

# Barriers preventing the deployment of Small Wind Systems and the Economic Advantages

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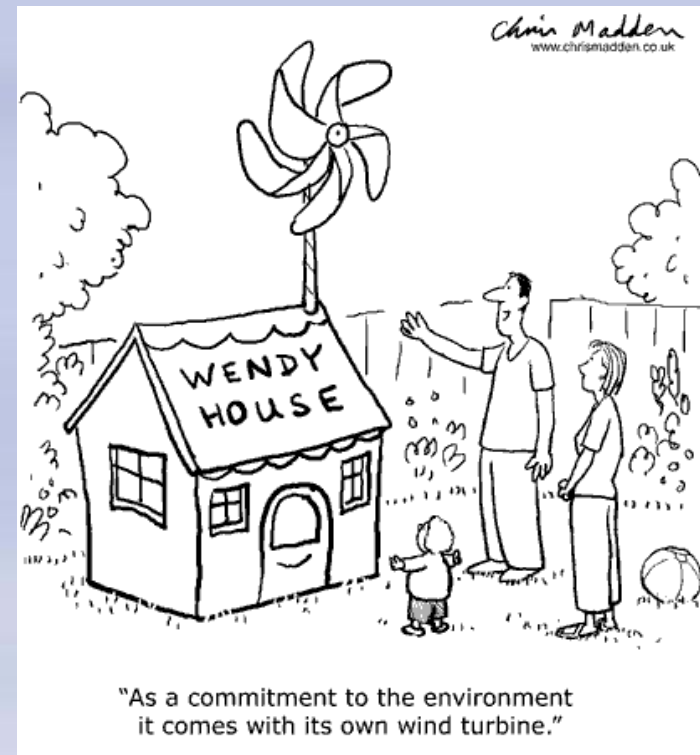


*EU Sustainable Energy Week, Brussels 14 April 2011*

- Wind – a free fuel
- Utility turbines getting bigger reducing the cost of power
- High capital & finance costs
- Small wind turbines – absolute limit on power generated



- Wind Resource & potential output
- The cost of electricity
- Economic viability - Incentives & subsidies
- Installation costs & financing
- Ongoing life cycle costs
- Planning regimes
- Accreditation schemes – manufactures and installers



# Financial Perspective

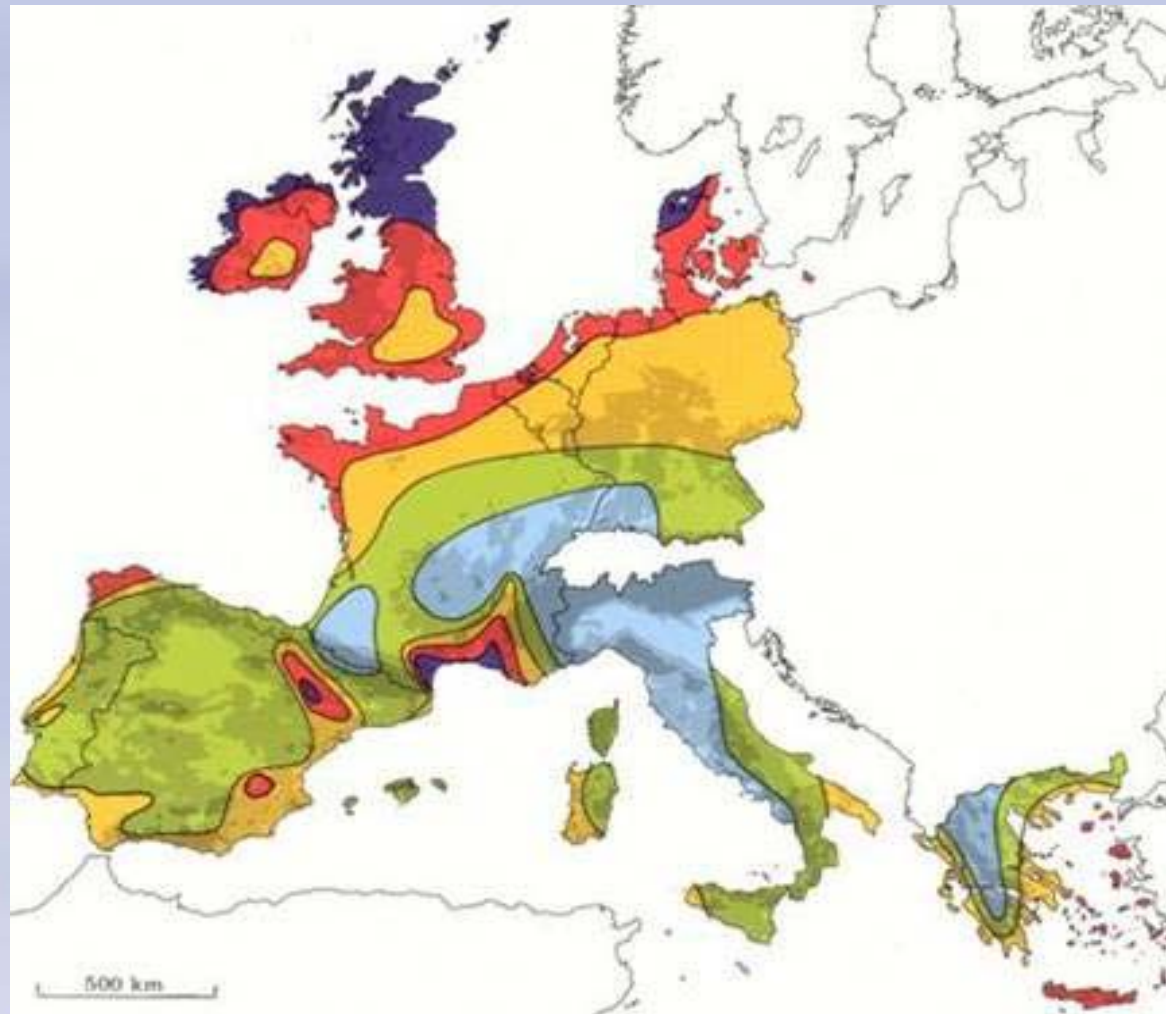
- Rate of return on investment required?
- Public or private funding?
- Pay back over life of turbine or bank loan?



# The Fuel

- 1 - 2% of the sun's energy is converted into wind energy
- Wind speed increases with height
- Wind speeds decrease due to surface roughness
- Small wind systems depend on the annual average wind speed
- Power generated by a wind turbine increases with the cube of the wind speed
- Sites located only 100m apart can be significantly different
- Wind resource is frequently overestimated in databases

# European Wind Atlas (50m)



Speed range depending upon topography (m/s)	
Risø National Laboratory 1989	
	> 6.0 - > 11.5
	5.0 - 11.5
	4.5 - 10.0
	3.5 - 8.5
	< 3.5 - < 7.0

# UK Wind Resource (25m)



**Annual mean wind speed  
25m above ground level (m/s)**

ETSU for the DTI (UK) 1989

	> 10
	9 - 10
	8 - 9
	7 - 8
	6 - 7
	5 - 6
	< 5

# Small Wind Systems

Size	Rated capacity	Typical Annual Energy Production (KWh)	Total height (m)	Typical Installation Cost (€K)	€ / KW
Micro	0.5 - 1.5 kW	Up to 4000	10 -18	0.5 -5	4000 - 6000
Small	1.5 – 15 kW	Up to 40,000	12 - 25	2.5 - 50	
Small / Medium	15 – 100 kW	Up to 200,000	15 - 50	5 -350	Approx 3500
Utility Scale	2 - 7 MW	Up to 21,000,000	50 - 200	2500	Approx 500



# The Warwick Wind Trials

*UK October 2007 – October 2008*



- 26 building-mounted, grid connected microwind systems < 2kW in urban sites.
- Only 5 sites had annual average wind speed > 5 m/s – the lower limit of financial viability
- Capacity Factor 0.85% - some used more energy than produced.
- National Wind Speed Database overstates speeds in urban areas by 40 -75% and can exaggerate outputs by a factor of 8 or more.
- The major factor affecting accuracy of energy output predictions is the accuracy of wind speed prediction



# Market Growth?

- Building Mounted v free standing?
- Building Mounted – ‘micro’
- Free standing – ‘small’ turbines’
- Feed-In-Tariffs
- Microgeneration Strategy  
- Local authorities can now sell energy to the grid



Table of tariffs up to 2013

Technology	Scale	Tariff level for new installations in period (p/kWh) [NB tariffs will be inflated annually]			Tariff lifetime (years)
		Year 1: 1/4/10 – 31/3/11	Year 2: 1/4/11 – 31/3/12	Year 3: 1/4/12 – 31/3/13	
Anaerobic digestion	≤500kW	11.5	11.5	11.5	20
Anaerobic digestion	>500kW	9.0	9.0	9.0	20
Hydro	≤15 kW	19.9	19.9	19.9	20
Hydro	>15-100 kW	17.8	17.8	17.8	20
Hydro	>100 kW-2 MW	11.0	11.0	11.0	20
Hydro	>2 MW – 5 MW	4.5	4.5	4.5	20
MicroCHP pilot*	<2 kW*	10*	10*	10*	10*
PV	≤4 kW (new build)	36.1	36.1	33.0	25
PV	≤4 kW (retrofit)	41.3	41.3	37.8	25
PV	>4-10 kW	36.1	36.1	33.0	25
PV	>10-100 kW	31.4	31.4	28.7	25
PV	>100kW-5MW	29.3	29.3	26.8	25
PV	Stand alone system	29.3	29.3	26.8	25
Wind	≤1.5kW	34.5	34.5	32.6	20
Wind	>1.5-15kW	26.7	26.7	25.5	20
Wind	>15-100kW	24.1	24.1	23.0	20
Wind	>100-500kW	18.8	18.8	18.8	20
Wind	>500kW-1.5MW	9.4	9.4	9.4	20
Wind	>1.5MW-5MW	4.5	4.5	4.5	20
Existing microgenerators transferred from the RO		9	9.0	9.0	to 2027

Renewable Energy Obligation Certificates are effectively outmoded for wind installations of about 1.5 MW and above. Thus Small Wind relies now on FIT entirely

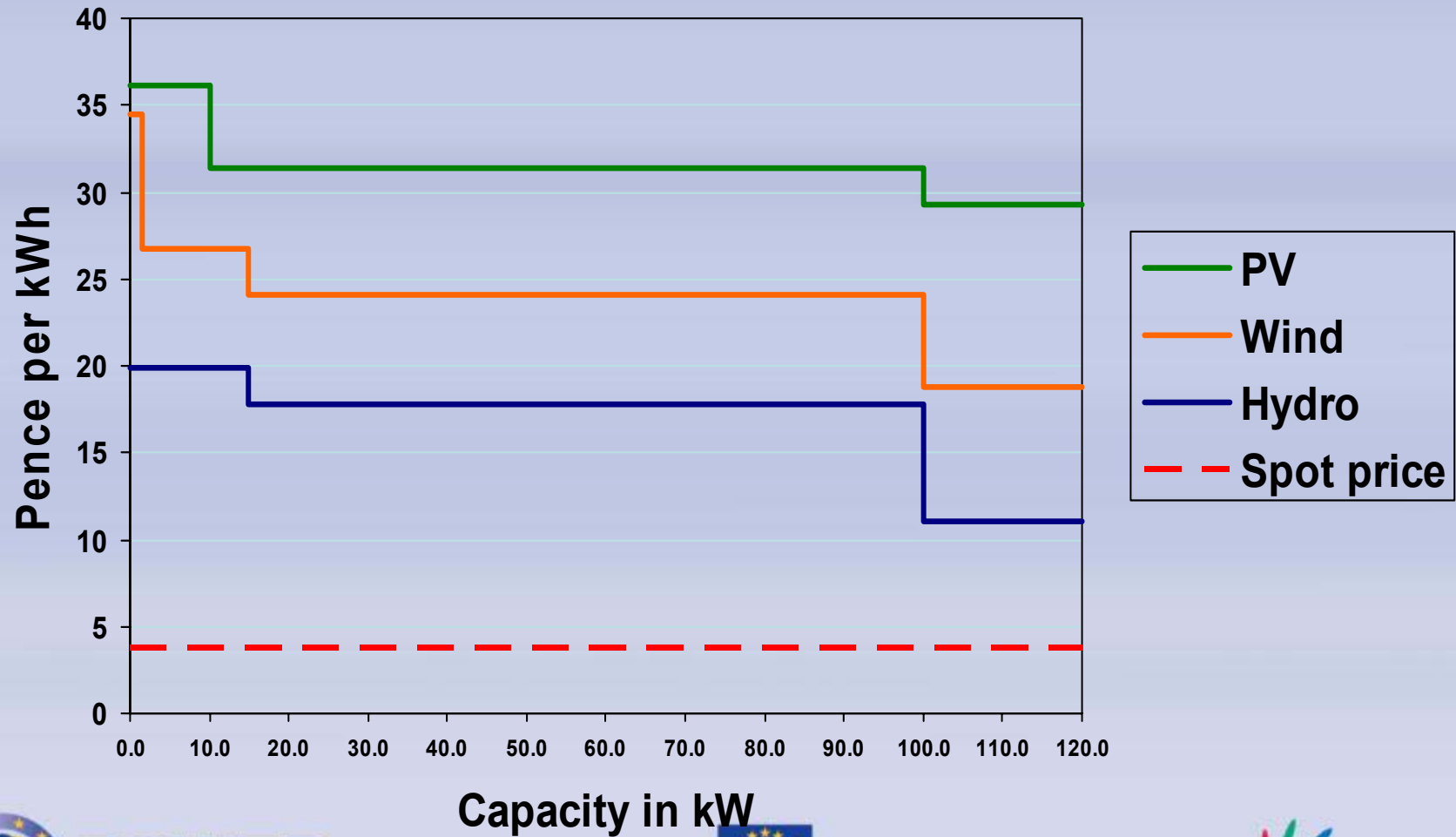
Covers systems from the very small up to 5 MW

FITs are designed to put all qualifying technologies on an equal economic footing returning 6- 8% p.a. on capital plus export payment before tax.

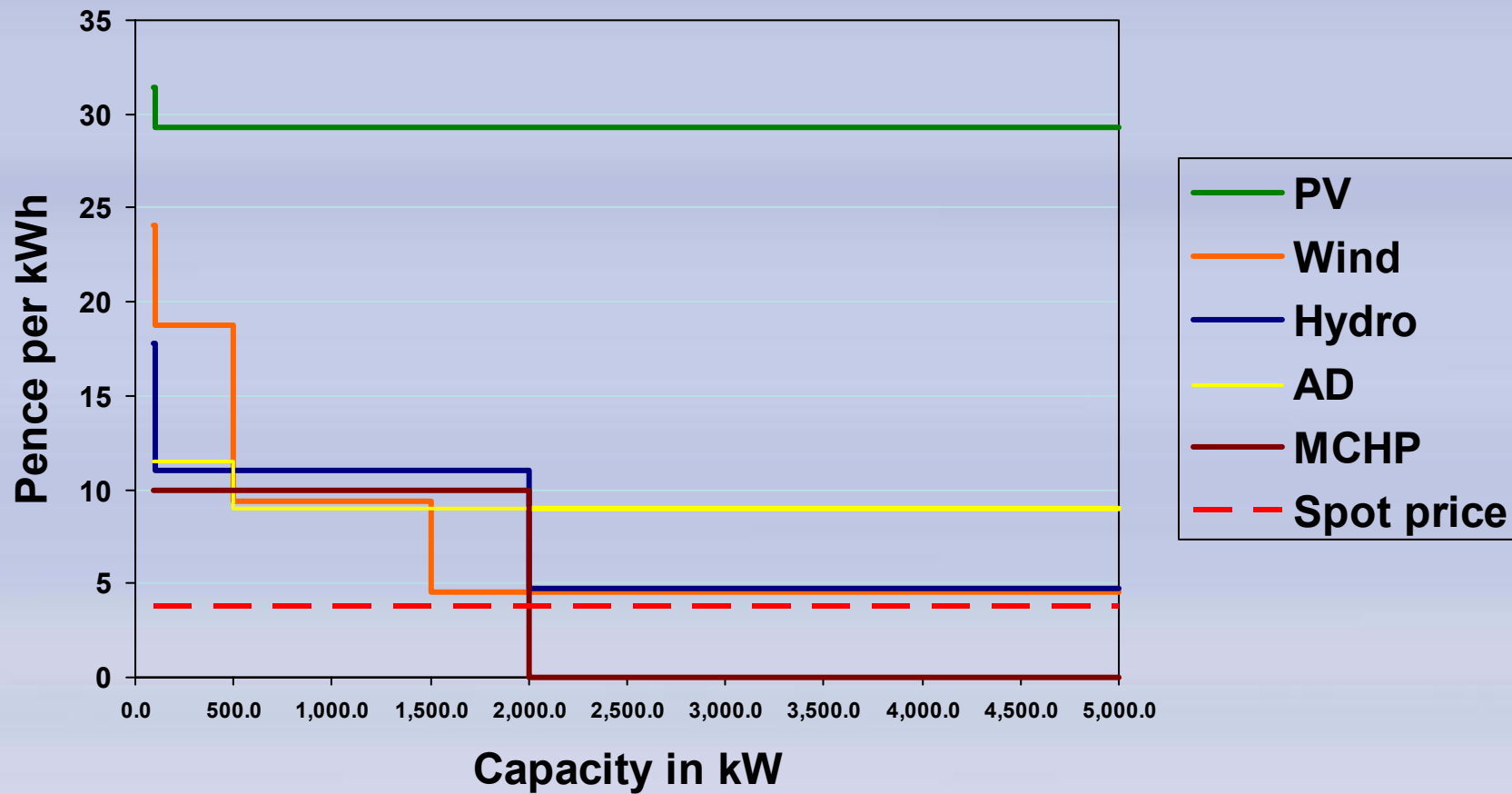
# UK Feed-In-Tariff Review

- At the start of the first bi-annual review of the FIT scheme the UK government has announced its intention to implement a 75% reduction in FIT rates for larger (>50KW) solar PV schemes to prevent speculative investment.
- Similar changes not expected for wind systems as they have not been the target of large scale investors.

# Structure of FITs: Small Generators (up to 100 kW)



# Structure of FITs: Large Generators (up to 5 MW)



# Metering for Feed-In Tariffs



FIT payments require a **generation meter**.

Some UK Electricity suppliers will buy exported electricity at an agreed price, typically 3.5p per kWh

Exported electricity must be metered for systems larger than 30kW

Exported electricity may be metered or “deemed” to be 50% of total power generated until smart meters are enforced

# Typical 100 kW Wind Turbine Parameters

- 21 m diameter rotor
- 35 m high tower
- 100 kW maximum rated power (at 14 m/s)
- No power produced below 3 m/s
- Produces 220,000 kWh electricity (at AMWS of 6 m/s)
- Electricity generation worth £53,000/year at FIT of 24.1p/kWh + export tariff of 3p/kWh
- Must be installed by an MCS certified installer
- Installed cost of £260,000 = 5 year payback



# UK General Permitted Development Orders

GPDO introduced 6 April 2008 gave permitted development status to some microgeneration schemes such as PV, solar thermal ground/water heat pumps, biomass and CHP



GPDO not yet granted to SWT but consultation has taken place as is likely lead to GPDO for wind.

GPDOs have location limits – typically exclude Conservation Areas, Listed Buildings, other sensitive areas

# Economic Viability factors

- Risks
  - Poor wind (local wind defect) - disrepute and losses
  - Poor installation - disrepute and losses
  - Unreliable/degradation – annoyance, lost production, cost
- Opportunities
  - Rural investors (good sites, easier planning, bigger)
  - Industrial/commercial sites (good sites, bigger) FIT
- Other issues
  - Planning Consent
  - Connection Cost
  - Loans, interest rate, Return on Investment
  - Availability, Reliability & Maintenance
  - Cost of Turbine Model Accreditation



# Risk Factors - again

## Poor Wind Assessment

Wind charts indicate statistical wind speeds at say 25m in unobstructed locations. Local topography may create highly significant reduction. Problem in urban areas especially but also in rural and industrial settings where immediate landscape, and nearby building or vegetation impact

Wind sampling is statistically limited by duration and errors may be large or biased





# Example: Community Wind Turbine



A 33 metre rotor diameter, 50 metre tower with a rated capacity of 330 kW. Including planning, installation and connection will cost around £700,000

With a realistic capacity factor of 24% produces 700,000 kWh per year. All the electricity is exported to the grid; the generation tariff for wind power at this scale is 19.7 pence per kWh.

The community can expect to receive:

Generation tariff: 700,000kWh x  
£0.197/kWh = £137,900

Export tariff: 700,000kWh x  
£0.031/kWh = £21,700

Less annual maintenance  
expense (5% of capital cost)-  
£35,000

**Total annual income £124,600**



The turbine will have paid off its cost in less than 6 years, and will generate profits of around £1.8 million over a 20-year lifespan.



# Summary

Valuable industry set to employ many people on systems for both home and export markets

The introduction of FITs has created an ambiance of financial confidence and rapid growth forecasts but some barriers and risks remain:



- Industry Reputation Risk from poor site assessment
- Individual financial risk due to poor wind estimation
- Planning is subject to local decisions. GPDO will cover only a limited range of sizes and locations, if and when it is introduced

Thank you for your  
attention

Any questions?