WATER UTILITY ENERGY CHALLENGE

How the Competition Works

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GREAT LAKES BASIN
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PLEASE NOTE: This is a pilot competition. This document may be revised periodically to ensure the rules and methodology of competition are most fitting for the real conditions and capabilities of competitors.

The Water Utility Energy Challenge is a competition between Great Lakes water utilities to reduce pollution emissions (particularly mercury) related to energy usage of their water distribution systems.

The competition is funded by the Great Lakes Protection Fund. American Water Works Association in cooperation with Wayne State University (WSU), Growth Capital Network, CDM Smith, Energy Emissions Intelligence, and Great Lakes and St. Lawrence Cities Initiative is providing project management and technical assistance.

**Why Participate?**

- Want to show your utility’s support and commitment to your community by using innovation and cutting edge technology?
- Want to reduce harmful emission pollutants (especially mercury) in the Great Lakes region?
- Want to optimize your pumping systems?
- Want to reduce your O&M costs?
- Want to showcase your utility and win $20,000 in the process?

If you said yes to any one of these questions, this competition can help you achieve your goal. The competition runs April 2017 – March 2018, but you can REGISTER to try out the technology for free today!

**Technology**

Interested utilities have an opportunity to use two novel, state of the art technologies developed at WSU to monitor pollution emissions and optimize their systems: LEEM and PEPSO.

About LEEM: The Locational Emissions Estimation Methodology (LEEM) tool is a data service that employs a sophisticated system of databases and models to specify the marginal power plant emissions attributed to energy use on a location-specific basis.

In real-time, as well as forecast 24-hours in advance, LEEM provides the mechanism to **link point of energy consumption to the point of energy production**, allowing detailed quantification of the quantities and composition of emissions. By modifying when and where (specific pump combinations or specific facility operations) energy
is used, a utility can shift its power demands from coal-fired power plants to natural
gas, nuclear or renewable sources. It can even assist in the shift from more polluting
to less polluting coal fired power plants (providing such detail, even within the same
class of generators).

About PEPSO: The second tool available to competitors is Polluting Emission Pump
Station Optimization (PEPSO), a software package developed by WSU that uses LEEM
technology to **optimize pump operations** of water distribution systems for energy and
emission reduction.

Utilities are not required to use PEPSO or LEEM technologies to participate; however,
there are location, technical, and data requirements of the competition that are
explained further in this document. PEPSO and LEEM may help competitors collect
this information.

**Register for the Trial Period**

Before moving forward with a competition application, interested utilities can
participate in the Trial Period and use PEPSO and LEEM in their own system. Any utility
can register and download PEPSO and access LEEM, the videos and user manual. The
Trial Period is December 2016 – February 2017. Registration is free, and there is no
obligation to apply for the competition.

Register [www.awwa.org/competition](http://www.awwa.org/competition).

**Competitor Characteristics**

An ideal competitor has the following characteristics and access to data:

- Located in the Great Lakes region and preferably in the Great Lakes
  watershed area (see Figure 1)
- Significant energy consumption
- Good flexibility in space and time of energy consumption (e.g. having
  multiple elevated water storage with considerable capacity)
- An archive of hourly historical energy usage for the water utility for the past 3
  years
- An archive of hourly historical energy usages for each pump station (PEPSO
  Only)
- A calibrated and accurate hydraulic model (PEPSO Only)
Geographic Location

*Figure 1 - US Counties and Canadian Census Districts located in the Great Lakes watershed*

The utility must be located in one of the Great Lakes States or Provinces: Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and, on a case-by-case basis, Ontario. *Figure 1* shows the border of the Great Lakes watershed by a yellow line and the US counties and Canadian census districts which are within or intersected by the Great Lakes watershed by purple color.

Water Distribution System Characteristics

System characteristics include:

**For Water Utility Using LEEM Only:**
All water utilities in the Great Lakes states can utilize LEEM to learn about, and then manage, electricity-related emissions. There is no minimum size or other dimensions necessary.

**For Water Utilities Using PEPSO**
Nearly all water utilities can also use PEPSO to optimize pump operations to reduce both energy and energy-related emissions.
Number of pump stations
At least one pump station is required, while it is preferable that the utility include multiple pump stations with unique electricity tariffs (different energy price schedules).

Daily water demand
No minimum demand is required.

Storage volume
No minimum volume is required, although it is preferable (for the purposes of this competition) for the system to include elevated water storage with a minimum capacity of >20% of the daily demand.

Water source
Whereas one water source is required, a system with multiple water sources is preferred.

Pump type
No limit. Multiple variable speed pumps with a parallel configuration at different pump stations is preferred.

Electricity tariff
In order to provide the utility detailed cost information corresponding to various control strategies, it will be essential for the utility to provide the technical team information about the tariff schedules for the system. This will also allow the use of PEPSO for cost optimization. However, the tariff information is NOT an essential part of the emissions competition.

Data Availability
Reliable information and archived operation data is critical. The more detailed, the better.

Water utilities should be able to provide electrical usage data on an hourly basis for the past 3 years. This data will be used to establish a baseline of electrical usage that will be used for the competition.

For water utilities using PEPSO, each utility will need to provide a reliable and calibrated EPANET model proving the current system conditions and archived hourly energy usage data providing of each pump station in its system. During the competition, the utility will periodically report the hourly energy usage at the pump stations.
Apply for the Competition

AFTER a utility has become familiar with LEEM and PEPSO and is ready to apply for the competition, the technical team will assist the utility in preparing its application. To get started, contact Lauren Bigelow at wuec@growthcap.net, 888.996-4458. There is no fee to apply, and the application deadline is February 28, 2017.

The application will collect data on the physical characteristics of the utility’s distribution system, data on the operation of the water network, and availability of the system’s data.

Competitor Selection

All completed applications will be reviewed by the technical team and the competition’s Scientific Board to identify 6-8 utilities to participate in the competition. Reviewers will assess each utility’s ability to meet the criteria and requirements outlined in this document. Reviewers may contact the utility for more information if needed. Reviews will be conducted and notifications of final competitors will be made in March 2017.

Utilities not chosen to participate in the competition can still use PEPSO or LEEM and will have full access to the videos and user manual. However, technical team support is reserved for utilities that are selected for the competition.

Data Collection and Protection

Unless otherwise specified in writing by the utility, utility specific data collected during the registration/application process and competition is confidential and will only be shared internally with the project team including the technical team and the competition’s Advisory Board and Scientific Board.

However, the competing utility’s percentage of emissions reduction data or other aggregated data may be used or publicized by the project team or the Great Lakes Protection Fund without written request.

Utility data is secured on the utility’s server. PEPSO uses the hydraulic model of the utility’s water distribution system and records information it provides about pumps,
electricity tariff, etc. in a project file that can be kept on the utility’s server. Except for the location of the electricity meter that PEPSO sends to the LEEM server to receive related emission data, nothing else is sent by PEPSO.

**Baseline Scenario and Inputs**

Once a utility is identified as a final competitor, the technical team will work with the utility to determine its baseline scenario. The archived hourly energy usage data will be used to develop the baseline scenario for each competitor. The values will be multiplied by emission rate values (lb/kWh) reported by LEEM, to calculate hourly emissions.

For PEPSO-only users, the initial input required of all competitors is locational information providing the energy consumption points (pump stations) in their transmission/distribution system. This information can be provided using the template in **Table 1**. Typically, each pump station has a single electricity meter with a single electricity tariff. However, if a pump station has multiple meters with multiple tariffs, each meter should be reported as a separate energy consumption point and line in **Table 1**.

In order to define the baseline scenario, each competitor will provide 3 years of archived hourly energy consumption values of each energy consumption point listed in **Table 1**. To be able to normalize the results, the competitors will be required to report their water demand during the time period associated with the energy consumption archive.

**Table 1 - Raw reporting table of energy consumption points (pump stations)**

<table>
<thead>
<tr>
<th>Energy consumption point name</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>[- - - - - -]</td>
<td>[ - - ]</td>
<td>[ - - ]</td>
</tr>
</tbody>
</table>

**Reporting**

Competitors will submit monthly reports, that will be used to create feedback about their emission optimization. Competitors will report hourly energy usage at each energy consumption location (e.g. pump station, buildings, etc.).
Scoring Process

Each competitor can win the competition by reducing the energy-related pollution emissions (especially mercury) of their system. At the conclusion of the competition, emissions will be scored and two top winners will be awarded. First place is a $20,000 cash award and Second place is a $10,000 cash award. Scores will be tallied and reviewed by the competition’s Scientific Board. Table 2 illustrates the criteria and weight used to determine the first and second place winners.

Table 2 - Criteria for selecting competitors with the highest pollution emission reduction

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Unit</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Mercury (Hg) reduction</td>
<td>%</td>
<td>32</td>
</tr>
<tr>
<td>% of Carbon Dioxide (CO2) reduction</td>
<td>%</td>
<td>16</td>
</tr>
<tr>
<td>% of energy usage change</td>
<td>%</td>
<td>16</td>
</tr>
<tr>
<td>% of Nitrogen Oxide (Nox) reduction</td>
<td>%</td>
<td>16</td>
</tr>
<tr>
<td>% of Lead (Pb) reduction</td>
<td>%</td>
<td>8</td>
</tr>
<tr>
<td>% of Sulfur Dioxide (SO2) reduction</td>
<td>%</td>
<td>8</td>
</tr>
<tr>
<td>Amount of Mercury (Hg) reduction</td>
<td>lb</td>
<td>8</td>
</tr>
<tr>
<td>% of peak power demand reduction</td>
<td>%</td>
<td>4</td>
</tr>
<tr>
<td>Amount of Carbon Dioxide (CO2) reduction</td>
<td>lb</td>
<td>4</td>
</tr>
<tr>
<td>Amount of energy usage reduction</td>
<td>kWh</td>
<td>4</td>
</tr>
<tr>
<td>Amount of Nitrogen Oxide (Nox) reduction</td>
<td>lb</td>
<td>4</td>
</tr>
<tr>
<td>Amount of Lead (Pb) reduction</td>
<td>lb</td>
<td>2</td>
</tr>
<tr>
<td>Amount of Sulfur Dioxide (SO2) reduction</td>
<td>lb</td>
<td>2</td>
</tr>
<tr>
<td>Amount of peak power demand reduction</td>
<td>kW</td>
<td>1</td>
</tr>
</tbody>
</table>
Thank you for your interest in the Water Utility Energy Challenge!

Trial Period: 12/1/16 - 2/28/17
Application Deadline: 2/28/17
Final Competitors Announced: 3/2017
Competition: 4/2017-3/2018

Questions?
Contact Lauren Bigelow
wuec@growthcap.net
888-996-4458