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# Healthy Homes Vermont 2018

EFFICIENCY VERMONT PROGRESS REPORT

October 4, 2019

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## Introduction

### **The Vermont Healthy Homes Story**

Many Vermonters in low-income households are at a greater risk of health problems due in part to the buildings in which they live. The nexus between building energy efficiency and better health is now becoming *the* target for improving housing conditions for vulnerable populations. It is a target shared by both the health and energy sectors, with historical and ongoing support from the social services sector.

This report offers a story of pilot projects under the new Vermont Healthy Homes Program. The projects have demonstrated a successful partnership among those three sectors, applying their respective funding sources and human resources to pave the way for more positive health outcomes for people at risk of respiratory and other conditions exacerbated by inadequate housing conditions. The project concept, with its necessary partnerships, may be scaled to a cost-effective, program-level component of energy efficiency programs statewide, and as a model for other jurisdictions.

### **Common Observations of the Health, Energy, and Social Services Sectors about Housing**

A significant number of Vermont's affordable housing advocates, program managers, and developers want to see increased support for improving the housing conditions of lower-income households. These improvements can involve everything from outdoor infrastructure (wells and septic systems) to building weatherization services, to lead hazard abatement.

The State of Vermont uses its federal Community Development Block Grant funds for housing rehabilitation loans managed by five non-profit housing organizations. U.S. Department of Agriculture Rural Development (USDA) offers home repair grants to qualifying homeowners through its local offices. Funds from each of these sources can be used to make needed improvements, whether the resident is in a single-family house or living in a multi-family unit.

In parallel, the State-administered federal Weatherization Assistance Program (WAP; U.S. Department of Energy and U.S. Department of Housing and Urban Development) not only offers essential building energy improvement services to low-income Vermonters, but also allocates a small portion of funds for each project to cover costs of essential repairs to the home, before installing the weatherization measures. The Low-Income Home Energy Assistance Program (LIHEAP; U.S. Department of Health and Human Services) has long recognized that public subsidies for heating assistance could go further if its programs could address housing conditions that cause excess energy use.

### **The Role of an Efficiency Program in this Nexus**

Efficiency Vermont, Vermont's statewide energy efficiency utility, currently has residential energy improvement programs that use the State's building codes to incorporate health and safety standards in the building energy improvement projects it supports. These programs also incorporate additional requirements that comply with national program standards.

For example, Efficiency Vermont's current Home Performance with ENERGY STAR® Program<sup>1</sup> (HPwES) uses health and safety requirements defined by the Building Performance Institute's (BPI) Building Analyst standard.<sup>2</sup> These are the same requirements specified by the U.S. Environmental Protection Agency and the U.S. Department of Energy.

Efficiency Vermont contracts with the state's five WAP partners to install electrical efficiency measures, and to provide electrical efficiency coaching to occupants when providing VT Office of Economic Opportunity (OEO)-funded thermal efficiency coaching. The efficiency coaching created by VT OEO, which oversees the federal and state WAP providers, covers health and safety information and coordinated referrals for housing rehab, health, social service, and energy efficiency needs. In 2014, VT OEO, launched the One Touch program to electronically manage the referrals among the WAP partners, Efficiency Vermont, and community-based organizations. Residents in more than 1,200 single-family homes have participated in the One Touch survey program; 25 percent of those surveys have triggered a health or housing referral.

### **The Role of a Social Service Agency**

In 2016, NeighborWorks of Western Vermont (NWWVT), a local homeownership and housing rehab center began combining Efficiency Vermont's HPwES energy efficiency incentives with Rutland Regional Medical Center's in-home asthma program, for shared customers. The Vermont Department of Health and a grant from the medical center's community benefits fund support the program by delivering integrated home energy and building rehabilitation program services for 55 patients with asthma, chronic obstructive pulmonary disease or home mobility challenges. NWWVT partnered with the Vermont WAP and BROCC, a local WAP affiliate, in delivering weatherization-plus-health services to low-income pilot customers.

### **How the Evidence Informed the Resulting Intentional Collaborations**

In 2017, Efficiency Vermont created the Healthy Homes Opportunity Assessment to explore the opportunity for further engagement with Vermont's healthcare community beyond facility-related energy efficiency. Efficiency Vermont designed the assessment to inform possible collaboration models that could resolve some of

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<sup>1</sup> U.S. Environmental Protection Agency and the U.S. Department of Energy, n.d. "About Home Performance with ENERGY STAR."

[https://www.energystar.gov/index.cfm?c=home\\_improvement.hpwes\\_sponsors\\_about](https://www.energystar.gov/index.cfm?c=home_improvement.hpwes_sponsors_about).

<sup>2</sup> Building Performance Institute, n.d. "Current Standards."

<http://www.bpi.org/standards/current-standards>.

Vermont's residential energy efficiency challenges related to indoor environmental air quality. The assessment identified market gaps and barriers, and areas where Efficiency Vermont could meet partner goals while advancing its own service mission and meeting regulatory metrics for program performance.

From the assessment, Efficiency Vermont established the Healthy Homes Vision: ***Through energy efficiency, Vermont homes are safe, affordable, comfortable, durable, and resilient. These attributes result in improved population health and a reduction in greenhouse gases.***

The following Healthy Homes program objectives support the vision:

- 1. Providing cost-effective services that improve indoor environmental quality while reducing energy burden***
- 2. Increasing benefits through strong healthy-home collaborations and partnerships***
- 3. Efficiency Vermont becomes a creditable and valued leader in the health / energy nexus***
- 4. Efficiency Vermont creates a clear policy advocacy and regulatory strategy for healthful, affordable homes.***

To meet program objectives and support its vision, Efficiency Vermont leveraged existing partnerships with the Vermont WAP, the Department of Health, community organizations, and hospitals to establish a Healthy Homes Program incorporating the following specific aims:

- Creation of a roadmap for integrating healthy-home principles and resources into all of Efficiency Vermont's residential program designs and services, and document processes for each program or housing type, to enable market-wide consistency and transparency
- Build a culture of healthy homes in Vermont by raising awareness with consumers, health care providers, and building contractors on the connections among indoor environmental quality, energy efficiency, and health
- Launch pilots testing how a collaboration among health care providers, weatherization programs, and Efficiency Vermont can use a [Weatherization Plus Health](#) service approach for customers with chronic respiratory illness, remediating fall hazards in customers' homes, improving housing quality and indoor air quality, and tracking health outcomes from these services
- Use industry research to quantify the health-related non-energy benefits of low-income weatherization retrofits
- Expand the use of One Touch to new partner organizations and consumer markets
- Identify health-specific and indoor environmental quality-specific products with opportunities for energy efficiency improvements; these products can range from oxygen concentrator equipment to whole-house balanced ventilation and advanced kitchen ventilation

- Evaluate program data for indoor environmental quality metrics and create new tracking procedures for measuring and reporting indoor air quality before and after energy efficiency services

## Background and Significance: Healthy Homes Principles, Efficiency Practice

Living conditions have an effect on health.<sup>3,4</sup> Nationwide, government health departments, health care providers, and social workers are now providing multi-trigger, multi-component interventions to reduce building occupant exposure to indoor asthma triggers and deteriorating lead paint. Several of these partnerships involve Home Performance and weatherization contractor networks. They also address chronic emphysema and bronchitis. The list of other illnesses affected positively by comprehensive residential building retrofits covers non-respiratory conditions such as multiple chemical sensitivity, chronic chill, hypertension, allergies, mental health, and arthritis.

### Healthy Homes and Vermont Housing Stock

The U.S. Centers for Disease Control and Prevention (CDC) and the National Center for Healthy Housing (NCHH) define a *healthy home* as one that is: dry, clean, safe, well ventilated, pest free, contaminant free, maintained, and thermally controlled.

### 8 Healthy Homes Principles



Principles: U.S. Department of Housing and Urban Development  
Graphic: airmid

Figure 1. Attributes of healthy homes.

NCHH describes the characteristics of Vermont houses comprehensively, through its *Vermont 2017 Healthy Housing Fact Sheet*.<sup>5</sup>

- **Essential characteristics.** The age of an average Vermont home is 66 years. A significant number of those houses are cold in winter, have high air leakage, and have basement moisture problems for at least some of the year.

<sup>3</sup> Krieger, James., and Donna Higgins, 2002. "Housing and Health: Time Again for Public Health Action," *American Journal of Public Health* 92 (5):758-68.  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1447157/>.

<sup>4</sup> Wilson, Jonathan, David Jacobs, Amanda Reddy, Ellen Tohn, Jonathan Cohen, and Ely Jacobsohn, 2016. *Home Rx: The Health Benefits of Home Performance*. U.S. Department of Energy.  
<https://betterbuildingsolutioncenter.energy.gov/sites/default/files/attachments/Home%20Rx%20The%20Health%20Benefits%20of%20Home%20Performance%20-%20A%20Review%20of%20the%20Current%20Evidence.pdf>.

<sup>5</sup> Here is the link to the fact sheet: [https://nchh.org/resource-library/Healthy-Housing-Fact-Sheet\\_VT.pdf](https://nchh.org/resource-library/Healthy-Housing-Fact-Sheet_VT.pdf)



Many Vermonters struggle to maintain comfortable indoor living temperatures in both the winter and summer. Thirty percent of children live in households with a high housing cost burden; and 13 percent of Vermont children live in poverty.

- **Condition of houses.** Deferred maintenance is common to houses in poor condition. Many homes have lead paint, asbestos insulation (or other asbestos-containing materials), active knob-and-tube wiring, and other known and unknown hazardous building materials. Sixty percent of Vermont housing is likely to contain lead-based paint. More than a quarter (27 percent) of the housing was built prior to 1940. In 2015, 585 Vermont children who received blood lead screenings had elevated blood lead levels (5 µg/dL or higher).
- **Conditions in the home: Pests.** Mice and other rodents create chronic pest issues for homeowners in Vermont, and there are few certified integrated pest management companies.
- **Conditions in the home: Contaminants.** Tens of thousands of untested and unregulated chemicals are on the market. It is challenging for any consumer to live contaminant-free in a home.
- **Chronicity.** Low-income Vermonters are especially likely to live in poor-quality housing, which exacerbates adverse health conditions. Finding ways to alleviate symptoms or ways to fund routine home maintenance for Vermonters on Medicaid is also challenging. Medicaid recipients are three times more likely to visit an emergency department for asthma than those on other insurance.
- **Respiratory problems.** In Vermont, 11 percent of adults and 8 percent of children have asthma. Of these, 80 percent have two or more indoor environmental triggers at home. One in eight Vermont homes has elevated levels of indoor radon. One in every three adults aged 65 and older falls each year in a Vermont home.

Efficiency Vermont supports utility ratepayers in meeting their energy goals *while also ensuring that home energy upgrade projects consider the eight principles of a healthy home.*

## Methods: The First Healthy Homes Pilot Project

Efficiency Vermont collaborated in 2017 with the Vermont WAP to locate an appropriate WAP provider and a hospital to design and launch the Healthy Homes Vermont Pilot. This process involved (1) building on the gaps identified in the Healthy Homes Opportunity Assessment, (2) using lessons from health impacts of energy

efficiency research,<sup>6</sup> (3) examining weatherization-plus-health programs such as the Washington State Weatherization Plus Health program<sup>7</sup> and the NWWVT and Rutland Regional Healthy Homes Initiative, and (4) becoming familiar with Vermont's One Touch data set<sup>8</sup> and its potential for data analysis.

By fall 2017, Efficiency Vermont, Northeastern Vermont Regional Hospital (NVRH), Vermont WAP, and the Northeast Employment and Training Organization (NETO), the local WAP affiliate, agreed to collaborate on a 10-home weatherization-plus-health pilot. Planning continued into early winter. The team drafted a project charter and determined process flow.

The pilot sought to quantify the effects of efficiency-plus-health measures on patients, health care providers, and weatherization service providers. The objective was to expand Vermont-specific evidence related to the intersection of energy efficiency and health, so that this evidence could inform future policy and program decisions.

### **Pilot Process**

NVRH identified patients with severe COPD or uncontrolled asthma,<sup>9</sup> and whose household incomes made them eligible for WAP services (that is, their incomes are at or below 80 percent of area median income, or AMI). These households' occupants did not smoke or have any known occupational or recreational exposures causing respiratory symptoms. They owned their homes or were cooperative property owners and were willing to participate in the education program and quality valuation study.

NVRH then conducted an initial home environmental assessment and a self-managed care coaching visit to each patient, explaining the program. The assessment process also involved patient support in completing the WAP application and pilot consent form.

NETO qualified the patient for WAP customer services and scheduled a walkthrough of the home, accompanied by an Efficiency Vermont Healthy Homes consultant who holds a BPI HHE credential. Together, NETO and Efficiency Vermont identified energy-plus-health opportunities for the home, in consultation with the customer. Efficiency Vermont installed air quality monitoring equipment to measure indoor and outdoor fine particulate matter (PM 2.5), relative humidity, temperature, home-dependent nitrogen dioxide, and indoor radon and carbon dioxide (CO<sub>2</sub>). The air quality test results informed the energy-plus-health scope of work.

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<sup>6</sup> Wilson, J., et. al. Home Rx: The Health Benefits of Home Performance, US DOE, December 2015.

<sup>7</sup> <https://www.commerce.wa.gov/growing-the-economy/energy/weatherization-and-energy-efficiency/matchmaker/weatherization-plus-health-wxh/>

<sup>8</sup> [https://data.surveygizmo.com/r/541053\\_5bd5b84b85bb51.74060046](https://data.surveygizmo.com/r/541053_5bd5b84b85bb51.74060046)

<sup>9</sup> Defined as One or more unscheduled emergency/hospital or urgent care visits in past 12 months for asthma and/or COPD acute exacerbation, 2 or more per year primary office visits for asthma and/or COPD symptoms, and/or 2 or more refills of rescue inhalers in last 12 months.



When appropriate, NVRH, NETO and Efficiency Vermont supported or will support the customer in coordinating, as needed, Medicaid's Choices for Care for in-home cleaning, Vermont's Healthy & Lead-Safe homes Program,<sup>10</sup> USDA Rural Development programs,<sup>11</sup> and others.

Efficiency Vermont managed the project, coordinating services as needed between NETO and the partner organizations. NVRH, NETO / Vermont WAP, and Efficiency Vermont paid for supplies and repairs.

NVRH conducted pre- and post-project health surveys to monitor changes in medical needs and quality of life. NETO tracked pre- and post-project energy use, and Efficiency Vermont conducted pre- and post-project air quality monitoring.

## Research Questions: How Effective?

The combination of home weatherization-plus-healthy-home repair measures and in-home patient education on energy practices is expected to reduce symptoms and acute exacerbation events for low-income COPD and asthma patients and improve patient mental health. The following questions pertain from this assumption:

1. **Lowering medical costs.** To what extent will reducing acute exacerbation events for patients also reduce the use of Medicaid and / or insurance services?
2. **Enhancing air quality.** To what extent will indoor air quality improve as a result of home weatherization-plus-healthy-home repair measures?
  - o This question will consider changes in PM 2.5, carbon dioxide (CO<sub>2</sub>), relative humidity, temperature, and radon levels.
3. **Targeted and whole-house ventilation vs exhaust-only ventilation.** To what extent do homes receiving spot-balanced ventilation offer improvements in indoor air quality and health, compared to homes receiving only exhaust-only spot ventilation:
  - o This question will also consider the effects of whole-house-balanced ventilation system measures on IAQ and health.
4. **Healthcare financial support for energy plus health.** Do health care partners accept as reasonable the full program costs of providing weatherization-plus-health measures and in-home patient education as a supplement to traditional treatment and medication programs for patients with severe COPD / asthma?

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<sup>10</sup> Offered by the Vermont Housing & Conservation Board. <https://vhcb.org/our-programs/healthy-lead-safe-homes>

<sup>11</sup> The most relevant service for individuals is USDA's Single-Family Housing Repair Loans & Grants program, <https://www.rd.usda.gov/programs-services/single-family-housing-repair-loans-grants>. Other loan programs might also pertain, depending on the customer's specific needs. <https://www.rd.usda.gov/programs-services>.

- This question will also consider the costs plus the administration of partnerships with weatherization agencies and health care providers.
- This question will consider the answers in the context of improved outcomes for high-risk COPD / asthma patients.

## Analysis and Discussion: Pilot Under Way

By the end of 2018, NVRH screened seven patients with home visits.<sup>12</sup> Of those, three met the initial eligibility criteria for the program, and two were a good fit.

The eligible patient who was not a good fit for the program had previously received weatherization services from NETO and Efficiency Vermont. That person was in declining health and chose not to receive the additional plus-health scope. NVRH continues to support that customer with aging-in-place services and self-managed care coaching.

Of the four ineligible patients, one will become eligible, once the home is put into the patient's name and once the patient addresses a hoarding problem in the home. NVRH supported the customer in determining a pathway for transferring the title of the home and continues to work with the customer on clutter reduction and self-managed care coaching. NVRH hopes to enroll the patient into the program in 2019. Efficiency Vermont and NETO provided this customer with electrical efficiency upgrades, including a new heat-pump water heater (HPWH), refrigerator, washing machine, and LED bulbs. They also conducted a healthy-home energy visit to help the customer identify simple no- and low-cost modifications that can increase the healthfulness of the home.

The following two pilot homes participated in the Healthy Homes pilot:

### **Pilot Home 1**

Pilot Home 1 is a typical farmhouse, built around 1901 on a rubble foundation with later additions on poured concrete foundation. The Efficiency Vermont project team identified the following energy-plus-health opportunities:

- Basement dampness and rodent activity
- Need for wall and attic air sealing and insulation
- Rodent activity in living spaces
- Need for a return air-to-air handler
- Need for rust-free supply ductwork
- Inefficient wood stoves, water heater, and freezer
- Faulty gas stove / oven
- Musty carpet in an office

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<sup>12</sup> One member of the NVRH team had controlled asthma. Without exception, after that team member visited each home, the team member had an asthma attack.

- Clutter and excessive trash throughout
- Lead paint
- Two dogs sleeping in patient bedroom

Figure 2 and Figure 3 capture Pilot Home 1 conditions, before the project began.



Figure 2. Pilot Home 1 basement conditions, prior to the project.



Figure 3. Pilot Home 1 living spaces, prior to the project.

Figure 4 and Figure 5 show air quality monitoring results prior to Pilot Home 1's energy-plus-health retrofit. The Efficiency Vermont team completed the

monitoring in June 2018, with outer doors and the windows shut and air conditioning on.

Instruments used included a Dyls 1700 particulate sensor, CO2meter.com CO2 1% CO2, relative humidity and temperature meter (CM-0016), and Hobo U32 Pro V2 relative humidity and temperature sensor. AirChek 3-7 day activated charcoal kits were used for testing radon levels in the basement and on the first floor, and UMEX 200 passive samplers were used for indoor and outdoor NO<sub>2</sub> sampling. Radon and NO<sub>2</sub> results were below action limits.

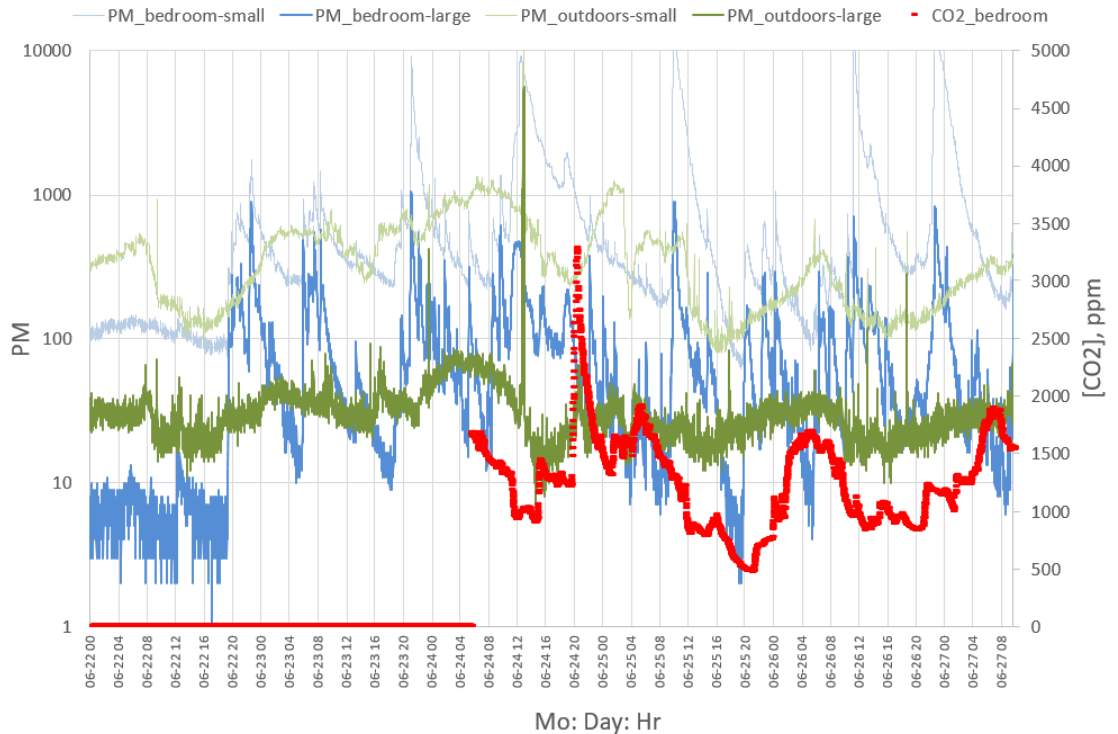


Figure 4. Pilot Home 1 indoor and outdoor PM (particle count) and CO<sub>2</sub> levels, prior to the retrofit project. (note: Small particles = 1+  $\mu\text{m}$  and Large particles = 5+  $\mu\text{m}$ )

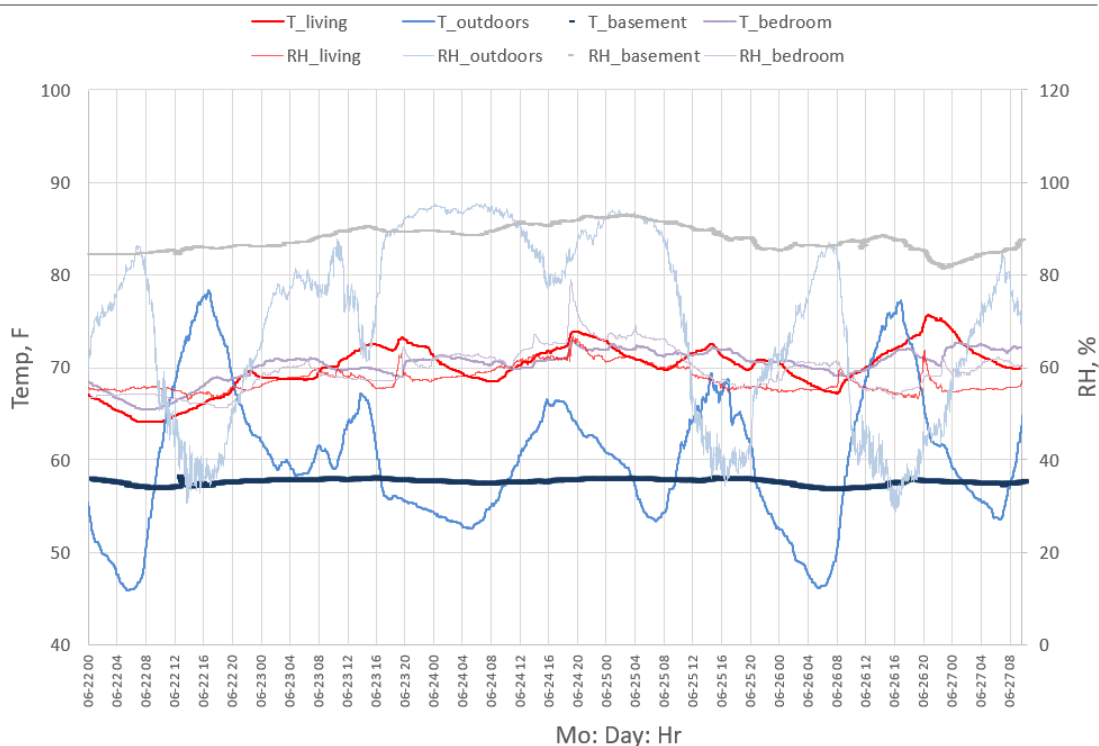


Figure 5. Pilot Home 1 indoor and outdoor temperature and relative humidity, prior to the retrofit project.

NVRH provided self-management coaching and connected the patient with additional in-home care services:

- Housecleaning
- Green cleaning supplies and recipes
- A wedge pillow for improved breathing
- A new mattress cover and pillow covers
- A HEPA vacuum and replacement bags
- A spot HEPA air purifier for the bedroom

The energy-plus-health scope of work also involved:

- Trash hauling
- Moisture management
- Thermal shell air sealing and insulation
- Heating system cleaning and ducting improvements
- Replacement of the gas stove with an electric one
- Conversion of the wood stove to a high-efficiency pellet stove, and removal of a second wood stove
- Electrical efficiency upgrades (new freezer, lighting, HPWH)
- Lead abatement and advanced ventilation through ducted HRV with MERV 13 filtration

Figure 6 offers two images of the basement, following inspection and repairs.





*Figure 6. Pilot Home 1 basement encapsulation and repairs.*

The project team had worked with the Vermont Healthy & Lead-Safe Homes Program to have the home tested for lead and a scope of work developed for lead abatement. Despite all partners working to move the project along as quickly as possible, the lead program inspection schedule and scoping delayed the attic and living space energy efficiency upgrades by four months. Later, the energy efficiency upgrades were delayed another six months because the weatherization team had capacity constraints in their schedule.

The Healthy & Lead-Safe Homes Program subsequently had to respond to emergency cases, which postponed and reduced the funding available for lead remediation at Pilot Home 1. The project team has since determined future collaborative process improvements for other projects that will allow smoother and more rapid action in achieving the lead remediation goals. Although the challenges are likely to persist because of each respective program's requirements, the project team is still considering coordination improvements.

The project team anticipates finalizing project installations in the summer of 2019, completing post-retrofit health surveys then and conducting post-retrofit air quality testing in the summer or winter of 2019. The success of that work will depend on the residents' use of air conditioning during the summer (the aim is to retest when the home is in a "closed" condition).

### **Pilot Home 2**

Pilot Home 2 is a 1980s manufactured home with an addition on a wood foundation. Pilot Home 2 had previously received weatherization services involving underfloor and attic insulation, improved dryer ducting to the outdoors, furnace cleaning and tuning, kitchen ventilation, a new electric water heater, and duct



sealing in the crawlspace. At the time of the weatherization project, the home did not require additional bathroom ventilation.

The well pump was located under the floor of the bedroom closet and had been air sealed and insulated outside the building's thermal envelope. After the initial weatherization project, the homeowner had noticed ice build-up on the well pump piping and decided to remove the flooring of the closet to provide heat to the pump. In doing this, the homeowner opened the conditioned living space to the unconditioned and uninsulated crawlspace. Subsequently, the homeowner was no longer able to use the bedroom in the winter and instead used the room for storage, closing it off to the rest of the house.

The project team determined that Pilot Home 2 was a good candidate for addressing the following energy-plus-health issues:

- Exterior drainage issues along foundation and movement of the ground poly cover under the home
- Crawlspace humidity and pests with connectivity to living space through ductwork
- Moving well-pump into conditioned space and sealing penetrations and hole in closet floor
- Missing threshold between the addition and the original home, creating a trip hazard
- Bathroom plumbing leak at the sink
- Inadequate bathroom ventilation
- Highly fragrant personal care and cleaning products
- Pet challenges from three cats, one bird, fish, and one dog (with poor house training)

**Figure 7** and **Figure 8** show conditions in Pilot Home 2, prior to the energy-plus-health retrofit project.



*Figure 7. Pilot Home 2's bedroom closet, prior to energy-plus-health project.*



*Figure 8. Pilot Home 2's bathroom, showing plumbing leak containment, cleaning supplies, and ventilation fan, prior to the energy-plus-health project.*

**Figure 9** shows Pilot Home 2's crawlspace conditions prior to the energy-plus-health retrofit.



*Figure 9. Crawlspace beneath the manufactured home, showing exposed plumbing and inadequate sealing and insulation.*

During the program, the resident of Pilot Home 2 had received a high-efficiency stacked washer and dryer. The resident decided to self-install the unit but did not connect the NETO-provided dryer vent to the new dryer, instead placing a mesh bag over the dryer outlet. Efficiency Vermont coached the resident on why the vent was needed and encouraged the occupant to line-dry clothing until NETO could help with proper venting installation.

**Figure 10** and **Figure 11** show air quality monitoring results prior to the energy-plus-health retrofit. The monitoring was completed in October 2018 with the home closed, and with the new dryer installed without proper ventilation.

The same monitoring devices were used as in Pilot Home 1. The radon and NO<sub>2</sub> levels were below action limits.

# Healthy Homes Vermont 2018

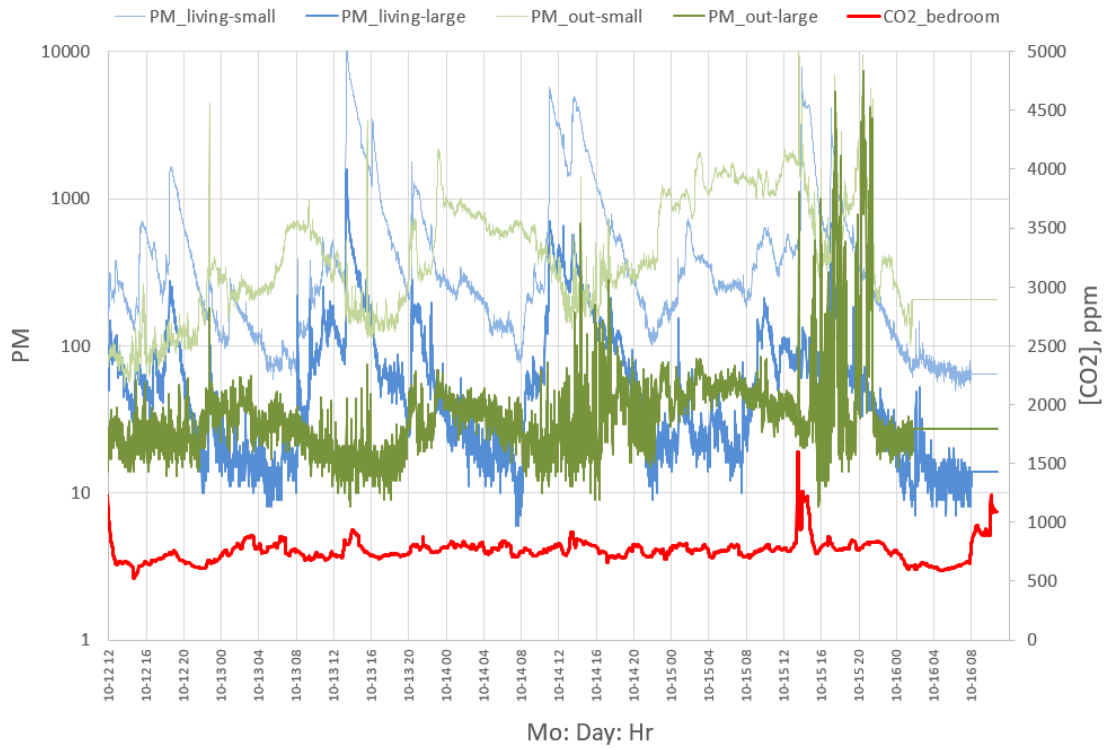


Figure 10. Pilot Home 2's indoor and outdoor PM and CO<sub>2</sub> readings, prior to the energy-plus-health retrofit.

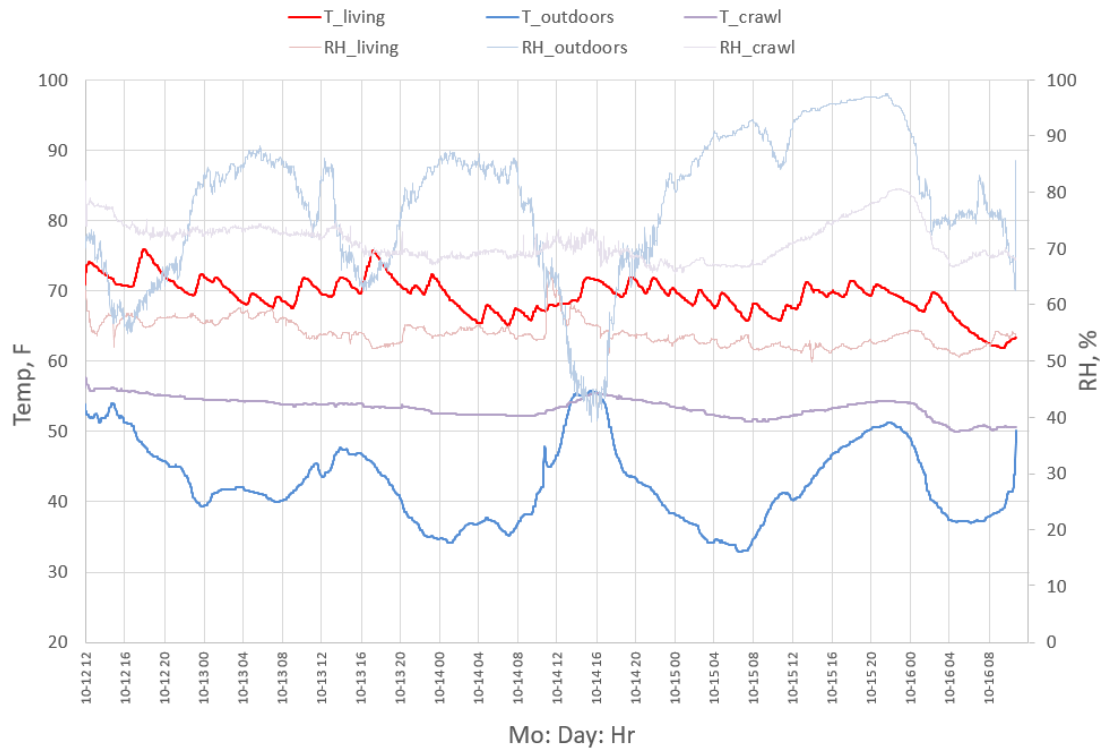


Figure 11. Pilot Home 2's indoor and outdoor temperatures and relative humidity levels, prior to the energy-plus-health retrofit.

NVRH coached the patient on self-management, connecting the patient with additional in-home care services. Like the patient in Pilot Home 1, the patient in Pilot Home 2 received:

- Cleaning support
- Natural, non-toxic cleaning supplies
- Wedge pillow for respiratory support
- A new mattress cover and pillow covers
- HEPA vacuum and replacement bags
- A spot HEPA air purifier for the bedroom

The energy-plus-health scope of work involved:

- Encapsulating and insulating the crawlspace
- Fixing the bathroom leak
- Properly venting the new clothes dryer
- Improving bath ventilation
- Moving the well-pump into the bedroom closet
- Resealing the closet floor.

For the crawlspace, the project team decided to put poly on the floor and line the walls with a combination of rigid foam and closed cell spray foam. Because it was November at the time of the scheduled installation, the team deferred the spray foam installation to the summer of 2019. The rest of the project proceeded to completion, and the homeowner reported the following improvements in quality of life: increased indoor comfort, the ability to use the bedroom in the home all year, and the ability to take a shower in the morning. The project team anticipates completing post-retrofit health surveys in the summer of 2019, and post-retrofit air quality testing in the winter of 2019.

## Next Steps

### **Continuing the Pilot in 2019**

The partners plan to conduct energy-plus-health retrofits on eight more homes in 2019. The expansion of scope will come from distributing new program flyers and reaching out through the hospital and surrounding health care provider offices to recruit more patient candidates. Efficiency Vermont will repeat team member training to facilitate team building and ensure consistent program processes. All partners have agreed to continue the program, pending availability of funds.

### **Expanding to Springfield in 2019**

In 2018, the Vermont Department of Health Asthma Program extended grant funding to Springfield Hospital for in-home asthma self-managed care education and trigger reduction. The Vermont WAP agreed to continue its partnership with Efficiency Vermont, and thus confirmed funding for SEVCA, the local WAP affiliate,

to work with Efficiency Vermont and Springfield Hospital on a 10-home weatherization-plus-health pilot for uncontrolled asthma customers. The partners anticipate launching that pilot in early 2019, using the same process as the NVRH / NETO / Efficiency Vermont pilot.

### **An Opportunity with the University of Vermont**

Using results from the One Touch data, the Vermont WAP identified an opportunity to partner with the University of Vermont Medical Center's Falls and Fires Prevention program and the Vermont Department of Health Injury Prevention program<sup>13</sup>. The partnership plans to add falls prevention measures at the time of weatherization, if crews notice opportunities for reducing fall hazards in homes. Falls are the leading cause of death by unintentional injury in Vermont, and account for many hospitalizations and emergency department visits. Efficiency Vermont will support the pilot with program management and anticipates a launch in early 2019.

## Conclusions: Promising Early Results

The initial pilot findings and results show promise for patient health improvements and increased program collaboration in addressing energy-plus-health needs of low-income Vermonters. Early results for the ongoing work confirm:

- Partnering with the NVRH Community Health Team, and the Department of Health to provide high-quality leads to energy efficiency programs
- Residents benefit from ongoing coaching on how to operate and maintain a home for optimized indoor environmental quality and energy performance.
- When community programs collaborate with appropriate partners to achieve health- and energy-related goals, they reduce individual program administrative burden and can leverage energy funds that help to improve indoor environmental conditions. Nevertheless, there is still room for streamlining processes.
- Health stakeholders like the Department of Health and healthcare providers like hospitals are very interested in how to deploy and leverage the energy workforce to improve home environmental conditions and experimenting with these approaches to address upstream health needs
- The energy-plus-health pilot program responds to recommendations from a 2013 report of the Thermal Efficiency Task Force to the state legislature.<sup>14</sup> Its results in 2019 will further inform the value of this work and answer the research questions posed in this progress report. Dissemination of these results will also add significant value to the parts of the health care industry that address respiratory illness.

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<sup>13</sup> One Touch data. [https://data.surveygizmo.com/r/541053\\_5bd5b84b85bb51.74060046](https://data.surveygizmo.com/r/541053_5bd5b84b85bb51.74060046)

<sup>14</sup> Vermont Department of Public Service, 2013. *Thermal Efficiency Task Force: Analysis and Recommendations. A Report to the Vermont General Assembly: Meeting the Thermal Efficiency Goals for Vermont Buildings.* [https://publicservice.vermont.gov/sites/dps/files/documents/Energy\\_Efficiency/TETF/TETF%20Report%20to%20the%20Legislature\\_FINAL\\_1\\_15\\_13\\_2.pdf](https://publicservice.vermont.gov/sites/dps/files/documents/Energy_Efficiency/TETF/TETF%20Report%20to%20the%20Legislature_FINAL_1_15_13_2.pdf).