Technical Appendix: Methodology and Assumptions for Estimating GHG Emission Reductions Through Bio-Oil Production Based on the 'GHG Emissions of Ensyn Bio-Oil' Report

Introduction

This appendix outlines the methodology and assumptions utilized in estimating the greenhouse gas (GHG) emission reductions associated with bio-oil production from wood feedstock using Ensyn Corporation's Rapid Thermal Processing (RTP)™ technology. The estimates are grounded in the findings and methodologies detailed in the "*Analysis of GHG Emissions of Ensyn Corporation's Bio-Oil from Rapid Thermal Processing (RTP)™ Wood Feedstock"* (GHG Emissions of Ensyn Bio-Oil) report prepared by (S&T)² Consultants Inc., which employs a comprehensive life cycle assessment (LCA) model. The GHG Emissions of Ensyn Bio-Oil report has been attached to the application as support for the GHG Reduction Calculation spreadsheet.

GHG Reduction Estimate Method

The GHG emission reductions are determined through a detailed "cradle-to-grave" LCA, as detailed in the report. This methodology assesses the environmental impacts across all life cycle stages of bio-oil, from raw material extraction to final disposal, with a specific focus on emissions from the production and utilization phases.

Models/Tools Used

- **GHGenius Model**: The GHGenius LCA model, developed for Natural Resources Canada and enhanced by (S&T)² Consultants Inc., serves as the primary tool for analyzing emissions. This model, detailed in the report, provides a robust framework for assessing the emissions of GHGs and criteria pollutants from various fuel production and utilization scenarios.

Measure Implementation Assumptions

The implementation of the bio-oil production process incorporates several key assumptions as outlined in the report:

- **Feedstocks**: The analysis considers wood residues and short rotation forestry as feedstocks, assuming these are environmental burden-free at their generation point, aligning with LCA standards.
- **System Efficiency**: The report details the energy inputs and efficiency of the RTP™ process, including assumptions on electricity and natural gas consumption essential for the operation and energy balance of the bio-oil production process. These assumptions are integral to accurately estimating the GHG emissions associated with bio-oil production.

GHG Reduction Estimate Assumptions

The methodology for estimating GHG emission reductions relies on several critical assumptions highlighted in the "GHG Emissions of Ensyn Bio-Oil" report:

- **Emission Factors:** Utilizing standardized emission factors for GHGs (CO2, CH4, N2O) allows for consistent and reliable estimation of emissions from various stages of bio-oil production and utilization.

- **Energy Consumption**: Assumptions regarding the amount of energy consumed per unit of bio-oil produced, including the specific requirements for electricity and natural gas, are based on operational data provided by Ensyn and analyzed within the GHGenius model.

Reference Case Scenario

- **Business as Usual (BAU) Scenario**: The BAU scenario assumes a continuation of current practices without the implementation of bio-oil production. This scenario's GHG emissions projections serve as a benchmark against which the bio-oil's emission reductions are measured, considering the carbon intensity of regional electric power as a significant factor.

Measure-Specific Activity Data

Activity data specific to the bio-oil production process, including energy savings, electrical output, and the amount of bio-oil produced, are essential for quantifying GHG emission reductions. These data points, derived from the report, underpin the calculations and assumptions used in the GHG Emission Reduction Calculation spreadsheet attached to the application.

GHG Emissions Reduced

The "GHG Emissions of Ensyn Bio-Oil" report provides a detailed analysis of the GHG emission reductions achievable through the deployment of bio-oil in thermal applications and electricity production. It quantifies the reductions for bio-oil derived from wood residues and short rotation forestry, showcasing the potential for substantial environmental benefits. The report's findings form the basis of the GHG Emission Reduction Calculation spreadsheet, ensuring a transparent and detailed presentation of the estimated GHG reductions.