

# 10 OF THE BEST

## Storage system integrators

**Storage integration** | Our team profile 10 of the leading global system integrators working in energy storage today. This is a handful of the names that are designing systems, solving problems, executing projects and shaping the industry around us. By: Andy Colthorpe and John Parnell with Tom Kenning, Danielle Ola, David Pratt and Liam Stoker

### S&C Electric

Founded in Chicago in 1911, S&C Electric Company has a long history of providing system integration services across a range of electric power systems. It began working with energy storage more than a decade ago and now has 189MWh of battery storage projects worldwide.

Its three core products offer scalable energy storage products for a number of applications, including what is thought to have been the US' first and largest solar storage project to stack revenue streams and build the case for storage.

S&C's 7MW PureWave SMS Storage Management System was used to provide fully integrated storage management and power conversion for 3MWh of lithium-ion batteries, connected to Half Moon Ventures' (HMV) 4.2MW solar plant at the village of Minster in Ohio.

It allowed HMV to bid into the PJM frequency regulation market, providing grid reliability for more than 60 million customers, while Minster was able to defer US\$350,000 of transmission and distribution costs. The award-winning project also provides backup power and shaves the peak demand of the village.

The company is also heavily involved in the development of micro-grids and off-grid technologies. Past projects. This includes upgrading Santa Rita Jail near San Francisco to a fully functioning micro-grid using on-site generation; an advanced micro-grid in Texas for utility Oncor and its 10 million Texan customers; and using the off-grid technologies to bring power to two schools in Zambia.

Last year S&C acquired all outstanding common shares of intelligent micro-grid control systems company IPERC to help it continue this work.

Engineers at S&C's Europe, Middle East,

and Africa business unit are based locally in the UK, with vital system parts stored centrally. S&C says this helps it maintain system uptime of greater than 98% and deliver a high standard of service for its customers.



### Renewable Energy Systems Group

With a history that stems back more than 25 years, Renewable Energy Systems Group – more commonly known as RES – lays claim to be the world's largest independent renewables company. With 12GW of renewable generation under its portfolio and offices in 15 countries, its stated aim is to lead the global transition towards clean power generation with an emphasis on wind, solar, storage and transmissions infrastructure. Revenues for the year ended 31 October 2015 amounted to £107.3 million, a staggering 131% year-on-year increase on the £46.4 million it recorded in 2014, however its operating loss also grew throughout the year as the group's cost of sale proved prohibitive.

RES completed its maiden UK-based utility-scale storage facility last year, deploying a 300kW/640kWh BYD-developed battery on the site of a 1.5MW solar park in Copley Wood, Butleigh, constructed by UK solar stalwarts British Solar Renewables. RES acted as the EPC on behalf of local grid operator Western Power Distribution, which used the battery and the solar farm with which it's co-located to deliver various ancil-

### S&C PureWave storage and PV arrays



### A RES project for frequency regulation near Chicago taken during construction

lary services. It has been funded through the UK energy regulator Ofgem's Network Innovation Allowance to test the commercial feasibility of similar co-located projects.

RES also offers its 'RESolve' suite of operations and management tools to battery storage projects it develops, offering to optimise asset operation owing to particular performance parameters or revenue streams available. The software communicates with the battery via SCADA systems to optimise for separate load-shifting and frequency services, while also incorporating forecasted generation outputs when co-located with renewables.

To date, RES has developed more than 140MW/92MWh of battery storage projects in three countries including the UK, Germany and the US, which has seen the bulk of its storage deployment so far. The company has a further 200MW of battery storage in its pipeline, including several projects in the UK.

### Nidec

Heavy industrial manufacturer and system integrator Nidec ASI functions across a range of sectors from petrochemicals to steel. The company was created when Japanese parent Nidec acquired the Italian firm Ansaldo Sistemi Industriali in 2012.

In November 2016, the company installed and commissioned what was then the largest utility-scale project in the world.

## The West Burton project

<b>Customer:</b>	EDF Energy Renewables
<b>Location:</b>	Co-located with the West Burton gas-fired power plant, Nottinghamshire, UK
<b>Contract price:</b>	£7 (US\$8.77) per MW per EFR/h
<b>Contract length:</b>	15 years

The 90MW project was comprised of six 15MW Nidec systems using LG Chem batteries. The site provides frequency regulation and voltage control for the German utility Steag. The investment was rumoured to have topped US\$100 million.

Its most eye-catching project win in the energy storage space in the UK came when it partnered with EDF Energy Renewables for the 49MW/34MWh system that the French utility won as part of the UK's enhanced frequency response (EFR) auctions. Nidec is providing the batteries and the power conversion system for the project in West Burton, Nottinghamshire (see box, above). The deal saw the company take its market share in the UK at the time to 33%.

The company has gained a reputation as a giant provider of giant battery energy storage systems and is surely in a strong position to continue reaping the rewards as energy storage tenders proliferate.



Credit: Nidec

### Siemens

The German industrial giant has been active in the power electronics market for some time and its energy storage business has been accelerating at a rapid pace since 2014. Back then, the company established a partnership with battery manufacturer LG Chem. Siemens said at the time that it hoped the arrangement would enable the pair to "accelerate their dominance" in the energy storage market.

The company has been winning business in Italy, via a tie-up with utility firm Enel, the UK and of course in its native Germany. It has also delivered a smart-grid pilot for 20,000 homes in Rotterdam. While Siemens has enjoyed much success on its own, it is also about to become one half of a new entity that could be well placed to dominate.

In July, Siemens formed another partnership, this time with power distribution company and project developer AES. The

**Andrés Gluski,  
president and  
CEO of AES at the  
launch of Fluence**

**Siemens in-house  
hardware, the  
Siestorage system**

two created a joint venture company, Fluence, which will offer hardware from both parties as well design, engineering and system integration. Between them they have completed almost 500MW of energy storage systems and will leverage the scale of Siemens to operate in 160 countries.

"As the energy storage market expands, customers face the challenge of finding a trusted technology partner with an appro-



Credit: Siemens

Credit: Siemens

propriate portfolio and a profound knowledge of the power sector. Fluence will fill this major gap in the market," said Ralf Christian, CEO of Siemens' energy management division at the time of the launch.

### Greensmith Energy

The US firm has installed almost 200MW of energy storage since its inception in 2008. The lion's share is in its domestic market with a handful over the border in neighbouring Canada and a double-digit number of installs in Australia.

Greensmith was among the firms to deliver projects at breakneck speed in response to the Aliso Canyon gas leak and the urgent tender that followed. The design, integration and installation of the 20MW/80MWh energy storage system took less than four months.

Of the more than 180MW installed by the company, 130MW was completed in 2016, an indication of the sector, and the

company's current trajectory.

"There's no question 2016 was another record-setting year for Greensmith and the energy storage industry as a whole, particularly from a grid-scale perspective," said John Jung, president & CEO of Greensmith Energy. "As the industry begins to grow and expand, Greensmith has seen rapid transition from test systems and pilots to bankability and ROI over the past eight years. As perhaps the largest provider of energy storage software and turnkey systems to some of the largest power companies in the world, coupled with tier-one battery and PCS vendor relationships globally, Greensmith enjoys a holistic view of the entire market."

In July 2017, Finnish power company Wärtsilä completed a US\$170 million acquisition of Greensmith.

### NextEra Energy Resources

One of the US' biggest deliverers of energy storage systems is a subsidiary of Fortune 200 energy company NextEra Energy and sister to utility Florida Power & Light. Between them the latter two have PV pipelines to the end of 2018 of 403MW and 600MW respectively.

The company has also developed, constructed and operates energy infrastructure projects that include more than 90MW of energy storage.

Nearly all based in the US, with a couple of exceptions in Ontario, Canada, notable projects to date include a 20MW/10MWh installation serving the PJM service area's frequency regulation market completed in 2014 in Illinois.

Since then NextEra Energy Resources has developed or constructed multi-megawatt projects in Pennsylvania, Maine, Arizona, New Jersey and California. With the exception of the 14MW California project, all of these plants serve front-of-meter grid or network services markets.

In May it was announced that a 30MW/120MWh energy storage system coupled with a 100MW PV power plant being built by NextEra for utility Tucson Electric Power in Arizona could deliver energy at a historic low price. The utility will be able to source renewable power for less than three cents per kilowatt-hour from the combined installation for a 20-year period – although this discounts the cost of constructing the storage system itself. Another NextEra US project worth mentioning is a 5MW/40MWh system being built near Long Island, New York, to deliver stored energy to a substation close to a 90MW wind farm.

**Nidec's project  
for Steag was the  
largest in Europe  
at the time of  
completion**

## Greensmith in numbers

<b>16</b>	The number of batteries the company has experience working with
<b>14</b>	The number of inverters the company has experience working with
<b>1</b>	The company's claimed market position
<b>180MW</b>	Greensmith's total installed capacity
<b>1/3</b>	The proportion of energy storage in the US delivered by Greensmith in 2014
<b>4</b>	The number of months needed to install a 20MW/80MWh system in California

## AES

Arlington, Virginia-based AES Energy Storage, a wholly-owned subsidiary of the Fortune 200 global AES Corporation Group, was responsible for the first ever grid-scale advanced battery storage solution in commercial operations in 2007. It has delivered several multi-megawatt projects based on its Advancion Li-Ion platform in the past couple of years, in countries including the Netherlands, Northern Ireland and the US.

AES has 476MW of interconnected energy storage deployed, under construction or in late-stage development. Company president John Zahurancik recently said it took AES nine years to reach 118MWh of projects, yet in just six months of 2016, AES Energy Storage was able to deliver 120MWh of energy storage.

### Timeline of achievements:

- Indiana, 2008 – AES introduced the first grid-connected lithium-ion batteries
- PJM, 2008 – AES introduced the first grid battery compensated within a power market
- New York, 2009 – AES introduced the first battery qualified as a generator by the Federal Energy Regulatory Commission (FERC)
- West Virginia, 2011 – AES received the first storage private letter ruling to allow it to be paired with renewable generation under the ITC
- Chile, 2012 – AES was the vendor for the first lithium-ion battery project financed with a power station
- California, 2014 – AES secured the first long-term PPA for a grid battery, a 20-year PPA for Southern California Edison
- Philippines, 2015 – AES breaks ground on the country's first ever battery-based energy storage facility
- Northern Ireland, 2016 – AES completed the UK's biggest battery-based energy storage array
- California, 2017 - AES announced the financial close of a US\$2 billion project in California combining more than 1GW of gas generation with 100MW of energy storage
- Global, 2017 – AES launched an energy storage tech and services JV with Siemens called Fluence

## Yunicos

From self-confessed origins as “solar hippies from Berlin” with the corporate slogan “Let the fossils rest in peace” and a sign at their headquarters informing visitors that they

are “...leaving the CO2 producing sector of the world”, Yunicos is explicit in its intentions but has never let idealism prevent it from also being a serious business entity.

The company delivered Europe's first ‘commercial battery park’, a 14.5MWh grid-balancing system for WEMAG in Germany. In 2016, over 75MW of contracts were awarded to the US-German system integrator, including a 49MW battery storage system in the UK for utility giant Centrica. Yunicos has installed over 200MW of systems and has a claimed 1.2GW pipeline over the next two years.

The company was bought out for US\$40 million by power generation equipment hire company Aggreko earlier this year. We have yet to see what impact this will have, but Yunicos has said that it enables the company to scale up its efforts, and quickly.

One of the earliest to recognise the importance of revenue stacking, using battery systems for multiple applications and therefore multiple value streams, Yunicos has also been involved in a range of island grid projects, with perhaps the most celebrated among them a ‘grid-forming’ multi-megawatt installation on the Portuguese territory of Graciosa that reduces the island population's reliance on diesel by two-thirds.

The company has also launched its own range of energy storage hardware, power converter unit and a standalone, easily deployable storage solution called the YCube.

## NEC ES

As of the beginning of this year, the Massachusetts-headquartered energy storage development and manufacturing subsidiary of Japanese IT and network integration firm, NEC Corporation, had installed and commissioned around 120MW of grid-scale energy storage (GSS) installations delivering services such as peak shaving, renewables integration, frequency response, frequency regulation and voltage regulation across Europe, Asia and South America. In total, NEC Energy Solutions has in excess of 250MW of storage systems installed, under construction, or in the contracting phase around the world.

The company provided major utility Southern California Edison (SCE) with its first grid energy storage pilot system under a procurement programme established in 2015, while its largest installed system to date stands at 32MW/8MWh in Elkins, West Virginia.

The company has claimed some other

big project wins this year, including a 48MW/50MWh system in Germany with Mitsubishi and Eneco, set to begin operation in December 2017 and a contract with UK developer Low Carbon for the construction of 50MW of projects supplying frequency response services.

“Some companies call us an energy storage EPC; that seems to fit fairly well,” Roger Lin, NEC ES director of marketing said, comparing the company's role in integrating and procuring technologies and sites to an EPC's job in a “traditional generation plant”.

“What we say is that we're an end-to-end solutions provider for energy storage systems for the electric grid.”

## LG CNS

The information services subsidiary of the South Korean mammoth LG Corporation is most active in the field of large-scale public infrastructure IT network implementation but is also involved in a dizzying array of other business sectors.

Along with solar, wind, fuel cell and smart city project development, one of those other areas is energy storage systems. Within its own domestic market, the company lists 85MW / 85MWh of projects completed to date. These include three substation projects in Nongong (36MW), Uiryong (24MW / 8MWh) and Shin Youngin (8MW).

Also of significance are three commercial energy storage projects delivered to fellow LG Group company LG Chemicals in South Korea, designed to reduce grid energy usage and peak demand, including a 3MW/27MWh plant in Iksan and a 4.5MW/21.3MWh plant in Ochang.

As might be expected, LG CNS has a partnership agreement in place with LG Chem – which is a clearly separated part of the group – for battery supply. LG Chem is supplying 40MW of batteries for two systems LG CNS is developing and constructing, one of 24MW and the other 16MW, for frequency regulation and renewables integration respectively, on the US island territory of Guam, announced in May this year. The Guam systems will utilise LG CNS' energy management system (EMS) in conjunction with the lithium-ion batteries.

LG CNS appears to be looking to expand its footprint abroad, seeing the Guam project as a strategic opportunity to get closer to the US markets and Australia due to the island territory's geographical and political ties. ■