SYNOPSIS  Faced with both local and national competition for talent and patrons, Bangor’s premiere theater institution wrestled with the utility costs of the challenging 1919 Bangor Opera House and stage lighting.

SCOPE  The Penobscot Theatre Company replaced an oil-fired, hot-air furnace with condensing, gas-fired boilers with heat exchanger. The traditional, incondencent stage lighting is in the process of being updated with modern LED models and a new control panel.

RESULTS  Initial air sealing saved approximately 25% off fuel bills before other upgrades. The 45 year-old furnace running at 50% efficiency was replaced with new condensing boilers that run 95% efficient. Upgraded LED stage lighting is projected to save $1,500 annually in materials and reduce the electric bill by 25%. Total savings amount to about $12,000 per year.

<table>
<thead>
<tr>
<th>STAGE LIGHTING</th>
<th>WATTS</th>
<th>LIFESPAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incandecent Bulbs</td>
<td>1,000</td>
<td>50 Hours = 20 Shows</td>
</tr>
<tr>
<td>LED Bulbs</td>
<td>&lt;100</td>
<td>10,000 Hours = 4,000 Shows</td>
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</tbody>
</table>
**Lighting Overhaul**

As lighting technology has advanced, so has stage lighting. For the Penobscot Theatre Company, modernizing their stage lighting wasn’t just about saving in utility and materials costs, it was also about attracting the best talent. Executive Director Mary Budd says, “**Lighting specialists coming out of theatre programs today are being trained on advanced technology. We’re not going to attract them to our corner of the world with last-century infrastructure.**” The efficiency numbers are real, though. Conventional canister lights use incondescent bulbs with an average lifespan of 50 hours (approximately 20 performances). Its LED equivalent lasts an estimated 10,000 hours (about 4,000 shows). Furthermore, incandescent canister lights get their coloration with gel sheets cut and adhered to the lighting unit. Color variations during a performance are limited to the gel sheets hung on lights. LEDs, by comparison, provide a virtually unlimited color span, controled by a central lighting board. Gel sheets have a servicable limit, too, of a couple shows. The amount of staff time committed to change bulbs and to order, cut, and swap out gel sheets is not inconsequential. LED units are considerably lighter than their incondescent comparables, reducing strain on mounting rigging.

**Heating Upgrade**

When the Bangor Opera House’s oil-fired furnace failed, the Penobscot Theatre Company took the opportunity to modernize their heating technology.

Three new gas-fired condensing boilers (95%+ efficient) were installed in the rear of the opera house (below, left). Placememnt of the new units was influenced by the need to exhaust out an exterior wall (below, right). Located in Bangor’s historic district, the Theatre Company sought to install the exhaust pipes discretely in a rear alley.

**Still To Do**

The Theatre must address the three-story rigging tower above the stage (below, left) that captures hot air. After a first round of air-sealing (below, right, in orange foam), the opera house could benefit from a second round.