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ECONOMIC IMPACT OF THE PROVINCIAL GOVERNMENT'S CLEANBC ROADMAP TO 2030

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Business Council of
British Columbia
Est. 1966

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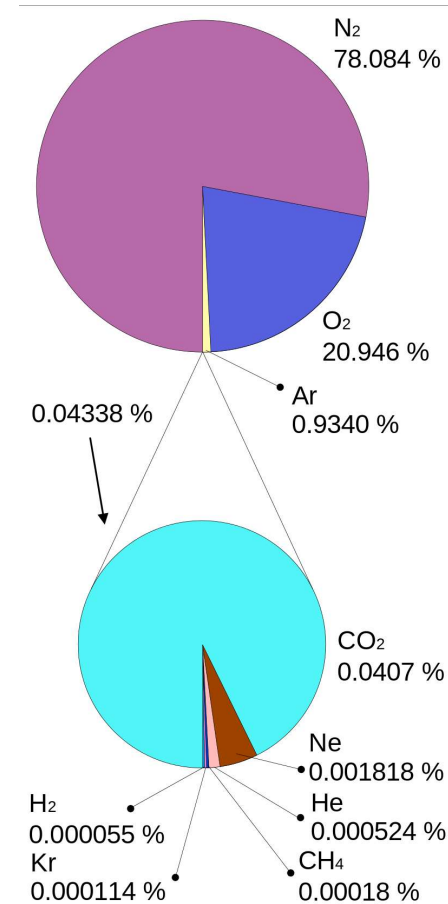


OUTLINE

- Resignation
 - working in the energy and GHG world since 1988
- Surprise (but kind of not)
 - government's economic modelling of CleanBC policies
- Concern
 - implications of the results – prosperity, incomes, jobs, opportunity
- Wait a sec ...
 - economic dimensions not widely known
- Further reflections
 - additional context and a path forward

LET'S BE CLEAR ABOUT A FEW THINGS

- Energy density matters
- Fossil fuels are long term compressed dead things = big energy density
- Biofuels are short terms dead things = small(er) energy density = more of them to do the same amount of work
- Renewable electricity have big issues too = spatial and embedded fossil energy
- Carbon is not a gas
- Climate change can't be managed, GHG emissions can (to some extent)
- Energy is the oxygen of economies
- Reliable and affordable energy are critical
- Models aren't facts



Carbon

atomic number	6	[12.0096, 12.0116]	atomic weight
symbol	C		acid-base properties of higher-valence oxides
electron configuration	[He]2s ² 2p ²		crystal structure
name	carbon		physical state at 20 °C (68 °F)

Other nonmetals	Solid
Hexagonal	Weakly acidic

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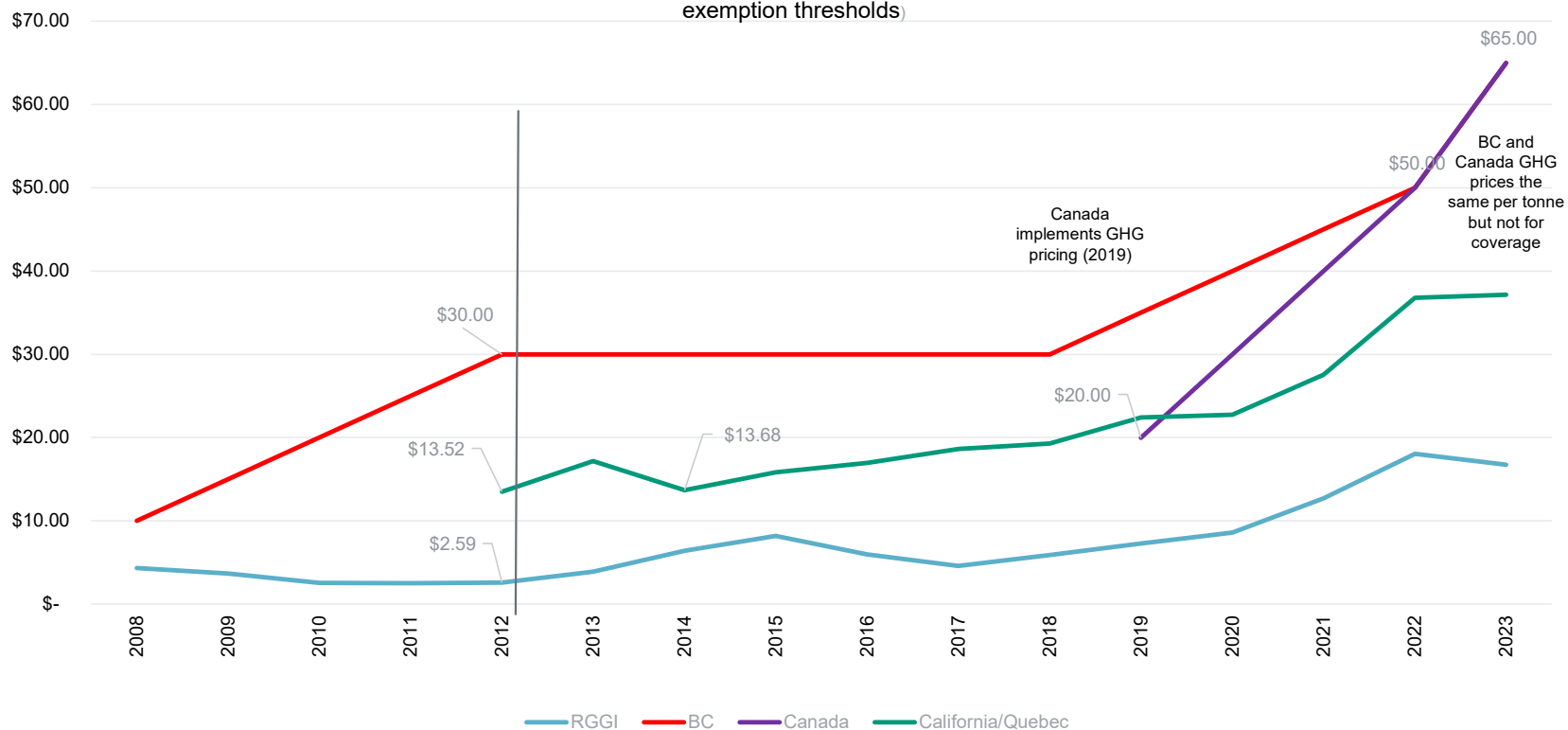


GREENHOUSE GAS EMISSIONS TAX 101

- Greenhouse gases are considered externalities – effects of private decisions creating public costs
- Emissions tax is a way of making “hidden” costs visible
- Objective of the theory: raise the price of GHGs (anything) to change behaviour about consumption
- Simple and not so simple – energy is price inelastic for most consumers
- Three forms
 - Direct tax on the GHG content of fuels (what BC has had since 2008)
 - Emissions trading system (California/Quebec - 2012, EU - 2005, RGGI - 2008)
 - Output based pricing system (Canada and all provinces by 2024)
 - Differences create competitiveness issues
- Functionally supposed to be an alternative to regulation. Currently a toll on the bridge of regulation

GHG pricing Differences over time (2008 to 2023, average annual)

NOTE: RGGI is electricity only. CA, QC and Canada only a portion of emissions (CA-QC free allowances, Canada exemption thresholds)





KEY DIFFERENCES

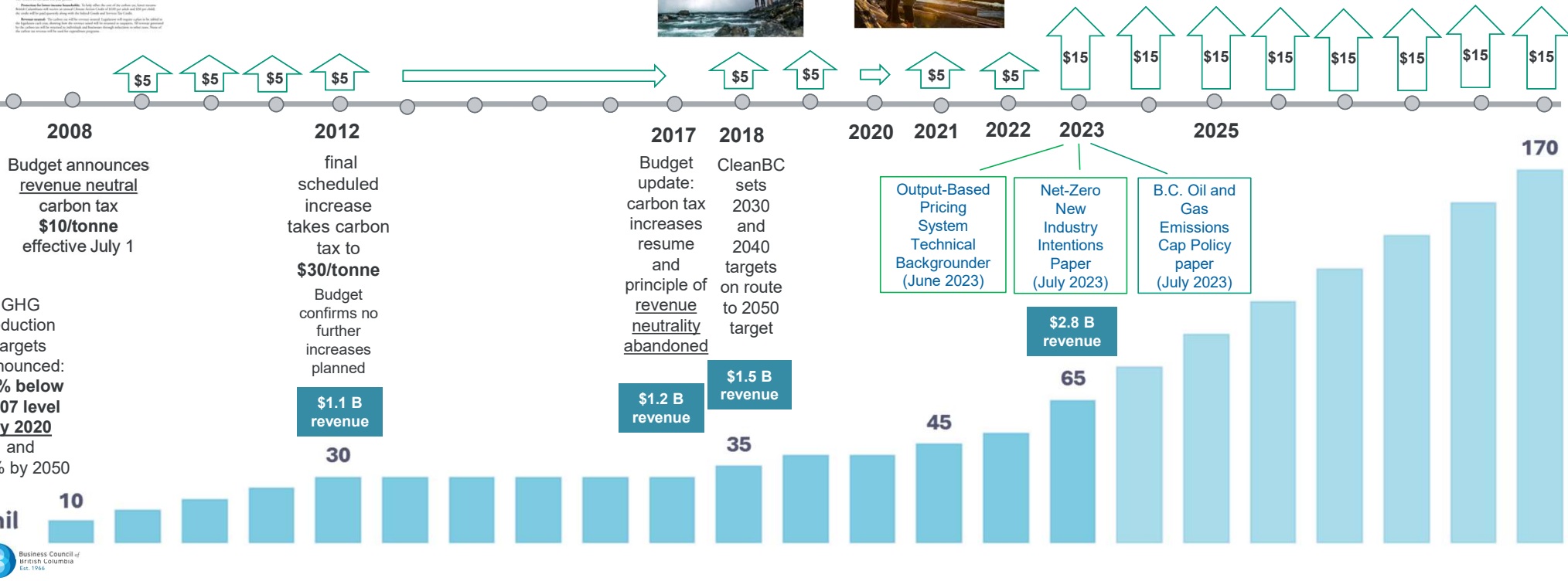
- Tax approach:
 - Price transparency
 - No cap
 - Generally, doesn't not apply to exported goods
 - Fixed/regulatory price
 - No/few protections for energy intensive trade exposed industries
 - BC 2008 GHG tax: belated and backwards "refund" based on report filing on activities with a fixed payment of \$30/t CO₂e
- ETS
 - "Cap" on emissions
 - Protection of energy intensive trade exposed industries
 - ETS: free allowances, market pricing system, current CA/QC auction settlement prices: ~48/t CO₂e
 - Output based: protection thresholds, differ across the country = unequal, internal carbon leakage, regulated price

HISTORY AND CURRENT PLAN FOR CARBON TAX



BACKGROUND: B.C.'S REVENUE-NEUTRAL CARBON TAX

On July 1, 2008, carbon tax was introduced by the government of British Columbia as a key component of its balanced budget. The carbon tax was designed to encourage individuals and businesses to make more environmentally responsible choices, reducing greenhouse gas emissions and improving air quality. The tax was set at \$10 per tonne of carbon dioxide equivalent (CO₂e) and was applied to a wide range of goods and services. The government also announced that it would use the revenue from the carbon tax to fund a variety of programs and services, including infrastructure, education, and health care. The carbon tax was a key part of the government's strategy to reduce greenhouse gas emissions and improve air quality. It was a revenue-neutral measure, meaning that the government did not expect to raise or lose any net revenue from the tax. The carbon tax was a landmark policy in British Columbia's history, and it has been a key part of the province's climate change strategy ever since.





SURPRISE (AND DISBELIEF BUT KIND OF NOT)

GOVERNMENT'S ECONOMIC MODELLING RESULTS ARE POSTED ON MINISTRY'S WEBSITE

[tion and sustainability](#) > [Climate change](#) > [Data and inventories](#) >

Provincial Forecast of greenhouse gas emissions

B.C.'s Provincial Forecast of Greenhouse Gas Emissions and Supporting Metrics (Provincial Forecast) contains projections to 2030 of the greenhouse gas (GHG) emissions include represent BC raw GHG emissions, including emissions from land use change and abatement outside of BC. BC's progress to its GHG emissions reduction targets is calculated using the adjusted total, which includes post-modelling adjustments made by BC government for publication in the 2022 Climate Change Report. Total GHG impact from CleanBC does not equal the sum of individual policy impacts due to policy overlap when CleanBC is modelled as a package.

The Provincial Forecast also includes other related metrics such as energy use. It contains these projections for the CleanBC scenario and only policies announced as of July 2017.

The Climate Action Secretariat prepares and publishes the Provincial Forecast conducted by Navius Research. Each year, the modelling used to create recent and accurate input data available.

Current Provincial Forecast

The [2022 Provincial Forecast \(XLSX, 102KB\)](#) projects that, under CleanBC, B.C. will reduce greenhouse gas emissions by 43.2 million tonnes of carbon dioxide equivalent (MtCO₂e) in 2030 (including abatement from B.C. utilities purchasing renewable natural gas production) to a decrease of 32% (21.1 MtCO₂e) from 65.5 MtCO₂e in 2007, the baseline. This is a decrease of 39 percent (25.4 MtCO₂e) from 2007, achieving 97 percent of the reduction required by B.C.'s target. Post-modelling adjustments are described in more detail in the [methodology report \(PDF, 1.2MB\)](#) that accompanies the Provincial Forecast.

After including post-modelling adjustments (which account for technical limitations of the model and policies that were not included in the modelling), net emissions in 2030 are projected to be 40.1 MtCO₂e under the [CleanBC Roadmap](#). This is a decrease of 39 percent (25.4 MtCO₂e) from 2007, achieving 97 percent of the reduction required by B.C.'s target. Post-modelling adjustments are described in more detail in the [methodology report \(PDF, 1.2MB\)](#) that accompanies the Provincial Forecast.

<https://www2.gov.bc.ca/gov/content/environment/climate-change/data/provincial-forecast>

Some persistent “clicking” leads to GHG and GDP modelling results in an Excel spreadsheet

ECONOMIC MODELLING RESULTS: REFERENCE SCENARIO AND CLEANBC SCENARIO

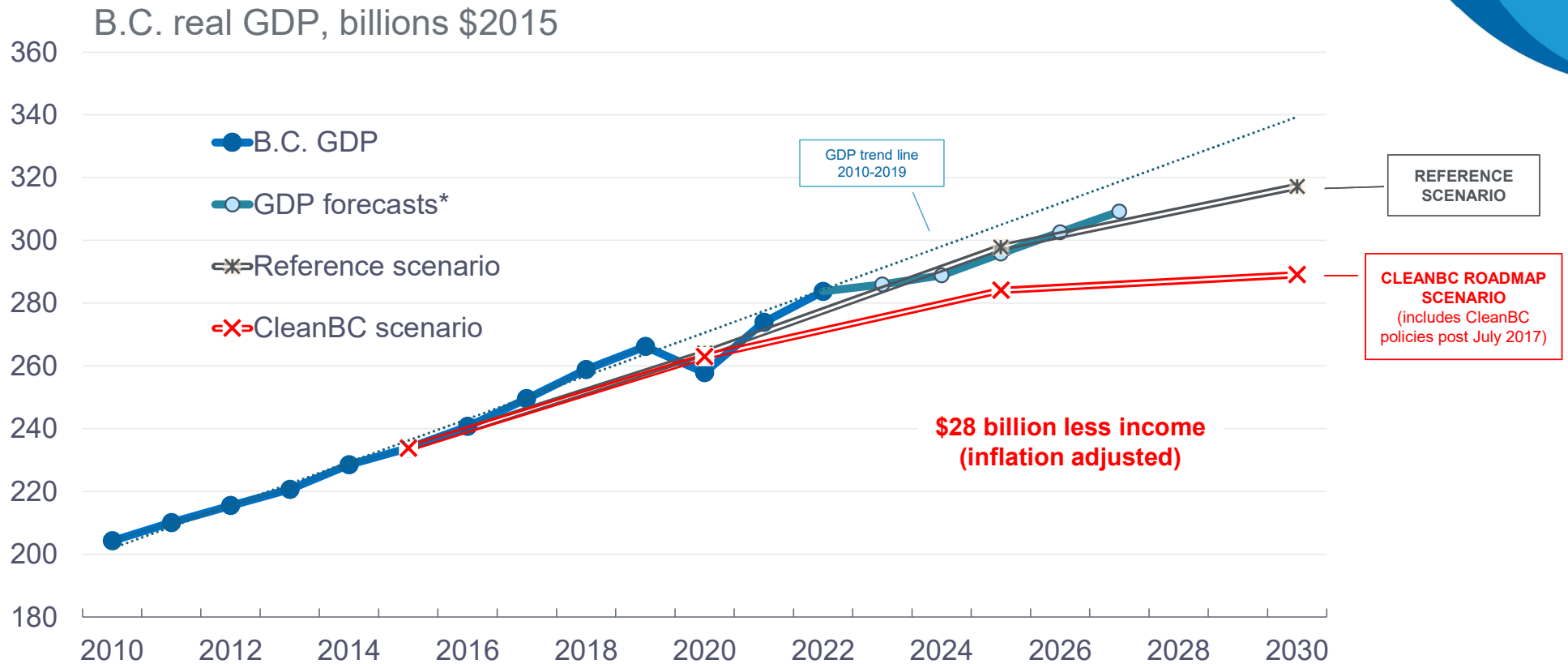
GDP: Reference Scenario					
Unit: billion 2015 \$	2015	2020	2025	2030	
TOTAL ¹	233.8	264.1	297.8	317.2	
FOSSIL FUEL INDUSTRY	8.4	8.9	15.6	16.5	
Coal Production	1.2	1.6	1.7	1.8	
Upstream Oil and Gas	5.4	4.8	9.8	10.0	

GDP: CleanBC Scenario					
Unit: billion 2015 \$	2015	2020	2025	2030	
TOTAL ^{1,2}	233.8	263.0	284.1	289.1	
FOSSIL FUEL INDUSTRY	8.4	8.8	14.6	13.6	
Coal Production	1.2	1.6	1.6	1.5	
Upstream Oil and Gas	5.4	4.7	9.3	8.5	

Difference		
	2025	2030
TOTAL	-13.7	-28.1
FOSSIL FUEL INDUSTRY	-1.0	-2.9
Coal Production	-0.1	-0.3
Upstream Oil and Gas	-0.5	-1.4

Economic modelling projections show B.C.'s economy is \$28 billion smaller under the CleanBC scenario

CLEANBC POLICIES EXPECTED TO REDUCE B.C.'S ECONOMIC GROWTH BY \$28 BILLION



ECONOMY-WIDE INCOME (GDP) REDUCTIONS

Difference: CleanBC less Reference scenario \$2015

Unit: billion 2015 \$	2030
TOTAL^{1,2}	-28.1
FOSSIL FUEL INDUSTRY	-2.9
Coal Production	-0.3
Upstream Oil and Gas	-1.4
Natural Gas Production and Processing	-1.5
Conventional Oil Production	0.0
Oil, Natural Gas, and CO ₂ Transmission	0.1
Downstream Oil and Gas	-1.1
Petroleum Refining	-0.3
Natural Gas Distribution	-0.3
Liquefied Natural Gas	-0.5
Oil and Gas Services	-0.1
ELECTRICITY	0.8
Electricity Generation	0.7
Electricity Distribution	0.1
TRANSPORT	-3.5
Transit	-0.2
Air	-0.3
Truck	-1.0
Rail	-1.0
Other Transport	-1.0

Difference: CleanBC less Reference scenario \$2015

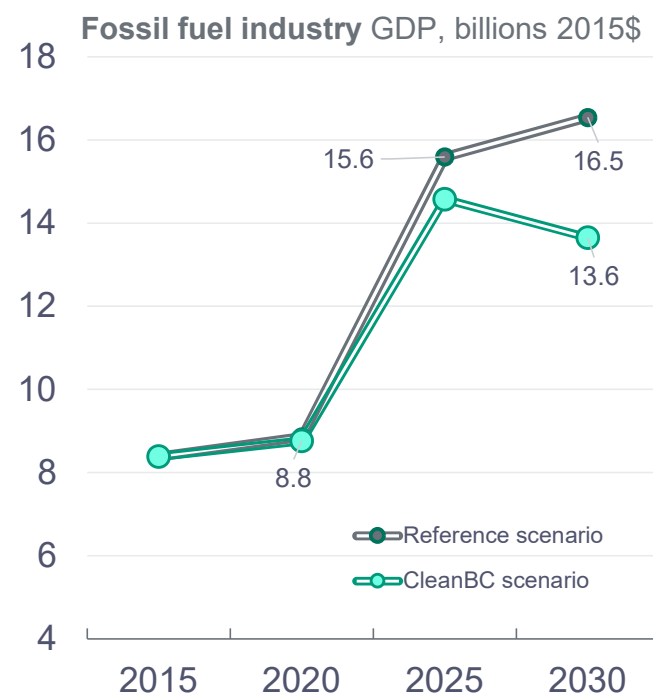
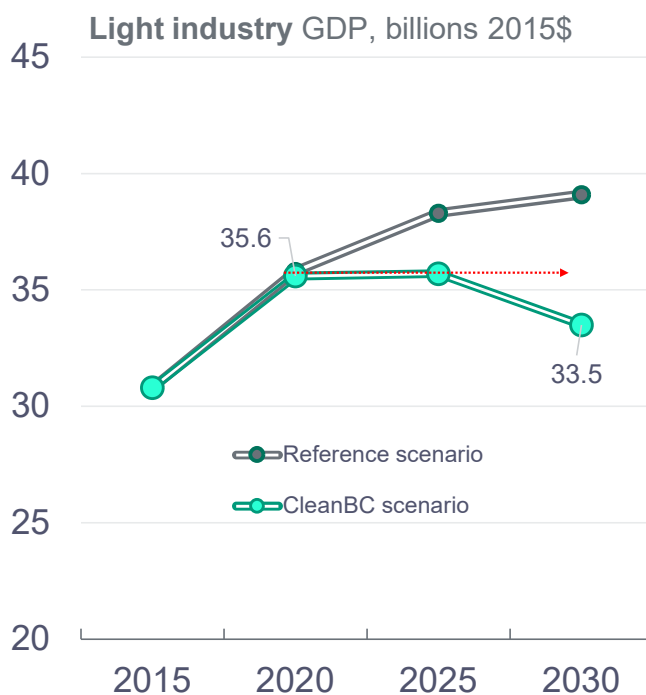
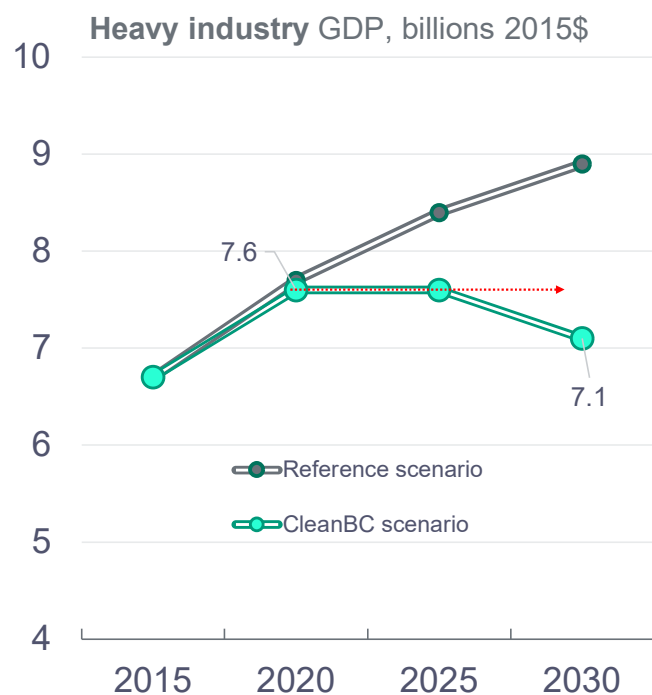
Unit: billion 2015 \$	2030
HEAVY INDUSTRY	-1.7
Mining	-0.3
Metals	-0.1
Pulp and Paper	-1.0
Non-Metallic Minerals	-0.1
Chemicals and Fertilizers	-0.2
BUILDINGS	-15.1
Service Industry	-15.1
Residential	-
AGRICULTURE	-0.2
Agriculture	-0.2
WASTE	-
Waste	-
LIGHT INDUSTRY	-5.6
Light Manufacturing	-3.2
Construction	-1.9
Forest Resources	-0.5

<https://www2.gov.bc.ca/gov/content/environment/climate-change/data/provincial-forecast>

1. Values are outputs of Navius' gTech model and may differ from historic values published elsewhere.
2. The GDP projection under CleanBC is significantly affected by policies still being designed and may be different in future modelling.

CLEANBC POLICIES REDUCE INCOME (GDP) BELOW 2020 LEVELS IN B.C.'S FOUNDATIONAL SECTORS

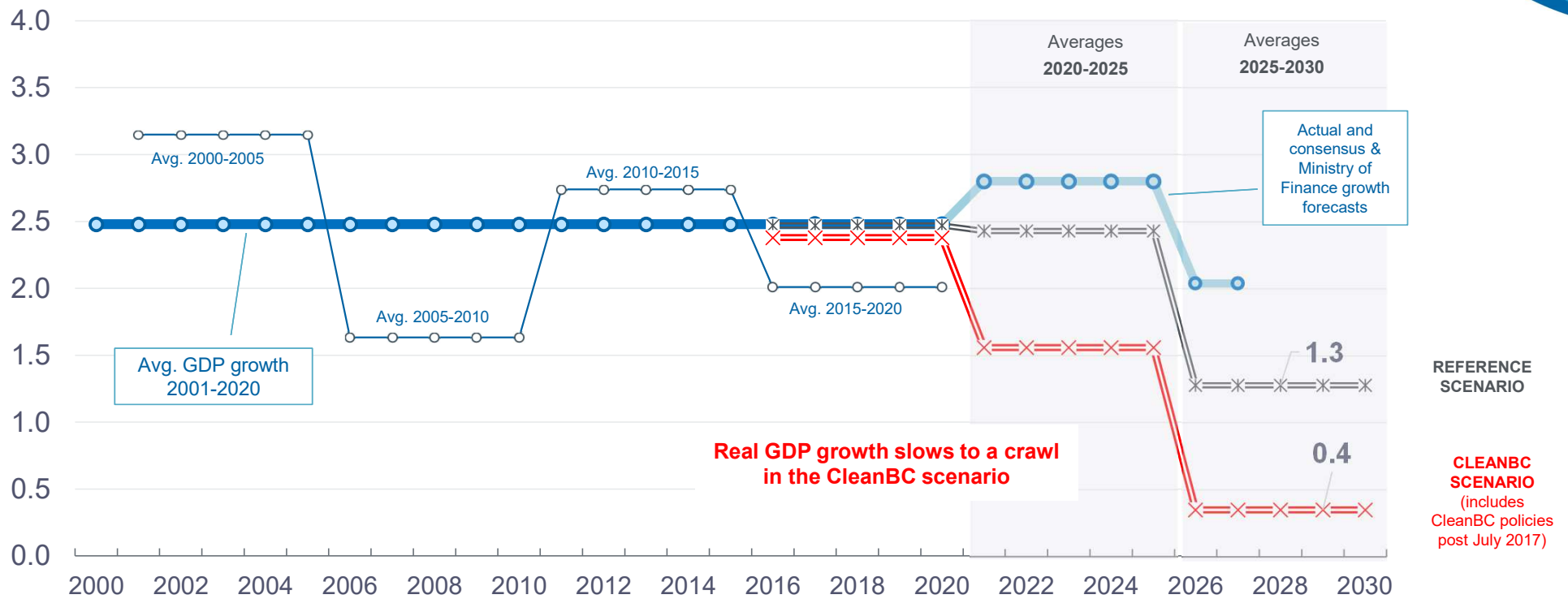
GDP projections by sector, Reference scenario and CleanBC scenario, billions 2015\$



B.C.'S AVERAGE ANNUAL ECONOMIC GROWTH SLOWS TO JUST 0.4% IN THE SECOND HALF OF THE DECADE

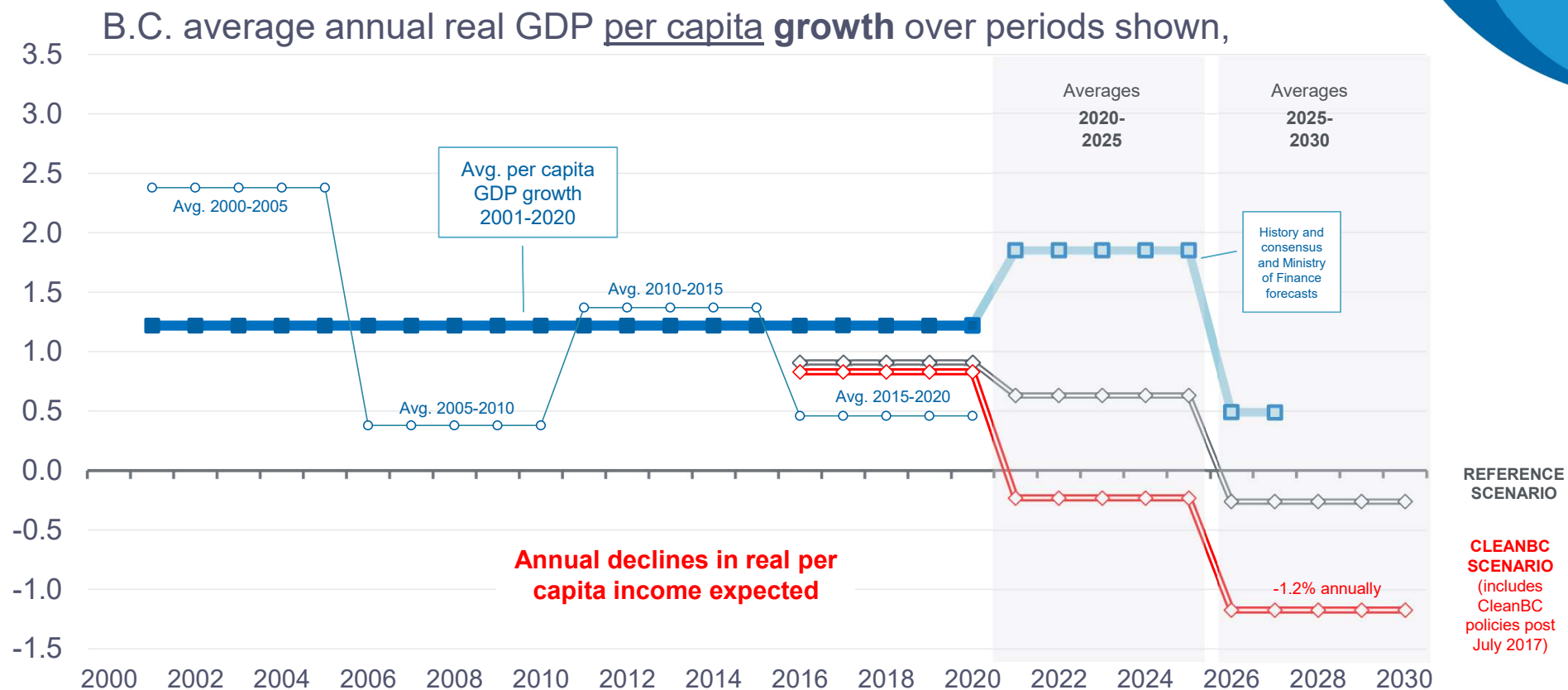
14

B.C. average annual real GDP growth over periods shown, %



SECOND HALF OF DECADE WILL SEE REAL PER CAPITA INCOMES DECLINE BY MORE THAN 1% ANNUALLY

15



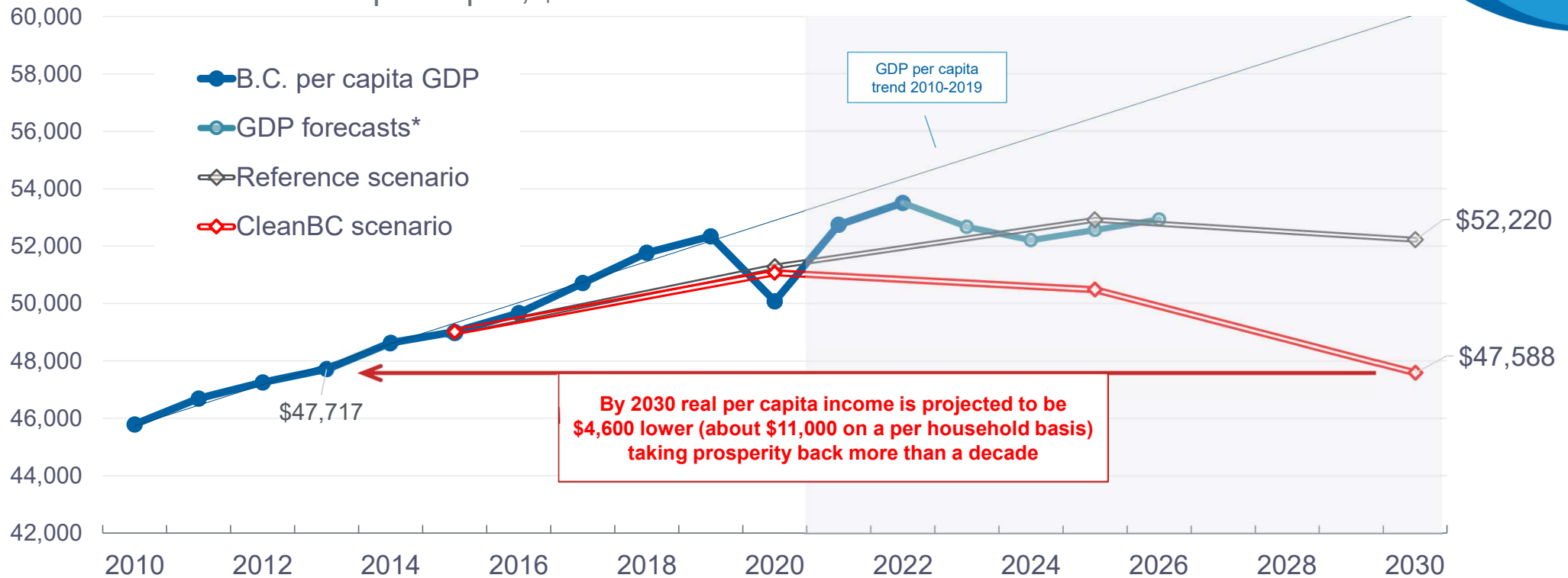
GDP at factor prices. 2020 average based on actual 2021 and 2022 growth, 2023 BCBC forecast, and 2024 and 2025 Ministry forecasts. 2025-2027 Ministry forecasts, BC Budget 2023 p.105. Population growth forecasts 2023-2027 from BC Budget 2023, 2028-2030 assumed to be 1.5%. Statistics Canada, Table: 36-10-0402-01.



CONCERN (INCOMES, JOBS, PROSPERITY...?)

CLEANBC POLICIES TAKE PROSPERITY BACK TO LEVELS CIRCA 2013

B.C. real GDP per capita, \$2015

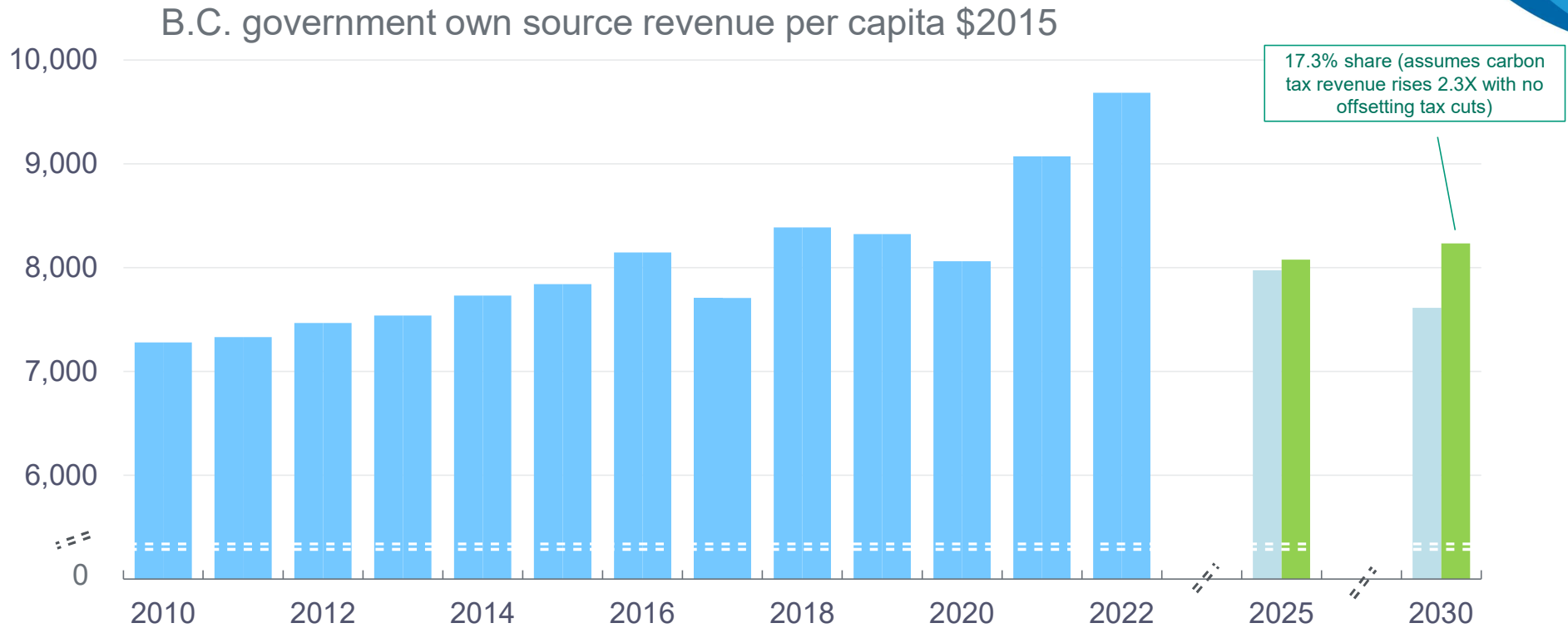


WHAT HAPPENS TO JOB GROWTH WHEN GDP GROWTH SLOWS TO JUST 0.4% PER ANNUM?

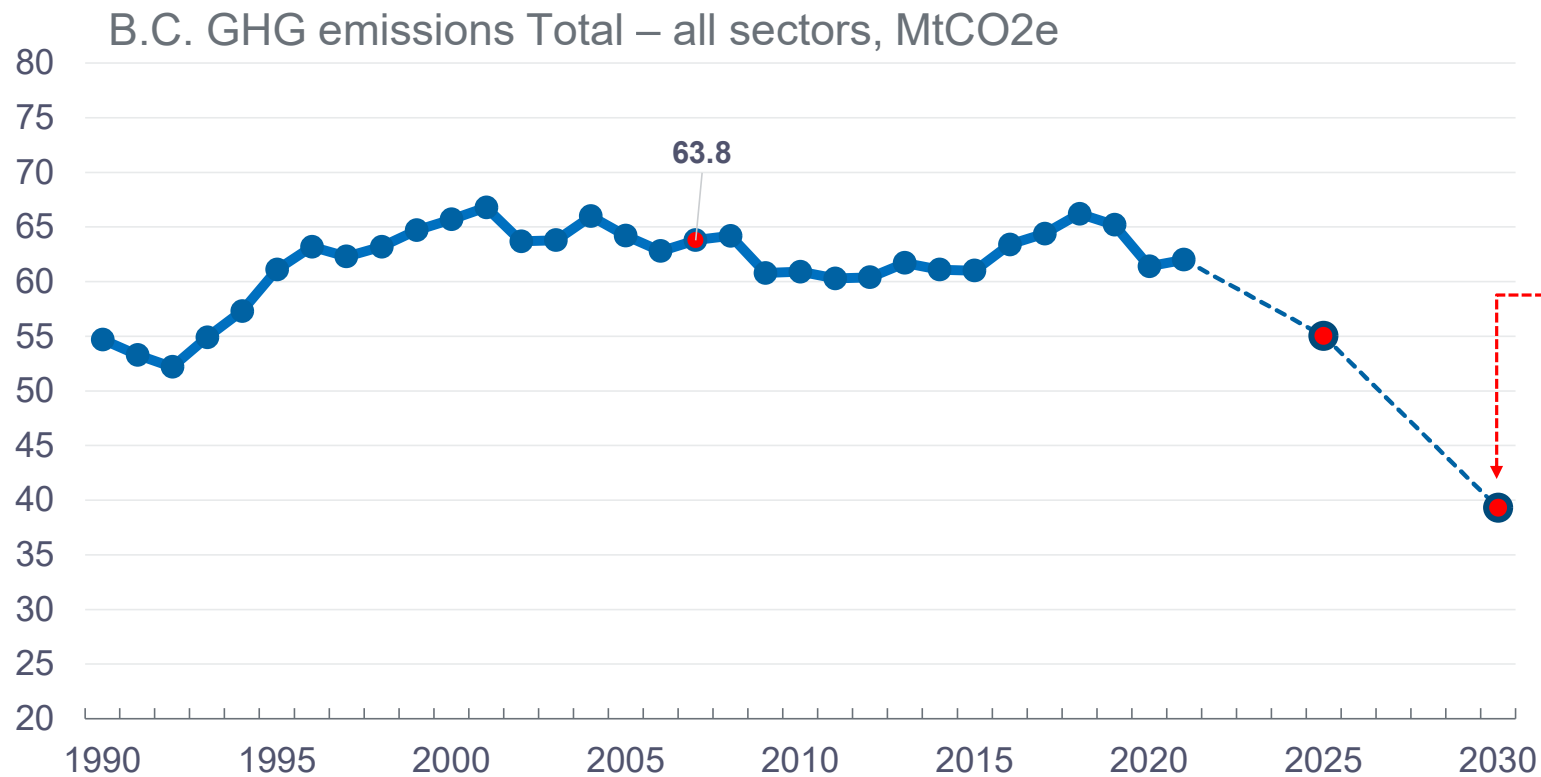
B.C. average annual real GDP and employment growth over periods shown, %



LESS INCOME (GDP) = LESS GOVERNMENT REVENUE



AMBITIOUS GHG REDUCTION TARGETS

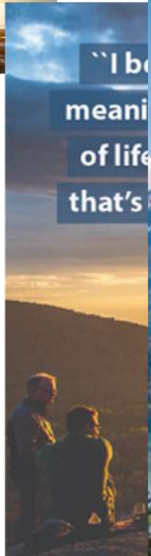


B.C. has legislated targets for reducing greenhouse gas emissions **40% below 2007 levels by 2030**, 60% by 2040, and 80% by 2050.

The government also has an interim target to reduce emissions 16% by 2025.

WAIT A SEC...

PUBLIC COMMUNICATIONS FOR CLEANBC ROADMAP AS GOOD FOR INVESTMENT AND ECONOMIC PROSPERITY



[https://news.gov](https://news.gov.bc.ca/factsheets/clearing-the-path-to-a-new-climate-strategy)

"British Columbians are poised to show the world how we can and will do better on climate action and economic prosperity."

- Minister George Heyman



<https://news.gov.bc.ca/factsheets/clearing-the-path-to-a-new-climate-strategy>

Andrew Weaver, professor, school of earth and ocean sciences, University of Victoria -

"I am thrilled with the release of the CleanBC Roadmap that fulfils our original commitment in CleanBC to fully meet our legislated greenhouse gas emissions target for 2030. The roadmap's comprehensive, sector-wide approach to emissions reduction leaves no stone unturned. It is a generational plan for future prosperity providing new opportunities for people and businesses. And it's a plan that signals to the world that B.C. is going to lead the way in the transition to a low-carbon future."

GOVERNMENT'S PUBLIC FACING ROADMAP DOCUMENT CONTAINS ONLY CURSORY DISCUSSION OF ECONOMIC IMPACT

23



1 of 66 pages discusses jobs and GDP impacts

1.4 Modelling and Economic Analysis

To forecast the impacts of our climate actions, B.C. follows well-established best practices, using the best available data and sophisticated computer modeling. However, projections change over time as new information becomes available and methodologies are updated and it can be challenging predicting specific outcomes a decade or more away. As noted earlier, we now expect the measures in CleanBC (not including Roadmap actions) to achieve 32 to 48% of our 2030 targets – compared to the original estimate of 75%. The increased gap is due to several factors, including:

- Updated modelling: for example, new data on natural gas and electricity have lowered projected GHG reductions from industrial electrification
- Higher than expected emissions in sectors such as transportation and pulp and paper
- Changes in the federal approach to measuring emissions from sectors such as waste.

Detailed information on model updates and estimates are available as part of the 2021 [Climate Change Accountability Report](#).

Through the measures in this Roadmap we expect to reach 100% of the 2030 emissions target.

Impacts on jobs and GDP

In today's economy, citizens and the global financial community are insisting that governments and companies have credible, long-term plans to reduce climate pollution – making this Roadmap an economic necessity.

Based on provincial data, we expect investment in Roadmap initiatives to generate approximately 18,000 direct and spinoff jobs with:

- GDP increases of 19% by 2030 and 89% by 2050 from 2020 levels
- Job growth of 7% and 37% by 2030 and 2050 respectively from 2020 levels.

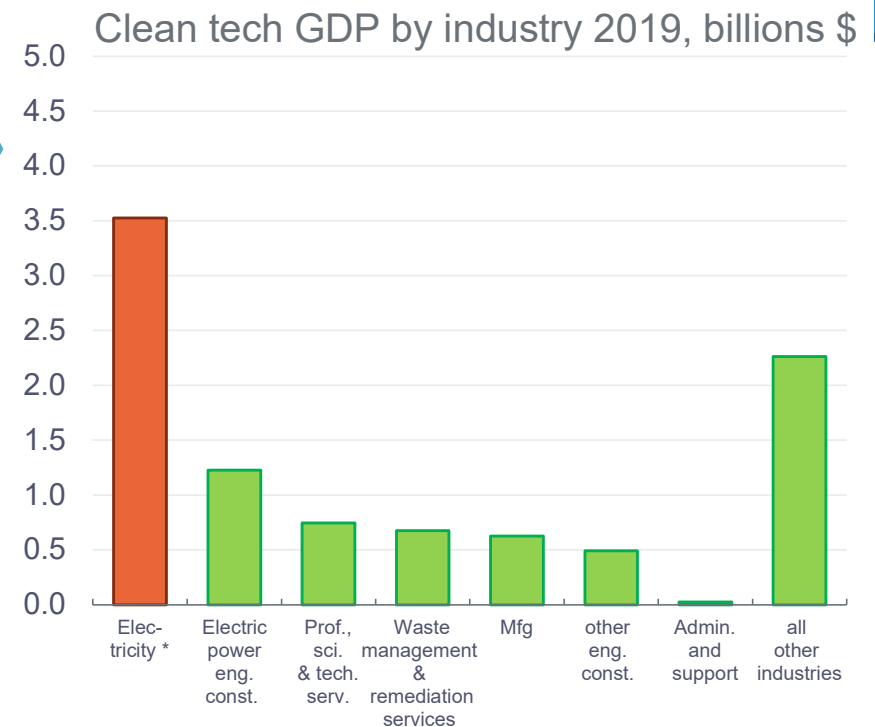
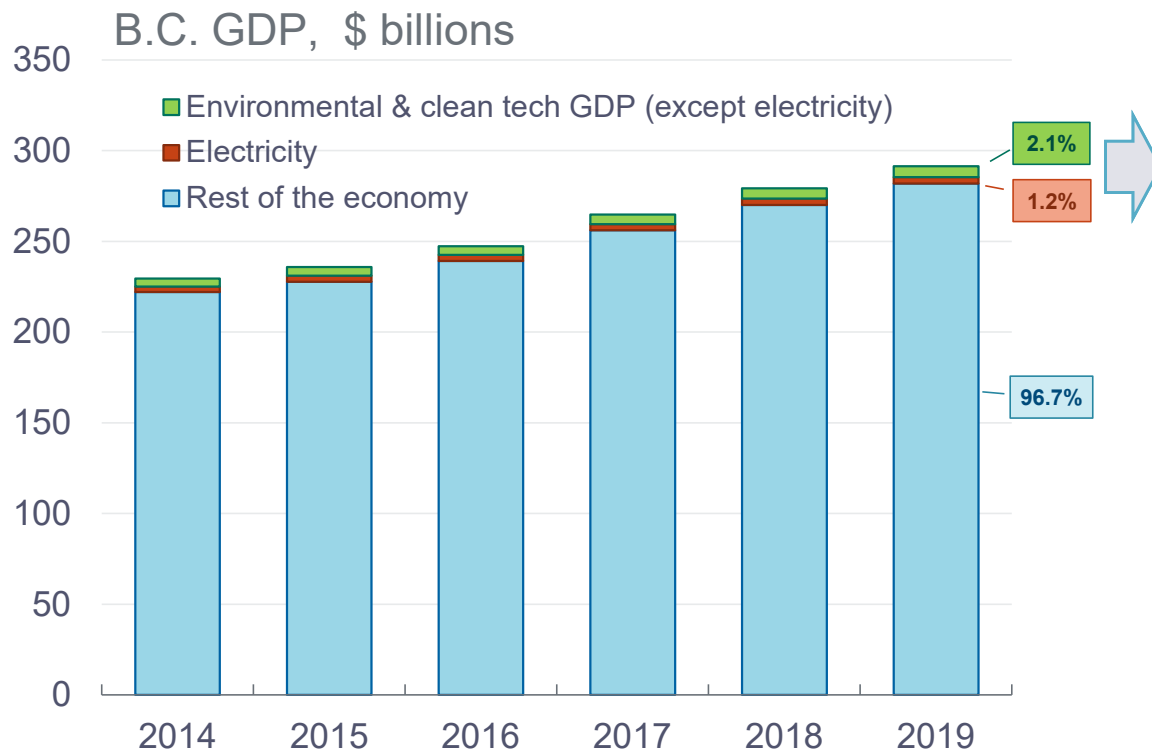
These are conservative estimates; the economic benefits could be even greater if, for example, new clean technologies turn out to cost less than we expect. The Roadmap, like any credible climate plan, will increase the cost of fossil fuels. Government will minimize the impacts by continuing the Climate Action Tax Credit and providing increased support to help people and businesses reduce emissions and costs.

Based on provincial data, we **expect investment in Roadmap initiatives to generate approximately 18,000 direct and spinoff jobs** with:

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The Roadmap, like any credible **climate plan**, will **increase the cost of fossil fuels**. Government will **minimize the impacts by continuing the Climate Action Tax Credit** and providing increased support to help **people and businesses** reduce emissions and costs. (emphasis added)

ENVIRONMENTAL AND CLEAN TECHNOLOGY SECTOR ACCOUNTS FOR 3.3% OF THE ECONOMY



AS POLICY IMPLEMENTATION BEGINS, IMPACT ON INDUSTRY IS BEING IDENTIFIED

In addition to the proposed OBPS, there are two other policy proposals that seek to accelerate decarbonization for heavy industry in the Province of British Columbia, including the Net-Zero New Industry (feedback due August 15) and the B.C. Oil and Gas Emissions Cap Policy Paper (feedback due later this fall). We would classify these policy items as being adjacent and redundant to the proposed OBPS, which could have compounding impacts on industry as they face similar challenges in achieving either. We summarize these proposals at a high level below. While on its own the OBPS is not materially different from the estimated obligations under CIIP, when applied in combination with these other policies, the financial implications, complexities, and regulatory burden could make further development in the Province of British Columbia potentially uneconomic for much of industry. This is especially the case for operators who can simply shift capital and operations to other jurisdictions, such as Alberta or the U.S. In a sense, we believe these policies could act as an indirect production cap for industry in BC.

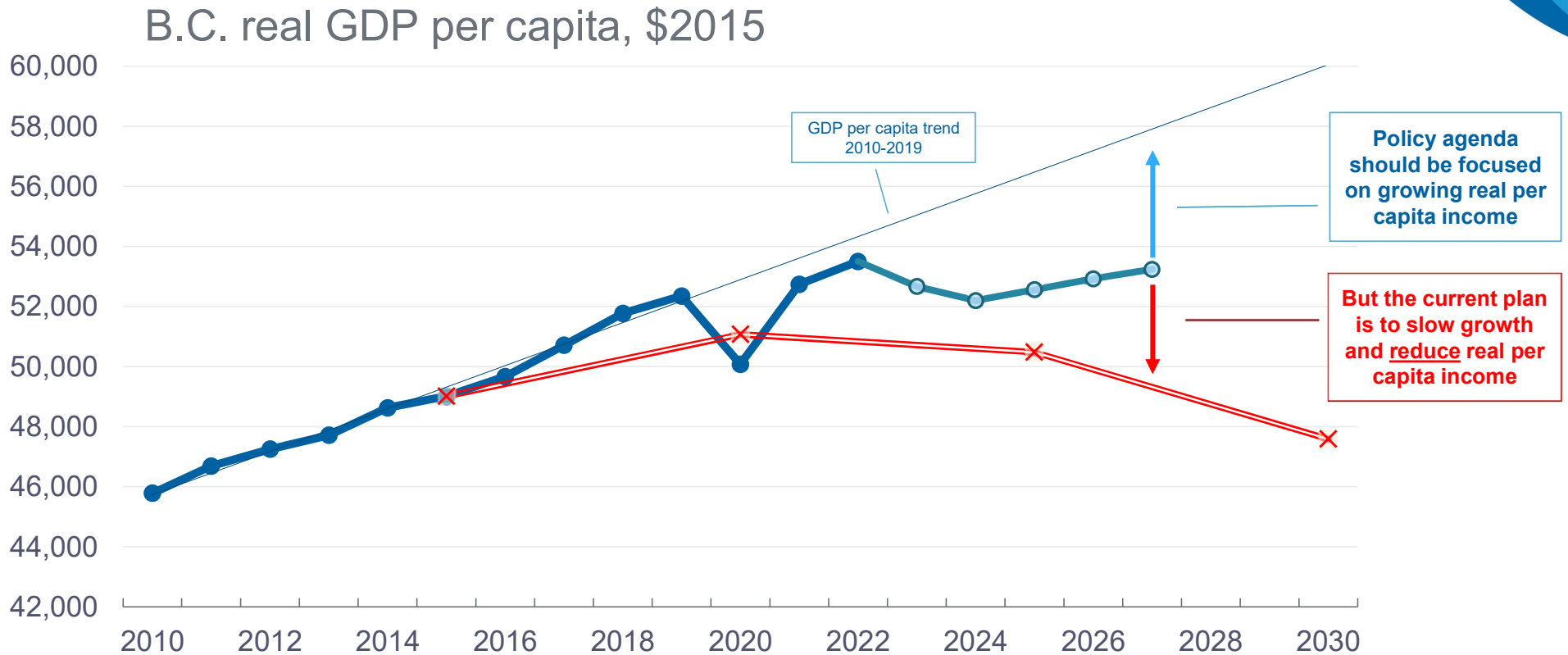
FURTHER REFLECTIONS


LOST OUTPUT (INCOME) FROM B.C. ADOPTING CLEANBC POLICY AGENDA WILL BE PRODUCED IN OTHER JURISDICTIONS

Putting a price on carbon can be an effective way to encourage investments in key transition technologies to accelerate decarbonization. However, when applied unevenly across jurisdictions, imbalances are created, causing a phenomenon known as carbon leakage. This is where high emissions intensive activities shift to more lenient jurisdictions. If this were to occur en masse, the jurisdictional source of emissions would change but no net global reduction would be realized, and in certain instances, where production shifts to jurisdictions that do not prioritize any part of ESG, there may even be an increase in emissions. Carbon leakage can be more pronounced in circumstances where solutions are unobtainable, due to financial or logistical reasons, and the costs of the associated program cannot be passed along to consumers, which is the case in global commodity markets. That said, each individual jurisdiction will have its own emissions aspirations and will implement policies to help achieve those goals while attempting to balance competitiveness issues. As such, we believe that carbon pricing will continue to increase, both in terms of price and coverage, and we view it as a minor but growing liability for much of heavy industry.

BMO Capital Markets, *Carbon Innovation* September 5, 2023.

KEY TAKE AWAY – A SIGN AND MAGNITUDE PROBLEM

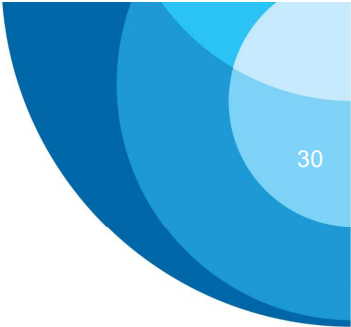


 GDP at factor prices rebased to \$2015 to align with Modelling CleanBC data; *2023-2024 forecasts are bank consensus projections and 2025-2027 based on expenditure-based GDP growth from BC Budget 2023 p.105. Population growth forecasts 2023-2027 from BC Budget 2023, 2028-2030 assumed to be 1.5%. Statistics Canada, Table: 36-10-0402-01.



A PATH FORWARD

- Recalibrate Roadmap 2030 targets and policy timelines in consultation with the public, business, Indigenous and local government
 - Details and design of CleanBC and its component parts matter
 - Net Zero New Industry Policy approach limits future developments, undermines aspiration of Indigenous people around the province
 - OBPS needs adjustment to manage both domestic and international carbon leakage
 - Oil and gas cap not needed
 - Most technologies referenced are emerging. The only mature technology is electricity = substitution issues, expansion constraints (spatial, technical), affordability and reliability issues
- Adopt “the world needs more B.C.” mindset



APPENDIX

ECONOMY-WIDE INCOME (GDP) LOSSES

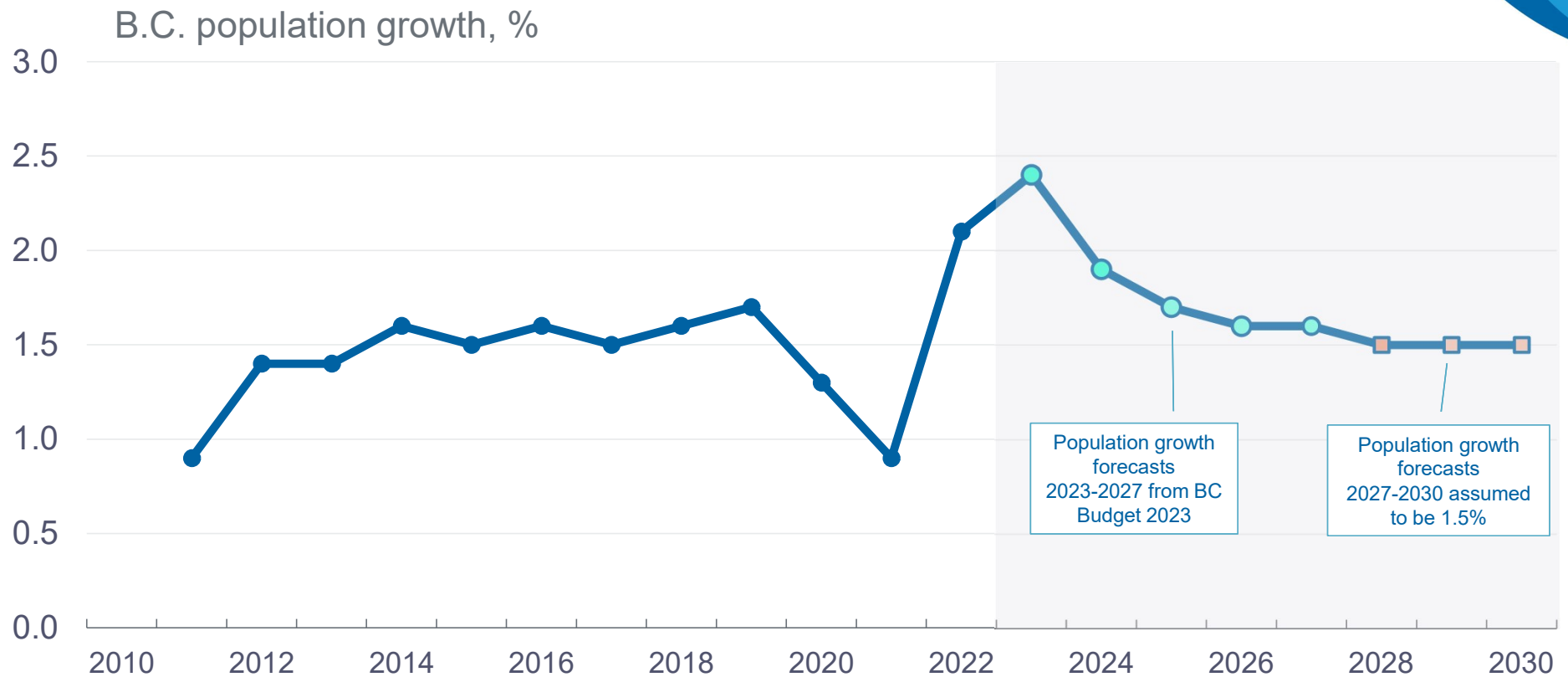
GDP: Reference Scenario						growth %	GDP: CleanBC Scenario						growth %	Difference: CleanBC less Reference scenario \$2015				% difference: CleanBC vs Reference scenario			
Unit: billion 2015 \$	2015	2020	2025	2030	2020-30		2015	2020	2025	2030	2020-30		2020	2025	2030		2020	2025	2030		
TOTAL ^{1,2}	233.8	264.1	297.8	317.2	20.1		233.8	263.0	284.1	289.1	9.9		-1.1	-13.7	-28.1		-0.4	-4.6	-8.9		
FOSSIL FUEL INDUSTRY	8.4	8.9	15.6	16.5	86.7		8.4	8.8	14.6	13.6	55.7		-0.1	-1.0	-2.9		-1.0	-6.5	-17.5		
Coal Production	1.2	1.6	1.7	1.8	9.5		1.2	1.6	1.6	1.5	-7.0		0.0	-0.1	-0.3		-0.4	-6.1	-15.4		
Upstream Oil and Gas	5.4	4.8	9.8	10.0	107.5		5.4	4.7	9.3	8.5	80.7		-0.1	-0.5	-1.4		-1.7	-5.1	-14.4		
Natural Gas Production and Processing	4.0	3.3	8.2	8.3	152.5		4.0	3.2	7.6	6.8	113.4		-0.1	-0.5	-1.5		-3.4	-6.4	-18.3		
Conventional Oil Production	0.3	0.2	0.3	0.2	-12.4		0.3	0.2	0.2	0.2	-10.6		0.0	0.0	0.0		-0.7	-2.8	1.4		
Oil, Natural Gas, and CO ₂ Transmission	1.1	1.3	1.4	1.5	12.0		1.1	1.4	1.4	1.6	16.0		0.0	0.0	0.1		2.2	2.0	5.8		
Downstream Oil and Gas	1.4	2.0	3.6	4.4	119.1		1.4	2.0	3.2	3.3	63.9		0.0	-0.4	-1.1		0.0	-10.2	-25.2		
Petroleum Refining	0.7	1.0	0.6	0.7	-27.1		0.7	1.0	0.4	0.4	-61.2		0.0	-0.1	-0.3		0.3	-24.7	-46.5		
Natural Gas Distribution	0.8	1.0	1.0	1.0	2.2		0.8	1.0	0.9	0.7	-26.8		0.0	-0.1	-0.3		-0.3	-10.8	-28.6		
Liquefied Natural Gas	-	-	2.0	2.6	-		-	-	1.9	2.2	-		-	-0.1	-0.5		-	-5.6	-17.9		
Oil and Gas Services	0.4	0.4	0.5	0.4	-1.8		0.4	0.4	0.5	0.3	-20.1		0.0	-0.1	-0.1		-0.8	-10.3	-19.3		
ELECTRICITY	3.9	4.6	5.4	5.7	25.0		3.9	4.7	5.6	6.5	38.4		0.1	0.2	0.8		2.6	3.5	13.7		
Electricity Generation	3.3	4.0	4.8	5.1	27.2		3.3	4.1	4.9	5.8	40.9		0.1	0.2	0.7		2.8	3.2	13.9		
Electricity Distribution	0.6	0.6	0.7	0.7	10.8		0.6	0.6	0.7	0.8	22.6		0.0	0.0	0.1		1.4	5.5	12.3		
TRANSPORT	16.6	19.2	21.2	22.1	14.8		16.6	19.0	19.4	18.6	-2.4		-0.2	-1.8	-3.5		-0.9	-8.4	-15.8		
Transit	0.3	0.3	0.4	0.4	31.8		0.3	0.3	0.3	0.2	-44.1		0.0	-0.1	-0.2		1.0	-16.5	-57.2		
Air	2.2	2.4	2.8	3.1	25.2		2.2	2.4	2.7	2.7	13.0		0.0	-0.1	-0.3		-0.7	-4.7	-10.4		
Truck	7.1	8.4	9.3	9.6	14.0		7.1	8.4	8.9	8.6	2.8		0.0	-0.5	-1.0		-0.5	-5.2	-10.2		
Rail	1.7	1.9	2.2	2.7	39.3		1.7	1.9	1.7	1.7	-9.0		-0.1	-0.5	-1.0		-3.4	-22.7	-36.9		
Other Transport	5.4	6.1	6.4	6.3	3.4		5.4	6.1	5.8	5.4	-11.7		-0.1	-0.6	-1.0		-0.9	-9.3	-15.3		
HEAVY INDUSTRY	6.7	7.7	8.4	8.9	15.1		6.7	7.6	7.6	7.1	-6.5		-0.1	-0.7	-1.7		-0.8	-8.6	-19.4		
Mining	2.4	2.8	3.3	3.5	22.4		2.4	2.8	3.2	3.2	11.7		0.0	-0.1	-0.3		-0.7	-4.4	-9.3		
Metals	0.4	0.7	0.6	0.7	-1.3		0.4	0.7	0.6	0.6	-8.5		0.0	0.0	-0.1		-1.2	-3.9	-8.4		
Pulp and Paper	2.5	2.5	2.5	2.7	7.7		2.5	2.5	2.1	1.7	-32.6		0.0	-0.4	-1.0		-0.5	-15.9	-37.8		
Non-Metallic Minerals	0.7	0.9	1.1	1.0	10.8		0.7	0.9	1.0	0.9	1.4		0.0	-0.1	-0.1		-1.4	-5.2	-9.8		
Chemicals and Fertilizers	0.7	0.7	0.8	1.0	32.8		0.7	0.7	0.7	0.7	5.1		0.0	-0.1	-0.2		-1.3	-11.0	-21.9		
BUILDINGS	165.6	186.1	206.8	222.4	19.5		165.6	185.5	199.1	207.4	11.8		-0.6	-7.7	-15.1		-0.3	-3.7	-6.8		
Service Industry	165.6	186.1	206.8	222.4	19.5		165.6	185.5	199.1	207.4	11.8		-0.6	-7.7	-15.1		-0.3	-3.7	-6.8		
Residential	-	-	-	-	-		-	-	-	-	-		-	-	-		-	-	-		
AGRICULTURE	1.8	1.8	2.1	2.5	41.3		1.8	1.7	2.0	2.3	32.8		0.0	-0.1	-0.2		-0.7	-5.6	-6.7		
Agriculture	1.8	1.8	2.1	2.5	41.3		1.8	1.7	2.0	2.3	32.8		0.0	-0.1	-0.2		-0.7	-5.6	-6.7		
WASTE	-	-	-	-	-		-	-	-	-	-		-	-	-		-	-	-		
Waste	-	-	-	-	-		-	-	-	-	-		-	-	-		-	-	-		
LIGHT INDUSTRY	30.8	35.8	38.3	39.1	9.1		30.8	35.6	35.7	33.5	-5.9		-0.2	-2.6	-5.6		-0.7	-6.7	-14.3		
Light Manufacturing	10.8	12.9	14.9	16.7	29.5		10.8	12.8	13.5	13.5	5.8		-0.1	-1.4	-3.2		-1.0	-9.6	-19.2		
Construction	16.7	20.8	21.1	20.0	-3.7		16.7	20.7	20.3	18.1	-12.5		-0.1	-0.8	-1.9		-0.4	-4.0	-9.6		
Forest Resources	3.4	2.1	2.3	2.4	10.9		3.4	2.1	2.0	1.9	-11.0		0.0	-0.3	-0.5		-0.7	-13.3	-20.3		

B.C. Ministry of Environment.

1. Values are outputs of Navius' gTech model and may differ from historic values published elsewhere.

2. The GDP projection under CleanBC is significantly affected by policies still being designed and may be different in future modelling.

MODERATE POPULATION GROWTH ASSUMPTIONS USED TO ESTIMATE PER CAPITA VALUES



MACROECONOMIC MODELS ARE USEFUL FOR ESTIMATING POLICY IMPACTS



“To forecast the impacts of our climate actions, B.C. follows well-established best practices, using the best available data and sophisticated computer modeling.” p.21

Modelling CleanBC: 2022 Methodology Report

Understanding the macroeconomic impacts of policy

As a full macroeconomic model (specifically, a CGE model), gTech provides insight about how policies affect the economy at large. The key macroeconomic dynamics captured by gTech are summarised in Table 6.

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The uncertainties in modelling mean that all models will err in their forecasts of the future. However, some models are more correct than others. The analysis of CleanBC employs highly sophisticated models that provide powerful insights into the effects of the plan. Further, at a future date, the uncertainties inherent in the forecast could be examined in much greater detail.

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Emission reductions and other policy impacts are calculated relative to a reference scenario representing business-as-usual with only policies announced as of July 2017. Policies are grouped and simulated as packages to quantify total reductions, accounting for potential interaction or overlapping of individual policies.

Table 6: Macroeconomic dynamics captured by gTech

Dynamic	Description
Comprehensive coverage of economic activity	gTech accounts for all economic activity in BC as measured by Statistics Canada national accounts ³⁰ . Specifically, it captures all sector activity, all GDP, all trade of goods and services and a large number of transactions that occur between households, firms, government, and people/firms outside of BC. As such, the model provides a forecast of how government policy affects many different economic indicators, including GDP, investment, household income, etc.
Full equilibrium dynamics	gTech ensures that all markets in the model return to equilibrium (i.e. that the supply for a good or service is equal to its demand). This means that a decision made in one sector is likely to have ripple effects throughout the entire economy. For example, greater demand for electricity in BC requires greater electricity production in BC. In turn, greater production necessitates greater investment and demand for goods and services from the electricity sector, increasing demand for labour in construction services and finally leading to higher wages.
Sector detail	gTech provides a detailed accounting of sectors in BC. In total, gTech simulates how policies affect over 80 sectors of the economy. Each of these sectors produces a unique good or service (e.g. the natural gas sector produces natural gas, while the services sector produces services) and requires specific inputs into production. Of these inputs, some are not directly related to energy consumption or GHG emissions (e.g. the demand by the natural gas sector for services or labour requirements) but other inputs are classified as “energy end-uses”. Covered energy end-uses (along with sectors and fuels) are listed in Appendix A: “Covered sectors, fuels, end-uses”.

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CLEANBC POLICIES IN THE MODEL

Table 2: Summary of CleanBC policies and their representation in the model

Policy	Description
Multi-sector	
Strengthened carbon tax	<p>The analysis assumes a continued increase of the carbon tax until it reaches \$50/tCO₂e in 2022 and \$170/tCO₂e in 2030. The modelling follows the adjusted COVID-19 carbon price schedule, in which the rate remained constant at \$40/tCO₂e in 2020, rather than increasing to \$45/tCO₂e.</p> <p>Revenue collected from the tax increase is recycled towards general revenue, as well as to fund transfers to households and to achieve additional industrial emissions reductions under the CleanBC Program for Industry, described below.</p>
Strengthened clean electricity mandate	The analysis assumes that by 2030, 100% of electricity produced in BC is required to be clean.
Household fuel PST exemption	From 2019, the modelling assumes that all residential fuels and electricity consumed by commercial and industrial users are exempt from the PST.
BC Hydro's electrification plan	<p>BC Hydro's 2021 electrification plan proposes new programs and incentives to advance the switch from fossil fuels to clean electricity in buildings, vehicles, businesses, and industry. The modelling includes nearly \$160 million to promote electrification in these sectors.</p> <p>Although the BC Hydro plan outlines additional resources for public education and plan implementation, no further funding is modelled because 1) impacts from funding public education are very uncertain, and 2) the BC Hydro plan does not give sufficient details to model the funding of plan implementation.</p>
Natural gas utility GHG reduction standard	From 2030, allowed annual emissions from the combustion of natural gas and propane by utility building and industry customers (excluding transportation, LNG and upstream oil and gas) is capped at 6.0 MtCO ₂ e.
Federal climate funding	The modelling includes funding for various federal climate initiatives announced in plans such as "A Healthy Environment and a Healthy Economy" and the "2030 Emissions Reduction Plan".

Industry	
CleanBC Industrial Incentive Program (CIIP)	The analysis assumes that an additional incentive is provided for industrial large final emitters to reduce GHG emissions by returning an increasing portion of carbon tax revenue above \$30/tCO ₂ e to facilities that reduce their emissions relative to a world-leading emissions intensity benchmark.
CleanBC Industry Fund (CIF)	The CIF provides funding to support the adoption of low-carbon technologies by businesses covered by the CIIP. The modelling assumes a portion of carbon tax paid above \$30/tCO ₂ e by industrial large final emitters is invested in low-carbon technologies.
Industrial electrification	The analysis assumes increased electricity consumption in the upstream natural gas sector. The modelling implicitly includes the connection to the DCAT and PRES transmission lines.
Oil and gas sector methane regulations	The analysis assumes that all oil and gas facilities adopt technologies in keeping with regulated best practices for reducing methane venting and leaks by 45% in 2025 and 75% in 2030.
Oil and gas sectoral target	The modeling requires that the oil and gas sector reduces its emissions by 33% from 2007 by 2030.

CLEANBC POLICIES IN THE MODEL

Transport	
Light-duty ZEV sales mandate	The modelling assumes that a fraction of new light-duty vehicles sold in BC are low to zero-emissions, requiring 26% zero-emissions vehicle sales by 2026, and 90% by 2030.
Heavy-duty ZEV sales mandate	The analysis requires that by 2030 44% of on-road heavy-duty and 23% of medium-duty vehicles sold in BC are zero-emissions. The modelling assumes 60% of these vehicles are battery electric and 40% are hydrogen fuel cell.
Heavy-duty ZEV stock mandate	The modeling requires that from 2030 onwards, 19% of on-road heavy-duty vehicles in use are zero-emissions. The modelling assumes 60% of these vehicles are battery electric and 40% are hydrogen fuel-cell.
Zero-emissions bus mandate	The analysis requires 100% of new buses sold be zero-emissions by 2029, with 41% of buses in use zero-emissions by 2030. The modelling assumes 60% of these ZEVs are battery electric and 40% are hydrogen fuel cell.
Strengthened ZEV incentives	The analysis assumes provincial incentives for the purchase of low- to zero- emissions vehicles of \$52 million in 2019, \$25 million in 2020, and \$93 million per year beginning in 2021. Additionally, the modelling includes the Federal iZEV incentive program targeting low- to zero-emissions vehicles.
Strengthened Low-Carbon Fuel Standard (LCFS)	The analysis assumes that on average fuel suppliers reduce the life-cycle emissions intensity of transport fuel pools by 18.3% in 2025, and 30% in 2030 from 2010 levels. Aviation and marine fuels receive an additional separate requirement to reduce life-cycle emissions intensity by 0.5% by 2025 and 5.0% by 2030 from 2010 levels.
Strengthened light-duty vehicle emissions standards	The analysis assumes that tailpipe emissions standards for new light-duty vehicles sold are strengthened such that the emissions intensity of new light-duty vehicles sold in Canada declines to 119 grams per kilometer in 2025 and 107 grams per kilometer in 2030.

Strengthened heavy-duty vehicle emissions standards	The analysis assumes that new medium- and heavy-duty vehicles sold in Canada must meet seller fleet-wide GHG emissions standards. The standards are modelled as a reduction in the average emissions intensity of medium- and heavy-duty vehicles of 20% by 2025 and 24% by 2030, relative to 2015.
Light-duty vehicle travel reduction	The analysis requires total vehicle kilometers travelled to decline by 25% by 2030, relative to 2020 levels. Policies able to achieve this reduction are in development. The aim of these policies is to increase walking, cycling, and transit use.
Freight energy intensity reduction	The analysis requires the emissions intensity of freight (in tCO ₂ e/tkm) to be reduced 10% by 2030 relative to 2020 levels. Policies able to achieve this reduction are in development.

Buildings and communities

Strengthened BC Building Code	The analysis assumes that starting in 2030, all new buildings are required to meet zero-emissions standards.
Heating equipment standards	The analysis assumes that starting in 2030, new space and water heating equipment must be supplied by heat pumps or electric resistance.
Building retrofit code	Requires the improvement of heat load demand when buildings are retrofit. This policy is currently under development by the BC government
Building incentives	The analysis includes the provincial Better Homes and Better Buildings incentives.
Organic waste diversion	The analysis assumes an increase of the organic waste diversion rate from municipal, agricultural, and industrial solid waste to 95% by 2025.