Powering Remedial Systems in Massachusetts

NEWMOA
“Moving Toward More Sustainable Remediation”

Wednesday, December 4, 2013 – Dayville, CT
Thursday, December 5, 2013 – Westford, MA

Thomas M. Potter
MADEP’s Acting Clean Energy Director
State Lead Groundwater Pump and Treat Systems

After 10 yrs states perform O&M

Baird O&M similar to POTW or municipal 21E or Brownfield

Source: Groundwater Pump and Treat Systems: Summary of Selected Cost and Performance Information at Superfund-financed Sites, 2001
Baird & McGuire History

- Former Chemical Manufacturing Facility
  Operated from 1912 to 1983 (70 years)
  Located in Holbrook, MA – 32 Acres
- Site Listed on NPL in 1983
1986 ROD: Groundwater, Soil, Sediment

• Incineration of Soils and River Sediments
  • From 1995 to 1998
  • 248,000 cubic yards of soil & sediment incinerated (12.5 acres of soil)
  • Residual ash buried on site (300 cubic yards failing TCLP stabilized)

• Pump and Treat System
  • Started 1993 to treat incineration dewatering and process flows
  • Effluent discharge to infiltration basins
  • EPA RSE done in 2001 and upgrades completed in 2004
  • Transferred to state (MassDEP) in 2004
  • MassDEP improvements on-going
  • Monitoring SVOC, Pesticides and Arsenic
  • Cleanup Levels set at drinking water standards, MCLs & State GW1
  • LNAPL discovered in 1996 and recovery from 1999 to present
1989 ROD: Cochato River Sediment
- Dredged in 1994
- Wetland Restoration

1990 ROD: Municipal Water Supply
- Reopening of old well field to replace lost supply planned
- ESD issued in 2003 to expand existing water capacity at the Upper Reservoir/Great Pond
Remediation – 1996 to 2006*

A) Incinerator & Restored Wetland
B) Groundwater Treatment Plant
C) Bauer, Inc.
D) Excavation
E) Backfilled Incinerated Ash
F) Cochato River

* Treatment must achieve groundwater restoration at drinking water standards, MCLs and GW1
Arsenic 2004 to 2010 (blue area above MCL of 10 ug/l)
State Operation of Treatment System Since 2004
Concerned with plant operations, site conditions, cost, energy and GHG

• Significant Cost Reductions through Automation and Reduction in Staff, Elimination of On-Site Laboratory and Reduction of Process and Site Monitoring - 2004 to 2006

• Energy Efficiency Opportunity Study (SAIC for MassDEP) – 2006

• Utility Audits Phase One, National Grid (lights and sensors, VFDs on extraction, bio-clarifier, influent, filter press pumps) – 2008

• Carbon Footprint Analysis and CHP/GWSHP Study (US EPA OSRTI and MassDEP) – 2009

• Utility Audits Phase Two, National Grid (VFD on blower, energy efficient blower motor) – 2010

• Feasibility Study of Third-Party Financing of 500 kW Solar PV to Provide All Electricity Needs for the P&T Facility (possibly GWSHP) with Power Purchase Agreement – 2012

• Optimization Study (US EPA and MassDEP) Assess Remaining Duration of Clean-up and Alternatives to Pump & Treat – 2013

• Replacement and Relocation of Extraction Wells to Treat Arsenic Contamination – On-going
Metals Removal System and Neutralization
(4.25 HP)

Solids Handling
6 HP plus transport

Bio Tanks Used as Inefficient Air Strippers
(45 HP)

Extraction System & Flow Equalization
120 gpm
(10.5 HP)

Pressure Filters
(11.5 HP)

GAC
(68,000 lbs/year)
(0.5 HP)

Off Gas Treatment
5 HP & 3,000 lbs GAC/yr

Effluent Tank and Discharge to Infiltration Galleries
(3 HP)

Average motor horsepower indicated in parentheses
Prior Efforts on Energy and GHG Emissions

2. Utility Audits Phase One – 2008 (lights and sensors, VFDs on extraction, bio-clarifier, influent, filter press pumps)
3. CHP and Carbon Footprint Analysis – 2009 (Combined EPA and MassDEP Study)
4. Utility Audits Phase Two – 2010 (VFD on blower, energy efficient blower motor)
Why Solar Baird? Continuation of On-Going Efforts

Climate Registry Information System

CRIS: Climate Registry Information System
Entity Emissions Detailed Report
Massachusetts Department of Environmental Protection
(Public)
3/12/2012 17:10:10 EDT

<table>
<thead>
<tr>
<th>Operational Control: National - US</th>
<th>CRIS: Climate Registry Information System</th>
<th>Entity Emissions Detailed Report</th>
<th>Massachusetts Department of Environmental Protection</th>
<th>Public</th>
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</thead>
</table>

1. GHG Reductions – 13% PV, 17% PV and GWSHP
2. Potential for Savings - Third Party Financing
Third Party Financing Model of Solar at Baird & McGuire

PPA – Power Purchase Agreement

- Federal Government
- Tax-related incentives

- Project Developer & Owner
  * Provides capital
  * Constructs & operates project
  * Sells electricity & renewable credits

- Host Customer
  * Hosts project on its land/roofs
  * Buys physical power from project

- Utility or Other Solar Renewable Energy Credit (SREC) Buyer

- SREC Prices
- ACP Ceiling
- Spot Market
- Clearinghouse Floor 0.28 $/kWhr

Interconnection Agreements

Utility
Net Metering
Sells Electricity
Investigation of Solar PV for Meeting all Energy Needs at Baird

Net Metering
Solar Carve Out Program
Third-Party Financing Model for Solar
  no up front capital expenditure
  potential savings on energy from day one

• Examined the Size of Available Area (GIS) and Used IMBY NREL Solar Estimator and DOER Financial Spreadsheet

• Issued an Request For Information to Gauge Interest

• Funded Feasibility Study to Verify Assumptions and Expected Benefits, and Obtain Support for Power Purchase Agreement (PPA) and Procurement

• PPA Duration – remaining duration of the remedy? alternatives to P&T? Questions lead to Optimization Study completed May 2013
Why Renewable Energy for Operating Remedial Systems?

Where renewable energy projects are technically and financially feasible, they can provide:

- Reductions in projected annual electricity costs (vs. utility costs) for 20+ years
- Known electricity costs for 20+ years (i.e., budget predictability)
- Reductions in greenhouse gases vs. utility power (cleaner & local electricity generation)
- Jobs, some local and near term
- Productive re-use of land with few alternative uses
- Use of publicly funded incentives on public projects
Main Feasibility Study Topics

• **How** technical and financial feasibility review was conducted

• **Results** in benefits and risks of solar PV project at Baird & McGuire

• **Tips** for performing renewable energy feasibility reviews on contaminated sites
How: Going from Land Availability through Technical & Financial Feasibility

• Is there enough land to (a) produce a feasible project, and (b) meet the economic and environmental goals of the site owner/operator?

• If no, stop there OR find off-site project that can serve site and/or community via community net metering

• If yes,
  • Size and design the system to optimize electricity production, cost, and/or local materials (allowing for remediation access)
  • Determine preferred ownership structure
    • Third-party ownership brings access to federal tax benefits, among other features
  • Calculate project costs for different contract lengths
  • Review & mitigate project risks
    • SREC price risk can be a significant factor in many states
How: Site Limitations

- Wetlands – 100 ft buffer
- Cochato River – 200 ft buffer
- 100 year Floodplain
- Property Ownership – PRP
- Setbacks and Easements
- Remedy and Contamination
How: Establish Optimum Solar Array Size \( (502.32 \text{ kW}_{\text{DC}}) \) to Match On-Site Electricity Consumption

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<tr>
<th>Annual Electricity (kWh)</th>
<th>Year of Solar Project Operation</th>
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<tr>
<td>700,000</td>
<td>1</td>
</tr>
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<td>650,000</td>
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<td>400,000</td>
<td>29</td>
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</table>

Note: On-site electricity consumption would increase with use of groundwater source heat pump for heating; solar array size could increase to match.
Outside Lighting Upgrade Project (Update)

Replaced 3950 W Existing Lights High Pressure Sodium with 961 W LED
Operation time 10 hrs/day

Electricity savings 10,910 kWhr per year ~1.7% of total annual load

Cost Savings 1,637 $/year
How: Design Optimum Solar Array on Site

• Land Contours
• Shading
• Remediation Access
• System Components

Note: The seven red circles on the layout are monitoring wells
How: Financial Feasibility

- 626,900 kWh of output in year 1, degrading by 0.5% annually
  - 14.25% capacity factor in year 1
  - Local measurements of sunlight at site
  - Custom system design
  - System output from NREL System Advisor Model (SAM)
- System costs from then-recent bids for 500 kW\textsubscript{DC} ground mounted systems using comparable equipment: $3,914/kW including interconnection study & sales tax, or $1.97 million total system cost
- Third-party financed using “power purchase agreement” (PPA) and net metering (eliminating some charges)
- Calculated PPA electricity rate for host (MassDEP) that provided sufficient (10% on equity) return for owner – DOER Financial Spreadsheet
- Assumed current federal solar incentives (investment tax credit and MACRS accelerated depreciation) stay in place
  - Several additional assumptions using industry norms
## Recent Installation Costs (Update)

**DOER Spreadsheet Sensitive to Installation Costs**

<table>
<thead>
<tr>
<th>Town</th>
<th>Zip Code</th>
<th>Installation Year</th>
<th>Operational Status</th>
<th>Date Installed</th>
<th>Company Name</th>
<th>Cost</th>
<th>Unit Cost</th>
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<td>Tewksbury</td>
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### Results: Economics

<table>
<thead>
<tr>
<th>PPA Contract Length</th>
<th>Lifetime Net Present Value (NPV) Savings to Site</th>
<th>% Savings to Site vs. Projected Utility Costs</th>
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</thead>
<tbody>
<tr>
<td>10 years</td>
<td>$69K</td>
<td>9%</td>
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<tr>
<td>15 years</td>
<td>$279K</td>
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<tr>
<td>20 years</td>
<td>$438K</td>
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<tr>
<td>25 years</td>
<td>$654K</td>
<td>32%</td>
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<tr>
<td>30 years</td>
<td>$887K</td>
<td>35%</td>
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</table>

Note: Results are very sensitive to Massachusetts Solar Renewable Credit (SREC) price ($0.285/kWh for first 10 years, which is net auction floor) and conventional utility price (4%/yr escalation) assumptions, panel degradation, O&M costs, etc.

Update: SREC II Program – proposed declining SREC pricing and SREC factors for market sector
Results: Emissions Reductions

- During first year of solar PV system operation (626 MWh):
  - 518,328 pounds of CO$_2$
  - 48 pounds of CH$_4$
  - 9 pounds of N$_2$O
- During 20 years of solar PV system operation (11,960 MWh, accounting for performance degradation against constant utility fuel mix):
  - 9,902,880 pounds of CO$_2$
  - 921 pounds of CH$_4$
  - 179 pounds of N$_2$O

$\sim$ 10 million lbs of CO$_{2eq}$

Source: Climate Registry Information System emissions data for Baird & McGuire and emissions calculations do not consider life-cycle emissions of solar PV system production
Results: Jobs

• During Construction and Installation:
  • ~ 18 FTE Jobs on this ~ $2 million capital project
  • Assumed (8 x 60 kW) inverters from Solectria (HQ in Lawrence, MA) and mounting system from Panel Claw (HQ in North Andover, MA)
  • Sharp crystalline-silicon panels (Buy American-compliant, manufactured in Tennessee)
• Annual O&M: 0.1 to 0.2 FTE Jobs

Note: Modeled using NREL Jobs and Economic Development Impact (JEDI) tool.
Project Risks

System Owner

• Liability protections
• System access/control
• Massachusetts SREC market
• Utility interconnection/permitting time
• National cost of solar (modules & federal tax incentives)

System Host (MassDEP)

• Inflexibility of long-term contract
• Net metering & conventional electricity rates
• Site damage during construction and operations
• Owner default
• Soft costs (professional labor) for feasibility and procurement

Note: Some of the risks can be mitigated in the PPA contract, while others are market based and cannot be easily mitigated
Tips: Overall

• Understand, and ideally improve, the electricity situation on-site before considering renewable energy supply

• High-quality data from the site are essential
  • See example categories on next page

• Understand differences between direct ownership and third-party contracts

• Document each step – paves the way for procurement of successful projects and replication of the feasibility study

• Don’t reinvent the wheel
  • US EPA Re-Powering America
  • US DOE/NREL
  • MassDEP & MassDOER
THANK YOU!

Thomas M. Potter  
Massachusetts Department of Environmental Protection  
Bureau of Waste Site Cleanup  
Acting Clean Energy Director

MassDEP, One Winter Street, 6th Fl  
Boston, MA 02108  
617-292-5628  
Thomas.Potter@state.ma.us

Mass Department of Environmental Protection (MassDEP) Clean Energy Results Program:  
http://www.mass.gov/dep/cleanenergy.htm

Mass Department of Energy Resources (DOER)  

Massachusetts Clean Energy Center (CEC)  
http://masscec.com/
### RPS Solar Carve-Out Program v1.0

**Key Scenario Definitions**

Entry Cells

- **Scenario A: Non-Taxable Rebate** - Assumes that the state rebate is non-taxable, but is subtracted from the cost basis for purposes of determining tax credits and accelerated depreciation.

- **Calculation Cells (Not for Entry)**

- **Scenario B: Taxable Rebate** - Assumes that the state rebate is taxable, but is not subtracted from the cost basis for purposes of determining tax credits and accelerated depreciation.

Both Scenarios assume that the project owner can use both federal and state tax benefits.

**Select Taxable or Non-Taxable Entity**

<table>
<thead>
<tr>
<th>Taxable</th>
<th>Non-Taxable</th>
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<tr>
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### Project and Customer Cost Assumptions

- **Solar Photovoltaic System Size**: 502320 Watts (DC STC)
- **State Tax Rate**: 8%
- **Total System Cost/Watt**: 3.914 $/Watt (DC STC)
- **Effective Tax Rate**: 40%
- **Total System Cost**: 1,965,872.00 $

### CEC Rebate Assumptions

- **5 Year Accelerated Depreciation Schedule (MACRS)**
- **Federal Tax Credit**: 30%
- **State Tax Deduction**: 100%
- **Rebate per/Watt**: -

### Effective Tax Rate Assumptions

- **Federal Tax Rate**: 35%
- **Effective Tax Rate**: 40%
- **Total System Cost**: 1,965,872.00 $

### Project Performance and Savings/ Cost Assumptions

- **Annual Net Capacity Factor**: 14.24667%
- **Annual Production Degradation**: 0.909%
- **Depreciation Life**: 5 Years
- **Electricity Revenue (Avoided Costs)**: 0.0901 $/kWh
- **Electricity Revenue Annual Adjustor**: 4.0%
- **Net Cost**: 1,965,872.00 $
- **SREC Contract Price**: 0.285 $/kWh
- **SREC Contract Term**: Years (must be equal to or less than project life)
- **Annual Operations and Maintenance Cost Factor**: 37.00 $/kW/Year
- **Annual Operations and Maintenance Cost**: 18,586 $/Year
- **Inverter Life, Replace Every X Years**: 16 Years
- **Future Inverter Replacement Cost**: 0.30 $/Watt (DC STC)
- **Solar Project Financial Analysis Summary**

### Solar Project Financial Analysis Summary

- **Net Present Value**: 250 $
- **Simple Payback (100% Cash only)**: Year 6
- **Estimated Return on Equity**: 10.91%
## PRO FORMA AND PRODUCTION

<table>
<thead>
<tr>
<th>Project Output</th>
<th>Start-Up</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
<th>Year 9</th>
<th>Year 10</th>
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<tbody>
<tr>
<td>Annual Generation (kW)</td>
<td>626,900</td>
<td>623,765</td>
<td>620,646</td>
<td>617,543</td>
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## FINANCIAL SCHEDULES

### INCOME STATEMENT

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<th>Description</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
<th>Year 9</th>
<th>Year 10</th>
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<td>Electricity Revenue (Avoided Cost)</td>
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<td>$ -</td>
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<td>$ -</td>
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<td>SREC Auction Revenue</td>
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<td>$177,773</td>
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<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
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<td>$ -</td>
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<td>Total Revenue (Avoided Costs)</td>
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### Replace Inventory

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<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
<th>Year 9</th>
<th>Year 10</th>
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<td>Operations &amp; Maintenance Costs</td>
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<td>$(19,768)</td>
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<td>Inverter Replacement Cost</td>
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<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
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<td>$ -</td>
<td>$ -</td>
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<tr>
<td>Total Operating Expenses</td>
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<td>$(320,830)</td>
<td>$(192,498)</td>
<td>$(192,498)</td>
<td>$(26,249)</td>
<td>$ -</td>
<td>$ -</td>
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</tr>
<tr>
<td>Federal Depreciation Expense</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
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<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td></td>
</tr>
<tr>
<td>EBITDA</td>
<td>$(316,634)</td>
<td>$(317,638)</td>
<td>$(103,181)</td>
<td>$25,790</td>
<td>$26,469</td>
<td>$123,469</td>
<td>$200,533</td>
<td>$214,414</td>
<td>$222,363</td>
<td>$263,588</td>
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<tr>
<td>Interest Expense</td>
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</tr>
<tr>
<td>EBIT</td>
<td>$(316,634)</td>
<td>$(317,638)</td>
<td>$(103,181)</td>
<td>$25,790</td>
<td>$26,469</td>
<td>$123,469</td>
<td>$200,533</td>
<td>$214,414</td>
<td>$222,363</td>
<td>$263,588</td>
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<tr>
<td>Federal taxes saved/(paid)</td>
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<tr>
<td>State taxes saved/(paid) [can not deduct federal depreciation expense]</td>
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</tr>
<tr>
<td>Net Income</td>
<td>$(316,634)</td>
<td>$(317,638)</td>
<td>$(103,181)</td>
<td>$25,790</td>
<td>$26,469</td>
<td>$123,469</td>
<td>$200,533</td>
<td>$214,414</td>
<td>$222,363</td>
<td>$263,588</td>
<td></td>
</tr>
</tbody>
</table>

### CASH FLOW STATEMENT

#### Cash From Operations

<table>
<thead>
<tr>
<th>Description</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
<th>Year 9</th>
<th>Year 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Income</td>
<td>$(656,034)</td>
<td>$(172,506)</td>
<td>$(165,079)</td>
<td>$220,533</td>
<td>$219,718</td>
<td>$218,967</td>
<td>$217,079</td>
<td>$216,564</td>
<td>$215,143</td>
<td>$213,879</td>
<td>$157,614</td>
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<tr>
<td>Federal Depreciation Expense</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td>Cash Flow From Operations</td>
<td>$(656,034)</td>
<td>$(172,506)</td>
<td>$(165,079)</td>
<td>$220,533</td>
<td>$219,718</td>
<td>$218,967</td>
<td>$217,079</td>
<td>$216,564</td>
<td>$215,143</td>
<td>$213,879</td>
<td>$157,614</td>
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#### Cash From Investing

<table>
<thead>
<tr>
<th>Description</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
<th>Year 9</th>
<th>Year 10</th>
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<tbody>
<tr>
<td>One Time Solar Investment Tax Deduction (Actual Cash Value)</td>
<td>$(1,965,872)</td>
<td>$110,089</td>
<td>$589,762</td>
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<tr>
<td>Total Cash Flow From Investment</td>
<td>$(1,855,783)</td>
<td>$110,089</td>
<td>$589,762</td>
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#### Cash From Financing

<table>
<thead>
<tr>
<th>Description</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
<th>Year 9</th>
<th>Year 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan Disbursement</td>
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<td>$ -</td>
<td>$ -</td>
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<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td>Loan Repayment (Principal)</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
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</tr>
<tr>
<td>Cash Flow From Financing</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
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</table>

### Simple Payback Year

- Year 6
## Estimated Cost Savings to the Baird & McGuire Site from On-Site Solar PV PPA

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>PPA Project Year</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Projected Electricity Consumption at GWTF Main Meter (kWh):</td>
<td>625,603</td>
<td>625,603</td>
<td>625,603</td>
<td>625,603</td>
<td>625,603</td>
<td>625,603</td>
<td>597,451</td>
<td>597,451</td>
<td>597,451</td>
<td>597,451</td>
</tr>
<tr>
<td>Projected All-In Utility Electricity Rate ($/kWh):</td>
<td>$0.11850</td>
<td>$0.12324</td>
<td>$0.12817</td>
<td>$0.13330</td>
<td>$0.13863</td>
<td>$0.14417</td>
<td>$0.14994</td>
<td>$0.15594</td>
<td>$0.16218</td>
<td>$0.16866</td>
</tr>
<tr>
<td>Projected Utility Electricity Costs (in absence of solar project) ($)</td>
<td>$74,134</td>
<td>$77,099</td>
<td>$80,183</td>
<td>$83,391</td>
<td>$86,726</td>
<td>$90,195</td>
<td>$93,803</td>
<td>$93,165</td>
<td>$96,892</td>
<td>$100,768</td>
</tr>
<tr>
<td>Assumed Solar PPA Rate ($/kWh):</td>
<td>$0.09010</td>
<td>$0.09370</td>
<td>$0.09745</td>
<td>$0.10135</td>
<td>$0.10540</td>
<td>$0.10962</td>
<td>$0.11401</td>
<td>$0.11857</td>
<td>$0.12331</td>
<td>$0.12824</td>
</tr>
<tr>
<td>Projected Solar PPA Payments by Site ($)</td>
<td>$56,484</td>
<td>$58,449</td>
<td>$60,483</td>
<td>$62,588</td>
<td>$64,766</td>
<td>$67,020</td>
<td>$69,352</td>
<td>$71,766</td>
<td>$74,263</td>
<td>$76,848</td>
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<tr>
<td>Assumed Solar PPA Rate ($/kWh):</td>
<td>$0.09010</td>
<td>$0.09370</td>
<td>$0.09745</td>
<td>$0.10135</td>
<td>$0.10540</td>
<td>$0.10962</td>
<td>$0.11401</td>
<td>$0.11857</td>
<td>$0.12331</td>
<td>$0.12824</td>
</tr>
<tr>
<td>Projected Loss Rate on Offset Utility Electricity Supply Directly Offset by Solar Output (kWh):</td>
<td>125,121</td>
<td>125,121</td>
<td>125,121</td>
<td>125,121</td>
<td>125,121</td>
<td>125,121</td>
<td>125,121</td>
<td>119,490</td>
<td>119,490</td>
<td>119,490</td>
</tr>
<tr>
<td>Projected Losses to Site on Offset Utility Electricity Supply Directly Offset ($)</td>
<td>$0.01170</td>
<td>$0.01217</td>
<td>$0.01265</td>
<td>$0.01316</td>
<td>$0.01369</td>
<td>$0.01423</td>
<td>$0.01480</td>
<td>$0.01540</td>
<td>$0.01601</td>
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<tr>
<td>Projected Loss Rate on Offset Utility Electricity Supply Directly Offset ($)</td>
<td>$1.464</td>
<td>$1.522</td>
<td>$1.583</td>
<td>$1.647</td>
<td>$1.713</td>
<td>$1.781</td>
<td>$1.852</td>
<td>$1.980</td>
<td>$1.913</td>
<td>$1.990</td>
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<tr>
<td>Projected Net Metered Electricity (kWh):</td>
<td>500,482</td>
<td>500,482</td>
<td>500,482</td>
<td>500,482</td>
<td>500,482</td>
<td>500,482</td>
<td>477,961</td>
<td>477,961</td>
<td>477,961</td>
<td>477,961</td>
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<tr>
<td>Projected Loss Rate on Net Metered Electricity ($/kWh):</td>
<td>$0.02000</td>
<td>$0.02080</td>
<td>$0.02163</td>
<td>$0.02250</td>
<td>$0.02343</td>
<td>$0.02531</td>
<td>$0.02639</td>
<td>$0.02737</td>
<td>$0.02847</td>
<td>$0.02967</td>
</tr>
<tr>
<td>Projected Losses to Site on Net Metering Utility Credits ($)</td>
<td>$10,010</td>
<td>$10,410</td>
<td>$10,826</td>
<td>$11,259</td>
<td>$11,710</td>
<td>$12,178</td>
<td>$12,665</td>
<td>$12,579</td>
<td>$13,082</td>
<td>$13,606</td>
</tr>
<tr>
<td>Projected Annual Solar Overproduction vs. Site Electricity Consumption (kWh):</td>
<td>1,297</td>
<td>1,297</td>
<td>1,297</td>
<td>1,297</td>
<td>1,297</td>
<td>1,297</td>
<td>1,297</td>
<td>1,297</td>
<td>1,297</td>
<td>1,297</td>
</tr>
<tr>
<td>Projected Avoided Utility Cost Wholesale Rate ($/kWh):</td>
<td>$0.03885</td>
<td>$0.04040</td>
<td>$0.04202</td>
<td>$0.04370</td>
<td>$0.04545</td>
<td>$0.04727</td>
<td>$0.04916</td>
<td>$0.05112</td>
<td>$0.05317</td>
<td>$0.05530</td>
</tr>
<tr>
<td>Projected Avoided Utility Wholesale Payments to Site ($)</td>
<td>($550)</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>($540)</td>
<td>($254)</td>
<td>($599)</td>
</tr>
<tr>
<td>Assumed Replacement REC Charges to Site ($)</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
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<td>$0</td>
<td>$0</td>
<td>$0</td>
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<tr>
<td>Projected Total Electricity Costs at Site with Solar PV Project ($)</td>
<td>$67,907</td>
<td>$70,382</td>
<td>$72,893</td>
<td>$75,494</td>
<td>$78,189</td>
<td>$80,979</td>
<td>$83,870</td>
<td>$85,784</td>
<td>$89,003</td>
<td>$92,344</td>
</tr>
</tbody>
</table>

### Difference between GWTF’s Estimated Utility Electricity Costs and Costs with Solar Project

- **Projected Savings (Loss) on Solar PPA vs. Conventional Utility Supply ($)**: $6,227, $6,717, $7,290, $7,896, $8,538, $9,216, $9,933, $10,781, $11,688, $12,624.