DAKOTA ENERGY SYSTEMS

THE ENERGY HARVESTING ERA

Introduction

We are now at a time in history, when both the opportunity and the potential for harvesting energy are at an all-time high, moving energy harvesting systems from niche applications to broad-scale practicality, in our desire to address the issue of climate change and global warming.

Energy harvesting, also known as energy scavenging, fundamentally captures residual energy as a byproduct of a commercial, industrial or manufacturing process and is therefore considered **"free"** energy. Typically, this residual energy is simply released into the environment as waste (heat) – Fig. 1.

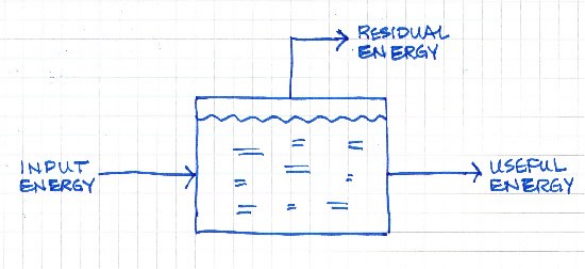

Fig. 1 – Energy Balance

And recovering even a fraction of this residual energy can and will have a significant economic and environmental impact.

Recognizing that energy can neither be created nor destroyed, but only transformed, we know that electrical energy driving a pump motor is simply converted into mechanical energy, and if not fully transformed as work, it is lost to the ambient environment as heat.

Leading this energy harvesting industry "mega-trend" is Dakota Energy Systems, LLC (DES), by the application of their **"patented"** Hydro Electric Power System (HEPS) – Fig. 2.

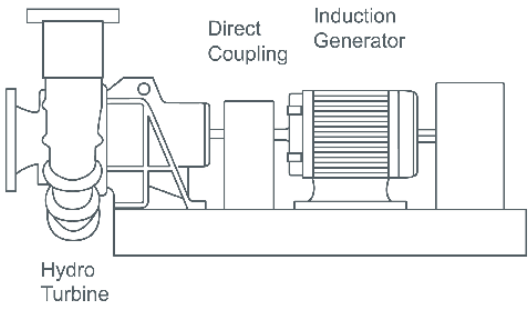

Fig. 2 – DES HEPS (Generic)

What makes the DES HEPS so unique in its application is its simplicity of design, construction and operation, along with its relatively low cost of implementation.

We recognize that the world is full of complicated, expensive and flashy energy harvesting technology, examples of which include mechanical energy resulting from vibration, or stress and strain, thermal energy from industrial processes like furnaces or combustion engines, or chemical energy occurring from biological processes, or electromagnetic energy captured via inductors, coils and transformers, or huge amounts of RF energy in the environment as a result of radio transmitters and television

broadcasting, all of which harvest residual energy in relatively small quantities.

But rather than follow that same line of technology development, DES decided to focus on simplicity and low cost, thereby developing a patented technology that will literally change the face of energy harvesting applications for years to come.

The Basis of DES HEPS Technology

Certainly, within the United States, and most certainly around the world, there are existing building facilities, specifically in the industrial sector, that utilize water-based (hydronic) closed loop or open loop piping systems for many of their industrial processes.

And many of these (most of these) are constant volume (flow) systems, with large capacity and large horsepower, oversized pumps that operate very inefficiently, in what would be considered very harsh environments, i.e. dirty, dusty, wet, hot, etc.

Because of this seemingly inefficient pump operation, the first and almost automatic reaction of most industrial plant operators is to pursue the installation of variable frequency drives (VFDs) on the constant volume (flow) pumps, for the primary purpose of what the industry calls a "soft-start" opportunity, unfortunately at a very high capital cost, without performing any true economic life-cycle cost analysis, hoping and believing that energy will be saved based solely on the information presented in generic VFD marketing literature.

The challenge of course is that in most industrial applications, the actual available variation in the flow range of the pump is minimal, and if it does change, it doesn't happen often, because the industrial facility is expected to operate at full capacity, 24/7/365, to ensure maximum production opportunity (and maximum business revenue).

So this is where the DES HEPS patented technology becomes most relevant and applicable.

We take a high-pressure, high-volume (flow), constant-volume, closed-loop (or open loop) piping system, and merely attach our DES HEPS technology to this system, thus harvesting the excess flow that is otherwise not required for the industrial process, and we route that flow through a turbine, which is connected to a generator, thereby harvesting residual mechanical energy from the existing mechanical piping system, from which electrical energy has already been transformed, and/or the price for which such electrical energy has already been paid – Fig. 3.

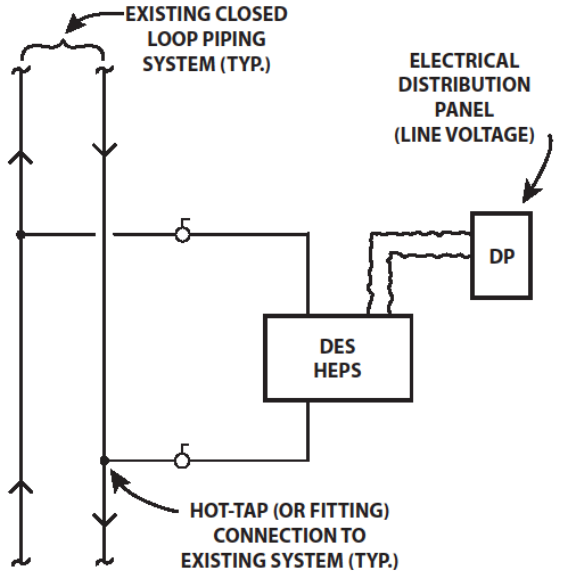

Fig. 3 – Typical DES HEPS Installation

This simply makes the entire existing closed-loop (or open-loop), hydronic piping system as efficient as it can possibly be, while not being 100% efficient (no system is 100% efficient --- there are always system losses, the degree to which we are attempting to reduce).

The DES HEPS technology does not "create" energy, but rather harvests (captures) residual energy from existing closed-loop (or open-loop) hydronic piping systems (mechanical energy), which is then converted back into electrical energy and simply routed back into the "in-house" electrical system from which the electrical energy originated, for an immediate reduction of the new electrical energy required to drive the pump and/or processes.

At no time will the DES HEPS technology ever harvest more energy than that which has already been transformed, so unlike wind or solar-generated power (truly "created" power, at a very high cost per KW of energy production), there is never an opportunity for back-feeding electrical energy into an existing electrical grid, thus eliminating any need for challenging interconnection agreements with a local utility company. The residual energy harvested by/from a DES HEPS system is used immediately and locally – where it is needed - and is ONLY available when the existing closed-loop (or open-loop) piping/pumping system to which the DES HEPS is connected is operating.

This residual energy is emission-free, carbon-neutral, suffers no distribution losses and is used immediately where it is needed --- good for both the short term and the long term --- not like other bridging technologies.

In the event of a power loss to the facility, unless the existing closed-loop (or open-loop) piping/pumping system to which the DES HEPS is connected is on emergency power, the DES HEPS no longer functions.

And even if the existing closed-loop (or open-loop) piping/pumping system is on emergency power, and continues to operate, a transfer switch (if required – provided by others) has already disconnected the facility from the grid, so there can be no potential for back-feeding of power into the grid from the DES HEPS.

DES HEPS Life Expectancy

Because of the simplicity of the DES HEPS design, and despite the potentially harsh environmental conditions typically associated with commercial, industrial or manufacturing facility applications, we anticipate a long-life subject to basic service maintenance being

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provided, i.e. bearing and/or seal replacement, lubrication, etc.

DES HEPS Capital Cost

Because each DES HEPS application is custom designed/selected (no 2 applications are the same), it is not possible to indicate an exact capital cost for each different application. An actual total cost will be developed once we understand the existing closed-loop (or open-loop) piping system to which we intend to apply our DES HEPS.

Please note that in all cases, our goal is to design and install a system or systems that will accomplish a simple payback of two (2) to four (4) years or less – some applications might be higher, some might be lower – depending on the operating time period – preferably 24/7/365.

Actual DES HEPS Installation

We have included herein one (1) example of an actual custom-designed DES HEPS installed in an industrial facility.

We are monitoring all recorded data via an electronic meter and software.

Specific design criteria are 400 GPM of constant volume hydronic flow, at 67 PSIG, via a hot-tap on a 10 inch header, delivered through a 4 inch DES HEPS piping system to our DES HEPS system (nominal 9 KW system). Actual recorded data indicates approximately 8.0 KW of harvested energy. See figures Fig. 4, Fig. 5 and Fig. 6.

Fig. 4 – Actual DES HEPS – Hot Tap

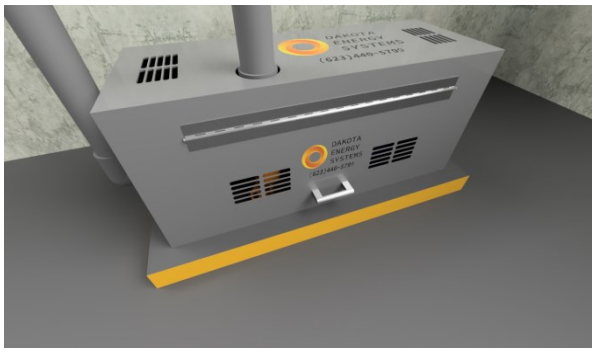

Fig. 5 – Actual DES HEPS Installation

Fig. 6 – Actual DES HEPS Data Meter

If this system operates 24/7/365 as intended, that is 70,080 KWH of energy harvested in one (1) year. At $0.16 per KWH (average)*, that is an energy cost savings of $11,213 annually. Given our capital cost for this actual installation, the result is a simple payback of 3.2 years.

More important than even the energy cost savings (although that is typically the bottom-line for our clients), is the savings of 70,080 KWH of energy that the local utility did not have to provide to this facility. By itself that has a definite impact, although maybe small, relative to the overall demand on the utility grid, the

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environment (climate change) and global warming.

Realize that this is only one (1) of 3 closed-loop piping systems that has been tapped within this facility. If we install a similar system for the other two (2) systems within this industrial facility, and let's say we hypothetically secure another 8.0 KW each, 24/7/365, we will now have decreased our annual utility demand by 210,240 KWH or $33,639 annually. We are now talking about serious energy savings (KWH) and energy cost ($) savings. In just one (1) facility.

Imagine what the potential is throughout the United States (now) and the world (tomorrow).

**Example-If this project were in California, and assuming an electrical rate of $0.26 per KWH rather than $0.16, and the system was actually operating at 9 KW, 24/7/365, that would be 78,840 KWH harvested annually, for a cost savings of $20,498, with the first cost for the DES HEPS9 improved even further by a one-time SDG&E customer rebate of $4,500, the customer payback would be 1.5 years. Without the SDG&E rebate the payback is 1.72 years.*

Conclusion

By 2031, the United States is projected to demand 31% more energy than is currently available today. If even possible, recognize that it takes years to design, permit and construct a new electrical generating plant, and that assumes the political factions/regulatory bodies will even allow such construction.

By harvesting energy from existing (or new) commercial, industrial or manufacturing facilities with the application of a DES HEPS, rather than demanding more new energy, we may not eliminate this growth-need for new energy, but we might at least slow-it-down.

The **"patented"** DES HEPS technology clearly represents a simple, low-cost, practical solution to harvesting energy that can be applied - TODAY.

No other energy harvesting system on the market today offers the collective performance, ease of installation, environmental benefit or cost advantages afforded by the DES HEPS.

And there is no need for further R & D, i.e. additional high investment in other technologies, which ultimately requires the willingness of potential buyers/clients to accept those new technologies.

The DES HEPS technology is so simple and basic that it does not test the aptitude of our clients. They accept it immediately once they understand how simple it really is.