An aerial photograph of an offshore wind farm. In the foreground, a service vessel with a red cabin and a flag is moving across the water, leaving a white wake. To the right, a large, cylindrical turbine nacelle is being transported on a barge. The water is dark blue with shimmering sunbeams reflecting off its surface. In the background, a long line of wind turbines stretches across the horizon under a clear sky.

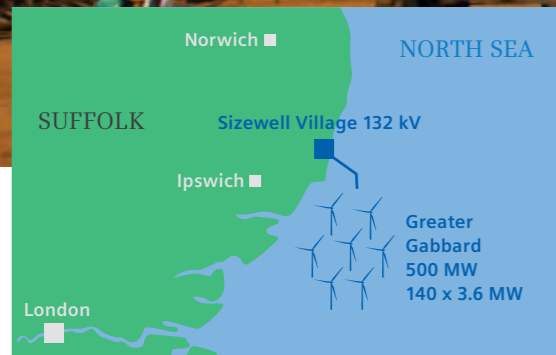
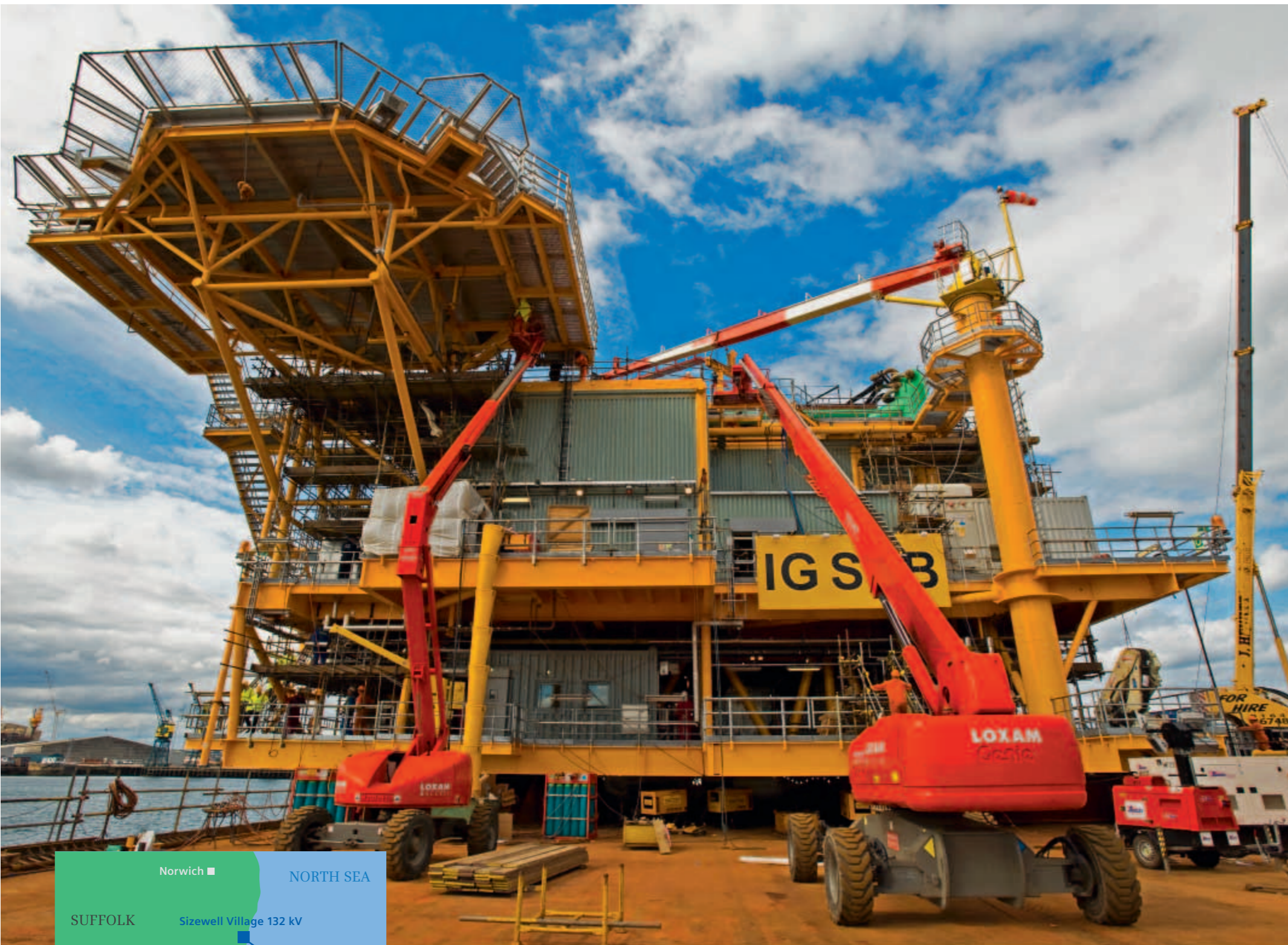
*"Calm at sea! The sunbeams flicker
falling on the level water and
athwart the liquid jewels ploughs
the ship her emerald furrow."*

Winds of Change for Renewable Energy

So wrote the illustrious German poet Heinrich Heine of the North Sea. Perhaps the Germans have always been able to bring a positive attitude to these waters, famed more in Britain for their grey hue and bad weather. By harnessing their power for what will be the world's largest offshore wind farm, Siemens Energy will connect an important renewable source of electricity to the grid of the UK.

By Daniel Whitaker

When completed, the Greater Gabbard installation will look a lot like this offshore wind farm in Lillgrund, Sweden.



Greater Gabbard offshore substation – main platform with a weight of 2,000 tons. Rollout party at Hartlepool and preparations for shipping to the offshore position.



Greater Gabbard onshore substation at Leiston: power quality for grid access of world's largest wind farm – components for three SVC Plus systems "under construction."

Photos: Ian Berry/Agentur Focus
Graphic: independent Medien-Design



Construction site at Leiston with two of three compensation circuits. The substation connects the 132-kV AC sea cables from the offshore platform with the grid on the mainland.

Certainly the North Sea has always linked the UK and Germany, allowing trade and the Anglo-Saxon migration that created one-half of British culture. The British Royal Family also made this maritime crossing, after leaving their home in Hanover for several generations of new employment at Buckingham Palace. Today, the North Sea represents both a great resource and a devastating threat for the two countries. The opportunity lies in what Heine called “the uncouth North wind” and how it can be harnessed to generate electricity. Prime Minister Gordon Brown has enthusiastically called for a massive 33,000 MW of new wind-fueled power for the UK by 2020, while Brussels has underscored this by decreeing that a fifth of all EU generation must be renewable by then. The attraction is clear: This power source produces zero carbon emissions, and even though generation is intermittent, the cost of wind power itself is minimal. And more specifically, the British Isles are famously windswept: 40 percent of the wind potential of the European land mass is in the UK, and its surrounding seas are gustier still. But the danger associated with this same stretch of sea is just as evident. Unless renewable energy replaces

our current reliance on fossil fuel, both the east coast of Britain and the north coast of Germany will join other parts of the planet vulnerable to a future of rising sea levels. All of these issues come together 25 kilometers off the coast of the English county of Suffolk in that same North Sea, where Siemens is building what will be the world’s largest offshore wind farm, Greater Gabbard. Some 140 giant turbines each reach 130 meters at blade tip – almost half the height of the Eiffel Tower – and cover an area the size of Birmingham or Munich. They can rotate 360 degrees, as well as tilt up and down, in order for their great blades to catch the winds that whip up over this stretch of water. Acting through the generators inside each turbine, 504 MW of power can be produced, transforming on two great sea platforms into a voltage of 132 kV, and then exported through undersea cables to the mainland. Back on the Suffolk shore, a substation, combined with compensation equipment, will ensure a safe connection to the UK’s national electricity grid. The destination of much of the flow will be 120 kilometers southwest: electricity-hungry London, where it could provide clean energy to over 280,000 homes. Together, these links

will also amount to the world’s largest sea-land grid connection. On the other side of the country, an optimistic John Willcock sits at his desk in Siemens’ Manchester base. His office has just been confirmed as the company’s first center of competence for offshore grid connections outside of Germany, and he’s quick to point out that the collaboration from the Power Transmission team in Germany has directly led to the UK’s success so far. “We’re at the start, the exciting bit,” he says. The government’s 2020 renewable obligation has given a strong impetus to offshore wind farm plans around the British coast. Rob Hastings, the UK Crown Estate’s Director of Marine Estates, seems to agree. He has offered up leases on designated seabed on behalf of that same Royal Family that came over from Hanover, and admits that “wind energy is the only renewable technology that can deliver the required quantity by the required timescales.” All of this new capacity needs to be connected to the existing grid, which is currently set up for inland fossil plants, not to take in power along the more sparsely populated coast. That means a great deal of new investment in connections and high-voltage transmission networks, and John Willcock, Director of Major Projects for Transmission for Siemens, and his team are the people to help make that happen. While Willcock feels “there’s momentum now,” Greater Gabbard will still be an important test case. Siemens has the chance to show what it can do – bringing together skills from work on oil and gas platforms in other stretches of the North Sea, experience with onshore substation design, construction and connection, and over a century of playing a major part in the British electricity sector. There isn’t another company in the UK that spans the spectrum of energy production in this way. At Greater Gabbard, most of the components are provided by Siemens. The main external-sourced sub-supply are the two offshore platforms, which are manufactured

and commissioned from UK manufacturers in Hartlepool and South Shields. The remote surveillance systems that will monitor the turbines and the collector substations on the platforms come from the Siemens Industry sector.

Managing Challenges and Risks

A few desks away from Willcock’s office, project manager Anwer Amara-Korba says Greater Gabbard is his “biggest and most complex challenge so far” in a successful decade with Siemens since cutting his teeth in Algeria’s gas industry. His experienced team brings specialist engineering talent from well beyond Europe. Ahmed Shafiu, for example, who manages the vital interface with the owners of the UK transmission system, National Grid, is from the Maldives. Beyond its human resources, Amara-Korba’s team draws on Siemens’ broad – and proven – technology portfolio. The connection from the turbine is secured with the only modular circuit breaker able to be installed in wind turbines. The team’s interaction with National Grid is eased by prior intensive network and system studies carried out by the Siemens design experts at the Siemens head office for grid connections based in Erlangen, Germany. The transformers are some of the world’s most reliable, built by Siemens in Dresden and Linz. The team itself seems to hum like a perfectly efficient machine. The project is jointly owned by Airtricity, the renewables arm of Scottish and Southern Energy (SSE), and RWE npower renewables, the UK subsidiary of RWE Innogy. They have chosen

Photo: Ian Berry/Agentur Focus, Graphic: Siemens

“Greater Gabbard represents an important step toward the increasing use of renewable energy to meet the UK’s electricity needs.”

Andreas J. Goss, CEO of Siemens UK

Innovation Meets Experience: SVC Plus® Tackles Changing Energy Demands

Three SVC Plus systems are located in the onshore substation at Leiston, Suffolk.

What is SVC Plus?

SVC stands for Static Var Compensation, a technology for power quality in high-voltage systems. Plus is Siemens’ innovative and universally applicable solution for grid access of renewable energies and for enhancement of grid efficiency.

New Power Industry Challenges

Power producers and system operators all over the world are faced with increasing demands for highly efficient power transmission, low-cost power delivery, and high system security (no blackouts).

Benefits of SVC Plus

- Improved dynamic stability of transmission systems
- Increased power quality; reduction of risk of voltage collapse and blackout
- Highly efficient flicker reduction in industrial applications
- Low harmonic generation and low

noise emissions thanks to the use of modular multilevel converter technology

- Increased adaptability for limited space due to compact, standardized component design
- Fast, efficient cost-effective solution
- Reduces time and resources needed for project development, installation and commissioning
- Fewer components mean simplified design, planning and engineering tasks



Outside, a nondescript white containerized solution; inside, high-tech power electronics.

Siemens as their partner for the wind turbines, with Fluor as balance-of-plant contractor, who in turn has engaged Siemens to design and build the grid connection. From his own headquarters in the Scottish city of Perth, Colin Hood, SSE’s Chief Operating Officer, ex-

plains that at a total value of 1.5 billion pounds, Greater Gabbard is the company’s largest generation project ever. “But it won’t be the last of its kind,” he says with assurance. “The nature of the business is changing. We hope for a major project every 18 months.” It isn’t only that Europe is turning from fossil fuels to renewables as an energy source, but also, as Hood says, that “the future lies in joint ventures and long-term relationships.” The amount of funds needed for each major new offshore wind farm and the range of skills required to build them well, combined with those risks that no technological skill can overcome, mean that strong, enduring partnerships are a must. A lot of new

“Nobody has a track record like Siemens in offshore turbines and grid connections.”

Kevin McCullough, CEO of RWE npower renewables

capacity will be needed, and the government will be looking to award generation licenses to consortia that can point to a solid track record in construction, operation and connection. Hood knows that there will always be dangers. He notes that the rolled and welded steel used for the wind turbines required “an armed escort from the Chinese Navy as it sailed from Shanghai through waters favored by Somali pirates – just in case.” But with the right partners, the risks can be minimized and the inevitable problems confronted. The goal is that offshore capacity building will eventually become “more like a conveyor belt – a program of works, rather than individual projects,” says Hood. For both client companies, there was no doubt that Siemens was their pre-

ferred technology partner. “They’re a trusted supplier, and they won’t walk away from issues,” says Hood. His counterpart, Kevin McCullough, Chief Operating Officer at RWE npower renewables, agrees. “Nobody has a track record like Siemens in offshore turbines and grid connections,” he says, adding that he also appreciates their commitment to service.

A Look to the Future, a Nod to the Past

It isn’t just managing financial risk that the companies involved in Greater Gabbard care about. Everyone adheres to the health and safety mantra “zero harm.” High turbines and offshore platforms will always be dangerous workplaces, the very winds that make Greater Gabbard so attractive

also create peril. Ron Smith, Siemens UK’s Head of Transmission and Distribution, knows this from years spent working with offshore oil rigs. “The North Sea can be a dark, cold place so our focus has to be on ensuring our people are safe when working on offshore projects.” He goes on to say, “We are developing remote diagnostic and condition monitoring solutions which will allow 24-hour monitoring at onshore control centers of all offshore installations and which will minimize the need for physical inspections by our service team.”

And the underlying mood is very positive. “It’s an unprecedented time of change,” says Kevin McCullough, while Ron Smith thinks it’s “the most exciting era in my very varied 34 years with Siemens.” And continues, “With such change, our customers are looking for a safe pair of hands and we know we can offer this given the significant experience we’ve gained over recent years. During this time we’ve been working in close and collaborative partnerships with our traditional UK customers and it is a real pleasure to extend that approach to new customers in the offshore sector such as SSE, RWE, Vattenfall and E.ON.”

There is also the possibility that wind will do better than “zero harm” to the environment. Initial reports show that the monopiles on which the turbines rest soon become unique habitats for mollusks and marine life which attract fish.

Jens-Peter Saul, Head of Siemens Energy for Northwest Europe, who oversees all of Siemens’ involvement in Greater Gabbard, says, “We are entering a new energy age.” But his pride goes beyond Siemens being the market leader in offshore grid connections, and wind turbines in Northwest Europe including the UK. Saul adds, “Our customers expect more reliable, economical and environmentally responsible solutions than ever before. During the next decade, the UK grid will undergo structural change to connect renewable energy sources and ensure the government’s 2020 energy



“Greater Gabbard won’t be the last of its kind. The nature of the business is changing.”

Colin Hood, COO of Scottish and Southern Energy

targets are met. Our customers are depending on our technology and our people to increase efficiency and lower their environmental impact, and we’re in a unique position to help them right across the energy chain, from oil and gas production through to power generation, transmission, distribution and metering services.”

Key to the ongoing success of the business is the development of local competency. As Saul explains, “Greater Gabbard is a good example of how building up a strong local team in offshore grid connections as well as our wind turbine business is paying off. We have improved the relationships with our customers as we are able to get closer to them. We are far more responsive, and as a result we are now a clear market leader. Our customers know that they can contract wind turbines and grid connections and that Siemens can provide the systems that will work together as an integrated package. No other supplier can deliver both.” And for all of the future-oriented

aspects of this turn in Europe’s and indeed the world’s approach to energy, there are some close links to the past. Sir William Siemens, another German who crossed the North Sea from Hamburg, was later knighted by Queen Victoria. The Siemens organization that he founded was also a great success in Britain, where he married, is buried, and where he served as personal advisor to the government on the laying of international telegraph cables. Indeed, the UK headquarters is only a few kilometers from Godalming, which in 1881 saw the world’s first ever electric street lighting and its first ever commercial generation of electrical power – organized by Sir William. The Godalming plant was also driven by nature’s power – in this case, a water wheel.

Daniel Whitaker is a London-based freelance journalist who specializes in writing about technology, business and economics. His work has appeared in such prestigious publications as the Financial Times, the Times, the Observer, the Economist and the Daily Telegraph, among others.

Summary

The Rise of Wind

- Across the world, there is growing demand for renewable energy, and offshore wind in particular. The UK will be a major market.

Greater Gabbard

- Siemens is building the world’s largest offshore wind farm in the North Sea, 25 kilometers off the coast of Suffolk, for two client companies: Scottish and Southern Energy (SSE) and RWE npower renewables.

The Role of Siemens

- Siemens was chosen because of its portfolio of products, its reputation for service and reliability, and in particular for its skill at grid connections.

Glossary

■ Compensation System

(Siemens SVC Plus®): A system that uses power electronics, reactors and capacitors to ensure that the power and voltage coming from the wind turbines meet the exact requirements of the UK electricity grid.

■ **Monopiles:** Substructures that each of the 3.6-MW turbines are built on, providing support and stability. Made of steel and hammered precisely into the sand below, they are built to withstand the battering of the tide and winds for decades.

■ Siprotec / Sicam System:

Protection, monitoring and control equipment which can be remotely controlled by the customer, ensuring that all is functioning well both offshore and onshore.

■ Gas-Insulated Switchgear (NX Plus 33 kV, 8DA10 13.9 kV and 8DN8 132 kV):

Compact and maintenance-free switchgear ensure highly reliable distribution of electricity with advanced safety features on both substations.

■ Transformers (132/21 kV and 33/132 kV):

Situated on the offshore platforms and onshore substations, these raise and lower the power’s voltage for more efficient transport of electricity.

For further glossary terms see: www.siemens.com/glossary



Greater Gabbard’s goal: harnessing the power of the North Sea’s fierce winds.

Photos: Getty Images, Scottish and Southern Energy

Further Information

www.siemens.com/energy
www.siemens.com/energy/svc-plus
www.siemens.co.uk/energy