Distributed Generation Options for Urban China

Runzi Gao
Worcester Polytechnic Institute

Xianjing Hu
Worcester Polytechnic Institute

Kevin Hugnagle
Worcester Polytechnic Institute

Xueyang Lin
Worcester Polytechnic Institute

Follow this and additional works at: http://digitalcommons.wpi.edu/gps-posters

Recommended Citation
http://digitalcommons.wpi.edu/gps-posters/187

This Text is brought to you for free and open access by the Great Problems Seminar at DigitalCommons@WPI. It has been accepted for inclusion in Great Problems Seminar Posters by an authorized administrator of DigitalCommons@WPI.
Distributed Power Plant Options in Urban China

Xianjing Hu, Xueyang Lin, Runzi Gao, and Kevin Hufnagle (distributed-power@wpi.edu)
Advisor: Professor David Spanagel (Humanities & Arts – spanagel@wpi.edu)

Abstract

China relies on electricity generated from large, centralized power plants to meet the demands of its unprecedented economic development; these plants exhaust the country’s resources and pollute its environment. Distributed power plants provide another option. Based on technical research on the potential reliability and carbon emissions of various plant designs as well as surveys of Chinese students’ attitudes toward the alternative infrastructure, we created a series of recommendations for supplying power to China’s capital, Beijing. The most feasible power option involves constructing a collection of combined cooling, heating, and power (CCHP) distributed generation systems.

Background

In order to preserve a healthy air quality level at the Beijing Olympics, the provinces of northern China reduced the amount of emissions from their coal power plants, and Beijing city officials limited non-emergency vehicles from using the city’s main roads based on their license plate numbers.

Goals/Methodology

• Determine the most reliable and environmentally friendly types of distributed power plants for the Beijing area by analyzing the emissions and electricity supply that current power plants create when serving this municipality.
• Measure Chinese citizens’ willingness to use these distributed power plants by creating a questionnaire for Chinese citizens and interviewing WPI students from China.
• Create a set of plant construction guidelines for the Chinese government.

Results

These maps depict the results of the questionnaire. The red regions on each map indicate the areas where the students agreed the most with each statement.

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Monthly Supply to Grid (GWh)</th>
<th>Emission Factor (tons CO2/GWh)</th>
<th>Percent CO2 Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional centralized power plant that serves NCPN</td>
<td>Coal</td>
<td>1425</td>
<td>1101</td>
<td>0</td>
</tr>
<tr>
<td>Jingfeng</td>
<td>CCGT</td>
<td>194.8</td>
<td>388.4</td>
<td>8.859</td>
</tr>
<tr>
<td>Shijiazhu</td>
<td>CCGT</td>
<td>99.67</td>
<td>496.6</td>
<td>3.824</td>
</tr>
<tr>
<td>Beijing Taiyanggong</td>
<td>CCHP</td>
<td>272.2</td>
<td>462.5</td>
<td>11.09</td>
</tr>
<tr>
<td>Hebei Shang/Manjiang East</td>
<td>Wind</td>
<td>16.67</td>
<td>0</td>
<td>1.147</td>
</tr>
</tbody>
</table>

Gas-based distributed power plants would provide urban Chinese citizens with a reliable electricity supply and would produce less carbon dioxide than coal plants.

Acknowledgments

We would like to thank all of the Chinese students who completed our questionnaire and the WPI students from China who offered us their opinions during the interviewing process.

Recommedations

• Install at least three distributed CCHP power plants in place of centralized coal power plants within the North China Power Network annually.
• Continue increasing the electricity supply capacity of distributed power plants, especially those that use renewable resources.
• Develop an educational program informing Chinese citizens about the benefits of using electricity from distributed power plants.

Key References

