INNOVATION NATION
Wind Power

According to Sask Power, a key utility company in Saskatchewan, their wind farm covers electrical needs of 60,000 homes a year. One Giant Wind Turbine is equal in height to a twelve-story building, with rotors spanning 50 meters (164 feet). Copenhagen Offshore Wind Project in Denmark features 20 massive turbines standing 2 km (1.24 miles) out to sea, where the winds are most consistent and strong in the area. Two turns of a rotor covers electrical needs of one person for one day. The Offshore Wind Project covers 40% of Copenhagen's power. Still, there are days with no wind, and the cost of construction for an offshore turbine is twice as much as for a turbine on land. Since wind is unreliable, even 100% efficient turbines would need power plant backup for days without wind. Thus the biggest challenge facing wind power technology now is finding ways to store generated energy for use on still days.

Traditional wind turbine design (a single rotor on a fixed pedestal) hasn't changed for over a thousand years and has proven problematic when applied to large-scale electricity production. Wind farms are expensive and take up real estate, limiting commercial viability of wind power adoption. An independent inventor in Boron, California, Doug Selsam, has developed multi-propeller turbines, one of which, the Superturbine, can generate the same amount of power with the use of $1/10^{th}$ of material that goes into traditional giant turbine construction. The Superturbine consists of a series of propellers on a single driveshaft. There is no gearbox or complex mechanics, and only one moving part – the shaft in the generator. Sufficient spacing between propellers enables each to grab wind gusts without blocking one another out, and the entire construction is set at an angle to the wind direction to maximize its efficiency. It is meant to stretch across mountain passes, where winds are strong. Watch Doug's team test out a120 foot long prototype on a windy day in Mojave Desert.

Another variant Doug demonstrates is the Sky Serpent Superturbine, the first flying wind turbine in the world. Unlike the cross-canyon version, it is not stationary: one end is lifted in the sky by helium balloons in order to harness the stronger winds at higher altitude. The team tests out a prototype with an 8 ft drive shaft, capable of generating 3 kilowatts of power, but Doug envisions a flying Superturbine reaching as far up in the sky as the jet stream.

Learn how a radio ozone probe sent on a weather balloon from Bratt's Lake Observatory, Saskatchewan, collects data on wind speeds at different heights in the atmosphere:

Height	***Wind Speed***
1 km (0.62 miles)	*20km/hr (12.4 mph)*
…	*40 km/hr (24.9 mph)*
4 km (2.49 miles)	*80 km/hr (49.7 mph)*
11 km (6.84 miles - Jet Stream height)	*250 km/hr (155.3 mph - twice as strong as hurricane wind on the ground)*

Barry Ireland, President and CEO of VBINE Energy introduces yet another innovative turbine design, capable of grabbing wind gusts from any direction and run efficiently under low wind speeds. This makes VBINE, a vertical axis wind turbine, perfect for harnessing a reliable form of man-made wind – the updraft in plant exhaust stacks. Learn about capabilities of VBINE as a prototype goes through a test.

Questions

Q: Where are wind speeds the highest – at high or low altitudes?
A: At high altitudes

Q: How many propellers does a Giant Wind Turbine have?
A: One

Q: What are the challenges to Wind Power technology?
A: Cost, real estate, unpredictable nature of wind.