CEQA Climate Change Analysis for Proposed Biomass Power Generation Facility

Extended Abstract 14

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INTRODUCTION

On September 27, 2006, former Governor Arnold Schwarzenegger signed into law California Assembly Bill 32 (AB-32), the California Global Warming Solutions Act of 2006, which codifies a comprehensive program of regulatory and market mechanisms to achieve specific reductions of GHG emissions in California. It designates the California Air Resources Board (ARB) as responsible for monitoring and reducing GHG emissions.

The passage of AB-32 raised many questions regarding how it would affect the evaluation during the California Environmental Quality Act's (CEQA) review process of a project's contribution to global climate change. CEQA requires state and local agencies within California to follow a protocol of analysis and public disclosure of environmental impacts of proposed projects and adopt all feasible measures to mitigate those impacts. AB-32 does not reference CEQA, but does arguably find that global climate change poses a risk to California's environment. This implies that GHG emissions must be considered during CEQA review. The Office of Planning and Research (OPR) prepared guidelines regarding the feasible mitigation of GHG emissions which have been adopted by CEQA. The adopted amendments to the CEQA Guidelines contain two additional Environmental Checklist questions pertaining to GHG emissions from a review project. These are:

- Will the project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?
- Will the project conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

In January 2008, the California Air Pollution Control Officer's Association (CAPCOA) presented a white paper to serve as a resource for public agencies in determining GHG thresholds for applicability of AB-32. The white paper presents a 900 Metric Tonnes of Carbon Dioxide Equivalent per year (MTCO2e/yr) screening threshold for projects. Project emissions in excess of this threshold would require further analysis with regards to climate change.

An independent electricity generation company has proposed building a state-of-the-art biomass processing facility in California that would combust 500 bone dry tons per day of wood waste biomass, produce 23 MW of electricity, and emit estimated GHG emissions in excess of the CAPCOA established threshold of 900 MTCO2e/yr. The facility would be strategically sited to

respond to the growing need to dispose of local biomass accumulation from landscaping, manufacturing, and construction in a less carbon-intensive manner. Construction and operation of the proposed facility over a 20 year period will divert this biomass from landfills and convert the biomass to a renewable energy source.

A Climate Change Analysis (CCA) of the potential GHG emissions resulting from the proposed biomass energy project was performed following the Lead Agency's guidelines and was compared to a "Business as Usual" alternative. Methodologies employed include a comprehensive inventory of potential emissions from the proposed facility, analysis of mobile source emissions due to biomass transport mileage reductions under the proposed project, and modeling of landfill GHG emissions. These modeling calculations are limited by the accuracy of the assumptions and the extent of the data provided by the project contact.

EXPERIMENTAL METHODS

The methodology used to perform the Climate Change Analysis (CCA) estimated potential GHG emissions from; the biomass energy project scenario over a 20-year period and a Business as Usual (BAU) scenario. The GHG emissions included in the analysis are CO_2, Methane and N_2O, and are reported as metric tons of CO_2 equivalents (CO_2e). The overall emissions from these two scenarios were then evaluated to determine whether the project will have a significant impact on the environment or will conflict with AB32's goal of reducing California's emissions of GHG. The approach, assumptions and calculation methodology for each scenario are explained in the following two subsections.

Biomass Energy Project Emissions Calculations

As a large biomass fueled power plant, the proposed facility has two significant sources of GHG emissions, those from combustion of the biomass over a 20 year operating period, and the transportation of biomass to the facility. All anticipated emissions associated with the project (water usage, electricity usage, natural gas usage, solid waste disposal) were considered in the assessment, but for the purpose of brevity only the two significant sources were included in detail in this abstract.

Transportation

The proposed facility has the potential to combust approximately 500 bone dry tons per day of biomass. This will be trucked in from processing centers in the surrounding area. The following truck mileages and GHG emissions were calculated for the project:

Table 1. Truck Miles and GHG Emissions for Biomass and Ash Transport.

Transport Category	Trips per day	Miles per day	Annual miles	20-year miles	Annual Emissions* (MTCO2e)	20-year Emissions (MTCO2e)
Biomass	24	1,104	402,960	8,059,200	767	15,351
Ash disposal	2	40	14,600	292,000	28	556
Total	26	1,144	417,560	8,351,200	795	15,907

*Note: See Table 4 for emissions factors used.

GHG Emissions from Biomass Combustion at Facility

Estimated GHG emissions from combustion of biomass at the facility are shown in Table 2. The estimated are calculated using a factor called the Global Warming Potential (GWP) which scales each pollutant's propensity for global warming relative to CO_2 (GWP = 1). GHG emission estimates are presented for maximum potential annual emissions and for 20 years of facility operations.

Table 2. Facility Energy Generation GHG Emissions Estimates.

Greenhouse Gas	Emission Factor[1] (lbs/MMBtu)	Annual Boiler Input (MMBtu)	Annual Emissions (lbs)	GWP[1]	Annual Emissions (MTCO2e)	Total Annual Emissions (MTCO2e)	Total 20 Year Lifetime Emissions (MTCO2e)
CO_2	206.61	3,083,520	637,086,067	1	289,585	295,358	5,907,160
Methane	6.61E-02		203,759	21	1,945		
N_2O	8.81E-03		27,165	310	3,828		

Table 3 summarizes the annual and 20-year GHG emissions for the proposed project, including a small amount of secondary emissions from water usage.

Table 3. Summary of Proposed Project GHG Emissions.

Emissions Category	Annual Emissions (MTCO2e)	20-year lifetime emissions (MTCO2e)
Water	6	107
Transportation	795	15,907
Combustion of Biomass	295,358	5,907,160
Total Emissions	**296,153**	**5,923,067**

Business as Usual Emissions

The significant GHG emissions associated with the BAU scenario are the additional transport emissions from hauling the biomass to the existing disposal locations as well as from landfilling and combustion at the disposal locations.

Transportation Emissions

Biomass that will be delivered and processed in the facility will be diverted from other existing disposal facilities. Therefore, the following analysis shows the equivalent amount of GHG emissions that would be emitted to the atmosphere if the facility is not constructed (i.e. the biomass continues to be disposed of at existing disposal facilities). The existing disposal facilities include three landfills and another, older biomass facility. The analysis shows that continued trucking of biomass to the existing landfill and powerplant disposal sites will result in approximately 25 million trucking miles over a 20 year period. By comparison, by diverting biomass to the proposed facility only approximately 8 million trucking miles will occur over the same 20 year period. Therefore, diverting biomass to the proposed facility will save approximately 17 million trucking miles over 20 years. The emissions estimates associated with this trucking mileage are provided in Table 4.

Table 4. Reduction in GHG Emissions by Trucking Biomass to Proposed Facility versus Existing Disposal Options.

Greenhouse Gas	Emission Factor (lbs/mile)	Total Truck Mileage Saved	[1]GWP	Total Emissions Reduction (MTCO2e)
CO_2	14.195	17,203,224	1	32,246
Methane	1.37E-04		21	6
N_2O	2.11E-04		310	25
			Total	32,277

Direct Landfill Emissions

For the three existing landfill disposal alternatives, methane (CH_4) will be emitted from biological decomposition of the deposited biomass. A portion of this CH_4 subsequently escapes into the atmosphere through various portions of the landfill. Also, collected landfill gas that is burned or flared results in products of combustion that are discharged to the atmosphere, some of which are considered greenhouse gases. The ARB Landfill Emissions Tool Version 1.2 (the Tool) was used to estimate the amount of greenhouse gases generated from biological decomposition of biomass within the landfill.

Since the proposed facility is expected to operate at least 20 years, the annual amount of biomass that could be processed at the facility was entered into the Tool each year over 20 years. Since biological decomposition will occur in landfills for a much longer period than 20 years, the Tool was used to the estimate GHG emissions over a 50 year period.

It was assumed that landfills with efficient gas collection and combustion systems capture and combust approximately 80 percent of the gases generated within the landfill, with 20 percent of the landfill gases escaping to the atmosphere as CH_4. A summary of these landfill emissions is provided in Table 5.

Table 5. Landfill CH_4 and CO_2 Gas Generation.

Length of Time Biomass Decomposing in Landfill	80% Gas Collection Efficiency		
	CH_4 (metric tons)	CO_2 (metric tons)	CO_{2e} (metric tons)
20 Year Landfill Total	79,664	939,911	2,612,848
50 Year Landfill Total	303,215	3,577,478	9,944,988

Existing Powerplant Emissions

The emissions from the existing biomass power plant are provided in Table 6.

Table 6. Existing Power Plant GHG Emissions Estimate.

Annual Bone Dry Tons Diverted from Existing Power Plant	Emission Factor[2] Metric Tons CO_2e/Ton Biomass	Annual Metric Tons of CO_2e	Metric Tons of CO_2e released during 10 Year Remaining Plant Lifetime
73,000	1.5975	116,618	1,166,180

RESULTS/DISCUSSION

Operation of the proposed biomass facility for 20-years will result in a significant reduction in the amount of GHGs emitted compared to the BAU scenario. Under the BAU scenario, 73,000 tons of biomass will to be combusted at the existing long-distance power plant, resulting in increased GHG emissions mainly due to greater biomass transport distances. The BAU scenario also assumes continued landfilling of 292,000 tons of biomass over 20 years. This landfilling will result in increased GHG emissions due to the generation and release of methane from the biological decomposition of the deposited biomass, and the release of CO_2 due to combustion of some of this methane. Significantly, these landfill emissions will continue for more than thirty years beyond the initial 20 year life of the proposed project. Table 7 presents the GHG emissions expected under the proposed project and BAU scenarios.

Table 7. Summary of Percent Emissions Reductions over BAU Scenario

With Project		**Business as Usual**		**Percent Reduction**
	metric tons CO_2 e		metric tons CO_2 e	
Combustion of Biomass at Proposed Power Plant	5,907,160	Combustion of Biomass at Existing Power Plant	1,166,180	
Transportation of Biomass to Proposed Plant	15,907	Transportation of Biomass to Landfills and Power Plant	48,118	
Transportation of Ash Residue	550	Transportation of Ash Residue	Unknown	
Landfilling of Biomass	0	Landfilling of Biomass	9,945,000	
Water Use	107	Water Use	Unknown	
Total	5,923,724	**Total**	11,159,298	**47%**

SUMMARY

As presented, the proposed project will result in a 47 percent reduction in GHG emissions as compared to the BAU scenario. The BAU scenario is conservative and greater reductions may be realized especially if a landfill capture efficiency of less than 80% is used. The GHG reductions presented in this analysis will be realized up through year 20 of the facility's operation. Given this demonstration of GHG emission reductions, the project will not have a significant impact and will not impede the implementation of AB-32. The project as designed will utilize advanced technology to minimize emissions of criteria and toxic pollutants as well as GHGs.

REFERENCES

1. EMFAC2007 (Version 2.3) [Software]. (2007). California Air Resources Board. Retrieved from, http://www.arb.ca.gov/msei/onroad/latest_version.htm
2. "California Mandatory Greenhouse Gas Reporting Rule." *California Code of Regulations* Title 17, Appendix A
3. ARB Landfill Emissions Tool (Version 1.2) [Software]. California Air Resources Board. Retrieved from,

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