

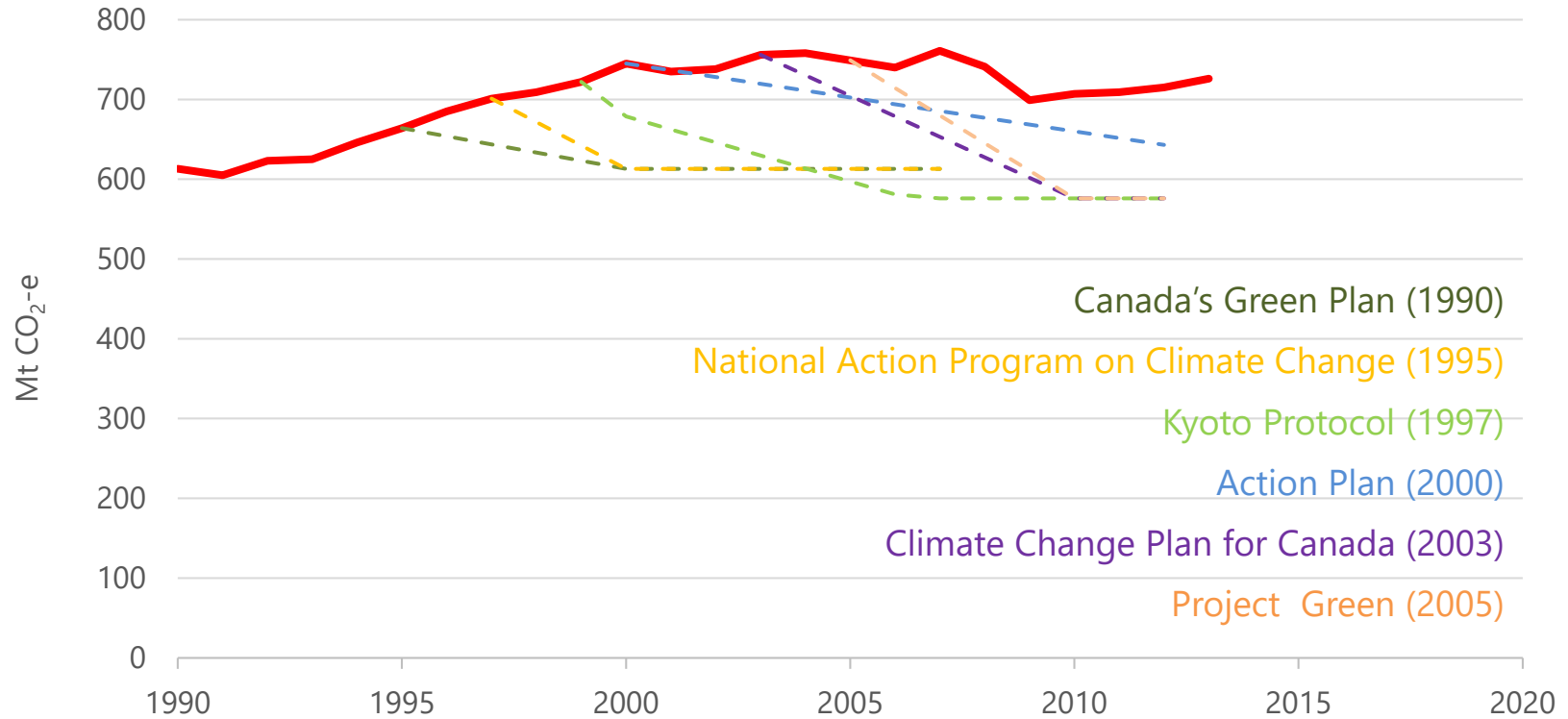
# Renewable energy and carbon pricing

Warren Mabee

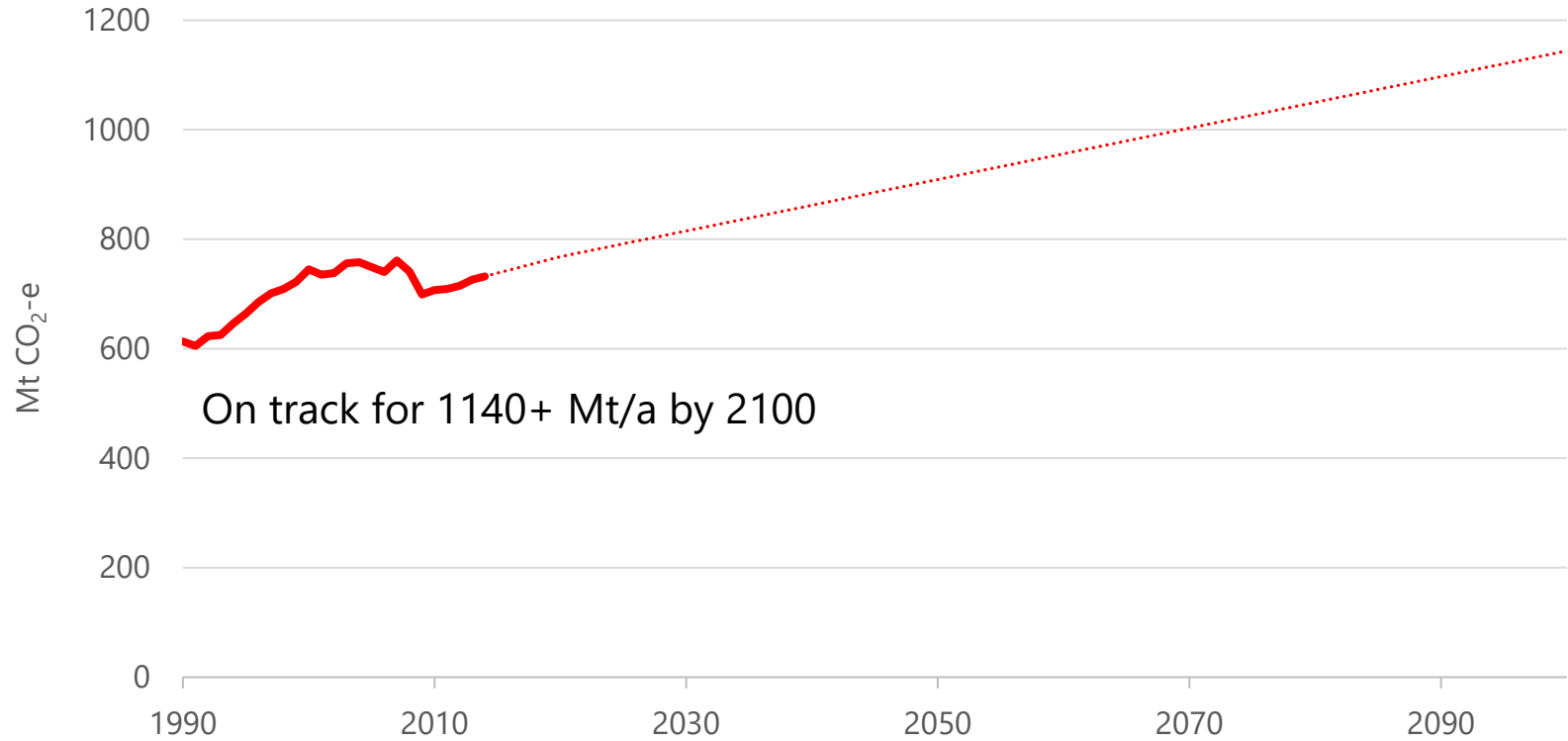
*Bioindustrial Innovations: Unlocking Value and Tackling Climate Change*

Edmonton, Canada, 24 November 2015

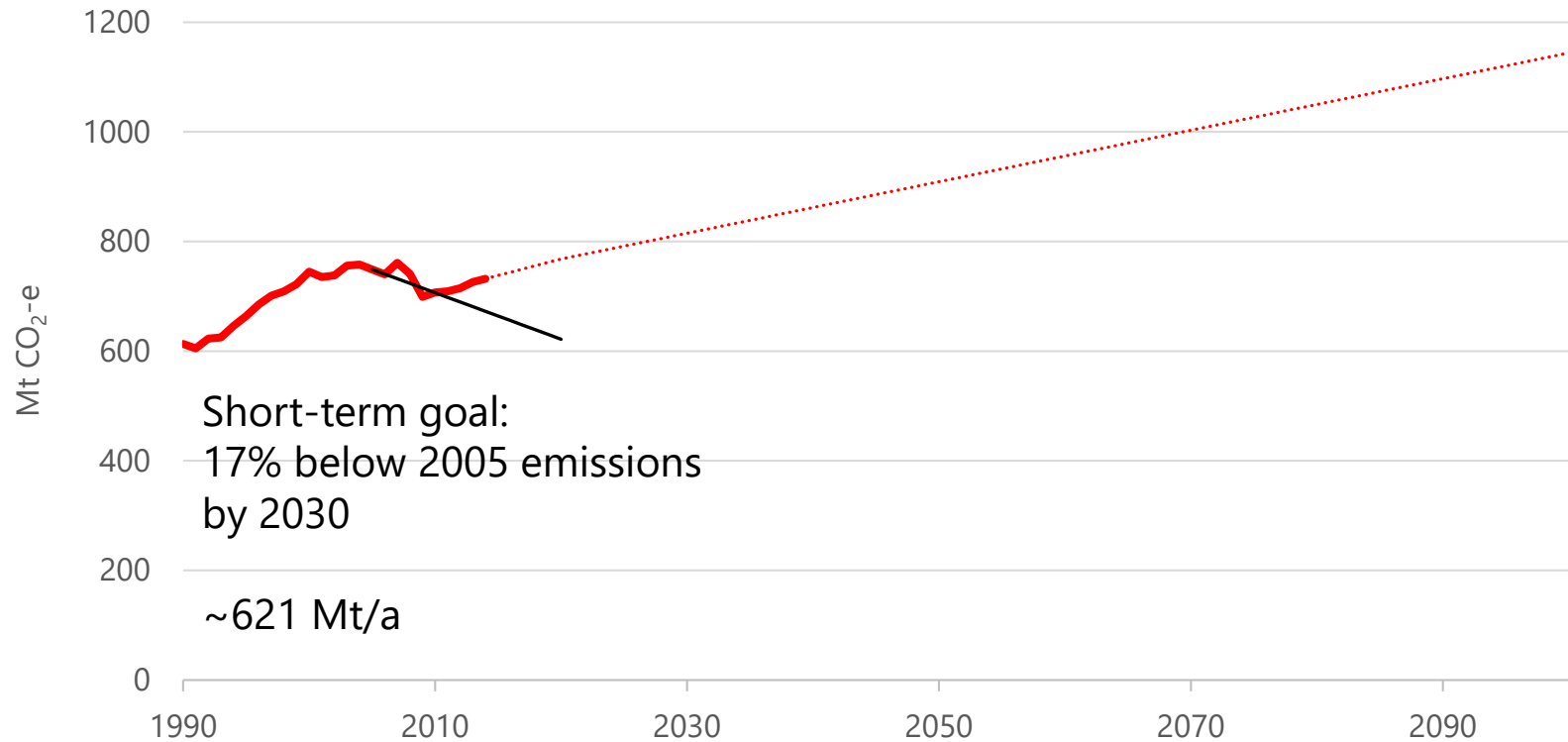
# Lack of action on GHG emissions



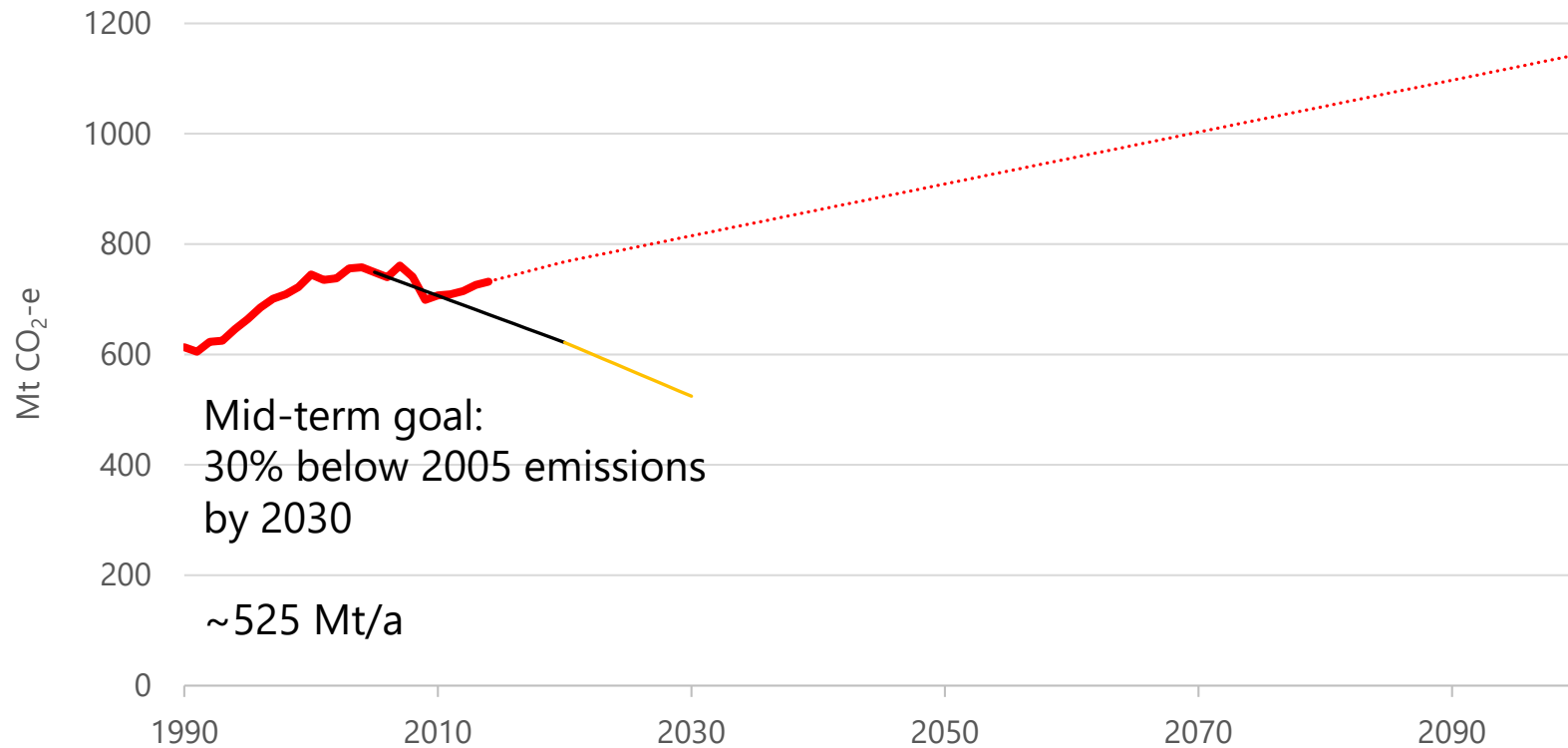
# Recall



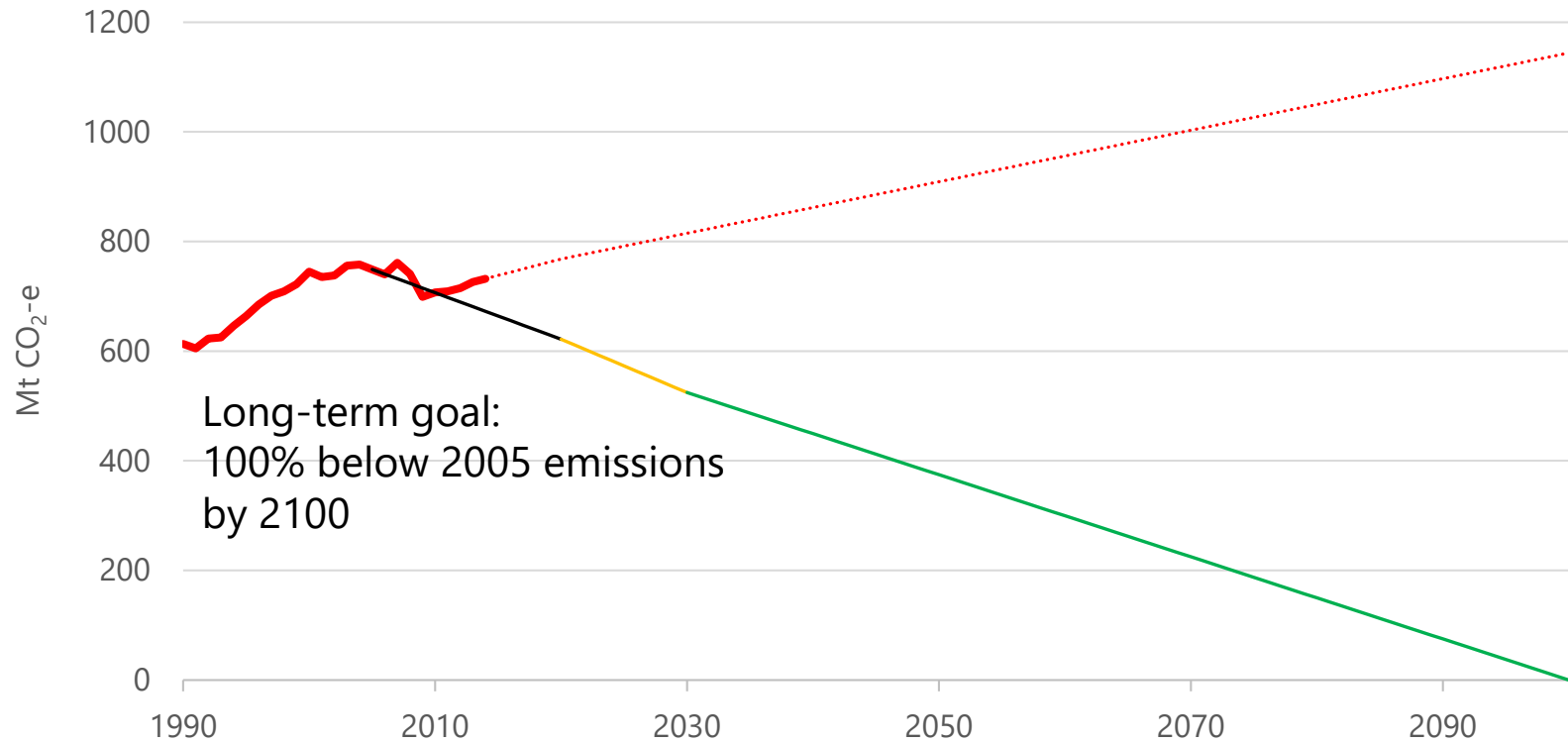
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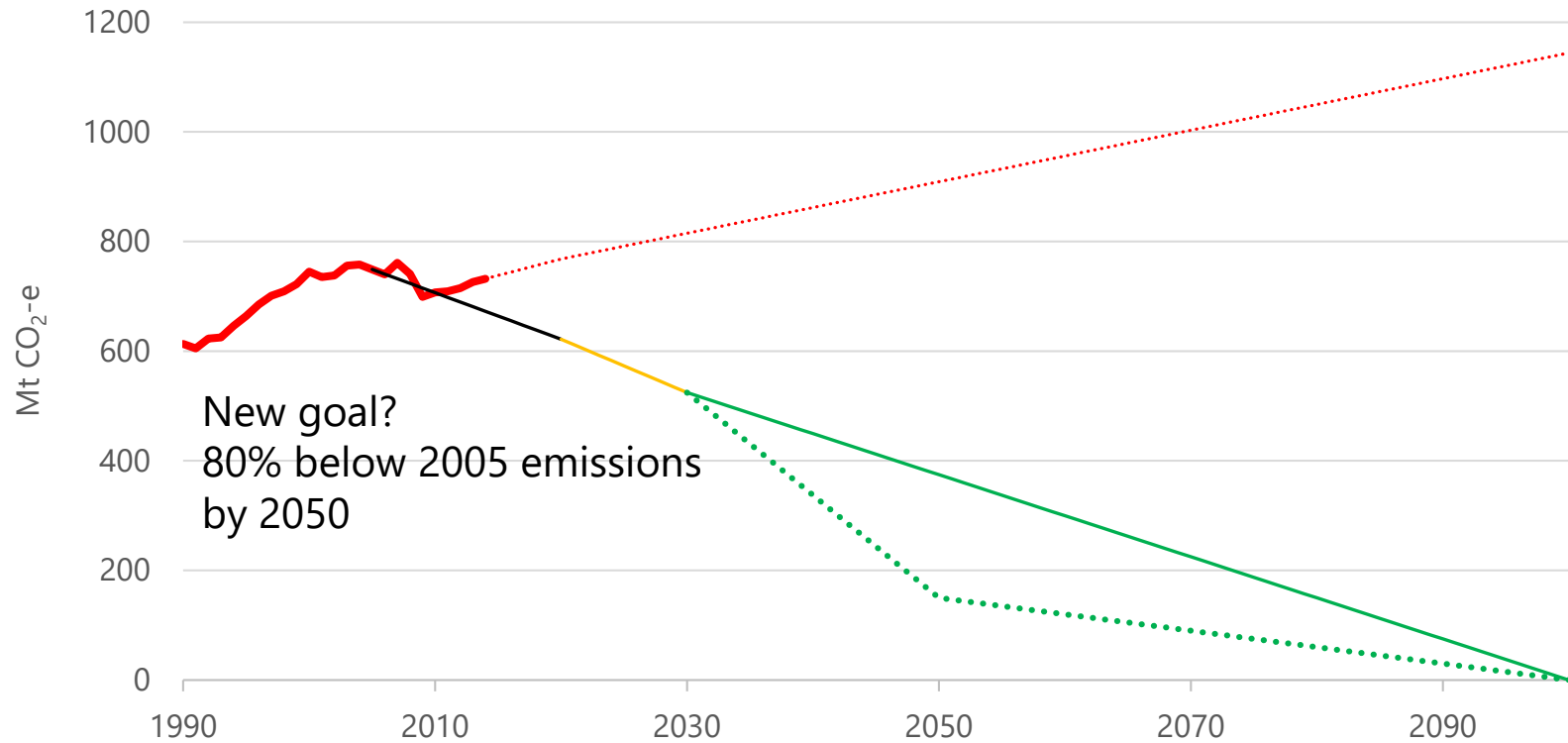
# Recall



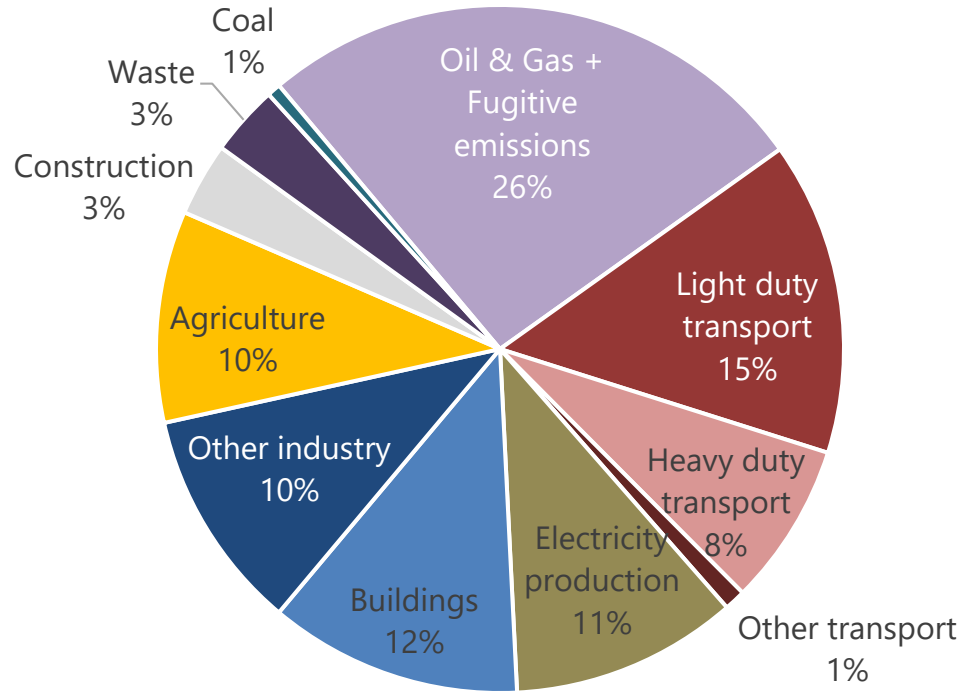
# Recall



# Recall



# Total emissions (2014): 732 Mt CO<sub>2</sub>-e





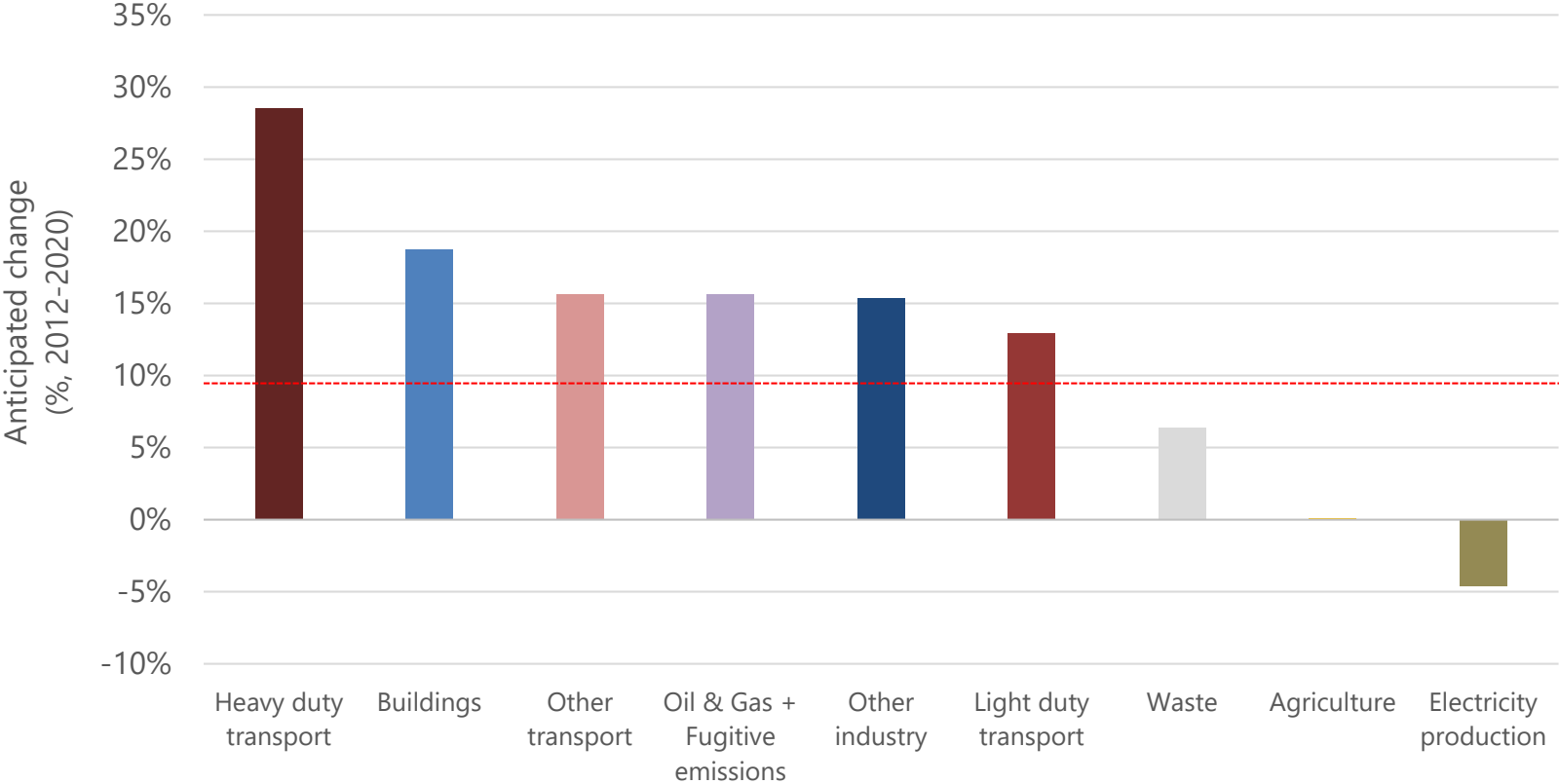
# Ranking the problems

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Source	Rank by total
Oil & gas	1
Light-duty transport	2
Electricity	3
Buildings	4
Other industry	4
Agriculture	4
Heavy-duty transport	6
Waste	7
Other transport	8

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# Anticipated change in GHGs by 2020



# Ranking the problems

Source	Rank by total	Rank by growth	COMBINED RANK
Oil & gas	1	4	1
Light-duty transport	2	6	4
Electricity	3	9	7
Buildings	4	2	2
Other industry	4	5	5
Agriculture	4	8	8
Heavy-duty transport	6	1	3
Waste	7	7	9
Other transport	8	3	6

# Key ideas

It's clear that fuels for light-duty and heavy-duty transport top are dominant needs to meet the GHG challenge

- Heavy-duty transport – trucks/diesel fuel – is the fastest-growing source of GHG emissions in Canada
- Will light-duty vehicles require liquid fuels, or electricity?

Bioproducts to help green the oilsands also a priority for Canada

Demand for power is not so critical; emissions are dropping in electricity production already

# Research priorities and policy gaps

# Action

1. Pumping oil
2. Keeping warm
3. Moving stuff
4. Moving people

# Short-term

Biodiluents

Low carbon fuels

Biodiesel

Ethanol

# Long-term

Renewable switch

Design/conservation

Green diesel

Renewable electricity

# Biofuel priorities

Biodiluents

Biodiesel

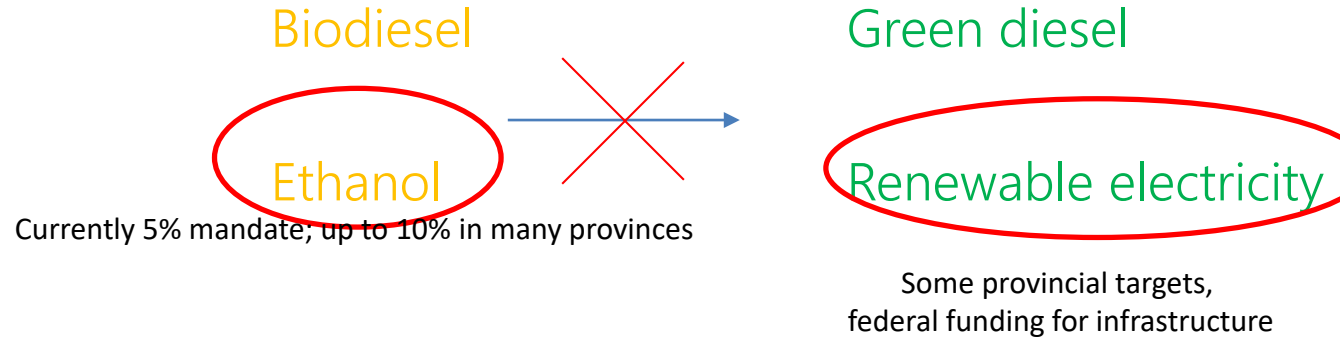
Ethanol

Green diesel

Renewable electricity

# Policy gaps

## Biodilutents





# Policy gaps

## Biodilutents

Currently 2% mandate

Biodiesel

Ethanol

No targets, limited  
research focus

~~Green diesel~~

Renewable

electricity

# Policy gaps

~~Biofuels~~

Wide range of bioproducts under consideration;  
industry focus, not GHG strategy

electricity

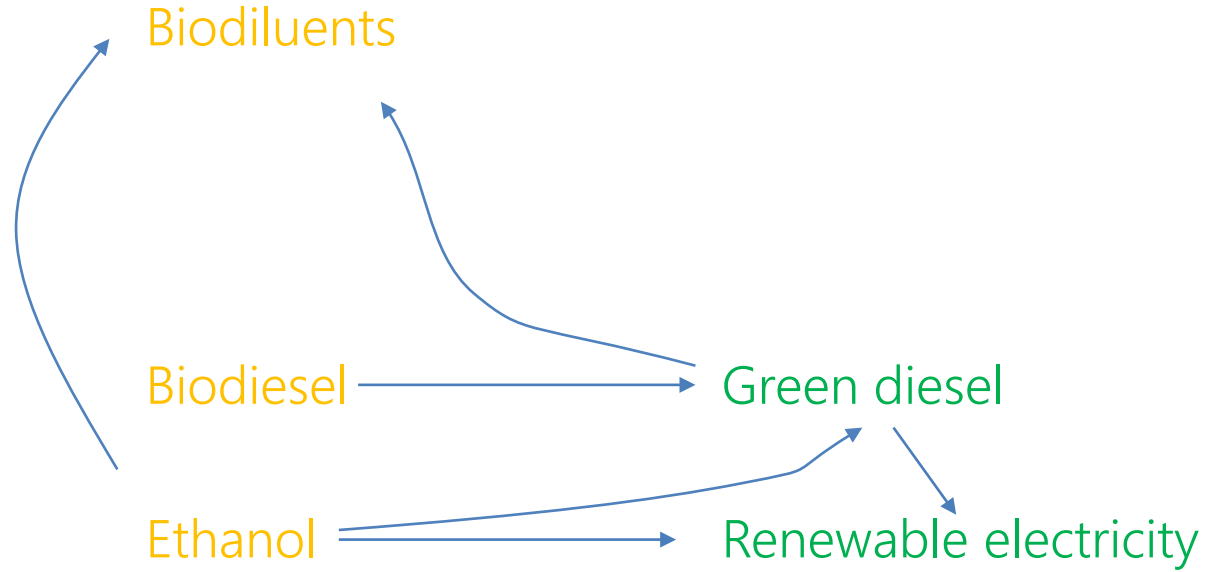
Biodiesel

Green diesel

Ethanol

Renewable

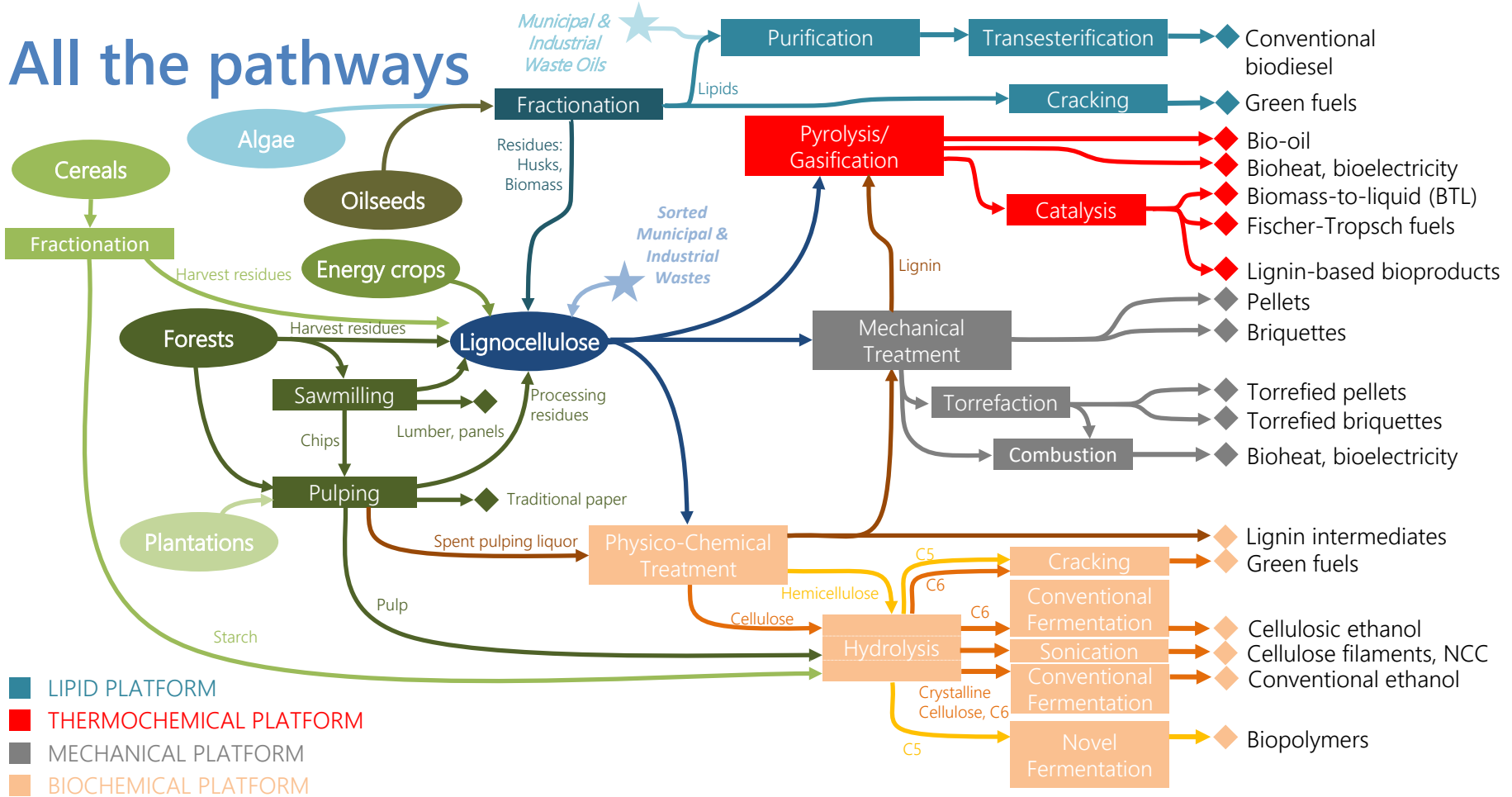
# Policy gaps



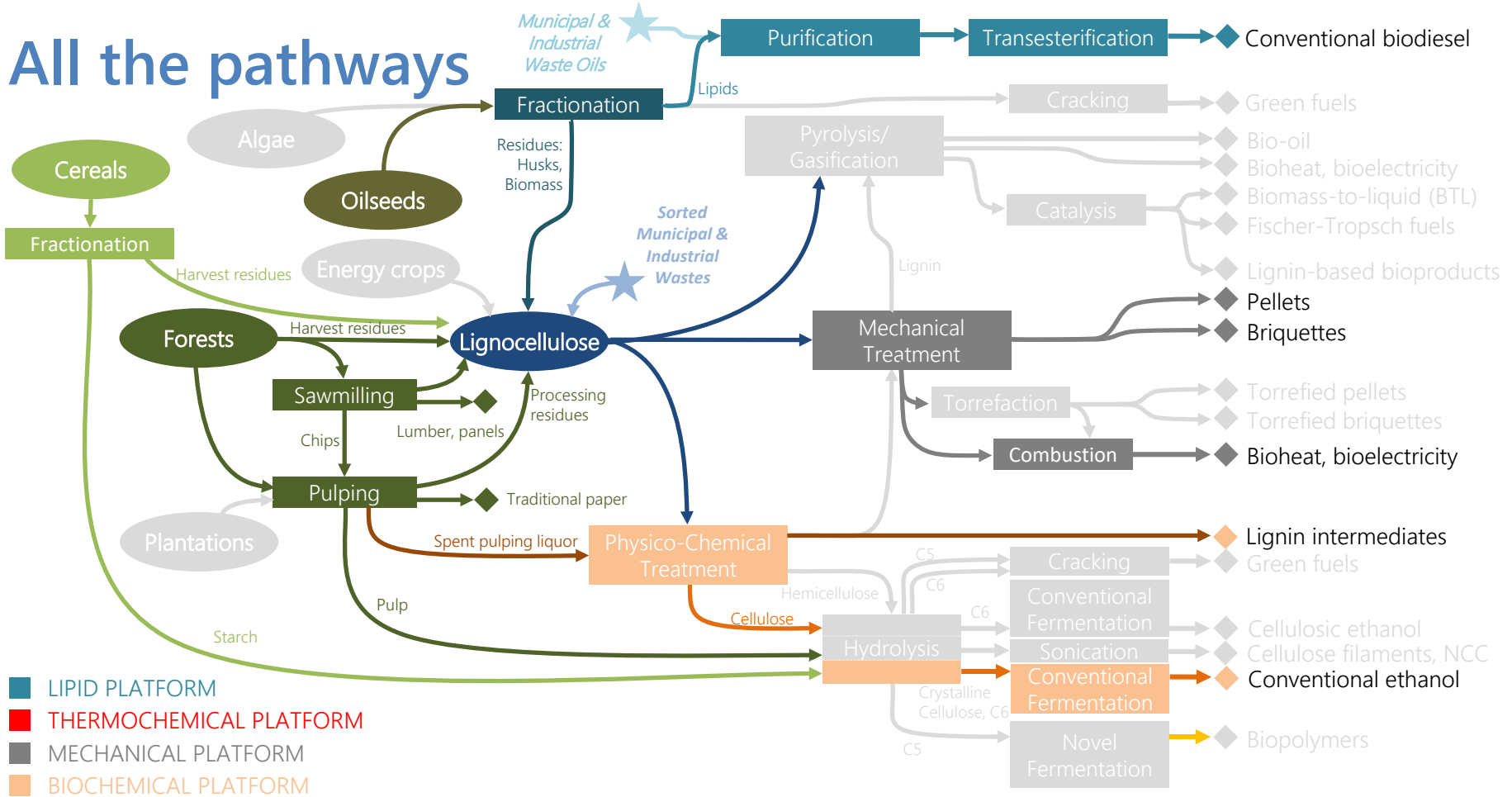
Ultimately, a strategy is required that links these components together to meet the challenges ahead

# Technological challenges

# All the pathways



# All the pathways



# Key points

Huge range of technological pathways; too much choice on the menu

R&D strategies have focused on platforms that can deliver higher-value products as well as biofuels

No concentrated R&D strategy that has focused on heavy-duty fuel replacements – potential for cross-pollination across platforms

# Carbon policies

## Alberta

11% population

37% emissions

Carbon levy (2017):  
C\$30/t (by 2018)

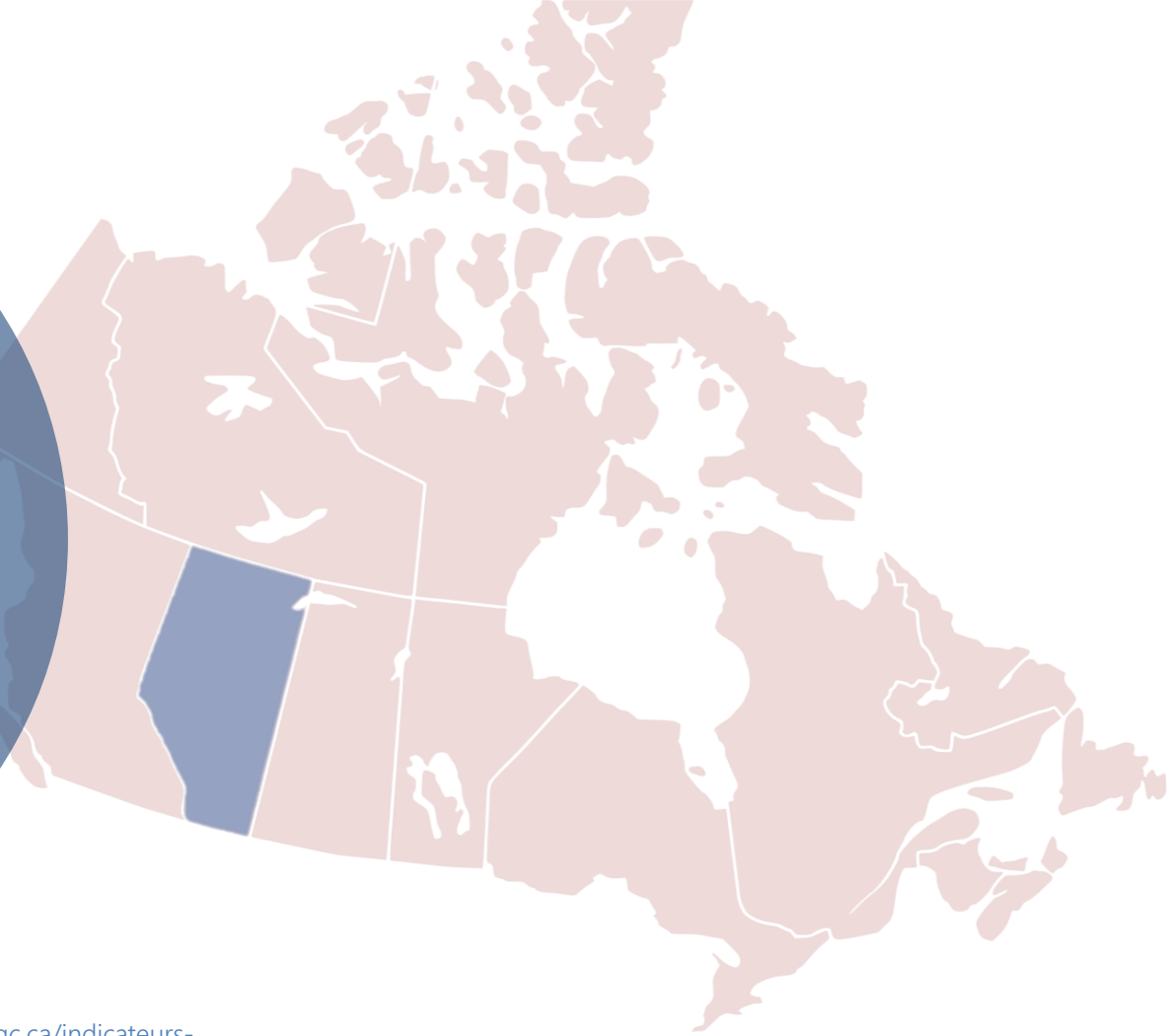
Target:

50 Mt below business as  
usual by 2020\*

Affects entire economy

Revenue neutral\*\*

\*Old target





# Carbon policies

BC

13% population

9% emissions

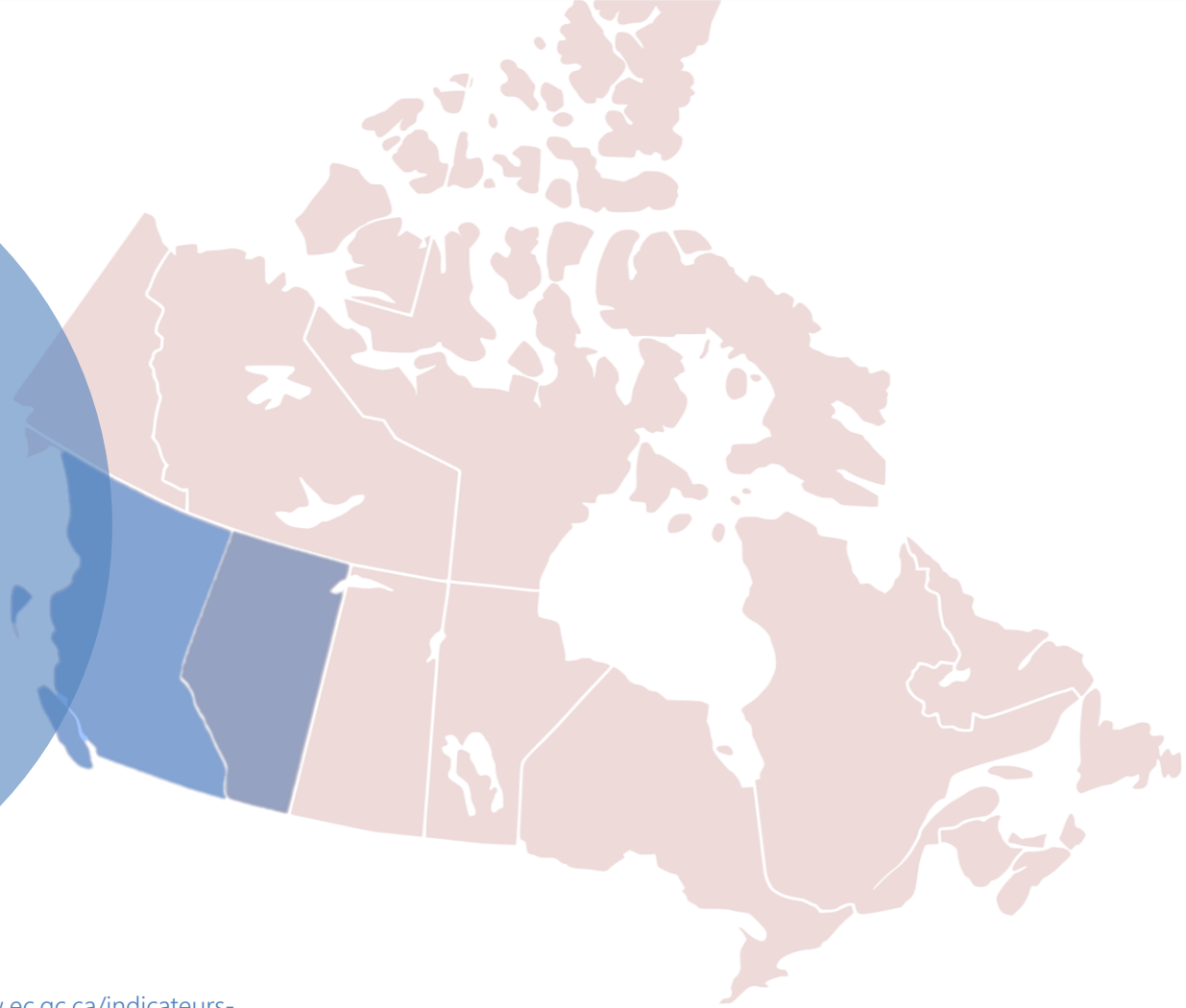
Carbon tax (2008):

C\$10-30/t

Target: 18% below 1990  
by 2020

Affects entire economy

Revenue neutral



# Carbon policies

## Ontario

39% population

24% emissions

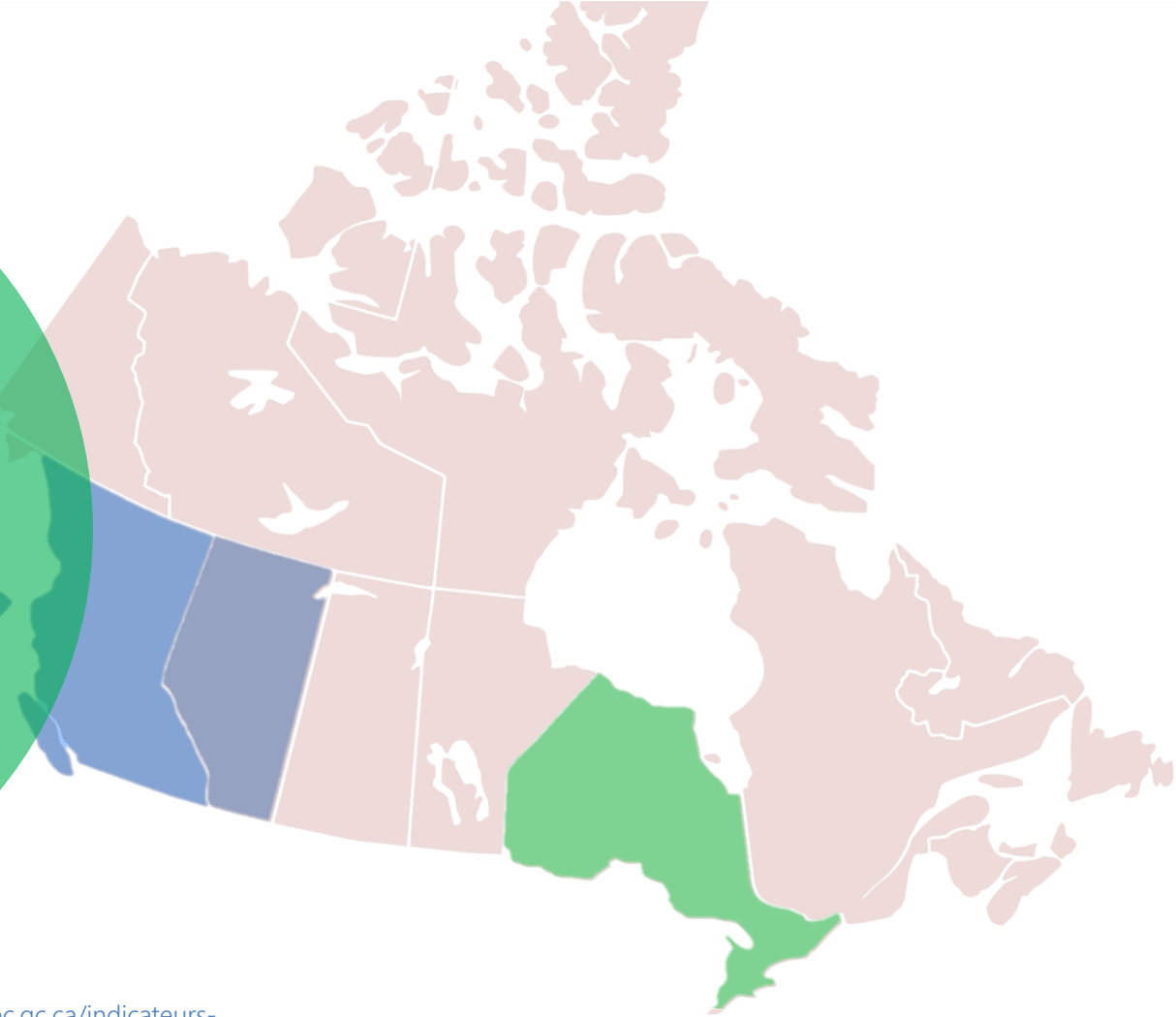
Cap & trade (2017):  
*likely\**

C\$10-30/t

Target: 15% below 1990  
by 2020

Affects emitters  
>25,000 t/year

*\*Nic Rivers estimate*



# Carbon policies

Quebec

23% population

11% emissions

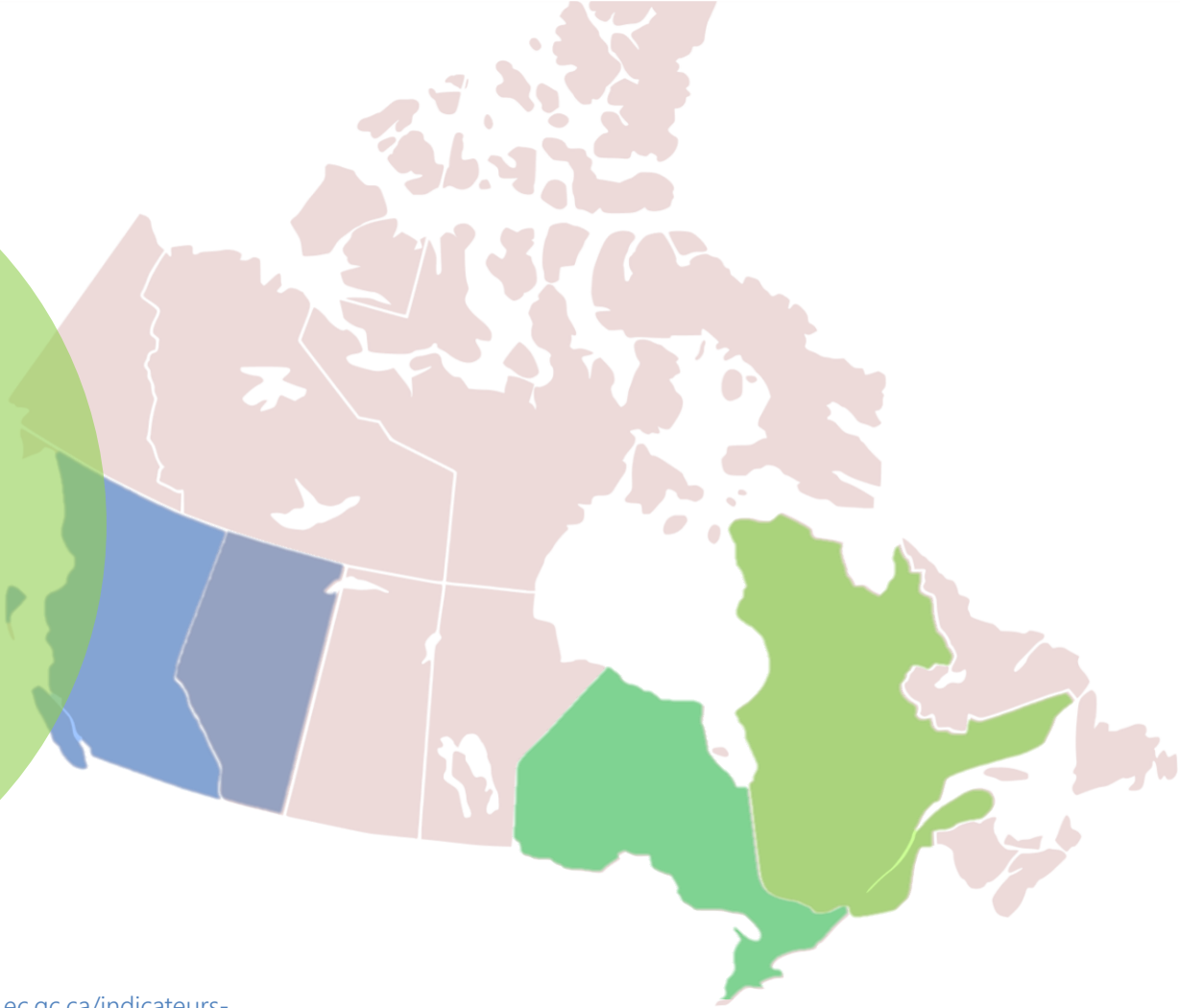
Cap & trade (2013):

*reserve price of*  
C\$12.08/t

Carbon tax (2007):

C\$3.50/t

Target: 20% below 1990  
by 2020



# Biofuel implications



Canada can now be viewed as two distinct blocks:

Western block using carbon taxes, eastern block using cap and trade

Biofuel producers count under **cap and trade**, **carbon tax** as large emitters  
(Must negotiate for recognition of GHG benefits associated with fuel product)

Biofuel consumers under **carbon tax** receive a benefit -> potentially drives uptake

# Takeaways

Emission problems, solutions uneven across Canada; need national targets linked to sectors to help guide provincial actions

- Large proportion of transport needs biofuels to make significant reductions

Biofuel producers face a challenge: different carbon \$ programs recognize the value of these products in different ways

No matter what the system there is a benefit to moving to energy neutrality: shifting from natural gas and fossil inputs to using biomass components to power facilities, produce extra electricity

- Ideally, cap and trade would fund capital investment to deliver change

# Team and partners

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**FFABnet**

Functionalized Fibre and Biochemicals Network



**ACW** | Adapting Canadian Work and Workplaces

