Newton Ferrers and Noss Mayo U3A Environmental Group

WIND POWER

A REVIEW

Issues for Consideration

1. Introduction to Wind Power
2. The demand for electric power in the villages of Netwon Ferrers and Noss Mayo
3. Power Generation from wind – Options
4. Environmental Impact on the District
5. Payback Period
6. Affect on the people of the villages

Introduction to Wind Power

1. 1% to 3% of the energy from the sun is converted into wind energy
2. This is 50 to 100 times more energy than is converted into biomass by all the plants on Earth by photosynthesis
3. However most of the energy is at high altitudes and that which can be harnessed is intermittent and variable requiring alternative standby capacity to be available
4. Capacity Factor [ratio of actual productivity in a year compared to the theoretical maximum]

Wind Turbines	Quoted	35%
	In practise	20%
Compares to:		
	Coal fired power stations	85%
	Gas fired power stations	80%
	Nuclear	90%

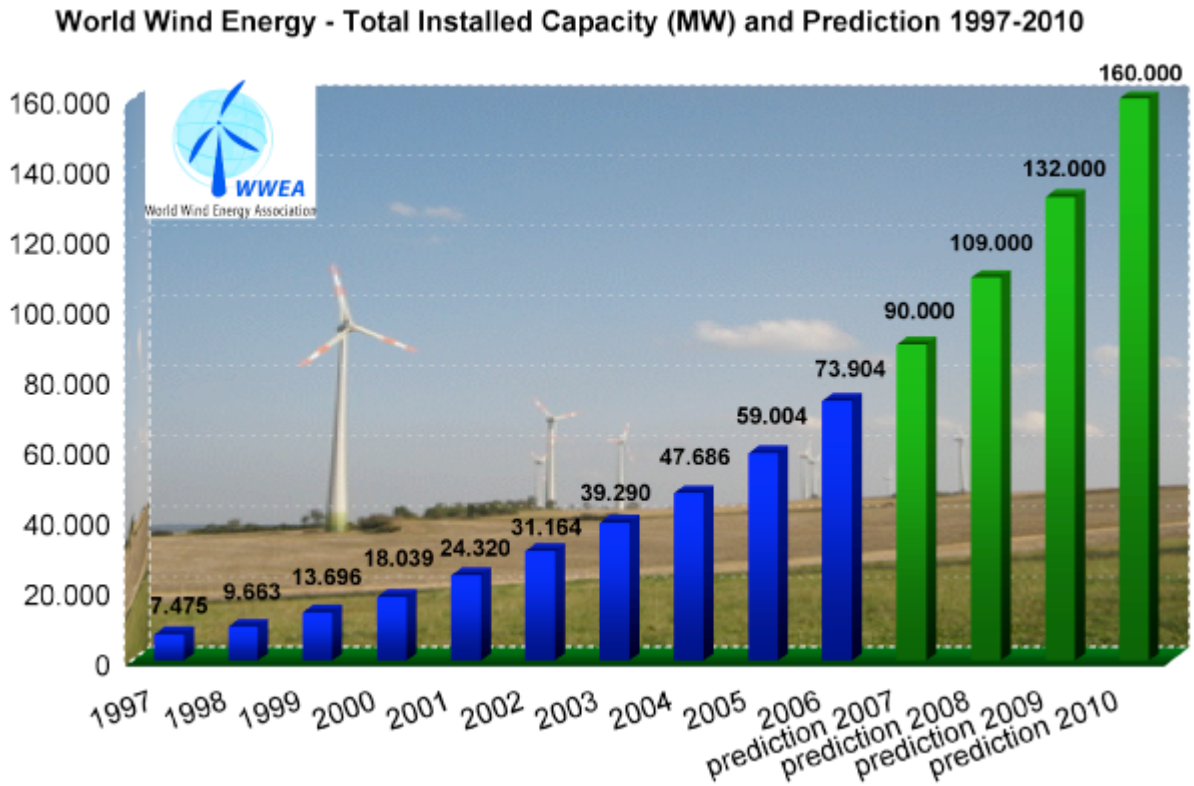
Introduction to Wind Power (cont)

5. Wind turbines only commence operating at wind speeds of around 10mph and have a cut off speed above 50mph
6. Wind power currently generates less than 1% of the worlds electricity
7. The UK generates less than 1% of its electricity by wind power- the target is 10% renewable generation by 2010 [around 12,000MW of wind generation being considered]
8. Other countries have invested more in wind power and generate a larger portion of their demand:

Denmark	20%	3140MW
Spain	9%	11,615MW
Germany	7%	20,622MW

9. Due to the unpredictability of wind power, through life costs are very dependant on assumptions made on availability
10. A British Wind Energy Association report gives the average generation cost onshore of 3.2pence per KWhr

Introduction to Wind Power (cont)



Information from DTI Windspeed Database

Location : National Grid Reference SX5448
Court Road, Newton Ferrers

Average Wind speed in MPH :

At 45m above ground

15.8	14.5	15.2
16.3	16.0	15.8
16.7	16.9	16.9

At 25m above ground

14.7	12.9	13.8
15.2	14.7	14.5
15.4	15.8	15.8

At 10m above ground

12.9	10.3	12.0
13.6	12.9	12.7
13.6	14.5	14.5

Note:

1 . Each grid is 1km square

2 .Squares around central yellow grid square are wind speeds for surrounding grids

Demand for Power – Newton and Noss

1. Number of houses to be supplied: Approximately 1,100

2. Average power consumed:
   - Per household: 16.5KWhrs/day
     6MWhrs/year
   - Newton & Noss: 6,600MWhrs/year
   - Average power consumption 18MWhrs/day

3. Peak power consumed
   - Per household :
     - Base load 2.5KW
     - Peak demand 10KW
   - Newton & Noss:
     - Peak demand 11MW
   - For this model assume 50% of houses require peak demand together 5.5MW

Note: Peak demand requires confirmation by statistical analysis of area

Note:
1.Average electric kettle uses 2 KW
2.Average light bulb uses 60W

TO MEET MAXIMUM DEMAND IN VILLAGES APPROXIMATELY **5.5MW** OF WIND GENERATING CAPACITY REQUIRED

Wind Generator Options

1. Wind Farm
2. Single Commercial Wind Generator
3. Large Domestic Wing Generators
4. Small Domestic Wing Generators

1. Wind Farm

Carland Cross Wind Farm
Cornwall

Built	1992
Installed Capacity	6MW
Number of turbines	15
Turbine rating	400KW
Approximate cost	£5M
Noise	???

Note: This could not be considered truly as a Community project as it would have to be built a significant distance from the village requiring a large area of land with very significant investment

2 . Single Commercial Wind Generator

Sizes up to 5MW Wind Generators are now available

Approximate cost £4m

Typical Dimensions of 3.6 MW size :

Diameter of rota	107m	340ft
Tower height	80m	260ft
Maximum height (Blade tip to ground)	133m	436ft

Noise at 100m : ???

Note:

a) Would be required to be connected to the local Grid system

b) Should be possible to sell the excess generation not required by the villages to the Grid

3 . Large Domestic Wind Generator

Iskra ATS-1 Turbine:

Rating 5KW

At wind speeds:

11mph	1KW
15mph	2KW
20mph	2.5KW

Approximate cost £20,000
(Less 10% subsidy)

Dimensions:

Rota diameter	5.4m	17ft
Tower height	12m	39ft
Maximum height	14m	46ft

Noise: 35db at 100 m - Designers recommended generator should be located at least 75 m from houses

Note: a) Meets a single household's base load at 20mph wind speeds
b) Sufficient power with 20mph wind speed to boil a kettle
c) Would require 1,100 to meet base load demands for villages
d) Unlikely to be able to sell excess generation to Grid

4. Small Domestic Wind Generator

Windsave WS1000Plug'n'Save

Rated Output 1KW at 27mph
(Strong wind)
At wind speeds (estimate):
11mph 0.07KW
15mph 0.17KW

Approximate cost £1675
(less 10% subsidy)

Dimensions:
Rota diameter 1.75m 5ft 9ins
Height Roof height

Noise:52 db 5m behind generator
with wind speeds of 16mph - NOISY

Note: a) With a wind speed of 15mph would nearly light two 60w light bulbs
b) Suppliers state that the 'opportunities for exporting electricity from the premises are negligible' to the Grid

Payback Period

1) Single Commercial Wind Generator of 5MW

On a simple basis (ignoring interest, price increase etc)

	£k
1.Approximate cost of installation for a 5MW generator	4,000
Less government subsidy (10%)	400
TOTAL	3,600

2. Basing on power sold at 3.2 pence per KWhr to Grid

Generation/year 5MWx8760hrsx 0.2 [availability] = 8760MWhrs

Selling of power 8760MWhrsx£0.032/KWhr = £280k /year

Pay back period £3,600k/ £280k = 12.9 Years

Note:

1) Expected life is in excess of 20 years

2) It would be necessary to involve the local Distribution company and most likely the National Grid. Excess generation could therefore be sold, but all electricity would require to be purchased by households at a price higher than the generation cost for use of the distribution system.

Payback Period

2) <u>Large Domestic Wind Generators</u>:

On a simple basis (ignoring interest, price increases etc)

	£
1.Cost of supply and installation for a 5KW generator	20,000
Less government subsidy (10%)	2,000
TOTAL	18,000

2. Saving in electricity costs at 10 pence/KWhr

Generation/year 5KWx8760hrsx 0.2 [availability] = 8760 KWhrs

Savings in electricity purchase 8760KWhrsx£0.1/KWhr = £876 / year

Pay back period £18,000/ £876 = 20.5 Years

Notes:

1. With maintenance life expectancy is anticipated to be in excess of 15 years – this requires to be confirmed
2. Not likely to be able to sell excess power to grid

Payback Period

3) <u>Small Domestic Wind Generators</u>:

On a simple basis (ignoring interest, price increases etc)

	£
1.Cost of supply and installation for a 1KW generator	1,675
Less government subsidy (10%)	168
TOTAL	1,507

2. Saving in electricity costs at 10 pence/KWhr

Generation/year 8760hrs x 120W = 1051KWhrs

Savings in electricity purchase 1051KWhrsx£0.1/KWhr = £105 / year

Pay back period £1,507/ £105 = 14.3 Years

Notes:

1. Average generation figure of 120W, quoted by supplier, is only 12% of Rated Output – compares to 20% for larger generators
2. Life expectancy quoted by supplier is 10 years
3. Not likely to be able to sell excess power to grid

Environmental Impact on villages

1. **Visual Impact**

   a) Single Commercial Wind Generator:

   Could generate a significant amount of the demands of the villages, but would have a very significant visual impact on villages and the surrounding countryside

   b) Large Domestic Wind Generators:

   Generators that could sensibly contribute to power demands would be of significant height, around 40ft, and would have considerable impact on neighbours if used in the centre of the villages

   c) Small Domestic Wind Generators

   For any significant contribution to the Carbon Footprint a very large number would be required which would have a significant visual impact on the village

Environmental Impact on villages (cont)

2 . Noise

a) Single Commercial Wind Generator:

The generator would be required to be located outside the villages on farmland to be acceptable and meet satisfactory noise levels of 35 decibels near habitation (the noise of a birds twittering as presently required at the boundaries of power stations)

b) Large Domestic Generators:

These would only meet existing legislation for power stations of 35 decibels provided the sizes of the gardens were large

c) Small Domestic Generators

When delivering any power of significance these generators make 52decibels of noise at a distance of16 ft (5metres) away which is a significant and likely to cause disturbance to neighbours in an area of average sized gardens

3 . Bird strikes

Although these do occur the frequency, even on large generators, is very small (about 1/generator/yr). There is more concern about bat strikes.

Effect on the people of the villages

Advantages:

- Contribution in reduction of carbon footprint
- Over a long period small savings on cost of electricity may be made

Disadvantages:

- Unpredictable savings in carbon footprint
- Visual pollution to the village / surrounding countryside
- Noise pollution to those close by:

  Single commercial generators 500m+ ?

  Large domestic generators 100m

  Small domestic generators Noisy when generating any significant power
- Major disruption during construction if 5MW generating capacity is installed

Conclusions

As a means of harnessing renewable energy on a Community basis Wind Generation using Domestic Generators is not suitable as:

- Large numbers would be required to have any significant influence on the carbon footprint
- Households would obtain little benefit, if any, from their installation
- The visual and noise impact on the village environment would be considerable

A single Commercial Wind Generator, although perhaps being more suitable, requires a major investment over a long period of time with the related commercial risks due to the forward pricing of competitive electricity and the unpredictability of wind. It is debatable that it could be considered as a Community project.

It is recommended that alternative projects harnessing renewable energy are considered, such as solar energy.