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Holland Board of Public Works

Power for the 21st Century Sustainable Return on Investment Analysis

Final Report

September 21, 2012

HDR Corporation
Decision Economics

Risk Analysis · Investment and Finance
Economics and Policy

Holland Board of Public Works

Power for the 21st Century

Sustainable Return on Investment Analysis

FINAL REPORT

Prepared by

HDR Corporation

October 15, 2012

NOTE

Unless otherwise stated, all dollar figures in this report are expressed in constant 2012 prices.

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EXECUTIVE SUMMARY

HDR was engaged to provide a Sustainable Return on Investment (SROI) analysis for the Holland Board of Public Works (HBPW) in Holland, Michigan, with respect to various options for addressing its base load electric generation needs. SROI is an approach to determining the public value of a project or initiative and to determine if the project is worthwhile. It answers the question of whether a project provides benefits (net of its costs) and therefore should be undertaken:

- Is the public value sufficient to justify the money required to develop the project?
- Which option provides the greatest return relative to project cost?

The generation options examined are: (i) 70 NMW Circulating Fluidized Bed Boiler & Steam Turbine; (ii) LM2500 Gas Turbine Combined Heat & Power Facility; (iii) 2x1 LM2500 Gas Turbine Combined Cycle Power Plant; (iv) James De Young Unit 5 Biomass Conversion; (v) 8 MW Solar Photovoltaic (PV) Plant; (vi) 20 MW Wind Farm, (vii) 4 MW Digester Gas Combined Heat & Power Facility; (viii) 2x1 LM6000 Gas Turbine Combined Cycle Power Plant; and, Air-Quality Control System (AQCS) Retrofits to James De Young Units 4 and 5.

The options have been combined into portfolios of generation options, called "scenarios" hereafter and summarized in Table 1.

Table 1: Scenario Resource Portfolio Matrix

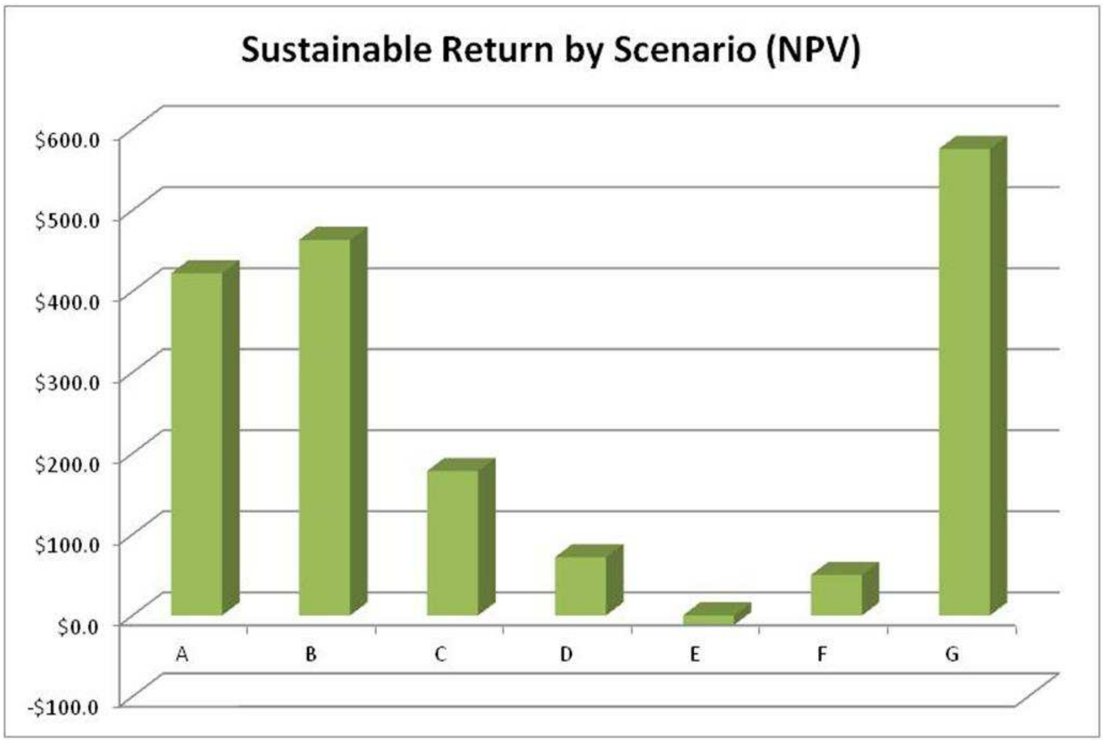
	JDY U10 CFB	LM2500 CHP	2x1 LM2500 CCPP	JDY U5 Biomass	Solar PV	Wind	Digester Gas CHP	2x1 LM6000	AQCS Retrofits
Main Fuel:	Solid Fuel	Gas	Gas	Biomass	Solar	Wind	Dig. Gas	Gas	Coal
BASE CASE	✓								✓
SCENARIO A		✓	✓						
SCENARIO B		✓	✓	✓	✓	✓	✓		
SCENARIO C	✓	✓			✓	✓	✓		
SCENARIO D	✓	✓							
SCENARIO E									✓
SCENARIO F									
SCENARIO G								✓	

As much as possible, these scenarios will reflect the scenarios considered in the Community Energy Efficiency and Conservation Strategy Plan and will be assessed in terms of their costs, benefits, and risks.

Overall Synopsis of Results

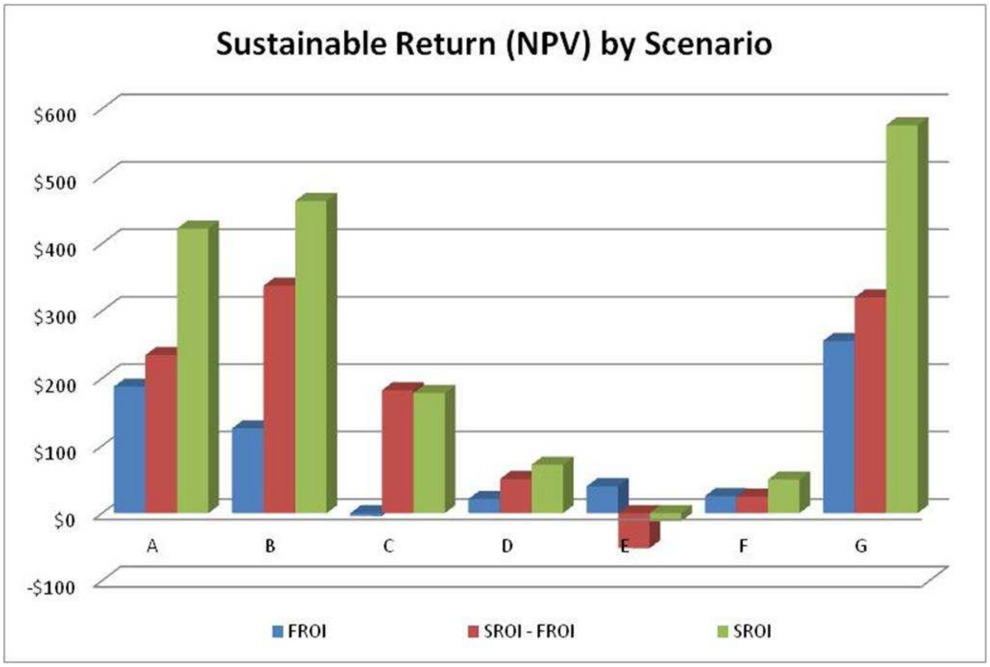
The following summarizes the results of the SROI analysis for each scenario and <u>all results are incremental to the Base Case</u>. All but one scenario (Scenario E) provides a positive SROI relative to the base case (see Figure 15). However, there is a strong trend in the analysis that indicates that the scenarios with natural gas (Scenario's A, B & G) provide the greatest public value relative to the other options, each with an NPV in excess of $400 M with Scenario G having the highest NPV of $576 M. The NPV of all other scenarios are less than $200 M, with Scenario C having the highest NPV of $178 M in that group.

Figure 1: SROI by Scenario, NPV $M



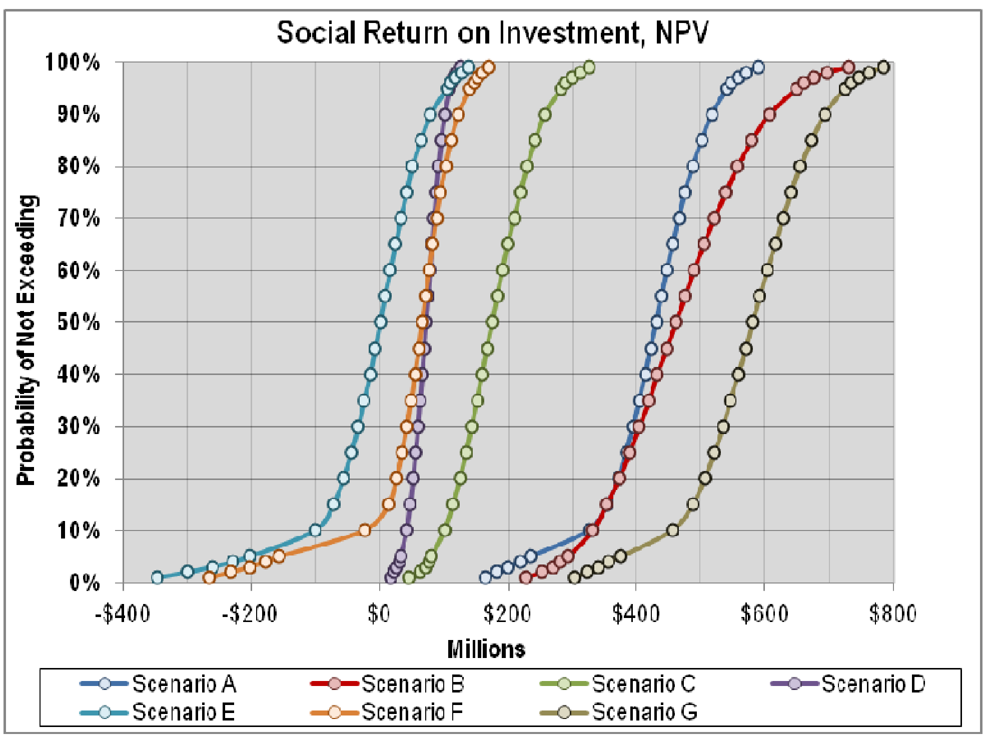
A key finding is that the three highest ranking scenarios on an overall SROI basis also rank the highest from both a financial and non-financial basis (see Figure 2). In general, two effects dominate the overall SROI analysis and they are positively correlated between scenarios: electricity rate reductions and emissions savings.

Figure 2: SROI by Component, NPV $M



The next set of outputs shows risk-adjusted information (in the form of S-curves) with regards to the Net Present Value (NPV) for each of the scenarios. The purpose of the S-Curves is to show the range of possibilities, expected outcomes, and their probability of occurrence. The probabilistic SROI results are displayed in Figure 3 demonstrating that Scenarios A, B and G rank highest.

Figure 3: SROI S-Curve Summary



1. INTRODUCTION

HDR was engaged to provide a Sustainable Return on Investment (SROI) analysis for the Holland Board of Public Works (HBPW) in Holland, Michigan, with respect to various options for addressing its base load electric generation needs. SROI is an approach to determining the public value of a project or initiative and to determine if the project is worthwhile. It answers the question of whether a project provides benefits (net of its costs) and therefore should be undertaken:

- Is the public value sufficient to justify the money required to develop the project?
- Which option provides the greatest return relative to project cost?

This public value indicates not just the financial or net “cash” benefits of a project, but also incorporates the value of broader social, health and environmental impacts that may be, in some stakeholders’ opinion, the primary reason for undertaking the project. Non-financial considerations such as reliability (e.g., reduced probability of outages), increased flexibility (e.g. ability to use multiple fuels such as biomass, tire derived fuel, petroleum refinery coke byproduct, and biosolids from a wastewater treatment facility), ability to provide local benefits (e.g. street and sidewalk snow melting, maintaining a commercial harbor status and funding, and ability to provide district heating), and the environment (e.g., reduction in greenhouse gas emissions and other pollutants) are also valued. By monetizing these benefits and costs, SROI reveals the full public value of a project and determines if the public benefits outweigh the public costs.

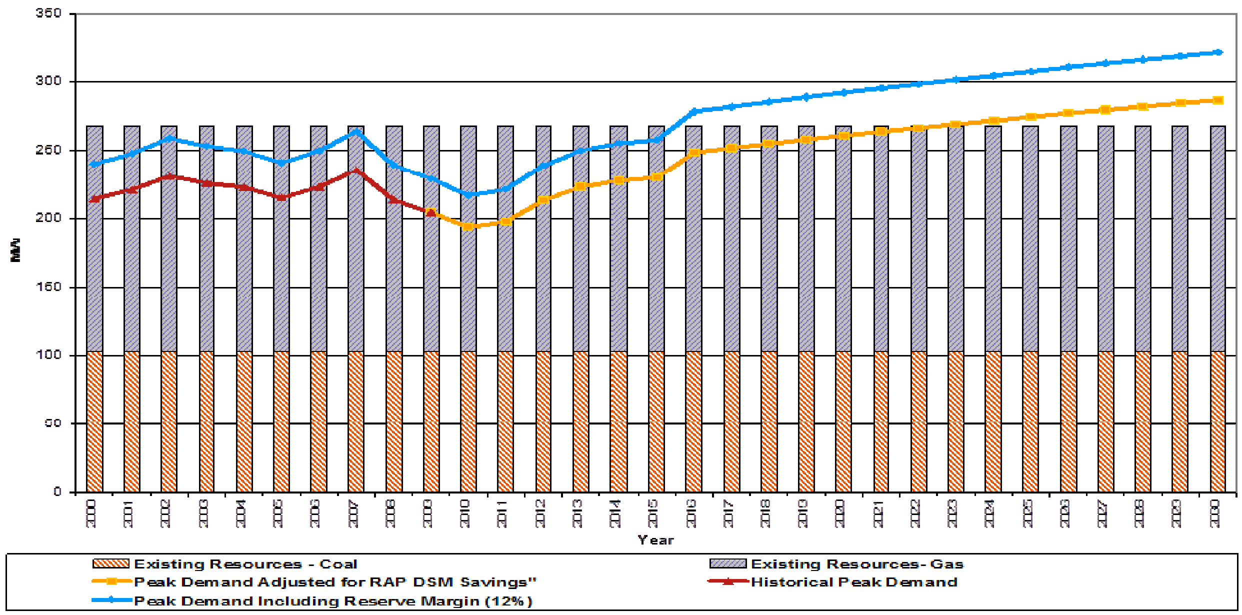
This report documents the results and the risk-adjusted probability curves of the results to summarize which options are expected to provide more value and what are the key components of that value: economic, social and environmental.

The report is structured as follows:

- Introduction
- SROI Background
- Option & Scenario Descriptions
- Cost & Benefit Structure
- SROI Inputs
- Key Findings
- Appendices

Energy consumption has steadily risen in Holland over the past thirty years, and this trend is expected to continue despite future planned demand-side management efforts. Figure 4 shows that Holland BPW's current installed electric generating capacity will be inadequate in the upcoming years.

Figure 4: Holland BPW Peak Electricity Capacity[1]



> "The recession our country experienced over the past decade slowed our need for further expansion, but it didn't reverse it. In spite of the recession Holland continued to grow, including the recent addition of two large investments in our community by LG Chem and Johnson Controls. These two facilities alone will require more energy than is currently used by all our residential customers combined."[2]

In addition to increases in forecasted energy load, Holland BPW acknowledges that:

> "The greater Holland community is at a crossroads in determining how best to meet its future power needs. Factors at work are long-term growth in power demand, regulatory requirements for the use of renewable energy sources, rising demand for power world wide and the cost and difficulty of maintaining

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[1] Garforth International LLC. *Community Engagement 2011 Communications Plan.* 2011

[2] http://p21decision.com/p21-start-thinking/whats-the-problem/ - "On July 21, 2011 the maximum hourly Peak Demand was 225 MW. With a 12% reserve margin, that puts required capacity at 252 MW, putting current generation capacity close to maximum. Holland's electric usage is growing: A single new industry like LG Chem adds approximately 20 MW of demand."

the aging equipment at the De Young plant, which currently produces a significant portion of the community's electricity."[3]

In order to address these issues, HBPW has proposed several options to replace and augment its generation portfolio.

The options under consideration are:

1. 70 NMW Circulating Fluidized Bed Boiler & Steam Turbine
2. LM2500 Gas Turbine Combined Heat & Power Facility
3. 2x1 LM2500 Gas Turbine Combined Cycle Power Plant
4. James De Young Unit 5 Biomass Conversion
5. 8 MW Solar Photovoltaic (PV) Plant[4]
6. 20 MW Wind Farm[5]
7. 4 MW Digester Gas Combined Heat & Power Facility
8. 2x1 LM6000 Gas Turbine Combined Cycle Power Plant
9. Air-Quality Control System (AQCS) Retrofits to James De Young Units 4 and 5

These options will be described in further detail in Section 3. The options have been combined into portfolios of generation options, called "scenarios" hereafter. As much as possible, these scenarios will reflect the scenarios considered in the Community Energy Efficiency and Conservation Strategy Plan and will be assessed in terms of their costs, benefits, and risks.

The assessment involves collaboration between HBPW, HDR, third-party firms, and local stakeholders. This collaboration resulted in a Sustainable Return on Investment (SROI) analysis, the methodology of which is described in Section 2

Several steps were undertaken before the SROI analysis could be conducted, however. In September 2011, an initial Risk Analysis Process (RAP) session was held in Holland. The RAP session had a panel of stakeholders including members of HBPW, the Holland community, and HDR to discuss potential project costs and benefits, and the inputs necessary to model them. A second RAP session was held in November 2011, at which preliminary values for the inputs discussed in the first session were presented and debated by a similar panel. The stakeholder input from these RAP sessions was combined with research and best-practices to produce the assumptions and inputs that were used in the cost-benefit model.

Most costs and benefits analyzed were contingent on generation dispatch simulations conducted by Ventyx, an ABB Company, engaged by HBPW. Ventyx used its *Strategist* modeling software to

[3] Holland BPW Press Release: "Air Quality Permit Allows Holland Board of Public Works to Move Ahead with Power Options Evaluation" February 11, 2011.

[4] 24 MW of Solar Capacity will be installed per the 40 year Community Energy Plan; however, only 8 MW will be installed in the 25-year period of the SROI analysis

[5] The Community Energy Plan called for 37 MW of wind, however, 20 MW appeared more viable given recent development efforts.

forecast generation unit operational data for each scenario. Using inputs provided by HDR, HBPW, and Ventyx's *Midwest Spring 2012 Power Reference Case*, the *Strategist* model determined the least-cost generation scenario throughout the project term, and the output of the model simulation included energy generated, heat produced, operating costs, and other necessary inputs to the SROI model. It should be noted that the "least-cost" generation scenario as determined by Ventyx did not consider full societal costs. However, pollutant emissions were assigned a unit cost value and factored in to the levelized cost of energy for each generating unit only to the extent that these represented compliance costs for Holland BPW. Emissions below the regulatory limits were not considered in the dispatch of the generation options.

With the necessary scenario operational output completed, the scenarios were then evaluated using HDR's SROI methodology, which is explained in the following section.

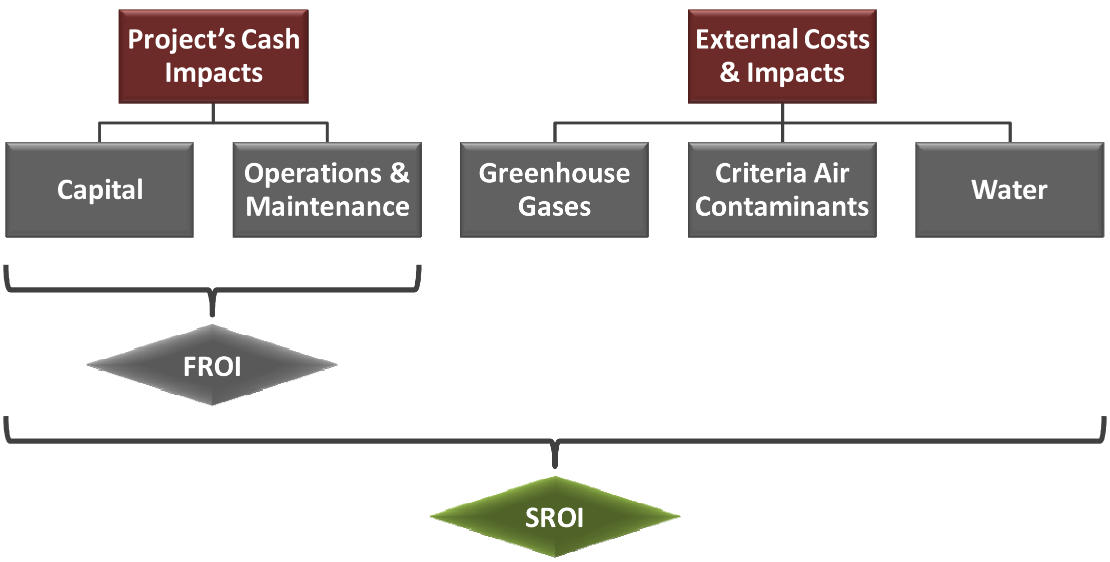
2. SUSTAINABLE RETURN ON INVESTMENT

SROI is an enhanced form of Cost-Benefit Analysis (CBA), which incorporates risk analysis and provides a triple-bottom line view of a project's economic results. SROI monetizes (converts to monetary terms) all relevant social and environmental impacts related to a given project in addition to providing the equivalent of traditional financial metrics. For HBPW, outputs are split into two primary perspectives: Financial Return on Investment (FROI) and Sustainable Return on Investment (SROI).

- FROI metrics includes only the cash impacts to HBPW and the Holland Community.
- SROI adds the external non-cash impacts that affect society to the FROI, including costs and benefits associated with items such as greenhouse gases (GHG's) and criteria air contaminants (CAC's), the City's snowmelt system, commercial harbor status, etc.).

Figure 5 highlights the general impacts included in the FROI and SROI analysis perspectives.

Figure 5: SROI Framework



Since traditional life-cycle cost methods fall short in the accurate quantification of all positive and negative externalities[6], HDR has developed the SROI process. Today, corporate social responsibility is the concept that organizations should consider the interests of society by accounting for the impact of their actions on customers, employees, their communities, and other stakeholders – including the environment. While there has been talk about responsible corporate citizenship, and there have indeed been tangible examples of its implementation, for the most part the discussion has not translated into a systematic action plan. If positive and negative

[6] In economics, an externality is a non-internalized cost or benefit resulting from one economic agent's actions that affect the well-being of others. For instance, pollution and other forms of environmental degradation are the result of some production process and are not reflected in the price of the goods or services being produced.

externalities were quantified, managers and investors could design, manage, and fund organizations that maximized the combined financial, environmental, and social returns.

HDR's SROI process takes into account the entire scope of potential costs and benefits related to sustainability measures, while simultaneously incorporating a risk analysis component over the project's life cycle. This includes traditional inputs such as savings on utility bills and costs associated with producing electricity, but also inputs such as quantifying the environmental savings from reduced carbon emissions, the increased economic development to the Holland area, better reliability in the power supply system, improved water quality to Lake Macatawa, and emission savings from reduced criteria air contaminants.

HDR's SROI process involves four distinct steps:

1. Develop the structure and logic of the business case: This involves economic analysts researching all information available regarding the relevant sustainable strategies and graphically illustrating the calculations required.
2. Quantify input assumptions and assign risk ranges: This step involves building the "first cut" of the SROI model, populating the model with the best preliminary information available, and developing the initial calculations regarding the sustainable strategies to be analyzed.
3. Facilitate a Risk Analysis Process (RAP) session: This is a meeting, similar to a one-day charrette, whereby all key stakeholders are brought together to develop and reach consensus on all of the inputs and calculations used in the model.[7]
4. Simulate outcomes and quantify probabilistically: The final step in the process involves generating the SROI metrics such as Net Present Value, Discounted Payback Period, Internal Rate of Return, etc.

Risk analysis and Monte Carlo simulation techniques were used to account for uncertainty in both the input values and model parameters. All projections were expressed as probability distributions (a range of possible outcomes and the probability of each outcome). Finally, each element was developed or converted into monetary values to estimate the overall impacts in comparable financial terms.

HDR's analysis produced results on both a financial and sustainable basis using net present value (NPV) as the primary evaluation metric. NPV is the net value that an investment or project adds to the value of the organization, calculated as the sum of the present value of future cash flows less the present value of the project's costs.

In addition, HDR's SROI analysis includes the following assumptions:

- The social costs of greenhouse gases and air pollutants are based on the best available scientific studies.[8] They include, among others: human health impacts, reduced agricultural

[7] See Appendix D for a detailed description of HDR's Risk Analysis Process

[8] – Interagency Working Group on Social Cost of Carbon, US Government. For regulatory impact analysis under Executive Order 12866. 2010

yields, accelerated depreciation of man-made materials, and lost recreation usage due to impaired forest health and other impacts.

A full overview of the SROI process, including an explanation of S-curves, can be found in Appendix A.

- Muller, et al. 2007: Measuring the Damages of Air Pollution in the United States
- Holland and Watkiss. 2002: Estimates of the marginal external costs of air pollution in Europe. Published Studies.
- Friedrich, Rabl and Spadaro. 2001: Quantifying the Costs of Air Pollution: the ExternE Parameter of the EC. H.
- Scott Matthews and Lester B. Lave. 2000: Applications of Environmental Valuation for Determining Externality Costs.
- U.S DOT. 2002. Highway. Economic Requirements System State-Version, Technical Report.
- U.S DOT. 2009. Final Regulatory Impact Analysis. *Corporate Average Fuel Economy for MY 2011 Passenger Cars and Light Trucks.* National Highway Traffic Safety Administration

3. OPTION & SCENARIO DESCRIPTION

The following section describes each of the generation options under consideration, and how they will be combined into different scenarios.

The generation options examined are:

1. 70 MW Circulating Fluidized Bed Boiler & Steam Turbine
2. LM2500 Gas Turbine Combined Heat & Power Facility
3. 2x1 LM2500 Gas Turbine Combined Cycle Power Plant
4. James De Young Unit 5 Biomass Conversion
5. 8 MW Solar Photovoltaic (PV) Plant[9]
6. 20 MW Wind Farm
7. Digester Gas Combined Heat & Power Facility
8. 2x1 LM6000 Gas Turbine Combined Cycle Power Plant
9. Air-Quality Control System (AQCS) Retrofits to James De Young Units 4 and 5

These eight options are described in further detail below. A summary of capital costs and fixed and variable operating costs associated with each option is included in Appendix B.

Generation Options

70 MW Circulating Fluidized Bed Boiler & Steam Turbine – "JDY Unit 10 CFB"

A new circulating fluidized bed (CFB) boiler and steam turbine generator (STG) will be installed in approximately the same area as the retired James De Young (JDY) Units 1 and 2 (demolition costs for Units 1 and 2 are not included in the capital cost estimate). The STG will generate nominally 70 MW of net power output by receiving superheated steam from the CFB boiler. The specific fuel blend to be burned has not been finalized; however, it is expected that some combination of Petroleum Coke, biomass, tire-derived fuel and/or coal will be utilized. Significant additions and retrofits to the existing JDY fuel handling facilities to accommodate the various fuels such as conveyor upgrades, scales, and unloading systems are accounted for in the capital and O&M cost estimates. Additionally, it is anticipated that the facility will require the addition of selective non-catalytic reduction (SNCR), dry sorbent injection (DSI), a bag house, a dry scrubber, and a new cooling tower.

LM2500 Gas Turbine Combined Heat & Power Facility – "LM2500 CHP"

A new combined heat and power (CHP) facility utilizing a single GE LM2500 combustion turbine generator (CTG) exhausting to a single pressure heat recovery steam generator (HRSG) will

[9] 24 MW of Solar Capacity will be installed per the 40 year Community Energy Plan; however, only 8 MW will be installed in the 25-year period of the SROI analysis

generate nominally 30 MW of power and produce nominally 120,000 lb/hr of steam for industrial process and/or for district heating. The CHP facility will be located in the general area of the Industrial Park and requires a tie-in to the existing HBPW gas pipeline. The HRSG includes both selective catalytic reduction (SCR) and an oxidation catalyst for carbon monoxide (CO) and volatile organic compound (VOC) emissions mitigation.

2x1 LM2500 Gas Turbine Combined Cycle Power Plant – "2x1 LM2500 CCPP"

A new combined cycle power plant (CCPP) utilizing two GE LM2500 CTG's exhausting to two double-pressure HRSG's generating steam for a single STG will produce nominally 80 MW of net power output. The facility will be located at the existing JDY site occupying the general area where retired Units 1 and 2 are located as well as a small portion of the existing coal pile (demolition costs for Units 1 and 2 are not included in the cost estimate however required general site remediation due to the coal pile is). The HRSG's include both SCR and an oxidation catalyst for CO and VOC emissions mitigation. The CCPP will require a tie-in to the existing HBPW gas pipeline as well as a new cooling tower. When possible, existing JDY facilities (such as the water treatment facilities and storage facilities) were utilized for the new combined cycle plant and such was taken into account in developing the capital and operating costs.

James De Young Unit 5 Biomass Conversion – "JDY U5 Biomass"

The existing JDY Unit 5 boiler is converted to burn woody biomass and is capable of producing nominally 22 MW of net power output. Required retrofits and additions to the existing fuel handling facilities to handle the biomass such as conveyor upgrades, scales, and unloading systems are included. It is assumed that the existing Unit 5 AQCS equipment will be utilized and no new air pollution control equipment will be added.

8 MW Solar Photovoltaic Plant – "Solar PV"

An 8 MW fixed axis solar PV plant will be installed at an undetermined location. It is assumed that the City of Holland will need to purchase land for the installation; however, the costs associated with this are not included in the capital cost estimate.

20 MW Wind Farm – "Wind"

A wind farm with 20 MW of rated capacity will be installed at an undetermined location. It is assumed that the City of Holland will need to purchase land for the installation; however, the costs associated with this are not included in the capital cost estimate.

Digester Gas Combined Heat & Power Facility – "Digester Gas CHP"

A digester gas CHP facility utilizing a Solar Centaur CTG exhausting to a single pressure HRSG will produce approximately 4 MW of net power output as well as 23,000 lb/hr of steam for process and/or district heating. The facility will be located at either the existing JDY site or at the wastewater treatment facility. The facility capital & operating costs include both the power island and the anaerobic digester (digester portion of capital & operating costs provided by vendor proposal).

2x1 LM6000 Gas Turbine Combined Cycle Power Plant – "2x1 LM6000"

A new combined cycle power plant utilizing two GE LM6000 CTG's exhausting to two double-pressure HRSG's supplying steam to a single steam turbine will produce nominally 114 MW of net output. The facility will be located adjacent to the existing JDY site. The HRSG's include both SCR and an oxidation catalyst to mitigate CO and VOC emissions. The CCPP will require a tie-in to the existing HBPW gas pipeline as well as a new cooling tower.

Emissions Compliance Alternatives – "AQCS Retrofits"

In addition to new generation options, alternatives were considered for ongoing operation of the existing JDY facility with associated plant modifications as required to comply with forthcoming environmental regulations. This section provides a brief description of the emissions compliance options for the existing units at JDY. All options assume that JDY Unit 3 will be retired. For the new bag house alternatives, it is assumed that the existing JDY Unit 3, 4, and 5 electrostatic precipitators (ESP's) will be demolished. Consequently, it is assumed that the costs associated with the Unit 3 and 5 ESP demolitions will be shared between the Unit 4 and Unit 5 bag house projects as the location of the new bag houses will be in the general vicinity of these two existing ESP's. The costs associated with the Unit 4 ESP demolition are included in the Unit 4 bag house project costs (existing Unit 4 ESP is located on the facility roof).

A stand-alone bag house and DSI system (utilizing milled Trona) for SO2 mitigation will be installed for Unit 4 at grade between the existing ash handling access road and the main JDY facilities (equipment relocated as necessary). This option requires a significant amount of new ductwork to bring the Unit 4 flue gas to grade as the existing Unit 4 ESP is located on the facility roof. Additionally, the Unit 4 boiler will be retrofitted with a selective non-catalytic reduction (SNCR) system injecting ammonia into the boiler flue gas path for NOx emissions control.

A stand-alone bag house and DSI system (utilizing milled Trona) for SO2 mitigation will be installed for Unit 5 between the existing ash handling access road and the main JDY facilities (equipment relocated as necessary). A stand-alone bag house for Unit 5 requires some new ductwork however it is anticipated that the majority of the existing ductwork can be utilized. Additionally, the Unit 5 boiler will be retrofitted with a selective non-catalytic reduction (SNCR) system injecting ammonia into the boiler flue gas path for NOx emissions control.

Snow Melt System

The City of Holland currently operates a snowmelt system with a nominal heating capacity of 36 mmBtu/hr. The current system is supplied with waste heat from the JDY Unit 3 cooling water system which, per the Community Energy Plan (CEP), will retire circa 2016. After JDY Unit 3 retires, the snowmelt system will require waste heat from existing resources (other JDY units remaining in operation), new generation alternatives, or dedicated gas-fired boilers; the heat source is ultimately decided by which electric generating resource Scenario is under consideration. Based on the technology options utilized in each Scenario, snowmelt system performance and costs were developed utilizing waste heat from the plant's heat rejection system from JDY Unit 10 (CFB), the 2x1 LM2500 CCPP, the 2x1 LM6000 CCPP, and JDY Unit 5 (when kept in operation past 2016). Additionally, performance and costs were developed utilizing gas-fired packaged boilers for pure market purchase situations. In addition to satisfying the current snowmelt capacity of 36 mmBtu/hr, performance and costs were developed for expanding the system to nominally 100 mmBtu/hr.

Required snowmelt temperatures are achieved by driving up the STG condenser back pressure which, depending on the technology option, is achieved by recirculating hot cooling water (applies to JDY Unit 5 as it utilizes once through cooling) or shutting off cooling tower fans (applies to other base load generation options under consideration as these utilize cooling towers). The snowmelt area expansion benefit, total installed capital costs, and incremental operating costs (power consumption, O&M, fuel consumption, and emissions) were developed. Noted power consumption variances are attributed to changes in STG output as a result of varying back pressure.

District Heating

District heating performance and costs were developed for the LM2500 CHP, 2x1 LM2500 CCPP, digester gas CHP, and 2x1 LM6000 CCPP new generation alternatives. For the CHP options, two cases were examined: one based on utilizing the generated process steam and the other utilizing both the process steam and available waste heat recovered from a stack water heater. The stack water heater is located in the CTG exhaust gas flow path as an additional tube bundle in the HRSG. For the CCPP options, there is no dedicated process steam generated (all steam sent to the STG) and, as such, only performance and costs associated with a stack water heater were developed. Installing a stack water heater results in a higher CTG exhaust pressure drop and consequently decreased CTG output.

Scenario Descriptions

Different portfolios of options, or "scenarios," were developed as different alternatives for meeting Holland's increasing energy demand. There are eight scenarios (A-G) including the base case. Scenarios A-D reflect, as much as possible, scenarios A-D in the Community Energy Plan.[10] These scenarios are the alternative cases evaluated in the SROI analysis, and are described below.

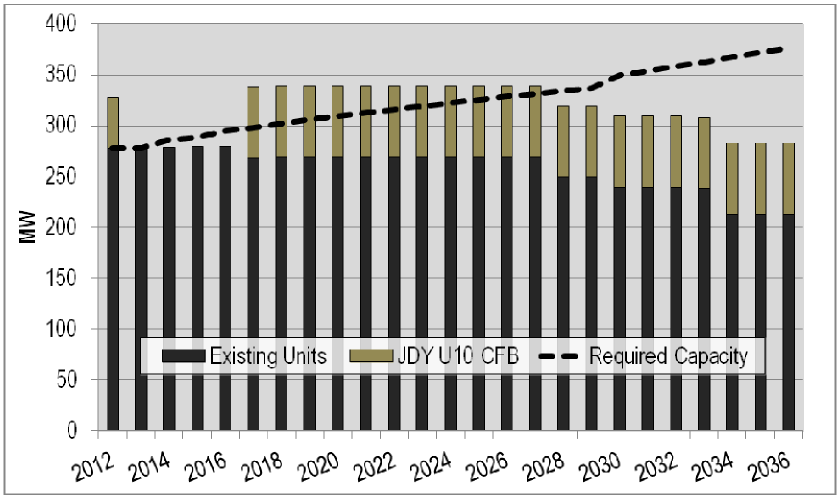
Note that for each scenario, any load that cannot be satisfied by HBPW's new or existing units would be purchased from the energy market. HBPW's existing units are assumed to continue operating unless otherwise stated. All capital costs provided in this section are in real, undiscounted 2012 dollars.

Base Case

In the base case, JDY units 4 and 5 will immediately undergo AQCS retrofits, incurring capital costs of $28 million. JDY U10 CFB is constructed at a capital cost of $329 million, and will begin operation in 2017. The CFB unit runs on a fuel mixture of petroleum coke, biomass, coal, and tire-derived fuel. HBPW's firm capacity in the base case over the 25-year analysis period is shown in Figure 6.

[10] Garforth International LLC. *Community Engagement 2011 Communications Plan.* 2011

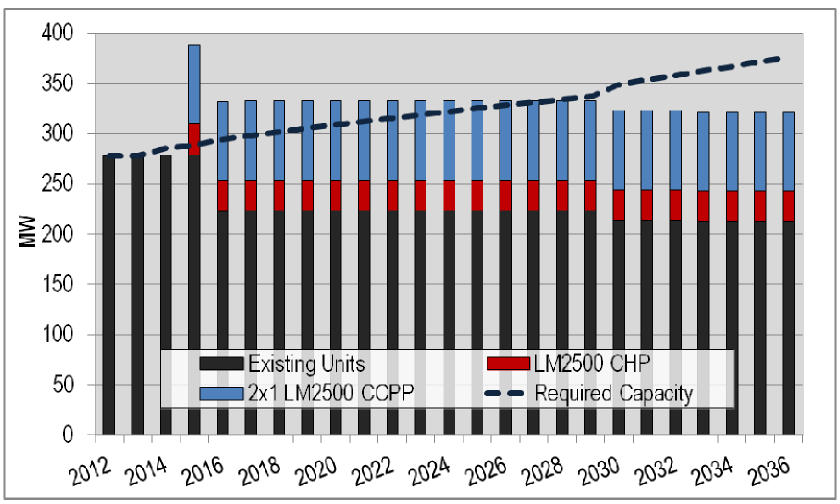
Figure 6: Firm Capacity – Base Case



Scenario A

In scenario A, no AQCS retrofits will be conducted, and JDY units 4 and 5 will cease operation in 2016. A 2x1 LM2500 combined cycle power plant and an LM2500 CHP plant will begin operation in 2015, and will be constructed at a capital cost of $147 million and $60 million, respectively. HBPW's firm capacity in scenario A over the 25-year analysis period is shown in Figure 7.

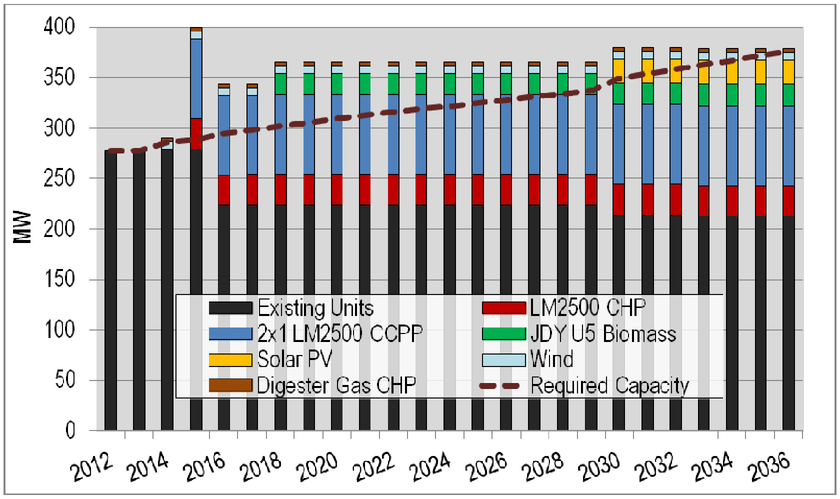
Figure 7: Firm Capacity – Scenario A



Scenario B

In scenario B, no AQCS retrofits will be conducted, and JDY units 4 and 5 will cease operation in 2016. 20 MW of wind capacity will be installed for $47 million, and will begin operation in 2014. A digester gas CHP facility will also begin operation in 2014, and will cost $35 million. A 2x1 LM2500 combined cycle power plant and an LM2500 CHP plant will begin operation in 2015, and will be constructed at a capital cost of $147 million and $60 million, respectively. 22 MW of capacity go online in 2018 with the $66 million JDY U5 Biomass retrofit option. Finally, in 2030, 8 MW of Solar PV capacity will be installed. Capital costs for the 8 MW of Solar PV total $59 million. HBPW's firm capacity in scenario B over the 25-year analysis period is shown in Figure 8.

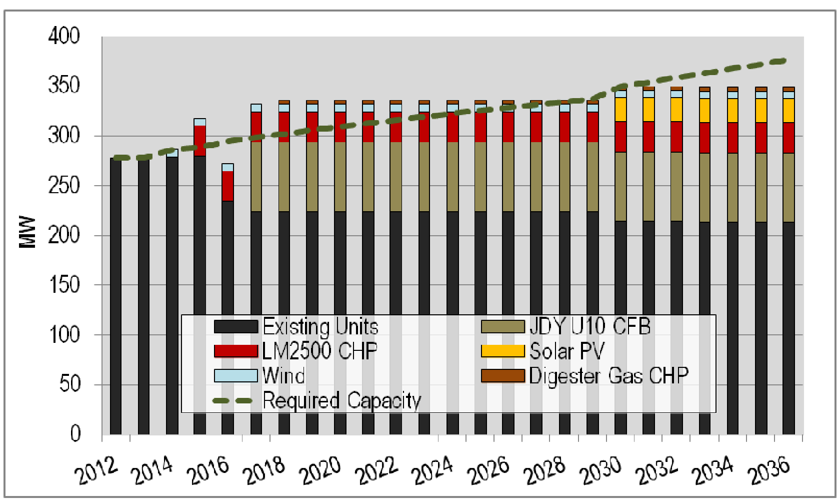
Figure 8: Firm Capacity – Scenario B



Scenario C

In scenario C, no AQCS retrofits will be conducted, and JDY units 4 and 5 will cease operation in 2016. 20 MW of wind capacity will be installed for $47 million, and will begin operation in 2014. A digester gas CHP will also begin operation in 2014, and will cost $35 million. An LM2500 CHP plant will begin operation in 2015, and will be constructed at a capital cost of $60 million. JDY U10 CFB is constructed for $329 million, and will begin operation in 2017. The CFB unit runs on a fuel mixture of petroleum coke, biomass, coal, and tire-derived fuel. Finally, in 2030, 8 MW of Solar PV capacity will be installed. Capital costs for the 8 MW of Solar PV total $59 million. HBPW's firm capacity in scenario C over the 25-year analysis period is shown in Figure 9.

Figure 9: Firm Capacity – Scenario C

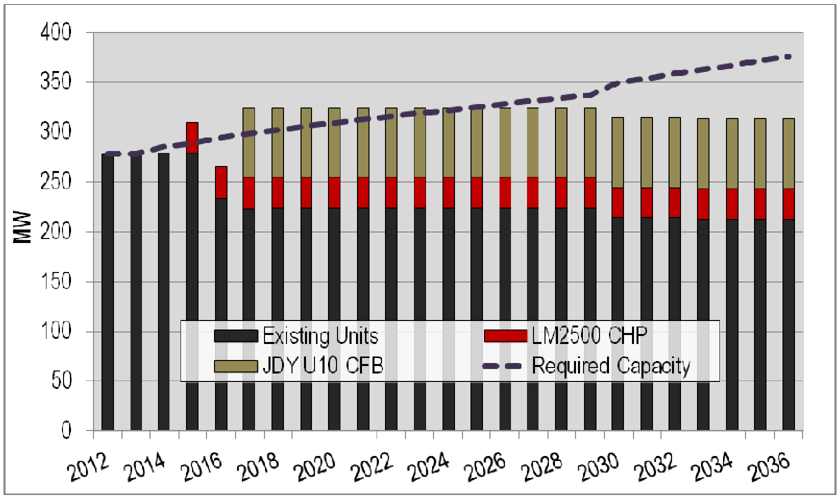


Scenario D

In scenario D, no AQCS retrofits will be conducted, and JDY units 4 and 5 will cease operation in 2016. An LM2500 CHP plant will begin operation in 2015, and will be constructed at a capital cost of $60 million. JDY U10 CFB is constructed for $329 million, and will begin operation in 2017. The

CFB unit runs on a fuel mixture of petroleum coke, biomass, coal, and tire-derived fuel. HBPW's firm capacity in scenario D over the 25-year analysis period is shown in Figure 10.

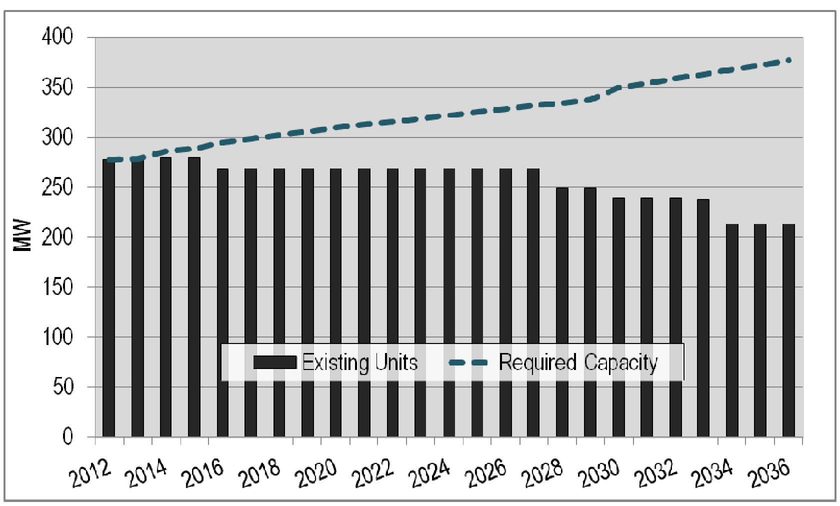
Figure 10: Firm Capacity – Scenario D



Scenario E

In scenario E, JDY units 4 and 5 will immediately undergo AQCS retrofits, incurring capital costs of $28 million. The remainder of electricity needs will be satisfied by existing units and market purchases. HBPW's firm capacity in scenario E over the 25-year analysis period is shown in Figure 11.

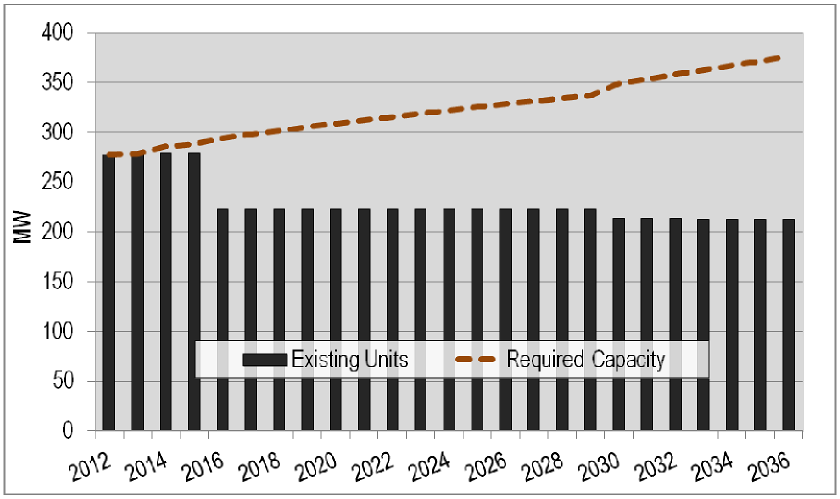
Figure 11: Firm Capacity – Scenario E



Scenario F

In scenario F, no AQCS retrofits will be conducted, and JDY units 4 and 5 will cease operation in 2016. The remainder of electricity needs will be satisfied by existing units and market purchases. HBPW's firm capacity in scenario F over the 25-year analysis period is shown in Figure 12.

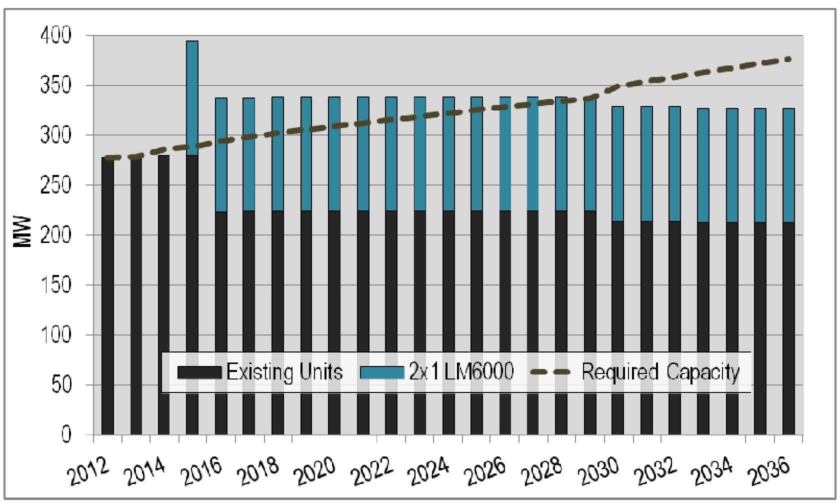
Figure 12: Firm Capacity – Scenario F



Scenario G

In scenario G, no AQCS retrofits will be conducted, and JDY units 4 and 5 will cease operation in 2016. A 2x1 LM6000 CCPP facility will be constructed at a capital cost of $182 million, and will begin operation in 2015. HBPW's firm capacity in scenario G over the 25-year analysis period is shown in Figure 13.

Figure 13: Firm Capacity – Scenario G



These scenarios are summarized in Table 2. A checkmark (✓) in a scenario's row signifies that the generation option in the respective column is included in that scenario.

Table 2: Scenario Resource Portfolio Matrix

	JDY U10 CFB	LM2500 CHP	2x1 LM2500 CCPP	JDY U5 Biomass	Solar PV	Wind	Digester Gas CHP	2x1 LM6000	AQCS Retrofits
Main Fuel:	Solid Fuel	Gas	Gas	Biomass	Solar	Wind	Dig. Gas	Gas	Coal
BASE CASE	✓								✓
SCENARIO A		✓	✓						
SCENARIO B		✓	✓	✓	✓	✓	✓		
SCENARIO C	✓	✓			✓	✓	✓		
SCENARIO D	✓	✓							
SCENARIO E									✓
SCENARIO F									
SCENARIO G								✓	

4. COST & BENEFIT METHODOLOGY

Through the SROI process, including the two RAP sessions, a number of costs and benefits were identified. These costs and benefits have been separated into two categories – financial (cash based) and social/environmental (non-cash based). Financial costs and benefits calculate actual cash flows accruing to Holland BPW or the community of Holland.[11] These revenues and costs/expenditures are the basis of a traditional Return on Investment (ROI) analysis. Social costs and benefits are externalities that are not usually captured in ROI analyses, and do not have a price set by a market. An example is the benefit of a snowmelt system. The James De Young Unit 3 waste heat is rejected into the condenser cooling water. In the winter, this water with excess waste heat is directed to the snowmelt system before being discharged into Lake Macatawa. The benefit to the community has no price but the benefits include no salting, no plowing, no slipping or sliding, no track-in to store carpeting, and the sidewalk bricks are not prone to frost heave throughout the winter months.

Adding these non-cash costs and benefits allows us to evaluate how each option will impact society at large, and reveal the "hidden" value of the option. Social benefits and costs that do not involve actual cash flows will be monetized so they may be evaluated alongside the financial costs and benefits. Together, the net financial and social costs and benefits give the scenario's SROI.

Table 3 below provides the cost and benefit categories for assessing the various scenarios. The specific impacts are based on consultation with the project team and other stakeholders, best-practices, independent research and feedback from the RAP sessions. Note that some categories are listed as both costs and benefits because they represent a transfer from one party to another. That is, the benefit received by one party is paid for by another. While these items will cancel out in the overall evaluation, including them in the analysis allows each stakeholder group to see how its account is affected.

[11] Impacts are calculated for each of Holland BPW, its customers and owners - the Holland community.

Table 3: Benefit and Cost Summary

Name	Impact Type	Description	Category
Generated Energy Revenue, HBPW	Benefit	Revenue Holland BPW receives from selling generated energy to consumers. This revenue is offset as a cost to the consumer.	Financial
Generated Energy Revenue, Interchange	Benefit	Revenue Holland BPW receives from selling energy into the MISO wholesale market.	Financial
District Heating Revenue	Benefit Cost	Quantifies the revenue attributed to district heating service. Rates are set so that costs are recovered.	Financial
Snow Melt Revenue	Benefit Cost	The added revenue associated with increased snow melt capacity is calculated as a financial benefit to HBPW, and a cost to the community. Rates are set so that costs are recovered.	Financial
Renewable Energy Credits	Benefit Cost	Michigan's Renewable Portfolio Standard (RPS) legislation dictates 10% of energy must be from "renewable" technology. This RPS requirement is tracked through Renewable Energy Credits (RECs). Credits may be bought or sold, and are earned by generating electricity with renewable technology. If HBPW does not meet its requirement in a given year, it will incur a cost to purchase RECs; if HBPW has earned more credits than necessary, they will sell the excess credits and produce revenue.	Financial
Retired James De Young Land Value	Benefit Cost	Some scenarios allow for the retirement of James De Young. The land may then be sold, resulting in revenue to HBPW, and cost to the community.	Financial
Reduced Biosolids Treatment & Transportation Cost	Benefit	Generation technologies that burn biosolids avoid the transportation and treatment of biosolids costs that otherwise would be incurred.	Financial
Capacity Purchases/Sales	Cost Benefit	If HBPW owns more capacity than necessary, it may sell the excess capacity; if it has less than necessary, it must purchase the shortfall.	Financial
Fixed Costs	Cost	Overhead costs paid by HBPW that do not vary by the amount of generation.	Financial
Energy Purchased From MISO	Cost	This financial cost is incurred when energy is purchased from the MISO wholesale market instead of generated by HBPW.	Financial

Name	Impact Type	Description	Category
Owner's and Engineering, Procurement, & Construction Costs	Cost	These represent up front capital costs paid prior to plant operation.	Financial
Fixed O&M Costs	Cost	Fixed O&M costs are those financial operating and maintenance costs that do not fluctuate with equipment usage.	Financial
Variable O&M Costs	Cost	Represent equipment maintenance costs that are primarily dependent upon the hours the equipment is operating.	Financial
Fuel Costs	Cost	Are the costs incurred to purchase fuel burned to generate electricity.	Financial
Cross-State Air Pollution Rule Cost	Cost	A penalty paid for every ton of nitrous oxides and sulfur oxides emitted over allocated limits.	Financial
General Fund Transfer	Cost Benefit	Although HBPW does not have to pay corporate taxes, it is required to make a payment in lieu of tax.	Financial
Savings due to District Heating	Benefit	By implementing a district heating system, customers will spend may spend less to heat their building than they otherwise would have to.	Financial
Electricity Service Cost	Cost	This category is the offset of HBPW's generated energy revenue (consumer).	Financial
Increased Economic Activity due to Snowmelt System	Benefit	Increasing the area of the snow melt system should attract more people into downtown Holland, which will boost business income in the area.	Financial
Business Relocation Benefit	Benefit	Because HBPW tends to charge lower electricity rates than local utilities, businesses are more likely to situate in Holland, all else being equal.	Social
Reduced Biomass Shipping Costs	Benefit	If new generating options can burn biomass fuels, the cost associated with transporting biomass can be reduced or avoided.	Social
Avoided Costs Due to Snowmelt	Benefit	The snow melt system allows the community to avoid many costs, including the costs of plowing and salting.	Social
Social Value of Parkland	Benefit	If land at JDY was to be sold and converted to some alternative use, the public would benefit	Social

Name	Impact Type	Description	Category
		from the alternative land use. As a conservative estimate, one can assume that the area would be left as parkland, and the benefits of parkland are quantified in this category.	
Reduced Landfilling of Tires	Benefit	If new generating options can burn tires as fuel, the net social cost associated with disposing tires in a landfill versus a CFB can be reduced or avoided	Social
Loss of Commercial Harbor Status	Cost	If the project causes Lake Macatawa to lose its commercial harbor status, the cost of dredging normally funded by the U.S. Army Corps of Engineers would fall on Holland instead	Financial
Water Quality Improvements	Benefit	Some options will reduce the amount of thermal discharge into the lake, which is expected to improve water quality. Improved water quality is a social benefit, and can be monetized.	Social
Emission Savings Due to District Heating	Benefit	By channeling heat into the district heating system, the additional energy that would have otherwise been generated to produce this heat is no longer required. The reduction in generation brings about a reduction in emissions.	Social
Criteria Air Contaminant & Greenhouse Gas Emissions	Cost	Different methods of generating electricity produce pollutants at different rates. Emissions produced may be quantified and monetized.	Social

These benefits and costs accrue or affect different groups of stakeholders in the energy generation decision.

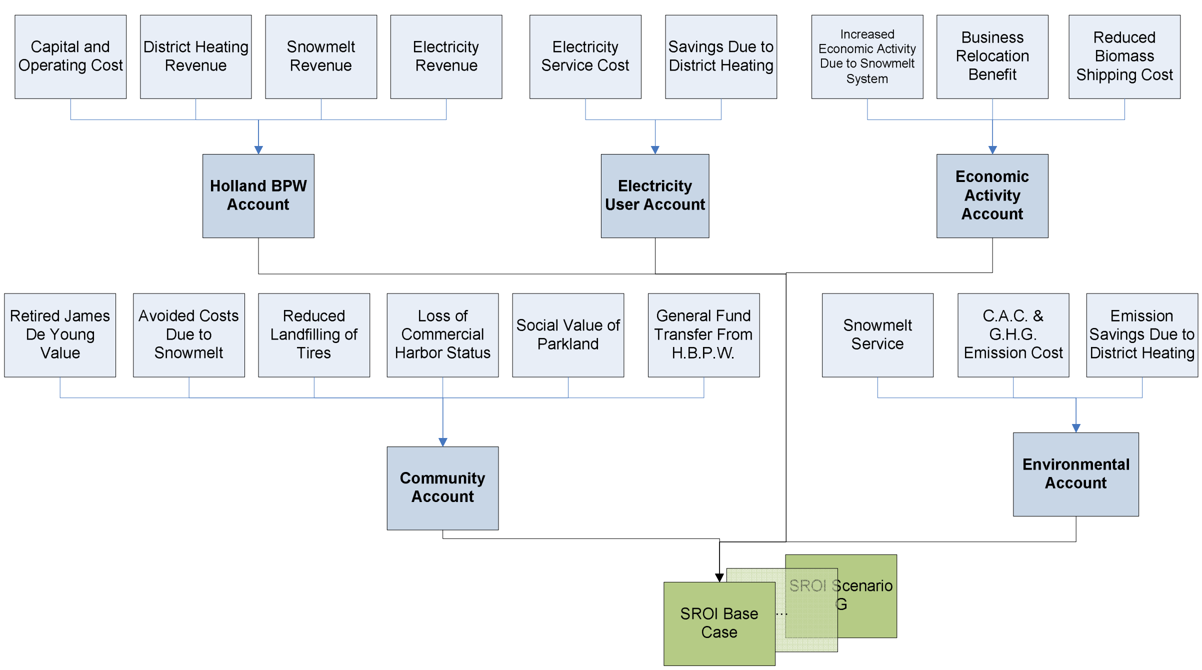
Based on the discussion of the (net) benefit categories that are important in making the P21 decision at the first RAP session, we have organized the costs and benefits into five broad stakeholder groups, or accounts. The Sustainable Return on Investment (SROI) model estimates the benefits minus costs for these five accounts:

1. Holland BPW
2. Electricity User
3. Environmental
4. Economic Activity
5. Community

Each cost and benefit will be mapped into one of these five categories. The SROI of each category gives an indication as to how each stakeholder group is affected by the P21 decision. The overall scenario SROI weighs the project's total benefits against its total costs. Where feasible, each individual cost and benefit was quantified.

The overall SROI is not a simple sum of the individual accounts. This is because some benefits or costs may appear in more than one account. This is shown in the table above where items may be both a benefit and a cost. For example, the revenue Holland BPW receives from selling generated energy is a benefit to Holland BPW and a cost to its customers. So this item will enter into the Holland BPW account as a benefit, the Holland residents account as a cost and will cancel out in the overall SROI accounting. These accounts are illustrated in Figure 14.

Figure 14: SROI Accounts



5. INPUT ASSUMPTIONS

This section provides an overview of the key data assumptions leveraged in the SROI process to derive the various impacts and the FROI and SROI.

Basic Study Parameters

The study period for the analysis is 2012 through 2036 or 25 years in total. All impacts are discounted using a 3 percent real discount rate and reported in 2012 $.

Holland BPW Account

The Holland BPW account is fundamentally a flow through account whereby capital and O&M expenditures made by Holland BPW are ultimately recovered from electricity users no matter what the generation option is. For example, scenarios with lower operational costs over the study lifecycle will result in lower electricity rates and therefore benefit electricity users. Ultimately, Holland BPW will not materially be “better-off” or “worse-off” for any given scenario as benefits and/or costs flow through to other accounts.

The key inputs for the derivation of Holland BPW impacts are summarized here.

Ventyx Inputs

Output from the Ventyx Dispatch Model is the primary exogenous source of data for the SROI analysis for each of the scenarios over the project lifecycle. The following annual inputs were received from Ventyx:

- Unit Generation;
- Interchange Energy Purchases & Sales;
- Holland CO_2, NO_x, SO_x, and Hg Emissions;
- Renewable Energy Credit Prices;
- Cross-state Air Pollution Rule Prices;
- Fuel consumption;
- Power Capacity Purchases & Sales;
- Loss of Load Hours;
- Michigan Energy Grid Resource Profile;
- Fuel Prices; and,
- Michigan Energy Prices.

As these outputs are taken as fixed inputs to the SROI analysis, no probability distribution is defined on these inputs. Each input is considered at “equilibrium” with all the other inputs and therefore applying probabilistic analysis independently on these inputs would not be appropriate.

Three distinct scenarios were provided as input based on low, medium and high natural gas price forecasts. The medium case scenario is assigned an 80 percent probability of occurrence and the low and high scenarios are each assigned a 10 percent probability in the SROI analysis.

New Generation Options Capital Costing

The capital costs, including owner's costs, associated with each new generation technology options are provided in Table 4. These reflect median cost estimates. A probability distribution for each estimate was derived by assuming a 10 percent probability that costs could be 15 percent lower (than the median estimate) and a 10 percent probability that costs could be as much as 25 percent higher. That is, the cost estimates have more upside risk than downside risk.

Table 4: Capital Cost Estimates by New Generation Option, Median Estimates, $M of 2012$

Technology	Median Estimate
JDY Unit 10 CFB	$329.1
LM2500 CHP	$61.0
2x1 LM2500 CCPP	$147.2
JDY U5 Biomass	$66.0
Solar PV	$59.1
Wind	$46.6
Digester Gas CHP	$35.2
2x1 LM6000	$182.2
AQCS Retrofits	$28.4

A summary of capital costs and fixed and variable operating costs associated with each option is included in Appendix B.

Variable and fixed operating and maintenance cost estimating factors were developed and provided as input factors into the Ventyx Dispatch Model runs. These factors are summarized in Table 5.

Table 5: O&M Cost Estimation Factors

Technology	Variable O&M $/MWh	Fixed O&M $/kW
JDY Unit 10 CFB	$8.41	$24.33
LM2500 CHP	$3.96	$25.67
2x1 LM2500 CCPP	$3.34	$8.06
JDY U5 Biomass	$8.22	$14.18
Solar PV	$0.00	$28.02
Wind	$0.00	$40.10
Digester Gas CHP	$10.80	$319.79
2x1 LM6000	$3.34	$11.32

Revenue from Electricity Users

To determine how changes in Holland BPW expenditures over the project lifecycle from different electricity generation options translate into residential and commercial electricity rates to consumers and thus revenues to Holland BPW, a rate adjusting algorithm was developed. Load forecasts, projections of expenditures from existing units, new generation units and energy purchases, were used to adjust rates to ensure that the overall Holland BPW account impacts were approximately "break-even". That is, in cases where overall expenditures increased, electricity rates increased to offset these expenditures and in cases were overall expenditures decreased, electricity rates were lowered to eliminate any surpluses.

Snowmelt and District Heating Costs and Revenues

The costs for existing and expanded snowmelt and district heating services vary by technology. The study assumes a 15% probability that the existing snowmelt system will be expanded and snowmelt capital costs have an accuracy range of +/-30 percent (relative to the median)[12].

Table 6: Capital Cost Estimates for Snowmelt by New Generation Option, Median Estimates, $M of 2012$

Technology	Existing	Expanded
JDY Unit 10 CFB	$0.2	$10.5
2x1 LM2500 CCPP	$0.2	$10.5
2x1 LM6000	$0.2	$10.5
JDY U5	$0.2	$10.5
Natural Gas Fired Burner	$7.1	$24.0

Table 7: Capital Cost Estimates for District Heating by New Generation Option, Median Estimates, $M of 2012$

Technology	Base	Stack Water Heater
LM2500 CHP	$11.2	$12.7
2x1 LM2500 CCPP	$0.0	$6.8
Digester Gas CHP	$6.6	$7.1
2x1 LM6000	$0.0	$8.6

The capital costs for district heating snowmelt have a probability distribution of 20 percent less than the median to 30 percent greater than the median with 80 percent confidence.

Similar to "revenues from electricity users", snowmelt service and district heating expenditures are recovered from users in the form of revenues.

[12] The range of possible values reflects a probability distribution of +/- 30 percent of the median estimate with an 80 percent confidence.

Retired JDY Land Value

For scenarios where the James De Young Plant is retired (Scenario E, F and G), the site (17 acres) is remediated and sold to the City.

Table 8: Value per Acre of Retired James De Young Property

	Median	10'th percentile	90'th percentile
Value* per Acre	$105	$74	$247

Note: *Value based on a survey of nearby property assessments

Payments in Lieu of Taxes

Transfers are made from the Holland BPW account to the community account to reflect payments in lieu of taxes. The tax rate is assumed to average 5 percent over the entire study period.

Electricity User Account

The electricity user account is impacted by changing electricity rates relative to the base case. Changes in rates are derived by the rate adjusting algorithm discussed previously for the Holland BPW account. The impact on the electricity user account is determined by the electricity consumed times the difference in rates.

Additional savings can be realized for customers that utilize district heating as the variable costs associated with providing the system are low. The benefits to district heating customers are the savings from using Holland BPW district heating service relative to purchasing the service from competitors providing natural gas.

Economic Activity Account

Three different impacts were identified for the economic activity account:

- Increased business activity due to the snowmelt system;
- Business relocation benefits whereby businesses relocate to Holland due to lower electricity rates; and,
- Reduced biomass shipping costs.

Snowmelt

While an increased snowmelt system is expected to result in attracting new customers and economic activity to Holland, the increased snowmelt system is the same for all scenarios and therefore does not differentiate any scenario on a relative basis. Therefore, it is recognized as a benefit but is not monetized.

Business Relocation Benefits

It is recognized that one of the drivers for a business' decision to relocate is the cost of electricity. This benefit reflects the increase in local economic activity through wages derived from incremental businesses locating in Holland due to lower electricity rates. As electricity rates change by scenario, so does the relative value of this benefit. The key inputs used in the derivation of these benefits is provided in Table 9 were primarily derived from the Bureau of Labor Statistics.

Table 9: Inputs for Business Relocation Benefit

	Median	10'th percentile	90'th percentile
Average Salary	$40,721	[redacted]	
Holland Employment	114,805		
Percentage of employment from new establishments	4.0%	3.6%	4.4%
Elasticity of Relocation Decision with respect to electricity rates	-2.0	-2.2	-1.5
% of new establishments considering alternate sites	10%	9%	11%

Reduced Biomass Shipping

Some scenarios (e.g., Scenarios B, C, D, and the base case) utilize biomass as an energy source. In scenarios where biomass is not used as fuel, the biomass has to be transported to an alternative site assumed to be Flint, Michigan. The economic impact here is the additional transportation costs for Scenarios A, E, F and G.

Table 10: Inputs for Reduced Transportation Costs

	Median	10'th percentile	90'th percentile
Miles to be shipped	145	[redacted]	
Cost per ton/mile	$0.04	$0.033	$0.053

Environmental Account - Emissions

The environmental account consists of the monetary value of changes in emission levels. The key inputs for the derivation of these impacts are summarized here. For the purposes of this study, the emission estimates have been bounded by what impact Holland BPW has locally. Downstream or upstream activities such as the impact of coal or natural gas extraction activities in other jurisdictions is not considered a project impact and has therefore not been considered.

The amount of emissions from generation for each scenario was simulated through the Ventyx Dispatch Model. HDR provided emission rates by technology as input to Ventyx and they are summarized in Appendix B. In addition to the emissions from generation, reductions in emissions were estimated separately and included for district heating, but they represent a small fraction of the overall impact.

Emissions from the Ventyx model were monetized through the SROI process using monetary estimates sourced through the literature for greenhouse gases and criteria air contaminants.

- Gases that trap heat in the atmosphere, predominantly CO2, are called greenhouse gases (GHG). Increased emissions of GHG due to human activities have been linked to global warming and changes in the climate pattern. The monetary value of the damages that may be caused by these changes currently and in the future over the entire life-cycle of GHG in the atmosphere is the social cost of GHG, sometimes also referred to as social cost of carbon (SCC). This cost is expressed in unit form in dollars per ton of emissions emitted in a given year ($/t). Naturally occurring greenhouse gases in the atmosphere help regulate the Earth's climate by trapping the energy from the sun and reflecting some of it to the surface. This greenhouse effect is a natural phenomenon that creates warmer conditions on Earth and makes life, as we know it, possible. However, concentrations of GHG in the atmosphere have grown significantly since pre-industrial times largely because of human activities involving the burning of fossil fuels and permanent forest loss. The rise in GHG concentrations is amplifying the natural greenhouse effect and warming the planet, affecting wind patterns, precipitation, ocean levels, and storm events. The monetary value of these damages over the entire life cycle of GHG in the atmosphere is the SCC.
- Criteria air contaminants (CAC) are a set of air pollutants emitted from many sources in industry, primarily as a result of the combustion of fossil fuels or industrial processes. CAC in particular refer to a group of contaminants that include sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC), and fine particulate matter (primarily $PM_{2.5}$). CAC are known to have adverse effect on human health, animals, vegetation, physical structures, and visibility, both on their own and through chemical reactions with other pollutants that form secondary pollutants causing smog and acid rain. The social costs of CAC reflect the monetary valuation of these damages expressed in terms of dollars per unit of emissions, typically per one ton ($/t). Unlike GHG emissions, which are recognized to have global impacts, CAC are regional and local due to their inherent chemical nature and dispersion in the atmosphere. CAC costs are estimated using complex methodologies, frequently referred to as impact pathway analysis. The impact pathway models take into account differing meteorological conditions across geographic locations and utilize local climate models, population density data, evidence on the prevalence of health and other impacts caused by various pollutants, and unit costs of the various individual impacts.

The monetary value and range of emission values used in the SROI analysis is based on a literature review compiled by HDR. The estimates are summarized in Table 11.

Table 11: Monetary Value of Emissions, $ per Ton (2012 $)

Emission	Median Value	10'th percentile	90'th percentile
Social Cost of Carbon	$22	$13	$104
Sulfur Dioxides (SOx)	$17,856	$1,906	$50,940
Particulate Matter (PM)	$187,490	$4,194	$288,968
Volatile Organic Compounds (VOC)	$1,897	$635	$3,715
Nitrogen Oxides (NOx)	$5,281	$381	$15,858

Community Account

Several impacts were identified in the community account and are outlined below. Many are simply a transfer from other accounts and do not impact the overall SROI/FROI results.

Loss of Commercial Harbor Status

For scenarios where James De Young Units 4 and 5 are shut down (e.g., Scenarios A, B, C, D, F & G), it is assumed that the community loses its commercial harbor status and therefore the US Army Corps of Engineers will no longer provide dredging for the harbor. It is assumed that dredging is performed annually but that the community pays for it.

Table 12: Annual Dredging Costs ($000)

Emission	Median Value	10'th percentile	90'th percentile
Annual Dredging Costs	$274	$200	$767

Value of Parkland

For scenarios where the James De Young site is no longer utilized by HBPW (Scenario E, F and G), the site (17 acres) is remediated and sold to the City and utilized as parkland. To approximate the social value of additional parkland, "uplift premiums" on assessed property values with 1500 feet of the site was utilized.

Table 13: Inputs for the Derivation of Parkland Value

	Median	10'th percentile	90'th percentile
Appraised Residential within 1000-1500 ft	$369	$294	$443
Appraised Commercial within 500 ft	$249	$199	$299
Appraised Commercial within 500-1000 ft	$495	$394	$592
Appraised Commercial within 1000-1500 ft	$346	$433	$520
Residential Uplift within 1000-1500 ft	1.8%	1.5%	2.2%

	Median	10'th percentile	90'th percentile
Commercial Uplift within 500 ft	7.0%	4.5%	15.2%
Commercial Uplift within 500-1000 ft	2.6%	2.3%	3.0%
Commercial Uplift within 1000-1500 ft	1.8%	1.5%	2.2%

Landfilling of Tires

In the base case (and Scenarios C and D), tire-derived fuel is employed and therefore tires do not go to the landfill. For scenarios that do not utilize TDF, there is an additional cost for putting tires in the landfill.

Table 14: Inputs for Derivation of Landfilling Costs

Emission	Median Value	10'th percentile	90'th percentile
Social Cost of Landfilling per Tonne	\$30.19	\$0	\$36.23
Tonnes of tires diverted per year	85,300	76,700	93,800

Payments in Lieu of Taxes

Transfers are made from the Holland BPW account to the community account to reflect payments in lieu of taxes. The tax rate is assumed to average 5 percent over the entire study period.

Snowmelt Service Costs

The costs associated with Holland BPW's expansion of the snowmelt service are assumed to be recovered from the community. The investments required to provide snowmelt service in Scenario's E and F are relatively expensive as dedicated natural gas boilers are required.

Snowmelt service does provide other benefits to the community such as reduced snow clearing costs etc. but these impacts are identical in all scenarios and therefore have not been quantified.

6. KEY FINDINGS

The following section summarizes the results of the SROI analysis for each scenario and all results are incremental to the Base Case. The results contained herein are the output of the Monte Carlo simulation, and mean and percentile values correspond to the mean and percentile value of each line item individually.

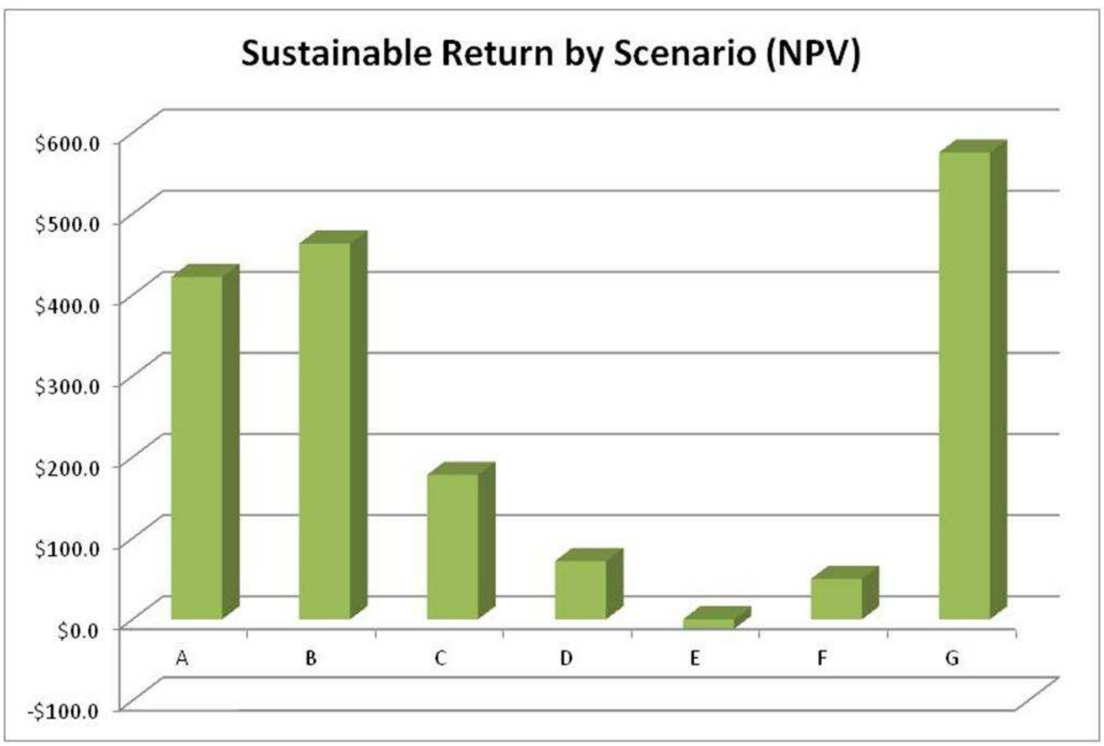
All monetary values in this section should be considered to be in **mean present value** (PV) terms and incremental to the base case, unless otherwise stated. Finally, please note that the levelized cost of energy does not directly correspond to the forecasted HBPW electricity rate.

A detailed set of SROI results can be found in Appendix C.

Overall Synopsis of Results

All but one scenario (Scenario E) provides a positive SROI relative to the base case (see Figure 15). However, there is a strong trend in the analysis that indicates that the scenarios with natural gas (Scenario's A, B & G) provide the greatest public value relative to the other options, each with an NPV in excess of $400 M with Scenario G having the highest NPV of $576 M. The NPV of all other scenarios are less than $200 M, with Scenario C having the highest NPV of $178 M in that group.

Figure 15: SROI by Scenario, NPV $M



A key finding is that the three highest ranking scenarios on an overall SROI basis also rank the highest from both a financial and non-financial basis (see Figure 16: FROI by Scenario, NPV $M and Figure 17: Non-Financial Return, NPV $M). In general, two effects dominate the overall SROI analysis and they are positively correlated between scenarios: electricity rate reductions and emissions savings.

Figure 16: FROI by Scenario, NPV $M

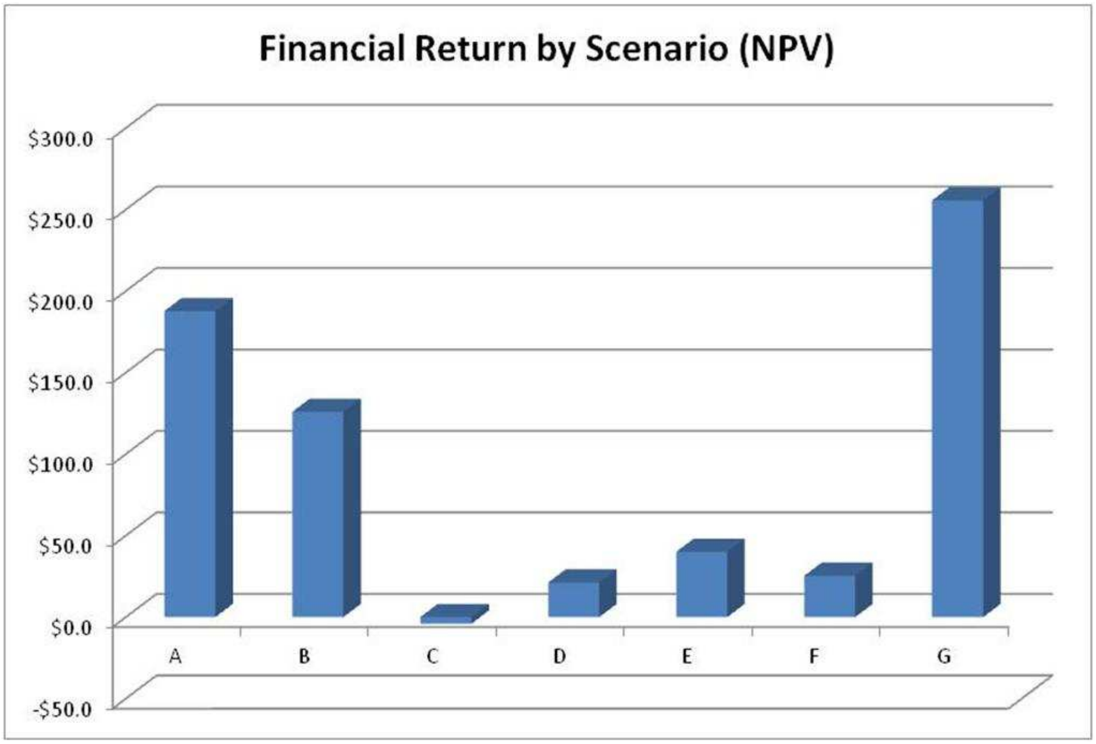


Figure 17: Non-Financial Return, NPV $M

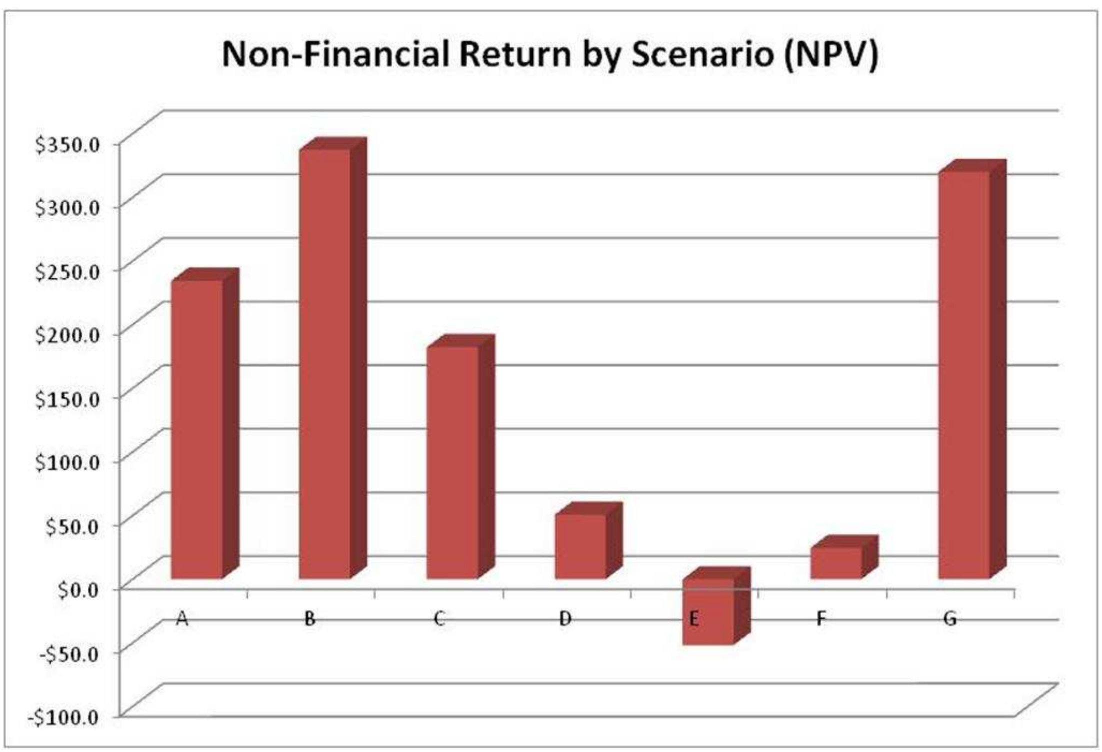
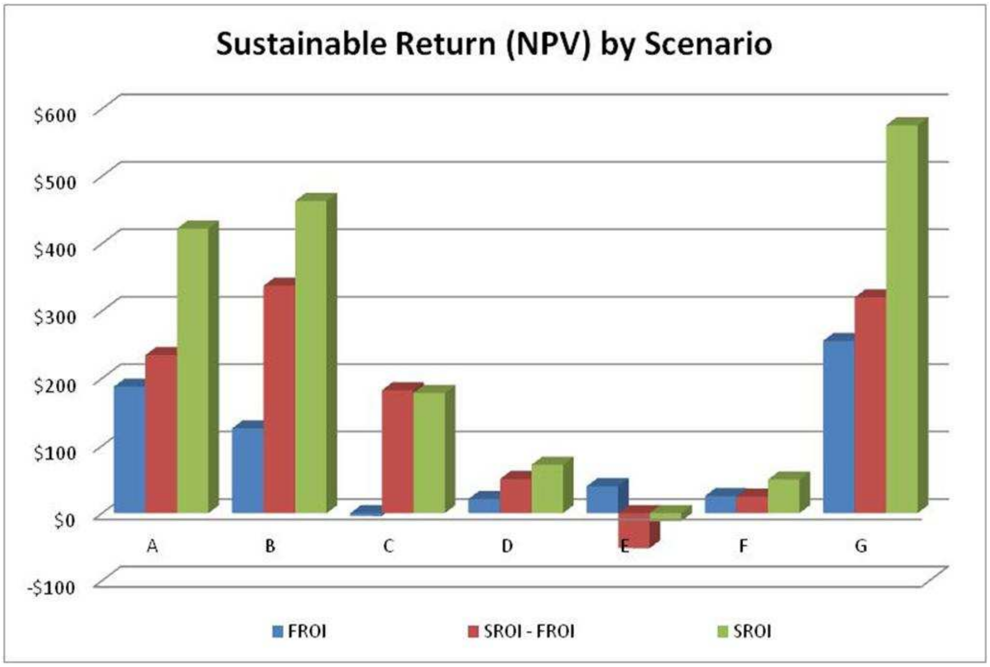


Figure 18: SROI by Component, NPV $M



The next set of outputs shows risk-adjusted information (in the form of S-curves) with regards to the Net Present Value (NPV) for each of the scenarios. The S-Curves identify the probability distributions from each perspective in a cumulative manner and synthesize the results into an intuitive risk analysis model. The S-curves are generated from a Monte Carlo risk simulation. The purpose of the S-Curves is to show the range of possibilities, expected outcomes, and their probability of occurrence. The probabilistic SROI and FROI S-curve results are displayed in Figure 19 and Figure 20 respectively demonstrating that Scenarios A, B and G rank highest.

Figure 19: SROI S-Curve Summary

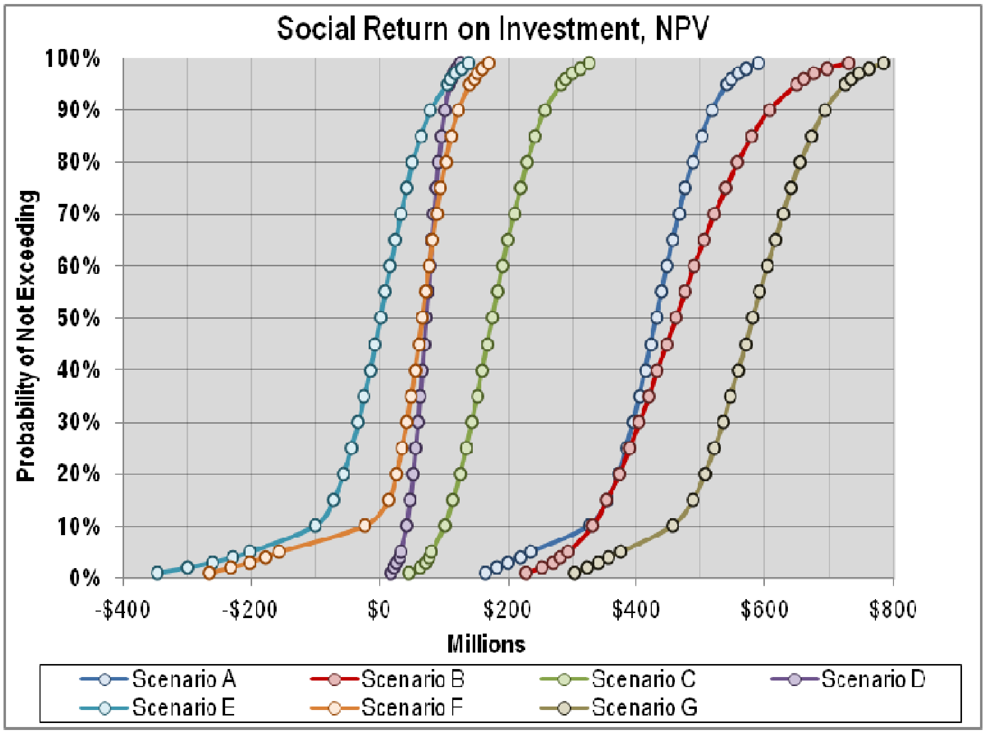
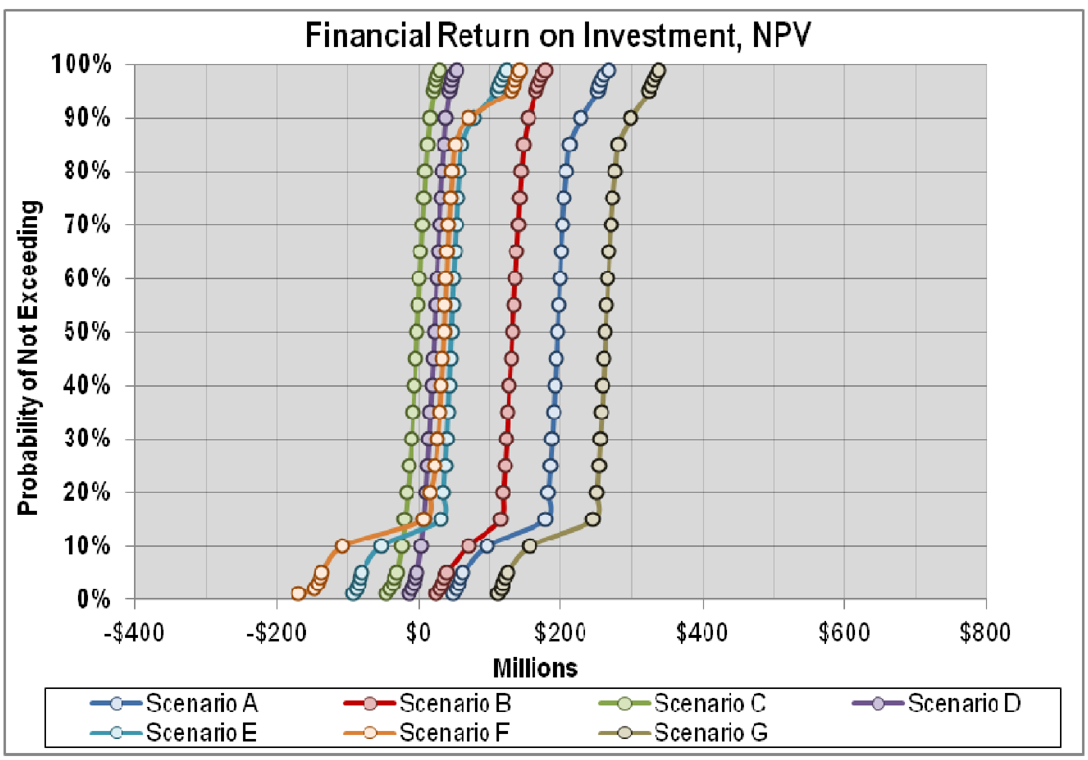


Figure 20: FROI S-Curve Summary



The major components of the public value, or SROI, are displayed in Table 15. While there are many different impacts by scenario, the main impacts relate to electricity service cost savings and the value of reduced emissions. While there are many different impacts that comprise the overall NPV, these two effects dominate the results.

Table 15: Contributions to the SROI NPV, $M

	A	B	C	D	E	F	G
Net Present Value	**$422**	**$465**	**$178**	**$72**	**-$12**	**$50**	**$576**
Electricity Service Cost	$185.0	$116.0	-$26.1	$2.0	$56.9	$67.0	$283.4
Criteria Air Contaminant Emissions	$118.8	$185.5	$107.9	$21.6	-$75.9	-$32.1	$176.1
Greenhouse Gas Emissions	$104.0	$164.3	$80.6	$25.0	$16.8	$33.7	$113.8
Business Relocation	$41.7	$19.6	-$5.8	$4.6	$36.2	$52.7	$60.0
Savings due to District Heating	$17.6	$20.8	$20.6	$17.5	$0.0	$0.0	$2.2
Snow Melt Service	$1.1	$1.1	$1.7	$1.7	-$7.7	-$25.8	$1.0
Loss of Commercial Harbor Status	-$4.4	-$4.4	$0.0	$0.0	-$0.5	-$4.4	-$4.4
Reduced Landfilling of Tires	-$28.6	-$28.6	$0.0	$0.0	-$28.6	-$28.6	-$28.6
Other	-$13.0	-$8.9	-$0.8	-$0.4	-$8.8	-$12.7	-$27.9

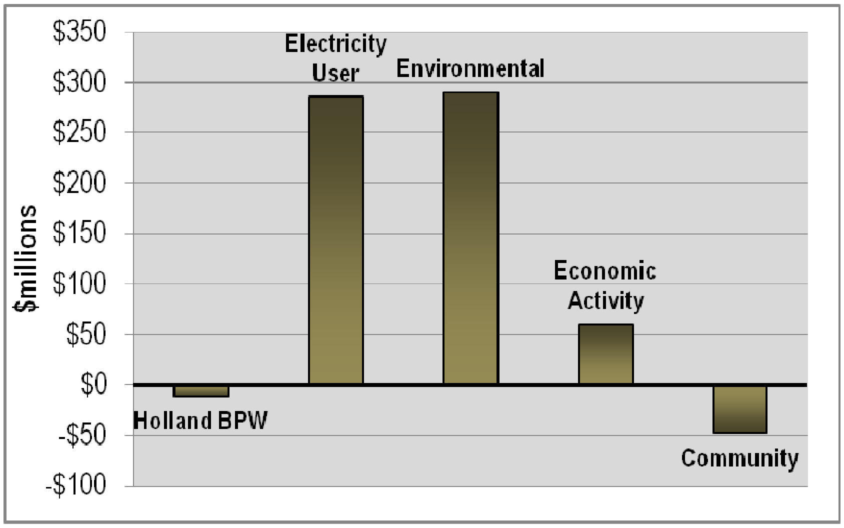
A summary of the emissions changes relative to the Base Case is provided in Table 16 highlighting that scenarios A, B and G provide the greatest emissions reductions for most emission categories with Scenario B providing the greatest environmental benefits.

Table 16: Mean Emissions Savings Summary

Mean Emission Savings Relative to Base Case								
Emission	**Unit**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Hg	lbs	31	81	39	-9	-26	-46	61
SO_x	tons	4,867	10,392	7,142	1,145	-7,502	-4,744	8,417
PM	tons	258	92	-47	-5	309	288	286
VOCs	tons	-79	-156	12	7	18	21	-85
NO_x	tons	3,841	5,464	3,109	1,229	-1,728	507	5,036
CO_2e	tons	3,214,147	5,229,384	2,387,894	531,303	570,564	1,151,404	3,771,269

Another way to look at the overall impacts is by account or stakeholder group. Figure 21 displays the impacts by account for the Scenario with the highest NPV, Scenario G. Again, the vast majority of the benefits relate to the electricity user accounts through lower rates and the environmental account through reduced emissions. The Holland BPW account has an approximately zero impact as it is really a flow-through account expending money and recovering that money through electricity rates. The community and economic impact account impacts are small in relation to the total impacts.

Figure 21: SROI NPV by Account, Scenario G



The balance of this section provides results by individual scenario (again note that all values are expressed incrementally from the Base Case).

Scenario A Summary Results

Scenario A has a mean FROI NPV of $188 million and a mean SROI NPV of $422 million. Scenario A's mean levelized cost of electricity is $85.7/MWh, or $6.5/MWh less than the base case (Figure 22).

Figure 22: FROI and SROI S-Curve Summary, Scenario A

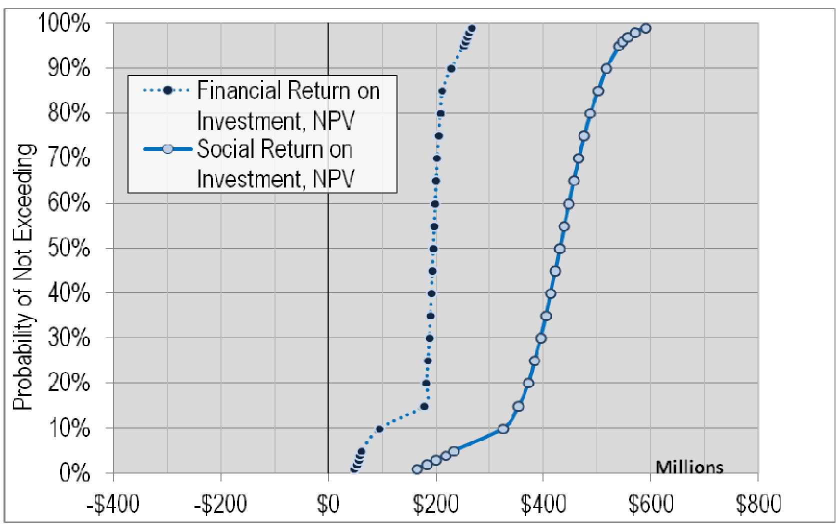


Figure 23: Levelized Cost of Electricity, Scenario A

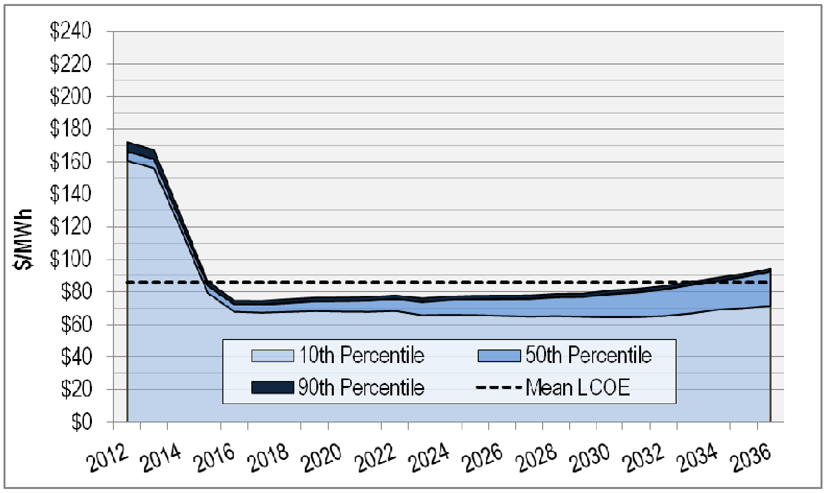


Table 17: Major Public Benefits, Scenario A

Account (Mean Rank)	Net Present Value (millions)			
	Mean	10%	50%	90%
Savings due to District Heating (3)	**$17.63**	$13.18	$17.94	$21.13
% savings (4)	***58.2%***	*48.3%*	*59.3%*	*66.6%*
Electricity Service Cost Savings (2)	**$184.97**	$150.55	$192.52	$232.73
Emission Savings (3)	**$222.81**	$147.60	$218.26	$304.13
Business Relocation Benefit (3)	**$41.72**	$31.20	$42.09	$50.52
Reduced Biomass Shipping Costs (5)	**-$0.01**	-$0.01	-$0.01	-$0.01
Reduced Landfilling of Tires (4)	**-$28.64**	-$30.67	-$28.68	-$26.60
Avoided Loss of Commercial Harbor (8)	**-$4.41**	-$4.77	-$4.40	-$4.06
Reduced Snow Melt Service Cost (4)	**$1.08**	$0.57	$0.68	$3.05

Figure 24: SROI Net Present Value by Account, Scenario A

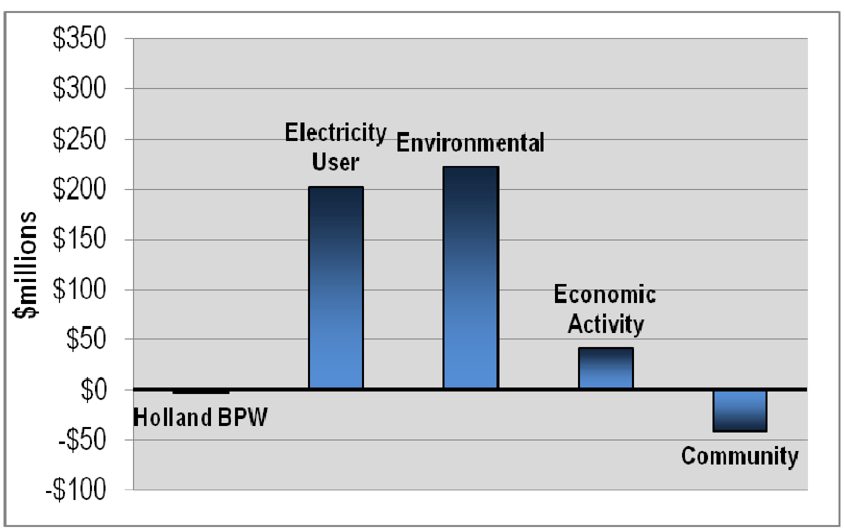
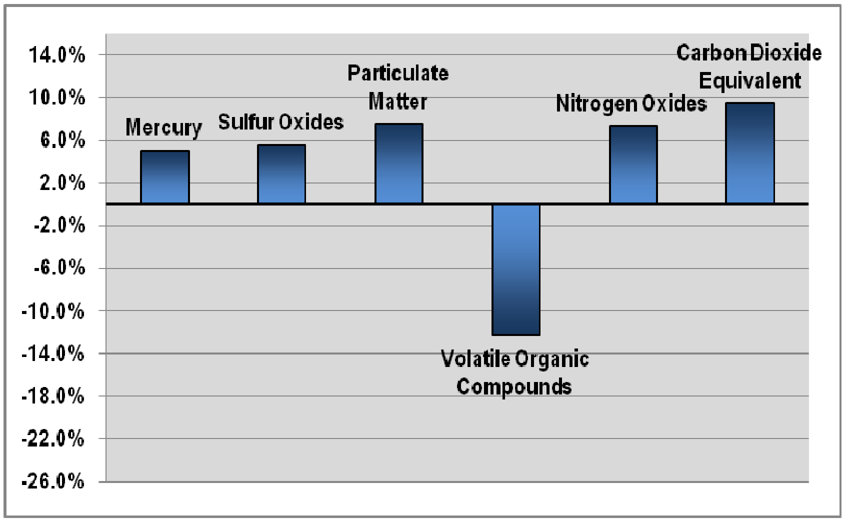


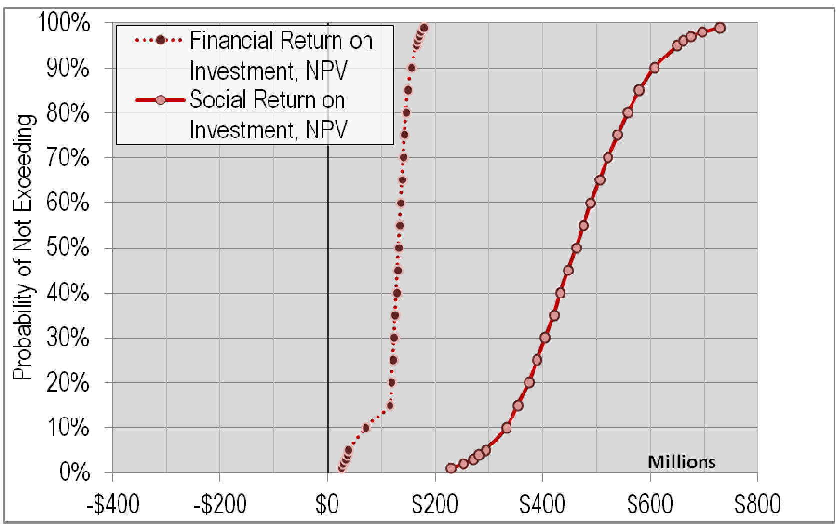
Figure 25: Emissions Savings as % of Base Emissions, Scenario A



Scenario B Summary Results

Scenario B has a mean FROI NPV of $126 million and a mean SROI NPV of $465 million.

Figure 26: FROI and SROI S-Curve Summary, Scenario B



Scenario B's mean levelized cost of electricity is $86.7/MWh, or $5.5/MWh less than the base case.

Figure 27: Levelized Cost of Electricity, Scenario B

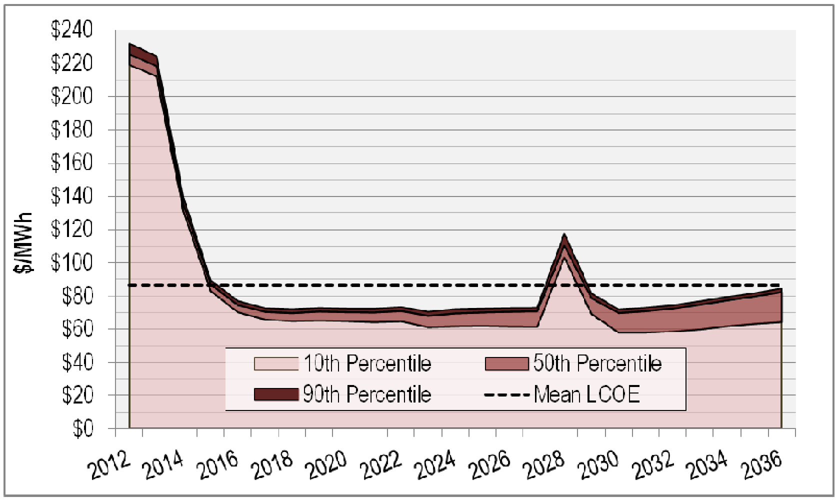


Table 18: Major Public Benefits, Scenario B

Account (Mean Rank)	Net Present Value (millions)			
	Mean	10%	50%	90%
Savings due to District Heating (1)	**$20.75**	$15.62	$21.17	$24.89
% savings (3)	***59.2%***	*49.6%*	*60.2%*	*67.3%*
Electricity Service Cost Savings (3)	**$116.01**	$83.63	$121.88	$148.86
Emission Savings (1)	**$349.81**	$227.46	$340.03	$484.30
Business Relocation Benefit (5)	**$19.56**	$13.72	$19.95	$24.63
Reduced Biomass Shipping Costs (4)	**-$0.00**	-$0.00	-$0.00	-$0.00
Reduced Landfilling of Tires (4)	**-$28.64**	-$30.68	-$28.65	-$26.55
Avoided Loss of Commercial Harbor (7)	**-$4.41**	-$4.77	-$4.40	-$4.07
Reduced Snow Melt Service Cost (3)	**$1.14**	$0.62	$0.74	$3.17

Figure 28: SROI Net Present Value by Account, Scenario B

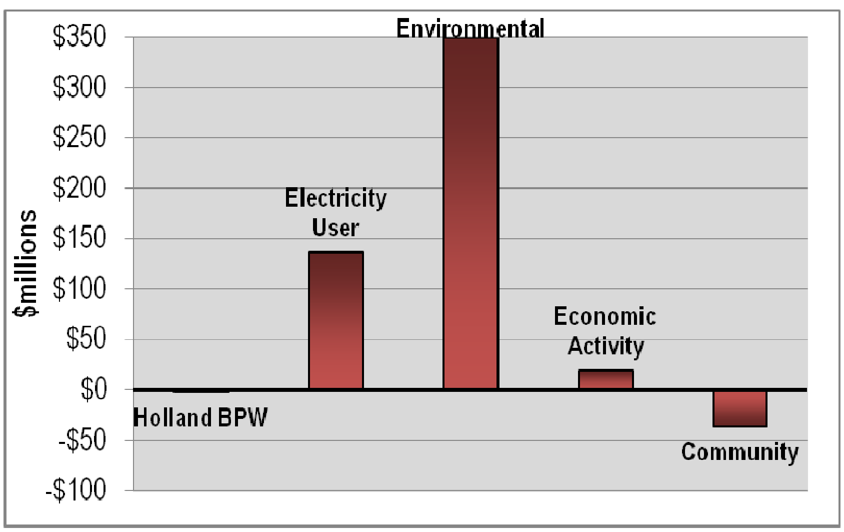
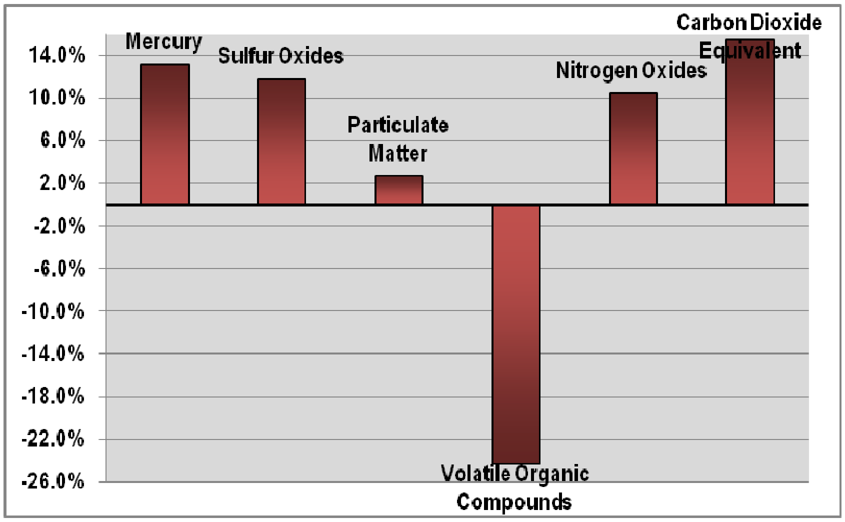


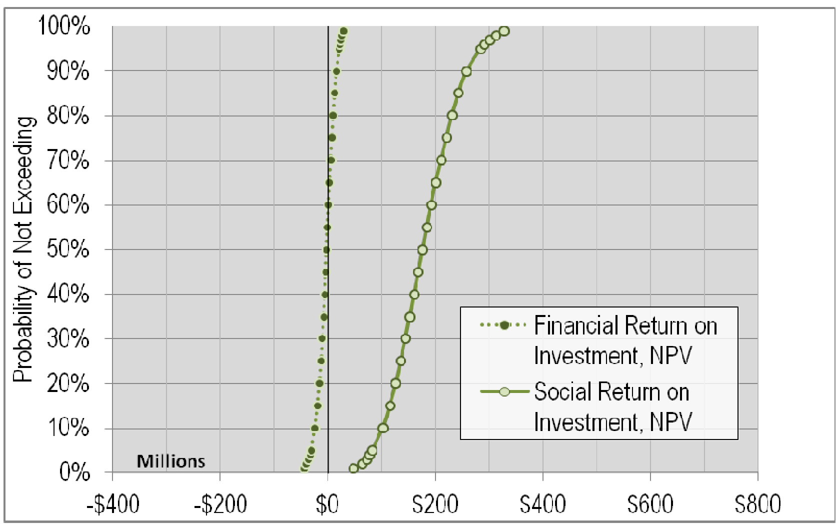
Figure 29: Emissions Savings as % of Base Emissions, Scenario B



Scenario C Summary Results

Scenario C has a mean FROI NPV of -$4 million and a mean SROI NPV of $178 million.

Figure 30: FROI and SROI S-Curve Summary, Scenario C



Scenario C's mean levelized cost of electricity is $91.8/MWh, or $0.4/MWh less than the base case.

Figure 31: Levelized Cost of Electricity, Scenario C

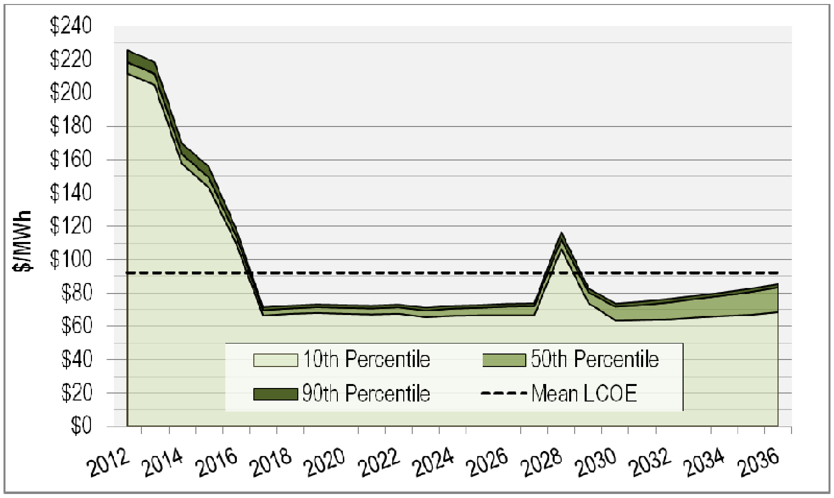


Table 19: Major Public Benefits, Scenario C

Account (Mean Rank)	Net Present Value (millions)			
	Mean	10%	50%	90%
Savings due to District Heating (2)	**$20.61**	$15.69	$20.97	$24.56
% savings (1)	***61.4%***	*52.1%*	*62.3%*	*69.2%*
Electricity Service Cost Savings (8)	**-$26.15**	-$45.83	-$25.81	-$7.55
Emission Savings (4)	**$188.51**	$119.40	$184.62	$262.38
Business Relocation Benefit (8)	**-$5.77**	-$13.05	-$5.42	$1.21
Reduced Biomass Shipping Costs (3)	**-$0.00**	-$0.00	-$0.00	-$0.00
Reduced Landfilling of Tires (3)	**$0.00**	-$0.91	-$0.01	$0.92
Avoided Loss of Commercial Harbor (1)	**$0.00**	$0.00	$0.00	$0.00
Reduced Snow Melt Service Cost (1)	**$1.71**	$1.13	$1.28	$3.92

Figure 32: SROI Net Present Value by Account, Scenario C

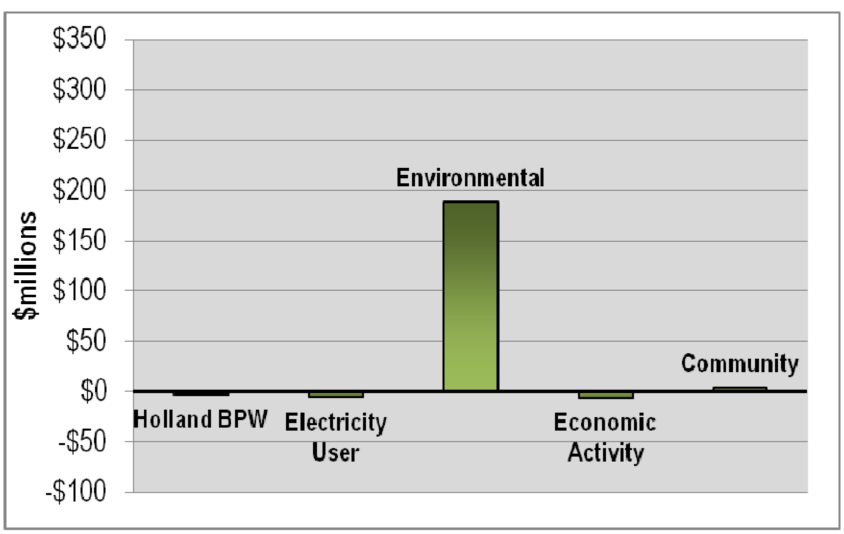
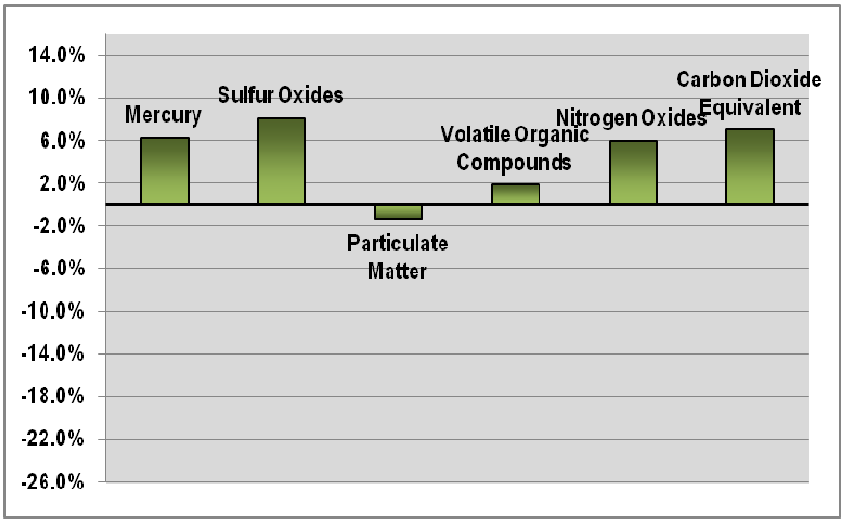


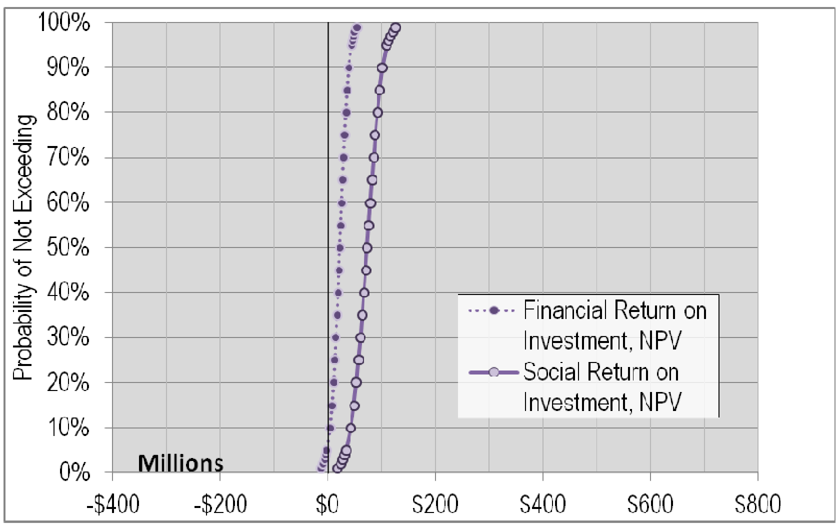
Figure 33: Emissions Savings as % of Base Emissions, Scenario C



Scenario D Summary Results

Scenario D has a mean FROI NPV of $21 million and a mean SROI NPV of $72 million.

Figure 34: FROI and SROI S-Curve Summary, Scenario D



Scenario D's mean levelized cost of electricity is $91.7/MWh, or $0.6/MWh less than the base case.

Figure 35: Levelized Cost of Electricity, Scenario D

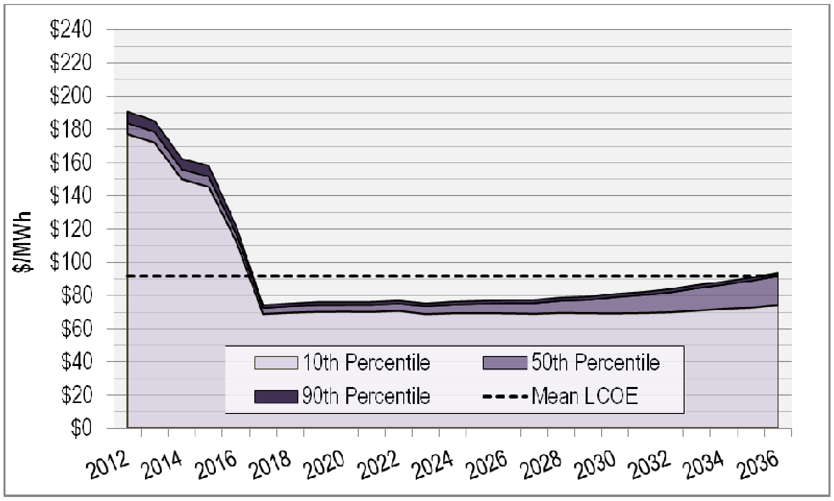


Table 20: Major Public Benefits, Scenario D

Account (Mean Rank)	Net Present Value (millions)			
	Mean	10%	50%	90%
Savings due to District Heating (4)	$17.48	$13.35	$17.81	$20.89
% savings (2)	*60.6%*	*51.4%*	*61.7%*	*68.6%*
Electricity Service Cost Savings (6)	$1.96	-$16.92	$2.81	$20.07
Emission Savings (5)	$46.66	$26.90	$45.38	$67.35
Business Relocation Benefit (6)	$4.56	$0.08	$4.63	$8.98
Reduced Biomass Shipping Costs (1)	$0.00	-$0.00	$0.00	$0.00
Reduced Landfilling of Tires (2)	$0.00	-$0.92	$0.00	$0.90
Avoided Loss of Commercial Harbor (1)	$0.00	$0.00	$0.00	$0.00
Reduced Snow Melt Service Cost (2)	$1.70	$1.12	$1.27	$3.85

Figure 36: SROI Net Present Value by Account, Scenario D

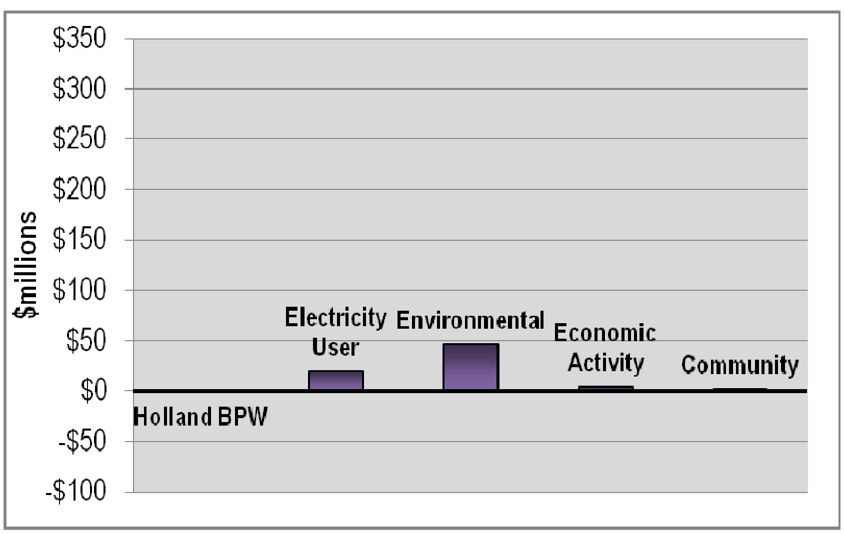
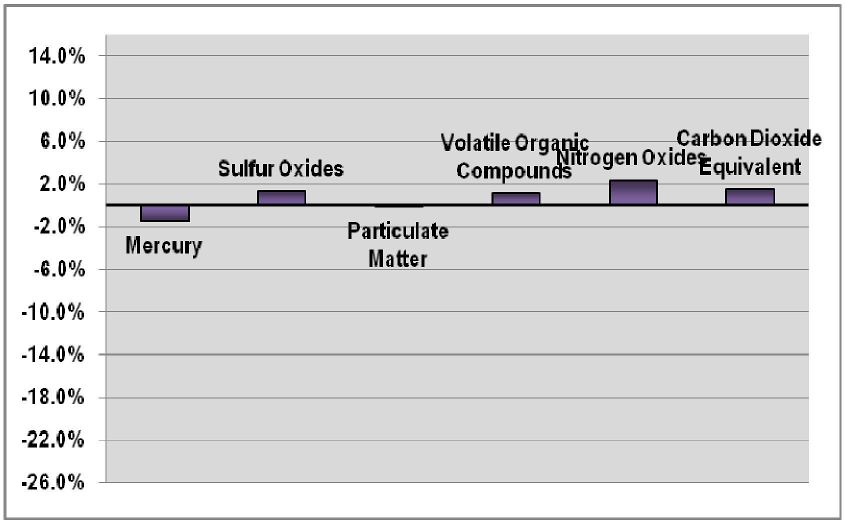


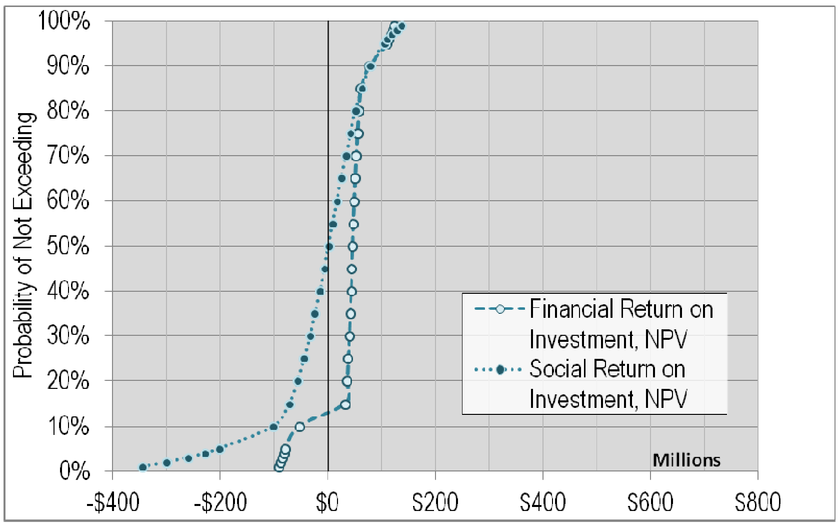
Figure 37: Emissions Savings as % of Base Emissions, Scenario D



Scenario E Summary Results

Scenario E has a mean FROI NPV of $40 million and a mean SROI NPV of -$12 million.

Figure 38: FROI and SROI S-Curve Summary, Scenario E



Scenario E's mean levelized cost of electricity is $94.5/MWh, or $2.2/MWh more than the base case.

Figure 39: Levelized Cost of Electricity, Scenario E

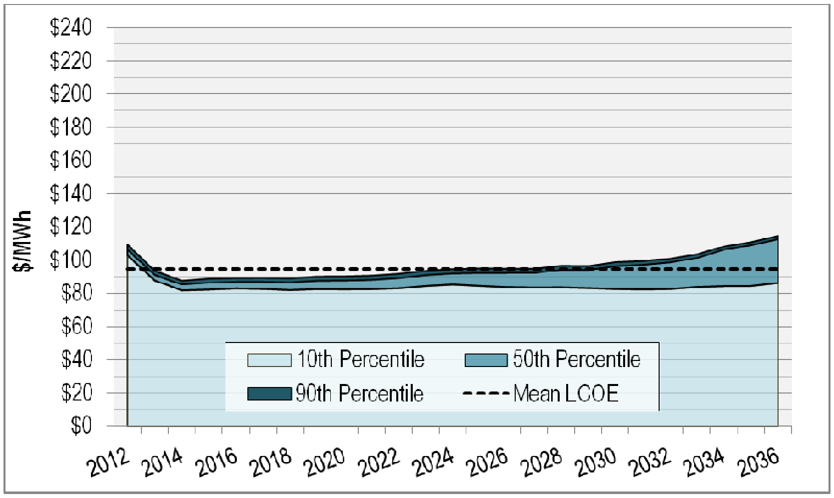


Table 21: Major Public Benefits, Scenario E

Account (Mean Rank)	Net Present Value (millions)			
	Mean	10%	50%	90%
Savings due to District Heating (6)	**$0.00**	$0.00	$0.00	$0.00
% savings (6)	***#N/A***	*#N/A*	*#N/A*	*#N/A*
Electricity Service Cost Savings (5)	**$56.88**	$33.68	$63.00	$103.90
Emission Savings (8)	**-$59.15**	-$124.71	-$52.15	$1.18
Business Relocation Benefit (4)	**$36.17**	$25.11	$36.64	$44.93
Reduced Biomass Shipping Costs (5)	**-$0.01**	-$0.01	-$0.01	-$0.01
Reduced Landfilling of Tires (4)	**-$28.64**	-$30.66	-$28.68	-$26.56
Avoided Loss of Commercial Harbor (4)	**-$0.51**	-$0.61	-$0.50	-$0.41
Reduced Snow Melt Service Cost (7)	**-$7.66**	-$11.21	-$7.15	-$5.58

Figure 40: SROI Net Present Value by Account, Scenario E

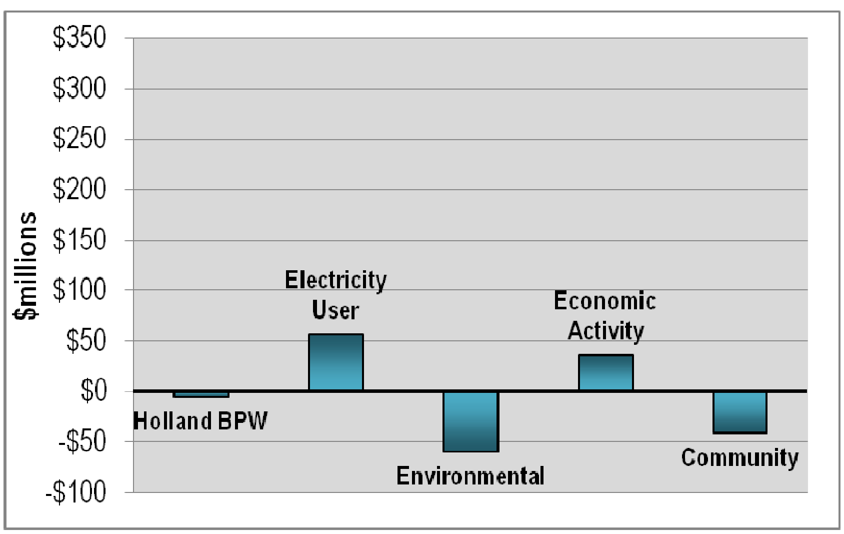
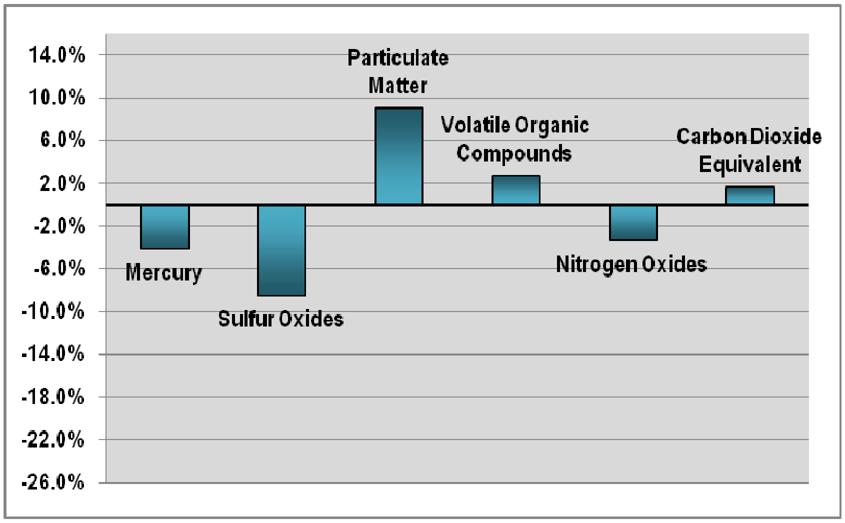


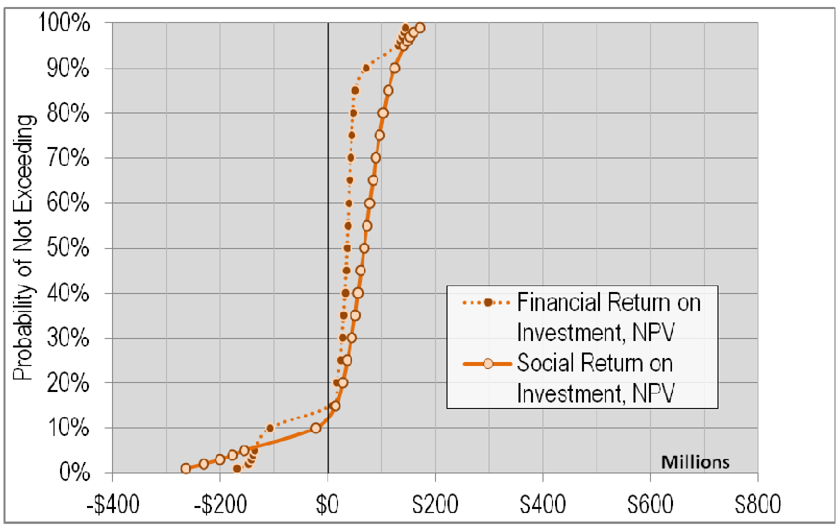
Figure 41: Emissions Savings as % of Base Emissions, Scenario E



Scenario F Summary Results

Scenario F has a mean FROI NPV of $25 million and a mean SROI NPV of $50 million.

Figure 42: FROI and SROI S-Curve Summary, Scenario F



Scenario F's mean levelized cost of electricity is $94.5/MWh, or $2.2/MWh more than the base case.

Figure 43: Levelized Cost of Electricity, Scenario F

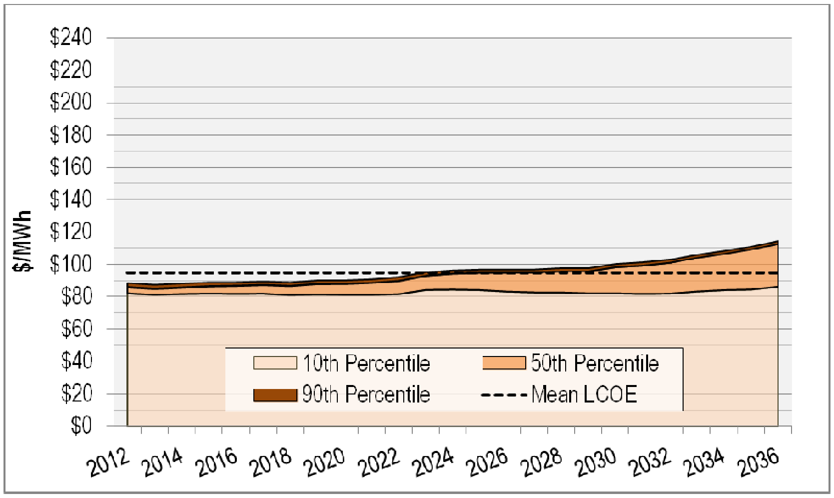


Table 22: Major Public Benefits, Scenario F

Account (Mean Rank)	Net Present Value (millions)			
	Mean	10%	50%	90%
Savings due to District Heating (6)	$0.00	$0.00	$0.00	$0.00
% savings (6)	#N/A	#N/A	#N/A	#N/A
Electricity Service Cost Savings (4)	$67.02	$46.16	$74.94	$148.16
Emission Savings (6)	$1.64	-$45.35	$4.09	$48.50
Business Relocation Benefit (2)	$52.74	$40.84	$53.05	$62.74
Reduced Biomass Shipping Costs (5)	-$0.01	-$0.01	-$0.01	-$0.01
Reduced Landfilling of Tires (4)	-$28.64	-$30.64	-$28.68	-$26.53
Avoided Loss of Commercial Harbor (6)	-$4.41	-$4.77	-$4.40	-$4.07
Reduced Snow Melt Service Cost (8)	-$25.80	-$50.19	-$21.73	-$18.50

Figure 44: SROI Net Present Value by Account, Scenario F

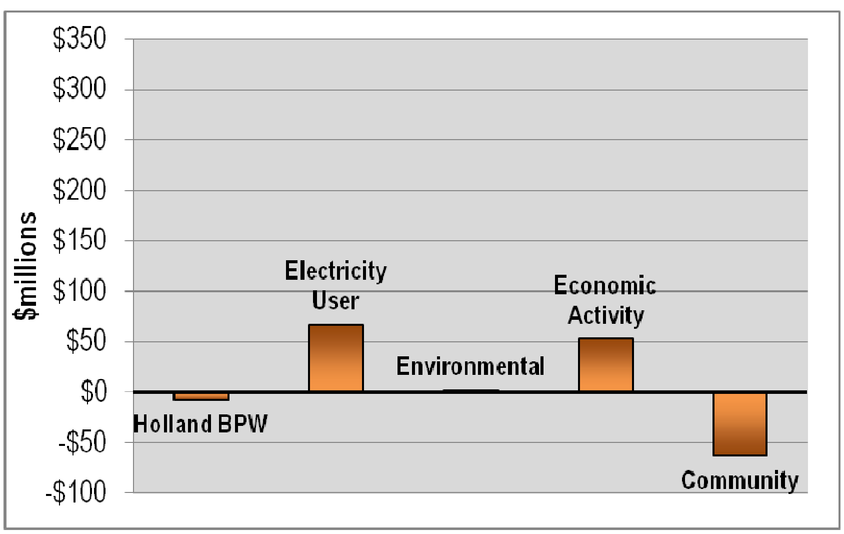
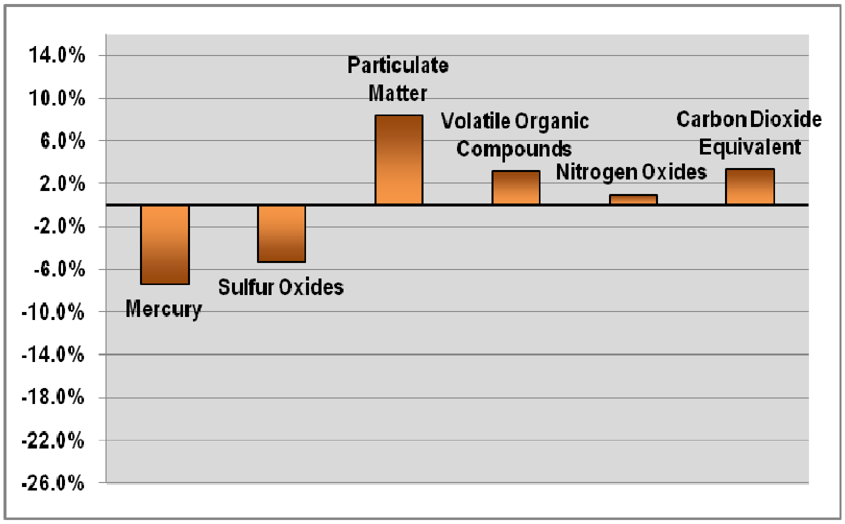


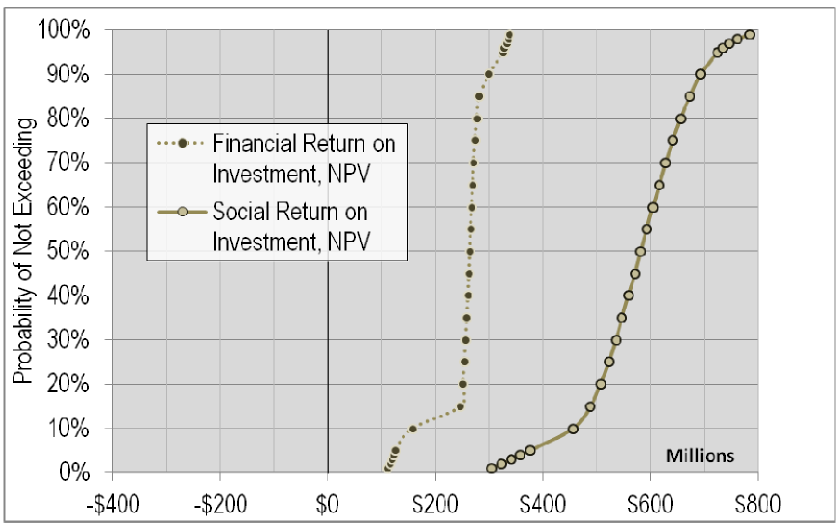
Figure 45: Emissions Savings as % of Base Emissions, Scenario F



Scenario G Summary Results

Scenario G has a mean FROI NPV of $256 million and a mean SROI NPV of $576 million.

Figure 46: FROI and SROI S-Curve Summary, Scenario G



Scenario G's mean levelized cost of electricity is $81.5/MWh, or $10.7/MWh less than the base case.

Figure 47: Levelized Cost of Electricity, Scenario G

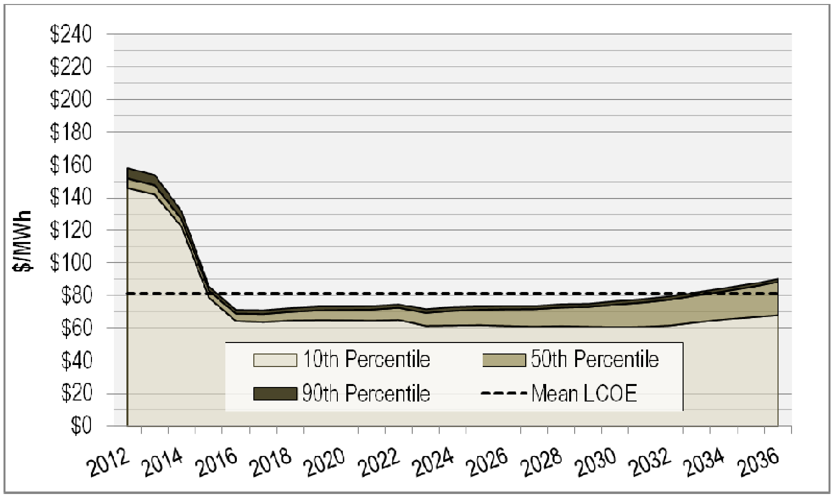


Table 23: Major Public Benefits, Scenario G

Account (Mean Rank)	Net Present Value (millions)			
	Mean	10%	50%	90%
Savings due to District Heating (5)	**$2.20**	$0.00	$2.36	$4.03
% savings (5)	***23.1%***	*5.9%*	*24.8%*	*38.0%*
Electricity Service Cost Savings (1)	**$283.40**	$254.49	$291.26	$328.07
Emission Savings (2)	**$289.92**	$192.78	$285.68	$394.18
Business Relocation Benefit (1)	**$60.03**	$46.72	$60.18	$71.79
Reduced Biomass Shipping Costs (5)	**-$0.01**	-$0.01	-$0.01	-$0.01
Reduced Landfilling of Tires (4)	**-$28.64**	-$30.65	-$28.68	-$26.57
Avoided Loss of Commercial Harbor (5)	**-$4.41**	-$4.77	-$4.40	-$4.07
Reduced Snow Melt Service Cost (5)	**$1.04**	$0.53	$0.63	$3.03

Figure 48: SROI Net Present Value by Account, Scenario G

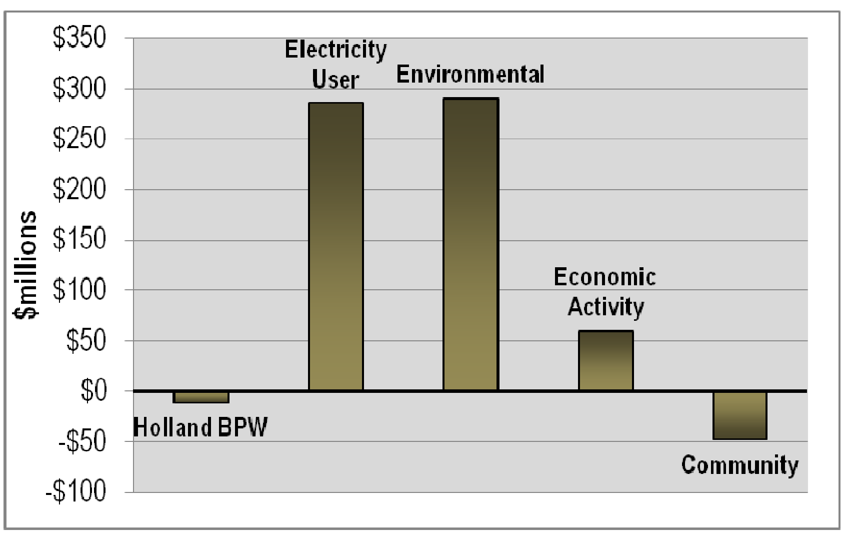
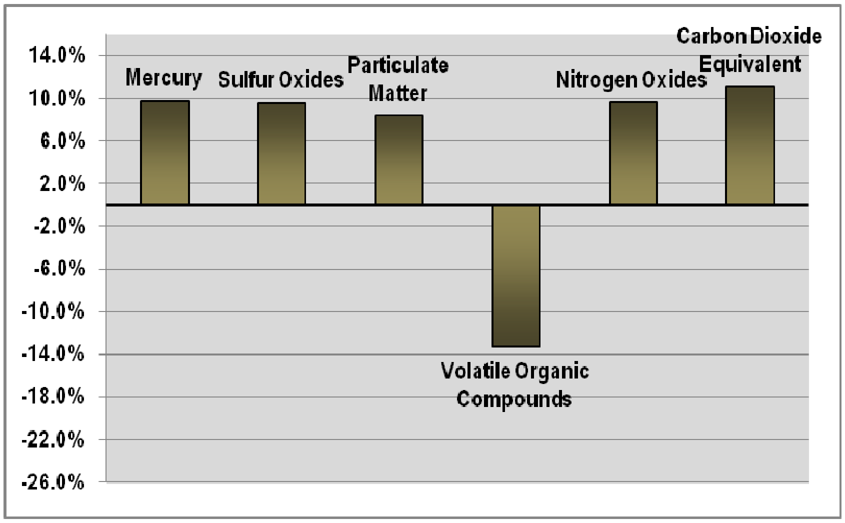


Figure 49: Emissions Savings as % of Base Emissions, Scenario G



APPENDIX A: OVERVIEW OF SROI & RAP

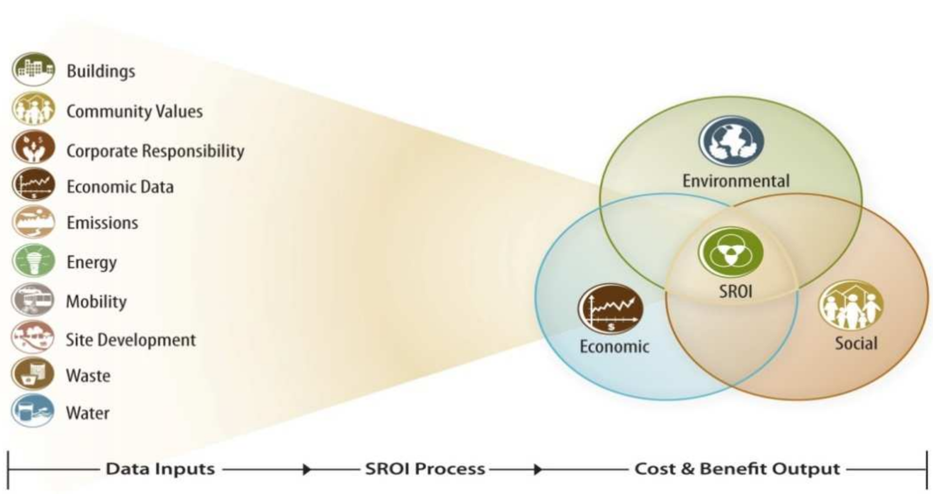
Issues related to sustainability, sustainable communities, and sustainable development is at the forefront of social debate today. Sustainable development is typically defined as the pattern of development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, Brundtland Commission, 1987). Sustainable development combines the financial considerations of development with broader socio-economic concerns including environmental stewardship, human health and equity issues, social well-being, and the social implications of decisions.

While the importance of these issues is widely recognized, organizations are challenged when they try to integrate sustainability considerations into their investment and operating decisions. Traditional financial evaluation tools used to assess an investment project, such as Business Case Analysis or Life-Cycle Cost Analysis (LCCA), rely exclusively on financial impacts. These traditional tools have two primary drawbacks:

1. An inability to accurately quantify the non-cash benefits and costs accruing to both the organization in question and to society as a whole resulting from a specific investment (sustainable benefits and costs).
2. A failure to adequately incorporate the element of risk and uncertainty.

HDR's Sustainable Return on Investment (SROI) process is a broad-based analysis that helps overcome these drawbacks by accounting for a project's triple-bottom line – its full range of financial, economic, as well as social and environmental impacts (see Figure A-1).

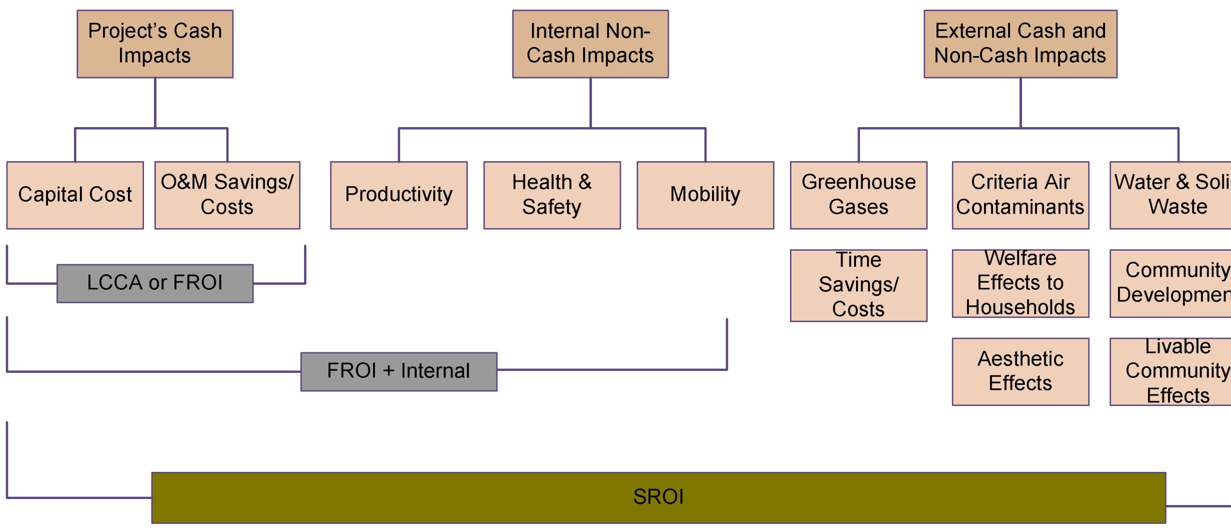
Figure A-1: SROI Methodology Guides Your Decision Making Process



The SROI process builds on best practices in Cost-Benefit Analysis and Financial Analysis methodologies, complemented by Risk Analysis and Stakeholder Elicitation techniques. The SROI process identifies the significant impacts of a given investment, and makes every attempt to credibly value them in monetary terms. Any relevant impacts that cannot be monetized are also identified, and ideally quantified in some way. Results are presented in innovative ways that help clients and their stakeholders prioritize projects, better understand trade-offs, and evaluate risk.

A key feature of SROI is that it converts to dollar terms (monetizes) the relevant social and environmental impacts of a project yet still provides the equivalent of traditional financial metrics (referred to as "Financial Return on Investment (FROI)"). FROI accounts for internal (i.e., accruing to the organization) cash costs and benefits only, while SROI accounts for all internal and external costs and benefits. Figure A-2 below illustrates how traditional financial models differ from SROI.

Figure A-2: Comparison of SROI to Traditional Life-Cycle Costing



The SROI process includes the traditional financial impacts, such as savings on utility bills or reduced/ higher O&M costs, internal productivity effects and a range of social and environmental impacts that would result directly from the evaluated project. Examples include:

- Value of enhanced productivity from employees working in a green building (e.g., fewer sick days or performing a task more efficiently);
- Quantified and monetized value of reduction in environmental emissions;
- Quantified and monetized value of reduction in generation of waste;
- Value of time savings and costs resulting from the evaluated project; and,
- Value of quality of life improvements, including improvements to households and broader community.

The SROI tool allows decision makers to promote transparency, accountability, and efficient use of all social resources to maximize the "triple bottom line" of economic, social and environmental value created by treating wastewater.

The SROI process involves four steps:

1. Development of the structure and logic of costs and benefits over the project life cycle. This involves determining the costs and benefits that result from the proposed investment and a graphical depiction to quantify these values. In particular, this step focuses on quantification of all broad (financial and sustainable) costs and benefits.
2. Quantification of input assumptions and assignment of risk/uncertainty, or initial risk analysis. This step involves building the preliminary outline of the SROI model, populating the model with initial data assumptions and performing initial calculations for identified costs and benefits (financial, social and environmental).
3. Facilitation of a Risk Analysis Process (RAP) session. This is a meeting, similar to a one-day charrette, which brings together key stakeholders to reach consensus on input data values and calculations to be used in the model.
4. Simulation of outcomes and probabilistic analysis. The final step in the process is the generation of SROI metrics, including Net Present Value (NPV), Discounted Payback Period, Benefit-Cost Ratio and the Internal Rate of Return, in addition to the traditional financial metrics. Financial metrics are included as a point of comparison and to transparently and comprehensively illustrate the relative merits of all potential investment scenarios being analyzed.

Each of the above steps is discussed in detail below.

<u>Step 1: Structure and Logic of the Cost and Benefits</u>

A "structure and logic model" depicts the variables and cause and effect relationships that underpin the forecasting problem at-hand. The structure and logic model is written mathematically to facilitate analysis and also depicted diagrammatically to permit stakeholder scrutiny and modification during Step 3.

<u>Step 2: Central Estimates and Probability Analysis</u>

Traditional financial analysis takes the form of a single "expected outcome" supplemented with alternative scenarios. The limitation of a forecast with a single expected outcome is clear – while it may provide the single best statistical estimate, it offers no information about the range of other possible outcomes and their associated probabilities. The problem becomes acute when uncertainties surrounding the underlying assumptions of a forecast are material.

Another common approach to provide added perspective on reality is "sensitivity analysis." Key forecast assumptions are varied one at a time, in order, to assess their relative impact on the expected outcome. A concern with this approach is that assumptions are often varied by arbitrary amounts. A more serious concern with this approach is that, in the real world, assumptions do not veer from actual outcomes one at a time but rather the impact of simultaneous differences between assumptions and actual outcomes is needed to provide a realistic perspective on the riskiness of a forecast.

Risk analysis provides a way around the problems outlined above. It helps avoid the lack of perspective in "high" and "low" cases by measuring the probability or "odds" that an outcome will actually materialize. A risk-based approach allows all inputs to be varied simultaneously within their distributions, avoiding the problems inherent in conventional sensitivity analysis. Risk analysis also recognizes interrelationships between variables and their associated probability distributions.

Risk analysis and Monte Carlo simulation techniques can be used to account for uncertainty in both the input values and model parameters. All projections and input values are expressed as probability distributions (a range of possible outcomes and the probability of each outcome), with a wider range of values provided for inputs exhibiting a greater degree of uncertainty. Of note, each element is converted into monetary values to estimate overall impacts in comparable financial terms and discounted to translate all values into present-value terms. Specifying uncertainty ranges for key parameters entering the decision calculus allows the SROI framework to evaluate the full array of social costs and benefits of a project while illustrating the range of possible outcomes to inform decision-makers.

Each variable is assigned a central estimate and a range to represent the degree of uncertainty. Estimates are recorded on Excel-based data sheets (see Figure A-3). The first column gives an initial median. The second and third columns define an uncertainty range representing a 90 percent confidence interval—the range within which there exists a 90 percent probability of finding the actual outcome. The greater the uncertainty associated with a forecast variable the wider the range.

Figure A-3: Example of Data Input Sheet *(Illustrative Example)*

Data Input	Median	Low	High	Realized
Percent reduction in electricity use	30.0%	22.5%	37.5%	**30.0%**
Building sqft	252,752	252,752	252,752	**$ 252,752**
Cost of electricity per kWh	$ 0.100	$ 0.050	$ 0.250	**$ 0.117**
Electricity use in kWh per sqft/year	49.33	39.46	59.19	**49.33**

Probability ranges are established using both statistical analysis and subjective probability assessment. Probability ranges do not have to be normal or symmetrical. In other words, there is no need to assume a bell-shaped normal probability curve. The bell curve assumes an equal likelihood of being too low and too high in forecasting a particular value. For example, if projected unit construction costs deviate from expectations, it is more likely that the costs will be higher than the median expected outcome than lower.

The Excel-based risk analysis add-on tool @Risk transforms the ranges depicted in Figure A-4 into formal probability distributions (or "probability density functions"), helping stakeholders understand and participate in the process even without formal training in statistical analysis.

The central estimates and probability ranges for each assumption in the forecasting structure and logic framework come from one of three key sources, as described below:

- The best available third party information from a variety of sources, including the Environmental Protection Agency, the Department of Energy, the Federal Highway

Administration, the Bureau of Labor Statistics, other government agencies, financial markets, universities, think tanks, etc.

- Historical analysis of statistical uncertainty in relevant time series data and an error analysis of forecasting "coefficients," which are numbers that represent the measured impact of one variable (say, fuel prices) on another (such as the price of steel). While these coefficients can only be known with uncertainty, statistical methods help uncover the level of uncertainty (using diagnostic statistics such as standard deviation, confidence intervals, and so on). This is also referred to as "frequentist" probability.
- Subjective probability assessment (also called "Bayesian" statistics, for the mathematician who developed it) in which a frequentist probability represents the measured frequency with which different outcomes occur (i.e., the number of heads and tails after thousands of tosses). The Bayesian probability of an event occurring is the degree of belief held by an informed person or group that it will occur. Obtaining subjective probabilities is the subject of Step 3.

An example of Determining a Social Value:

Monetizing a ton of CO_2: as with all inputs used in its studies, HDR uses a probability distribution to represent the potential value for a ton of CO_2 (in this case a PERT distribution was used). In order to define the PERT distribution we require three key data points: an expected median or 50th percentile value, a low value representing the minimum realistic value and a high value representing the highest realistic value. In order to determine which would be the most appropriate data point, a meta-analysis of over 200 recent scientific estimates of the social cost of CO_2 was conducted.

For the upper and lower bounds, we used two well-established yet extreme views of the theoretical impact on the planet of an incremental ton of CO_2; the median value was generated under the auspices of several US Federal departments to assist agencies in regulatory impact analysis:

- Lower: $11.99/Metric Ton in 2005$ (Source: William D. Nordhaus, A Question of Balance: Weighing the Options on Global Warming Policies, 2008, Table 5-4)
- Median: $21.40/Metric Ton in 2007$ (Source: Federal Interagency Working Group on Social Cost of Carbon (IWGSCC), 2010)
- Upper: $85.00/Metric Ton in 2005$ (Source: Nicholas Stern, The Economics of Climate Change: The Stern Review, 2006)

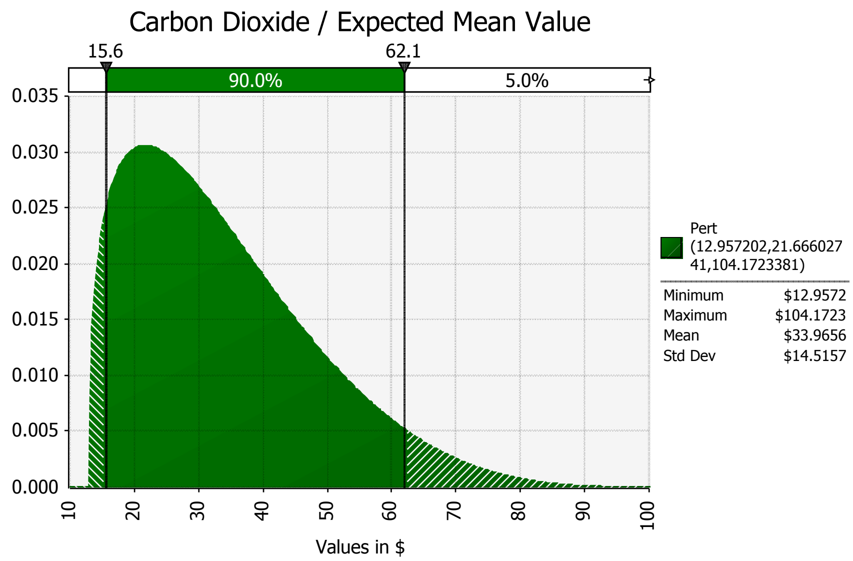
These values are based on the calculation of the expected damage caused by climate change including not only impacts on market outputs like food and forestry but also estimates of losses from non-market impacts. The most comprehensive damage studies include such factors as the greater intensity of hurricanes, impacts of changes in Temperature and precipitation on food production, ecosystem services, recreation, and the increased burdens of disease. The estimates also include adjustments for the risk of low-probability, high-consequence events such as abrupt climate change. The primary difference between these estimates is in the discount rate used to value future impacts.

After the aforementioned numbers are adjusted for inflation to 2012$ and converted to a short ton, the lower, median, and upper values become $12.96, $21.67, and $104.17 respectively.

Using these three values with a PERT distribution results in an expected mean price of **$33.97**/short ton (see Figure A-4 below).

This value is then escalated annually using rates derived from the Federal Interagency Working Group on Social Cost of Carbon.

Figure A-4: Probability Distribution for the Value of a Ton of CO2 (2012$ Illustrative Example)



Step 3: Expert Evaluation: The RAP© Session

The third step in the SROI process involves the formation of an expert panel to hold a charette-like one or two day meeting that we call the Risk Analysis Process (RAP) session. We use facilitation techniques to elicit risk and probability beliefs from participants about:

I. The structure of the forecasting framework; and,

II. Uncertainty attached to each input variable and forecasting coefficient in the framework.

In (i), experts are invited to add variables and hypothesized causal relationships that may be material, yet missing from the model. In (ii), the initial central estimates and ranges that were provided to panelists prior to the session are modified based on subjective expert beliefs and discussion.

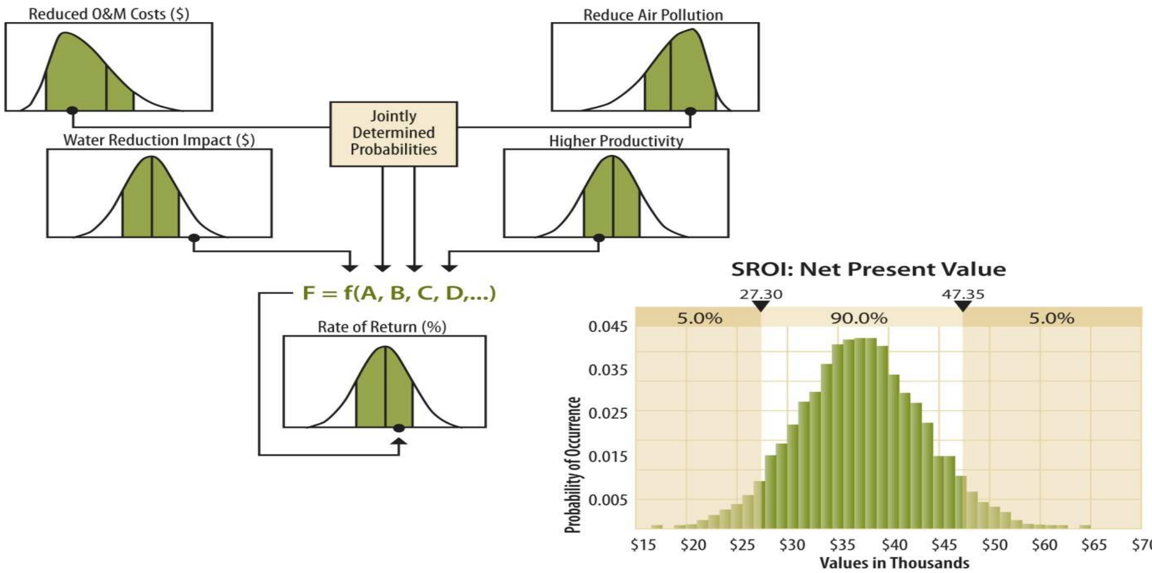
Examples of typical RAP session participants include:

- **Client**
  - Project tam
  - Technical specialists
  - Financial experts
- **HDR**
  - Facilitator
  - Economists
  - Technical Specialists
- **Outside Experts**
  - Public Agencies and Officials
  - Business Groups

Step 4: Simulation of Outcomes and Probabilistic Analysis

In step four, final probability distributions are formulated by the risk analyst (Economist) and represent a combination of probability information drawn from Steps 2 and 3. These are combined using simulation techniques (called Monte Carlo analysis) that allow each variable and forecasting coefficient to vary simultaneously according to its associated probability distribution (see Figure A-5 for graphical representation of this process).

Figure A-5: Combining Probability Distributions *(Illustrative Example)*



The result of the analysis is a forecast that includes estimates of the probability of achieving alternative outcomes given the uncertainty in underlying variables and coefficients.

For example, probability distribution of NPV of a project is demonstrated in Figure A-6 and Table A-1. As the figure and the table show, the average expected outcome of the hypothetical project is an NPV of $392.41 over the period of analysis considered.

There is a 10 percent chance that the NPV will exceed $580.11, and a 1 percent chance that the NPV will exceed $751.29. However, the proposed project also has a downside and a non-zero probability of performing at a much lower magnitude of NPV than the average outcome. Specifically, as the table shows there is a 99 percent probability that the NPV will exceed the negative $36.29.

This implies that there is a risk (about 1 percent to 2 percent in this case) that the NPV of the project considered would fall below zero, or generate no net benefits. Examining the table further, one can also determine that there is a risk of underperformance of the project, or the situations when the project generates net benefits that are much lower than the mean expected outcome.

Figure A-6: Risk Analysis of Net Incremental Benefits of a Project

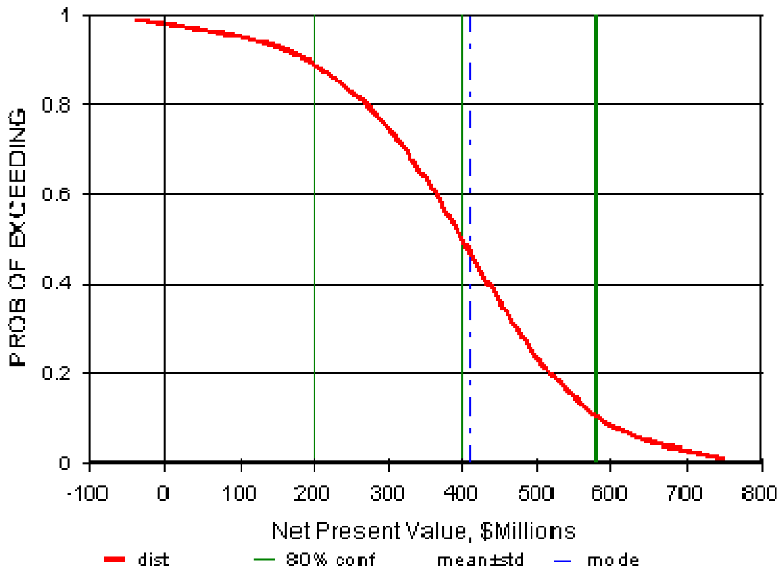


Table A-1: Risk Analysis of Net Present Value of a Project (Illustrative Example)

Project Net present Value ($ M)	Probability of Exceeding Value Shown at Left
-$36.29	0.99
$128.11	0.95
$**200.01**	**0.90**
$275.91	0.80
$325.05	0.70
$364.50	0.60
$**400.05**	**0.50**
$434.81	0.40
$471.95	0.30
$516.08	0.20
$**580.11**	**0.10**
$636.22	0.05
$751.29	0.01
$**392.41**	**Mean Expected Outcome**

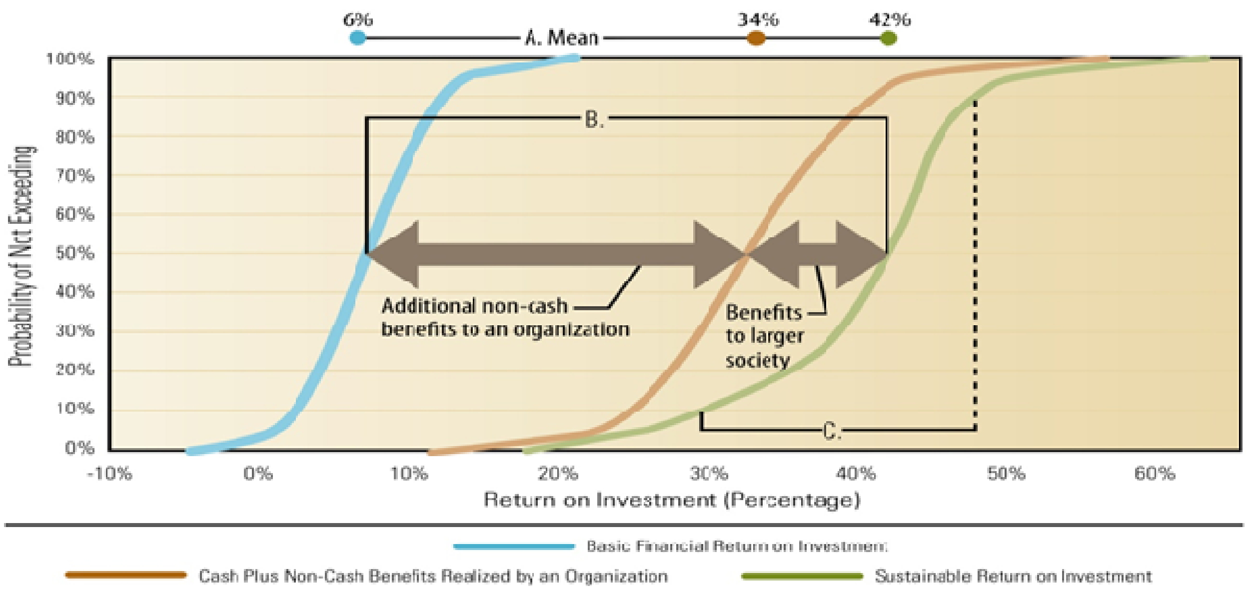
Using the SROI process, the net present value of a project (as in the example above) and other evaluation metrics can be estimated taking into account the three types if impacts discussed earlier: (1) only project cash impacts, (2) project cash impacts and non-cash impacts internal to the organization, and (3) all comprehensive societal or sustainable impacts. This allows decision-makers the ability to prioritize worthy—but competing—projects for funding based on the maximum financial and societal returns. In the following example, a project's outcome metrics are synthesized into an intuitive risk analysis model based on estimated return on investment.

A. Compare the financial return on investment and sustainable return on investment. In this example, the mean sustainable return on investment is more than double the traditional return on investment.

B. Evaluate non-cash benefits, such as improvements in employee health and productivity, and the benefits to larger community.

C. Assess the statistical likelihood that return will fall within an 80 percent confidence interval. In this example, sustainable return on investment ranges from 15 percent to 34 percent.

Figure A-7: The Sustainability "S" Curve to Optimize the Total Value of Your Projects



APPENDIX B: RESOURCE OPTION COST SUMMARY

B.1 Introduction

The following appendix summarizes estimated performance, capital costs, and operating costs as well as the basis for calculating each for various new generation options and emissions compliance alternatives. The performance and costs were developed based on the assumptions and parameters defined within this appendix. All operating cost values are presented as first year costs assuming a commercial operation date of 2012.

B.2 New Generation and Emissions Compliance Options Basis

B.2.1 Capital Cost Basis

Capital costs are calculated based on utilizing an Engineer, Procure, and Construct (EPC) contracting strategy. EPC costs include direct costs such as equipment and labor, construction indirect costs, project indirect costs, and EPC contingency and fee. In addition, Owner's costs for each option have also been estimated and a total project cost was determined. Owner's costs include project management, interest during construction, and insurances, and other miscellaneous costs incurred by the owner during development, permitting, and construction. Capital costs are non-escalated values representing 2012 costs.

Major equipment costs were obtained from vendor quotations. Demolition and site work for each of the options is site and technology specific. It was assumed that the demolition of retired Units 1 and 2 would not be included in the capital costs for any of the options.

B.2.2 Operating Cost Basis

Fixed Costs

Fixed operating costs include:

- Plant Staffing
- Insurance
- Site/Building Maintenance Costs
- Annual equipment maintenance that is not variable based on hours of equipment operation
- Note: property tax not included/required

The assumed values used to develop fixed costs as well as expected staffing requirements are summarized in the tables below and assume that no additional staffing is required for the emissions compliance alternatives. Note that the staff requirements for each option are incremental additions to the existing Holland BPW work force.

Table B-1: Fixed Operating Cost Values

Fixed Cost	First Year Price (2012)
Annual Cost for Salaried Staff	$121,899
Annual Cost for Hourly Staff	$97,520
Insurance	0.050% of EPC Project Cost
Property Tax	0.000% of Net Book Value
Annual Site / Building Maintenance Cost	$150,000

Table B-2: Assumed Staffing Requirements

Description	Incremental Salaried Staff	Incremental Hourly Staff
JDY Unit 10 CFB	2	9
LM2500+ CHP Plant	1	3
2x1 LM2500 CC (JDY)	0	0
Unit 5 Biomass Retrofit	0	0
24 MW PV Plant	0	1
37 MW Wind Farm	0	1
4 MW Digester Gas CHP Plant	0	2
2x1 LM6000 CC	2	2

Variable Costs

Variable costs represent equipment maintenance and consumable consumption costs that are primarily dependent upon hours of operation of the equipment. These costs include:

- Equipment Maintenance Costs
- Outsourced labor/maintenance costs for combustion turbines (LTSA contracts), steam turbines, AQCS equipment, etc.
- Cost of delivered materials consumed
- Cost of disposal of byproducts produced
- Spare Parts

Maintenance costs were estimated individually for the following equipment (as applicable to each option):

- Boiler / HRSG
- Combustion Turbine
- Steam Turbine
- Material Handling Systems
- AQCS Equipment
- Balance of Plant

No startup fuel costs are included in the variable operating costs. The quantity of startup fuel for a cold start and a hot start are estimated on a per start basis for input into the Ventyx model. The costs associated with consumed materials and byproducts are based on the costs in the table below.

Table B-3: Consumable First Year Costs

Consumable	First Year Unit Price (2011)
Consumable Escalation Rate	2.0%
Ammonia	$630.00 / Ton (as NH3)
Clarified Water	$0.25 / kgal
Demineralized Water	$4.60 / kgal
Cycle Chemical Feed	$0.013 / Ton steam produced
Waste Water Treatment	$0.00 / kgal
Limestone	$18.25 / Ton
Lime	$140.00 / Ton
PAC	$2,200.00 / Ton
Trona	$210.00 / Ton

B.3 New Generation and Emissions Compliance Options Results

Performance, capital costs, and operating costs for the new generation options and emissions compliance alternatives are tabulated in the following sections. Project capital costs are calculated on an EPC basis and include the Owner's costs broken out as a separate line item. Fixed operating costs are presented on a $/kW basis as these costs do not vary based on plant dispatch. Variable operating costs are presented on a $/MWh basis. Note that the operating costs for the emissions compliance alternatives are incremental additions to the existing JDY Unit 4 and 5 operating costs.

B.3.1 New Generation Options

The results for the new generation options are tabulated below.

Table B-4: New Generation Options – Capital Costs

Project Costs	JDY U10 CFB	LM2500 CHP Plant (Ind. Park)	2x1 LM2500 CCPP (At JDY Site)	JDY U5 Biomass Retrofit	8 MW Solar PV	20 MW Wind	Digester Gas CHP Plant	2x1 LM6000 CCPP (New Site)
EPC Cost ($1,000)	$261,983	$50,669	$121,194	$54,838	$50,000	-	$29,255	$149,967
EPC Cost ($/kW)	**$3,735**	**$1,662**	**$1,541**	**$2,520**	**$6,250**	**-**	**$7,341**	**$1,312**
Construction Schedule (months)	54	26	32	26	14	-	26	32
Owner's Costs	$67,098	$10,317	$26,041	$11,166	$9,056	-	$5,957	$32,223
Total Project Cost ($1,000)	**$329,080**	**$60,986**	**$147,235**	**$66,004**	**$59,056**	**$46,649**	**$35,212**	**$182,189**
Total Project Cost ($/kW)	$4,691	$2,001	$1,872	$3,033	$7,382	$2,332	$8,836	$1,594

Table B-5: New Generation Options – Performance and Operating Costs

Ventyx Inputs		JDY U10 CFB	LM2500 CHP Plant (Ind. Park)	2x1 LM2500 CCPP (At JDY Site)	JDY U5 Biomass Retrofit	8 MW Solar PV	20 MW Wind	Digester Gas CHP Plant	2x1 LM6000 CCPP (New Site)
Min. Capacity (Net)	**MW**	26.1	15.2	21.4	8.8	0.0	0.0	1.9	31.0
Max. Capacity (Net)	**MW**	70.1	30.5	78.6	21.8	8.0	20.0	4.0	114.3
Start-up Fuel Hot Start, per Start	**MMBtu**	4772	233	432	1035	0	0	43	623
Start-up Fuel Cold Start, per Start	**MMBtu**	9544	1866	1152	2070	0	0	116	1662
Variable O&M	**$/MWh**	8.41	3.96	3.34	8.22	0.00	0.00	10.80	3.34
Fixed O&M	**$/kW**	24.33	25.67	8.06	14.18	28.02	40.10	319.79	11.32
Annual Maintenance Outage	**%**	5.75%	3.18%	3.18%	5.75%	0.00%	0.00%	3.18%	3.18%
Annual EFOR	**%**	4.00%	3.00%	3.00%	5.00%	83.87%	66.00%	15.00%	3.00%
NOx Rate	**lb/MMBtu**	0.09	0.015	0.015	0.10			0.015	0.015
SO2 Rate	**lb/MMBtu**	0.097	0.0008	0.0008	0.27			0.0008	0.0008
Total Equivalent CO2	**T/MWH, gross**	0.943	0.585	0.418	0.207	0.000	0.000	1.177	0.415
CO2 Rate	T/MWH, gross	1.071	0.585	0.418	1.479	0.000	0.000	1.177	0.415
CO2 Rate, Biomass Carbon Neutral	T/MWH, gross	0.745	NA	NA	0	NA	NA	NA	NA
Equivalent CO2 from N2O	T/MWH, gross	0.198	<0.01	<0.01	0.207	<0.01	<0.01	<0.01	<0.01
Mercury Rate	**lb/GW-hr, gross**	0.0078	negligible	negligible	0.0032	negligible	negligible	negligible	negligible
Min. Load Heat Rate (Net)	**Btu/kWh**	13,759	12,811	8,818	19,237	na	na	18,718	8,364
Max. Load Heat Rate (Net)	**Btu/kWh**	11,338	10,177	7,320	15,703	na	na	14,496	7,251
Heat Rate Curve (MMBtu/h v. MW):									
Constant Term:		116.8367	52.1131	85.3106	52.5522	-	-	16.4561	91.3643
1st Order Term:		9.1171	10.8648	4.3030	13.1708	-	-	9.8339	5.0323
2nd Order Term:		0.0079	-0.0803	0.0246	0.0055	-	-	0.1336	0.0124

B.3.2 Emissions Compliance Alternatives

The results for the emissions compliance alternatives are tabulated below.

Table B-6: Emissions Compliance Alternatives – Capital Costs

Project Costs	**New U4 Bag House + DSI**	**New U5 Bag House + DSI**	**U4 SNCR**	**U5 SNCR**
EPC Cost ($1,000)	$9,363	$8,398	$2,974	$3,281
EPC Cost ($/kW)	**$468**	**$336**	**$149**	**$131**
Construction Schedule (months)	18	18	9	9
Owner's Costs	$1,766	$1,584	$511	$563
Total Project Cost ($1,000)	**$11,129**	**$9,982**	**$3,485**	**$3,844**
Total Project Cost ($/kW)	$556	$399	$174	$154

Table B-7: Emissions Compliance Alternatives – Performance and Operating Costs

AQCS Compliance Alternatives - Incremental O&M Costs					
		U4 New Bag House	U5 New Bag House	U4 SNCR	U5 SNCR
		DSI	DSI	-	-
Incremental O&M Costs					
SNCR Incremental O&M Cost	$/MWh	$0.00	$0.00	$1.59	$1.58
DSI System Incremental O&M Cost	$/MWh	$2.94	$2.84	$0.00	$0.00
Bag House Incremental O&M Cost	$/MWh	$0.37	$0.32	$0.00	$0.00
Total Incremental O&M Cost	**$/MWh**	**$3.31**	**$3.17**	**$1.59**	**$1.58**
Auxiliary Power Consumption Increase					
SNCR Power Consumption	kW	0	0	25	25
DSI System Power Consumption	kW	60	60	0	0
Incremental ID Fan Power Consumption	kW	97	197	0	0
Total Auxiliary Power Increase	**kW**	**157**	**257**	**25**	**25**

Table B-8: Emissions Compliance Alternatives – Emissions Comparison for JDY Units 4 & 5

Emissions Comparison					
		JDY 4		JDY 5	
		Current	With Baghouse, DSI, and SNCR	Current	With Baghouse, DSI, and SNCR
SO2	lb/mmBtu	0.900	0.450	0.900	0.450
NOx	lb/mmBtu	0.860	0.560	0.420	0.273
PM	T/MWh	0.000230	0.000065	0.000174	0.000066

B.3.3 Snowmelt system basis

The following assumptions were utilized in this analysis for establishing snowmelt costs:

1. Expanding the snowmelt system will not require demolition and repaving of the roads & sidewalks.
2. Installed capital costs for the base load generation options are identical. The delta observed between the generation options is in the form of incremental power consumed and is calculated as STG output variances resulting from varying back pressure.
3. No additional staff is required to operate and maintain the expanded snowmelt system.
4. An allowance has been included for tying into the existing snowmelt system.
5. Typical percentage allowances for indirects, fees, contingency, and owner's costs have been utilized to develop total project costs.

B.3.4 District heating basis

The following assumptions were utilized in this analysis for establishing district heating costs:

1. The majority of the municipal right of way issues will already have been resolved. Additionally, no demolition and repaving of roads and/or sidewalks is included in the cost estimates.

2. As the process steam load is unknown, it is assumed that the steam from the CHP plants will be utilized for district heating and will heat a hot water loop to be sent out to the customers.
3. The hot water is supplied to the customers at 200 deg F and returned at 150 deg F.
4. The main district heating header loop is assumed to extend from JDY / industrial park and include, at a minimum, tie-ins to the hospital, aquatic center, and Hope College.
5. It is assumed that no additional staff is required to operate and maintain the district heating system.
6. Typical percentage allowances for indirects, fees, contingency, and owner's costs have been utilized to develop total project costs.

Note that the results for district heating provided in the following section provide costs for the stand alone technology options under consideration. For Scenarios A, B, and C, more than one of the technology options are utilized and, as such, costs associated with installing the district heating header loop need only be counted once. This is taken into account in this analysis.

B.3.4 Snowmelt and district heating results

The results for the snowmelt and district heating systems are tabulated below.

Table B-9: Snowmelt System – Performance, Capital Costs, and Operating Costs.

		JDY Unit 10 (CFB)		2x1 LM2500 CCPP		2x1 LM6000 CCPP		JDY Unit 5		NG-Fired Boiler	
		Existing Snowmelt	Expanded Snowmelt	Existing Snowmelt	Expanded Snowmelt	Existing Snowmelt	Expanded Snowmelt	Existing Snowmelt	Expanded Snowmelt	Existing Snowmelt	Expanded Snowmelt
Snowmelt Costs & Benefits											
Snowmelt Duty	mmBtu/hr	36	100	36	100	36	100	36	100	36	100
Snowmelt Area Expansion	**ft2**	**0**	**800,000**	**0**	**800,000**	**0**	**800,000**	**0**	**800,000**	**0**	**800,000**
Total Project Cost	**$1,000**	**$230**	**$10,500**	**$230**	**$10,500**	**$230**	**$10,500**	**$230**	**$10,500**	**$7,060**	**$23,970**
Incremental Power Consumption	kW	57	223	272	528	293	547	598	931	187	521
Incremental O&M Costs (Fixed Annual)	$1,000/yr	$5	$10	$5	$10	$5	$10	$5	$10	$38	$76
Additional Fuel Consumption (HHV)	mmBtu/hr	0	0	0	0	0	0	0	0	46	129
Incremental Emissions											
NOx	lb/hr	0	0	0	0	0	0	0	0	4.5	12.6
SOx	lb/hr	0	0	0	0	0	0	0	0	0.027	0.076
CO	lb/hr	0	0	0	0	0	0	0	0	3.8	10.6
CO2	lb/hr	0	0	0	0	0	0	0	0	5443	15120
PM (Total)	lb/hr	0	0	0	0	0	0	0	0	0.34	0.96
VOC	lb/hr	0	0	0	0	0	0	0	0	0.25	0.69

Table B-10: District Heating System – Performance, Capital Costs, and Operating Costs.

		LM2500 CHP		2x1 LM2500 CCPP		Digester Gas CHP		2x1 LM6000 CCPP	
		Base	Stack WHTR	Base	Stack WHTR	Base	Stack WHTR	Base	Stack WHTR
District Heating Costs & Benefits									
Total Heating Duty	mmBtu/hr	123	140	0	9	25	30	0	28
Total Area Heated	**ft2**	**3,442,425**	**3,921,322**	**0**	**264,600**	**692,229**	**828,326**	**0**	**770,000**
Total Natural Gas Displacement	mmBtu/hr	142	161	0	11	29	34	0	32
Total Project Cost	**$1,000**	**$11,200**	**$12,670**	**$0**	**$6,780**	**$6,580**	**$7,070**	**$0**	**$8,620**
Incremental Power Consumption	kW	192	251	0	72	39	85	0	285
Incremental O&M (Fixed Annual)	$1,000/yr	$6	$17	$0	$11	$2	$12	$0	$12
Emissions Savings									
NOx	lb/hr	13.1	14.9	0.0	1.0	2.6	3.1	0.0	2.9
SOx	lb/hr	0.083	0.095	0.000	0.006	0.017	0.020	0.000	0.019
CO	lb/hr	5.56	6.33	0.00	0.43	1.12	1.34	0.00	1.24
CO2	lb/hr	16,676	18,996	0	1,282	3,353	4,013	0	3,730
PM (Total)	lb/hr	1.06	1.20	0.00	0.08	0.21	0.25	0.00	0.24
VOC	lb/hr	0.76	0.87	0.00	0.06	0.15	0.18	0.00	0.17

APPENDIX C: DETAILED SROI RESULTS

@RISK Results - Incremental Summary – Mean

DISCOUNTED SUMMARY	A	B	C	D	E	F	G
Total Financial Benefit	*-$170.6*	*-$79.1*	*$73.0*	*$25.4*	*-$49.3*	*-$33.3*	*-$295.1*
Total Social Benefit	*$26.1*	*$5.9*	*$8.6*	*$17.0*	*$7.5*	*$24.3*	*$35.7*
Total Financial Cost	*-$358.3*	*-$205.0*	*$77.0*	*$4.3*	*-$89.2*	*-$58.6*	*-$550.6*
Total Social Cost	*-$208.4*	*-$333.5*	*-$173.6*	*-$33.8*	*$59.3*	*-$0.3*	*-$284.3*
Financial Return on Investment, NPV	$187.7	$125.9	-$4.1	$21.2	$40.0	$25.3	$255.6
RANK, FROI	2	3	8	6	4	5	1
Social Return on Investment, NPV	$422.2	$465.3	$178.2	$71.9	-$11.8	$49.9	$575.6
RANK, SROI	3	2	4	5	8	6	1

Holland BPW Account	*A*	*B*	*C*	*D*	*E*	*F*	*G*
Financial Benefits	-$179.3	-$95.0	$49.8	$7.6	-$46.6	-$31.1	-$283.3
Social Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL BENEFITS	-$179.3	-$95.0	$49.8	$7.6	-$46.6	-$31.1	-$283.3
Financial Costs	-$176.7	-$92.2	$52.6	$7.9	-$41.6	-$23.5	-$272.4
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	-$176.7	-$92.2	$52.6	$7.9	-$41.6	-$23.5	-$272.4
Financial Return on Investment	*-$2.6*	*-$2.8*	*-$2.8*	*-$0.3*	*-$5.0*	*-$7.5*	*-$10.9*
Social Return on Investment	*-$2.6*	*-$2.8*	*-$2.8*	*-$0.3*	*-$5.0*	*-$7.5*	*-$10.9*

Electricity User Account	*A*	*B*	*C*	*D*	*E*	*F*	*G*
Financial Benefits	$17.6	$20.8	$20.6	$17.5	$0.0	$0.0	$2.2
Social Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL BENEFITS	$17.6	$20.8	$20.6	$17.5	$0.0	$0.0	$2.2
Financial Costs	-$185.0	-$116.0	$26.1	-$2.0	-$56.9	-$67.0	-$283.4
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	-$185.0	-$116.0	$26.1	-$2.0	-$56.9	-$67.0	-$283.4
Financial Return on Investment	*$202.6*	*$136.8*	*-$5.5*	*$19.4*	*$56.9*	*$67.0*	*$285.6*
Social Return on Investment	*$202.6*	*$136.8*	*-$5.5*	*$19.4*	*$56.9*	*$67.0*	*$285.6*

Environmental Account	A	B	C	D	E	F	G
Financial Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits	$13.0	$15.0	$14.4	$12.4	$0.0	$0.0	$4.2
TOTAL BENEFITS	$13.0	$15.0	$14.4	$12.4	$0.0	$0.0	$4.2
Financial Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Costs	-$209.8	-$334.8	-$174.1	-$34.3	$59.2	-$1.6	-$285.8
TOTAL COSTS	-$209.8	-$334.8	-$174.1	-$34.3	$59.2	-$1.6	-$285.8
Financial Return on Investment	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*
Social Return on Investment	*$222.8*	*$349.8*	*$188.5*	*$46.7*	*-$59.2*	*$1.6*	*$289.9*

Economic Activity Account	A	B	C	D	E	F	G
Financial Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits	$41.7	$19.6	-$5.8	$4.6	$36.2	$52.7	$60.0
TOTAL BENEFITS	$41.7	$19.6	-$5.8	$4.6	$36.2	$52.7	$60.0
Financial Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Financial Return on Investment	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*
Social Return on Investment	*$41.7*	*$19.6*	*-$5.8*	*$4.6*	*$36.2*	*$52.7*	*$60.0*

Community Account	A	B	C	D	E	F	G
Financial Benefits	-$8.9	-$4.8	$2.5	$0.3	-$2.7	-$2.2	-$14.0
Social Benefits	-$28.6	-$28.6	$0.0	$0.0	-$28.6	-$28.4	-$28.4
TOTAL BENEFITS	-$37.6	-$33.5	$2.5	$0.3	-$31.3	-$30.7	-$42.4
Financial Costs	$3.3	$3.3	-$1.7	-$1.7	$9.2	$32.0	$5.1
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	$3.3	$3.3	-$1.7	-$1.7	$9.2	$32.0	$5.1
Financial Return on Investment	*-$12.3*	*-$8.1*	*$4.2*	*$2.0*	*-$11.9*	*-$34.2*	*-$19.1*
Social Return on Investment	*-$40.9*	*-$36.7*	*$4.2*	*$2.0*	*-$40.5*	*-$62.6*	*-$47.6*

@RISK Results - Incremental Summary - 10th Percentile

DISCOUNTED SUMMARY	A	B	C	D	E	F	G
Total Financial Benefit	*-$223.7*	*-$117.0*	*$53.5*	*$5.3*	*-$105.0*	*-$120.7*	*-$344.3*
Total Social Benefit	*$14.4*	*-$2.5*	*-$0.4*	*$10.2*	*-$4.0*	*$11.9*	*$21.7*
Total Financial Cost	*-$452.3*	*-$271.2*	*$39.7*	*-$32.6*	*-$189.9*	*-$216.7*	*-$643.7*
Total Social Cost	*-$285.5*	*-$462.3*	*-$243.5*	*-$49.7*	*-$1.1*	*-$47.2*	*-$387.7*
Financial Return on Investment, NPV	$95.6	$70.1	-$24.5	$3.4	-$53.6	-$108.5	$156.4
RANK, FROI	2	3	6	4	7	8	1
Social Return on Investment, NPV	$325.4	$331.8	$101.3	$42.2	-$100.9	-$23.9	$455.7
RANK, SROI	3	2	4	5	8	7	1
Holland BPW Account	***A***	***B***	***C***	***D***	***E***	***F***	***G***
Financial Benefits	-$226.1	-$128.4	$31.2	-$10.9	-$100.0	-$114.9	-$330.6
Social Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL BENEFITS	-$226.1	-$128.4	$31.2	-$10.9	-$100.0	-$114.9	-$330.6
Financial Costs	-$223.9	-$125.8	$33.8	-$10.7	-$94.7	-$107.3	-$319.2
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	-$223.9	-$125.8	$33.8	-$10.7	-$94.7	-$107.3	-$319.2
Financial Return on Investment	*-$3.0*	*-$3.2*	*-$3.2*	*-$0.7*	*-$6.1*	*-$9.2*	*-$12.6*
Social Return on Investment	*-$3.0*	*-$3.2*	*-$3.2*	*-$0.7*	*-$6.1*	*-$9.2*	*-$12.6*
Electricity User Account	***A***	***B***	***C***	***D***	***E***	***F***	***G***
Financial Benefits	$13.2	$15.6	$15.7	$13.4	$0.0	$0.0	$0.0
Social Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL BENEFITS	$13.2	$15.6	$15.7	$13.4	$0.0	$0.0	$0.0
Financial Costs	-$232.7	-$148.9	$7.6	-$20.1	-$103.9	-$148.2	-$328.1
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	-$232.7	-$148.9	$7.6	-$20.1	-$103.9	-$148.2	-$328.1
Financial Return on Investment	*$104.8*	*$77.3*	*-$26.5*	*$1.0*	*-$40.6*	*-$74.3*	*$180.6*
Social Return on Investment	*$104.8*	*$77.3*	*-$26.5*	*$1.0*	*-$40.6*	*-$74.3*	*$180.6*

Environmental Account	A	B	C	D	E	F	G
Financial Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits	$8.1	$9.4	$9.0	$7.8	$0.0	$0.0	$0.0
TOTAL BENEFITS	$8.1	$9.4	$9.0	$7.8	$0.0	$0.0	$0.0
Financial Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Costs	-$286.9	-$463.6	-$244.1	-$50.3	-$1.2	-$48.5	-$389.0
TOTAL COSTS	-$286.9	-$463.6	-$244.1	-$50.3	-$1.2	-$48.5	-$389.0
Financial Return on Investment	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*
Social Return on Investment	*$147.6*	*$227.5*	*$119.4*	*$26.9*	*-$124.7*	*-$45.3*	*$192.8*

Economic Activity Account	A	B	C	D	E	F	G
Financial Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits	$31.2	$13.7	-$13.1	$0.1	$25.1	$40.8	$46.7
TOTAL BENEFITS	$31.2	$13.7	-$13.1	$0.1	$25.1	$40.8	$46.7
Financial Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Financial Return on Investment	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*
Social Return on Investment	*$31.2*	*$13.7*	*-$13.1*	*$0.1*	*$25.1*	*$40.8*	*$46.7*

Community Account	A	B	C	D	E	F	G
Financial Benefits	-$11.2	-$6.5	$1.6	-$0.6	-$5.0	-$5.8	-$16.3
Social Benefits	-$30.7	-$30.7	-$0.9	-$0.9	-$30.6	-$30.4	-$30.5
TOTAL BENEFITS	-$40.7	-$36.3	$1.2	-$1.0	-$34.4	-$34.4	-$45.7
Financial Costs	$1.4	$1.2	-$3.9	-$3.8	$7.1	$24.5	$3.2
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	$1.4	$1.2	-$3.9	-$3.8	$7.1	$24.5	$3.2
Financial Return on Investment	*-$14.4*	*-$10.0*	*$3.0*	*$0.8*	*-$15.4*	*-$57.6*	*-$21.5*
Social Return on Investment	*-$44.3*	*-$39.8*	*$2.6*	*$0.4*	*-$44.4*	*-$85.8*	*-$51.0*

@RISK Results - Incremental Summary - 50th Percentile

DISCOUNTED SUMMARY	A	B	C	D	E	F	G
Total Financial Benefit	*-$179.0*	*-$85.8*	*$73.0*	*$24.0*	*-$55.8*	*-$44.8*	*-$303.6*
Total Social Benefit	*$26.2*	*$5.5*	*$8.4*	*$16.6*	*$8.1*	*$24.6*	*$35.9*
Total Financial Cost	*-$374.3*	*-$217.5*	*$76.7*	*$2.5*	*-$101.6*	*-$80.0*	*-$566.9*
Total Social Cost	*-$204.7*	*-$324.1*	*-$170.0*	*-$33.4*	*$52.2*	*-$2.8*	*-$280.2*
Financial Return on Investment, NPV	$195.1	$131.6	-$3.3	$21.6	$45.7	$35.2	$262.9
RANK, FROI	2	3	8	6	4	5	1
Social Return on Investment, NPV	$430.9	$461.3	$175.7	$72.2	$1.1	$66.6	$581.1
RANK, SROI	3	2	4	5	7	6	1

Holland BPW Account	*A*	*B*	*C*	*D*	*E*	*F*	*G*
Financial Benefits	-$187.6	-$101.8	$49.9	$6.5	-$52.9	-$42.0	-$291.7
Social Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL BENEFITS	-$187.6	-$101.8	$49.9	$6.5	-$52.9	-$42.0	-$291.7
Financial Costs	-$185.0	-$98.9	$52.6	$6.9	-$47.9	-$34.5	-$280.8
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	-$185.0	-$98.9	$52.6	$6.9	-$47.9	-$34.5	-$280.8
Financial Return on Investment	*-$2.6*	*-$2.8*	*-$2.8*	*-$0.3*	*-$5.0*	*-$7.5*	*-$10.9*
Social Return on Investment	*-$2.6*	*-$2.8*	*-$2.8*	*-$0.3*	*-$5.0*	*-$7.5*	*-$10.9*

Electricity User Account	*A*	*B*	*C*	*D*	*E*	*F*	*G*
Financial Benefits	$17.9	$21.2	$21.0	$17.8	$0.0	$0.0	$2.4
Social Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL BENEFITS	$17.9	$21.2	$21.0	$17.8	$0.0	$0.0	$2.4
Financial Costs	-$192.5	-$121.9	$25.8	-$2.8	-$63.0	-$74.9	-$291.3
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	-$192.5	-$121.9	$25.8	-$2.8	-$63.0	-$74.9	-$291.3
Financial Return on Investment	*$210.5*	*$142.8*	*-$4.8*	*$20.0*	*$63.0*	*$74.9*	*$293.5*
Social Return on Investment	*$210.5*	*$142.8*	*-$4.8*	*$20.0*	*$63.0*	*$74.9*	*$293.5*

Environmental Account	A	B	C	D	E	F	G
Financial Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits	$12.3	$14.0	$13.5	$11.6	$0.0	$0.0	$4.1
TOTAL BENEFITS	$12.3	$14.0	$13.5	$11.6	$0.0	$0.0	$4.1
Financial Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Costs	-$206.0	-$325.4	-$170.7	-$33.9	$52.1	-$4.1	-$281.5
TOTAL COSTS	-$206.0	-$325.4	-$170.7	-$33.9	$52.1	-$4.1	-$281.5
Financial Return on Investment	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*
Social Return on Investment	*$218.3*	*$340.0*	*$184.6*	*$45.4*	*-$52.1*	*$4.1*	*$285.7*

Economic Activity Account	A	B	C	D	E	F	G
Financial Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits	$42.1	$19.9	-$5.4	$4.6	$36.6	$53.0	$60.2
TOTAL BENEFITS	$42.1	$19.9	-$5.4	$4.6	$36.6	$53.0	$60.2
Financial Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Financial Return on Investment	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*
Social Return on Investment	*$42.1*	*$19.9*	*-$5.4*	*$4.6*	*$36.6*	*$53.0*	*$60.2*

Community Account	A	B	C	D	E	F	G
Financial Benefits	-$9.3	-$5.1	$2.5	$0.3	-$2.9	-$2.7	-$14.4
Social Benefits	-$28.7	-$28.6	$0.0	$0.0	-$28.7	-$28.5	-$28.5
TOTAL BENEFITS	-$38.0	-$33.7	$2.5	$0.3	-$31.6	-$31.1	-$42.8
Financial Costs	$3.7	$3.6	-$1.3	-$1.3	$8.7	$27.9	$5.4
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	$3.7	$3.6	-$1.3	-$1.3	$8.7	$27.9	$5.4
Financial Return on Investment	*-$12.9*	*-$8.6*	*$4.0*	*$1.7*	*-$11.7*	*-$30.4*	*-$19.7*
Social Return on Investment	*-$41.4*	*-$37.0*	*$4.0*	*$1.8*	*-$40.5*	*-$58.9*	*-$48.0*

@RISK Results - Incremental Summary - 90th Percentile

DISCOUNTED SUMMARY	A	B	C	D	E	F	G
Total Financial Benefit	*-$133.4*	*-$44.3*	*$92.8*	*$47.5*	*-$26.3*	*$10.9*	*-$263.3*
Total Social Benefit	*$37.6*	*$14.8*	*$18.7*	*$24.2*	*$16.6*	*$34.6*	*$48.2*
Total Financial Cost	*-$286.4*	*-$138.1*	*$116.0*	*$43.2*	*-$44.3*	*$24.5*	*-$491.7*
Total Social Cost	*-$136.8*	*-$215.5*	*-$107.5*	*-$15.8*	*$124.8*	*$46.6*	*-$188.6*
Financial Return on Investment, NPV	$229.1	$154.9	$14.9	$38.3	$77.6	$69.7	$299.1
RANK, FROI	2	3	7	6	4	5	1
Social Return on Investment, NPV	$517.5	$606.6	$257.3	$100.9	$79.4	$122.8	$692.8
RANK, SROI	3	2	4	6	7	5	1

Holland BPW Account	*A*	*B*	*C*	*D*	*E*	*F*	*G*
Financial Benefits	-$143.0	-$61.4	$69.1	$27.4	-$24.8	$11.0	-$254.4
Social Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL BENEFITS	-$143.0	-$61.4	$69.1	$27.4	-$24.8	$11.0	-$254.4
Financial Costs	-$139.5	-$58.0	$72.0	$28.0	-$18.6	$16.9	-$242.5
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	-$139.5	-$58.0	$72.0	$28.0	-$18.6	$16.9	-$242.5
Financial Return on Investment	*-$2.2*	*-$2.4*	*-$2.4*	*$0.1*	*-$3.9*	*-$5.8*	*-$9.2*
Social Return on Investment	*-$2.2*	*-$2.4*	*-$2.4*	*$0.1*	*-$3.9*	*-$5.8*	*-$9.2*

Electricity User Account	*A*	*B*	*C*	*D*	*E*	*F*	*G*
Financial Benefits	$21.1	$24.9	$24.6	$20.9	$0.0	$0.0	$4.0
Social Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL BENEFITS	$21.1	$24.9	$24.6	$20.9	$0.0	$0.0	$4.0
Financial Costs	-$150.6	-$83.6	$45.8	$16.9	-$33.7	-$46.2	-$254.5
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	-$150.6	-$83.6	$45.8	$16.9	-$33.7	-$46.2	-$254.5
Financial Return on Investment	*$245.0*	*$167.2*	*$14.0*	*$37.4*	*$95.4*	*$107.1*	*$330.5*
Social Return on Investment	*$245.0*	*$167.2*	*$14.0*	*$37.4*	*$95.4*	*$107.1*	*$330.5*

Environmental Account	A	B	C	D	E	F	G
Financial Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits	$19.2	$22.1	$21.1	$18.2	$0.0	$0.0	$6.7
TOTAL BENEFITS	$19.2	$22.1	$21.1	$18.2	$0.0	$0.0	$6.7
Financial Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Costs	-$138.1	-$217.0	-$108.0	-$16.0	$124.7	$45.3	-$190.5
TOTAL COSTS	-$138.1	-$217.0	-$108.0	-$16.0	$124.7	$45.3	-$190.5
Financial Return on Investment	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*
Social Return on Investment	*$304.1*	*$484.3*	*$262.4*	*$67.4*	*$1.2*	*$48.5*	*$394.2*

Economic Activity Account	A	B	C	D	E	F	G
Financial Benefits	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits	$50.5	$24.6	$1.2	$9.0	$44.9	$62.7	$71.8
TOTAL BENEFITS	$50.5	$24.6	$1.2	$9.0	$44.9	$62.7	$71.8
Financial Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Financial Return on Investment	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*	*$0.0*
Social Return on Investment	*$50.5*	*$24.6*	*$1.2*	*$9.0*	*$44.9*	*$62.7*	*$71.8*

Community Account	A	B	C	D	E	F	G
Financial Benefits	-$7.1	-$3.1	$3.5	$1.3	-$1.5	-$0.1	-$12.5
Social Benefits	-$26.6	-$26.5	$0.9	$0.9	-$26.5	-$26.3	-$26.4
TOTAL BENEFITS	-$33.6	-$30.2	$3.9	$1.7	-$27.5	-$25.8	-$38.5
Financial Costs	$4.1	$4.0	-$1.1	-$1.1	$12.7	$56.3	$6.2
Social Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
TOTAL COSTS	$4.1	$4.0	-$1.1	-$1.1	$12.7	$56.3	$6.2
Financial Return on Investment	*-$7.8*	*-$4.6*	*$6.2*	*$4.0*	*-$9.5*	*-$27.8*	*-$14.6*
Social Return on Investment	*-$36.4*	*-$33.1*	*$6.4*	*$4.1*	*-$36.8*	*-$55.4*	*-$43.3*

Holland BPW Account	A	B	C	D	E	F	G
Financial Benefits							
Generated Energy Revenue (HBPW)	-$185.0	-$116.0	$26.1	-$2.0	-$56.9	-$67.0	-$283.4
Generated Energy Revenue (Interchange)	-$0.4	$1.4	-$0.9	$0.6	$6.6	$13.5	-$3.0
District Heating Revenue	$12.2	$13.7	$12.5	$11.0	$0.0	$0.0	$7.5
Snow Melt Revenue	-$1.1	-$1.1	-$1.7	-$1.7	$7.7	$25.8	-$1.0
Renewable Energy Credits Sold	-$1.6	$6.9	$13.8	-$0.3	-$1.6	-$1.6	-$1.6
Retired James DeYoung Land Value	$0.0	$0.0	$0.0	$0.0	$1.1	$1.8	$1.8
Reduced Biosolids Treatment & Transportation Cost	-$3.4	$0.0	$0.0	$0.0	-$3.4	-$3.4	-$3.4
Financial Costs							
Capacity Purchases (Sales)	-$30.1	-$82.8	-$21.1	$4.1	$183.7	$230.5	-$86.4
Fixed Cost	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Owner's	-$32.2	-$3.1	$24.8	$5.7	-$62.9	-$67.2	-$36.2
Engineering, Procurement, Construction	-$103.4	$46.4	$122.1	$25.6	-$245.5	-$269.1	-$124.8
Fixed O&M	-$53.9	-$15.0	-$9.5	-$40.2	-$23.2	-$74.9	-$55.8
Variable O&M	-$14.8	-$8.9	-$0.1	-$3.0	-$18.8	-$25.3	-$11.3
Fuel	$48.8	$53.8	-$16.9	-$12.4	-$21.1	-$42.5	$81.8
Renewable Energy Credits Purchased	$8.4	-$2.9	-$2.9	-$0.1	$8.2	$8.2	$8.4
Cross-State Air Pollution Rule, NOx	-$0.9	-$0.8	-$0.4	-$0.3	-$0.1	-$0.9	-$0.9
Cross-State Air Pollution Rule, SOx	-$0.5	-$0.5	-$0.2	-$0.1	$0.0	-$0.5	-$0.5
General Fund Transfer	-$8.9	-$4.8	$2.5	$0.3	-$2.7	-$2.2	-$14.0
Energy Purchased from MISO	$0.2	-$85.7	-$56.2	$19.5	$126.9	$185.2	-$49.5
Site Remediation Cost	$0.0	$0.0	$0.0	$0.0	$6.5	$10.7	$10.7
Snow Melt Cost	-$1.0	-$1.1	-$1.6	-$1.6	$7.3	$24.5	-$1.0
District Heating Cost	$11.6	$13.1	$11.9	$10.4	$0.0	$0.0	$7.1

Electricity User Account	A	B	C	D	E	F	G
Financial Benefits							
Savings due to District Heating	$17.6	$20.8	$20.6	$17.5	$0.0	$0.0	$2.2
Financial Costs							
Electricity Service Cost	-$185.0	-$116.0	$26.1	-$2.0	-$56.9	-$67.0	-$283.4
Environmental Account	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Social Benefits							
C.A.C. Savings due to District Heating	$3.2	$3.7	$3.6	$3.1	$0.0	$0.0	$1.1
G.H.G. Savings due to District Heating	$9.8	$11.3	$10.8	$9.3	$0.0	$0.0	$3.1
Social Costs							
Criteria Air Contaminant Emissions	-$115.6	-$181.8	-$104.3	-$18.6	$75.9	$32.1	-$175.0
Greenhouse Gas Emissions	-$94.2	-$153.0	-$69.8	-$15.7	-$16.8	-$33.7	-$110.7
Economic Activity Account	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Financial Benefits							
Increased Economic Activity due to Snowmelt System	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits							
Business Relocation	$41.7	$19.6	-$5.8	$4.6	$36.2	$52.7	$60.0
Reduced Biomass Shipping Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Increased Employment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Community Account	A	B	C	D	E	F	G
Financial Benefits							
General Fund Transfer from H.B.P.W.	-$8.9	-$4.8	$2.5	$0.3	-$2.7	-$2.2	-$14.0
Avoided Costs due to Snow Melt	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits							
Social Value of Parkland	$0.0	$0.0	$0.0	$0.0	$0.0	$0.2	$0.2
Reduced Landfilling of Tires	-$28.6	-$28.6	$0.0	$0.0	-$28.6	-$28.6	-$28.6
Financial Costs							
Loss of Commercial Harbor Status	$4.4	$4.4	$0.0	$0.0	$0.5	$4.4	$4.4
Retired James DeYoung Land Value	$0.0	$0.0	$0.0	$0.0	$1.1	$1.8	$1.8
Snow Melt Service	-$1.1	-$1.1	-$1.7	-$1.7	$7.7	$25.8	-$1.0

@RISK Results - Incremental Summary - 10th Percentile

Holland BPW Account	A	B	C	D	E	F	G
Financial Benefits							
Generated Energy Revenue (HBPW)	-$232.7	-$148.9	$7.6	-$20.1	-$103.9	-$148.2	-$328.1
Generated Energy Revenue (Interchange)	-$2.5	$0.4	-$2.0	-$0.8	-$0.8	$0.9	-$4.2
District Heating Revenue	$9.9	$11.2	$10.2	$9.0	$0.0	$0.0	$0.0
Snow Melt Revenue	-$3.0	-$3.2	-$3.9	-$3.8	$5.6	$18.5	-$3.0
Renewable Energy Credits Sold	-$6.9	$5.9	$11.8	-$1.4	-$6.9	-$7.0	-$6.9
Retired James DeYoung Land Value	$0.0	$0.0	$0.0	$0.0	$0.8	$1.2	$1.2
Reduced Biosolids Treatment & Transportation Cost	-$3.6	$0.0	$0.0	$0.0	-$3.6	-$3.6	-$3.6
Financial Costs							
Capacity Purchases (Sales)	-$30.1	-$82.8	-$21.1	$4.1	$183.7	$230.5	-$86.4
Fixed Cost	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Owner's	-$35.3	-$6.5	$20.9	$1.9	-$65.7	-$69.9	-$39.4
Engineering, Procurement, Construction	-$116.4	$32.4	$106.0	$10.4	-$256.8	-$280.2	-$138.2
Fixed O&M	-$56.7	-$17.8	-$12.4	-$42.9	-$26.5	-$77.7	-$58.6
Variable O&M	-$35.1	-$25.3	-$6.0	-$8.9	-$35.7	-$45.8	-$32.0
Fuel	-$0.2	$22.1	-$56.1	-$49.8	-$70.9	-$113.7	$37.1
Renewable Energy Credits Purchased	$5.9	-$4.6	-$4.7	-$0.2	$5.6	$5.7	$5.9
Cross-State Air Pollution Rule, NOx	-$1.7	-$1.6	-$0.9	-$0.9	-$0.5	-$1.7	-$1.7
Cross-State Air Pollution Rule, SOx	-$0.9	-$0.7	-$0.4	-$0.4	-$0.1	-$0.9	-$0.9
General Fund Transfer	-$11.2	-$6.5	$1.6	-$0.6	-$5.0	-$5.8	-$16.3
Energy Purchased from MISO	-$54.7	-$108.6	-$62.6	-$1.2	$49.4	$76.4	-$84.4
Site Remediation Cost	$0.0	$0.0	$0.0	$0.0	$5.5	$9.1	$9.1
Snow Melt Cost	-$2.9	-$3.0	-$3.7	-$3.7	$5.3	$17.6	-$2.9

District Heating Cost	$9.4	$10.6	$9.7	$8.5	$0.0	$0.0	$0.0

Electricity User Account	A	B	C	D	E	F	G
Financial Benefits							
Savings due to District Heating	$13.2	$15.6	$15.7	$13.4	$0.0	$0.0	$0.0
Financial Costs							
Electricity Service Cost	-$232.7	-$148.9	$7.6	-$20.1	-$103.9	-$148.2	-$328.1

Environmental Account	A	B	C	D	E	F	G
Social Benefits							
C.A.C. Savings due to District Heating	$2.1	$2.5	$2.3	$2.1	$0.0	$0.0	$0.0
G.H.G. Savings due to District Heating	$5.0	$5.8	$5.5	$4.8	$0.0	$0.0	$0.0
Social Costs							
Criteria Air Contaminant Emissions	-$171.6	-$284.5	-$164.3	-$30.1	$13.4	-$8.7	-$261.7
Greenhouse Gas Emissions	-$154.8	-$250.4	-$113.3	-$27.0	-$28.6	-$60.0	-$181.3

Economic Activity Account	A	B	C	D	E	F	G
Financial Benefits							
Increased Economic Activity due to Snowmelt System	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits							
Business Relocation	$31.2	$13.7	-$13.1	$0.1	$25.1	$40.8	$46.7
Reduced Biomass Shipping Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Increased Employment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Community Account	A	B	C	D	E	F	G
Financial Benefits							
General Fund Transfer from H.B.P.W.	-$11.2	-$6.5	$1.6	-$0.6	-$5.0	-$5.8	-$16.3
Avoided Costs due to Snow Melt	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits							
Social Value of Parkland	$0.0	$0.0	$0.0	$0.0	$0.0	$0.2	$0.2
Reduced Landfilling of Tires	-$30.7	-$30.7	-$0.9	-$0.9	-$30.7	-$30.6	-$30.6
Financial Costs							
Loss of Commercial Harbor Status	$4.1	$4.1	$0.0	$0.0	$0.4	$4.1	$4.1
Retired James DeYoung Land Value	$0.0	$0.0	$0.0	$0.0	$0.8	$1.2	$1.2
Snow Melt Service	-$3.0	-$3.2	-$3.9	-$3.8	$5.6	$18.5	-$3.0

@RISK Results - Incremental Summary - 50th Percentile

Holland BPW Account	A	B	C	D	E	F	G
Financial Benefits							
Generated Energy Revenue (HBPW)	-$192.5	-$121.9	$25.8	-$2.8	-$63.0	-$74.9	-$291.3
Generated Energy Revenue (Interchange)	-$1.6	$0.4	-$1.5	$0.2	$5.8	$12.3	-$4.2
District Heating Revenue	$12.0	$13.5	$12.2	$10.8	$0.0	$0.0	$8.0
Snow Melt Revenue	-$0.7	-$0.7	-$1.3	-$1.3	$7.2	$21.7	-$0.6
Renewable Energy Credits Sold	-$1.1	$7.1	$14.1	-$0.2	-$1.1	-$1.1	-$1.1
Retired James DeYoung Land Value	$0.0	$0.0	$0.0	$0.0	$1.0	$1.7	$1.7
Reduced Biosolids Treatment & Transportation Cost	-$3.4	$0.0	$0.0	$0.0	-$3.4	-$3.4	-$3.4
Financial Costs							
Capacity Purchases (Sales)	-$30.1	-$82.8	-$21.1	$4.1	$183.7	$230.5	-$86.4
Fixed Cost	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Owner's	-$32.2	-$3.1	$24.9	$5.7	-$62.8	-$67.2	-$36.2
Engineering, Procurement, Construction	-$103.2	$46.5	$122.3	$25.5	-$245.3	-$268.9	-$124.7
Fixed O&M	-$53.9	-$15.0	-$9.5	-$40.2	-$23.2	-$74.9	-$55.7
Variable O&M	-$13.8	-$8.2	$0.3	-$2.5	-$17.8	-$24.3	-$10.3
Fuel	$58.4	$61.0	-$13.4	-$9.3	-$14.4	-$32.3	$91.0
Renewable Energy Credits Purchased	$8.5	-$2.8	-$2.8	-$0.2	$8.4	$8.4	$8.6
Cross-State Air Pollution Rule, NOx	-$0.8	-$0.8	-$0.3	-$0.3	-$0.1	-$0.8	-$0.9
Cross-State Air Pollution Rule, SOx	-$0.5	-$0.4	-$0.1	-$0.1	$0.0	-$0.4	-$0.5
General Fund Transfer	-$9.3	-$5.1	$2.5	$0.3	-$2.9	-$2.7	-$14.4
Energy Purchased from MISO	-$18.6	-$100.3	-$62.6	$13.6	$112.7	$165.6	-$68.2
Site Remediation Cost	$0.0	$0.0	$0.0	$0.0	$6.5	$10.7	$10.7
Snow Melt Cost	-$0.6	-$0.7	-$1.2	-$1.2	$6.8	$20.6	-$0.6

District Heating Cost	$11.4	$12.8	$11.6	$10.2	$0.0	$0.0	$7.6
Electricity User Account	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Financial Benefits							
Savings due to District Heating	$17.9	$21.2	$21.0	$17.8	$0.0	$0.0	$2.4
Financial Costs							
Electricity Service Cost	-$192.5	-$121.9	$25.8	-$2.8	-$63.0	-$74.9	-$291.3

Environmental Account	A	B	C	D	E	F	G
Social Benefits							
C.A.C. Savings due to District Heating	$3.2	$3.7	$3.6	$3.1	$0.0	$0.0	$1.1
G.H.G. Savings due to District Heating	$8.9	$10.4	$10.0	$8.5	$0.0	$0.0	$2.9
Social Costs							
Criteria Air Contaminant Emissions	-$116.4	-$176.0	-$101.3	-$18.0	$67.2	$26.2	-$170.4
Greenhouse Gas Emissions	-$85.2	-$138.7	-$63.5	-$13.1	-$13.7	-$29.1	-$100.6

Economic Activity Account	A	B	C	D	E	F	G
Financial Benefits							
Increased Economic Activity due to Snowmelt System	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits							
Business Relocation	$42.1	$20.0	-$5.4	$4.6	$36.6	$53.1	$60.2
Reduced Biomass Shipping Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Increased Employment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Community Account	A	B	C	D	E	F	G
Financial Benefits							
General Fund Transfer from H.B.P.W.	-$9.3	-$5.1	$2.5	$0.3	-$2.9	-$2.7	-$14.4
Avoided Costs due to Snow Melt	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits							
Social Value of Parkland	$0.0	$0.0	$0.0	$0.0	$0.0	$0.2	$0.2
Reduced Landfilling of Tires	-$28.7	-$28.6	$0.0	$0.0	-$28.7	-$28.7	-$28.7
Financial Costs							
Loss of Commercial Harbor Status	$4.4	$4.4	$0.0	$0.0	$0.5	$4.4	$4.4
Retired James DeYoung Land Value	$0.0	$0.0	$0.0	$0.0	$1.0	$1.7	$1.7
Snow Melt Service	-$0.7	-$0.7	-$1.3	-$1.3	$7.2	$21.7	-$0.6

@RISK Results - Incremental Summary - 90th Percentile

Holland BPW Account	A	B	C	D	E	F	G
Financial Benefits							
Generated Energy Revenue (HBPW)	-$150.6	-$83.6	$45.8	$16.9	-$33.7	-$46.2	-$254.5
Generated Energy Revenue (Interchange)	-$1.6	$1.3	-$1.5	$0.2	$5.8	$12.3	-$3.5
District Heating Revenue	$15.0	$16.8	$15.2	$13.4	$0.0	$0.0	$9.9
Snow Melt Revenue	-$0.6	-$0.6	-$1.1	-$1.1	$11.2	$50.2	-$0.5
Renewable Energy Credits Sold	-$0.9	$7.3	$14.5	-$0.2	-$0.9	-$0.9	-$0.9
Retired James DeYoung Land Value	$0.0	$0.0	$0.0	$0.0	$1.4	$2.4	$2.4
Reduced Biosolids Treatment & Transportation Cost	-$3.3	$0.0	$0.0	$0.0	-$3.3	-$3.3	-$3.3
Financial Costs							
Capacity Purchases (Sales)	-$30.1	-$82.8	-$21.1	$4.1	$183.7	$230.5	-$86.4
Fixed Cost	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Owner's	-$29.0	$0.2	$28.8	$9.5	-$60.1	-$64.5	-$33.1
Engineering, Procurement, Construction	-$90.6	$60.0	$138.3	$40.9	-$234.6	-$258.1	-$111.5
Fixed O&M	-$51.2	-$12.2	-$6.6	-$37.4	-$19.8	-$72.2	-$53.0
Variable O&M	-$13.8	-$8.2	$0.3	-$2.5	-$17.8	-$24.3	-$10.3
Fuel	$58.4	$61.0	-$13.4	-$9.3	-$14.4	-$32.3	$91.0
Renewable Energy Credits Purchased	$9.2	-$2.5	-$2.5	-$0.1	$9.0	$9.0	$9.2
Cross-State Air Pollution Rule, NOx	-$0.8	-$0.8	-$0.3	-$0.3	-$0.1	-$0.8	-$0.9
Cross-State Air Pollution Rule, SOx	-$0.5	-$0.4	-$0.1	-$0.1	$0.0	-$0.4	-$0.5
General Fund Transfer	-$7.1	-$3.1	$3.5	$1.3	-$1.5	-$0.1	-$12.5
Energy Purchased from MISO	-$18.6	-$100.3	-$55.5	$13.6	$112.7	$165.6	-$68.2
Site Remediation Cost	$0.0	$0.0	$0.0	$0.0	$7.4	$12.3	$12.3
Snow Melt Cost	-$0.5	-$0.6	-$1.1	-$1.1	$10.6	$47.7	-$0.5

District Heating Cost	$14.3	$16.0	$14.5	$12.7	$0.0	$0.0	$9.4

Electricity User Account	A	B	C	D	E	F	G
Financial Benefits							
Savings due to District Heating	$21.1	$24.9	$24.6	$20.9	$0.0	$0.0	$4.0
Financial Costs							
Electricity Service Cost	-$150.6	-$83.6	$45.8	$16.9	-$33.7	-$46.2	-$254.5

Environmental Account	A	B	C	D	E	F	G
Social Benefits							
C.A.C. Savings due to District Heating	$4.3	$4.9	$4.7	$4.1	$0.0	$0.0	$1.5
G.H.G. Savings due to District Heating	$15.7	$18.3	$17.5	$15.0	$0.0	$0.0	$5.5
Social Costs							
Criteria Air Contaminant Emissions	-$58.2	-$89.0	-$49.9	-$7.7	$143.2	$72.7	-$97.6
Greenhouse Gas Emissions	-$46.4	-$75.8	-$35.0	-$6.1	-$6.9	-$12.5	-$55.1

Economic Activity Account	A	B	C	D	E	F	G
Financial Benefits							
Increased Economic Activity due to Snowmelt System	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits							
Business Relocation	$50.5	$24.6	$1.2	$9.0	$44.9	$62.7	$71.8
Reduced Biomass Shipping Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Increased Employment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Community Account	A	B	C	D	E	F	G
Financial Benefits							
General Fund Transfer from H.B.P.W.	-$7.1	-$3.1	$3.5	$1.3	-$1.5	-$0.1	-$12.5
Avoided Costs due to Snow Melt	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Social Benefits							
Social Value of Parkland	$0.0	$0.0	$0.0	$0.0	$0.0	$0.3	$0.3
Reduced Landfilling of Tires	-$26.6	-$26.5	$0.9	$0.9	-$26.6	-$26.5	-$26.6
Financial Costs							
Loss of Commercial Harbor Status	$4.8	$4.8	$0.0	$0.0	$0.6	$4.8	$4.8
Retired James DeYoung Land Value	$0.0	$0.0	$0.0	$0.0	$1.4	$2.4	$2.4
Snow Melt Service	-$0.6	-$0.6	-$1.1	-$1.1	$11.2	$50.2	-$0.5

Other Metrics	A	B	C	D	E	F	G
Capacity Purchases (Sales), MW	-543	-1,385	-391	22	2,817	3,509	-1,407
District Heating Savings to Consumers	58.2%	59.2%	61.4%	60.6%	0.0%	0.0%	23.1%
Mercury Emissions (lbs)	-31	-81	-39	9	26	46	-61
Sulfer Oxides Emissions (tons)	-4,867	-10,392	-7,142	-1,145	7,502	4,744	-8,417
Particulate Matter Emissions (tons)	-258	-92	47	5	-309	-288	-286
Volatile Organic Compounds Emissions (tons)	79	156	-12	-7	-18	-21	85
Nitrogen Oxides Emissions (tons)	-3,841	-5,464	-3,109	-1,229	1,728	-507	-5,036
Carbon Dioxide Equivalent Emissions ('000 tons)	-3,214	-5,229	-2,388	-531	-571	-1,151	-3,771

@RISK Results - Incremental Summary - 10th Percentile

Other Metrics	A	B	C	D	E	F	G
Capacity Purchases (Sales), MW	-543	-1,385	-391	22	2,817	3,509	-1,407
District Heating Savings to Consumers	58.2%	59.2%	61.4%	60.6%	0.0%	0.0%	23.1%
Mercury Emissions (lbs)	-31	-81	-39	9	26	46	-61
Sulfer Oxides Emissions (tons)	-4,867	-10,392	-7,142	-1,145	7,502	4,744	-8,417
Particulate Matter Emissions (tons)	-258	-92	47	5	-309	-288	-286
Volatile Organic Compounds Emissions (tons)	79	156	-12	-7	-18	-21	85
Nitrogen Oxides Emissions (tons)	-3,841	-5,464	-3,109	-1,229	1,728	-507	-5,036
Carbon Dioxide Equivalent Emissions ('000 tons)	-3,214	-5,229	-2,388	-531	-571	-1,151	-3,771

@RISK Results - Incremental Summary - 50th Percentile

Other Metrics	A	B	C	D	E	F	G
Capacity Purchases (Sales), MW	-543	-1,385	-391	22	2,817	3,509	-1,407
District Heating Savings to Consumers	58.2%	59.2%	61.4%	60.6%	0.0%	0.0%	23.1%
Mercury Emissions (lbs)	-31	-81	-39	9	26	46	-61
Sulfer Oxides Emissions (tons)	-4,867	-10,392	-7,142	-1,145	7,502	4,744	-8,417
Particulate Matter Emissions (tons)	-258	-92	47	5	-309	-288	-286
Volatile Organic Compounds Emissions (tons)	79	156	-12	-7	-18	-21	85
Nitrogen Oxides Emissions (tons)	-3,841	-5,464	-3,109	-1,229	1,728	-507	-5,036
Carbon Dioxide Equivalent Emissions ('000 tons)	-3,214	-5,229	-2,388	-531	-571	-1,151	-3,771

@RISK Results - Incremental Summary - 90th Percentile

Other Metrics	A	B	C	D	E	F	G
Capacity Purchases (Sales), MW	-543	-1,385	-391	22	2,817	3,509	-1,407
District Heating Savings to Consumers	58.2%	59.2%	61.4%	60.6%	0.0%	0.0%	23.1%
Mercury Emissions (lbs)	-31	-81	-39	9	26	46	-61
Sulfer Oxides Emissions (tons)	-4,867	-10,392	-7,142	-1,145	7,502	4,744	-8,417
Particulate Matter Emissions (tons)	-258	-92	47	5	-309	-288	-286
Volatile Organic Compounds Emissions (tons)	79	156	-12	-7	-18	-21	85
Nitrogen Oxides Emissions (tons)	-3,841	-5,464	-3,109	-1,229	1,728	-507	-5,036
Carbon Dioxide Equivalent Emissions ('000 tons)	-3,214	-5,229	-2,388	-531	-571	-1,151	-3,771

@RISK Results - Levelized Cost of Electricity - Mean

	Base	A	B	C	D	E	F	G
2012	$177.28	$166.44	$225.66	$218.49	$183.83	$106.33	$85.57	$151.85
2013	$158.87	$161.83	$218.40	$211.54	$178.43	$91.10	$84.58	$147.89
2014	$151.76	$123.03	$134.79	$163.59	$156.04	$85.29	$85.30	$126.71
2015	$152.13	$83.55	$86.53	$149.28	$151.59	$86.28	$86.02	$82.75
2016	$119.67	$72.14	$74.16	$114.37	$117.49	$86.82	$86.33	$68.65
2017	$74.33	$71.95	$70.07	$69.34	$72.01	$86.86	$86.84	$68.39
2018	$75.30	$72.89	$69.31	$70.38	$72.93	$86.55	$86.26	$69.67
2019	$75.99	$73.88	$70.21	$71.06	$73.72	$87.49	$87.45	$70.54
2020	$76.00	$74.03	$69.86	$70.65	$73.77	$87.58	$87.54	$70.78
2021	$75.88	$74.29	$69.67	$70.31	$73.79	$87.99	$88.17	$71.03
2022	$76.55	$75.35	$70.54	$70.90	$74.56	$88.99	$89.43	$72.11
2023	$74.43	$73.44	$67.75	$68.98	$72.93	$90.79	$92.59	$69.05
2024	$75.29	$74.64	$69.14	$70.13	$73.89	$91.75	$93.84	$70.30
2025	$75.65	$75.14	$69.64	$70.59	$74.33	$92.05	$94.28	$70.88
2026	$76.04	$75.40	$70.07	$71.20	$74.77	$92.10	$94.39	$71.24
2027	$76.20	$75.51	$70.39	$71.53	$74.91	$92.16	$94.56	$71.33
2028	$77.74	$76.50	$110.30	$111.73	$76.25	$94.09	$95.39	$72.36
2029	$78.49	$76.75	$78.24	$79.88	$76.70	$94.12	$95.51	$72.67
2030	$80.67	$78.50	$69.36	$71.12	$78.42	$96.28	$98.11	$74.28
2031	$81.66	$79.60	$70.51	$72.30	$79.62	$97.10	$99.07	$75.53
2032	$83.10	$81.25	$72.04	$73.77	$81.21	$98.53	$100.76	$77.22
2033	$85.05	$83.92	$74.43	$75.85	$83.59	$101.15	$103.89	$79.92
2034	$87.57	$86.59	$76.96	$77.74	$85.63	$106.46	$106.46	$82.52
2035	$89.80	$89.20	$79.27	$79.93	$87.92	$109.17	$109.17	$85.16
2036	$92.64	$92.48	$81.98	$82.55	$90.74	$112.72	$112.72	$88.32
Total LCOE	**$92.25**	**$85.75**	**$86.75**	**$91.81**	**$91.68**	**$94.48**	**$94.49**	**$81.53**

@RISK Results - Levelized Cost of Electricity - 10th Percentile

	Base	A	B	C	D	E	F	G
2012	$170.78	$160.80	$219.20	$211.63	$177.15	$102.85	$82.39	$145.84
2013	$152.92	$156.28	$212.32	$204.82	$172.02	$87.89	$81.44	$142.04
2014	$145.78	$118.86	$130.65	$157.68	$150.08	$81.94	$81.98	$122.12
2015	$145.96	$79.70	$82.91	$143.21	$145.41	$82.43	$82.27	$78.83
2016	$115.28	$67.88	$70.19	$109.93	$112.92	$83.09	$82.07	$64.32
2017	$71.24	$67.32	$65.82	$66.42	$68.90	$82.80	$82.20	$63.69
2018	$72.09	$67.81	$64.76	$67.43	$69.67	$82.16	$81.16	$64.55
2019	$72.57	$68.29	$65.17	$67.97	$70.14	$82.68	$81.63	$64.87
2020	$72.50	$68.00	$64.72	$67.48	$70.23	$82.56	$81.37	$64.80
2021	$72.30	$67.85	$64.10	$67.10	$70.12	$82.68	$81.36	$64.48
2022	$72.95	$68.34	$64.61	$67.49	$70.74	$83.18	$81.91	$64.99
2023	$70.53	$65.88	$61.17	$65.43	$68.83	$84.52	$84.38	$61.42
2024	$71.13	$66.13	$61.72	$66.28	$69.38	$85.38	$84.60	$61.66
2025	$71.23	$65.94	$61.94	$66.54	$69.48	$84.55	$84.32	$61.86
2026	$71.06	$65.51	$61.57	$66.54	$69.31	$83.85	$83.41	$61.38
2027	$71.15	$65.09	$61.40	$66.61	$69.04	$83.61	$82.92	$60.97
2028	$71.49	$65.33	$103.14	$106.28	$69.57	$83.71	$82.88	$61.33
2029	$71.58	$65.02	$69.17	$73.97	$69.37	$83.26	$82.37	$60.94
2030	$71.63	$64.65	$57.84	$63.42	$69.28	$82.75	$82.37	$60.68
2031	$71.46	$64.82	$57.90	$63.83	$69.50	$82.47	$82.05	$60.86
2032	$72.04	$65.41	$58.66	$64.09	$69.90	$82.74	$82.23	$61.62
2033	$72.98	$66.85	$59.88	$65.25	$70.84	$83.92	$83.45	$63.52
2034	$74.01	$69.03	$61.76	$66.14	$71.94	$84.45	$84.29	$65.33
2035	$74.43	$70.07	$63.14	$66.86	$72.58	$84.54	$84.61	$66.66
2036	$76.04	$71.36	$64.16	$68.43	$74.16	$86.31	$86.32	$67.94
Total LCOE	**$84.93**	**$74.67**	**$77.46**	**$85.81**	**$84.50**	**$83.03**	**$81.79**	**$70.92**

@RISK Results - Levelized Cost of Electricity - 50th Percentile

	Base	A	B	C	D	E	F	G
2012	$177.17	$166.35	$225.65	$218.39	$183.69	$106.44	$85.79	$151.71
2013	$158.73	$161.81	$218.43	$211.38	$178.41	$91.33	$84.82	$147.78
2014	$151.51	$123.07	$134.83	$163.45	$155.94	$85.57	$85.56	$126.64
2015	$152.01	$83.88	$86.83	$149.18	$151.46	$86.62	$86.37	$83.06
2016	$119.77	$72.43	$74.47	$114.47	$117.49	$87.19	$86.68	$68.95
2017	$74.70	$72.27	$70.38	$69.69	$72.35	$87.18	$87.16	$68.68
2018	$75.71	$73.22	$69.68	$70.72	$73.34	$86.88	$86.58	$69.97
2019	$76.43	$74.24	$70.61	$71.47	$74.15	$87.87	$87.78	$70.90
2020	$76.48	$74.38	$70.21	$71.08	$74.22	$88.00	$87.86	$71.14
2021	$76.40	$74.69	$70.04	$70.73	$74.23	$88.38	$88.53	$71.34
2022	$77.05	$75.70	$70.90	$71.38	$75.03	$89.39	$89.77	$72.47
2023	$74.97	$73.77	$68.10	$69.44	$73.38	$91.20	$92.90	$69.37
2024	$75.88	$75.00	$69.49	$70.64	$74.36	$92.15	$94.13	$70.64
2025	$76.31	$75.48	$70.06	$71.10	$74.88	$92.47	$94.62	$71.24
2026	$76.71	$75.74	$70.47	$71.79	$75.37	$92.50	$94.73	$71.54
2027	$76.86	$75.79	$70.76	$72.11	$75.45	$92.51	$94.83	$71.62
2028	$78.46	$76.79	$110.34	$112.09	$76.84	$94.43	$95.65	$72.61
2029	$79.20	$77.00	$78.57	$80.46	$77.34	$94.42	$95.74	$72.96
2030	$81.48	$78.77	$69.72	$71.77	$79.04	$96.60	$98.32	$74.54
2031	$82.49	$79.80	$70.80	$72.94	$80.24	$97.39	$99.25	$75.75
2032	$84.03	$81.46	$72.38	$74.45	$81.87	$98.81	$100.95	$77.43
2033	$86.02	$84.11	$74.77	$76.55	$84.35	$101.49	$104.09	$80.07
2034	$88.41	$86.64	$77.31	$78.48	$86.41	$106.56	$106.56	$82.57
2035	$90.69	$89.24	$79.64	$80.74	$88.81	$109.27	$109.29	$85.18
2036	$93.55	$92.50	$82.37	$83.35	$91.63	$112.80	$112.80	$88.30
Total LCOE	**$92.61**	**$85.72**	**$86.81**	**$92.06**	**$91.92**	**$94.51**	**$94.45**	**$81.48**

@RISK Results - Levelized Cost of Electricity - 90th Percentile

	Base	A	B	C	D	E	F	G
2012	$183.97	$172.19	$232.00	$225.44	$190.63	$109.64	$88.23	$158.01
2013	$165.22	$167.46	$224.41	$218.27	$185.00	$93.80	$87.16	$153.94
2014	$157.94	$127.10	$138.82	$169.77	$162.28	$87.91	$87.94	$131.41
2015	$158.58	$86.38	$89.33	$155.59	$157.99	$89.10	$88.76	$85.56
2016	$123.86	$74.62	$76.85	$118.66	$121.87	$89.47	$88.83	$71.15
2017	$76.76	$74.45	$72.57	$71.57	$74.32	$89.57	$89.33	$70.92
2018	$77.76	$75.49	$71.86	$72.62	$75.26	$89.32	$88.79	$72.21
2019	$78.50	$76.40	$72.74	$73.33	$76.10	$90.36	$90.01	$73.19
2020	$78.47	$76.56	$72.31	$72.94	$76.10	$90.49	$90.04	$73.35
2021	$78.34	$76.85	$72.26	$72.62	$76.20	$90.92	$90.67	$73.68
2022	$79.05	$77.91	$73.18	$73.22	$76.93	$91.96	$92.04	$74.66
2023	$76.95	$75.98	$70.38	$71.30	$75.30	$93.87	$95.10	$71.62
2024	$77.85	$77.23	$71.87	$72.50	$76.30	$94.92	$96.28	$72.84
2025	$78.26	$77.74	$72.27	$72.96	$76.77	$95.27	$96.80	$73.35
2026	$78.70	$77.78	$72.68	$73.66	$77.26	$95.17	$96.88	$73.80
2027	$78.92	$77.90	$72.85	$73.97	$77.38	$95.11	$96.86	$73.70
2028	$80.44	$78.82	$117.35	$116.53	$78.83	$96.86	$97.73	$74.76
2029	$81.32	$78.98	$81.38	$82.80	$79.32	$96.68	$97.69	$75.03
2030	$83.65	$80.75	$71.74	$73.75	$81.10	$98.98	$100.23	$76.52
2031	$84.83	$81.74	$72.88	$74.97	$82.20	$99.60	$101.27	$77.80
2032	$86.24	$83.37	$74.38	$76.56	$83.88	$101.08	$102.88	$79.43
2033	$88.24	$86.15	$76.72	$78.48	$86.28	$103.75	$105.98	$81.99
2034	$90.33	$88.59	$79.36	$80.49	$88.41	$108.46	$108.37	$84.42
2035	$92.58	$91.06	$81.60	$82.71	$90.72	$111.08	$111.08	$87.06
2036	$95.47	$94.33	$84.42	$85.22	$93.44	$114.66	$114.60	$90.13
Total LCOE	**$94.08**	**$86.82**	**$88.54**	**$93.65**	**$93.46**	**$95.67**	**$95.42**	**$82.69**

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