

IMPLEMENTATION MODEL: MASSACHUSETTS 2012 STATE ENERGY PROGRAM COMPETITIVE AWARD

SAPHIRE PROGRAM

Energy use in public housing and public schools is critical to meeting state energy savings goals, but these sectors have traditionally been underserved. Many public housing and public school buildings depend on heating oil, and a switch to wood pellets or another renewable source would significantly lower energy costs and air pollutant emissions. Efforts to achieve deep energy savings in this sector have been hindered by a lack of access to low-interest financing and capital for energy efficiency and renewable energy upgrade projects. To overcome these challenges, Massachusetts created the SAPHIRE Program, a technical assistance and financing program for energy efficiency improvements and renewable thermal energy retrofits in public housing and public schools with financial support from a 2012 U.S. Department of Energy State Energy Program Competitive Award. Projects facilitated by SAPHIRE will result in estimated cost savings of nearly \$600,000 annually.

Goal

Greenhouse Gas
EMISSION REDUCTION

↓ **25%** BY **2020**

Achieve a greenhouse gas (GHG) emission reduction of 25% by 2020, from a 1990 baseline, as well as an 80% reduction by 2050.

Barrier

Public Housing & Schools
LACK ACCESS TO
CAPITAL &
LOW-INTEREST FINANCING

Public housing developments and public schools lack access to capital and low-interest financing for energy efficiency and thermal renewable energy upgrade projects.

Solution



Massachusetts Department of Energy Resources (DOER) created the Schools and Public Housing Integrating Renewables and Efficiency (SAPHIRE) Program to provide technical assistance and funding to public housing developments and public schools to perform energy efficiency and renewable thermal projects.

Outcome



The SAPHIRE Program resulted in energy efficiency and renewable thermal projects in seven public schools and 14 multifamily public housing sites. These projects are expected to yield nearly \$600,000 in energy cost savings annually. SAPHIRE projects were expected to yield GHG reductions of up to 85%.

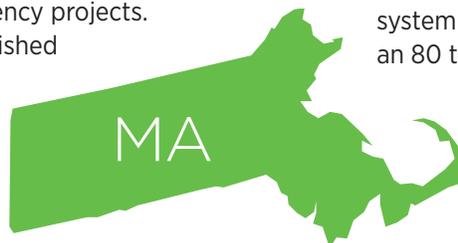
POLICIES

Through experience administering public building energy programs, DOER identified public housing and public schools as underserved constituencies with the best potential for energy cost savings and GHG emissions reductions. These sectors face challenges to adopting energy efficiency measures and switching to cleaner fuels. Public housing developments typically suffer from a backlog of needed repairs and capital upgrades. Massachusetts regional public schools are often located in areas without natural gas access, and therefore rely on costly, carbon-intense heating oil or propane for heating fuel. Oftentimes, a single school's capital budget is shared across multiple municipalities, complicating the process of selecting capital upgrade projects.

To address these issues, DOER has worked with public schools on energy efficiency and renewable energy projects through Massachusetts' Green Communities Grant Program and the Recovery Act-funded Energy Efficiency and Community Block Grant Program (EECBG). DOER has also worked with the Massachusetts Department of Housing and Community Development (DHCD) on integrating energy efficiency and renewable energy into its capital upgrade pipeline. Despite these efforts, energy savings potential in these sectors remained largely untapped.

New laws mandating steep reductions in GHG emissions and increases in utility investments in energy efficiency and renewable energy further propelled DOER to action.

- In August 2008, the Global Warming Solutions Act** was enacted, and it mandated an 80% reduction of GHG emissions from all sectors in the economy by 2050 from a 1990 baseline.
- In 2010, the Clean Energy and Climate Plan 2020** reinforced the mission of the Global Warming Solutions Act. The plan included a 25% interim target for GHG emission reductions by 2020 and identified 27 strategies to achieve the target. Strategies for reducing energy use in buildings represented the greatest single GHG savings potential at 9.8% by 2020. Some of these strategies included solar hot water and other renewable thermal technologies.
- The 2008 Massachusetts Green Communities Act** (amended in 2012) required investor-owned electric and gas utilities to implement energy efficiency programs for consumers. Utilities administer programs sponsoring energy assessments and offer rebates, incentives, and financing mechanisms for energy efficiency projects. The Green Communities Act also established DOER's Leading By Example and the Green Community Grant Program to support capital upgrades in public facilities.



DOER recognized the importance of expanding its efforts throughout the public sector to meet the aggressive new targets.

In 2012, DOER, with financial support from a 2012 U.S. Department of Energy State Energy Program Competitive Award, created the SAPHIRE Program to work directly with public housing and public schools to cut GHG emissions, energy costs, and promote the local clean energy industry. SAPHIRE provides dedicated one-on-one technical assistance to public housing sites and public schools to determine the feasibility of renewable thermal heating upgrades combined with energy efficiency measures. Renewable thermal technologies like biomass heating can save money, generate environmental benefits, and create local jobs. Conversion of a heating system from oil to wood pellets typically results in an 80 to 90 percent reduction of GHG emissions. SAPHIRE also provides technical assistance to public housing sites and public schools on applying for grant funding, utility rebates, or low-cost financing for cost effective projects.

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PROCESS – PROGRAM DESIGN

DOER hired two program managers, each with an ability to coordinate outreach efforts with public housing and public schools organizations. One manager had experience providing technical assistance to local governments on clean energy projects and coordinating Massachusetts' EECBG program; the other had experience in clean energy finance and coordinating clean energy projects in the public housing sector. These two program managers developed a procedure for selecting and financing the most effective energy efficiency and renewable thermal projects in Massachusetts's public housing and public school portfolio.



DOER **SAPHIRE FUNDING**

QUALIFIED ENERGY
CONSERVATION BOND FUNDING
\$10 MILLION

ALTERNATIVE COMPLIANCE
PAYMENT (ACP) FUNDING
\$3.7 MILLION

OTHER SOURCES OF **SAPHIRE FUNDING**

MASS SAVE® UTILITY
ENERGY EFFICIENCY
PROGRAM FUNDING

CAPITAL ASSISTANCE
BUDGETS

SCHOOL IMPROVEMENT
FUNDING

Mass Save® utility energy efficiency program funding, which includes rebates for high efficiency lighting and air-source heat pumps, and interest-free financing for certain types of projects. The Mass Save Low Income Multi-Family program specifically provides incentives for low-income populations such as public housing residents.

Capital assistance budgets for scheduled improvements under the direction of DHCD.

School improvement funding awarded by the Massachusetts School Building Authority (MSBA) through its Accelerated Repair and Major Repair program. The MSBA programs are funded through a small portion of the state sales tax.

PROCESS – IMPLEMENTATION

With staffing and funding in place, program managers began to identify public housing developments and public schools where SAPHIRE could make a big difference. Critical to the success of SAPHIRE was developing partnerships with MSBA and the administrators of the Low-Income Energy Affordability Network (LEAN). Working with MSBA and LEAN helped DOER identify and prioritize schools and public housing buildings for SAPHIRE.

1

PRIORITIZE ENERGY PROJECTS WITH HIGHEST RATE-OF-RETURN



SAPHIRE used web-based software to determine which public housing developments and public schools would provide the greatest opportunities for reductions in energy costs and GHG emissions.

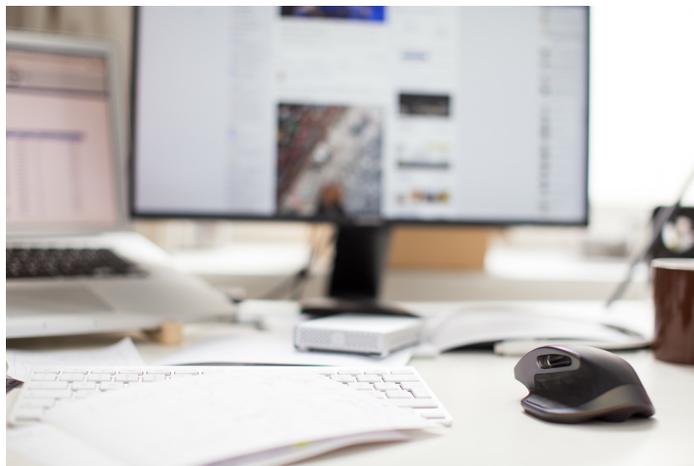
Program managers used this software to benchmark public housing sites and identify properties using heating oil or electric radiant heat and those with relatively high energy use intensities and costs. SAPHIRE also coordinated with DHCD to collect energy utility data

To measure energy performance in public schools, program managers used Mass Energy Insight (MEI), a tool developed by DOER in 2009 with Recovery Act funding. Where MEI did not provide information about a school's primary heating fuel source, SAPHIRE cross-referenced the schools with municipal locations known to have no access to natural gas, and flagged schools that were located in these areas as potential project sites.

DOER also worked closely with the MSBA to identify schools in need of assistance with boiler replacement and building envelope improvements.

2

OUTREACH TO BUILDING OWNERS



Once SAPHIRE selected prime candidates for energy upgrades, the program managers launched a campaign to communicate renewable thermal technology options and their benefits to public housing sites and public schools. Program managers encouraged building managers to apply for a no-cost feasibility study of potential options for converting their heating systems.

SAPHIRE launched a webpage at DOER and presented program information to the Massachusetts Association of Regional Schools, the Massachusetts Association of School Superintendents, and the Massachusetts Facility Administrators Association. Program managers reached out to school superintendents and facility managers through e-mail newsletters and meetings. SAPHIRE produced four different brochures for distribution and made them available on the webpage.

SAPHIRE also collaborated with the Massachusetts School Building Authority and the DOER Green Communities program, to reach their extensive contacts in the public housing and public school communities and magnify outreach.

3

DIRECT TECHNICAL ASSISTANCE

The program managers provided direct technical assistance to public school and public housing representatives in developing capital projects.

SAPHIRE used funding from DOER's State Energy Program Competitive award to provide no-cost feasibility studies to 13 public schools. The program managers then held in-person meetings with the schools to discuss the findings. They discussed multiple renewable thermal technologies, including biomass, geothermal, air source heat pumps, and solar thermal. For each site, SAPHIRE sought the most practical technology with the greatest potential reductions in GHG emissions and energy costs. If sufficient support was found for an upgrade, SAPHIRE offered the school grant funding for up to 75 percent of the cost of construction, capped at \$350,000. Program managers reviewed the schematic designs for construction projects and provided recommendations and comments to ensure compliance with DOER's technical specifications.

No-cost feasibility studies were also provided to public housing developments. Project SAPHIRE used DHCD's existing capital budget and \$2 million in ACP funding to pay for all construction costs. Since DHCD manages its public housing utility bills, energy cost savings realized by the projects reverted back to the DHCD budget as monetary savings.

4

MEASURE ENERGY PERFORMANCE

SAPHIRE tracks building energy performance before and after upgrades. SAPHIRE grants require upgraded schools and housing developments to provide baseline and ongoing energy performance and fuel delivery data. Program managers develop case studies about successful projects to use as communication tools to recruit additional schools and public housing developments to participate in SAPHIRE.



SAPHIRE

PROVIDED NO-COST FEASIBILITY STUDIES TO
13 PUBLIC SCHOOLS



MEASURING SUCCESS

SAPHIRE monitors participants' ongoing energy performance with software tools (including MEI), but also measures success through the following metrics:

- Number of public schools engaged
- Percentage of public school sector engaged
- Number of feasibility studies launched
- Building square footage analyzed by feasibility studies
- Number of active construction projects
- Percentage GHG emissions reduction or tons avoided
- Dollars of potential or realized energy cost savings

OUTCOMES

SAPHIRE facilitated 21 projects in public schools and public housing authorities with a combined annual savings of nearly \$600,000 annually. SAPHIRE reached 38 percent of all regional school districts to communicate program benefits, resulting in 13 feasibility studies of renewable thermal technologies at over one million square feet of school buildings. The feasibility studies yielded seven active construction projects with an estimated total cost savings of \$428,000 annually. The public schools had an overall tendency to select biomass as their preferred renewable thermal technology primarily for financial reasons. The upfront cost for geothermal systems was prohibitive and, since their buildings operate primarily during colder months of the year, geothermal systems would not realize significant savings from building cooling. Once retrofitted, these schools can expect to see 80 percent to 90 percent reductions in carbon emissions by switching from oil heating to wood pellet heating. An additional \$170,000 in potential annual energy cost savings was also identified in those school districts that are still deciding whether to proceed with construction of recommended measures. The project with the biggest GHG emissions savings was the Southern Berkshire

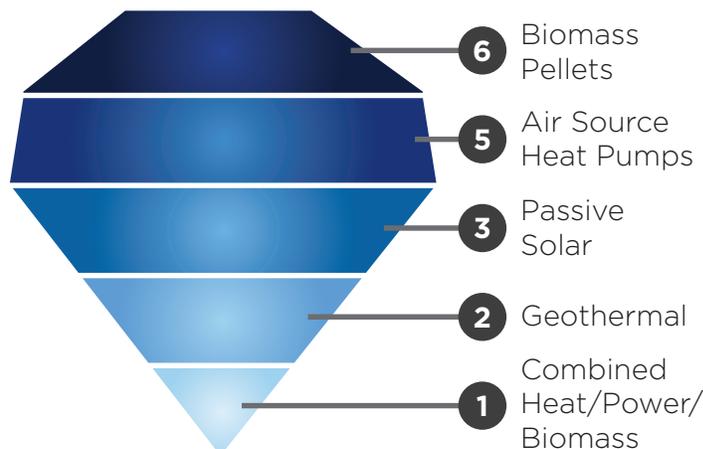
SAPHIRE PROJECTS
ARE SAVING NEARLY
\$600,000
ANNUALLY

Regional school district, whose fuel switching and energy efficiency measures were expected to reduce GHG emissions by approximately 85%.

SAPHIRE facilitated 14 construction projects at public housing developments. Public housing sites installed various technologies, including solar thermal for hot water, air source heat pumps for heating and cooling of apartments, and biomass for centralized heating and hot water. The 14 projects are anticipated to result in combined annual cost savings of \$168,000. The most dramatic decrease in GHG emissions was the showcase project in Montague, where three biomass boilers replaced aging oil boilers, and GHG emissions were reduced by 71 percent.

SAPHIRE resulted in significant GHG and energy cost savings for public schools and public housing developments in Massachusetts. The projects upgraded over 850,000 square feet of schools and public housing developments, resulting in estimated annual savings of nearly \$600,000, and significant GHG reductions of up to 85%. SAPHIRE helps Massachusetts reduce energy costs and meet its energy and climate goals.

NUMBER OF ENERGY EFFICIENCY PROJECTS IMPLEMENTED



TOOLS & RESOURCES

Green Jobs Act of 2008

Green Communities Act of 2008

Heating and Cooling in the Massachusetts Alternative Portfolio Standard: Report to the Legislature December 2012

Global Warming Solutions Act

Clean Energy and Climate Plan 2020

Project SAPHIRE Webpage

Massachusetts Department of Energy Resources

Massachusetts Department of Housing and Community Development

Air Source Heat Pumps Handout (Attachment)

Biomass Heating System Handout (Attachment)

Geothermal Heat Pump Handout (Attachment)

Solar Thermal System Handout (Attachment)