Alternative Generation Proposal by Enviva and Albioma for 47MW of Biomass Generating Capacity

Submitted to the Regulatory Authority of Bermuda

Supplementary Response to the Consultation Document:

Comments on Integrated Resource Plan Proposal Consultation

08 August 2018

Contents Pages

Executive Summary

Further to the Regulatory Authority of Bermuda's (the 'RAB') extension of the Integrated Resource Plan (the 'IRP') proposal consultation to the 17 August and the issue by the RAB of 'Guidelines for Alternative Generation Proposals' on 22 June 2018, this is a *supplementary response* (to that already submitted to the RAB by Enviva and Albioma on 22 June) and provides an 'Alternative Generation Proposal' for 47MW of biomass based generating capacity.

This alternative generation proposal:

- *Is forecasted to deliver a lower 'Levelized Cost of Electricity' (LCOE) and lower per annum electricity costs than any of BELCO's generation scenarios, including its 'least cost' Scenario 3 (natural gas)*.

- *Is consistent with the purposes of the Electricity Act 2016 and is submitted by entities that have experience of deploying and utilising biomass electricity generation.*

This proposal also offers the following strategic advantages to Bermuda:

(i) To have a combination of the leading biomass fuel provider (Enviva) and an entity that can build and operate a biomass energy plant (Albioma), provides significant strategic benefits to Bermuda. One of the key sensitivities in BELCO's own forecasts of the cost of electricity is the cost of fuel. The strategic combination of Enviva and Albioma provides a solution to fuel price volatility.

(ii) The statement in the national electricity policy with regards to the importance of independent power producers (IPPs) to Bermuda suggests this is clearly a national priority. Enabling diversity away from exclusive reliance on BELCO for the generation of electricity is critical for an island such as Bermuda, particularly given such diversity would bring supply security, along with economic, environmental, and technological advantages.

In addition, we note the following:

- *Both the European Union and the US Environment Protection Agency have recognised biomass as a renewable fuel source. This is a key, positive, differentiator against BELCO's proposed generation scenarios, utilising natural gas and fuel oil*.

- There is no certainty that natural gas will be an approved fuel for use in Bermuda. If it is not, *the predicted lower LCOE by this proposal would be likely to deliver even greater benefits when compared to BELCO's higher cost generation scenarios (1,2 and 4 of the IRP proposal)*.

- *There are significant advantages to biomass electricity generation that relate to: (i) the predicted lower cost of infrastructure to import biomass fuel, (ii) lower emissions than fuel oil and natural gas, (iii) biomass-based generation provides secure 'baseload' electricity supply, and (iv) the potential longer term use of biomass sourced in Bermuda*.

We believe that this alternative generation proposal has clear cost and environmental benefits *that should necessitate a significant biomass sourced baseload generating capacity (of 47 MW), assumed to commence operations in 2020, be included in the final IRP approved by the RAB.*

Background to this alternative generation proposal

Enviva and Albioma have already submitted a response (on 22 June) to the RAB consultation on the IRP proposal. On 9 July, the RAB informed Enviva and Albioma that there had been an extension to the original 2 July response deadline, to 17 August. Furthermore, it was noted that the RAB issued 'Guidelines for Alternative Generation Proposals' on 22 June.

This supplementary response is an 'Alternative Generation Proposal' for consideration by the RAB. Enviva and Albioma's initial response provided a detailed assessment of the methodological and data deficiencies in the IRP proposal (including BELCO's evaluation of a Biomass IPP), along with recommendations as to how they could be remedied. We reiterate that *it is critical that the RAB address those issues to ensure a fair and equitable approach to considering alternative generation proposals versus those provided by BELCO.*

Structure of the alternative generation proposal

In the 'Guidelines for alternative generation proposals', issued on 22 June, the RAB identifies some inputs it expects to be included in proposals, namely:

(i) Data on capital, operating and fuel cost of future generation technical, and other operating characteristics, and expected retirement dates;
(ii) Assumptions on future macroeconomic performance (e.g. growth) and government policy;
(iii) Technical and operational characteristics of future generation technologies and their availability;
(iv) The price of input fuels and other related commodities, as well at the availability and price considerations of import infrastructure;
(v) Costs related to network infrastructure upgrades (if required);
(vi) Sensitivity analysis of possible 'high' and 'low' cases along with base case scenarios for each source of uncertainty. These scenarios would be expected to be targeted at the assumptions that have the greatest impact on overall system costs.

Para 2.1: Guidelines for alternative generation – RAB 22 June 2018

In this alternative generation proposal, we address those of the six areas identified above that are applicable, as follows:

- *Part A* provides a summary output of the financial and business plan models developed by Enviva and Albioma. This includes a direct comparison of outputs to BELCO's generating scenarios, as well as BELCO's evaluation of a biomass based IPP.
- *Part B* provides background information on Enviva and Albioma, as well as information on biomass fuel and technology.
- *Part C* explains the basis of the 'renewable' validation for biomass fuel.
- *Part D* provides explanation, by Enviva and Albioma, of their approach to various macro-economic issues that relate to the alternative generation proposal.
- *Part E* provides a summary of the reasons why biomass electricity generation should be included in the final IRP approved by the RAB.

PART A: COST OF ELECTRICITY - OUTPUT OF THE FINANCIAL AND BUSINESS PLAN

A1 Scenarios and related sensitivities

This proposal utilises two scenarios (A and B) for modelling and predicting the costs of a biomass generating capacity (an independent power producer - 'IPP') of 47 MW in Bermuda. The utilisation of two scenarios allows for the identification and assessment of:

- sensitivity to the LCOE when applying BELCO's IRP proposal assumptions and methodology,

  and

- sensitivity to potential variations in cost inputs.

Scenario A

Scenario A follows BELCO's approach to cost allocation, methodology and data as they are included in its proposed scenarios for bulk generation. In particular, in this scenario, we have focused on several key determining aspects of BELCO's approach:

(i) Costs relating to both a lack of accounting separation and a lack of clarity on cost allocation by BELCO

In its 22 June response to the RAB, we noted various methodological and data deficiencies in the BELCO IRP proposal. In particular, in the absence of regulatory accounting separation being applied to BELCO it was impossible to determine the extent to which BELCO's allocation of costs to its generating activities was fair and non-discriminatory i.e. that full and relevant costs were being allocated to BELCO's bulk generation activities, to ensure that its proposed cost scenarios were not artificially low. On this point, we note the following:

- *Land costs*

  There are no 'land costs' allocated by BELCO to the bulk generation licensee, nor to the generating activities of the same. Under accounting separation, it would be expected that a lease charge of some form would be charged by BELCO Group to the bulk generation licensee.

- *Allocation of relevant BELCO legacy costs to bulk generation*

  There appear to be no allocations of relevant legacy BELCO costs to bulk generation. These may include a portion of BELCO's legacy and current pension costs, as well as land clearance and clean-up costs such as from prior generation plant. Accordingly, land clearance costs have been excluded by Enviva and Albioma.

(ii) Failure by BELCO to file proposed grid interconnect costs as per condition 18 of the TD&R license

As we understand it, BELCO has failed to meet its obligation (under condition 18 of its Transmission, Distribution and Retail (TD&R) license) to file the proposed basis of grid interconnect charges and costs. It appears that the RAB has not pursued BELCO for the same. Without this information, proposed alternative generation scenarios cannot include any potential grid interconnect costs in their cost of electricity forecasts. Moreover, BELCO appears not to have included such grid interconnect costs in its own generation scenarios (not even, it would appear, in Scenario 4, which includes a potential new site for LPG-based generation).

(iii) Inflation

As our response of 22 June explains, BELCO's approach to assuming zero percent GDP growth for the period of the IRP lacks credibility (as well as substantiation) and needs to be remedied by the RAB (see further explanation in Part D of this document). For the purposes of our Scenario A, BELCO's apparent assumption of 2% inflation is used as an escalator for relevant costs.

Scenario B

In Scenario B, we address the apparent deficiencies outlined above by including:

(i) potential grid interconnect costs,

(ii) land development and permit costs, and

(iii) a forecasted inflation rate of 1.7% (see Section D1).

A2 Approach to the RAB's different applicable periods

The RAB has asked for alternative generation proposals to be submitted as part of the IRP proposal consultation process. In terms of the period relative to alternative generation proposals and the IRP proposal, we note the following:

(i) That the relevant period for alternative generation proposals as specified in the RAB consultation document of 2 May 2018 is three years, apparently from the date of the consultation document.

(ii) That the RAB Notice of 17 November 2017 requested BELCO to submit an IRP proposal that '*covers a period of three years from the date that the Authority approves the IRP*'.

(iii) That in the 'Integrated Resource Plan Guidelines' issued via the RAB notice of 15 December 2018, the RAB specifies a planning horizon of 20 years (para 3.4).

(iv) That the IRP proposal submitted by BELCO in February 2018 provides cost of electricity scenarios for a 'study period' of 20 years with the start year being 2018. BELCO provided no proposal for a three year period.

There is clearly an inconsistency between (i) and (ii) above. Furthermore, given (iv), it appears that the BELCO IRP proposal has failed to address the RAB requirement for a three-year period and has exclusively focused on a 20-year planning horizon and related scenarios.

In the context of the above, Enviva and Albioma have made the following working assumptions regarding the necessary output from its own cost of electricity modelling and forecasting:

a) That there is a 20-year period for the projected cost of electricity forecasts for both Scenario A and B. [Enviva and Albioma typically assess Biomass IPP projects over a 30-year planning horizon].

b) Given that Enviva and Albioma envisage that it would take at least 18 months to establish operating capacity in Bermuda, it has used BELCO's projected cost of electricity for the period prior to commencement of biomass generation capability, i.e. for the years 2018 and 2019.

A3 Biomass cost of electricity: Scenarios A and B

In its IRP proposal, BELCO utilises a LCOE methodology. The discount rate used by BELCO for the calculation of its LCOE is not clearly defined. We have estimated the assumed rate (by BELCO) to be 8% and have chosen the same value for their calculation.

We have also incorporated in our LCOE calculation the advantage of the reduction of the CO_2 emissions brought by the use of wood pellets instead of LNG (0,3 tCO_2/MWh). The values of Assumed Carbon Pricing used for these calculations are from the "Base Case" used by BELCO in its IRP.

We provide both the LCOE and the predicted per annum cost of electricity for a biomass generating capability in both scenarios for a 20-year period starting in 2018 (as utilised by BELCO).

Appendix 1 provides the high-level spreadsheets. This section provides the summary data. Taking each scenario in turn:

Scenario A – Cost of electricity via 47MW Biomass generating capability

Scenario A	Based on 20 year 'study' period as per BELCO IRP proposal
Levelized cost of electricity (LCOE) in USD/MWh	165.2

Predicted cost of electricity (MWh) per annum (without CO_2 effect)

Scenario A (commencing year 2018)

18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
140.7	135.5	157.1	160.2	163.5	166.7	170.1	173.5	176.9	180.5	184.1	187.8	191.5	195.3	199.2	203.2	207.3	211.4	215.7	220.0

Scenario B – Cost of electricity via 47MW Biomass generating capability

Scenario B	Based on 20 year 'Study' period as per BELCO IRP proposal
Levelized cost of electricity (LCOE) in USD/MWh	164.3

Predicted cost of electricity (MWh) per annum (without CO2 effect)

Scenario B (commencing year 2018)

18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
140.7	135.5	159.3	162.0	164.8	167.6	170.4	173.3	176.2	179.2	182.3	185.4	188.5	191.7	195.0	198.3	201.7	205.1	208.6	212.2

Comparison of biomass alternative generation proposal output and BELCO evaluation of biomass IPP

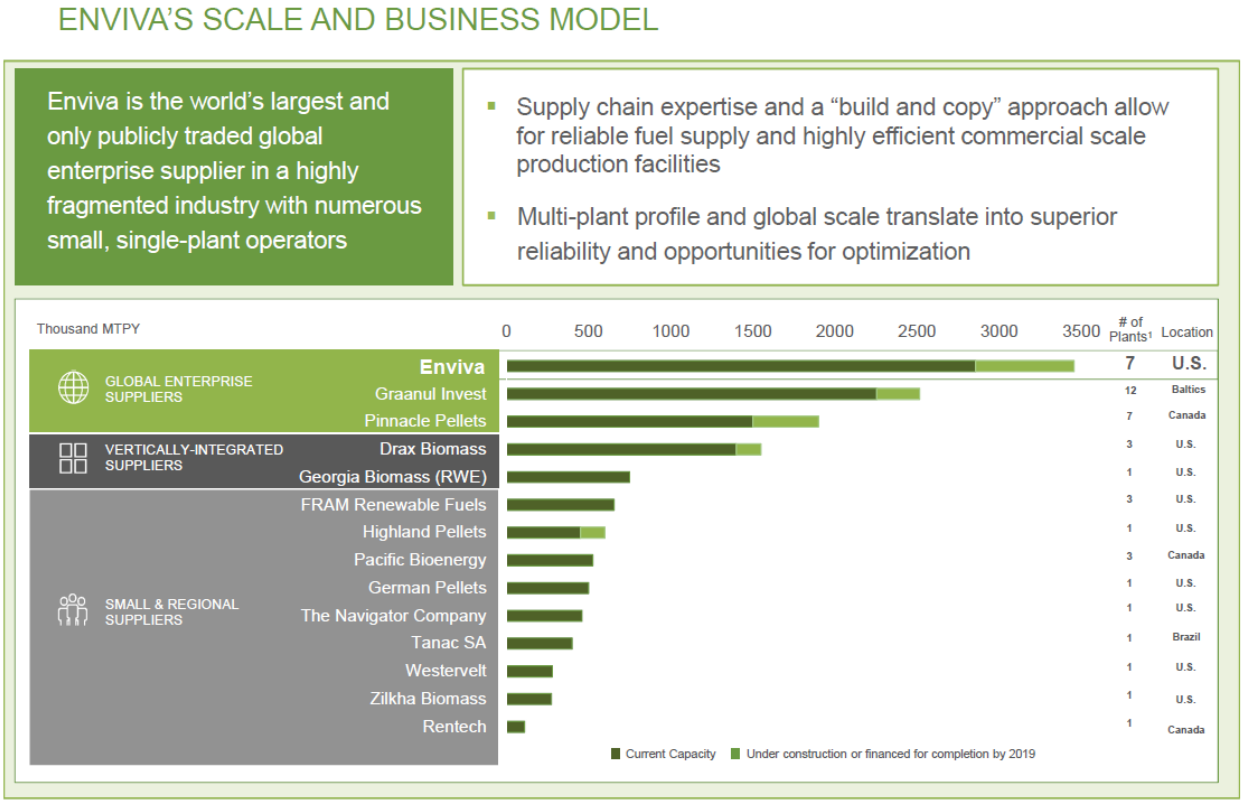
	Biomass Scenario A	Biomass Scenario B	BELCO – IRP proposal biomass evaluation
Capital cost (USD/MW)	2,600	2,700	4,900
Fixed O&M annual cost (USD/MW)	126	126	220
Variable O&M annual cost (USD/MWh)	5.00	5.00	4.25
Heat rate for biomass steam boiler (Btu/kWh)	11,600	11,600	15,000
Capacity factor	90%	90%	89%
Biomass fuel cost (USD/ MMBtu)	9.1	9.1	12.0

PART B: INFORMATION ON INVESTOR PROFILE, FUEL, CAPITAL AND TECHNOLOGY

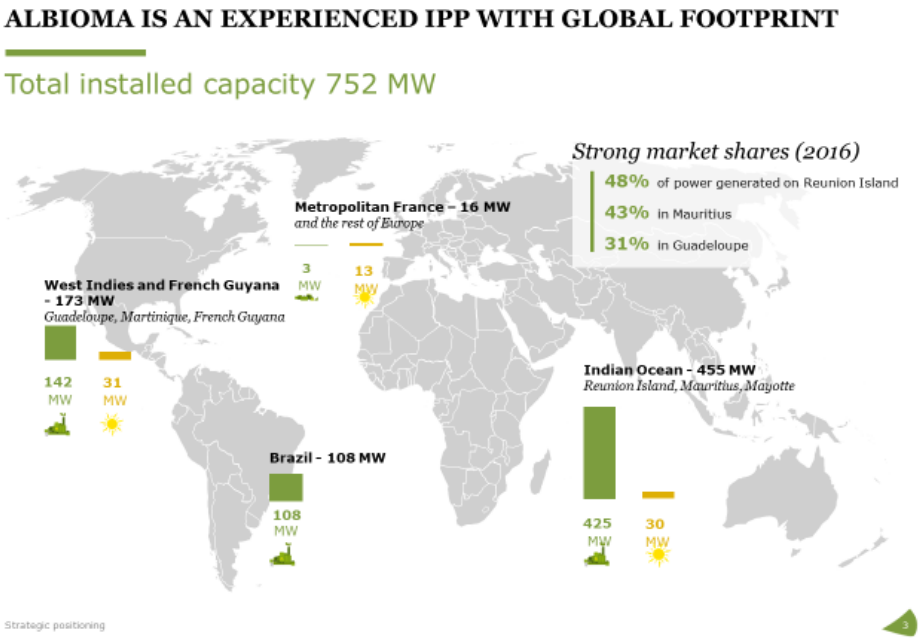
B1 Biomass IPP investor profile

Both Enviva and Albioma are active participants and investors in the global energy sector. They have strong credentials in the provision of fuel for electricity generation (Enviva) and the financing, building and operation of energy plants (Albioma).

Enviva has grown to become the largest supplier of biomass to the global utility industry including to the EU, UK, Caribbean, and Asia. Enviva is quoted on the NYSE.



Albioma has a strong record of financing, building and operating energy plants, with a focus on biomass, on non-interconnected island grids. Albioma is a Paris Euronext quoted company, which owns and operates several biomass power plants including in Guadeloupe, Mauritius, Re-Union Island, and Martinique.



Key operating statistics for 2017 are :

10 thermal power stations	**480** experts	**752 MW** installed
2.5 M people supplied with electricity	**€403 m** of revenue	**3.6 TWh** of electricity produced
2.3 Mt of recovered bagasse	**€138 m** of EBITDA	**120 kWh/tc** exported the grid in the overseas territories

B2 Access to capital

As listed companies with a wide set of operations and revenue base, both companies have access to finance and capital on competitive and cost-effective terms. Both companies envisage using a mixture of debt and equity to finance the proposed Bermuda biomass IPP. In terms of the type of debt available to the companies this is long term debt (with a maturity of greater than 10 years) at highly competitive rates (see for example hereunder the balance sheet and debt structure from Albioma end of 2017).

A strong balance sheet to finance growth

- Gross debt increased following debt raisings to finance projects currently under construction (Galion 2, TAC Saint-Pierre, IED)
  - Residual life of 11 years
  - Group average interest rate of 4.0% (of which France 3.8% and Brazil 11.9%)
  - 91% of debt covered or at fixed rates
  - Non-recourse project debts other than Brazil debt (€25 m) and projects under construction

(In € millions)	31-Dec-17	31-Dec-16	*Change*
Project debt	622	563	*11%*
Corporate debt	85	85	*0%*
Total gross debt	707	648	*9%*
Cash	(92)	(96)	*-5%*
Guarantee deposits and equivalents	(3)	(3)	*-5%*
Total net debt	613	549	*12%*
Net debt / EBITDA 12 moving months	4.4x	4.2x	
Net debt excluding construction projects / EBITDA 12 moving months	3.4x	3.6x	
Gearing[1]	131%	125%	

Notes
1. Net debt/Equity

B3 Biomass technology

The proposed Power Plant will be split into three identical units, each of 17 MW gross capacity (15.57 MW net capacity supplied to the grid). This configuration allows for the security of supply in Bermuda in case of an accidental trip of one unit.

Each Unit will consist of:

- One high efficiency boiler, with travelling grate (spreader stoker) or fluidized bed combustion mode, producing high pressure and temperature steam. The boilers will be equipped with all flue gas treatment systems required for compliance with European emission norms.
- One condensing turbogenerator.
- One condenser cooled with air in order to avoid the use of water.
- One transformer elevating the voltage outlet generator to the voltage of the Bermudian transmission network.

The Plant will also be equipped with the following installations, common for the three units :

- Fuel and ash handling and storage.
- Fresh water treatment (Desalinization and demineralization of sea water).
- Used water treatment.
- Compressed air production.
- Fire detection and extinction.
- Electrical and control rooms.

The proposed types of equipment are very robust and reliable, and suited for an island location like Bermuda. (It should be noted that Albioma has more than 25 years' experience in designing and operating biomass plants on islands such as Reunion, Mauritius, Martinique, and Guadeloupe).

The life expectancy of the plant is higher than 30 years, and the expected yearly availability (including planned and unplanned maintenance) is 92% (90% utilized in the calculations).

With a rate of call of 95% (base load) and an availability of 90% of the Plant, the biomass needs would be approximately 240 000 metric tons per year.

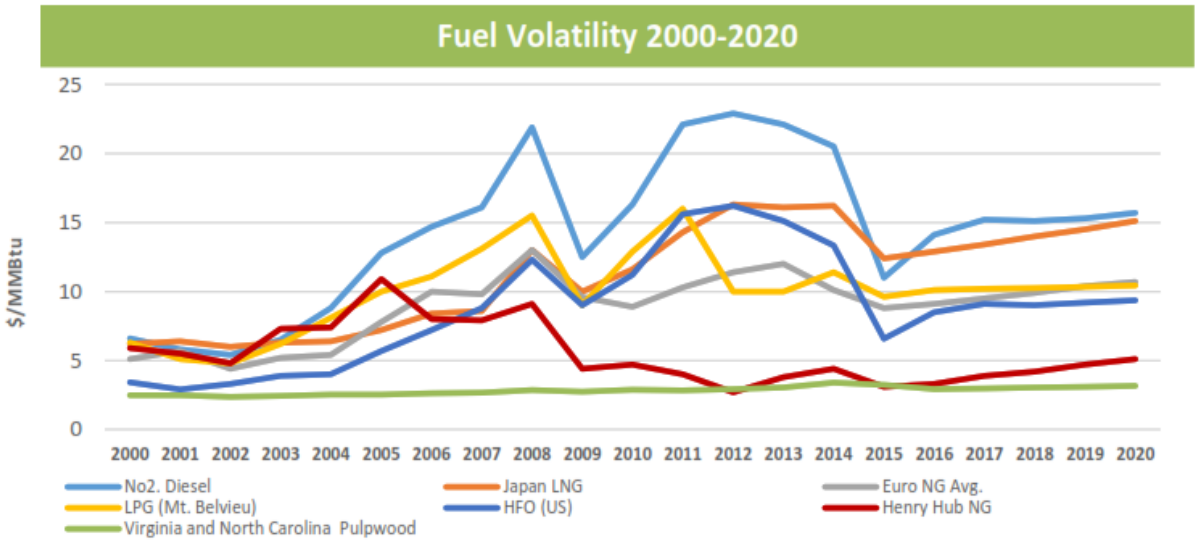
In order to guarantee the safety of the electricity supply in Bermuda, the Plant will be equipped with storage (partially on land and partially on barge) equivalent to one-month consumption, allowing sufficient time for rescheduling the ship transport in case of bad weather conditions (such as hurricanes).

B4 Biomass fuel

The fuel for this project would be sourced from Enviva's supply chain, which is the world's largest. Enviva's state of the art wood fibre sourcing and pellet manufacturing systems are coupled with the industry's most sophisticated port and logistics capabilities, which are all based in the southeast of the United States. This part of the US is one of the world's largest wood supply regions and offers an abundant resource basin with clear legality and sustainability characteristics. The direct connection and proximity of the proposed biomass generating project to the underlying supply chain will ensure unprecedented energy security and reliability for the nation of Bermuda.

Enviva currently owns and operates eight pellet manufacturing plants with the capability of producing over 3,000,000 MT of wood pellets annually. Our expansion continues as we develop additional plants and a fifth port in the Gulf of Mexico. By 2019 we expect to have a production capacity of 4,000,000 MT per year.

Enviva typically enters into long-term fuel supply agreements with its customers that provide guaranties on quality and schedule along with stability on price. Importantly, since the wood feedstock costs in the United States are stable and predictable – and not linked with fossil fuel prices such as oil or natural gas – the volatility associated with conventional fuels can be avoided. The chart below highlights how fossil fuel prices have changed over the past two decades compared to the stable prices of pulpwood in Virginia and North Carolina.



(1) Castalia Strategic Advisors 2016 Study on Viability of LNG in Bermuda, all data except timber
(2) TimberMart-South: Pine Pulpwood and Hardwood Pulpwood from the North Carolina and Virginia fiber baskets, assuming 50:50 hardwood/softwood mix

PART C: BIOMASS AS A RECOGNISED RENEWABLE FUEL

Biomass has rapidly evolved to become a recognised form of renewable fuel in both the US and the European Union. There is a multitude of background information as to the policy and emerging legislative context of biomass fuel in the context of renewable electricity generation. What follows is a short summary.

C1 The European Union

Leading climate experts have recognized sustainably-sourced wood biomass as a carbon-beneficial energy feedstock when used to displace fossil fuels. Accordingly, nations on the forefront of addressing climate change have included biomass in their renewable energy policies. Most recently, the European Union finalized new biomass sustainability criteria for their Renewable Energy Directive (RED II) that will increase the share of renewables in Europe's final energy consumption to 32% in a cost-effective manner by 2030. These sustainability criteria include LULUCF (Land Use, Land Use Change and Forestry) requirements that ensure proper accounting of carbon impacts of forest biomass used for energy. In order to meet the requirements, biomass feedstocks must be sourced from a country that includes the forestry and land use sectors in its reporting under the Paris climate accord, or from a forest supply area where carbon stocks are either stable or increasing over the long term.

All of Enviva's plants are certified under the Sustainable Biomass Partnership ('SBP'), which is the emerging standard for all suppliers in the EU and increasingly around the world. SBP holds all this information on their site [1]. (Enviva may be found via a search on the same web site. All Enviva plants are included with relevant information).

Enviva maintains numerous other sustainability certifications and has a sophisticated sustainability criteria and tracking program in the forest products sector (including the origin via GPS coordinates of tracts). Enviva make all this information publicly available on its website, under the track and trace program[2].

C2 The USA

In the US, the legacy of biomass regulation has mostly been on a state by state basis. However, in April 2018, *the Federal Environment Protection Agency (EPA) released policy guidance that all future woody biomass derived from managed forests would be considered carbon neutral in future regulations.* The EPA guidance and policy is provided in Appendix 2.

C3 Potential long-term use of Bermuda biomass for generating electricity

Albioma has experience of operating Energy plants that utilise locally sourced biomass fuel. There is potential for Bermuda's biomass to be used as fuel for the energy plant. However, this would be subject to liaison with the Government with respect to how such biomass would be sourced, the development of associated facilities, necessary permits, and necessary engineering evaluation etc. As such, this is currently a speculative possibility that has not been included in the forecasted cost of fuel.

[1] https://sbp-cert.org/accreditations-and-certifications/certificate-holders
[2] http://www.envivabiomass.com/sustainability/track-and-trace/

PART D: APPROACH TO MACROECONOMIC ISSUES

D1 The key issues of inflation and economic growth

In our response of 22 June 2018, we noted that, within the IRP proposal, BELCO had included a significantly reduced electricity demand forecast (compared to that in the 2016 BELCO IRP). One of the factors cited by BELCO as a reason for this was the predicted state of the Bermuda economy over the 20-year study period. In particular, BELCO made an assumption that GDP growth for Bermuda would be zero percent for the 20-year period. In our response, we questioned the credibility of such an assumption and also noted the lack of substantiating rationale and analysis from BELCO.

We have already requested that the RAB resolve this issue. In our June response, we recommended that the RAB commission its own analysis of the forecasted GDP for Bermuda and that this be consulted on.

In its guidelines for alternative generation proposals, the RAB asks for views on macro-economic performance and Government policy as part of any proposal. For the purposes of the alternative generation proposal, the following observations are provided.

BELCO's assumption of zero percent real GDP growth

(i) BELCO's apparent approach to inflation – inconsistent with Government data.

BELCO appear (although it is not clearly identified in their IRP proposal) to have assumed a yearly inflation rate of 2% (this appearing to be the inflator for fixed and variable O&M costs). However, CPI statistics provided by the Bermuda Government[3] indicate that CPI has tracked lower than 2% for the last four years (to January 2018)

A COMPARISON OF RATES OF INFLATION (%)
Selected Countries & Bermuda

	2014	2015	2016	2017	Jan 18
Bermuda	2.0	1.5	1.5	1.9	+1.6
United States[1]	0.8	0.7	2.1	2.1	+2.1
Canada[2]	2.0	1.1	1.4	1.6	+1.7
United Kingdom[3]	2.4	1.0	1.8	3.6	+4.0

Sources:
1. US Bureau of Labour Statistics
2. Statistics Canada
3. UK Office of National Statistics

Source - https://www.gov.bm/bermuda-business-statistics - January 2018 CPI Report

Taking the average CPI figure for the years 2014 – 2018 (with the 2014 CPI being for the period from January 2013), this is calculated as 1.7%.

[3] https://www.gov.bm/bermuda-business-statistics

(ii) The effect of 1 Bermuda dollar = 1 US dollar = lower inflation

In the IRP proposal, BELCO provide a very limited statement that there is, in its view, no validity to linking the performance of the Bermuda economy with the US economy. *We assert the converse. The strength of the US dollar clearly has a positive effect on the price of imports into Bermuda. Bermuda is heavily reliant on imports, as indeed are the CPI statistics. The US dollar has strengthened significantly against all major currencies over the last twelve months.*

(iii) Nominal GDP and Government Policy

BELCO do not appear to provide figures for nominal GDP. However, given the BELCO assumption of zero percent real GDP growth, the forecast by BELCO appears to be one of a stagnating economy over 20 years. As per our prior response, it is important that the RAB commission an independent forecast of the Bermuda economy and consult on the same. In the meantime, we note that the Government's budget of February 2018 has various key features, these being:

- Job creation incentives.
- Strategic focus on expanding key sectors of the economy including tourism and finance.
- Re-distributive tax strategy.

Since the 2018 budget, the Government has announced various other initiatives to achieve these aims (creating more optimal conditions for building development, a strategic plan for tourism, fintech etc).

In the context of the observations and commentary above, in general terms, we are more optimistic than BELCO regarding the long term economic prospects of Bermuda and would expect to be able to provide such views at the point at which the RAB consult on a forecast of the Bermuda economy.

D2 BELCO and access to capital

On 21 June 2018, BELCO announced the terms of its financing for debt relating to the replacement of approximately 50% of its generating capacity. Included was the following detail:

'The Financing includes a US $91.4 million, 12-year export finance loan, guaranteed by EKF, Denmark's Export Credit Agency, paying floating interest based on six-month LIBOR, together with a US $16.1 million, 5-year commercial loan paying floating interest based on three-month LIBOR. Both loans are arranged by HSBC Bank Bermuda Limited and HSBC Securities (USA), Inc., and are anticipated to close shortly after signing.

BELCO also entered into an interest rate swap, fixing the above floating rates for these loans'.

Source Ascendant press release 21 June 2018

Consistent with our June response, we point out that this detail would indicate that BELCO's weighted average cost of capital (WACC) is higher than the 8% used by BELCO in its IRP proposal, and should reflect the risks that BELCO faces when seeking to secure debt beyond the current five-year period.

As has already been explained, our proposed working capital base is reflected in the output of scenarios A and B. In general terms, we believe that our own access to capital is more cost effective and competitive than BELCO's.

D3 How this macro-economic analysis is utilised

As has been mentioned in Section A1, scenarios A and B utilise differing rates of inflation. The average rate of inflation for the period 2014 – January 2018 is 1.7%. This is utilised in Scenario B. Scenario A utilises BELCO's apparent assumption of 2.0% inflation.

In terms of GDP, Enviva and Albioma's more optimistic view of the Bermuda economy suggests that the demand for electricity may be greater than BELCO predict in the 2018 IRP proposal. This implies that the demand forecast provided in BELCO's 2016 IRP would be consistent with a more optimistic view of the Bermuda economy. However, this is the limit to our commentary on, and utilisation of, our analysis of the Bermuda economy. As per the recommendation in our response of 22 June, we recommend that the RAB consult independently on what the central GDP forecast (for Bermuda) should be for the IRP, as well as its relationship to the demand for electricity.

PART E: RATIONALE FOR INCLUSION OF 47MW BIOMASS GENERATING CAPACITY WITHIN THE FINAL APPROVED IRP

The RAB consultation document of 2 May states (as per section 42 of the Electricity Act):

'The Alternative Proposal should demonstrate; (i) how its inclusion in the IRP would result in an electricity supply that is more consistent with the purposes of the EA and Ministerial directions; and (ii) how it uses technology that is in commercial operation in another jurisdiction'. *Para 50*

In addition, the purposes of the Bermuda Electricity Act 2016 are specified as:

Purposes of this Act

6 The purposes of this Act include the following, namely, to seek—

(a) to ensure the adequacy, safety, sustainability and reliability of electricity supply in Bermuda so that Bermuda continues to be well positioned to compete in the international business and global tourism markets;

(b) to encourage electricity conservation and the efficient use of electricity;

(c) to promote the use of cleaner energy sources and technologies, including alternative energy sources and renewable energy sources;

(d) to provide sectoral participants and end-users with non-discriminatory interconnection to transmission and distribution systems;

(e) to protect the interests of end-users with respect to prices and affordability, and the adequacy, reliability and quality of electricity service;

(f) to promote economic efficiency and sustainability in the generation, transmission, distribution and sale of electricity.

Electricity Act 2016 - Bermuda

In addition, the following extract is noted with regards to the 'National Electricity Sector Policy of Bermuda' of 2015'*:*

Para 5.4 Independent Power Producers

It is the Government's policy to create an enabling environment for IPPs to introduce competition in bulk generation, help reduce the cost of power in Bermuda, develop new energy sources, and contribute to achieving the other objectives of this Policy. For example, the Government recognises that IPPs may bring unique expertise that can yield high-quality generation using technologies not currently in the electricity matrix, thus promoting energy security and realising more opportunities to reduce local and global emissions. IPPs are entities that provide energy, capacity, and ancillary services (for example storage) for commercial purposes, exclusively to the Electric Utility under long-term contracts that have been secured through the IRP process.

National Electricity Sector Policy of Bermuda 2015

We propose that the inclusion of a 47MW biomass generating capability in the final approved IRP is entirely consistent with the RAB's request to demonstrate both how this proposal represents (i) generating technology already in operation in other jurisdictions, as well as (ii) meeting the purposes of the Electricity Act and the stated aims of the national electricity sector policy. Specifically, the proposed biomass generating capability:

A. is more cost effective than BELCO's proposed generating scenarios (1-4) in its IRP proposal.

B. utilizes renewable fuel (which is recognised as renewable in other global jurisdictions including the US and the European Union). This achieves a major policy objective of the Bermuda Government for electricity to be generated via renewable sources.

C. provides critical 'diversity' of baseload generating capacity/supply on a reliable and secure basis.

D. is being offered and proposed on the basis of companies that have wide experience and credentials in providing both biomass fuel and building, owning and operating biomass energy plants.

E. is being offered and proposed via companies who have access to the required long-term financing needed, with such financing being available on competitive terms.

For all the above reasons the proposed biomass 47MW generating capacity should be included within the final approved IRP. In addition, two further justifications are provided that relate to the strategic advantages for Bermuda of a biomass IPP, as per this proposal:

1. To have a combination of the leading biomass fuel provider (Enviva) and an entity that can build and operate a biomass energy plant (Albioma), provides significant strategic benefits to Bermuda. One of the key sensitivities in BELCO's own forecasts of the cost of electricity is the cost of fuel. The strategic combination of Enviva and Albioma provides a solution to fuel price volatility.

2. The statement in the national electricity policy with regards to the importance of independent power producers (IPPs) to Bermuda suggests this is clearly a national priority. At its simplest level, enabling diversity away from exclusive reliance on BELCO for the generation of electricity is critical for an island such as Bermuda, particularly given such diversity would bring supply security, along with economic, environmental, and technological advantages.

Appendix 1

Scenario A spreadsheets

YEAR			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ENERGY EXPORT		GWh	***351,4***	***351,4***	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**
AMORTIZED CAPITAL COSTS																						
	Debt service Génération	$000			9 827	10 024	10 224	10 429	10 638	10 850	11 067	11 289	11 514	11 745	11 980	12 219	12 464	12 713	12 967	13 226	13 491	13 761
	Debt service T&D	$000			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATING COSTS																						
	Fuel costs	$000			37 077	37 818	38 575	39 346	40 133	40 936	41 755	42 590	43 441	44 310	45 196	46 100	47 022	47 963	48 922	49 901	50 899	51 917
	Variable O&M	$000			1 855	1 892	1 930	1 968	2 008	2 048	2 089	2 130	2 173	2 216	2 261	2 306	2 352	2 399	2 447	2 496	2 546	2 597
	Fixed O&M	$000			6 451	6 580	6 712	6 846	6 983	7 122	7 265	7 410	7 558	7 710	7 864	8 021	8 181	8 345	8 512	8 682	8 856	9 033
Total COSTS		**$000**	***49 453***	***47 623***	**55 210**	**56 314**	**57 440**	**58 589**	**59 761**	**60 956**	**62 175**	**63 419**	**64 687**	**65 981**	**67 301**	**68 647**	**70 019**	**71 420**	**72 848**	**74 305**	**75 791**	**77 307**
		$/MWh	***140,7***	***135,5***	**157,1**	**160,2**	**163,5**	**166,7**	**170,1**	**173,5**	**176,9**	**180,5**	**184,1**	**187,8**	**191,5**	**195,3**	**199,2**	**203,2**	**207,3**	**211,4**	**215,7**	**220,0**

YEAR				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Discount rate	**8,0%**			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Energy export			[GWh/y]	*351,4*	*351,4*	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4
Net Energy sales			[kUSD]	*49 453*	*47 623*	55 210	56 314	57 440	58 589	59 761	60 956	62 175	63 419	64 687	65 981	67 301	68 647	70 019	71 420	72 848	74 305	75 791	77 307
CO2 savings		*2 015*	*USD/t*	*0,00*	*0,00*	*0,00*	*0,00*	*20,00*	*20,75*	*21,50*	*22,25*	*23,00*	*23,75*	*24,50*	*25,25*	*26,00*	*29,00*	*32,00*	*35,00*	*38,00*	*41,00*	*44,00*	*47,00*
		Inflated	*USD/t*	*0,00*	*0,00*	*0,00*	*0,00*	*22,50*	*23,75*	*25,02*	*26,34*	*27,69*	*29,07*	*30,50*	*31,97*	*33,48*	*37,98*	*42,62*	*47,41*	*52,35*	*57,44*	*62,69*	*68,10*
			kUSD/y	-	-	-	-	*- 2 373*	*- 2 503*	*- 2 638*	*- 2 776*	*- 2 919*	*- 3 065*	*- 3 216*	*- 3 371*	*- 3 530*	*- 4 004*	*- 4 493*	*- 4 998*	*- 5 519*	*- 6 056*	*- 6 609*	*- 7 180*
Corrected energy costs			[kUSD]	*49 453*	*47 623*	55 210	56 314	55 068	56 086	57 123	58 180	59 256	60 354	61 471	62 610	63 771	64 643	65 526	66 422	67 330	68 250	69 182	70 127
			615712	49453	44096	47334	44704	40476	38171	35997	33947	32014	30192	28473	26853	25324	23769	22309	20939	19653	18446	17313	16249
			3726	351	325	301	279	258	239	221	205	190	176	163	151	140	129	120	111	103	95	88	81
	LCOE	[USD/MWh]	**165,2**																				

Scenario B spreadsheets

YEAR				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ENERGY EXPORT		**GWh**		***351,4***	***351,4***	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**	**351,4**
AMORTIZED CAPITAL COSTS																							
	Debt service Génération	$000				10 596	10 776	10 960	11 146	11 335	11 528	11 724	11 923	12 126	12 332	12 542	12 755	12 972	13 192	13 417	13 645	13 877	14 113
	Debt service T&D	$000				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATING COSTS																							
	Fuel costs	$000				37 077	37 707	38 348	39 000	39 663	40 337	41 023	41 720	42 430	43 151	43 885	44 631	45 389	46 161	46 946	47 744	48 555	49 381
	Variable O&M	$000				1 855	1 886	1 918	1 951	1 984	2 018	2 052	2 087	2 122	2 158	2 195	2 232	2 270	2 309	2 348	2 388	2 429	2 470
	Fixed O&M	$000				6 451	6 561	6 672	6 786	6 901	7 018	7 138	7 259	7 382	7 508	7 635	7 765	7 897	8 032	8 168	8 307	8 448	8 592
Total COSTS		**$000**		***49 453***	***47 623***	**55 979**	**56 930**	**57 898**	**58 882**	**59 883**	**60 901**	**61 937**	**62 990**	**64 061**	**65 150**	**66 257**	**67 383**	**68 529**	**69 694**	**70 879**	**72 084**	**73 309**	**74 555**
		$/MWh		***140,7***	***135,5***	**159,3**	**162,0**	**164,8**	**167,6**	**170,4**	**173,3**	**176,2**	**179,2**	**182,3**	**185,4**	**188,5**	**191,7**	**195,0**	**198,3**	**201,7**	**205,1**	**208,6**	**212,2**

YEAR				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Discount rate	**8,0%**			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Energy export			[GWh/y]	*351,4*	*351,4*	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4	351,4
Net Energy sales			[kUSD]	*49 453*	*47 623*	55 979	56 930	57 898	58 882	59 883	60 901	61 937	62 990	64 061	65 150	66 257	67 383	68 529	69 694	70 879	72 084	73 309	74 555
CO2 savings		*2 015*	*USD/t*	*0,00*	*0,00*	*0,00*	*0,00*	*20,00*	*20,75*	*21,50*	*22,25*	*23,00*	*23,75*	*24,50*	*25,25*	*26,00*	*29,00*	*32,00*	*35,00*	*38,00*	*41,00*	*44,00*	*47,00*
		Inflated	*USD/t*	*0,00*	*0,00*	*0,00*	*0,00*	*22,50*	*23,75*	*25,02*	*26,34*	*27,69*	*29,07*	*30,50*	*31,97*	*33,48*	*37,98*	*42,62*	*47,41*	*52,35*	*57,44*	*62,69*	*68,10*
			kUSD/y	-	-	-	-	- *2 373*	- *2 503*	- *2 638*	- *2 776*	- *2 919*	- *3 065*	- *3 216*	- *3 371*	- *3 530*	- *4 004*	- *4 493*	- *4 998*	- *5 519*	- *6 056*	- *6 609*	- *7 180*
Corrected energy costs			[kUSD]	*49 453*	*47 623*	55 979	56 930	55 526	56 379	57 245	58 125	59 018	59 924	60 845	61 779	62 727	63 380	64 036	64 696	65 360	66 028	66 700	67 376
			612087	49453	44096	47993	45193	40813	38371	36074	33915	31886	29977	28183	26496	24910	23305	21802	20395	19078	17845	16692	15612
			3726	351	325	301	279	258	239	221	205	190	176	163	151	140	129	120	111	103	95	88	81
	LCOE	[USD/MWh]	**164,3**																				

Appendix 2 – US Environmental Protection Agency and Biomass – April 2018

EPA's Treatment of Biogenic Carbon Dioxide (CO_2) Emissions from Stationary Sources that Use Forest Biomass for Energy Production

Introduction

The use of biomass from managed forests[1] can provide numerous environmental, energy and economic benefits. Specifically, forest biomass use for energy can bolster domestic energy production, provide jobs to rural communities, and promote environmental stewardship by improving soil and water quality, reducing wildfire risk, and helping to ensure our forests continue to remove carbon from the atmosphere.

EPA recognizes the importance of the nation's forest resources and related industries, and the role that biomass can play in renewable energy strategies. These principles are core elements of provisions in the *Consolidated Appropriations Act, 2018*.[2] Those provisions explicitly direct EPA, the Department of Energy and the Department of Agriculture to establish policies that "reflect the carbon-neutrality of forest bioenergy and recognize biomass as a renewable energy source, provided the use of forest biomass for energy production does not cause conversion of forests to non-forest use." Such policies would also be consistent with Executive Order 13783,[3] *Promoting Energy Independence and Economic Growth*, which requires executive agencies to review requirements that may hinder domestic energy production. Furthermore, in response to Executive Order 13777, *Enforcing the Regulatory Reform Agenda*,[4] many forest and forest products industry stakeholders provided comments about uncertainty related to the treatment of forest biomass used for energy in EPA programs. These comments explained that regulatory uncertainty concerning biogenic carbon dioxide (CO_2) emissions from the use of forest biomass for energy has made planning future investments riskier for these industries and forest communities, hindering growth of the U.S. bioeconomy.

To proactively address congressional directives and stakeholder concerns specific to the use of forest biomass for energy, EPA's policy in forthcoming regulatory actions will be to treat biogenic CO_2 emissions resulting from the combustion of biomass from managed forests at stationary sources for energy production as carbon neutral. EPA's ongoing work under the Renewable Fuels Standard (RFS) and Title II will not be impacted by this policy and will continue to be governed by the existing regulatory and statutory process and requirements already in place.[5]

Policy Summary

EPA's rationale and basis for applying this policy is as follows. In treating biogenic CO_2 emissions associated with the use of forest biomass for energy at stationary sources as carbon neutral, the Agency has balanced the Executive Orders and Congressional direction described above with the following considerations:

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[1] 'Managed forest' is a forest subject to the process of planning and implementing practices for stewardship and use of the forest aimed at fulfilling relevant ecological, economic and social functions of the forest (IPCC). Also, in this document, it specifically comprises lands that are currently managed or those that are afforested, to ensure the use of biomass for energy does not result in the conversion of forested lands to non-forest use.

[2] https://www.congress.gov/115/bills/hr1625/BILLS-115hr1625enr.pdf

[3] www.whitehouse.gov/presidential-actions/presidential-executive-order-promoting-energy-independence-economic-growth/

[4] https://www.gpo.gov/fdsys/pkg/FR-2017-06-28/pdf/2017-13551.pdf

[5] https://www.epa.gov/renewable-fuel-standard-program/regulations-and-volume-standards-renewable-fuel-standards

- U.S. forests have been historically and are currently a net sink of carbon; in 2015, the forest sector offset approximately 11.2 percent of gross U.S. greenhouse gas emissions.
- Use of biomass for bioenergy can support the management of U.S. forests and can lead to increased carbon sequestration from U.S. forests over time.
- Draft EPA analysis suggests that use of various biomass feedstocks for energy at stationary sources can result in negligible net contribution to atmospheric concentrations of CO_2 depending on factors related to feedstock characteristics, production and consumption, and alternative uses.
- Use of biomass feedstocks from managed forests for energy at stationary sources can provide multiple environmental benefits, such as pest management, improved water and soil quality, and wildfire risk reduction.
- Use of these biomass feedstocks for energy at stationary sources can provide numerous economic benefits to rural communities, including new jobs and income from forest biomass industry and support of existing tourism and recreation industries in forested areas.
- EPA's technical work on a framework for assessing the net atmospheric contribution of biogenic CO_2 emissions from biomass feedstocks used by stationary sources for energy production, includes an ongoing peer review by EPA's Science Advisory Board (SAB). However, this process has not to date resulted in a workable, applied approach.
- Many forest and forest products industry stakeholders view the lack of a clear EPA policy on the treatment of biogenic CO_2 emissions resulting from the combustion of forest biomass for energy at stationary sources as an impediment to the use of biomass from managed forests for bioenergy purposes, thus frustrating the realization of its expected environmental and economic benefits.

The Agency's approach is a pragmatic one, promoting the environmental and economic benefits of the use of forest biomass for energy at stationary sources, while balancing uncertainty and administrative simplicity when making programmatic decisions.

This statement of agency policy is not a scientific determination and does not revise or amend any scientific determinations that EPA has previously made. Rather, this statement of policy is intended to: 1) provide clear recognition of the benefits of using forest biomass for energy production at stationary sources; and 2) signal the Agency's intent to treat the biogenic CO_2 emissions associated with the use of forest biomass for energy by stationary sources as carbon neutral in future regulatory actions and in various programmatic contexts, in accordance with the Executive Orders and Congressional direction described above.

This statement of agency policy does not represent a final agency action and does not directly address the treatment of biogenic CO_2 emissions at any particular stationary source or in any specific regulatory context or other EPA program such as voluntary programs. Any changes to the current treatment of biogenic CO_2 emissions at a specific entity or in a specific regulatory program or other context will be accomplished through the appropriate mechanisms, including, as necessary, a notice of any proposed rulemaking, the basis for such changes, and an opportunity for public comment.

Technical Summary

Through photosynthesis, plants absorb CO_2 from the atmosphere and add it to their biomass as carbon, a process referred to as sequestration. When plant biomass is harvested or cleared from the land and burned for energy, used as an input to an industrial process, or biodegraded as part of waste treatment processes, the carbon in biomass is released into the atmosphere as CO_2.

EPA tracks all anthropogenic greenhouse gas (GHG) emissions and sequestration, including those resulting from the use of bioenergy, via the *Inventory of U.S. Greenhouse Gas Emissions and Sinks*. Consistent with Intergovernmental Panel on Climate Change (IPCC) methodologies, the Inventory provides a holistic approach to estimating carbon sequestration and GHG emissions at the national level across all sectors. Biogenic CO_2 emissions related to activities affecting terrestrial carbon stocks, such as harvesting trees, are captured within the land-use, land-use change, and forestry sector of the Inventory, even if a portion of those emissions, such as the CO_2 emissions from biomass combustion, ultimately take place at facilities typically associated with a different inventory sector (e.g., the energy sector). [6] This national land sector inventory approach is well suited to track national trends, but it cannot attribute changes in forest carbon stocks to particular activities, such as the use of forest biomass for energy.

The scientific and technical considerations relevant to assessment of the GHG emissions and other land use-related outcomes from biomass use for energy production can be complex, as there are several interrelated biophysical, energy and market systems underpinning biomass production and use. Beginning in 2010, in response to stakeholder comments, [7] EPA sought to advance the technical understanding for assessing the net biogenic CO_2 emissions associated with the use of biomass at stationary sources. In 2011, as part of this process to advance our technical understanding, EPA submitted for peer review with the EPA Science Advisory Board (SAB) a draft technical report[8] presenting considerations for evaluating the biogenic CO_2 emissions associated with biomass use for energy at stationary sources (2011 Draft Framework). The SAB peer review of the 2011 Draft Framework[9] found that it is not scientifically valid to assume that all biogenic feedstocks are carbon neutral, but rather that the net biogenic carbon profile related to the use of biomass feedstocks depends upon factors related to feedstock characteristics, production and consumption, and alternative uses. The SAB also asserted that use of some biomass feedstocks may have minimal net biogenic CO_2 emissions and others may require more analysis.[10] Furthermore, the SAB also acknowledged that in addition to scientific elements, EPA may need to consider the tradeoffs and benefits of different accounting approaches and other practical implementation issues to inform policy choices when

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[6] While included in the reported net carbon sequestration/CO_2 emissions in the land-use sector of the Inventory, the biogenic CO_2 emissions from combustion of biomass for energy are also quantified for informational purposes in the energy sector of the Inventory as a memo item, but are not included in that sector's total to avoid double-counting.

[7] FR Notice [EPA–HQ–OAR–2010–0560; FRL–9175–9], Call for Information: Information on Greenhouse Gas Emissions Associated with Bioenergy and Other Biogenic Sources <https://19january2017snapshot.epa.gov/sites/production/files/2016-08/documents/biogenic_ghg_srcs_cfi_7.15.10_fr.pdf>.

[8] Draft Accounting Framework for Biogenic CO_2 Emissions from Stationary Sources (2011) < https://19january2017snapshot.epa.gov/sites/production/files/2016-08/documents/biogenic-co2-accounting-framework-report-sept-2011.pdf>.

[9] EPA Science Advisory Board Review of the 2011 Draft Accounting Framework for CO_2 Emissions for Biogenic Sources Study (2012) <https://yosemite.epa.gov/sab/sabproduct.nsf/0/57B7A4F1987D7F7385257A87007977F6/$File/EPA-SAB-12-011-unsigned.pdf>.

[10] A number of forest biomass feedstocks, such as certain industrial byproducts, have been demonstrated to result in little to negligible contribution to net atmospheric concentrations of CO_2 when used for energy at stationary sources.

assessing biogenic CO_2 emissions from stationary sources.[9] The SAB further acknowledged that accounting for biogenic CO_2 emissions associated with stationary sources involves both scientific and policy considerations, including the policy context in which the accounting is applied.[11]

In November 2014, EPA released a revised second draft of its technical report (2014 Revised Framework)[12], which incorporated input from the SAB's review of the 2011 Draft Framework and stakeholder comments and presented a potential framework for assessing biogenic CO_2 emissions. Final recommendations from the SAB peer review process of the 2014 Revised Framework remain uncertain as there is disagreement among the SAB on specific technical elements.[13]

As a result, while a valuable exercise, the lengthy and intensive process of assessment and discussion, including among the SAB, has not to date resulted in a workable, applied approach for consistently assessing the net atmospheric contribution of biogenic CO_2 emissions at stationary sources. In addition, broader considerations also motivate EPA to establish this policy, including the substantial environmental and economic benefits associated with the use of forest biomass, the benefits of providing clarity to stakeholders, and direction from Congress and relevant Executive Orders.

National Forest Carbon Stocks and the Role of Bioenergy

While it is not possible to discern from national forest carbon stock estimates the effects of a particular stationary source's use of forest biomass for energy, general U.S. carbon stock trends in the land sector, including changes in forest biomass consumption, are captured in the *Inventory of U.S. Greenhouse Gas Emissions and Sinks.* U.S. forested lands currently remove more CO_2 from the atmosphere than they emit (i.e., they are a net sink of carbon); in 2015 the forest sector offset approximately 11.2 percent of gross U.S. GHG emissions.[14] While there is some uncertainty within the scientific community about whether U.S. forests will remain a net carbon sink over the coming years, recent research shows that under current market and environmental conditions, continued forest land investment and management can allow for continued and even increased U.S. forest carbon stocks in the future. Specifically, landowners can anticipate future markets for woody materials and accordingly invest in forested lands.[15]

Changes in demand for forest-derived biomass could influence how U.S. land owners manage forests and the related forest carbon stocks. For example, in the short term, increased biomass demand may

[11] In fact, the SAB acknowledged in its review of both the Draft and Revised Frameworks that it was difficult to conduct a scientific review of the Framework in the absence of information about the applied policy context in which it would be used.
[12] Revised Framework for Assessing Biogenic CO_2 Emissions from Stationary Sources. (2014) < https://19january2017snapshot.epa.gov/sites/production/files/2016-08/documents/framework-for-assessing-biogenic-co2-emissions.pdf>.
[13] Disagreement remains between EPA's Biogenic Carbon Emissions Panel and the EPA Chartered SAB, specifically on the issue of the timeframe for assessment of biogenic CO_2 emissions from the use of biomass at stationary sources. The disagreement is focused on whether the timeframe should be a policy-specific horizon or based on the time horizon in which all terrestrial impacts (positive and negative) associated with biomass use for energy are included.
[14] *Inventory of U.S. Greenhouse Gas Emissions and Sinks*: 1990-2015 < https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2015>.
[15] Tian, Xiaohui, Brent Sohngen, Justin Baker, Sara Ohrel, and Allen A. Fawcett. 2018. *Will U.S. Forests Continue to Be a Carbon Sink?* Land Economics February 2018. 94 (1): 97–113. ISSN 0023-7639.

change forest product market dynamics and how the forest industry sources materials. Stakeholders have raised concerns regarding near term land-use changes in response to increased biomass demand. Over time, stronger markets for biomass from managed lands could potentially bring more added value to forested lands and lead to increased forested lands and carbon sequestration.[16] This market development could help reduce the conversion of forest lands to non-forest uses. EPA recognizes the importance of ensuring the management of forests protects and conserves biologically sensitive areas and, in the ongoing implementation of this policy, will continue to closely monitor overall bioenergy demand and landscape conditions for changes that might have negative impacts on public health or the environment. EPA will continue to evaluate the applicability of this policy of treating biogenic CO_2 as carbon neutral based on relevant information, including data from interagency partners on updated trends in forest carbon stocks. This safeguard, among others, serves to ensure that EPA periodically assesses the need to revisit this treatment in the future.

Environmental and Economic Benefits of Bioenergy

EPA recognizes it is also important to consider additional roles of biomass and the land sector in GHG mitigation strategies and in the economy. Biomass from forest management activities can provide significant energy, economic, and environmental benefits to the U.S. For example, thinning and fuel treatments in western states can reduce the risk of forest fires, while simultaneously providing an energy source for the electric grid. The use of forest biomass for energy at stationary sources can also provide environmental benefits, such as improved soil and water quality, which help facilitate healthy forests. Healthy forests support outdoor recreation and tourism, bringing much needed income to rural communities. Landowners and communities benefit from the economic gains of their forests, which in turn allows them to invest more in the habitats and ecosystems that sustain these industries. The use of forest-derived bioenergy can also play a role in promoting domestic energy security for the U.S. and provide flexibility for stationary sources to use a variety of feedstock resources, potentially lowering costs. The U.S. has historically had a large forest products industry and continued growth is expected in the bioeconomy.[17] Thus, forest-derived bioenergy can provide new markets and new products to the U.S. bioeconomy.

Currently, many U.S. states recognize the benefit of using biomass as renewable energy in their state electricity generation mixes, as evidenced by the number of state renewable portfolio standards (RPS) that include some biomass as an eligible renewable energy resource. Many international programs also recognize that biomass can have benefits and encourage its use for energy production through national energy policies, such as the United Kingdom Renewables Obligation program.[18] These U.S. state and international programs have shown that diverse energy resources and unique economic, environmental and renewable energy goals can promote bioenergy development, as well as responsible land management. An EPA policy treating biogenic CO_2 emissions from the use of biomass from managed forests at stationary sources for energy as carbon neutral, as presented in this document, will foster the alignment of EPA regulatory actions with the treatment of biogenic CO_2 emissions in U.S. state and

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[16] Latta, Greg S., Justin S. Baker, Robert H. Beach, Steven K. Rose, Bruce A McCarl. 2013. *A multi-sector intertemporal optimization approach to assess the GHG implications of U.S. forest and agricultural biomass electricity expansion*. Journal of Forest Economics 19 (2013) 361–383.

[17] Biomass Research and Development Board. 2016. *Federal Activities Report on the Bioeconomy* <https://www.energy.gov/sites/prod/files/2016/02/f30/farb_2_18_16.pdf>.

[18] https://www.ofgem.gov.uk/environmental-programmes/ro

international programs. For example, the California Cap-and-Trade Program[19] and the Regional Greenhouse Gas Initiative (RGGI)[20] among Northeast and Mid-Atlantic states exempt biogenic CO_2 emissions from a compliance obligation, provided that specified types of biomass are used that meet certain requirements. In addition, the European Union Emission Trading Scheme (EU ETS)[21] exempts biogenic CO_2 emissions at stationary sources from a compliance obligation.

Conclusion

For the reasons described above, EPA's policy in forthcoming regulatory actions will be to treat biogenic CO_2 emissions resulting from the combustion of biomass from managed forests at stationary sources for energy production as carbon neutral. Although this policy announcement does not itself alter sources' obligations with regard to GHGs and CO_2 in any particular regulatory program, the Agency is committed to addressing regulatory uncertainty about how it treats biogenic CO_2 emissions in forthcoming actions under various EPA programs. The Agency also recognizes that technical, policy, legal, and Congressional contexts may change over time and plans to revisit this treatment of biogenic CO_2 emissions at stationary sources as necessary. Various tools, including data from our interagency partners, are available to help EPA periodically assess the need to revisit this treatment in the future. For example, the *Inventory of U.S. Greenhouse Gas Emissions and Sinks* can be used to track broad trends in forest carbon stocks over time.

EPA's policy treatment of biogenic CO_2 emissions associated with forest biomass use at stationary sources for energy production aims to provide clarity to forest and forest product industry stakeholders. As directed by Congress and Executive Orders, this policy seeks to ensure that biomass from managed forests plays a key role in addressing the energy needs of the U.S., furthering U.S. energy dominance, in an environmentally and economically beneficial way.