Sage Policy Group, Inc.

Why the Fairfield Renewable Energy Project Makes Sense for Baltimore and Maryland

Submitted by:

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On behalf of:

Energy Answers Baltimore

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Executive Summary

Sage would like to thank the Maryland Department of Business and Economic Development for their gracious counsel and moral support for this study.

The Project

The Fairfield Renewable Energy Project (the "Project"), a fully permitted 159 megawatt (MW) power plant, will use 4,000 tons per day of Processed Refuse Fuel ™ (PRF) derived from municipal solid waste (MSW) as its basic fuel source. With a location on the Fairfield Peninsula in Baltimore City, the Project will create 1.3 million megawatt hours (MWh) of electricity annually in Central Maryland, the area within the state most affected by congestion and its associated higher costs of electricity. The Project will recover recyclable metals and other reusable materials from the MSW and will also cogenerate industrial steam, thereby creating incentives for the co-location of related businesses in an Eco-Industrial Park. The Project's major benefits are tied to its status as a Tier 1 renewable energy provider, the displacement of coal, diminished greenhouse gases (GHG), competitive electricity prices, materials recovery, and economic and fiscal benefits for Baltimore City and Maryland.

Were this renewable energy to be directly purchased by the State of Maryland in lieu of the non-renewable energy mix currently being purchased, the premium the State would pay would be $0.0351 per kilowatt hour (kWh). This represents a small premium relative to the approximately $0.29 per kWh in business sales/economic activity inuring to Marylanders (of which 87 percent would impact the City of Baltimore). In other words, the benefits of embracing this Project and its technology are equal to nearly ten times the premium that the State of Maryland would pay for a renewable, green energy source. Moreover, the Eco-Industrial Park supported by the Project would generate an additional $0.15 in annual business sales/economic activity for each kWh produced. The Sage study team concludes that the Project represents a substantial bargain for the people of Maryland and also forwards the State's objective of promoting greener technology.

Economic and Fiscal Impacts to the State of Maryland

The construction and operation of the Project will be a significant economic development event for Baltimore City and the State of Maryland, creating immediate well-paying jobs and generating a wide range of tax revenues that will benefit all levels of government. The construction phase of the power plant will occur over a period of approximately 3 years, during which time the State will not be incurring an energy payment for the electrical output of the facility. During its construction phase, the Project will generate an average of 620 direct jobs each year and 358 additional indirect and induced jobs in Maryland. Exhibit E1 reflects construction phase economic and fiscal impacts for both the Project and associated Eco-Industrial Park.

Exhibit E1: Benefits from Construction of the Project and Eco-Industrial Park

Facility	*Total Jobs Supported*	*Type of Impact*	*Value over 3 Years (millions)*
Fairfield Power Plant	2,934	Fiscal	$32.3
		Labor Income	$131.4
		Business Sales	$394.4
Eco-Industrial Park	1,722	Fiscal	$19.4
		Labor Income	$68.3
		Business Sales	$263.3
Combined Fairfield Power Plant and the Eco-Industrial Park	4,656	Fiscal	$51.7
		Labor Income	$199.7
		Business Sales	$657.7

Once operational, the Project will support 813 total jobs. The associated Eco-Industrial Park will support 542 jobs once multiplier effects are fully considered for a total impact of 1,355 jobs. Tax receipts to State and local governments in Maryland will expand by $52.5 million per annum. Ongoing fiscal and economic benefits for both the project and the Eco-Industrial Park are presented in Exhibit E2.

Exhibit E2: Annual Benefits from Operation of the Project and Eco-Industrial Park

Facility	*Total Jobs Supported*	*Type of Impact*	*Annual Value (millions)*	*Value per kWh*
Fairfield Power Plant	813	Fiscal	$42.8	$0.0338
		Labor Income	$27.5	$0.0217
		Business Sales	$367.2	$0.2897
Eco-Industrial Park (1)	542	Fiscal	$9.7	$0.0077
		Labor Income	$23.3	$0.0183
		Business Sales	$195.7	$0.1544
Combined Fairfield Power Plant and the Eco-Industrial Park	1,355	Fiscal	$52.5	$0.0414
		Labor Income	$50.8	$0.0401
		Business Sales	$562.9	$0.4441

(1) The Eco-Industrial Park estimates are based on three businesses that might be initial tenants of this industrial park. Actual tenants and their business interests will depend on future marketplace dynamics.

Environmental and Societal Benefits to Marylanders

The Project will generate numerous benefits in addition to the economic and fiscal impacts described above:

- By adding 159 MW of generating capacity in Maryland, the Project will reduce the estimated 1,080 MW shortfall of Maryland-based power generation by 15 percent. The value of reducing this shortfall by 159 MW is estimated at $44 million to $118 million annually.
- By using MSW as its fuel source, the Project will divert approximately 1.5 million tons of MSW annually from landfills, reducing Maryland's landfill demand by 26 percent and preserving land for higher uses.
- By diverting MSW from landfills, the Project will reduce the associated generation of GHG emissions by 1.9 million tons annually and qualify for existing regional GHG credits and any future carbon credits.

- The Project's ability to recover recyclable metals and other reusable materials from the MSW used as its fuel source will result in the displacement of over 750,000 tons of coal that would otherwise be needed for power generation, primary metals smelting, or concrete product manufacturing.
- On a comparative basis, the bundled price of electricity delivered by the Project is lower than that of any of the long-term renewable energy contracts current with DGS.

Project's Energy Rate

If the State incorporates social benefits into its calculations of utility, the effective price of the Project's energy is well below current rates in Maryland. Quantifiable benefits, as shown in Exhibit E3, are even more significant when considerations include:

- The reduced congestion costs associated with local production of energy;
- The corresponding reductions in the importation of electricity;
- The Regional Greenhouse Gas Initiative (RGGI) and other credits to which this renewable energy project would be entitled; and
- Potential national carbon legislation.

Exhibit E3: Project benefits in terms of value per kWh (2011 dollars)

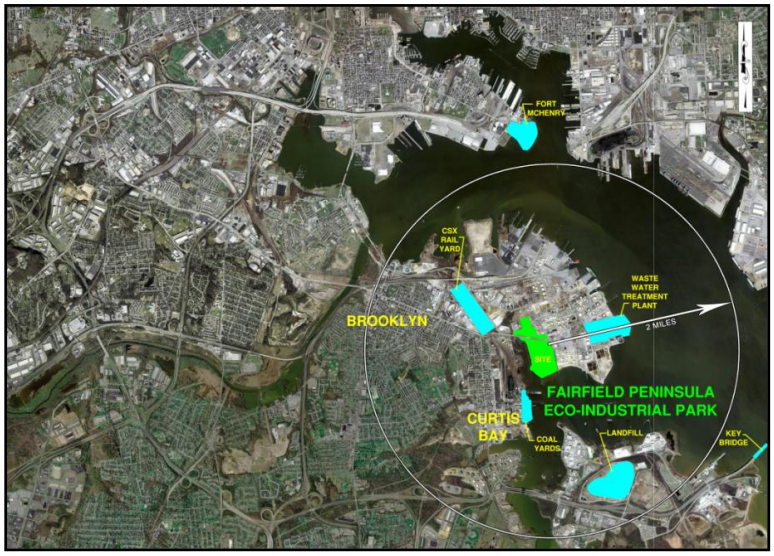
Effective price of Project's electricity	*High*	*Low*	***Midpoint***
Bundled price	$0.1236	$0.1236	**$0.1236**
Value of added capacity	$0.0348	$0.0929	**$0.0639**
Price after capacity credit	$0.0888	$0.0307	**$0.0597**
Value of RGGI credit		$0.0028	
Price after RGGI credit, before carbon credit	$0.0859	$0.0278	**$0.0569**
Value of carbon credit		$0.0246	
Price after carbon credit replaces RGGI credit	$0.0642	$0.0061	**$0.0351**

Bottom Line

Upon a full consideration of its associated environmental, economic, societal and fiscal benefits, the Fairfield Renewable Energy Project presents the State of Maryland with a substantial bargain for new energy generation. This Sage Policy Group report concludes that the Project's overall benefits to both the State of Maryland and the City of Baltimore easily exceed its costs and recommends that the State engage in a long-term power purchase agreement for the Project's remaining Tier 1 renewable energy generation or induce local utilities to enter into long-term power purchase agreements to support private financing of this facility.

1.0 Introduction

This report examines the economic, fiscal and environmental impacts of the Fairfield Renewable Energy Project (the "Project") being developed by Energy Answers Baltimore, LLC for a 90-acre "brownfield" site on the Fairfield Peninsula in the Curtis Bay area of Baltimore City, as shown below. The Project will use Processed Refuse Fuel ™ (PRF) derived from municipal solid waste (MSW) as its basic fuel source to produce renewable energy to be distributed through the power grid as well as heat that can be used to produce steam for local distribution. The technology to be used at the Project represents a refinement of PRF technology, successfully used for over 20 years at the Energy Answers' designed SEMASS Resource Recovery Facility in Massachusetts.[1]



In addition to the renewable energy power plant, the Project includes the creation of fuel production facilities (FPFs) in the Baltimore region. These FPFs would receive MSW, remove and recover valuable materials (e.g., recyclable metals), and process (i.e., shred) the remaining MSW in order to convert it into a more efficiently combustible fuel.

This Sage Policy Group report quantifies and monetizes the Project's various benefits to the extent possible, but also considers less directly measurable, but equally important impacts that the Project can have in the areas of economic efficiency, environmental practice, and sustainable development. In particular, the report quantifies the true cost of energy generated by the Project once its associated environmental, economic, societal and fiscal benefits undergo a complete accounting.

[1] The SEMASS facility, which serves all of Cape Cod and nearby areas of southeastern Massachusetts, has operated and expanded in one of the more environmentally sensitive areas of New England. See Appendix for more information on the SEMASS plant.

2.0 Project Overview

- Four Stages

Because the proposed power plant will rely on MSW as its fuel source, the operation of the Project will directly generate a series of benefits that are not only unique, but also give rise to additional secondary benefits that enhance its overall value. A basic description of the total process highlights the benefits that are derived from the potential for resource recovery at many stages in the overall operation of the Project.

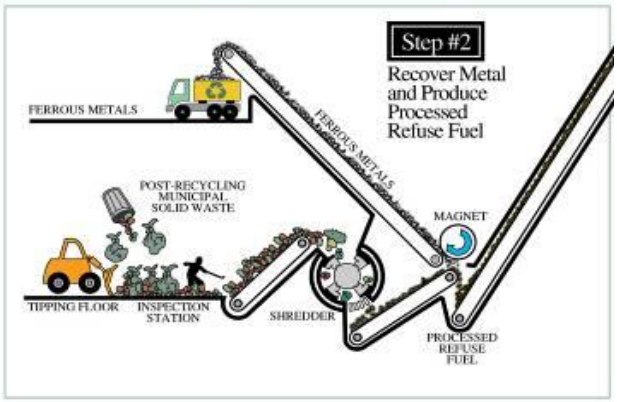
The first stage in the Project's resource recovery process is the initial processing of MSW, which will occur at several FPF locations in the Baltimore region. The major elements at this stage are: (1) the receipt of the MSW; (2) the diversion of ferrous metals and other materials that possess values higher than their comparative values as fuel; and (3) the preparation of the remaining MSW for processing into a more efficient fuel source. Benefits associated with this step include reduced demand for landfill space used to dispose of MSW and the recovery, reuse, and recycling of materials with intrinsic value. The actions and benefits of this stage are summarized in Exhibit 1.

Exhibit 1. Initial processing of MSW

Processes	Benefits
	• Diversion of MSW from landfills • Reduction in GHG emissions • Recovery of reusable materials • Recovery of recyclable materials

After the initial processing, the MSW is shredded to create Processed Refuse Fuel™ (PRF), thereby enhancing its value as fuel by increasing its uniformity and combustion efficiency in order to meet boiler performance specifications that increase the value of the materials that are ultimately recoverable post-combustion. Ferrous metals are also extracted from the PRF before combustion. These processes are described in Exhibit 2.

Exhibit 2. Production of Processed Refuse Fuel [TM] and additional ferrous recovery

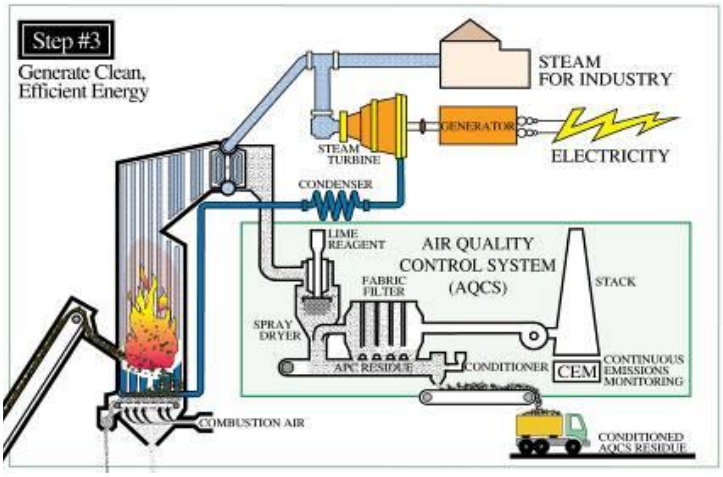
Processes	Benefits
	• Enhancement of fuel value and combustion efficiency • Ferrous metal recovery

Once ferrous metals are extracted from the shredded MSW, the PRF is delivered to the Project for combustion. Because the material has been shredded, its combustion is more efficient and thorough than it would be without processing. The combustion temperatures are also more easily controlled: high enough to meet the needs for power generation, but low enough to avoid melting and agglomeration and to allow for effective, post-combustion extraction of metals and other non-combustible materials.[2] The production of steam drives the Project's turbine generator that creates electricity. Surplus heat will also be available as steam for industrial uses.

Air quality control technology represents a major part of the power production process and will reduce and control emissions generated by the Project. Specifically, the technology will permit the achievement of the lowest applicable national emissions standards for this type of facility. A byproduct of these emission controls is conditioned fly ash, a recyclable material. These processes and the associated benefits are summarized in Exhibit 3.

[2] Typical waste-to-energy plants burn un-shredded MSW. Among the consequences of this technology, compared to the PRF technology used by the Project, are less complete combustion and higher combustion temperatures, which tend to fuse non-combustible materials.

Exhibit 3. Energy production and emissions control

Processes	Benefits
	• Production of renewable electricity • Production of industrial steam • Air quality control • Creation of recyclable aggregate • Recovery of recyclable materials

The final stage is the processing of bottom ash, the noncombustible material that falls to the bottom of the combustion chamber. Because of the relatively low combustion temperatures allowed by the use of PRF, this bottom ash is relatively easily separated into ferrous metals, non-ferrous metals, and other reusable materials (e.g., glass, ceramics). At the higher combustion temperatures that would be required if the MSW were not pre-processed, these non-combustible materials would tend to fuse into undifferentiated masses of slag that greatly complicate the process of separating metals from other materials. This in turn would reduce the volume of recoverable metals and significantly reduce the value of the materials recovered after combustion. Exhibit 4 presents the activities in this final stage.

Exhibit 4. Ash-processing & recovery of materials

Processes	Benefits
	• Recovery of recyclable ferrous materials • Recovery of recyclable nonferrous materials • Recovery of recyclable aggregate

- Valuable Byproducts and Incentives for Businesses

Unlike many other energy generating plants, the Project will also generate industrial steam and a variety of recyclable, reusable, and compostable materials that can be inputs for other businesses. These inputs create development opportunities that can add considerable value to the overall Project, particularly for businesses that can locate in close proximity to the power plant. Given the Project's use of MSW as its fuel source, other industries can potentially form symbiotic relationships with the Project, providing fuel from their waste streams. Exhibit 5 lists examples of the types of businesses that can work in tandem with the Fairfield Project by using the Project's products or taking advantage of the Project's unique fuel needs.

Exhibit 5. Businesses that directly benefit from the Project's outputs

Business	*Relationship to Project*
Paper mill	• Uses recovered, recycled paper • Uses steam and electricity • Provides sludge and wastewater for cooling
Aquaculture, greenhouses, hydroponic farming	• Uses compost • Uses steam • Uses CO_2
Nonferrous metal smelter	• Uses recovered nonferrous materials • Uses electricity • Provides wastewater for cooling
Asphalt, tar, macadam plant	• Uses recovered processed ash • Uses steam and electricity
Concrete and concrete products plant	• Uses recovered boiler aggregate and conditioned fly ash • Uses electricity
Ethanol and biofuels plant	• Uses recovered cellulose materials • Uses steam and electricity
Tire recycling plant	• Uses electricity • Provides granulated tire waste for fuel
Pharmaceutical plant	• Uses steam and electricity • Provides product and packaging waste as fuel • Provides wastewater for cooling

The co-location of related business in the Eco-Industrial Park should translate into more favorable electricity pricing for these new businesses as they will have the opportunity to procure wholesale electricity directly from the Project. As a result, these businesses will not incur Baltimore Gas and Electric's distribution charge of approximately $0.013 per kWh. In addition, the Project will cogenerate industrial steam that can be used by new businesses in their manufacturing process. This availability of industrial steam can eliminate the need for these businesses to build their own steam generation capacity. The capital costs for a package boiler that would be necessary to meet the steam needs of any new business in the Eco-Industrial Park is estimated at $2.5 million. This amount would be a direct savings to any business that co-locates in the Eco-Industrial Park.

The land uses envisioned by the Project and the Eco-Industrial Park are consistent with the recent Baltimore City Master Plan. That plan designates the site for these activities as industrially zoned land within MIZOD, the Maritime Industrial Zone Overlay District created by the city in 2004 to preserve the industrial waterfront and the employment created by industrial businesses. Plans for the design of the Project and Eco-Industrial Park also adhere to design goals in the Master Plan for streets and streetscapes, urban design and landscaping, architecture, green space, and waterfront buffer zones.

Finally, the ability of the Project to convert waste products into energy also converts a cost (i.e., waste disposal) into a benefit (i.e., fuel). Coupled with the Project's ability to convert its own waste streams into valuable inputs for other businesses, the Project creates an ability to minimize or even eliminate environmental problems that plague governments, citizens, and private businesses. The overall benefit of the Project moves from a typical, consumption-based model of electricity production relying on the continuous extraction of fossil fuels, toward a sustainable model based on the recovery of energy and resources from MSW. The Project will also be situated on a "brownfield" site, another form of recycling. Moreover, by diverting MSW from landfills, the Project will reduce the need for waste disposal, moving the state and the region toward sustainability.

3.0 Project Benefits beyond Electricity

- Power Plant will Generate Diverse Set of Benefits

Because of the multifaceted nature of the Project, the benefits that it creates are similarly multifaceted. These benefits are discussed in broad categories and are quantified to the extent possible.

The heart of the Project is the PRF-fired power plant, which will have a 159 MW capacity and a designed annual capacity factor of at least 91 percent (i.e., the plant will operate at least 91 percent of the time on an annual basis). Under these conditions, the power plant will produce approximately 1.3 million MWh of electricity annually. Solar panels will be installed on the roof of the power plant to provide additional thermal power to the Project and increase the Project's overall generating efficiency (estimated at a typical capacity factor of 22.5 percent and an equivalent of almost 4 million kWh of power).

- Credits

Because the Project will generate Tier 1 renewable energy, the Project contributes to goals set by the Maryland Renewable Portfolio Standards (RPS) related to renewable energy and the reduction of pollution that would be generated by a corresponding fossil fuel-fired power plant.[3] Specifically, the Project qualifies for renewable energy credits (RECs) that are included in the "bundled" sales price for the electricity it generates. Over the first 17 years of the Project's operation, the net present value of the associated RECs is between $159 and $194 million.[4,5]

As the negative impacts of GHG emissions have become more widely acknowledged, a growing number of states has begun to adopt laws and standards governing the amount of carbon they emit. These laws and associated regulations provide insight into the perceived value of carbon emission reduction. Maryland is currently 1 of 10 Northeastern and Mid-Atlantic States that participate in the Regional Greenhouse Gas Initiative (RGGI), a collective, market-based effort to reduce greenhouse gas emissions. RGGI caps emissions and sets a goal of reducing CO_2 emissions from the power sector by ten percent by 2018. To fulfill individual reduction levels,

[3] "The objective of § 7-701 *et seq.* of the Article (RPS Statute) is to recognize and develop the benefits associated with a diverse collection of renewable energy supplies to serve Maryland. The State's RPS Program does this by recognizing the environmental and consumer benefits associated with renewable energy." (Public Service Commission of Maryland, Renewable Energy Portfolio Standard Report of 2011, February 2011, Page 2)

[4] Net Present Value calculation based on forecasted REC prices in the PPRP Long-Term Electricity Report for Maryland, an output of 1,264,296 MWh per year, and discount rates of 8 percent and 10 percent.

[5] "Under the LTER Reference Case and the High Renewables scenarios, Tier 1 RECs prices are estimated to range between $2 per REC to $28 per REC (in 2010 dollars). RECs prices increase through 2014 then stabilize within the range of $24 per REC to $26 per REC between 2015 and 2023. After 2023, RECs prices decline in real terms to a level of $12 per REC by 2030." (Page ES-14 of the PPRP Long-Term Electricity Report for Maryland, July 15th, 2011).

states buy and sell emissions allowances through auctions. The Project would contribute significantly to Maryland meeting its RGGI commitment to emission reductions from the power sector.

Regional efforts to constrain greenhouse gas emissions may eventually engender efforts on a national scale. For instance, the Maryland Department of Natural Resources' Power Plant Research Program evaluated the impacts to Maryland of the enacting of national carbon legislation. Were this legislation to pass, the Project would be eligible for credits associated with 1.9 million tons of GHG emissions reduction resulting annually from the Project's operation.[6] The Sage study team used this figure to determine the benefit of carbon reduction that would be produced by Project operations. It should be noted that while these benefits can be realized through contribution to RGGI goals, they are not presently available from a national emissions reduction program. However, both RGGI - and national program-based calculations provide insight into the societal value of this aspect of the Project's future operations.

Finally, any national carbon legislation would supersede the existing RGGI program. Thus carbon credits available through such national legislation would replace, rather than supplement or add to, existing RGGI credits.

- Reduced Congestion and Capacity Shortfalls

Because the Project will be located in the center of BGE's service area, it will reduce congestion by replacing power imported from outside the zone (and outside Maryland). This reduction of congestion is valued at $9.7 million per year according to Sage estimates. Congestion is a by-product of the state's shortage of generating capacity and the resulting problems with overloaded distribution lines.

Maryland is a net importer of electricity because the state's generating capacity is insufficient to meet demand for electricity. The shortfall of capacity has been estimated at 1,080 MW and the value of reducing that shortfall has been estimated at $300 million to $800 million.[7] With a capacity of 159 MW, the Project can address roughly 15 percent of that shortfall. The value of the Project's ability to add capacity within Maryland then ranges from $44 million to $118 million (including the value of reducing congestion). This potential value will directly benefit every ratepayer in the BGE zone.

The potential to reduce electricity prices by increasing capacity and lowering congestion in Maryland, especially in the most industrialized region of the state, could be a boon to attracting new industrial facilities. In recent years, Maryland has ranked in the top quarter of all states in

[6] Estimate of GHG reductions from RTI International, "Analysis of Municipal Solid Waste Management Alternatives for the Greater Baltimore Region," October 2011.
[7] Final report of the Public Service Commission of Maryland to the Maryland General Assembly – Options for Re-Regulation and New Generation, p. 28.

terms of the costliness of electricity. Despite a reduction in average prices from 2009 to 2010, Maryland's prices for commercial and, particularly, industrial customers are well above the national averages although similar to prices for some nearby states. When all Maryland electricity customers are considered, prices for electricity remain 28 percent to 33 percent above national averages. See Exhibit 6 for more details on electricity prices by sector in recent years.

Exhibit 6. Average Retail Price of Electricity to Ultimate Customers (cents per kilowatt hour)

Sector	*Year*	*Rank among states*	*Maryland*	*U.S. Total*	*MD as share of U.S.*
Residential	2010	12	14.54	11.63	125%
	2009	10	15.12	11.61	130%
Commercial	2010	13	11.64	10.30	113%
	2009	13	12.11	10.25	118%
Industrial	2010	12	9.45	6.81	139%
	2009	9	9.93	6.87	145%
Transportation	2010	9	10.09	11.03	91%
	2009	11	10.53	11.30	93%
All sectors	2010	12	12.72	9.91	128%
	2009	11	13.20	9.93	133%

Source: EIA

- Steam

In addition to electricity, the Project will generate steam that can be distributed to industrial users. The availability of this steam represents an impetus for the creation of an Eco-Industrial Park of co-located businesses that can benefit from synergistic relationships with the Project's power plant.

The basic energy generation characteristics of the Project are summarized in Exhibit 7. The bundled price of a kilowatt hour of electricity produced by the Project is listed, as are the various credits and values, noted above, that reduce the effective cost of this electricity. As noted above, carbon credits based on future national legislation would replace existing RGGI credits.

Exhibit 7. Energy generation and prices for the Project

Energy production characteristics	*Values*
Electricity production	159 MW
Annual capacity factor	91%
Annual output (MWh/year)	1.27 million
Bundled sales price (2011 dollars per kWh) (1)	$0.1236
Annual savings based on capacity needed in BGE zone (2011 dollars per kWh) (2)	$0.0348 – $0.0929
Annual RGGI credits (2011 dollars per kWh) (3)	$0.0028
Annual carbon credit (2011 dollars per kWh)(4)	$0.0246
Steam extraction capacity at 830^{o} F, 850 psig (pph)	200,000 – 300,000

Notes.
1. Bundled price includes the value of Tier 1 renewable energy credits.
2. Prorated share of capacity benefit of $300 million to $800 million for 1,080 MW of generating capacity needed in the BGE zone, including congestion savings of $9.7 million.
3. Annual RGGI credits based on an estimated reduction of 1.9 million tons per year, valued at $1.89/ton.
4. Carbon credits are based on the values associated with the national legislation described in the PPRP Long-Term Electricity Report for Maryland, July 15th, 2011.
Sources: Energy Answers, Sage.

In addition to energy products, the Project will generate value by recovering materials from the PRF. Ferrous metals (e.g., steel, iron) will be extracted before and after combustion while nonferrous metals (e.g., aluminum, copper) will be extracted after combustion. The ash generated by combustion will also be recovered and used as input to the manufacture of concrete products and other building materials. These noncombustible materials represent almost all the residue from the generation of electricity. Because they have value and are not waste streams, the Project will generate almost no residual waste that must be land-filled. Exhibit 8 summarizes the volume and estimated value of the materials that will be recovered each year. In today's dollars, the resale value of these materials is roughly $19 million.

Exhibit 8. Recoverable materials generated annually by the Project (2011 dollars) (1)

Materials	*Tons per year*	*Value per ton*	*Total*
Pre-combustion ferrous	43,395	$102	$4.5
Post-combustion ferrous	12,217	$70	$0.9
Post-combustion nonferrous	9,518	$1,393	$13.3
Post-combustion boiler aggregate	193,234	$1.86	$0.4
Total			**$19.1**

Note. 1. Values provided by Energy Answers were adjusted from 2014 dollars to 2011 dollars using an annual escalator of 2.5 percent.
Source: Energy Answers

Because these recoverable materials can be used as inputs for other industries, the $19 million value of these materials underestimates the potential value of economic activity that these materials can create. As the source materials for secondary smelting or concrete product manufacturing, these materials can become an impetus for other business development and the

jobs, income, and business sales such development would create. In recent years, the operations of secondary smelters add at least 30 percent or 40 percent to the value of the scrap that they purchase.[8] If all the recovered metals generated by the Project were purchased by Maryland-based secondary smelters, these smelters would generate over $40 million in economic activity in the state and support more than 100 jobs. See Appendix B for more details.

[8] U.S. Bureau of the Census, Sector 31: Annual Survey of Manufactures: General Statistics: Statistics for Industry Groups and Industries: 2008 and 2009.

4.0 Cost Effective, Reliable Renewable Energy Generated in Maryland

Maryland's energy policy includes a requirement that 20 percent of all the state's energy consumption be derived from renewable energy sources by 2022. While 2 percent of the state's energy consumption is specifically to come from solar energy, the remaining 18 percent can come from a variety of sources including biomass such as MSW.[9]

State government has been committed to renewable energy since 2001 when an executive order established a goal to derive 6 percent of the electricity used by state government from renewable sources. This goal was increased to 10 percent from Tier 1 resources in 2006.[10]

In furtherance of these mandates, Maryland's Department of General Services (DGS), in partnership with the University System of Maryland, has entered into a series of 20-year Power Purchase Agreements (PPAs) with renewable energy providers. These PPAs are examples of the government using its purchasing power to support societal goals despite the relatively high price associated with such purchases. It should be noted, however, that these PPAs were the result of RFPs for power purchases and represent best available prices at the time of those RFPs. It is also worth noting that all contracts were signed for planned, rather than existing facilities and that the PPAs provide the underlying support to finance these projects.

- A Bigger Investment associated with Cheaper Electricity

Exhibit 9 compares the characteristics of the providers of these DGS long-term renewable energy contracts to the Project. At 159 MW the gross capacity of the Project is roughly three to 12 times that of the providers with existing contracts. Available capacity, defined as gross capacity multiplied by capacity factor, is highly favorable to the Project, which has available capacity that is eight times to 10 times the onshore wind projects and almost 50 times the photovoltaic solar project. This is largely due to the concept of capacity factor, which is a measure of how much of the gross capacity is utilized on an ongoing basis. In addition to unavoidable stoppage for maintenance and repairs, solar and wind capacity factors are reduced by other factors. Photovoltaic power capacity can be utilized an estimated 22.5 percent of the time. Wind power is available 27 percent of the time for onshore turbines.

[9] Susan Cochran et al, "Current Means of Electricity Production in Maryland and Potential Alternatives," League of Women Voters, 2009.

[10] "Maryland Power Plants and the Environment: A review of the impacts of power plants and transmission lines on Maryland's natural resources (CEIR-15)," Maryland Department of Natural Resources, January 18, 2010.

Exhibit 9. The Project versus current contracts for renewable energy

Project	*Location*	*Type*	*Gross capacity (MW) (1)*	*Capacity factor (2)*	*Capital (millions) (1)*	*Operating jobs (1)*	*Comparative Price per MWh (3)*
Mount St. Mary's	Maryland	Photovoltaic solar	13	22.5%	$60	2	$241
Pinnacle Wind Force	West Virginia	Land wind	55	27.0%	$131	6	$143
Synergics Roth Rock	Maryland	Land wind	50	35.0%	$119	6	$149
Fairfield	**Maryland**	**MSW**	**159**	**91.0%**	**$1,000+**	**191**	**$123**

Notes.
(1) Material provided by Company publications, DGS contracts, and/or industry consultants.
(2) Capacity factor is the percent of time power is generated. Wind capacity factors from Levitan & Associates (wind), U.S. DOE (solar), and Energy Answers (MSW).
(3) Prices are presented in 2011 dollars. Values represent comparable prices under the assumption that all facilities were located in the BGE service area where congestion and credit for adding capacity are highest. Except for Fairfield, all other facilities are located in outlying areas and have little effect on congestion problems in Central Maryland.
Sources. Energy Answers, Sage

Furthermore, as measured by capital costs, the scale of the Project is seven to 16 times the size of the other providers. This translates directly into the economic impacts associated with construction as well as permanent jobs once the Project is in operation. Only a handful of jobs are associated with the other energy providers the state has contracted with, but the Fairfield Project will create an estimated 191 union operating jobs in a Baltimore industrial area that has suffered significant employment loss in recent years.

Finally, the comparative bundled price of electricity in today's dollars delivered by the Project is lower than that of any of the providers under contract with DGS. The comparative price embodies the substantial value of the Project's location in the area of Maryland most affected by congestion, in comparison to the other providers located in outlying areas of the state or in West Virginia, as well as other factors to provide a "level playing field" perspective on these prices. Land-based wind is 16 percent to 20 percent more expensive, while photovoltaic solar is 95 percent more expensive. Exhibit 9 provides relevant statistical detail.

5.0 Economic Impacts of the Project

- Direct and Secondary Impacts of the Project and associated Eco-Industrial Park

The construction and operation of the Project will be a significant economic development event for Baltimore City and Maryland. The following tables present the economic impacts of construction and operation of the Project itself and of the Eco-Industrial Park, comprising businesses from industries that have strong, mutually beneficial links to the Project and that are expected to locate next to the Project. These tables list employment, income, and business sales impacts. Employment is defined as a mix of mostly full-time, but some part-time jobs where each job represents 1 year of work.[11] Income represents the compensation and benefits that are associated with these jobs. Finally, business sales are the value of goods and services that are generated as a result of the Project and Eco-Industrial Park. Business sales are a measure of the economic activity generated by the Project. These impacts are estimated for Baltimore City, where the Project's power plant will be located, and for Maryland. City impacts are embodied by statewide impacts.

Direct impacts are distinguished from indirect and induced impacts. Direct impacts are the jobs, income, and business sales directly associated with construction or operations. For the Project, direct construction jobs include, for example, the workers actually building the power plant while the indirect jobs are those associated with the many suppliers that will provide goods and services to the construction contractors. Induced impacts are the jobs, income, and business sales that depend upon the consumer spending of the direct and indirect workers for anything from housing to birthday presents. For the operational phase, direct impacts include, for example, the jobs at the power plant or Fuel Production Facilities created by the Project and the income associated with these jobs. Indirect jobs include those in the supply chain for the Project. Induced impacts are those associated with the consumer spending of the direct and indirect operational phase workers.

- Construction Phase Impacts of the Project's Power Plant

The construction phase will occur over a period of approximately 3 years. Over that period, construction of the power plant will generate 1,860 years of direct labor, an average of 620 jobs each year of the Project. When the indirect and induced employment impacts are included, total employment impacts are more than 2,600 years of work in the City and over 2,900 years of work in Maryland. Total income impacts of Project construction range from $117 million in the City

[11] Average hours worked per week varies by industry. In the utilities industry, including power generation, time worked per week has averaged 41 to 42 hours in recent years according to the Bureau of Labor Statistics. Indirect and induced jobs represent a broad range of industries. Average hours per week for all private employment have averaged about 34 hours in recent years.

to $131 million statewide, while business sales range from $368 million (City) to $394 million (Maryland). See Exhibit 10 for summary detail.

Exhibit 10. Economic impact of construction phase of the Project, occurring over 3 years

Baltimore City	*Jobs (years of labor)*	*Labor Income (millions)*	*Business sales (millions)*
Direct	1,860	$86.3	
Indirect/Induced	792	$30.2	
Total	**2,652**	**$116.5**	**$367.9**
Maryland			
Direct	1,860	$86.3	
Indirect/Induced	1,074	$45.1	
Total	**2,934**	**$131.4**	**$394.4**

Source: Sage; IMPLAN

It should be noted that Energy Answers has met repeatedly with labor organizations in the Baltimore area to discuss the Project and to determine the ability of local construction workers to supply the skills needed to build the plant and install all necessary equipment. These discussions have confirmed that local, Maryland-based workers have the required array of skills and qualifications to construct the Project.

- Post-Construction/Permanent Operating Impacts of the Project

Once operational, the Project will support 191 direct, green jobs at the Power Plant and Fuel Production Facilities with associated income of $14 million. As shown in Exhibit 11, total impacts in the City include 589 jobs with income of $21 million and business sales of $320 million. Statewide total impacts of the Project's operations include 813 jobs, $28 million of income, and $367 million in business sales. This volume of business sales means that economic activity worth approximately $0.29 per kWh is created in Maryland for each kWh generated by the Project. Details are presented in Exhibit 11.

Exhibit 11. Economic impact of operations of the Project, annual impacts

Baltimore City	*Jobs (years of labor)*	*Labor Income (millions)*	*Business sales (millions)*
Direct	191	$14.3	n/a
Indirect/Induced	398	$7.0	n/a
Total	**589**	**$21.3**	**$319.7**
Maryland			
Direct	191	$14.3	n/a (1)
Indirect/Induced	622	$13.2	n/a (1)
Total	**813**	**$27.5**	**$367.2**

Note. (1) Detail not available
Source: Sage; IMPLAN

- Construction Phase Impacts of the Eco-Industrial Park

The Eco-Industrial Park estimates are based on three businesses that might be initial tenants of this industrial park. Actual tenants and their business interests will depend on future marketplace dynamics. The following estimates are intended to be illustrative of the benefits that could be generated by an industrial park that took advantage of the potential benefits of the Project. The direct impacts of these illustrative facilities and businesses include 1,092 years of construction labor with $51 million of income. Total impacts of construction in the City include an estimated 1,556 years of labor with income of $61 million and $247 million of business sales. For Maryland, total impacts are 1,722 years of labor with associated income of $68 million and business sales of $263 million. See Exhibit 12 for additional detail.

Exhibit 12. Economic impacts of construction phase of the Eco-Industrial Park, occurring over 2 years

Baltimore City	*Jobs (years of labor)*	*Labor Income (millions)*	*Business sales (millions)*
Direct	1,092	$50.6	n/a
Indirect/Induced	464	$10.6	n/a
Total	**1,556**	**$61.2**	**$246.7**
Maryland			
Direct	1,092	$50.6	n/a (1)
Indirect/Induced	630	$17.7	n/a (1)
Total	**1,722**	**$68.3**	**$263.3**

Source: Sage; IMPLAN, (1) Detail not available

- Post-Construction/Permanent Operating Impacts of the Eco-Industrial Park

When the illustrative businesses projected as tenants in the Eco-Industrial Park reach a steady state of operations, these establishments will employ an estimated 152 workers with income of $11 million. Total impacts in the City include 422 jobs with income of almost $20 million and business sales of $176 million. Statewide operational impacts include 542 jobs with income of $23 million and business sales of $196 million (the equivalent of $0.15 per kWh generated by the Project) as shown in Exhibit 13.

Exhibit 13. Economic impact of operations of the Eco-Industrial Park, annual impacts

Baltimore City	*Jobs (years of labor)*	*Labor Income (millions)*	*Business sales (millions)*
Direct	152	$11.4	n/a
Indirect/Induced	270	$8.3	n/a
Total	**422**	**$19.7**	**$176.0**
Maryland			
Direct	152	$11.4	n/a (1)
Indirect/Induced	390	$11.9	n/a (1)
Total	**542**	**$23.3**	**$195.7**
Source: Sage; IMPLAN; (1) Detail not available			

- Total Economic Impacts: Project Plus Eco-Industrial Park

The combined economic impacts of constructing the Project and the Eco-Industrial Park are presented in Exhibit 14. These include almost 3,000 direct construction years of work with associated income of $137 million. Total impacts for the City include 4,200 years of work with $178 million in income and $615 million in business sales. Statewide total impacts are estimated at more than 4,600 years of work with $200 million in income and business sales of $658 million. These impacts are generated over the multiyear construction periods.

Exhibit 14. Economic impact of construction phase of the Project and Eco-Industrial Park, occurring over 3 years

Baltimore City	*Jobs (years of labor)*	*Labor Income (millions)*	*Business sales (millions)*
Direct	2,952	$136.9	n/a
Indirect/Induced	1,256	$40.7	n/a
Total	**4,208**	**$177.7**	**$614.6**
Maryland			
Direct	2,952	$136.9	n/a (1)
Indirect/Induced	1,704	$62.8	n/a (1)
Total	**4,656**	**$199.7**	**$657.7**
Source: Sage; IMPLAN; (1) Detail not available			

Total economic impacts on an annual basis of the operations of the Project and Eco-Industrial Park are summarized in Exhibit 15. Direct jobs are estimated at 343 with income of $26 million. Total City impacts include more than 1,000 jobs with income of $41 million and business sales of $496 million. Statewide total impacts are estimated at 1,355 jobs with $51 million in income and $563 million in business sales. Statewide business sales represent economic activity worth more than $0.44 per kWh for each of the Project's kWh created annually.

Exhibit 15. Economic impact of operations of the Project and Eco-Industrial Park, annual impacts

Baltimore City	*Jobs (years of labor)*	*Labor Income (millions)*	*Business sales (millions)*
Direct	343	$25.7	n/a
Indirect/Induced	668	$15.3	n/a
Total	**1,011**	**$41.0**	**$495.7**
Maryland			
Direct	343	$25.7	n/a
Indirect/Induced	1,012	$25.1	n/a
Total	**1,355**	**$50.8**	**$562.9**

Source: Sage; IMPLAN

There are important qualitative considerations as well. Employees of the Project will be green-collar workers. The same will be true of at least some (perhaps all) of the workers at establishments in the Eco-Industrial Park. These are the kinds of jobs that are commonly seen as a harbinger of the future economy; one in which industries producing environmental benefits and fostering sustainability also provide economic benefits. These jobs are also well paid. On average, compensation including benefits averages $75,000 annually for all direct jobs generated by the Project and the Eco-Industrial Park. Construction of the Project's power plant will also provide much needed work for the construction trades, particularly for the highly skilled crafts workers who will be needed to build a sophisticated and complex industrial plant.

The direct jobs created by the Project include a substantial number of operational and maintenance positions that are similar to those in manufacturing. One in five of the 191 direct jobs are classified as management, professional, and administrative and range from accounting clerks to the power plant manager. Remaining jobs are in operations of machinery or equipment or maintenance (e.g., mechanics and electricians). Total compensation for all these workers includes benefits valued at 33 percent of annual salaries. Average total compensation for all positions is just under $75,000 with the lowest total compensation estimated at $46,550. A summary of positions created by the Project is presented in Exhibit 16.

Exhibit 16. Positions at the Project

Facility	*Type of position*	*No. of positions*	*Total compensation*	*Average total compensation/ position*	*Lowest total compensation/ position*
Power Plant	Management, professional, admin	22	$2,300,900	$104,586	$46,550
	Operations	71	$4,583,925	$64,562	$55,328
	Maintenance	22	$1,723,467	$78,339	$69,160
	Total	115	$8,608,292		
Fuels Production Facilities	Management, professional, admin	16	$1,409,800	$88,113	$59,850
	Operations	44	$3,011,333	$68,439	$58,094
	Maintenance	16	$1,283,610	$80,226	$77,459
	Total	76	$5,704,742	$75,062	
All facilities	**Grand total**	**191**	**$14,313,034**	**$74,937**	

Source. Energy Answers

6.0 Fiscal Impacts of the Project

- Tax Revenues Generated by the Project during Construction and Operations

The construction and operation of the Project will generate a wide range of tax revenues that will benefit all levels of government. These include sales and use taxes on the purchase of goods, State income tax revenue, business taxes and other payments, taxes on corporate profits, personal taxes and other payments, and social insurance taxes and payments.

The Project itself will generate an estimated $32 million in taxes during construction and $43 million annually once operations begin. This ongoing $43 million in fiscal benefits equates to roughly $0.03 per kWh. Exhibit 17 and Exhibit 18 provide details regarding these estimated fiscal impacts during the construction and operational phases, respectively.

Exhibit 17. Fiscal impacts of construction phase of the Project, occurring over 3 years

Type of Tax	*Value (millions)*
Direct Sales/Use Taxes	$17.7
Direct Individual State Income Tax	$3.9
Indirect Business Tax and Payments	$7.5
Indirect Corporate Profits Tax and Payments	$2.0
Indirect Personal Tax and Payments	$1.1
Indirect Social Insurance Tax and Payments	$0.2
Total	**$32.3**
Source: Sage, Grant Thornton	

Exhibit 18. Fiscal impacts of operations of the Project, annual impact

Type of Tax	*Value (millions)*
Direct Individual State Income Tax	$0.6
Indirect Business Tax and Payments	$36.4
Indirect Corporate Profits Tax and Payments	$1.8
Indirect Personal Tax and Payments	$4.0
Indirect Social Insurance Tax and Payments	$0.1
Total	**$42.8**
Source: Sage, Grant Thornton	

- Tax Revenues Generated by the Eco-Industrial Park during Construction and Operations

The businesses in the Eco-Industrial Park will generate an estimated $19 million in tax revenue during the construction period and $10 million annually once operations begin (or $0.007 per kWh). Details regarding these revenue streams are presented in Exhibits 19 and 20, respectively.

Exhibit 19. Fiscal impacts of construction phase of the Eco-Industrial Park, occurring over 2 years

Type of Tax	*Value (millions)*
Direct Sales/Use Taxes	$7.8
Direct Individual State Income Tax	$2.3
Indirect Business Tax and Payments	$4.7
Indirect Corporate Profits Tax and Payments	$0.5
Indirect Personal Tax and Payments	$4.0
Indirect Social Insurance Tax and Payments	$0.1
Total	**$19.4**
Source: Sage, Grant Thornton	

Exhibit 20. Fiscal impacts of operations of the Eco-Industrial Park, annual impacts

Type of Tax	*Value (millions)*
Direct Individual State Income Tax	$3.8
Indirect Business Tax and Payments	$3.8
Indirect Corporate Profits Tax and Payments	$0.4
Indirect Personal Tax and Payments	$1.7
Indirect Social Insurance Tax and Payments	$0.0
Total	**$9.7**
Source: Sage, Grant Thornton	

- Total Fiscal Impacts: Project plus Eco-Industrial Park

The combined fiscal impacts of the Project and the Eco-Industrial Park are presented in Exhibits 21 (construction) and 22 (operations), respectively. Almost $52 million in taxes are generated during the construction period. The annual tax revenue generated by the Project and Eco-Industrial Park is estimated at more than $52 million or $0.041 per kWh.

Exhibit 21. Fiscal impacts of the construction phases of the Project and Eco-Industrial Park, occurring over 3 years

Type of Tax	*Value*
Direct Sales/Use Taxes	$25.5
Direct Individual State Income Tax	$6.2
Indirect Business Tax and Payments	$12.2
Indirect Corporate Profits Tax and Payments	$2.5
Indirect Personal Tax and Payments	$5.1
Indirect Social Insurance Tax and Payments	$0.3
Total	**$51.7**
Source: Sage, Grant Thornton	

Exhibit 22. Fiscal impacts of operations of the Project and Eco-Industrial Park, annual impacts

Type of Tax	*Value*
Direct Individual State Income Tax	$4.4
Indirect Business Tax and Payments	$40.2
Indirect Corporate Profits Tax and Payments	$2.2
Indirect Personal Tax and Payments	$5.7
Indirect Social Insurance Tax and Payments	$0.1
Total	**$52.5**

Source: Sage, Grant Thornton

- Real and Personal Property Taxes

It is highly likely that the Project and the Eco-Industrial Park businesses will be eligible for several tax incentive programs that provide relief from real and personal (i.e. business equipment) property taxes for periods up to 10 years. In the long run, however, all these properties would be likely to pay such taxes. Exhibit 23 provides an estimate of these taxes on the basis of current estimates of the construction and equipment costs for the Project and Eco-Industrial Park. Construction and equipment costs can change as projects evolve over time. Moreover, Baltimore City may reduce property tax rates in the future. Therefore, the estimates of annual property taxes should be considered subject to uncertainty.

Exhibit 23. Project costs and property taxes (annual impacts)

Types of costs and taxes	*Power Plant (millions of dollars)*	*Eco-Industrial Park (1) (millions of dollars)*
Construction costs	$253.0	$263.3
Equipment	$671.0	$108.7
Total	**$924.0**	**$372.0**
Real property, Baltimore City (2)	$5.7	$6.0
Real property, Maryland (2)	$0.3	$0.3
Personal property, Baltimore City (2)	$38.0	$6.2
Total	**$44.1**	**$12.4**

Notes. 1. Total project costs for the Eco-Industrial Park are reported at $372 million while construction costs are reported at $263.3 million. It is assumed that all other project costs are for equipment.
2. For fiscal year 2012, real property tax rates are 2.268 percent for Baltimore City and 0.112 percent for the State of Maryland; the personal property tax rate for the City is 5.67 percent. The State does not levy a separate personal property tax.
Sources. Grant Thornton, Maryland Comptroller, Sage

7.0 Quantifying the Benefits of Sustainability

The Project creates a range of environmental benefits that support its overall sustainability. These benefits begin with the diversion of waste from landfills, including the displacement of other more detrimental fossil fuels and the reduction of air pollution. By utilizing a brownfield site, the Project also recovers and preserves land. The technology employed also reduces the utilization of water and wastewater discharge. The Project also represents a significant opportunity for Maryland to reduce its GHG emissions. Finally, there is also massive recovery of reusable materials from ash that will provide sources of recycled aggregates and sand for construction products.

The Project is designed to burn 4,000 tons of Processed Refuse Fuel™ derived from MSW each day. If the Project were not developed, this waste would be buried in landfills. Assuming that the Project operates 91 percent of the time as expected, almost 1.5 million tons of MSW would be diverted from landfills annually. In 2009 Maryland disposed of 5.6 million tons of waste including 2.7 million tons of waste exported to out-of-state facilities.[12] By diverting MSW from landfills, the Project can reduce almost a quarter of the strain on Maryland's demand for space in landfills and potentially cut the exportation of waste to other states in half. See Exhibit 24 for details.

Exhibit 24. MSW diverted from Maryland landfills by the Project

Factor	*Value*
MSW: tons/day	4,000
Days/year	365
Operating load factor	91%
MSW: tons/year	1,460,000
Total waste disposed in Maryland (tons) (1)	5,641,910
Reduced need for waste disposal in Maryland as a result of the Project	25.87%

Note. (1) Waste disposal does not include recycling. Waste generated is equal to waste disposed plus recycling
Source: Maryland Department of the Environment, Maryland Solid Waste Management and Diversion Report 2010, Table 2, page 3.

As noted above, the Power Plant and Eco-Industrial Park will be sited on an existing 90-acre "brownfield" site, the former site of an industrial chemical manufacturing plant. With these new uses, this abandoned site will be returned to an active, economically beneficial life.

The most common fuel for electricity generation in Maryland is coal, almost all of which is imported from outside of the state. The use of MSW as a fuel source will mean that a substantial volume of coal will not be required. Based on the Btu-equivalent values of MSW and coal, the

[12]Maryland Department of the Environment, *Maryland Solid Waste Management and Diversion Report 2010,* page 3

Project will displace the need for 627,626 tons of coal per year with a heat value of roughly 12,800 billion Btus.[13]

Coal is also commonly used in the production of metals and concrete products. The Project's recovery of metals in the waste stream will obviate the need for fuel to convert ores to metal (i.e., primary smelting). The volume of metals recovered would require an estimated 131,000 tons of coal each year to produce.[14] The recovery of boiler aggregate will avoid the need for an estimated 55 tons of coal annually. In total, the operation of the Project will reduce dependence on coal by more than 750,000 tons per year as detailed in Exhibit 25.

Exhibit 25. Reduced dependence on coal

Factor	*Displaced coal (tons/year)*
Use of MSW	627,626
Recovery of metals	131,000
Recovery of boiler aggregate	55
Total	**758,691**
Sources: Energy Answers, Department of Energy, U.S. Energy Information Administration	

The use of processed MSW as fuel rather than fossil-based fuels, particularly coal, reduces the amount of carbon that is emitted into the atmosphere. The U.S. Environmental Protection Agency estimates that one ton of MSW used as fuel in a typical waste-to-energy power plant reduces GHG emissions by one ton. By using more efficient PRF technology and state-of-the-art pollution control technology, the Project will improve efficiency by 30% relative to a typical mass-burn waste-to-energy plant. GHG emissions are also reduced because MSW is not buried in landfills and, as in some present cases, not transported to landfills outside Maryland. Based on 4,000 tons per day of fuel consumption, total GHG emissions reduction is approximately 1.9 million tons annually.[15]

A decrease of GHG by 1.9 million tons per year represents a substantial reduction. With the average passenger car producing about 5.3 tons of CO_2 (4.8 metric tons), the GHG reduction of the Project would equal the emissions of over 360,000 cars or about 14 percent of all passenger cars in the State of Maryland.[16]

[13]EIA, Annual Energy Outlook 2006, DOE/EIA-0383 (2006) (Washington, D.C., February 2006), Table A16; DOE, Renewable Energy Technology Characterizations, EPRI TR-109496, 1997 and Program data; EIA, Annual Energy. Review 2004, DOE/EIA-0384 (2004) (Washington, D.C., August 2005), Table A6; Annual Energy Outlook 2006, DOE/EIA-0383 (2006) (Washington, D.C., February 2006), Table F1; Sage

[14] Energy Answers power point presentation dated May 6th, 2011.

[15] Op. cit., RTI International.

[16] EPA has estimated that the average passenger car emits 4.78 metric tons of CO_2 annually. (U.S. Environmental Protection Agency, Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle, EPA420-F-05-004 February 2005, http://www.epa.gov/oms/climate/420f05004.htm). In 2009, Maryland had 2,583,261 registered

Currently, coal accounts for 59 percent of all electricity generation in Maryland. Nuclear power accounts for another 29 percent. All other fuels contribute at most 4 percent, including natural gas (4 percent), hydroelectric (3 percent), and oil (2 percent). All renewable fuels account for only about 1.2 percent.

With the exception of a minor amount of coal mined in Maryland, virtually all the non-renewable fuels used to generate electricity in the state are imported. For example, over half of the coal used in Maryland power plants is sourced from West Virginia, with Pennsylvania providing most of the rest. A minor amount of coal is imported from Russia. Maryland lies within the Marcellus Shale formation, which may provide a source of natural gas in the future. Currently, however, all natural gas and oil are imported, as is all nuclear fuel.[17]

Therefore, the Project will not only diversify the mix of fuels used for generating electricity in Maryland, but will also increase the use of Maryland-sourced fuel. By relying on fuel from Maryland, the Project will reduce the amount of economic activity that is created outside of Maryland through use of non-Maryland fuels. It is estimated that each dollar spent on fuel for electricity generation results in three dollars of total economic activity.[18] Thus the substitution of Maryland-based fuel (i.e. MSW) for imported coal or other fuel keeps the resulting economic activity in Maryland, rather than exporting that economic activity to other states (or Russia).

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passenger cars (not including light trucks). United States Department of Transportation - Federal Highway Administration, Highway Statistics, 2009, http://www.fhwa.dot.gov/policyinformation/statistics/2009/mv1.cfm.

[17]Op. cit., Susan Cochran et al.

[18]International Center for Sustainable Development, "*Economic Development Potential of Clean Energy Technology in Maryland and Feasibility Study for a Maryland Clean Energy Center,*" December 31, 2006.

8.0 Project Infrastructure Sharing

The developer of the Project will install several utilities to support the operations of the Project and the adjacent Eco-Industrial Park. Included in this infrastructure is a 4.5-mile electrical transmission duct bank that will connect the Project's power plant to the BGE Pumphrey substation. This duct bank will be deliberately oversized to accommodate additional future electrical connection needs from future generating units. Fiber optic lines will also be run in this electrical transmission duct bank, which will have capacity for additional fiber optic or electrical lines. Still being assessed is the viability of running a natural gas pipeline to the Fairfield peninsula. This pipeline would provide needed gas supply to an area currently underserved.

This enhanced infrastructure on the Fairfield Peninsula provides attributes that can benefit other businesses currently sited there. These attributes can also be a means of attracting other businesses and industries to the area.

9.0 Other Contributions

The Project's power plant will use 3 million gallons per day of treated wastewater effluent from a nearby waste water treatment plant. The reuse of treated water creates benefits along multiple dimensions. Industrial use of treated wastewater reduces demand on potable sources of freshwater and diminishes the volume of discharged wastewater, thus reducing pollution of rivers and ground waters and having a beneficial impact on aquatic environments. Furthermore, the Project's purchase of treated wastewater effluent will generate approximately $500,000 in annual net revenue for the City of Baltimore.

10.0 Summary of Project Benefits

Maryland is a net importer of electricity. Analysis produced for the Maryland Public Service Commission concluded that Maryland could benefit from additional generating capacity of 1,080 MW.[19] Shortfalls in generating capacity create a number of problems for Marylanders and increase the cost of electricity in part because of the congestion associated with importing power.

Therefore, one of the principal benefits of the Project is the development of a significant generating capacity at a location in the very midst of electrical power demands in Maryland. With a capacity of 159 MW, the Project reduces the state's shortfall by 15 percent.

By using MSW as a fuel source rather than coal, the predominant fuel in Maryland and a fuel that is almost completely imported into the state, the Project generates a host of benefits, including reduced GHG emissions and a reduced demand for land-filling of MSW. These benefits can be monetized and converted to values for each kilowatt hour of electricity generated by the Project.

Exhibit 26 lists the bundled price of electricity produced by the Project and then reduces that cost by the value of enumerated benefits that the Project creates. The value of adding capacity in Maryland is estimated as a range of $300 million to $800 million for the 1,080 MW shortfall. This range gives rise to a range of effective prices for the Project's electricity. Other credits have only one estimated value as shown in the exhibit.

Exhibit 26. Project benefits in terms of value per kilowatt hour of electricity (2011 dollars)

Effective price of Project's electricity	*High*	*Low*	*Midpoint*
Bundled price	$0.1236	$0.1236	$0.1236
Value of added capacity	$0.0348	$0.0929	$0.0639
Price after capacity credit	$0.0888	$0.0307	$0.0597
Value of RGGI credit	$0.0028		
Price after RGGI credit, before carbon credit	$0.0859	$0.0278	$0.0569
Value of carbon credit	$0.0246		
Price after carbon credit replaces RGGI credit	**$0.0642**	**$0.0061**	**$0.0351**
Benchmarks			
DGS (1)	$0.0885		
Mean residential price (2)	$0.0916		

Notes. 1. DGS price based on auctions of bulk power for state energy users. 2. Mean residential price of BGE electricity as reported in Baltimore Sun, April 26, 2011. Sources. See Exhibit 7 for Project prices and credits.

[19] "Final report of the Public Service Commission of Maryland to the Maryland General Assembly," December 10, 2008.

The various credits that will be earned by the Project mean that the effective price of its electricity is substantially below the bundled price. The midpoint effective price after taking into consideration the value of capacity credit alone ($0.0597) is below the average residential price for BGE customers ($0.0916) and the average price paid by DGS for bulk power ($0.0885). Credits for reduced GHG drive the effective price even lower.

Maryland has mandated ambitious goals for statewide electricity purchases from renewable energy providers. Based on existing long-term contracts that DGS has already signed, the Project can provide cheaper and more consistently reliable electricity and much greater capacity, and deliver this power from a site at the heart of the state's zone of most intense energy demand.

The green jobs created by the Project and the ability of the Project to attract other green jobs and industries add to overall benefits. These jobs are well paid. This economic activity will generate substantial tax benefits for the City and the State. Ongoing operations of the Project will create an annual stream of almost $43 million each year. The Eco-Industrial Park will add almost $10 million annually to this stream of revenues.

Finally, the economic activity created by the Project will be substantial. For each kWh of electricity generated by the Project, economic activity worth as much as $0.44 per kWh will be generated in Maryland. This includes almost $0.04 per kWh of taxes and other fiscal benefits for state and local governments in Maryland. The Project and its benefits are also "shovel ready" ─ the Project is already fully permitted, ready to close financing, begin construction and create production and other jobs immediately.

Appendix A

SEMASS Resource Recovery Facility

The SEMASS Resource Recovery Facility, developed by Energy Answers, provides the communities of Cape Cod and southeastern Massachusetts with an alternative to land-filling their solid waste and is an integral part of a regional solution which includes well established programs for reduction, recycling, and composting.

The best testimony to the acceptance of the SEMASS resource recovery system is the fact that it was built in one of the most environmentally sensitive areas in the U.S., in a relatively affluent community with significant tourism and surrounded by cranberry bogs and other agriculture. Later when the expansion application was submitted to the Massachusetts Department of Environmental Protection, it was approved without any negative comments.

Energy Answers' PRF technology has been in operation at the SEMASS Resource Recovery Facility in Rochester, Massachusetts since 1988. SEMASS was designed and developed by Energy Answers to solve solid waste disposal problems in an environmentally sensitive and economically attractive way by emphasizing the total recovery and reuse of waste materials with energy generation. The company developed and managed the private financing for the base plant, with a capacity of 2,000 tons per day, as well as the expansion, which brought SEMASS to its current capacity of 3,000 tons per day. Energy Answers was also the general manager and co-operator of the SEMASS project from 1988 to 1996. The SEMASS Partnership was sold to American Ref-Fuel in June 1996, and subsequently to Covanta Energy, to allow Energy Answers to devote its efforts toward implementing the resource recovery technology on a world-wide scale. Energy Answers International retains all rights to the technology at SEMASS, which will continue to serve as a model for future projects.

The original design for the SEMASS facility constructed in 1989 was state-of-the-art, using very progressive design attributes which resulted in maximizing the positive impacts of resource recovery. Some of the more significant design aspects, or results, are listed below:

- Maximum net electric energy generation per ton of waste for any waste-to-energy facility in the world - 590 kWh/ton.
- Maximum total energy generation from waste - 650,000 MWh/year.
- Minimum residue generated/ton of waste 11.5%; includes 9% fly ash for which uses are being developed.
- Only separate fly ash and bottom ash recovery and treatment system in the U.S.
- Only dry bottom ash removal system in the U.S.
- Only fully integrated bottom ash materials recovery system in the U.S. and Canada.
- First large-scale U.S. waste-to-energy facility with spray dryer scrubber for neutralization of acid gases and dioxin.
- First U.S. facility with rail delivery of waste (from all Cape Cod, Massachusetts communities).
- Zero water discharge facility with minimum water consumption per ton of waste processed (+/- 135 gallons/minute).

Appendix B

Economic Activity Associated with Recovered Metals

The Project will recover over 65,000 tons of metals from MSW that is processed and used as fuel. Exhibit A1 summarizes the current value of these recovered metals which approaches $19 million.

Exhibit A1. Value of metals recovered by the Project

Type of metal	*Tons recovered*	*Value/ton*	*Annual value (millions)*
Pre-combustion Ferrous	43,935	$102	$4.5
Post-combustion Ferrous	12,217	$70	$0.9
Non-ferrous	9,518	$1,393	$13.3
Total			$18.7
Source: Energy Answers, Sage			

These recovered metals can be used by secondary smelters to produce ferrous or non-ferrous metal ingots or products. Secondary smelting is much more energy efficient than primary smelting (i.e. the production of metals from ore). The major cost of operations for secondary smelting is the cost of materials, presumably scrap (i.e. recovered metals), which accounts for 70 percent or more of the value of shipments (i.e. revenue) of secondary smelters that produce metals in ingots or other forms that are then used to produce metal products. Using this ratio, an estimate of total value of shipments can be made. Exhibit A2 uses this method to estimate the annual value of smelter shipments that would be made from scrap recovered by the project. As shown, the $19 million of scrap is converted into $25 million of smelter shipments.

Exhibit A2. Value of metals recovered and value of smelter shipments

Type of metal	*Annual value of scrap (millions)*	*Ratio of scrap to smelter shipments*	*Annual value of smelter shipments (millions)*
Pre-combustion Ferrous	$4.5	70%	$6.4
Post-combustion Ferrous	$0.9	70%	$1.2
Non-ferrous	$13.3	77%	$17.2
Total	$18.7		$24.8
Source: Energy Answers, U.S. Bureau of the Census, Sage			

The economic impacts associated with secondary smelting operations valued at $25 million annually are summarized in Exhibit A3. These impacts would be in addition to the economic impacts of the Project itself. Over 100 jobs would be supported with income of $7 million. Total business sales would exceed $40 million. These impacts include the direct impacts of smelting operations as well as the indirect and induced impacts supported by smelting operations. If these smelters were located in Maryland, then these impacts would be an additional benefit the state from the Project.

Exhibit A3. Economic impacts of secondary smelters (values in millions of 2011 dollars)

Type of metal	*Jobs*			*Income*			*Business sales*		
	Direct	Indirect/ induced	Total	Direct	Indirect/ induced	Total	Direct	Indirect/ induced	Total
Pre-combustion Ferrous	14	20	34	$0.9	$1.3	$2.2	$6.4	$5.2	$11.5
Post-combustion Ferrous	3	4	6	$0.2	$0.3	$0.4	$1.2	$1.0	$2.2
Non-ferrous	20	53	73	$1.5	$3.1	$4.7	$17.2	$9.7	$26.9
Total	36	77	113	$2.6	$4.7	$7.3	$24.8	$15.8	$40.6
Sources: Sage, IMPLAN									

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