KENLY COMMUNITY WIND DRAFT CONSTRAINTS, LAYOUT AND COST ASSESSMENT
AIMS

• To understand the site constraints and their relative impact
• To identify layouts based on fixed costs and potential revenue
• To agree one layout to develop further
CONSTRAINTS

- Main roads – topple distance
- Site roads and footpaths – buffer distance
- O/head power lines across the site
- Houses – noise (500m) and shadow flicker (10 rotor diameters)
- Settlements – 2km guidance in Supplementary Planning Guidance
- Designated sites
- Aviation
- Telecoms
- Grid connection
- Fixed and operating costs
 CONSTRAINTS – GRID CONNECTION

- Option 1 Connection to existing line rated at 11kV and can carry 500kW
- **Option 2 new connection to St Andrews could carry 12MW**
- Option 2B new connection to Anstruther (substation not rated high enough)
- Option 3 33kV connections requires upgrade of line with several km of new fibreoptic circuit at St Andrews and more to link back to Cupar or Leven
  - May enable 18MW to be fed in
Figure 8 - 33kV Network

The green lines in this figure show 33kV circuits. The red circles show primary substations where 33/11kV transformer(s) step the voltage down to 11kV (note that 11kV circuits are not shown). The red squares are grid supply points (GSPs) where the transmission system voltage (132kV in this case) is stepped down to 33kV. The black circle shows the approximate location of the proposed wind farm site.
<table>
<thead>
<tr>
<th>Maximum Wind Farm Capacity</th>
<th>Preferred Option(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6MW</td>
<td>Connection on new 11kV circuit to existing St Andrews 11kV primary substation.</td>
</tr>
<tr>
<td></td>
<td>The rating of the 33/11kV transformers at St Andrews will require to be assessed – if replacement is required the wind farm would be liable for a portion of this cost.</td>
</tr>
<tr>
<td>12MW</td>
<td>Connection on two new 11kV circuits to existing St Andrews 11kV primary substation.</td>
</tr>
<tr>
<td></td>
<td>Rating of the 33/11kV transformers at St Andrews will require to be assessed – if replacement is required the wind farm would be liable for a portion of this cost.</td>
</tr>
<tr>
<td>12 - 20MW</td>
<td>Connection at 33kV to St Andrews primary substation.</td>
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<tr>
<td></td>
<td>If the 33kV system between Cupar and St Andrews is reinforced (including installation of fibre optic cable within conductor), then a 33kV connection may be more attractive than option 2A above.</td>
</tr>
<tr>
<td></td>
<td>Connection of more than 12MW will in our view require a 33kV connection.</td>
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<tr>
<td></td>
<td>At present this is likely to be prohibitively expensive due to the requirement to install lengthy, new buried fibre optic protection circuits back to the GSP at Cupar.</td>
</tr>
<tr>
<td></td>
<td>However, we understand that SP have developed provisional proposals to reinforce the 33kV system between Cupar and St Andrews, including installation of new 33kV lines with a fibre optic cable within a conductor.</td>
</tr>
<tr>
<td></td>
<td>We understand this project is not formally authorised at present with no formal timescales.</td>
</tr>
</tbody>
</table>
CONSTRAINTS - COSTS

• FIXED COSTS
  – Design and planning
  – Renewables equipment
  – Installation and commissioning
  – Grid connection costs
  – Civils and electrical works on site
  – Consultancy, land acquisition
  – Contingency

• OPERATING COSTS
  – Maintenance
  – Insurance
  – Use of system charges
  – Administration costs
  – (Rent and Rates)
DRAFT LAYOUTS TAKING ACCOUNT OF CONSTRAINTS INC. COSTS
<table>
<thead>
<tr>
<th>Layout Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td><strong>WTG Type</strong></td>
<td>Enercon E33</td>
<td>Vestas V52</td>
<td>REpower MM82</td>
<td>REpower MM82</td>
<td>Vestas V90</td>
</tr>
<tr>
<td><strong>Number of WTGs</strong></td>
<td>30</td>
<td>14</td>
<td>5</td>
<td>6</td>
<td>4</td>
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<tr>
<td><strong>Installed Capacity of wind farm (MW)</strong></td>
<td>9.9</td>
<td>11.9</td>
<td>10.25</td>
<td>12.3</td>
<td>12</td>
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<tr>
<td><strong>Design and Planning (£'000s)</strong></td>
<td>486</td>
<td>486</td>
<td>486</td>
<td>486</td>
<td>486</td>
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<tr>
<td><strong>Renewable Energy Equipment (£'000s)</strong></td>
<td>13,231</td>
<td>12,049</td>
<td>9,963</td>
<td>11,956</td>
<td>10,692</td>
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<tr>
<td><strong>Installation and Commissioning (£'000s)</strong></td>
<td>1,470</td>
<td>1,339</td>
<td>1,107</td>
<td>1,328</td>
<td>1,188</td>
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<td><strong>Grid Connection (£'000s)</strong></td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Infrastructure, Civil and Electrical Works (£'000s)</strong></td>
<td>Included in renewable energy equipment</td>
<td>2,374</td>
<td>1,928</td>
<td>2,170</td>
<td>1,955</td>
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<tr>
<td><strong>Other (£'000s)</strong></td>
<td>1,011</td>
<td>1,192</td>
<td>1,006</td>
<td>1,194</td>
<td>1,128</td>
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<tr>
<td><strong>TOTAL Capital Cost (£'000s)</strong></td>
<td>18,199</td>
<td>19,439</td>
<td>16,491</td>
<td>19,134</td>
<td>17,449</td>
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<tr>
<td><strong>TOTAL Capital Cost per MW (£'000s)</strong></td>
<td>1,838</td>
<td>1,634</td>
<td>1,609</td>
<td>1,556</td>
<td>1,454</td>
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</tbody>
</table>
Figure 1 - Preliminary Layout – 30 x Enercon E33 330kW – Maximum Capacity

Legend
- Site Boundary
- Buffer of Site Boundary (16.7m)
- Orange Telecom Link
- Buffer of Orange Telecom Link (116.7m)
- Small Roads and Footpaths
- Buffer of Small Roads and Footpaths (16.7m)
- Roads
- Buffer of Roads (61m)
- Houses
- Buffer of Houses (500m)
- Settlements
- Buffer of Settlements (2km)
- Sites of Special Scientific Interest (SSSI)
Figure 3 - Preliminary Layout – 7 x REpower MM82 Evolution 2.05MW – Maximum Capacity
Figure 4 - Preliminary Layout – 5 x Vestas V90 3MW – Maximum Capacity
Figure 5 - Preliminary Layout – 6 x REpower MM82 Evolution 2.05MW – Installed Capacity Limited to 12MW
Figure 6 - Preliminary Layout – 4 x Vestas V90 3MW – Installed Capacity Limited to 12MW
Figure 7 - Preliminary Layout – 6 x REpower MM82 Evolution 2.05MW – Compliant with Landscape Capacity Guidance