

## Executive Summary

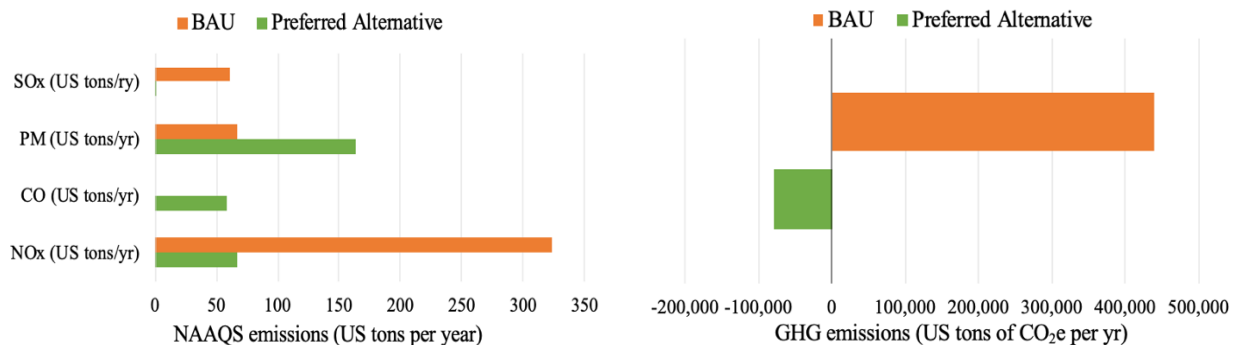
Redwood Coast Energy Authority (RCEA) was interested in alternative utilizations of waste woody biomass due to the questionable community support for the two existing combustion biomass powerplants in Humboldt County. Decreases in energy production resulting from implementation of an alternative was not required to be analyzed in this report.

### Design Process

The project design process began with examining different utilizations of waste woody biomass. Alternative utilizations were subject to two key constraints, to follow regulatory guidelines and to provide at least the same amount of employment opportunities that are currently present at the existing combustion biomass plants. The client weighted criteria considered for each alternative included: Aesthetics, Community Support, Payback Period, Employment Opportunities, Project Implementation, Air Quality, and Carbon Sequestration. The four alternatives considered were a biomass Densification Facility, Particleboard Facility, Distribution Network, and Community-Scale Gasification Facility. The Delphi and Pugh methods were then used in the Decision Analysis to examine how the alternatives were expected to perform.

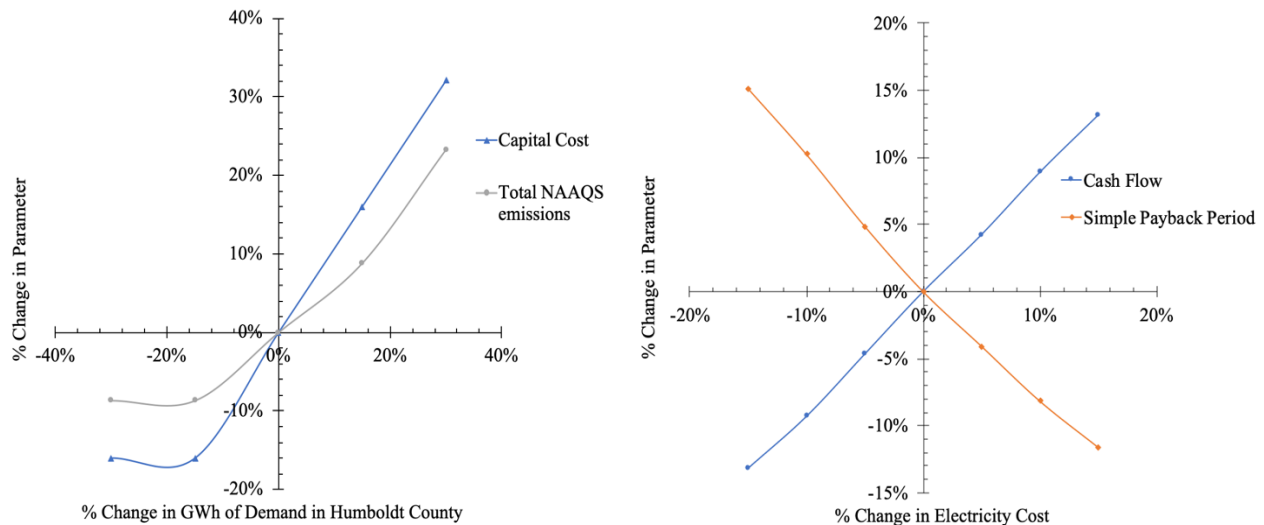
### Key Results

The results of the Decision Analysis determined that the preferred alternative would be a combination of the Community-Scale Gasification Facilities and Distribution Network alternatives. The combined alternative would dedicate 84% of the woody biomass waste to the gasification uses, and the other 16% to the distribution network. Gasification facility placement would be within three Humboldt County cities, each city having two 5 MW gasification facilities. Determined optimum locations for the gasification facilities to minimize the travel distance of the woody biomass are Garberville, Fortuna, and McKinleyville. The gasification component helps RCEA meet their local 2030 renewable energy goals. The Distribution Network consists of one facility for storage and distribution of the biomass material. It also consists of an onsite community garden that could be up to 150 acres and consume some of the biomass itself as mulch. The most centralized location for the distribution network is in Rio Dell, but this can be altered to maximize population exposure.



**Figure ES-1:** The GHG emissions and NAAQS emissions for both the business as usual and preferred alternative (CARB 2020).

Figure ES-1 describes the anticipated emissions from the preferred alternative in comparison to business as usual emissions from the current biomass facilities (CARB 2020). Note that gasification is considered carbon neutral in California and biochar production from gasification contributes to carbon sequestration (CEC 2020a). The total capital cost for the preferred alternative is 105 million dollars with a present net worth benefit of 238 million dollars. Sensitivity analyses were performed on energy demand in Humboldt County as well as consumer electricity cost. Figure ES-2 shows the results of the sensitivity analyses.



**Figure ES-2:** The sensitivity analyses conducted on total energy demand and consumer electricity cost.

***Limitations and Recommendations for Future Work***

The preferred alternative is heavily dependent on having a reliable stream of waste woody biomass. With capital costs reaching more than 100 million, this investment should be backed with a reliable relationship between the local saw mills and facility operators to ensure a steady stream of woody biomass to the preferred alternative. It is recommended that the preferred alternative is implemented as a combination of the Distribution Network and Community-Scale Gasification alternatives, this way the Distribution Network can act as a flow equalization basin for the gasification facilities. Excess biomass can be stored and distributed, and the community garden can still act as a community benefit if no biomass is coming in. For future work, it is recommended that the client investigate the potential for the gasification facilities to be funded through State grant money since gasification makes up a majority of the capital cost, and is considered a renewable energy resource in California (CEC 2020a). Another recommendation for future work is to investigate a potential partnership for the community garden aspect of the Distribution Network. Local city and county parks may be interested in a partnership as well as local universities looking for research space.