



## Small wind turbines from

## The Alternative Energy Company Ltd



**A complete guide to selecting your site and size of turbine, planning, funding and reducing your energy bills.**

|                                       |    |
|---------------------------------------|----|
| Introduction.....                     | 2  |
| Small wind turbine systems.....       | 3  |
| Schematic Diagrams .....              | 5  |
| Typical off-grid installation .....   | 5  |
| Typical grid-connected installation.. | 5  |
| Is my site suitable?.....             | 6  |
| Locating your turbine .....           | 9  |
| Wind direction.....                   | 9  |
| Local topography.....                 | 9  |
| Proximity to neighbours etc.....      | 9  |
| Planning.....                         | 10 |
| Tower Type and Height.....            | 10 |
| Guyed cable tower.....                | 11 |
| Freestanding (taper) tower.....       | 11 |
| Electrical Connection .....           | 12 |
| Grant Assistance.....                 | 13 |
| Project Costs.....                    | 13 |
| What happens now?.....                | 14 |
| Appendix.....                         | 15 |
| Technical Details .....               | 15 |
| Blades .....                          | 15 |
| Generator .....                       | 15 |
| Concrete Base Details .....           | 16 |

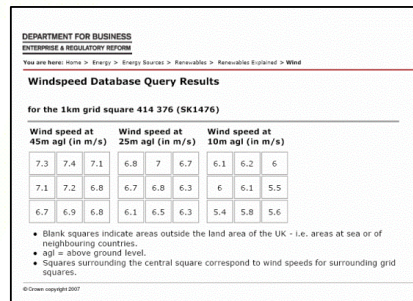
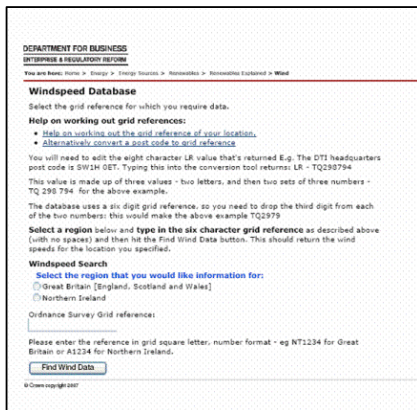
# Introduction

Thank you for your interest in a Wind Turbine from The Alternative Energy Company Ltd.

The purpose of this guide is to help you to understand all the relevant matters when you are considering purchasing a small wind turbine from us. It should help to take you through all of the necessary stages in considering your purchase, but of course if you need any further assistance, the company will do its utmost to assist you at every stage.

When considering the purchase of a wind turbine, there are a number of things which you will need to consider. The internet contains a great wealth of information on the subject, and a good starting point is to study the information available on the website of the British Wind Energy Association (BWEA), [www.bwea.com/small/index.html](http://www.bwea.com/small/index.html), which explains several things such as how wind turbines work, planning permission guidelines, selling your electricity etc

One fundamentally important factor to consider is the suitability of the proposed site, and in particular the average wind speeds in the area. Again, the BWEA has a useful page [www.bwea.com/noabl/index.html](http://www.bwea.com/noabl/index.html), which enables you to estimate the average wind speed at your site, simply by inserting your postcode:



Remember there are many topographical features which can affect the actual wind speed your turbine will see. These are explained in greater detail later.

Another very informative site is that of the Danish Wind Industry Association [www.windpower.org/en/tour.htm](http://www.windpower.org/en/tour.htm). This comprehensive tour will dramatically increase your knowledge on the subject and provide strong pointers as to whether your site is likely to be suitable for a wind turbine.

Now that you have confirmed the suitability of your site, this manual proceeds to give information on the following:

- Obtaining a comprehensive quotation following a site survey by TAEC™
- Applying for planning permission (and permission to connect to the electricity grid if relevant)
- Grant assistance with the project
- Ordering, delivery and installation
- Selling surplus electricity to a Utility company and claiming Renewable Obligation Certificates (ROCs)

## Small wind turbine systems

There are two systems available for generating electricity from the wind, with a turbine which is stand-alone (off-grid), or one which is grid-connected. Generally speaking, the former type range in size from 100 W up to about 1000 W and require a battery bank to store the power generated. They are principally used in remote locations to power lights, small electronic monitoring devices, electric fences, small pumps etc and may more properly be referred to as Micro systems.

Small grid-connected turbines range in size from 1000 W up to 50 kW and are connected directly to the existing mains supply. They reduce consumption of electricity from the grid and if sufficiently large will be able to export power back to the grid when power generated exceeds demand at the site. This can generate revenue from the Utility company and in the form of Renewables Obligation Certificates (ROCs).

All systems basically comprise:-

- 1 **The Turbine.** Three highly aerodynamically efficient fibreglass blades shaped like propellers convert the energy in the wind into rotary motion of a generator to produce electricity. Power is produced in three phase at fluctuating voltage and current, dependent on windspeed.
- 2 **Speed limiter.** Most small turbines start to produce electricity at a wind speed of about 2.5 metres per second, the "Cut-in" wind speed. In very high winds above the "Cut-out" wind speed, a built-in control system prevents excessive rotor speed. A common method of achieving this function is called a Yaw control which turns the blades out of the direct line of the wind.
- 3 **Tower.** Wind is slowed down by frictional contact with the ground, especially by trees, buildings or other rough surfaces. Thus the higher a turbine can be mounted, the more power it will generate. Since the power produced is proportional to the cube of the wind speed, this means that twice the wind speed produces eight times as much power. This is why turbines should be mounted as high as possible and why building-mounted turbines are rarely cost-effective. Two types of tower are available from TAEC™:-
  - A **Guyed** tower which has 4 guy wires tensioning the tower from a point about half-way up to four points in the ground. The tower itself can thus be smaller and lighter, but the wires may be unsuitable in locations frequented by animals or humans.
  - A **Free-Standing** tower, which is a substantial steel column, taking up less ground area but requiring a larger and stronger central foundation. TAEC™ towers have a clever folding design which enables the turbine to be lowered safely to the ground for periodic maintenance.
- 4 **Inverter.** Your turbine will generate AC power at a fluctuating rate (voltage and current) dependent on the speed of the wind at any time. If your turbine is off-grid, the inverter converts the AC to DC such that it can be stored in the battery bank. If your turbine is grid-connected, the inverter converts the fluctuating AC to DC and then back into a stabilised AC which matches that of the grid-supplied electricity (240 VAC and 50hz if single phase). Larger turbines of 10kw and above supply power from the inverter at three phase 415 VAC.



The inverter has in-built safety features. If the grid supply fails for instance, it is essential that the supply from your turbine is also switched off so that there is no danger of electrocution to any maintenance personnel whilst the problem is being fixed. This means also that the turbine cannot supply your property whilst there is no grid supply.

- 5 **Connecting Cable.** Your turbine will be connected to its control gear and to your electrical connection point by cable. Generally this is likely to be an armoured cable which will be routed in a suitable trench. The cable must be sized suitably such that there is not an excessive voltage drop. The actual size will be determined by the distance involved and power output of the turbine.
  
- 6 **Meters.** For a grid-connected installation, it is necessary to install a meter which measures power exported to your electricity supplier so that you can claim this back against your electricity bill. A separate ROC (Renewable Energy Certificates) meter should also be installed. This measures all the energy your turbine generates whether you use it or sell it to your supplier, and enables you to claim ROCs which can be traded nationally. A ROC is awarded for every MWh (1,000 kWh) generated annually and are rounded to the nearest MWh, so a turbine producing 9,600kWh per year will be eligible for 10 ROCs. The price may vary and is driven by government targets for the amount of energy produced from renewable sources. For information on trading ROCs see the following links:-  
[www.good-energy.co.uk](http://www.good-energy.co.uk)  
[www.greenenergy.co.uk](http://www.greenenergy.co.uk);  
[www.ecotricity.co.uk](http://www.ecotricity.co.uk)  
[www.tradelinksolutions.com](http://www.tradelinksolutions.com)  
[www.smartestenergy.com](http://www.smartestenergy.com)

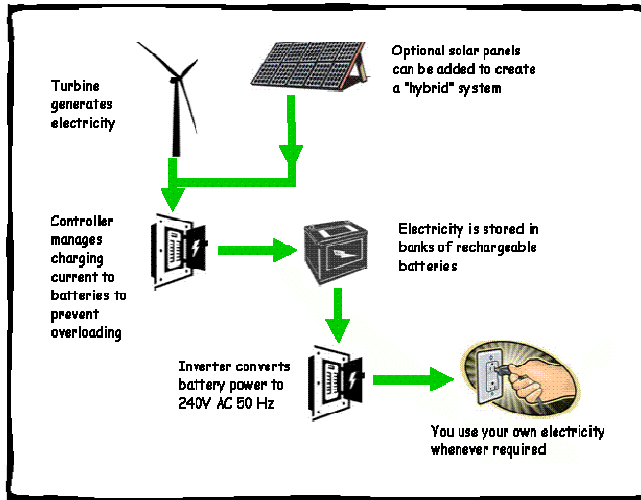
TAEC



# Schematic Diagrams

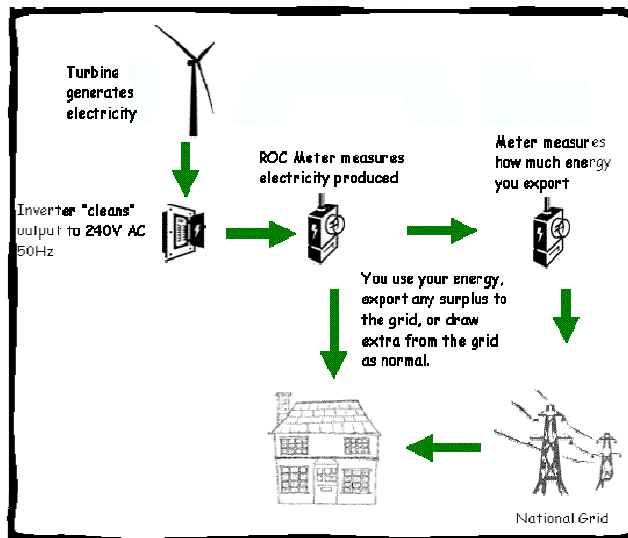
## Typical off-grid installation

Off grid installations are typically used for remote locations where it is uneconomic to take a grid-connection to the property. TAEC™ is also able to supply solar panels which can form part of a hybrid system and charge the batteries if there is no wind.



## Typical grid-connected installation

With grid connected systems, your turbine is connected to a power inverter which stabilises the turbines output at 240V AC, 50Hz, and synchronises this output with that of the National Grid. Any energy which your turbine produces and which you do not immediately need will be exported to the National Grid and bought by your utility company. Conversely, you can still draw energy from the grid directly if you are drawing more power at any given time than your turbine is producing.



## Is my site suitable?

Your postcode is sufficient to obtain an estimate of the annual mean wind speed (AMWS) at your site from the government database called the NOABL. Visit [www.bwea.com/noabl/index.html](http://www.bwea.com/noabl/index.html) and follow the instructions. When you see the wind speed tables, the most important figure is the centre block of the right hand table which gives the AMWS at a height of 10 metres above ground level (this being the approximate height of the hub of your potential turbine). A figure of 5 or greater is recommended as suitable for turbine installation, 6 or 7 is better still.

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### Windspeed Database

Select the grid reference for which you require data.

**Help on working out grid references:**

- Help on working out the grid reference of your location.
- Alternatively, convert a post code to grid reference.

You will need to edit the eight character LR value that's returned E.g. The DTI headquarters post code is SW14 0ET. Typing this into the conversion tool returns LR = TQ29794  
This value is made up of three values - two letters, and then two sets of three numbers - TQ 296 794 for the above example.

The database uses a six digit grid reference, so you need to drop the third digit from each of the two numbers: this would make the above example TQ2979

Select a region below and type in the six character grid reference as described above (with no spaces) and then hit the Find Wind Data button. This should return the wind speeds for the location you specified.

**Windspeed Search**

Select the region that you would like information for:

Great Britain (England, Scotland and Wales)

Northern Ireland

Ordnance Survey Grid reference:

Please enter the reference in grid square letter, number format - eg NT1234 for Great Britain or A1234 for Northern Ireland.

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### Windspeed Database Query Results

for the 1km grid square 414 376 (SK1476)

| Wind speed at 45m agl (in m/s) |     |     | Wind speed at 25m agl (in m/s) |     |     | Wind speed at 10m agl (in m/s) |     |     |
|--------------------------------|-----|-----|--------------------------------|-----|-----|--------------------------------|-----|-----|
| 7.3                            | 7.4 | 7.1 | 6.8                            | 7   | 6.7 | 6.1                            | 6.2 | 6   |
| 7.1                            | 7.2 | 6.8 | 6.7                            | 6.8 | 6.3 | 6                              | 6.1 | 5.5 |
| 6.7                            | 6.9 | 6.8 | 6.1                            | 6.5 | 6.3 | 5.4                            | 5.8 | 5.6 |

- Blank squares indicate areas outside the land area of the UK - i.e. areas at sea or of neighbouring countries.
- agl = above ground level.
- Squares surrounding the central square correspond to wind speeds for surrounding grid squares.

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Bear in mind that this figure covers an area of 1 square kilometre, and is not able to take account of specific topographical features at your site. Wind speed is heavily influenced by the proximity of buildings, trees etc. The power generated by a turbine is proportional to the cube of the wind speed. Thus for twice the wind speed, the power generated increases by a factor of 8 times. It is vital therefore to choose the windiest possible location available.

Sites at the top of hills, or where the wind is funnelled by local geography will have significantly greater AMWS than other areas within the same square on the database. The prevailing wind direction in the British Isles is from the West / South West, therefore sites fully exposed to the west and south-west are preferable.

Please also bear in mind the caveats mentioned on the BWEA site. It is not able to give a guaranteed figure for your site, and does not take account of local wind conditions such as sea breezes etc.

Turbulence in the wind has a significant effect on a wind turbine both in terms of the available power and in terms of wear and tear. For this reason, turbines situated in urban areas or too close to obstructions such as buildings and trees will perform less well than those situated in "clean" wind.

The air density also affects how much energy can be captured from wind. Air with a significant moisture content such as is found in coastal regions is heavier and will enable greater energy extraction.

Using the tables below which give the approximate annual energy output of the TAEC™ turbine range you can now estimate how much electricity your site might produce.

| Power per year(kWh) |       |      |       |       |       |       |        |        |
|---------------------|-------|------|-------|-------|-------|-------|--------|--------|
| Wind speed(m/s)     | Model |      |       |       |       |       |        |        |
|                     | 300   | 500  | 1000  | 2000  | 3000  | 5000  | 10K    | 20K    |
| 2.5                 | 123   | 131  | 184   | 377   | 412   | 683   | 1367   | 1586   |
| 3                   | 210   | 228  | 324   | 648   | 710   | 1183  | 2365   | 2733   |
| 3.5                 | 333   | 368  | 517   | 1034  | 1130  | 1875  | 3758   | 4345   |
| 4                   | 491   | 543  | 771   | 1542  | 1682  | 2803  | 5606   | 6491   |
| 4.5                 | 701   | 780  | 1095  | 2190  | 2391  | 3995  | 7980   | 9242   |
| 5                   | 955   | 1069 | 1498  | 3005  | 3285  | 5475  | 10950  | 12676  |
| 5.5                 | 1279  | 1419 | 1997  | 3995  | 4371  | 7288  | 14577  | 16872  |
| 6                   | 1656  | 1848 | 2593  | 5195  | 5676  | 9461  | 18922  | 21900  |
| 6.5                 | 2102  | 2348 | 3303  | 6596  | 7218  | 12027 | 24055  | 27848  |
| 7                   | 2628  | 2935 | 4126  | 8243  | 9014  | 15023 | 30047  | 34777  |
| 7.5                 | 3232  | 3609 | 5072  | 10135 | 11090 | 18475 | 36958  | 42775  |
| 8                   | 3924  | 4380 | 6150  | 12308 | 13455 | 22426 | 44851  | 51912  |
| 8.5                 |       | 5256 | 7376  | 14761 | 16136 | 26902 | 53795  | 62266  |
| 9                   |       | 6237 | 8760  | 17520 | 19158 | 31930 | 63860  | 73917  |
| 9.5                 |       |      | 10302 | 20604 | 22531 | 37554 | 75108  | 86925  |
| 10                  |       |      | 12019 | 24029 | 26280 | 43800 | 87600  | 101388 |
| 10.5                |       |      |       |       | 30423 | 50703 | 101406 | 117366 |
| 11                  |       |      |       |       | 34979 | 58298 | 116596 | 134948 |
| 11.5                |       |      |       |       |       |       |        | 154202 |
| 12                  |       |      |       |       |       |       |        | 175200 |
| 12.5                |       |      |       |       |       |       |        | 198029 |
| 13                  |       |      |       |       |       |       |        | 222749 |

Formatted Table

You can see that at a site with an AMWS of 6m/s, a TAEC™ 3kW machine should generate 5.67 MWh per annum.

An average home uses about 4MWh per annum. A farm or small commercial premises will use more and you can read from past electricity bills what your typical annual usage is. You need to add together the total number of units of electricity used per year. If you have dual rate metering, remember to add night rate units also. A unit is 1 kWh, so 1000 units = 1 MWh. You can thus judge how much saving a TAEC™ installation will make. If you choose a turbine with greater output than your annual usage, then the electricity you will sell to the utility company plus the value of ROCs act as additional return on your investment. Currently no tax is payable on this income. TAEC™ turbines have a life



expectancy of 20 years, and we do not believe that electricity prices will do anything other than continue to increase.

A typical cost for electricity at present is £75 / MWh. Adding to this the market value (selling price) per ROC of about £40 gives a saving through self-generation of about £115 / MWh. A typical turbine generating 8.7 MWh per annum will thus produce savings (or income) of £1000 per year. (e.g. a 1kW machine with an average wind speed of 9 m/s)

If your site seems suitable from the above analysis, then it is time to contact TAEC™ to discuss the project in more detail. Ideally we shall need the exact geographical location of your site, described by its six figure grid reference. A postcode is insufficient because many properties might be covered by just one code. However you may use this as a starting point as follows:-

Log on to [www.magic.gov.uk/website/magic/](http://www.magic.gov.uk/website/magic/) Select:- Rural Designations- Statutory on the drop down menu, enter your Postcode and click on Open Map. Increase the scale to something like 1:1000 (such that 1cm represents 10m on the ground) then move the cursor point to the exact position for your turbine and left click. The map will re-draw with this position at its centre. Move to the Generate Bookmark icon at the top of the screen which will now display a long web address for your site. The six figure numbers following xygridref in the address are the eastings and northings respectively which pinpoint your site exactly according to the Ordnance Survey grid.



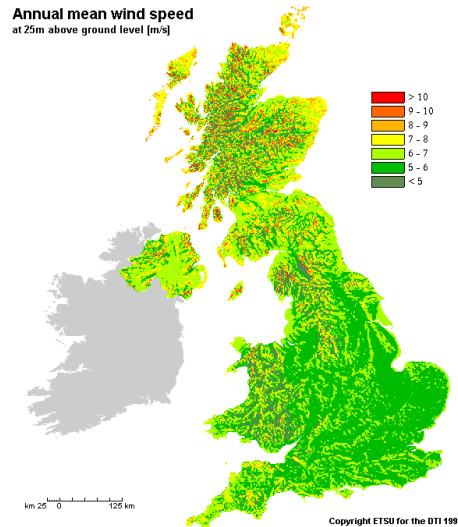
## Locating your turbine

### Wind direction

The UK benefits from the best wind resource in Europe, which makes wind turbines a real alternative. As mentioned above, for a turbine to work effectively it needs to be in the path of as much wind as possible. For more information on wind in the British Isles visit

[www.metoffice.gov.uk/climate/uk/location/southwestengland/wind.html](http://www.metoffice.gov.uk/climate/uk/location/southwestengland/wind.html)

Although this site concentrates on the characteristics for south west England, the prevailing wind direction for the whole of the country is similar being from the south west and / or west, as demonstrated by the wind rose for Plymouth.



### Local topography

A very useful and detailed study of the factors affecting best position can be viewed on [www.windpower.org/en/tour/wres/euromap.htm](http://www.windpower.org/en/tour/wres/euromap.htm) Look in particular at the pages entitled "The tunnel effect", "The hill effect" and "Turbine siting". These should enable you to decide which position on your available site will offer best wind conditions.

Be very careful to choose a site as far away from trees or buildings as possible. These create both wind shadow reducing efficiency and increased turbulence which reduces efficiency and may also cause extra wear on your turbine. A distance of 20H (where H is the height of an obstruction) is generally considered to offer clean wind. Obstructions in the direction of the prevailing wind will obviously have more effect than obstructions to one side or behind the turbine.

### Proximity to neighbours etc

It is clearly desirable to choose a site which will not affect neighbouring properties. Although TAEC™ turbines are not noisy (tests show that they produce less noise than local traffic) there are many misconceptions in the public domain which suggest that turbines create noise nuisance. It is generally the case that as wind speed rises, the noise of the wind becomes greater than the turbine noise.

Another consideration is shadow flicker which can be caused by the rotating blades interrupting or reflecting sunlight. This effect is generally more noticeable in early morning or late evening when the sun is low in the sky. Self-evidently the effect can be worse in winter when the sun is generally lower for a longer period of time. Try to avoid a position which locates the turbine between a neighbour's window and early morning or late evening sun.

Generally speaking, your site should be as far away from neighbouring properties as possible bearing in mind that longer cable runs will be more costly than short runs. However distances of up to 200m can be managed economically.

Your site will need access for machines to excavate the foundations and for a lorry (probably equipped with a hydraulic crane) to deliver the turbine.

Please note that TAEC™ does not supply turbines suitable for mounting on domestic buildings and does not recommend the fitting of any turbine to a house. Apart from the fact that such a position will make the machine inefficient due to turbulence and low wind speeds close to an obstruction, all turbines will cause some vibration through their structure. This is acceptable in a free-standing unit but may damage or cause nuisance in residential or commercial structures. Building-mounted turbines which you may have seen are generally installed on top of substantial concrete structures such as blocks of flats, office blocks etc/

## Planning

Under current UK Law, all wind turbines (with possible exceptions for small machines on agricultural buildings) need planning permission. Your local authority will have a standard application form and will charge a fee which varies between £150 and £275 depending on the authority. From mid-year 2007, you will also have to submit a Design and Access statement to accompany the application. The process is straightforward, but TAEC™ can assist you with advice or even manage the whole application process for you (at a price which we will quote dependent on complexity etc).

Most authorities are beginning to be more supportive of small wind installations under pressure from government to meet renewable energy targets. Your Local Authority's website will give more information about whether they have specific policies in place with respect to turbines. General planning guidelines (Planning Policy Statement 22) can be viewed on [www.communities.gov.uk/publications/planningandbuilding/planningpolicystatement5](http://www.communities.gov.uk/publications/planningandbuilding/planningpolicystatement5). However this document is generally more relevant to large commercial wind farm developments.

Some authorities allow small turbines in sensitive areas such as Green Belt, National Parks and Areas of Outstanding National Beauty (AONBs), but these are decided on a case by case basis.

It is a good idea to consult your neighbours and anyone else who might be affected by your proposed installation in advance of submitting your application. You will get some idea as to whether there is likely to be serious opposition or support and this is helpful for inclusion in your Design and Access Statement.

## Tower Type and Height

As mentioned earlier in this guide, the higher you can mount your turbine above ground the better. Wind speeds are higher due to less friction from the ground. This means that you should choose the tallest tower which is feasible for your turbine and for which you can get planning permission.

Towers come in two types, guyed or freestanding. Guyed towers are thinner and rely on four guys to provide stability. Such an installation requires five smaller foundation pads and takes up more ground area. It will be less suitable where animals are allowed close to the base or where the guy ropes may cause other obstructions. The guys must be loosened in order to lower the tower for maintenance.



A freestanding tower requires one large foundation pad and is made from fabricated steel. It is heavier than a guyed tower, but TAEC™ towers have a unique folding design which enables them to be lowered easily for periodic maintenance.

TAEC™ towers are available in the following heights:-

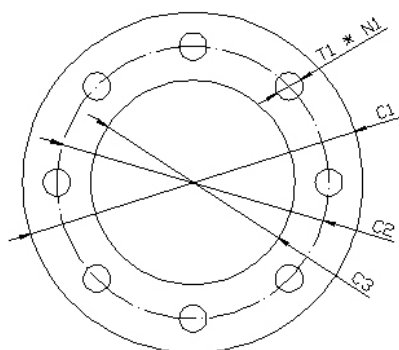
### Guyed cable tower

| Model         | Aeolus 300 | 500W | 1kW  | 2kW   | 3kW   | 5kW   | 10KW  | 20KW   |
|---------------|------------|------|------|-------|-------|-------|-------|--------|
| Height(m)     | 6          | 6    | 6    | 9     | 9     | 12    | 12    | 18     |
| Diameter (mm) | 48         | 89   | 114  | 140   | 273   | 273   | 325   | 377    |
| Thickness     | 2.5        | 3.25 | 3.25 | 3.5   | 6     | 6     | 6     | 8      |
| Sections      | 3          | 2    | 2    | 3     | 2     | 3     | 3     | 3      |
| Weight(kg)    | 23.5       | 41.8 | 54   | 107.5 | 360.5 | 480.6 | 574.2 | 1328.4 |

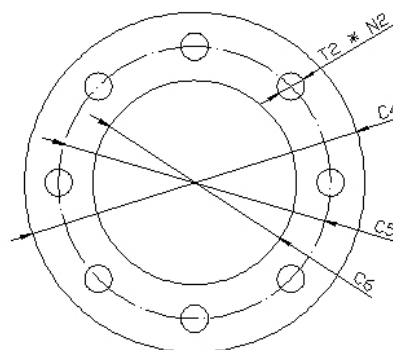
### Freestanding (taper) tower (refer to figure below)

| Model          | Symbol in figure 1 | 1kW | 2kW | 3kW | 5kW  | 10KW | 20KW |
|----------------|--------------------|-----|-----|-----|------|------|------|
| Height (m)     | -                  | 6   | 9   | 9   | 11.5 | 11.5 | 11.5 |
| Thickness (mm) | -                  | 6   | 6   | 8   | 8    | 8    | 10   |
| Weight (kg)    | -                  | 252 | 461 | 727 | 1087 | 1290 | 2105 |
| Top flange     | C1 (mm)            | 150 | 150 | 280 | 280  | 280  | 500  |
|                | C2 (mm)            | 120 | 120 | 200 | 200  | 200  | 460  |
|                | C3 (mm)            | 90  | 90  | 160 | 160  | 160  | 310  |
|                | T1 (mm)            | M12 | M12 | M16 | M16  | M16  | M20  |
|                | N1                 | 6   | 6   | 12  | 12   | 12   | 16   |
| Bottom flange  | C4 (mm)            | 550 | 800 | 800 | 950  | 1200 | 1500 |
|                | C5(mm)             | 450 | 600 | 700 | 800  | 1000 | 1200 |
|                | C6(mm)             | 385 | 510 | 510 | 650  | 820  | 955  |
|                | T2(mm)             | Φ20 | Φ22 | Φ24 | Φ33  | Φ33  | Φ40  |
|                | N2                 | 12  | 12  | 12  | 12   | 16   | 16   |





Top of taper tower



Bottom of taper tower

## Electrical Connection

Your turbine will be either connected to a battery bank in the case of an off-grid installation, or to the mains for an on-grid installation. In both cases, connection is made via sophisticated circuitry supplied by TAEC™.

The power output from your turbine will be in AC and will vary according to wind speed. Firstly this is rectified to convert the AC (Alternating Current) to DC (Direct Current). DC can be fed into the battery bank of an off-grid installation, but there are controllers which limit the amount of power if the batteries are fully charged, and they will in this case send the power to an appropriate dump load.

For an on-grid installation, the DC power is converted by an inverter back into AC but with a frequency which now coincides exactly with that of the mains grid (50Hz).

As well as the rectifiers and inverters, the circuitry includes switches to isolate your turbine during maintenance and installation. A special switch also disconnects your turbine if the grid supply fails. This is to prevent electrocution of anyone repairing the grid who will expect it to be totally isolated.

The electrical connection will also include meters to measure voltage and current from the turbine, power exported to the grid and in most cases a ROC meter.

Connections to the national grid are permitted under regulation G83/1 provided the embedded power generator outputs less than 16 amps per phase. You will however need to seek permission in advance from your local DNO (Distribution Network Operator). TAEC™ can do this on your behalf provided you supply the Name of your DNO and your Meter Point Administration Number (MPAN). This is not your account number or your meter serial number. It is a series of boxes often at the bottom of your bill which uniquely identifies your property within the electricity distribution system. It will look something like this:-

|          |    |      |      |
|----------|----|------|------|
| <b>S</b> | 02 | 811  | 120  |
|          | 23 | 2376 | 6025 |



## Grant Assistance

Grants for your domestic turbine installation are available under the Low Carbon Buildings Program (Stream One). Visit [www.lowcarbonbuildings.org.uk/micro/](http://www.lowcarbonbuildings.org.uk/micro/) This site provides information and the relevant application forms which can be filled in on-line. In order to qualify for grant assistance, both the products and installation company which you choose must be accredited under the BRE Certification scheme. We can put you in touch with one of our registered installation companies if your enquiry has not already come through them.

There are additional sources of funding for commercial / community projects e.g. the LCBP Stream 2, Phase 2 (see web-site above). In addition other grants may be available, including some from power generating companies who encourage the use of "Green" technology.

## Project Costs

It is not possible to give a firm quotation on costs until a full site survey has been carried out by TAEC™ personnel and all unknowns are quantified e.g. turbine type, tower height, cable run length, site access, metering requirements etc.

As an indication, however, the figures below give some approximate costs for TAEC™ equipment:

### TAEC™ 5kW turbine

|                                       |                           |
|---------------------------------------|---------------------------|
| Turbine including tower and inverter: | £12,200                   |
| Groundworks and installation:         | £ 2,500 - £ 6,500         |
| Electrical equipment and connection:  | £ 2,000 - £ 2,500         |
| <b>Total Installation cost:</b>       | <b>£ 16,700 - £21,200</b> |

### TAEC™ 20kW turbine

|                                       |                           |
|---------------------------------------|---------------------------|
| Turbine including tower and inverter: | £ 39,550                  |
| Groundworks and installation:         | £ 5,000 - £ 9,000         |
| Electrical equipment and connection:  | £ 3,500 - £ 4,500         |
| <b>Total Installation cost:</b>       | <b>£ 48,050 - £52,050</b> |

A TAEC™ approved installation company will always carry out installation of your turbine and its connection to batteries / the grid. This is our policy to ensure quality installations and is in any case mandatory if you are applying for grant assistance. We can complete the whole project for you, or you may choose to employ separate contractors for foundations or trench digging to our specifications if you prefer.



## What happens now?

We hope that this manual has been of use in suggesting whether a TAEC™ wind turbine is right for you. If any further questions have arisen we will be happy to assist you further.

Assuming that you feel your site is suitable for a wind turbine and you are considering placing an order, please contact TAEC™ to discuss your requirements and to arrange for our site surveyor to visit you to carry out a full site survey.

We look forward to hearing from you!

The Alternative Energy Company Ltd  
Meridian House  
8 Sycamore Business Park  
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TAEC



## Appendix

### Technical Details

The tables below give further information on the comprehensive TAEC™ range of wind turbines.

#### Blades

| Model                        | Aeolus 300   | 500W        | 1kW  | 2kW  | 3kW   | 5kW   | 10KW  | 20KW |
|------------------------------|--------------|-------------|------|------|-------|-------|-------|------|
| Blade Material               | Carbon fibre | Fibre glass |      |      |       |       |       |      |
| Number of blades             | 3            |             |      |      |       |       |       |      |
| Diameter (m)                 | 1.5          | 2.5         | 2.7  | 3.2  | 4.5   | 6.4   | 8     | 10   |
| Swept Area (m <sup>2</sup> ) | 1.80         | 4.90        | 5.70 | 8.00 | 15.90 | 32.20 | 50.30 | 78.5 |

#### Generator

The generator is a 3-phase permanent magnet alternator.

| Model               | 300W | 500W | 1KW  |
|---------------------|------|------|------|
| Rated power (W)     | 300  | 500  | 1000 |
| Rated voltage (DCV) | 24   | 24   | 48   |
| Rated voltage (ACV) | 34   | 34   | 68   |
| Rated current (DCA) | 12   | 21   | 21   |
| Rated current (ACA) | 8    | 15   | 15   |
| Rated speed(rpm)    | 400  | 400  | 400  |
| Max speed (rpm)     | 500  | 500  | 500  |
| Weight (kg)         | -    | -    | 34   |

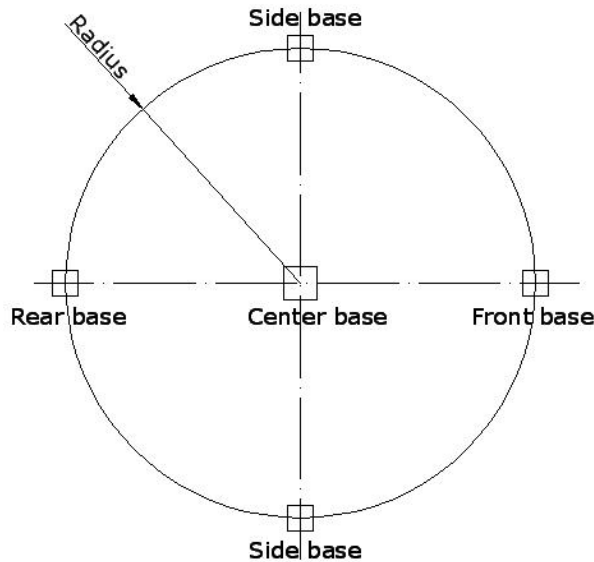
| Model               | 2KW  | 3KW  | 5KW  | 10KW    | 20KW  |
|---------------------|------|------|------|---------|-------|
| Rated power (W)     | 2000 | 3000 | 5000 | 10000   | 20000 |
| Rated voltage (DCV) | 120  | 240  | 240  | 240/360 | 360   |
| Rated voltage (ACV) | 170  | 339  | 339  | 339/509 | 509   |
| Rated current (DCA) | 17   | 13   | 21   | 42/28   | 56    |
| Rated current (ACA) | 12   | 9    | 15   | 30/20   | 40    |
| Rated speed(rpm)    | 400  | 220  | 200  | 180     | 90    |
| Max speed (rpm)     | 500  | 275  | 250  | 225     | 112   |
| Weight (kg)         | 39   | 280  | 325  | 387     | 960   |

### Concrete Base Details

For guyed cable tower (refer to figure below)

|   |             |      |     |     |
|---|-------------|------|-----|-----|
| Model   | 300W        | 500W | 1kW | 2kW |
| Radius (m)                                    | 3.0         | 3.0  | 3.0 | 4.0 |
| Center base dimension (m) (LxWxD)             | 0.8*0.8*0.6 |      |     |     |
| Side, front & rear base dimension (m) (LxWxD) | 0.6*0.6*0.6 |      |     |     |

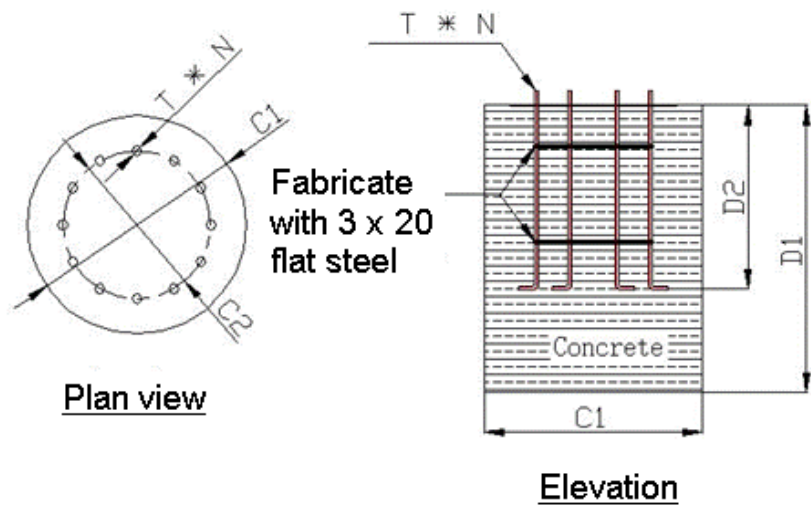
|   |                 |     |      |             |
|---|-----------------|-----|------|-------------|
| Model   | 3kW             | 5kW | 10KW | 20KW        |
| Radius (m)                                    | 4.0             | 6.0 | 6.0  | 8.0         |
| Center base dimension (m) (LxWxD)             | 0.8 x 0.8 x 1.6 |     |      | 1.0x1.0x1.0 |
| Side, front & rear base dimension (m) (LxWxD) | 0.6 x 0.6 x 1.0 |     |      | 1.5x1.5x1.0 |



For freestanding (taper) tower (refer to figure below)

| Model                                  | Symbol in figure | 1kW | 2kW | 3kW | 5kW | 10KW | 20KW |
|--|------------------|-----|-----|-----|-----|------|------|
| Depth (m)                              | (D1)             | 1.2 | 1.5 | 1.5 | 1.6 | 2.0  | 3.0  |
| Diameter (m)                           | (C1)             | 1.0 | 1.0 | 1.2 | 1.5 | 1.8  | 2.5  |
| Depth of ground bolts (m)              | (D2)             | 0.8 | 1.2 | 1.2 | 1.2 | 1.6  | 2.0  |
| Ground bolt pitch circle Diameter (mm) | (C2)             | 450 | 600 | 600 | 700 | 1000 | 1200 |
| Type of ground bolts                   | (T)              | M18 | M18 | M20 | M24 | M24  | M30  |
| Number of ground bolts                 | (N)              | 12  | 12  | 12  | 12  | 16   | 16   |





**Noise measurements**

| Model            | 20kW       | 10kW | 5kW  | 3kW  | 2kW  | 1kW  | 500  | Aeolus 300 |
|------------------|------------|------|------|------|------|------|------|------------|
| Wind Speed (m/s) | Sound (db) |      |      |      |      |      |      |            |
| 3                | 29.7       | 21.3 | 20   | 20.9 | 24.6 | 23.3 | 20.9 | 20.9       |
| 4                | 34         | 21.7 | 22.6 | 27.8 | 24.8 | 24.8 | 22.7 | 23.4       |
| 5                | 38.2       | 29.4 | 24.5 | 36.2 | 29.5 | 30.9 | 26.2 | 28.5       |
| 6                | 40.9       | 30.6 | 32.2 | 40.2 | 35.2 | 36.9 | 33.6 | 36.7       |
| 7                | 45.1       | 41.4 | 35.6 | 45.8 | 40.7 | 42.2 | 40.3 | 43.6       |
| 8                | 48         | 44.5 | 40.4 | 46.9 | 48.2 | 49   | 45   | 49.8       |
| 9                | 51.3       | 50.3 | 44.7 | 48.9 | 52.6 | 53.4 | 52.7 | 51.6       |
| 10               | 54.6       | 54.8 | 48.6 | 59   | 61.8 | 62.4 | 58.4 | 61.8       |
| 11               | 57.5       | 58.4 | 58.4 | 62.4 | 65.8 | 64   | 59.5 | 66.2       |
| 12               | 61.7       | 59.4 | 59.3 | 64.6 | 70.5 | 70.7 | 63.3 | 69.5       |

Test position: At 12m distance from the generator.  
 Note: The sound value includes wind noise.

Your Local Distributor is:

