Big Kinetic

turbines (wind etc)

ITP Feddersen/Energy

Axis

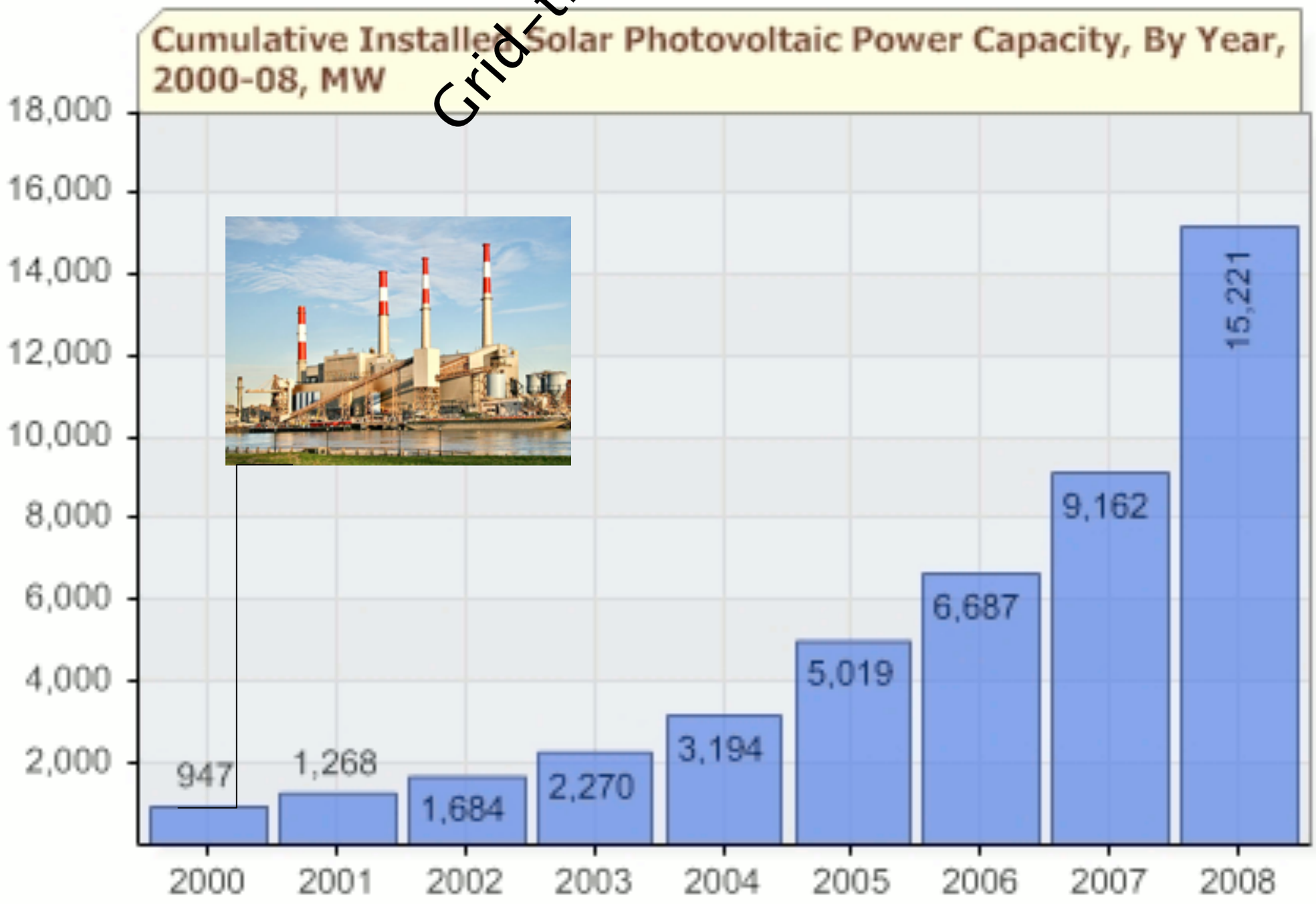
“Vertical” (Perpendicular to wind)

“Horizontal” (Parallel to wind)

Blade Type

Lift

Drag



Source: http://www.energyandcapital.com/
Inset: Big Allis, first 1GW generator, in Queens.

2011:67GW

60GW

50GW

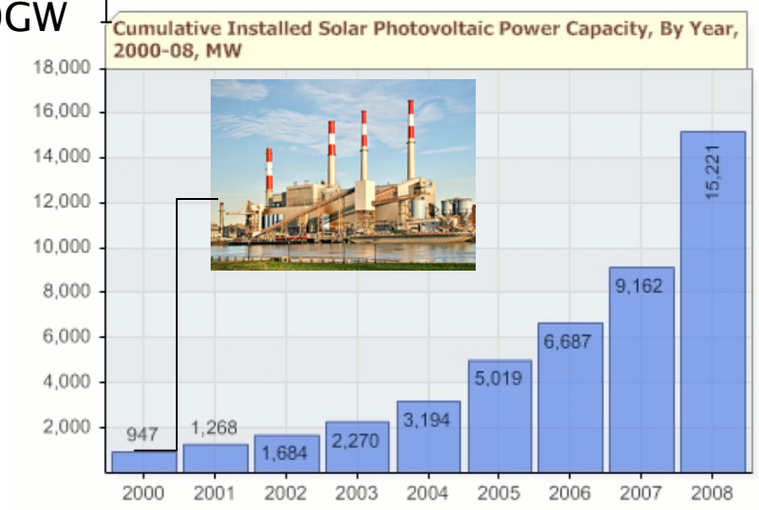
2010:40GW

40GW

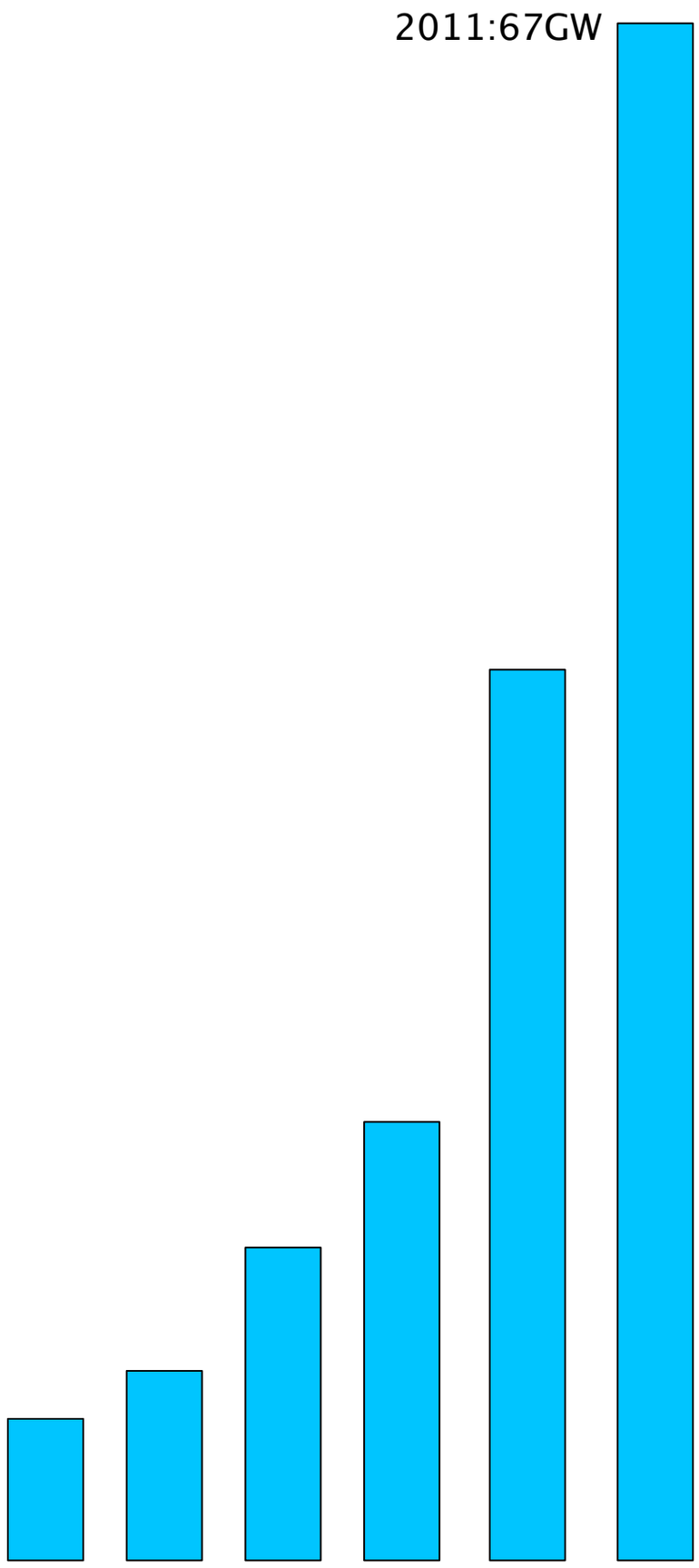
30GW

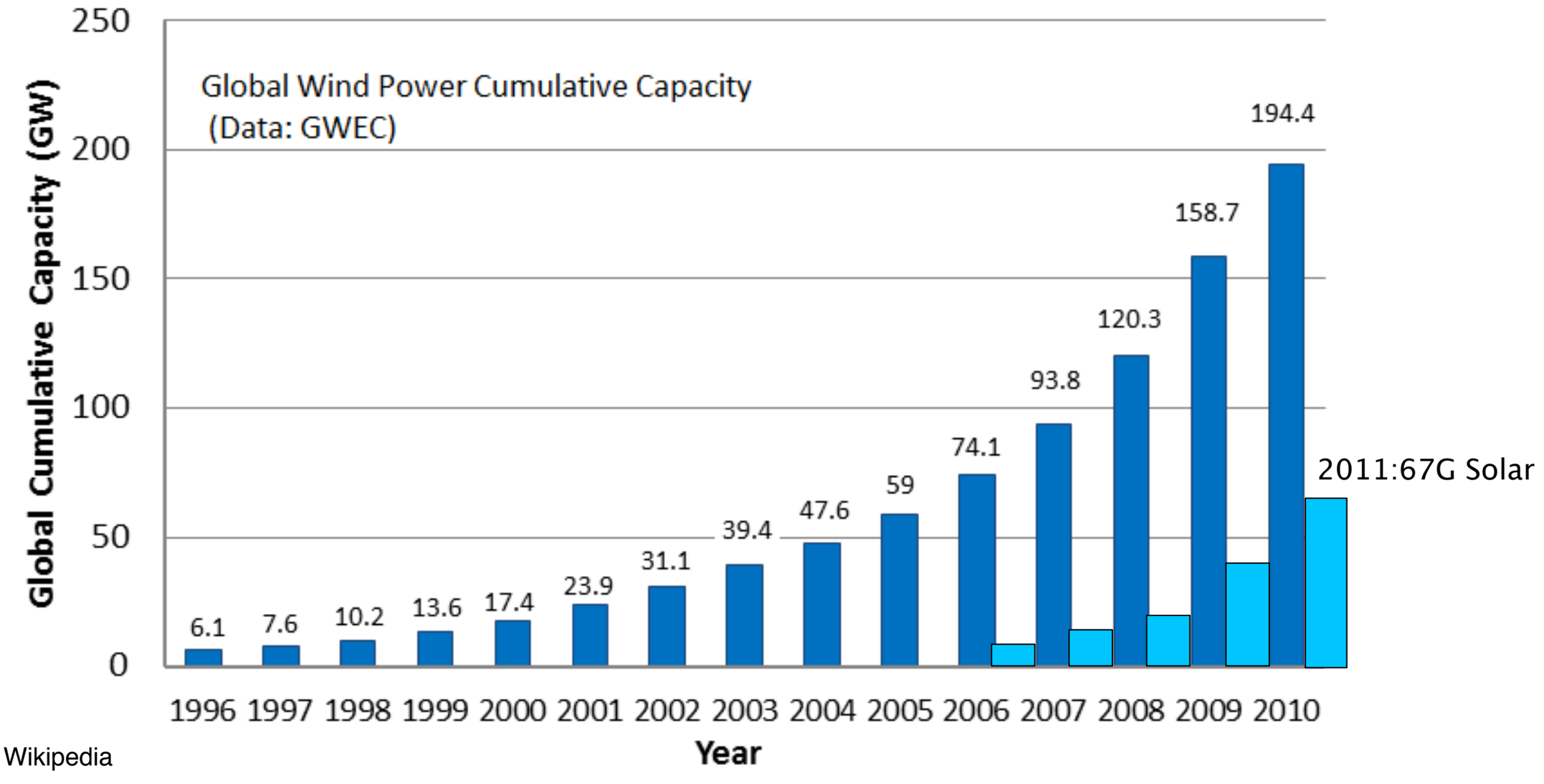
2009:22GW

20GW



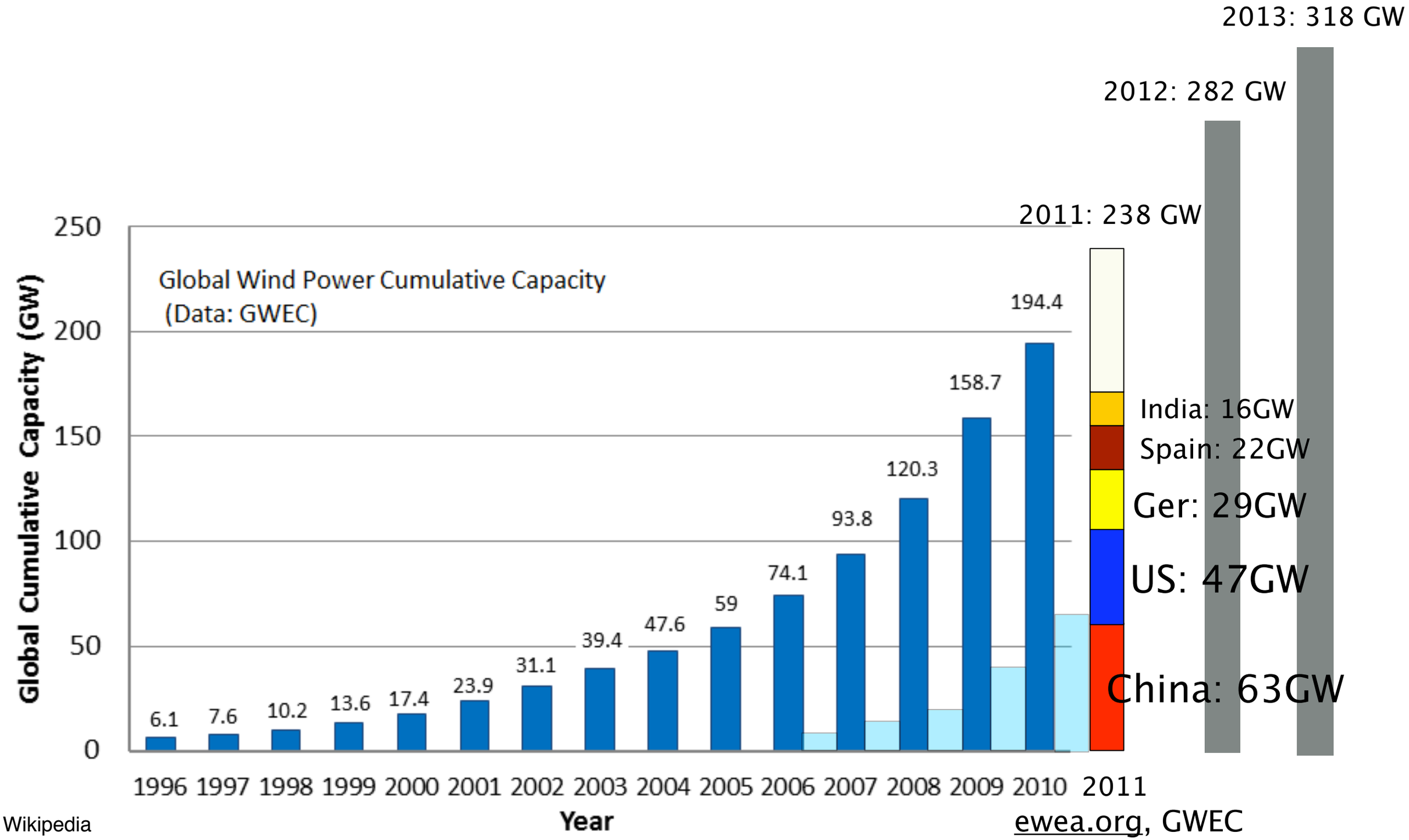
GTMedia, wikipedia


2011:67GW



2011:67G Solar

Wikipedia



Wikipedia

ewea.org, GWEC

~ 2MW typical turbine size

2.3 MW

x 11,500*

*200 watt output

2.3 MW

x 22*

*140 hp output

2.3 MW

x 435

*1000 MW

http://www.juwisolar.com/

Google Earth

2.2 MW solar installation for
Mars Corp, Hackettstown, NJ

Brooklyn Wind Turbine

Vestas V27
225 kW

572 m²
swept area

13.5m blade length

31m tall

Project West Wind

Siemens 2.3
2.3 MW

5,026 m²
swept area

40m blade length

67m tall

Mahinerangi

Vestas V90
3 MW

6,082 m²
swept area

44m blade length

80m tall

Enercon E126
7.58 MW

12,469 m²
swept area

63m blade length

135m tall

“Ninety individual blades, each of them 128 feet long and weighing 77,000 pounds, were offloaded from the Chinese freighter ‘Gong Yin 1’ at the port and are now being loaded onto railcars. The blades were manufactured by Vestas Wind Systems, a Danish company, and are bound for a terminal in Manly, Iowa, that handles wind turbine components. The blades are composed of carbon and glass fiber.”

http://omnitrax.com/

An 83.5-m-long blade made by Denmark’s SSP Technology in transit to Scotland in 2013. It was called the longest blade in the world at the time.

http://www.globalconstructionreview.com

With the largest wind turbine blade more than 200 ft long, moving wind blades from the factory floor to the project site can require up to eight hauls using multiple transportation modes. The Aeroscraft can pick up wind blades from the factory floor and deliver them directly to locations without infrastructure.

http://aeroscraft.com

Capacity factor: 20 - 40%

2.3 MW × 365 days × 30% = 6 GWh

Wikipedia

Offshore wind

Makani M30 30kW
prototype airborne turbine

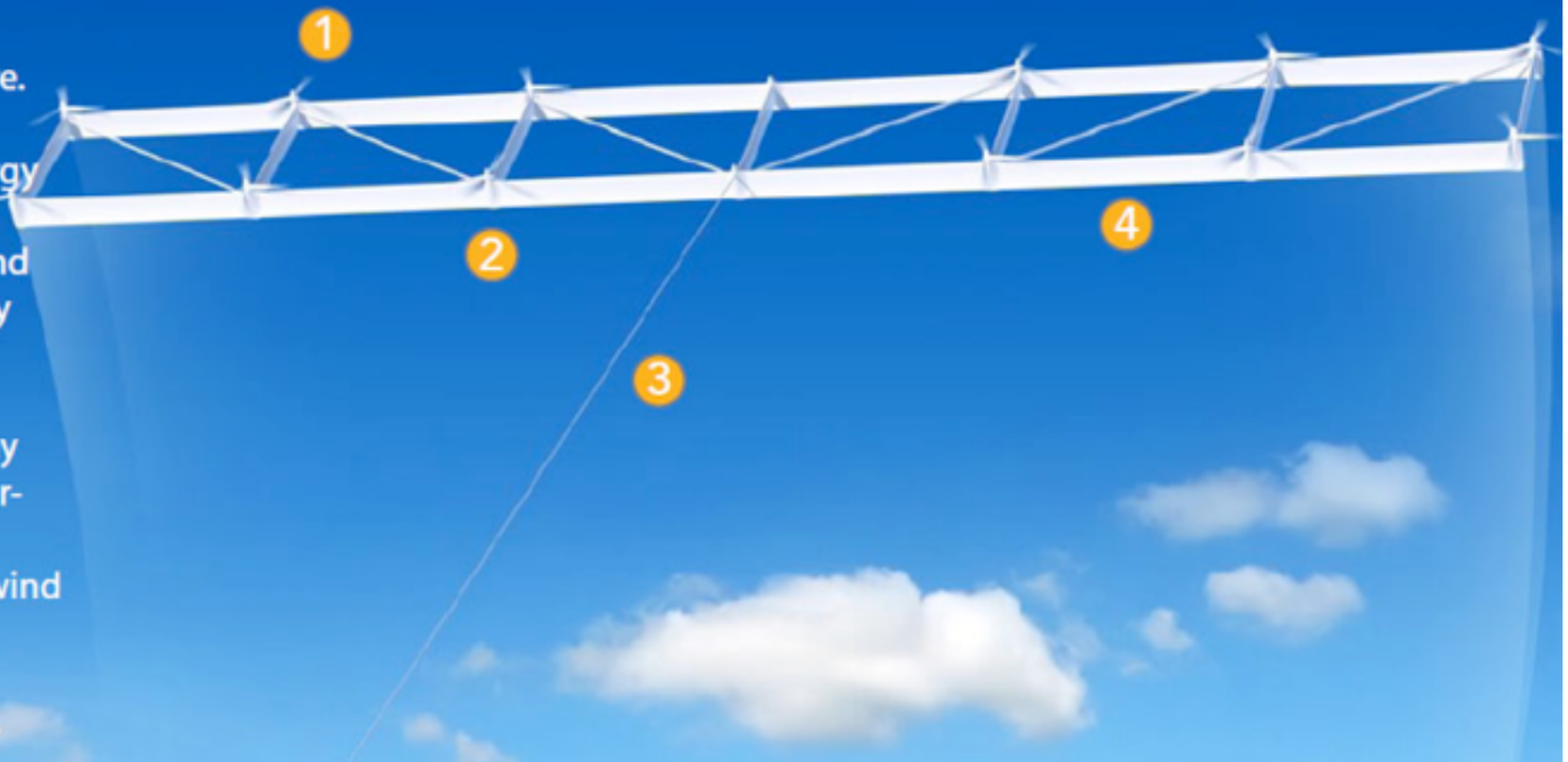
Airborne Wind Turbines

Joby RIP 2012

Joby Energy is developing airborne wind turbines which will operate in the upper boundary layer and the upper troposphere.

While knowledge of the tremendous energy in high-altitude wind is not new, recent advances in power electronics, sensors, and control systems now make our technology practical.

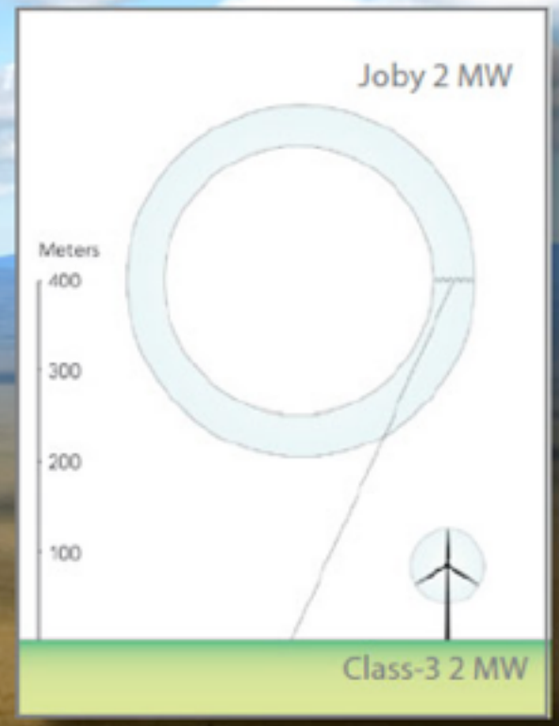
Our multi-wing structure supports an array of turbines. The turbines connect to motor-generators which produce thrust during takeoff and generate power during crosswind flight. Orientation in flight is maintained by an advanced computer system that drives aerodynamic surfaces on the wings and differentially controls rotor speeds. A reinforced composite tether transmits electricity and moors the system to the ground. The high redundancy of the array configuration can handle multiple points of failure and remain airborne.



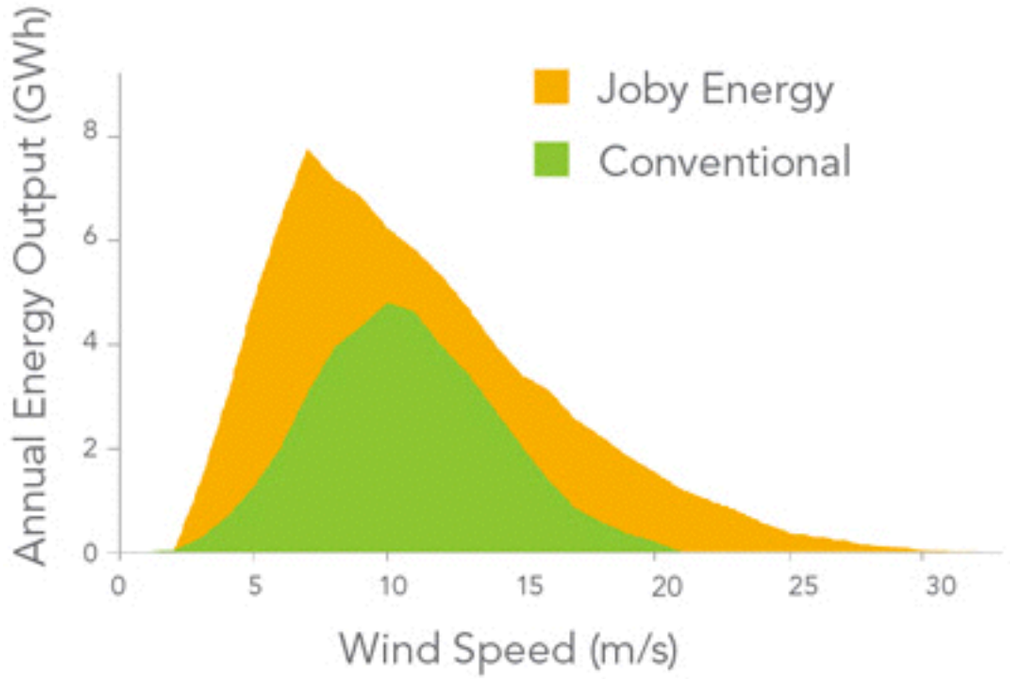
How It Operates

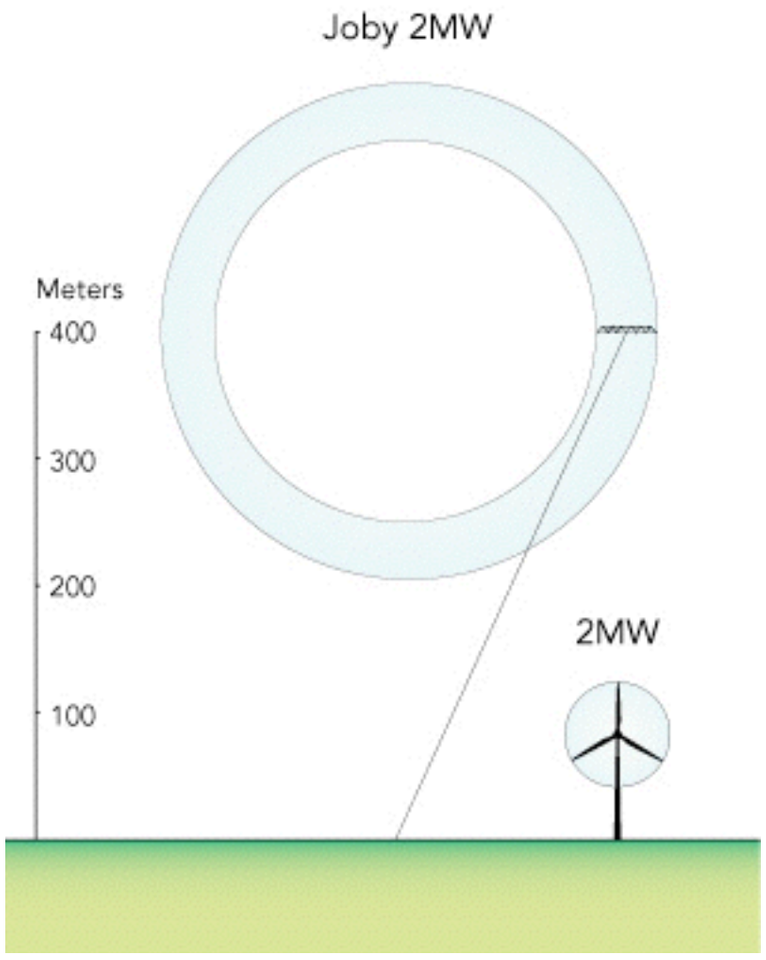
Joby turbine

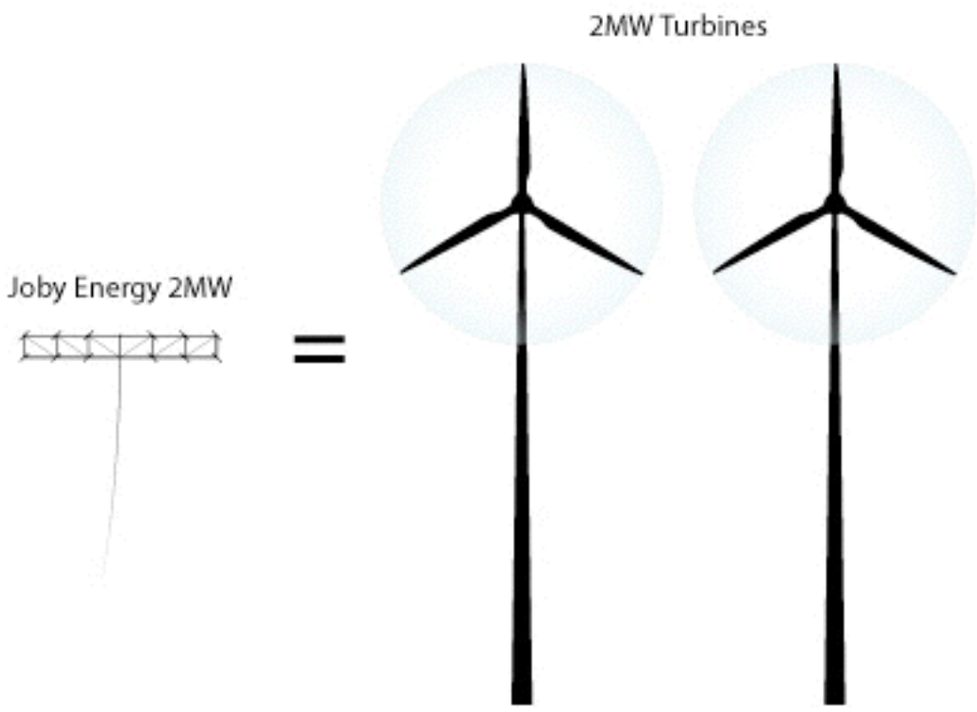
For launch, the turbines are supplied with power to enable vertical take-off. Upon reaching operating altitude, the system uses the power of the wind to fly cross-wind in a circular path. The high cross-wind speeds result in the turbines spinning the generators at high speeds, eliminating the need for gearboxes and increasing efficiency. The energy is transferred to the ground through the electrical tether. During occasional periods of low wind the turbines are powered to land the system safely.



Joby turbine data
(predicted)





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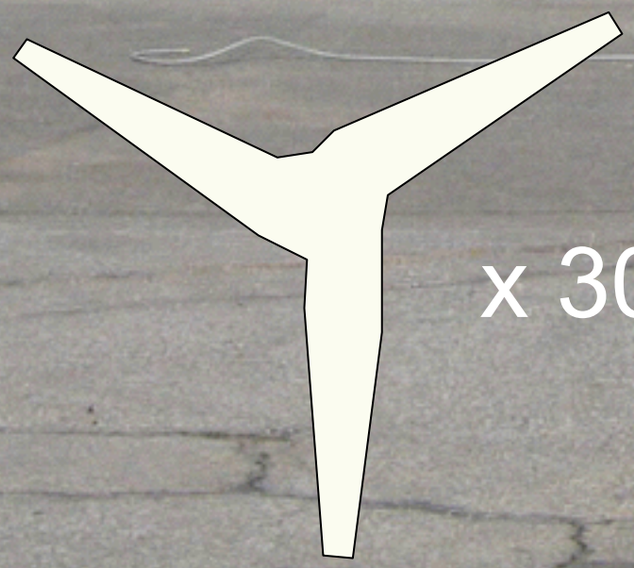
www.petzl.com

- Phase 1 (2002 – 2006): Prototype Testing
- Phase 2 (2006 – 2009): Demonstration
- Phase 3 (Current): MW-Scale Build-Out

Verdant Power East River turbines

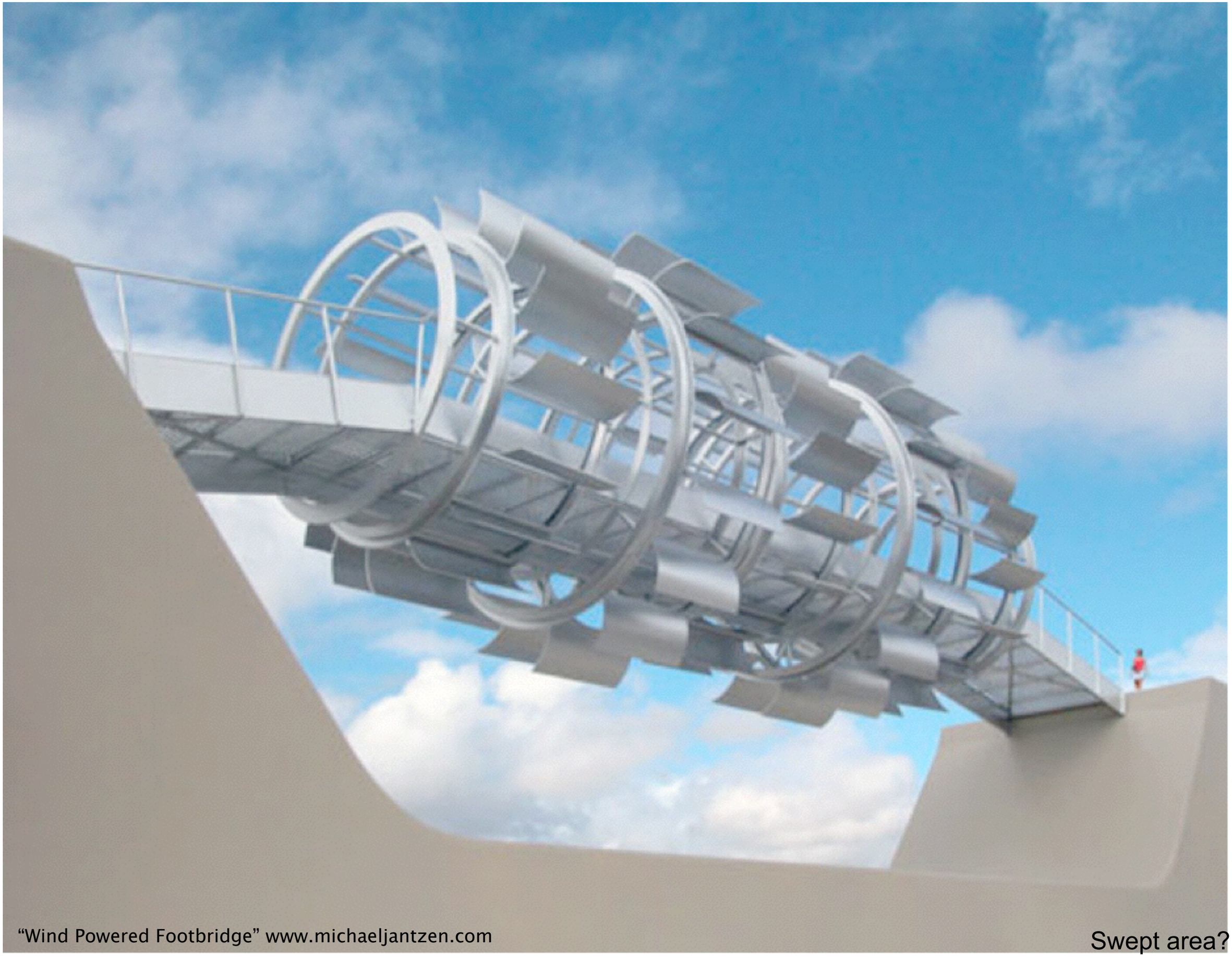


x 30 = 1 MW

Verdant Power East River turbines

Source of wind?

Source of wind?



"Wind Powered Footbridge" www.michaeljantzen.com

Swept area?