



CARBON TAX VS CAP AND TRADE

BIO-ENERGY IMPLICATIONS

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AGENDA

Introduction

Background

Carbon Tax

Cap and Trade

Implications to Bio-Energy

INTRODUCTION

le-ef.com Consulting – Christine Schuh, P.Eng., PhD

Led PwC's Climate Change Practice for a decade

Manages Alberta's Tech Fund GHG accounting (ERA was the CCEMC)

Developed ISO 14064-3 and ISAE 3410 – standards for GHG assurance

Written verification/validation guidance documents for Alberta and BC

Assisted in WRI/GHG Protocol, Windmade standards

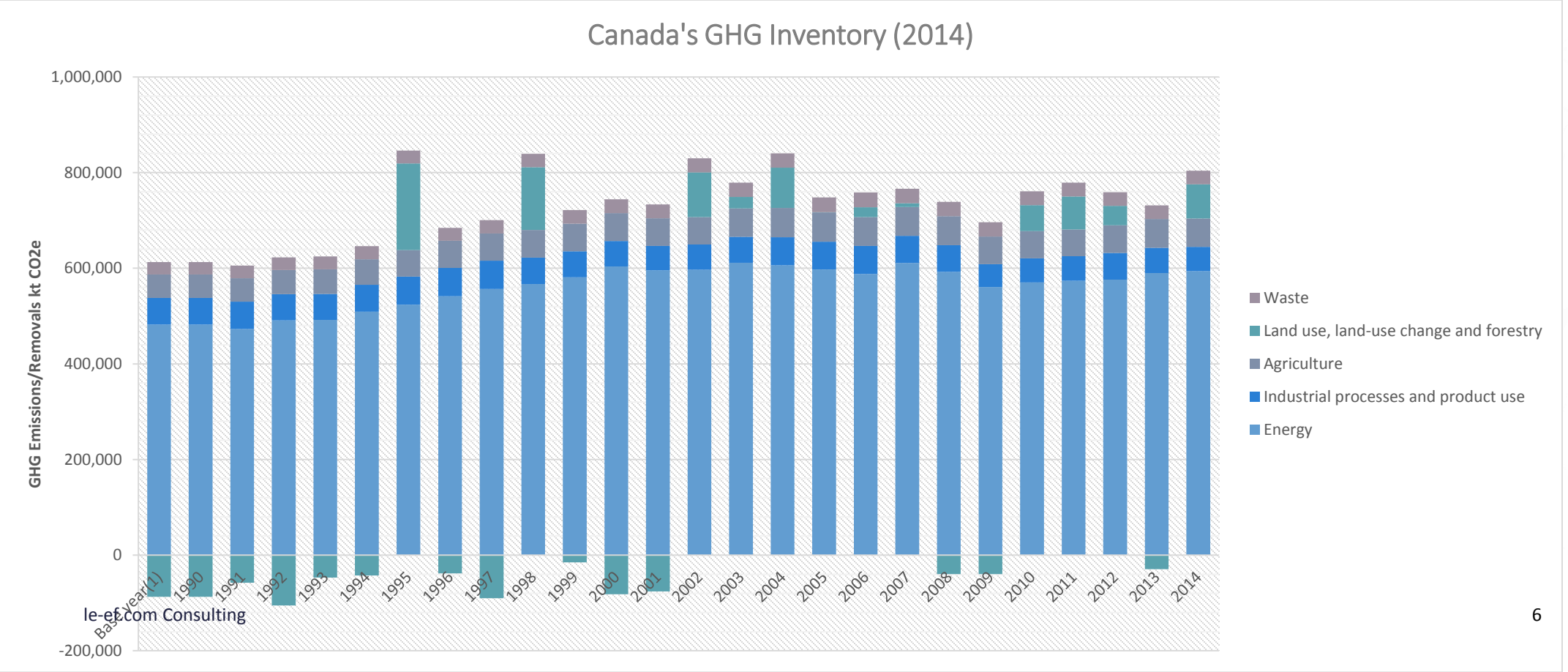
Conducted over 100 verifications/validations on non-financial information

OBJECTIVE

To compare the quantification methodologies used to derive a carbon tax versus an offset

BACKGROUND

CANADA'S GHG INVENTORY



CARBON TAX

CARBON TAX

Carbon tax is shorthand for **carbon dioxide tax** or **CO2 tax**.

A carbon tax is a fee intended to make users of fossil fuels pay for climate damage their fuel use imposes by releasing carbon dioxide into the atmosphere, and also to motivate switches to cleaner energy.

Because CO2 is released in strict proportion to the fuel's carbon content, the carbon tax can be levied “upstream” on the fuel itself.

CARBON TAX



Provide revenues for the government

Redistribute wealth from the rich to the poor

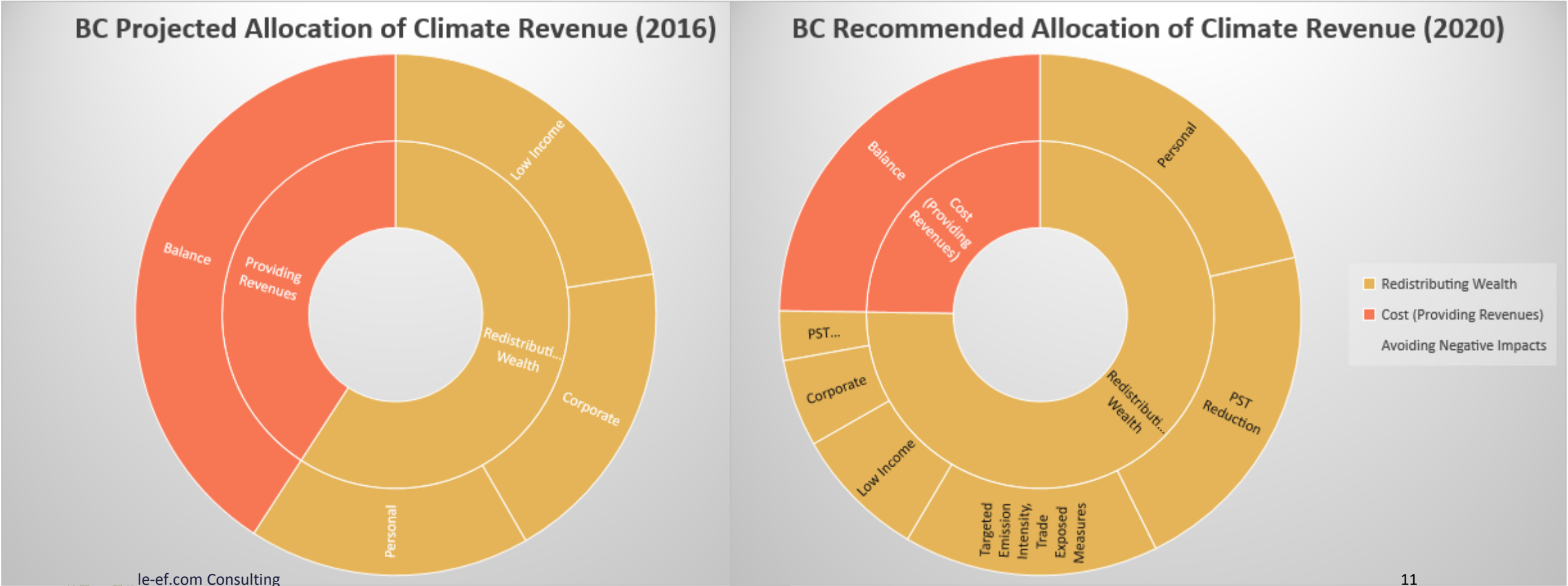
Avoid negative externalities

CARBON TAX

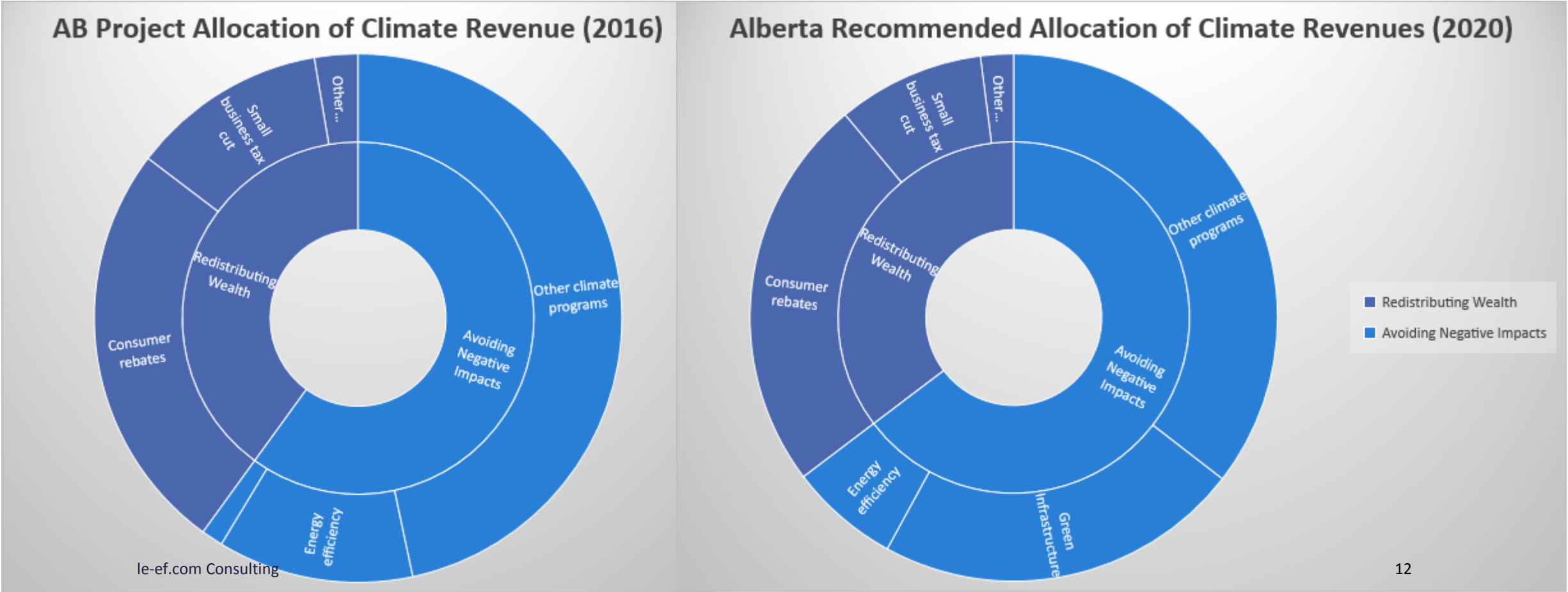
Carbon tax goes into general revenues. The government then decides how these revenues are used.

Objective	Use	Example
Providing revenues	Improving the tax-benefit system Reduce outstanding public debt Spending on other social objectives	Transfers to municipal governments
Redistribute wealth	Cushioning the adverse impacts of carbon pricing	Business/personal tax cuts Rebates
Avoid negative impacts	Spending on complementary environmental policies	Methane reduction program Technology fund

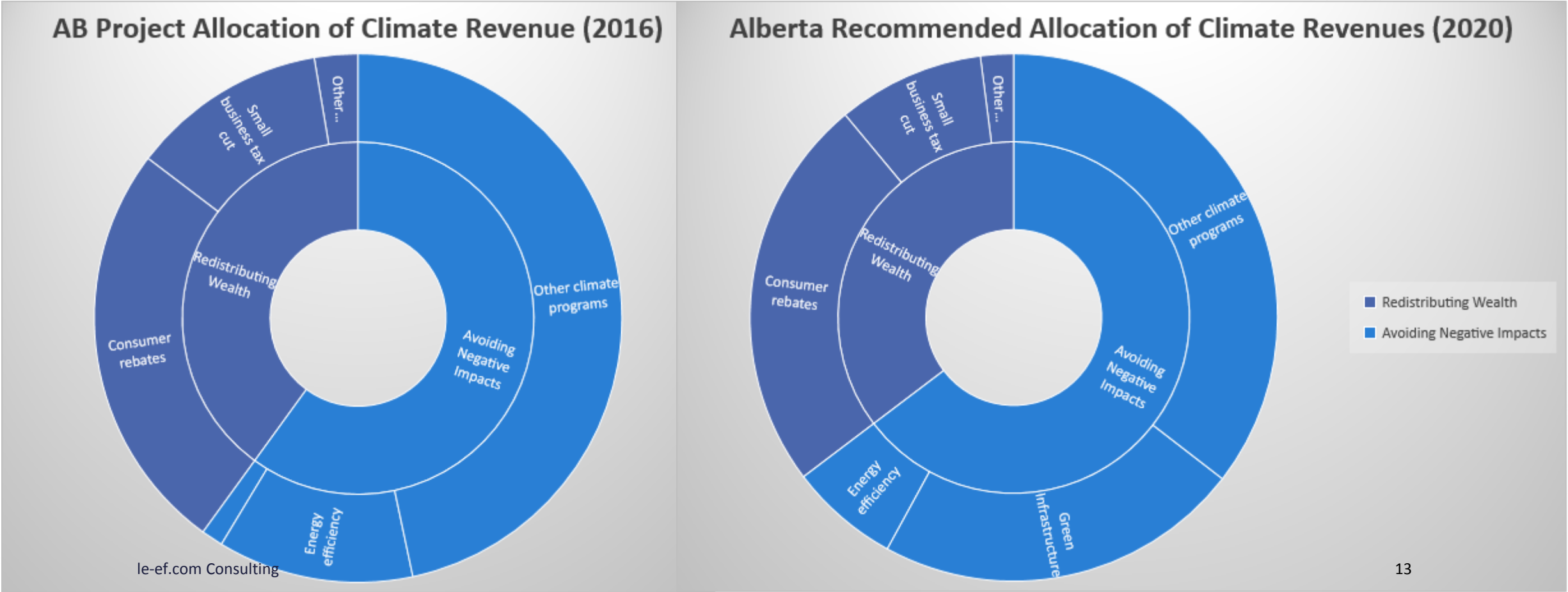
CARBON TAX – ALLOCATION (BC EXAMPLE)



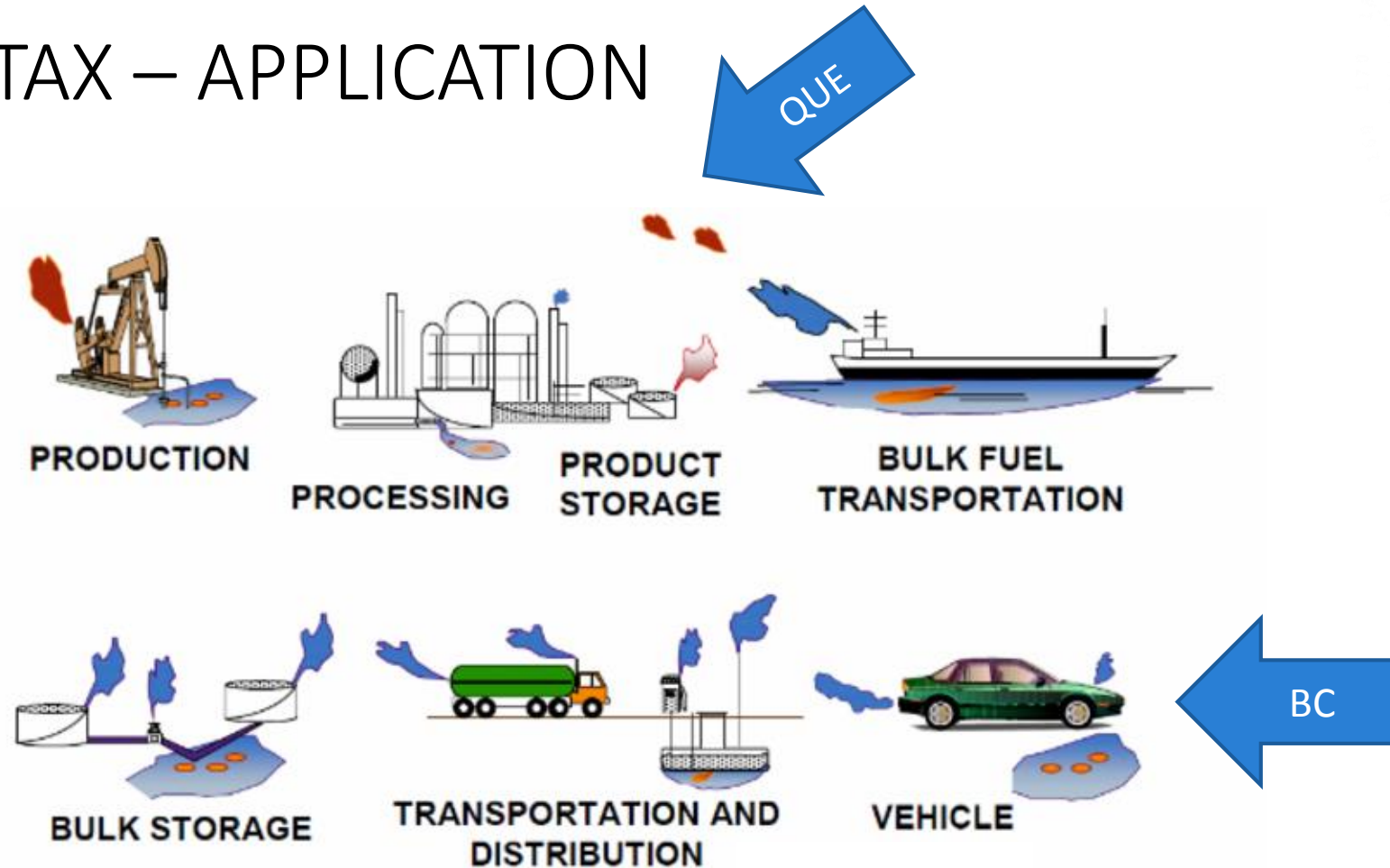
CARBON TAX – ALLOCATION (AB EXAMPLE)



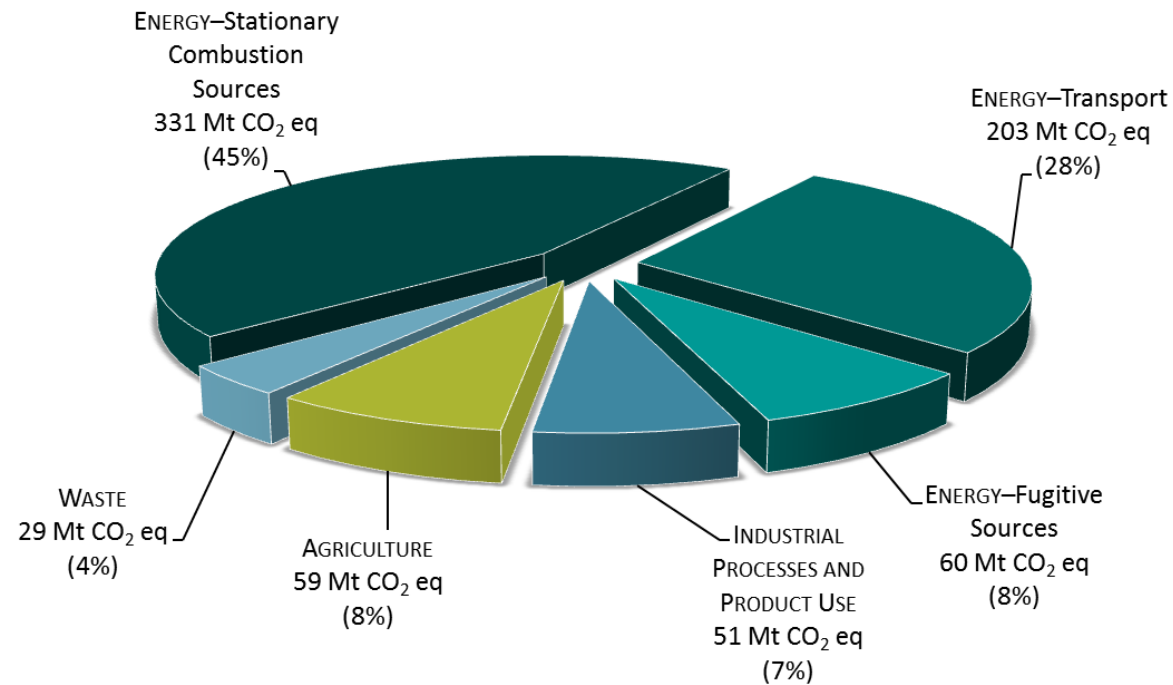
CARBON TAX – ALLOCATION (AB EXAMPLE)



CARBON TAX – APPLICATION



CARBON TAX – COVERAGE



Canada's GHG National Inventory Report , 2016

CARBON TAX - SUMMARY

Aspect		Comments
Use	General revenue Redistribute wealth Avoidance of negative externalities	A cost based system
Application	Producers Consumers	
Coverage	Carbon dioxide from the combustion of fossil fuels	Excludes all other GHGs, fugitive, process, land-use changes, LCA, biomass-based fuels

CAP AND TRADE

CAP AND TRADE

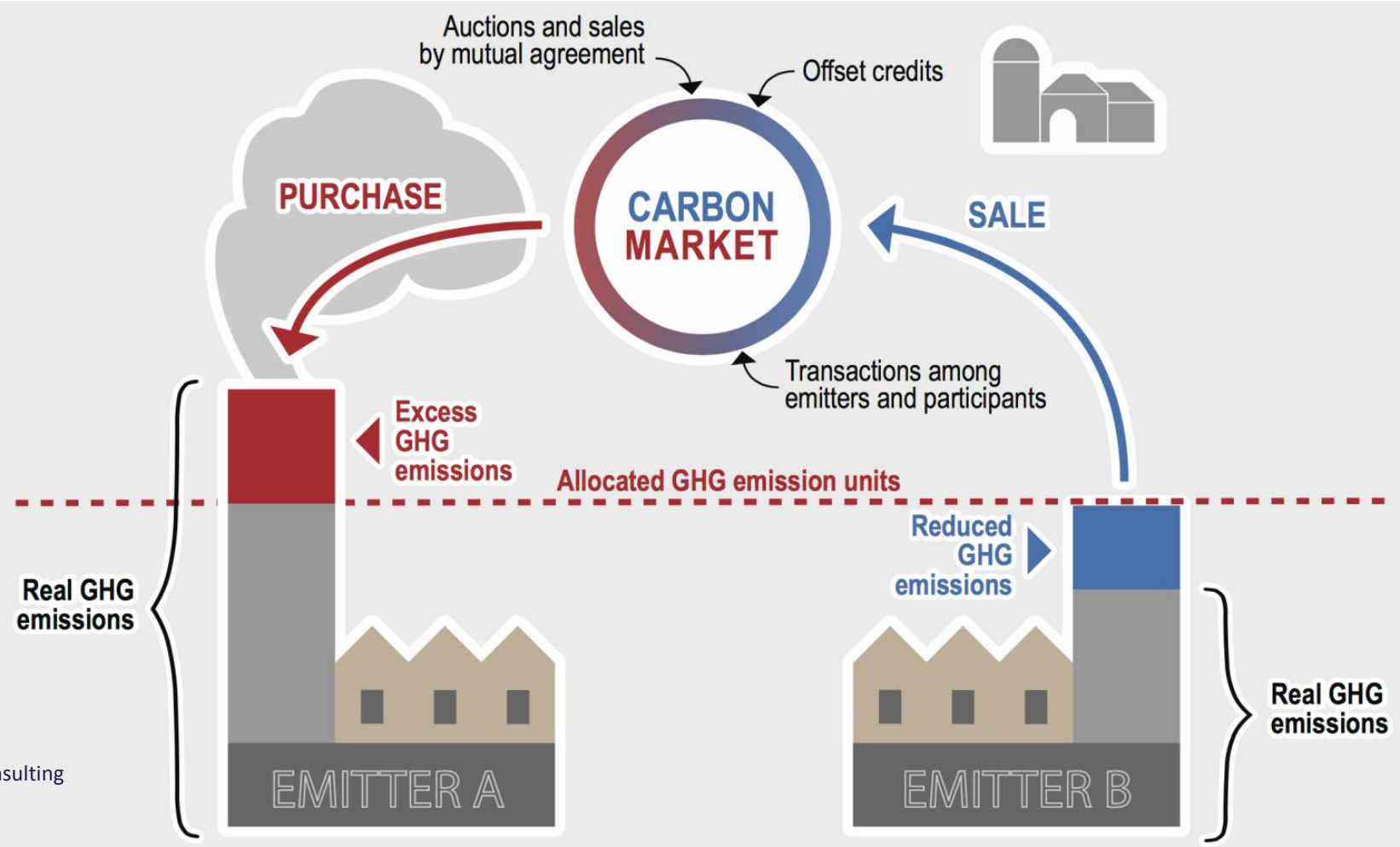
Program enacted to promote environment-friendly policies by mandating emissions through the generation of allowances. The emissions allowance is strictly controlled and must not exceed the predetermined cap amount. Emissions allowances are allocated to facilities/businesses, and are restricted by government.

If a facility generates more emissions than allowed, they can purchase carbon credits to compensate for the amount that they are over.

If a facility generates less emissions than allowed, they can trade their remaining allowances.

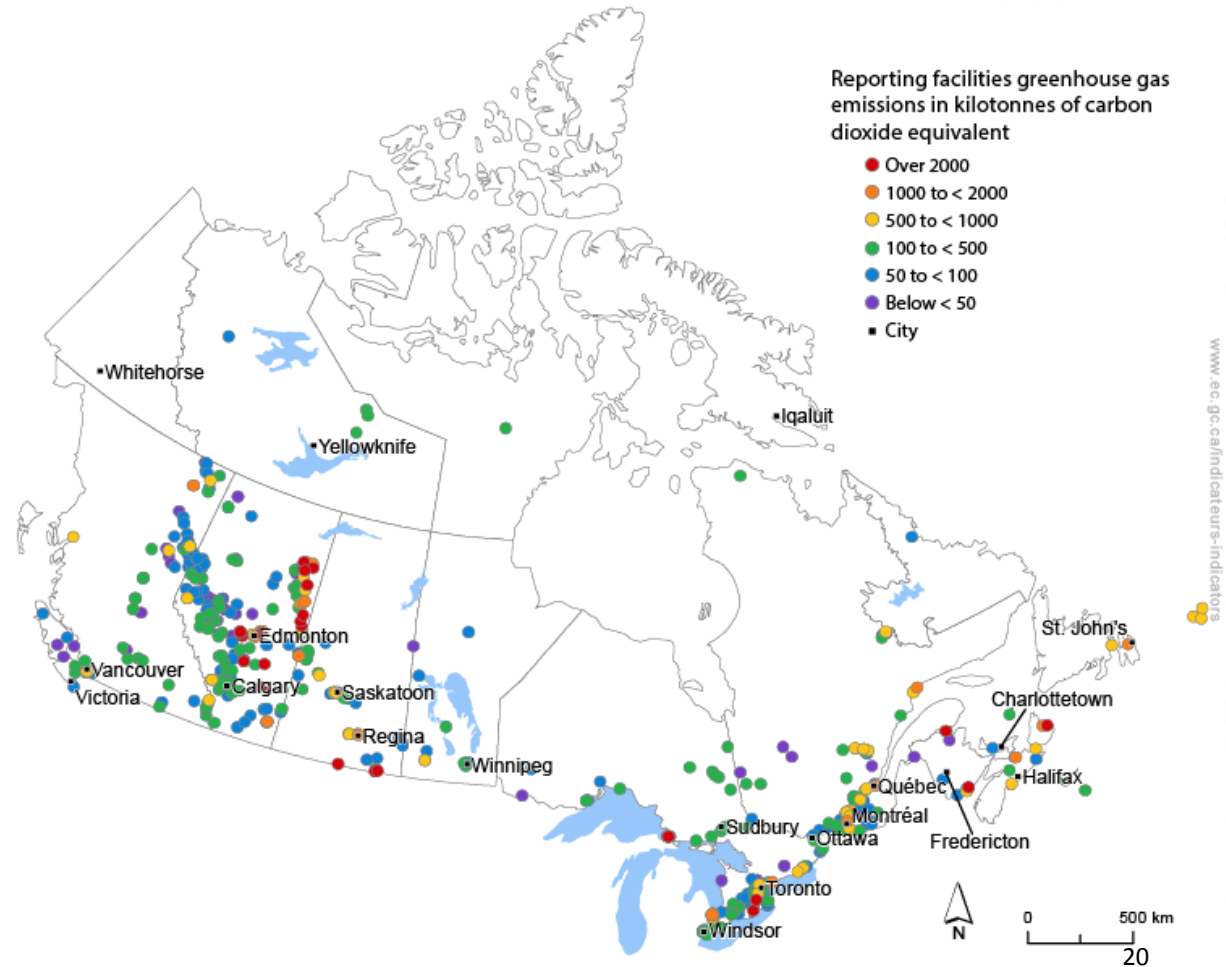
A carbon credits are generated by projects outside the facilities/businesses that receive allowances. A carbon credits is an asset that values, in tonnes of CO₂e, the amount of emission reductions caused by a project. The emission reduction is a comparison of the emissions that would have occurred in absence of the project.

CAP AND TRADE

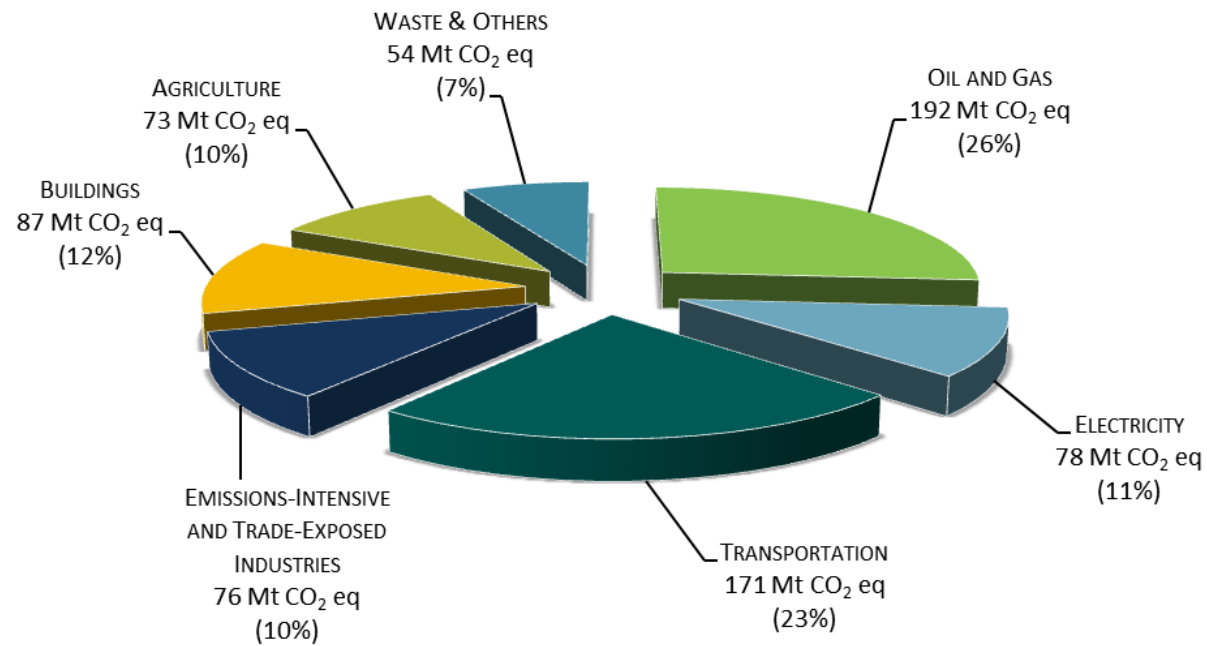


CAP AND TRADE

In 2014, over one third (36%) of Canada's greenhouse gas (GHG) emissions came from 574 facilities. The total emissions reported by those facilities was 264 megatonnes of carbon dioxide equivalent (CO₂ eq).



CAP AND TRADE



CAP AND TRADE - SUMMARY

Aspect		Comments
Use	Avoidance of negative externalities Increase in positive externalities	A cost/benefit based system
Application	Emitters Off setters	Regulated and non-regulated
Coverage	Larger point sources	Tends to ignore distributed sources unless aggregation mechanisms are used

IMPLICATIONS FOR BIO-ENERGY

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Most systems under development use both a carbon tax and a market based mechanism (cap and trade) with the boundaries between the two carefully delineated.

Bio-energy can participate in

Selling bio-fuel to the consumer (carbon tax)

Selling bio-fuel to a regulated entity under the market based mechanism (cap and trade – emitter)

Selling carbon/offset credits to the emitter (cap and trade – off setter)

Selling renewable electricity made from biofuel (generator) as an offset

Selling renewable electricity made from biofuel (generator) as a renewable energy certificate

GHG ACCOUNTING IMPLICATIONS FOR BIO-ENERGY

Sell bio-fuel (\$20/tonne CO₂e)

	Emission factor	Carbon tax	Cost
	g CO ₂ /L	\$/t CO ₂	\$/L
Gasoline	2316	20	0.046
5% Ethanol blend	2200	20	0.044
15% Ethanol blend	1969	20	0.039
Ethanol benefit	232		0.005

GHG ACCOUNTING IMPLICATIONS FOR BIO-ENERGY

Claim an offset/carbon credit project as ethanol supplier

1000 L Ethanol facility

Corn feedstock (Manitoba)
 2.5 kg feedstock/kg ethanol
 10% waste in feedstock
 10% feedstock locally sourced (50 km)
 0.17 kWh/kg ethanol electricity
 2.6 MJ NG/kg ethanol heat
 1% kg waste/kg ethanol

Baseline		kg CO ₂ e
	Landfill	26
	Gasoline use	2,497
		2,523
Project		
	Fertilizer	96
	Land use change	296
	Transportation	177
	Chemicals	398
	Biofuel production	527
	Biofuel use	6
	Waste	0
		1,500

Emission Reduction	1,023 kg CO ₂ e
Emission Reduction Intensity	1.02 kg CO ₂ e/L
\$17/tonne CO ₂ e	0.017\$/L

GHG ACCOUNTING IMPLICATIONS FOR BIO-ENERGY

Claim an offset/carbon credit project as renewable energy supplier

2 Tonne Waste Biomass Facility
*(equiv to 1000 L ethanol facility
in terms of energy in)*

100% of biomass is waste
Alberta electricity displacement
42% heat rate
6% parasitic losses
1% energy used for processing
Transportation same in baseline
and project

Baseline		kg CO2e
	Transportation of biomass waste	13
	Disposal of biomass waste	318
	Electricity generation	3,881
		4,212
Project		
	Transportation of biomass waste	13
	Processing of biomass	70
	Electricity generation	3
		86

Emission Reduction	4,126 kg CO2e
Emission Reduction Intensity	0.63 kg CO2e/kWh
Emission Reduction Intensity	4.13 kg CO2e/L
\$17/tonne CO2e	0.070\$/L

GHG ACCOUNTING IMPLICATIONS FOR BIO-ENERGY

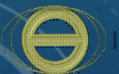
	GHG Intensity (kg CO ₂ e/L)	\$/tonne CO ₂ e	\$/L
Carbon Tax	232	20	0.044
Bio-ethanol project	1020	17	0.017
Biomass waste to energy project	4130	17	0.070

QUESTIONS

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