



Comments to Efficiency Maine on Triennial Plan VI

June 26, 2024

College of the Atlantic has set the goal to eliminate fossil fuel consumption campus-wide by 2030. Over the past three years, we have reduced the fossil fuel consumption and resulting carbon emissions of our buildings by roughly 50% per square foot, based on heating oil and propane bills. Our strategy has involved air sealing and insulating existing buildings combined with electrifying our heating and hot water systems with heat pumps, and generating electricity with local solar. Meanwhile, new buildings we have constructed have exceeded building codes and approached Passive House standards for insulation and air-tightness.

We have worked with a variety of Efficiency Maine's qualified contractors, and have become an EMT residential registered vendor ourselves as we have increasingly led our own projects using student and staff labor. As the Director of Energy, I have taught 'Building Science and Energy Auditing' training students to conduct home energy audits, and a hands-on 'Practicum in Sustainable Energy' where we have directly implemented energy improvements. Over the past two years, more than 50 students have participated in projects helping to conduct energy audits, air seal, insulate and install vapor barriers in our buildings on campus.

In 2022, we participated in Efficiency Maine's pilot program for Commercial Split System Heat Pump Water Heaters, led by Ridgeline Energy Analytics. Through this program, we installed a heat pump water heating system for the domestic hot water in our largest dorm, which houses 56 students. We didn't have an adequate source of waste heat in the building, so our system uses outside air as the heat source, with four compressors located outside and four storage tanks in the basement. This system has been operational for more than a year, demonstrating its capabilities year-round.

We also participated in an Efficiency Maine pilot program for whole-house ducted heat pumps. After successfully installing a unit through the pilot program in one of our off-campus houses, we hired the same contractor to install two whole-house ducted heat pumps to replace a kerosene furnace in one of our older 'cottages' on campus. This system saved more than \$5,000 in heating costs (after accounting for the increased electricity usage) in its first winter.

We have participated in Efficiency Maine rebate programs for heat pumps, heat pump water heaters, weatherization, and EV chargers in addition to the two pilot programs mentioned. While our overall experience has been great, we have some recommendations to improve offerings, increase energy savings and have greater impact moving forward. I would be happy to have a follow-up conversation or provide additional details about any recommendations included.

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1. What discrete initiatives might we be missing?

- A. EPA WaterSense (low-flow) shower heads: These are the single most cost-effective energy improvement. For a typical family of 4, switching from 2.5gpm to 1.5gpm shower heads will save 10,000 gallons of water and 35 gallons of heating oil, 46 therms of gas, 51 gallons of propane or 400-1,200kWh each year, based on 30 minutes with the shower running/day.

Efficiency Maine should set the goal of replacing every shower head in Maine with a WaterSense shower head by 2030. These are available for as little as \$5 each from Conservation Mart:

<https://www.conservationmart.com/water-savings/low-flow-showerheads/>

With ~750,000 homes, ~50,000 guest lodging rooms, and ~100,000 dorms, nursing homes, and other beds throughout the state, there are between 1.5 and 2 million showers statewide. Replacing all the showerheads would cost less than \$20 million (at \$10/each), but would save more than 2.5 billion gallons of water and 1 trillion BTU (equivalent to 9 million gallons of heating oil at 85% efficiency or 104,000 MWh if every one was heated with a heat pump water heater) each year. This type of 'low-hanging fruit' needs to be prioritized to reduce statewide carbon emissions as quickly as possible. Every hardware store in the state should have a bin of discounted (\$0.99?) 1.5 GPM showerheads next to the checkout.

- B. Please create a weatherization program for small commercial buildings: Currently Efficiency Maine offers no support for small businesses trying to air seal and insulate their buildings. The custom thermal program has a minimum threshold equal to saving ~3,000 gallons of heating oil each year. There are thousands of small businesses (law offices, dentists, doctors, etc) across Maine that are in old homes. Many of these are old Victorians, some of the least efficient buildings in the state. If these buildings were still being used for residential purposes, they would be eligible for \$4,000-\$8,000 in rebates. Instead, they aren't eligible for anything. Many businesses are less energy-conscious than a typical family (they want their employees and customers to be comfortable and happy), and cranking up the heat is an easy way to keep people happy, and less expensive than hiring someone new. This makes these buildings one of the most important to air seal and insulate, to achieve the most energy savings. There are businesses in old buildings like this in every town across the state.
- C. K-12 energy efficiency and clean energy education (details below under workforce development)
- D. Electric bike rebates (details below under EVs)
- E. Support for Window Dressers insulating window inserts. These reduce drafts, significantly improve window R-value, reduce radiative heat loss so that occupants feel



warmer, and eliminate window condensation and the resulting mold and mildew that grows. www.windowdressers.org Each window insert adds ~R-2, tripling the R-value of a single-pane window or doubling the efficiency of older double-pane windows. Each one will save 5-10 gallons of heating oil each year (depending on window area and existing window type), and they cost less than 1/10th as much as replacement windows. We were quoted 30x more for triple pane windows (not including installation) than it cost to make Window Dressers for all the windows in a single building.

What alternative approaches to organizing these programs should we consider? What are the most important program aspects that the Plan should maintain and what program elements might we consider changing?

- Please set long-term goals that align with Maine's Climate Goals. We need to transition every home and business off of fossil fuels by ~2045 (sooner would be better). This will require weatherizing 750,000 homes and 150,000 small businesses over the course of ~20 years. **How do we scale up to weatherizing 50,000 homes and businesses every year?** The urgency of climate change is increasing, and the most important step we can take is to eliminate fossil fuel use. This requires an economy-wide transition, and engaging in cross-sector collaborations with many other industries like real estate, finance, education, etc.
- For residential improvements, please increase the requirement (in the weatherization requirements checklist) for basement/crawlspace insulation to include the entire foundation wall. The current requirement to insulate 2' below the frost line is inadequate. Concrete and granite conduct heat rapidly. 6-8" of granite or concrete has a lower R-value than 1" of wood, which is considered a thermal bridge. Below the frost line, the ground is still only 33-40 degrees. This portion of basement walls (in a 1,200sf basement) can lose heat equal to 300 gallons of oil each year. Spray foam (or other insulation types) should be required from floor to ceiling in basements and crawl spaces. Home owners will generally only have a spray foam contractor on site once, so we should require them to do it right. It is very worthwhile to spray foam the bottom half of a basement wall, and typically has a payback of 4-6 years.

2. Innovation:

What emerging technologies, operational or behavioral conservation measures, or grid support/load management strategies should we consider for future Innovation Program pilot projects?

- K-12 Energy efficiency education (details below under 'workforce development')
- EPA WaterSense showerheads (details above)

3. Public Information and Outreach:

In what specific ways could we improve these resources and services? What examples from other entities should we consider?

- The goal is to transition every home and business in Maine entirely off of fossil fuels. Make this the headline, show people what they can do to achieve this. At COA, we have



created a simplified process - '10 Steps to a Zero-Emissions Home', showing how to transition any home in Maine off of fossil fuels

(<https://docs.google.com/document/d/1MtBRmvYsPNVvsz9cJdGiaWeOFV2hqQ2v5Pn9UHeelLc/edit>). Please include a similar overview in your marketing for residents and businesses. People need to see the 'big picture' - the goal of zero carbon emissions - with an easy process for how to get there.

- Partner with low-income programs (LIHEAP, WIC, SNAP, etc) to distribute EMT rebate information directly to the program participants. Send quarterly mailers to low-income households participating in these programs with details on the (free) heat pump water heater, (80%) rebates for heat pumps and weatherization, and loan details for how they can install these energy-saving systems with NO upfront cost. Include information on the entire process - how they can transition their home entirely off of fossil fuels.
- Partner with local banks and credit unions to offer efficiency/clean energy loans at all their retail branches, then help the banks to advertise them. People should see advertising for 'home efficiency loans' at every bank and credit union in the state, with information on rebates, tax credits and other incentives available.

4. Evaluation, Measurement and Verification:

- EM&V is important. No recommendations at this time.

5. Workforce:

Please comment on training needs of the energy efficiency workforce. Please also share any recommendations about the approach the Trust's Plan should take to support workforce training.

- Fund K-12 energy efficiency education to create a pipeline of future workers. It is essential for students to learn about energy efficiency and career opportunities in the weatherization, heat pumps, and clean energy sector at the middle and high school level in order to know that these are careers available in Maine. This was identified as a need in the 2022 Maine Clean Energy Workforce Report. As part of the curriculum, these students can perform basic energy assessments of their homes and their schools, identifying energy improvement opportunities, and will take home information on Efficiency Maine's rebate programs, providing active community outreach to their families, neighbors and relatives.

College of the Atlantic has partnered with the non-profit Envirolution to offer this type of training to middle and high school teachers. We had 6 Maine teachers participate in our pilot program in June 2023, and we would like to scale this up to 25 teachers annually going forward. For \$200,000/year, we can train 25 teachers and provide them with all the materials to lead hands-on lessons in their classrooms, and each teacher will reach 50-100 students each year (1,250-2,500 students annually for each cohort of teachers trained). Within 5 years we could have 125 teachers working with 6,250-12,500 students annually, or double that if Efficiency Maine funded two cohorts per summer.



As part of this training, teachers see the steps we've taken to transition buildings off of fossil fuels, participate in a residential energy audit with a blower door test and infrared cameras, and learn about efficiency rebates and career opportunities in Maine. The hands-on lessons teach about insulation, air sealing, light bulbs, appliances, and other concepts of home efficiency.

- Partner with community organizations (tribes, non-profits, K-12 schools) to offer BPI training in communities around the state. We need to ramp up the weatherization workforce at least 10x in the next decade to meet climate goals. We particularly need contractors available to help people in rural communities. Tribes and non-profits can help fill the gap where there aren't contractors available, if you provide training and workforce development support.

6. Equity:

Please comment on how the Trust may continue to prioritize delivering benefits equitably to low-income and other priority communities while also advancing goals of maximizing energy savings, carbon reductions, and market transformation.

- Partner with low-income programs (LIHEAP, WIC, SNAP, etc) to distribute EMT rebate information directly to the program participants. Send quarterly mailers to low-income households participating in these programs with details on the (free) heat pump water heater, (80%) rebates for heat pumps and weatherization, and loan details for how they can install these energy-saving systems with NO upfront cost. Include information on the entire process - how they can transition their home entirely off of fossil fuels.

7. Demand Management:

What other technologies or strategies might the Trust consider as part of the Demand Management program in the next Triennial Plan period?

- Bi-directional EV charging - using EV batteries for meeting peak demand, and as backup for buildings during outages. COA would be excited to participate in a pilot program. We hope to replace our fleet of 12 to 15 passenger vehicles with electric vans or mini-buses. These would need to have large batteries, which could be used for demand management or backup power when the vehicles are not in use.

8. Electric Vehicle Initiatives:

Please comment on what additional priorities or strategies the Trust should put in the Plan for transforming the market for electric vehicles?

- Please offer rebates and low-interest loans for electric bikes. Globally, two and three-wheeled electric vehicles have offset more oil than all the electric cars, trucks and buses combined (<https://www.anthropocenemagazine.org/2023/08/how-many-wheels-should-your-next-ev-have/>). E-bikes are significantly less expensive than electric cars, but rebates and low-cost financing can make them accessible to everyone. Electric bikes require a small



fraction of the metal, batteries and other resources of electric cars, and encourage people to get fresh air and exercise.

9. Efficiency Maine Green Bank:

As the Trust's financing offerings continue to expand, what other sectors of the market or technologies might benefit from expanded or alternative forms of financing?

- Please remove the maximum loan amount (\$7,500) for low and moderate income residential projects, and finance the full project amount for any improvement that qualifies for any Low or Moderate-Income rebate. A complete home energy retrofit (eliminating fossil fuel use) could include \$10,000-\$20,000 in insulation, vapor barrier and health and safety measures, \$10,000-\$15,000 in heat pumps, and \$2,000-\$4,000 for a heat pump water heater, for a total cost of \$25,000-\$40,000 (or more if new windows or doors are needed). Even with \$13,000-\$18,000 in rebates, there is often another \$12,000-\$25,000 in costs. Tax credits are delayed so aren't helpful for the upfront costs unless someone has access to low-interest financing. To transition their home entirely off of fossil fuels, homeowners need to be able to finance the balance of the project costs. These improvements save thousands of dollars each year (we've seen 5-8 year paybacks on projects at COA), but require the ability to pay the entire upfront cost.
- Partner with local banks and credit unions to offer efficiency/clean energy loans at all their retail branches. People should see advertising for 'home efficiency loans' at every bank and credit union in the state, with information on rebates and other incentives available.
- Offer financing for efficiency businesses to scale up. Low-interest loans can help our small weatherization and heat pump businesses to purchase box trucks, spray foam rigs, and other equipment needed to add more crews to their team.
- Partner with Maine Public Employee Retirement System to create a home energy loan program for all 100,000 public employees & retirees statewide. This could be funded by MainePERS as a revolving loan fund, and offer 0-2% interest loans to all public employees for home efficiency and electrification projects. Concept paper available here: <https://docs.google.com/document/d/1gHPAs6s1CdOyxI4PxoUda8N3JhfEfjmQgljMYvyHk5k/edit?usp=sharing>
- Partner with mortgage lenders to prioritize Energy Efficient Mortgages and upfront financing for transitioning homes off of fossil fuels at the time of sale. I have led trainings for Realtors and lenders in Nevada on the FHA EEM program: https://www.hud.gov/program_offices/housing/sfh/eem/energy-r There are 16,000-20,000 homes sold in Maine each year; if energy improvements were financed into the mortgage, this would achieve nearly half of what is needed annually.

10. Beneficial Electrification: Which measures, strategies, and program design elements might the Trust consider as part of incorporating beneficial electrification in Triennial Plans V, VI, and beyond?

10 Steps to a Zero Emissions Home

- 1. EPA WaterSense showerheads** *Energy savings of 5-10%*
 - A 1.5GPM showerhead uses 40% less water and thus 40% less energy to heat the water.
 - A typical family will save 10,000 gallons/year of hot water with low-flow showerheads.
- 2. LED light bulbs** *Energy savings of 5-10%*
 - LEDs use 85% less energy than incandescent bulbs, and reduce monthly energy costs by \$20-40 for an average home.
- 3. Window Dressers** *Energy savings of 5-10%*
 - Insulated window inserts improve indoor comfort and energy efficiency for less than 1/10th the cost of replacing windows. www.windowdressers.org
- 4. Heat pump water heater (HPWH)** *Energy savings of 10-20%*
 - Use 70% less energy than a standard electric water heater.
 - Significant rebates available through Efficiency Maine that increase their affordability.
 - Side benefit of helping dehumidify the space they're in, like a damp basement.
- 5. Electric appliances** *Energy savings of up to 10%*
 - Measure your refrigerator's energy use and upgrade to an EnergyStar model as needed.
 - Replace gas cooking equipment with induction or electric for health and safety.
- 6. Energy audit** *Health and Safety*
 - Have a comprehensive audit to assess air leakage and insulation needs for your home.
 - Measures energy use, identifies opportunities for improvements, and identifies moisture problems or health and safety needs like ventilation and mold remediation.
- 7a. Basement/crawl space** *Energy savings of 10-30%*
 - Sealing the basement or crawlspace blocks rodents and heat loss.
 - Vapor barrier prevents ground moisture from getting into the house - reducing mold.
 - We recommend 3" of spray foam (R-21) from the basement floor up over the rim joist to air seal and retain heat. This is an incredible improvement for fieldstone foundations.
 - Make sure the contractor uses HFO/5th generation/low-Global Warming Potential spray foam. Older HFC blowing agents have 500x the carbon emissions!
- 7b. Attic and wall air sealing and insulation** *Energy savings of 10-25%*
 - Because warm air rises, a significant portion of heat loss is through the attic.
 - Air sealing first ensures that insulation works properly.
 - We recommend 18-24" of cellulose insulation to achieve R60-R80 in attics.



- 8. Air source heat pumps** *Energy savings of 10-40%*
 - Provide winter heating and summer cooling and dehumidification for your home.
 - Work in temperatures as low as -15F, and can be the sole source of heat if your home is well insulated.
- 9. Electric Vehicle**

A 2020 study by Consumer Reports found that the lifetime ownership costs were significantly lower for EVs. Most EVs saved between \$6,000 - \$10,000 over their lifetimes.
- 10. Solar** *Energy production up to 100%*
 - Install rooftop solar to supply all your electricity needs.
 - 30% federal tax credit and financing options are available.
 - Battery backup is needed for solar to work during a power outage

Other: High-efficiency wood stove

New high-efficiency wood stoves are up to twice as efficient as older models, cutting wood consumption by up to half while providing as much heat to the home. Wood stoves are a great source of backup heat during power outages.

Other: Whole-home surge protection

As we electrify our energy consumption, and especially with the complex electronics in these systems, it is essential to install whole-home surge protection. These devices can cost \$100-400, and need to be installed by an electrician. A single surge event can cause more damage than the upfront cost of the surge protector.

Other: Ventilation

As we seal our buildings and reduce air leakage (drafts), mechanical ventilation becomes more important. In many homes, exhaust fans in the kitchen and bathrooms are adequate. When homes are very tight, ventilation that both exhausts stale air and brings in fresh air is needed. Energy-recovery and heat-recovery ventilators exchange heat between the incoming and outgoing air, to temper the fresh air coming in and reduce heat loss.

Efficiency Maine: Rebates and support

Efficiency Maine's website has additional information on federal tax credits and energy rebates available in Maine. They are a great source for finding a contractor in your area to help with any of these improvements: www.energymaine.com/at-home/