

# Enhancing Historic Preservation Through Life-Cycle Cost Assessment

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## SUMMARY

The HVAC system in the U.S. Customhouse in Portland, Maine, consumed valuable interior space, posed an environmental risk, and adversely affected indoor air quality. The Historic Preservation through Technology project team conducted a lifecycle cost analysis and determined that an upgrade of the HVAC system to a GSHP system would save money over the life span of the new system.

## MOTHER EARTH AS A SOURCE OF HEAT

The Historic Preservation through Technology project consisted of upgrading the HVAC system in a historic building while preserving and reusing its historic elements.

The existing HVAC system in the U.S. Customhouse in Portland, Maine, consisted of an oil-fired boiler and a chiller with an air-cooled condenser unit. Because the building occupied the entire site, the condenser was located in an interior mechanical room vented to the outside, consuming valuable interior space. Fuel oil was stored in an underground 6,000-gallon, single-walled tank extending beyond the property line and posing an environmental risk. The condenser unit, when idle, allowed for infusion of vehicle emissions from the street, adversely affecting indoor air quality.

To address these problems, the project team investigated alternative systems and proposed a ground source heat pump (GSHP) system. Although initial costs exceeded the simple replacement of the existing system, the team's life cycle cost analysis demonstrated that the GSHP system would be more cost-effective over the useful life of the system.

After the interior condenser was removed, a natural-gas-fired emergency generator was installed to provide emergency electrical power and supplemental power during periods of peak demand, which allowed the building to qualify for a discounted electrical utility rate. Built in 1877, the Customhouse originally relied on a passive convection system of 12 vent shafts for ventilation. The shafts, which had been sealed for many years, were reopened and ducted for use as the interior air distribution system,

servicing a function nearly the same as that for which they were originally intended.

The reduced energy consumption of the new system is the primary cause of cost savings—projected to be 30 percent over a conventional system. Operational data since the system went into service indicate savings of more than 40 percent.

This is the second GSHP system installed in Maine, demonstrating that this technology can work in the New England climate. The Portland project now serves as a prototype for a larger project: the construction of a new U.S. Courthouse in Springfield, Mass., which will use a 23-well GSHP system.

## RESOURCES

### More Best Practices

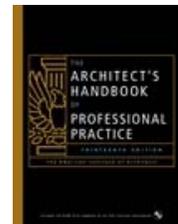
The following AIA Best Practices provide additional information related to this topic:

- 11.08.01 Building Commissioning and Maintenance
- 16.01.02 Green Roof Design
- 11.08.15 Saving Historic Lighthouses by Changing Ownership

### For More Information on This Topic

See also "Historic Preservation," by Robert Burley, FAIA, and Dan L. Peterson, AIA, in *The Architect's Handbook of Professional Practice*, 13th edition, Chapter 18, p. 627.

See also the 14th edition of the *Handbook*, which can be ordered from the AIA Bookstore by calling 800-242-3837 (option 4) or by email at [bookstore@aia.org](mailto:bookstore@aia.org).



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### Key Terms

- Design
- Historic preservation
- Sustainability