Wind Power and the Built Environment

Integrating wind power generation capabilities in a mixed-income residential development in Chicago.

Building forms can indeed increase the velocity of the wind and thereby improve the effectiveness of turbines integrated into the architecture. The wind tunnel tests confirmed that the roof funnel forms were able to increase the velocity of the wind by a factor greater than 1.5. And the testing of the tower model illustrated just how much or little a building mass can negatively impact the effectiveness of wind turbines.

We were able to take conceptual ideas and refine them using qualitative analysis through discussion and research, then test those designs in a controlled environment in order to calculate quantitative results.

Future classes will have the opportunity to build upon this to consider in greater depth the intricate relationship between efficiency of design through additional testing and expressive design through greater analysis of the social and political aspects of this site.

**Design Program & Requirements**

- **Design Goals**: Integration of wind power generation into the architecture.
- **Design Program & Requirements**: Building forms can indeed increase the velocity of the wind and thereby improve the effectiveness.
- **Orientation**: Building placement & orientation can influence wind patterns. Consider access to transportation, community, green spaces, and wind direction.
- **Elements of Program**: Site, building placement & orientation, streets, parking areas. Consider access to transportation, community, green spaces, and wind direction.
- **Parameters**: Wind speed increase factors by orientation and the relationship between these two building types. And the two mid-rise towers were treated as one building type and the four flat test model at orientation 2. Thereby, developing designs with a sense of context and research, then test those designs in a controlled environment in order to calculate quantitative results.

**Results**

**Wind Speed Increase Factors by Orientation**

- Tower: 2.07
  - Orientation: 1
  - Orientation: 2
  - Orientation: 3
- Eight Flat: 1.9
  - Orientation: 1
  - Orientation: 2
  - Orientation: 3

**Energy Production Capacity**

<table>
<thead>
<tr>
<th>Orientation</th>
<th>Combined Annual Data</th>
<th>Tower</th>
<th>Eight Flat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16,144.36</td>
<td>3,490.45</td>
<td>12,653.91</td>
</tr>
<tr>
<td>2</td>
<td>18,160.40</td>
<td>3,794.07</td>
<td>14,366.33</td>
</tr>
</tbody>
</table>

**Conclusions**

Building forms can indeed increase the velocity of the wind and thereby improve the effectiveness of turbines integrated into the architecture. The wind tunnel tests confirmed that the roof funnel forms were able to increase the velocity of the wind by a factor greater than 1.5. And the testing of the tower model illustrated just how much or little a building mass can negatively impact the effectiveness of wind turbines.

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