Control centre watches over vast turbine fleet

Iberdrola is controlling everything going on across its 34 wind farms in North America from a single hub in downtown Portland, Oregon, thanks to its custom-made software and dedicated staff. Mark Anderson gains an insight into the state-of-the-art facility

Decked out in soothing colours, ergonomic furniture and computer screens galore, Iberdrola's new North American wind plant control centre appears much like any other ultramodern high-tech office space.

But something unusual is taking place in the building directly across the street from the company's US headquarters in downtown Portland, Oregon. Iberdrola, with six turbine types across the US, is expected to reach a generation total of 5GW by the end of 2010 and the new control centre is an ambitious attempt to command its entire fleet from a central hub.

Such is the interest in the project that the facility has had a steady parade of visitors — often three daily tours since opening early this year — including regulators, independent power producers, original equipment manufacturers (OEMs) and public-broadcasting documentary filmmakers. "There are definitely economies of scale that you can exploit if you centralise things in a particular way," says Iberdrola operations vice-president Kevin Devlin. "So, really, the idea here is to migrate everything on to a common platform."

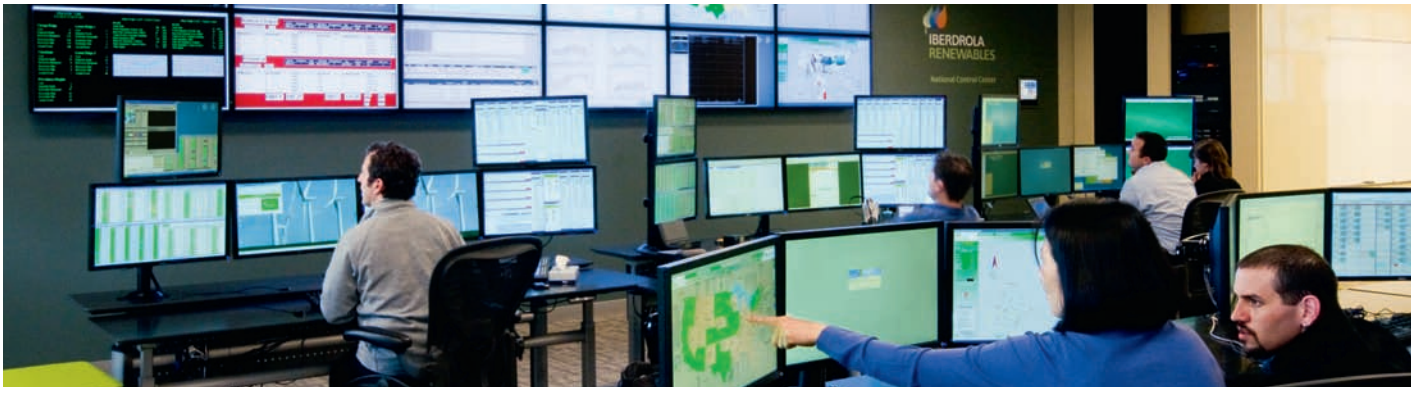
That platform is an offshoot of Iberdrola's pioneering 2006 effort on its home turf in Toledo, Spain. But while the Spanish centre handles more megawatts, the US version must navigate several regional transmission operators, regulatory quirks specific to more than a dozen individual states and federal compliance — all while balancing wind generation across broad coverage areas and assimilating a 600MW co-generation plant the company owns near the southern Oregon border.

While Iberdrola, the world's leading wind developer, will not reveal the new control centre's price tag, the project is something few industry players could afford to pursue. "I'd rather not go there," Devlin says. "But it's not cheap. The biggest investment, really, is the software. There are obviously hardware charges, but we have a huge amount of software."

Taking control

The software is largely developed from scratch. Its basic purpose is to adapt each turbine's factory-installed supervisory control and data acquisition (Scada) system for interface with Iberdrola's precise requirements. "That could be a Gamesa system, it could be a GE system, it could be a Mitsubishi system — and now it would be our system," says Harm Toren, managing director of US operations services and co-architect of the facility. "We're designing these interfaces to be our own. I want to be in control of my own destiny around software upgrades, controls and hardware-replacement programmes. I can't take the risk of the OEMs providing that to me directly, because the risk would be that they go out of business or the technology

{CONTINUED}



Misson control
Iberdrola staff work around the clock to monitor the firm's 2,500-plus turbines

gets old or they charge me too much. We're taking ownership of that."

Overall, the system's expansive fibre-optic network connects a Byzantine maze of substations and transmission lines, sending detailed information to the control centre from Iberdrola turbines in cornfields, on ridgelines and throughout windy land tracts from coast to coast. The system monitors wildlife concerns, including bat studies in Pennsylvania and sensitive avian migratory paths in Texas near the Gulf of Mexico. And it tracks weather patterns — so field technicians can quickly be called down from turbine towers wherever bad weather is brewing.

Hands-on control-centre operation is shared by around a dozen employees. They work in pairs in 12-hour shifts around the clock, covering 365 days a year. These technicians tend, remotely, to more than 2,500 turbines at Iberdrola's 34 wind farms. Training helps prepare recruits to assimilate a dizzying flood of information and make quick decisions — curtailing or resetting turbines, pitching blades, identifying false radar signals and exchanging vast amounts of real-time data with various parties. Mistakes, Toren says, can cost big money. "And they often have to respond and make things happen within a two-minute window," he adds. "You can have all the technology in the world, but without the right management, without the right people sitting at these controls, it will never work."

Room to grow

The facility itself remains a work in progress and is geared for expansion as Iberdrola expects to add between 500MW and 1GW to its yearly North American totals in the near future. An empty back wall offers untapped space for ever more computer screens in an effort to display every aspect of the business — including live income information. "You asked if we have a screen that counts the money," Toren says. "Well, yes, we do — although we probably wouldn't let you see that as you walked in the door."

Field work The control centre gathers information from Iberdrola's 34 wind farms across North America

Security and reliability are built into the centre's design. Thumbprints serve as keys and guests must sign a logbook while video cameras gather permanent records. Grids of metal are hidden behind floor and ceiling tiles to guard against nefarious human entry. A 60-minute emergency power supply allows warm-up time for a dedicated diesel generator in case of significant power outage. "It'll operate reliably for a couple of days even without refuels," Toren says. "And then we have a refuelling contract that goes along with that. From an infrastructure and electrical reliability standpoint, this is an extremely hardened facility."

By necessity, the system co-ordinates with Iberdrola's energy traders, meteorologists and information technology (IT) staff. "There are some people behind the curtain," Toren says. "There's a whole wind operations staff that really focuses on starting at the programmable logic control on the turbine, bringing that all the way through the switches and fibre optics. There are a little over a dozen people devoted just to that. We've separated them out from our corporate

{CONTINUED}

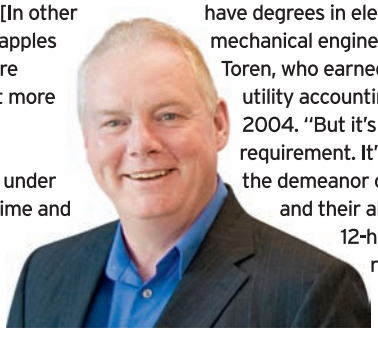
SLEEPING WITH THE ENEMY FROM NUCLEAR SUBMARINE TO IBERDROLA'S CONTROL CENTRE

In a former life, Harm Toren spent more than eight years with the US Navy – serving as a nuclear engineering officer and living on a submarine. Toren, Iberdrola's managing director of American operations services, says there are very few similarities between running a nuclear submarine and looking after a growing fleet of 2,500-plus wind turbines. But the few that do exist have huge value.

Toren, who entered the electricity-generating business shortly after leaving the Navy in 1984, says mistakes can be costly in either line of work. But he believes military experience transfers well to working in the control centre of a major wind power producer and Iberdrola has hired its share of veterans – including operations and maintenance director Blaine Sundwall, a co-architect of the US facility and a fellow navy man.

"We've got a lot of military people because they've got the discipline and they've done the shift work," Toren says. "The military trains us to communicate very effectively from a technical standpoint." They repeat back the exact words on the telephone, he explains, to make sure they have got the right message.

But he jokes: "[In other ways] it's kind of apples and oranges. There certainly are a lot more complications to carrying nuclear warheads. You're under water for a long time and there's a central command telling people what to do – procedures and policies all set in place by the White House."



Harm Toren

Toren isn't the only one to carve an unusual path to a post at the centre. Some recruits come from a computer background, others are former turbine technicians and still others come from energy trading. And lack of a college degree is not a deal-breaker. "It's helpful if people have degrees in electrical and mechanical engineering," says Toren, who earned an MBA in utility accounting and finance in 2004. "But it's not a requirement. It's really all about the demeanor of an individual and their ability to accept a 12-hour shift on a rotating basis."

Toren doubles as the head turbine shopper for Iberdrola's ever-expanding North American fleet – a task that dovetails nicely with comprehensive knowledge of the control centre. As a first-tier customer, Iberdrola can make purchases based on which turbines work best with its software and even motivate original equipment manufacturers (OEMs) to design machines with certain specifications in mind.

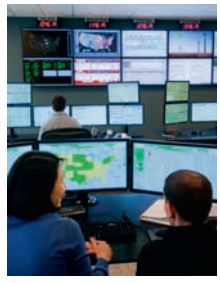
"I don't want to get into a one-turbine-is-better-than-another discussion here," Toren says. "But we talk about it every single day. I'm responsible for negotiating all the turbine supply agreements, so I have a tremendous amount of leverage. And, in at least one OEM's case, they came in and said, 'What would you like to have? Because that's what we're going to do.'"

IT so that they can focus on the controls and the operations and really bring everything up to the level that we need."

All of which adds up to what Iberdrola sees as pursuit of total optimisation. "Landowners have a choice of whose turbine they put on to their land," Toren says. "If a landowner puts an Iberdrola turbine on to their wind farm, we can help ensure that it operates safely, that they've got somebody to communicate with on a round-the-clock basis and that we will maintain their site in a most optimum way. We'll deliver the highest dollar revenue to them, within reason, in the entire industry by making sure that our turbines run at the most efficient levels."

So, is the possibility of contracting to make third-party wind farms more efficient — or even selling an off-the-shelf version of the software — something that Iberdrola might eventually explore? "We've thought about it," Toren says. "But at the moment we're treading water just trying to keep up with our own growth and technology."

As if to illustrate the point on a windy late-April day, breezes are blowing unexpectedly hard across the country and Iberdrola's system is operating very robustly at around 70% of its maximum output capacity. But that makes for dicey hourly forecasts and one screen's display tells Toren the company is losing money as it has to curtail turbines to prevent the grid being overloaded with generation that exceeds the forecast. "I don't want to tell you how much that's worth right there," Toren says. "But it's a lot. A lot. And I have to think about the risk — contractual and commercial risk — about doing this for somebody else. You wouldn't really want a General Electric or a Mitsubishi or a Suzlon or a Siemens or a Vestas doing this for us."



Screen grab Among the centre's many computer screens is one that counts the firm's live income

Evolving challenges

Meanwhile, the control centre evolves and endless issues need ongoing adjustment as Iberdrola's business grows. "We've got 34 sites sitting out there — soon to be 40, 50, 60," Toren says. "I've got all these individual telecom networks and it's hard enough controlling and managing one. So we're trying to figure out a way to have all of that become automatic to where, simply, the system detects the fault, identifies the plant, pops up that image on a screen and gives me an alarm. That's just one example. And when we get that done, we'll have 50 other things we'll need to be doing."

Yet Toren remains convinced that Iberdrola's work in progress remains well ahead of the curve. "There's a lot of technology sitting behind here that we're just not willing to expose," he says. "But I think ours is the state-of-the-art facility. This is a relatively small industry and we have good connections. And from the people I've interfaced with, whether they're OEMs or other independent power producers or whoever walks through this room, they say: 'Wow – this is unbelievable.'" WW