State of Biofuels in Québec

Exploring consumption, costs and carbon abatement

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Technology modeling

Macroeconomic modeling

Fuel and electricity modeling

Outline

1. Biofuel consumption
   - Current
   - Projected to 2030
2. Effects
   - Carbon emissions
   - Cost to consumers
3. Policy implications

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Quick reminder that 'biofuel' refers to:

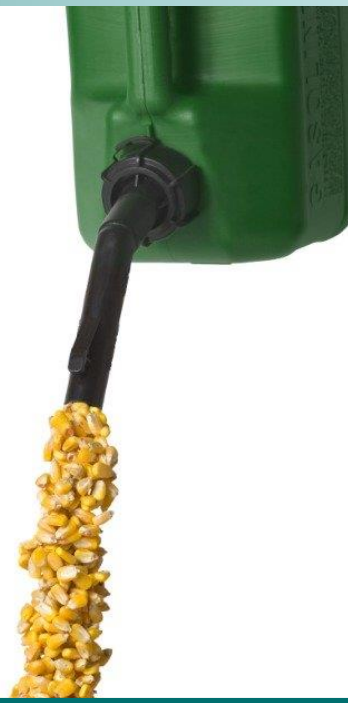
- Ethanol to replace gasoline in passenger transport

  Main feedstock in Québec is corn

- Biodiesel or renewable diesel (HDRD) to replace diesel in commercial transport

  Main feedstock in Québec is tallow (animal fat)

- Carbon intensity of biofuels varies by feedstock, but is lower than fossil fuels



Ethanol is 48% less emissions intensive than gasoline

Biodiesel is 87% less emissions intensive than diesel

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1. Biofuel consumption

Biofuel consumption is driven by policy

- This includes: renewable fuel blending requirements, low carbon fuel standards, and carbon pricing
- Québec currently has no provincial biofuel blending requirements and is covered under federal regulations

Biofuel blending policies in 2019

	B.C.	Alberta	Sask.	Manitoba	Ontario	Canada
Gasoline	5%	5%	7.5%	8.5%	5%	5%
Diesel	4%	2%	2%	2%	4%	2%

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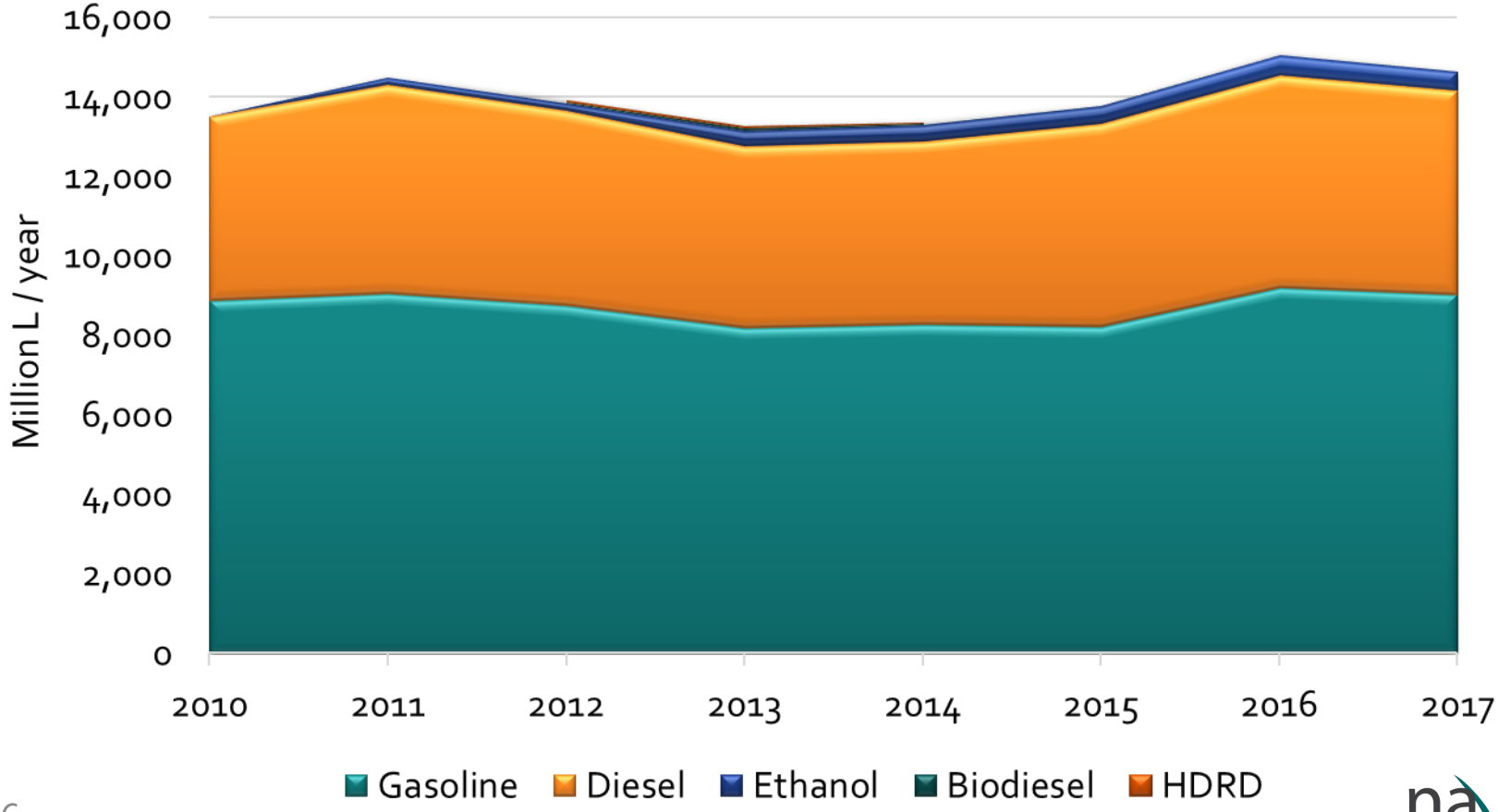
1. Biofuel consumption: current

- 14,600 million L of transportation fuel was consumed in Québec in 2017
- ~3% was biofuels



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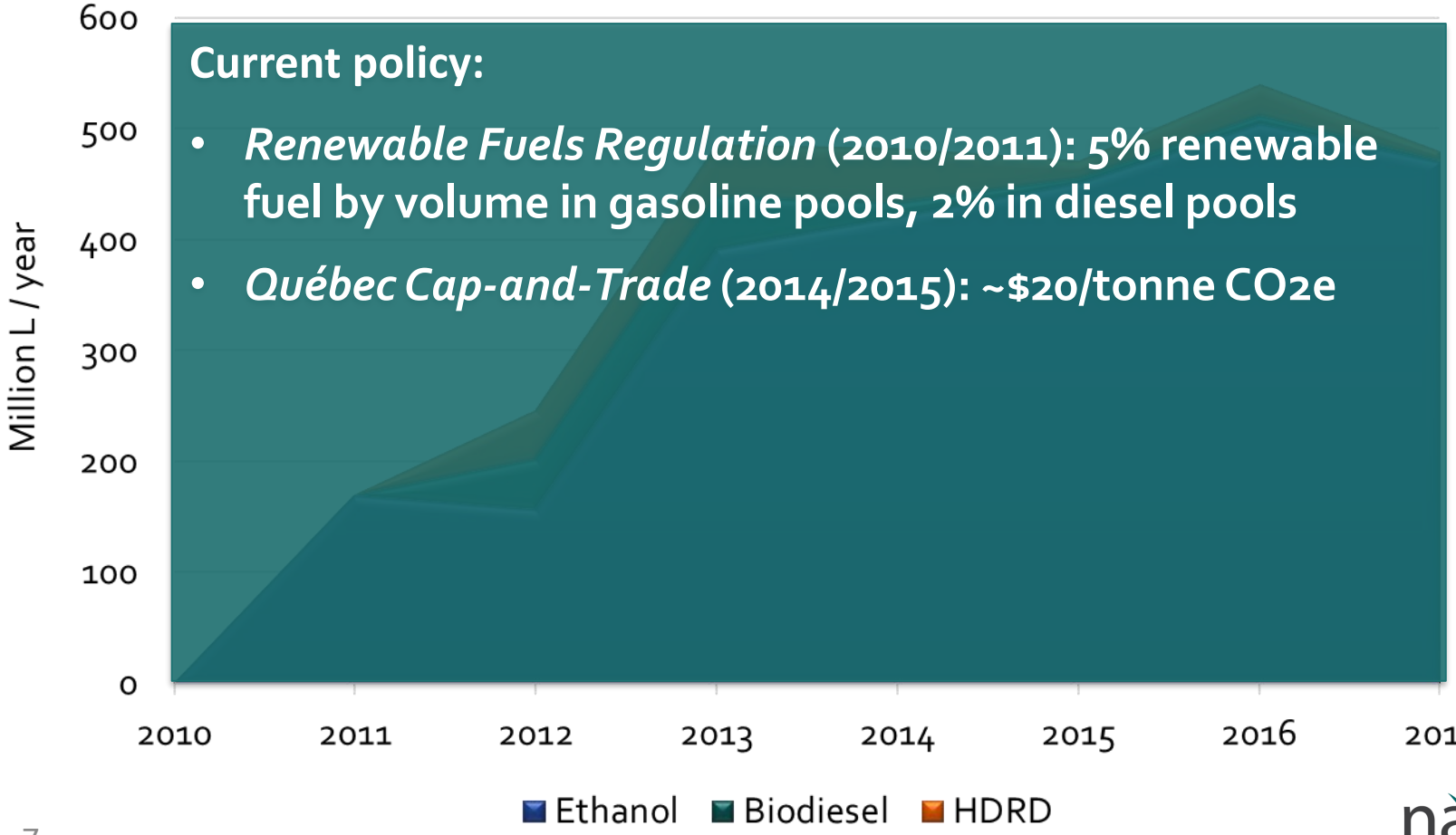
Biofuel consumption in Québec has increased under federal regulations



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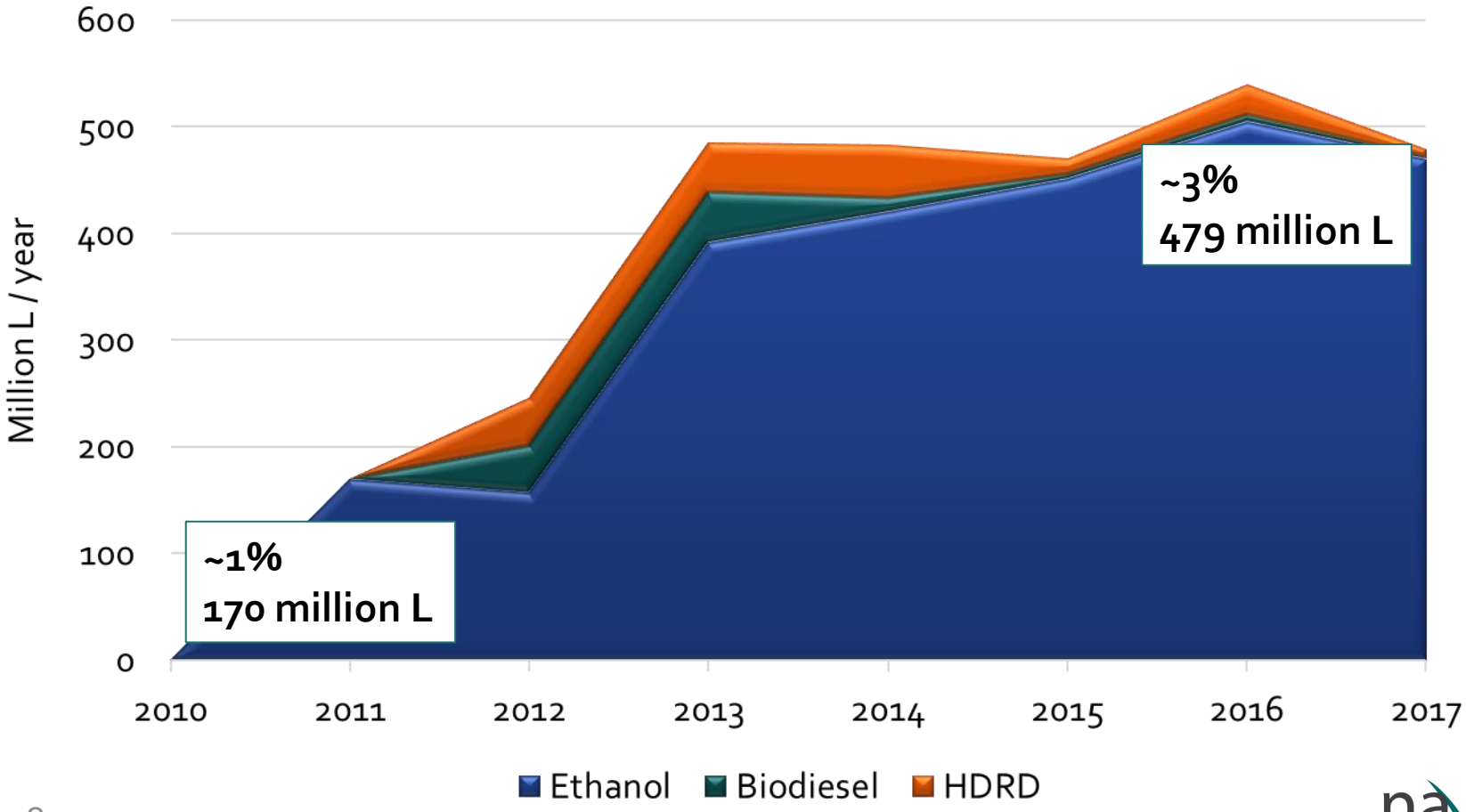
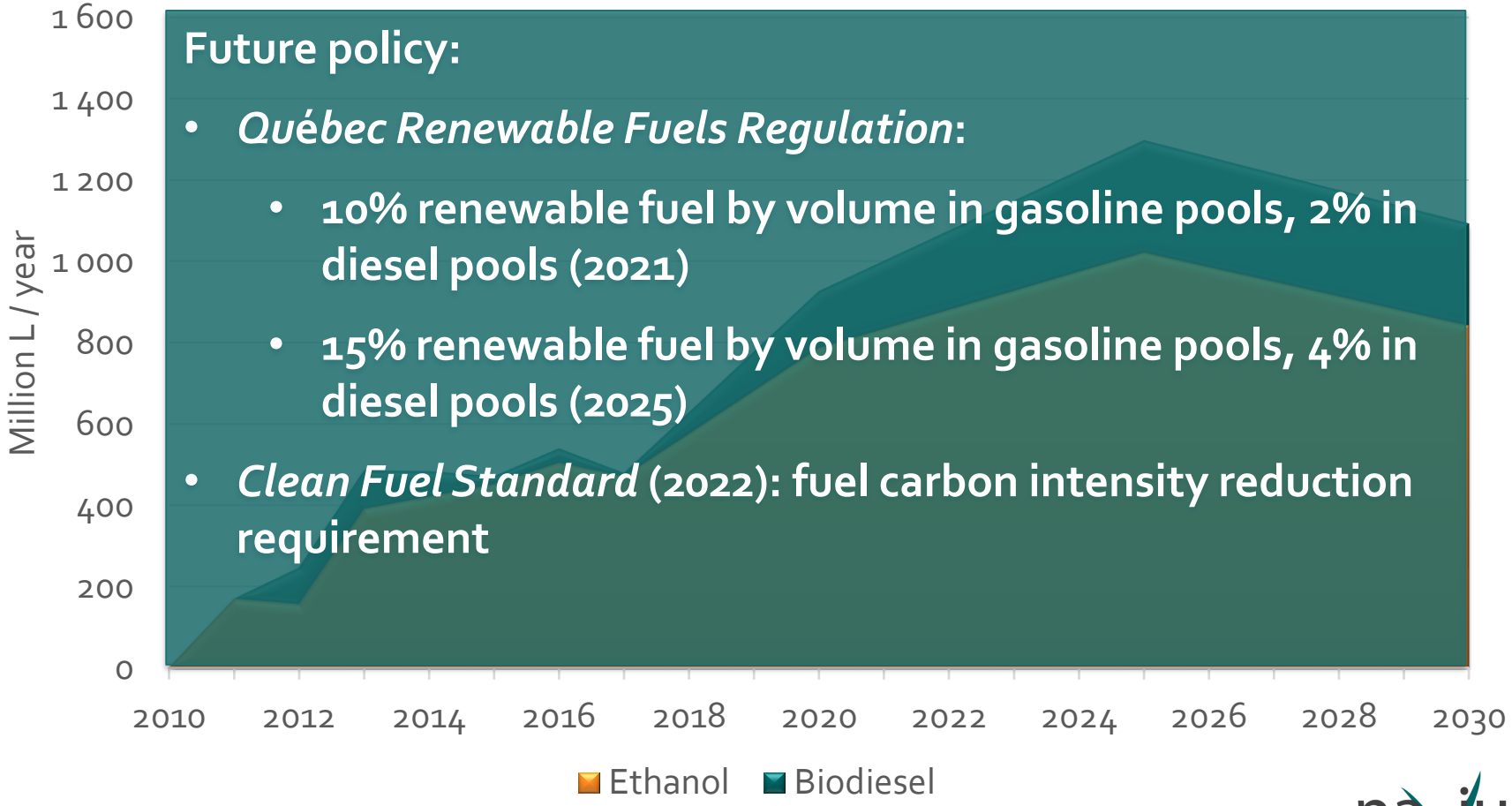


1. Biofuel consumption: projected to 2030

..and is expected to continue to increase under future regulation



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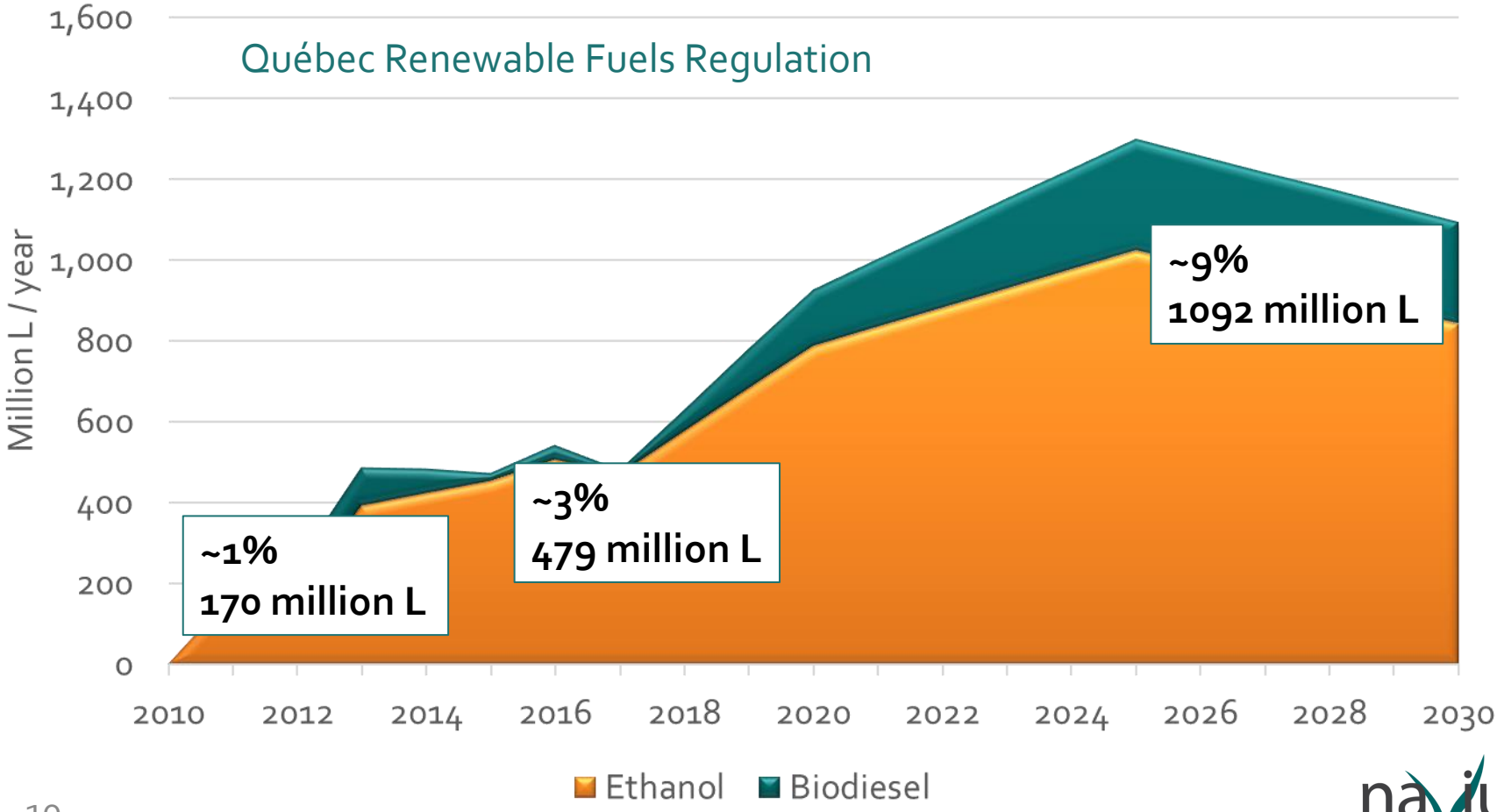

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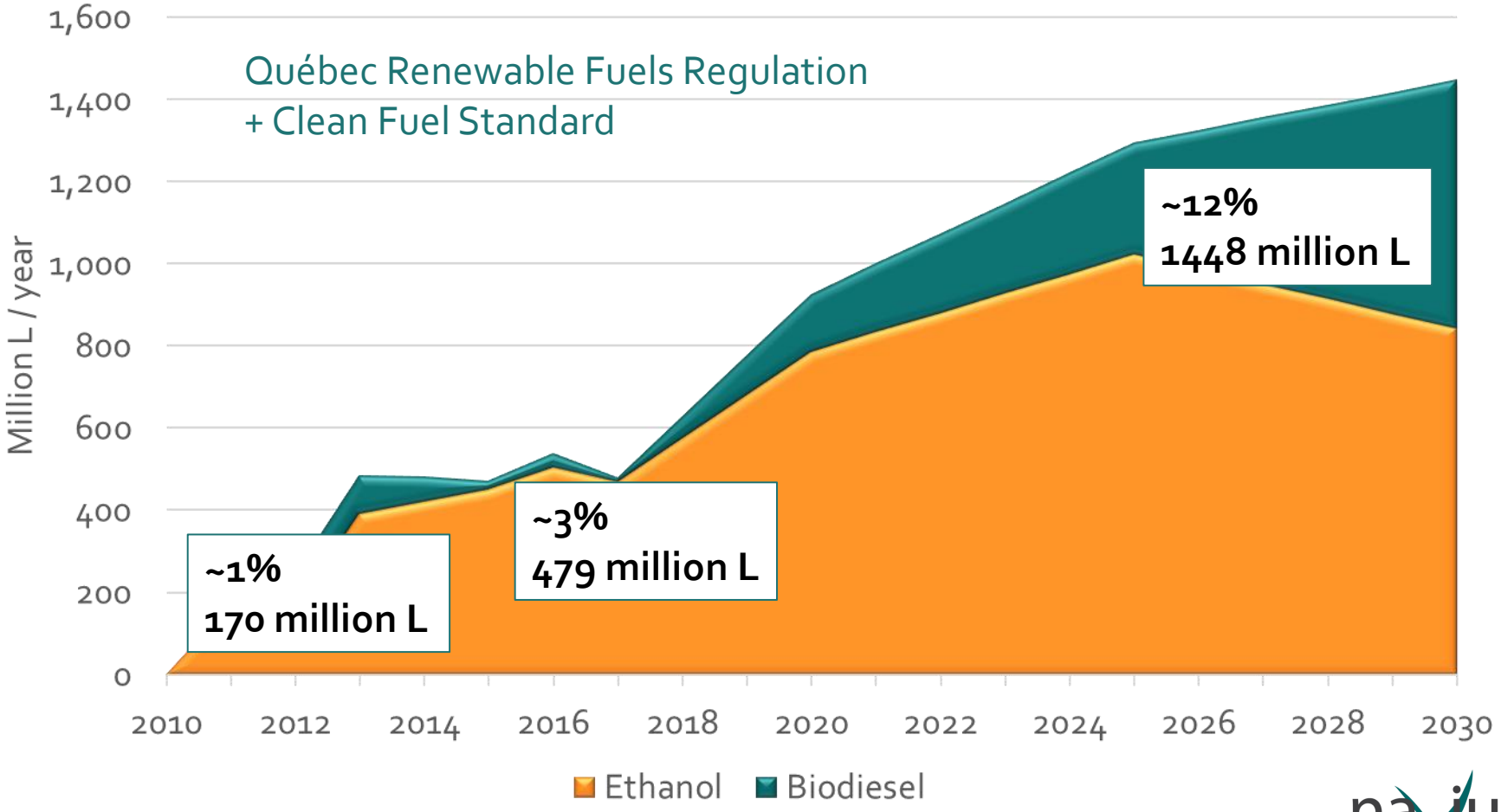
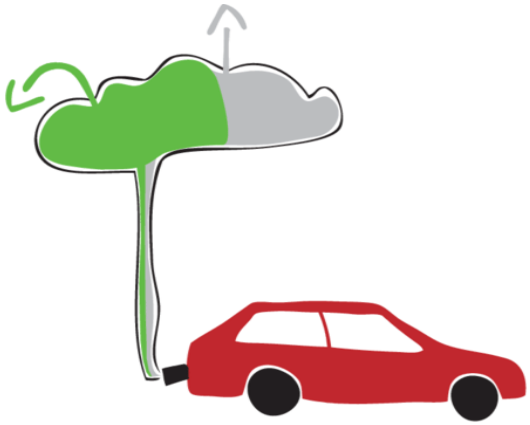
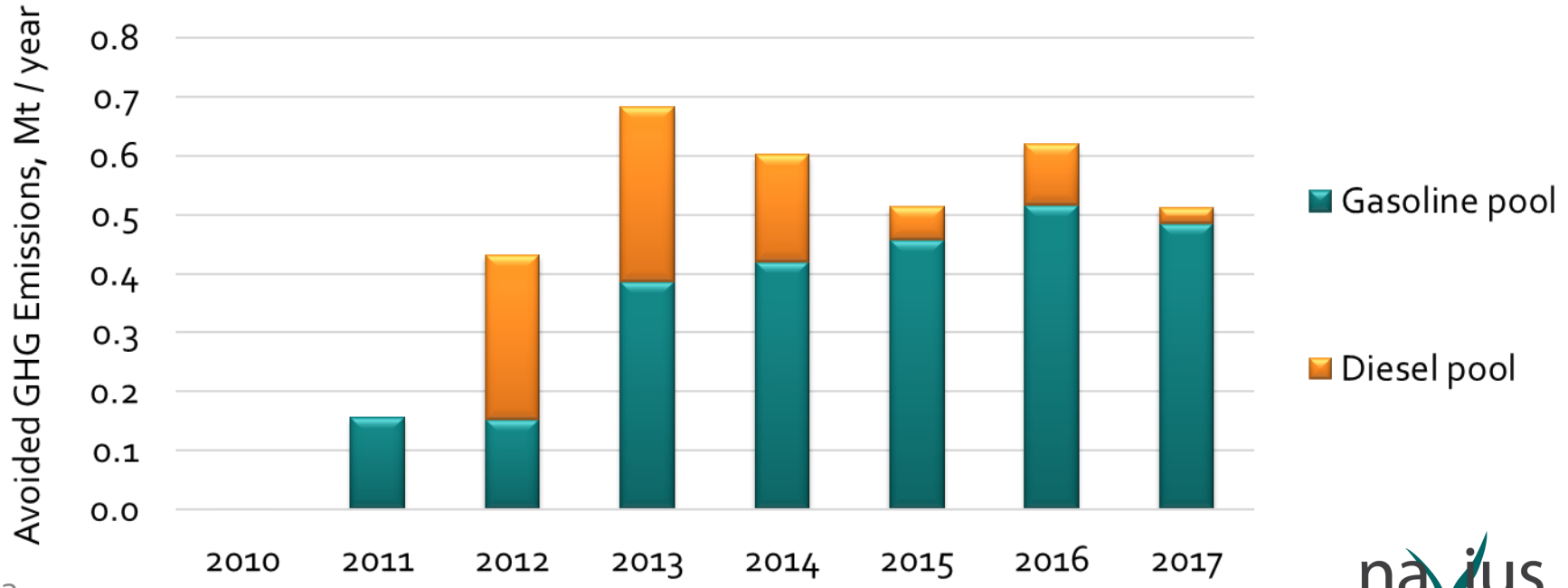


2. Effects: carbon emissions

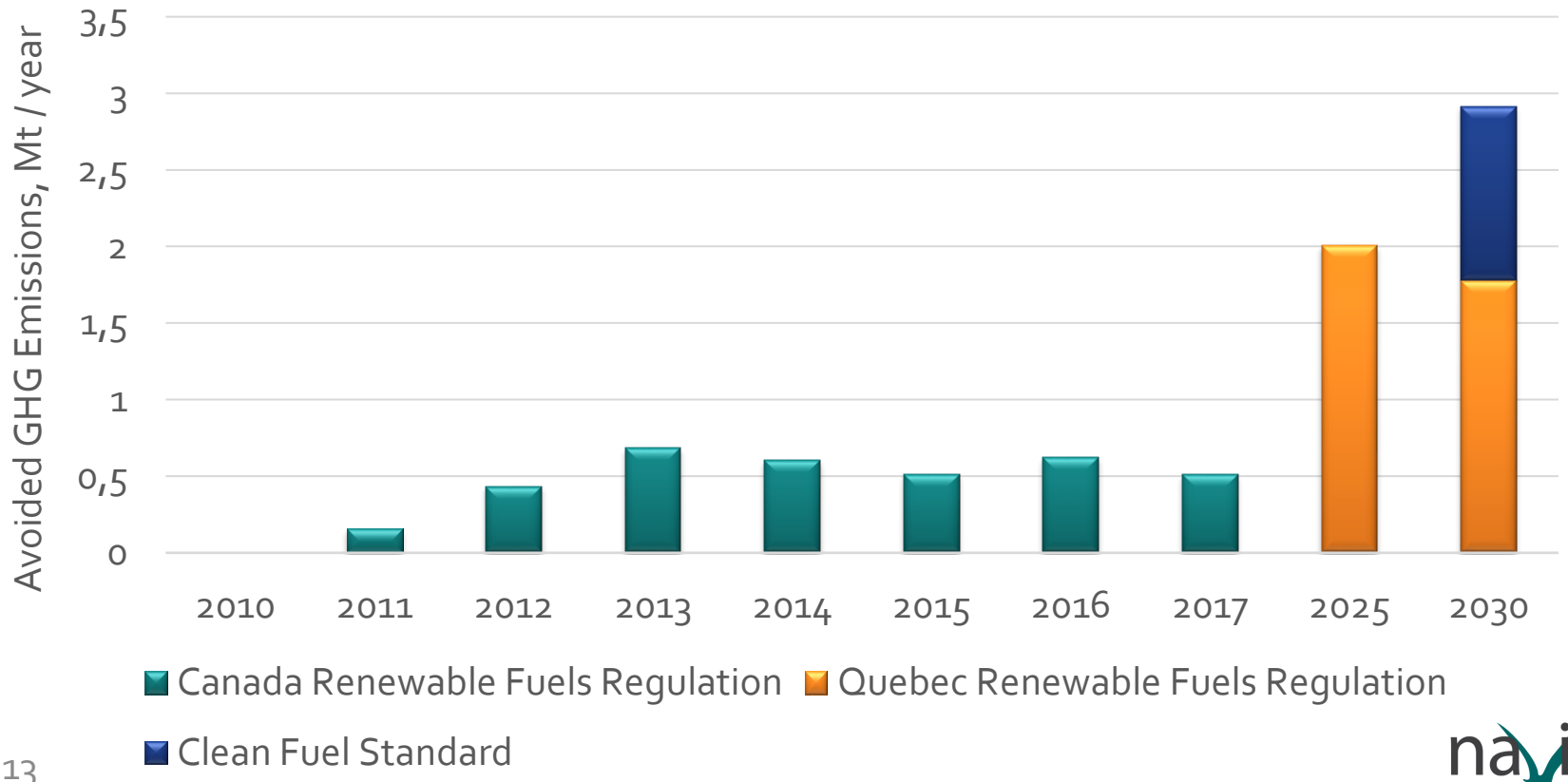


- Quebec emitted 78 Mt of carbon in 2017
- ~3% biofuel in the fuel stream led to **~0.5 Mt of avoided emissions**
- This is an increase from 0.2 Mt of avoided emissions in 2011 to 0.5 Mt in 2017



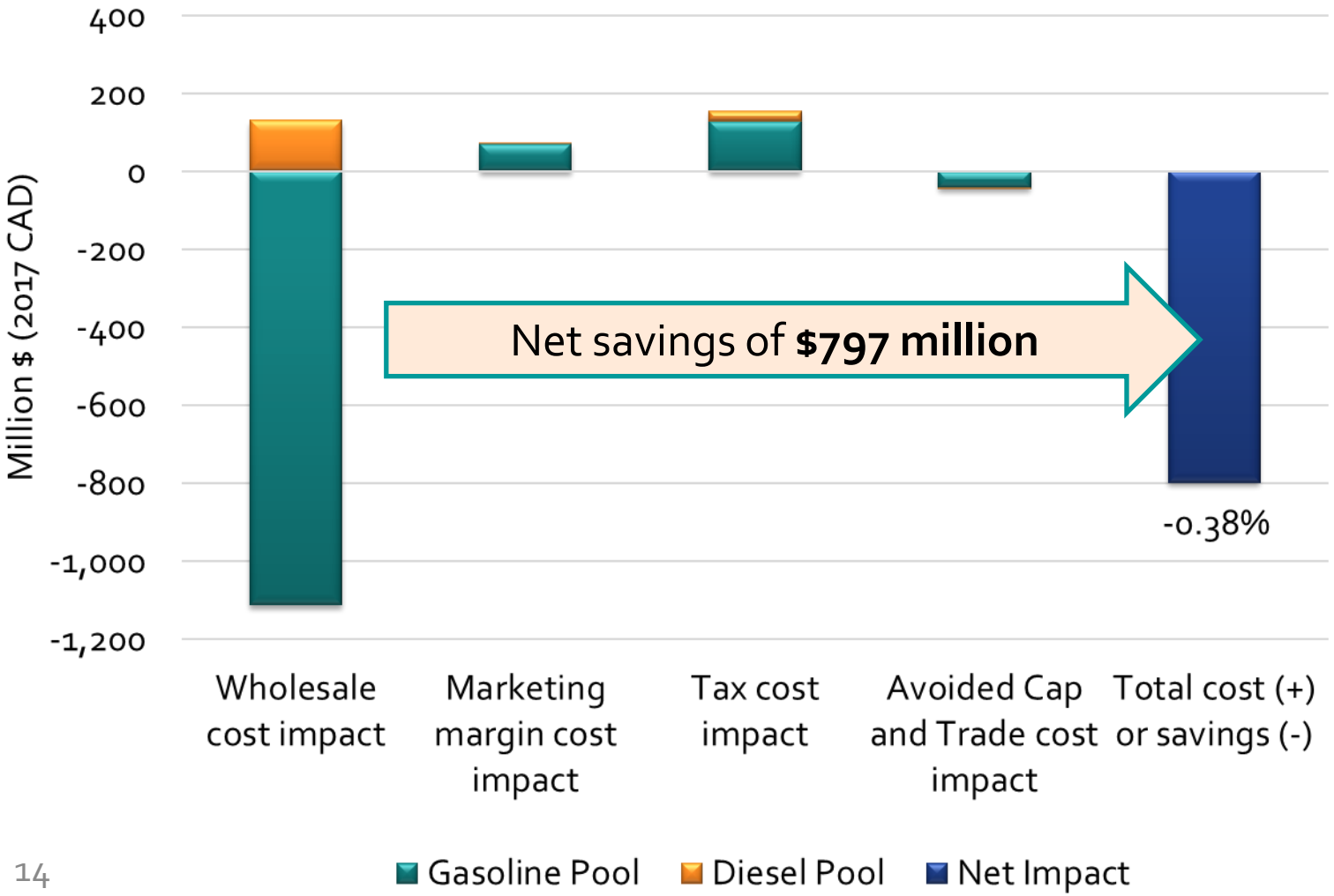
2. Effects: carbon emissions

- Quebec aims to reduce emissions to 54 Mt by 2030
- Future biofuel consumption is projected to **avoid 2-3 Mt of emissions in 2030**



2. Effects: cost to consumers

Cumulative cost impact of biofuel consumption in Québec (2010-2017)



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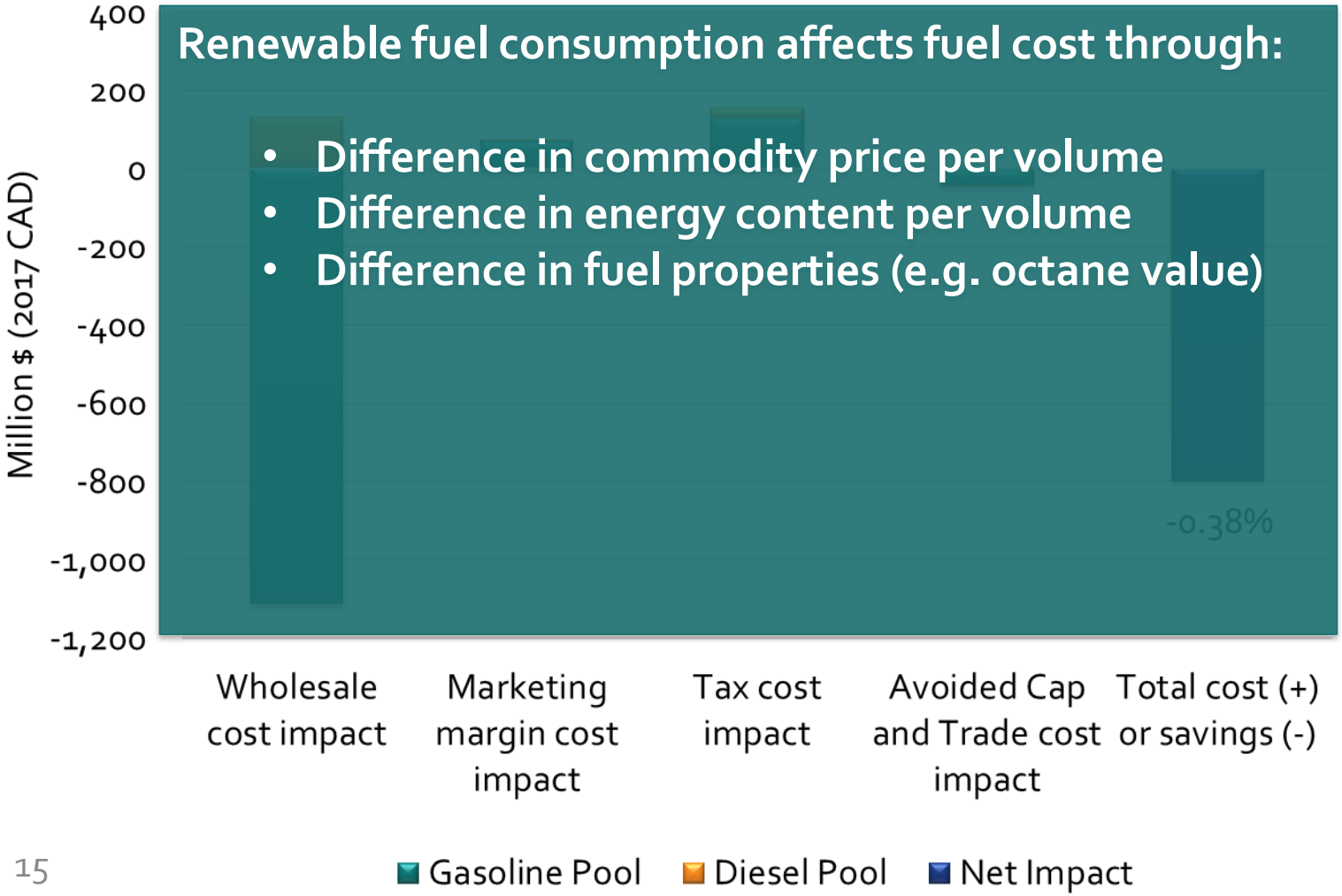

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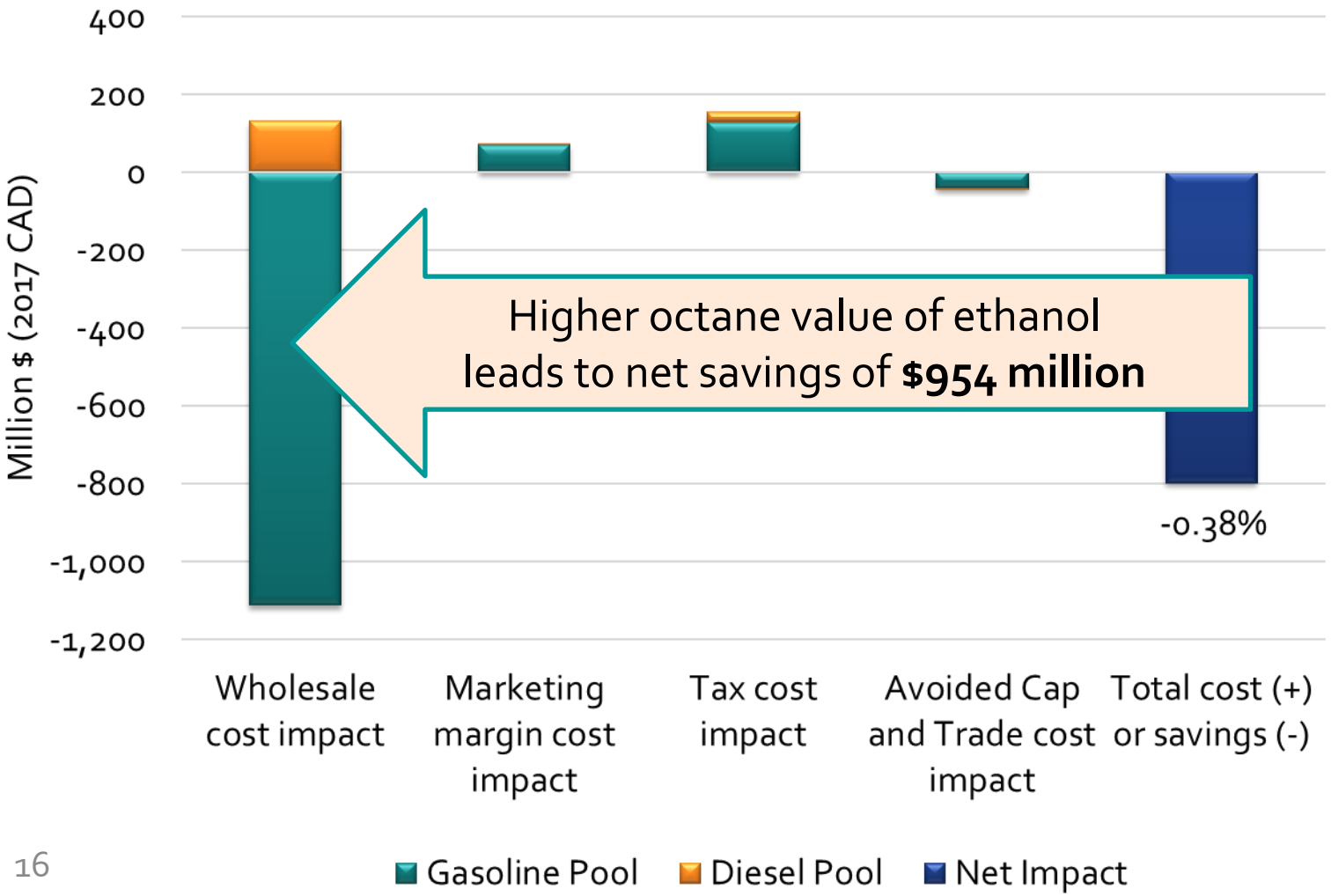

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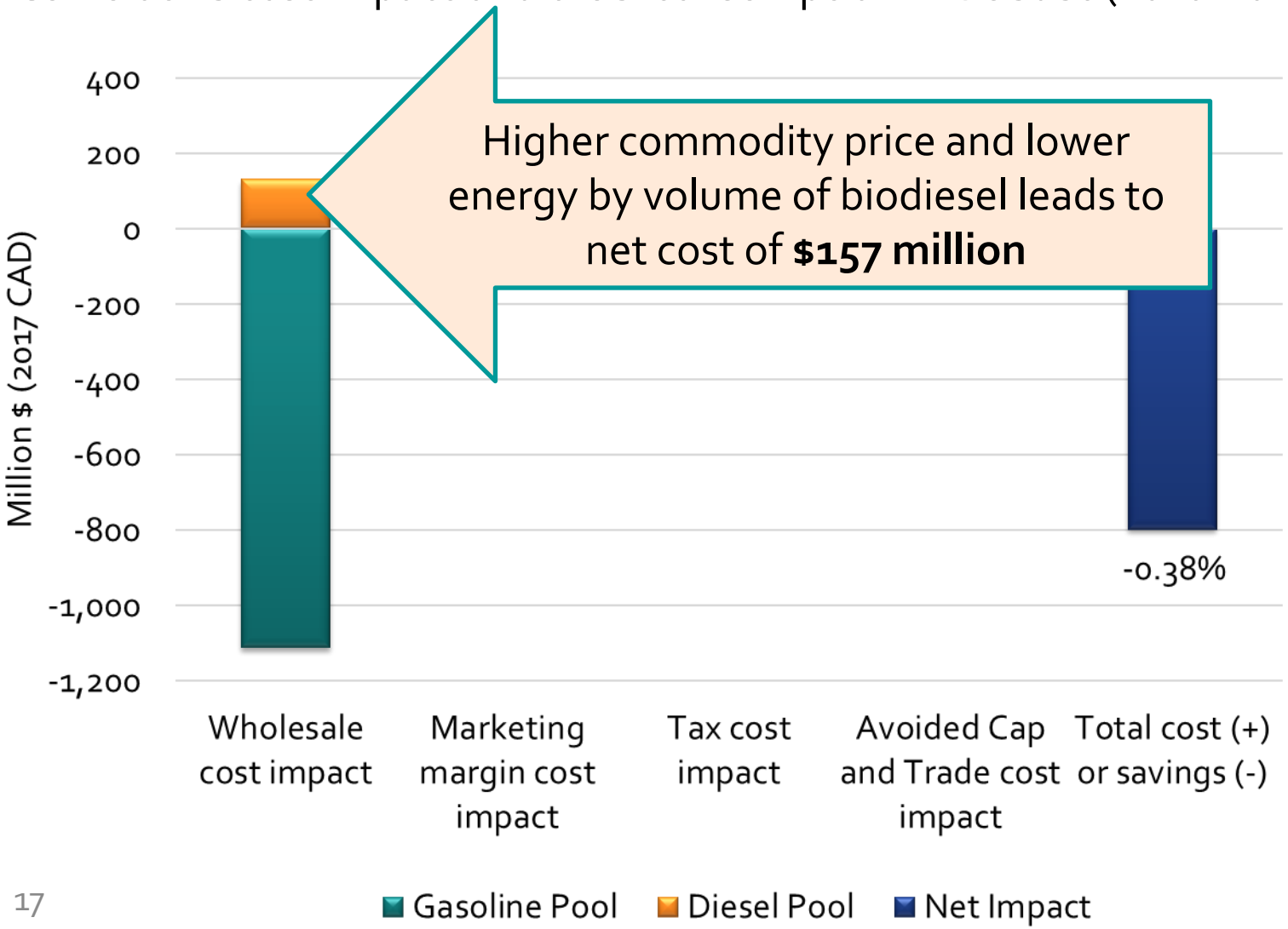

How does this affect Québec consumers?

Gasoline car/light truck:	Diesel long-haul truck:
• -0.82% change in annual fuel cost • Save $17.2 / year	• +0.30% change in annual fuel cost • Cost $116.4 / year

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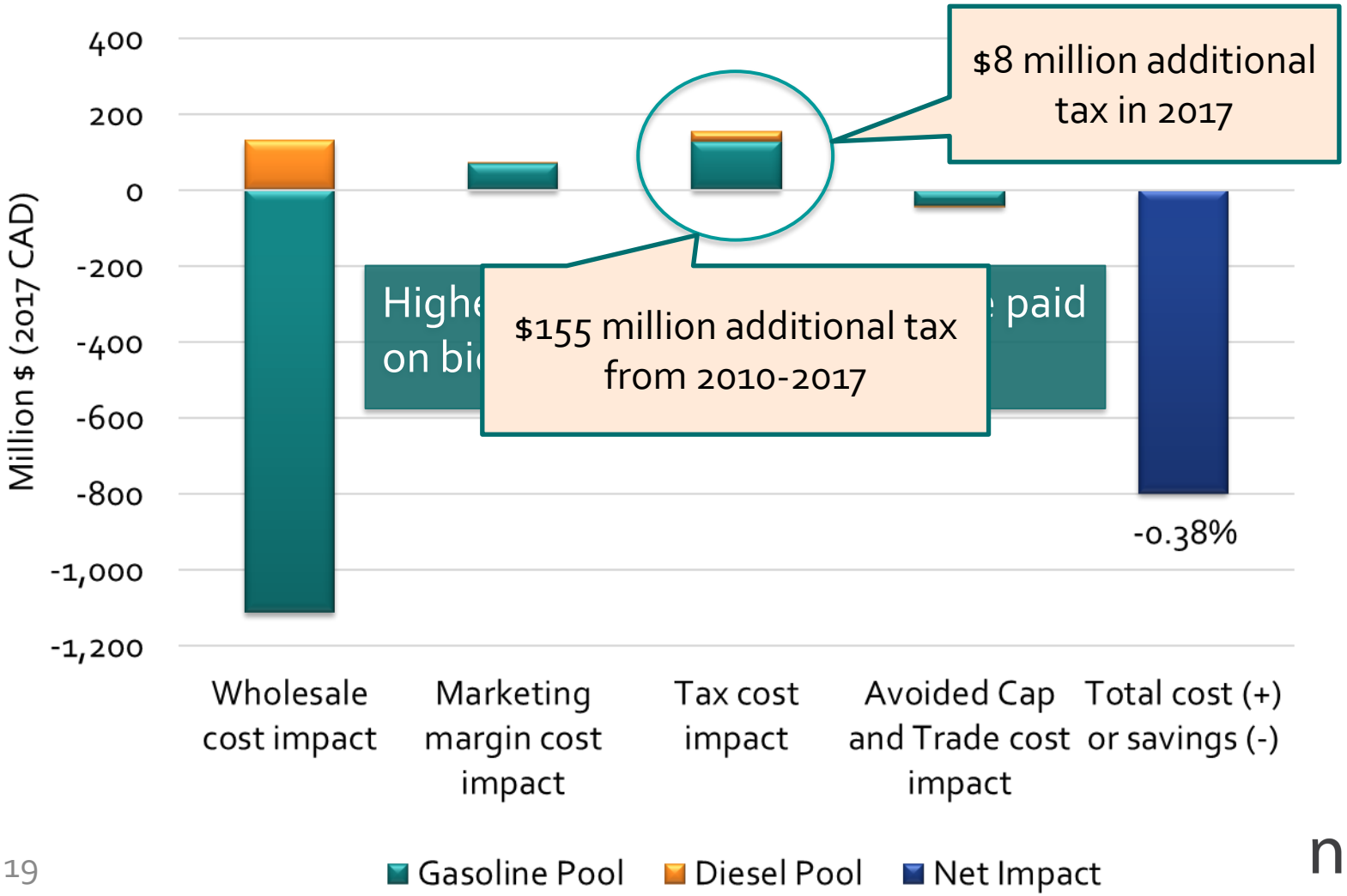
3. Policy implications

Cumulative cost impact of biofuel consumption in Québec (2010-2017)



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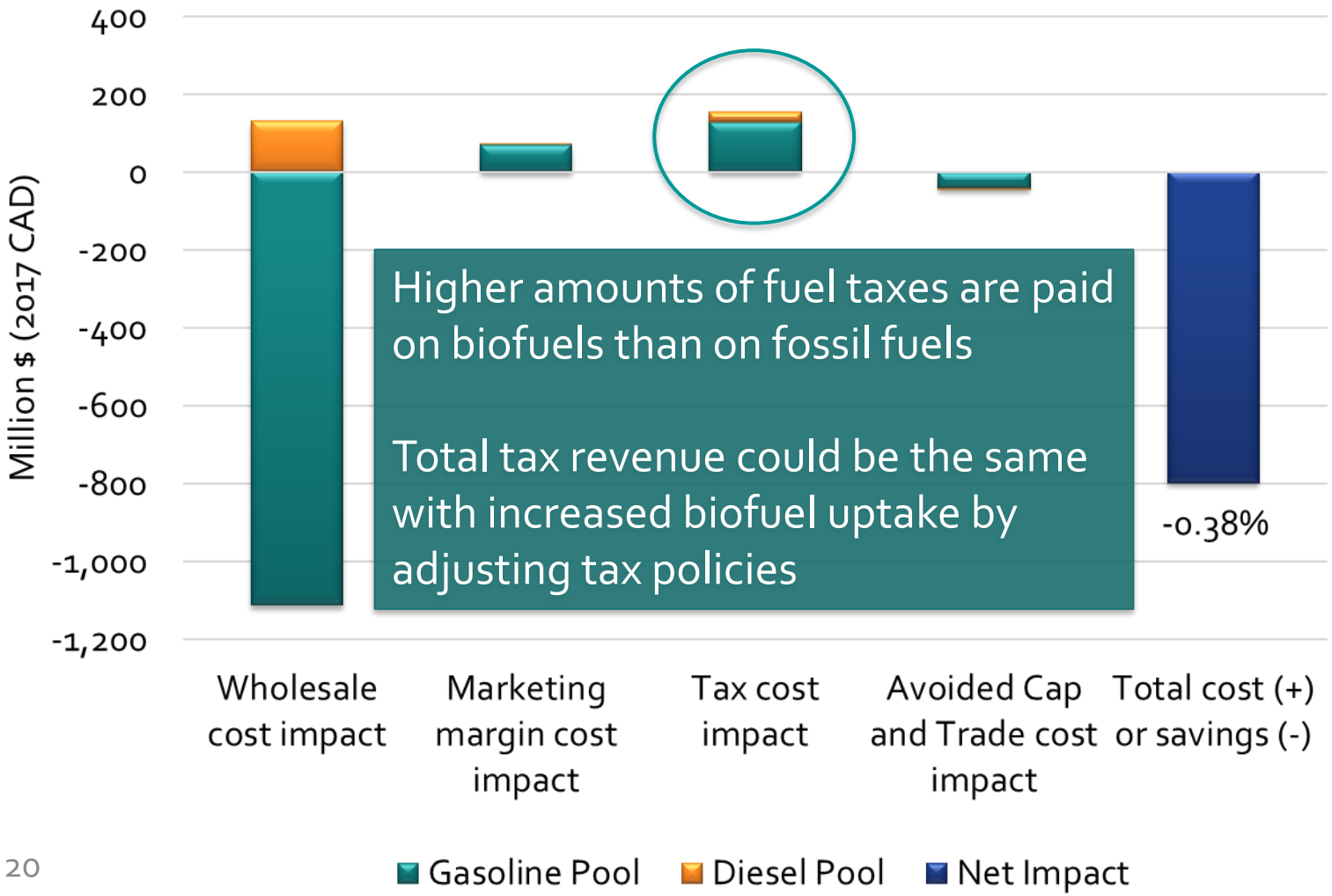

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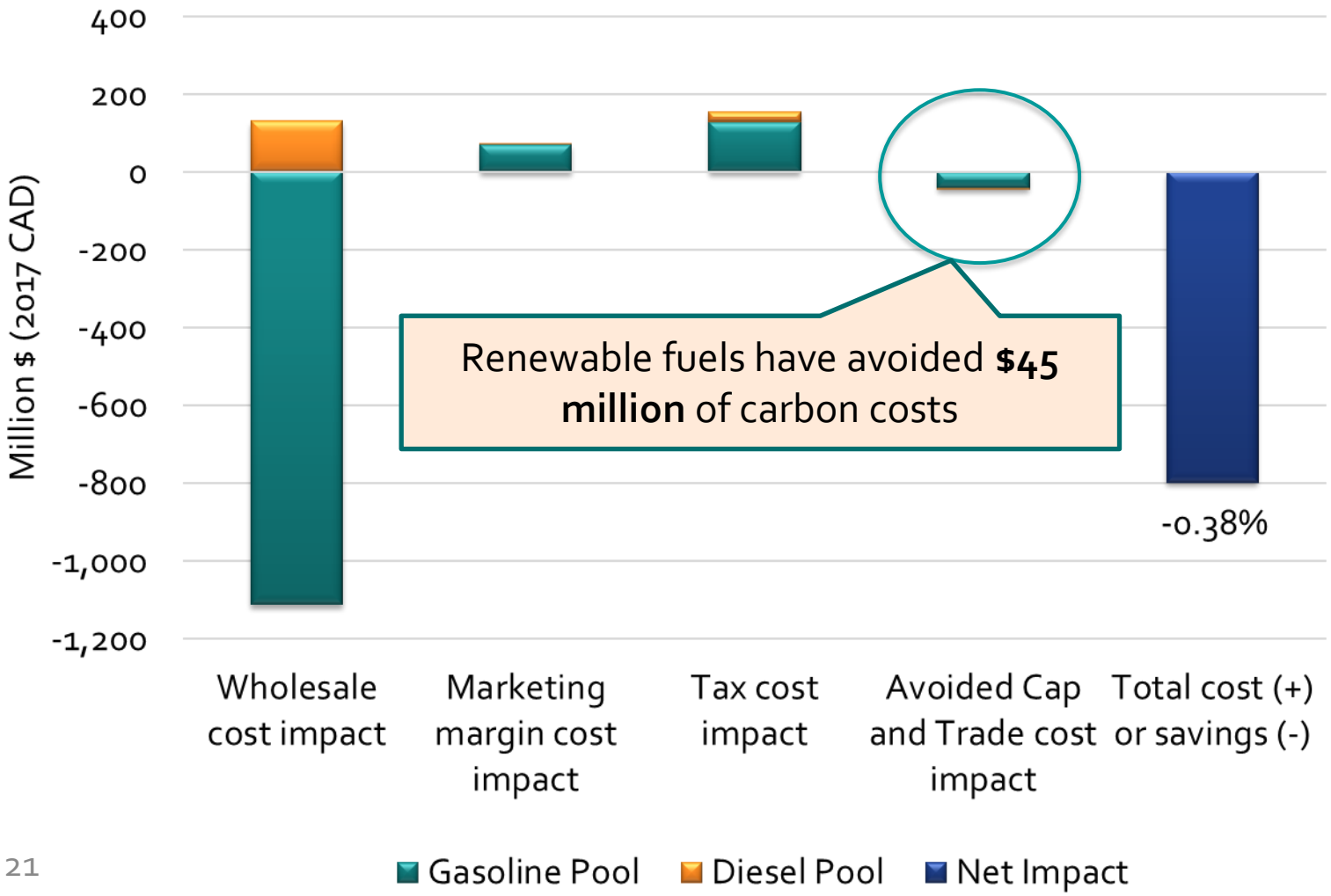
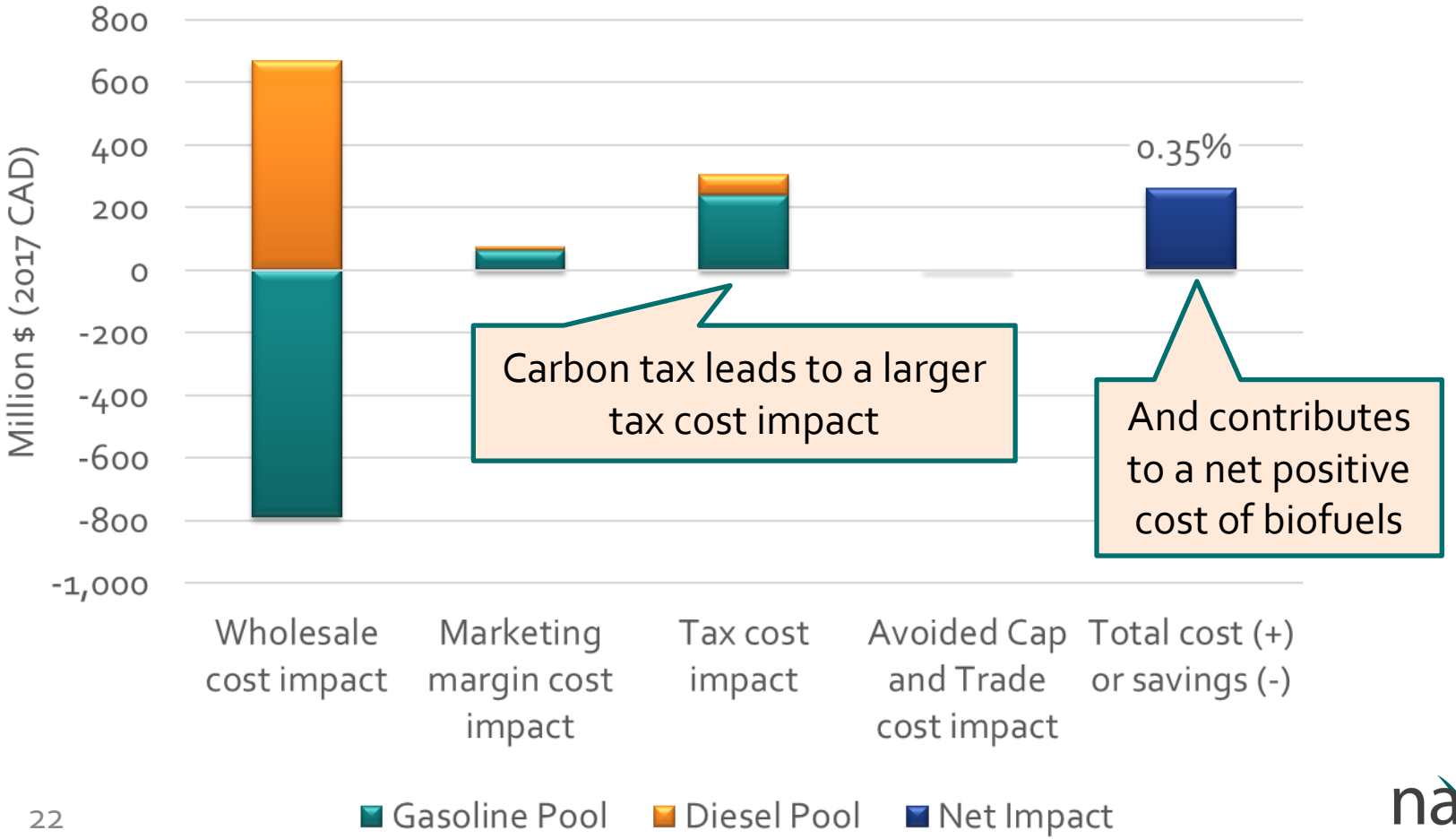


3. Policy implications

Not all provincial carbon pricing systems exclude biofuels

E.g. Cumulative cost impact of biofuel consumption in B.C. (2010-2017)



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3. Policy implications

Biofuel consumption is driven by policy

- Lack of policy alignment can confuse the price signal
- Provincial regulation (not CFS) is expected to drive future biofuel demand in Québec

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Thank you!

Brianne Riehl

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Extra Slides

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Extra Slides

Emission abatement cost of biofuels

Québec

- $-354 / tCO2e in gasoline pool
- $169 / tCO2e in diesel pool

Canada

- $-256 / tCO2e in gasoline pool
- $153 / tCO2e in diesel pool

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Extra Slides

Biofuel production

- 175 million L/year of ethanol are currently produced in Québec; 65 million L/year of biodiesel
- About 50% of biofuel consumption is imported to the province
- Opportunity for second generation biofuels:
  - *Greenfield Global* considering second generation biofuels in expansion of production from 175 to 300 million L/year
  - *Enerkem Inc.* currently produces ethanol from wood waste, proposes to expand to using industrial/commercial waste
  - *Ensyn* currently produces biocrude from wood waste

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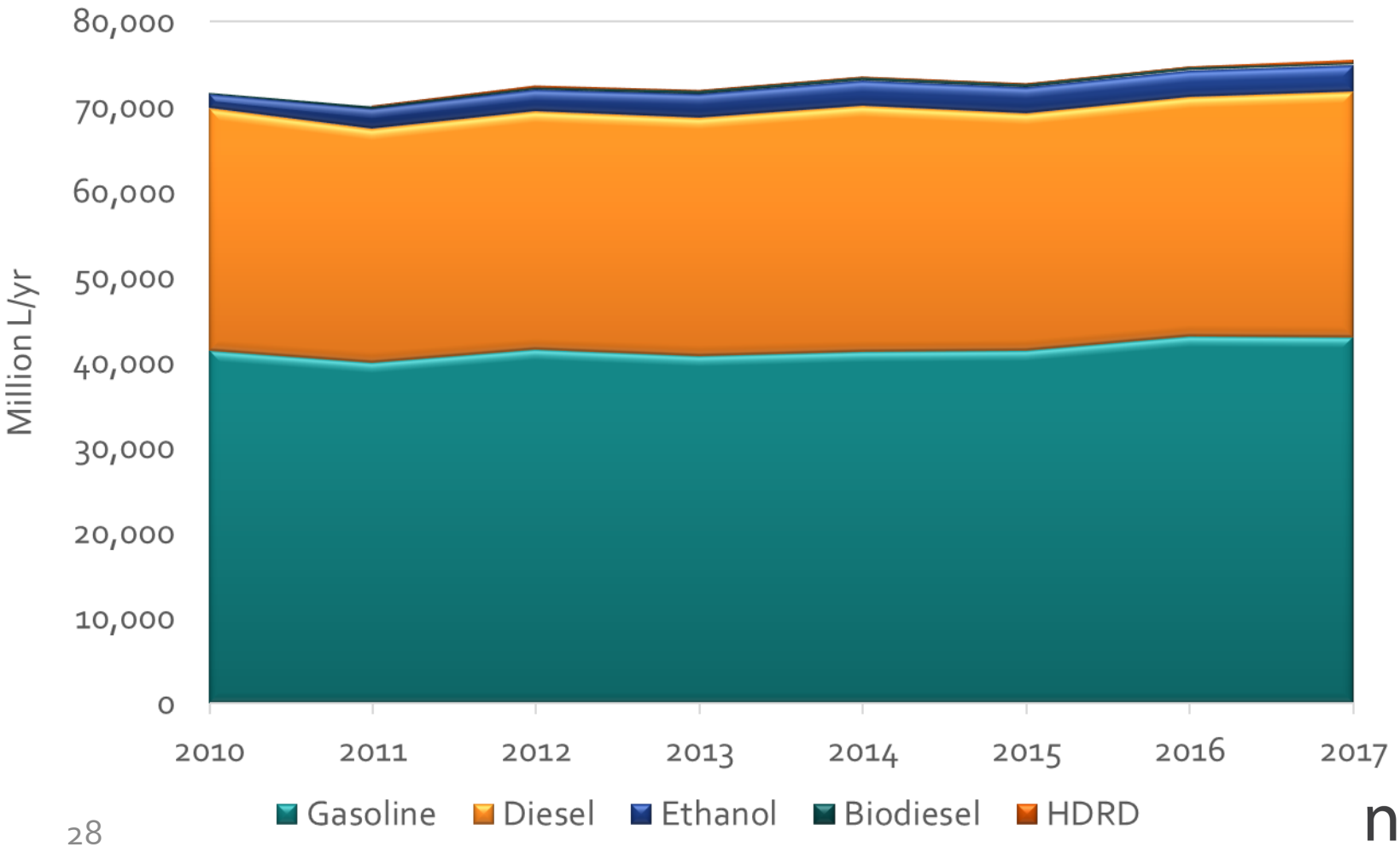
Biofuel consumption in Canada



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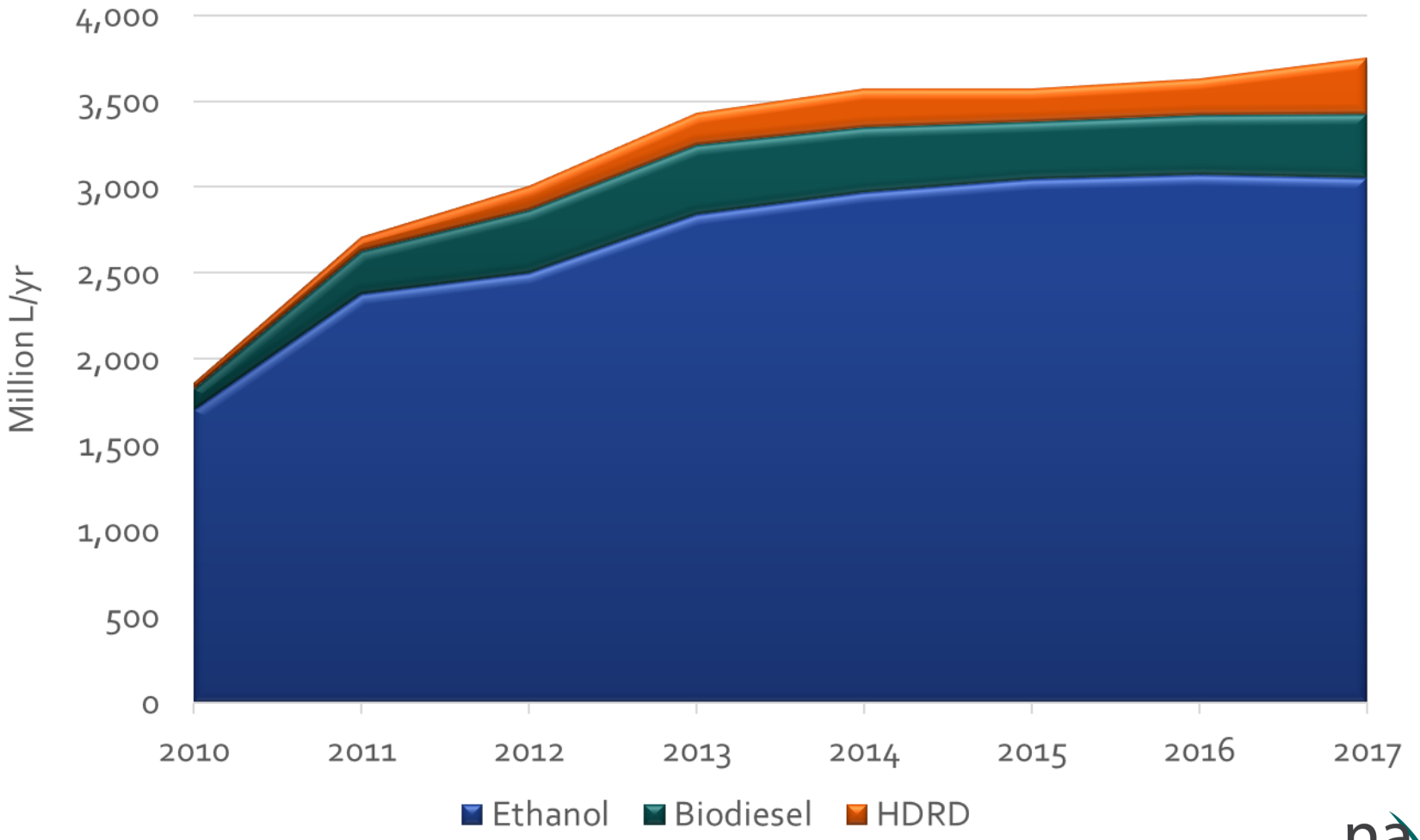

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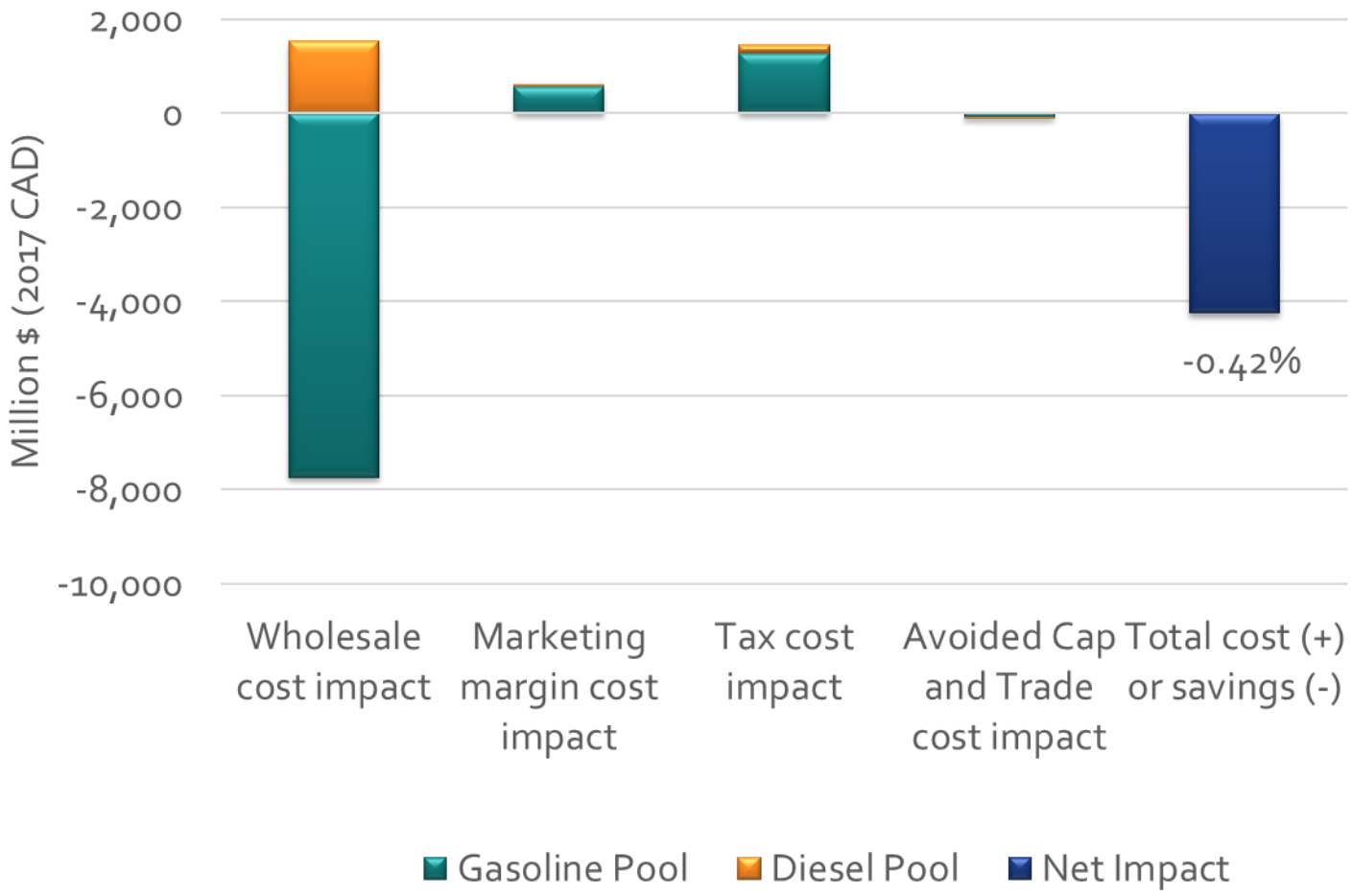
Cumulative cost impact of biofuel consumption in Canada (2010-2017)



Extra Slides

Cumulative cost impact of biofuel consumption in Canada (2010-2017)

	Gasoline Pool	Diesel Pool	Net Impact	% change
Wholesale cost impact	-7,745	1,532		
Marketing margin cost impact	573	32		
Tax cost impact	1,284	170		
Avoided cap-and-trade cost impact	-81	-14		
Total cost (+) or savings (-)	-5,969	1,720	-4,249	-0.42%

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Average consumer cost of biofuels in Canada

Gasoline car/light truck:	Diesel long-haul truck:
• -1.15% change in annual fuel cost • Save $22.8 / year	• +0.65% change in annual fuel cost • Cost $235.3 / year

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Avoided emissions from biofuel blending in Canada