A giant with a brain

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Smart turbines: embedded intelligence is the next engine growth factor for the automotive industry. Specialists estimate that in less than 10 years, the software element will represent 60% of the value of a vehicle, compared to 20% today. When you think about the pace of change in the wind industry today, we can expect a similar trajectory.

Making big turbines smarter

Both the wind and automotive industries are based on the design and manufacture of mechanical devices, even though neither size nor age can be compared. Over the last few years, the automotive industry has been confronted with an unparalleled digital disruption. From electronic engines driving to breakdown diagnosis software, it reached even deeper levels with the intelligent connected autonomous vehicle. Subjects as complex as data protection held by a vehicle soon emerged.

This evolution has been achieved through the integration of innovative software technologies, powerful data processing and AI, which are taking an increasingly important space in the vehicle value chain, and represent a potential business in terms of monetizable services. Without these developments, historical car manufacturers could have been on the verge of disappearing altogether, swept away by the new mobility solutions that are developing at high speed.

Such innovations do not necessarily come from the manufacturers themselves, but generally speaking, more so from their suppliers, or else even from innovative digital companies that have no historical link with the automotive sector. Digital giants like Google or Apple are now investing in this sector and considering launching their own vehicles.

Would it be so incongruous to imagine a similar evolution in the wind industry?

The energy market is in deep mutation. The prices of renewable energies are constantly falling and cutting into the ROI. Very recently, a court of law in Netherlands imposed binding emission reduction targets on an Oil Major. All across the continents, the USA, EU and China are setting ambitious targets to accelerate the energy transition in a rarely shared impulse.

However, for the time being, the wind industry's main ambition, both in the technology and marketing fields, has been to race for size. Bigger and bigger turbines are conceived, built and bought in an effort to lower the purchase price per KW. Not so long ago, the automotive sector walked the exact same path, throwing all energy and marketing into SUVs to try and preserve their margins.

At Sereema, we took a bet that sooner rather than later, we, in the Wind Industry, would realize as well that this was not the way to go. Our belief is that the future path will dwell on manufacturing both smarter and bigger machines. Hence the digital race towards smart turbines, most likely induced by companies with Intelligence in the DNA.

Digital-induced innovation

Software, Intelligence and automated data processing will become more and more important in the operation of wind farms.

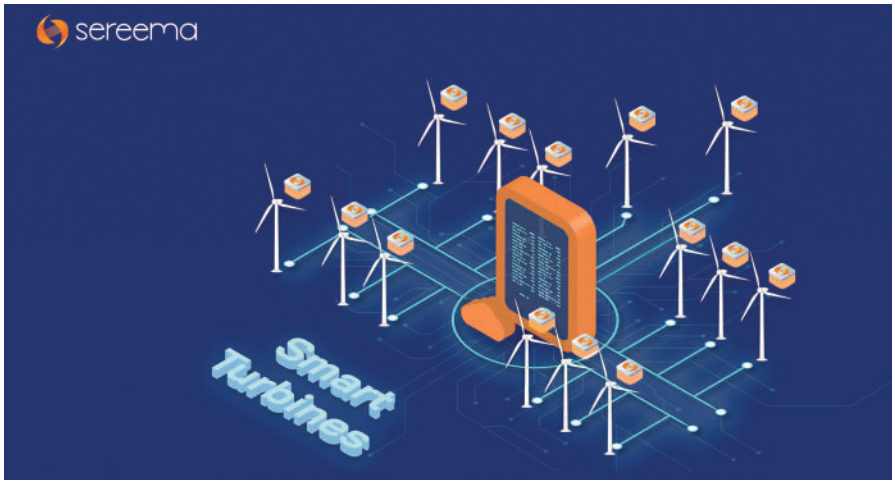
The composition of the value chain will evolve with an increasing share of the digital part in the global value. This evolution is inevitable, the only fuzzy line being its speed.

The driver's seat behind the wheel of this evolution will not necessarily be restricted to the manufacturers. Just like the automotive sector, it is bound to be distributed among an ecosystem of equipment manufacturers and innovative digital players such as Sereema. For all that, it does not mean that manufacturers will be excluded from this transformation. They will still play a central role, but the speed of innovation requires an agility and a capacity for change that is often incompatible with the DNA of these large behemoths.

Such a cluster of innovative companies is already thriving and building up as we speak. Tomorrow we might become direct suppliers to turbine manufacturers, whereas today we have mainly been involved in the operations and maintenance steps. This abundant and rich offer of innovation meets a market need.

Turbine design will evolve with the integration of more and more software components making the machines intelligent, capable of better diagnostics, but above all of better optimization and adaptation to their operating environments. In short: higher performance with lower overall operating costs.

In the end, it doesn't really matter where the innovation comes from, be it the turbine



Swarm operating mode for higher performance

manufacturer, one of its suppliers or a partner or bought-out innovative company. What is important is that the innovation irrigates the sector in a favorable context, that makes digital transition painless where the low cost of money boosts its development. As a bonus it also tames the risks on the profitability of the wind projects through a combination of the drop in electricity tariffs and rising interest rates, which is likely to make digitalisation even more necessary but also painful.

Autonomous wind turbine

Streamlined data processing is already feeding investment, assets or maintenance managers with comprehensible info to help them make the right decisions. And this is just the beginning. Most of the existing systems use a single source of data. The industry hasn't yet acquired enough 'digital maturity' to be able to define common standards for data sharing, and data cross processing.

The key value isn't in the data itself, but in all the info that could be automatically extracted from one or several data sources. Customizable information that is relevant to each target should be available in several formats. The needs differ according to the profile of the data reader, analyst, expert. For example, financial investors long for an overall view of profitability of their assets, considering that most of their field operations are outsourced. They need additional information to better value their assets at resale, but also to better secure their investments in new projects.

Whereas utilities, or big IPPs are in dire need of information that SCADA can't deliver to fit to a more integrated strategy, and their desire to keep close control of the assets in the field. Their technical teams are skilled and able to exploit technical data and information in a very efficient way to fine tune their wind farms operations, challenging O&Ms, maximizing the performance and optimising their operation costs when maintenance is insourced.

Digital solutions need to adapt to these various contexts: packaging raw material in the right format, depending on the targeted audience... human beings or even machines! Of course, in order to fully embrace the digitization path, we need to lift any remaining barriers. Ascertaining that we're way past algorithms identifying trends and anomalies that indicate operational issues. Today the wind industry has reached its 'coming of age' realization that only a combination of engineering, data analysis and machine learning expertise will provide the accurate interpretation of the data, draw out the trends of tomorrow's turbine's best behaviors in their local context.

That's why the next step will be making not only big wind turbines, but even smarter ones! The existing technological bricks make it possible today to design enhanced turbines with in-built 'intelligence'. Real time auto-regulation based on information provided by data processing will enable AI to apply optimization decisions.

The turbines will be able to permanently adapt to local conditions or to pre-program maintenance actions by eliminating low value-added human decision steps.

Once more time, we can reflect on the parallel with autonomous vehicles, merging data from different sources and processing a safe and optimized behavior, in sync with its environment and other moving, or still vehicles.

Current technologies hint at the future, where each smart wind turbine will not only optimize itself as an isolated entity, but as part of a group of machines within one or several wind farms.

More precisely, imagine a turbine that can adapt to its conditions and environment. Once a turbine recognizes where it stands, and what it's surrounded by, it can learn from it and know how to behave. This opens a door towards real optimisation where the turbine will be able to operate better on its own, knowing all there is to regarding wind conditions and changes. This translates into more performance and less wear, more energy and more lifetime.

A swarm operation mode where each unit will react in tandem with its own data merged with its neighbors. The maximum wind farm performance is not necessarily equal to the sum of the maximum of each individual unit thanks to the synchronization of the swarm.

The potential double-digit gains in global performance gives a new perspective to the development of wind energy. Tackling wake effect impact on performance is one of the most obvious application cases, but there are many more to be developed.

We've chosen the automotive industry as a use case to be compared to the Wind industry, but AI has infused across a wide range of other industries: healthcare, finance, HR, transportation, energy... It will deeply impact the wind industry's value chain. Wind power must embrace its data-driven nature faster to improve its value proposition and to keep playing a key role in the energy transition.

Many digital solutions have been developed and marketed in the last couple of years, which proves that a dynamic and rich ecosystem is emerging, meeting real market needs. These solutions should not be considered systematically as competitors, even if sometimes they target the same budgets, but more as complementary pieces of a larger digital puzzle.

Being one of the pioneers of this adventure is very exciting, the development perspectives are even more so. If you're reading and you're not in the driver's seat, there's still room for passengers, join us and hop on, engine's revving up!

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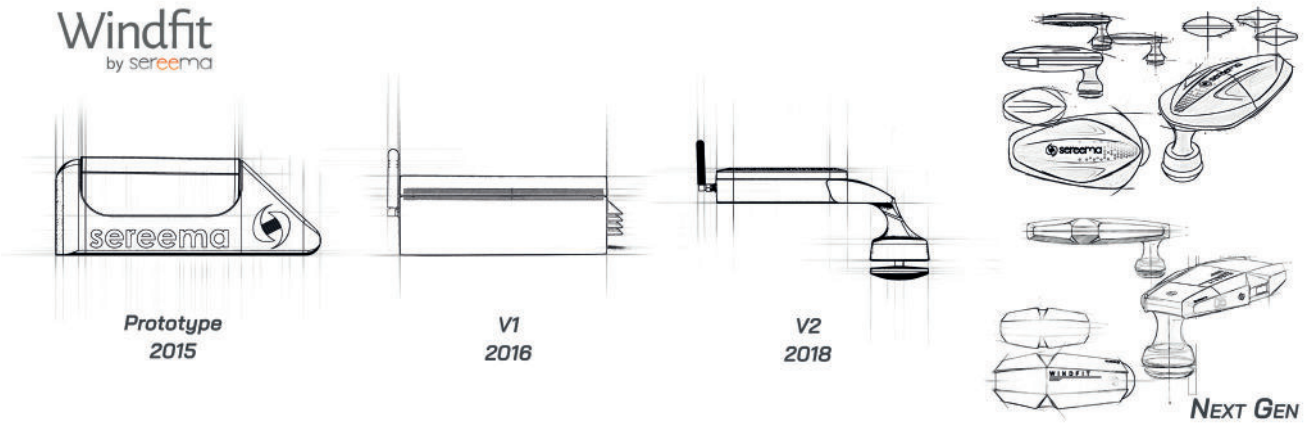

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