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**CONSTRUCTION PROJECTS COMMITTEE**  
**THURSDAY, MAY 22, 2008**  
**NASHUA HIGH NORTH LECTURE HALL**  
**6:00 PM**

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A meeting of the Construction Projects Committee was held at Nashua High North on **Thursday, May 22, 2008**. Alderman McCarthy called the meeting to order at **6:07 p.m.**

Present: Alderman McCarthy, Alderman Tabacsko, Mr. Kelley, Mr. Hallowell

Also Present: Mr. Mealey, Mr. Smith, Alderman Teeboom, Alderman Flynn, Mr. Vaughan, Mr. Haas, Mrs. Ziehm, Mr. Mosher, Mr. Dowd, Gary Maedl

***Presentation and Discussion – Gary Maedl***

**Mr. Maedl**

Reviewed handout of systems that have been installed. Rough estimate for Fairgrounds elementary School \$2.2 million. This schematic shows 6 wells. This is a very simple system and that's why it's so successful and so inexpensive. Showed classroom as an example of how system would be installed. Each unit in each room has its own heat recovery ventilation unit. This system would conform to the standards of 6 changes per hour. Stale air is exhausted out through the existing grill.

The advantages are: It has the lowest first cost and fastest return cost of any geo thermal design; It has been proven on hundreds of school installations across the US & Canada; It's rapid installation can be achieved in a few months with no disruption of school operations; There are no transport losses of heated media; It allows exact room by room temperature and fresh air control; It has a 4.36-4.99 COP with 50 degree water on our 2-ton units and does not need any supplemental solar or boiler to name a few. A low-cost with big gains is that we can integrate water-cooled refrigeration with the refrigeration in the school kitchen. That has a 30% operational savings. The only maintenance required for a system like this is washing of the air filter roughly 3 times a year. There are no other maintenance during the first 10 years and that's guaranteed.

**Mr. Hallowell**

Have you done any schools yourself?

**Mr. Maedl**

We did the red barn on Broad Street and have been doing geothermal since 1978. I'm one of the pioneers. We did some at the University of Buffalo.

**Mr. Hallowell**

Not too may schools.

**Mr. Maedl**

I am currently doing 3 other schools that I forgot to mention.

**Alderman Teeboom**

I understand from our attorney, that you can make a presentation here but you cannot bid on this job. How would you see your participation on this job?

**Mr. Maedl**

Anyway the city wants it to be. I just want to make sure that the name of geothermal does not get inured by a system that costs too much money and doesn't do what it promises to do.

**Alderman Teeboom**

What exactly would you do?

**Mr. Maedl**

Whatever the city wanted me to do. There isn't a lot to do here... it's not rocket science.

**Alderman Teeboom**

Can I ask what your rate is?

**Mr. Maedl**

\$150 per hour.

**Alderman Teeboom**

We talked a lot about the amount of air that gets displaced, the amount of noise and amount of air that gets refreshed. Kids get sick when air isn't moving.

**Mr. Maedl**

I would want to conform with the current standard, although it has not become law yet. The desired db level is 25 db and the max for scholastic environments is 35 db. This system would be set up with the inside console insulated with egg crate foam so there would be no noise coming from the compressor area. The speed of the airflow coming out of the distribution grills would be very, very slow. We could easily guarantee that the system would never exceed 35 decibels.

**Alderman Teeboom**

Are you moving enough air? Have you looked at the CO2 levels?

**Mr. Maedl**

Well it's all tied to that same CFM per person regulation. The other beauty of this system is that it has the ability to sense if the building is occupied. There's no reason to overheat and run fresh air through a room that's not occupied. This system can automatically take care of itself on a room-by-room basis.

**Alderman Teeboom**

I've seen literature where people touch the controls and really mess things up. There should not be controls in the room that should be touched by anyone.

**Mr. Maedl**

According to all the reports that I gave you everybody disagrees with you. It all says that the controls should be in the teacher's hands.

**Alderman McCarthy**

But that is not policy in this district and it is not up for grabs.

**Mr. Maedl**

Okay. We can set it up so that it's completely automatically on a room-by-room basis.

**Alderman Teeboom**

How is it centrally controlled?

**Mr. Maedl**

It is not centrally controlled. You decide the parameters for each room and it all ties into an intelligent thermostat.

**Alderman Teeboom**

When you price the \$2.2 million, what did that include?

**Mr. Maedl**

Everything I just told you.

**Alderman Teeboom**

You didn't say much about life cycle... when will it pay for itself?

**Mr. Maedl**

In four to seven years.

**Alderman Teeboom**

Is that based on current fuel costs?

**Mr. Maedl**

I've done lots of these systems and it's never 7 years. It's usually closer to 4 years.

**Alderman Teeboom**

Where is the closest school that implemented this approach, if we wanted to see it?

**Mr. Maedl**

Westborough, MA. It was done by water and energy and one of the first ones done in the area.

**Alderman Teeboom**

We have 3 schools. Suppose you did just one school. Would it be possible to move on Fairgrounds and complete it this summer and then do a performance analysis, do a bond to make sure it meets that spec... then if we like it you proceed next summer with the next two schools.

**Mr. Maedl**

I would have to sit down and see if we could get it done by the middle of August... this is nearly June already and we'd have to ensure equipment delivery. We could actually do a portion of the school, put in one well and do one wing to see how it will work. It's virtually a la carte.

**Alderman McCarthy**

When you say "we", how many people are there in your firm?

**Mr. Maedl**

Three without directors, etc. But I work closely with a number of sub-contractors. For design, you only need me.

**Alderman McCarthy**

What is the liability limits on your emissions and errors insurance?

**Mr. Maedl**

One million.

**Alderman Teeboom**

One thing puzzles me. Why would you want to fool around with this job?

**Mr. Maedl**

Because I don't want this done wrong. This is my town. How embarrassing would that be for me? I'll have to move if you do it wrong.

**Alderman McCarthy**

You've said that twice now. Is it your assertion that the proposal that's in front of us is technically not correct?

**Mr. Maedl**

Yes, it is my assertion that it is not correct.

**Alderman McCarthy**

Describe to me how it's not correct.

**Mr. Maedl**

Well, the calculations of the COP's are not valid. The highest COP you'll see on any compressor is going up just under 6. So, to include the COP's the way that is done is just not right. It's not a fair comparison. There are a lot of little assumptions that are wrong. It's not just one, two or three things wrong. There are hundreds of things wrong. All the little assumptions that are wrong add up to a big mistake. But don't take my word for it. Talk to Dr. Phetteplace. He's got far more credentials than I do and he agrees 100% with me. Talk to some of the other geothermal experts in the business, or who wrote the book on this and see what they say.

**Alderman McCarthy**

Somebody needs to tell me why when we get an estimate that says here's the life cycle cost with the solar, and I go through the calculations and they certainly seem to be correct in terms of energy usage and what's likely to be the efficiencies and someone just says well that's just not true... you don't need the solar. I don't understand the engineering behind that. No one is saying here's where the number is wrong that shows that the addition of solar is more efficient. Isn't it just possible that that's correct?

**Mr. Maedl**

If you add solar to the system, yes it is more efficient. But the cost of rate of return of adding that solar is crazy. It doesn't pay for itself.

**Alderman McCarthy**

That's not what the spreadsheet we have before us says.

**Mr. Maedl**

It's like a giant onion. And in order to prove it wrong, you'd have to do the same amount of time if not more of doing the forensic and reverse engineering to peel the onion back and say layer by layer what's wrong with it. The bottom line is, you're talking about a system that at the very minimum per school is over \$4 million (by their own claims) and one of their arguments is that you don't want to double the cost of the system in order to take care of that 15% peak in the middle of winter. Well, I can do the system for around \$2 million and they are doubling the price.

**Alderman McCarthy**

But that system at \$4 million includes a significant amount of other work.

**Mr. Maedl**

No, at \$4 million it does not.

**Alderman Teeboom**

That's not true. It's over \$15 million with the additional work.

**Alderman McCarthy**

What is the size of the vents under the windows?

**Mr. Maedl**

It's 4-6 inches wide and runs the whole length of the window. That's a minimum of 12 and a maximum of 20+.

**Alderman McCarthy**

So it's about 3 square feet. When you say the exhaust velocity of the air is low, describe what low is.

**Mr. Maedl**

125 to 300 feet a minute.

**Alderman McCarthy**

That is not low compared to the velocities of the displacement system that's proposed or the one that we currently have at Fairgrounds Junior High.

**Mr. Maedl**

Yes, I understand what it says. How can you get the air from a remote location to a location that's hundreds and hundreds of feet away without a duct that is this big around and moving it at very high velocities to reduce the heat loss in the transmission... and then how do you step it down from 1200 feet a minute to 100 feet a minute suddenly when it reaches the wall coming into the classroom? It can't be done.

**Alderman McCarthy**

I can tell you that if we go to Fairgrounds Junior High where that system exists, that it works and it works essentially silently.

**Mr. Maedl**

Quiet is relative to who's in there at the time.

**Mr. Hallowell**

You made a couple of reference with Dr. Phetteplace. Have you discussed anything with him since he was here?

**Mr. Maedl**

No, I didn't.

**Mr. Hallowell**

You've made some statements about what he said, etc., and since he's not here I would prefer you didn't make those statements. He didn't see your full design. He also made comments the night he was here that he did not believe the open loop system was exactly the system you told us we shouldn't do for a host of reasons. He was very clear on that.

**Mr. Maedl**

There are a lot of people in the geothermal system that feel that way about the open loops.

**Mr. Hallowell**

I respect that you came here and provided some information for me. But you can't on the one can't say that Dr. Phetteplace is well respected and use him to say he's validating your system, and then on the other hand say he's one of those people who doesn't...

**Mr. Maedl**

If I sounded like I was saying that Dr. Phetteplace validated my system, I'm sorry. That's not what I'm saying at all. He described distributed water source heat pumps as the way to do schools, as opposed to a centralized system. That was the sole reference I made to what he said. Nobody anywhere is doing schools as a centralized system when they're doing schools. It just doesn't make sense.

**Alderman Tabacsko**

I thank you for coming tonight. Am I to understand that there's not a single centralized geothermal system in the country?

**Mr. Maedl**

No, that's not true. All the school examples that I've been able to find and all the ones that have been referenced to me by other experts in the geothermal industry are all decentralized systems. Within those systems you have the option to have centralized and decentralized controls. I believe 2 of the reports I gave you have state that they prefer to have the controls in the hands of the teachers. That's the School Board's decision. The cost differential is not very big.

**Alderman Tabacsko**

Is there any data for how centralized systems are performing? It sounds to me like part of what we're discussing is the basic concept of whether you want to have 69 individual unit things in the classroom or not. I would think that large buildings with multiple rooms whether that's schools, or nursing homes, etc. would be similar applications and would be valuable information to look at.

**Mr. Maedl**

Right. I don't want to mislead you in any way. The majority of commercial facilities that are built today are installed with centralized systems. This centralized system typically takes the form of a "roof top" unit. These are probably, not only the most inexpensive way... but the most common way that heating/cooling is done. However, they are enormously inefficient. So you have a first cost that is nominal, but the cost of operation is astronomical. So they try and do all kinds of ways to control the system from that point forward to make it more efficient. In the better buildings, like skyscrapers you have another thing called a VAV (variable air volume box). This is probably the most common, high-end system used for high-end buildings. It's a decentralized type of approach, and HVAC has been moving more towards a decentralized approach because of the cost efficiencies and control efficiencies.

**Alderman Tabacsko**

The idea that no boiler or backup boiler is necessary in your system... that's an open loop system?

**Mr. Maedl**

That's an open loop system. If you were to make it a closed loop system, you're drilling cost for the wells would go, because you'd need more wells, and...

**Alderman Tabacsko**

What would that do the cost of \$2.1 million?

**Mr. Maedl**

It would add another \$500,000 to it.

**Alderman Tabacsko**

And there's no worse case scenario with no boiler where we're going to have to send kids home because we can't maintain the heat in the building? That's a guarantee?

**Mr. Maedl**

I've been doing it 30 years and it hasn't happened yet.

**Alderman Tabacsko**

But obviously, that's a concern in a school.

**Mr. Maedl**

In a decentralized system, the chances of the entire system failing and going down are approaching zero. Whereas in a centralized system, the chances of the system failing, even for a nominal problem is much, much greater.

**Mr. Smith**

You mention the filter, which is washable at the inlet of each individual system. By inlet, do you mean by up on the roof or back in the unit itself?

**Mr. Maedl**

At a minimum there's one where the air comes in from the outside. I'd have to take a look at it... we might want to add a second one right before the HRV, we usually do. You would need a ladder to get to it. But it doesn't have to be there. What would happen over time though, the dust would collect in the trunk that's coming into the room, and dust has been known to cause problems in the past. So we like to stop it farther up the stream if possible.

**Mr. Smith**

I saw in your estimates that you have 69 unit. So every single space has its' own?

**Mr. Maedl**

Every single classroom has its' own. Some of the rooms have more than one, like the library.

**Mr. Smith**

Do you find yourself aligned with any particular control system?

**Mr. Maedl**

I like Honeywell thermostats. Traditionally I don't like any of the control systems that are out there.

**Mr. Smith**

You seem to be involved in a lot of different things. Are you a professional engineer? Do you have a PE?

**Mr. Maedl**

I do not have a license yet. I just took the exam this spring and don't have the results yet. I'm not confident.

**Mr. Smith**

In mechanical?

**Mr. Maedl**

Yes.

**Mr. Vaughan**

You say that the only maintenance is washing the filters, but I imagine that doesn't mean that things can't go wrong or need some maintenance. It seems to me that the more individual units I have, the more things I have that could potentially go wrong over time. What have I misunderstood in that analysis?

**Mr. Maedl**

Nothing, you're absolutely right. If I have 10 machines, each with a compressor in it vs. 100 machines with a compressor in it, I have a 10 times greater chance of a compressor failure with 100 machines than with 10 machines. You'll sometimes here people say that heat pumps don't work up here in the NE, and that's completely untrue. Now back to your maintenance question, we'll guarantee that system, no questions asked. 100% parts and labor, no matter what and instant response for 10 years. So you have absolutely no other maintenance costs than cleaning the filter. The filter is guaranteed for life. The compressors are made of the best, most durable materials. So the first 10 years your maintenance cost is zero, no matter what. In the next 10 years, it will be nominal. The things that can fail in a water source heat pump are the compressor, the ICM Board, the reversing valve and you might lose a coil. These things often last for 25 years.

**Mr. Vaughan**

*(Not audible)*

**Alderman Teeboom**

Open vs. closed loop... Dr. Phetteplace has pros and cons for both, but he does prefer closed loop. So, why did you choose open loop?

**Mr. Maedl**

For one, it saves \$500,000 in installation costs and it's about 20% more efficient than a closed loop. Simply because you're dealing with 50+ degree water.

**Alderman Teeboom**

One of the problems we have is fresh air intake because of the busses and cars in front. How do you get around a row of classrooms that are sitting right near that driveway when a bus pulls in?

**Mr. Maedl**

We're exhausting on that side and pulling the air from the glass block roof area.

**Alderman Teeboom**

Would you have to do a test to determine what the final design should be?

**Mr. Maedl**

No. You can if you want to, but we typically don't.

**Mr. Smith**

Are you continuously monitoring the water quality, or periodically checking it?

**Mr. Maedl**

You can monitor it if you want to, but it's not done automatically.

**Mr. Smith**

Where is the air entered into the classroom from the system?

**Mr. Maedl**

The HRV is on the backside of the heat pump itself.

**Mr. Smith**

It seems to me that without ductwork that gradually gets smaller, you're going to have an issue with too much air on one side and not enough air on the other end of the classroom.

**Mr. Maedl**

You would think so, but at the red barn we tested exactly that and it is completely balanced. You do have to know how to design your ductwork to do that, but it's doable.

**Mr. Smith**

But you make use of existing grills, correct?

**Mr. Maedl**

Not necessarily. That would probably be a whole separate system like you see in the airports.

**Mr. Smith**

But you're using the grills that are already in the classrooms in the casework, right?

**Mr. Maedl**

No, we're not using the grills. Where the grills are, this unit would replace that.

**Mr. Smith**

So your cost includes all that stuff... cutting the wood and then doing that?

**Mr. Maedl**

No, it does not. This sound issue has come up since I wrote that estimate so I would have to see how much additional money it would take.

**Mr. Smith**

That's for the older classrooms. How would you work on the newer classrooms? Would you make use of the existing ductwork there?

**Mr. Maedl**

No, because it was not done well. I need to have the inlet on one side and the exhaust on the other because I want cross flow in the room. If it's possible, I would like to reuse the baseboard for heating. So I'm going to circulate 120-degree water through that baseboard at a nominal cost, increase the comfort level and reuse existing materials.

**Mr. Smith**

So you're going to make use of the existing exterior grill in front of the classrooms. Are you exhausting or returning all the air from a single point basically in the corner of each classroom? That's pretty typical.

**Mr. Maedl**

No, because the air that's being exhausted is going to be pulled down from a duct on top. We're washing the glass with the fresh or conditioned cool air that is recaptured at the top and brought down to the HRV. The fresh air is also brought down at the same time.

**Mr. Smith**

So, there are actually 2 ducts. Your drawing shows one. So this is not just fresh air.

**Mr. Maedl**

As drawn there, it's a 12-inch duct, which we don't really need. All systems are a mixture of air. Nobody can afford to run 100% outside air.

**Alderman McCarthy**

You're talking about delivering 20 CFM per occupant of outside air. And the air is going to come in from a duct that's how big?

**Mr. Maedl**

A 6 or 8-inch duct will handle it. I don't know what the velocity would be, but it wouldn't be over 800 feet a minute.

**Alderman McCarthy**

Actually, if you're pulling 450-500 CFM through a pipe with a 6-inch diameter, with less than ¼ sq. ft. surface area, the linear velocity has to be 1800 feet per minute.

**Mr. Maedl**

No, it's 5.5 per sq. ft...

**Alderman McCarthy**

450 cubic feet through ½ sq. foot hole... so you're going to have 4 times the velocity...

**Mr. Maedl**

I have tables for this stuff.

**Alderman McCarthy**

You don't need tables... it's simple math. It's 1800 feet per minute.

**Mr. Maedl**

I just said a minute ago that the duct shown on the drawing is a 12-inch duct, didn't I?

**Alderman McCarthy**

I just asked you, and you said about 6 inches.

**Mr. Maedl**

I said 6 or 8 inches for the inlet size.

**Alderman McCarthy**

Okay, and the inlet side has to pass 450 cubic feet per minute...

**Mr. Maedl**

I don't know. I would have to sit down and do the math.

**Alderman McCarthy**

At 6 inches, it's going to be moving through that pipe pretty fast.

**Mr. Maedl**

Then we make it bigger. It should be approximately the same size as the exhaust board.

**Mr. Smith**

If we're using existing exhaust port designed in 1954, it doesn't sound like it would be adequate.

**Mr. Maedl**

If it isn't, we'd have to make another accommodation, but I'd be surprised if it weren't large enough. The duct on the backside of it can be much larger. I just did a house in Vermont and the architect didn't want anything to show, so the air inlets are ¾ inch high and 11 inches long. He's crazy.

**Alderman Teeboom**

He's looking for 600 cubic feet per minute, not 450.

**Alderman McCarthy**

450-600 just makes the problem 1/3 worse.

**Alderman Teeboom**

You design the pipe for whatever it can handle. I don't understand your point.

**Mr. Maedl**

We take 600 CFM and divide it by 5.5 (square inches) equivalent to 800 feet per minute. That's 109 square inches.

**Alderman Teeboom**

That's a lot more than a 6-inch pipe.

**Alderman McCarthy**

We don't need to do the arithmetic here. Are there any other questions? Thank you Mr. Maedl.

Alderman Tabacsko moved to adjourn. **So voted at 7:32 p.m.**

*Submitted by Jacki Waters*