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Wind Energy Project Final Report

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East Bay Energy Consortium

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East Bay Energy Consortium (EBEC)

Wind Energy Project
Final Report

Daniel Mendelsohn, ASA
Deborah Crowley, ASA

March 1, 2010
### Review - Load Summary

<table>
<thead>
<tr>
<th>Town</th>
<th>kWh</th>
<th>kW</th>
<th>kW - offset</th>
<th>kW- avg.</th>
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<tbody>
<tr>
<td>Barrington</td>
<td>1,924,142</td>
<td>220</td>
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<td>Bristol</td>
<td>3,204,203</td>
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<td>365.8</td>
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<tr>
<td>Little Compton</td>
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<td></td>
<td>62.5</td>
</tr>
<tr>
<td>Middletown</td>
<td>4,532,025</td>
<td>517</td>
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<tr>
<td>Newport</td>
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<tr>
<td>Tiverton</td>
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<td>Warren</td>
<td>2,673,452</td>
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<tr>
<td>Portsmouth</td>
<td>4,095,966</td>
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<td>EP*</td>
<td>8,878,668</td>
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<td><strong>TOTAL</strong></td>
<td>58,133,191</td>
<td>6,636</td>
<td>377</td>
<td><strong>6,259</strong></td>
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</table>

- **Annual Load** – 58.1MM kWh which equates to an average demand of 6,259kW (6.26MW) over a year (8760 hours)
- **Based on net capacity factor of 25% the entire load could be offset by 25MW installed capacity**
Review - Minimum Wind Criteria

- Projected Savings based on the value of offset energy
- Cost of Energy
- Production Estimates
- WTG Performance
- Wind Resource

- Minimum wind speed for EBEC assumed 6.4m/s
  - Based on current energy rates (conservative)

### Table: Project Cost Analysis

<table>
<thead>
<tr>
<th>Projects &lt;3 MW</th>
<th>Units</th>
<th>Single WTG</th>
<th>Two WTG</th>
<th>&gt; 3 WTG</th>
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<tbody>
<tr>
<td>Avg Hub Ht. Wind Speed</td>
<td>m/s</td>
<td>6.4</td>
<td>6.4</td>
<td>6.5</td>
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<td>Project Cost</td>
<td>$/kW</td>
<td>3000</td>
<td>2925</td>
<td>2850</td>
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<td>Debt Term</td>
<td>years</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Debt Interest Rate</td>
<td></td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
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<tr>
<td>Capacity Factor</td>
<td></td>
<td>25%</td>
<td>24%</td>
<td>25%</td>
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<tr>
<td>Capital Recovery Cost</td>
<td>$/kW-year</td>
<td>$241</td>
<td>$235</td>
<td>$229</td>
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<tr>
<td>Annual Energy Production</td>
<td>kWh/kW</td>
<td>2,173</td>
<td>2,073</td>
<td>2,165</td>
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<tr>
<td>Capital Recovery Cost</td>
<td>$/kWh</td>
<td>$0.111</td>
<td>$0.113</td>
<td>$0.106</td>
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<tr>
<td>O&amp;M Cost</td>
<td>$/kWh</td>
<td>$0.025</td>
<td>$0.025</td>
<td>$0.020</td>
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<tr>
<td>Total Project Cost</td>
<td>$/kWh</td>
<td>$0.136</td>
<td>$0.138</td>
<td>$0.126</td>
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<tr>
<td>Net Metering Energy Value</td>
<td>$/kWh</td>
<td>0.114</td>
<td>0.114</td>
<td>0.105</td>
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<tr>
<td>REC Value</td>
<td>$/kWh</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
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<tr>
<td>Total Project Revenue</td>
<td>$/kWh</td>
<td>0.139</td>
<td>0.139</td>
<td>0.130</td>
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<tr>
<td>First Year Revenue - Cost</td>
<td>$/kWh</td>
<td>0.003</td>
<td>0.001</td>
<td>0.004</td>
</tr>
</tbody>
</table>
Review - Siting Criteria

• **Minimum Wind Speed**
  - 6.4m/s

• **Lot Ownership**
  - Town or EBEC Provided Lot
  - May consider specific private lots

• **Lot Size**
  - 10 acres minimum
    - Derived from Fall Zone of typical utility scale WTG
    - Geometry of Lot not considered at this time

• **Zoning**
  - Not considered
  - Most towns do not have regulations
  - Most Zoning ordinances consider fall zone, noise and shadow
Review - Economics

• 25MW required installed to offset entire EBEC Load

• Estimated Project Costs:
  – Project cost estimated by $/kW installed rules of thumb
  – True $/kW of installation affected by:
    • Wind Turbine Costs
    • Project Size (construction of 10MW project lower $/kW than ten individual 1MW projects)
    • Project Site (construction/access/delivery/permitting costs)
    • Electrical Interconnect
  – Estimated average $/kW between 2,650 – 3,000 $/kW
    • For 25MW project – equates to $66-75MM
  – Economic assessment based on comparison of project costs, revenues and projected savings
Review - Approach

- GIS used as database for screening properties
- Plot of Areas with minimum wind speed
- Overlay of Lots for Consideration
  - Little Compton had no GIS parcel delineation
    - List of town properties was reviewed
    - Sites based on acreage were considered for further evaluation
- Removal of Lots under minimum size requirement (some exceptions)
- Removal of Lots not meeting minimum wind speed (some exceptions)
- Lots also removed at Town’s/EBEC request
- Result - list and map of parcels passing through screening process
Review – Preliminary Results

• East Providence, Barrington & Warren & sites screened out
• Bristol, Portsmouth, Middletown & Newport sites screened out or removed
• 25 Town Lots plus combination of 4 Private Lots Pass through Screening
Review - Results

Little Compton

- 6 Potential Town Sites and 1 Potential Private Site
  - Some potential parcels co-located equating to three separate locations in town
- Lot sizes available from Vision Appraisal Website
- Lot Size Considered Less than 10 acres due to source of information and potential for abutting Town Lots
Review - Results
Little Compton
Results

Tiverton

- 25 Potential Town Site
- 1 Potential Private Site
- Fire District Sites not initially considered/not included in final ranking however are potentially available for development
- Fort Barton, Landfill & Weetamoo Woods thought unlikely for development
Electrical Interconnect

- Site review of Tiverton & Little Compton performed
- Transmission and distribution lines mapped
  - 12.47kV line to most areas
- Interconnect costs developed by potential project (group areas)
  - Tiverton
    - Industrial Park (1->3 WTGs)
    - Brayton Rd. (1-3 WTGs)
    - Eight Rod Way (1- >3 WTGs)
  - Little Compton
    - Amy Hart Path (1-3 WTGs)
    - Meeting House Lane (1 WTG)
    - Swamp Road (1-3 WTGs)

- Costs
  - 1 WTG on 12.47kV line - $430k
  - $300-$400k/mi to get to 12.47kV line
  - 2 WTGs on 12.47kV line - $750k
  - 3 WTGs require new, dedicated 12.47kV line to Fish Rd substation:
    $400k/mi + $1.55M
  - 4+ WTGs require new, 115kV line to Fish Rd substation + sub upgrade:
    $500k/mi + $2.7M (+ $1.7M for each add. Group of 4)
Ranking Process

- Site ranking developed on individual parcel basis
- Estimate potential project size based on lot size
- Develop preliminary project development costs including interconnect
- Develop preliminary project annual payment
  - 5% interest rate and 30% rebate assumed
  - Above assumptions similar to CREB financing – no rebate
- Estimate potential annual production
  - Weibull distribution
  - 1.65 MW power curve
  - Increased losses > 2 WTGs
- Estimate annual revenue
  - Production
  - RECs
  - Net, Less debt service + O&M
- Final Rank developed based on annual revenue trend estimates
<table>
<thead>
<tr>
<th>Parcel</th>
<th>Name</th>
<th>Description</th>
<th>Wind Speed</th>
<th>Acres</th>
<th>WTGs</th>
<th>Annual Prod. (kWh)</th>
<th>Cost ($)</th>
<th>Annual pmt (30% rebate)</th>
<th>Annual prod. Rev ($)</th>
<th>Annual net revenue Rank</th>
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<tr>
<td>44</td>
<td>Tiverton - Private</td>
<td>BRAYTON RD</td>
<td>6.2</td>
<td>174.0</td>
<td>6</td>
<td>20,099,472</td>
<td>30,000,600</td>
<td>($1,685,128)</td>
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<td>FISH RD</td>
<td>6.4</td>
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<td>17,949,168</td>
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<td>111 SWAMP RD</td>
<td>7.0</td>
<td>81.5</td>
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<td>12,950,958</td>
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<td>FOGLAND RD</td>
<td>6.7</td>
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<td>8,109,111</td>
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<td>3,654,449</td>
<td>5,260,000</td>
<td>($295,453)</td>
<td>$416,607</td>
<td>$121,154</td>
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<td>Town Of Tiverton</td>
<td>BRAYTON RD</td>
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<td>1</td>
<td>3,654,449</td>
<td>5,260,000</td>
<td>($295,453)</td>
<td>$416,607</td>
<td>$121,154</td>
</tr>
</tbody>
</table>
Results Summary

• East Providence, Barrington & Warren
  – Screened Out due to insufficient Wind at Municipal Owned Sites

• Bristol, Portsmouth, Middletown and Newport
  – A few lots each, areas reflective of smaller projects – subsequently screened out

• Tiverton
  – Many lots, some on the cusp of the economical wind speed

• Little Compton
  – A few lots, some with a large area and high wind speed

• Little Compton and Tiverton have less developed abutting areas to municipal lots
Phase II

• Develop project(s) from top ranked sites
  – Focus now on Tiverton Industrial Park (Fish Rd.)
  – Town lots + water/fire district lots

• Vet selected sites
  – Meet with town planners, zoning board, water/fire board
    – Deed search

• Joint decision meeting – finalize project definition

• Detailed technical & economic feasibility study

• Evaluate competing strategies (Dzykewicz)
Results

Tiverton