



By Matt Ottinger

CHARGING AHEAD

Battery Storage Advances Provide a Jump Start

Lithium ion. Lead acid. Redox flow.

While these may sound like intriguing names for burgeoning heavy metal bands, they are actually some of the more commonly used types of batteries.

Batteries have taken on a critical role as energy storage becomes the generator that illuminates the United States and other civilized nations. David Roberts, president of the Battery Innovation Center (a non-profit innovation lab in the WestGate@Crane Technology Park) reveals battery evolutions are becoming much more ubiquitous in daily life and a resurgence of investment capital is flowing back into energy storage.

“People are finally understanding energy storage becomes an enabler for other things – just like the Internet of Things becomes an enabler of other things,” he says, pointing to the crossover of battery development into the tech sector.

Roberts notes battery applications are not just in transportation, but drones, wearables, microgrids and even agribusiness as large farming operations begin to enlist battery-driven robot vehicles.

Sunnier days for storage

Indianapolis Power & Light Company (IPL) and its parent company AES Corporation are taking an all-of-the-above strategy on energy production and battery storage is a critical component in the effort. IPL has earned international accolades from the Edison Electric Institute for its Advancion Array platform – the first grid-scale, battery-based energy storage system in the 15-state Midcontinent Independent System Operator (MISO) region.

IPL is now using AES’ Advancion 4, the fourth generation of this technology. Richard Benedict, the company’s director of project development, explains the latest iteration stems from lessons learned from previous models and can instantaneously match supply and demand of electricity. An IPL statement also reports it helps balance out intermittent resources like wind and solar energy.

“The batteries are like a Swiss Army knife; they can do a lot of different things,” he notes, adding the lithium-ion batteries used are similar to those found in a Chevy Volt or Tesla Model 3. “Here in Indianapolis, we’re providing primary frequency response, but in other places the Advancion system is providing capacity and storage of renewable energy and backup energy for the grid.

“The Advancion system is in four continents and now the figure is close to four million megawatt-hours (of delivered service), so it’s really about taking these products and adapting them to what customers need,” Benedict adds. “For example, in Chile the grid stretches out for a long distance in a remote area. You have these long transmission lines and if you lose something, you might have a problem in that local area.”

IPL has deployed almost 100 megawatts of solar energy through nearly 40 solar farms in the last several years. Indianapolis was also recognized by the Environment America Research & Policy Center as being the city (behind Honolulu) with the second highest amount of solar panels installed per person.

Benedict projects drastic decreases in the use of coal and oil in the region and hopes regulations can keep pace with battery storage progress.

“I think the biggest thing is you have to have the right regulations in place,” he asserts. “Batteries can do a lot of things. The rule shouldn’t be: ‘To be a generator, you have to look like a classic coal plant or natural gas plant.’ If you can put a battery somewhere instead

of a transmission line, you should be able to put a battery in.”

Lead is not dead

When the average Midwesterner hears about lead, it’s often in a negative context. Lead pipes poison Flint, Michigan and tainted water troubles East Chicago. Lead has also been deemed a scourge in paint, plates and much more.

Yet lead acid batteries, which power not only modern automobiles but also cell phone towers, large data centers and many industrial applications, should not be met with the same scorn, according to Terry Murphy, president and CEO of the Hammond Group.

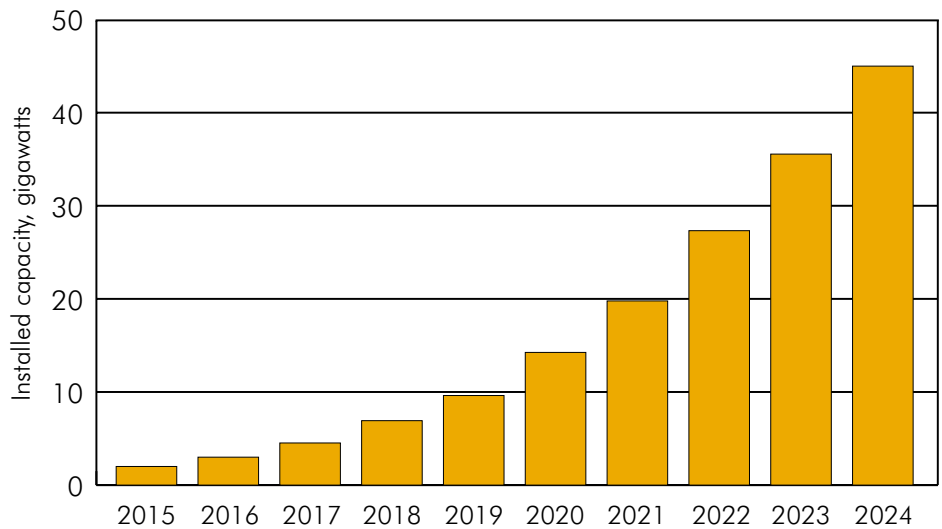
Hammond Group, which has two facilities in Hammond and others in Pennsylvania, Asia and Europe, focuses on advanced chemistry and making batteries better using additives, advanced carbons and other materials that help batteries charge.

“Lead makes sense in a battery,” Murphy explains. “What’s interesting is that lead acid batteries are the most recycled consumer product on the planet, which I don’t think people appreciate. The lead acid battery in your car came from another lead acid battery. The plastic, the acid in the battery and all the lead – 99% of that battery goes into the next battery. It’s an amazing technology because it’s so sustainable.”

According to Battery Council International (BCI), experts estimate that 80% of lithium-ion batteries will end up in landfills. BCI awarded Hammond Group with

Battery Boom

Global energy-storage capacity is forecast to increase 15-fold by 2024



Source: Bloomberg New Energy Finance

its 2016 Innovation Award for the company’s advances in battery chemistry – namely in charge acceptance and cycle life.

“When your phone’s halfway down, you can plug it in and in about half an hour it’s back to 100%,” Murphy explains, describing the concept of charge acceptance. “Lead acid batteries historically haven’t worked that way. If your battery’s getting bad, you might put a trickle charge on it overnight and hope it’s good in the morning.”

Hammond Group develops mixes with additives, known as “expanders,” that have

advanced carbons and materials added into the paste that allow batteries to behave more like lithium ion and charge quickly.

“We also worked to increase cycle life so the number of charges it could take dramatically increased,” Murphy adds.

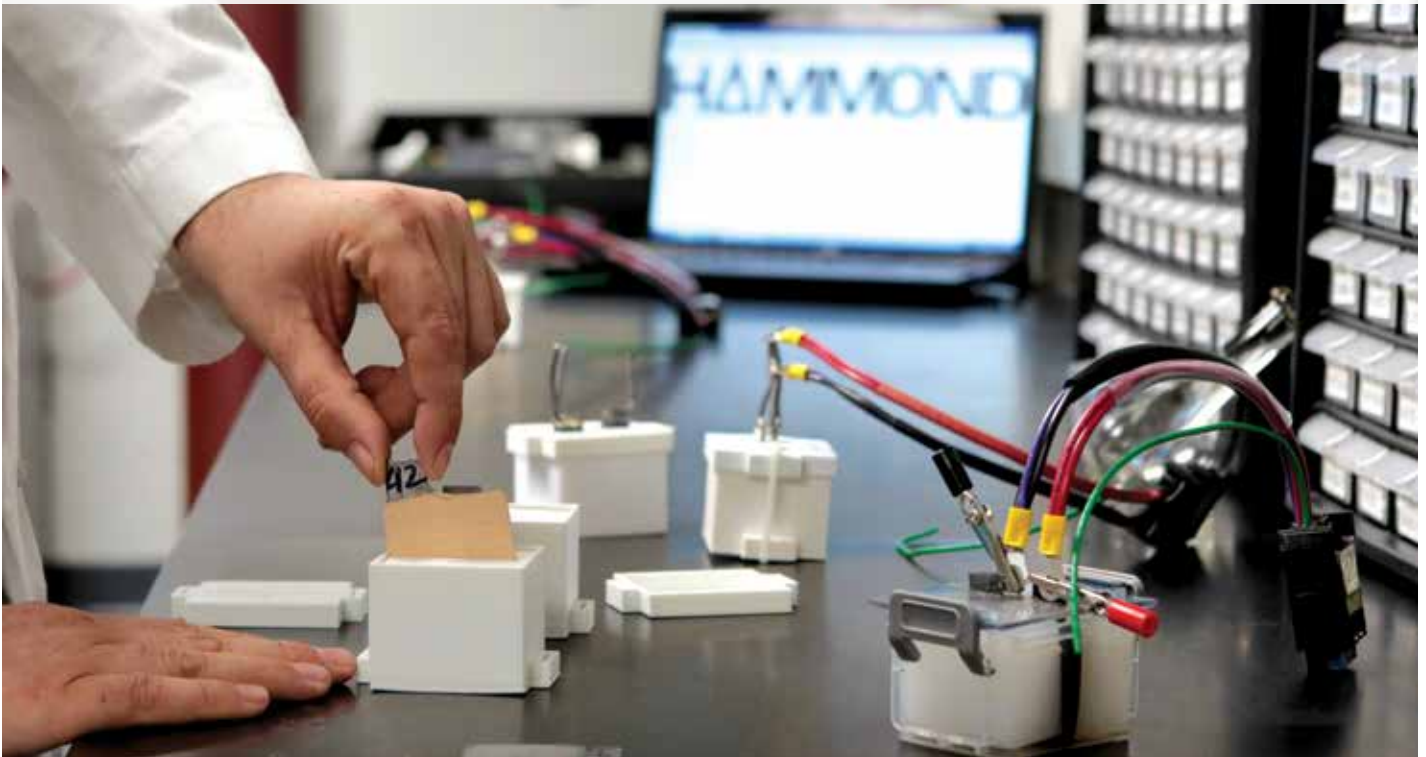
He asserts lithium-ion batteries have also fallen short of performance projections in hybrid automobiles.

“That’s still with the federal government subsidizing a hybrid automobile up to \$7,500 (via a tax credit),” he points out. “That’s a lot of taxpayer money and there’s still no



An engineer performs tests in the Battery Innovation Center lab, while lithium-ion batteries help Indianapolis Power & Light continue to revolutionize energy storage.

Hammond Group improves battery life by creating optimal additive mixes, striving to get the most out of lead acid batteries. CEO Terry Murphy welcomes a diversity of models in the effort to maximize energy efficiency.



elasticity in that marketplace. The reality is the lithium-ion battery is just too expensive. And if they run out of life, the problem is it's not for the entire life of the automobile. So if the battery pack costs you \$10,000 to replace, it may cause a premature end of life on the entire asset."

Enhancements in powertrains and usage of superchargers could be a breakthrough in maximizing potential of lead acid batteries, in Murphy's opinion, as development is currently underway with several car manufacturers. He foresees affordable "true hybrid" cars that combine torque, acceleration and high gas mileage in the near future.

Feeling the flow

Flow batteries, which are rechargeable and use electrolyte liquids and electrochemical cells, are another avenue for automobile enhancement. Purdue researchers have developed the "Ifbattery," an instantly rechargeable battery that could revolutionize hybrid and electric vehicles. The innovative aspect of the battery is that it lacks a membrane.

"Membrane fouling can limit the number of recharge cycles and is a known contributor to many battery fires," says John Cushman, Purdue professor and Ifbattery LLC co-founder, in a statement. "Ifbattery's components are safe enough to be stored in a family home, are stable enough to meet major production and distribution requirements and are cost effective."

A benefit, according to researchers, is these batteries would not require recharging stations and the infrastructure redevelopment that goes along with their construction. It would use an energy storage system that would enable drivers to fill up their electric or hybrid vehicles with fluid electrolytes.

Powerhouses

Households of the future could soon be taking a more independent

approach to power. This concept became more mainstream when Elon Musk unveiled Tesla's Powerwall technology to the public in 2015, in which a rechargeable lithium-ion battery is attached to a home (and ideally paired with a solar panel system).

"That's frankly not new technology," Roberts reveals. "It's just that Musk has a way to make things much more sexy and attractive. But I'd say the big change is we've gotten much better PR for what storage can do."

This distributed storage concept augments the benefits of placing energy closer to the consumption site.

"I think home energy storage is a major development with the ability to microgrid – the ability to detach from the main grid and be able to sustain your base activities using storage on site," Roberts proposes. "It's basically like being able to turn off city water and go to well water in the event of a disaster."

He predicts that savvy home buyers may soon include batteries as a "must-have" in search criteria.

"I think you'll see more houses with batteries on site and maybe in 10 years when you look at a house, you'll ask if it has its own energy storage unit already in place or not. More consumers will demand it when they understand the security and peace of mind it can provide at home."

Roberts believes the evidence of battery advancements rests in our hands – and at our feet – each day.

"You're seeing changes in a day-to-day aspect with your phone; the iPhone 8 has battery performance light years ahead of where it was two generations ago," he concludes. "In five to 10 years, you'll see batteries in smart transportation – far more hybrids, if not completely electric. Even if you argue (Corporate Average Fuel Economy) standards will be relaxed, I think the issue of being less reliant on fossil fuels and foreign oil from a security standpoint will be more important."

RESOURCES: Richard Benedict, Indianapolis Power & Light Company, at www.ippower.com | Terry Murphy, Hammond Group, at www.hmndgroup.com | David Roberts, Battery Innovation Center, at www.bicindiana.com