**I’m guessing you probably don’t need me to give you any clues about what this thing is. Admittedly you don’t see too many of them with lurid green blades or any of this nonsense sticking out the back, but, you know, a wind turbine isn’t it? And it’s bigger brothers and sisters are now a fairly regular sight across large parts of many of the countries where you good folks are watching from.**

**Generally speaking, the grown-up versions all have a very tall mast and three blades attached to a central nacelle with a heavy-duty gearing system inside to translate the rotational kinetic energy of the blades into useful electrical energy via a generator.**

**They form part of a sub-category called Horizontal Axis Wind Turbines, or HAWTs.**

**But they’re not the only way you can get electrical energy from wind. There’s a whole other sub-category called Vertical Axis Wind Turbines or VAWTs. These things are extremely popular among the DIY enthusiast fraternity, many of whom have rigged up rudimentary versions in their back yards or gardens to provide useful power for their homes.**

**Now a new company has taken the basic concept of a vertical axis turbine to create a commercial model that’s designed to work even when there’s no prevailing wind.**

**So how do they do that?**

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

**The science of wind turbine dynamics and efficiencies is pretty much an entire field of technical expertise in it’s own right. There’ve been all sorts of different approaches and designs over the years, all aimed at achieving the optimal overall performance. Vertical axis turbines, or VAWTs, tend to fall into one of two sub-sub categories. Savonius turbines like this one, or Darrieus turbines like these. And you’ll find dozens of very entertaining DIYers on You Tube who’ve chopped up oil drums and various other articles to produce their own homemade energy generators.**

**When it comes to grid-scale commercial wind turbines though, there are various reasons why horizontal axis turbines have generally been favoured over vertical axis. At those sorts of enormous dimensions, early development prototypes of VAWT systems proved less efficient, and in the days before we had new-fangled composite materials, VAWTS also proved less reliable as well, with turbine blades tending to shear off with the constant changing directional forces from the wind. In depth comparisons between HAWTS and VAWTS are beyond the scope of this video, but if you want to dive more deeply into it then I can highly recommend jumping over to my YouTube buddy Rosie Barnes’ channel where you can find two excellent videos explaining the pros and cons of each turbine type. And you can go straight to the first of those videos by clicking up there somewhere.**

**VAWTs do have some advantages though. They’re obviously much more compact than HAWTs, and they can take energy from the wind regardless of which direction it’s coming from. HAWTs have to have an extra mechanical set up inside the mast, called a Yaw system, which turns the turbine into the prevailing wind so that the blades can keep turning.**

**So vertical axis turbines have the potential to provide very useful energy in more urban settings where space is at a premium.**

**Designing a vertical axis wind turbine that doesn’t necessarily require the wind to be blowing though, might seem like a bit of a crazy endeavour, especially for a commercial enterprise. But that’s exactly what British start up Alpha 311 are planning to do by installing their turbines onto motorway lamp posts, road bridges and roadside buildings, effectively harvesting the wasted air flow produced by the vehicles driving past.**

**The company was founded in 2018 by business partners Barry Thompson and John Sanderson. Having researched existing studies of the potential for roadside turbines they realised that the focus was usually either on placing turbines right at the top of lampposts, where they wouldn’t get any benefit at all from oncoming traffic, or building entirely new infrastructure in addition to the hardware that was already there, which of course always proved to be cost prohibitive.**

**So, the initial concept that Alpha 311 pursued was to retrofit existing infrastructure with low level turbines that would get the benefit of traffic air flow, and they thought that would probably provide enough power just to run the lamps at the top of the posts that the turbines would be attached to. But when their working prototype was formally assessed by the Institute of Thermofluids here in the UK, even factoring out any prevailing wind conditions and assuming no traffic at all between 10pm and 7am, the results still showed far more electricity generation potential than originally anticipated.**

**The A311 turbine blades start to turn in an air flow speed as low as one point two metres per second. Typical average motorway traffic speeds of sixty miles an hour produce a residual air flow of five point four metres per second, which is about twelve miles an hour. At that speed, each turbine has a generating capacity of just over two point five kilowatts with a thirty percent efficiency, or power coefficient to be more precise. The performance calculations were based on a five-point four-mile section of the M2 motorway in the South East of England. Using department of transport data for hourly rates of traffic flow, the analysis showed that a single turbine would produce an average daily energy generation of just under six kilowatt hours. And that particular stretch of road can accommodate four hundred and ten turbines, so the total annual electricity generation along that section worked out at just over eight hundred and sixty megawatt hours. Which is definitely worth having.**

**The turbines are made from durable recycled composite materials and have a hollow internal sleeve designed to be very easily retrofitted around existing posts. Each unit will be up to 2 metres in height and they’ll be extremely light, weighing between three and a half and eight kilograms, depending on the model. That doesn’t just improve their efficiency, it also makes them extremely easy to install. The blades themselves will be partly shroude to ensure the optimum energy harvesting from air flows in both directions and to avoid any cancelling out interference. Unlike horizontal axis turbines, Alpha 311’s turbine doesn’t need a bulky yaw system, because it can use air flow from any direction. And it has no heavy gearing system either, just a neat little static magnetic stator, housed in the base of the unit, with a stainless steel rotor inside it which is attached directly to the base of the turbine. As the rotor turns within the stator, it generates an electrical current that gets sent to a charge controller via the cabling that already exists to supply the lamppost with power. The charge controller then sends that the current through an inverter and back into the local grid with far smaller transmission losses than other more remotely located power sources. The space allocated for the magnetic stator also houses a centre array for data collection from sensors that can be mounted onto the lamppost, which means that Alpha’s system can also monitor air quality, weather conditions, and traffic statistics, all of which can be sent out via an Internet of Things, or IOT gateway to monitoring stations in real time via a 4G or 5G wireless connection.**

**Now you super-smart technically minded types out there might be thinking all that apparently free energy is coming from vehicles that all require energy to make them move in the first place, and in the vast majority of cases today, that energy will have come from fossil fuels in the form of diesel or petroleum. But those vehicles are all punching a hole in the air and causing air flow around them regardless of whether there’s a turbine or a building or anything else at the side of the road. And that air flow is essentially just wasted energy. So, scooping it up into turbine blades that can drive a generator to produce electricity is a smart use of an already existing resource.**

**So, what about the cold hard numbers that I know you folks like to see?**

**Well, Alpha 311 provide a price comparison between a three-megawatt solar farm requiring fifteen point six-five acres, and a three megawatt installation of a hundred and twenty five of their turbines along a four point five kilometre stretch of road.**

**The solar farm would comprise twelve thousand panels. A typical twenty-five year power purchase agreement, or PPA, with an agreed cost of between four point seven and six point three pence per kilowatt hour would equate to a total cost of between thirty eight point two and fifty one point three million pounds .**

**Alpha 311 won’t employ PPA agreements. Instead, they’ll simply lease the hardware and any energy generated is available for the customer to do what they like with – even sell it back to the grid if they want. Leasing a hundred and twenty-five fully installed turbines would cost twenty nine thousand pounds per month, which over the same twenty five year period equates to eight point seven million pounds, or one point seven four million pounds for a five year lease period.**

**So, on that basis, the numbers do seem to stack up quite favourably.**

**Production is currently in full flow for ten turbines that will be sited on round towers surrounding around the O2 centre in east London.**

**After that, Alpha 311 will be supplying fifty-four turbines to a New York development called Green Asphalt.**

**The medium-term goal is to get these turbines installed on motorways and trunk roads all over the United Kingdom and the wider world, but Alpha 311 have longer term aspirations beyond that too. Although the quoted performance figures are based on traffic air flow, the turbines obviously do work just as well in prevailing wind conditions. One obvious secondary application for compact lightweight turbines like these is on telecommunications masts. There are hundreds of thousands of those things across the globe, enabling our mobile phones to work wherever we go. A typical 5G mast uses about seven kilowatt hours of energy every day. One of these turbines installed on each of those masts would provide all the power they need, removing a significant load from our national grids. And as long as the relevant regulations are adhered to, there’s no reason why smaller versions of these turbines couldn’t be installed on domestic homes, possibly even in conjunction with solar power and battery storage, to provide a much wider time window of power generation for the householder. That sort of system would pull a lot of people even here in the UK out of fuel poverty, and in developing nations it would be yet another option for people in remote off grid areas to consider alongside solar, and micro-hydropower that we looked at in a recent video.**

**It is very early days, with the first production run only just going through now, and I know that one of the criticisms these start- up companies get is that they’re unproven and might not achieve the numbers they’re predicting. And I get that, it’s a perfectly reasonable challenge.**

**But companies like Alpha 311 and so many others all over the world are all working towards the same basic end goal, which is to develop working alternatives to the existing dominance of fossil fuels on our electrical grids. Alpha 311’s installations will never replace onshore and offshore wind turbines, nor are they designed to. But they can provide a very valuable complimentary power source that will improve the diversity of renewable energy inputs onto those grids, and for that reason I for one think they should be applauded.**

**No doubt you’ve got your own views on this one though. If you have, or if you work in related industries and you’ve got insight that you can share, then jump down to the comments section below and leave your thoughts there.**

**That’s it for this week though.**

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