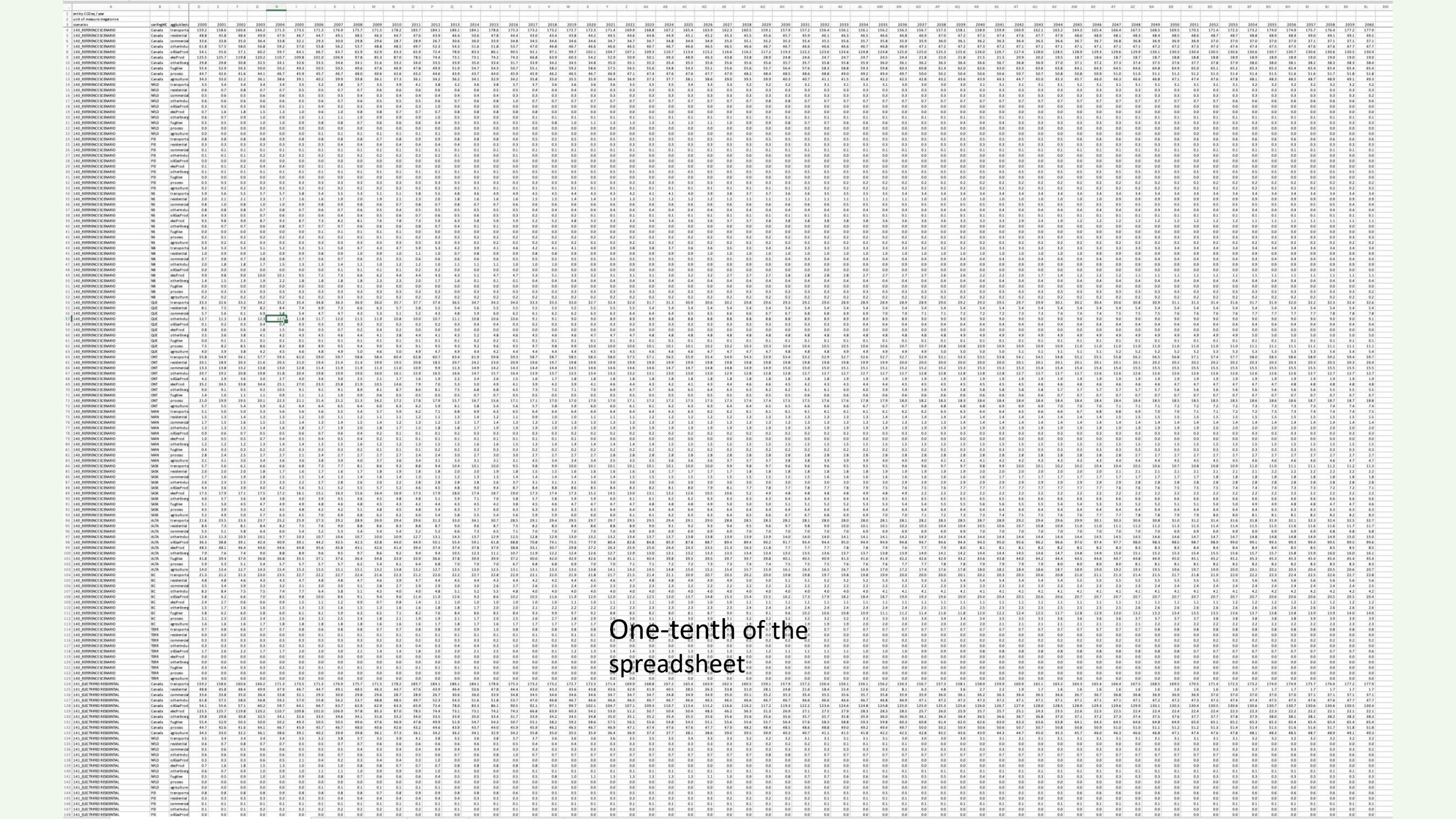
- To support a new approach, there is a need for an agency at arms-length-from-government to compile data and develop exploratory computer models and make them freely accessible to all stakeholders.

Messages
from CACOR's Pathways Study

The findings of this study using a powerful computer simulation model are presented in the body of the report, province by province:

- 73,000 data points;
- Reports can be tailored by province and region.

These messages are *broad observations for general audiences* drawn from the findings by the authors and the editor of the report.

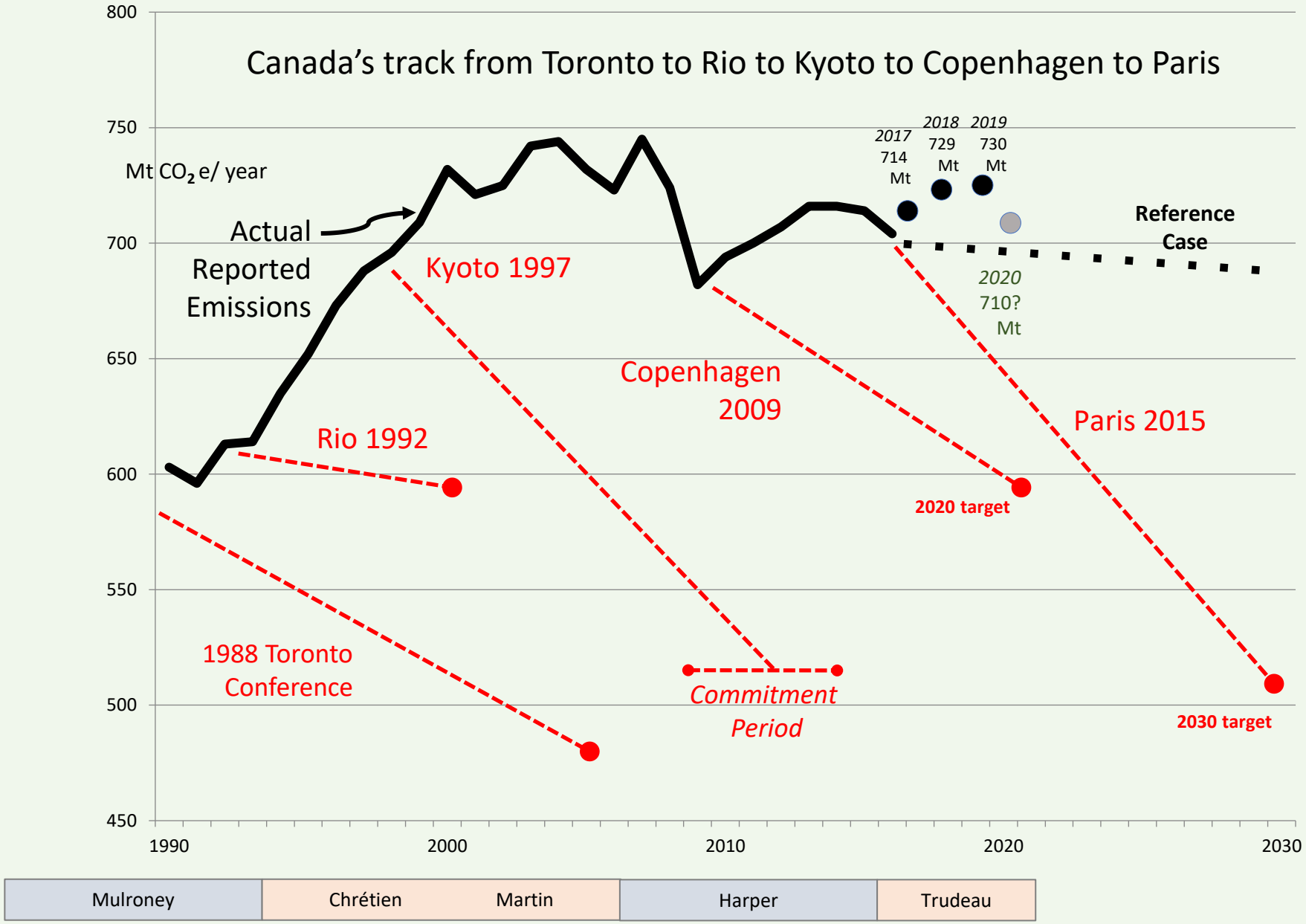

One-tenth of the spreadsheet

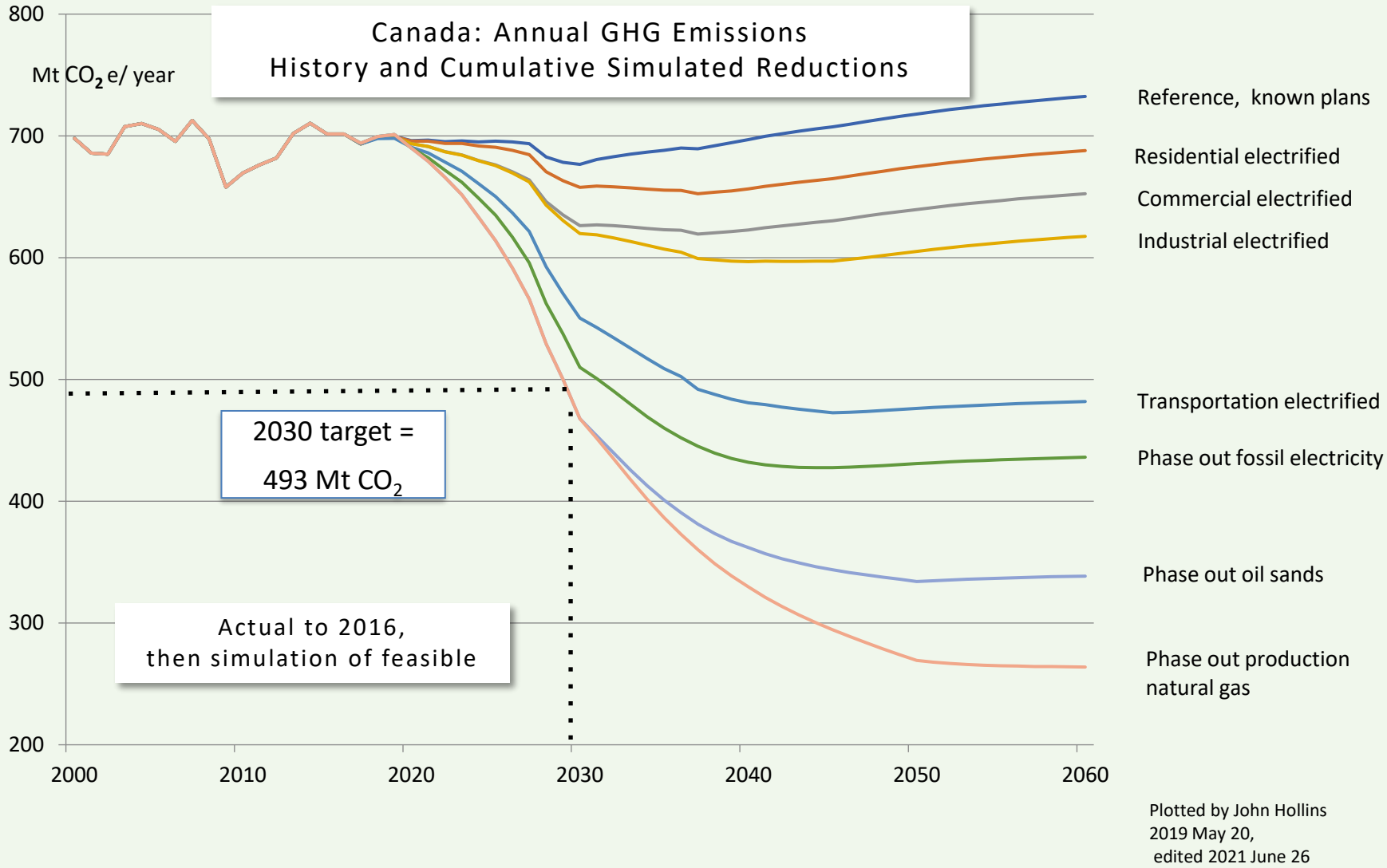
Issue

1. Repeated failure

Canada has failed repeatedly during three decades
to meet every emission targets to which it formally committed.

It is evident from the simulation experiments performed
during the course of this project that the target for 2030
that Canada accepted in the Paris Agreement in 2015 will be missed.


Canada's track from Toronto to Rio to Kyoto to Copenhagen to Paris
Mt CO_2 e/ year
800
750
700
650
600
550
500
450
1990
2000
2010
2020
2030
Actual Reported Emissions
2017 714 Mt
2018 729 Mt
2019 730 Mt
2020 710? Mt
Reference Case
Kyoto 1997
Copenhagen 2009
Paris 2015
Rio 1992
2020 target
1988 Toronto Conference
Commitment Period
2030 target
Mulroney
Chrétien
Martin
Harper
Trudeau


Canada: Annual GHG Emissions
History and Cumulative Simulated Reductions
Mt CO_2 e/ year
800
700
600
500
400
300
200
2000
2010
2020
2030
2040
2050
2060
2030 target =
493 Mt CO_2
Actual to 2016,
then simulation of feasible
Reference, known plans
Residential electrified
Commercial electrified
Industrial electrified
Transportation electrified
Phase out fossil electricity
Phase out oil sands
Phase out production
natural gas
Plotted by John Hollins
2019 May 20,
edited 2021 June 26

Context

2. Strategic issue

This issue is about much more than simply reducing emissions.

- It is about changing paths of social and economic development.
- It involves the entire economy, the extraction and processing of primary resources, manufacturing, commerce, trade, and the behaviour of consumers.
- The emissions of the national economy are embedded in stocks of plant and equipment, buildings and consumer goods in which substantial investments have been made.
    - ❖ There is inevitable inertia.
    - ❖ Major changes to infrastructure take decades rather than years.

Diagnosis

3. Approach

Canada has pursued the same approach to the reduction of greenhouse gases during the three decades since it went to Kyoto in 1997.

This approach has been based only on conventional short-term economic and political thinking.

- It has not worked.

- If Canada wishes to succeed, it has to understand the practically feasible options.

Diagnosis

4. Targets without a way to hit them

Targets have been set simply in terms of policy prescriptions, in the absence of understanding of physically coherent pathways from current high-emitting
activities to those that would be low or non-emitting.

Without such understanding:

- it is not possible to know what progress is being made along the way.
- Milestones cannot be set and used to assess the effectiveness of policies and programs in a timely manner.
    - ❖ By the time it becomes clear that a target will be missed, it is too late to adjust policies and programs to recover.

Solution

5. Tools fit for purpose

A competent Canadian strategy can be built only by using tools fit for the task.

- That has not been the case.
- Canada's policy has relied exclusively on tools based on conventional micro- and macro-economic theory; they have not been fit for purpose.
  - They provide a short-term approach without understanding of practical feasibility, inadequate to deal competently with the long-term issue of global heating and technological development and deployment.
- Despite being an early leader, the Government of Canada for the past two decades has failed to recognize the long-term and systemic nature of the issue of global heating;
  - it has not invested in appropriate tools.

6. Public good

The climate crisis is a collective-action problem addressing the public good.

- It imposes costs on future generations that the current set of economic agents — households and corporations — have no direct incentive to fix. [Carney 2021].
  - ❖ The resolution of the crisis will require that coordinated and purposeful actions be taken by most if not all economic agents.

Solution

Public good, 2

- The engagement of all stakeholders is essential.
  - Stakeholders must be informed by clear science and modelling of options.

- A new approach is essential, one that is:
  - participatory and adaptive;
  - that creates an informed public.
    - ❖ Simulation modelling enables the engagement of participants in such an approach.

Issue

7. Provincial considerations

Canada's practical options can be understood only in the context of vastly different provincial circumstances.

- The Pan-Canadian Framework does not specify how the commitment made for the entire country in Paris in 2015 is to be met collectively by the individual provinces and territories, other than alluding to the same percentage target.

Issue

Provincial, 2

One basic conclusion is that

- Canada will never be able to meet its commitments as long as it continues to produce huge and increasing quantities of oil and gas. It simply does not add up.
- With known plans, the emissions of two large producers of fossil fuels, Alberta and British Columbia, continue to increase for four decades.
  - The level of emissions and the trends are such that it would not be possible to counter balance them by reductions of greater than 30% in other provinces that start from a lower base.
    - ❖ It is evident from the analysis reported here that a piecemeal approach is not going to work.

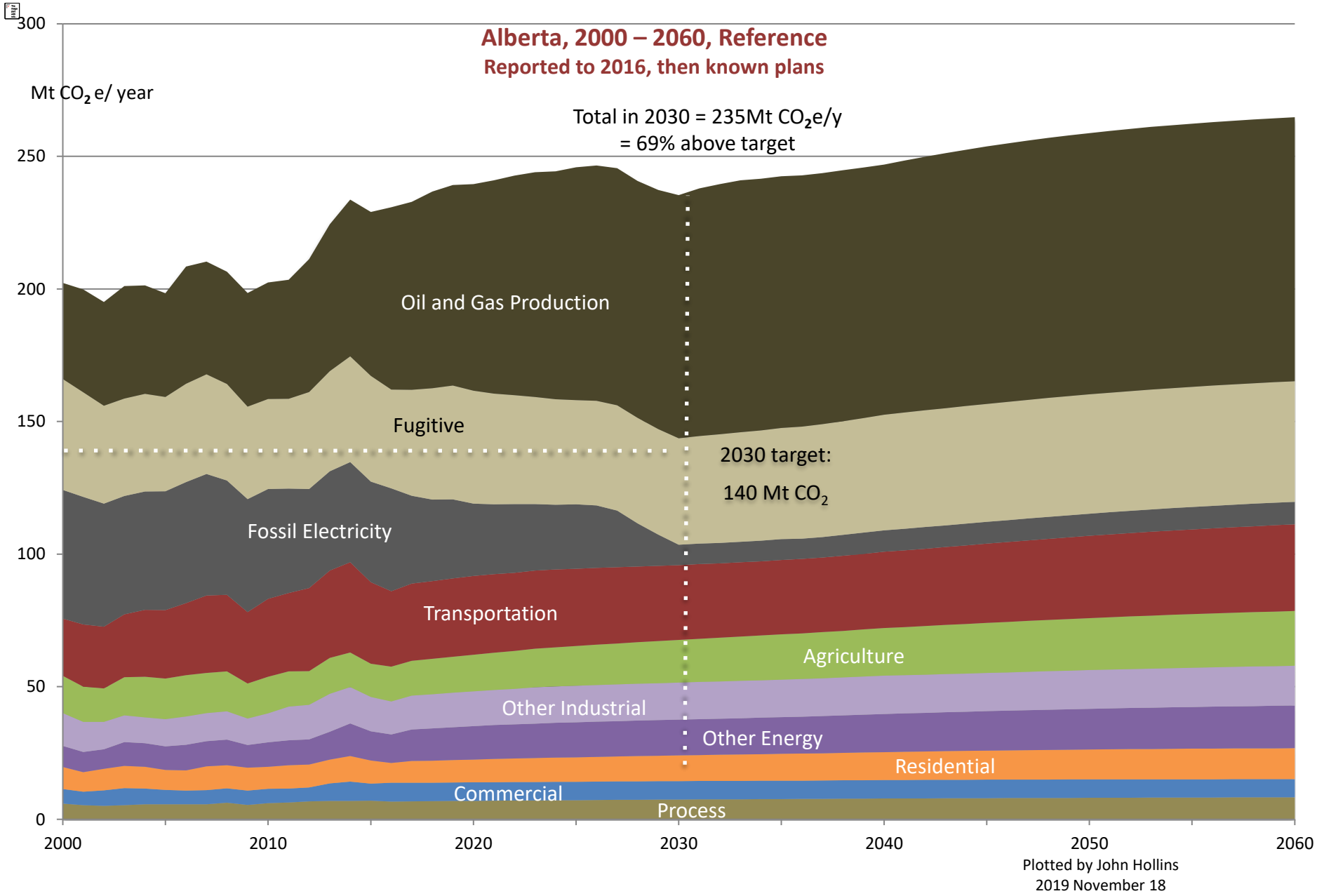
If you (Canadians) are going to meet those targets,

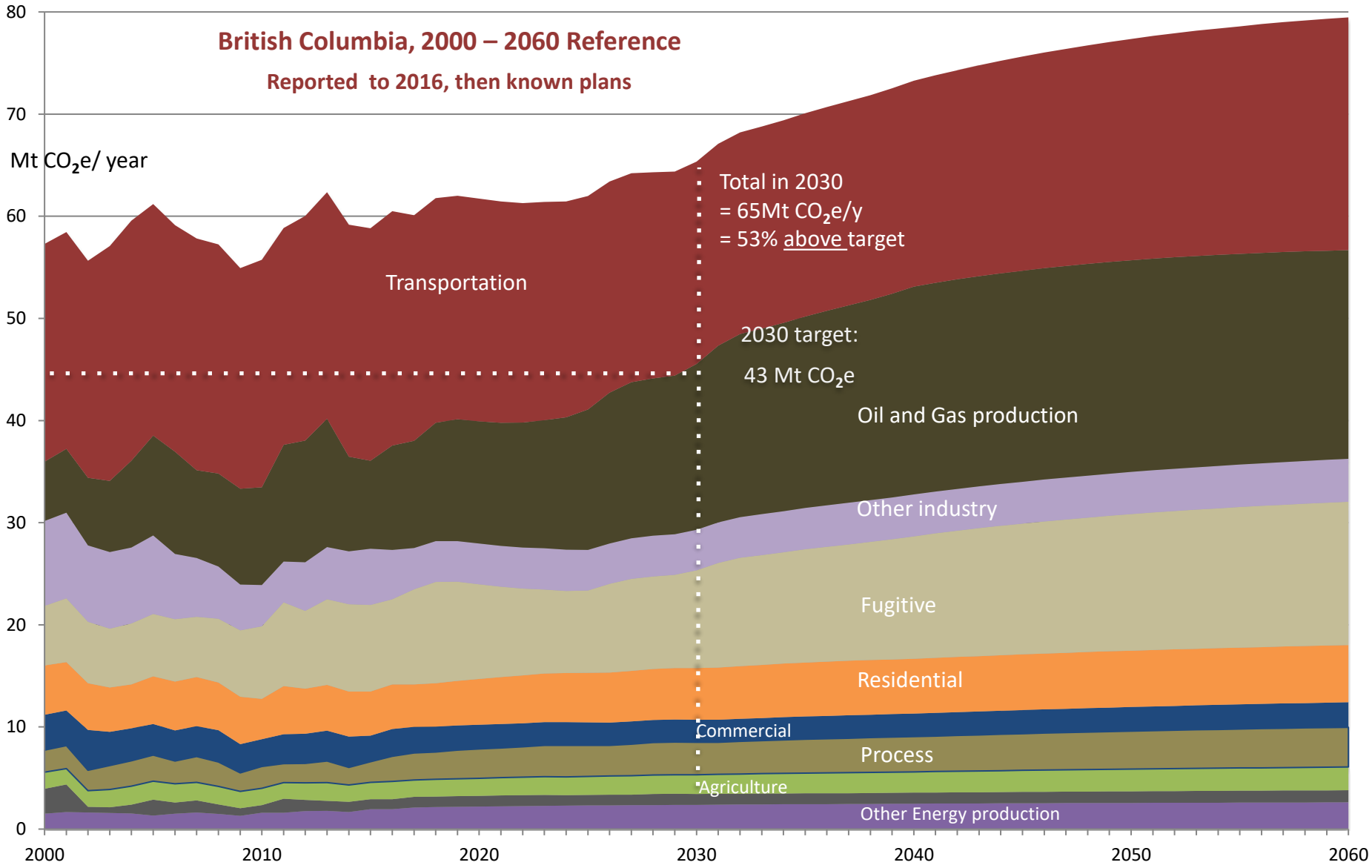
you will have to stop financing fossil fuels very, very soon.

Eric Usher, Head, UNEP Finance Initiative

Corporate Knights, Summer 2021

CACOR Pathways is able to make this case with a picture.


Alberta, 2000 – 2060, Reference
Reported to 2016, then known plans
Mt CO_2 e/ year
Total in 2030 = 235Mt CO_2e/y
= 69% above target
300
250
200
150
100
50
0
Oil and Gas Production
Fugitive
2030 target:
140 Mt CO_2
Fossil Electricity
Transportation
Agriculture
Other Industrial
Other Energy
Residential
Commercial
Process
2000
2010
2020
2030
2040
2050
2060
Plotted by John Hollins
2019 November 18


British Columbia, 2000 – 2060 Reference
Reported to 2016, then known plans
Mt CO_2e/ year
Total in 2030
= 65Mt CO_2e/y
= 53% above target
Transportation
2030 target:
43 Mt CO_2e
Oil and Gas production
Other industry
Fugitive
Residential
Commercial
Process
Agriculture
Other Energy production
80
70
60
50
40
30
20
10
0
2000
2010
2020
2030
2040
2050
2060

Seven natural gas producers have teamed up with the Nisga'a Nation to submit a plan to export gas.

THE GLOBE AND MAIL

REPORT ON BUSINESS

OTTAWA/QUEBEC EDITION ▪ MONDAY, JULY 19, 2021 ▪ GLOBEANDMAIL.COM

LNG firms, Nisga'a Nation unite on $55-billion venture

Energy megaproject in British Columbia plans to export liquefied natural gas to Asia

BRENT JANG VANCOUVER

Seven natural gas producers have teamed up with the Nisga'a Nation to submit a plan to regulators for approval to build a $55-billion energy megaproject in British Columbia, saying they have learned valuable lessons from other initiatives that have failed to materialize over the past decade.

Calgary-based **Birchcliff Energy Ltd.** is leading the group of producers known as Rockies LNG, which has enlisted Houston-based Western LNG LLC to help carry out plans to construct the B.C. project to export liquefied natural gas to Asia.

Their Ksi Lisims LNG project is named after the Nass River in the Nisga'a language.

Ksi Lisims LNG's filing to regulators doesn't provide a detailed breakdown of the costs, but the total price tag includes a wide range of items, including floating modules to supercool natural gas into liquid form. The project will rely heavily on electric-motor technology in refrigerant compressors, using electricity from BC Hydro during the liquefaction process instead of the LNG industry's traditional reliance on turbines powered by natural gas.

"As set out in the Nisga'a treaty, the Nisga'a Nation owns and controls Nisga'a lands, which includes approximately 2,000 square kilometres at the lower end of the Nass River," according to a 135-page document, dated July 2, filed by the proponents to the B.C. Environmental Assessment Office. The proponents say they anticipate the provincial regulator will likely lead the environmental review, in a collaborative process with the Impact Assessment Agency of Canada, which will also scrutinize the proposal.

The property where the terminal would be located is called Wil Milit, situated near Pearse Island in the Portland Canal in northwestern B.C. "The project site is remote, located approximately 15 kilometres west of the Nisga'a community of Gingolx at the mouth of the Nass River," the document said.

NATURAL GAS, B7

CANNABIS

'MUCH HARDER RETAIL GAME NOW'

As the number of legal pot stores in Ontario has exploded over the past seven months, experts warn the mushrooming growth could lead to a wave of closures B2

OPEC, allies end dispute after five countries get higher limits

JON GAMBRELL DUBAI

OPEC and allied countries agreed Sunday to raise the production limits imposed on five countries next year and boost their production by two million barrels per day by the end of this year, ending a dispute that roiled oil markets.

The disagreement, sparked by a demand by the United Arab Emirates to increase its own production, temporarily upended an earlier meeting of the cartel. In a statement Sunday, the cartel announced that Iraq, Kuwait, Russia, Saudi Arabia and the UAE would see their limits rise.

"What bonds us together is ... much beyond what you may imagine," Saudi Energy Minister Prince Abdulaziz bin Salman said. "We differ here and there but we bond."

Prince Abdulaziz declined to elaborate on how they came to that consensus, saying it would see the cartel "lose our advantage of being mysterious and

Globe and Mail, 2021 July 19

Provincial, 3

Issue

- Tasking each province with the same percentage reduction,
  even if that were possible, would not be the most cost-effective way
  to achieve the commitment made by Canada.

Solution

- ❖ Reductions in each province need to be negotiated to secure
  a competent plan for the entire country of Canada:
  - ➢ The task would no doubt be politically challenging;
  - ➢ It requires governments to collaborate, as in wartime:
  - ➢ A national commitment is essential.

Solution

8. Energy information

The analyst for this Pathways project assembled data from a wide array of sources.

- A model without data is like a Tesla without a battery.

- There is a need for a Canadian energy information agency with a mandate:
  - to inform public policy on energy and emissions;
    - ❖ It should be at arms-length from government and be provided with stable funding for a significant term.

Solution

Energy information, 2

- It would compile data from a wide range of sources.
- It would invest in the development of modelling tools appropriate for delineating biophysically coherent pathways for energy and emissions within the context of the structure of the Canadian economy.
    - ❖ It would make the data and the tools transparent and freely accessible to all stakeholders.

Messages

1. Repeated failure, *issue*
2. Strategic issue, *context*
3. Approach, *diagnosis*
4. Targets without a way to hit them, *diagnosis*
5. Tools fit for purpose, *solution*
6. Public good, *context and solution*
7. Provincial considerations, *issue and solution*
8. Energy information, *issue and solution*

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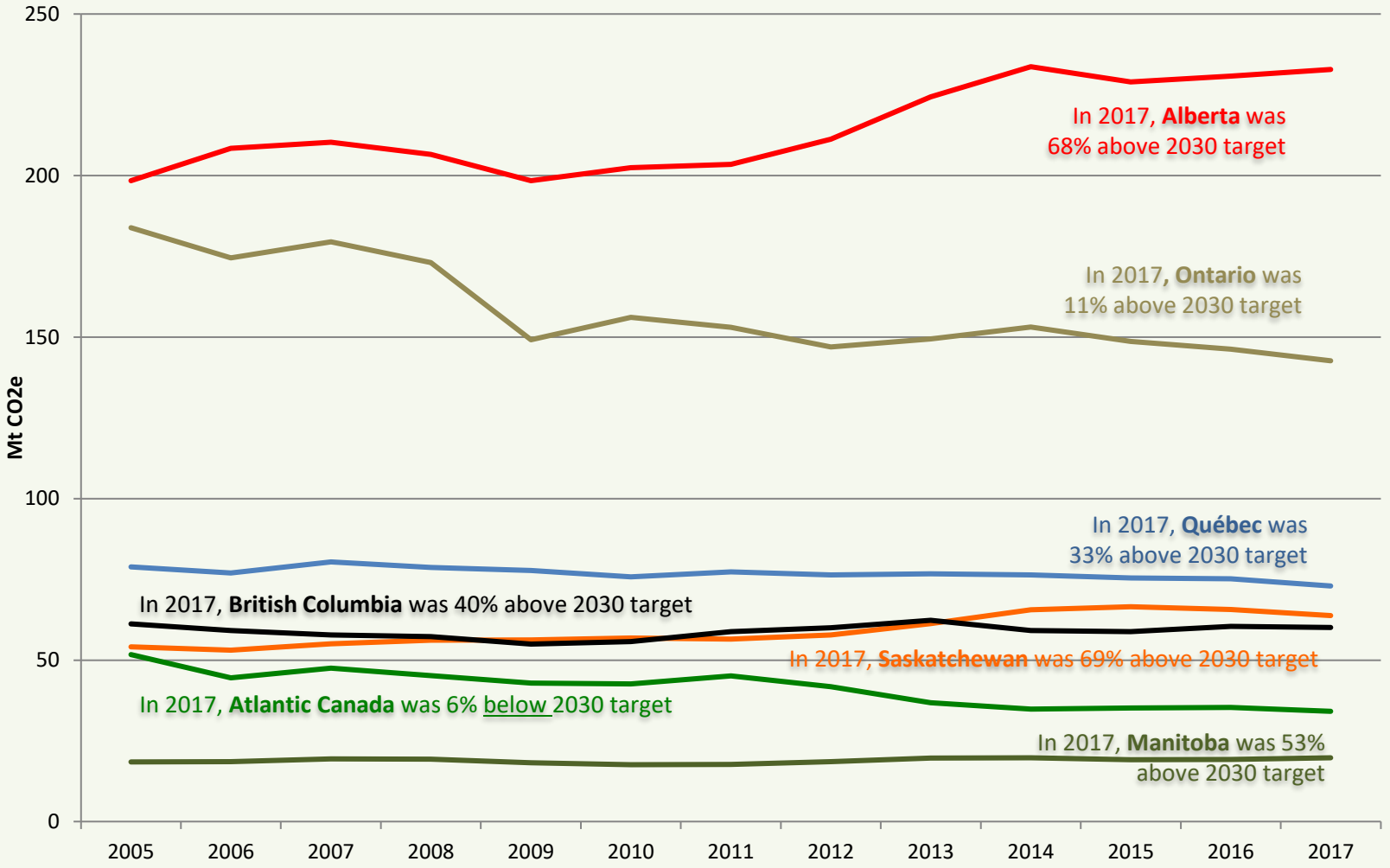
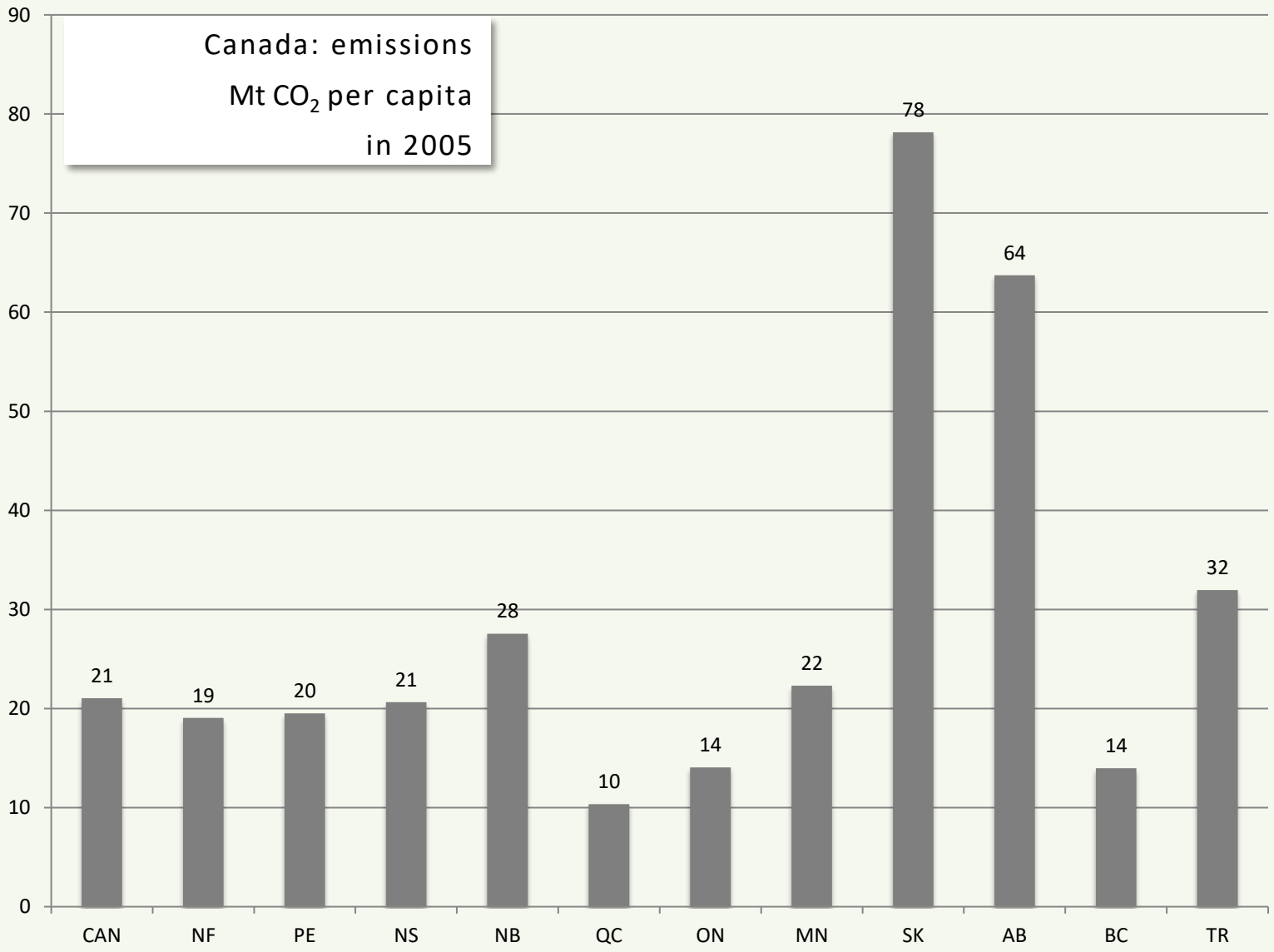
SPARES

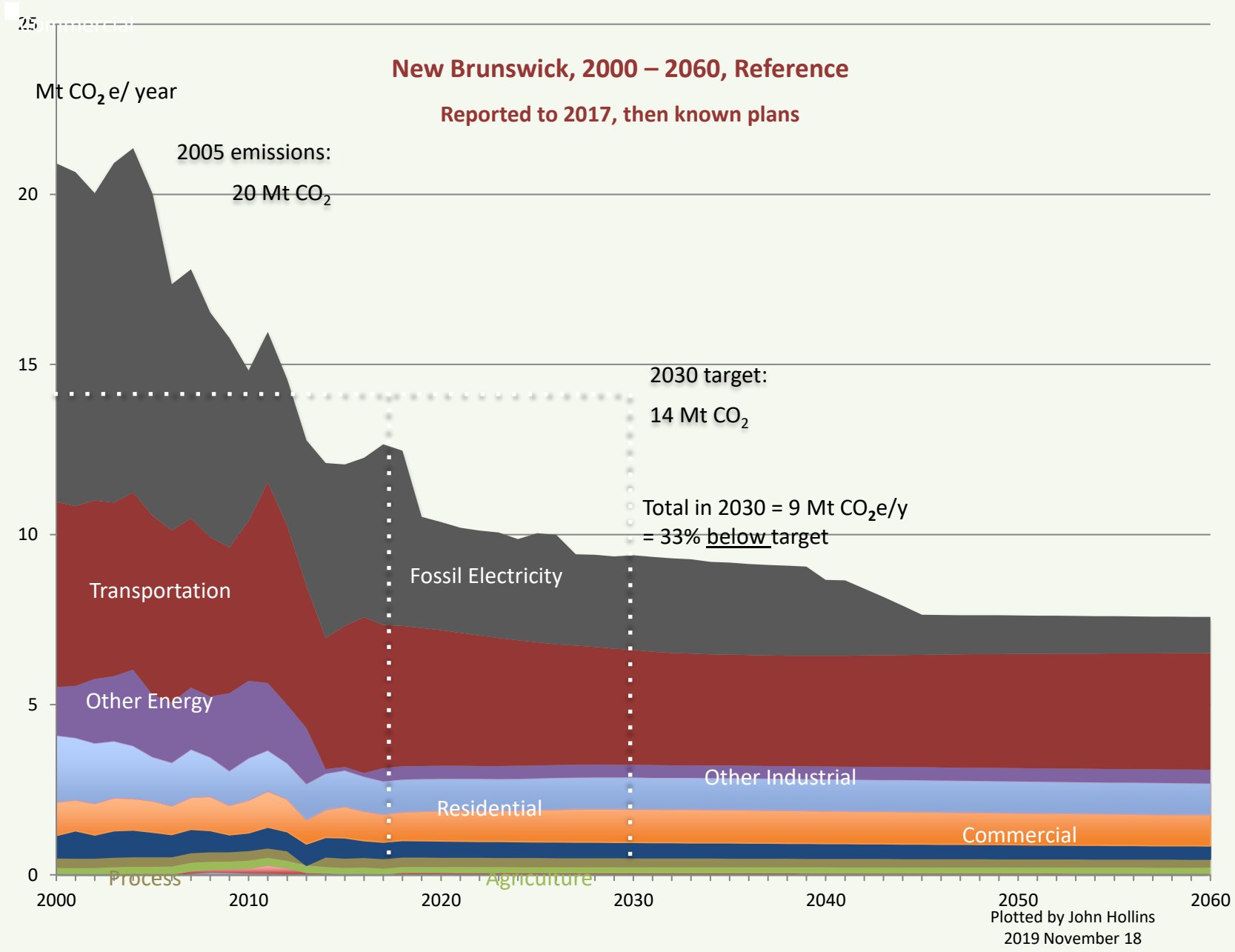
Reported Provincial Emissions, 2005 - 2017 and relation to Canada's Paris target




Canada: emissions
Mt CO_2 per capita
in 2005
90
80
70
60
50
40
30
20
10
0
21
19
20
21
28
10
14
22
78
64
14
32
CAN
NF
PE
NS
NB
QC
ON
MN
SK
AB
BC
TR

Good news

- New Brunswick
  - Provincially-owned electrical utility
    - With foresight; has
      - already closed two of four oil and coal-fired generating stations
      - already met Canada's Paris target
- Nova Scotia similar
  - has also closed coal-fired generating stations


New Brunswick, 2000 – 2060, Reference
Reported to 2017, then known plans
Mt CO_2 e/ year
2005 emissions:
20 Mt CO_2
2030 target:
14 Mt CO_2
Total in 2030 = 9 Mt CO_2e/y
= 33% below target
Transportation
Fossil Electricity
Other Energy
Other Industrial
Residential
Commercial
Process
Agriculture
25
20
15
10
5
0
2000
2010
2020
2030
2040
2050
2060
Plotted by John Hollins
2019 November 18

Sorted by rating by Corporate Knights, 2021 Spring

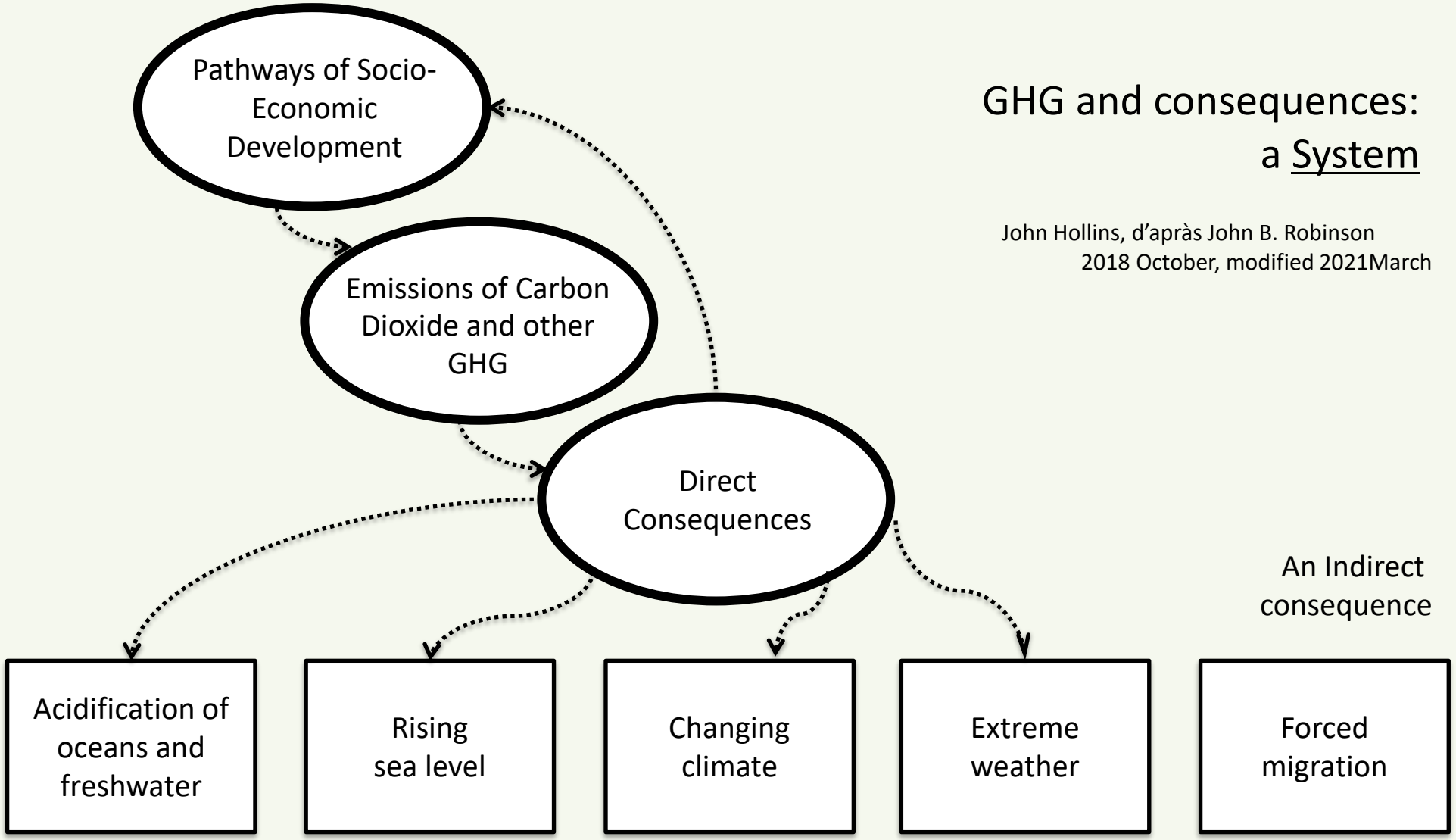
	Rating	Mt/cap	Mt	%
NB	A	16.0	16.0	2.2%
NS	A	17.7	17.0	2.4%
QC	A-	9.4	83.0	11.7%
YU	B	14.8	0.6	0.1%
NWT	B	26.9	1.2	0.2%
NU	B-	18.2	0.7	0.1%
BC	B+	13.2	66.0	9.3%
PEI	B+	11.4	1.7	0.2%
MN	C-	16.3	22.0	3.1%
ON	C-	11.5	165.0	23.2%
AB	D-	63.4	273.0	38.4%
SK	D+	65.4	65.4	9.2%

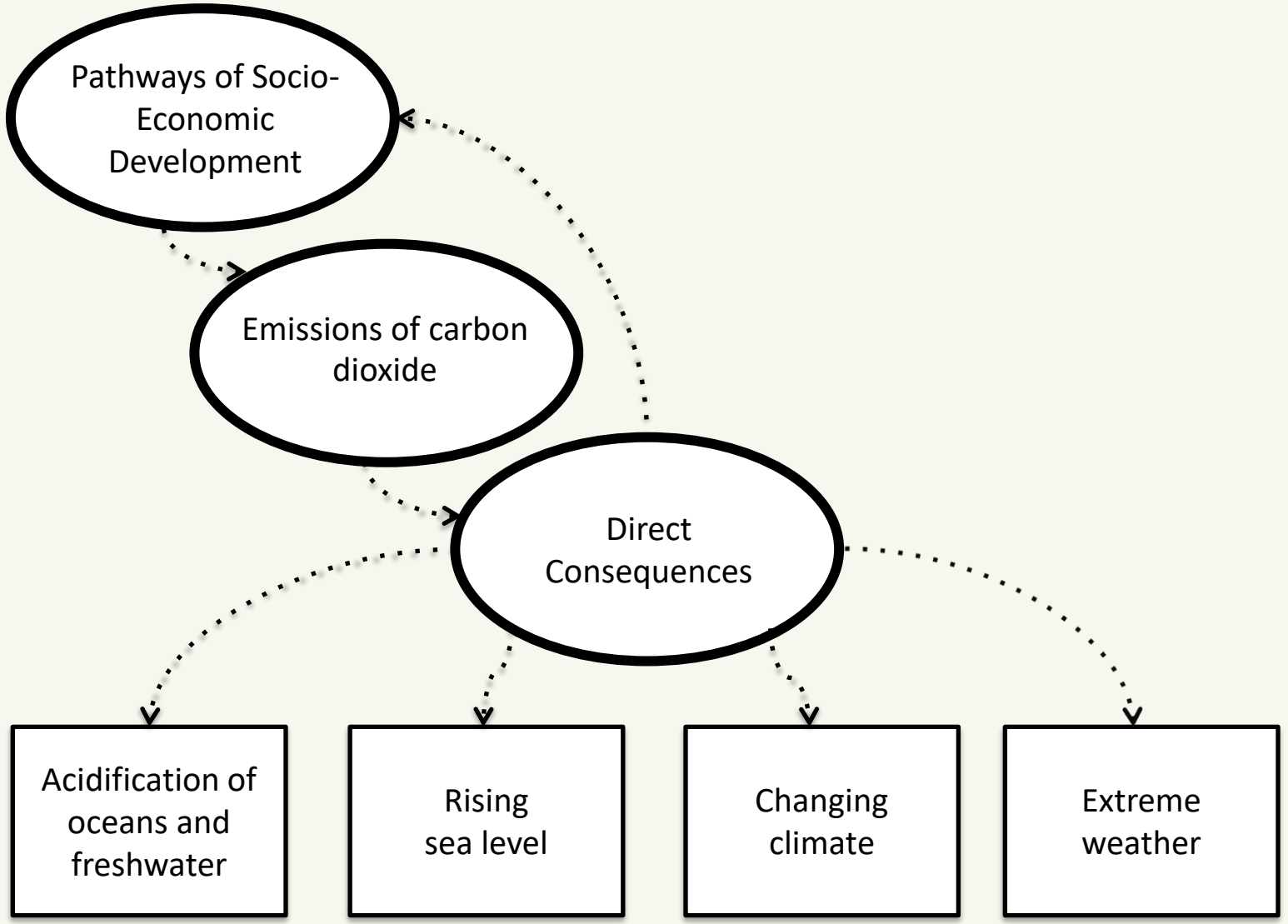
Sorted by emissions by province, Corporate Knights, 2021 Spring

	Rating	Mt/cap	Mt	%
AB	D-	63.4	273.0	38.4%
ON	C-	11.5	165.0	23.2%
QC	A-	9.4	83.0	11.7%
BC	B+	13.2	66.0	9.3%
SK	D+	65.4	65.4	9.2%
MN	C-	16.3	22.0	3.1%
NS	A	17.7	17.0	2.4%
NB	A	16.0	16.0	2.2%
PEI	B+	11.4	1.7	0.2%
NWT	B	26.9	1.2	0.2%
NU	B-	18.2	0.7	0.1%
YU	B	14.8	0.6	0.1%

GHG and consequences: a System

John Hollins, d'apràs John B. Robinson
2018 October, modified 2021March





John Hollins, after John B. Robinson