INTRODUCTION

- We analyzed the performance of 10 MWp grid connected photovoltaic (PV) systems installed on 35 structures at Arizona State University (ASU).
- PV systems vary in type (fixed tilt vs. tracking), size (13 kW – 2.6 MW) and module type.
- Real time data for building energy usage, PV generated electricity and meteorological data was used to analyze:
  - Peak electricity demand offset
  - Effect of dust storms on PV system performance
  - Annual capacity factors of installed PV systems

This, once in a thirty year, dust storm limited the visibility and coated every object with a thick layer of dust.

A small thunderstorm (precipitation < 0.2 inch) followed the dust storm five days later.

EFFECTS OF DUST STORM

ANNUAL CAPACITY FACTORS

Capacity factor = \[ \frac{\text{Energy output (kWh)}}{\text{System size (kW)} \times \text{Time (h)}} \]

<table>
<thead>
<tr>
<th>Building</th>
<th>System size (kW)</th>
<th>System type</th>
<th>Module type</th>
<th>Avg. capacity factor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>161</td>
<td>Fixed</td>
<td>Poly-silicon</td>
<td>20.3</td>
</tr>
<tr>
<td>B</td>
<td>80</td>
<td>Fixed</td>
<td>Poly-silicon</td>
<td>20.3</td>
</tr>
<tr>
<td>C</td>
<td>70</td>
<td>Fixed</td>
<td>Poly-silicon</td>
<td>20.1</td>
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<tr>
<td>D</td>
<td>108</td>
<td>Fixed</td>
<td>Poly-silicon</td>
<td>19.4</td>
</tr>
<tr>
<td>E</td>
<td>76</td>
<td>Fixed</td>
<td>Poly-silicon</td>
<td>21.0</td>
</tr>
<tr>
<td>F</td>
<td>42</td>
<td>Fixed</td>
<td>Poly-silicon</td>
<td>18.5</td>
</tr>
<tr>
<td>G</td>
<td>880</td>
<td>1-axis tracker</td>
<td>Poly-silicon</td>
<td>23.0</td>
</tr>
<tr>
<td>H</td>
<td>711</td>
<td>1-axis tracker</td>
<td>Poly-silicon</td>
<td>22.4</td>
</tr>
<tr>
<td>I</td>
<td>23</td>
<td>Fixed</td>
<td>Poly-silicon</td>
<td>20.4</td>
</tr>
</tbody>
</table>

- Average annual capacity factor: **22.4%**
- Seasonal variations in capacity factors due to incident solar radiation and temperature effects.

System Advisor Model (SAM) was used to simulate the effect of different tracking cases on capacity factors.

- Annual capacity factor for a fixed 20 degree tilt system is equal to a 33 degree tilt (latitude) system.

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