Black box boundary

- Clearly define the system which requires power measurement
Black box boundary continued

- I/O generator server may be in the same rack
  - Rack level fans, rack level controller, switch
  - What is the real system under test
Redundancy in power supplies

- Measure both power feeds
- Both power supplies operational
Systems get large

- Multiple racks of equipment to measure
- Use a clamp on the main line feed
Double check

- Power should be close to what is expected
- Verify power factor
- Voltage sense close to the load
- If using current transformer
  - Has the correct phase
  - Settings on the power meter
- Three phase setup (double check)
  - Wire correct
  - Settings on the power meter
- Syncing clocks between power meter and Vdbench
## Input power requirements

<table>
<thead>
<tr>
<th>NOMINAL INPUT VOLTAGE RANGE</th>
<th>Phases</th>
<th>AC INPUT FREQUENCY RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-120 VAC RMS</td>
<td>1</td>
<td>47 – 63 Hz</td>
</tr>
<tr>
<td>200 – 240 VAC RMS</td>
<td>1</td>
<td>47 – 63 Hz</td>
</tr>
<tr>
<td>200 - 480 VAC RMS</td>
<td>3</td>
<td>47 – 63 Hz</td>
</tr>
</tbody>
</table>
Power meter requirements

- **Power Meter accuracy**

<table>
<thead>
<tr>
<th>Power Consumption (p)</th>
<th>Minimum Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>p ≤ 10 W</td>
<td>± 0.01 W</td>
</tr>
<tr>
<td>10 &lt; p ≤ 100 W</td>
<td>± 0.1 W</td>
</tr>
<tr>
<td>p &gt; 100 W</td>
<td>± 1.0 W</td>
</tr>
</tbody>
</table>

- **Sampling period of 5 second or less**
- **Sampling rate of 0.2 samples/second or greater**
Environmental monitoring

- Monitor temperature during the test
  - Measure in degrees Celsius
  - Measured in 0.1 degree resolution
  - Sample in a period not greater than 1 minute
  - Measured at primary air inlet
    - Center of the storage configuration
Difference between Emerald and ENERGY STAR

ENERGY STAR has tighter input voltage requirements
- For systems Equal to or less than 1500W
  - Standard input voltages with ±1.0%
  - Total Harmonic Distortion (THD) of 2.0%
- For systems greater than 1500W
  - Standard input voltage ±5.0%
  - Total Harmonic Distortion (THD) of 5.0%

With tight THD requirements need to get the power meter as close to the System Under Test

Temperature sensor
- Overall accuracy of ±0.5C or better
- 50 mm in front of the main airflow inlet