



## **Battery Energy Storage Systems (BESS)**

## **Integration into Waste-to-Energy (WtE) Sites**

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*Did you know?...*

**...That battery storage is the fastest responding dispatchable source of power on electric grids?**

## Introduction

The purpose of these *Bright Ideas* is to bring awareness to topics that most people would never think about. We are hoping to stimulate the conversation, so that we can encourage some of the brightest minds in this country to consider the potential in what these concepts offer.

Working in association with the contacts we have through our *3e Research Alliance*<sup>SM</sup>, we plan to engage subject matter experts, and discover new approaches to existing methods. In our previous discussions, we have urged a “back-to-basics” approach to looking at these critical issues that we face today.

Using that as a backdrop, this latest concept, battery energy storage systems (BESS), also known as battery storage power systems, is an exciting and promising technology that is creating new opportunities in the energy generation world. We will describe the history and background, as well as offer details on what hurdles have arisen. This is a very exciting concept, and one that we want to encourage people to embrace, no matter which end of the environmental debate you are on.

## Background

As is the case with any technology, there are portions of BESS that come from decades of related ideas, and are put together with a new focus towards current needs and issues. This is similar to our vortex technology, in that we have embraced the core technology, and added new features that were not available prior, but that enhance efficiency.

BESS has been in the market since the late 1990s. Advancements have been relatively slow, but over the last 10 years or so, significant technical strides have been made. Our goal is to find a sustainable solution that we can integrate into our waste-to-energy (WtE) facilities.

### A quick primer on utility-scale batteries

One technology, pumped storage hydropower (PSH) is a type of hydroelectric energy storage. It acts similarly to a giant battery system, in that it can store power and then release it as needed.

Utility-scale batteries, namely BESS systems, offer the other concept to store and release electricity. There are three types: lead-acid-based batteries, lithium-ion-based batteries, and sodium-based batteries. Of the three, sodium-based batteries are not fully commercialized.



***BESS indoors***



***BESS outdoors tied to wind and solar***

While technology continues to advance, one key issue continues to plague this industry. Batteries suffer from deterioration over time. This is also called ageing, or more specifically, cycle ageing. This is caused by the constant charge-discharge cycles that occur. Ageing can cause overheating, and in some rare cases, possibly fire. One way to battle this issue is to keep the BESS in its own enclosed facility, but

that as well as extensive fire suppression is generally cost-prohibitive, making the purpose of the battery storage less appealing. This is not to say that all battery systems for this utility-scale will catch on fire. It's not very common. But, the obvious problem that comes to the forefront is NIMBY – Not In My Back Yard. Nobody wants even the remote possibility of a fire billowing large amounts of smoke to be near a residential or populated area.

### Our Advantage

Something that we have as an advantage is our size. We are a base-load power generation technology, but with an extremely small footprint. What this means is that our overall system design for a complete WtE facility, allows us to set these facilities up in many more locations.

But first, a quick detour. We're fully aware of the environmental issues related to power generation. We are proud to be able to offer environmentally friendly operations due to the lack of any harmful emissions from our system. We are a technology that is known as a small emitter, meaning that the volume of CO<sub>2</sub> that comes from our process is less than 7%.

However, even with that small volume of CO<sub>2</sub> emitted, we can offer a means of being a net zero power generator. We can achieve that in a manner not available to current power plants, mostly due to their size. The other reason for such low volumes of CO<sub>2</sub> is simply the design of our vortex chamber.

Many thermal systems that produce some type of exhaust require exhaust scrubber equipment that is not only costly, but physically very large. In our vortex chamber, there are two phases; the first is the virtually immediate destruction of combustible waste materials. The second is a process where residual ash material which is still combustible, gets caught up in the 90mph, 2,000°F vortex, acting like a typical exhaust scrubber, but occurring on the inside of the vortex chamber.

Because of our smaller system size, will use a compound named monoethanolamine (MEA). In our carbon capture method, we will pass the emissions from our vortex unit through the MEA (which is a viscous liquid material), which “collects” the CO<sub>2</sub>. As the MEA is later boiled, it gives off the CO<sub>2</sub> which is collected and stored. In essence, it’s like creating a still for capturing the CO<sub>2</sub> gas.

### Our Bright Idea

As you can see by our desire to reach a net-zero power generation, we are extremely focused on providing clean, sustainable energy. In developing these leading-edge technologies, we need to be adaptable to the market needs, which includes not always being a base-load generation, but using battery storage to offer an enhanced supply of power to the grid.

Our idea is to initiate a total WtE facility with complete power management and distribution. We will achieve that with three options by:

1. *...installing WtE facilities with BESS systems, in landfills around the country.* There are currently nearly 2,000 active, and over 10,000 closed landfills in the U.S. If a battery storage system were to catch fire, it would not be near any populated area, and easily contained.

Landfill reclamation is the process of reclaiming the land in place of a landfill for other uses. With current technology, the only things that can be built on top of a reclaimed landfill are parks and golf courses. This is because in only digging up the buried waste materials and then chemically neutralizing it, there is still a threat of methane leakage. With our method, the land is dug up, we separate the dirt from the waste, and then completely destroy the waste materials, and clean fill can be brought in. With this method we are not only expanding the use of BESS systems, but after the reclamation is completed, structures and buildings can be built over the old landfill.

2. *...installing WtE facilities with BESS systems, in coal mines throughout the U.S.* One issue that hampers the coal industry is not being able to properly close down a mine, since it contains residual coal, also called coal fines.

Coal fines can’t be used in typical coal-fired furnaces because of their higher levels of SO<sub>2</sub>, or sulfur dioxide. Our technology can easily and at a relatively low cost, install scrubbers. In addition, there is very little value in the coal fines other than burning them, so coal mine owners find that the value proposition is very low. Like the landfill option, coal mines are extremely remote and not close to populated areas.

3. *...installing WtE facilities with BESS systems at closed military bases in the U.S.* In the U.S., there are more than 350 closed military bases. These were realigned and closed with the BRAC Commission in the 1990s. Through a program called Phoenix Base Project, a non-profit corporation, these bases can be reopened and repurposed. Each base could have a complete WtE facility, and while they may have some inhabitants once they are reopened, they are still a remote site, and perfect for adding a BESS system.

### Implementation

As we touched on earlier, we are using our contacts and connections with research groups through various universities and colleges around the country, to implement a unique process for research and development. As part of an ongoing program, we are establishing an alliance comprised of some of our top minds from various universities, governmental



agencies, as well as innovators and entrepreneurs that can provide valuable resources. The purpose and goal is to once and for all develop or enhance technologies that can make a **real** difference in how we provide environmentally safe energy while also strengthening our economy.

Over the past years, we have been talking to lawmakers at local, state, and federal levels, proposing two simple steps that will ensure that our energy programs are addressed properly:

1. Allow for fast-tracking of all issues related to alternative or renewable energy programs, such as permits, legislation, funding, and more. This will ensure that these critical issues no longer get bogged down in the mess of bureaucratic red tape.
2. We also propose that alternative energy programs be given the same tax benefits that are currently only provided to renewable energy. This will encourage new technologies to emerge or be discovered, that could make a real difference in our desire for:

Energy Independence  
Economic Strength  
Environmental Security



### Show Me The Money!

To best understand what the available market is on just the three vertical markets we are talking about here:

- ✓ *Landfills:*  
 $1,500 + 10,000 = 11,500$  sites  
 $11,500 \times \$10 \text{ million} = \mathbf{\$115 \text{ billion}}$
- ✓ *Coal mines:*  
 $300$  available mine sites  
 $300 \times \$10 \text{ million} = \mathbf{\$3 \text{ billion}}$
- ✓ *Closed U.S. military bases:*  
 $350$  available base sites  
 $350 \times \$10 \text{ million} = \mathbf{\$3.5 \text{ billion}}$

If we only put one WtE facility at each site, it would be a **\$121.5 billion** market.

### In Summary

Sometimes, life altering moments don't come in the form of a brand-new piece of technology, but rather from blending things together to create something incredible. That is exactly what we have with our **Bright Idea**.

When two or more technologies are joined together, not only do you get a great solution to an issue, but you can also do something else. We refer to our vortex technology as having synergy – where the results are greater than the sum of the parts.

In this situation, integrating state-of-the-art battery systems into a WtE system, we again achieve that synergy. We aren't just solving one issue, but we are solving several:

1. Performing landfill reclamation in an environmentally friendly manner, allowing the land to be used for a wide range of development.
2. Reopening and repurposing closed U.S. military bases around the country.
3. Helping the coal industry to be able to use residual coal in a way that was not available to them previously.
4. Helping to enhance the BESS systems market, and allowing for wider use of this amazing technology that is only now on the cusp of becoming a widely used concept, but one that has been needed for these applications, and many others.

### Contact Us

For more information about these concepts, our **ThermoMAX™** Series Thermal Vortex System, or any of our programs such as our legislative efforts, please contact us at the following:

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