



Trends in the small wind industry

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Ampair[®]

Small is ... Festival 2011, **Practical Action**

Rugby, 3rd September 2011



Why do people want small wind turbines ?

Off grid power



Alaska

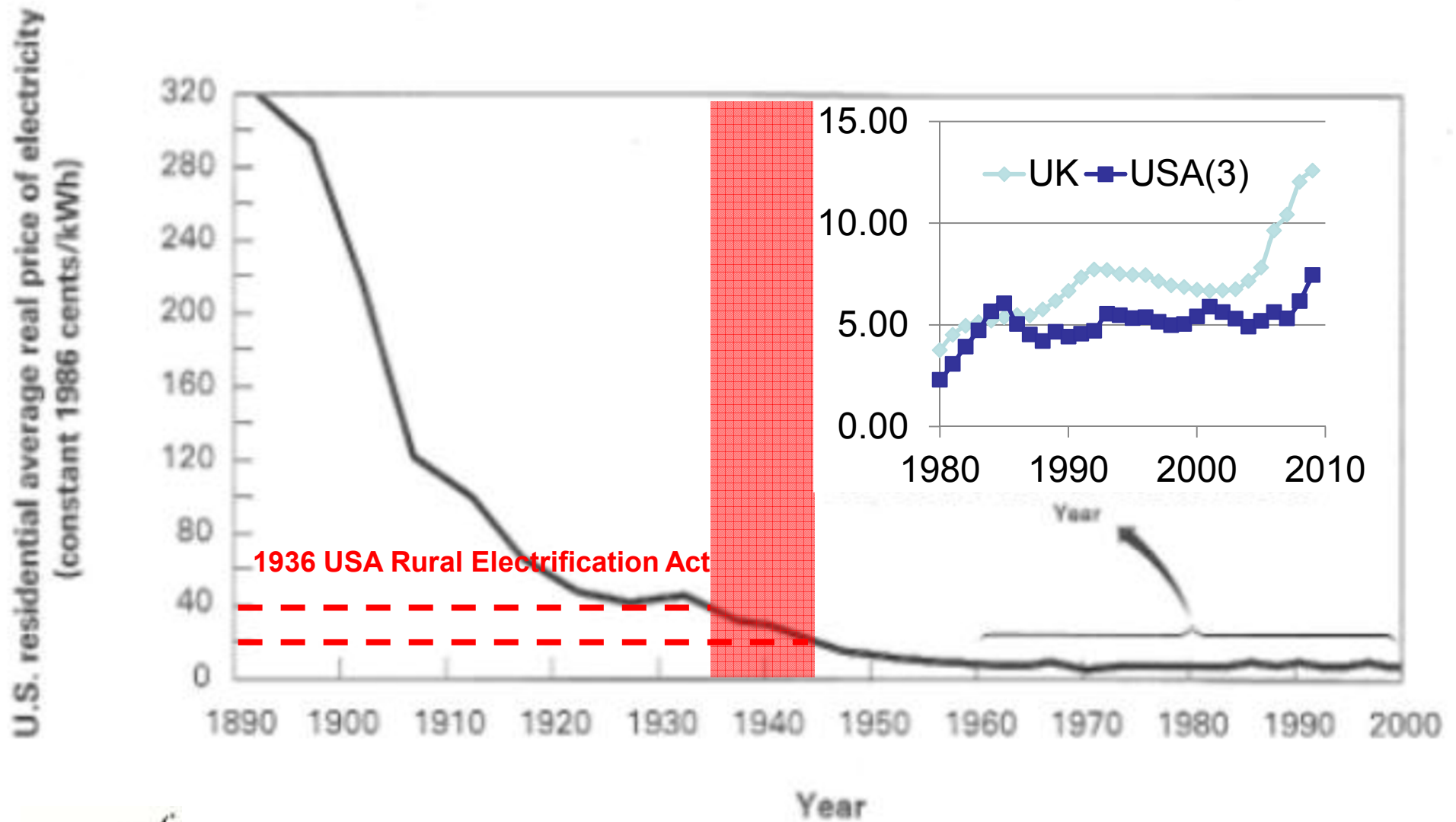
On grid power



UK

US & UK residential electricity price

1986 c/kWh main chart; MOD p/kWh for inset chart



Small wind system designs + setup

- Micro** - 0 – 1.5 kW
- Small** - 1.5 – 15 kW
- Medium** - 15 – 100 kW +

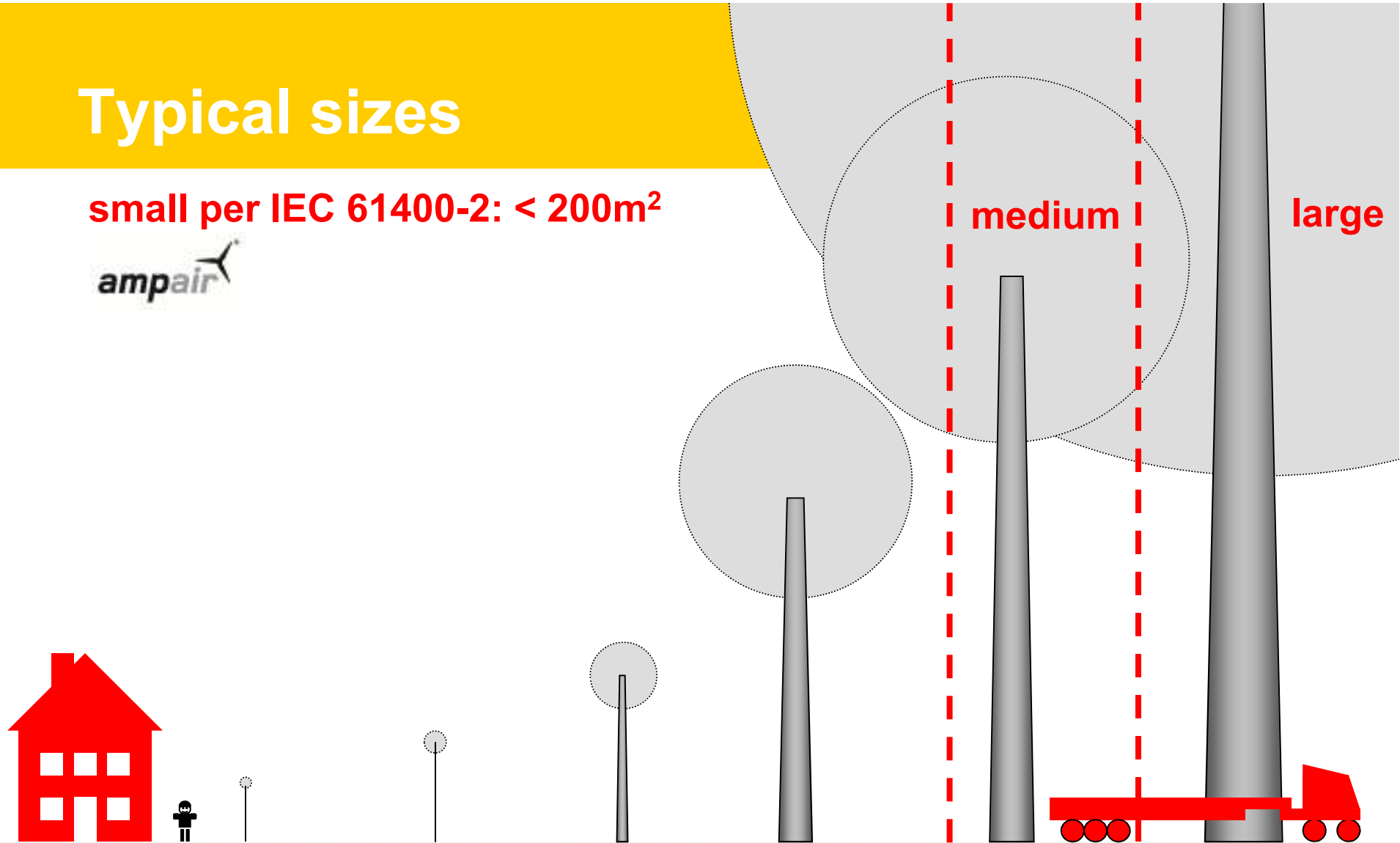
Freestanding / Building mounted
Horizontal axis / Vertical axis

Off grid / On grid



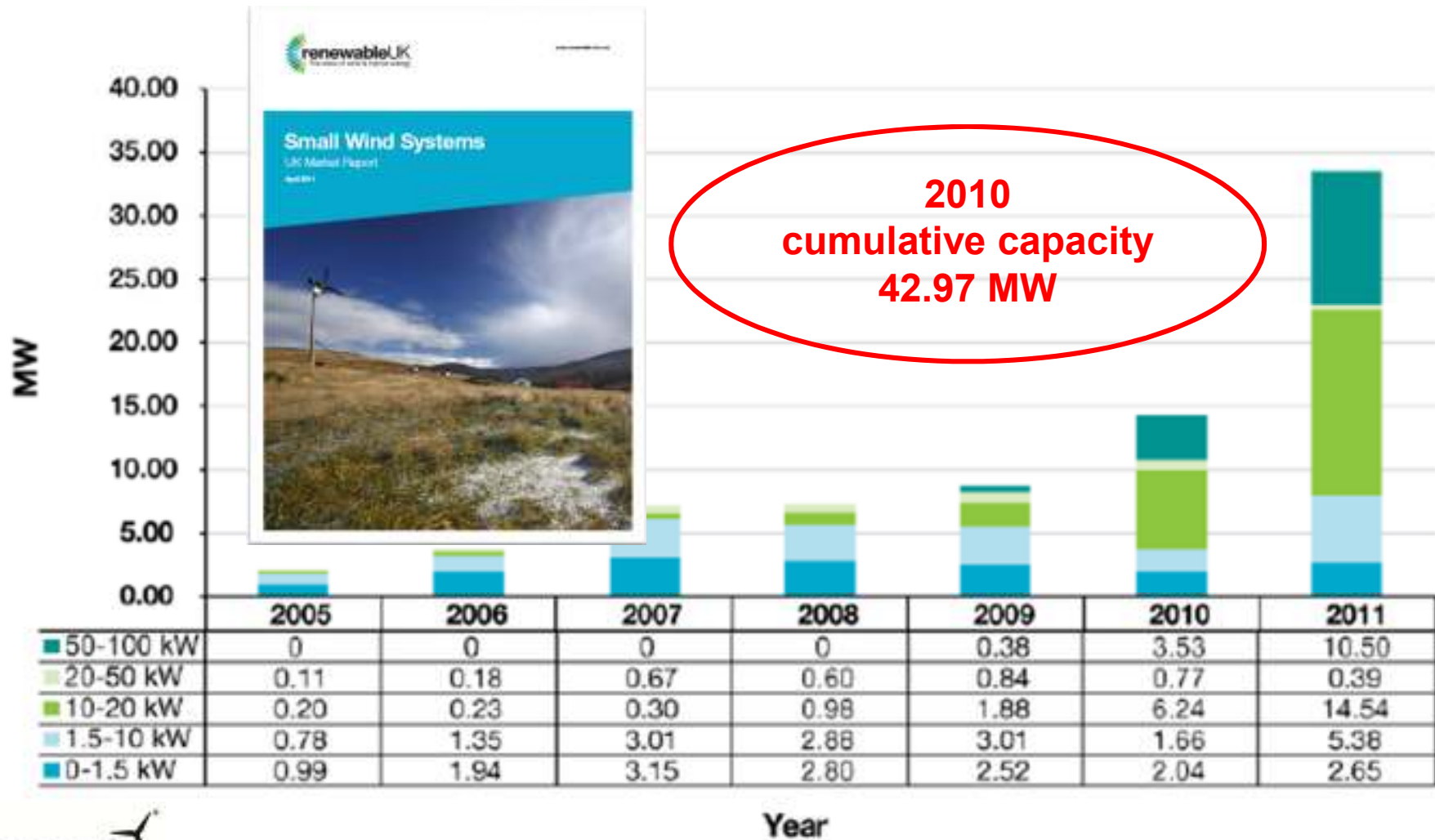
Typical sizes

small per IEC 61400-2: < 200m²

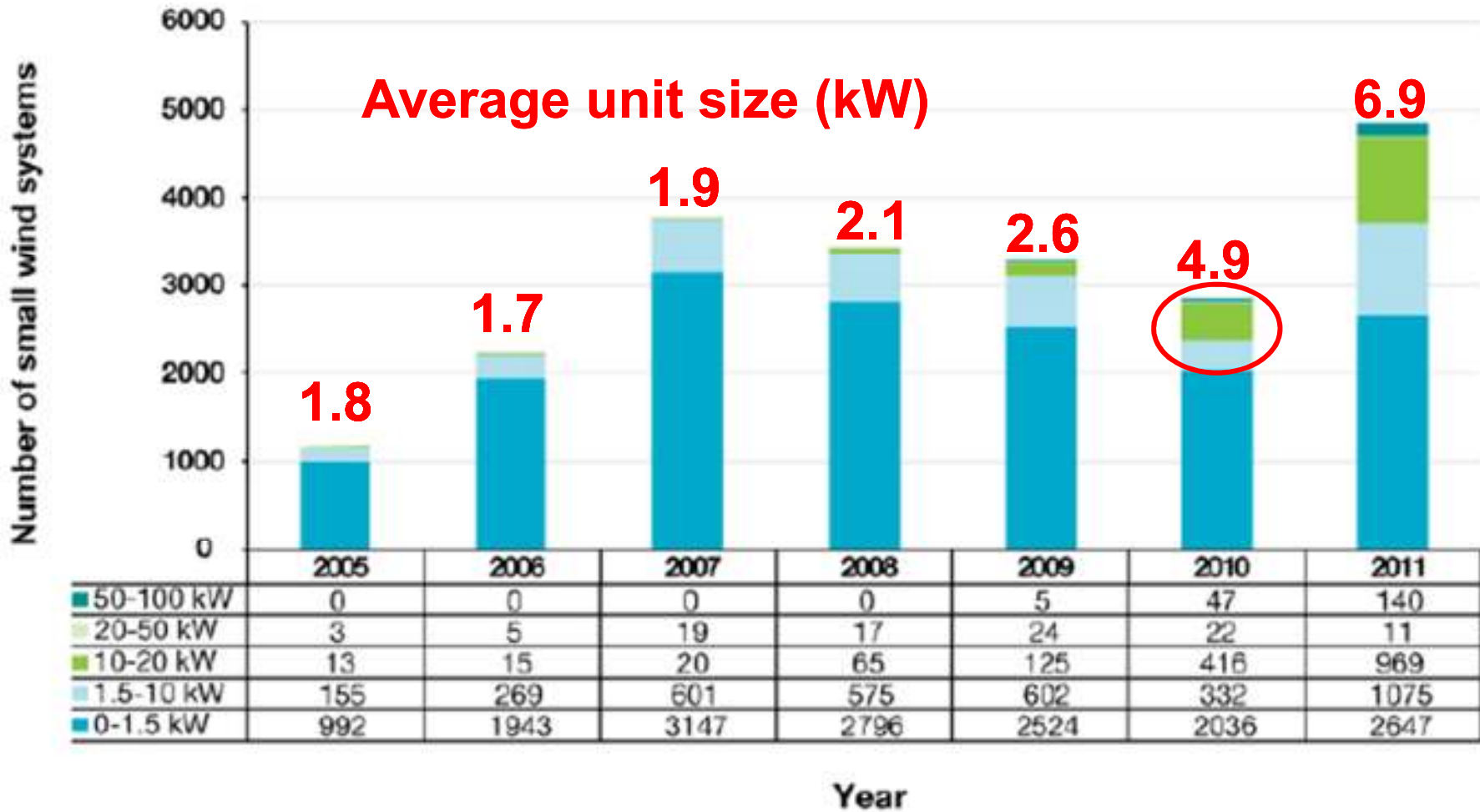


Power	0.3 kW	0.6 kW	6-10 kW	30-50 kW	100 kW	1 MW
Diameter, m	1.2 m	1.7 m	5-7 m	14-16 m	25 m	80 m
Height, m		8 m	12-15 m	24-32 m	50 m	120 m

UK annual deployment 14.23 MW (+65% on 2009)

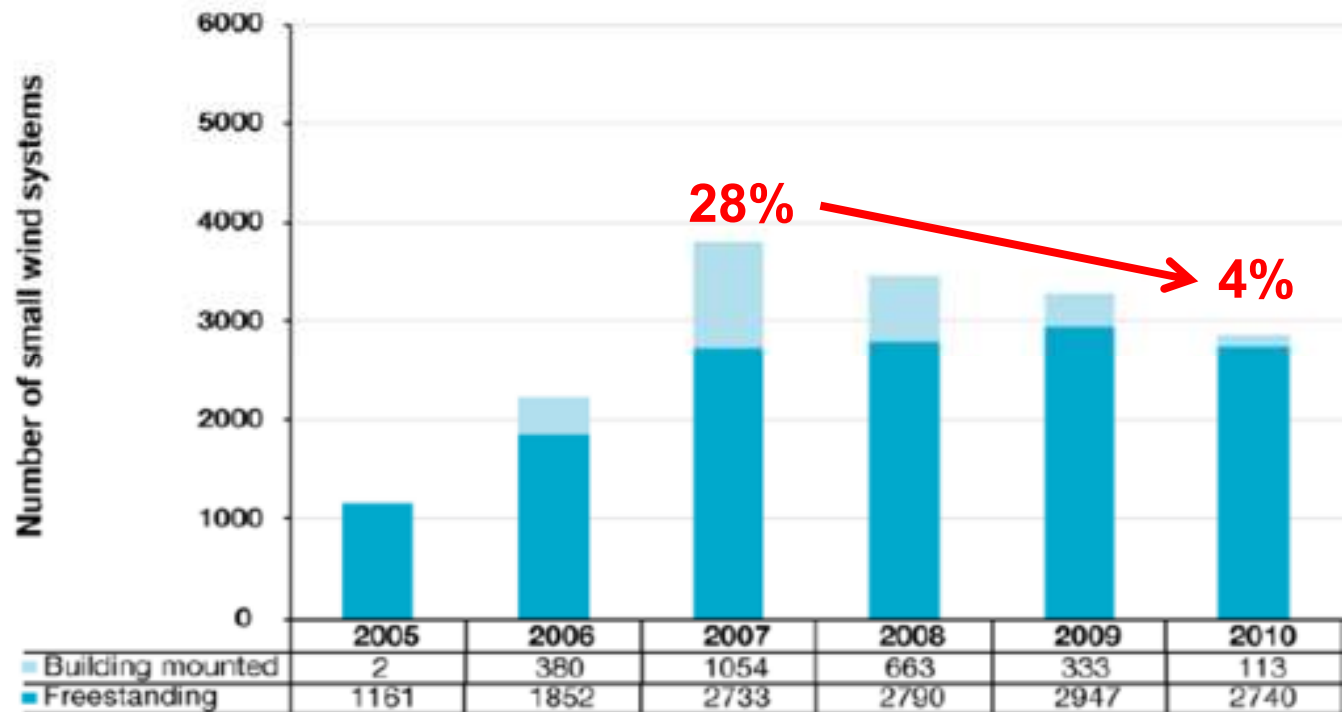


UK annual deployment 2,853 systems installed



UK annual deployment

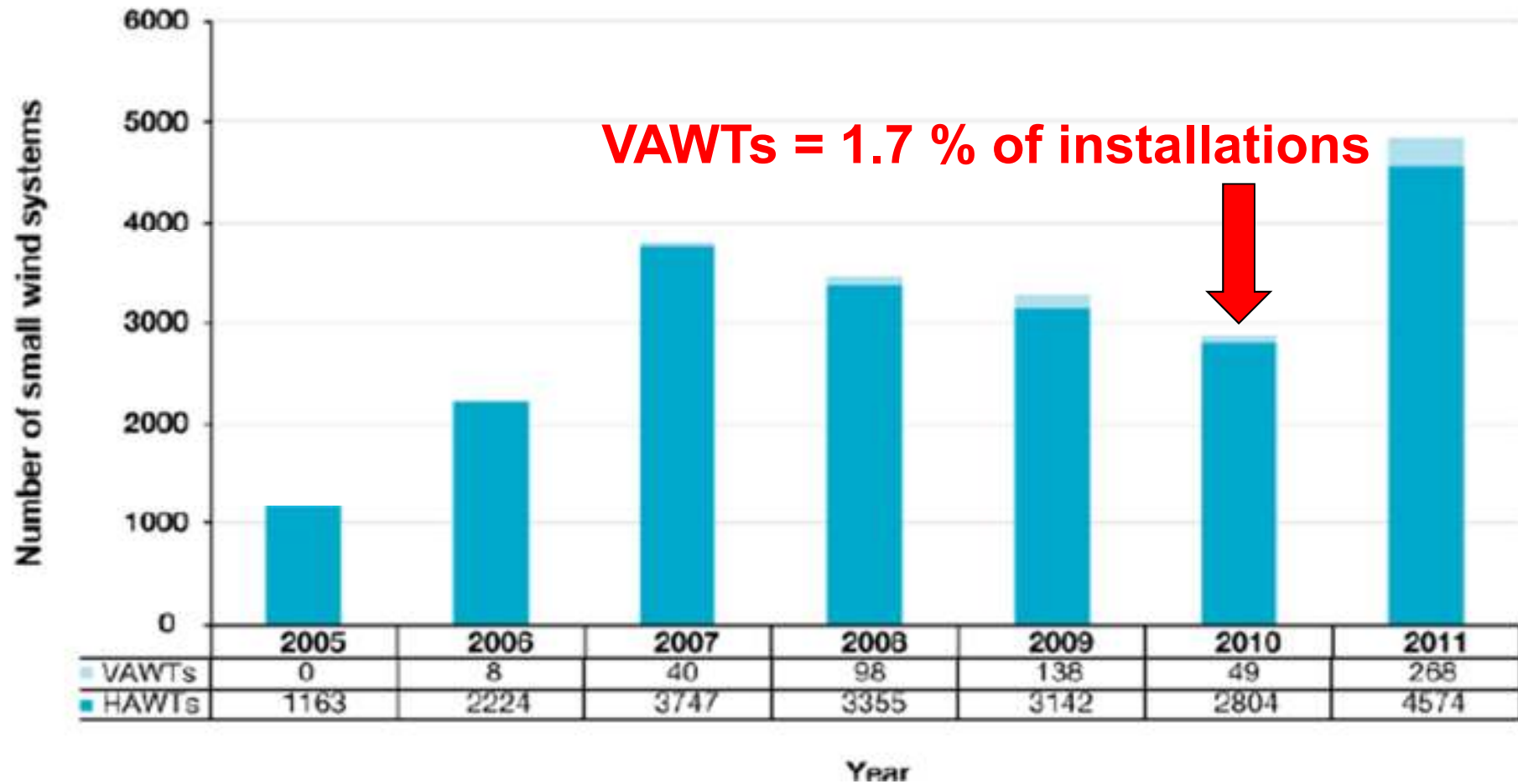
Building mounted (4% of 2010 installations)



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UK annual deployment HAWTs & VAWTs



MCS is here, for the benefit of consumers

	Product Name	Manufacturer	Product Type	Product Model	Certification No.
	Evance...	Evance Wind Turbines Limited	Wind Turbine	R9000...	MCS WT0039/01
	Evoco...	Evoco Energy Limited	Wind Turbine	Evoco 10...	MCS WT0054/01
	Gala-Wind 133-11kw...	Gala-Wind Ltd	Wind Turbine	GW 133-11kw...	TUV 0002
	Proven Energy P35...	Proven Energy	Wind Turbine	P35...	TUV 0001
	Proven Energy P35-2...	Proven Energy	Wind Turbine	P35-2...	TUV 0003
	quietrevolution QR 5 v1.3...	quietrevolution	Wind Turbine	QR 5 v 1.3...	TUV 0004
	Skystream 3.7...	Southwest Windpower, Inc.	Wind Turbine	Skystream 3.7...	MCS WT0043/01
	Skystream Marine 3.7...	Southwest Windpower, Inc.	Wind Turbine	Skystream Marine 3.7...	MCS WT0043/02
	Xzeres -442SR Wind Generator...	Xzeres Wind Corp	Wind Turbine	Xzeres-442SR Wind Generator...	BBA0071

9 products
 7 manufacturers
 3 certification bodies
 275 installers



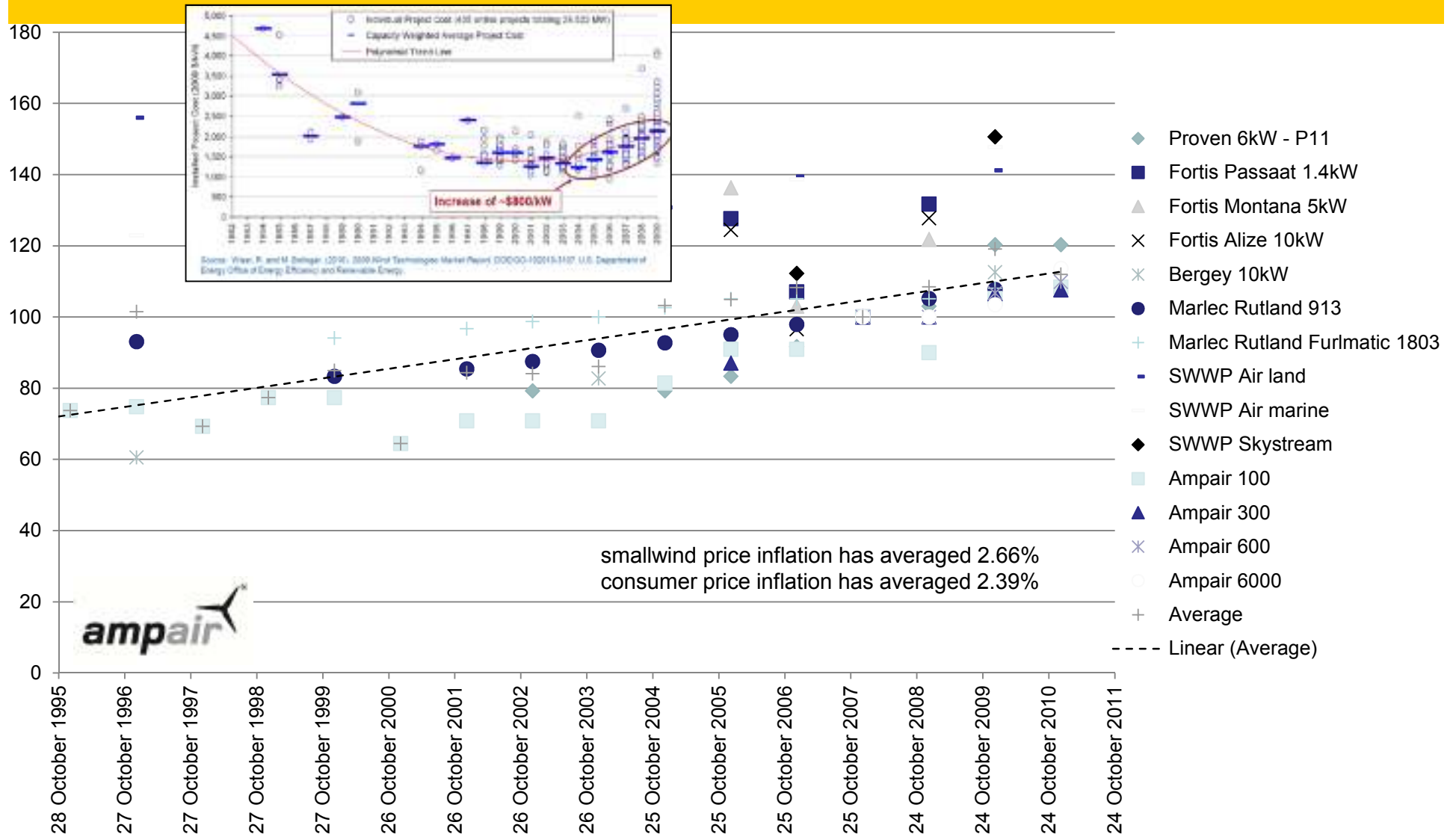
See:

MCS 006

MIS 3003

Small Wind Turbine Retail Price Evolution

(normalised for money of the day prices in manufacturer's local currencies, 2008 = 100)

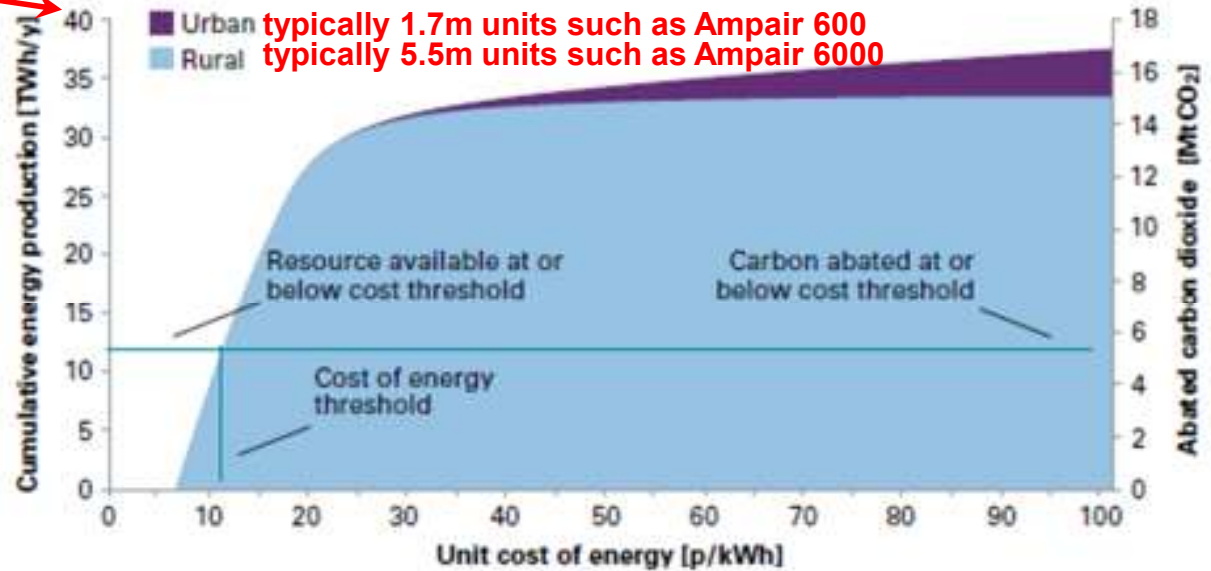


Market *Cost-resource curve and selected data for UK small-scale wind energy*

corresponds to 5 million 6kW turbines of 5.5m diameter

a) Cost-resource curve

The chart is based on 100% market penetration. In the table, the 100% market penetration bracket means 'if every turbine at or below a given cost of energy were installed', while the 10% bracket means 'if 10% of turbines at or below a given cost of energy were installed'.



b) Selected data from cost-resource curve

Sources: Met Office and Entec

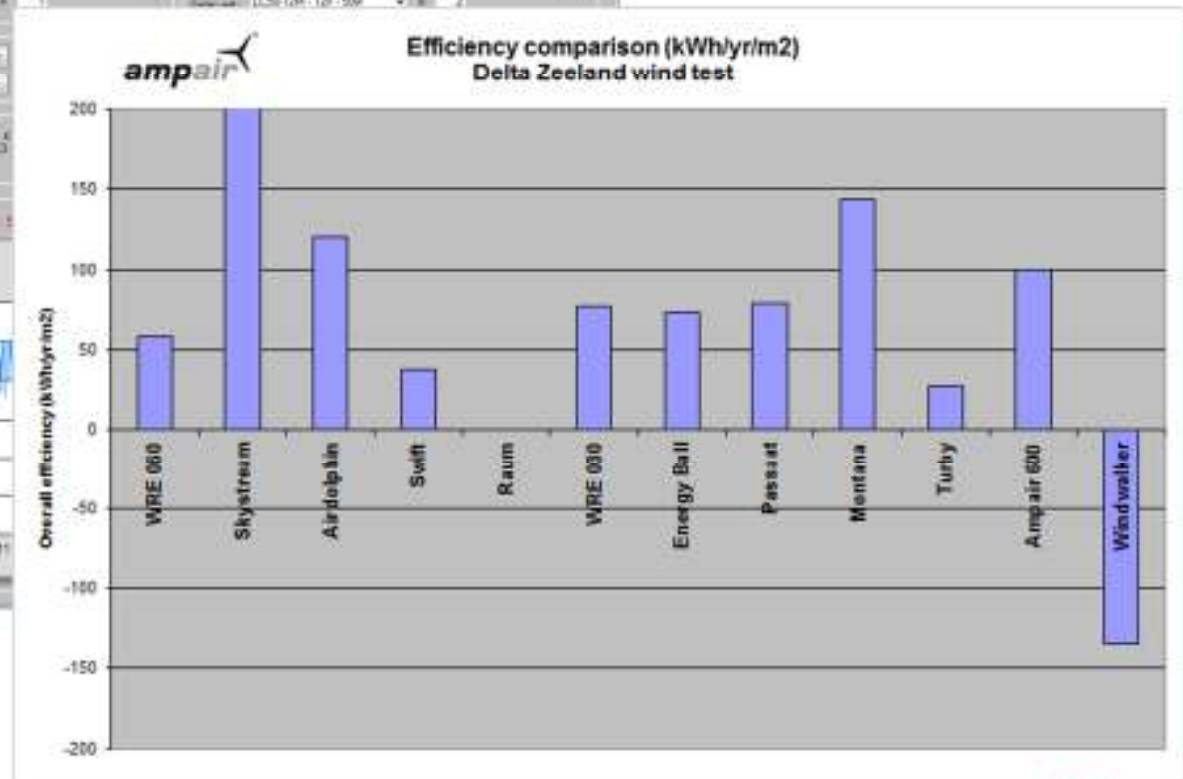
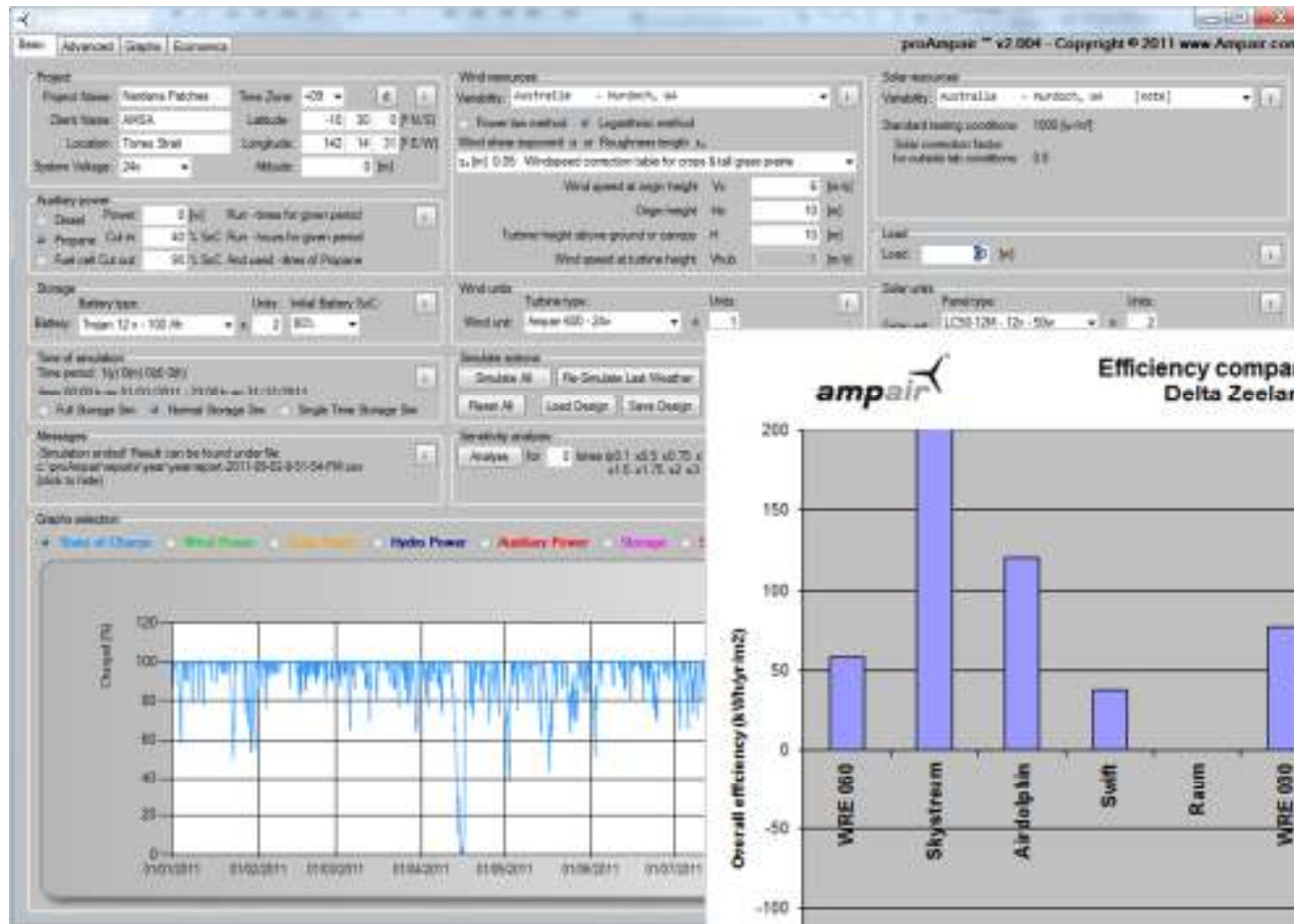
		Cost of energy	
		<12p/kWh	<100p/kWh
Market Penetration	100%	15 TWh/year 6.3 MtCO ₂ /year	37 TWh/year 16 MtCO ₂ /year
	10%	1.5 TWh/year 0.6 MtCO ₂ /year	3.7 TWh/year 1.6 MtCO ₂ /year



Longer term – doing without subsidy

Turbine and site	Annual energy production	8,000	kWh/yr	Y (yield, from AEP tables)
	Export fraction	20%		F
Production	Electricity exported	1,600	kWh/yr	$E_{exp} = Y \times F$
	Electricity used directly	6,400	kWh/yr	$E_{dir} = Y \times (1-F)$
Price	Unit price of exported electricity	£ 0.13	£/kWh	P_{exp}
	Unit price of imported electricity	£ 0.13	£/kWh	P_{imp}
	Unit price of generation tariff	£ 0.23	£/kWh	P_{gen}
Value	Value of exported electricity	£ 208	per year	$V_{exp} = E_{exp} \times P_{exp}$
	Value of electricity used directly	£ 832	per year	$V_{dir} = E_{dir} \times P_{dir}$
	Value of generation tariff	£ 1,840	per year	$V_{gen} = (E_{exp} + E_{dir}) \times P_{gen}$
	Total value	£ 2,880	per year	$V_{tot} = V_{exp} + V_{dir} + V_{roc}$
Cost	Cost of turbine	£ 17,000		C_{tur}
	Cost of install	£ 5,000		C_{inst}
	Total capital cost of install after grant	£ 22,000		$C_{capex} = C_{tot} - G$
	Annual operating cost	£ 150	per year	C_{opex}
Simple payback	Simple payback	8	years	$T_{pay} = C_{capex} / (V_{tot} - C_{opex})$
Internal rate of return	Turbine life	20	years	L
	Internal rate of return	10.3%		IRR = interest rate for NPV of zero
Cost of electricity, cash basis	Over simple payback period	£ 0.36	per kWh	
	Over turbine life	£ 0.16	per kWh	

Market economies drive innovation





Questions

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