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## Engineers race to steal nature's secrets

Giant wind turbines based on a seed, and desalination plant that mimics a beetle

**John Vidal, environment editor**

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A new generation of small green companies is emerging with radical but proven ideas to revolutionise engineering and create anything from intelligent fridges to colossal wind turbines moored at sea.

The designers hope their projects will transform energy supplies and cut carbon emissions in the next 20 years. They include huge wind turbines, more powerful than any seen before, anchored to the seabed 20 miles off the coast; fridges that monitor the national grid to use less power; a desalination plant that is also a theatre; and a tidal lagoon that protects the coast while generating electricity.

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The new companies are rethinking major infrastructure projects using natural objects as their basis. The aero-generator turbine, now being laboratory tested before sea

trials next year, mimics sycamore seeds that spin like propellers in the slightest breeze. Its twin arms could each be as tall as the Eiffel tower, and the structure could be moored like an oil platform in 450 feet of water.

Each turbine, said Martin Pawlyn, an architect with Grimshaw - which developed the transparent "biomes" at the Eden Project in Cornwall - could produce 20 megawatts of electricity, nearly five times as much as any existing wind turbine. "A cluster of 100 of them spread over just a few square miles of ocean, each turning at just a few revolutions a minute, could outperform almost all Britain's existing wind farms put together," he said.

"We are now learning from natural eco-systems, and are scaling up projects. We are going back to first principles, taking our inspiration from nature."

The desalination plant, essential in countries that suffer water shortages, is also being rethought. Mostly banished to the edges of cities, they are disliked for needing large amounts of energy and looking like ill-designed boxes. Architects working with designer Charlie Paton have developed one that needs next to no energy and can double up as an open-air theatre. It has been proposed by Grimshaw for the city of Las Palmas in the Canary Islands, historically short of fresh water.

The structure, looking like a wall of glass and steel, uses simple evaporators and condensers to produce large quantities of fresh water. "The inspiration came from the Namibian fog-basking beetle, which uses its shell as a condensing surface for moisture, which allows it to survive in the desert," said Mr Pawlyn. "There are countless other examples like this that we can turn to when tackling some of the environmental issues that we now face."

The idea has been used in three commercial greenhouses in the Middle East to grow food using salt water. Seawater cools and humidifies the air in the greenhouse and sunlight distils fresh water.

A radical but simple design proposed for north Wales is a 15km-long tidal energy scheme that could generate up to 450 megawatts of power and protect the coastline from erosion and severe storms. It could be constructed from dredged sand and seabed material, or waste slate from disused Welsh quarries. Long rows of hydroelectric generators would turn and generate electricity as the tide rushes in and out. North Wales has some of the highest tidal ranges in the world.

"It would protect Rhyl and neighbouring towns with 30 linear miles of breakwater, reducing the risk of flooding disasters like the one in 1990. But it would not be visually intrusive. It works well with wind power, and it would even be possible to move it," said Mr Pawlyn.

The scheme could also offer a natural but nearly invisible

shelter, allowing a marina to be built and a depressed area of north Wales to be regenerated. "We are trying to raise the utilitarian [infrastructure project] to another level. It's the idea of celebrating nature, and learning from it to rethink environmental problems," said Mr Pawlyn.

Other ideas being developed include sewage treatment processes that generate 20% more electricity than usual, and giant solar heaters that would concentrate sunlight on to solar cells, producing 30 times as much electricity as today's cells.

Mark Shorrocks, a director of venture capital firm Low Carbon Accelerator, which is aiming to raise £50m to back dozens of small green technology companies, said the market for imaginative, new renewable energy technologies was taking off, and was expected to more than double in the next few years. Solar energy is expected to be a £50bn market by 2015.

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