**If, like me, you’ve furnished about eighty percent of your home with items from a well-known Swedish furniture retailer, then I imagine the experience of trying to follow their assembly instructions will be seared into your psyche forever. A long time ago, in a previous job, I had the opportunity to visit their hallowed head office in Almhut, Sweden where I saw the lengths they go to to make those instructions as simple and globally comprehendible as possible, even paying unemployed people a days wages to come in and build a selection of new products specifically to assess how easy the instructions are to use. Even so, it’s still surprisingly easy to assemble a panel back to front or upside down. That’s fairly irritating if you’re at home and you have to start building your Billy bookcase again, but it pales into insignificance compared to what these guys have to do. Their assembly instructions are for a one hundred and twenty metre tall flat-packed wooden wind turbine tower.**

**So, what’s going on here? is this some kind of gimmicky art installation or a genuine solution for the wind power industry?**

**Hello and welcome to Just Have a Think.**

**As you may know, there’s a bit of a global movement in the architectural world right now towards creating large structures using timber instead of the steel and concrete that we’ve become accustomed to. The production of steel and cement accounts for about sixteen percent of all global greenhouse gas emissions. In stark contrast, using timber for construction locks up the carbon that the tree sucked out of the atmosphere while it was growing. So, as long as the source of the timber is a genuinely sustainable and carefully managed forest or plantation, then reverting back to timber construction offers a promising potential contribution to a more climate friendly future.**

**That philosophy is part of the motivation for a Swedish engineering and industrial-design company called Modvion, who are planning to reintroduce wood as a structural material for turbine towers.**

**It’s not as crazy as you might think either. In fact, the more you dig into the details, the more you realise it’s actually a very smart structural solution as well as being far more climate friendly.**

**During a recent interview with Zac and Jesse from the Now You Know channel, Modvion’s CEO Otto Lundman and Development Engineer Geir Söderin explained that wind turbines provide better power returns as they get taller because increasing the height gets you to stronger and more consistent winds. The power of the wind is the cube of its speed, so if you double the wind speed you multiply the power by eight times.**

**Going higher also means much larger blades with a much larger sweep area. That means you can have a larger generator on each turbine and that reduces the cost per kilowatt hour, making the whole thing more economically attractive.**

**But the taller the tower, the larger its diameter needs to be to support the structure. The current industry standard material for the towers, as I’m sure you know, is tubular steel, and the really tall steel towers are now becoming very difficult to physically get to site because the size limit for road transport is a diameter of 4.5 metres. Go beyond that and you won’t get under some bridges, or over them for that matter, and you can forget about going through any road tunnels.**

**So, advantage number one of the Modvion system is that flat pack feature I mentioned earlier.**

**Not only are the towers constructed in stackable cone sections, but each cone section is itself constructed in separate segments. That means you can lay the segments flat and stack them up on the back of a truck, making them much easier to move around.**

**The guys from Modvion refer to timber as nature’s carbon fibre, which is a nice way of thinking about it! And if it’s layered up as a stack of very thin veneers then you can produce an extremely strong but very light material compared to steel, which is advantage number two. The locally sourced spruce timber that Modvion use is only one sixteenth of the weight of steel by volume, and that means they can achieve the same strength as steel for thirty percent less weight. So, in fact, the taller the towers become, the more advantageous it is to use a timber construction, not just for transport but for weight and strength too. There is some steel in the construction. It’s used for the adapters at the base and top of the tower, to provide an interface with the steel components in the turbine construction, but the main structure is one hundred percent timber.**

**You might be thinking that a wooden structure would start to rot away over time, resulting in collapsing turbines all over the place, but these things are rated to last just as long as steel towers. If a longer life is specified by the client, then the wall thickness can easily be increased at the Modvion factory by adding more layers of veneer.**

**The final protective coating is a specialised polymer providing a similar level of protection for the timber as the steel towers get from their rust inhibitor paints.**

**What about fire? I hear you cry. And it’s a fair question. According to Modvion though, it’s very difficult to cause a structure like this to ignite, because it’s so dense. In these massive wood constructions, if there was a fire then the side exposed to it would only start to char, and at a very predictable and controllable rate. At high temperatures steel gets soft and starts to buckle, so in these sorts of huge constructions wood can actually hold its structural integrity longer than steel.**

**And then there’s advantage number three, which is the carbon sequestration I mentioned at the start of the video.**

**The life cycle emissions from a one hundred and ten-metre-tall wind turbine tower made of steel are about twelve hundred and fifty tonnes of carbon dioxide. The same tower made of wood produces lifecycle emissions of around a hundred and twenty-five tonnes of CO2 – a ninety percent reduction. And because the timber also stores carbon, the tower’s actual climate impact is lower still. A wooden construction stores approximately one point eight tonnes of carbon dioxide per tonne, so a one hundred and ten-metre tall tower would have a carbon dioxide storage capacity of as much as five hundred and forty tonnes, which means a net climate impact of about minus four hundred tonnes of CO2. And of course, at the end of the tower’s operational lifespan you’re left with a whole bunch of extremely recyclable material, so as long as it’s used for something structural and useful, then that carbon will be locked away more or less indefinitely.**

**Modvion built their first 30 metre tall test tower just outside Gothenburg in April twenty-twenty, and in June twenty twenty-one the giant Danish wind turbine manufacturer Vestas announced that it would be investing in Modvion to help accelerate progress towards full scale production with a view to eventually integrating wooden towers into their own turbine installations, the first of which will be a one hundred and fifty metre tall tower supporting a turbine in the four to four point five megawatt class, scheduled for completion in twenty twenty-two.**

**Now you might be watching this thinking it’s all very well to replace the towers with a more sustainable alternative, but it’s actually the blades that are the least environmentally friendly and most difficult to recycle element of a wind turbine. And of course, you would be quite right. They’re typically made of a complicated combination of fibre glass, carbon fibre and resin.**

**At the moment, the best they can hope for in their second life is to be ground up and used as aggregates in road building, but in reality, most turbine blades end up in landfill or worse still, get burned. The industry is painfully aware of this environmental Achilles heel though and is racing to find more climate friendly alternatives, like this one being developed by Siemens Gamesa in Spain. Their latest innovation, which they’ve cunningly called the Recyclable Blade is made with a new type of resin that can be efficiently separated from the other materials so that that they can be reused in future production. Vestas also claim to have new technology to recycle their blades and they have a stated goal to make all their turbines zero waste by twenty forty.**

**And for existing blades that’ll be coming to the end of their operational lives over the coming years, there are now designers and architects looking for ways to repurpose them instead of destroying them and adding to our global environmental catastrophe.**

**Startups like Global Fibreglass Solutions have a technology that can press decommissioned blades into fibreboards for flooring and walls. And how about this cycle shelter, made from an entire section of a decommissioned wind turbine blade. The United Nations projects that nearly seventy percent of the human population will be living in cities by 2050, so these kinds of smart solutions will become an important part of those urban environments.**

**It’s a great example of the sort of lateral thinking that we humas are absolutely brilliant at if we just have a think about how to turn challenges into opportunities.**

**If you’ve got other examples of wind turbine repurposing solutions, then it’d be great to hear from you in the comments section below.**

**That’s it for this week though.**

**As always, a big thank you to the folks at Patreon who keep these videos completely independent and ad-free. And a quick shout out to the folks who’ve joined since last time with pledges of ten dollars or more a month.**

**They are**

**Mike Butler**

**Tristan Juliette**

**Thom McDonald**

**MW**

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**Jim Monaghan**

**Chris Norton**

**Yachal Upson**

**Savusol (save us all) Green**

**Joseph Stone**

**Tamari Sofi**

**Vladimir Jirasek**

**Paul Desjardins**

**Martin Côté Beck**

**Ryan Thompson**

**AND**

**Jacques Gagne**

**And of course, a huge thank you to everyone else who’s joined since last time too.**

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**As always, thanks very much for watching, have a great week, and remember to Just Have a Think.
See you next week.**