

# Memorandum

TO: Jessie Baker  
Assistant City Manager

FROM: Harold Garabedian  
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RE: Projected cost of fuel oil and the cost of thermal energy from DHM

DATE: 20 January 2014

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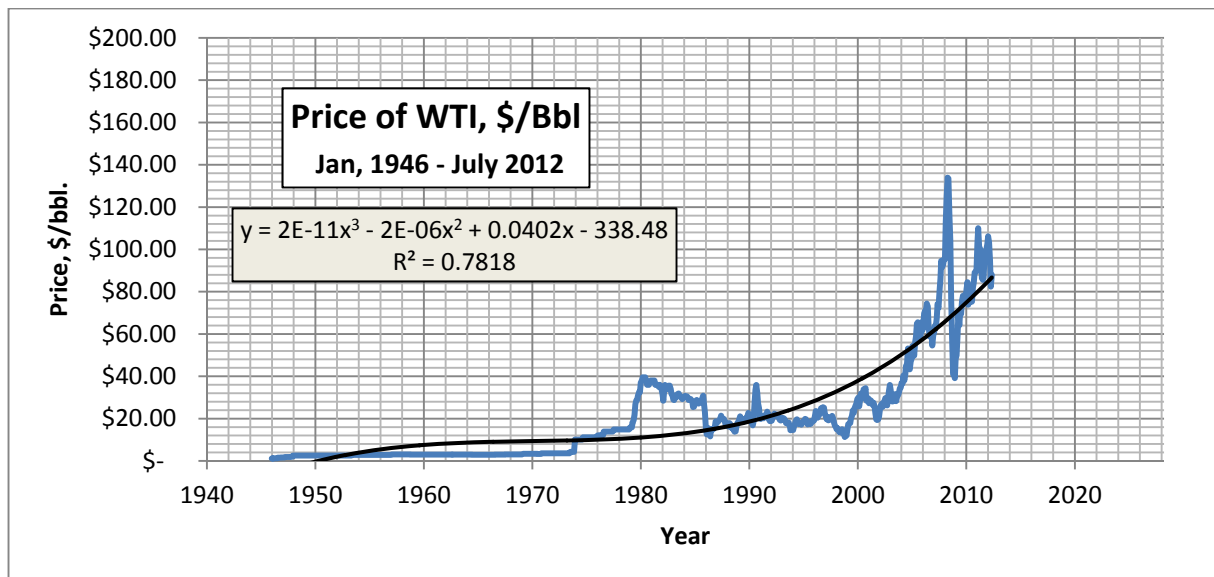
To assist customers in making the decision as to whether to join the district heat system, District Heat Montpelier (DHM) provided an analyses based on the potential customer's specific information of the expected the cost of the customer if they continued to heat with current fuel oil system or to connect to DHM.

## **Fuel Oil Pricing**

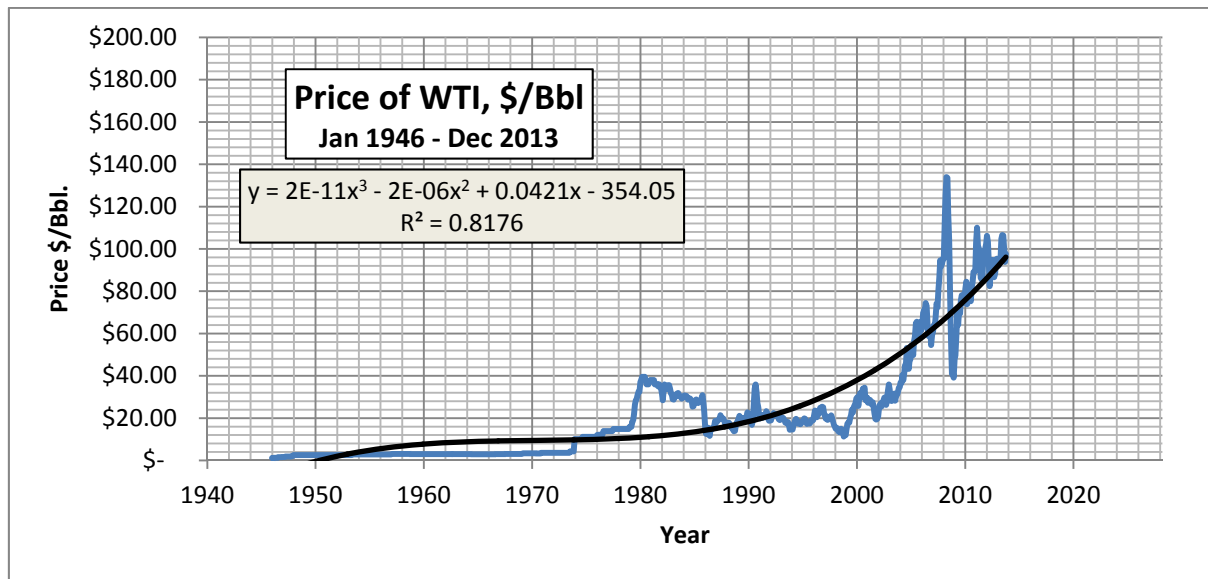
One of the key parameters in this analysis was the future cost of fuel oil. A review of historical energy process was undertaken. This review considered the price of crude oil, regional wholesale pricing and the City's actual fuel oil costs. Let me review the information regarding crude oil pricing and regional wholesale pricing.

The cost of fuel oil is tied to the cost of crude oil. A metric for tracking the cost of crude oil is the price of West Texas Intermediate (WTI). WTI has historically been used as benchmark in oil pricing. WTI is the underlying commodity of the New York Mercantile Exchange's oil futures contracts.

During development of DHM, the historical pricing of WTI was reviewed and summarized in the following graph:

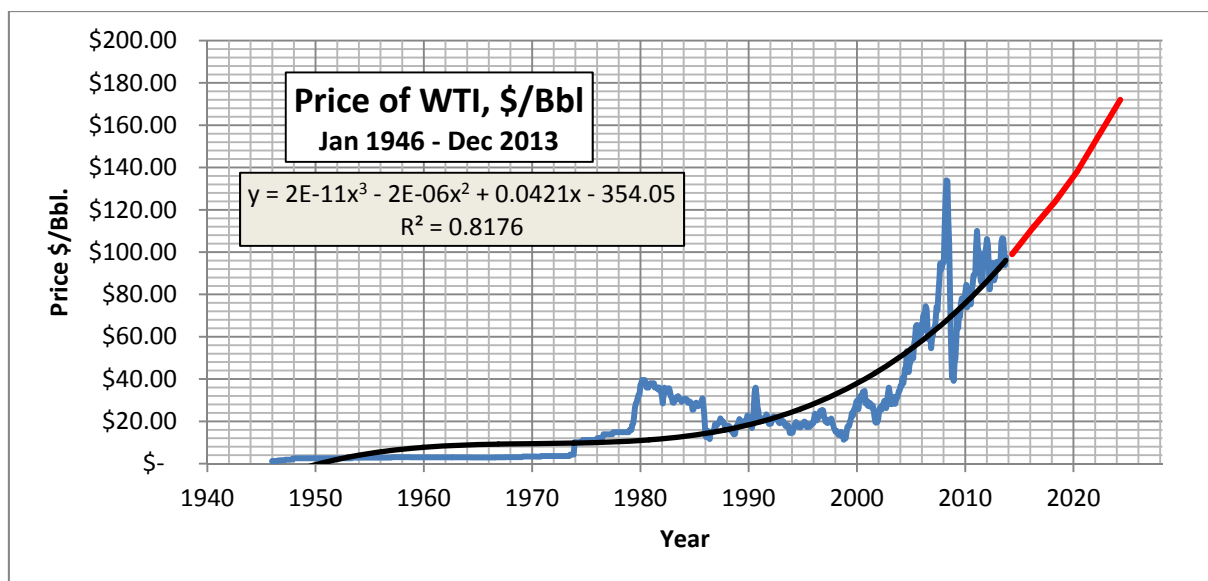


Curious to see how pricing had changed since this chart was produced, I updated with the most recent data. It results in the following graph:



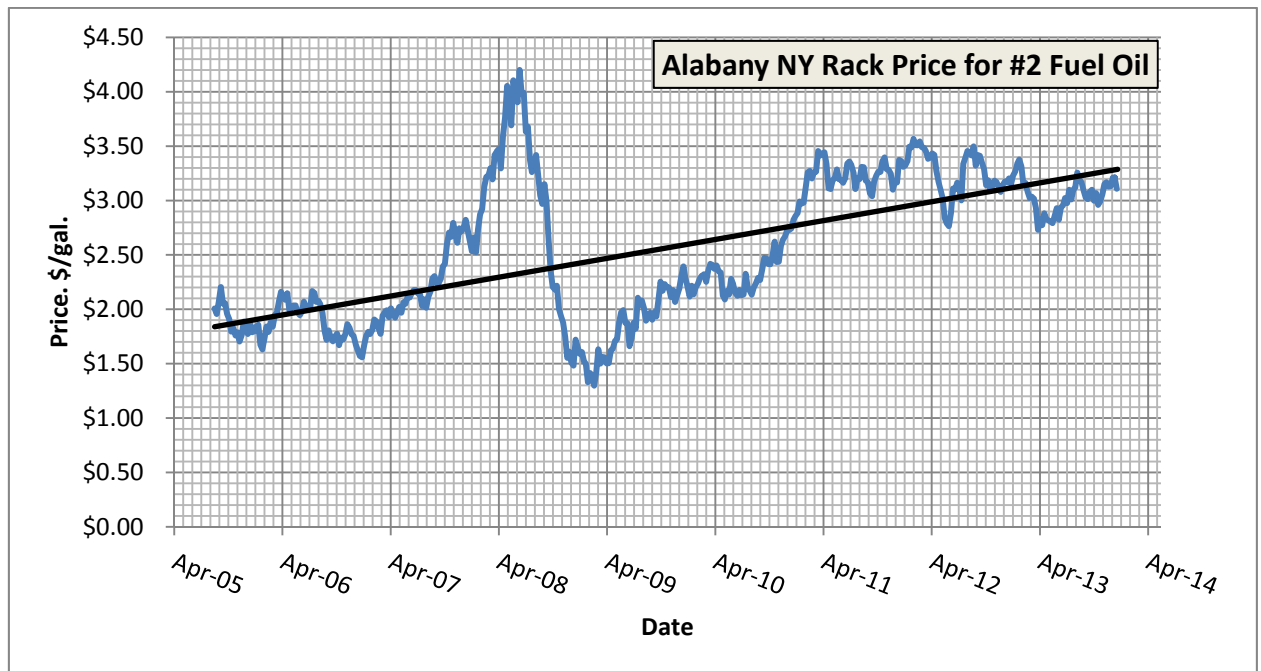
The updated data tightens the relationship of cost increasing with time. This can be seen in the R-squared value of the equation of the line that best fits the data. The value increases from 0.7818 to 0.8176. This is about a five percent increase in the “goodness of fit”: while not overwhelming it re-enforces the point that fuel oil prices continue to increase overtime.

Based on these and the trendline equation, the following projection of WTI results,



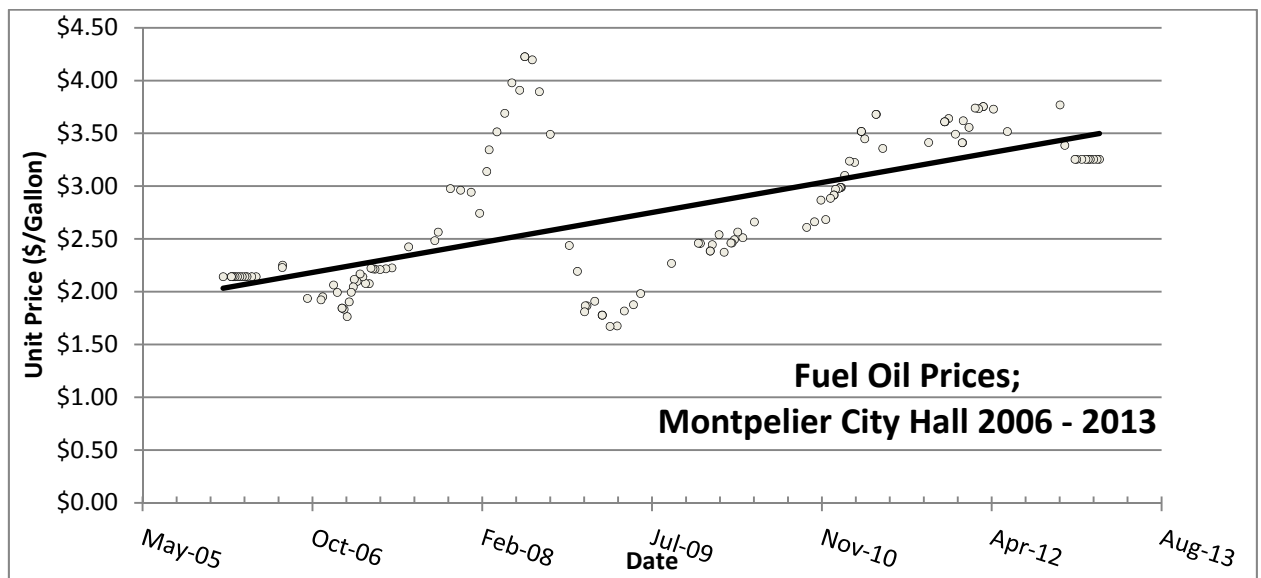
This trendline is equivalent to crude oil having a compound average growth rate of 5.72% per year.

With regard to the regional wholesale pricing, the weekly rack price posted for the port of Albany, NY was reviewed. These data have been updated as well. As we all know the price of fuel oil can be highly variable. I think the graph captures that well. However, as the trendline present underlying this variability is long term increasing trend in the price. This is consistent with the price of crude oil, the feedstock to fuel oil.



The price increase for the eight year period January 2006 through January 2014 is a compound annual average growth rate of 7.15% per year.

The price paid for fuel by City Hall is depicted below.



For the period January 2006 through February 2013, the price of fuel oil to the City increased by an annual average compound growth rate of 6.09% per year.

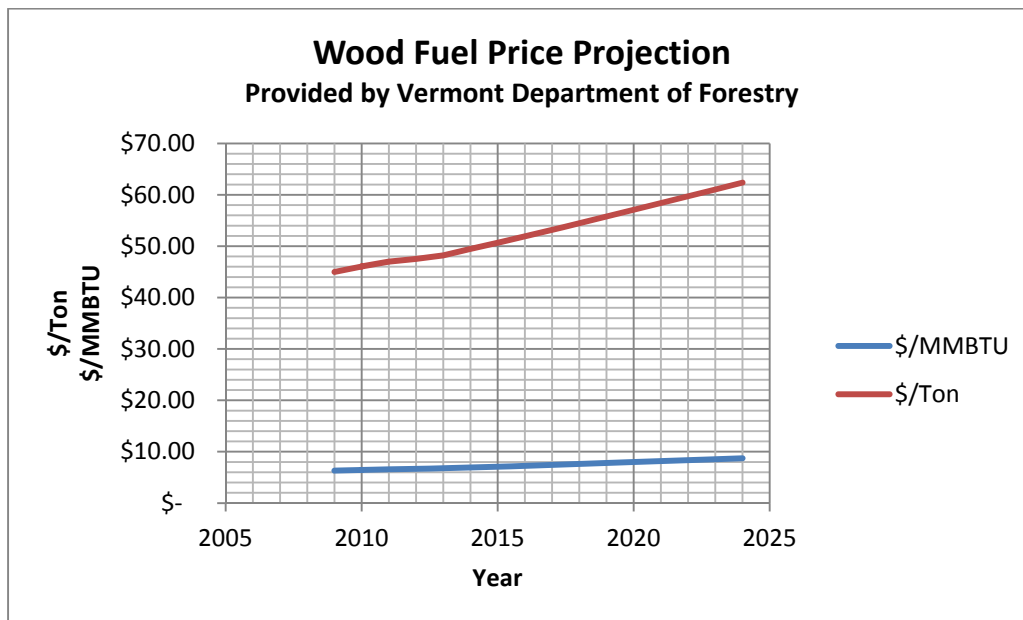
Summary of Compound Average Growth Rate (CAGR) of Petroleum Products		
Product	Period	CAGR, % per year
WTI – crude oil	1946 – 2013	5.72
Albany Rack Price – Regional Wholesale	2006 – 2014	7.15
City Hall	2006 – 2013	6.09

With the price increases of the various commodities ranging from 5.72% to 7.15% per year, the customer comparison analyses used a fuel oil cost increase factor of 5.25% per year. It is believed that the use of this number imparted a degree of conservatism in the analyses in that it potentially underestimated the future cost of fuel oil for those considering joining DHM.

**Cost of Wood Fuel**

While data are more on wood fuel pricing, the available data was reviewed to consider how wood fuel may increase in the future.

The most complete data are from the Vermont Forestry Department in their annual survey of wood chip prices paid by the 33 schools in Vermont that heat with wood chips. These data indicate the long term pricing of wood chips would increase at CAGR of 2.20% per year.



**Cost Comparison of heating with a conventional fuel oil vs. service by DHM**

A cost comparison of service between heating with a conventional fuel oil system compared to service from DHM has several considerations beyond the price of fuel. A complete analysis considers both the capital costs and the operational costs of each system. Additionally, from a cash-flow prospective, one may want to consider how these costs are paid for, and their timing.

For the Carr Lot development, which unlike all other building we reviewed is new construction, I would think the cost comparison would include more capital cost savings.

Should this building be developed to be connected to district heat from the outset, the design of the building would not need to include a boiler, fuel storage facilities or a exhaust chimney. Additionally the mechanical room to house the heat exchanger could be smaller than a room to house a boiler. Not requiring a boiler/chimney would eliminate some permitting requirements and the need for an annual boiler inspection; not to mention all the associated maintenance and repairs. The Heat exchanger equipment usual is not fitted on the floor and therefore is less prone to flooding, and the equipment in general is more resilient to ill effects of any flood that it might be subjected. Not having fuel stored on site is very beneficial, given the proximity to the river and the concerns for potential flooding. Not having on site fuel storage eliminates costs, risks and liability. If underground storage of the fuel was contemplated, connection to district heat would remove involvement of another permitting program and a regulatory responsibility of the building owner.

Maintenance costs of service from district are far less. The heat exchangers are not active devices like boilers. The major maintenance item are the pumps, which the building would have with a boiler.

Another thought to consider when considering connection to DHM is how energy is paid for. With a conventional fuel oil system, one is purchasing fuel that must be purchased in advance and stored before use. The amount energy one derives from the purchased is dependent on the equipment the facility has to burn the fuel. With district heat, one purchased thermal energy (what actually heats the building) and pays only for the energy used after it is used. Billing is monthly and it is for the energy used previously. With fuel oil, to get the best price, one has to purchase an entire winter/annual need in advance, tying up one's capital.

The twenty year analysis for the rates of DHM indicates very stable pricing. While wood chips are less costly than fuel oil, the equipment necessary to convert wood chips into useful energy is capital intensive. This is why DHM rates are projected to be stable. DHM's dominant costs are the capital costs to create and deliver energy. And these costs are fixed. DHM's Operational, while variable, are the lesser costs.

Another contributor to stable pricing is the structure of municipal bonds. Repayment so these bonds are fixed for their twenty year life and, unlike a mortgage, following a declining balance payment. So as some of the variable cost may increase over time, the annual bond payment is declining.

In consulting with District Heat St. Paul, their thirty year history confirms stable pricing. Their rates have increased less than the price of inflation (CPI) over that amount of time.