RECOMMENDATIONS BY THE TRURO ENERGY COMMITTEE FOR THE CLOVERLEAF AFFORDABLE HOUSING PROJECT

Submitted to the Truro Zoning Board of Appeals and the Truro Select Board
July 27, 2020

Introduction

Background

The Truro Energy Committee first became involved in the Cloverleaf project last September. At that time the project had progressed to the stage where a preliminary plan could be considered. Last November we received the plans and application. As you know, our progress was stalled when the Town prohibited committee meetings due to Covid-19. As soon as that prohibition was lifted, the Energy Committee was able to resume its work, culminating in this submittal.

Truro Energy Committee Role

Our role in the process is spelled out in our Select Board charge:

- To prepare a baseline study of greenhouse gas emissions of the entire town of Truro.
- To prepare a set of goals for the reduction of those emissions.
- To prepare plans outlining the specific policies necessary to achieve those goals.
- To help put the plans into effect, and to monitor their effects.

Of course, our efforts also need to be cognizant of the larger context of Truro itself:

> *"The challenge for the town is to retain the elusive "Rural Character" and to accept change at the same time -- or, better still, to shape that change towards a common vision of Truro's future."*
>
> —Truro's 2005-2010 Local Comprehensive Plan, page 14

And we are cognizant of our place in the Commonwealth, where the goals were most simply stated by the Governor:

> *"I'm committing the Commonwealth to achieving an ambitious climate goal: net-zero greenhouse gas emissions by 2050."*
>
> —Massachusetts Gov. Charlie Baker in his January 2020 State of the Commonwealth address

And these goals have broad local support, especially from our state Senator Julian Cyr who was instrumental in codifying that goal in Senate Bill S.2478:

> *"I'm proud of leaders … for joining… the Commonwealth as Green Communities and making a commitment to reduce carbon emissions and protect our fragile coastal environment …The Cape and Islands particularly need to take a bold action to address climate change and plan for a carbon-free future."* [i]
>
> —Massachusetts *State Senator Julian Cyr, February 2020 mass.gov/news*

In the few months since these goals have been quantified, the state is already moving to implementation, and will be setting 2030 goals soon:

> *"The Commonwealth is working to determine how best to achieve this emissions limit through its 2050 Roadmap, a nation-leading quantitative and qualitative planning effort that will chart multiple technical and policy pathways by which the Commonwealth can equitably and cost-effectively achieve net zero emissions by 2050, and will conclude with the publication of a long-range 2050 Roadmap report. The state's 2050 Roadmap analysis will directly inform the state's 2030 emissions limit, which will be set at the end of this year together with the publication of a second report detailing the state's plan to achieve that limit, the Massachusetts Clean Energy and Climate Plan for 2030."*
>
> —Establishing Net Zero Emissions Target, *April 2020 mass.gov/news*[ii]

Truro Energy Committee Goals for Cloverleaf

It is our goal to advise and encourage a project that is more affordable to tenants, offers sustainability that aligns with State and Truro goals and emissions limits, and provides the developer with an economical project. We are confident that these goals can be achieved.

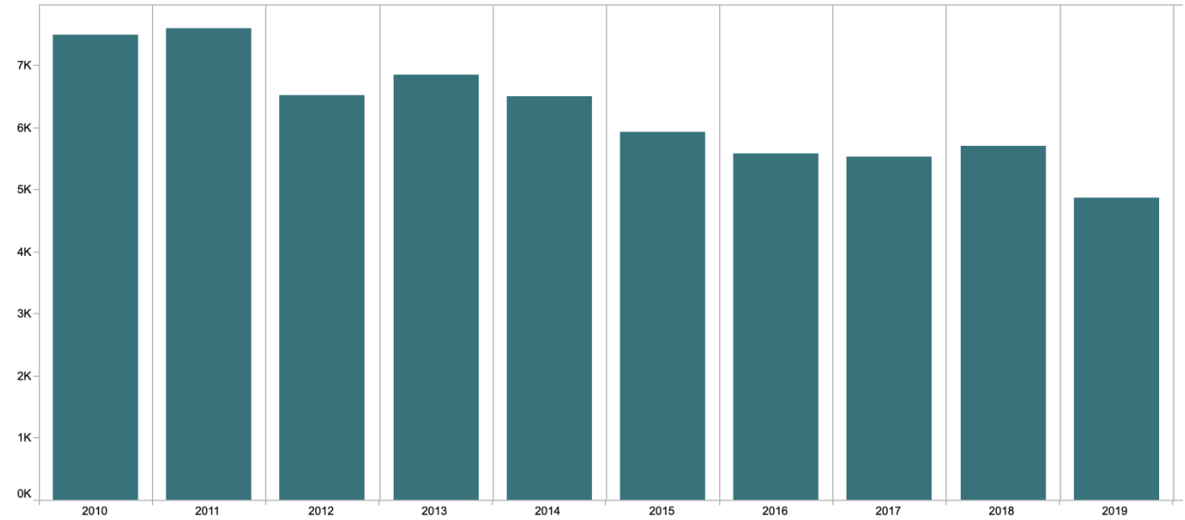
Recent History of Truro Energy Use Reduction

In 2011 Truro became the first Green Community on the Lower and Outer Cape. Tiny rural Truro, the smallest town of the 15 towns on Cape Cod, was leading the way. It wasn't until 3 years later that Wellfleet and then Provincetown followed.

As part of that effort we received grant assistance to reduce the carbon footprint of our six large buildings by 20% in five years. These "Big Six" are the Central School, Public Safety Building, Library, Community Center, Town Hall, and DPW. If the Cloverleaf is approved and constructed at anywhere near its proposed scale, it will take its place as one of the seven largest building complexes on Town land.

We knew that it would be harder to reduce the emissions from our vehicles (e.g., not many hybrid-electric snowplow trucks on the market yet), so we would have to reduce our building energy usage by even more than 20% to make up for most of the heavy vehicles. So that on a blended basis of buildings and vehicles we could come close to the overall 20% goal.

Truro Building Energy Usage (in million BTUs per year, weather normalized)
35% reduction from 2010 to 2019



2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
7,493	7,601	6,524	6,854	6,511	5,922	5,579	5,529	5,699	4,877

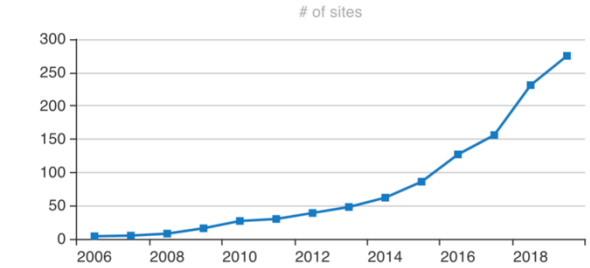
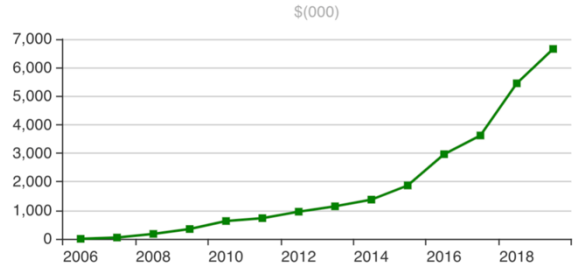
In 2011, a 20% reduction in energy usage was considered a successful effort, but that was before we learned more about the alarming and accelerating approach of climate change. In order to deal with the negative effects of climate change, the Commonwealth is setting new goals of another 30% reduction in the next 10 years, to get us to a 50% total reduction by 2030 and continuing on past that with additional 25% reductions in each decade thereafter. That will then take us to net-zero emissions by 2050.

This is a goal now that has broad support. From the Governor who underscored it in his State of the Commonwealth address, to our state Senator Julian Cyr who was instrumental in codifying that goal in Senate Bill S.2478, to even more recent roadmaps coming from the state departments.

Truro's Commitment to Solar Energy

In 2016, Truro took steps to build a solar farm on the landfill. However, due to delays in getting approval for the landfill cap for placing solar panels on it, the Town entered into an agreement at year end to purchase all the solar output of a 552kW solar array in Canton. This solar energy from over 1,500 panels is sufficient to meet 100% of the electricity demands for the Big Six buildings as well as all other town requirements.

In parallel with this move to 100% solar power of town buildings, Truro residents have been demonstrating their increasing commitment to renewable energy by installing solar panels on their own properties. In the past dozen years, Truro homeowners and businesses have installed almost 300 solar systems for a total private cumulative investment of almost $7 million. This is remarkable and shows Truro's commitment to renewable energy. Even as incentives have been reduced over the years, the costs of solar panels have fallen and an increasing number of Truroites have been making that investment each year.

Solar Installations in Truro (cumulative)	Solar Investments by Truro ($000 cumulative)
	

It is our hope that the Cloverleaf project will adopt a similar approach to energy efficiency and solar electricity production, and follow in these footsteps.

Learning from This Experience

In the past 5 years, 3 major events have prompted a change of approach:

1. an increased awareness of the severity and adverse impacts of climate change;
2. policy changes at the state, regional and town levels to mitigate emissions which are the major contributor to climate change;
3. demonstrated success of new construction methods that can be part of the solution by providing structures with net-zero carbon emissions.

Setting goals, while a necessary step, is not where the real work gets done. Truro learned this during the last 9 years of our Green Communities 20% emissions reduction programs. We find ourselves constantly trying to overcome deficiencies resulting from the past and even current approaches to building. As a result, often our efforts only yield marginal changes in carbon emissions but at a significant cost of retrofit and/or equipment changes.

New Approaches Needed

The key lesson learned as we go forward is that the carbon footprint of a building is pretty firmly set at birth. Once a building is built, it often takes expensive corrective action or retrofits to change that footprint.

That is why it is so important that buildings such as the Cloverleaf be designed to be energy efficient from the very start and to anticipate, where easy and inexpensive, future cost reductions and/or technology changes.

It used to be that the building codes incorporated energy considerations. For example, dictating the minimum amount of insulation in a wall. But as methods improved and energy measures became more important, and technology evolved, building codes started to change every three years. That is why we now see the energy code, as part of the building code, changing in 2009, 2012, 2015, 2018 and soon expected again in 2021.

In fact, energy considerations have become so important, that the Commonwealth is planning to transfer the responsibility for the energy code from the Board of Building Regulations and Standards to the Department of Energy Resources.

Zero-Energy Affordable Housing

How does this affect Affordable Housing? Only favorably. Building for energy efficiency is just good building and sustainable practice. CO2 emissions don't care who lives in the unit and what their income is. If you care about the environment and believe the overwhelming science about the serious effects of climate change, you will build this way. If you want to offer the unit as an affordable rental, you'll build it to be even more energy efficient and somewhat smaller. Smaller units can be actually more efficient energy-wise.

In fact, the recent Truro bylaw change that permits ADU's on private lots from 400 square feet to 1000 square feet have encouraged several projects, from which we have actual energy performance data. One recent Truro project has been measured, consisting of a single unit, 1-bedroom ADU of 672 square feet, and it has achieved and exceeded net-zero energy efficiency by 19% for the past two calendar years. See Appendix D for details.

Truro Cloverleaf and the Energy Committee

The Energy Committee expressed our concerns to the Housing Board 10 months ago about the necessity of the Cloverleaf project not detracting from Truro's goals. At that time, it was decided that we should work directly with the developer. After some initial exploratory meetings, we finally received a set of plans that could form the basis for further research on our part.

Subsequent to that we have held numerous meetings of the Committee, as well as with a number of consultants and state agencies. After a number of months of research and consultations, we have arrived at a set of seven specific recommendations. Some of these recommendations have grant funding available or are available at very little cost. It is our hope that they are all adopted.

The Energy Committee realizes that the ZBA is being asked to waive certain bylaws that Truro has developed after years of thoughtful deliberation. If the Cloverleaf becomes a good citizen of Truro, and helps Truro achieve its net-zero goals as one of the Big Seven building complexes, then in this Committee's view, it will go a long way to demonstrating public worthiness for requested waivers.

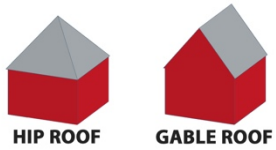
Conversely, if the Cloverleaf does not step up to become a partner in achieving these goals, then an inequitable burden will fall on the rest of Truro citizens who will have to make additional sacrifices to compensate for the lack of participation by the Cloverleaf. Such an outcome will not be one of Truro's finest moments. Instead, as the Governor's office says, we should be striving to find *"…pathways by which the Commonwealth can equitably and cost-effectively achieve net zero emissions."*

SPECIFIC RECOMMENDATIONS

We have examined the preliminary plans provided, and as a result of that have come up with a set of specific recommendations. All recommendations have been made with an eye toward being economical for the project.

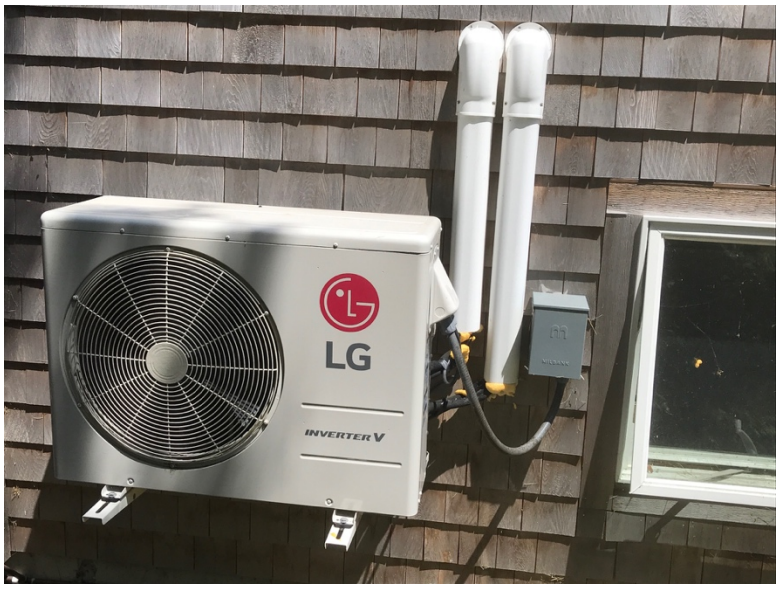
Some have grant funding that can be secured to implement them. Others have incentives, subsidies, and/or reasonable paybacks resulting in a favorable return on investment.

It should be noted that government-funded incentives and subsidies are not constant over time. New technologies often get added incentives to foster their adoption, but then later those incentives are reduced. Likewise, many technologies exhibit a declining cost curve over time, helped by increasing volumes of manufacturing. As these component costs decrease, the incentives are often reduced appropriately. But in most areas, we observe the all-in cost of acquisition and operation improves over time and will be finally determined at the time of acquisition and based on the incentive landscape at the time.

Recommendation	Funding Available
1. Energy Efficiency and Sustainable Design Plans **A. It is recommended the Developer provide an Energy Efficiency and Sustainable Design plan as part of the Developer's application for a Town Building Permit.** Commentary: Appendix A contains the one-page application for funding for the design of a highly energy efficient project. This incentive is funding only for Passive House designs and/or designs which include electrification of HVAC (see Recommendation #4 below). **B. It is recommended the Developer provide a rooftop solar energy system cost-benefit analysis as part of the Developer's application for a Town Building Permit.** Commentary: Depending on the availability of incentives, solar electric systems are generally cost effective with a favorable payback. By performing a cost-benefit analysis the Developer can determine if it warrants installation during construction or should be deferred until the economics are more favorable. **C. The proposed hip roof design is sub-optimal for maximizing roof area available for locating solar panels. Our recommendation is that the cost-benefit analysis recommended above include a sensitivity analysis using the more traditional Cape Cod gable roof design.** Commentary: A hip roof has 4 vertical ridges on each corner. These ridges interrupt a rectangular array of solar panels, and thus reduce the amount of electricity that can be generated from the roof by about 1/3. See Appendix B for additional information.  	Yes

Recommendation	Funding Available
## 2. Solar Ready **In the event a solar energy system is not included in the original construction plan, we recommend that the Developer install all necessary internal electric conduits from rooftop to ground level for each occupied structure for potential future solar energy system development. In addition, the roof structural design should assure sufficient capacity for a solar system weight loading and wind uplift loading.** Commentary: Conduits for solar panels are easy and inexpensive to install during the framing of a building. It requires little additional plumbing effort during construction to avoid placing vents and pipes in the middle of a roof. Similarly, almost all modern roofs are adequate to accommodate solar systems structurally, but, in case of shortfalls, structural retrofits can be many times the cost of the modest changes needed during construction. Given the 30-year trend of declining solar costs, solar will almost certainly be cost-effective within a few years of project completion if it is not cost-effective initially – hence the recommendation that the building be made solar-ready. 	Very Small Cost

Recommendation	Funding Available
## 3. Tenant-Responsible Energy Usage **Provide independent unit metering as an inexpensive and important incentive for occupants to conserve energy, thereby further enhancing the affordability of each unit. Metering solar production independently of metering electrical usage by each unit is also recommended.** Commentary: Metering each unit's electrical usage is inexpensive if wired properly during construction. Doing so encourages energy conservation by tenants, which reduces the monthly operating cost of that unit, making it just that more affordable. It also discourages the occasional irresponsible tenant from increasing the cost assessed to other responsible tenants. **MILBANK CL200-D 200A WATT-HOUR METER** **Description**: MILBANK CL200-D 200A WATT-HOUR METER **Technical Description**: E-Z Read Watt-Hour Meter; Type Self-Contained Sub-Meter; Display Type Digital; Voltage Rating 120/240 VAC; Current Rating 200 Ampere; Frequency Rating 60 Hz; Form Factor 2S; Resolution 1 Kwa; Application Metering Accessory; Applicable Standard ANSI **UPC:** 78457267253 **Part Number:** CL200-D **Manufacturer:** MILBANK MILBANK **Retail Price:** ~~$160.72 / ea~~ **Your Price:** $45.49 / ea **Total Available:** In Stock *Mouse over image to zoom, click to enlarge* *Electric meter costs **$46***	Very Small Cost

Recommendation	Funding Available
## 4. Fossil-Fuel-Free Heating and Cooling **It is recommended the Developer pursue a fossil-fuel-free project by utilizing HVAC electric "mini-splits" for each individual unit.** Commentary: Electric mini-splits are a common form of HVAC installation today and represent a cost-effective and fossil-free alternative. They also provide cooling capability in the summer. Town buildings are using them extensively now with over 20 mini-splits installed among the "Big Six" buildings. Projects are currently eligible for Alternative Energy Certificates of $3,000 per unit if HVAC is all electric (MA DOER).  	Cape Light Compact and MA Alternative Energy Certificates

Recommendation	Funding Available
## 5. Fossil-Fuel-Free Domestic Hot Water **Pursue a fossil-fuel-free project by utilizing electric heat pump water heaters for domestic use.** Commentary: Heat pump water heaters use electricity to move heat from one place to another instead of generating heat directly. Therefore, they can be two to three times more energy efficient than conventional electric resistance water heaters. [iii] See Appendix C for more information. 	Possible Cape Light Compact incentives

Recommendation	Funding Available
## 6. Electric Vehicle Charging **Provide an electric vehicle (EV) charging system design as part of the Developer's application for a Town Building Permit. Initiate a process with the incumbent electric utility to develop and implement an infrastructure design to allow for the installation of electric vehicle (EV) charging stations on the property for no less than ten vehicles.** Commentary: "Annual sales of EVs will exceed 3.5 million vehicles in 2030, reaching **more than 20 percent of annual vehicle sales in 2030**." [iv] Not planning for EV charging stations now could force about 20% of multi-unit residents to continue to only buy gasoline powered vehicles, as they would have no place to charge an EV. As with the solar-ready recommendation, making the facility EV-charging-ready will be a fraction of the cost of a retrofit later, e.g., laying conduit under a parking lot before paving vs after. And EVs will surely be much more prevalent during the lifetime of the proposed facility. EV charging stations are an important link in achieving net zero goals and reducing fossil-fuel consumption from vehicles. The Town of Truro has two charging stations in the process of being installed at selected locations at Town buildings. The technology is available now.	Eversource Periodically the state offers incentives for charging station kiosks for multi-family structures.

Recommendation	Funding Availability
## 7. Energy Tracking **Participate in Truro's Green Community energy usage tracking program, along with the other large facilities in town.** Commentary: Truro has been tracking the energy consumption of its six largest buildings and complexes since 2011. This has been a critical factor in measuring and reducing our carbon footprint. The Cloverleaf will become a seventh large complex and will be the largest or next to largest complex, next to the Truro Central School, currently the largest. Cloverleaf should join in this quarterly energy tracking. This is important for Truro to meet its greenhouse gas reduction goals. **Making sense of energy data** A free, Web-based tool, MassEnergyInsight is helping Massachusetts cities and towns to understand their energy use and reduce their carbon footprint by delivering customized, easy-to-use reports on electricity, natural gas, and oil use. MassEnergyInsight is provided *at no cost* to Massachusetts communities by the Massachusetts Department of Energy Resources (DOER) as part of the Massachusetts Green Communities Program.	No Out-of-Pocket Cost as an add-on to Town tracking

SUMMARY

Just the Beginning…

Although the Energy Committee has been studying the project for the last 10 months, we do not view our assistance and advice as being over at this time. This report is based on the best information we have at this point in time, and on the Cloverleaf plans as they are now, and on the Commonwealth's and other assistance that we are aware of at this time.

As the project evolves and the ecosystem of assistance also evolves, additional areas of assistance and technical advice will as well. The Committee remains available to assist in any way appropriate.

This is Truro's largest housing project of its kind. We have high hopes and expectations that it will turn out to provide mostly affordable units, and that all units will contribute to the Commonwealth's and Truro's net-zero greenhouse gas emissions goals.

Next Steps

Climate Action Committee Coordination

Coordination with the Climate Action Committee is one of the Energy Committee's charges. We have kept that committee informed of our progress and have provided a copy of our final recommendations. We had originally hoped to make a joint set of recommendations, but with the recent restart from both Committees' Covid-19 sidelining there was just not enough time to do so, and still get this document completed in a timely fashion.

Local Comprehensive Planning Committee Coordination

Coordination with the Local Comprehensive Planning Committee is another of the Energy Committee's focuses. We have also kept that committee informed of our progress and have provided a copy of our final recommendations.

Zoning Board of Appeals Advisory

Should the ZBA wish additional information or clarifications, please feel free to ask. That includes any advisory input that the Energy Committee can render to this important process and project.

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Appendix A - Application for Design

Residential New Construction Registration Form

Customers applying to the Mass Save® Residential New Construction or Passive House incentive are required to fill out the form below.

Owner and Contact Information

Legal Name (check recipient)			Owner/Contact Name	Title
Mailing Address			Cell	Office Phone
City	State	ZIP	Email	

Primary Contact *(if not listed above)*

Company Name			Primary Contact Name	Title
Mailing Address			Cell	Office Phone
City	State	ZIP	Email	

Building Information

Building Name				
Site Address	City	State	ZIP	
Number of Units	Number of Floors	Total Unit Residential Area (SF)	Total Common Area* (SF)	Commercial Fit-Out Component? ☐ Yes ☐ No
Renewables? None	Electric Vehicle Charging? None	Electric Provider None	Natural Gas Provider None	Mixed Use? ☐ Yes ☐ No	Other Fuel Sources? None
Building Code 9th Edition	Energy Code IECC 2018	Stretch Code? ☐ Yes ☐ No	LEED® Required by Code? No	

*Common Area includes any space within the building that serves a function in support of the residential part of the building that is not part of a dwelling unit. This includes corridors, stairs, lobbies, laundry rooms, and recreation rooms, as well as building management offices and maintenance spaces. Parking is excluded.

Timeline *(dates required and may be estimated)*

Current Status	100% CDs complete	Construction Start	Construction Completion
Pre-Schematic Design			

Unit Type *(indicate quantity for all that apply)*

Low Income (below 60% AMI)	Affordable (60%–80% AMI)	Market Rate

Voluntary Standards *(check all that apply)*

ENERGY STAR® Multi-Family	USGBC LEED®	NAHB Green	Passive House	Other (please indicate)
☐ Yes ☐ No	No	No	No	

Please email completed form to **multifhr@icf.com**.

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Updated 5/2020

https://www.masssave.com/-/media/Files/PDFs/Save/Residential/Residential_New_Construction_RegistrationForm.pdf

Appendix B - Hip Roof vs Gable Roof

Below are two photos of both roof types, each with solar panels on them. Each of the two buildings are approximately the same size. It is apparent, when viewing the hip roof in the first photo, that the hip ridge in the foreground interrupts the alignment of solar panels, when compared to the gable roof on the second photo.

Hip Roof with Solar

Gable Roof with Solar

Appendix C - Heat Pump Water Heater

Heat Pump Water Heaters — Game Changers In Efficiency
https://cleantechnica.com/2020/04/26/heat-pump-water-heaters-game-changers-in-efficiency/

The issue is that, until recently, heating anything almost always meant burning something. And burning things creates pollution. Let's call this dilemma, "the heating conundrum."

And then, in the last 5–10 years, a new kid on the block appeared — heat pump water heaters. Heat pump water heaters (HPWH) hold tons of promise for getting us out of the heating conundrum and becoming the water heating method of the 21st century.

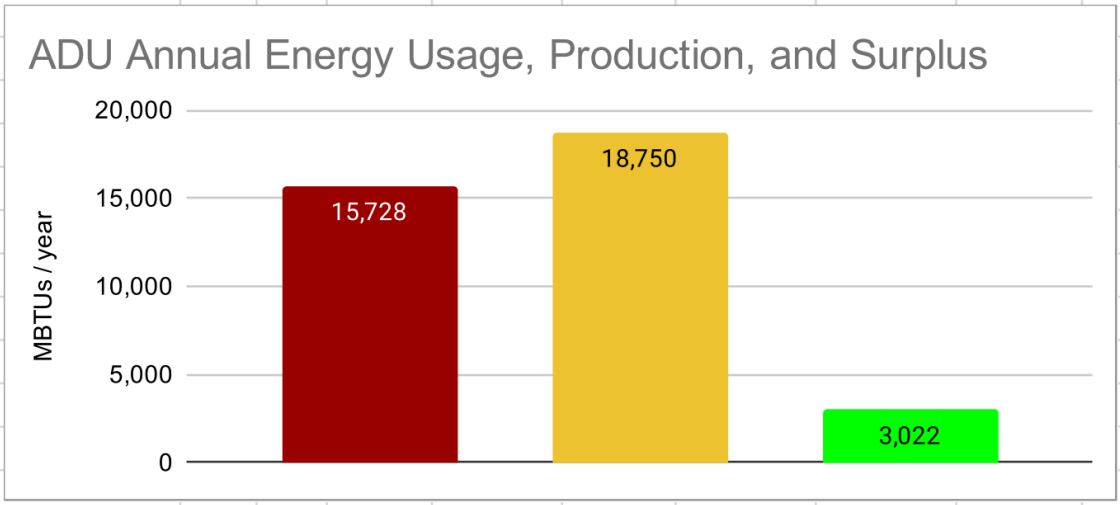
Heat Pump Water Heater - Worth it?
https://www.youtube.com/watch?v=omivdhxdGv0

How it Works: Hybrid Heat Pump Water Heaters
https://www.youtube.com/watch?v=78cEYhjFldI

Appendix D – 1 Bedroom ADU Zero-Energy Performance

Zero-Energy Affordable Dwelling Unit - 1 Bedroom *built* *2017*

672 **Sq Ft**



		MBTUs	
Total Usage	15,728	all energy usage	100%
Solar Panel Production	18,750	from 12 panels	119%
Net Energy SURPLUS	**3,022**		**19%**

Energy	Annual				MBTUs	Electricity Usagel Details			
Usage	Usage		**MBTUs**	BTUs per	per SF	Beg Meter	End Meter	Jan-Dec	Usage
Electricity	3387	kWh	**11,555**	3412	17.2	973	4411	2018	3438
Propane	46	gals	**4,172**	91502	6.2	4411	7746	2019	3335
								Avg	3387
TOTAL Usage			15,728						
			MBTUs			Solar Electric Production Details			
Production						Beg Meter	End Meter	Apr-Mar	Gen
12 Solar Panels	5495	kWh	18,750	3412	27.9	2575	7899	2018	5324
			MBTUs			7899	13565	2019	5666
								Avg	5495
Net Energy SURPLUS			3,022	19%	4.5				
			MBTU = 1000 BTUs						

References – Mass Save

https://www.masssave.com/en/saving/residential-rebates

https://www.masssave.com/saving/residential-rebates/multi-family-high-rise-new-construction

https://www.masssave.com/saving/residential-rebates/passive-house-incentives

References – Massachusetts Building Codes

https://www.mass.gov/files/documents/2018/06/08/Appendix%20AA%20Stretch%20Energy%20Code.pdf

References – MA Decarbonization Roadmap

> "…ensure Massachusetts reduces greenhouse gas emissions by at least 80% by 2050 and achieve net-zero emissions."

https://www.mass.gov/info-details/ma-decarbonization-roadmap

> A level of statewide greenhouse gas emissions that is equal in quantity to the amount of carbon dioxide or its equivalent that is removed from the atmosphere and stored annually by, or attributable to, the Commonwealth; provided, however, that in no event shall the level of emissions be greater than a level that is 85 percent below the 1990 level.

https://www.mass.gov/doc/final-signed-letter-of-determination-for-2050-emissions-limit/download

https://www.mass.gov/news/baker-polito-administration-issues-letter-establishing-net-zero-emissions-target

https://malegislature.gov/Bills/191/S2477/BillHistory?pageNumber=2

FOOTNOTES:

[i] https://www.mass.gov/news/baker-polito-administration-designates-31-cities-and-towns-as-green-communities

[ii] https://www.mass.gov/news/baker-polito-administration-issues-letter-establishing-net-zero-emissions-target

[iii] https://www.energy.gov/energysaver/water-heating/heat-pump-water-heaters

[iv] https://www.eei.org/resourcesandmedia/newsroom/Pages/Press%20Releases/EEI%20Celebrates%201%20Million%20Electric%20Vehicles%20on%20U-S-%20Roads.aspx