Affordable Heat Consortium:

INITIAL REVIEW OF FINDINGS & STRATEGIES

revised draft, 14 February 2014

Thermal Efficiency Eastport

Sunrise County Economic Council

washington county RENEWABLE ENERGY working group

CONTENTS [click on any heading to jump]

1. BACKGROUND & NEXT STEPS FOR THE AFFORDABLE HEAT CONSORTIUM

Everyone benefits from cheaper, cleaner heat, but few believe they can access the potential savings. Superior systems exist, but they are not affordable. Meanwhile, winter heating costs claim a big portion of most business and household operating budgets. Besides being large, they are both volatile and rising[1] steadily towards insupportable levels. Many non-affluent Maine residents on fixed incomes are forced to choose between adequate heat, sufficient food, and medicine.[2] This suggests that many people might care about affordable heat: Maine residents who pay for inefficient systems, regional business owners, policy makers, health care providers, those who pay the hospital bills, and banks facing foreclosures.

Targeted responses to unaffordable heat in Maine do not address the full scope and urgency of the need. Many studies show that households with the highest heating "affordability gap" – that is, the homes that demand too high a percentage of disposable income to maintain minimum warmth through the winter – also pay the most, on average, per unit of heating fuel and consume that fuel in homes with the least insulation. More precisely, the 21,000 Maine households at or below 50% of the Federal Poverty Level spend around 77% of their disposable income on winter heat.[3] Leaving direct expenditures aside, Mainers who struggle to stay warm get sick more often and rely more on publicly-subsidized health care services.

Flexible, elegant and efficient heating systems exist and have been widely deployed – mostly in countries taking aggressive measures to reduce their carbon emissions profile. Affordable heat for non-affluent Mainers would bring comfort, regional prosperity, and health along with lower monthly utility bills. To accelerate our arrival at this destination, a permanent "affordable heat consortium" (AHC) for Down East Maine was created in late 2013. It is meant to assist the deployment of proven heating systems and fuels that would bring cheaper, healthier, and more efficient warmth to non-affluent communities. This consortium is intended to serve as a collector and distributor of vertically-integrated heating solutions, ready to feed them into strategies for community-led innovation that deliver guaranteed cash savings, increased comfort during winter, a cleaner environment, and better physical health.

At the outset, the AHC addressed three key questions for which we did not have predetermined answers: Why do so few non-affluent Maine residents have access to affordable heat? What are the costs and impacts of the current state of things? What should a group like ours do to improve the situation?

The recently released findings of the Down East Maine Renewable Energy Working Group isolate some topics of special relevance to affordable heat, with emphasis on the linked challenges of front-end transition costs, market distortion, and fair policy frameworks. That report indicates that the status quo is full of opportunities, that there is need for new incentives to encourage early adoption of affordable energy systems and fuels, that adoption is further obstructed by lack of reliable and affordable access to capital for installation, transition & retrofit, which is further complicated by insufficient access to reliable information about retrofitting options (coupled with a lack of time and energy to investigate them and an absence of trustworthy technical guidance) and insufficient specialized workforce capacity to support large-scale transition to affordable heating systems.

Next steps for the AHC revolve around the demonstration projects described in the final section of the document, which reflect the research findings to date, strategic directions based on these findings and known best practices elsewhere, consortium deliberations to date, exploration of the topics raised by the Renewable Energy working group, prioritizatioun of recommended strategies for field-testing, and relative merit of proposed demonstration sites at which to conduct those tests.

---

1 The slope of heating oil prices rose steadily in Maine since 1999, based on U.S. Energy Information Administration weekly data.

2 See *Heat or Eat? Cold Weather Shocks and Nutrition in Poor American Families*, working Paper #9004 from the National Bureau of Economic Research (June 2002).

3 2000 census figures cited in "On the Brink 2010: The Home Energy Affordability Gap" (April 2011).

2. FINDINGS FROM THE INITIAL CONSORTIUM MEETING

The AHC will support discussion of affordable heating strategies and explore ways to implement those strategies for non-affluent Maine property owners. The near-term goal is to articulate, and demonstrate, ways to access affordable heat that can be widely deployed in rural Maine; as one participant put it, "provide precedent of infrastructure and delivery of heat sources that reinforce the rural Maine ecology and economy." It may be that these goals will change as the work goes forward and research reshapes our sense of what is important.

The AHC conducted its initial meeting on 25 October 2013. The following consortium members were able to participate on the phone or in person:

Kathy Billings (Bangor Hydro Heat Pump Program)
Matt Bray (Maine Energy Systems)
Jon Calame (Thermal Efficiency: Eastport)
Harold Clossey (Maine Development Foundation)
Steve Cole (Coastal Enterprises, Inc.)
Ken Daye (Sunrise County Economic Council)
Judy East (Washington County Council of Governments)
Sally Erickson (Eastport Energy Committee)
Hugh French (Tides Institute)
Mark Green (Washington Hancock Community Agency)
Rafi Hopkins (Eastport Energy Committee)
Kirstin Sechler (Minerva Partners)
Damon Weston (Eastport Energy Committee) and
Asher Woodworth (Thermal Efficiency: Eastport)

We also received written feedback in advance on some key questions from three consortium members unable to attend:

Mike Eisensmith (Northern Maine Development Commission)
Kiel Moe (Harvard Graduate School of Design) and
Patrick Woodcock (Governor's Energy Office)

The following issues were brought to the foreground for discussion during this initial meeting:

market orientation & the hybrid ESCO model

In response to the question "What would success look like for this effort?" it was generally agreed that solutions to the affordable heat challenge should be robust, repeatable, and scalable. This seems to largely rule out heavy reliance on soft money (which yet could be essential during the startup and demonstration phases of activity) and points to market drivers. One good example is the "energy service company" (ESCo) or "energy service provider" (ESP), which often provides front-end capital and a performance contract to an end-user when the overall consumption and potential savings promise a "discount savings" payback favorable to both parties. Most qualifying projects require central decision making, as with a university campus or municipality. The AHC discussed the possibility of creating a hybrid ESCo comprised of regional investors who, in addition to seeking a favorable return on investments through heating retrofit projects, have a desire to work with smaller rural communities, strengthen the regional economy and assist with the transition away from less affordable, sustainable fuel source and systems.

access & brokerage

In response to the question "What are the major obstacles separating non-affluent Maine residents from access to affordable heat?" most participants agreed that a chronic lack of reliable, useful information brings many curious property owners to a halt. Though many pieces of the puzzle are available, it can be difficult to find them and pull them together into a coherent picture. One participant noted that the process of finding resources to support energy transition is "not for the faint of heart." Another said it could be "arduous work" and that the majority who took advantage of one program had a bachelor's degree. It was generally agreed that these information and coordination barriers are regrettable.

The idea of the 'broker' for affordable heat emerged, a person or office that would have the relevant information at hand, ready to assist from start to finish, making sure all available resources are utilized. In addition to comparative information (regarding fuels, systems, subsidies, contractors, studies, etc.), the broker could also connect consumers with peers, advocates, auditors, supplies, and services that help them complete a customized retrofit project. Could the hybrid ESCo imagined above also serve as the broker for these clients, effectively allowing for 'single door' shopping for capital, information, fuels, systems, and technical support? The group considers this prospect worth more exploration.

fuel switching & public policy

One participant noted that opportunities for heating retrofit may be hampered by limitations on state and federal funds. One limitation is a restriction on "fuel switching" which may confine some property owners to weatherization projects even when the larger savings would be generated by alternate fuels – biomass or solar instead of oil, for example. It was generally agreed that further investigation of this condition is needed, since an obvious long-term goal in relation to environmental impacts is the shift away from carbon-intensive heating fuels towards cleaner, renewable ones. If access to useful information is one barrier to affordable heat (as above), then contradictory or compromised public policies are another. Further exploration of this issue will include careful review of Maine's new Omnibus Energy Bill (LD 1559).

front-end capital & robust pathways to retrofit

Repeatedly throughout the discussion, AHC members discussed the challenge of up-front capital. It was noted by several that many of the financial incentives for weatherization and retrofit in Maine are anchored in rebates and tax credits that are not useful to non-affluent heat consumers – they often have neither the savings nor the taxable income to take advantage of them. Another research task for the coordinating partners will be to inventory all the existing incentives and assess the extent to which they depend on household income above the rural average. Since many renewable fuel heating systems cost several times what a new conventional system does, the problem remains: how to pay for a new heating system which promises substantial savings (enough to pay for itself within a handful of years) but costs more than can be afforded? Is the desirability of such replacement systems meaningless?

At this fork in the road, participants noted that many non-affluent heat consumers in Maine are between a rock and a hard place; they can afford neither the status quo nor the available alternatives. The AHC agreed that an essential task will be to address the challenge of meeting the need for front-end capital for retrofit in a reliable way for non-affluent heat consumers in Maine. In this regard, the ongoing input of consortium partners in the banking and finance sectors will be of special relevance, along with further investigation and expansion of the ESCo model (or other investment-centered models) as above.

public health & externalized costs

The AHC is a specialized group with a practical focus, but it is hard to overlook the concerns and impacts that might be considered the 'siblings' of the affordable heat challenge. One of these is the "excess winter morbidity" (EWM) phenomenon, which is the spike in circulatory and cardio-vascular complaints observed by medical professionals during the winter season. This is commonly attributable, in part, to dangerously low indoor temperatures, which are in turn the result of non-affordable heat. These health issues are more direct and measurable than broad environmental impacts on public health (air pollution, exposure to solar radiation, etc.) which are also related to the use of conventionals heating fuels but usually left out of the cost equation ('externalized costs'). While the importance of EWM to those who get sick is obvious, it might also be noted that increased doctor and hospital visits are part of the life cycle costs of the existing heating infrastructure in rural Maine (and many other place where cold winters, low household income, and older housing stock converge).

cost burden & fuel poverty

Several participants noted that the cost of heat does not fall equally on the shoulders of all Maine consumers, though the unit price of fuels may be similiar. It was noted that the portion of disposable income used by non-affluent heat consumers to stay warm is considerably larger than the portion spent by others. As a international rule of thumb, when a property owner or tenant spends more than 15% of disposable income for this purpose, s/he experiences "fuel poverty" and this threshold formally distinguishes affordable from unaffordable heat.

Though studies are few, the "Home Energy Affordability Gap" (HEAG) shows that for Maine residents with incomes at or below the federal poverty level (constituting about 71,708 households, 13% of all households in the state), the amount spent for winter heating above and beyond the portion of disposable income considered affordable (heating budget "shortfall") was about $3,264 per household and $144m in aggregate. For Down East Maine, it was worse: shortfalls of about $3,654 per household representing spending at least 30% beyond the affordable threshold. Put differently, if non-affluent residents in Down East Maine could heat their homes affordably, they would have about $3,654 more to spend on other things each year. With a cost burden that high, you would think that the topic of affordable heat would attract widespread interest from policy makers and heat consumers alike. This does not seem to be the case. It may be, as some participants suggested, that most non-affluent heat consumers do not perceive any available, affordable alternatives to their problem. It may be that they are put off by forms, incompatible incentives, or the assumption that retrofit is only for the wealthy.

the string box v. the great pacific garbage patch

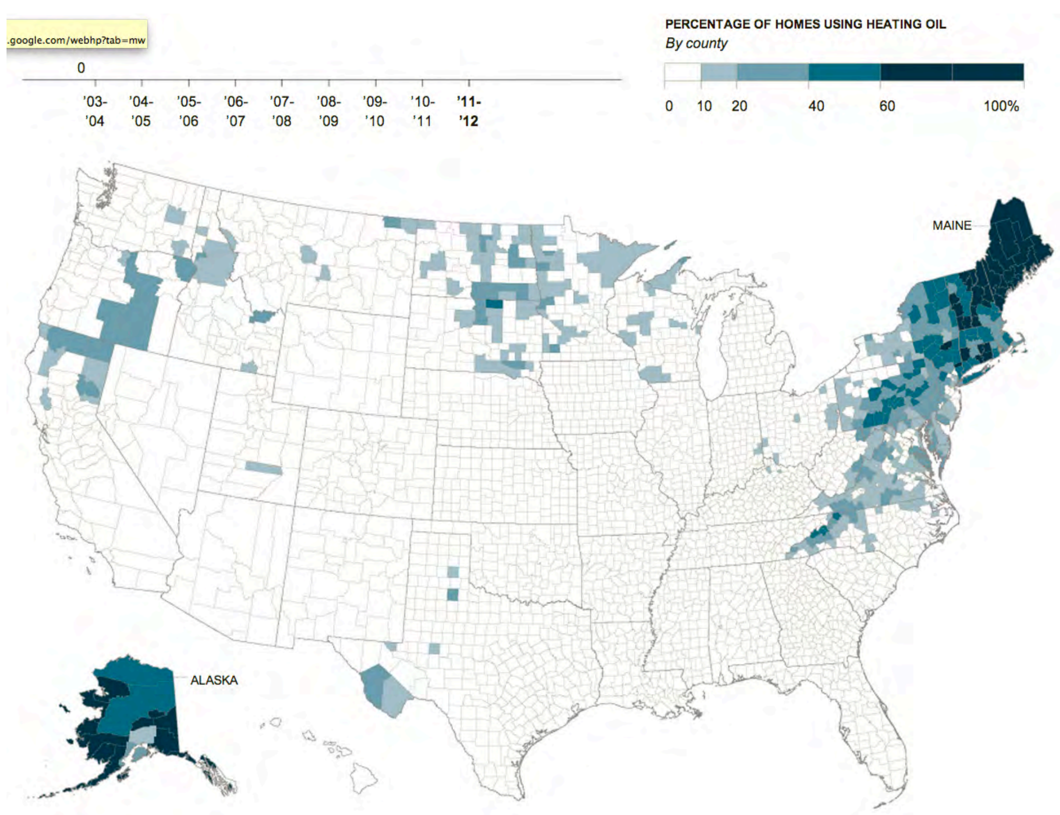
In response to the question, "How did we get into this pickle in the first place?", some participants noted that efficiency – frugality, conservation in the strict sense, consuming less – is no longer a characteristic American virtue. While Mainers of several generations back might have saved spare pieces of string in a box set aside for a future need, today we have a churning mass of plastic much larger than the area of Texas (the Pacific Trash Vortex). Several participants suggested that a solution to the affordable heat problem in Maine is tied to deeply-seated behaviors, assumptions, and values that undermine efficiency. A question therefore arose as to whether affordable heat initiatives should try to shift these values or "meet people where they are." One participant noted that the bulk of potential savings lie with fuel switching and heating system retrofit, making efficiency considerations "a band aid on a bullet wound." Others consider efficiency the anchor and starting point for affordable heat activities. The AHC coordinating partners will explore further baseline assumptions and attitudes of non-affluent Maine heat consumers in order to bring useful information to the table next time.

3. STAYING WARM IN MAINE

The line between Maine's assets and liabilities in relation to energy can be blurry. Its low population density, rural character, and traditional self-reliance means that Mainers are generally frugal and resilient; on the other hand, energy distribution networks are more costly to create and maintain under these demographic conditions, so unit prices for fuel are high. Mainers have historically harvested renewable biomass locally for heating, but traditionally they generally burn it in inefficient ways. Maine burns large amounts of fossil fuels per capita, but also has the best renewable source profile for electricity generation along with the highest wood and wood waste power generation capacity in the United States – a resource basket and clean energy production capacity that are largely untapped.

3.1. heating energy consumption

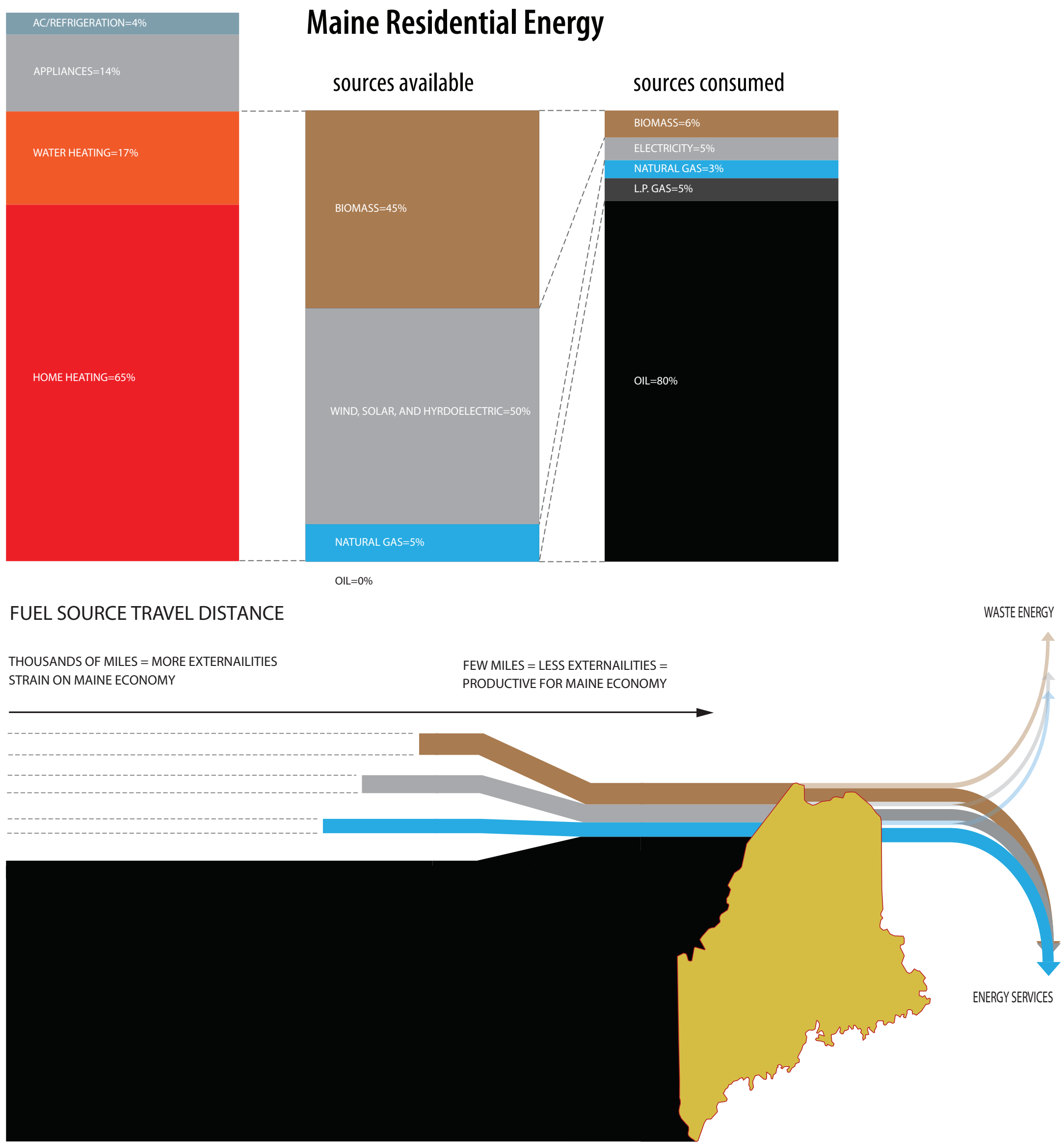
As of 2011, Maine's overall energy consumption was 26th in the country (at approximately 311m BTU per capita annually), but the cost of that energy ranked much higher – at 10th in country (approximately $5,508 per capita annually, amounting to 14% of Mainers' personal income on average and a statewide expenditure of $7.32b for the year).[4] Since Maine residents have household incomes generally well below the national average, these figures spell out a painful picture: those with less to spend spend more per unit of energy. The map below, published in 2013 by the *New York Times*, shows the special dependency on fossil fuel for structural heating in Maine, reflecting recent data from the US census showing that 75.6% of Maine's homes use #2 heating oil,[5] is by far the highest proportion of heating oil dependency of any state in the continental U.S.:



[4] US EIA Maine state profile based on 2011 data, link here.

[5] From the Energy Information Agency website.

Another way to look at Maine's energy consumption profile in relation to heating strategies is to compare regionally available energy sources with the fuels actually burned, as below:



Here, the discrepancy between regionally available energy sources (mostly renewables in the form of biomass, wind, solar, and tidal sources) and current dependencies is evident. Environmental concerns aside, Maine's reliance on heating oil is problematic because it demands an increasingly large portion of household incomes, it contributes to energy insecurity, it exposes consumers to price volatility, it wastes resources on long-distance fuel transport, and it constitutes a large annual net export of wealth out of the state (and, in large part, out of the country). The port of Eastport provides a useful snapshot of this condition: hundreds of containers of wood chips and pellets produced in Maine leave the docks for Europe, where they will be used to generate cleaner electricity, while oil from the Persian Gulf arrives to heat homes and businesses locally. Strange!

3.2. cost & burden of winter heating

Many observers have noted that American dependence on non-renewable energy sources is both expensive and dangerous. What is true for the country is urgently true for Down East Maine. In a perfect world, the price of energy in this region would include the cost of health care, lost productivity, and foreclosures as residents are forced to choose between essentials in the winter season. One study finds that "the use of fossil fuels for energy creates external effects in the future through its emissions of atmospheric greenhouse gases (GHGs) that cause climate change, subsequently resulting in damages to ecosystems and society."[6] Many studies agree that the earth will emit the trillionth ton of harmful carbon into the upper atmosphere in June 2043 (we are about half way to that threshold currently), while the International Energy Agency warns that we will reach the 6°C mark by 2050 at current rates of fossil fuel usage – both tons of carbon and warming degrees are benchmarks for irreversible, widespread harm.

One scholar of energy issues in Maine (also a contributor to the renewable energy working group component of this project) goes on to observe: "The human and environmental costs from failing to promptly reduce dependence on carbon-dioxide emitting sources for electricity, heating, and transportation are dire and indisputable." Thaler illustrates links between climate change and poverty, water scarcity, disease, political instability, and public health, such that it poses "an urgent and potentially irreversible threat" to all communities. These assertions place a large burden on the current generation of policy makers, who are "uniquely placed in human history: the choices we make now—in the next 10–20 years—will alter the destiny of our species (let alone every other species) unalterably, and forever...." [7]

These are broad concerns, and important ones, but for many they seem intangible and difficult to believe. One yardstick that is easier to grasp is the cost of residential heat in the winter – a significant source of anxiety for many people in Maine. While heat is just one feature of Maine's overall energy consumption profile, it is useful as a barometer for the challenge of efficient and affordable energy use overall.

For those who live and work in Down East Maine, the high cost of energy given existing consumption patterns can become tangible through a home energy affordability gap analysis. Since it is commonly assumed that a household should not spend more than 6% of its disposable income on home heating, it is easy to measure the "gap" between what is considered affordable (no more than 6% of the income available within a particular segment of the Maine population) and is actually spent to stay warm. As the table on the following pages indicates, the situation in Down East Maine (figures for Washington County were used in relation to statewide averages) is worthy of concern.

This "Home Energy Affordability Gap" (HEAG) shows that for Maine residents with incomes at or below the federal poverty level (constituting about 71,708 households, 13% of all households in the state), the amount spent for winter heating above and beyond the portion of disposable income considered affordable (heating budget "shortfall") was about $3,264 per household and $144m in aggregate. For Down East Maine, it was worse: shortfalls of about $3,654 per household representing spending at least 30% beyond the affordable threshold. Put differently, if non-affluent residents in Down East Maine could heat their homes affordably, they would have about $3,654 more to spend on other things each year.

---

6 National Research Council. *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*. Washington, DC: The National Academies Press, 2010. (link here)

7 Thaler, Jeffrey. "Fiddling as the World Floods and Burns: How Climate Change Urgently Requires a Paradigm Shift in the Permitting of Renewable Energy Projects", in *Environmental Law*, Fall 2012, Vol. 42 Issue 4: 1101-1156. (link here)

To quantify the gap between "affordable" home energy bills and "actual" home energy bills, Fisher, Sheehan & Colton (FSC) developed a model that estimates the "home energy affordability gap" on a county-by-county basis for the entire country.

Maine 2012 Home Energy Affordability Gap: Washington County

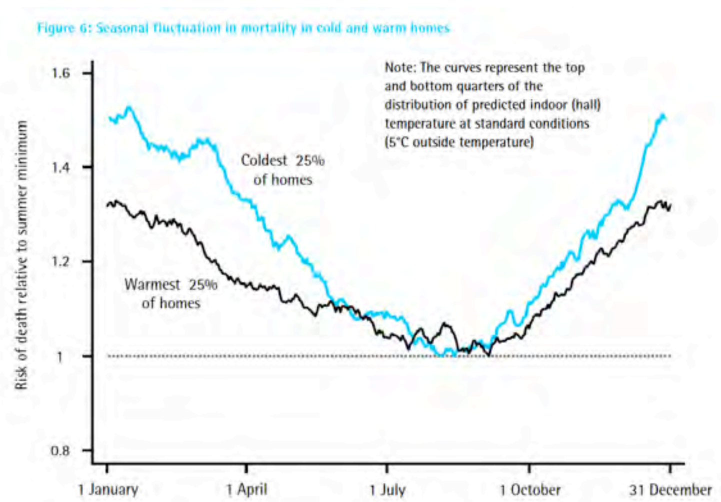
Average amount by which actual home energy bills exceeded affordable bills (amount exceeding 6% of gross household income).

Energy costs as a percentage of income. Housing analysts consider an energy burden of more than 6% to be unaffordable.

13% of Maine residents (about 71,708 households, with 2.34 persons per household) earn below 100% of the FPL

average household income in relation to federal poverty level		household avg shortfall	households	aggregate shortfall	home energy burden
< 50%	Washington County	$3,992	963	$3,844,296	67.9%
	Maine	$3,600	26,469	$95,288,400	60.7%
50-99%	Washington County	$3,654	1,927	$7,041,258	36.2%
	Maine	$3,264	44,134	$144,053,376	32.4%
100-124%	Washington County	$3,291	953	$3,136,323	24.1%
	Maine	$2,904	25,127	$72,968,808	21.7%
125-149%	Washington County	$3,049	1,082	$3,299,018	19.8%
	Maine	$2,651	26,673	$70,710,123	17.7%
150-184%	Washington County	$2,759	1,144	$3,156,296	16.2%
	Maine	$2,349	38,207	$89,748,243	14.5%
185-199%	Washington County	$2,517	515	$1,296,255	14.1%
	Maine	$2,093	16,957	$35,491,001	12.6%
<200%	Washington County		6,584	$21,773,446	
	Maine	$2,862	177,567	$508,259,951	
		LIHEAP allocation for 2012:		$38,500,000	
		Maine households < 200% FPL without energy help:		164,117	

For those who have an income and food but struggle to bridge this winter heating affordability gap, researchers in the U.K. coined the term "fuel poverty". One study finds that "It is now well documented that fuel poverty has a number of adverse health impacts, especially on the elderly. Chronic exposure to low ambient temperatures in the home resulting from fuel poverty often leads to a physiological condition in humans known as 'cold strain'. While short episodes of cold stress are unlikely to cause serious adverse health impacts among the young and healthy, such physiological effects are damaging to the cardiovascular and respiratory systems of the elderly, and may exacerbate current ill health or diminish resistance to infections in healthy persons."[8]



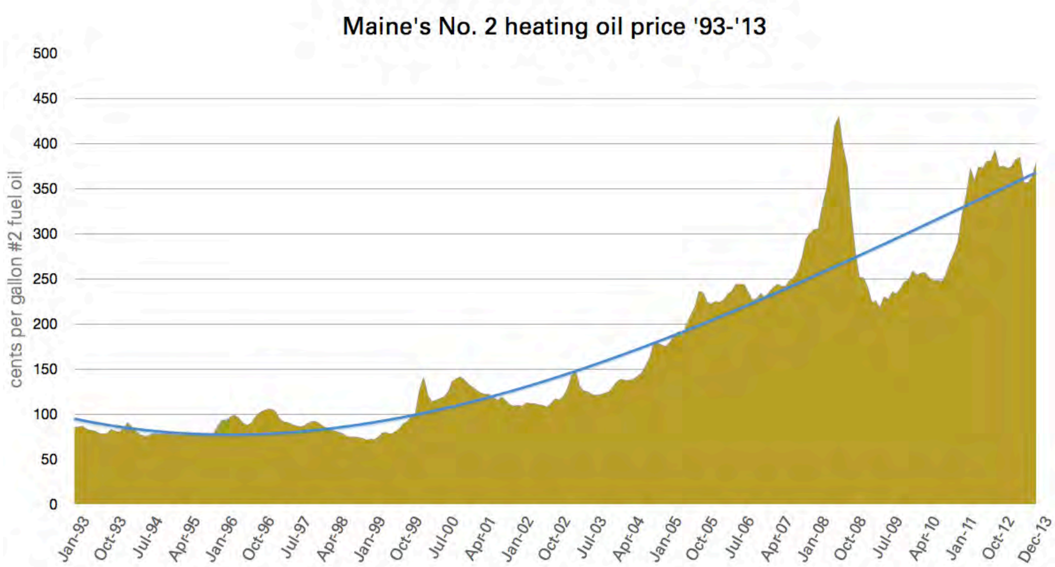
This figure from the Irish study shows a seasonal pattern of cardiovascular deaths using data for the years 1986-96 collapsed into one artificial year of 365 days. Two patterns stand out: indoor temperature is linked to excess mortality, and indoor temperature is also linked to fuel poverty, which in turn is tied to income.

Over and over, these correlations appear in medical studies, affirming that low

8 Healy, John D. & J. Peter Clinch. "Fuel poverty, thermal comfort and occupancy: results of a national household-survey in Ireland," in *Applied Energy*, 2002, vol. 73, issue 3-4, pages 329-343. (link here)

indoor temperature can be an important predictor of excess winter mortality.[9] Unfortunately, prominent economic and demographic trends in Down East Maine bring together many of the baseline conditions that give rise to fuel poverty: long winters, old housing stock, low household income, high energy prices for heating, and wide affordability gaps.

As for unit prices, with ups and down the long-term trend is made clear in the chart below, showing the evolution of retail heating oil prices over a decade in Maine:



In 2013, Maine "exported" about $720m after it consumed about 305,797,000 gallons of heating oil. Of those millions, about 78% left the region, according to the EIA's "Home Heating Oil Report 2010"– more specifically, for each dollar spent, 62% pays for the crude and 16% pays for refining, mostly in the Gulf Coast states.

Such a heavy reliance on non-renewable fuels for heating is not just regrettable in light of regional economics, social justice, and the raft of public health risks that comes with it. In the case of Maine, this large net export of precious wealth is also taking place in the most forested state in the United States, with sustainable biomass harvests of more than 16 million tons per year.[10] In 2008 the Governor's Task Force on Wood to Energy concluded that Maine has a sustainable wood supply sufficient to convert 45,000 homes (about 10% of Maine residences) from oil to wood heat. The forest products sector historically has been – and could remain – the mainstay of Maine's manufacturing sector if value added refined fuel gradually replaces some or perhaps eventually all of the pulp production while displacing the use of heating oil.

Jobs and income tied to wood pellet fuel production, for example, are generated directly through the production of pellets and indirectly through retention of disposable income. This may be especially relevant to the economic prospects for Down East Maine.

---

9 Wilkinson, P. & Ben Armstrong. *Cold Comfort: The Social and Environmental Determinants of Excess Winter Death in England, 1986-96*, Policy Press, Dec 1, 2001. (link here)

10 Maine Forest Service Assessment of Sustainable Biomass Availability, July, 2008. (link here)

3.3. policy context

Four major pieces of constructive legislation seek to support affordable heating systems in Maine:

a. In September 1999, as part of electricity market restructuring, Maine's Public Utilities Commission (PUC) adopted a Renewable Portfolio Standard (RPS) which placed an obligation on electricity supply companies to produce a specified fraction of their electricity from renewable energy sources, such as wind, solar, biomass, and geothermal.[11] In June 2009, new policies allowed certified renewable energy generators to earn renewable energy certificates (RECs) for every unit of electricity they produce, and to sell these along with their electricity to supply companies. Supply companies may then pass their acquired RECs back to the Maine PUC to demonstrate compliance with the RPS. RECs provide a mechanism by which to track the amount of renewable power being sold and to financially reward eligible power producers. For each unit of power that an eligible producer generates, a certificate or credit is issued.

   Maine's RPS requires that at least 30% of retail electricity sales come from renewable sources, although state electricity distributors had already surpassed that goal. In June 2006, Maine adopted another renewable portfolio goal to increase all renewable energy to 40% of total capacity and class I new renewable energy capacity (renewables came on-line after September 1, 2005) by 10 percent between 2007 and 2017 (with a 1% increase in required renewable capacity imposed each year). In February 2010, new policy provided for Community Based Renewable Energy Production Incentive through the RPS also to offer a 1.5 credit multiplier for larger qualifying community-based renewable energy projects up to 10 MW (or $0.10 per kWh for solar, wind, hydro projects under 1 MW) with long-term project contracts up to 20 years.[12]

b. In December 2005, Maine signed on to the Regional Greenhouse Gas Initiative (ReGGI) and was eventually joined by eight other states (Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont) ReGGI is a market-based, mandatory cap-and-trade consortium intended to reduce power plant greenhouse gas emissions in the Northeastern United States and Eastern Canada. Power sector CO_2 emissions are capped at 188 million short tons per year through 2014. The cap will then be reduced by 2.5 percent in each of the four years 2015 through 2018, for a total reduction of 10 percent. Under RGGI, electric generators with over 25 megawatts (MW) of fossil fuel-based capacity must purchase emissions allowances for every ton of greenhouse gas emitted. Generators that reduce emissions can purchase fewer allowances, and may sell surplus allowances to generators less able to meet emission reduction targets.

c. In June 2009 the Efficiency Maine Trust Act (Public Utilities 35-A chapter 97) was passed to establish an Efficiency Maine Trust (EMT) and direct its Trustees to invest RGGI auction proceeds in electric and fossil fuel energy efficiency programs. Proceeds from the sale of Maine's RGGI CO_2 allowances are allocated by the EMT. Efficiency Maine is funded in part by a 1.45 mill rate per kWh on all electricity bills in the state, and the Maine PUC reported that these energy-efficiency investments will save more than $100 million with a benefit to cost ratio of 3.8 to 1.

d. In June 2013, the Maine State Legislature passed the Omnibus Energy Bill LD 1559 in order to: 1.) provide support for reducing the cost of energy to residents of the State; 2.) maximize the use of cost-effective weatherization and energy efficiency measures, including measures that improve the energy efficiency of energy-using systems, such as heating and cooling systems and system upgrades to energy efficient systems that rely on affordable energy resources; 3.) reduce economic insecurity from the inefficient use of fossil fuels; 4.) increase new jobs and business development to deliver affordable energy and energy efficiency products and services; 5.) enhance heating

[11] More details are available on the DSIRE web site, here.

[12] Please see the Maine PUC web site for the incentives program, here.

improvements for households of all income levels through implementation of cost-effective efficiency programs, including weatherization programs and affordable heating systems; 6.) simplify and enhance consumer access to technical assistance and financial incentives by coordinating dispersed programs under a single administrative unit; and 7.) utilize cost-effective energy and energy efficiency investments to reduce greenhouse gas emissions.

The goals of the bill include: 1.) Reducing energy costs, including residential heating costs; 2.) weatherizing substantially all homes whose owners or occupants are willing to participate in and share the costs of cost-effective home weatherization to a minimum standard of weatherization, as defined by the trust, by 2030; 3.) reducing peak-load demand for electricity through trust programs by 300 megawatts by 2020; 4.) by 2020, achieving electricity and natural gas program savings of at least 20% and heating fuel savings of at least 20%, as defined in and determined pursuant to the measures of performance approved by the commission under section 10120; 5.) creating stable private sector jobs providing alternative energy and energy efficiency products and services in the State by 2020; and 6.) reducing greenhouse gas emissions from the heating and cooling of buildings in the State by amounts consistent with the State's goals.

Other energy-related policies in Maine seems demonstrate ambivalence or even present obstacles – though apparently not by design – to the expansion of renewable energy infrastructure in the state. Two examples are summarized below.

e. Functioning as a statewide stop-gap measure, the Low Income Home Energy Assistance Program (LIHEAP) is a federal social services program established in 1981 funded annually through Congressional appropriations and distributed to each of the fifty states, U.S. territories and tribal governments through the United States Department of Health and Human Services (HHS), while administration of the program is left up to state. In Maine, LIHEAP generally means that struggling residents receive cash disbursements earmarked for heating fuel. In light of the HEAG analysis above, it is clear that existing sources of energy assistance do not adequately address the predictable shortfalls in Maine. In 2012, the gross LIHEAP allocation to Maine was $38.5m to assist with approximately 16,865 low-income heating bills, down from $51.5m for 25,129 Maine households in 2011.

   Meanwhile, the 2012 shortfall for home heating totaled $508.3m incurred by 177,567 households. More simply, LIHEAP met only 7.6% of the winter need and left about 155,000 household in the cold. The scale of LIHEAP is a problem, and questions also arise regarding its scope. Since LIHEAP funds – by definition – allow struggling property owners to buy emergency heating fuel when they need it most, it becomes an annual lump-sum investment in existing fuels and systems. As noted above, Maine is disproportionately dependent on fossil fuels for heating, making the LIHEAP program – by default – a subsidy for the fossil fuel industry. The long-term expediency of LIHEAP is poor to the extent that the state's heavy reliance on fossil fuels is a concern.

f. Thaler points out that local, state and federal regulations governing renewable energy development projects have become "so unduly burdensome, slow, and expensive" that they will chill investment in renewable carbon-free energy sources and projects in Maine. He notes that the maze of federal and state regulatory requirements facing renewable energy projects in general and offshore wind in particular requires a year or more to complete and be approved, with large front-end consultant and legal expenditures before any permits have been approved. These hoops inevitably create substantial delays, costs, risks, and deterrents to project implementation. These delays postpone the arrival of affordable, reliable heating alternatives for non-affluent Maine property owners.

4. REGIONAL CONSTITUENT PERSPECTIVES

Complementing systems research are the perceptions of three end-users in the Down East region whose heating needs may be representative of a cohort. In-depth consultations were conducted under the auspices of the Renewable Energy Working Group and complemented by AHC research findings.

4.1. Tide Mill Farm (Edmunds, ME)

Tide Mill Organic Farm

Carly and Aaron are part of the the ninth generation of the Bell family to manage the Tide Mill Farm, and they have their hands full. We spoke with them on a chilly evening after dark while Aaron milked the cows and Carly made sure a bunch of different things were seen to.

It was easy to see why the challenge of re-thinking energy consumption would take a back seat to the endless list of pressing concerns on a small family farm in Maine. Regardless, they provided many useful insights to our study and affirmed a readiness to try new energy strategies if the options are clear, accessible, and persuasive.

If money were no object, what changes to the way you consume energy would you make first?

Carly and Aaron understand the many advantages of renewable energy consumption, and are fully informed about the long-term benefits of fossil fuel reduction. An ideal solution, from their point of view, would be not only a decisive shift away from fossil fuels (upon which the running of the farm now largely depends in the form of diesel and #2 oil) but also a centralized co-generation biomass plant that utilized locally-harvested wood scrap to provide heat and power to the farm's numerous and dispersed buildings.

Several existing conditions mitigate in favor of such an alternative:

- ☑ Much of the basic infrastructure needed to install such a 'Tide Mill Farm heating district' – much like those recently adopted on college campuses throughout the northeast US and in Europe – is already available;
- ☑ heating and other energy needs are currently substantial enough to justify such a comprehensive improvement;
- ☑ the local work crews have much of the technical skill needed to create and maintain such a system;
- ☑ the possibility for savings from such an improvement is great;
- ☑ Tide Mill Enterprises, a forest management and wood harvesting operation that is tied to Tide Mill Farms, currently harvests and delivers biomass to be used as a fuel source to various locations including the biomass electrical facility in Jonesport.

What barriers currently prevent you from making these changes?

The constraints on this best-case-scenario were predictable: lack of front-end capital, lack of information about technical options and specifications, lack of local examples, lack of time to investigate and sort out the above. A recurring theme in our conversation was the difficulty that Carly and Aaron perceived in accessing reliable, usable information on various fuel sources (diesel, oil, biomass pellets, etc), and efficiency and energy improvements that are available to them and their business.

This lack of information extended to questions of the costs and benefits associated with switching from one fuel/system to another, and a lack of guidance about the pathways required to make such changes; Carly and Aaron spoke about the challenge inherent in upgrading a multifarious operation like theirs from the current system(s), which though inefficient and more costly perhaps, were working for the time being. Carly, in particular, remarked that the demands of running a multifaceted dairy, vegetable and animal farm make it near impossible to even think about finding the time it would take to sit down and think through all of the variables that go into transitioning to a comprehensive, cheaper, and more sustainable system; Carly and Aaron spoke about the piecemeal approach to improvements and renovations that they arbitrarily found themselves using.

Since the largest energy cost/consumption at the Tide Mill Farm is attached to hot water used for sanitation chores in the dairy and animal processing facilities, as well as heating for the greenhouses, it would make sense to streamline a system around hot water (so that a single system heated sanitation water, domestic hot water, and warm water for radiant heating installations.

Still, it was clear that without the time, energy and resources to take a look at the entire operation as a whole, with detailed consideration of needs, loads, and efficiencies, individual upgrades would continue to be dealt with as they arose, and more often than not that will mean going with the cheapest option that can be implemented immediately, leading back to fossil fuels and related systems. Carly and Aaron underscored the need for upfront capital to undertake retrofits and improvements that come with a hefty initial price tag, and expressed the need for time to think comprehensively and plan wisely.

Have you sought support from Maine's existing energy programs? If so, how was the process?

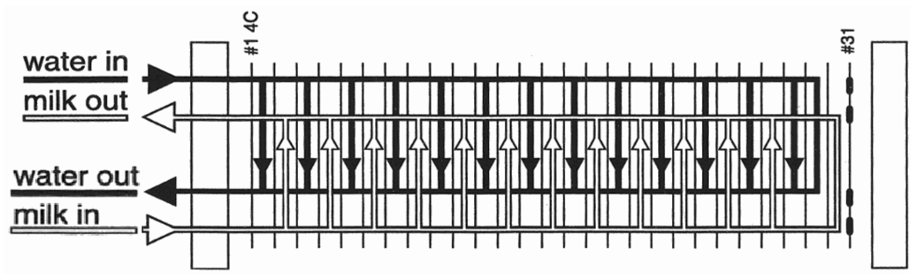
Aaron and Carly have explored several grant, subsidy, and loan programs, but the time needed to identify, apply, and comply with programs often exceeds time available outside of farm demands...a steep hill to climb even when significant support lies on the other side. They expressed continuing interest in these options and their need for technical guidance in order to navigate the applications and understand the long-term paybacks.

When you think about the costs of heating, do you think in terms of your budget, impact on the environment, public health, or all of the above?

It was clear that the full range of potential benefits to be associated with a transition from non-renewable to renewable energy sources is familiar to Aaron and Carly. The Tide Mill Farm as a whole embraces the ethic of local, sustainable food production grounded in organic production, so its commitment to environmentally-conscious and community-supported approaches is evident. How to translate this ethic and commitment to their energy consumption is, for the moment, neither clear nor apparently affordable. Yet the prospect of renewable energy use on a family farm named for a traditional source of renewable energy – hydro-electricity provided by tidal turbines installed in local stream beds – is appealing.

How are people in your community coping with the escalating costs of conventional energy?

Our discussion centered on traditional and contemporary energy uses at Tide Mill Farm – a sort of small community unto itself. One energy efficiency measure that had long been employed there was especially ingenious: a dedicated liquid-to-liquid heat exchanger that pulls heat from milk just taken from cows (which anyway needs to be cooled) and uses it to preheat the water used to rinse and sanitize the milking equipment. This preheating process saves a lot of energy bringing the water up to temperature while taking advantage of the heat already bought and paid for in the form of hay metabolized by the dairy cows. The employment of these bovine batteries is a good example of sustainable problem solving in context.



A diagram of a simple plate heat exchanger designed for the dairy industry, which cools milks and warms water for cleaning.

4.2. Univ. of Maine, Machias campus (Machias, ME)

If money were no object, what changes to the way you consume energy would you make first?

Mr. Farris expressed strong interest in renewable energy systems, with special emphasis on solar and geothermal applications. One goal would be to make the Fitness Center, which includes a large indoor pool used intensively throughout the year, self-sustaining with a water heating system fueled by solar panel installed on the roof. [The Fitness Center used to require 32,000 gallons of fuel oil each year to supply a boiler installed in 1968, and now it consumes 16,000 gallons annually with 4 new oil boilers and a propane heater for the pool.]

What barriers prevent you from making these changes?

Farris observed that "a great system will sell itself" because an alternative fuel or system will pay for itself. In his exploration of the relative benefits of solar, pellet, and geothermal systems, he has been frustrated. Many renewable systems "sound great" in terms of fuel unit costs and payback periods associated with capital outlays, but he emphasized that institutional savings must be considered primarily in relation to technical costs for repairs and maintenance over the life of a system. Mr. Farris calls this the "true cost" of the system. His point raises the problem of technical support for alternative, renewable-energy systems in Maine; this technical support can be hard to secure, and remote, bringing special costs. Mr. Farris noted that "windshield time" for specialized or far-flung technicians can become a problem for late-night emergencies; UMM can spend $700 just to get a technician to appear from Bangor.

These marginal costs can push otherwise attractive renewable energy options out of range of many institutional budgets, and for the moment this seems to be the case at UMM. And so a circular dilemma emerged from the conversation: despite his desire to move away from non-renewable systems, Mr. Farris notes that dependency (on remote technicians) is expensive, such that it is essential to "use local help", but qualified local tradesmen are generally not available to support the installation of renewable energy systems at the campus scale. ("Location, location, location..." Mr. Farris said.) This leads back to continued investment in conventional systems, which tend to be less expensive in terms of acquisition, installation, and maintenance, but more expensive in terms of long-term efficiency (power and heat per BTU) and carbon emissons.

One way around these concerns is the adoption of a 'performance contract' with an energy service company (or ESCO), but Mr. Farris said that the ESCOs he approached about energy transition were not interested in a contract with UMM due to low consumption (in relation to their minimum investment thresholds) and lack of central heating plant (a dispersed, and therefore inefficient, campus network). Meanwhile, Mr. Farris is asked by the University to keep his labor and maintenance costs low, creating something of a Catch-22 with respect to adoption of alternative, renewable energy systems with low market saturation – which account for most renewable options in Maine as of late 2013.

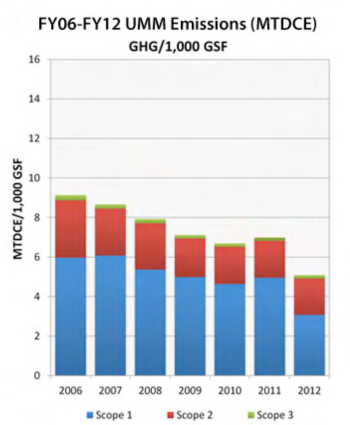
When you think about the costs of heating, do you mainly think in terms of your budget, impact on the environment, public health, or all of the above?

Mr. Farris places emphasis on the long-term, "true costs" of a new system, which he also linked to an understanding of the "real cost per BTU". He offered the example of wind turbines that might be wrecked in a severe winter storm: with a primary power system down, it may be that a specialized technician is unavailable, out sick or on vacation, putting classes and life support systems on campus at risk...such that the cost of such an outtage is nearly incalculable. So Mr. Farris made it clear that in his role he must consider a number of 'worse case scenarios' when weighing the relative merits of a renewable energy system which might be, in a good day, obviously superior to convential non-renewable fuel systems.

On the brighter side, Mr. Farris noted the very high public relations value of energy efficiency and green energy in the campus setting. He suggested that when you can show the administration that your campus is out-performing peer institutions in relation to BTUs per square foot and overall environmental sustainability[13], you gain support. When you can show parents that the campus is safe, comfortable, and frugal, impresses them, and enrollment goes up – since the parents are paying the bills. There is a lot of room, Mr. Farris suggested, to document and refine these performance-based statistics in order to strengthen the case for increased investment in renewable energy systems. According to Mr. Farris' observations, the adoption of green energy systems could become an important selling point for UMM in the increasingly competitive marketplace of undergraduate campuses. Meanwhile, up-front investment and high labor costs push in the opposite direction.

How are people in your community coping with the escalating costs of conventional energy?

The UMM campus consists of eleven buildings used in all seasons. Since 2006, carbon emissions are down 44%[14], thanks to control systems (more sensitive, linked to outdoor temperature schedules), temperature-averaging thermostats (placed on 4 levels in each large building, with 4 sensors each to balance hot and cold spots[15]), conservation measures, LED lighting, and new windows. Much of this progress was coordinated and planned by a campus energy team, of which Mr. Farris is a leading member. Since such significant reductions in energy consumption are possible through conservation and efficiency measures, it is interesting to consider how much more thrifty the UMM energy consumption profile could be – both in terms of dollars spent and carbon emissions generated – if a transition to renewable energy systems were made.



UMM annual energy consumption, down 44% 2006-2012.

---

13 UMM tracks its performance with contracted assistance from Sightlines LLC, which issues regular reports of facilities benchmarking and analysis in relation to campus sustainability within a national cohort.

14 Here is a link to recent UMM heat initiatives, which have reduced campus-wide energy consumption dramatically, but none of which indicate a substantial investment in or strategic pivot towards renewable fuels.

15 It is interesting to note that Mr. Farris chose to leave the old thermostats (no longer functioning) in place when the new, more efficient thermostats were installed. This allows occupants to manipulate 'placebo devices' room by room while the digital sensor made real measurements and adjustments.

4.3. Eastport Energy Committee (Eastport, ME)

When you think about the costs of heating, do you think in terms of your budget, impact on the environment, public health, or all of the above?

The problem of winter heating costs was foregrounded among all energy concerns, since it seems to constitute – for many Eastport residents – a major budgetary burden, and may even be linked to local real estate foreclosures. This question of winter heating "fallout" – along with related concerns like fuel poverty and excess winter morbidity – seem to deserve further exploration and study, according to EEC members. The perception was that residents of Eastport and the surrounding area were mixed in their priorities, many concerned with all of the above issues, but that by and large the most important single issue across the board had to do with cost: up-front costs of acquisition and installation of renewable energy heating systems in particular. While the environmental and public health components of the energy question were acknowledged, it was generally felt by EEC members that operating budgets for both local businesses and households were such that affordability becomes a forced priority.

How are people in your community coping with the escalating costs of conventional energy?

It seems that many people in the Eastport area are coping with the escalating costs of conventional heat by using cord wood to supplement their fuel bills, which are almost exclusively tied to the consumption of heating oil and propane for heating purposes. (It was observed that demand for cord wood had risen so much recently that it was becoming increasingly difficult to buy raw uncut, un-split logs on short notice.) Some residents are sectioning off parts of their houses for the colder months, and putting on extra layers of clothing. Some migrate south in the winter, noting that it can be less expensive to acquire or rent property in warmer places for a few months than to pay for heat in Eastport. (Some Eastport residents speculate that some foreclosures in the town and beyond are prompted by unaffordable heating bills which, under certain hardship conditions not altogether rare, a domino effect.)

Meanwhile, only a small handful of properties in Eastport rely on renewable heating fuel systems (most notably the South Street Greenhouse owned by Sally Erickson and Tim Bennett, and the Tides Institute StudioWorks building on Water Street).

Several initiatives to look at energy and heating challenges are now underway in Eastport. The Energy Committee itself is a new body created by the City Council to make studied recommendations about efficiency and consumption. The non-profit "Thermal Efficiency: Eastport" project seeks to inform ongoing conversations about heating systems in particular, and both of these efforts are participants in the "Affordable Heat Consortium" which is a year-long effort to articulate and implement strategies that put efficient, sustainable heating systems within reach of non-affluent residents of Washington County and beyond. While all of these activities are in early stages of development, they indicate a growing interest in the question of energy use and optimal expenditure of regional resources.

Do you perceive any resistance to the adoption of renewable energy alternatives in your community?

There does not seem to be resistance to a transition to renewable energy systems, but few have considered it. The greatest challenges to the adoption of more renewable sources of energy and heat come from access to capital. The perception was that people in Eastport and the surrounding area are open to alternatives to costly oil, but:

1. They lack access to good information about what else is out there;

2. They lack access to the upfront capital that is required for improvements; and

3. Even if they did miraculously acquire a system that was more efficient, used a renewable fuel, and was less costly, sufficient technical workforce is not present in the area to properly maintain and service such systems.

Perceptions were unanimous that people in Eastport and the surrounding area were especially adverse to debt of any kind. The feeling was that people are so tight on their finances as it is, that it is impossible for the average resident to imagine going any (further) into debt. This leads to a conversation about the relationship of heating systems with household income (a relationship addressed by the concepts of "fuel poverty" and "home energy affordability gaps" addressed elsewhere in this report), the age of housing stock in a community, and health (a subject contained by the notion of "excess winter morbidity" and the patterned relation of energy costs with compromised public health).

4.4. key constituent concerns

Across all stakeholders consulted, a few shared or recurrent concerns are summarized below.

… regarding what is desirable:

realization of long-term savings while recognizing the need to decrease environmental impacts of fossil fuel consumption; employment of centralized, rationalized, locally sustainable, efficient and consolidated power and heat; utilization of affordable renewable energy sources; capture of low-hanging fruit (e.g. water-to-water heat exchange for dairy sterilization, or direct solar water heating for swimming pool); implementation of model approaches which can be adjusted and repeated regionally; reclaiming lost sheep – the small to mid-sized institutions, rural residences, and isolated rural communities which often miss the benefits of energy transition.

… regarding major constraints in relation to renewable energy deployment:

lack of front-end capital for system retrofit, fuel switching, and efficiency upgrades; resistance to incurring debt; insufficient information about options coupled with a lack of time and energy to investigate them; absence of trustworthy (neutral) technical guidance; the cheapest option immediately at hand is generally an upgraded version of the status quo; lack of local technicians to support new/unfamiliar systems; early adoption of alternative fuels and systems is generally expensive and uncertain; many prefer the Devil they know; local technicians and suppliers would like to share in benefits of investment in renewable fuel systems, but lack acquaintance.

… regarding existing programs in support of renewables:

high 'transaction costs' prove often prohibitive; eligibility is uncertain and applications are complex, time-consuming, and expensive; special subsidies, credits, rebates and tax incentives can be difficult to assess and navigate; specialized monitoring of progress (e.g. "Sightlines" in Machias); Efficiency Maine strong but of limited purview.

… regarding costs and benefits of transition from fossil to renewable energy sources:

short-term budgeting is primary, esp. regarding the barricade of winter heating expenses; traditional thrift and ingenuity mitigates both for and against energy transition; self-help preferred for sustainability and local resource reliance.

… regarding coping strategies:

belt-tightening; specialized local inquiry; improved systems monitoring; estimating the cost of the status quo; inefficient renewables (e.g. cord wood).

5. CASE STUDIES

Prospects for better access to affordable heat in Down East Maine can be put into perspective alongside non-affluent regions and small, rural communities – in the northeast and elsewhere – which have made the transition with good results. A small sample of renewable energy projects are summarized below. They were chosen to demonstrate a range of challenges and solutions that correspond well to the issues of primary concern raised during the fact-finding and consultation phases of this project.

The keys to their success transferrable to the Down East region include the following: strong local leadership and ambitious, comprehensive local energy transition strategies (Güssing, Austria); a highly collaborative approach and emphasis on winter heating (Berlin, NH & Cambridge Energy Alliance); linkage of energy concerns with broader strategies for poverty alleviation, sustainable housing, and public health (Haringey's Affordable Heat Strategy, UK); clean energy municipal financing, coordinated on-bill financing, reduction of bureaucratic adoption barriers, and 'class action' transition negotiation (Cambridge Energy Alliance).

5.1. Berlin, NH Model Neighborhood Program,

Northern Forest Center
Thriving Communities & Healthy Forests

Launched in the autumn of 2011, the Model Neighborhood Project is a collaboration among the Northern Forest Center, Berlin BetterBuildings, the City of Berlin (pop. 10,051) and Maine Energy Systems to subsidize the installation and use of state-of-the-art, high efficiency wood pellet boiler systems as direct replacements for traditional boilers fueled by imported #2 heating oil. The 40 participating Berlin households are expected to save an average of 40% on home heating costs while injecting their remaining energy dollars into the regional economy.

To help meet the costs involved in the transition from fossil fuels to advanced wood pellet boilers, Berlin homeowners received direct financial assistance of up to 60% from two funding sources: the Northern Forest Center's direct cash Subsidy of $11,000, and 1% loans through the Berlin BetterBuildings Program and assorted local lending institutions. These funds were earmarked for the purchase and installation of biomass heating systems, as well as any additional expenses related to repairs or upgrades to the chimney, circulation system or other elements of the heating system.

One reason the Northern Forest Center wanted to contribute to the Berlin program was to showcase the diversity of buildings in which you could install the pellet boilers. Aware of the obstacles, the collaborative team designed a process to encourage owner-occupied buildings in Berlin to participate, with an aim to make it as affordable enough to allow people at all economic levels to benefit. An overall goal was to help communities benefit from "forest-based initiatives" through subsidized deployment of regionally-produced renewable fuels.

Berlin advocates note that this approach brings parallel benefits: 1.) it helps a Northern Forest community to save money on heating, 2.) it supports the regional market for low-grade wood, a consideration important to local landowners who must sell wood to keep their forested properties viable, 3.) it supports wood-based manufacturing since pellet manufacturing in Northern Forest communities is a value-added industrial process, and 4.) it keeps heating dollars circulating in the regional economy since 100% of every dollar spent on locally produced pellets is retained to foster jobs in local communities. Based on its initial successes in Berlin, NH, the Model Neighborhood project was expanded in 2013 to communities of Farmington and Wilton, Maine in partnership with Western Maine Community Action.

5.2. Cambridge Energy Alliance, MA

In May 1999, the Cambridge City Council voted to join Cities for Climate Protection (CCP), an international consortium of communities working to reduce the impacts of climate change by reducing greenhouse gas emissions from fossil fuels. As a member of CCP, the City created a city-specific greenhouse gas emissions inventory and subsequently set targets and strategies to reduce these emissions through a comprehensive and well-defined plan. To help achieve these goals, the City created the Cambridge Energy Alliance (CEA) in 2007 as a non-profit organization.

In 2007, the State of Massachusetts announced the creation of a $2 million loan fund for local governments to supplement start-up costs for energy efficient programs modeled after CEA. In 2008, CEA became a National Council for Public-Private Partnerships Innovation Service Award Winner. In 2011, CEA became part of City government, continuing its mission of helping Cambridge residents and businesses identify and arrange financing for all cost-effective energy efficiency improvements for their homes and businesses.

The CEA in partnership with the City of Cambridge addressed a voluntary goal of retrofitting 50% of Cambridge buildings and reducing the city's emissions by 10% over five years. The program targeted all building types, and was designed to make energy improvements through a number of selected energy service companies (ESCOs). For the residential market, homeowners could take advantage of a free audit, paid for by state public benefit charge funds. All the work is specified and implemented by an ESCO that CEA has selected for the residential market.

CEA directs customers who need help with financing to two loan options: 1.) They have negotiated a rate of 9.75% for an unsecured personal loan with East Cambridge Savings Bank, with a maximum loan amount is $25,000 for a term of up to 10 years for energy efficiency, solar thermal, or solar PV. The approval rate for these loans is projected to be approximately 80%.; 2.) customers with less than 80% of the area median income could apply for a loan from Citizens Bank at a program-subsidized interest rate of 1-3%.

Project objectives included reduction in energy usage, development of more sustainable energy sources and the mobilization and education of the community. Another important objective of CEA was to develop a program that can be a model of community collaboration for other cities and towns as they embark on their own energy efficiency programs.

5.3. Affordable Warmth Strategy for Haringey (United Kingdom)

In 2001 the Government published its "U.K. Fuel Poverty Strategy," with the primary aim to tackle the growing numbers of households who could not afford to heat their homes (for whatever reason) to an acceptable level. Through this strategy, the Government is under a statutory duty to ensure the eradication of fuel poverty in vulnerable households by 2010 and in all other households by 2016. The Home Energy Conservation Act 1995 (HECA) required every local authority with housing responsibilities to produce an energy conservation report identifying practical and cost effective measures to improve the energy efficiency of all residential accommodation in their area.

The multi-partnership Affordable Warmth Strategy for Haringey (pop. 230,000) was launched in November 2009 by David Kidney MP, Parliamentary Under Secretary of State for Energy and Climate Change, and it identifies how to tackle fuel poverty and promote energy efficiency. Its mission was to make sure that no family in Haringey lives in a cold, unheated home and that people know how to use energy in their homes efficiently in order to save money and reducing CO_2 emissions.

According to the U.K. Government, a household is said to be in fuel poverty if it needs to spend more than 10 percent of its income on fuel to maintain a satisfactory heating regime (usually 21 degrees for the main living area, and 18 degrees for other occupied rooms). Haringey Council defined any household where the occupants are unable to heat their property to a sufficient degree, so as to ensure their personal comfort, as a household that is suffering from fuel poverty.

In practice, several factors contribute to Haringey fuel poverty, including; low income, rising fuel prices, inadequate insulation, household composition relating to property size, inefficient heating systems, and lack of information and awareness about how fuel poverty can be tackled. Vulnerable groups on low incomes, especially older people, are typically most affected by fuel poverty. In some cases, they are faced with a choice that would be unimaginable to most: to heat or eat[16]. There is a greater prevalence of fuel poverty among people aged over 60 years of age, single people under 60, and households with children. The consequences of fuel poverty can be severe; fuel poor householders are more susceptible in particular to respiratory illness such as bronchitis and asthma, and are at increased risk of strokes and heart attacks.

The associated stress and anxiety that often goes hand in hand with fuel poverty can also lead to feelings of helplessness and depression. There are an estimated 25,000 excess winter deaths between December and March every year in the U.K., a figure is far in excess of those in much colder countries such as Russia and Finland. Since these figures are not related to low external temperatures only, it is widely recognized that fuel poverty is a likely factor. If fuel poverty were eradicated, the savings to the National Health Services in the U.K. would run into millions of pounds each winter.

Haringey Council and its partners worked hard over many years to alleviate the impact of fuel poverty in the Borough, but historically lacked a co-ordinated approach. With its affordable warmth strategy, Haringey seeks to effectively reflect existing good practice and to support existing frameworks for the delivery of affordable warmth measures. This strategy was developed by the Integrated Housing Board and is a sub-strategy of the overarching Housing Strategy 2009-2019.

In order to deliver this vision, four aims were adopted:

1. Engage with people to improve awareness and understanding of fuel poverty and energy efficiency such that all agencies play a part in reducing the number of people in fuel poverty and residents know what help may be available to them, and how to get it.
2. Increase the energy efficiency of housing across Haringey to reduce long term levels of fuel poverty within the Borough regardless of whether the housing is social rented, privately rented or owner occupied.
3. Maximize resources and opportunities for tackling fuel poverty, since many funding opportunities are available, old and new.
4. Link to other strategies, since affordable warmth should not be seen in isolation.

[16] The 2002 "Heat or Eat? Cold Weather Shocks" study by the National Bureau of Economic Research (link here) found that non-affluent American adults consume 147 fewer calories during then winter than in the summer (a 7.9% decline), adults with children consume 241 fewer calories (an 11.6% decline), and poor children consume 197 fewer calories (a 10.9% decline).

5.4. Güssing, Austria

Güssing is a small rural town in the Burgenland district with about 3,800 inhabitants, located about 200 km south of Vienna near to the Hungarian border. Throughout the Cold War, proximity to this border discouraged industrial investments, which led to a lack of jobs for the residents of Güssing, many of whom migrated to other regions for work. In the late 1980s, Burgenland was the poorest and least developed region of Austria, and the Güssing region was one of the poorest within Burgenland. But because 40% of the region surrounding Güssing is forested, sufficient raw material was available to meet the energy needs of the whole city; in the early 1990s, the mayor of Güssing and other visionary residents worked out a concept to take advantage of it.

In 1998, the largest biomass-based district heating system in Austria was commissioned, providing heat for 95% of the residents of Güssing, with a total pipe network length of more than 20 km. The consumers are mainly private houses (300), public offices, schools, and hospitals (50). There is a growing demand for industrial heat throughout the year.

Beginning in January 2002, a steam biomass gasification process runs a combined heat and power (CHP) plant able to supply all of Güssing's electricity needs, so that now Güssing is supplied by 100 % renewable energy which is fully based on locally-harvested biomass and the plant produces more biodiesel than the local community consumes. Excess electricity is sold to the electrical grid at competitive rates. The biomass supply is secured by long term contracts. The fuel for the heat and power production are wood chips delivered by local wood farmers who have established a wood farmers association.

The acceptance of the CHP-plant by the people of Güssing as well as the local authorities has been high thanks to five key factors:

1.) A CHP-plant was the missing link for complete local energy supply by biomass;
2.) The production of heat and electricity only from local raw material;
3.) Sufficient, renewable stocks of local biomass are available;
4.) Energy supply is now independent from oil prices, and
5.) Local jobs were created not only by the demands of the CHP power plant but also by the stabilization and invigoration of the local wood-working industry.

Güssing the first community in the European Union to produce its whole energy demand – electricity, heating/cooling, fuels – out of renewable resources, all resources from within the region. In addition, Güssing was the first community in the European Union to cut carbon emissions by more than 90%, helping it attract a steady stream of scientists, politicians, and eco-tourists.[17] In 2008, Güssing built a research institute focusing on thermal and biological gasification and production of second-generation fuels. That same year a solar manufacturer started producing PV modules in Güssing, producing 850 megawatts of modules a year and employing 140 people.

[17] Tirone, J. "'Dead-end' Austrian town blossoms with green energy" in *The New York Times*, August 28, 2007.

5.5. The Island Insitute energy efficiency initiatives

ISLAND INSTITUTE

The Island Institute based in Rockland, Maine is a regionally-active non-profit serving island residents with community-scale energy projects, emphasizing renewable energy production and weatherization. Their Maine Community Wind Program was designed to provide environmental, financial and technical services to island and coastal communities for model projects. It seeks to demonstrate how wind projects in the coastal area can be sited without adverse environmental and aesthetic impacts, and provide long-term economic benefits for local residents.

Of special note is their highly pragmatic and effective home weatherization work in remote communities through the Community Energy program. The goal was to overcome transaction costs, information barriers, and disabling front-end expenses in order to allow non-affluent island residents to upgrade the heat retention of their homes. The Island Institute built a program up around Efficiency Maine rebates and incentive to make the weatherization work easy and affordable for homeowners, and worthwhile for contractors.

Their method is to team up with local partners (groups of residents linked to contractors that agree to work on a "batch" of projects, streamlined in scope, over the course of a week) to organize island "Weatherization Weeks", completing home energy assessments and basic air sealing and insulation work on six to 10 island homes in that period. These low-cost, high-savings improvements have saved the average island homeowner an average of $450, paying for themselves within the first heating season. Focusing first on the "low-hanging fruit", Weatherization Weeks allow homeowners to make significant energy efficiency upgrades without spending thousands of dollars and often motivatethem to proceed with more impactful efficiency projects. In many cases, the cost of one day's focused testing and weatherization work can be recuperated through the resulting efficiency savings gained over the subsequent year – the gift of a year for the price of a day.

This program, implemented on a limited scale by II in a handful of constituent island communities in 2013, was a success, and generated more interest from residents than could be fulfilled. It appears that, with discounts and reliable guidance and logistical streamlining, many property owners overcome transaction cost barriers to assert their interest in more affordable heating.

By taking on the challenge of brokerage, this program addressed several of the issues that are at the foreground of discussion by the Affordable Heat Consortium, all concerned with access to information, technical services, and funding. Though it did not underwrite the weatherization work directly and took advantage only of commonly available assets, the Island Institute acting as as a dynamic 'middle man' brought resources together in ways that probably would not have been possible without them. This seems to suggest that the broker's role is central to the deployment of many existing tools and resources, especially for non-affluent and remote rural communities without ready access to specialized contractors.

5.6. transferrable best practices

Two of the case studies above (Shutesbury, MA and Güssing, Austria) show the **positive impact of energy transition** and **coordinated heating system retrofit** in small, non-affluent communities very similar in size and demographic profile to most towns and cities in Down East Maine. Shutesbury's example shows the value of **local leadership**, participation in **larger networks** (ICLEI), modest budget allocations well-spent, **energy use monitoring** at a community scale, **dedicated budget reductions** earmarked for energy efficiency investments, and an active local energy committee. In Güssing, strong local leadership was also essential, along with an ambitious and **comprehensive local energy transition strategy** that placed emphasis on the **creation of locally-sustainable solution to the heating problem, new jobs** and **revenues** for local business.

The most nearby example cited here is Berlin, NH, which also has a community profile similar to many in Hancock and Washington counties. Berlin is a non-affluent city with a flagging economy historically reliant on forest-based industries whose future prospects are uncertain. By taking a highly **collaborative approach** to local concerns, new vitality was injected into these industries. Berlin focused on one renewable fuel, wood pellets, and emphasized **winter heating** as a central component of energy consumption. Partnerships, smart planning, and **efficiencies of scale** allowed the Model Neighborhood Project to negotiate strong subsidies and loan products on behalf of participating residents.

Collaboration was key to success for Cambridge Energy Alliance (a **public-private partnership** with the City and local **energy service companies**), Haringey's Affordable Heat Strategy (**inter-agency coordination** at the borough level, along with strong national support). In other cases, a collaborative approach to affordable heat and household energy led to the creation of clean energy **municipal financing districts**, coordination of **on-bill financing** with local utilities on behalf of participating residents, and other approaches to lower and spreading front costs of retrofit. In each of these cases, program design allowed for the study, adaptation, and **transfer of successes** to other communities with matching goals.

In Vermont and elsewhere, support at the regional, state, and national levels can accelerate forward movement: **red tape and complex arrangements** with lenders and contractors can be taken care of on behalf of participants; **favorable lending rates** can be negotiated as a sort of 'class action' for energy transition; **coordination with public utilities** agencies allows for steady, long-term funding streams, which in turn support **interest rate buy-downs** that put retrofit capital within reach of non-affluent property owners; **comprehensive monitoring and data collection** can provide insights about leverage and program scope adjustments that would otherwise be too expensive or difficult to gather while providing a basis for new investments.

A few tools and strategies stand out as especially relevant to deployment of affordable heating strategies in Down East Maine, summarized very briefly below in no special order.

monetizing hidden costs of non-renewables

To level the playing field for renewable energy developers in Maine, policy makers can tip the scales in their favor with tax credits, subsidies, loan guarantees, etc. A complementary approach is to curtail subsidies to the non-renewable energy sector by internalizing its historically "unpriced" or "social" or "negative externalized" costs – measured in terms of pollution, public health impacts, compromised security, 'lives and treasure,' etc. – so that 'market failures,' barriers, and distortions are partially corrected.[18] The simplest way is to reverse-subsidize conventional energy is with aggressive carbon taxes, though the current political climate does not support that approach. Another way to address "hidden" costs of non-renewable fuels is to utilize attributive life cycle cost accounting when comparing the efficiency of different fuels and systems. In 2009, the estimated externalized costs of fossil fuel use in the U.S. were $240b,[19] so if these costs were put back into the unit price of fossil fuels, the effort to bring renewable fuels and systems to scale would intensify, converting a market failure into a market triumph.

Several researchers have observed that while hidden costs remain subsidized for incumbent technologies, superior technologies swim against the current of "path dependency" that can "lock in societies into energy or infrastructure options that may be inferior in terms of cost efficiency or accumulated social costs in the long term...."[20] One study notes that "[t]here is a constant need for mechanisms for sustainable development that internalize environmental or social externalities... when external costs are included, the relative advantage of renewable energies is highlighted...."[21] Another states the case more bluntly when it concludes that "the removal of both direct and indirect subsidies to power-generation technologies and the appropriate pricing of fossil (and nuclear) fuels to reflect the environmental damage (local, regional and global) created by their combustion are essential policy strategies...."[22]

heat districts & shared energy infrastructure

In Helsinki, Finland fuel was expensive after WW2, so the city established its district heating system in 1952 and hot water is now distributed to almost the entire city. The case of Güssing shows some of the virtues of small-scale, shared heating infrastructure (along with the benefits of biomass co-generation). Instead of installing and maintaining a boiler in every house, a central plant could provide hot water to an entire district of 300 houses with all the attendant efficiencies of scale. The numbers speak in favor of heat districts, but the social habits of American communities do not. This is probably why heat districts are mainly seen on college campuses or highly organized corporate parks. It need not be this way, though. Small communities – especially those with woody biomass stocks within 50 miles – are well-poised to pool ideas, resources, and political will in order to share expensive infrastructure.

power purchase & performance contracting

High front costs are a recurrent obstacle to renewable energy transition, retrofit, and startup production, calling for a market-driven, comprehensive way to distribute and manage risk. One study notes that the high upfront costs of renewable energy technologies may inhibit uptake by low-income consumers who lack access to cash or credit and may "prefer to keep the initial cost low rather than minimizing the operating costs which run over a longer period of time...." [23] Access to capital for renewable energy deployment and efficiency measures may be addressed by outsourcing investment risks in return for shared savings.

---

[18] Market failures can be caused by (1) misplaced incentives; (2) distortionary fiscal and regulatory policies; (3) unpriced costs such as air pollution; (4) unpriced goods such as education, training, and technological advances; and (5) insufficient and incorrect information; meanwhile the unpriced costs of conventional fuels insure that "more fossil energy is consumed than is socially optimal" according to M. Brown's "Market failures and barriers as a basis for clean energy policies" in *Energy Policy* 29 (2001): 1197ff. (link here)

[19] Greenstone, Michael & Adam Looney. "Paying Too Much for Energy? The True Costs of Our Energy Choices", MIT Department of Economics Working Paper No. 12-05: Feb. 2012. (link here)

[20] Unruh, G. "Understanding carbon lock-in." in *Energy Policy*, v. 28, n. 12, Oct. 2000: 817-830. (link here)

[21] Sathaye, Jayant & Atiq Rahman. "Renewable Energy in the Context of Sustainable Development" in the *Special Report Renewable Energy Sources and Climate Change Mitigation*, for the Intergovernmental Panel on Climate Change, 2009, chapter 9: 761ff. (link here)

[22] Owen, Anthony D. "Renewable energy: Externality Costs as Market Barriers," in *Energy Policy* 34 (2006) 632–642. (link here)

[23] Reddy, S., & J.P. Painuly. "Diffusion of renewable energy technologies – barriers and stakeholders' perspectives." in *Renewable Energy*, v. 29 n. 9, 2004:1436. (link here)

This approach asks end-users pay to enter a long-term contract for power, or heat, at guaranteed rates (termed 'performance contracting') while investors – often organized as an 'energy service company' (ESCO) – pay for capital costs, fuel, and maintenance. In this arrangement, prohibitive initial investments are avoided by consumers while investors benefit from highly predictable returns. National ESCOs increasingly involved with renewable energy include Siemens, Johnson Controls, and Honeywell International; at present, Down East Maine is served by only one ESCO specializing in biomass installations, PelletCo.

feed-in tariffs

When governments subsidize renewable energy development, that is good for the developer, but often – if the subsidies are funded from general sources – the taxpayers are paying on one end for a discount on the other. This arrangement is considered regressive and non-optimal. The feed-in tariff (FIT) is an alternative to taxpayer-subsidized incentives for renewable energy programs. It creates a financial incentive to produce clean electricity from renewable sources and feed it into the public grid. With a FIT, the government mandates electric utilities to pay a prescribed above-market rate for electricity generated by net-producers preferential, technology-specific renewable energy. It is market-driven, so it takes a burden off of strapped state and federal budgets, and it permits renewable growth to scale with a predictable return on investment. A 2008 European Commission report noted that "well-adapted feed in tariff regimes are generally the most efficient and effective support schemes for promoting renewable electricity," especially when coupled with subsidies, soft loans, and quota obligations.[24]

Clean Energy Municipal Financing (CEMF) & **on-bill financing (OBF)**

CEMF uses a special municipal tax to finance energy improvements. A municipality provides funding for the program through the issuance of a bond that is repaid through a line item on the property tax bills of participating property owners and guaranteed by a lien. If the property is sold prior to the end of the repayment term of 20 years, the new owner takes over the remaining special tax payments as part of their property's annual tax bill – this kind of repayment obligation that is tethered to a property, not a person, is called on-bill financing. In this arrangement, there is no up-front cost to the property owner[25] and interest payments on the project are sometimes tax deductible, similar to a home mortgage. The long repayment period and transferability of the payments allows property owners to invest in comprehensive energy savings and renewable projects that pay back over a longer time frame than many existing financing options allow.

local energy producers & **markets**

The serious challenge to community-scale energy projects is demonstrating a consistent return on investment to attract the right mix of public and private financing. A smaller scales – towns and rural communities, for example – the risks are fewer and the decision-making pathways less complex, making these places strong candidate sites for renewable energy deployment experimentation and demonstration. "The local government has a critical role to play in climate leadership, galvanizing stakeholders, bringing focus to zones, and leveraging public financing," says Rhys Roth, director of strategic innovations for Climate Solutions.[26]

---

[24] In April 2013, the Joint Standing Committee on Energy, Utilities and Technology of the Maine Legislature held a hearing on a bill that proposes to enact a comprehensive feed-in-tariff program to be administered by the Commission for renewable technologies of up to 500 kW. The prices for long-term contracts under this process can be expected to be significantly above wholesale market prices and thus the program essentially represents a renewable resource incentive subsidy that is ultimately paid for by the general body of ratepayers. Legislative action on LD 1085 has been postponed for further study until 2014. (link to pending legislation here)

[25] This addresses the capital market barriers that can inhibit efficiency purchases. According to Brown's 2001 study, different energy producers and consumers have varying access to financial capital, and at different rates of interest. In general, energy suppliers can obtain capital at lower interest rates than can energy consumers, resulting in an "interest rate gap."

[26] Tucker, Libby. "Cities Use Creative, Targeted Lending to Speed Energy Projects" in the *New York Times*, January 6, 2009. (link here)

This approach is affirmed by Efficiency Maine's Community-Based Renewable Energy Pilot Program and the proposed feed-in tariff legislation, which offers special financial incentives for projects created within a "renewable energy opportunity county" defined by its lower-income demographic profile. This incentive pushes investment opportunities towards smaller, rural communities in Maine, where innovation can have the shortest turnover cycle and largest impact.

Meanwhile some studies indicate that the political atmosphere at national and state echelons is so inimical to energy transition and that its inertia is intractable. A regional approach, though less efficient in relation to scale, is more likely to succeed. Since "the political forces needed for major changes in U.S. energy policy are not in place," as one observer notes, progress with renewable energy deployment is more likely when "action can be taken at the margin."[27] Community-owned energy production models can transform the wider energy economy if self-supporting trust networks are enabled both within and between communities and other partners.[28] One study from the UK notes that such potentials are vastly overlooked in current policy debate.[29]

lower transaction costs

Numerous studies demonstrate that consumers invest in upgrades of their buildings, appliances, cars, and other equipment for safety, health, comfort, aesthetics, reliability, convenience, and status reasons. Though it promises undisputed benefits and substantial cash savings, energy efficiency rarely is a high priority issue relative to these other factors.[30] What stands in the way may be a lack of trustworthy information about and intuitive access to the competing options, such that the "transaction costs" of obtaining information and access are higher than the perceived returns. Measurable ways to lower barriers include:

a.) reduced interest rates (interest buy-downs or earmarked loans),

b.) deductibility of interest payments;

c.) stretching underwriting criteria to include anticipated energy savings in the calculation of debt-to income ratio;

d.) loan guarantees and reserves to enable lenders to offer below-market rates to a wider pool of borrowers;

e) rebates offering a direct payment for implementing certain efficiency measures;

f.) subsidized transaction costs like free legal advice or energy audits before and after the installation of new systems or efficiency upgrades; and

g.) revision of building codes and permitting regulations to make the startup process for renewable energy developers quicker, easier, less costly, and less complicated.

---

27 Keohane, R. & D. Victor. "The Transnational Politics of Energy," in *Daedelus* Winter 2013, Vol. 142, No. 1: 97-109. (link here)

28 Rifkin in *The Third Industrial Revolution: How Lateral Power Is Transforming Energy, The Economy, And The World*. New York: Palgrave Macmillan: 2011 (link here) argues, "localised energy production creates the potential for a 'third industrial revolution' that could generate thousands of jobs and business opportunities through the creation of a distributed 'energy internet' – a system in which individuals can produce, deliver and receive renewable energy generated nearby."

29 "The focus on drawing new suppliers into the existing energy market and providing consumers with greater choice or purchasing power may bring bills down or limit their increase, but continues to treat the public as passive consumers rather than potential producers and 'market-makers' – those who are able to build and develop sustainable models for wider public good." in "Re-energising Our Communities: Transforming the Energy Market through Local Energy Production" by C. Julian and J. Dobson, a ResPublica green paper, 2012. (link here)

30 T'Serclaes, Philippine de, & Nils Devernois. "Promoting Energy Efficiency Investments: Case Studies in the Residential Sector" Paris: OECD/IEA and AFD, 2008. (link here)

6. THREE STRATEGIES RECOMMENDED

The goal of the AHC is to borrow from these best practices, merge them with regional circumstances, and demonstrate viable paths forward towards affordable heat. With so many good projects already proven elsewhere, the process appears straightforward. Yet transfer of these solution to Down East Maine has been halting and inconsistent. What prevents demonstrated successes from being translated? Chronic challenges include several that have already been addressed, like foggy decision-making, fuel pricc fluctuations and distortions, scarcity of reliable information regarding options, lack of affordable access to specialized labor, insufficient access to affordable investment capital, and high transaction costs. Keeping these challenges in mind, the AHC proposes three general strategies to guide the demonstration phase of the project, February - August 2014.

6.1. lower market fences blocking deployment of affordable heat solutions

Throughout the AHC exchanges and related research summarized in this report, would-be affordable heating end-users have pointed to front-costs as serious obstacles to their forward motion. The Maine property owners who stand to gain most from more affordable heating systems are currently least likely to acquire them. The picture that emerges is a high fence keeping individuals, institutions, and firms out of renewable energy's greener pastures.[31] The simplest way to enable the deployment and commercialization of renewable energy-based affordable heat systems in Down East Maine, as elsewhere, is to insist that the price of non-renewable energy reflects its comprehensive social cost – to recognize and eliminate market "externalities" that make non-renewables seem more cost-effective than they actually are. A related AHC goal is <u>to lower barriers that stall market entry of renewable energy producers & consumers</u>. This is a non-optimal alternative to removing market distortions associated with non-renewable energy production and consumption is the creation of new distortions that tip market scales in favor of renewable energy systems. Relevant tools are subsidies, tax credits, renewable energy certificates, energy service providers, feed-in tariffs, loan product interest guarantees and buy-downs, on-bill financing, and renewable portfolio standards.

<u>AHC demonstration project #1</u>: Create the blueprint for a permanent regional public-private energy service company (ESCO) to support affordable heat retrofit projects in the Down East Maine region, with a full description of costs, scope, operations, and staff requirements, ready for activation with appropriate funding. This project would envision the 'vehicle' which can deliver property owners securely to the other side of existing market barriers, and it ultimately must be driven by market forces. In this way it addresses the long-term concerns raised by the affordable heat consortium's research and consultations, and recognizes the instability of programs tied to soft money or temporary incentives. The primary product of this subproject would be a detailed proposal to be the centerpiece of an application for MTI's implementation grant support at the conclusion of this cluster initiative work.

6.2. broker useful information for affordable heat deployment

It seems likely that access to reliable information and technical guidance will allow many prospective affordable heating system consumers to take the plunge. For many, this transformation needs to be understood with numbers and convincing on-site demonstration in order to overcome or compensate for the high transaction costs associated with alternative energy adoption. (These principles are illustrated well by the success of the Island Institute's Weatherization Week program described in section 5.5 above.) A related AHC goal is <u>to show how the more expensive choice becomes the less expensive choice.</u> Standing associations with the more pricey (at the front end), less costly (over the lifetime of the system) heating systems should change, and the change would apply just as well to

---

[31] One study notes that these conditions fail to offer "a nimble platform for end-to-end innovation...rather, they suggest a business with high barriers to displacement of incumbents." Ernest J. Moniz, "Stimulating Energy Technology Innovation," in *Daedalus* Spring 2012, v.141, n.2: 83. (link here)

prospective investments in a new boiler, an improved heat retention envelope, a neighborhood heat district, or a municipal biomass co-generation plant.[32] Risk is distributed and participation stabilized when affordable heating system consumers can collaborate with trusted local actors, act jointly, pool investments, increase buying power, and achieve efficiencies of scale not available to individuals. Relevant tools are communication campaigns, energy service providers, rigorous statewide monitoring projects, 'early adopter' incentives, performance contracting, and free brokerage of impartial information.

AHC demonstration project #2: Create an 'affordable heat coach,' an information storefront, and a technical assistance referral network for affordable heat options headquartered in Eastport. This would be a temporary and experimental initiative to dramatically increase local access to reliable information in a typical community within the target region.

A prominent storefront location would be secured for an 8 month period (leading up to next winter's heating season) for the dissemination of information, and it would be staffed during regular hours by a trained contact person (like an ombudsman or liaison) who would interpret the information, make referrals on behalf of property owners, assist with cost-benefit assessments, and walk through all steps towards the adoption of recommended affordable heat solutions. This person would also make house calls and coordinate with specialized contractors to audit exisiting conditions and execute desired changes. This local contact person would not charge any fees for these services (this work will be subsidized for the trial period by the AHC program) and would not advocate for any particular system, fuel, product, etc. in order to establish impartiality and credibility as an advisor. The activities of the 'affordable heat coach' would be augmented by online resources and a toll-free telephone number.

The primary products of this subproject would be information exchange between the coach and property owners (engaged as individuals or groups) and an increase in affordable heat investments based on the usefulness of the information provided.

6.3. recruit a local energy transition community

Some studies indicate that the political atmosphere at national and state echelons is inimical to energy transition in general. A regional approach, though less efficient in relation to scale, may be more likely to succeed. For example, one observer notes that "the political forces needed for major changes in U.S. energy policy are not in place," so that progress with renewable energy deployment is more likely when "action can be taken at the margin." The case studies above suggest that community-owned energy production models can transform the wider energy economy if self-supporting trust networks are enabled both within and between communities and other partners. These findings point to the small, dispersed community as a locus where innovation has the shortest turnover cycle and largest impact.

More specially, the communities experiencing the largest heating "affordability gap" have the most to gain from this kind of experimentation, which speaks to the demographics of Down East Maine. A related AHC goal is to develop affordable heat demonstration projects operating at the community scale. One relevant tool is provided by Efficiency Maine's "Community-Based Renewable Energy Pilot Program" and the proposed feed-in tariff legislation, which offers special financial incentives for projects created within a "renewable energy opportunity county" defined by its lower-income demographic profile. Other tools include heat districts, clean energy municipal financing districts, feed-in tariffs, federal bonds earmarked for public school capital improvement projects, bulk purchase and storage of mechanicals and fuels, public-private partnerships, and model neighborhood projects.

---

[32] Another study observes that "...this shift in perspective converts the high costs and uncertain benefits of mitigating climate change into the manageable costs of mitigating climate change risks and the palpable benefits of avoiding foreseeable economic, social, and environmental damage." from M. Dworkin, R. Sidortsov, B. Sovacool, "Rethinking the Scale, Structure & Scope of U.S. Energy Institutions" in *Daedalus* Winter 2013, v.142, n.1: 129-145. (link here)

AHC demonstration project #3: Undertake transitional demonstration projects in Eastport, supported by the 'affordable heat coach' component above, in order to show the benefits of a concerted approach to investment in affordable heating alternatives. Emphasis would be on hands-on measures within the target community, based on a community-scale thermal energy consumption audit. This baseline research will dictate the optimal forms of invention, which will probably take the form of air sealing and fuel-switching in order to boost efficiencies. Of special interest will be augmentation of inefficient, expensive systems like oil furnaces with renewable fuel systems (like pellet stoves and boilers) and high-efficiency mechanicals (like air-exchange heat pumps). Every effort will be made to encourage groups of property owners (like a fuel-purchase cooperative, or a downtown heat district cohort) to undertake efficiency investments together, using their leverage to strengthen purchase power.

The primary products of this subproject would be 3-10 completed efficiency investments with measurable savings in the 2014-15 heating season.

The implementation budget for this project will support the completion of the three strategic initiatives outlined above.

8. REFERENCES

The following citations appeared in the footnotes of this report:

Bhattacharya, J., T. DeLeire, S. Haider & J. Currie. "Heat or Eat? Cold Weather Shocks," National Bureau of Economic Research Working Paper 9004, June 2002. (link here)

Borenstein, Severin. "The Private and Public Economics of Renewable Electricity Generation," in University of California Energy Institute at Haas Working Paper #221R, 2010: 2. (link here)

Brown, M. "Market Failures and Barriers as a Basis for Clean Energy Policies" in *Energy Policy* 29 (2001): 1197ff. (link here)

Dworkin, M., R. Sidortsov & B. Sovacool. "Rethinking the Scale, Structure & Scope of U.S. Energy Institutions" in *Daedalus* Winter 2013, v.142, n.1: 129-145. (link here)

El-Ashry, Mohamed T. "National Policies to Promote Renewable Energy," in *Daedalus* Spring 2012, v.141, n.2: 105-110. (link here)

Greenstone, Michael & Adam Looney. "Paying Too Much for Energy? The True Costs of Our Energy Choices", MIT Department of Economics Working Paper No. 12-05: 2012. (link here)

Healy, J. D. & J. P. Clinch. "Fuel poverty, thermal comfort and occupancy: results of a national household-survey in Ireland," in *Applied Energy*, 2002, vol. 73, issue 3-4: 329-343. (link here)

Houser, T., S. Mohan & R. Heilmayr. "A Green Global Recovery? Assessing US Economic Stimulus and the Prospects for International Coordination," for the Petersen Institute for International Economics, World Resources Institute Policy Brief: Feb. 2009. (link here)

Jacobson, G.L., I.J. Fernandez, P.A. Mayewski, & C.V. Schmitt (eds). *Maine's Climate Future: An Initial Assessment.* Orono, ME: University of Maine, 2009. (link here)

Julian, C. & J. Dobson. "Re-energising Our Communities: Transforming the Energy Market through Local Energy Production" a ResPublica green paper, 2012. (link here)

Keohane, R. & D. Victor. "The Transnational Politics of Energy," in *Daedelus* Winter 2013, Vol. 142, No. 1: 97-109. (link here)

Maine Forest Service Assessment of Sustainable Biomass Availability, July, 2008. (link here)

Moniz, Ernest J. "Stimulating Energy Technology Innovation," in *Daedalus* Spring 2012, v. 141, n. 2: 83. (link here)

National Research Council. *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use.* Washington, DC: The National Academies Press, 2010. (link here)

Owen, Anthony D. "Renewable energy: Externality Costs as Market Barriers," in *Energy Policy* 34 (2006): 632–642. (link here)

Reddy, S., & J.P. Painuly. "Diffusion of renewable energy technologies – barriers and stakeholders' perspectives." in *Renewable Energy*, v. 29 n. 9, 2004: 1436. (link here)

Sunrise County Economic Council, ***Renewable Energy Working Group final report***, draft 1/14.

Thaler, Jeffrey. "Fiddling as the World Floods and Burns: How Climate Change Urgently Requires a Paradigm Shift in the Permitting of Renewable Energy Projects", in E*nvironmental Law*, Fall 2012, v.42, n.4: 1101-1156. (link here)

Tirone, J. "'Dead-end' Austrian town blossoms with green energy" in *The New York Times*, August 28, 2007. (link here)

T'Serclaes, Philippine de, & Nils Devernois. "Promoting Energy Efficiency Investments: Case Studies in the Residential Sector" Paris: OECD/IEA and AFD, 2008. (link here)

Tucker, Libby. "Cities Use Creative, Targeted Lending to Speed Energy Projects" in the *New York Times*, January 6, 2009. (link here)

Unruh, G. "Understanding carbon lock-in." in *Energy Policy*, v. 28, n. 12, 2000: 817-830. (link here)

U.S. Dept. of Energy *Office of Renewable Energy and Efficiency Report*, May 2009. (link here)

Wilkinson, P. & Ben Armstrong. *Cold Comfort: The Social and Environmental Determinants of Excess Winter Death in England, 1986-96.* Policy Press, Dec 1, 2001. (link here)