



THE UNIVERSITY OF BRITISH COLUMBIA

# Long-Term Carbon and Commodity Price Forecast Report – Executive Summary

UBC Energy & Water Services

Joshua Wauthy

Jeff Giffin

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## Reviewers

The internal review of this report was conducted by UBC Energy and Water Services

The external review of this report was coordinated and funded by UBC Sustainability, and independently reviewed by the following third parties:

*Mark Jaccard (Professor, Simon Fraser University & President, MK Jaccard and Associates)*

*Brian McCloy (President, BW McCloy & Associates)*

*Trent Berry & Will Cleveland (Principals, Reshape Strategies)*

## Statement of Limitations

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# EXECUTIVE SUMMARY

## Background and Objectives

UBC is recognized globally for its 2010 Climate Action Plan's aggressive GHG reduction targets, a:

- 33% reduction below the 2007 GHG levels by 2015
- 67% reduction below the 2007 GHG levels by 2020
- 100% reduction below the 2007 GHG levels by 2050

Under the plan, UBC Vancouver achieved its 33 per cent reduction target in GHG emissions in 2016, despite a 16 per cent increase in building floor space and a 23 per cent increase in student enrolment. Building upon UBC's GHG reduction success, the 2020 Climate Action Plan (CAP2020) is under development and has identified two energy supply side greenhouse gas (GHG) reduction options which require further analysis:

- Option 1 proposes to run the Campus Energy Centre's (CEC) boilers on carbon neutral Renewable Natural Gas (RNG) to displace the use of conventional fossil-based natural gas.
- Option 2 proposes the addition of a 12 MW capacity biomass boiler to the current Bioenergy Research and Demonstration Facility (BRDF).

The objective of this study is to provide CAP2020 long-term forecasts and insight into the availability and pricing of biomass and renewable natural gas (RNG) relative to that of electricity and natural gas, including a review of carbon pricing policy and trends. The results from this study are intended to inform the modelling assumptions and sensitivities of the energy supply options' business cases to determine if there is a preferred direction that supports broader policy objectives of the University, toward achieving the 67 percent reduction in GHGs below 2007 levels.

## Methodology and Assumptions

This report presents the long-term pricing forecast for carbon, biomass, natural gas, renewable natural gas and electricity for the 2018-2035 period.

Pricing is developed from a UBC Vancouver site context, meaning that carbon pricing includes both carbon tax and carbon offsets, biomass pricing considers UBC's location and current supply contract, natural gas is based on Fortis Rate 22, electricity is based on Rate 1827 transmission service, and the starting point of all forecasts are based on historical actuals for UBC Vancouver.

Commodity forecasts were developed based upon a:

- Review of current and historical energy price trends in British Columbia
- Literature review of federal, provincial, utility, and regulatory policies, plans, and documentation as well as other carbon and energy pricing studies and forecasts.
- Survey of present-day and future regional demand for biomass and its suppliers.
- Peer review by third parties to provide an independent opinion of the study's assumptions and reasonableness of results.

For each commodity, an expected scenario forecast was developed alongside an upper bound scenario and a lower bound scenario with the following summarized assumptions:

<b>All Scenarios</b>	<ul style="list-style-type: none"> <li>• UBC Vancouver Campus site and rate structures</li> <li>• Inflation rate of 2.0% across all years</li> <li>• Exchange rate of 85 cents US to 1 dollar Canadian commodity</li> <li>• Forecast period of 2018-2035</li> </ul>		
	<b>Lower Bound Scenario</b>	<b>Expected Scenario</b>	<b>Upper Bound Scenario</b>
<b>Carbon Tax</b>	<ul style="list-style-type: none"> <li>• Reversal of the Federal Government’s Pan-Canadian Framework</li> <li>• No reversal of Provincially legislated carbon tax</li> <li>• Remains at \$30/tCO<sub>2</sub></li> </ul>	<ul style="list-style-type: none"> <li>• Federal Government’s Pan-Canadian Framework on Clean Growth and Climate Change</li> <li>• Increase tax by \$10/tCO<sub>2</sub> in 2021 and 2022 to \$50/tCO<sub>2</sub></li> </ul>	<ul style="list-style-type: none"> <li>• Pricing to limit warming to &lt;2°C</li> <li>• CLT’s recommendations to achieve BC’s climate targets</li> <li>• Starting in 2018, increase by \$10/tCO<sub>2</sub> each year to 2035</li> </ul>
<b>Carbon Offset</b>	<ul style="list-style-type: none"> <li>• No reversal of Provincially legislated carbon offset</li> <li>• Remains at \$25/tCO<sub>2</sub></li> </ul>	<ul style="list-style-type: none"> <li>• Fuel Switching &amp; Energy Efficiency Projects become larger share of offset portfolio projects</li> <li>• Offset increases by 2%</li> </ul>	<ul style="list-style-type: none"> <li>• Increase demand for offset projects for GGIRCA and ICAO’s CORSIA compliance</li> <li>• Offset increases by 4%</li> </ul>
<b>Biomass</b>	<ul style="list-style-type: none"> <li>• Low end of quoted price from aggregator.</li> <li>• \$50/BDT hog fuel increasing 5% every 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• High end of quoted price from aggregator.</li> <li>• \$55/BDT hog fuel increasing 5% every 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• High quality wood waste UBC currently receives.</li> <li>• \$71/BDT hog fuel increasing 5% every 5 years</li> </ul>
<b>Natural Gas</b>	<ul style="list-style-type: none"> <li>• Combined Sproule Forecast for Sumas &amp; Station 2</li> </ul>	<ul style="list-style-type: none"> <li>• Historical Average</li> </ul>	<ul style="list-style-type: none"> <li>• EIA Forecast for Henry Hub</li> </ul>
<b>RNG</b>	<ul style="list-style-type: none"> <li>• BERC rate structure following gas and carbon lower bound. Contract entered in 2020 and 2030</li> </ul>	<ul style="list-style-type: none"> <li>• BERC rate structure following gas and carbon expected. Contract entered in 2020 and 2030</li> </ul>	<ul style="list-style-type: none"> <li>• BERC rate structure following gas and carbon upper bound. Contract entered in 2020 and 2030</li> </ul>
<b>Electrical</b>	<ul style="list-style-type: none"> <li>• Capped and Targeted increases with inflation after 2024</li> </ul>	<ul style="list-style-type: none"> <li>• Capped rates and then 4.2% annual rate increases from FY2020 - 2035</li> </ul>	<ul style="list-style-type: none"> <li>• Capped rates and then 5.3% annual rate increases every year up until 2035</li> <li>• Rate rider increases by 2.5% in FY 2020</li> </ul>

Table 1: Summary of Forecast Assumptions

## Summary of Results

The results for the expected scenario for all commodities alongside their lower and upper bounds are shown below.

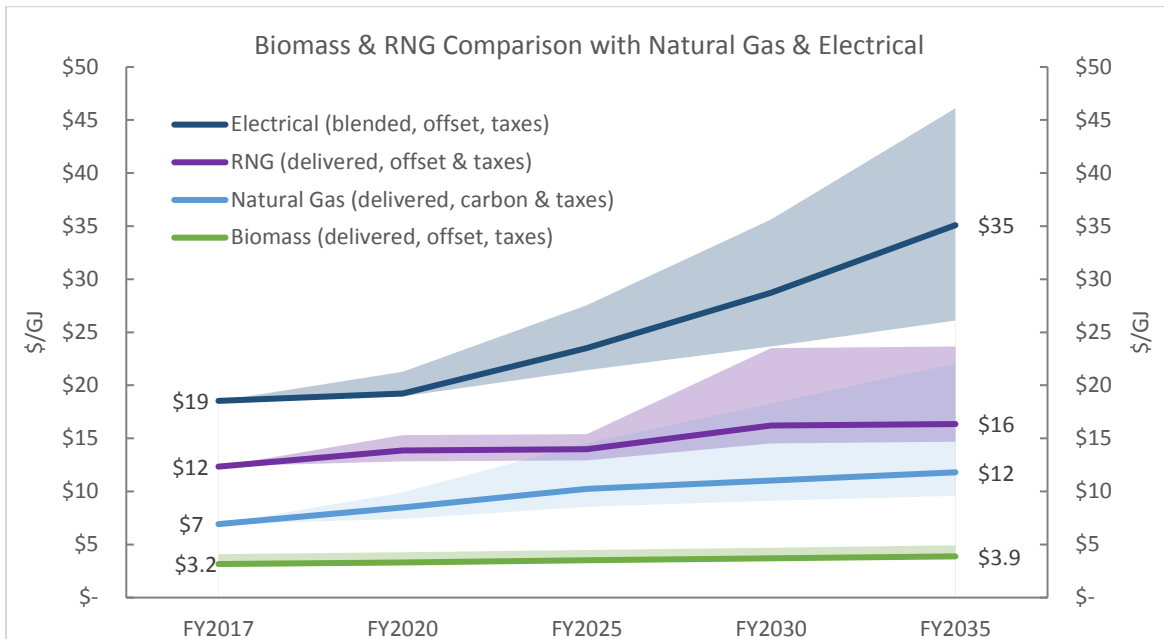


Figure 1: Commodity Forecasts with Upper & Lower Certainty Bounds

The results indicate that there is relative certainty and stability in the price of biomass when compared to the other commodities. This is largely due to the large surplus of wood waste in the region, even when taking into account several new biomass plants across the region, as well as the ability of entering into long term biomass supply contracts, as per UBC's current experience.

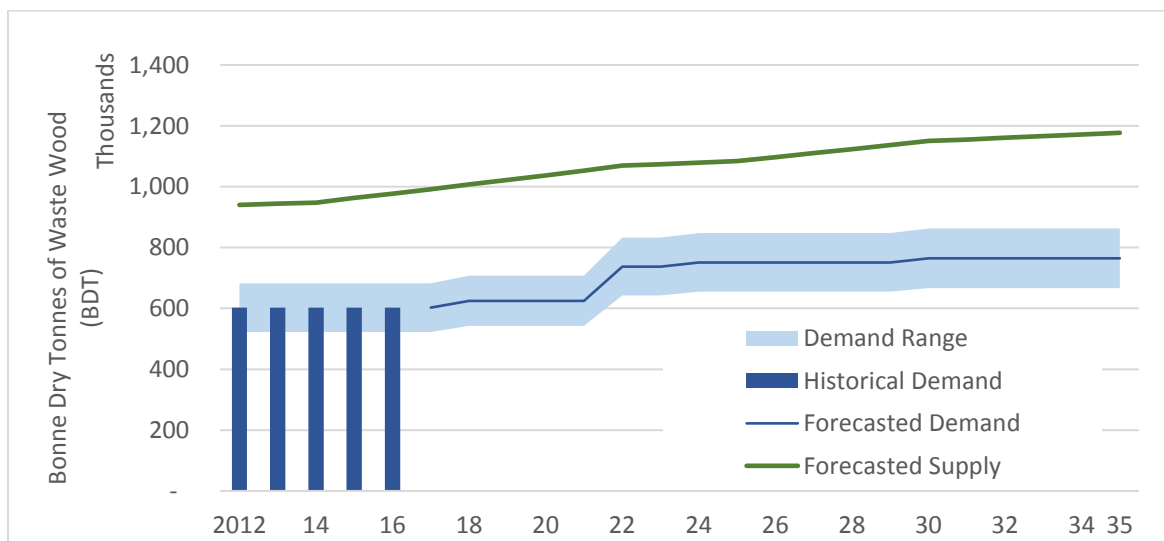


Figure 2: Regional Wood Waste Availability & Demand

Short term electrical pricing is also fairly certain as part of the BCUC’s capped rates, however beyond 2020 the uncertainty bounds widen due to BC Hydro’s growing deferral accounts and debt, viability of projects such as Site C, countered by provincial government interventions.

Natural gas, on the other hand, has historical seen great variability in pricing from local and global influences. The largest future influence, however, is likely to be carbon policies, either through a direct carbon tax or indirect clean fuel standards and taxes on fugitive emissions. RNG is pegged to the price of natural gas and the carbon tax, and so would also be influenced by carbon tax increases as shown in its variability in the upper bound scenario.

In recent years there is growing support at provincial, federal and global levels for increasing carbon pricing. Current levels are likely to increase due to upcoming federal policies and are unlikely to decrease from UBC’s current \$55/tCO<sub>2</sub>.

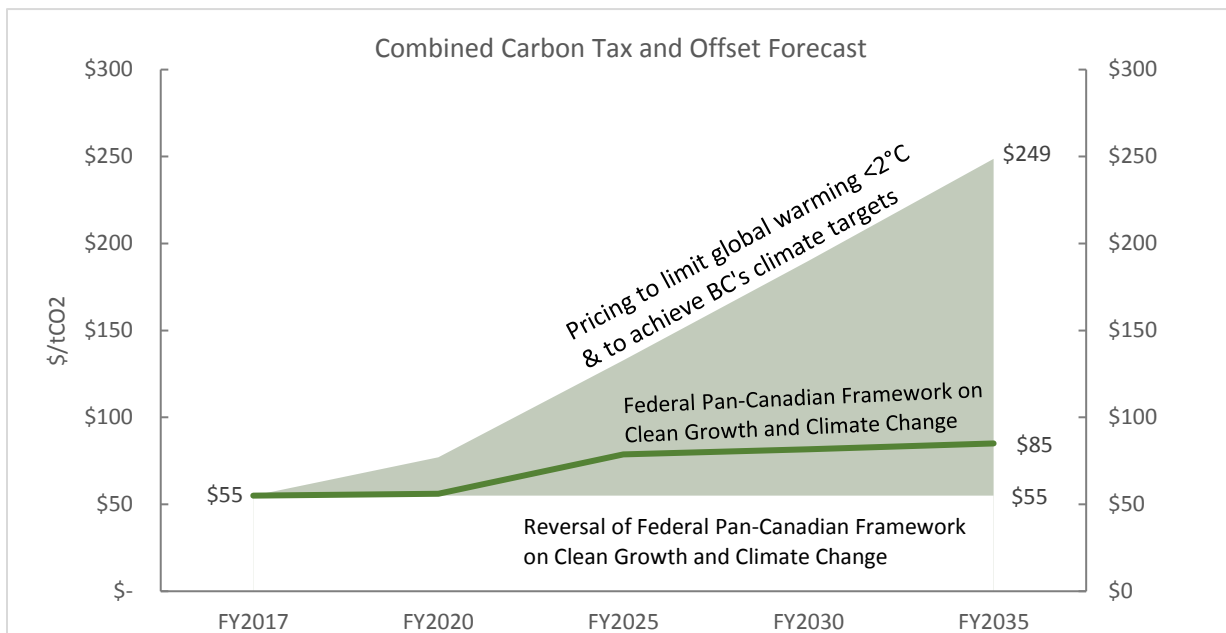


Figure 3: Carbon Tax & Offset Forecast Scenarios

The direct costs of carbon from each scenario for all commodities from 2018-2035 are shown below. UBC pays carbon offsets on all four of the commodities but carbon taxes only on natural gas.

	Emission Factor kgCO <sub>2</sub> e/GJ	Lower Bound \$/GJ	Expected Scenario \$/GJ	Upper Bound \$/GJ
Natural Gas	49.87	2.75	2.79-4.24	3.84-12.42
RNG	0.29	<0.01	0.01	0.01
Wood Fuel	2.24	<0.06	0.08	0.11
Electricity	2.964	0.07	0.10	0.15

Figure 4: Carbon emission factors and carbon costs by scenario