Minix

Presentation on increasing Wind Turbine energy efficiency: a new technology device for use in the Wind Turbine Power industry

“increasing the energy output of wind turbines”

Christian Hugues (Inventor)
christian.hugues@minix.fr

Michael Hobbs (Speaker)
m.hobbs@hawkinformation.com

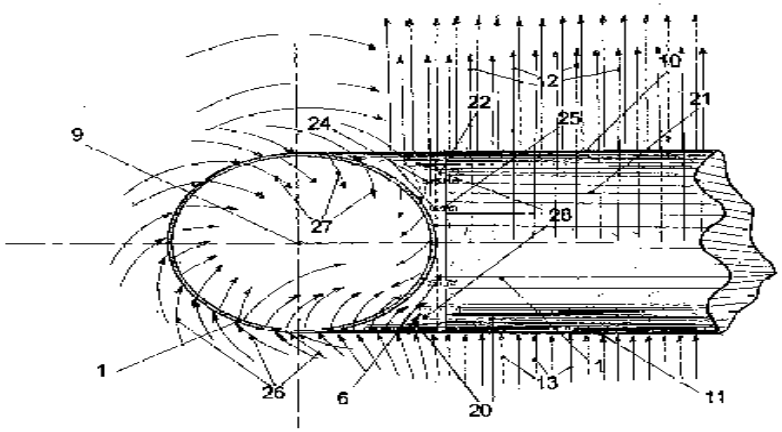
- Introductions
- What is it?
- Where can it be used?
- Why is it important?
- When can it be used?
- How can it be used?
- Market overview
- Testing
- Conclusions

Introduction to the team

- Hawk Associates (commercial)
- X,Y,Z Prototypes (manufacturing)
- Mr Hugues (inventor and owner of the Minix technology)

Minix. What is it?

- A device that renders a wind turbine blade more efficient
- A technology originally developed for aircraft wingtips
- Successfully tested at Mach 0.8
- A device designed to reduce induced drag and alleviate the vortex
- Technology protected by patents

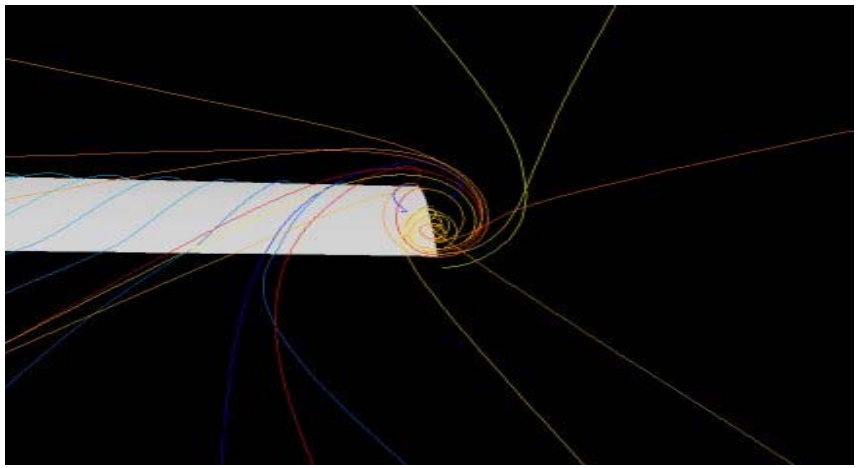


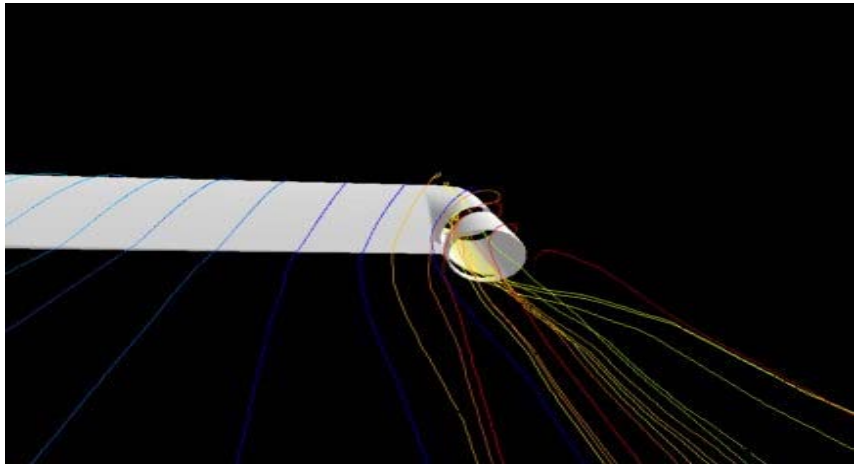
Where can it be used?

- Minix can be adapted to fit any airfoil
- Wind turbine, aircraft, helicopter blade, hydrofoil, F1 racing car....
- Applied to the tip of a blade
- On-shore or off-shore wind turbines
- Practical for new build machines or retrofit

Why is it important? Benefits?

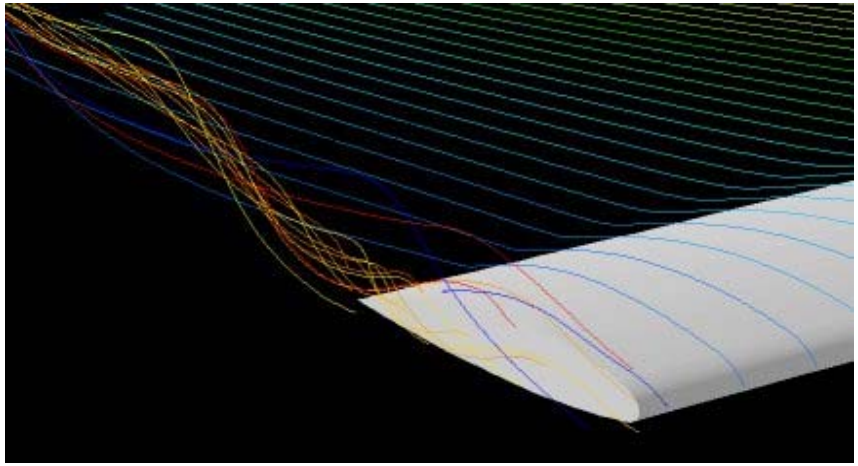
- Reduces induced drag on leading edge of wind turbine blade
- Results in an average gain of 14% in annual electricity production (independent, 3rd party results)
- Cost-effective method of increasing wind turbine power output
- Alternatively, used to reduce material costs (smaller blade length for same output)

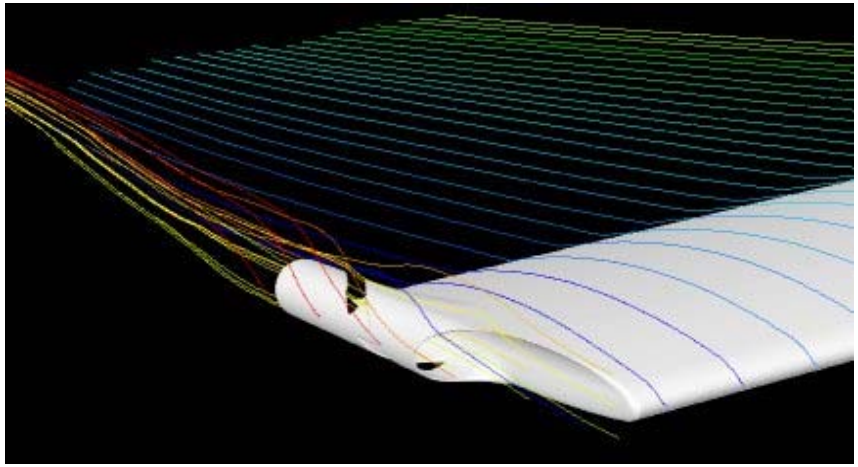




Why is it important? Benefits?

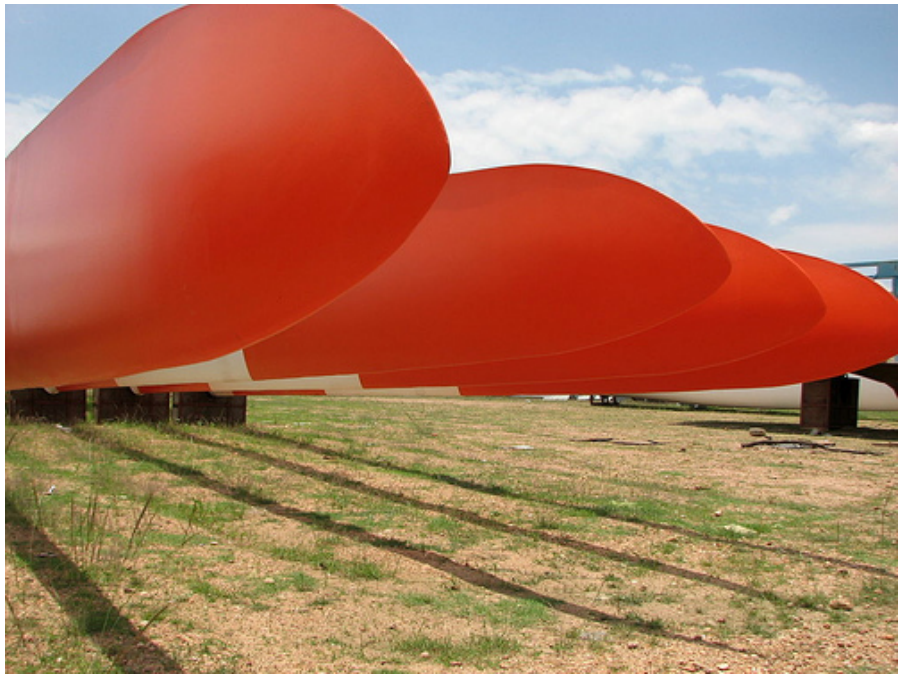
- Capable of reducing noise and vibrations on tower (environmental and mechanical impact)
- Increased efficiency per square metre for wind farms
- Axis commences turning at lower wind speeds





When can it be used?

- Minix is a tested and proven technology ready for production
- International patents for Minix N° 1 and N° 2
- Retrofit for existing wind turbines or wind farms, on or off shore



When can it be used?

- Integral part of design for new projects
- Helps all types of horizontal or vertical wind turbines
- Easily shipped pre-packaged or manufactured locally

Who is concerned?

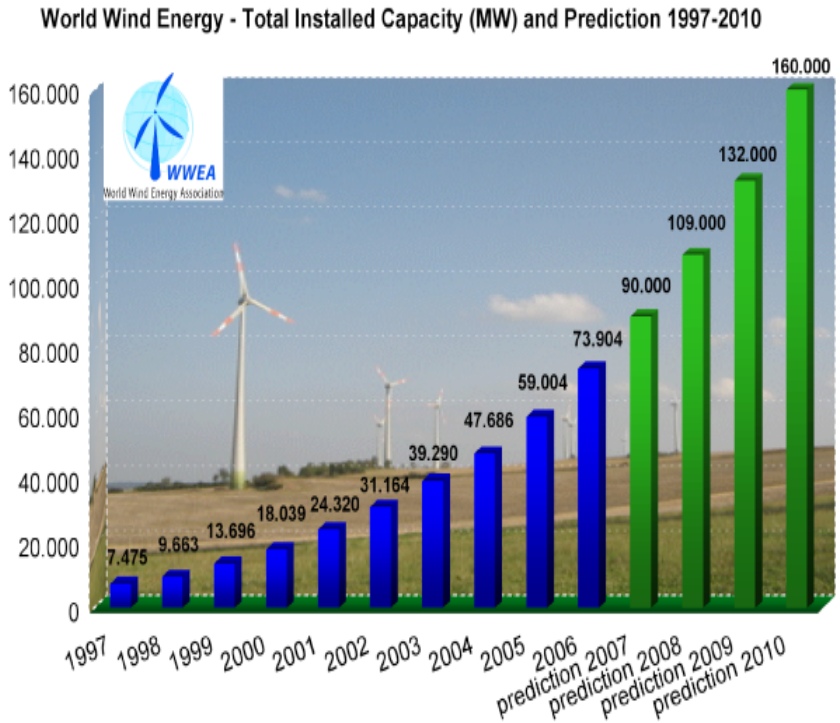
- Operators and users of wind power (horizontal, vertical, on-shore, off-shore)
- Wind turbine manufacturers required to meet growing demand
- Wind farm project managers requiring a competitive edge
- Wind turbine mechanics, engineers and designers
- Government authorities required to meet renewable energy targets
- Technology strategy advisors in renewable energy sector
- Financial backers and investment companies looking for quicker return on investment

How can it be used?

- Minix device is lightweight and durable (successfully tested on aircraft) and easily manufactured
- Easily fitted to the tip of the wind turbine blade
- Simple process of adapting the profile, creating the blade specific device and attaching it to the machine
- Design work includes the process of bolting on the device
- Designed from 'scratch' as part of the blade or easily retrofitted on site

Market Overview

- Renewable energy undergoing massive investment and change
- Government obligations to meet targets of CO2 reduction and wind power output
- Current demand is outstripping supply capability
- More and more Wind Turbines being built around the globe



Market overview

- Brings a viable and commercially available solution that improves energy output
- Innovative, market first
- Competitive edge to manufacturers
- Helps to meet client demand requirements
- Robust and sleek design

Testing: Wind Turbine Results Minix 2

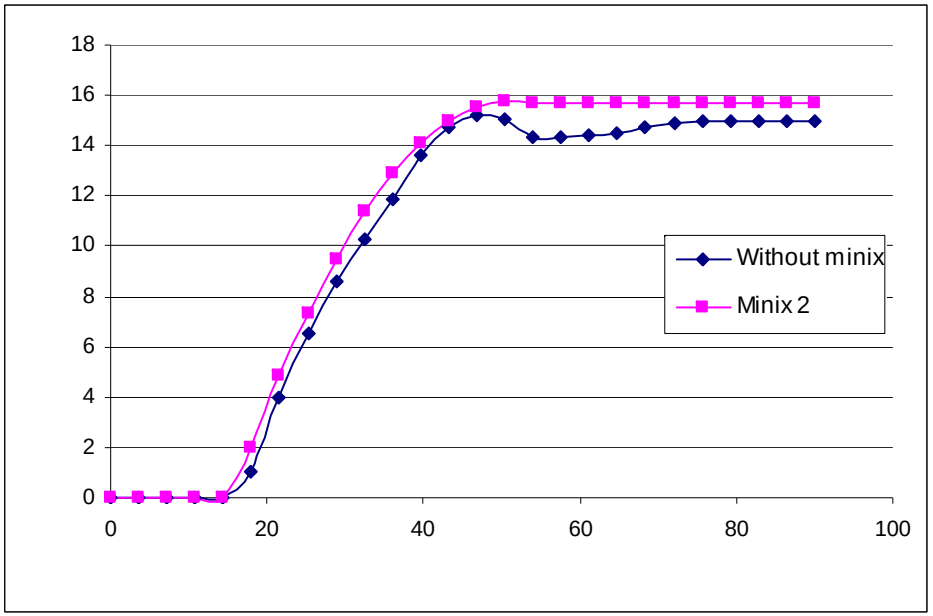
Wind Turbine Power Curve :

Speed m/s	Speed km/h	Power		Production	
		Without minix	Minix 2	Without minix	Minix 2
0	0	0	0	0	0
1	3,6	0	0	0	0
2	7,2	0	0	0	0
3	10,8	0	0	0	0
4	14,4	0	0	0	0
5	18	1	1,9855	0,139	0,275
6	21,6	4	4,8216	0,491	0,591
7	25,2	6,5	7,3309	0,648	0,731
8	28,8	8,6	9,5134	0,646	0,715
9	32,4	10,3	11,3691	0,543	0,599
10	36	11,9	12,898	0,411	0,446
11	39,6	13,62	14,1001	0,289	0,299
12	43,2	14,72	14,9754	0,180	0,183
13	46,8	15,2	15,5239	0,100	0,103
14	50,4	15,06	15,7456	0,051	0,053
15	54	14,3	15,7	0,023	0,025
16	57,6	14,3	15,7	0,010	0,011
17	61,2	14,4	15,7	0,004	0,005
18	64,8	14,5	15,7	0,002	0,002
19	68,4	14,7	15,7	0,001	0,001
20	72	14,9	15,7	0,000	0,000
21	75,6	15	15,7	0,000	0,000
22	79,2	15	15,7	0,000	0,000
23	82,8	15	15,7	0,000	0,000
24	86,4	15	15,7	0,000	0,000
25	90	15	15,7	0,000	0,000

Start speed	5	m/s
Cut out speed	25	m/s

Rédaction		
Alain FRYDMAN	TECHNI PROCESS	visa

Testing: Wind Turbine Results Minix 2



Power / Speed

Wind Turbine Power Curve

RESULTS			
Calculated production of electricity	Without Minix	Minix 2	
Average power output	3,5	4,0	kW
Daily production	84,9	96,9	kW.h
Monthly production	2 582	2 948	kW.h
Annual production	30 987	35 379	kW.h
Gain		**14%**	

Rédaction		
Alain FRYDMAN	TECHNI PROCESS	visa

Conclusions

- **Who?** Mr Christian Hugues, inventor of the Minix device and Hawk Associates, representing the commercial interests of the technology
- **What?** A new device that when fitted to the tip of a turbine blade (or any airfoil) reduces the induced drag
- **Why?** To make wind turbines more efficient. Saving money, reducing CO2 and material costs
- **Where?** French based company with worldwide market reach. Patented technology in France, Europe, US, Canada, Israel, etc….
- **When?** The technology exists now. Successful testing performed in the Wind Turbine sector
- **How?** Commercial application and integration is now possible. Visit us at Stand F2.

- Questions?
- Comments?

Come and visit us to find out more information on Stand F2

CONTACTS

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christian.hugues@minix.fr

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