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# SALT LAKE CITY COUNCIL STAFF REPORT

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**DATE:** October 2, 2006  
**SUBJECT:** Sewer Heat Pump Pilot Project  
**AFFECTED COUNCIL DISTRICTS:** Council District #4  
**STAFF REPORT BY:** Gary Mumford  
**ADMINISTRATIVE DEPT. AND CONTACT PERSON:** Department of Public Utilities  
LeRoy Hooton and Jeff Niermeyer

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## KEY ELEMENTS:

The Department of Public Utilities is proposing a joint pilot heat pump project with a private property owner (Lear Holdings, L.L.C.) to test the feasibility of using the City's sanitary sewer system as a part of a heat pump system at a building located at 808 E South Temple. The heat pump system will provide heating and cooling for the building. The system will include replacing a 60 foot section of sewer pipe with a double-wall stainless steel pipe. The space between the two walls will contain heat transfer fluid that will flow to a heat exchanger inside the building. The property owner will pay for the stainless steel pipe and all other components of the system. The Administration is proposing that the Department of Public Utilities will participate in the project by removing the current sewer pipe and installing the stainless steel pipe at a cost to the Sewer Fund of not more than \$10,000. The City will gain data from the pilot project that could be used in furthering the use of this technology in future projects.

The Administration states that it is anticipated that there will be environmental benefits as a result of a decrease in emissions since less energy will be required to heat and cool the building. An additional appropriation is not requested because the installation of the stainless steel pipe will be accomplished within existing salary budgets. Following a public benefit hearing required by Utah Code 10-8-2, the Administration requests that the Council adopt a resolution authorizing the use of public resources for the pilot project.

## MATTERS AT ISSUE / POTENTIAL QUESTIONS:

The Administration's transmittal points out that the use of sewer flows as a heat pump sources has been used elsewhere in the world at energy savings approaching 50%. However, the specific technology proposed to be used for this project is apparently new. The property owner will share data with the City relating to the performance, operation and maintenance of the pilot project.

The property owner has manufactured the 60-foot double sided stainless steel pipe that will serve as a heat exchanger when installed to replace an existing portion of a sewer line. The owner has requested that the City install the stainless steel pipe by November 15 in order to have the system in place for this winter's heating season.

The heat pump system works best when there is a heat source that maintains a near constant temperature. The sewage in the pipe has a temperature of between 55 to 60 degrees. The ground around the sewer pipe has a constant temperature of about 55 degrees. The inner pipe of the new stainless steel pipe carries the normal sewage flow. Heat transfer fluid is circulated in the space between the two pipes and gains heat or losses heat depending on the difference in temperature between the heat transfer fluid and the surrounding ground and sewage in the inner pipe. Heat is collected from the sewage and surrounding ground during the heating season and transferred to heat pumps to provide heat to the building. During the summer when there is a need to cool the building, the heat pump is operated in reverse direction and the excess heat in the building is sent to the sewage and the ground that surrounds the sewer pipe.

Utah Code Section 10-8-2 states that a city may appropriate money for city purposes only. Before a city can make a donation, the city must make a study identifying the benefits to the City of providing the contribution. The Code also requires a public hearing following 14-days advance notice. To ensure that the joint heat pump pilot project complies with Section 10-8-2, a study has been conducted and a public hearing scheduled. The Administration will finalize the study prior to Tuesday, October 3 and place it in the City Recorder's Office for public inspection.

At the briefing the Council may wish to ask representatives of the Administration whether this technology has the potential of heating and cooling City-owned buildings and whether this technology could be a source of revenue for the City's sewer fund on a large-scale basis. The Council may wish to ask for a follow-up written report on the results of the pilot project to be provided to the Council after both a winter and summer season. The report could include whether actual energy savings resulted and the estimated cost recovery period for the additional cost of this type of system over traditional heating and cooling systems.

## **OPTIONS:**

A date of October 17 has been advertised for a public benefit hearing. Options that the Council may wish to consider following the public hearing include:

1. Authorize the use of \$10,000 of public resources in connection with the pilot project.
2. Deny the use of public resources in connection with the project but encourage the City to allow the property owner to contract with the City or with a construction company to install the stainless steel pipe at the property owner's expense and with normal inspection by the Department of Public Utilities.
3. Request additional research or other information.

LEROY W. HOOTON, JR.  
DIRECTOR

# SALT LAKE CITY CORPORATION

DEPARTMENT OF PUBLIC UTILITIES  
WATER SUPPLY AND WATERWORKS  
WATER RECLAMATION AND STORMWATER

ROSS C. "ROCKY" ANDERSON  
MAYOR

## COUNCIL TRANSMITTAL

To: Rocky Fluhart, Chief Administrative Officer

September 26, 2006

Re: Jon Lear Heat Pump Project

Recommendation: The City Council allow the Department of Public Utilities to participate with in-kind labor, equipment and materials in the Jon Lear Heat Pump Project and hold a public hearing to comply with Utah Code Annotated Section 10-8-2.

Availability of Funds: FY 2006-07 Budget

Discussion: Mr. Jon Lear is proposing to use the City's sanitary sewer system as a part of installing a heat pump system at his building located at 808 East South Temple Street, Salt Lake City. In order to have the system in place for this winter's heating season, it will be necessary to install a 60-foot length of stainless steel pipe (heat exchanger) into the City's sewerline before November 15.

The use of sewer flows as a heat pump source of energy has been used elsewhere, but the system Mr. Lear is proposing to our knowledge is new. (Oslo, Norway for example uses a centralized system, which is connected to its public sewer system that serves many customers within the city).

Inasmuch as Mr. Lear is proposing to use the city's sewer system, Public Utilities is keenly interested in this project, both from the stand point of potential benefits the City may derive from the project; and secondly the stainless steel pipe is being integrated into a public system that Public Utilities relies on to serve other sewer customers and must be involved to ensure reliable service to its upstream customers. Based on this, it is desirable to have a joint "pilot project" to explore the possibilities of such a system. The two parties will share in all of the data, knowledge and experiences related to the performance, operation, maintenance of the proposed pilot project.

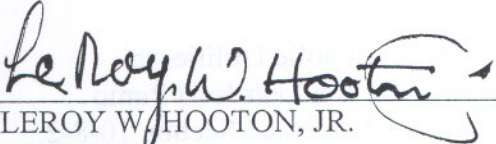
Mr. Lear at his sole expense has engineered and manufactured the stainless steel pipe heat exchanger. It is proposed that Public Utilities install the pipe within the City's sewer system adjacent to his building at an estimated total cost of \$10,000. Mr. Lear will install at his sole expense all of the heat pump system needed in the pilot project.

The Department of Public Utilities is requesting that the City Council allow the use of Public Utilities resources to install the stainless steel pipe into the City's sewer pipe adjacent to Mr. Lear's property at 808 East South Temple Street.

The Department of Public Utilities respectfully requests the City Council to schedule a public hearing on October 17, 2006 to consider public comments in connection with this pilot project. Attached is a proposed notice for publication.

Also, attached is a study and proposed resolution necessary to comply with Utah Code Annotated Section 10-8-2.

Contact Person(s): LeRoy W. Hooton, Jr. (483-6768); Jeff Niermeyer (483-6785) or Chris Bramhall (535-7683).

  
LEROY W. HOOTON, JR.  
DIRECTOR

Attachments

RESOLUTION NO. \_\_\_\_\_ OF 2006

(RELATING TO A STUDY PERFORMED IN COMPLIANCE WITH *UTAH CODE* SECTION 10-8-2 IN CONNECTION WITH A PILOT HEAT PUMP PROJECT TO BE UNDERTAKEN BY SALT LAKE CITY AND LEAR HOLDINGS, L.L.C, AND AUTHORIZING THE USE OF PUBLIC RESOURCES IN CONNECTION WITH SUCH PILOT PROJECT)

WHEREAS, Lear Holdings, L.L.C., a Utah limited liability company, has requested the assistance and participation of Salt Lake City in connection with a pilot project designed to utilize a portion of the City's sewage disposal system to heat and cool a private office facility; and

WHEREAS, pursuant to the requirements of Section 10-8-2(3), Utah Code Annotated, a study has been performed setting forth an analysis of the costs and benefits of, and demonstrating the purpose for, participating in the pilot project (the "Study"); and

WHEREAS, the City Council has, following the giving of not less than fourteen (14) days public notice, conducted a public hearing relating to the foregoing, in satisfaction of the requirements of Sections 10-8-2(3), Utah Code Annotated; and

WHEREAS, the City Council has reviewed the Study, and has fully considered the analysis and conclusions set forth therein, and all comments made during the public hearing,

NOW, THEREFORE, BE IT RESOLVED by the City Council of Salt Lake City, Utah:

1. The City Council hereby adopts the conclusions set forth in the Study, and hereby finds and determines that, for the reasons set forth in the Study, the net value to be received by the City as a result of its participation in the pilot project will constitute adequate consideration, or equivalent value, both tangible and intangible, for the benefit being provided by the City to Lear Holdings, L.L.C.

2. In the judgment of the City Council, the City's participation in this pilot project, as described in the Study, will provide for the safety, health, prosperity, moral well-being, peace, order, comfort, or convenience of the inhabitants of Salt Lake City.

3. The use of public resources in connection with the pilot project, as described in the Study, is hereby approved.

Passed by the City Council of Salt Lake City, Utah, this 17th day of October, 2006.

SALT LAKE CITY COUNCIL

By \_\_\_\_\_  
CHAIRPERSON

ATTEST:

\_\_\_\_\_  
CHIEF DEPUTY CITY RECORDER

CEB Docs/Doug Short Heat Pump Pilot Project.doc

APPROVED AS TO FORM  
Salt Lake City Attorney's Office

Date 9/26/06  
by Chris Brown

Notice is hereby given that the Salt Lake City Council will conduct a public hearing at 7:00 p.m., October 17, 2006, to allow an opportunity for public comment on the use by the City of public resources from the City's sanitary sewer enterprise fund in connection with a pilot project designed to heat and cool a private office facility using heat pump equipment connected to the City's sewage disposal system. The public hearing will be conducted in the Council Chambers, City and County Building, 451 South State Street, in Salt Lake City. A study setting forth an analysis of and demonstrating the purpose for this pilot project has been prepared and is available for review by interested persons at the office of the Salt Lake City Recorder in Room 415 of the City and County Building during normal business hours. Following the public hearing, the City Council may consider a resolution adopting the findings contained in the study, and approving the use of public resources for the project, in satisfaction of Section 10-8-2, Utah Code Annotated.

OCT 08 2006

## MEMORANDUM

TO: Steve Fawcett

FROM: Kay Christensen

DATE: September 12, 2006

CC: Leroy Hooton, Jeff Niermeyer, Chris Bramhall, Rocky Fluhart

SUBJECT: City participation in a heat pump pilot project: Study to Comply with Utah Code Annotated Section 10-8-2

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A private citizen, Jon Lear (Lear Holding), is renovating a building at 808 East South Temple (the historic Major Downey house) for use in his law practice. He wants to heat and cool the building using water heated and cooled by the sewer line running past the building. This project will require, in part, the replacement of 60 feet of clay sewer pipe with stainless steel pipe. The City has been asked to assume approximately \$10,000 in labor, equipment and associated material costs that would be born by the Sewer Fund (the City may assume some additional maintenance and repair costs as part of the agreement that is under negotiation).

The owner is interested in making the project as energy efficient and environmentally friendly as possible. A ground source heat pump system was chosen to perform the task because it requires up to 50% less energy to operate. These units move energy from the building to the earth when cooling and move energy from the earth to the building while heating.

Several options were proposed for the ground coupled system. The first proposal was a closed loop system (similar to many schools in the valley) using eight to ten boreholes. The second system proposed using non-consumptive water wells to produce water and then to re-inject the water to the same aquifer (similar to Westgate). The third system proposed was a system that would share energy with the potable water system. This system was immediately rejected by the Public Utilities Department because it involved returning the used water to the water system.



Options one and two are still available, but a fourth option was suggested at a meeting with Public Utilities; use of the City sewer system. After a considerable amount of research and discussion, the owner chose to explore the sewer heat exchanger idea because of the innovative nature of the idea and obvious ability to "reuse" a resource that had already been consumed.

Heat pumps work on a principle of moving heat from one source to another source. The heat pump system works best when there is a heat source that maintains a near constant temperature. The sanitary sewer system provides just such a heat source. The sewage in the sewer pipe is a fairly constant temperature of 55 to 60 degree Fahrenheit. Also, the ground around the sewer pipe is a constant temperature of around 55 degrees Fahrenheit.

To make the system operable, the owner has designed a double wall, stainless steel heat exchanger that would replace some of the city sewer pipe running along the 800 East side of the property and also exchange energy indirectly from the sewer to the building and vice versa. The space between the two walls of the pipe is filled with a heat transfer fluid (the heat transfer fluid is very similar to antifreeze. The heat transfer fluid is a closed loop and is separated from the water tank by another heat exchanger inside the building. The water in the tank is pumped to one side of this heat exchanger and the heat transfer fluid is on the other side). The inner pipe carries the normal sewage flow and the outer pipe is next to the ground. The heat transfer fluid is circulated in the space between the two pipes. The heat transfer fluid gains heat or losses heat depending on the difference in temperature between the heat transfer fluid and the surrounding ground and sewage in the inner pipe.

Using the heat exchanger, heat is collect from the sewage and surrounding ground during the heating season and transferred to the heat pumps to provide heat to the building. During the summer when there is a need to cool the building, the heat pump is operated in a reverse direction and the excess heat in the building is sent back to the heat exchanger to transfer the heat back into the sewage and the ground that surrounds the sewer pipe.

During periods of peak heating there may not be enough heat transfer capacity in the sewage and surrounding ground. When this condition exists,

the proposed system will use a secondary source to provide additional heat. The proposed source is a water tank located inside the building. The water in the tank can be refreshed from the household water supply to add additional heat.

Conversely, during the peak cooling season, the sewer pipe heat exchanger may not have enough heat transfer capacity to dissipate all of the heat from the building. The project will use the same indoor water tank as a secondary heat sink to dissipate heat from the building during period of high outside temperatures. The water temperature in the secondary tank can be kept cool by replacing the water with water from the culinary system.

The proposed system uses two heat exchangers. One is located on the sewer line the other located inside the building and connected via a pump to the water tank. When only the sewer system heat exchanger is being used, the heat transfer fluid is pumped around the sewer pipe and to the building heat pumps. When additional heating and cooling is needed the heat transfer fluid is pumped around the sewer and through a heat exchanger that is connected to the water tank. The water tank is separated from the city culinary system by a physical air gap. This eliminates any concern with cross connections.

To ensure that the action of Salt Lake City is in compliance with UCA 10-8-2, the following study has been conducted. UCA 10-8-2 states the purposes for which a municipal body may appropriate funds and the factors that must be considered in determining the propriety of such an appropriation. This study will consider the following factors:

- (1) The specific benefits to be received by the City;
- (2) The City's purpose in making the appropriation, including an analysis of how the safety, health, prosperity, moral well-being, peace, order, comfort or convenience of the residents of Salt Lake City will be enhanced; and
- (3) Whether the appropriation is "necessary and appropriate" to accomplish the City's goals.

*Benefits to Salt Lake City:* In return for the investment of \$10,000 in labor costs, the City will gain significant benefits:

- The City will gain valuable data that could be used in furthering the use of such technology in future projects. The project offers the opportunity to test this system and the theory behind it to determine if it is feasible on a larger scale.
- It is anticipated that there will be environmental benefits as a result of a decrease in CO<sub>2</sub> emissions. Since natural gas will not be used to heat or cool the building, the designers of the system expect CO<sub>2</sub> emissions to be reduced by approximately 25 tons a year. However, additional electricity will be needed to run the pump, creating approximately an additional 13 tons a year of CO<sub>2</sub> emissions. This could result in a net elimination of 12 tons a year of CO<sub>2</sub> emissions from the owner's system. On the City's part, it is also important to take into account the increased water demand created by the system and the increased need for energy to produce more water and treat the extra waste water (the project would require about 405,416 gallons just for heating and cooling. In the summer, some of that water could be used on the landscaping and offset the regular irrigation water, but even with this adjustment the system would still require 292,468 gallons during the winter and all of that water will end up in the sewer system to be treated). The increase in CO<sub>2</sub> emissions that the City will incur to meet this added water and sewage treatment demand is approximately 4 tons. This amount must be subtracted from the 12 tons of net CO<sub>2</sub> emissions calculated above for the owner's system. As a result, the overall reduction in CO<sub>2</sub> emissions is expected to be approximately 8 tons.
- The potential exists for Salt Lake City to form a subset energy utility to take advantage of the dual use of the public sewer system. This would increase the value of the sewer system and serve as a potential source of new revenue.
- The City may have the opportunity to have access to the proprietary technology tested in this project for use in other public buildings and facilities.

- This technology could potentially replace or reduce the size of gas furnaces and boilers and reduce the amount of water used by commercial cooling towers.

*Meeting Salt Lake City's Purposes and Enhancing the Quality of Life for Residents:*

- In 2002, on the eve of the Salt Lake City Winter Olympic Games, Mayor Anderson committed that Salt Lake City Corporation would abide by the guidelines set forth for the United States in the Kyoto Protocol. Salt Lake City committed to a 7% reduction in greenhouse gas emissions below 1990 levels by 2012, which is the equivalent of a 21% reduction from 2000 levels. We have seen tremendous results. With minor adjustments for new buildings which have been built, the City has reduced 20,300 equivalent tons of carbon dioxide emissions. We need to reach 26,700 tons to meet our Kyoto goal, so we are 76% complete. This small pilot project could result in the reduction of 8 tons of CO<sub>2</sub> emissions a year and offer the potential for much greater reduction.
- This project will enhance Salt Lake City's role as a leader in environmental sustainability and offer the potential for economic development in that area.
- The project will set an example of what can be done through public/private partnerships to enhance the environment and encourage such cooperation in the future.
- This pilot project epitomizes the purpose of Salt Lake City Green. Salt Lake City Green, launched by Mayor Rocky Anderson in 2001, is an innovative, award-winning environmental program that is helping to ensure a healthy, sustainable future for Salt Lake City. It is a program that can be duplicated by other municipalities

and the private sector. The philosophy behind Salt Lake City Green is “practical environmentalism,” which aims for innovative solutions that not only protect the environment but also improve the City’s social and economic welfare. In other words, all of our decisions would be based on the premise that we are affecting the livability of our City far into the future. We take this as a tremendous responsibility, reflected in the Great Law of the Iroquois Confederacy, which declares: “In every deliberation, we must consider the impact of our decisions on the next seven generations.” That is our guiding principle. The program involves all of City government and the community as a whole, providing a variety of opportunities for environmental accountability.

- Every ounce of CO<sub>2</sub> that is not produced and introduced to the atmosphere makes our air cleaner and enhances the quality of life of Salt Lake City residents.

*Accomplishing Salt Lake City’s Goals:* The proposed pilot project is necessary and appropriate to accomplish Salt Lake City’s goals in the area of sustainability and sound and innovative environmental leadership. It keeps Salt Lake City in the forefront of the effort to reduce the impact of global warming, while making a real contribution to that cause through the reduction of CO<sub>2</sub> in the atmosphere.

Based on the foregoing analysis, I conclude that the project offers Salt Lake City adequate benefit to meet the threshold required by U.C.A. 10-8-2 and therefore the contribution would comply with state law.