



PENOBSCOT  
THEATRE

BANGOR  
OPERA  
HOUSE

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**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, incondenscent stage lighting is in the process of being updated with modern LED models and a new control panel.

**RESULTS** Intial 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.

**STAGE LIGHTING**  
Incandecent Bulbs  
LED Bulbs

**WATTS**  
1,000  
<100

**LIFESPAN**  
50 Hours = 20 Shows  
10,000 Hours = 4,000 Shows

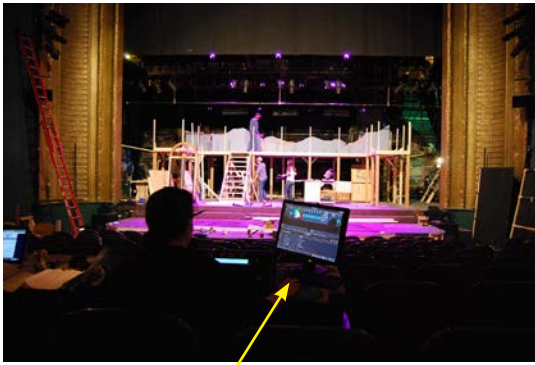


# I N P R A C T I C E

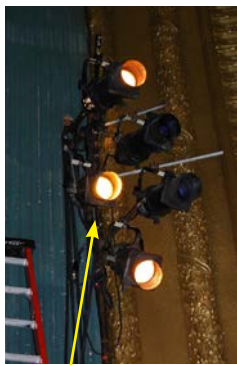
## Lighting Overhaul

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 incandescent 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, controlled 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 incandescent comparables, reducing strain on mounting rigging.



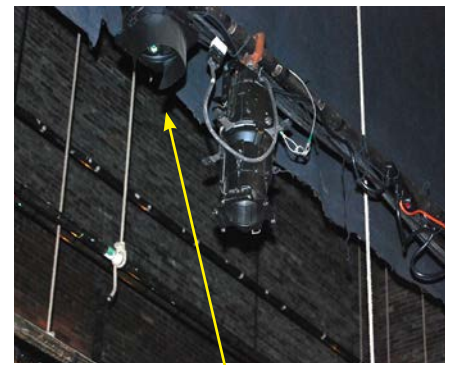
A lighting technician controls infinite LED color variations from a computerized control panel.



Traditional incandescent canister lights burn out about every 20 performances.



Incandescent stage lights use gel sheets attached to the casing to achieve colorization.



A new LED stage light is considerably smaller and lighter than its incandescent counterpart.

## 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). Placement 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.



To connect the rear boilers to the heat exchanger in the basement, the installer ran supply and return pipes underneath the auditorium (left). The supply pipes and hot-air ducts still need to be insulated.

## 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.

