Haverhill, Massachusetts

Mayor's Energy Task Force

Task Force Report
July 2007

Executive Summary

The task force believes that energy prices, while subject to fluctuation, are likely to continue growing in the long term. According to the EPA, energy demand in New England is growing at 2% per year. Closer to home, Moodys Investors Service has indicated that energy costs currently play a significant role in Haverhill expenditure increases:

> **The fiscal 2007 budget is 5.8% greater than the previous year with the main expenditure drivers being fuel and energy, health insurance, and educational costs.**
> -- Moodys Investors Service, *Haverhill (City of) MA, 31 OCT 2006*
> Source: [2] Haverhill's 2006 Report by Moody's

To reduce the impact of rising energy costs, Haverhill must take action. The most effective steps are those that reduce our energy use. In the long run we know that all of our energy sources will be renewable, and Haverhill can begin now by gradually adopting renewable sources. While these steps can be taken for the city government and school system, it is important to foster and enable energy conservation and clean renewable energy for Haverhill residents and businesses as well. Moving to a clean, renewable energy future brings health benefits, too.

The task force makes 10 recommendations that will:

- Reduce city energy use at city facilities
- Use renewable energy sources at city facilities
- Have vehicles using renewable bio-diesel fuel
- Establish Haverhill as a leader in energy policy
- Encourage Haverhill citizens to use clean, renewable power

In this report you will find the research to support the task force conclusions, the recommendations, and documents that will be helpful when taking action.

Table of Contents

Introduction

The Task Force

On 29 June 2006 the Haverhill City Council convened a subcommittee meeting to discuss biofuels. The City Council asked the Mayor to form a task force, and he agreed.

Members

Ted Becker
Ted is a teacher at the Nettle Middle School in Haverhill. His former experience includes employment at an energy services company.

Chris Donovan
Haverhill citizen and diesel advocate.

Jeff Dill
Jeff is Building Supervisor for Haverhill.

Jared Fortna
Jared Fortna of Haverhill is an Electrical Engineer who has a life-long interest in photo-voltaics and solar thermal. After his work with the Haverhill Task Force, he will be leaving Haverhill to work for Phoenix Geothermal Services of Auburn, NY.

Mike LaBonte – Chairperson
Mike is a telecommunications engineer who has had an interest in energy since childhood.

Kathy LaRoque
Haverhill citizen and diesel advocate.

David Swartz
Haverhill City Council, practicing attorney, former State Representative, former Assistant District Attorney.

Advisors

Jack Bevelaqua
Jack is Energy Conservation Improvement Program Manager at the Massachusetts Division of Energy Resources.

Robert Scatamacchia
Haverhill City Council

Goals

The key goals and principles for the Task Force are:

- Haverhill should reduce its energy "footprint" and expenditures.
- Haverhill should be at the forefront of newer energy technology.
- Recommendations should involve negligible capital investment from the general fund.

Meetings Held

Task force public meetings were held on the following dates:

- 16 October 2006 – Public meeting
- 22 January 2007 – Public meeting
- 26 February 2007 – Public meeting
- 19 March 2007 – Public meeting
- 19 April 2007 – Public meeting
- 7 May 2007 – Public meeting
- 14 May 2007 – Public meeting
- 31 May 2007 – Public meeting
- 25 June 2007 – Public meeting
- 18 July 2007 – Public meeting

In addition, Mike LaBonte attended an Energy Services Workshop conducted by the Division of Energy Resources 24 April 2007.

Web Site

All documents and communications regarding task force activities are stored on the task force web site:

http://havenergy.civiczone.net

Research

Current Haverhill Government Energy Expenses

Energy used by Haverhill government facilities can be estimated by the budget allocated. The total allocation for energy expenses in Haverhill's fiscal year 2007 budget is $4,717,604, about **3.2%** of the total city budget of $149,073,605.

Fund	FY2007 Budget	Energy Budget
General Fund	$135,502,325	$2,866,181
Sewer Fund	$7,086,721	$1,003,298
Water Fund	$6,484,559	$848,125
	$149,073,605	**$4,717,604**

Table 1: Haverhill FY2007 Budget

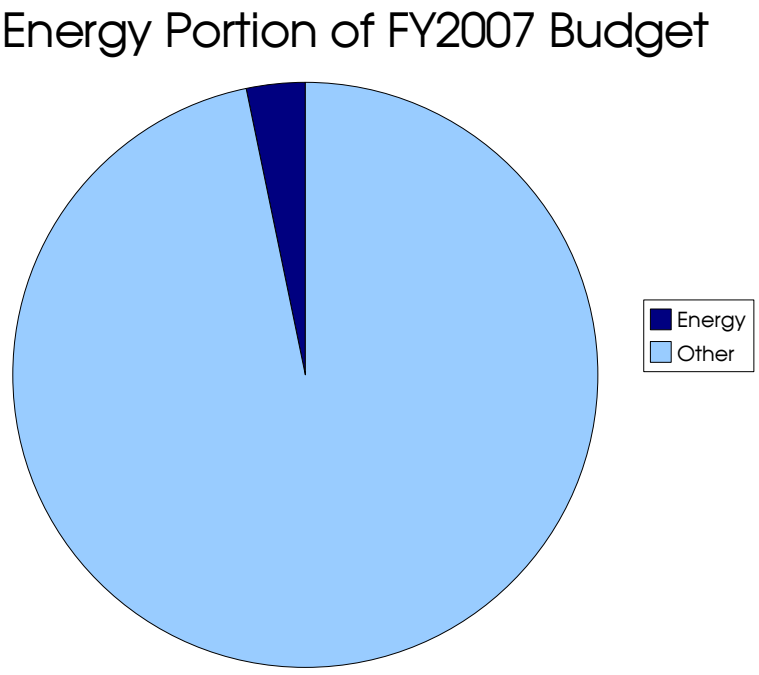


Figure 1: Energy Portion of Haverhill FY2007 Budget

The major energy expenditures in Haverhill currently are for the schools, wastewater, water, and street lighting.

Haverhill Facility Group	FY2007 Budget
Schools	$1,645,000
Wastewater	$1,003,298
Water	$848,125
Street Lights	$625,000
City Hall	$171,000
Police	$101,300
Library	$81,874
Citizen Ctr	$79,500
Fire	$75,000
Vehicles	$45,650
Parking	$20,250
Parks	$16,775
Stadium	$4,832
	$4,717,604

Table 2: Haverhill FY2007 Energy Budget Items

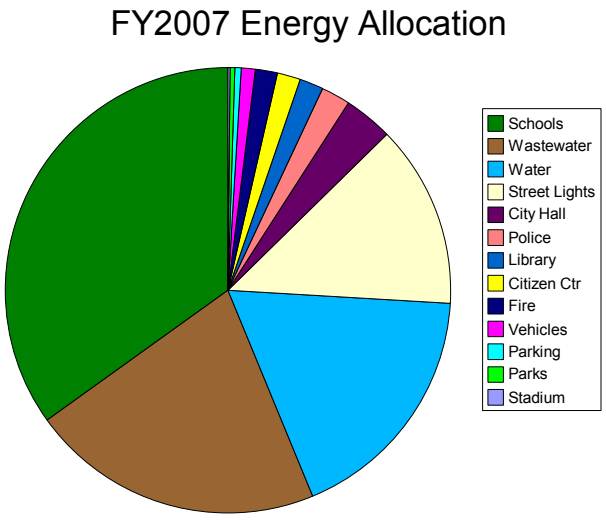


Figure 2: Haverhill FY2007 Energy Budget Allocation

Source: [1] *Haverhill Fiscal Year 2007 Financial Plan*

Most of the energy budget is for electricity, about 76 percent. Table 3 shows the energy items from the FY2007 budget, categorized as electricity and fuels.

Haverhill Facility	FY2007 Budget	Electricty	Fuel
Citizen Ctr-Electricity	$39,500	$39,500	
Citizen Ctr-Heat	$40,000		$40,000
City Hall-Utilities	$171,000	$128,250	$42,750
Fire-Utilities	$75,000	$56,250	$18,750
Library-Utilities	$81,874	$61,406	$20,469
Parking-Lighting	$20,250	$20,250	
Parks-Electricity	$8,775	$8,775	
Parks-Heat	$8,000		$8,000
Police-Utilities	$101,300	$75,975	$25,325
School Maintenance-Electric Elem	$425,000	$425,000	
School Maintenance-Electric HS	$200,000	$200,000	
School Maintenance-Electric Mid	$200,000	$200,000	
School Maintenance-Heat-Electric Elem	$45,000	$45,000	
School Maintenance-Heat-Gas Elem	$500,000		$500,000
School Maintenance-Heat-Gas HS	$50,000		$50,000
School Maintenance-Heat-Gas Mid	$20,000		$20,000
School Maintenance-Heat-Oil Elem	$125,000		$125,000
School Maintenance-Heat-Oil Mid	$80,000		$80,000
Stadium-Electricity	$4,832	$4,832	
Sttreet Lighting	$625,000	$625,000	
Vehicle Maint-Electricity	$25,650	$25,650	
Vehicle Maint-Heat	$20,000		$20,000
Wastewater-Electricity	$890,103	$890,103	
Wastewater-Heat & Hot Water	$113,195		$113,195
Water-Electricity	$783,125	$783,125	
Water-Pumping Fuel & Heat	$65,000		$65,000
TOTALS	**$4,717,604**	**$3,589,116**	**$1,128,489**

NOTES:
a) Assuming elec = 75% of utilities for City Hall, Fire, Library and Police
b) Electric heat counted as Electricity

Table 3: Haverhill FY2007 Electricity & Fuels Budget

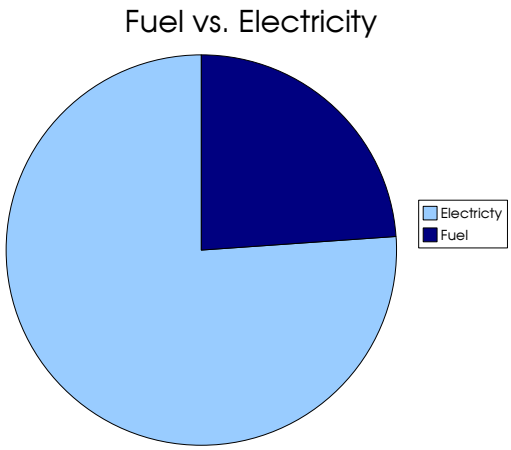


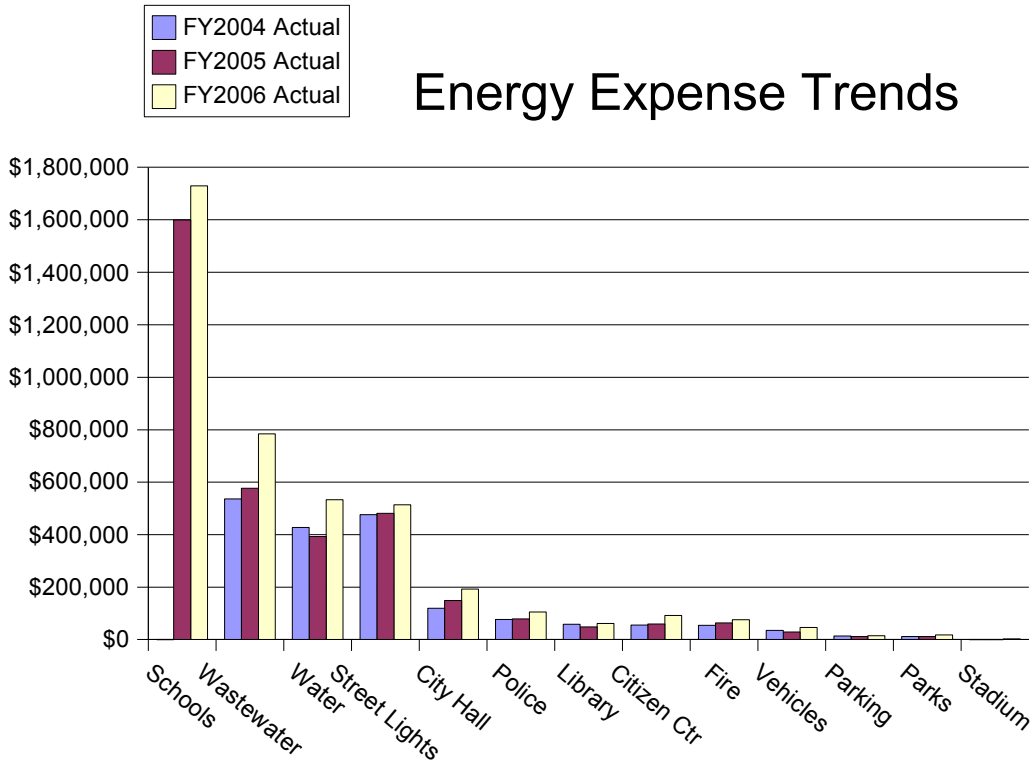
Figure 3: Fuels vs. Electricity

Haverhill Government Energy Expense Trends

Energy expenses from FY2004 to FY2006 have generally been on an upward trend (FY2004 schools data missing).

Haverhill Facility	FY2004 Actual	FY2005 Actual	FY2006 Actual
Schools	0	$1,599,536.61	$1,728,962.11
Wastewater	$536,300.27	$576,526.26	$783,954.61
Water	$427,797.55	$393,131.42	$532,804.71
Street Lights	$476,528	$481,238	$514,101
City Hall	$119,183.82	$148,825.40	$192,613.47
Police	$76,920.90	$78,389.95	$105,426.44
Library	$57,948.48	$48,336.35	$62,007.66
Citizen Ctr	$55,618.73	$59,347.25	$91,820.61
Fire	$54,292.05	$64,046.10	$75,481.41
Vehicles	$35,486.53	$29,458.95	$46,628.81
Parking	$13,609.27	$11,973.03	$14,976.60
Parks	$12,154.45	$11,987.02	$18,079.75
Stadium	0	$0.00	$2,416.76
TOTALS	**$1,865,840**	**$3,502,796**	**$4,169,274**

Table 4: Actual Energy Expenses 2004-2006
Source: Haverhill City Auditor 27 April 2007



***F**igure 4: Haverhill Energy Expense Trends*

Projections of FY2007 actual energy expenses using linear extrapolation are only rough estimates. If energy expenditure is linear, the total for FY2007 may come to nearly $5 million, a 19 percent increase over FY2006.

Haverhill Facility	FY2004 Actual	FY2005 Actual	FY2006 Actual	FY2007 YTD (2)	FY2007 Projected (4)	
Citizen Ctr-Electricity	$28,053	$27,881	$46,357	$35,872	$77,076	
Citizen Ctr-Heat	$27,566	$31,467	$45,464	$25,286	$65,688	
City Hall-Utilities	$119,184	$148,825	$192,613	$128,240	$249,285	
Fire-Utilities	$54,292	$64,046	$75,481	$74,302	$88,958	
Library-Utilities	$57,948	$48,336	$62,008	$70,012	$79,546	
Parking-Lighting	$13,609	$11,973	$14,977	$18,960	$18,734	
Parks-Electricity	$4,461	$6,187	$8,635	$8,136	$12,052	
Parks-Heat	$7,694	$5,800	$9,445	$6,553	$15,380	
Police-Utilities	$76,921	$78,390	$105,426	$86,247	$141,788	
School Maintenance-Electric Elem	(1)	$399,834	$517,995	$295,041	$671,077	
School Maintenance-Electric HS	(1)	$136,494	$145,997	$90,351	$156,160	
School Maintenance-Electric Mid	(1)	$71,878	$206,456	$142,755	$593,005	
School Maintenance-Heat-Electric Elem	(1)					
School Maintenance-Heat-Electric HS	(1)			$8,571	$10,498	(3)
School Maintenance-Heat-Electric Mid	(1)			$289	$354	(3)
School Maintenance-Heat-Gas Elem	(1)	$694,478	$572,165	$142,792	$471,393	
School Maintenance-Heat-Gas HS	(1)	$48,898	$55,753	$248,538	$63,570	
School Maintenance-Heat-Gas Mid	(1)	$22,705	$57,342	$247,270	$144,816	
School Maintenance-Heat-Oil Elem	(1)	$153,098	$106,741	$89,435	$74,420	
School Maintenance-Heat-Oil HS	(1)	$16,806	$10,992		$7,190	
School Maintenance-Heat-Oil Mid	(1)	$55,345	$55,521	$53,020	$55,698	
Stadium-Electricity	(1)	(1)	$2,417	$4,982	$6,102	(3)
Street Lighting	$476,528	$481,238	$514,101	$519,971	$549,210	
Vehicle Maint-Electricity	$17,584	$16,079	$19,793	$23,812	$24,365	
Vehicle Maint-Heat	$17,902	$13,380	$26,835	$16,981	$53,823	
Wastewater-Electricity	$481,308	$484,013	$699,584	$756,287	$1,011,166	
Wastewater-Heat & Hot Water	$54,992	$92,513	$84,371	$136,567	$76,945	
Water-Electricity	$404,030	$359,517	$493,923	$376,130	$678,579	
Water-Pumping Fuel & Heat	$23,768	$33,615	$38,881	$35,160	$44,973	
TOTALS	**$1,865,840**	**$3,502,796**	**$4,169,274**	**$3,641,558**	**$4,962,564**	

NOTES:
1) Data for some years is missing
2) YTD values are for 27 April 2007
3) Projected values linearly extrapolated from YTD
4) Projected values extrapolated from 2005-2006

***T**able 5: Haverhill Energy Expense Trends*
Source: Haverhill City Auditor 27 April 2007

Haverhill Natural Gas Trend

Figure 5 below shows annual natural gas usage in Haverhill for three years, in therms. This is for all users in the city, including businesses and homes. It shows essentially no growth from 2005 to 2006, but 11 percent growth from 2006 to 2007.

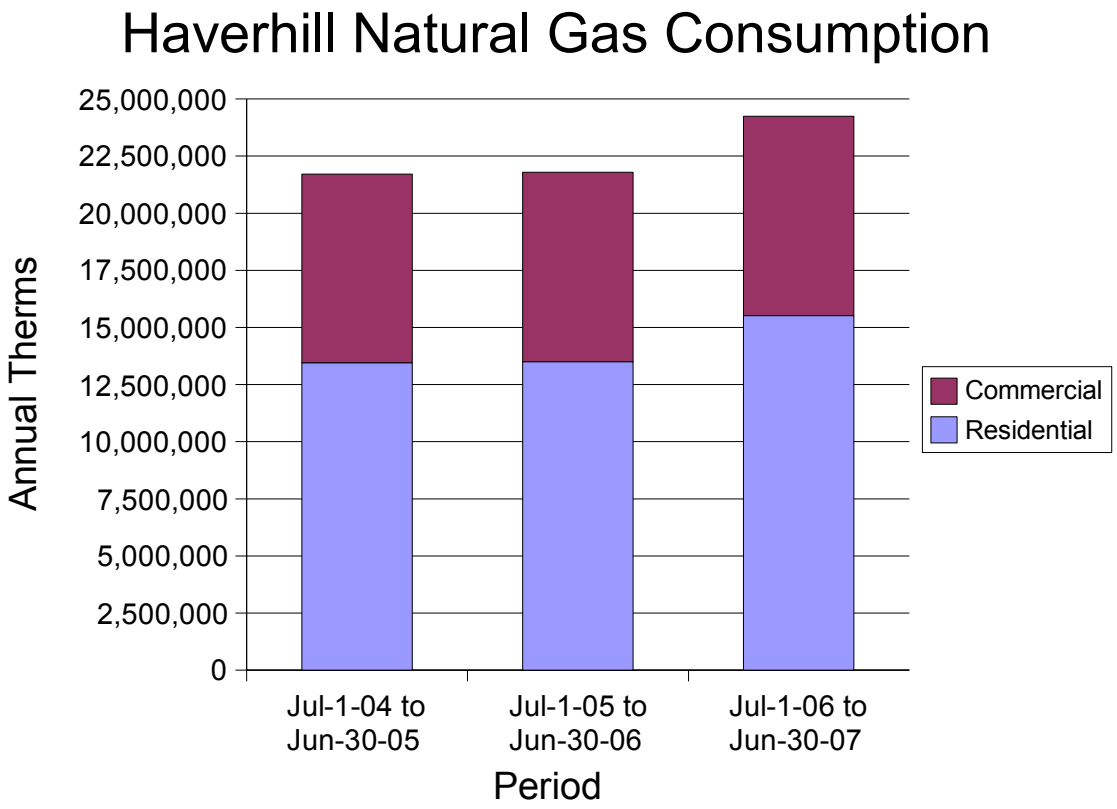


Figure 5: Haverhill Natural Gas Trend
Source: Keyspan

From 2006 to 2007, residential use of natural gas grew 15 percent. Commercial use, including government, grew 5 percent. These growth rates are well above the 0.6 percent per year United States growth rate projected by the Energy Information Administration in its International Energy Outlook 2007 [5]. Natural gas prices probably would rise steeply if overall demand grew at 11 percent. Haverhill should do its part to contain its use of natural gas.

Local Electrical Energy Cost Projection

With about 76 percent of Haverhill's energy budget going to electric power, the price trend for local electricity has a significant effect. The figure below shows National Grid prices for residential, commercial, and industrial electric rates. It also shows the linear trend for the G-1 commercial price and prices for the TransCanada supply contracts negotiated by Haverhill.

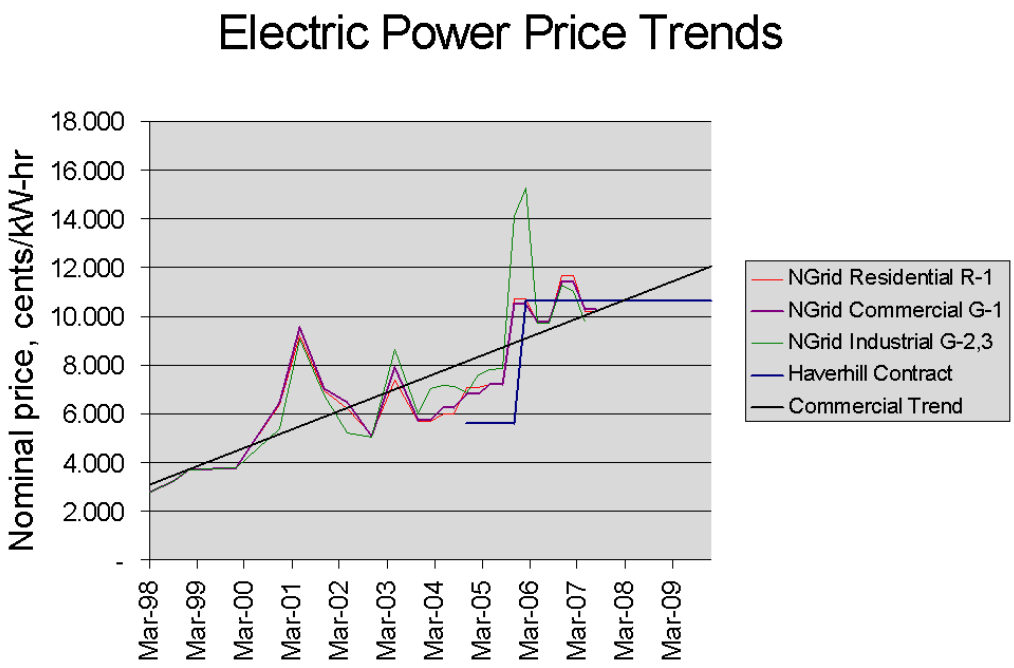


Figure 6: Electric Power Price Trends
Source: National Grid, Haverhill Water Department

Haverhill has a contract with TransCanada to supply electric power at a 10.625 cents/kW-hr base price through 2010. This can be compared with the National Grid G-1 price, which in May 2007 dropped from 11.406 cents/kW-hr to 10.281 cents/kW-hr. Looking at the linear trend line for the National Grid G-1 supply price, the rate of increase is 0.75 cents/kW-hr per year. This is 7.3% of the current price on a yearly basis. Residential prices follow roughly the same trend.

National Electrical Energy Costs

The figures below how the cost of electric power has changed. Bureau of Labor Statistics index numbers are not in dollars, and they are not adjusted for inflation. Figure 8 shows that electric prices have rarely shown a long-term falling trend.

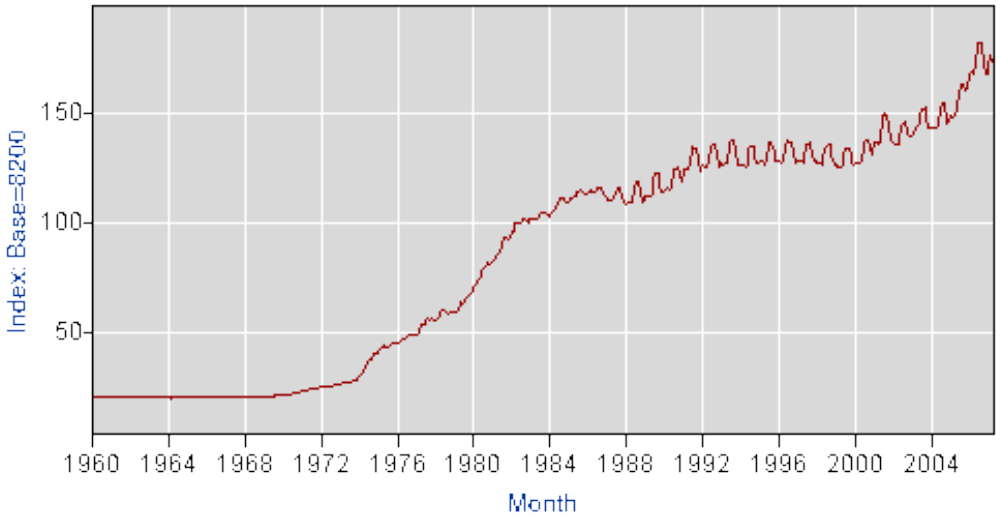


Figure 7: Industrial electric power price index, year 1982 = 100
Source: BLS WPU0543 as of 13 July 2007

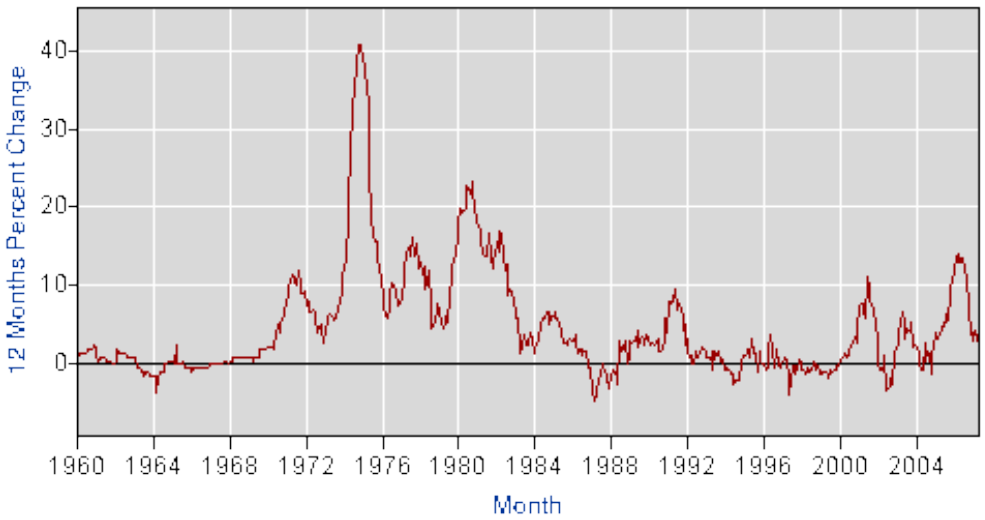


Figure 8: Industrial electric power price 12 month change rate
Source: BLS WPU0543 as of 13 July 2007

Future Energy Supply Considerations

The figure below shows that the main energy sources for the United States are petroleum, coal, natural gas, and nuclear. Electric power comes mostly from coal, nuclear, and some natural gas. Petroleum is the main supply for transportation. Buildings use mostly natural gas and some oil for heat.

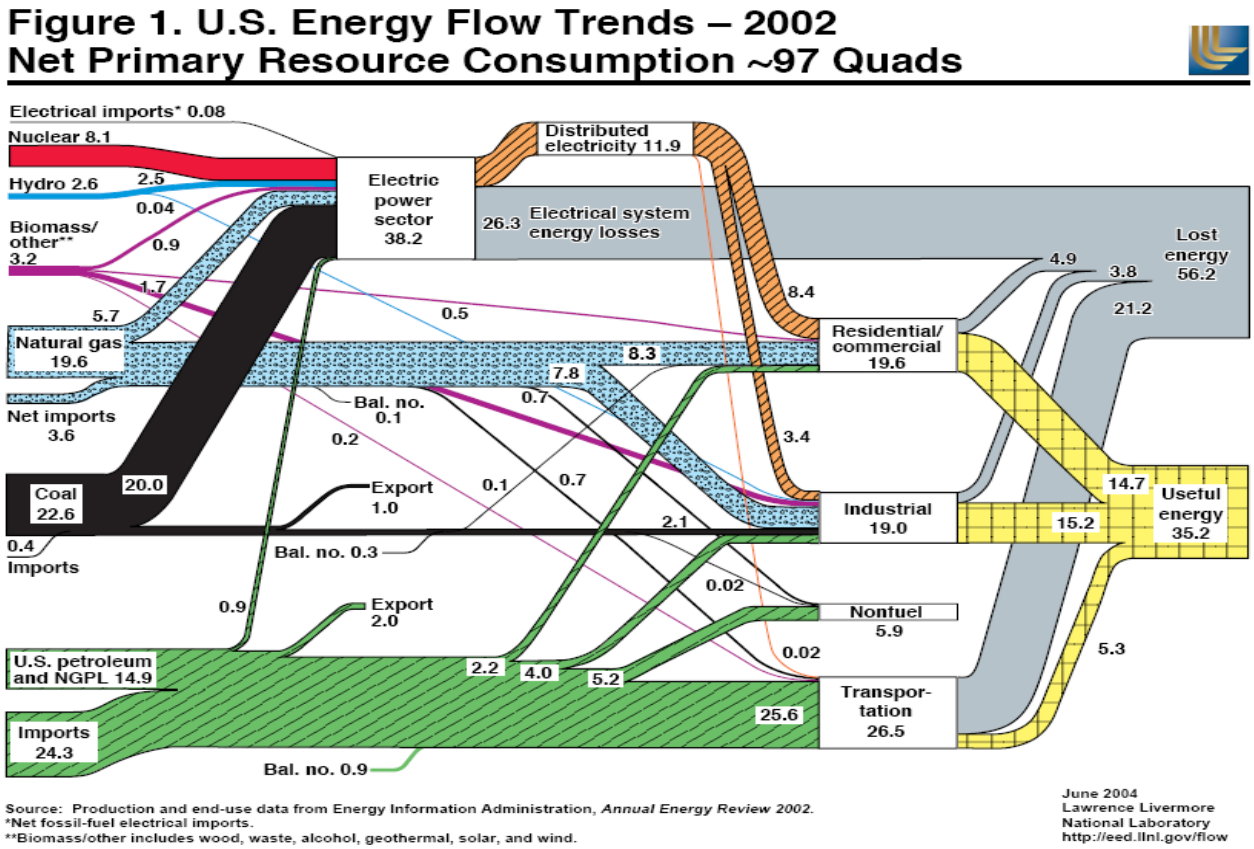


Figure 9: U.S. Energy Flow Trends – 2002
Source: Lawrence Livermore National Laboratory report #308904 (2004) [4]

The future supply of these sources is important for Haverhill. Since there are factors casting doubt on the future growth of coal, oil, natural gas, and nuclear energy, Haverhill must consider alternative energy sources and conservation. The following sections briefly examine the future of these sources.

Coal

The United States has the world's largest coal reserves, at 267 billion short tons (2005). Production of coal stands at 1,161 million short tons per year, and is growing at about 1.1 percent per year. Our coal reserves would last 230 years if coal production were to remain flat.

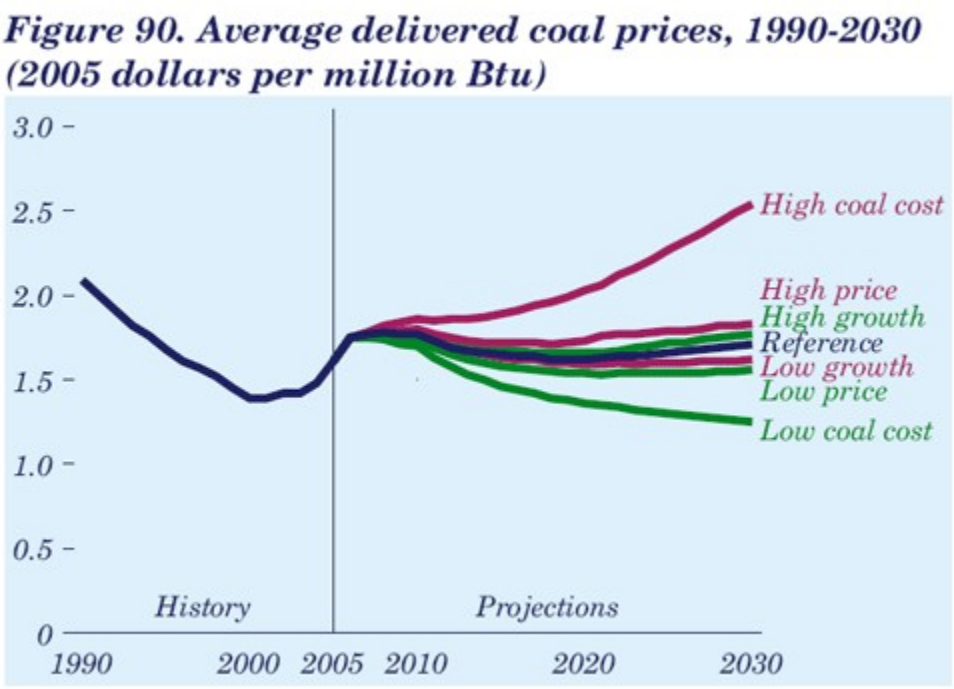


Figure 10: Coal Price Projections
Source: U.S. EIA Annual Energy Outlook 2007 [5]

But increasingly, planned coal-fired generating plants have been canceled due to sensitivity to the large quantities of CO2 emitted by coal plants, and their impact on global warming. Rising mining and transportation costs have been driving up the price of coal, although the EIA predicts fairly stable coal prices going forward. This should have the effect of stabilizing the electric power market.

Nuclear

Nuclear sources produce much of our remaining electric power. While no new nuclear generating facility has been built in the U.S. for at least 20 years, interest in doing so is rising. However, there are concerns for the supply of uranium needed for U.S.-style reactors. According to MIT nuclear expert Dr. Thomas Neff, the price of uranium has grown from about $10 per pound to about $85 per pound in just a few years [6]. The United States is largely reliant on foreign sources for nuclear fuel. Once Russian nuclear weapons are exhausted as a source in 2013, the price should increase

again dramatically. Electric power produced from nuclear sources most likely will see significant price increases at some point. Around the world, breeder reactors and thorium are used to help alleviate the uranium fuel supply problem. The United States currently has no active plans for similar measures.

Oil and Natural Gas

Global oil production may have reached its peak. In 1956 M. King Hubbert explained the concept of peak oil. He predicted that the U.S. would reach the peak of oil production in 1970, and he was right. The world as a whole appears to have reached the peak of global conventional oil production in 2005, and the peak of all petroleum

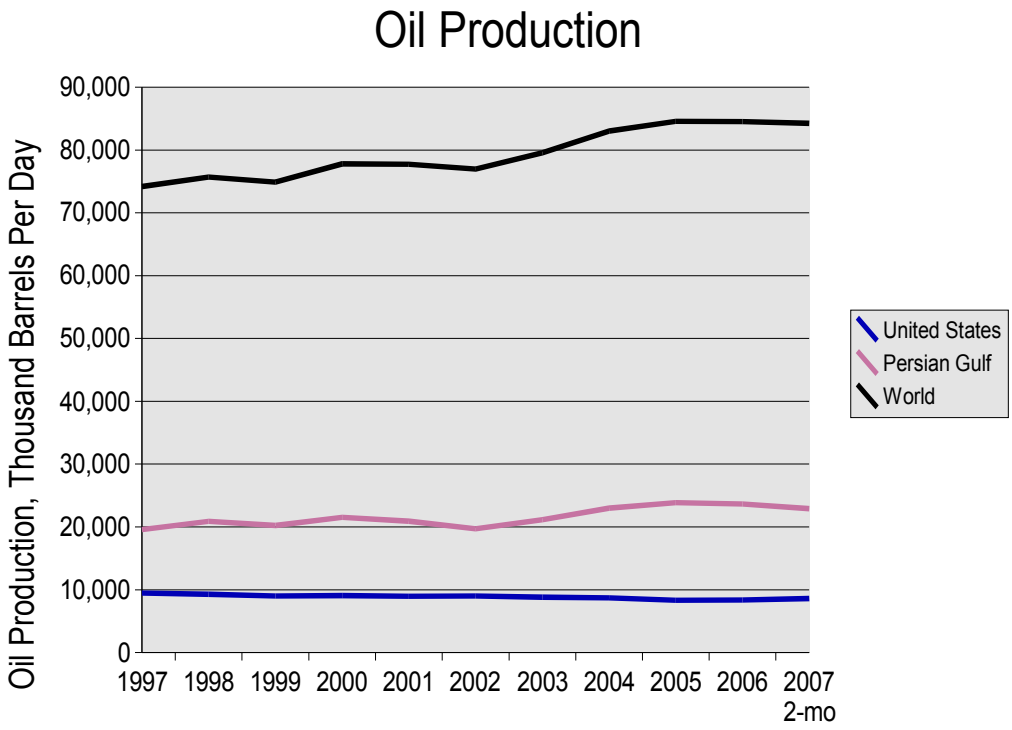


Figure 11: Oil Production
Source: U.S. Energy Information Administration
International Petroleum Monthly, April 2007

production including natural gas is predicted by the Association for the Study of Peak Oil to take place 2011 [8]. From that point production will decline.

Benefits of Energy Reduction and Alternative Supply

The most direct benefit of energy use reduction is reducing energy expenditure from city budgets. David L. O'Connor, Commissioner of the Massachusetts Division of Energy Resources (DOER) gave a keynote speech at the 27 April 2007 Performance Contracting Seminar in Worcester, MA. Mr. O'Connor described three other potential benefits:

- Revenue from selling Regional Greenhouse Gas Initiative credits
- Revenue from forward capacity agreements
- Revenue from selling Alternative Energy Portfolio Standard credits

These revenue opportunities have been difficult to pin down. The Haverhill Water and Wastewater departments have in the past participated in forward capacity arrangements, according to manager Robert Ward. However, this was discontinued as the incentives were reduced.

Clean Energy Benefits

Many, but not all, alternative energy sources are cleaner than mainstream sources. The Climate Change and Energy program at Clean Water Action summarizes the benefits of clean energy:

- Clean energy comes from low to no impact resources like the sun, wind, water, heat from the ground, and biomass.
- These resources are all renewable. Either they cannot be depleted or are naturally replenished when used at sustainable levels.
- Clean energy does not make pollution.
- Clean energy is also locally produced, and therefore promotes energy security and local economic growth.

Energy reduction should be the first priority, but unavoidable energy use should transition over time to clean sources to help Haverhill in terms of health and economy.

Exploring the Role of an Energy Manager

Some Massachusetts cities such as Boston, Cambridge, and Newton have permanent Energy committees or an energy manager. Others such as Fall River and Worcester have made use of a temporary energy manager.

In Haverhill an energy manager would:

- Monitor energy use and expense throughout the city
- Recommend behavioral changes to reduce energy use
- Recommend capital equipment upgrades to reduce energy use
- Be the focal point for city employees and contractors for all energy matters

Currently, energy policies are in place within Haverhill City Hall, the school system, and the Water and Wastewater departments. City Hall makes exclusive use of fluorescent lighting, and employees are instructed to shut off electrical devices when they are not needed.

The Haverhill school system achieves a reduction in energy use through:

- Energy conservation policies
- Energy use monitoring software
- Designation of an **energy auditor**

EnergyCAP software is used to track energy and manage use, among other items. An employee designated as energy auditor is responsible for communicating and enforcing energy conservation policies, as well as collecting energy use data through records examination and instrumentation. The EnergyCAP software automates reporting and analysis.

The Haverhill Water and Wastewater departments periodically look at energy use and try to find ways to reduce it. This task is quite different from other city facilities because most of the Water and Wastewater energy is used for pumps. Data collection and reviews are not done automatically. These departments look at both electric power supply cost reduction and electric power usage reduction. The latter can frequently be accomplished by upgrading pumps and/or the associated electric control systems.

A city energy manager would attempt to apply the techniques used in the school system to the city as a whole. To gain control of our energy use we must track it. The EPA has excellent web-based software that an energy manager could use to enter and track all building energy use. The energy manager would be responsible for grant writing and serve as coordinator for all energy related projects in the city including periodic evaluation of electric supply contracts.

The task force takes no position on whether the energy manager position would be a contractor, new employee position, or designation of an existing employee position.

Energy Savings Performance Contracting (ESPC)

With the new rules about RFP's and RFQ's that make it easier for cities to move on energy performance contracts, we advise the city to pursue this diligently. An energy service company or ESCo can be contracted to do a comprehensive energy audit of Haverhill's municipal buildings and schools.

The company will compile this data and recommend energy saving measures that may include HVAC, lighting, retrofit treatments and or installations that will provide energy savings over specific time period. The ESCo may guarantee energy savings with a certified energy audit. The City of Haverhill can pay for the ESCo services and energy treatment measures with the energy savings from increased efficiencies and decreased power and energy costs so there is no outlay of cash.

Figure 12 illustrates how the ESPC changes the city's energy expenses over time. During the contract period Haverhill would budget approximately the same amount for energy as before the contract, possibly slightly less. Actual energy expenses would be reduced, and the difference is used to pay in for the work that has been performed. After the contract period, the city simply saves money.

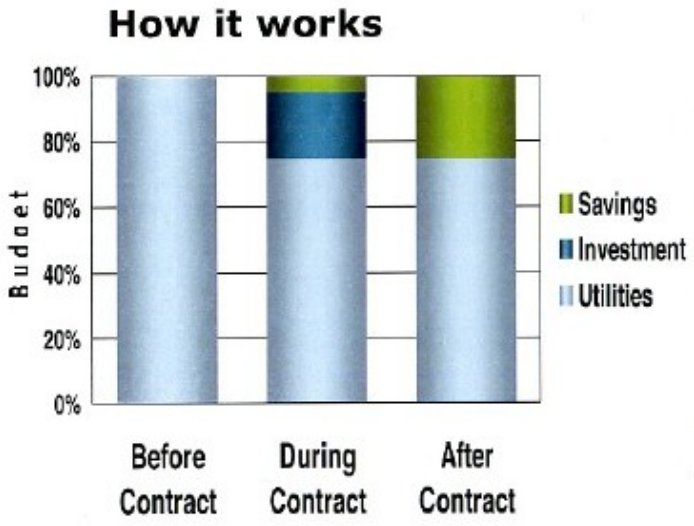


Figure 12: ESPC Economics

There is reason to believe that such opportunities may lie with the waste water and school departments. The simplicity of it is the turn key approach. An ESCo will provide a service package that includes design, engineering, financing, installation, and maintenance of retrofit measures and performance tracking.

Some of these contracts can be complicated and require experienced legal counsel. Often there many different contracting strategies that may involve some speculation regarding electric rates etc. There are also a wide variety of contract periods that range from 5 to 10 years. The process by which a successful ESCo implementation

may occur may be limited to the availability of city staff, i.e. an energy manager who doesn't exist.

RFP vs. RFQ

In Massachusetts General Law, chapter 25A, section 11C describes the Request For Proposal (RFP) process for seeking ESPCs. This requires fairly complete and detailed proposals, which must be compared considering a number of factors including cost. Contract terms are limited to 10 years.

MGL chapter 25A section 11I describes the newer Request for Qualifications (RFQ) process. This allows governments to seek contracts based on the ability of the vendor to provide the service. Since the effort to completely plan and cost estimate an ESPC is relatively large compared to the construction work, this allows the chosen ESCo to do a better job in the planning phase with lower risk, having secured the contract. Also, the RFQ process allows contract terms up to 20 years, more in tune with the payback periods of some energy savings measures.

Signing a contract for a period longer than 10 years allows more savings measures to be taken. Potential cost savings:

1. The contract can be designed so that the sum of actual energy expenses plus contract service fees is slightly lower than our current expenses. Doing so necessarily increases the contract term, however.
2. If the life of the installed equipment exceeds the contract term there may be a period of lower energy expenses without contract fees.
3. The city will be part of the effort to reduce energy demand, which will have the effect of reducing energy prices for everyone.
4. Using less energy can reduce our environmental and health costs.

Power Purchase Agreements

A power purchase agreement (PPA) is an agreement between an energy service provider and a building or land owner. Haverhill may be able to use a location like the waste water treatment plant to install a renewable energy source. Multiple renewable energy sources (solar, wind, biomass) could be evaluated for multiple locations in Haverhill.

Under a PPA the renewable energy service provider would finance, build, own and operate a renewable energy system for the city of Haverhill. In return for paying all the upfront and operation and maintenance costs for the project, the city would be agreeing to buy the electricity that the renewable energy system produces for a period in the range of 10 to 25 years. [12]

Advantages:

- No up-front costs.
- Fixed electrical costs during contractual agreement may be lower than rising market prices.
- Monthly billing and energy costs impact statements.
- All engineering and construction done be renewable energy service provider.

Disadvantages:

- Fixed electrical costs during contractual agreement may be higher than falling market prices.
- Need good investment grade credit rating.

In a typical PPA contract, the agreed purchase price for power is slightly lower than the going rate for power purchased from the grid. Since the facility is directly attached, there are no grid distribution charges for the generated power, resulting in some savings. Furthermore, the price may remain flat for the term of the contract. Given the electric price trends previously described, this seems like a good deal.

Massachusetts Technology Collaborative Programs

The Mass Technology Collaborative is the state's development agency for renewable energy. MTC seeks to promote economic development and a cleaner environment by promoting investment in energy conservation and renewable energy technologies.

MTC's Renewable Energy Trust has a variety of programs that fund projects addressing energy use at public facilities such as municipal buildings and schools. Information about some of the programs below is available directly at the MTC Home Page http://www.masstech.org:

- **MTC Green Schools Initiative**

  This initiative would provide the Haverhill Public School District with the information and resources necessary to help "design and build high-performance green schools. " Funding is available from MTC and MSBA.

  There are new state regulations from the Massachusetts School Building Authority (after July 2007) in place that require municipalities who have been approved for a grant to adopt "green design measures" for any new construction or major renovation. Annual energy savings of **up to 30%** are possible. Additional benefits are "decreased operating costs, reduced impact on the natural environment, and enhanced learning and teaching environments for students and teachers."

  We need to model environmental stewardship and commitment to green renewable energy in Haverhill's Public Schools. The best ways to teach these values to our children are implementing renewable energy systems at our schools, tracking their performance, and integrating their engineering design and energy performance into school curricula.

  http://www.masstech.org/rebates/green_schools.htm

- **MTC Community Energy Opportunities**

  MTC's Renewable Energy Trust is assisting communities in identifying energy conservation opportunities and renewable energy projects.

  Community officials can participate in energy related web presentations targeted specifically to municipal representatives.

  City officials can access free consulting services to help them implement renewable energy, energy efficiency and green buildings.

  http://masstech.org/renewableenergy/ceo.html

- **MTC Small Renewables Initiative**

  "This initiative provides rebates on a first-come first-served basis to public facilities of up to $50,000 for design & construction of solar electric, wind or hydroelectric energy projects that are up to 10 kilowatts in size. Rebates vary based on the characteristics of each project."

  Several of our schools might benefit from a retrofit of either a small wind turbine or a photovoltaic array. Golden Hill Elementary School might be a great site for small wind turbine. Nettle Middle School has a large south facing roof profile that might be suitable for a photovoltaic array. There may be several opportunities at other schools in the district.

  http://www.masstech.org/RenewableEnergy/small_renewables.htm

- **MTC Large Onsite Renewables Initiative**

  This program seeks to expand renewable energy technology throughout Massachusetts by developing a diverse portfolio of renewable energy projects. There are two types of grants available: Feasibility Grants and Design & Construction Grants. Design & Construction Grants can be either photo-voltaic or Non-photo-voltaic with $250,000 and $400,000 cap respectively. Eligible energy projects must produce at least 10 kilowatts of nameplate capacity and be located at a site that will consume at least 25% of the energy produced. In addition to the construction of energy facilities, the grants may be used to retrofit and renovate existing and even green buildings.

- **MTC Clean Energy Choice**

  This program allows residents of Haverhill to generate matching dollars for community renewable energy projects when they purchase electricity from clean renewable sources. Purchase of clean, renewable energy through programs such as National Grid's GreenUp are matched at a rate of 60 percent, and credited to the city in which the power is purchased. Purchasers of Clean Energy may also be eligible for a federal tax deduction. The City of Haverhill should actively promote the Clean Energy Choice program to encourage residents to choose clean green energy. The Energy task force has set a date of August 16th to promote this program to residents in the public seminar at the Haverhill Public Library.

  http://masstech.org/CleanEnergyOrg/index.htm

A popular purchase using Clean Energy Choice credits is the Big Belly® solar powered compacting trash receptacle shown in Figure 13 below. These are made by the Seahorse Power Company of Needham, MA.

Figure 13: BigBelly® solar trash compactor at Fanueil Hall

The Big Belly® saves energy by reducing the number of truck trips to empty trash cans by four times or more, according to the manufacturer. A testimonial from the Boston DPW reads:

> "*The enclosed bins prevent trash from blowing away or being rifled through, discourage the dumping of household trash, and save money by saving time required to empty the bins and the fuel costs to haul it away.*"

Environmental Protection Agency Programs

From the EPA New England website [11]:

> The Community Energy Challenge is an opportunity for municipalities across New England to identify simple and cost-effective measures that increase energy efficiency and renewable energy use while reducing air pollution and saving money.
>
> EPA is challenging all New England communities to save money and reduce air pollution by assessing their energy use, taking action to improve energy efficiency, and seeking out renewable energy choices. EPA will provide technical assistance to every community that chooses to Take the Challenge!

REDUCES STRAIN ON LIMITED ENERGY SUPPLIES
Energy demand in New England is growing at 2% per year.

- Energy efficiency can dramatically reduce the chances of price increases and supply disruptions. It is also the cheapest and most environmentally sound way to slow this increasing demand.
- Use of renewables helps diversify energy supply and supports domestic production.

ACCESSIBLE AND ACHIEVABLE
Every community has opportunities to improve energy efficiency and increase use of renewables cost-effectively *today*.

- Numerous national studies agree that, on average, 30% of the energy used in commercial, institutional and public buildings is wasted.
- Savings of 10% or more are well within the reach of every community and school district through sensible management changes and cost-effective upgrades using proven, existing technologies.
- A 10% reduction across New England's municipal and school buildings could save nearly $100 million, prevent billions of pounds of carbon dioxide emissions, and save enough energy to power tens of thousands of homes for one year.
- New England already offers a variety of renewable energy choices.

Communities that join the Challenge will receive:

- Targeted training and technical support in the use of the ENERGY STAR Portfolio Manager benchmarking software. Assessing performance is the first step toward identifying opportunities to improve energy efficiency through better facility management, upgrades to lighting, HVAC, controls, and other building systems and equipment.

- Assistance in efforts to increase their use of renewable energy, through renewable energy credits and the development of small scale renewable energy projects.

Communities that take the Challenge agree to:

- Make a commitment to improve energy efficiency
- Assess – benchmark – the energy performance of all municipal buildings, schools and/or drinking water and waste water treatment facilities in the community
- Set a goal to reduce energy use by 10% or more
- Return a Community Energy Challenge letter (2 pp., 73 KB, MSWORD) to EPA New England
- Promote energy efficiency and renewables to citizens, companies and organizations in the community

Why Benchmark?

- Using EPA's Benchmarking tool helps a community establish an energy use baseline, making it easy to track improvements in efficiency over time.
- Benchmarking provides a uniform tool to compare progress across communities.
- Buildings that are benchmarked and achieve a certain level of performance receive recognition from EPA.
- It is easy to track further progress in improving energy efficiency in buildings that have been benchmarked, making possible further energy and financial savings.
- These improvements can help a community meet other environmental goals, such as a reduction in local air pollution or greenhouse gas emissions

How will EPA help?

- EPA New England and EPA ENERGY STAR contractors will provide free, live web-based training in benchmarking and energy management, including follow up technical support, to all participating communities.
- EPA New England will recognize community achievements under the Challenge and track overall progress.
- Participating municipalities may be eligible for national EPA recognition:
- ENERGY STAR Leaders – for a demonstrated average reduction of 10% or more across all buildings.
- ENERGY STAR Label – awarded to buildings performing in the top 25% according to the National Energy Performance Rating System.

- EPA New England will organize additional recognition activities, including, but not limited to: media events to highlight progress; case studies posted on the web; and articles in general and trade publications.
- EPA will encourage members of our extensive partner network, notably regional utilities, and energy service and product providers, to help Challenge participants implement their energy efficiency plans

Renewable Electric Power

In Massachusetts, almost all electric power is put onto the electric grid, which is regulated by ISO New England. Supply must meet demand and as of now, there is not enough renewable energy being generated to meet demand. Energy generated by renewable resources is automatically put onto the electric grid and flows along side that of traditional energy. Some types of renewable energy provide a constant and steady stream of energy, while others are more sporadic; energy from traditional sources is used to bridge this gap. Investment by consumers in renewable energy will increase both supply and demand.

Currently, the electricity providers' revenue is closely linked to the amount of energy they generate. In order for renewable energy to compete with traditional energy, incentives need to be given to electric providers to invest more heavily in renewable energy. [13]

Electrical service in Haverhill is provided by National Grid. National Grid customers in Massachusetts may choose to have their electric power supplied from renewable sources through the GreenUp program. When signing up for this program, National Grid customers are able to choose one of three renewable power suppliers:

- Massachusetts Energy Consumers Alliance
  http://www.massenergy.com
- NewWind Energy
  http://www.NewWindEnergy.com
- Sterling Planet
  http://www.sterlingplanet.com

After you sign up a small additional fee will appear on your monthly National Grid bill. This funds the renewable power company you have chosen.

As described above, buying renewable power earns credits in the Massachusetts Technology Collaborative Clean Energy Choice programs. Haverhill electric customers who participate in the GreenUp program not only help support the development of renewable power, they also add to an MTC account that allows Haverhill to buy renewable energy products.

Bio-diesel

Bio-diesel is a domestically produced clean-burning alternative fuel manufactured from vegetable oils (primarily soybeans) or recycled oils (such as cooking oil). Bio-diesel is simple to use, biodegradable, and reduces air pollutants such as particulate matter, carbon monoxide, hydrocarbons, and air toxics. Bio-diesel used in cars and trucks must meet the standards set forth by the ASTM (American Society for of Testing and Materials) D 6751.

Bio-diesel can be used as a pure fuel or blended with petroleum in any percentage. The most common blends are:

1. B5 (5% bio-diesel, 95% petroleum)
2. B20 (20% bio-diesel, 80% petroleum)
3. B100 (100% bio-diesel)

Blends of B-20 or less can be safely used in diesel engines or stationary generators with no modifications. Bio-diesel may be used in its pure form (B100), but can gel in cold weather, which makes it unsuitable for many climates. B20, the most popular of the blends, has demonstrated significant environmental benefits with minimal increase in cost for fleet operations. The following is a partial list of public, private, and for-profit organizations throughout New England who have successfully implemented bio-diesel use:

Connecticut – The State DOT has been using B20 for five years.

Maine – LL Bean, Maine DOT, Oakhurst Dairy, City of Bangor.

Massachusetts – Cities of Medford & Cambridge, NSTAR, Harvard University, U Mass Amherst, Otis Air Force Base, Town of Brookline.

New Hampshire – New Hampshire DOT, Pease AFB, Keene State College, Mount Cranmore Ski Resort

Rhode Island – Used in water taxis, tour boats, school broilers.

Vermont – University of Vermont runs all buses on B2 bio-diesel.

Like gasoline, the price of bio-diesel fluctuates due to factors such as the cost of processing, marketing, distribution, retail station costs, region and taxes. Several tax credits have been created through the Energy Policy Act of 2005 that provide incentives to produces and blenders, which along with increased consumer demand and government mandates, are expected to stabilize if not lower prices in the future.

The charts below provide the latest data available (March 2007).

Table 9. Biodiesel (B20) Average Prices by Region from Clean Cities Sources

	Biodiesel (B20) Information Reported by Clean Cities ($ per gal)		*Diesel Information Reported by Clean Cities ($ per gal)*	
	Average Price / Standard Deviation of Price	*Approximate Number of Stations*	*Average Price / Standard Deviation of Price*	*Approximate Number of Stations*
New England	$2.66 / 0.01	2	$2.67 / 0.08	18
Central Atlantic	$2.35 / 0.71	2	$2.62 / 0.13	33
Lower Atlantic	$2.49 / 0.07	52	$2.52 / 0.09	46
Midwest	$2.47 / 0.10	8	$2.54 / 0.12	117
Gulf Coast	$2.76 / 0.45	2	$2.48 / 0.13	34
Rocky Mountain	$2.72 / 0.12	7	$2.63 / 0.11	27
West Coast	$2.77 / 0.32	6	$2.96 / 0.20	57
NATIONAL AVERAGE	$2.53 / 0.18	79	$2.63 / 0.21	332

Figure 14: B20 Bio-diesel prices

Table 10. Biodiesel (B2-B5) Average Prices by Region from Clean Cities Sources

	Biodiesel (B2-B5) Information Reported by Clean Cities ($ per gal)		*Diesel Information Reported by Clean Cities ($ per gal)*	
	Average Price / Standard Deviation of Price	*Number of Data Points*	*Average Price / Standard Deviation of Price*	*Number of Data Points*
New England	$2.68 / -.--	1	$2.67 / 0.08	18
Central Atlantic	$2.35 / -.--	1	$2.62 / 0.13	33
Lower Atlantic	$2.56 / 0.08	7	$2.52 / 0.09	46
Midwest	$2.73 / 0.04	3	$2.54 / 0.12	117
Gulf Coast	--	--	$2.48 / 0.13	34
Rocky Mountain	$2.67 / 0.11	2	$2.63 / 0.11	27
West Coast	--	--	$2.96 / 0.20	57
NATIONAL AVERAGE	$2.60 / 0.12	14	$2.63 / 0.21	332

Figure 15: B5 Bio-diesel prices

Table 11. Biodiesel (B99-B100) Average Prices by Region from Clean Cities Sources

	Biodiesel (B99-B100) Information Reported by Clean Cities ($ per gal)		*Diesel Information Reported by Clean Cities ($ per gal)*	
	Average Price / Standard Deviation of Price	*Number of Data Points*	*Average Price / Standard Deviation of Price*	*Number of Data Points*
New England	--	--	$2.67 / 0.08	18
Central Atlantic	$3.24 / 0.35	2	$2.62 / 0.13	33
Lower Atlantic	$3.32 / 0.81	2	$2.52 / 0.09	46
Midwest	--	--	$2.54 / 0.12	117
Gulf Coast	$2.36 / -.--	1	$2.48 / 0.13	34
Rocky Mountain	--	--	$2.63 / 0.11	27
West Coast	$3.44 / 0.65	9	$2.96 / 0.20	57
NATIONAL AVERAGE	$3.31 / 0.64	14	$2.63 / 0.21	332

Figure 16: B100 Bio-diesel prices
Source: U.S. Department of Energy

In April of 2007, the Massachusetts Division of Energy Resources announced the "Bio-fuels Implementation Plan", which outlines future bio-fuels requirements for all Massachusetts state vehicles (Appendix H. Under this plan, the Commonwealth will begin mandating the use of a minimum blend of B5 bio-diesel effective July 1, 2007.

Based upon this recent legislation and the preponderance of real world usage it is safe to conclude that bio-diesel is a safe alternative fuel choice for the city of Haverhill to embrace and be proud to showcase as evidence of forward thinking energy policy.

Recommendations

1 Have a City Energy Manager

The recommended energy projects will require more than part time attention. Whether a city employee or a contractor, a city energy manager would insure the success of energy programs. In particular, the ability to move forward on an energy savings performance contract improves with increased city capacity for coordinating activities. This person would become the central contact for ESCos, and would report status for all projects to the Mayor and City Council. The energy manager would also pursue grants and projects such as power purchase agreements, and play a key role in planning and negotiating energy supply contracts. The need for an energy manager may not be permanent.

2 Utilize the MTC Clean Energy Choice program

The Massachusetts Technology Collaborative Renewable Energy Trust offers matching grants through the Clean Energy Choice program. As of 30 April 2007 Haverhill had a credit of $9,344 in the program, resulting from the matching of renewable energy certificates purchased by Haverhill residents and businesses. This would be enough to purchase two Big Belly® solar trash compactors for use in Riverside Park, for example. Appendix A contains helpful information on the program, and Appendix I describes the Big Belly®.

3 Encourage Haverhill citizens to purchase clean electricity

As of 30 April 2007, 66 out of 22,976 Haverhill households were buying clean electric power. We can accelerate the accumulation of Clean Energy Choice credits by increasing participation by Haverhill citizens in National Grid's GreenUp program. This can be achieved through news articles, printed materials, and by making presentations to civic groups and at public events. Having knowledgeable people is an asset, as energy choice programs can be confusing. Annual efforts to educate and encourage the public will help Haverhill move toward clean, renewable energy.

4 Issue an energy savings performance contract RFQ

Haverhill may be able to conserve a great deal of energy by having an Energy Service Company (ESCo) analyze and improve city facilities. The services of such a company may be obtained through the simplified Request For Qualifications (RFQ) process. Appendix C contains Massachusetts general laws related to the process and Appendix D contains a list of DCAM certified contractors.

City department heads, as well as the Energy Manager and City Solicitor should be involved in the RFQ process as early as possible.

5 Pursue a power purchase agreement

The city can install alternative energy equipment such as solar photovoltaic and wind turbines with no capital expenditure through power purchase agreements. The contract for such an arrangement would require the city to purchase electric power generated by the equipment at a favorable fixed price for a fixed period. Considering the likelihood that electric prices will continue to rise, this would make economic sense.

Appendix E contains a partial list of companies offering renewable energy installations funded by power purchase agreements.

6 Consider the use of bio-diesel fuel for city vehicles

Based on the state Biofuels Implementation Plan and the preponderance of real world usage it is safe to conclude that bio-diesel is a safe alternative fuel choice for the city of Haverhill to embrace and be proud to showcase as evidence of forward thinking energy policy.

7 Incorporate renewable energy requirements in building standards for new development

The state EPA office will assist Haverhill with implementation of EnergyStar building standards.

8 Take the EPA Community Energy Challenge

Communities that take the Challenge agree to:

- Make a commitment to improve energy efficiency
- Assess – benchmark – the energy performance of all municipal buildings, schools and/or drinking water and waste water treatment facilities in the community
- Set a goal to reduce energy use by 10% or more
- Return a Community Energy Challenge letter to EPA New England
- Promote energy efficiency and renewables to citizens, companies and organizations in the community

These commitments are achievable, and some of them are recommendations in this report.

9 Consider evaluating alternative electric supply contracts to reduce expenses

Haverhill has fared reasonably well recently with its electric supply contracts. Insure that all stakeholders are involved in planning and negotiating contracts. Getting expert advice may be worth considering, along with maintaining charts of National Grid rates as well as contract prices and competitive quotes. Since electric prices have historically increased much more than they have decreased, longer term contracts seem to be a safe bet.

10 Continue to upgrade pumps and controls

The Water and Wastewater departments periodically save electricity by making their pumping systems more efficient. This practice should be institutionalized and regularly reported to the Mayor and/or Energy Manager.

Submission

This report is respectfully submitted to the City of Haverhill in the sincere hope that it will play a part in bringing to Haverhill the prosperity that comes with a bright energy future.

Ted Becker

Jeff Dill

Christopher Donovan

Jared Fortna

Mike LaBonte, chairperson

Kathleen LaRoque

David Swartz

References

[1] *Haverhill Fiscal Year 2007 Financial Plan*
http://www.ci.haverhill.ma.us/departments/auditor/budgetbook07.pdf

[2] *Haverhill's 2006 Report by Moody's*
http://www.ci.haverhill.ma.us/departments/auditor/Moods-rating-06.pdf

[3] *Massachusetts DOER - Energy Management Services in Massachusetts*
http://www.mass.gov/doer/

[4] *Lawrence Livermore National Laboratory – U.S. Energy Flow Trends - 2002*
http://www.llnl.gov/tid/lof/documents/pdf/308904.pdf

[5] *U.S. Energy Information Administration - Annual Energy Outlook 2007*
http://www.eia.doe.gov/oiaf/aeo/index.html

[6] *MIT - Lack of fuel may limit U.S. nuclear power expansion, Wed Mar 21, 2007*
http://web.mit.edu/newsoffice/2007/fuel-supply.html

[7] *Association for the Study of Peak Oil – April 2007 Newsletter*
http://www.peakoil.ie/newsletter/en/pdf/newsletter76_200704.pdf

[8] *National Bio-diesel Board*
http://www.bio-diesel.org

[9] *U.S. Department of Energy, Energy Efficiency and Renewable Energy*
http://www.eere.energy.gov/

[10] *U.S. Environmental Protection Agency New England Office*
www.epa.gov/ne/eco/diesel

[11] *EPA New England Community Energy Challenge*
http://www.epa.gov/region1/eco/energy/energy-challenge.html

[12] *MMA Renewable Ventures*
http://www.mmarenewableventures.com/Solutions/customer.html

[13] *Krottinger, Katy, 18 July 2007*

List of Appendices