Viridity Energy and the Southeastern Pennsylvania Transportation Authority (SEPTA) Awarded $900,000 from the State of Pennsylvania for Innovative Project to Recycle Energy Produced by Electric Public Transit

Pennsylvania Energy Development Authority (PEDA) grant will fund Viridity Energy's innovative energy storage project to help SEPTA achieve economic value and environmental benefits through deployment of smart grid solutions

September 1, 2010

PHILADELPHIA--(BUSINESS WIRE)--Viridity Energy, a Philadelphia-area smart grid company, today announced that it had received a $900,000 grant for its innovative pilot project with the Southeastern Pennsylvania Transportation Authority (SEPTA), the nation's sixth largest public transit organization. As part of the project, Viridity Energy will deploy its software optimization system to allow SEPTA to recycle the energy created from the regenerative braking ability of trains and trolleys at a high-use propulsion substation in Philadelphia, which will in turn improve power quality, produce energy savings and generate revenues. The State of Pennsylvania awarded the Viridity Energy "SEPTA Recycled Energy and Optimization Project" funding through the 2010 Pennsylvania Energy Development Authority (PEDA) grant program.

The project will pair the latest 21st century technologies and energy optimization practices with one of the country's oldest transportation systems, dating back to the deployment of electric trolleys in 1892. Mass transit systems across the country are striving to maintain high quality service while facing growing fiscal challenges which are further compounded by rising energy costs. The pilot represents a large and untapped potential for transit systems to help meet these challenges and at the same time improve grid reliability in highly populated urban neighborhoods.

The project calls for Viridity Energy and SEPTA to install a large-scale battery to capture the energy from regenerative braking of trains along a portion of the Market-Frankford Line, the highest ridership line in SEPTA's system. The Viridity Energy-SEPTA project will result in numerous economic, operational and environmental benefits including, but not limited to, the following:

- **Delivers Energy Savings** – SEPTA will capture and productively use electric power that would be otherwise wasted while reducing its electricity consumption.
- **Realizes Economic Value** – In addition to using less electricity and reducing operating costs, the project will generate significant revenues through participation in PJM's wholesale power markets.
- **Increases Operational Efficiency** – SEPTA will increase operation and maintenance efficiencies through improved power quality and system management.
- **Achieves Sustainability and Carbon Footprint Goals** – By reducing its use of electricity generated on the grid, the project will help SEPTA decrease its carbon emissions by 1,258 tons per year.
- **Enhances Grid Reliability** – The stored energy will help balance electric generation and electric load on the PJM interconnection system while assisting PECO Energy Company in preserving the reliability of its electric distribution system.

"We are delighted to receive this grant from PEDA and are looking forward to working with SEPTA to deploy the latest energy optimization techniques with the goal of improving their operational efficiency, reducing their carbon footprint and lowering their costs," said Audrey Zibelman, President and CEO of Viridity Energy. "This project is a perfect example of how smart grid innovations and advances in technology can effectively be paired with revenue opportunities from competitive energy markets to yield substantial economic, operational and environmental benefits to all the parties involved."

As part of the pilot project, SEPTA expects to generate approximately $500,000 in economic value for the agency. A successful pilot could lead to potential deployment at all 38 SEPTA substations. It is estimated that this expansion could translate into significant savings from SEPTA's current electricity spend.

"We are pleased to partner with Viridity Energy on this project under the PEDA grant program," stated Joseph M. Casey, General Manager, Southeastern Pennsylvania Transportation Authority (SEPTA). "Upon implementation, the storage system will serve as a foundation for measurable gains in both energy efficiency and voltage stability in this critical corridor, providing a replicable and scalable model for broader system-wide implementation. By moving towards energy storage, SEPTA will be assuming a leadership role among transit agencies."

"SEPTA's partnership with Viridity Energy supports Philadelphia's burgeoning market position as a cutting-edge center for smart grid technologies," said Rina Cutler, Deputy Mayor for Transportation and Utilities. "This kind of energy saving technology and improvement to transit service reliability advances the Mayor's *Greenworks Philadelphia* agenda."

About Viridity Energy

Viridity Energy is making the next generation of the smart grid a reality by providing large energy consumers with powerful tools to increase energy efficiency and decrease energy costs. The company's unique and flexible VPower™ platform enables customers to dynamically shift and balance energy load, integrate advanced energy technologies and convert existing energy investments into lucrative new revenue streams. Viridity Energy helps organizations achieve sustainability goals and contribute to the greater good by stabilizing energy price fluctuations. Headquartered in Conshohocken, Pennsylvania, Viridity Energy was founded in 2008 by former executives of PJM Interconnection. For more information visit www.viridityenergy.com

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SEPTA pilot program to capture, reuse subway energy

By Andrew Maykuth, Inquirer Staff Writer

September 2, 2010

The Market-Frankford Line is going hybrid.

SEPTA announced a pilot project Wednesday that would capture electricity generated by braking subway trains, much like a hybrid automobile produces power when it slows down.

The electricity will be stored in a large, railside battery array and reused when the train accelerates. The system is expected to reduce electrical power purchases 10 percent to 20 percent at each location of the batteries, said Andrew Gillespie, SEPTA's chief engineering officer for power.

But the system is designed to do more than capture power from the subway's dynamic braking system, said Audrey Zibelman, the chief executive officer of Viridity Energy Inc., the Conshohocken smart-grid innovator that devised the project for SEPTA.

The power-storage system is potentially so large - each battery array would store one megawatt of power - that SEPTA could further reduce its electric bill by buying cheap power at night to use or resell during expensive peak hours.

And SEPTA also could collect fees from the regional grid operator, PJM Interconnection L.L.C., by providing power on short notice - one or two seconds - to stabilize regional power flows on the grid.

Zibelman said the transit agency could realize energy savings "substantially higher" than the 20 percent target Viridity typically sets for a project. SEPTA currently spends about $20 million a year to buy electricity from Peco Energy Co. to power its trains, subways, and electrified trolley and bus fleet.

The pilot project, involving a single battery array at a SEPTA electric substation in Kensington, would cost about $1.5 million.

The Pennsylvania Energy Development Authority is underwriting the project with a $900,000 grant. Viridity will underwrite the remaining capital cost, Zibelman said.

If the project proves economic - Viridity estimates one battery array will generate $500,000 a year in value - SEPTA envisions installing the technology at all 33 electric substations that serve its subway and trolley lines.

The system will take advantage of regenerative-braking capacity already installed in the Market-Frankford Line and SEPTA's electrified buses and trolleys.

When applied, the brakes now convert the train's kinetic energy into electricity, which is transmitted into the third-rail system for use by other trains.

But when there are no other trains nearby to consume the electricity, the power is lost. Excess electricity from the brakes is converted into heat that is dissipated from vents in the carriage rooftops.

About half the power produced by the regenerative brakes is now lost, Gillespie said.

SEPTA says the batteries, in addition to capturing the regenerated power that is now lost, will help increase the system's electrical efficiency and stabilize the voltage - it operates on 600-volt direct-current power.

Zibelman envisions other transit agencies' adopting Viridity's technology.

"This is an opportunity," she said, "for us to develop a market."

Philly subway to capture energy from braking trains

CNET, By Martin LaMonica

September 1, 2010

Here's an unusual way to upgrade a subway system: add a giant battery.

Viridity Energy said on Monday it has been awarded a $900,000 grant by the Pennsylvania Energy Development Authority to build a system which will capture the energy from Philadelphia subway cars as they brake to enter a station.

The regenerative braking system will collected energy in a large battery installed along the busy Market-Frankford Line. The stored energy will be used to power trains when they leave the station and to earn money selling energy back to the grid.

"Essentially we're creating a microgrid that is integrated with the transmission grid and operated so that its optimized for efficiency and economics," said Audrey Zibelman, President and CEO of Viridity Energy.

The project, which Viridity hopes to be operating by next spring, will have a battery between one and one and a half megawatts of capacity which will replace the current system which cannot capture all the energy from incoming trains.

With the battery in place, it can power trains when they leave, cutting down on the operating costs of Southeastern Pennsylvania Transportation Authority (SEPTA).

The battery will be able to make money, too, by providing services to the grid. Using its stored energy, it can make money from grid operator PJM by supplying quick bursts of energy to maintain a steady frequency. SEPTA can also draw energy from the grid at off-peak times and supply it at peak times when the utility is looking to lower usage because energy prices are high.

Viridity Energy's hosted software is like a "network operating service" that optimizes how the energy is pulled into and dispatched from the battery, said Zibelman. The company, which makes money by getting a percentage of customers' revenue, is now evaluating what types of batteries it will use, she added.

"Electric vehicles are on everyone's mind right now as where we need to go, but we have an electric vehicle system already sitting here. Let's use those first," Zibelman said. "It's something could be done in almost any transit system.

SEPTA estimates it can save $500,000 a year on its electricity spending. If the project is successful, SEPTA hopes to replicate the model system-wide, Joseph Casey, SEPTA general manager said in a statement.

Martin LaMonica is a senior writer for CNET's Green Tech blog. He started at CNET News in 2002, covering IT and Web development. Before that, he was executive editor at IT publication InfoWorld. E-mail Martin.

Read more: http://news.cnet.com/8301-11128_3-20015306-54.html#ixzz0yIQobEk4

SEPTA to capture braking system energy for electricity

Philadelphia Business Journal - by Peter Key, Staff Writer

September 1, 2010

Viridity Energy Inc. said Wednesday that it and SEPTA have received a $900,000 grant from the state of Pennsylvania to fund a project to capture electricity produced by the braking systems of the trains on SEPTA's Market-Frankford Line.

Viridity, which develops smart-grid software, and SEPTA will install a battery in a substation to store electricity produced by the trains on a portion of the line. The stored electricity will be fed back into the line's electrical system, allowing SEPTA to reduce the amount of electricity it has to buy.

SEPTA and Conshohocken, Pa..-based Viridity said that if the project is successful, SEPTA could deploy batteries at all 38 of its substations and use them and Viridity's software to reduce its power bill significantly.

Viridity Energy and SEPTA Awarded $900,000 from State for Innovative Project

Mass Transit Magazine

September 1st, 2010

Viridity Energy announced that it had received a $900,000 grant for its innovative pilot project with the Southeastern Pennsylvania Transportation Authority (SEPTA), the nation's sixth largest public transit organization. As part of the project, Viridity Energy will deploy its software optimization system to allow SEPTA to recycle the energy created from the regenerative braking ability of trains and trolleys at a high-use propulsion substation in Philadelphia, which will in turn improve power quality, produce energy savings and generate revenues. The state of Pennsylvania awarded the Viridity Energy "SEPTA Recycled Energy and Optimization Project" funding through the 2010 Pennsylvania Energy Development Authority (PEDA) grant program.

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As part of the pilot project, SEPTA expects to generate approximately $500,000 in economic value for the agency. A successful pilot could lead to potential deployment at all 38 SEPTA substations. It is estimated that this expansion could translate into significant savings from SEPTA's current electricity spend.

"We are pleased to partner with Viridity Energy on this project under the PEDA grant program," stated Joseph M. Casey, general manager, Southeastern Pennsylvania Transportation Authority (SEPTA). "Upon implementation, the storage system will serve as a foundation for measurable gains in both energy efficiency and voltage stability in this critical corridor, providing a replicable and scalable model for broader system-wide implementation. By moving towards energy storage, SEPTA will be assuming a leadership role among transit agencies."

"SEPTA's partnership with Viridity Energy supports Philadelphia's burgeoning market position as a cutting-edge center for smart grid technologies," said Rina Cutler, deputy mayor for Transportation and Utilities. "This kind of energy saving technology and improvement to transit service reliability advances the Mayor's Greenworks Philadelphia agenda."

SEPTA, Viridity Energy land state funding for energy recycling project

ProgressiveRailroading.com

September 7, 2010

Generating Power 9/7/2010

Last week, Viridity Energy announced it received a $900,000 Pennsylvania grant for an energy pilot project with the Southeastern Pennsylvania Transportation Authority (SEPTA). The state awarded funding through the 2010 Pennsylvania Energy Development Authority grant program.

As part of the project, Viridity Energy will deploy its software optimization system, which would enable SEPTA to recycle energy created from regenerative braking of trains and trolleys at a propulsion substation in Philadelphia. The project calls for Viridity Energy and SEPTA to install a large-scale battery to capture the braking energy along a portion of the Market-Frankford Line.

The project will help SEPTA cut energy costs, increase operational efficiency and decrease carbon emissions, Viridity Energy officials said in a prepared statement. SEPTA expects the pilot to generate savings of about $500,000. If the pilot project is successful, the agency might deploy the software system at all of its 38 substations.

"By moving towards energy storage, SEPTA will be assuming a leadership role among transit agencies," said SEPTA General Manager Joseph Casey.

Philadelphia Subway Returns Power To Grid

By Jason Kambitsis, Wired – Autopia blog

September 8, 2010

Regenerative braking is common on hybrids like the Toyota Prius and EVs like the Nissan Leaf, and it long has been a source of energy for lights and other functions on trains. Now it's being used in southeastern Pennsylvania to generate electricity for the grid.

A huge battery will capture kinetic energy generated when trains apply the brakes while entering one of the busiest subway stations in Philadelphia. That energy will be used by the Southeastern Pennsylvania Transportation Authority or sold to the local utility. The transportation authority and smart-grid company Viridity Energy have received a $900,000 grant from the Pennsylvania Energy Development Authority for $1.5 million the pilot program.

The system will be installed along a stretch of the Market-Frankford line, which has the highest ridership in the system. It will generate 1.5 megawatts of energy that can be used by accelerating trains, stored for future use or returned to the grid. The transit authority will be able to sell the power on the wholesale energy market, or simply use it to improve its own voltage on the system. The transit agency also could purchase electricity at night when rates are low and store it in the batteries for use during the day.

Philadelphia subways use regenerative braking to some degree now; kinetic energy is converted to electricity that is returned to the system through the third rail. But the system still loses at least half the energy as heat.

Joseph M. Casey, general manager of the transportation authority, says the system will provide measurable gains in energy efficiency and voltage stability in a critical mass transit corridor. Audrey Zibelman, president and CEO of Viridity Energy, says the goal is to improve the transit agency's operational efficiency, reduce its carbon output and cut its costs.

The system is expected to come online next spring, and it could save the transit agency $500,000 in energy costs. The transit agency typically spends $20 million on electricity annually to power its trains, buses and trolleys, according to the Philadelphia Inquirer. If it were used at each of the 33 electrical substations serving the railway system, officials say, the agency could cut its energy consumption 40 percent.

ELECTRICITY: Project aims to turn commuter trains' wasted energy into cash

By Michael Burnham, E&E reporter, Greenwire

September 13, 2010

PHILADELPHIA -- Sparks fly and steel beams shake as electrified trains stop and go at Huntingdon Station on Market-Frankford, the city's busiest subway line.

The Southeastern Pennsylvania Transportation Authority's (SEPTA) nearby Letterly substation is able to capture about half of braking trains' kinetic energy to power outbound ones. The timing has to be just right, such as when a train is approaching the powder-blue, elevated platform from the other direction.

If only we could catch and release it all, at will, engineers have mused often. They are about to get their wish.

The Philadelphia-area startup Viridity Energy Inc. will use a $900,000 state grant to augment SEPTA's regenerative braking system with a device capable of storing up to 1.5 megawatts. Engineers are mulling everything from lithium-ion batteries to flywheels -- discs that maintain kinetic energy by spinning -- to store electricity in the bowels of the more than 80-year-old Letterly substation.

SEPTA will propel the Huntingdon Station's outbound trains with the power as well as sell it to PJM Interconnection LLC, the regional grid operator. Viridity will use its smart-grid software to show when the price is just right, such as on hot summer afternoons when Philadelphians crank up their window air conditioners and box fans.

"Clearly, SEPTA has a lot of electricity it's not leveraging," said Laurie Actman, Viridity's director of business development and government relations. "The battery will take the uncertainty away and enable [SEPTA] to reuse all of the power."

When approaching trains hit the brakes today, SEPTA converts the kinetic energy into electricity and sends it to a third rail at the Huntingdon station. If there are no nearby trains in need of propulsion, the energy is dissipated as heat through the rooftops of train carriages.

The pilot project, which will include a three-month demonstration in early 2012, will cost about $1.5 million. Viridity hopes to demonstrate that SEPTA could recoup the capital investment within three years through energy savings, Actman estimated.

SEPTA, the nation's fifth-largest transit agency by ridership, spends about $20 million annually to buy electricity from Peco Energy Co. to power a fleet that includes 38 electrified buses and a sprawling network of subway trains and trolleys.

The Letterly pilot project will reduce energy consumption by about 15 percent, which translates to about $500,000 annually, estimated Erik Johanson, a SEPTA strategy and sustainability planner. The project will also further the agency's bid to slash its greenhouse gas emissions 5 percent annually, he said.

"Any way we can reduce our electricity consumption and prepare for a carbon-priced world is clearly in our best interest," Johanson added.

'Increasingly valuable proposition'

Viridity has yet to prove the Letterly pilot project's wherewithal, but SEPTA officials are already mulling whether to install energy-storage devices in most of the agency's 34 active DC-current substations.

Building a new substation, not including land, would cost SEPTA between $5 million and $9 million, agency officials estimate. The cost of installing an energy-storage device in an existing substation would cost in the range of $1 million to $1.5 million.

"If we did this systemwide, we could save about $2 million a year on energy," Johanson estimated. "This [technology] is going to be an increasingly valuable proposition for us."

The prospect of cutting power bills and greenhouse gas emissions has spurred several other electrified transit operators to test energy-storage devices.

TriMet, the public transit operator for the Portland, Ore., metropolitan area, tested a Siemens-built unit of supercapacitors in 2004. The wayside unit was able to temporarily store energy captured from trains braking at a station on its MAX light-rail line.

The pilot project's basic technology "worked just fine," but the concept of a fixed energy-storage device was not ideal for a slower-moving line where trains pass by every 10-15 minutes, said Thomas Heilig, the agency's director of systems engineering.

"We came to the conclusion that it would be better for us to put units on the [train] cars than on the wayside," Heilig explained.

TriMet is seeking a $10 million grant from the Department of Transportation to install energy-storage units atop 20 of its train cars.

"This is a technology that could really save us some money," Heilig added.

SEPTA hopes a giant battery will capture energy now lost

Philadelphia Business Journal - by Athena D. Merritt Staff Writer

September 17, 2010

Every time a subway train brakes on **SEPTA**'s Market-Frankford Line electricity is generated. By next summer, a large-scale battery could be in place to capture and recycle that energy under a pilot project **Viridity Energy Inc.** started this week.

The energy conserving move on the transportation authority's highest ridership line is just one of several actions that SEPTA is planning or has made as part of a broader environmental sustainability strategy. All stand to benefit the transit agency when state-imposed energy rate caps on **Peco Energy Co.** expire Dec. 31.

SEPTA spends an estimated $20 million annually to power its subway, trolley and regional rail lines. The Market-Frankford Line project will turn what was once an expense on the books into revenue by enabling SEPTA to capture energy that can be used later or sold back to the power grid, Viridity Energy President and CEO Audrey Zibelman said.

If the installation of the truck-size, one megawatt battery proves successful, others are already lined up and waiting.

"Several [transit] agencies have reached out to us as a matter of interest," Zibelman said of the project, which if successful could lead to deployment at all 38 SEPTA substations. "We are in ongoing conversations with transit agencies in New York and Amtrak."

SEPTA has applied for a $2.7 million federal grant to install wayside storage super-capacitors at the Allison and Pine substations, which feed the Southwest Philadelphia trolley and Broad Street subway, respectively. With **Mondre Energy Inc.**'s guidance, SEPTA also struck an agreement last month to begin procuring about 40 megawatts of electric to power subway, trolley and railroad lines from Exelon and Sempra Energy. The contracts, which begin Jan. 1, are expected to save more than $8 million through the end of 2012.

"Basically they were able to give us a better rate than Peco," SEPTA spokesman Andrew Busch said.

SEPTA and MEI are also shopping for deals for electricity for offices, maintenance yards and other facilities, Busch said. Toward the end of the year SEPTA will put out requests for proposals for a project to install solar panels on roofs, SEPTA Director of Strategic Planning Byron Comati said. Like Viridity's project, the solar panels would give SEPTA another source from which energy can be drawn and sold back to the grid, Comati said.

"We have so much interest from the private sector on solar panels and their installation, which is very viable because we have so much square footage on our roofs," Comati said of SEPTA's maintenance shops for bus and rail.

A significant effort is also under way by SEPTA to convert to more energy-efficient lighting systems and boilers wherever possible. Last month, SEPTA received energy star certification for its headquarters at 1234 Market St., Comati said.

"When you have a large footprint in the region as SEPTA does, the opportunities for being very sustainability conscious are there," Comati said.

SEPTA subways go hybrid with lossless battery storage system

By John Steele

September 21, 2010

Philadelphians know SEPTA's Market-Frankford El as the Blue Line. But a new pilot program, which stores leftover power from the subway's regenerative braking system in a massive battery, would make the Blue Line a little greener, and provide SEPTA some much-needed capital.

Earlier this month, SEPTA and Conshohocken smart-grid firm Viridity Energy announced receipt of $900,000 from the Pennsylvania Energy Development Authority to install a massive storage battery--about the size of a cement truck--at SEPTA's Kensington electrical substation. The current regenerative braking system transmits electricity, collected as trains enter stations, to other electric vehicles. But if no other vehicles are in range, the electricity is lost. The battery, capable of storing up to a megawatt of electricity, would siphon energy to be resold to the power grid. Viridity estimates that this one battery will generate $500,000 a year in clean, green profit. SEPTA has already applied for new funding to install these battery systems at all 33 substations across their service area.

"With this technology, SEPTA can be very strategic with their power; when they are using it, when they are storing it and when they are selling it back into the grid," says Viridity Director of Business Development Laurie Actman. "At peak periods, the grid is willing to pay premium prices for sources of reliable load."

Since 2008, SEPTA has struggled to execute capital improvements to its transit infrastructure. Most recently, a proposed switch to SmartCards has drawn scrutiny from city media and transit bloggers. When Governor Ed Rendell made a play to turn state thoroughfare I-80 into a federal toll road, he promised a chunk of the resulting revenue to SEPTA. Since Rendell's proposal was defeated, SEPTA has been looking for other ways to fund improvements, from fare hikes to advertising on the sides of trains. The battery system technology could be the answer they have been looking for that will finally bring the Philadelphia subway into the 21st century.

"As we all know, SEPTA has always had a constrained budget and not enough money to invest in its infrastructure," says Actman. "For so long, SEPTA's infrastructure, that was built nearly a century ago, has been a liability. We are turning that into an opportunity."

Saft Selected by Viridity Energy to Provide Energy Storage for Southeastern Pennsylvania Transportation Authority: Li-ion energy storage battery will allow recovery of train braking energy alongside SEPTA rail tracks

PRNewswire via COMTEX

June 9, 2011

Saft lithium-ion (Li-ion) battery technology will supply megawatt level energy storage for the Southeastern Pennsylvania Transportation Authority (SEPTA) Recycled Energy and Optimization Project. Saft was selected by Viridity Energy to design, manufacture and commission the battery, which will also be one of the first dual purpose trackside Energy Storage Systems (ESS) in the United States.

The Energy Optimization project is designed to capture energy from rail cars through a regenerative braking process and then utilize the energy for accelerating trains, and to generate revenue through demand-side participation in power markets. A strong pilot could lead to potential deployment at up to 32 SEPTA substations.

Saft will provide one Intensium Max20 Li-ion megawatt energy storage system to capture train braking energy and then discharge it back to the third rail (power rail) to power trains leaving the station. The system will provide regenerative braking charge acceptance for SEPTA trains and power discharge back to the station to support rail traffic while simultaneously participating in the PJM Interconnection market for frequency regulation. As a fully integrated, containerized Li-ion solution, the Saft system will provide efficiency of greater than 95 percent and maximize system availability, as well as help to manage power flows.

Envitech Energy, a leader in providing the transit industry with new alternative energy storage traction solutions, was selected as the system integrator and will deploy its ENVISTORE System. The system controls the energy exchange between the network and Saft's ESS, recuperating the braking energy from the trains, storing it in the ESS and releasing it to the network upon command. The system will also assure line receptivity during braking and voltage regulation to improve the performance of the system.

"Saft is excited to be a part of SEPTA's recycled energy project, and for its potential to be deployed on a larger scale following a successful demonstration period," said Blake Frye, vice president of sales, Energy Storage for Saft North America. "Through this project, Saft is supplying the first dual purpose trackside energy storage system in North America from our dedicated Jacksonville, Fla. facility."

"We selected Saft's energy storage technology because of its proven performance and ability to meet the custom specifications of our energy management system," said Audrey Zibelman, president and CEO of Viridity Energy. "We needed a smart system that would easily integrate with our VPower(TM) software optimization system - Saft's Intensium battery met all our criteria."

"We are pleased to be working with Viridity, Saft and other partners on this exciting energy storage project," said Andrew Gillespie, SEPTA's chief engineering officer for power. "We can't wait to see how Saft's experience with onboard train applications and trackside power management will benefit the project."

The pilot project is targeted for commissioning by the end of 2011. Successful completion of the SEPTA project will demonstrate that energy storage can satisfy multiple value streams by accepting regenerative energy from train braking while simultaneously providing a revenue source by participating in the PJM frequency regulation marketplace.

Saving Electricity on a Philadelphia Subway Line

By Matthew Wald, New York Times

June 13, 2011

Subway trains need a lot of electricity to get going, turning electricity into kinetic energy, the energy of movement. When they pull into a station, many of them can do the opposite: generate electricity from their momentum. They turn their motors into generators to slow the train, producing current.

But in many systems, some of that energy goes to waste because of a bottleneck: the third rail, which carries current to the train, cannot handle as much energy as the train is generating during deceleration. Too much current pushes up the voltage, and when the voltage gets too high, the electricity is dissipated by running it through a piece of metal that converts it into heat.
But in Philadelphia, on the Market-Frankford line of the Southeast Pennsylvania Transit Authority, a new company called Viridity Energy will install batteries to capture a lot of that electricity and hold it while the train is in the station. Then it can deliver the power when the train starts up again or store it for a time of day when it is needed more.

“Economically, it will identify what’s the best thing for Septa to do, based on hours and prices in the market,” said Audrey Zibelman, the founder, president and chief executive of the company, which is based in Conshohocken, just west of Philadelphia.
Yet the batteries are fairly small. The whole installation stores only about 400 kilowatt-hours, which a house with central air conditioning could consume in a week or maybe less. But it can accept or discharge energy fast, at a rate of about 800 kilowatts — enough to run about 800 window air conditioners going full blast.

For short periods the battery pack can handle 1.5 megawatts. That’s about half of the theoretical maximum that a train could put out while it was braking, according to Kevin Morelock, director of the project. (The other half would go on the third rail system.) The amount of electricity the batteries will capture during each deceleration is small, 2 to 4 kilowatt-hours.

The trick is that Septa has thousands of train stops a year, so the system will empty and refill quite frequently. They will hold less than a dollar’s worth of electricity in each cycle but should save $135,000 a year for the transit authority, Ms. Zibelman said. The energy savings should reach 1,500 to 1,600 megawatt-hours a year, she said, enough to run 1,000 suburban houses for a year.

The batteries, to be built by Saft, a major manufacturer, will sit by the side of the tracks in a box that looks like a shipping container. Beyond capturing electricity, they will perform a second function: help keep the alternating current of the regional electric grid working at exactly the right rate.

The system is nominally 60 cycles, meaning that the electrons reverse course 60 times per second, but in practice that varies from 59.999 to 60.001. When it strays from that range, someone has to add or subtract energy, a service that the grid operators will pay cash for. For technical reasons, frequency control is becoming more of a challenge; because natural gas-fired plants and wind turbines generally do not regulate the frequency of the grid as well as old-fashioned coal plants do, some experts say, the job is getting harder. In New York, one company recently opened a plant that does this regulation work with flywheels.

Viridity, which plans to go into operation by the end of this year, will be hooked up by computer to the operator of the regional power grid, PJM. (The letters used to stand for Pennsylvania-Jersey-Maryland, but the system now sprawls from Delaware to Ohio and beyond, covering parts of 14 states.) Every few seconds, it can add energy or subtract it from the subway system's third rail network. That will change Septa's demand on the regional grid in a way that helps keep the grid at the proper frequency.

A third company, Envitech of Pointe-Claire, Quebec, will supply the electronic control system.

The project will cost $1.6 million, part of which will come from the Pennsylvania Energy Development Authority. Viridity says it will demonstrate that such projects can pay for themselves in savings.

SEPTA to install giant energy-saving battery

By Carolyn Beeler

June 19, 2011

SEPTA has chosen the French company Saft to manufacture a giant battery it hopes will help lower energy costs on the Market-Frankford line in Philadelphia.

The battery, which will be housed in a custom-built shipping container in a substation near the Tioga stop in Kensington, will capture and store the energy released by trains when they decelerate.

"Currently, the majority of that energy is being wasted because there's nothing to use that power," said SEPTA's Andrew Gillespie. "It becomes heat off the top of the car, so we want to capture that wasted energy."

The battery will sit underground about a block away from the train tracks. Gillespie projects it will supply about 10 percent of the power needed out of that substation, and will save SEPTA around $100,000 a year in electricity costs.

Right now, a small percentage of energy released by decelerating trains is transferred through the third rail, to give nearby trains leaving the station a boost. The battery system however, would capture more energy and store it for a longer time.

The new battery will also bring in additional revenue by helping regulate the grid, making power available at times of peak electricity usage, said Audrey Zibelman, head of Conshohocken-based Viridity Energy, which is partnering with SEPTA on the effort.

Zibelman says batteries have been installed in New York train stations in a similar pilot project, but this is the first effort she knows about that will also be able to perform regulatory functions.
A SEPTA representative said the battery should be installed by January; if the project is successful, it may expand.

SEPTA makes public transportation more sustainable

By Andy Sharpe, Delaware Valley Association of Rail Passengers

July 18, 2011

Next time you ride on SEPTA's Market-Frankford train, you might be helping to make Philadelphia a more sustainable city in more ways than you think. Soon, not only will you be using electric public transportation, but you'll be helping to conserve electricity through an innovative partnership between SEPTA, Viridity Energy, and the industrial-strength battery manufacturer Saft. This is all thanks to a $900,000 grant from the Pennsylvania Energy Development Authority (PEDA).

SEPTA, Viridity, and Saft hope that Market-Frankford Line trains will eventually be able to run on their own recycled power in a process known as regenerative braking. Saft will provide one megawatt battery along the railway that will enable trains to pick up their electricity from the braking of other trains. If all goes as planned, SEPTA will even be able to generate revenue by selling excess electricity back into the general power grid.

What is even more exciting about this is that Philadelphia will be the first city in the country to have a track-side battery to enable this degree of regenerative braking. This latest innovation for Philadelphia is expected to become a reality later this year. If all works as planned, SEPTA could introduce similar electricity regeneration at 32 substations all over the rail system.

Train to Tomorrow-Land

By David Ferris, Sierra Club Magazine

January/February 2012

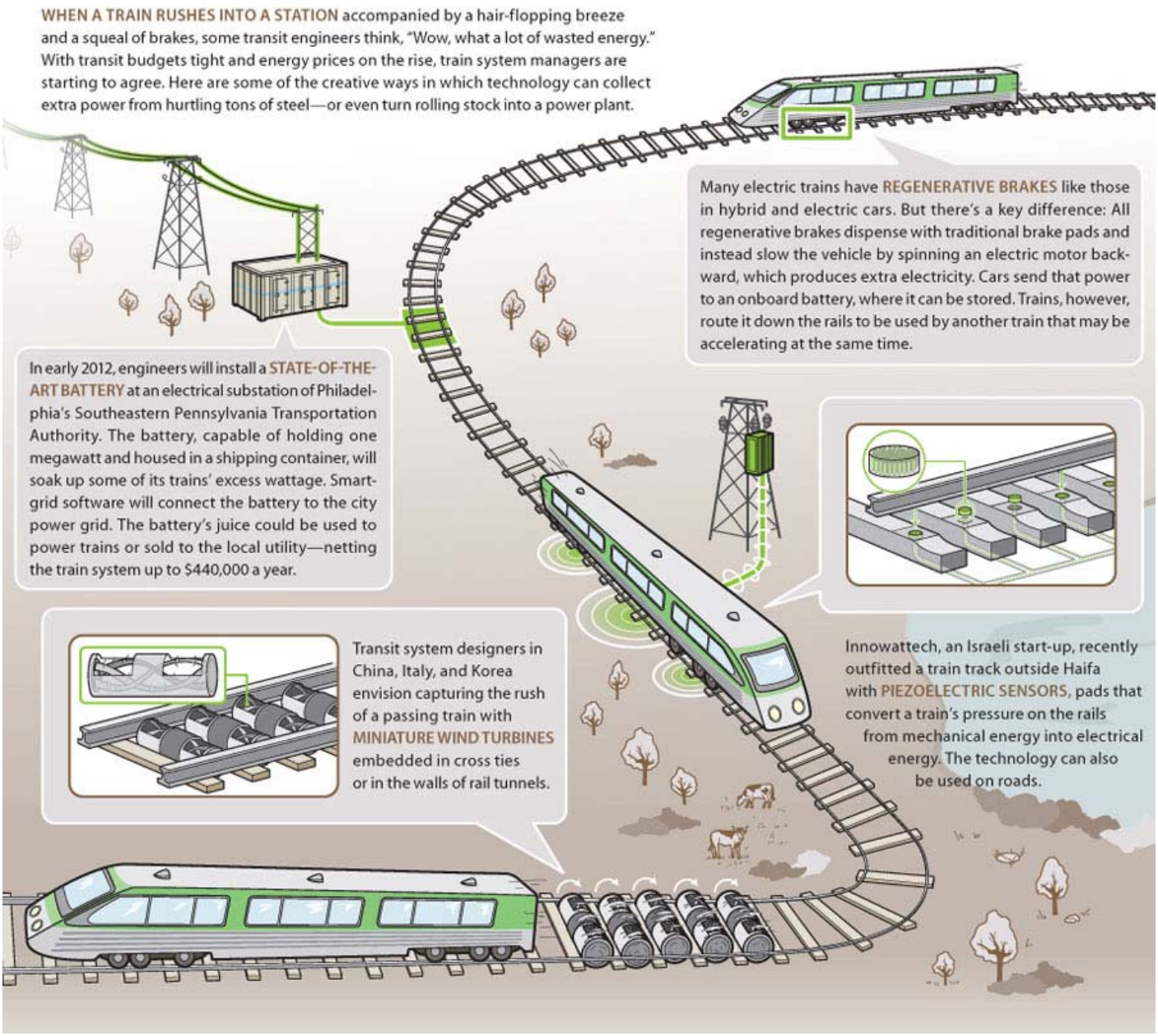
Andrew Gillespie's love for electric trains is a complicated thing. As the chief power engineer for the Southeastern Pennsylvania Transportation Authority, the sixth-largest U.S. transit system by ridership, he yearns for those gleaming bullet trains found in Japan and Germany. But he's in Philadelphia, where the electric rail lines are a century old and the system is perpetually short of money.

So when local smart-grid company Viridity Energy approached him with a plan to link his vast network of subway cars--and the electricity from their regenerative brakes--to the power grid, he saw the light. His agency could transform its creaky old infrastructure into an ultramodern asset and make cash by selling power to the local utility.

Though the pilot project involves just five subway stops, its potential is impressive. A six-car train can generate three megawatts (enough to power 125 homes) during the 15 seconds it takes to stop. Gillespie thinks the project can pay for itself in four years and then fund its own expansion to the rest of the system. Transit managers in other cities are closely watching Philadelphia's experiment.

Gillespie grew up in the 1970s playing with his dad's model trains, and he developed an early interest in electrified transit. "Electric trains are quiet, they're sleek, they can get to their top speeds much quicker. Diesels are dirty, they're loud, and they blow cinders," he says.

By trimming energy usage, the project will also help put the brakes on greenhouse-gas emissions from Pennsylvania's old coal-fired power plants. And perhaps help residents understand the role transit plays in making cities cleaner and more livable. "What I like about Philly is that there's a lot of opportunity to live car-free," Gillespie says. "Trains are an opportunity to make the area better."



Viridity Captures Train Braking Power, Sells It to the Grid

By Jeff St. John, Greentech

April 26, 2012

Electric-powered trains have been capturing the energy from regenerative braking for years now. But besides reducing power bills, they haven't done much with the energy they've saved.

Philadelphia-based startup Viridity Energy is seeking to put a grid value on that energy with a new battery-backed, grid-connected system installed with the Southeastern Pennsylvania Transit Authority (SEPTA) train system. After a year and a half of work, Viridity is now turning on the 800-kilowatt battery backed system, and will soon start bidding its energy reductions into demand response and frequency regulation markets.

It's the latest move by Viridity into the world of so-called microgrids, virtual power plants, or other systems that allow buildings (or trains, in this case) to share their power with the grid. SEPTA's project taps regenerative braking power at five downtown train stations along the Market-Frankford line, the city's most-used, using power equipment from Envitech and Viridity's "VPower" optimization software, and feeds it to an 800-kilowatt, 400-kilowatt-hour battery from Saft at the substation serving the five stations.

That's a pretty small battery, compared to the multi-megawatt wind power backup systems being installed around the world. But Kevin Morelock, Viridity's managing director of technical sales and partnerships, said in a Wednesday interview that Viridity's ability to manage and optimize the interplay of battery, train power system and grid interconnections should yield returns that make it worth the effort. How does it work? Well, when trains use their electric motors to slow down (usually approaching a station), that sends voltage down the "third rail" or overhead power line that supplies the trains their power. If there's a train ahead, it can capture that voltage itself -- but if there isn't a train, that over-voltage is generally dissipated as heat, Morelock said.

Viridity's system, on the other hand, taps the third rail and captures that voltage to charge the battery, he said. From there, the battery can be used either to power trains when power prices are high, to cushion substation loads to manage peak power moments, or to bid back into grid power markets, he said.

Those markets include so-called "economic" demand response -- turning down power use when the grid is at peak demand, usually at day-ahead or hour-ahead increments -- as well as frequency regulation markets, which require assets (usually gas-fired power plants) that can react in minutes, if not seconds, to balance fluctuations of grid frequency.

Viridity is already bidding battery-backed power into frequency regulation markets with partner and battery supplier Axion Power, which has installed Viridity's system at its New Castle, Pa. manufacturing plant.

Saft and Envitech are financing the SEPTA project, helped along with a $900,000 Pennsylvania state grant that Viridity landed last year, Morelock said. With that grant, Viridity is expecting a return on investment of about 2 to 3 years on the project, he said.

Building a similar system without a grant would likely double that payback period to four to six years, he noted. SEPTA is working on a second, similar project, backed by $1.2 million in federal grants, that will use a different set of batteries from an as-yet unnamed supplier, he said. Other companies looking to capture train braking power and apply it to grid needs include flywheel maker Vycon Power and ultracapacitor maker Maxwell Technologies.

Viridity raised $14 million in January 2011 and is balancing and storing power at several university campus microgrids, a wind power storage management project in Pennsylvania, and other locations. While batteries play a part in some of its projects, others are concentrating on building energy management systems that pre-cool libraries, turn down lights in unused corridors, or adjust thermostats during peak power times to shave energy that can be bid back into power markets.

In February of this year, Viridity launched a partnership with big energy services company ConEd Solutions that could see its technology deployed in offices and other buildings. It's also working with the developers of the Tres Amigas project, a multi-billion dollar effort to link the United States' three main power grids via a high-voltage direct current transmission hub in New Mexico.

Electric Wizards: SEPTA Generates Revenue Through Cutting Edge Technology

By Samantha Wittchen, GridPhilly

May 30, 2012

Innovation" might not be the first word Philadelphians associate with SEPTA—two tokens sold in a plastic bag that says "Go Green" seems, um, not innovative—but that reputation deserves to change. SEPTA is piloting a cutting-edge regenerative braking project that saves energy and money, and positions Philadelphia as a global leader in public transportation sustainability.

This change couldn't come at a better time. In August, Philadelphia will host the 2012 American Public Transportation Association's "Sustainability and Public Transportation Workshop." As hundreds of the industry's leading sustainability and environmental policy professionals descend on the city, SEPTA will showcase its progress on the Wayside Energy Storage System, a regenerative braking and energy storage system implemented at one of SEPTA's electrical substations on the Market-Frankford Line.

The project began in 2010 when SEPTA announced a partnership with local power technology firm Viridity Energy. Backed by funding from the Pennsylvania Energy Development Authority and the federal government, the pilot is set to reduce electrical usage at the substation by 10 percent. The project will conclude by the end of 2012.

Regenerative braking itself isn't new. New York, Seattle, Portland and Los Angeles all currently employ this technology, and SEPTA uses it to power the lights and air conditioning on trains. What makes SEPTA's pilot system innovative is its use of a large battery to store the electricity generated by braking trains. Viridity will monitor the battery using their software to determine whether it's more cost-effective for SEPTA to use the energy for powering trains or to sell the energy back to the grid.

Here's how regenerative braking works on SEPTA trains: Instead of using brake pads to create friction to slow the train, the braking mechanism puts the electric motor in reverse, turning it into an electric generator. The generator can then provide electricity to a variety of applications, like lights, air conditioning, other trains and storage devices (batteries). Any excess electricity that can't be stored is sent to a resistor bank on top of the train car and converted to heat. In the SEPTA pilot project, electricity stored in the battery can then flow to the grid.

The technology's scalability is what makes it so important and potentially transformative. There are more than two dozen substations where this technology could be replicated, explains Andy Gillespie, SEPTA's chief engineer for power, which would fundamentally change the way SEPTA manages power for its subways and trolleys.

The project may also save SEPTA a good chunk of change. Between reducing electricity costs and revenue generated by selling electricity, they're expecting a net annual benefit of $300,000. The savings will provide the capital to fund future projects at other substations, creating a positive loop of savings. The demonstration phase began on March 1, and the transit industry is closely watching this project to see if it can be a model for other transit systems throughout the country. The workshop in August will be a great opportunity to further the project (by attracting more federal transit dollars) and demonstrate Philadelphia's growth as an innovative sustainability leader.

SEPTA is Putting the Brakes – The El's Brakes – On Wasted Energy

By Andrew Maykuth, Philadelphia Inquirer

June 27, 2012

A lot of energy is wasted each time a train stops at one of the 28 stations on SEPTA's Market-Frankford Line.
In a six-car train, the brakes produce about 3 million watts of power during the 15 seconds it takes to halt the 400 tons of hurtling metal, plastic and humanity. Some of the electricity is reused by other trains on the line. Much of the power is lost — dissipated as hot air through the subway car's rooftop vents.

But what if the electricity produced by the train's regenerative brakes could be captured and reused, as it is with a hybrid vehicle? And what if the power could be resold at a profit?

That's what SEPTA and Viridity Energy, a Philadelphia smart-grid company, hope to accomplish. On Wednesday, the partners will formally launch a sophisticated battery-storage system to capture energy from the Market-Frankford El.

The Wayside Energy Storage Project, situated in Kensington, is generating a lot of excitement in energy-efficiency circles because it combines two concepts — reducing SEPTA's electric bill from Peco Energy Co., and selling stored energy back into regional power markets. It's all about the economics.

"By combining the two together, the return on investment goes up, and the payoff is much quicker." said Kevin Morelock, managing director of Viridity Energy.

SEPTA received a $900,000 grant from the Pennsylvania Energy Development Authority to prove the concept, which it hopes to replicate throughout the Market-Frankford Line. Viridity hopes the system, if it proves effective, can be reproduced in transit systems around the world.

Viridity estimates that the one-battery system alone will return more than $250,000 in total economic benefits a year.
SEPTA recently received a $1.5 million federal grant to build a second system. Andrew Gillespie, its chief power engineer, said the transit agency hopes the savings from the two units will fund the installation of up to 10 systems on the El, its busiest service.

"When the battery gets full, it discharges into the rails," said Gillespie. "When we do that, we are not buying power from Peco."
SEPTA aims to cut energy use 10 percent by 2015 and reduce greenhouse-gas emissions 5 percent a year. It currently spends about $20 million a year on electricity for its subways, trains and trolleys.

The project demonstrates the complexities of the "smart grid" system, where regional grid operators such as PJM Interconnection Inc. need to coordinate an increasingly scattered network of energy sources — solar panels, wind turbines, and small power generators — to maintain a delicate balance between supply and demand.

"It sounds like a simple concept, but it's actually very complicated to do, to control the system so we can participate in the wholesale market, at the same time we can capture the 're-gen' power," Gillespie said. "The two things have to work simultaneously. That's been the hardest thing to prove."

Just as a hybrid car recovers energy when it slows down, many electrified trains convert kinetic energy into electricity with regenerative brakes. On SEPTA's Market-Frankford Line, the power is put back into the third-rail system, for use by other trains.

The Wayside battery-storage project takes the concept one step further. By storing SEPTA's excess regenerated power in large battery systems, Viridity can control discharges to take advantage of PJM's fluctuating electricity markets.

SEPTA installed its battery system in a spare room at the Letterly Power Substation, a century-old brick building near the Huntingdon Station in Kensington.

The beauty of the system is hidden from view. Lithium-ion batteries, produced by Saft North America, are stacked in racks in a 20-foot white, refrigerated shipping container that has the visual appeal of a meat locker. The brains of the system, the switching and control equipment built by ABB Envitech, is housed in a beige metal cabinet. The two humming, unattended metal boxes are controlled remotely by Viridity personnel at 18th and Market Streets.

"On an average 65-degree day, electricity is probably selling for 10 cents a kilowatt," Gillespie said during a tour last week, when the temperatures had surpassed 90 degrees by 9 a.m. "You get a day like today, it could be selling at 25 cents a kilowatt. If you discharge your battery the right time, you could make 25 cents a kilowatt where you're only buying it for 10."

SEPTA also plans to participate in PJM's "frequency regulation market," which requires producers to add power to or subtract it from the grid on a moment's notice to ensure the system operates at a stable frequency. SEPTA's batteries, which can store up to 800 kilowatts, are well-suited to an instantaneous response.

Gillespie said SEPTA expects the one unit to reduce its power purchases by $90,000 to $150,000 a year, and to earn $75,000 to $250,000 a year by selling into PJM's energy markets. Viridity gets to keep 30 percent of the revenue from PJM, he said.

Viridity, which has worked with Drexel University and Thomas Jefferson University and its Center City hospital on energy-storage projects, is banking on the high visibility of the SEPTA project.

"There's a new generator in town," the company says in its promotional literature. "And it's pulling into a subway station near you."

Cutting the Electric Bill with a Giant Battery

By Matthew Wald, New York Times

May 30, 2012

A giant battery bank installed by the side of the Southeast Pennsylvania Transit Authority's subway tracks a little over a month ago is saving about nine megawatt-hours of power a week, its manufacturer says, which is more electricity than the typical apartment-dweller uses in a year.

The battery system, which I wrote about last year, is allowing the trains to run a bit like Prius hybrids. When they slow down at a station, their motors turn into generators, converting torque into current. Before the battery bank was installed, some of that current was returned to the third rail; but if the voltage got too high, it was shunted instead into a giant electric heater under the train, which simply dissipated the energy as heat.

Now the battery captures excess current, about 3.5 to 4 kilowatt-hours per train that stops, and puts it back on the line when a train is accelerating. Sometimes it does this for several trains at once.

The battery bank is also receiving signals every four seconds from the regional grid operator and either absorbing energy or giving it back to the grid to help balance supply and demand.

With the house current known as AC, for alternating current, electrons change direction at 60 cycles per second; if there is more supply than demand, they run a bit faster, and if there is more load than supply, they run a little more slowly. Essentially the battery owners get paid for helping keep the system as close to 60 cycles as possible.

Jim McDowall, the business development manager at Saft, which built the battery, said the combination of energy storage plus grid balancing would make the project profitable. The nine megawatt-hours cost about $90 each, he said, which would put the weekly savings in the range of $800.

As a storage device, the battery is more like a peanut butter jar than a wine jug; electrically speaking, it has a wide mouth and can empty and fill quickly, although its volume is small. It can accept or send out power equal to 1.5 megawatts, which is enough to light up a good-size shopping center, but it holds only 420 kilowatt-hours. That's plenty for this application, however.

Officials held a ribbon-cutting ceremony for the battery bank on Tuesday. Saft and the developer of the system, Viridity Energy, are hunting for other applications.

SEPTA Launches Cutting Edge Regenerative Braking Initiative

By Andrew Busch, SEPTA

July 27, 2012

Since the early 1900s, the Letterly Substation in Philadelphia's Kensington neighborhood has been providing the power needed to run one of the city's busiest train lines.

Now this facility is on the cutting-edge of 21st-century technology that is making public transit more sustainable and efficient, thanks to an innovative program to reduce power consumption and costs by harnessing the energy generated by trains.

The Southeastern Pennsylvania Transportation Authority (SEPTA) and Viridity Energy, a Philadelphia-based smart-grid firm, have launched a pilot project to bring regenerative braking energy—similar to that used by hybrid vehicles—to subway/elevated trains on the Market-Frankford Line. This line is SEPTA's busiest route, serving nearly 190,000 riders daily.

In a first-of-its-kind "wayside energy storage" project, SEPTA and Viridity have devised a way to capture, store, and reuse braking "El" trains' energy—the energy released when trains apply the brakes, usually dissipated as heat—building on the idea of an on-board battery. Instead of a single battery as in a car or bus, however, SEPTA's system comprises several large batteries (produced by Saft Batteries Inc.) and a controller (produced by ABB Envitech Inc.) located offsite—or wayside—at SEPTA's Letterly Substation.

Together with Viridity, SEPTA, a gold-level signatory to APTA's Sustainability Commitment, will connect to the frequency regulation market—used to keep the electricity grid in a state of equilibrium—and other demand-response programs to sell the excess electricity captured by the wayside energy storage device on the electric market. Later, SEPTA can use the stored energy to meet a variety of energy needs on the portion of the Market-Frankford Line served by that substation, including powering additional trains.

This process will help the agency conserve energy and cut down on electric costs. It also creates an opportunity to generate new revenue, as the captured energy can be sold on the power market.

SEPTA has more than 30 substations, many of which could eventually take advantage of this technology.

Other public transit agencies will be able to share results from this pilot to assist their efforts to similarly reduce energy use and greenhouse gas emissions. SEPTA and others hope that soon economies of scale will allow the expansion of this promising partnership to generate economic gains without external support.

"Through this pilot project, SEPTA will become even more energy efficient, which will help control operating costs—benefiting both customers and taxpayers," said SEPTA General Manager Joseph Casey. "We've made our system cleaner, greener, and more efficient in recent years through such efforts as replacing traditional diesel buses with diesel-electric hybrids and installing energy-efficient lighting at stations, facilities, and offices. These measures are helping us control costs in tough economic conditions and making us a better

neighbor in the communities we serve."

SEPTA anticipates that the energy optimization program could provide approximately 10 percent of the energy needed at Letterly Substation, which could reduce power bills by up to $190,000 a year. In addition, the agency could generate up to $250,000 in new revenues by selling captured power.

The pilot project, funded by a $900,000 grant awarded to Viridity by the Pennsylvania Energy Development Authority, is just the beginning of SEPTA's wayside energy storage initiative.

SEPTA is exploring additional grant and funding opportunities that could allow for similar energy optimization projects at other power substations. The transit authority recently received a $1.44 million FTA grant to install another device at a substation in Northeast Philadelphia. That grant will also be used to test alternative battery technology and determine the best fit for SEPTA's propulsion system.

These projects build on efforts undertaken as part of SEPTA's Sustainability Program, a major goal of which is making the public transit agency greener and more efficient, and providing for improvements to an aging system that are vital to keeping it moving for current and future customers.

Trains Try Regenerative Braking in Philly

By Keith Berry, Wired

September 5, 2012

A massive battery parked at a substation on SEPTA's Market-Frankford line is now storing energy captured from braking trains, saving the transit agency in energy costs and turning it into an electricity provider.

Nearly two years after we first reported on the initiative, SEPTA officially flipped the switch on the regenerative braking system in June, and early estimates show that power savings could be as much as 10 percent. Already, the Federal Transit Administration has granted SEPTA another $1.4 million to install a similar setup in another part of Philadelphia.

Currently, trains running along the Market-Frankford line use the same kind of braking technology found in most hybrid cars, converting kinetic energy from braking into electricity and sending it along the third rail to a massive array of more than 4,000 30 Ah nickel cobalt aluminum batteries. Otherwise, that energy would've been wasted as heat. By recapturing and reusing that energy, SEPTA estimates it could save up to $190,000 a year in energy costs, not to mention decreasing wear and tear on its trains' braking systems.

It's not just about saving energy, however. Once it's sent up the third rail and stored, that electricity can be sent across Philadelphia's power grid in times of high demand. SEPTA has partnered with "smart grid" specialists Viridity to enter the electricity market, and estimates they could be making between $75,000 and $250,000 in added revenue each year by reselling the energy captured from trains.

Viridity said that more than 95 percent of the energy that is stored at the substation can be reused – either to power trains or to be sold back to local utilities. That doesn't mean that the trains themselves are 95 percent efficient, however. According to the SAE's Off Highway Engineering magazine, the regenerative braking setup can only recapture 1.5 MW "because of limitations associated with funding for the project." That 1.5 MW is less than the full brake energy of just one train, and any additional brake energy is still wasted.

A Battery of Sustainable Ingenuity

By Joe Petrie, Mass Transit Magazine

June 3, 2013

As Southeastern Pennsylvania Transportation Authority (SEPTA) leaders have looked for ways to run fiscally leaner, sustainability has been a big focus.

One sustainability project that has garnered international acclaim is the installation of a giant battery within one of SEPTA's electrical substations to catch regenerative braking energy from a rail line and feed the energy back into the system. The agency has partnered with smart grid firm PJM Interconnection, which purchases the energy in order to stabilize its grid.

Two more similar batteries are now being planned by SEPTA, one of which agency General Manager Joseph Casey said is in procurement. And with 30 substations owned by the agency, SEPTA Strategy and Sustainability Planner Erik Johanson said there's a huge potential for savings.

"It's a couple hundred thousand per year. That actually makes the battery cost effective where before just relying on the battery it was barely a break-even scenario," he said. "Now it's potentially feasible to do it at multiple substations."

Andrew Gillespie, chief engineer of the engineering, maintenance and construction division of SEPTA, said the energy storage unit works similar to the battery in a Toyota Prius in order to capture the power and feed it back into the catenary system. After installing the system, Gillespie said the agency discovered the system caught a lot more regenerative power than expected, so it has reduced substation electric bills by about 10 percent.

Jacques Poulin, product manager of energy storage in rail transportation for ABB, which was involved in creation of the unit, said although regenerative braking has been around for roughly 20 years, the concept of trying to capture wasted electricity has only been discussed for about the last seven years. By capturing the energy and reusing it for trains still wastes about half of the captured energy, so reselling it to electric companies reduces the waste and the business model with Veridity Energy benefitted both the system and electric company.

He said the substation project remains unique in the world.

"The transit industry is keenly interested in improving its energy or carbon footprint for obvious reasons," he said. "There is public concern and they're trying to compete against the car, so they point out that it's greener to take public transportation and projects like this help improve that image and clearly draw attention to it."

With the success of the system, Gillespie said SEPTA wrote a competitive Transit Investment in Greenhouse Gas and Energy Reduction (TIGGER) grant to build a second unit at another substation, which will use super capacitors, which could double the life of the unit.

"So with that investment of $2 million, it now has a 20-year life and I'm paying it back in five to seven years," he said. "I just tripled my payback to SEPTA."

Although SEPTA could install the units at all 33 of its substations, Gillespie said it's not economically feasible due to the initial costs and the law of returns. However, there are 10 substations that could be a good first tier for this type of project.

"It has big promise so it has gotten a lot of attention," he said.

Poulin said the system does capture the majority of energy, but not all of it, saying it's not recommended because there comes a point where to get to zero waste of energy you have to over-dimension the system, which makes it regressively profitable.

"You're still capturing 90 percent of the surplus braking energy and you get a much better return than trying to capture that last 10 percent," he said.

How a 'dinky' energy storage project gives financial oomph to Philadelphia's subway system

By Julia Pyper, Climate Wire

June 6, 2013

PHILADELPHIA -- As the subway train headed north on the Market-Frankford line and pulled into an aboveground station, Erik Johanson shot out a finger toward the opposite track.

"That train right there is accelerating on power this train is generating," he said, with palpable excitement in his voice.

Johanson is the strategy and sustainability planner for the Southeastern Pennsylvania Transportation Authority, or SEPTA, which operates Philadelphia's multimodal public transportation system. Nothing about the subway ride with him last month seemed exceptional; the train started and stopped like normal. But a few stops away, Johanson explained, SEPTA had configured an innovative way to turn an everyday train ride into a method to conserve energy, save money and reduce greenhouse gas emissions.

A Philadelphia subway train with regenerative braking can be a power and income producer. Photo courtesy of the Southeastern Pennsylvania Transportation Authority.

The year the Letterly Substation in Kensington, Philadelphia, turned 100 years old, SEPTA started up what's believed to be the world's first wayside energy storage project to combine the energy-saving benefits of regenerative braking, or "regen," with the revenue benefits of selling some of that energy back to the grid.

The wayside, or "beside-the-train-track," energy storage project consists of a large stationary battery in a large white container, next to a smaller gray box that controls the system. The project is housed in what looks like an old gymnasium but was initially built to contain a giant rotary converter. The converter now long gone, SEPTA had more than enough space to store a battery.

Since the project came online in April last year, SEPTA has seen a nearly 20 percent reduction in power consumption at the substation. By tapping into the wholesale energy market, the transportation authority -- which is currently facing a $5 billion backlog in maintaining a state of good repair on its assets -- is also starting to turn train braking into a revenue generator.

Getting a battery charge from braking

Every time a train brakes on the 18 miles of track powered by the Letterly Substation, electricity is sent to the third rail system. It used to be that the regen energy went to waste unless another train was accelerating on the same track within a few miles away. This system, therefore, captured only a small portion of available braking energy. But now, with the energy storage device in place, SEPTA engineers calculate that the storage system will capture close to 40 percent of available braking energy.

With the controller and 800-kilowatt lithium-ion battery hooked up to the system, the substation sees when a train is braking and the voltage is rising. The system then opens up a switch and allows energy to flow into the battery. When the train stops braking, the battery will turn the switch off and store that energy until it detects another train speeding up and sends power back out to the rail.

Every time a train accelerates, the big gray controller box starts to emit a high-pitched buzz. If the train is running on battery power, that's electricity SEPTA doesn't have to buy from the utility. But the really innovative part of the system is where the Philadelphia-based utility Viridity Energy stepped in and proposed selling a portion of the battery power to the wholesale energy market.

Andrew Gillespie, chief engineer of SEPTA's engineering, maintenance and construction division, said he didn't believe he could make any money owning a battery. "I thought, 'Who cares about my little dinky wayside storage project?'" he said.

"Then Viridity comes along and says, 'Hey, you can take that same asset and you can leverage it, you can multiply its benefit,'" he said. "Of course, the pessimistic public employee goes, 'Yeah, prove it.' They did prove it."

The initiative was enabled by PJM Interconnection, the Eastern regional grid operator, which was looking for ways to balance electric supply and demand and willing to support storage projects to decentralize its energy production. PJM's interest in SEPTA's wayside energy storage project follows a growing trend toward building smaller, self-sustaining grid systems, or microgrids (*ClimateWire*, May 1).

According to PJM spokesman Ray Dotter, working with SEPTA and Viridity is about "making sure we provide fair and equal market opportunities to new innovative technologies that will help balance the grid and maintain stability."

Selling juice to the grid

When PJM needs a greater supply of energy, it sends a signal to Viridity to discharge some of SEPTA's battery power. As opposed to a coal- or gas-powered facility, which generally takes about 30 minutes to ramp up, the battery can respond within 4 seconds. PJM pays SEPTA and Viridity for every hour the battery is in the wholesale frequency regulation market.

The combination of SEPTA's localized energy savings through regenerative braking and PJM's demand for frequency regulation services has made the wayside energy project an income-generating asset.

The Letterly Substation project cost $1.8 million. Viridity brought $900,000 in grant money from the Pennsylvania Energy Development Authority and contributed some of its own capital. SEPTA supported the rest.

Viridity also had to make a significant investment in its software programs to manage the frequency regulation application with PJM. This software will now allow the company to invest in other regenerative braking projects or tap into managing the emerging renewable energy market.

"What we've demonstrated with SEPTA is how to harness a different flavor of difficult-to-predict, but not unpredictable, intermittent supply of energy. To us, we can look at it generically and solve the same problem by storing the energy from solar and wind and perhaps other sources as well," said Chad Von Eck, vice president of partner and delivery services at Viridity who oversaw the SEPTA wayside project.

Working with a transportation system is unique, however, because it's an energy source without ever intending to be. Since nearly all of SEPTA's subways, trains and trolleys came standard with regen capacity as they were upgraded over the last couple of decades, it's almost as though the energy they produce is free.

There's also a lot of untapped potential. Connecting the battery to help run trains reduced energy usage at the Letterly Substation by 10 percent. When SEPTA engineers found a way to increase the amount of energy they could capture in a given braking event from 700 volts to 735 volts, the energy savings jumped to nearly 20 percent.

"Basically, every one of these trains is a little generator. So when you increase the output of these little generators, it means there's more power to be used by the other trains," Gillespie said.

SEPTA is now running tests to see whether it's possible to capture 765 and even 790 volts of braking energy, which is expected to further increase the amount of energy available to send to other trains or store in the battery.

Electrifying financial possibilities

Through its energy savings, SEPTA is able to pay back the battery provider Saft Groupe SA as well as ABB Group, which created the control system that links the trains, the battery and PJM all together. Viridity and SEPTA then share the profits from the wholesale energy market. Under this model, SEPTA expects to pay off the project in six years. The life expectancy of the battery is 10 years.

"All of this remains budget neutral," Gillespie said, thanks to the energy savings.

Comparing the end of 2009 with the end of 2012, during which time the wayside energy storage project came online and SEPTA boosted the energy capture to 735 volts, the transit authority saved nearly $500,000 in electricity costs.

"I'm a policy person," Johanson said. "I get excited about this because the numbers are real."

Electricity usage on the Market-Frankford line was increasing until regen was clicked on in April of last year, which means the $500,000 in savings doesn't even reflect a full year of usage. SEPTA also expects savings to grow as it increases the voltage further to 765 by the end of this year.

The next step is to expand. Using money from its energy savings, SEPTA plans to put 10 wayside energy storage devices in place at its substations. By enhancing the potential of regenerative braking by increasing the voltage and building out the 10 storage facilities, SEPTA will cut its emissions by more than 35 million pounds of carbon dioxide equivalent. That's about equal to taking 3,000 cars off the road for one year.

SEPTA has already received a $1.44 million grant from the Federal Transit Administration to build its second project, priced at $1.8 million. The profits from the two projects combined should bring in close to $1 million per year, which can be reinvested into other projects. SEPTA also expects private firms will finance these projects once they see how cost-effective they are.

This model offers a new funding mechanism for the cash-strapped transit authority's sustainability program, Johanson said. The projects do require an upfront investment, but once the system is brought up to scale, the revenues generated can be invested directly into upgrading the transportation system.

"We are a transportation company; we can't justify doing this and then not do a transportation project," he said. "But if you can finance it on the savings, everyone wins."

Energy Recycling Gives Subways a 'Brake' on Bills

M. Corey Goldman, Financial Post

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Getting thousands of tons of steel, plastic and people moving along an underground track clearly takes a lot of energy. Less known, or at least less thought of, is how much energy it takes to stop.

While the high-pitched screech of a subway train coming to a halt is a good indication, the energy produced by brakes on metal isn't something most would consider possible to harness and re-purpose.

Andrew Gillespie is the exception. Mr. Gillespie is the chief engineering officer for power at the Southeastern Pennsylvania Transportation Authority, or SEPTA, the transit network that moves some four million people in and around the Philadelphia metropolitan area.

He and his colleagues have been intently watching over a test system currently running on a portion of SEPTA's rail transit line that allows captured energy from one train slowing down to, among other things, propel another train speeding up - a system provided by the Canadian arm of ABB Systems Inc.

"We consume about a half a billion kilowatts of power annually; my electric bill is anywhere from US$38-million to US$42-million," Mr. Gillespie says. "This is a technology that makes the whole system more efficient."

Like a hybrid car, ABB's solution is a way for mass transit systems to store and re-use dissipated braking energy as a means of saving money, boosting efficiency, being more environmentally friendly and even making money by selling some of the stored-up energy. Newer trains and streetcars have "regen" capacity

built into their braking systems. It's an innovative project initially conceived in the suburbs of Montreal by Jacques Poulin and a team of engineers at Envitech Energy, a company that had focused its efforts on solar-and windgenerated water treatment technologies but later moved into rail transportation. ABB, a global power and automation technologies firm, acquired LandTech Energy in 2011.

"It's an emerging technology that transit providers are starting to consider and explore, because it can pay for itself," says Mr. Poulin, product manager of energy storage in rail transportation at ABB's Point Claire, Que., facility. "It also helps reduce the carbon footprint."

While efficient at moving hundreds of people at a time, subways, streetcars and light rail lines aren't so efficient when it comes to energy consumption. Power consumption has risen significantly in the recent past with cities adding more electric-powered vehicles to their transit networks that include creature comforts such as air conditioning.

That's where ABB's system comes in.

Using a wayside, or "beside-the-traintrack," energy storage solution, the system detects when a train is braking and the voltage is rising, automatically taking that energy flow into an 800-kilowatt lithium-ion battery, or sending it back out when it detects another train accelerating.

If there isn't a need for the extra power stored, it can be sold back to the wholesale energy market, or the grid. Most riders wouldn't notice the equipment, which consists of a large stationary battery housed in a white cargosized container, and a smaller grey box beside it that controls the system.

Thanks to energy market de-regulation, U.S. energy providers can buy energy from private producers - companies or even individuals with solar panels or wind turbines, or a public entity like SEPTA. PJM Interconnection, the Eastern regional grid operator, has teamed with SEPTA to buy energy when it needs to balance out electricity supply and demand.

So far it's paying off. Since coming online last April, SEPTA has seen a nearly 20% reduction in power consumption at the substation, Mr. Gillespie says. The longer-term objective is to bring in from $150,000 to $200,000 a year in revenue, giving SEPTA a way to finance installing more systems along its network.

"We're seeing savings of anywhere between US$12,000 and US$20,000 a month," he says. "That's electricity that doesn't have to be produced, which means more cost savings and, equally important, less emissions."

Other cities have also begun to sign on for the new technology, including AGP Metro Polska, which runs the metro system in Warsaw as well as Montreal's STM, which in a few weeks will have a test version of ABB's system up and running on one of its "Arriere Gare" (literally "behind station") tracks. A spokesperson for STM confirmed that the project was underway.

For Philadelphia and other cities where the technology may eventually get rolled out, riders won't notice any difference.

"They actually won't notice it at all," Mr. Gillespie says. "The analogy I use a lot is it is the transit equivalent of a Toyota Prius [except] there's no room left to put the battery on the train so we put the battery on the wayside instead."