Global fleet, local knowledge: closing wind's expertise gap

As wind fleets expand across increasingly diverse operating environments, the expertise needed to solve their problems is becoming more dispersed. Closing the industry's knowledge gap means connecting local challenges with specialist experience from across the global wind sector and beyond.

An operator finds something on a blade they have not seen before. Who do they call? The engineer who designed that blade moved on years ago. The service provider has not seen the problem either. Somewhere in the world, there's probably a person who has spent 15 years working on precisely that failure mode. But there's no reliable way to find them.

That scenario plays out again and again. It's rare that a problem is unsolvable. A solution exists somewhere. The bigger problem is finding that solution, or the person close to solving it.

Wind has become a large, geographically dispersed industry with roughly 1.3 TW of installed capacity. The technical knowledge required to keep it running has dispersed with it. The knowledge is real, deep and often highly specialized, but it is scattered across the globe in small teams working in different markets.

This is not the first global industry to discover that no single organization can hold every discipline, and that different parts of the world present different problems.

A modern turbine spans aerodynamics, composites, tribology, power electronics, polymer chemistry, lightning physics, and structural fatigue. Aerospace faced the same disciplinary breadth and resolved the issue decades ago by building a deep, tiered base of specialist suppliers, each excellent at one thing, supported over generations.

Peter Giddings of the UK's Offshore Wind Growth Partnership makes the comparison directly. He notes that Airbus has been refining its supply chain for generations. Wind manufacturing has not had thirty years of stable business in which to do the same.

Wind is now building that structure, and the people solving problems bring expertise earned elsewhere.

Two answers, one problem

In January 2023, Andrew Billingsley took a call from Ørsted asking whether his company could recycle wind turbine blades. Billingsley is CEO of Plaswire, a polymer processor in Northern Ireland. It was not a wind company. Plaswire's business had been built on finding a way to use plastics from aircraft seat manufacturing and other waste nobody else would handle: residue pulled out of biodigesters and municipal waste plants.

He said yes before he was certain the company could do it.

Plaswire had a proprietary process for combining polymers that materials engineers said couldn't be combined. Ground blade fiber mixed well with the combined polymer. Plaswire says it now has capacity to process up to 11,000 tonnes of blades a year and has increased blade content in its product from ten percent to thirty percent. The company also reports that the resulting structural components can outperform the concrete and timber alternatives they replace.

The same waste stream produced an entirely different answer on the other side of the Atlantic. Everpoint Services in Houston, Texas decommissions wind and solar assets, leaving the company tasked with repurposing fiberglass blades. At a birthday party, Everpoint CEO Tyler Goodell put that problem to James Timmins, a drilling engineer who had spent his career planning and overseeing drilling operations for major oil companies.

Timmins realized that ground blade fiber might work as a fluid loss additive in oil, gas, and geothermal drilling, where fluid escaping into the formation can cost tens of thousands of dollars a day. Everpoint spent the next two years turning that idea into a product. The company says BladeBlok is patented and shipping globally from Houston.

Two regions, two answers, both effective. And in retrospect, it makes perfect sense. Northern Ireland has decades of depth in polymers and injection molding, so its answer was a polymer. Houston is a center of the global oil and gas industry, so its answer was drilling mud. Neither answer came out of the wind industry. Both came from regional industrial expertise meeting a problem that happened to land next to it.

Looking beyond Denmark

Modern wind turbine engineering grew up in Denmark, and in many ways it still lives there. The most prevalent turbine design was refined by Danish engineers. DTU Wind and Energy

Systems still anchors much of the research on wind turbines. Ask a hard aerodynamic question today and there is a fair chance the answer comes from within Denmark.

What has changed is that designing turbines and operating them are different problems. They no longer happen in the same places. A machine is designed in a small number of locations. It is then operated wherever the wind blows: West Texas, Queensland, Gujarat, the North Sea, and the Spanish meseta.

The fleet is also getting older and more varied as it grows. Machines commissioned during the last boom are aging in ways nobody modeled, on sites with conditions nobody anticipated. That combination generates operational questions faster than any single organization can answer them. Those questions are local, specific, and urgent.

Now, companies all over the world are being asked to solve wind's problems with legacy knowledge, often from an adjacent industry, that originated a long way from where the turbine was built.

The same blade, four climates

The industry's leading-edge erosion wisdom is shaped largely by northern European conditions. It is a real problem, well studied and well understood. It is also not the same problem in West Texas, where the air carries dust and insects, and where inspections routinely find turbines one to three years old that look as though they have run for far longer. Will Howell of Armour Edge describes one site near an open-cast mine where airborne marble particulates were destroying blades within two seasons.

India produces a variant that exists nowhere in Europe. During the northern dry season, a sticky, tar-like dirt builds on the blades until the flow separates and the blade effectively stalls. The monsoon washes it away. PowerCurve reports that the use of vortex generators in India has produced some of the largest energy gains it has recorded, exceeding five percent across a full year. India is now the fourth-largest wind market on earth, surpassing 56 GW; last year it added more capacity than Germany did.

Rosemary Barnes worked for a Danish blade manufacturer before returning to Australia in 2021 to work in operations. There, she found blades behaving unlike the ones she had known in Europe. The standard method of predicting erosion severity combines annual rainfall with tip speed. But when Barnes plotted Australian sites with known erosion problems against those two axes, she got a random scatter. The model had no predictive value in Australia.

Her firm, Pardalote Consulting, is now placing scientific-grade sensors in Australian wind farms to establish what actually drives erosion there.

A library of experts

Today, finding the right specialist can be difficult.

After six years hosting the Uptime Wind Energy Podcast, I increasingly think of the podcast as a library. In the past year alone, we've highlighted solutions from companies in Latvia, Denmark, Northern Ireland, Spain, Australia, Scotland, and the United States. As an organizer of the Wind O&M Australia event, one of our goals has been to bring international expertise to the local market. And similarly, to allow the global market to learn from knowledge that has been internal to Australia.

The answers are out there

The wind industry does not have time to solve the same problem twice.

Fleets are aging, budgets are tight, and a blade defect that sits unresolved for a season costs real production. The pressure is to move faster, and the fastest way to solve a problem is rarely on your own. The fastest way to solve a problem is to find the person who has solved it.

That search has to be a global one. The specialist who understands your failure mode may be in Copenhagen, Riga, Edinburgh, or Houston, working for a company you have never heard of. Geography is not a reason to rule them out. Increasingly it is the reason to go looking.

The Uptime Wind Energy Podcast has become one way of documenting that dispersed expertise, bringing together specialists working on specific problems across different markets.

The answers are out there.

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