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Name: RONALD F. SANTI

Address: 2916 Pine Spring Road Falls Church,

I represent: Verdant Power Inc. VA 22042

Address: 888 Main St, NY, NY 10006

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**Testimony of Josh Kanagy, Director of Business Development for Lucid Energy Technologies, before the New York City Council Committee on Environmental Protection
New York City's Hydropower Capacity: Present and Future Opportunities**

February 17, 2011

Introduction

Good afternoon Chairman Gennaro and members of the committee. My name is Josh Kanagy, Director of Business Development for Lucid Energy Technologies, LLP (Lucid Energy). I greatly appreciate the opportunity to discuss with the committee New York City's hydropower capacity and the opportunities this presents to the City. In my testimony, I will address points salient to the hearing. First, I will discuss New York City's capacity for hydropower. Next I will discuss Lucid Energy's experience and our core technology, and the associated regulatory issues. Finally, I will describe steps for the City to take advantage of its untapped hydropower resources.

New York City's Capacity for In-Conduit Hydropower

The New York City water system is an amazing feat of engineering. The system relies almost entirely on gravity to carry water from the Lower Hudson Watershed to the City, with pumping required for only the most elevated areas of the City. By the time the water reaches the Hillview Reservoir in Yonkers, it is 295 feet above sea level and traveling through the system with sufficient pressure to reach the sixth floor of most buildings through gravity alone.

Untapped energy, in the form of pressure, is available for capture and use as water flows through the many thousands of miles of water distribution and wastewater pipelines owned by the City. These pipelines, or conduits, that move water throughout the City's water distribution and wastewater collection and treatment systems form an important resource base for generating power. Power generated from the untapped energy in these pipelines is referred to as in-conduit hydropower.

Large and complex water systems like New York City's are comprised of many different pipes with varying diameters, flow rates and pressures. In fact, technologies exist to efficiently harvest energy across this spectrum. For instance, conventional hydropower technologies work well in high-pressure applications where significant pressure reduction is necessary. In fact, some newer hydropower technologies are specifically designed to replace pressure-reducing valves. Additionally, throughout the water infrastructure where excess pressure is available to extract, hydropower technologies such as Lucid's PowerPipe system can be effectively deployed to generate electricity.

At this juncture, before any formal study has been conducted, it is difficult to estimate the total power available to the City through the use of conventional and new, innovative in-conduit hydropower technologies. Suffice it to say, however, it is Lucid Energy's experience that water systems such as New York City's lend themselves to significant power generation. Based on our testing experience in the laboratory and in the field, I am confident that the New York City water system could produce considerable amounts of renewable energy from in-conduit hydropower.

Lucid Energy Background

Lucid Energy is commercializing an in-conduit hydropower technology called Northwest PowerPipe™. Our mission is to develop in-conduit hydropower systems that generate renewable energy for water utilities and municipalities.

The development of PowerPipe has been actively supported by our development partner Northwest Pipe Company, a highly regarded and long standing market leading manufacturer of steel pipes used in the water industry. Northwest Pipe has supplied steel pipe used in New York City's water system for over 25 years.

Lucid Energy has received over \$1 million from the Department of Energy in the form of two grants to further the development and commercialization of Northwest PowerPipe™.

Northwest PowerPipe™

Northwest PowerPipe™ is a unique, in-conduit hydropower system and is Lucid Energy's core technology. Its vertical axis turbine captures excess kinetic energy within water systems. The payback period associated with the deployment of PowerPipe is very competitive with other renewable energy technologies.

PowerPipe is modular and easily scalable so that a system can be designed to extract excess pressure without a significant impact on water distribution. In other words, our technology can generate power from a pipeline without impeding the operator's ability to move water to the consumer or through a waste water collection system.

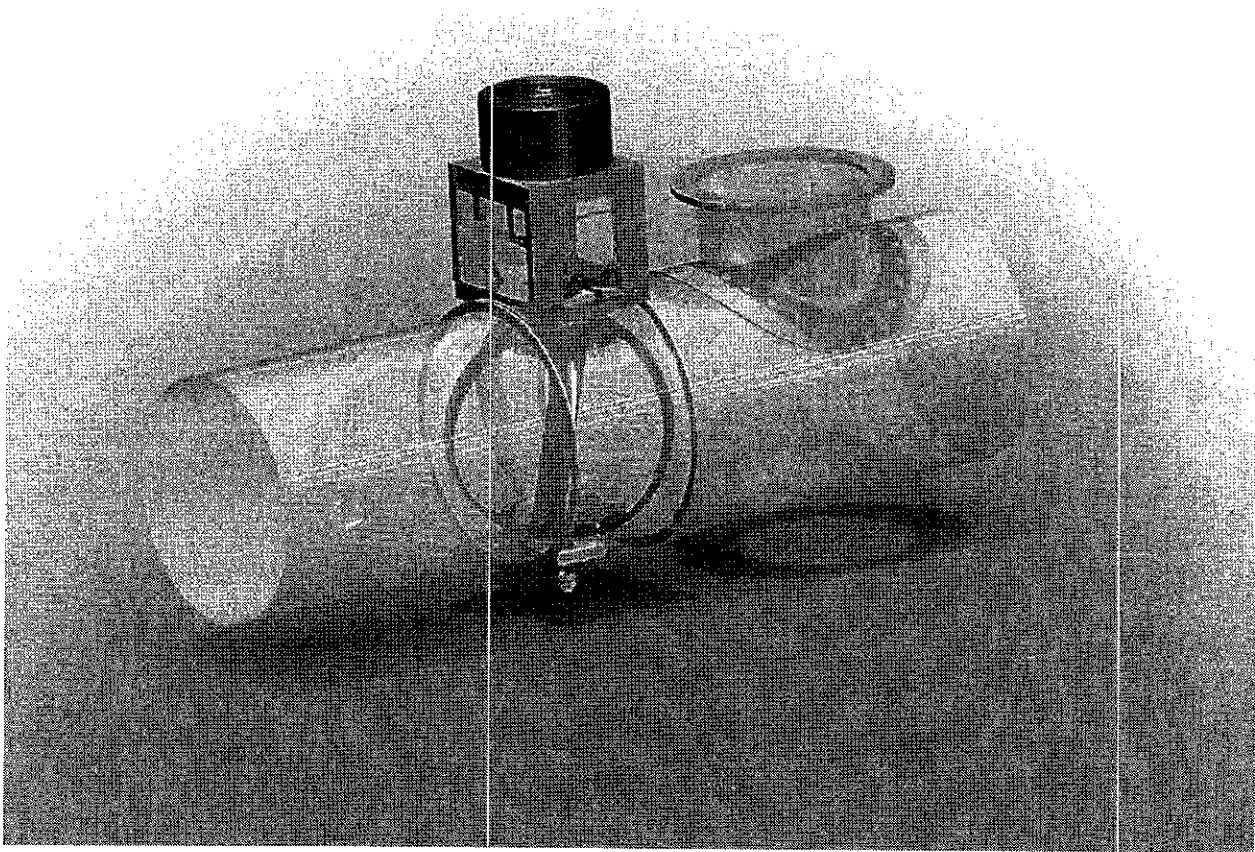


Figure 1: Northwest PowerPipe™

It should be pointed out that the amount of excess pressure required for the use of a PowerPipe system is very low compared to conventional hydropower technologies. PowerPipe allows for power extraction across a wide range of pressure conditions and fills a gap in the matrix of conventional hydropower, allowing for gravity-fed systems to generate power where it had not been previously possible.

In-conduit hydropower technologies such as PowerPipe do not threaten fish, wildlife or watersheds because they are deployed within a closed conduit system. This fact significantly eases the key regulatory burden associated with the development of conventional open water hydropower projects.

The benefits of harnessing the City's untapped hydropower with innovative technology such as PowerPipe are significant. These benefits are both environmental and economic in nature and outweigh the costs associated with such an undertaking.

Regulatory Climate for In-Conduit Hydropower

The Federal Energy Regulatory Commission (FERC) has primary jurisdiction over hydropower projects in the United States, and requires an approval process in order to commence with hydropower project development. Likewise, in-conduit hydropower projects are also subject to FERC jurisdiction. However, the good news is that in-conduit projects qualify for an exemption from the standard licensing process, and the exemptions are issued in perpetuity.

Obtaining an in-conduit project exemption is more expeditious and less costly than obtaining a traditional license. In the last year, FERC has announced plans to further expedite the process of obtaining an in-conduit exemption as a result of its work to further small and low-impact hydropower projects. Recently, FERC has partnered with several states to streamline the process for obtaining an in-conduit exemption. As a result, in-conduit exemptions have been issued by FERC in less than 90 days and rarely take longer than 180 days to be issued. This bodes well for forward thinking cities like New York City that wish to explore the potential for hydropower within its water system.

Recommended Steps for Exploring In-Conduit Hydropower in New York City

Lucid Energy believes that in-conduit hydropower presents New York City with a golden opportunity to generate renewable energy from its water system economically and expeditiously. In order to more fully understand this opportunity for the City and its constituents, Lucid Energy recommends that the following three actions be taken:

- Resource Assessment
 - Create a team of technical experts from government, the hydropower industry and New York City chartered to:
 - Identify the low hanging fruit, i.e. sites with:
 - Sufficient flow,
 - Excess pressure, and
 - Reasonably convenient access.
 - Create an inventory of New York City's potential hydropower assets that meet the defined parameters; and
 - Evaluate the benefits of deploying conventional and in-conduit hydropower within the identified inventory.
- Available in-conduit technologies assessment
 - Implement an in-conduit hydropower pilot study to:

- Evaluate the performance of technologies for suitability in wider deployment;
- Evaluate the impact of these technologies on water system performance; and
- Create a tangible demonstration of the City's commitment to clean energy and reduction of its carbon footprint.
- Regulatory Innovation
 - Initiate contact with FERC to develop a program specific to the needs of New York City to obtain:
 - Federal support for an in-conduit hydropower pilot study;
 - Federal support for wide-scale deployment of in-conduit hydropower; and
 - A negotiated agreement that eases the regulatory burden associated with low-impact and in-conduit hydropower.
 - Include consultation with state and local officials that have regulatory responsibility.

The action items required to assess the opportunities for New York City can and should proceed concurrently. The required assessments will take time to conduct and FERC has offered a window of opportunity to work on streamlining its process. The City should not miss this opportunity. Likewise, the Committee's support of such an assessment is critical for the City to benefit from its substantial capacity for hydropower development.

Conclusions

In the time it has taken me to give this testimony, millions of gallons of water have passed through the New York City water system. Those millions of gallons of water represent an enormous amount of energy that could be captured and turned into many megawatts of clean, renewable power. This committee can help the City understand the opportunity that exists within its own water system for generating renewable energy. Harnessing the hydropower capacity in its water system will bring economic benefit to the City in the form of revenue and jobs, and environmental benefit to the City by reducing its carbon footprint and its reliance on fossil-fuel based energy technologies.

Thank you again to Committee Chairman Gennaro and the members of the committee for allowing me to testify here today. It is my hope that the City takes this opportunity to improve its bottom-line and its environment.

I welcome the opportunity to answer any questions you may have.

Contact Information

My contact information is provided below for members of this committee or their staff that would like to receive additional information.

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Building a Smart & Sustainable Water Grid



rentricity

February 17, 2011

Contact Information:

P: (732) 319-4501 Frank Zammataro frankz@rentricity.com

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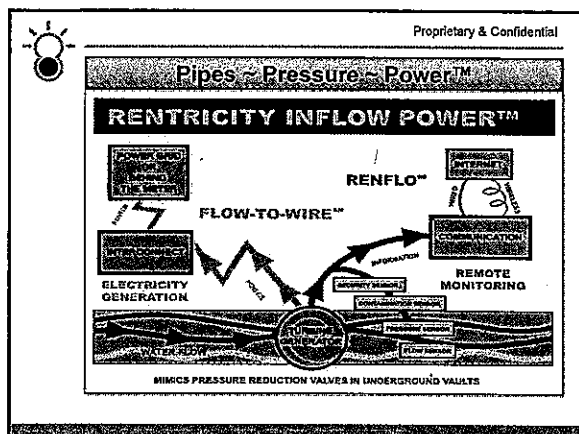
Rentricity Provides Clean Energy Recovery for the Potable, Waste and Industrial Water Industries

Water Company Services

- Energy Recovery & Monitoring using Flow-to-Wire™ Systems

Benefits

- Offset Electricity Rate Increases - Revenue Generation - Public Goodwill	- City Support by Lowering Carbon Footprint - Security & Monitoring - Operational Efficiency
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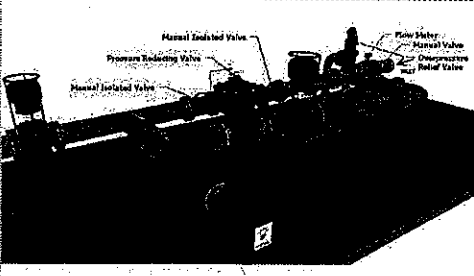
Energy Recovery in Solid Piped Water Systems/Distribution Points - Objectives

- Preserve Primary mission supplying safe, reliable drinking water
- System will be transparent to normal operations
- System under control of City/Utility at all times; either remote or local/manual
- Exact equipment and configuration and interconnect will be site specific

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Current Flow-to-Wire System (30kW – 350kW)



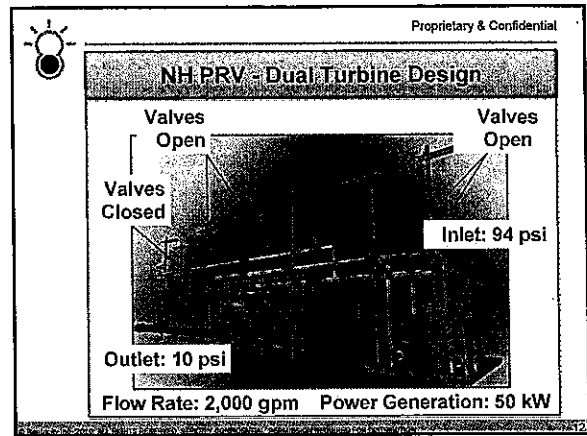
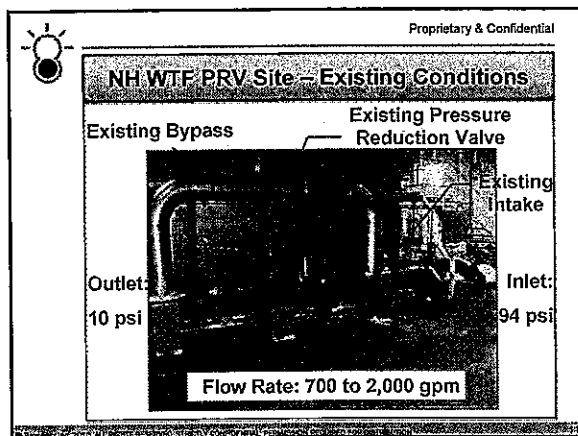
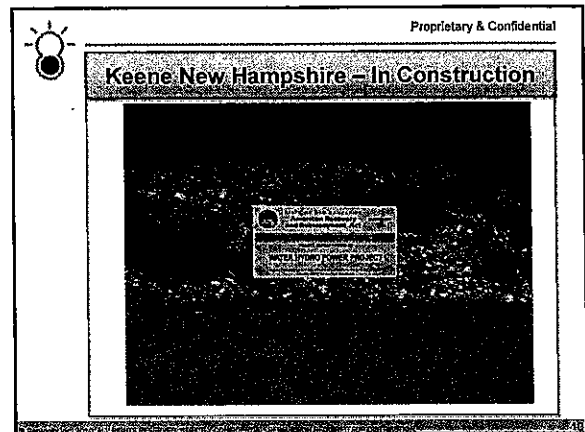
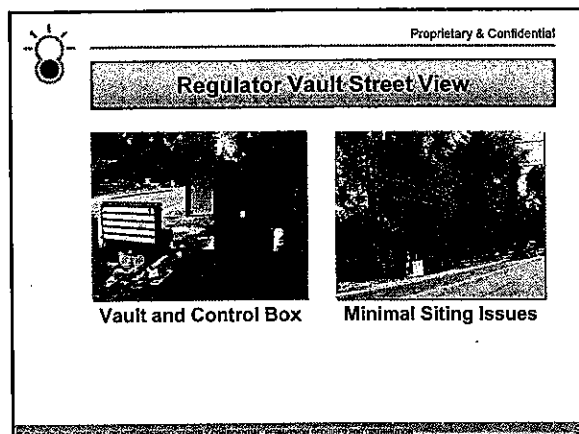
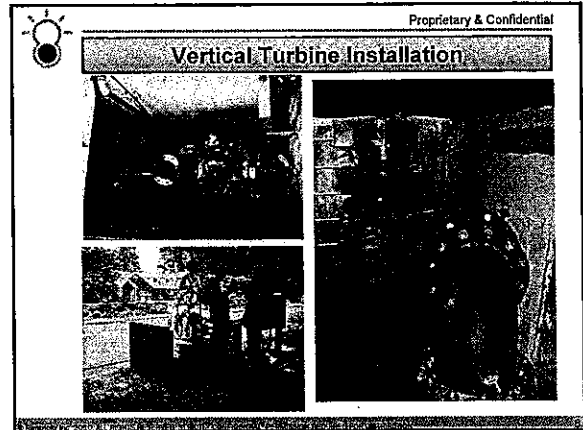
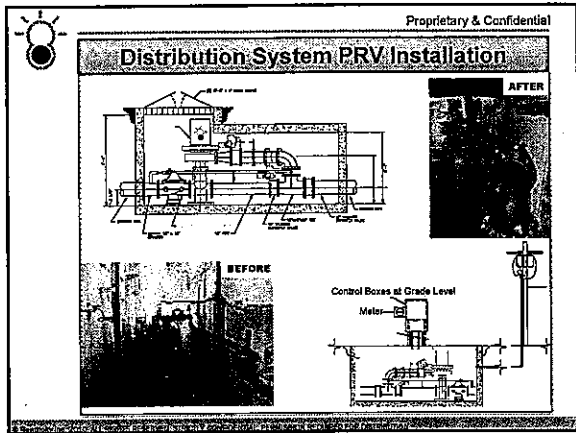
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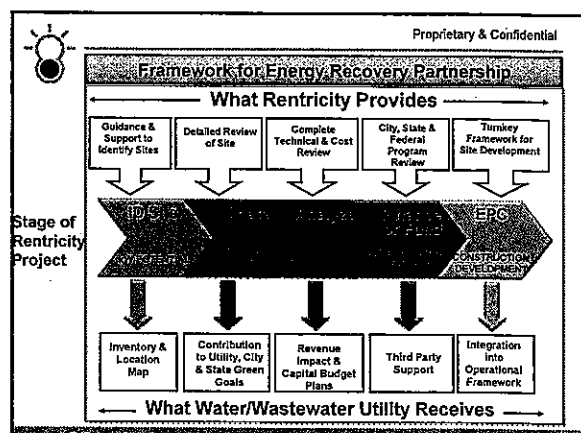
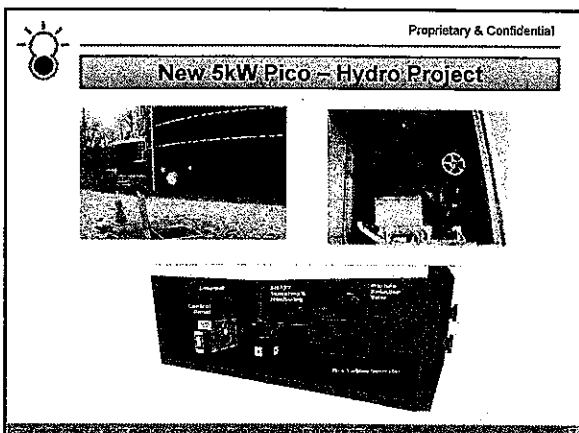
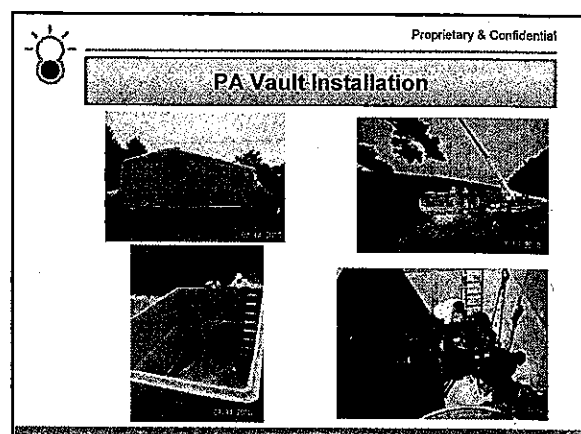
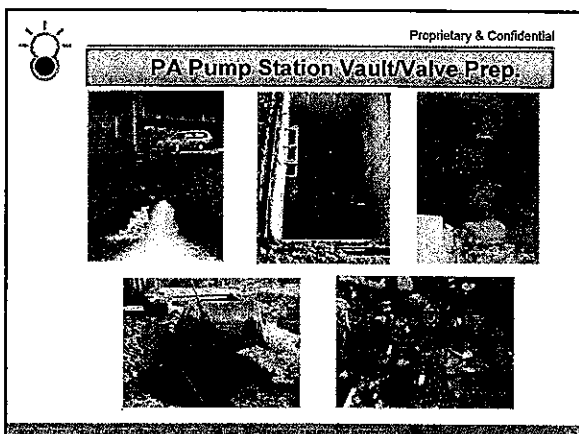
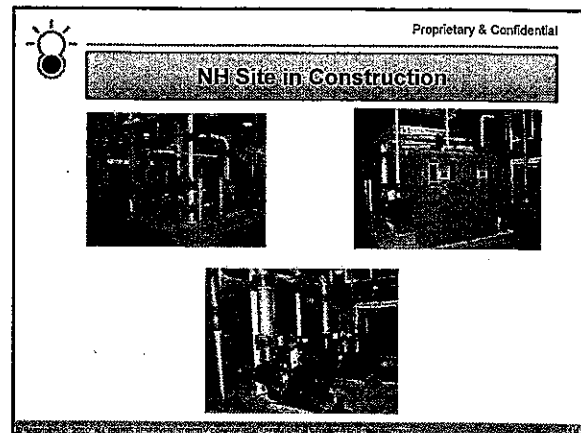
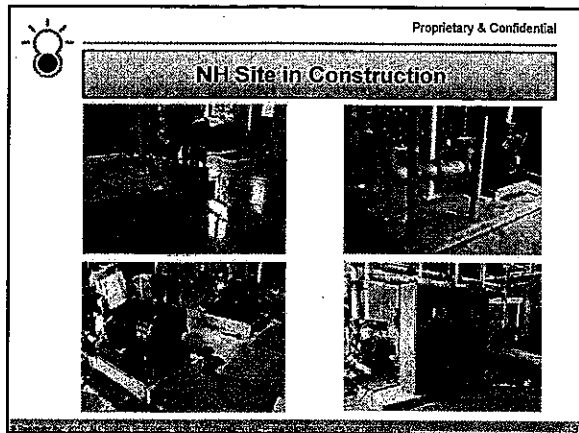
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Vertical Turbine Installation







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Rentricity Approach for Energy Recovery

- **Phase 1 - Feasibility Study**
Determine kW potential, indicative cost, relative ranking of sites, financing alternative.
- **Phase 2 - Preliminary & Detailed Design**
Functional design & engineering, spec of equipment, scope & cost for final phase.
- **Phase 3 - Procurement, Construction & Commercialization**
Implement project plan in accordance with approved design, schedule, budget, and permitting requirements.

Phased approach supports customer resource levels while preserving the success of the energy recovery mission.

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NYC Recommendations

- Determine the total hydropower and in-pipe hydrokinetic contribution to NYC PlaNYC and economic development goals.
- Further research the financial models/cost benefits of hydro-related development projects to foster a public/private shared value proposition.
- Pursue "fast track" plan with FERC for low environmental impact projects to expedite development.



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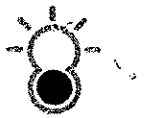
Testimony before the
New York City Council
Committee on Environmental Protection
February 17, 2011

By
Frank V. Zammataro
President & Founder, Rentricity Inc.
Located at the Accelerator for a Renewable Economy (ACRE Incubator)
160 Varick Street, New York City

Regarding
"New York City's Hydropower Capacity: Present and Future Opportunities"

Good afternoon Chairman Gennaro and Members of the Committee. I would like to commend the Council for tackling such an important issue during such a critical time. The need to increase renewable energy generation is well known throughout the country, but it would be easy for the New York City Council to rest on its laurels given the many programs already in place in the City. Considering alternatives for hydropower signals to the citizens of the City and State that the Council is not content with the status quo and is continually striving to improve policy for the benefit of New Yorkers. This is admirable, and we at Rentricity support you in your efforts.

Expanding New York City's hydropower complements PlaNYC by increasing energy efficiency and increasing the City's clean energy supply. Rentricity has efficient and proven technology solutions that can bring New York City significantly closer to its PlaNYC goals and New York State closer to its 2015 renewable energy targets.



Now to the matter at hand:

Developing New York City's hydropower resources would expand, by one, the types of energy generation that would qualify for the State RPS (Renewable Portfolio Standard). I will begin by providing industry context, then describing Rentricity's approach to hydropower, and then attempt to convey the significance that in-pipe hydrokinetic solutions will have to the environment, local businesses and the citizens of New York City.

Water and wastewater utilities are extremely energy intensive, consuming ~4% of the United States' electricity production. The cost of pumping and treating water represents about one-third of a water or wastewater utilities' operating budget. Compounding the problem, United States water utilities lose approximately 7 billion gallons of water per day through leakage. On average, approximately 20% of all water leaks back into the environment. More water lost means more water pumped and treated, which requires more electricity to be generated.

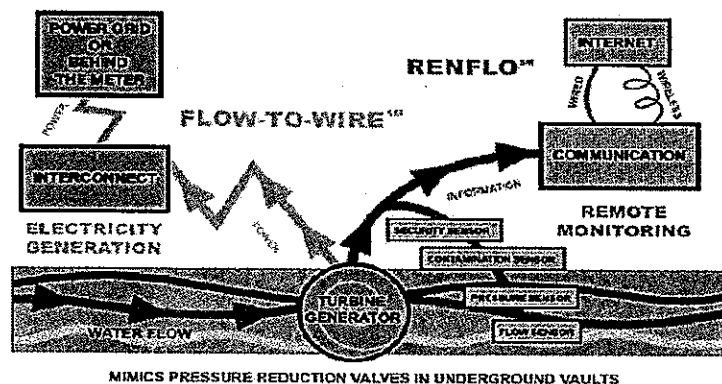
New York's aging water distribution infrastructure is both a problem and an opportunity. Much of it is over 100 years old and in disrepair. Energy recovery and operating efficiencies are often a lower priority to the basic need of moving water. It takes a great deal of pressure to deliver potable drinking water throughout the distribution systems in New York City. However, because that pressure is typically the result of gravity – water flowing downhill from reservoirs in mountainous areas to homes and businesses in lower regions – there is often an



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overabundance of it. Therefore, the pressure needs to be reduced before the water reaches its end-users, so that pipes don't explode and users can safely open taps. Water utilities and municipal water systems accomplish this reduction with valves – Pressure Reduction Valves (PRVs). To be specific, PRVs reduce the pressure to specified levels, but do nothing valuable with the excess pressure – it is simply released as waste heat. Rentricity takes advantage of this waste to create clean, renewable energy.

Rentricity is simply an energy recovery company. Our Flow-to-Wire systems are typically installed in parallel to PRVs and mimic their function, reducing pressure to usable levels. However, Flow-to-Wire systems use the excess pressure to spin water turbines, which then creates electricity. That electricity, the production of which produces no carbon emissions, is then either sold onto the electric grid or used “behind the meter” by water utilities or municipalities at treatment plant facilities and/or pump station buildings. Therefore, Rentricity provides an opportunity to upgrade water industry infrastructure with energy recovery technology and simultaneously powering “smart water grid” leakage monitoring components.



The installation of such systems in no way impedes the regular operations of the

water distribution system. Rentricity uses proven components that water managers see every day in their regular work. Water users enjoy the same services as always, but now the system is more efficient, using a wasted by-product – excess pressure – to create a valuable and much-needed resource: clean, renewable electricity. This type of in-pipe hydrokinetic energy recovery also has additional benefits over other forms of renewable generation. For example, because Rentricity installations deal with treated drinking water within pipes, far from fish and wildlife, they avoid most of the environmental concerns and excessive permitting that come along with more traditional forms of hydropower. Furthermore, because the water flow in pipes is highly predictable and consistent, Rentricity installations are extraordinarily efficient (70-80%), a far cry from solar power (~15%) or wind power (~40%), which rely on the sun shining or the wind blowing – natural events that are difficult to predict and sometimes quite inconsistent. In a head to head comparison, without government incentive, Flow-to-Wire installations have a \$3.50/W capital cost, an 80% capacity utilization, and a 40 year technology life which provides a 25% IRR; versus Solar's at \$4.50/W capital cost, a 15% capacity utilization factor, a 25 year life and 1% IRR; versus wind power's \$2.50/W, 40% capacity factor, 25 year useful life, and a resulting 14% IRR. This simply means that in-pipe hydropower costs less than competing renewable sources.

To sum up, Rentricity utilizes existing technology to take advantage of existing waste in order to create renewable electricity, all while leaving the operation of water systems untouched. Furthermore, it does so efficiently and cost-effectively.

But what kind of impact can this type of generation have?

Each Rentricity system produces between 30 and 300 kilowatts (kW) of power, roughly enough electricity to power 40 to 400 average homes. However, there are many sites for potential installations within each water system, so the overall potential power output is much larger. At this stage, it is difficult to accurately predict just how much electricity of this sort can be created in New York City, but given that over one billion gallons of potable drinking water flow through the City's pipelines daily, it could certainly be in the be 10's of megawatt level or greater, perhaps 1% of the City's total energy demand. It will behoove the City Council and other key city leaders to understand the contribution that hydropower, including in-pipe hydrokinetics, can contribute to the renewable energy goals of New York City. Rentricity stands ready to support NYC in this regard.

The Council should be pleased to learn that Rentricity has already started working towards creating in-pipe hydrokinetic power in a number of cities around the country and recently in Canada.

These slides represent Rentricity's approach and its very first commercial projects within drinking water infrastructure with the largest being a 325kW single site in Palos Verdes, California.

[Show PowerPoint Slides]

Rentricity has also worked with the NYCDEP to determine the potential

energy recovery from wastewater outfalls at the various plants around the City. In order to continue to move forward with the NYCDEP and expand throughout the state it is very important that Rentricity's type of power generation is recognized as a contribution towards New York City and State's energy goals.

That's where the NYC Council comes into play. First, by including in-pipe hydrokinetic power in the City's future PlaNYC 2030 initiative, the Council will expand the city's clean energy as set out in its established goals. This would also contribute to the State's 30% renewable energy goals by 2015. Second, the development of this new form of power will provide economic stimulus to the State and work for its local engineers and construction firms; Rentricity is already working with local New York City contractors, and many more stand to benefit from additional projects. Third, by expanding the City's hydropower goals, the Committee will incentivize Rentricity and other companies like it to choose New York City as a place of business; NYSERDA already provides incentives for this form of generation, and firms will likely follow the programs when deciding where to invest.

It has always been my personal belief that because the renewable energy field is so nascent, and because it is therefore difficult to predict which technologies will provide the best solutions, that lawmakers should strive to:

- 1) provide as broad and fair incentives as possible, and then
- 2) let the market choose the winners.

We at Rentricity believe that the solution we provide can be among the latter; the NYC Council has an opportunity today to provide the former, and we urge you to do so.

To sum up:

The Council should seek to understand the total hydropower (including in-pipe hydrokinetics) energy recovery potential in the NYC water and wastewater systems and its potential contributions to PlaNYC and economic development goals; and

The Council should continue to highlight and explore the predictable cash flows and investment returns from hydropower and related methodologies like Rentricity's that can foster public and private investment vehicles to promote greater adoption and a "shared value" proposition.

Finally, the Council has the opportunity to explore the reduction of permitting by the Federal Energy Regulatory Commission, and like the State of Colorado, may be able to develop a memorandum of understanding to fast-track projects given the low environmental impact.

I appreciate your time spent listening today, and your inclusion of my testimony in the Committee's deliberations. If you require any further information, please do not hesitate to contact me at frankz@rentricity.com or 732.319.4501. Thank you.