The answer, my friend, is

blowin' in the wind

Bob Dylan

A report on

SMALL SCALE WIND AND OTHER RENEWABLE ENERGY

Tim Armstrong

Churchill Fellow 2006

One ought never to turn one's back on a threatened danger and try to run away from it. If you do that, you will double the danger. But if you meet it promptly and without flinching, you will reduce the danger by half.

Sir Winston Churchill

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The Author

Tim Armstrong has extensive experience in energy management and the energy market and also with the operation, management, and maintenance of major plant and buildings Tim has a strong interest in energy management matters, particularly in ensuring that all forms of energy are produced and used in the most efficient and effective manner. He is a firm believer in the need to establish a full understanding of how and where energy is used.

Renewable forms of energy will play a major part in our future and Tim's interest in electricity generation and use led him to undertake this study trip.

Tim is an energy consultant at East Harbour Management Services Limited in Wellington, New Zealand.

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Cover Art

Winter - Summer by Richard Ponder

Richard Ponder is a Wellington painter who has developed his art into colourful free-flowing expressionistic paintings. This painting is reproduced from the book *Caught on Canvas* which features images of the landscapes and scenery around Wellington and inspirational quotes and stories from Richard's perspective. Further information about Richard, and his gallery of work, can be found at http://www.richardponder.com/

Photographs and Graphics

Some of the photographs and graphics in this report have been sourced from the Internet. The use of all photographs and graphics is gratefully acknowledged, although sources are not necessarily stated.

Contents

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The dawn of Small Wind?

Executive Summary

Research carried out in England, Scotland, Canada and USA has provided increased understanding of the drivers, incentives and other forms of support that are combining to raise the awareness and rate of implementation of renewable generation in these countries.

All countries visited have national and regional policies that require, (by regulation), an increasing portion of generation of electricity to be from renewable sources. These regulations work in conjunction with or are supplemented by financial incentives to drive increased use of renewable energy.

Drivers for the move to renewable generation of electricity and other uses of renewable energy include a commitment to reduce greenhouse gas emissions and a need to reduce dependence on imported fossil fuels.

Observations in the different regions visited include:

United Kingdom

- Membership of the European Union requires the UK, like other member countries, to increase the amount of electricity generated from renewable sources and to reduce carbon emissions.

- Additional pressure to increase renewable generation is the rapidly increasing dependence on imported natural gas which is the major fuel for generation. Presently 40% of electricity generation is fuelled by gas and the UK could be 90% dependent on imported gas by the end of this decade.

- The mounting of small wind turbines on houses has captured the public's imagination and these are now available 'off the shelf'.

- The Low Carbon Building Programme grant scheme for household and community renewable energy projects is very successful. Additional funding has just been injected into this scheme. An important requirement of the scheme is that certain energy efficiency measures must have already been taken in order to qualify for a grant.

- Many local government authorities require new developments to include a percentage of renewable energy.

- The Scottish Executive provides additional support for implementation and research and development of renewable generation. This support includes grid upgrades and development of marine energy test sites.

- There has been a quite recent trend of large private investment in companies developing and manufacturing small and medium sized wind turbines.

Canada

Most of the Canadian Government's renewable energy policy is in the hands of Natural Resources Canada, which has a mandate to promote the sustainable development and responsible use of Canada's mineral, energy and forestry resources, and to develop an understanding of Canada's landmass.

Federal support for renewable generation includes financial and tax incentives.

The Province of Ontario is being innovative in a number of energy related areas. Legislation is in place which requires the introduction of 'smart meters' throughout the province. It is expected that will allow consumers to make informed choices as to when and if they use electricity. The Ontario Standard Offer Program will pay small renewable generators a feed-in tariff well above normal rates and guaranteed for 20 years.

Many Canadian provinces have renewable generation targets or have tendered for its supply. Many of the incentives specifically target wind generation.

Hydro generation companies in Canada are still developing their very large hydro resources.

USA

The US claims to be the world's major manufacturer of small wind turbines. The impact of China on the market is not yet clear!

There are widespread federal and state incentives for renewable generation. The federal assistance for renewables does not apply to small wind at the moment although new legislation to provide subsidies for small wind is expected to be passed soon.

In spite of the lack of support, small wind installations have recently maintained an annual growth rate of 40%.

Net metering is required in over 40 states but there is no consistent policy in place for the mechanics of the metering.

Very large state, federal and private resources have been allocated to support the manufacture and use of photovoltaic (PV) systems. Growth of this technology is booming as a result.

There is very little interest in micro-wind turbines suitable for mounting on houses. Most installations involve mast mounted wind turbines where home owners have one acre or more of land.

Alternative Technology

There is a resurgence of interest in small and medium sized vertical axis wind turbines while some more extreme technologies are also being investigated.

The increasing investment in research of alternative renewable energy devices may result in new technologies not yet available on a commercial basis. It is likely that the multi-megawatt horizontal axis turbines will remain the mainstay of wind generation for many more years.

Britain and Canada are committing significant funding for research and development of wave and tidal generation technology. There may be an opportunity for New Zealand to become an important player in the marine energy sector.

Education and Promotion

The funding of test and demonstration sites for wind and other renewable generation has contributed to the growth in understanding of the reasons and needs for increased commitment to renewable energy. Schools are ideal locations for demonstration projects. Supermarkets and petrol stations are using renewable energy as visible signals to their customers of the companies' environmental responsibility.

The installation of the wind turbine above Wellington City in 1993 resulted in widespread public acceptance of the technology and showed the benefits which can be obtained by using prominent demonstration sites.

Small Wind in New Zealand

There is increasing interest in the application of small wind in New Zealand. Based on trends seen overseas, apart from the installation of some highly visible house mounted turbines, most applications for small wind turbines will be in rural locations where land is available to overcome visual and noise complaints. These will be owned privately or by community co-operatives. School sites make idea locations for demonstrating renewable energy technology but these would need to receive some

funding from local energy trusts or organisations such as the Electricity Commission.

There will be no significant uptake of small and medium scale renewable generation in New Zealand without the introduction of financial incentives.

Legislation is required for the introduction of net metering and to oblige renewable generation commitments in new developments.

Incentives

It is unlikely that New Zealand can achieve the desired increase in generation from renewable energy without targeted financial incentives or regulation. Such incentives could be in the form of negative support by implementing a carbon tax on thermal generators however this results in increased costs to the consumer. This research has shown that there are many possible forms of incentive and regulatory schemes and New Zealand should take advantage of the opportunity to study and learn from the experiences of others in this field.

The recently released draft New Zealand National Energy Strategy and National Energy Efficiency and Conservation Strategy promote increased use of renewable energy. As these documents as still in draft form and were not part of the initial study, I have not made significant reference to them in this report.

Background

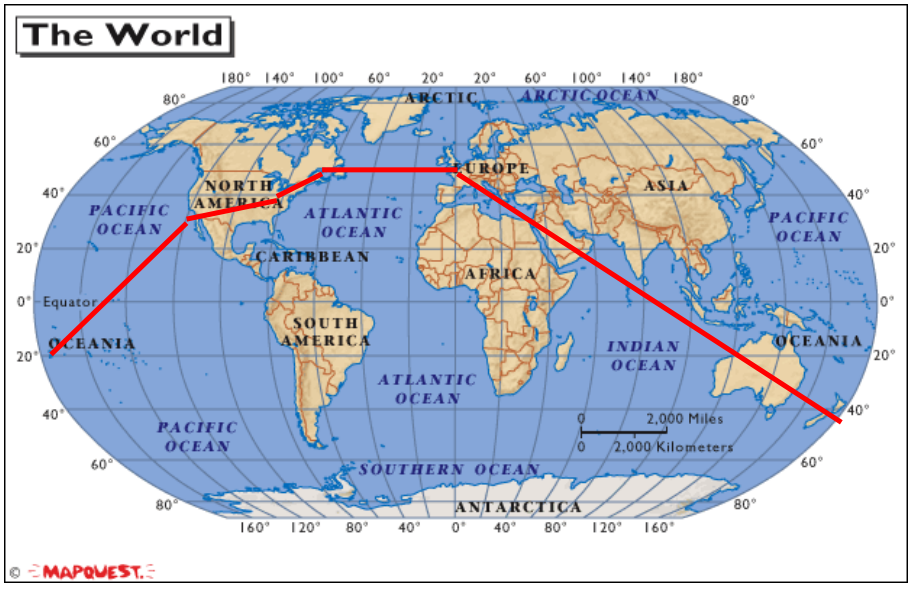
This report is the result of a research study tour undertaken by Tim Armstrong in September and October 2006. The aim of the research was to obtain up-to-date information on the work being carried out to develop small-scale electricity generation technology and to support and encourage its up-take. The policy and legislation researched applies to most forms of renewable generation but the focus was on Small Wind technology.

The purpose of this report is to detail the trip findings and to comment on the place that small-scale renewable generation may play in New Zealand's energy future.

Sincere thanks are extended to the three major sponsors who made the research possible and also to the New Zealand Wind Energy Association and East Harbour Management Services who have contributed towards the cost of producing this report. I also acknowledge the support of my colleagues who covered for me during my absence and encouraged me in my research.

The research involved visiting and interviewing a cross section of stakeholders with interests in small-scale renewable generation. These included government regulators, providers of grants and other forms of support, industry advocatory groups, electricity suppliers and equipment manufacturers. Internet based research has supplemented the trip findings.

The visits, over a five week period, took me to England, Scotland, Canada and USA. Experiences in each country helped build a deeper knowledge of the present and future international prospects for micro-scale renewable electricity generation and how these may apply in New Zealand.



Organisations visited were:

- Ofgem (Office of Gas and Electricity Markets), London, England.
- Energy Savings Trust, London, England.
- BWEA (British Wind Energy Association), London, England.
- Scottish Executive, Edinburgh, Scotland.
- Gullane Primary School, East Lothian, Scotland.
- Scottish Seabird Centre, North Berwick, Scotland.
- Energy Savings Trust, Edinburgh, Scotland.
- Scottish Power, Glasgow, Scotland.
- Proven Energy Ltd, Stewarton, Scotland.
- TUV NEL, East Kilbride, Scotland.
- Wind Institute of Canada, Prince Edward Island, Canada.
- Natural Resources Canada, Ottawa, Canada.
- Hydro Ottawa, Ottawa, Canada.
- CanWEA (Canadian Wind Energy Association), Ottawa, Canada.
- US Department of Energy, Washington, DC, USA.
- AWEA, (American Wind Energy Association), Washington, DC, USA.
- Aerotecture International, Inc, Chicago, USA.
- Bergey Windpower, Norman, Oklahoma, USA.

Please contact me if more details of these organisations or their personnel are required. tim.armstrong@eastharbour.co.nz

Introduction

The original intent of the research was to obtain information on the latest advances in the design and manufacture of small wind turbines that are suitable to generate electricity for direct household use. During preliminary research the author realised that the policies and support schemes for all small renewable generation technologies were equally as important as the technology and therefore widened the scope of the trip to address these matters as well.

Many of the regulations and incentives relate to both large and small-scale renewable schemes. As a result, this report reflects a larger overview of international renewable generation than first envisaged.

Research was carried out in England, Scotland, Canada and USA. The definition of small wind varied on the two sides of the Atlantic as did the types of support schemes in place.

A number of areas of interest outside of the scope of this report were discussed during the trip. Some of these topics, such as smart metering, are reported on in this report.

The report details findings in each country.

In general, devices rated at 1,000 watts (1MW) or less is known as 'micro' generators while those between this and 100kW are regarded as 'small'. Both terms are used to describe all these sizes in this report and in the industry in general.

Costs are given in the currency of the country being referred to at the time.

Since the research was carried out a number of significant documents have been released for discussion in New Zealand. The impact of resulting policy changes have not been considered in this report.

Often only basic details of the policies and procedures will be given in this report. Full details will be available on each organisation's website. The author may be able to provide more details and can be contacted at:
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The European Union

Membership of the EU puts obligations on countries to take steps to ensure the increased use of renewable energy.

The European Union's Renewables Directive 2001/77/EC1 has been in place since 2001. The directive aims to increase the EU's share of electricity produced from renewable energy sources to 21% (up from 15.2% in 2001), thus contributing to reach the overall target of 12% of energy consumption from renewables by 2010.

The Directive further stipulates that Member States have to provide better grid access for renewable energy generators.

Under the Directive, Member States have set up individual RES-E (electricity from renewable energy source) targets. They are free to choose their preferred support mechanism in order to achieve the targets until an EU-wide regulatory framework is adopted.

Increasing the share of renewables is expected to have many benefits, in particular:

– Improved security of energy supply.

– Enhanced competitive edge for the EU in the renewable energies technology industries.

– Mitigation of greenhouse gas emissions by the EU power sector.

– Mitigation of regional and local pollutant emissions.

– Improved economic and social prospects especially for rural and isolated regions.

The existing support systems

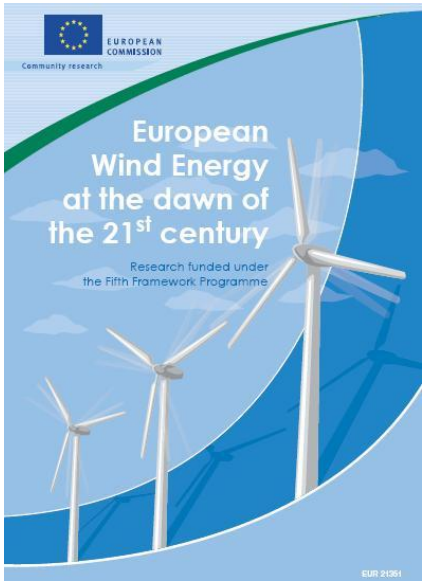
In the EU there are a range of different support systems operating. These can be broadly classified into four groups: feed-in tariffs, green certificates, tendering systems and tax incentives.

- **Feed-in tariffs** exist in most of the Member States. These systems are characterised by a specific price, normally set for a period of several years, which must be paid by electricity companies, usually distributors, to domestic producers of green electricity. The additional costs of these schemes are paid by suppliers and are passed through to the power consumers by way of a premium on the kWh end-user price. These schemes have the advantages of investment security and the promotion of mid- and long-term technologies.

- Under the **green certificate** system, RES-E is sold at conventional power-market prices. In order to finance the additional cost of producing green electricity, and to ensure that the desired green electricity is generated, all consumers (or in some countries producers) are obliged to purchase a certain number of green certificates from RES-E producers according to a fixed percentage, or quota, of their total electricity consumption/production. Penalty payments for non-compliance are transferred either to a renewables research, development and demonstration (RD&D) fund or to the general government budget.

- Pure **tendering**; with the State placing a series of tenders for the supply of RES-E, which is then supplied on a contract basis at the price resulting from the tender. The additional costs generated by the purchase of RES-E are passed on to the end consumer of electricity through a specific levy.

- Systems based on **tax incentives** are, in most cases, used as an additional policy tool.



European Union Directives have a major influence on the energy policies of the United Kingdom.

United Kingdom

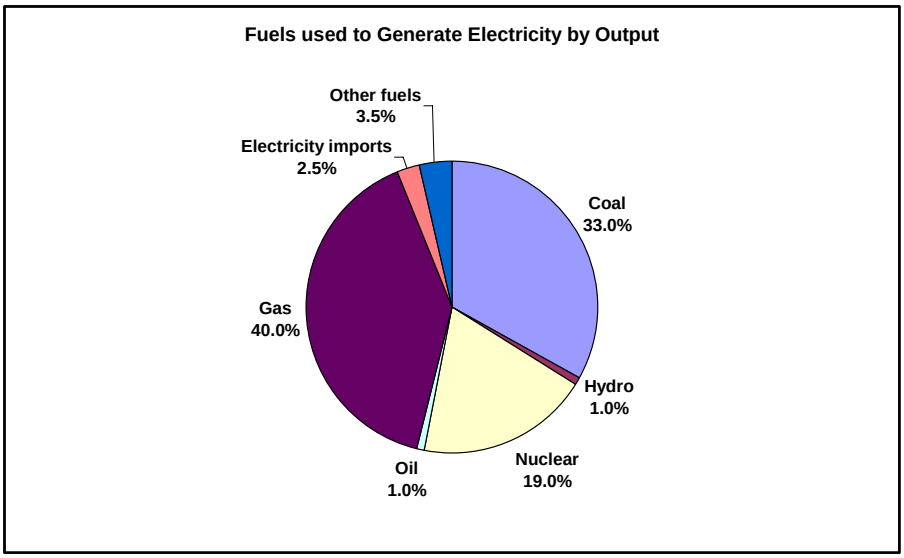
Security of Supply

UK Gas

Being a member of the European Union requires the United Kingdom to take steps to increase electricity generation from renewable energy sources.

Another major reason why Britain is putting so much effort into increased use of renewable generation is to reduce concern about its present and future availability of gas.

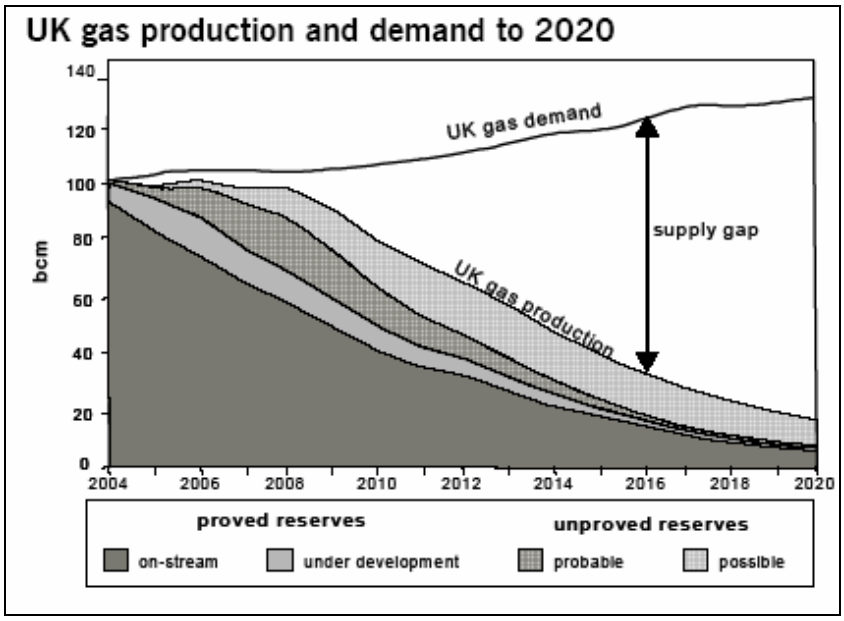
Presently over 40% of electricity generated in Britain is produced using gas. Nuclear energy supplies another 19%. In 2004 there was only a very small amount of electricity generated using renewable resources.



Source: Digest of UK Energy Statistics 2005

In Britain the era of cheap North Sea gas is over with prices increasing rapidly and there is a growing dependence on imported gas supplies. Retail gas costs have increased 71% since 2003. In the last few years the UK has moved from being a net exporter of gas to a net importer.

By 2009, it is planned to have infrastructure in place to allow 90% of the UK's gas supplies to be imported with present gas storage capacity to be doubled by 2010. Gas consumption is expected to increase by another 14% by 2011.



Source: **The Future of UK Gas Supplies** published by the Parliamentary Office of Science and Technology

The extent of this dependency on other countries is reflected by the infrastructure already in place or planned.

There are currently two gas import pipelines into the UK with a third being commissioned:

- UK-Belgium interconnector between Bacton in Norfolk and Zeebrugge in Belgium connects the UK to the mainland Europe gas network. An upgrade of this pipeline has just been completed doubling the capacity to allow importation of 16.5 billion cubic metres (bcm) per year.

- UK-Norway 'Vesterled' pipeline link connects St Fergus in Scotland to both the Frigg gasfield, a jointly operated offshore gasfield straddling UK and Norwegian waters, and to facilities on Norway's Heimdal field. This has a capacity of 11bcm per year.

- The 1,200km Langeled pipeline (shown in the map) is the world's longest subsea gas pipeline, designed to deliver up to 25 bcm/yr connecting the UK to the Norwegian continental shelf. It is now being commissioned with gas flowing from Norway. It will be able to

supply the UK with 20 per cent of its gas requirements, when it comes on full stream in October 2007.

- There is also a proposal to construct a pipeline from the Netherlands (Balgzand) to Bacton, importing upwards of 10 bcm a year from 2006/2007.

Future proposals include Danish and Russian gas pipeline routes, although the construction of these is less certain.

There is £10 billion of actual and planned investment in gas supply infrastructure and related transportation expected between 2005 and 2010.

UK's nuclear power stations

The UK currently has 23 operating reactors at 12 power stations, which provide approximately 20% of the electricity in the UK. The tables below give the nuclear stations currently operating in the UK. It can be seen that many are nearing the end of their published lifetime which increases pressure for replacement 'clean' electricity production.

	Capacity MW	**Published Lifetime**
Sizewell A	420	1966 - 2006
Dungeness A	450	1965 - 2006
Oldbury	434	1967 - 2008
Wylfa	980	1971 - 2010
Hinkley Point B	1220	1976 - 2011
Hunterston B	1190	1976 - 2011
Hartlepool	1210	1989 - 2014
Heysham 1	1150	1989 - 2014
Dungeness B	1110	1985 - 2018
Heysham 2	1250	1989 - 2023
Torness	1250	1988 - 2023
Sizewell B	1188	1995 - 2035

The Nuclear Decommissioning Authority [NDA] was set up in April 2005 to take responsibility for the UK's nuclear legacy. NDA's core objective is to ensure that the nuclear sites are decommissioned and cleaned up safely, securely, cost effectively and in ways that protect the environment.

The future of wind in the UK

The growth of wind farms in England is being threatened by rising public opinion against more turbines being erected in the countryside. As off-shore wind turbines have been developed and being installed around Europe there is increasing pressure that future large wind farms in England be sited off-shore.

An example of this is the 'London Array' which is being developed over 20 km off the Kent and Essex coasts, in the outer Thames Estuary. It is planned that up to 271 turbines will be installed over a four year period in an area of around 245km^2 on and between two sandbanks. The wind farm would be constructed in phases, and when fully complete would generate up to 1,000 MW of electricity.

This is enough to meet the electricity needs of 750,000 homes – around a quarter of Greater London or all of the homes in Kent and East Sussex.

Another planned development is the Thanet project located approximately 11 km to the east of Margate, Kent. The Thanet project is expected to have a total capacity of up to 300 MW

which, on average, is sufficient to supply approximately 240,000 homes.

Ofgem

Ofgem (Office of Gas and Electricity Markets) is the regulator for Britain's gas and electricity industries. Its role is to protect and advance the interests of consumers by promoting competition where possible, and through regulation only where necessary.

Ofgem's work focuses on the following areas:

- making gas and electricity markets work effectively;
- regulating monopoly businesses;
- securing Britain's gas and electricity supplies; and
- meeting its social and environmental responsibilities.

Ofgem operates under the direction and governance of the Gas and Electricity Markets Authority, which makes all major decisions and sets policy priorities for Ofgem. The Authority's role in the management of Ofgem is set out in its Rules of Procedure.

Ofgem is funded by a levy on the six major energy suppliers which totals about £35 million per year.

Metering

Ofgem is responsible for the energy metering regimes. Present requirements are that meters must be read once every 12 months and inspected every 24 months. Most people receive invoices every three months.

The intention is that the industry should develop common standards for meters and the Government has given £10m to encourage advances in metering. Requests for proposals for this money were being invited at the time of my visit.

Pressure for improved metering and billing is coming from the EU. The UK is trying not to mandate but rather encourage solutions. The aim is to improve the collection of data and provide better information to consumers.

Most suppliers presently offer the choice of flat or night and day rates.

The first major trial of smart meters in the UK was launched in April. Electricity firm EDF Energy, in partnership with fuel

poverty charity National Energy Action (NEA), installed the first of up to 3,000 electricity and gas smart meters into customers' homes in south London. Ofgem recently held a consultation into smart meters, which concluded that smart meters can deliver benefits to customers.

Energy Efficiency Commitment

In addition to the levy to fund Ofgem, one percent is added to gas and electricity consumers accounts to raise funds to support an 'Energy Efficiency Commitment' (EEC) which is administrated by Ofgem.

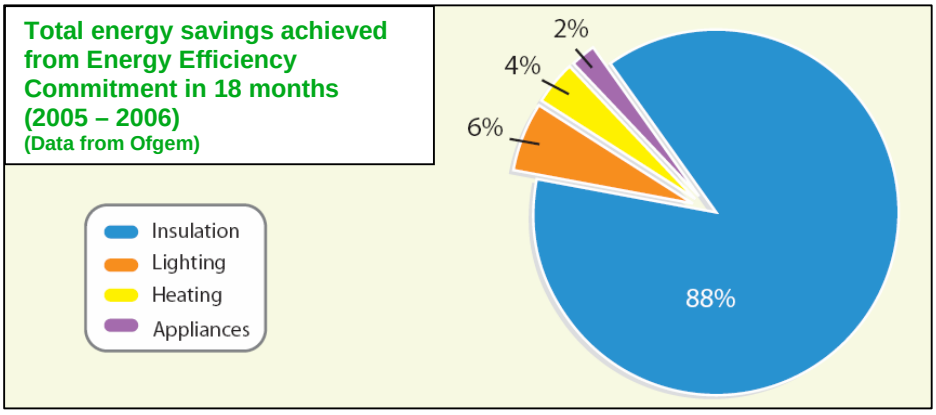
Under the EEC, electricity and gas suppliers are required to achieve targets for the promotion of improvements in domestic energy efficiency. The EEC is expected to contribute to the Climate Change Programme by cutting greenhouse gas emissions. Targets are set in response to submissions made by the suppliers which are quantified and approved by Ofgem.

At least 50% of energy savings must be focused on a priority group of low-income consumers in receipt of certain benefits including tax or pension credits. So it is expected that the EEC will also contribute to the eradication of fuel poverty. (Figures suggest that, in 2005, over two million households across the UK could not afford to keep warm at a reasonable cost.)

In the first few years of the EEC (2002 – 2005) one of the main incentives was subsidies of 50 – 100% to insulate homes. These have resulted in 800,000 wall and 500,000 loft insulations. (It should be noted that the predominant method of house construction is using brick cavity walls. These walls can be easily insulated by drilling holes and injecting insulating materials. (This method of insulating walls cannot be easily applied to the typical New Zealand timber framed home although some houses have had this done.) Also 40 million compact fluorescent light bulbs have been given away.

While the EEC funds are targeted at financing energy efficiency measures, there is a high probability that electricity and gas suppliers will meet some of their commitment by investing in small-scale renewable energy. The Climate Change and Sustainable Energy Act 2006, allows the Government to set national targets for micro-generation and to introduce a scheme to ensure that micro-generation systems are encouraged and promoted by local Councils. The Act expands the EEC to include micro-electricity generating technologies. This could extend the scheme to PV and micro-wind, but their inclusion would depend on the suppliers developing cost effective schemes.

Areas of energy saving are shown on the chart below.



Distributed Generation

Registered Power Zones

Ofgem has introduced the concept of 'Registered Power Zones' (RPZ). While this concept is aimed at larger generators it may be applicable for groups of small renewable energy generators if they are able to combine their outputs and act as a single virtual generator. The Registered Power Zones are intended to encourage Distribution Network Operators to develop new, more cost effective ways of connecting and operating generation that will deliver specific benefits to new distributed generators and broader benefits to consumers generally.

If a Distribution Network Operator employs genuine innovation in the way that it connects generation to the grid, it can seek to register the connection scheme with Ofgem as a Registered Power Zone. Ofgem will then decide whether the scheme qualifies, and if it does, the incentive element of Ofgem's Distributed Generation (DG) Incentive is increased for the first five years of operation.

Distributed generation is defined as that which is connected to lines of no more than 132 kiloVolts (kV) in England and Wales and 33 kV in Scotland. If a generator approaches an electricity supplier and wishes to connect to and supply into the grid, the supplier must make an offer to connect within 90 days. Connections below 16 amps/phase (4 kW) do not need to apply but only to be notified to the supplier who must connect them.

There is some interest by power companies to establish 'Virtual Power Stations', where a broker would aggregate the output from small generators into a single contract with the supplier. This would greatly reduce the administration for the companies and may result in higher buy back prices.

The concept of 'Windcrofting' promoted by Proven Energy Ltd is an example of how the output from small generation can be combined as a virtual power station. (See boxed item page 45.)

In November 2004, Price Control Review regulations were introduced to change the need to pay cost 80% of the asset cost at the time of connection. Now smaller initial charges can be paid at connection with ongoing charges spreading the financial load until generation income is available.

Distributed Working Group

The Electricity Networks Strategy Group (ENSG) provides advice to the Department of Trade and Industry (DTI), Ofgem, Department for Environment, Food and Rural Affairs (Defra), the Scottish Executive and the Welsh Assembly on issues associated with the development of distribution and transmission electricity networks. The ENSG has a number of sub groups including the Distributed Working Group (DWG).

The ENSG is chaired jointly by the DTI and Ofgem, and has senior representation from the Scottish Executive, the Welsh Assembly, Defra, the network operators, generators and other industry participants.

Among the work tasks being undertaken by the DWG is:

Work Programme 04: Facilitating Small-Scale Generation

Developing those solutions which would be needed to enable 'non-expert' users (such as home-owners) to take maximum advantage of emerging small-scale generation technology.

The objectives of the work programme are:

1. To remove the main regulatory and institutional barriers to the introduction of Micro-generation in Great Britain.

2. To develop simple, standardised solutions for the connection of Micro-generation to distribution systems.

3. In the short term, to implement solutions that can be effected within the existing regulatory and legislative framework.

4. To identify necessary changes to policy, regulation and legislation in order to bring about a more favourable general regulatory framework for Micro-generation.

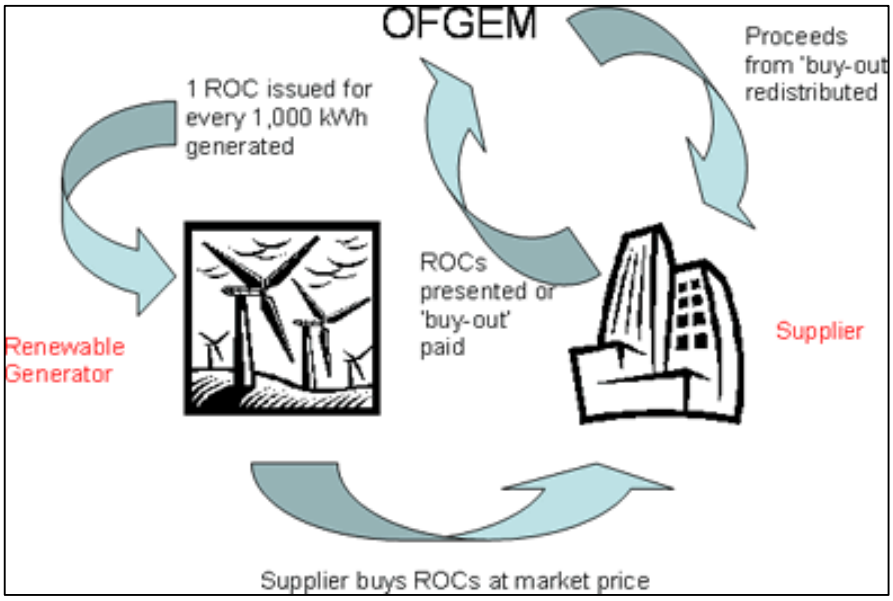
5. To advise on the forthcoming distribution price control review. In particular, to identify aspects of Distribution Network

Operators regulation that currently discourages the early adoption by consumers of Micro-generation.

The outcomes of this work stream are likely to be relevant to New Zealand.

Renewables Obligation

The Renewables Obligation Order is the government's mechanism for increasing the proportion of electricity produced from renewable sources. The obligation is on suppliers to source a specific percentage of the electricity they supply to retail customers from renewable sources. In 2005/06 this was 5.5% rising year each year until it is 15.4% in 2015/16.



For each megawatt hour of electricity generated from an accredited renewable source, a tradable certificate called a Renewables Obligation Certificate (ROC) is issued to the generator. These can then be sold to suppliers either with the electricity or separate from the electricity. Suppliers must be in possession of the number of ROCs matching the percentage of electricity they are obliged to supply from renewable sources in that year. Alternatively they can choose to pay a fixed sum for each megawatt hour of electricity that falls under the obligation but for which they do not hold a ROC.

The buy-out price is set by Ofgem and adjusted annually to reflect changes in the Retail Prices Index. In 2006/07 the buy-out price is £33.24 per MWh. In 2005/2006 the buy-out price was £32.33 per MWh.

As the quantity of electricity actually produced from renewable sources is currently less than the percentage the suppliers are obliged to supply, the tradable value of ROCs is high. ROCs have

regularly traded for over £40. This is because for every ROC a supplier presents he is given a corresponding proportion of the money raised from the buy-out payments. In 2004/05 this was £13.66 per ROC in England and Wales and £19.99 per ROC in Scotland. This system allows the supplier to make competitive decisions on how he will meet the terms of the Obligation.

Another incentive is that electricity generated from renewable sources qualifies for Levy Exemption Certificates (LECs) and for exemption from the Climate Change Levy (CCL). The CCL is a tax (0.43p/kW) on energy use by commercial customers.

Low Carbon Buildings Fund

In April 2006, the Department of Trade and Industry (DTI) launched its Low Carbon Buildings Programme (LCBP) which will run over three years and replaces the previous DTI Clear Skies and Solar PV grant programmes. £28 million has been allocated to support micro-generation projects in households, community organisations, housing associations, schools, the not-for-profit sector and private businesses. The scheme aims to demonstrate how energy efficiency and micro-generation can work hand in hand to create 'low carbon' buildings.

The Energy Act 2004 defines micro-generation as generating electricity from any plant with a capacity of less than 50 kW which uses a technology that reduces emissions of greenhouse gases.

DTI's low carbon buildings programme is managed by the Energy Saving Trust (EST).

There are 4 main aims of the programme:

1. To support a more holistic approach to reducing carbon emissions from buildings by demonstrating combinations of both energy efficiency measures and micro-generation products in a single development.

2. To see demonstrated, on a wider scale, emerging micro-generation technologies (with a focus on building integrated technologies).

3. To measure trends in costs of micro-generation technologies. It is expected that these costs should reduce over the lifetime of the programme against a 2005 baseline.

4. To raise awareness by linking demonstration projects to a wider programme of activities including developing skills and communicating the potential of micro-generation to change the attitudes and behaviour of consumers. Larger scale projects will seek to engage the construction industry in project replication by demonstrating the business case for developing low carbon buildings.

A householder must have first undertaken a number of energy efficiency measures before being eligible to apply for a low carbon buildings grant. These measures will ensure that households are minimising their energy requirements.

Before applying for a LCBP grant it is required that they have:

a. insulated the whole of the loft of the property to meet current building regulations e.g. 270mm of mineral wool loft insulation, or suitable alternative.

b. installed cavity wall insulation (if home has cavity walls).

c. fitted low energy light bulbs.

d. installed basic controls to the heating system to include a room thermostat and a programmer or timer.

An accredited installer must also be used. At the moment the scheme is self certified and it is taken on trust that the installation has been carried out. The installation must be an accredited product by an accredited installer.

Funding

Two streams of grants are available:

Stream one: £6 million for householders and £4 million for community organisations. Under Stream 1 community organisations can apply for up to 50% of the cost of buying and installing micro-generation technology, up to a maximum of £30,000.

The stream two fund (£18 million) for medium and large micro-generation projects by public, not for profit and commercial organizations is comprised of two categories:

- Stream 2A - to be allocated over seven funding rounds (and one reserve round) Maximum grant of £100k or 40-50% of total costs (excl. VAT).

- Stream 2B - to be allocated over three funding rounds (and one reserve round) Maximum grant of £1m or 40-50% of total costs (excl. VAT). Deadlines for applications will be twice a year.

Household Grants

The low carbon buildings programme will fund a range of micro-generation technologies for households as shown:

Technology	% Grant available
Solar photovoltaics	Maximum £3,000 per kW installed, up to a maximum of £15,000 subject to an overall 50% limit of the installed cost (exclusive of VAT)
Wind turbines	Maximum £1,000 per kW installed, up to a maximum of £5,000 subject to an overall 30% limit of the installed cost (exclusive of VAT)
Small hydro	Maximum £1,000 per kW installed, up to a maximum of £5,000 subject to an overall 30% limit of the installed cost (exclusive of VAT)
Solar thermal hot water	Maximum £400 regardless of size subject to an overall 30% limit (exclusive of VAT)
Heat pumps Ground / water / air source	Maximum £1,200 regardless of size subject to an overall 30% limit (exclusive of VAT)
Bio-energy 1.Room Heater/Stoves automated wood pellet feed	Maximum £600 regardless of size subject to an overall 20% limit (exclusive of VAT)
2. Wood fuelled boiler systems	Maximum £1,500 regardless of size subject to an overall 30% limit (exclusive of VAT)
Renewable CHP	Grant levels to be defined
MicroCHP (Combined heat and power)	Grant levels to be defined
Fuel cells	Grant levels to be defined

The largest number of grants has been to solar thermal hot water, but not the largest value as these are capped at £400 per system.

Many solar thermal (hot water) thermal installers have not worried about being accredited and offer a £400 discount instead. There is a suggestion that some may inflate their prices first!

Interest in grants is felt to be driven by recent energy cost increases (up to 95% in 3 years) and by increased interest in 'green' matters. Even after grants, payback may still be 10 – 15 years.

One purpose of the LCBP scheme is to provide some protection for fledgling industries and also to give credibility to plant and installers.

Applications for household LCBP grant can be made on-line. EST will provide guidance in filling out the applications. There has been little default by households, most pick up the grant. Some have pulled out in order to get a better grant such as Scottish or EEC funding. EST will provide guidance as to the best grant scheme.

Installation must be made within 6 months of the grant being approved. There is consideration of extending this particularly for wind where it may take much longer than this to obtain site approval and planning permission and to receive the hardware.

There is some criticism of the scheme that it is only suitable for those who can afford it without the grant. Because the user must pay all costs up front and then present receipts to EST before receiving the grant they must have the full funding available. There is some consideration of an arrangement to allow for interest free loans to cover the period before the grant is received.

Alternative funding

Some organizations are attempting to overcome the hurdle of having to meet the full initial cost. For example EDF Energy has set up a scheme with one supplier of evacuated solar hot water systems with payments made over 12 months added to the power bill. These still qualifies for the LCBP grant but the rule

that EST must be the last one to pay needs to be modified for this scheme to be successful.

nPower has a better Ground Source Heat Pump grant scheme than LCBP and this has taken some load off EST. This electricity retailer has forged a partnership with a supplier and offers a £1500 grant on all domestic installations of heat pumps. The grant is not means tested and there is no obligation to use or purchase any nPower products. As well as homeowners it is available to builders, developers, landlords and Housing Associations.

In November 2006 it was announced that an extra £6.2m in grants for private households will be available under the three-year Low Carbon Buildings Programme.

There has already been over £3m of grants allocated to households installing micro-generation - the demand has been so great that this represents half the total household budget committed in only the first year of the programme.

On projected demand levels this should allow the grant programme to operate until mid 2008.

By that time the Government hopes that some of the wider measures to promote micro-generation will be taking effect, and that the sector will have matured to a point where householder grants will no longer be necessary.

EST has 47 Energy Advice Centres around the UK. These are being upgraded to Sustainable Energy Centres and will be EST branded. EST has a low carbon vehicle R&D programme to develop low carbon fuels.

EST is funded directly by government through DTI.

Phase 2 of LCBP

This has been announced with a new £50m capital grant stream for the installation of micro-generation technologies in local housing authorities, housing associations, schools and other public sector buildings and charitable bodies. It is not open to private households or businesses. Large-scale projects can apply for individual grants up to £1m. This required clearance by the EU to allow state money to be given to private companies if the use is for the environmental benefit of all.

Projects must be building related so they cannot be stand alone. Projects must not be designed specifically to export to the grid. They may export to the grid but this cannot be the main purpose.

The Merton Rule

In October 2003 the London Borough of Merton became the first local authority in the UK to include a policy that requires new non-residential developments to generate at least 10% of their energy needs from renewable energy equipment such as solar panels and wind turbines.

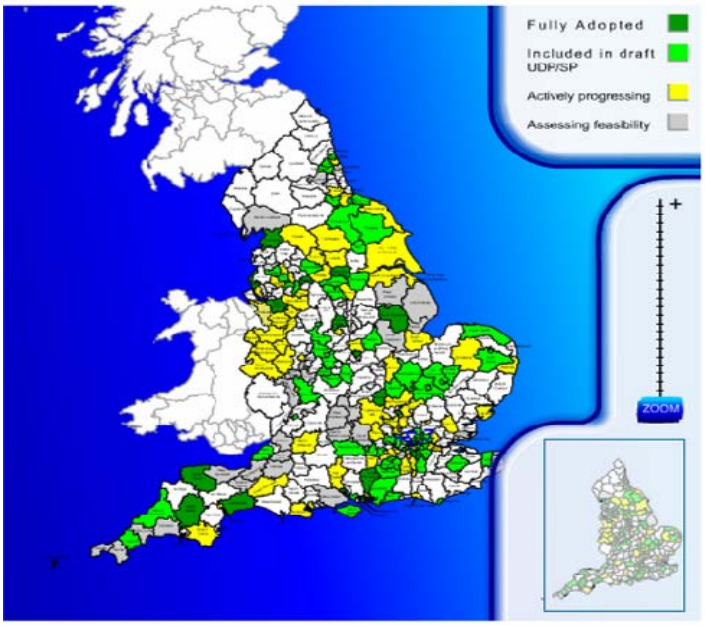
The policy reads: "*All new non-residential development above a threshold of 1,000 sqm will be expected to incorporate renewable energy production equipment to provide at least 10% of predicted energy requirements*."

Merton is now revising the policy so that residential developments will also have to cut their CO2 emissions by at least 10%. This policy shows how a local authority has been able to change the landscape of low carbon planning in a way that has significant implications for the renewable energy economy.

The policy has caught the imagination of many boroughs across England who have adopted similar prescriptive policies of their own.

What Merton Council has achieved is to demonstrate the power of local government to combat climate change, while at the same time driving the renewable energy economy and lowering fuel bills for residents and businesses.

As shown on this map, at least 160 local authorities are adopting, or considering adopting, prescriptive Merton Rule-like policies.



Scotland

While most of the incentive and grants schemes detailed previously are available in Scotland, there are some additional incentives available only in Scotland.

The Scottish Executive

The Executive was established in 1999, following the first elections to the Scottish Parliament. It is a coalition between the Scottish Labour Party and the Scottish Liberal Democrat Party. The Executive is led by a First Minister who is nominated by the Parliament and in turn appoints the other Scottish Ministers who make up the Cabinet.

Executive civil servants are accountable to Scottish Ministers, who are themselves accountable to the Scottish Parliament. It is responsible for most of the issues of day-to-day concern to the people of Scotland, including health, education, justice, rural affairs, and transport.

The Executive manages an annual budget of more than £27 billion in the financial year 2005/2006 which is due to rise to over £30 billion in 2007/2008.

Some energy policy is controlled from London but Section 36 of the Electricity Act has devolved some responsibility to the Scottish Executive in relation to generation over 50 kW. Smaller generation is covered in the Scottish Planning Act.

The Executive has set Renewables Obligation (Scotland) (ROS) of 18% of generation from renewable sources by 2010 and 40% by 2020 renewable sources for Scotland's electricity supplied through the national grid. Any micro-generation will be in addition to this target. Although planned new generation will meet the targets, the existing national grid is not able to transport the increased load. The Executive has plans to upgrade the grid from North Scotland to handle the increased generation.

There is a very high level of commitment to research, development and implementation of renewable energy in Scotland. This includes significant investment in developing marine energy. A number of people commented that, at one time, Scotland led the world in the development of wind turbines until funding dropped and Denmark took over. The intention is

that this will not happen with marine energy and that Scotland will become the word leaders in this technology.

Additional pressure in developing renewable energy results from the plan that two major nuclear and one coal-fired generation plants in Scotland are due to close in the next ten years.

Presently hydro provides about 12% of the generation and large wind farm developments already approved will meet the target of 18% renewable generation by 2010 and 40% by 2020.

Scotland exports electricity to England and Northern Ireland.

The Scottish Executive is seen to be very 'green' with the Liberal Party being anti-nuclear and strongly supporting renewables.

Steps which are being considered by the Executive to increase the uptake of renewable energy include:

- **Hydrogen and Fuel Cells**

Providing £2.5 million per annum over the next 3 years to develop potential and opportunities for hydrogen and fuel cell technology in Scotland:

1. Support for further demonstration projects involving hydrogen use in remote or off-grid communities in Scotland.

2. Projects funded to support unique Scottish technology that involves fuel cell design or production.

3. Projects funding to enable applications of hydrogen technologies and fuel cells which are currently at the research or development stage or ready to be demonstrated commercially.

4. An inter-university research centre is to be established in Scotland to create fuel cell and hydrogen-based intellectual property for future exploitation.

- **Marine**

Proposed amendments to the Electricity Act 1989 would allow wave and tidal devices, with generating capacity of greater than 1 megawatt, to use the testing facilities at the European Marine Energy Centre without being subject to the section 36 consents process.

The Executive is presently consulting whether regulations can be developed by which the Renewable Obligation Scotland (ROS) is amended to support increased generation of electricity from wave and tidal sources.

New planning guidelines are being developed which will focus more on small-scale generation. It is proposed that a 10% renewable generation component will be required in all new development (similar to the Merton Rule). The contribution is likely to be measured in reduction of CO_2 emissions.

Like England, Scotland is looking to make micro-generation a 'permitted development' which may not require planning permission. The main concern is how to manage the impact of such change on conservation areas and listed buildings.

Scottish Community and Householder Renewables Initiative

Although the LCBP scheme operates in Scotland, the Scottish Community and Householder Renewables Initiative (SCHRI), developed by the Executive, provides a 'one-stop' service for community groups and householders interested in developing renewable energy solutions to meet their own energy needs. An advisory service provides expertise, advice and development support to individual householders and community organisations including councils, housing associations and voluntary groups.

It is backed by a grant scheme that was established in January 2003. £3.7 million per year has been allocated to the scheme until 2007-08. The Energy Saving Trust (EST) operates the householder scheme throughout Scotland. While the service for communities is operated by EST only in the lowland areas and by Highlands and Islands Enterprise in other areas.

The SCHRI works to increase awareness of renewables technologies and their environmental impact and benefits, and by providing sustainable solutions to local or individual energy demand.

Capital funding is available up to a limit of 30% of the cost of a project and a maximum grant of £4,000 for householders; community

schemes can attract funding of up to £10,000 for feasibility studies and £100,000 for capital expenditure. More details on the scheme can be obtained at www.est.org.uk/schri

This funding does not require the energy saving measures that LCBP does before receiving a grant but advice on energy efficiency measures is normally provided when a grant is given.

A review of the SCHRI reported that;

- The existence of SCHRI funding has been very important to the development of the small-scale renewables sector in Scotland

- The programme has been successful in stimulating demand for small-scale renewables

Community

By May 2005, 146 community renewable energy projects had received capital funding worth £3.6 million. The funding was split by:

- wind turbines (28%)
- heating (19%)
- biomass, biofuel and energy from waste (18%)
- Heat pumps (16%)
- Combined technologies (16%)
- Hydro (3%)


Proven 6 kW turbine at Gullane School

The survey findings suggest that 92 projects would not have proceeded without SCHRI funding, while the remaining 54 would have either been delayed, or been of a smaller scale or lower quality.

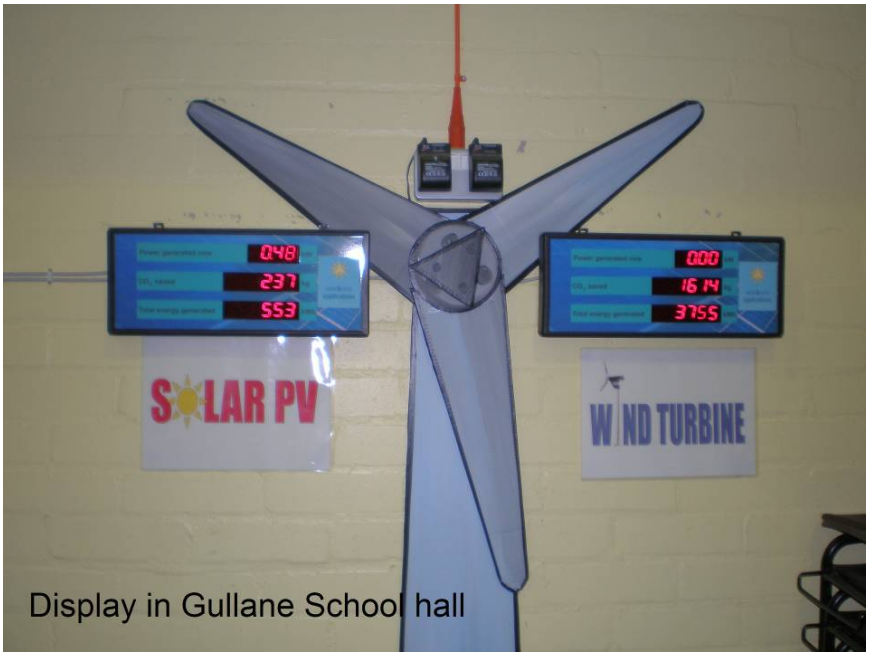
Household

During the same period, 378 grants worth £670,000 were issued to households to support the installation of renewable energy systems. The most popular technology assisted by the initiative has been solar hot water heating systems, which accounted for half of all allocated grants, followed by ground source heat pumps (GSHPs) (26%). At least 170 projects would not have proceeded without SCHRI funding.

The Scotland office of the Energy Saving Trust administers both the Low Carbon Building fund and the SCHRI for community

projects. The local scheme is generally more favourable than the LCBP fund for technologies other than photovoltaic; it also supports a wider range of technologies.

With the high level of applications for household grants, the EST in Scotland is now focusing its efforts on promoting the community scheme in those areas not covered by the Highlands and Islands Enterprise. It is possible, in some cases, to provide up to 50% of installation costs and to supplement this funding with some from local sources to meet all costs.



Display in Gullane School hall

This has happened at some schools such as Gullane Primary School east of Edinburgh. Both photovoltaic panels and a 6 kW wind turbine have been installed at Gullane. Schools are regarded as great demonstration and education sites and EST has funded projects up to 50 kW.

EST has funded biomass boilers (wood pellets) in medium sized projects such as schools, shopping centres and leisure centres. It is hoped that this support will help build up a biomass industry in Scotland with the establishment of wood pelletising plants. Presently wood pellets come from Northern Ireland.

By October 2006, EST had not received any applications for grants towards installation of domestic scale wind turbines, however expect up to 500 next year with numbers steadily increasing after that.

Investment

Many of the Scottish generator/retailers are involved in increasing levels of renewable generation and promoting smaller scale renewables to their customers. Scottish Power has just awarded £330m in contracts for wind turbines and civil

engineering work for its Whitelee windfarm on Eaglesham Moor near Glasgow, the biggest project of its kind in Europe. Siemens will build the 140 turbines for the 322 MW site.

Scottish Power is also supporting the development of the Pelamas wave device and a demonstration fuel cell combined heat and power (CHP) trial using reformed gas.

Renewable Devices Swift Turbines (RDST) has entered into an agreement with Scottish & Southern Energy plc (SSE), under which the companies will work in partnership to install 2,000 Swift Rooftop Wind Energy Systems. This deal represents a £9.2m investment in RDST and allows the companies to make a major impact on the rooftop wind energy market in the UK.

SSE will invest up to £12.5 million in a new government body designed to ramp up research into greener energy for the private sector. SSE has committed to giving £2.5m a year for five years to the proposed Energy Technologies Institute, expected to be operational by 2008.

The institute is being set up to "accelerate the development of secure, reliable and cost-effective low-carbon energy technologies towards commercial deployment", according to its prospectus.

It will also address issues such as securing the UK's energy supply and alleviating energy poverty.

SSE is joined by four major players in the world energy industry - Shell, BP, E.ON UK and EDF Energy - who have committed to funding the institute.

The government will fund the institute with £50m a year for ten years through the Department of Trade and Industry (DTI) and has said it wants up to ten private companies to match the investment.

The institute will select, commission, fund and manage research projects, selected competitively. DTI said private partners such as SSE would shape the research agenda for the institute to fit their needs.

Small Wind Technology in the United Kingdom

This section of the report looks at the small wind situation in the United Kingdom separately from that in North America as the markets and technology are significantly different.

Domestic-Scale Turbines

The development of small (micro) domestic-scale wind turbines in UK has received a large amount of publicity around the world. While small turbines have been used for many years to charge batteries, it is this new generation of turbines, which are capable of being mounted on houses and connected directly to the grid which has caught the public imagination.

Swift domestic wind turbines

The two models which have been at the forefront of this media interest have been the Windsave turbine developed in Glasgow and the Swift turbine developed by Renewable Devices in Edinburgh.

The expectation is that these turbines will be attached to the houses and plugged into the home's power supply.

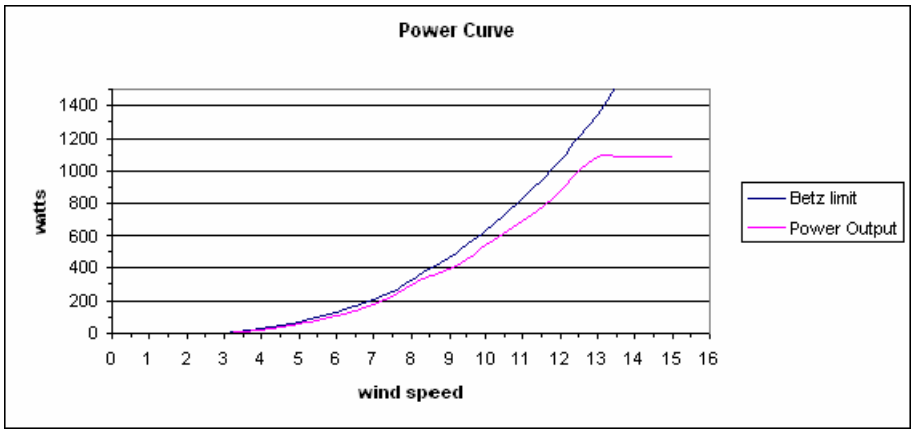
The specifications and claimed outputs for these units are;

	Windsave WS1000	Swift
Output	230 volt, 50 hz	230 volt, 50 hz
Rated power output	1,000 watts	1,500 watts
Annual power supplied	800 – 1,200 kWh	2,000 – 3,000 kWh
Cut in speed	4 m/s	2.3 m/s
Cut out speed	14 m/s	?
Weight	25 kg	?
Noise	53 dBA 5m behind @ 7 m/s	< 35 dBA
Blade diameter	1.75 metres	2.1 metres
Predicted life	10 years	20 years

There has been concern expressed that the output claims for these two turbines have been overstated and that purchasers will be disillusioned by their actual performance. Stated turbine capacities can only be achieved at quite high wind speeds. It will only be from now, when more installations are being made, that true performance in residential locations will be known.

There is little data available on how the turbulence around houses will impact on the effectiveness of the wind resource to drive these turbines. The potential for noise and vibration is also claimed to be unknown. Some of these concerns are shared by the Energy Savings Trust which requires a site inspection and report of predicted performance before they will approve a grant.

There are starting to be reports on the Internet from disgruntled people who have been told that their sites do not have good enough wind resources to qualify for a grant.



Windsave Ltd

Windsave is quite open about the low output of their turbine at lower wind speeds. They publish this power curve on their web site and advise that the average wind speed across the UK as 5.6 m/s at 10 metres above the ground.

The rated power output of 1,000 W can only be achieved with a wind speed of 12.5 m/s and few turbines will be mounted at a height of 10 metres.

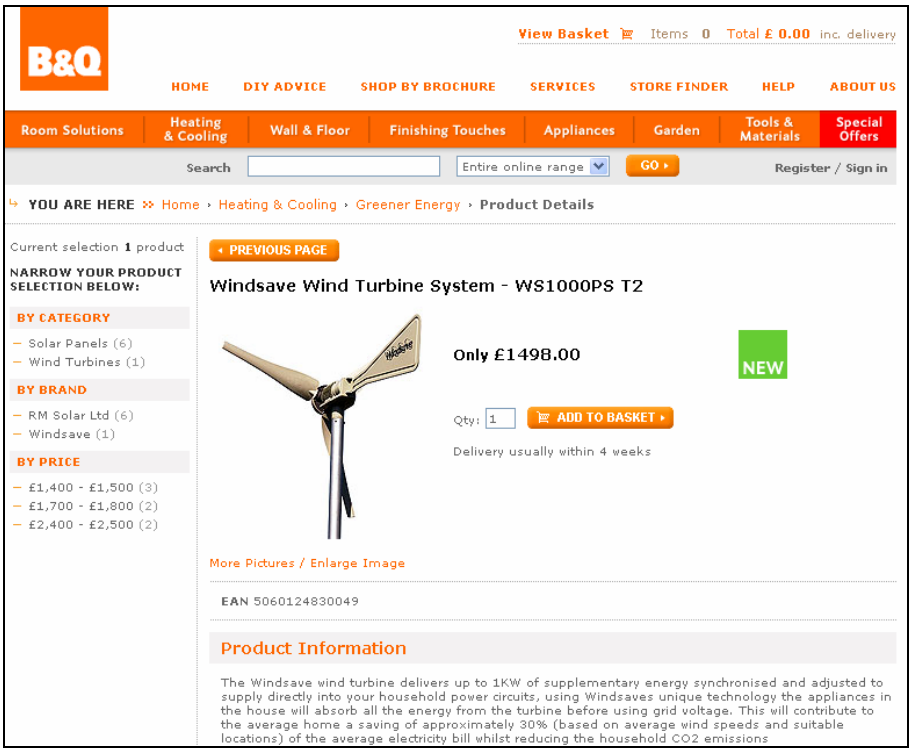
At the average wind speed of 5.6 m/s the output of the turbine is about 100 watts. Although output climbs with increased wind speed, there would be very little electricity generated below the average wind speed. While this chart is available on the Windsave web site the widely published output of 1,000 watts raises expectations which may be well above actual performance.

The author shares many of the concerns being expressed and these are only heightened when photos such as the one below

are being used by the manufacturer to promote its small wind turbine technology.

This photo shows a turbine mounted well below the top of a house and it seems that there would be a large degree of wind shading plus very turbulent wind flow. It seems unrealistic to expect anything like 5.6 m/s average wind speed for this installation especially as it is clearly not 10 metres above the ground.

The Windsave turbines are now being marketed through a national chain of hardware stores and are also soon to be available from a chain of electrical wholesalers. The author believes that the advertised price assumes a LCBP grant. An authorised installer must be used in order to qualify for a grant.



Even smaller wind turbines are now being sold with quoted maximum output of 250 watts and average of 85 watts. There seems to be little point in connecting one of these to the grid although they will have application for battery charging. The manufacturer of one such unit states that "*the Micro-turbine will*

operate most efficiently when it is mounted high above obstructions in free flowing laminar airflow. It may also be roof mounted – But as with any roof mounted wind turbine, performance may suffer due to the inherent turbulence present at rooftop level".

If Swift or Windsave sized turbine produced an average 100 Watts this would be an output of 876 kWh per year which is about 10% of the electricity used in a typical New Zealand house. This is a significant contribution and is more likely to be obtained in New Zealand conditions with higher average wind speeds in many locations. But it is yet to be seen whether these outputs can be achieved.

The need for house owners to obtain consent to attach a wind turbine to their house is being addressed by the British Government. Law changes are expected which will mean that consents are not required or be much easier to obtain.

> *"It is patently absurd that you should be able to put a satellite dish up on your house but should have to wrestle with the planning process for small scale micro-generation which is no more obtrusive. We want far more micro-generation to be treated as permitted development."*
>
> British Housing and Planning Minister Yvette Cooper 2005

From my observations, it seems likely that these turbines, particularly the Windsave, will prove to be much noisier than expected and that resistance to their use in residential areas will grow.

Medium Sized Wind Turbines

The production and application of larger, mast mounted medium sized wind turbines has a longer history in Britain with a number of well established machines available. The largest and best known manufacturer is Proven Energy Limited near Glasgow, Scotland which has installed over 700 wind turbine systems into 30 countries world-wide.

The turbines in this size range are more likely to be able to supply the needs of a household. Proven has stopped manufacture of its smallest (600 watt) unit and is concentrating on larger units. They promote the 2.5 kW turbines as being suitable for a 2 – 3 bedroom home when mounted on a 6 – 9 metre high mast. Proven will only sell this unit to a site with a minimum average wind speed of 5 m/s unless it is a

demonstration site such as a school. An explosion proof model has been developed for use on off-shore oil rigs.

The 6 kW turbines, mounted on a 9 – 15 metre high mast, are suitable for 5 – 6 bedroom homes or small commercial buildings. Although the manufacturers do not recommend mounting these turbines directly on buildings, one has been mounted on the Kirklees Council building in Huddersfield.

A new 15 kW model is being tested and will be on sale next year. This turbine should be mounted on a 15 – 25 metre high mast. This unit is claimed to be the first to be certified to the new European Conformity Standard.

Proven Production Facility

The manufacture of Proven wind turbines has a high manual content and about 7 or 8 turbines are built each week. Following an injection of investment funding a new factory is to be built at the existing site which should greatly increase production rates. The 6 kW is the largest selling size. Other new models are also being trialled.

Note that the stated capacities of the Proven turbines are specified at a wind speed of 5 m/s not the 12.5 m/s used for Swift and Windsave units.

Costs of the Proven turbines as listed on their website are;

Estimated System Costs (GBP £ & excl. VAT)							
Wind Turbine System	System Package	Turbine Cost	Basic System Cost (Export)	SCHRI Grant	LCBP Grant	In Scotland You Pay	In England & Wales You Pay
Proven 2.5	Grid	£ 3,655	£ 10,900	£ 3,270	£ 2,500	£ 7,630	£ 8,400
Proven 2.5	Battery	£ 3,655	£ 15,000	£ 4,000	£ 2,500	£ 11,000	£ 12,500
Proven 6	Grid	£ 7,765	£ 18,200	£ 4,000	£ 5,000	£ 14,200	£ 13,200
Proven 6	Battery	£ 7,765	£ 24,000	£ 4,000	£ 5,000	£ 20,000	£ 19,000
Proven 15	Grid	£ 14,900	£ 39,000	£ 4,000	£ 5,000	£ 35,000	£ 34,000
Proven 15	Battery	£ 14,900	£ 46,500	£ 4,000	£ 5,000	£ 42,500	£ 41,500

Proven Energy Ltd

Cost estimate includes delivery and installation but excludes any foundation work which may need to be carried out.

This chart of prices demonstrates the impact of the English and Scottish grants. It is claimed that for a 6 kW turbine with income from selling ROCs and electricity savings payback is approximately 7 years when a grant is obtained.

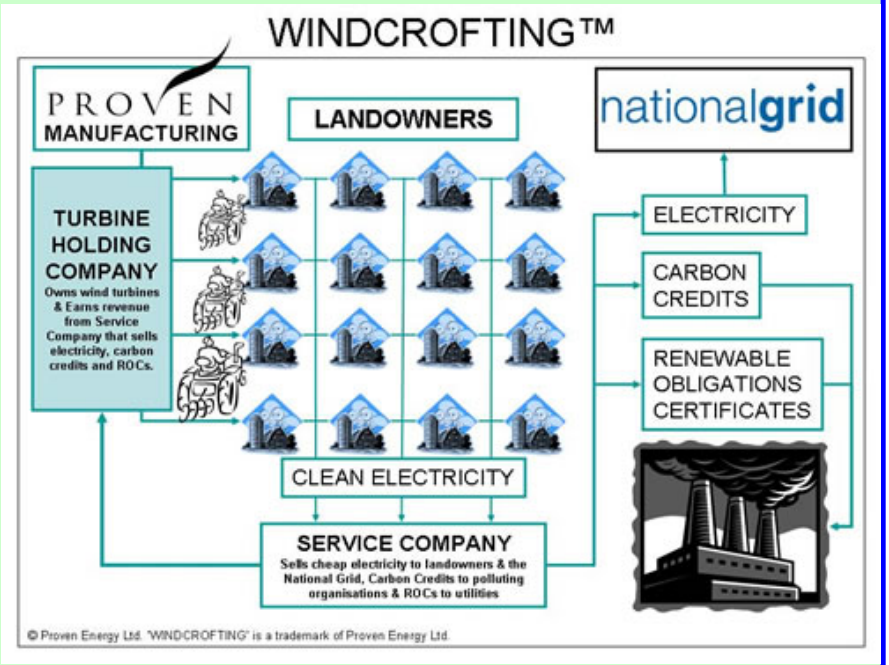
As most of the medium sized wind turbines are installed on large or rural there seem to be few consenting problems.

WINDCROFTING™

Proven Energy is promoting a new style of wind farm called windcrofting using their 15 kW machines.

The WINDCROFTING™ concept is that any landowner with a grid connection can sign up. In return for a 20-30 year land lease, the landowner will receive rent and may buy cheap electricity from the scheme. Excess electricity production will be sold to the National Grid at wholesale prices. Proven wind turbines would be sold to a Turbine Holding Company (THC). The THC is a special purpose financing vehicle. These turbines would be serviced by a Service Company (SC) that installs and maintains wind turbines and sells electricity to land owners and the national grid. Furthermore, the TSC would sell carbon credits and Renewable Obligation Certificates on the market.

The Company is launching a pilot scheme which is being funded by a UK property development company. The pilot is planned to take place in Gloucestershire with 4-5 turbines.



Following a launch in August 2006, Proven claim to have registered more than 400 interested parties by mid October and is currently in the process of signing up participating land owners. A large proportion of Proven's production capacity will be committed to the project.

NEL Wind Club

An interesting development in the research and development of small wind turbines in Scotland is the formation of the NEL Wind Club.

TUV NEL in East Kilbride, Scotland was formally a government owned national research laboratory but is now part of the German TUV Group. They provide testing facilities for a number of renewable energy devices particularly wind, marine and biomass. NEL is also carrying out research on energy storage, fuel cells and hydrogen production. Also being developed is a combined heat and power system using a reciprocating engine. NEL claims that this will have a better electricity/heat ratio (1:2) than the New Zealand designed Whispergen unit.

A fully developed wind turbine testing facility has been established at Myres Hill where turbines of many sizes are being tested for manufacturers. They also manage the Scottish Enterprise Energy Technology Centre.

TUV NEL expressed a very strong interest in becoming involved in possible joint ventures or exchanges with New Zealand, including staff placements. They also would be happy to receive renewable energy research questions from New Zealand and act as a clearing house passing the queries on to suitable other parties if need be.

As an extension of the wind turbine development and testing and in response to the many challenges faced by this growing sector, NEL has established a club to address issues associated with the development, testing, performance verification and implementation of small wind energy systems. The concept is that club members will get special considerations and also share some of their data.

At the time of this visit there were five members of the club. These are a combination of turbine and component manufacturers.

Benefits of Club membership include access to:

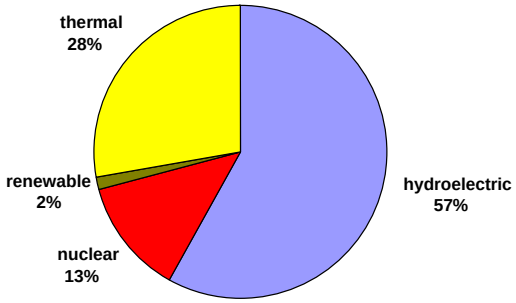
- The Myres Hill Test Facility
- The Scottish Enterprise Energy Technology Centre
- NEL's engineering and consultancy services at preferential rates, plus
- Opportunities to participate in collaborative R&D projects
- Creation of a forum for addressing technical, regulatory and training issues, and
- Participation in supply chain networking events

Canada

Hydro

Like New Zealand, Canada produces the majority of its electricity from hydro sources.

Canadian Electricity Generation 2003



There is still considerable potential for additional hydro generation in Canada. In Quebec over 1,000MW of new hydro

capacity is under construction, another 360MW will come from refurbishment of existing sites. About 1,300MW of new generation in planned. There is also likely to be development of run-of-river and low-head generation in other provinces.

Some provinces are exporting hydro generated electricity to USA during peak daytime periods and importing cheap electricity at night in order to conserve water resources. This takes advantage of the flexibility of hydro compared with thermal generation plants which mainly run continuously.

Wind Incentives

Although targeted at large wind turbines, it is worth noting the support the Canadian Government is giving to increase uptake of the technology.

Canada has installed 657 MW of new wind energy capacity in 2006, representing more than $1 billion in investment, and shattering the previous annual installation record of 240 MW set in 2005. As a result, Canada's total installed wind energy capacity sits at 1,451 MW, a virtual doubling of the 684 MW in place at the start of the year. This brings wind to about 5% of Canada's generation capacity.

Wind Power Production Incentive

The Government of Canada's Wind Power Production Incentive (WPPI), announced in 2001, is intended to encourage electric utilities, independent power producers and other stakeholders to gain experience in the wind energy sector.

WPPI will provide financial support for the installation of 1,000 megawatts of new capacity over five years and is expected to leverage approximately $1.5 billion in capital investments across Canada.

By displacing other electricity sources and through continued momentum, wind power capacity installed under WPPI, is projected to reduce Green House Gas emissions by three megatonnes annually by 2010. Under a new commitment, the programme has been extended and aims to have installed capacity of 4,000 MW by 2010. This programme is the main driver for wind energy deployment in Canada.

To be eligible for the incentive, the prospective producer must negotiate and sign a contribution agreement with National Resources Canada (NRCan). The agreement contains the following criteria, among others, for setting up a wind farm:

1. The wind farm must be commissioned between April 1, 2002, and March 31, 2007; (now 2010)

2. The wind farm must be independently metered at the point of interconnection with the electricity grid; and

3. The wind farm must have a minimum nameplate capacity of 500 kilowatts. In northern and remote locations, the minimum capacity is 20 kilowatts.

The amount of the incentive is about half of the current estimated cost premium for wind energy in Canada compared to conventional sources for facilities with good wind sources. The incentive is structured with a decline in premiums for wind energy over time. The incentive can be claimed for every kilowatt-hour of net production during the first ten years of production as follows:

Commissioning Date	**Amount of Financial Incentive for the ten- year period**
April 1, 2002 to March 31, 2003 inclusive	1.2 cents per kilowatt-hour (¢/kWh)
After March 31, 2003 and on or before March 31, 2006	1.0 ¢/kWh
After March 31, 2006 and on or before March 31, 2007	0.8 ¢/kWh

While a lower limit of 20 kW applies in some regions, it is possible that groups of small to medium turbines could qualify for this incentive.

Tax Incentives

For a number of years, Canada has offered tax incentives to encourage the development of efficient or so-called Green Energy Projects. These incentives include an accelerated capital cost allowance deduction for the capital cost of certain assets and an immediate deduction for certain expenses incurred in the development of Green Energy Projects.

In order to achieve these goals, two specific taxation measures are available to encourage investments in energy efficiency and renewable energy projects:

Capital Cost Allowance: Class 43.1

Class 43.1 in Schedule II of the Income Tax Act allows taxpayers an accelerated (50%) write-off of certain equipment that is designed to produce energy in a more efficient way or to produce energy from alternative renewable sources. Qualifying equipment includes wind energy systems including wind turbines, electrical generating equipment, supports, battery storage equipment and transmission equipment.

Generally the accelerated write-off is limited to the income earned from the project. This limitation does not apply however if the principal purpose of a project is to generate energy for use in the owner's business that is other than the sale of energy. This allows the accelerated deduction to be used by those who build green energy projects for their own businesses and then export the surplus energy to a grid.

Renewable and Conservation Expenses

Canadian Renewable and Conservation Expenses (CRCE) is a category of fully deductible expenditures associated with the start-up of renewable energy and energy conservation projects. The first exploratory wind turbine of each section of a wind farm can be fully deducted in the year of its installation.

The scheme has been extended so that, for larger farms where more than one turbine can be justified to test conditions, other test turbines can also be fully deductible. Test turbines must be at least 1.5 kilometres from any other turbines to allow for accurate wind monitoring.

Provincial Initiatives

In addition to Federal initiatives, most Canadian provinces also have incentives to help the uptake of wind energy.

Table 1 – Federal / Provincial initiatives on Wind Energy

Jurisdiction	Initiative	Status
Federal	Expanded the Wind Power Production Incentive (WPPI) in the 2005 Federal Budget to support the development of 4,000 MW of wind energy in Canada by 2010	Program expansion on hold and funds frozen as new government considers its position on wind energy for Fall 2006
British Columbia	50% of new generation to come from clean energy sources	2006 Call for Power awards 325 MW of power purchase agreements for wind projects
Alberta	An initial "threshold" of 900 MW of wind energy development established – work underway on policies (e.g., wind energy forecasting) to allow an increase in the threshold	More than 300 MW in place well over 900 MW of projects under development
Saskatchewan	Current initiatives will result in wind energy meeting 5% of electricity demand in Saskatchewan (about 200 MW)	Small projects RFP has led to recent awarding of 25 MW power purchase agreement
Manitoba	Manitoba Government seeking 1000 MW of wind energy within a decade	More than 100 MW in place, 300 MW RFP to be issued in Fall 2006
Ontario	Renewable Portfolio Standard (5% by 2007; 10% by 2010) – potentially four-fifths of this will be wind energy – 2100 MW by 2010	More than 300 MW, 975 MW of wind energy contracts awarded in RFP II. Standard Offer Contract program to be launched in November 2006 seeking 1,000 MW of renewable energy
Quebec	Quebec Government seeking 4,000 MW of wind energy by 2015	More than 200 MW in place,1200+ MW of wind energy contracts awarded, 2000 MW wind energy RFP has been issued
New Brunswick	NB Power seeking 400 MW of wind energy by 2016	220 MW of wind energy power purchase agreements to be signed in Fall 2006
Nova Scotia	Nova Scotia Government has indicated it would like 380 MW of wind energy by 2014	100 MW of wind energy now installed or contracted
Prince Edward Island	Government target of 15% of electricity coming from wind power in 2010 (60 MW) – notional goal of 100% by 2015	60+ MW of wind energy now installed or contracted
Newfoundland	Draft energy paper calls for 150 MW of wind energy	25 MW contract awarded in Fall 2006, future RFPs for 25 MW of wind energy to be issued

Ontario

The Ontario Renewable Portfolio Standard (RPS) requires that 5% (1350 MW) of the province's power comes from renewable sources by 2007 and 10% (2700 MW) by 2010. In addition, the Province of Ontario has recently released an RFP for 2,500 megawatts of new electrical generation capacity and/or demand-side management initiatives. It is unlikely that small wind installations will be counted as contributing to this target.

By 2020, it's projected that 18,000 MW of Ontario's existing electricity generating capacity will need to be replaced or refurbished, and that another 6,000 MW to 7,000 MW will need

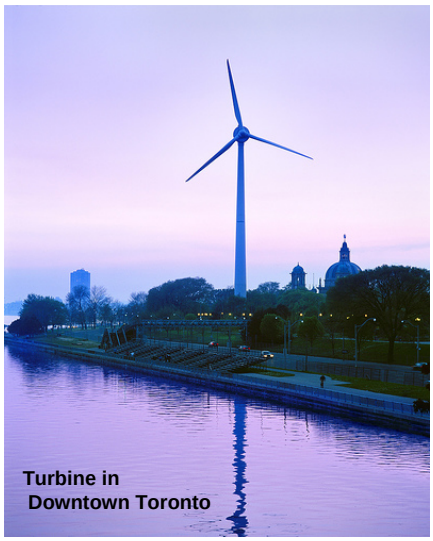
to be built or saved through demand-side measures just to keep up with economic and population growth.

Incentives

Ontario offers rebates of the provincial retail sales tax (RST) on the purchase of residential solar, wind, micro-hydroelectric or geothermal energy systems, or on any expansions or upgrades to existing systems installed in residential premises until November 25, 2007.

Standard Offer Program

The Ontario Power Authority (OPA), with the help of the Ontario Energy Board, has created a subsidy program called the Standard Offer Program (SOP).



Turbine in Downtown Toronto

Small generators under 10MW using selected renewable resources like solar, wind, small hydro and some biomass, will have the opportunity to sign a 20-year contract to sell power to the OPA and receive a guaranteed price per kilowatt hour for the energy delivered into the Grid, over the life of the contract.

The generator will be responsible for the entire cost of the project, including the costs of connecting to the existing electricity distribution system.

1. The parameters of the Standard Offer Program include:

   - The program is open to any renewable resource type that qualifies as a renewable resource including wind, small hydro-electric, solar, and some bio-mass.

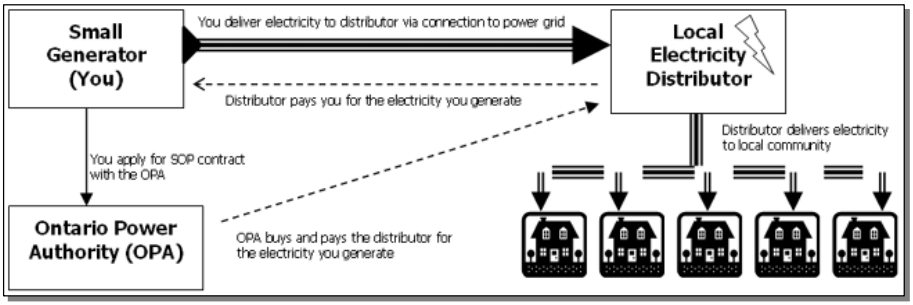
   - The maximum project size is limited to 10 megawatts (MW). No minimum project size is currently proposed.

   - To be eligible, projects must be connected to their local electricity distributor's low voltage (50 kV or less) distribution system.

   - There are no locational restrictions, other than those determined by the technical limitations of the local distribution system and also, the technical limitations of the high-voltage transmission system.

- For the first year of commercial operation, all eligible renewable resource type projects (except solar photovoltaic) will be paid a base rate of 11 cents per kilowatt hour (kWh) for each kWh delivered. The rate will escalate from 11 cents per kWh over the 20 year term of the contract. Projects that can demonstrate generation control will be eligible for an additional 3.52 cents per kWh for all electricity delivered during on-peak hours.

- A price of 42 cents kWh for solar photovoltaic projects. Solar PV projects will not receive the inflation escalation or peak premium.



2. Some of the requirements that the Generator will be responsible for include:

   - The requirement that all generators have an Ontario Energy Board generator license ($100 one time charge for generators under 5 MW).

   - The requirement that all generators of 5.0 megawatts or greater pay an annual $800 registration fee.

   - The requirement that all generators have a four quadrant meter and telecommunications capability to transmit the hourly data. These meters can cost $1000-$3000 installed and a dedicated phone line may be required.

   - The generator requires a new utility account, with a fixed monthly charge in the range of $10 to $30 per month, depending on the utility.

The OPA does not believe that very small, residential-scale projects will make a profit under the Standard Offer Program. In some cases, particularly the very small projects, Net Metering might be a better way to get involved. Part of the justification for the much higher payment for photovoltaic generation is that this occurs during the day when peak power is required.

Replacing Coal-Fired Generation In Ontario

Since 2003, the Ontario government has made significant progress in reducing the province's reliance on electricity from coal and reducing emissions from the province's coal plants. Ontario has initiatives that include reducing energy consumption, replacing coal-fired generating plants, adding new, clean generating capacity, expanding public transit, limiting urban sprawl, toughening industrial emission standards and mobilizing their neighbours to fight transboundary air pollution.

From 2003 to 2005, progress included:
• Closing the single-largest coal-fired electricity contributor to smog.
• Reducing total coal-fired electricity generation in Ontario from 36.2 terawatt-hours to 30.1 terawatt-hours, a drop of 17 per cent.
• Reducing carbon dioxide emissions, by 15 per cent.
• Reducing sulphur dioxide emissions by 28 per cent.
• Reducing nitrogen oxide emissions by 34 per cent.

The Ontario government has also made substantial progress in bringing cleaner sources of energy online. Some of these include:
• 1,350 megawatts of wind, solar, biomass and hydroelectric generation across the province.
• The Niagara Tunnel project, which will add enough electricity to meet the needs of 160,000 households
• 1400 megawatts new gas-fired generation
• Contract to refurbish 1,540 megawatts Nuclear Station.

The Ontario government had committed to replacing all of the province's coal stations by 2009, based on forecasted demand by the Independent Electricity System Operator (IESO).

The IESO has recently revised its projected supply capacity and future demand requirements, by as much as 2,500 - 3,000 megawatts.
That has prompted the government to decide it cannot proceed with its timetable to close all coal-fired generation by 2009.

Small Wind in Canada

In Canada, small wind is regarded as turbines with outputs under 300kW. As in other countries, turbines under 1kW are mainly used for off grid battery charging. Residential turbines are between 1 and 10kW with most being mast mounted and requiring at least ½ acres of land.

The Canada Wind Energy Association (CanWEA) believe that between 800 and 1,000 small wind turbines (SWTs) are sold in Canada each year with most of these being very small size. There are currently between 2,200 and 2,500 SWTs installed in Canada, 90% of which fall into the micro-wind turbine category. The total combined capacity of all SWTs is estimated to be between 1.8 MW and 4.5 MW, equivalent to the capacity of one to three modern utility-grade wind turbines. Their total annual

output is roughly 7.5 GWh per year, or the amount of electricity consumed by approximately 750 Canadian homes.

The majority of SWTs installed in Canada originate from the United States, with 96% of reported sales attributed to three U.S. manufacturers: Bergey, Southwest Windpower and Aeromax. Most of these imported turbines are micro-wind turbines in the range of 300 Watts to 1 kW.

The Canadian SWT manufacturing market consists of only six firms, five of which are focused on production of medium wind machines in the range of 20 kW to 50 kW. Canada has a small, but important niche in this size range.

CanWEA has developed a special web site covering 'small wind' http://www.smallwindenergy.ca/en/SmallWind.html
Included in the information developed is an estimate of the cost (C$) of generating electricity.

Comparison of SWTs at Constant 20% Capacity Factor (Canadian $)

	Rated Power			
	400 W	1 kW	10 kW	50 kW
Rotor diameter (m)	1.1	2.5	6.7	15
Tower height (m)	14	19	24	25
Rotor configuration	upwind	upwind	upwind	downwind
Number of blades	3	3	3	3
Turbine cost	$1,100	$2,800	$32,500	$110,000
Installation & BOS cost	$900	$3,600	$25,100	$55,000
Total installed cost	$2,000	$6,400	$57,600	$165,000
Total cost per kW installed	$5,000	$6,400	$5,760	$3,300
Net energy output (MWh/yr)	0.7	1.7	17.2	85.5
Energy production cost ($/kWh)	$0.37	$0.44	$0.31	$0.18

Wind Energy Institute of Canada

The Atlantic Wind Test Site (AWTS) was established over 20 years ago. Located at North Cape, on the northwestern tip of Prince Edward Island, it is one of the windiest areas in Canada. The test facility was funded by Natural Resources Canada and

the Government of Prince Edward Island as a collaborative project of State and Provincial governments.

The facility has been used to test both large and small wind turbines. AWTS has been able to test and produce power output curves for turbines to support the designers estimated outputs.


Vestas V90 turbine at PEI

A wind farm (16 x Vestas V47 – 660 KW) has been established on land next to the site by the PEI Energy Corporation and these turbines are also monitored as part of the project to establish a greater understanding of the performance of wind turbines. A Vestas V90 3 MW turbine has been installed and is being used by the manufacturer as a test bed.

Average wind speed on site is 8.2 m/s and the wind farm operates at 43% capacity factor. The turbines provide 5% of PEI's electricity with the balance imported from New Brunswick. Plans are in place for an additional 400 MW of wind generation on the island. If installed this would allow export of electricity to other provinces.

The location of this facility, at the end of a radial transmission and distribution system offers a unique opportunity to study such issues as system stability analysis.

AWTS was restructured in 2006 and is now the Wind Energy Institute of Canada (WEICan).

Wind Energy Institute of Canada
Institut de l'énergie éolienne du Canada
Prince Edward Island - Île-du-Prince-Édouard
CANADA

WEICan will work in close collaboration with many partners including universities, colleges and other research institutions, private sector companies, governments and utilities, to advance the development and commercialization of wind energy

technologies. Their new state-of-the-art facility was funded by the Atlantic Canada Opportunities Agency (ACOA). It consists of offices, boardroom, classroom, laboratory and workshop. The present staff of five is to be expanded to 15 within 6 months.

The University of New Brunswick's (UNB) has established a renewable Energy Technology Research Facility on the site.

Technical Advisory Committee
A Technical Advisory Committee (TAC) has been appointed to support the work of WEICan. TAC will consist primarily of engineers and researchers from industry, research institutions, universities/colleges, and government partners.

Core Funding
Operational funding is provided federally through NRCan and provincially through the PEI Energy Corporation. Additional funds will be collected through collaborative arrangements. The Institute hopes to become financially self sufficient with income gained from its research projects.

Small Wind Test Bed
The Wind Energy Institute of Canada (WEICan) has recently developed a Small Wind Test Bed (SWTB) to enable operational and performance tests to be carried out on smaller wind turbines. While the performance of larger wind turbines has been widely studied and details are, generally, readily available, there is little objective information on the performance and reliability of smaller wind turbines. The intent of the SWTB is to test a series of small (< 10 kW) turbines over a sufficient period of time to reasonably evaluate both the performance and the reliability of the units. The test results will be publicly available.

Two small turbines, the Bornay Inclin 3000 3 kW and the Abundant Renewable Energy ARE110 2.5 kW are currently under test at WEICan.

Other research includes:

The combined use of diesel and wind with the development of an advanced control system. There is a 400 kW installation on an island in New Foundland to reduce load on existing 1,000 kW diesel generators. Following successful implementation of this project further installations are now planned.

Biofuel use to establish the best blends for generator sets.

To allow potential generators to check whether they can make money generating electricity from renewable energy projects, Natural Resources Canada (NRCan) has made available, as part of its RETScreen suite of software, International Clean Energy Project Analysis Software which is a decision support tool. The software, provided free-of-charge, can be used worldwide to evaluate the energy production and savings, life-cycle costs, emission reductions, financial viability and risk for various types of energy efficient and renewable energy technologies (RETs).

The software which can be downloaded from http://www.retscreen.net/ang/d_o_view.php also includes product, cost and climate databases, and a detailed online user manual.

Smart Meters

Ontario has targets for the installation of 800,000 smart electricity meters by December 31, 2007 and installation of smart meters for all Ontario customers by December 31, 2010. The cost of smart meter deployment will be recovered through the electricity rates paid by all customers. The final cost has been estimated to be $3 to $4 per month per customer.

Installation has started following successful pilot programmes. The present electricity tariff structure is 5.8 cents/kWh for the first 600 kWh used in each summer month and 6.7 c/kWh for electricity used over this amount.

Customers will have access to their meter data through the Internet and/or telephone. The previous day's data ready for viewing by 8 a.m. the following day and for 13 months of history to be accessible to the customer.

Suppliers will introduce a comprehensive customer awareness and education campaign to ensure that customers understand their smart meter data.

Publicity makes the point that smart meters will not automatically result in energy conservation. However, if customers use the information provided by the smart meter, they will be able to adjust their consumption patterns to reduce their electricity usage or shift their electricity usage to lower rate periods.

The new tariffs will be;

Day	Time	Time-of-Use	Price (c/kWh)
Weekends & holidays	All day	Off-peak	3.4
Summer Weekdays (May 1st - Oct 31st)	7:00 a.m. to 11:00 a.m.	Mid-peak	7.1
	11:00 a.m. to 5:00 p.m.	On-peak	9.7
	5:00 p.m. to 10:00 p.m.	Mid-peak	7.1
	10:00 p.m. to 7:00 a.m.	Off-peak	3.4
Winter Weekdays (Nov 1st - Apr 30th)	7:00 a.m. to 11:00 a.m.	On-peak	9.7
	11:00 a.m. to 5:00 p.m.	Mid-peak	7.1
	5:00 p.m. to 8:00 p.m.	On-peak	9.7
	8:00 p.m. to 10:00 p.m.	Mid-peak	7.1
	10:00 p.m. to 7:00 a.m.	Off-peak	3.4

United States of America

U.S.A. Experience with Small Wind Turbines

The U.S.A. has made progress in establishing a foundation for its domestic Small Wind Turbine (SWT) market, and the country's R&D investments have helped to establish a number of stable turbine manufacturers with a reasonably consistent market. In 2001, U.S.A. manufacturers produced an estimated 13,400 small wind turbines less than 100 kW, with roughly half of these exported to other countries.

These manufacturers tend to focus on SWT under 10 kW, with strong sales for residential and battery-charging applications.

Experience in the U.S.A. indicates that SWT are most successful where there are complementary elements including:

- enabling policies (e.g. net metering, interconnection),
- market incentives (capital rebates or tax breaks),
- technology development (R&D, testing), and
- education and awareness-raising (published wind maps, guides for dealing with local bylaws, etc.).

As an example, California provides substantial rebates for SWT, sales tax incentives, "pro-SWT" net metering policies (allowing for systems up to 1 MW) as well as aggressive public awareness campaigns. In the past few years, the State's SWT promotion program has assisted directly in the installation of almost 300 SWTs with a total capacity of 1.6 MW, and a total installed cost of US$8 million.

Looking to the future, the U.S. small wind industry estimates that by 2020, the U.S. SWT industry could supply 50,000 MW, employ 10,000 people and be greater than a $1 billion per year industry.

Small wind installations have maintained an annual growth rate of 40% in spite of there being no direct Federal funding for small wind since 1985.

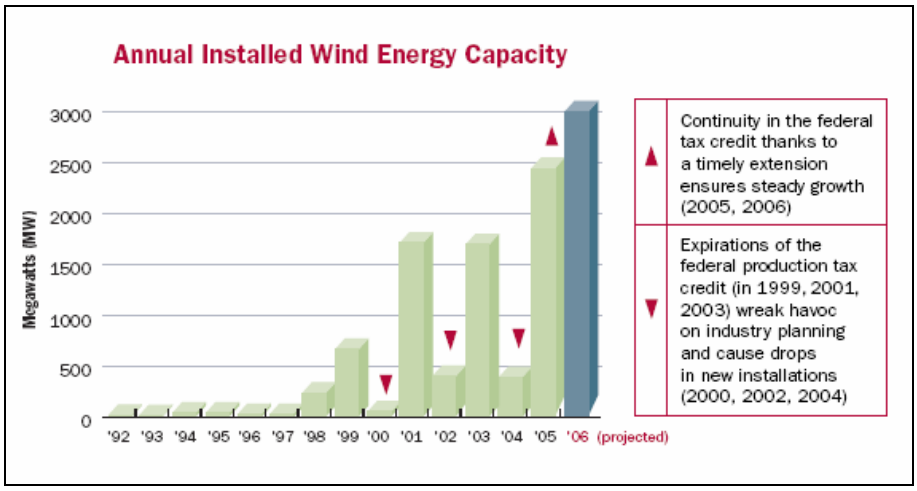
US Incentives for Renewable Generation

Federal support schemes have been targeting large generators with little support for small wind.

Renewable Electricity Production Tax Credit (PTC)

This is a 1.9 cent per kilowatt-hour tax credit for electricity generated by wind energy resources. The credit expired at the end of 2001, and was subsequently extended in March 2002. The tax credit then expired at the end of 2003 and was not renewed until October 4, 2004, when the credit was extended till December 31, 2005. The credit has now been extended till December 31, 2008.

As a result of the on-off nature of this credit, installation of large wind turbines has fluctuated greatly since 1999.



American Wind Energy Association

The 2002 Farm Bill

Section 9006 of The 2002 Farm Bill required the U.S.A. Department of Agriculture (USDA) to create a program to make direct loans, loan guarantees, and grants to agricultural producers and rural small businesses to purchase renewable-energy systems and make energy-efficiency improvements

This program is known as the Renewable Energy Systems and Energy Efficiency Improvements Program.

The maximum grant award is 25% of eligible project costs up to $500,000 for renewable energy projects and up to $250,000 for energy efficiency improvements. Assistance to one individual or entity is not to exceed $750,000. The minimum grant request is

$2,500 for renewable energy projects and $1,500 for efficiency projects. Eligible renewable energy projects include wind, solar, biomass and geothermal; and hydrogen derived from biomass or water using wind, solar or geothermal energy sources.

Under the guaranteed loan option, funds up to 50% of eligible project costs (with a maximum project cost of $10 million) are available. The minimum amount of a guaranteed loan made to a borrower is $5,000.

In 2003, 35 wind projects received grants totalling $7.4m and 38 wind projects totalling nearly $7.9m received grants in 2004.

This grant scheme has been credited with providing significant economic boasts to some rural areas and creating hundreds of new jobs.

Federal Energy Management Project (FEMP)

The Federal Energy Management Project (FEMP) requires the Federal Government to achieve the goal of:

- 3% of its energy supply from renewable sources by 2007, ramping up to 7.5% by 2013
- 20,000 PV systems installed by 2010.

Energy Policy Act

The Energy Policy Act of 2005 (EPACT), signed by President Bush on August 8, 2005 introduced Home Energy Efficiency Improvement Tax Credits.

Consumers who purchase and install specific products, such as energy-efficient windows, insulation, doors, roofs, and heating and cooling equipment in the home can receive a tax credit of up to $500.

The EPACT also provides a credit equal to 30% of expenditure for the purchase of photovoltaic and solar water heating property used exclusively for purposes other than heating swimming pools and hot tubs. The credit shall not exceed $2,000.

Improvements must be installed in or on the taxpayer's principal residence in the United States. Home improvement tax credits apply for improvements made between January 1, 2006 and December 31, 2007.

Small wind turbines were not included as qualifying expenditure and legislation has been introduced to Congress to try and overcome this discrepancy.

The 'Home and Farm Wind Energy Systems Act of 2006' calls for a tax credit equal to 30% of the amount paid by the taxpayer for qualifying wind energy property. The passage of the Act has been slowed by the recent elections.

The American Wind Energy Association recently hired a Small Wind Advocate to be part of the AWEA Legislative Department He will initially focus his efforts to support the legislation presently before Congress, which will benefit small wind turbines in ways similar to the solar and fuel cell tax credits enacted last year. He will also work to include small wind technologies in state initiatives and proposals including Renewable Portfolio Standards.

The American Wind Energy Association (AWEA) web site has a draft letter for those who wish to support this bill. This is an example of the lobbying work that AWEA carries out.

ACTION ALERT

Small Wind Tax Credit - Tell your Members of Congress to cosponsor a bill to create a 30% Investment Tax Credit for Small Wind Systems.

The U.S. House and Senate have introduced bills to create a 30% tax credit for the purchase of small wind systems used to power a home, farm or small business. Please contact your Members of Congress and ask them to cosponsor this legislation.

Take Action

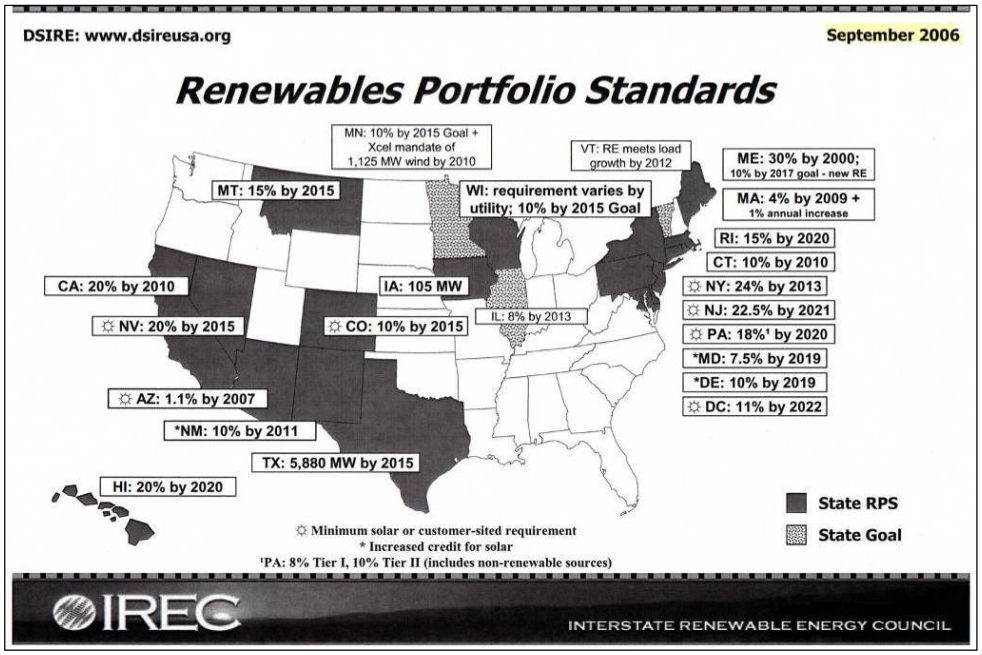
Instructions:
Please write a letter to your Members of Congress asking them to cosponsor a bill to create a 30% tax credit for the purchase of small wind systems used to power homes, farms and small businesses. Sample letters are provided for both your Senators and your Representative. The letter to your Senators asks them to cosponsor S. 2571, a comprehensive bill that includes the 30% small wind tax credit. The letter to your Representative requests him or her to cosponsor H.R. 4716, a bill that would create a 30% small wind tax credit.
Personalizing your letter is very important. Personalized letters are ten times more influential than form letters, even if you only add one or two sentences.
Here are a few ways you can personalize your letter.
1. Note how the 30% Small Wind Tax Credit will affect your company.
2. Mention that you are a constituent and note your hometown.
3. Include the number of employees your company employs in your state.

State Incentives for Renewable Energy

Most States have separate incentive schemes to encourage renewable energy. Details of individual States can be found at http://www.dsireusa.org/ The DSIRE Web site is updated each week with the addition of new programmes and the verification of or changes to existing programmes. On average, about 60 programs each month are verified or up-dated through contact with program administrators and other stakeholders throughout the U.S.A.

Renewable Energy Portfolio Standards

About twenty States have introduced Renewable Energy Portfolio Standards and there is pressure on Federal government to introduce a national requirement for a level of renewable generation. Many States have produced guides to encourage uptake of renewable generation. In Sacramento, California there is to be a RPS commitment for all residents.



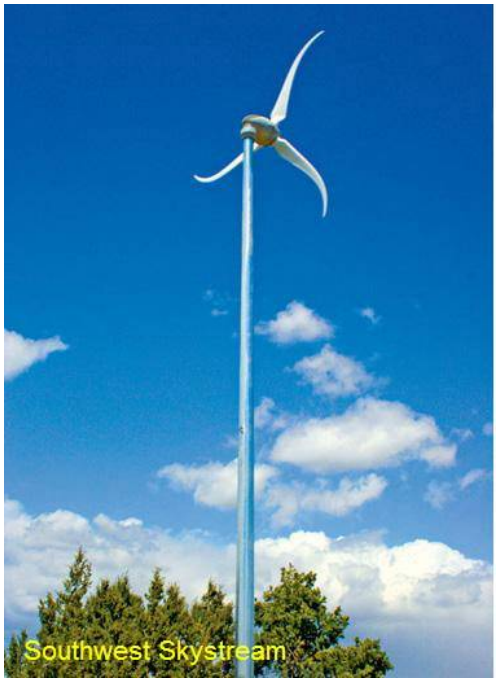
The Federal Energy Management Project (FEMP) has been extended with municipal buildings in Portland, Oregon and Santa Monica, California required to purchase 100% renewable power.

The Future of Small Wind in USA

A report produced by AWEA shows that small wind turbine (SWT) costs have decreased 7% over the past 5 years with manufacturers aiming to reduce costs by another 20% by 2010. More than 7,800 small wind turbines totalling 7.5 MW of capacity were sold in USA in 2004.
A requirement to provide net metering, which is critical for the uptake of small-scale renewable generation, has been introduced in 40 States plus Washington D.C.

While there are a number of manufacturers of small wind turbines in USA, the micro market is dominated by Southwest Windpower, which makes the Air X and Whisper turbines up to 3 kW. Over 90,000 turbines have been sold.

Following an injection of investment funding, Southwest has recently released the Skystream 3. 7 wind turbine which is designed for grid connected household use. This new turbine is claimed to be a breakthrough in design and price.



Rated at 1.8 kW, the 3.7 metre diameter blades are of radical design which are claimed to prevent over-speeding in strong winds.

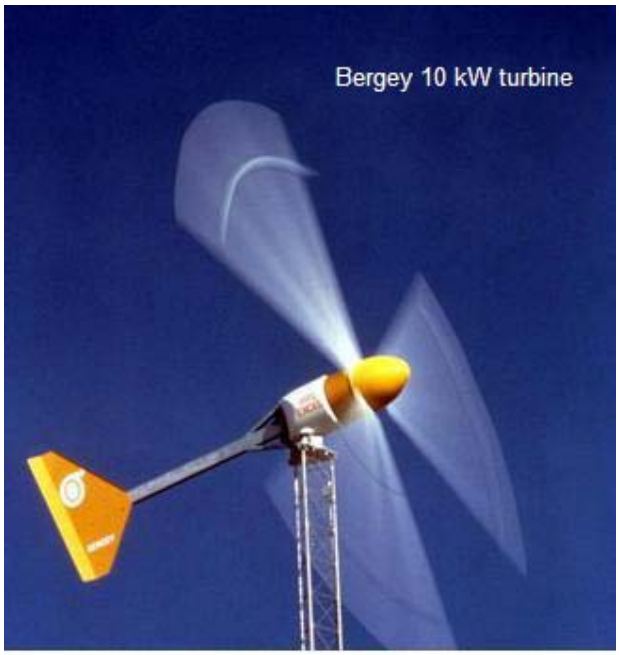
It is recommended that the Skystream be mounted on a 12 metre high mast with the owners having at least one acre of land.

The Skystream was developed in collaboration with the U.S. Department of Energy's National Renewable Energy Laboratory.

It is claimed that in an average wind (3.6 m/s) the turbine will produce 400kW per month at an installed price of US$9,000.

The dominant manufacturer of medium sized wind turbines in USA is Bergey Windpower. The Bergey 10 kW unit (7.5 kW when used to charge batteries) is used extensively to power remote homes. The 20 foot diameter unit is completely made in USA.

Bergey also sell an 8 ft diameter, 1 kW turbine which is partially manufactured in China.



Bergey Windpower claims to be the world's leading supplier of small and medium sized wind turbines. Bergey has installations in all 50 U.S. States and more than 90 countries, and an international network of about 600 dealers.

The Bergey web site gives their retail turbine and installation prices, in US$, as;

1 kW	24 VDC	24 VDC Output, Includes multi-function controller	BWC XL.1-24	$2,590
7.5 kW (Same wind turbine as 10 kW, but optimized for low wind speed performance as a battery charging system)	24 VDC	24 VDC Output, Includes Charge Regulator and 4:1 Step-Down Transformer. Peak power ~ 6.5 kW	BWC Excel-R/24	Special Request
	48 VDC	48 VDC Output, Includes Charge Regulator and 4:1 Step-Down Transformer	BWC Excel-R/48	$22,900
	120 VDC	Includes Charge Regulator	BWC Excel-R/120	$21,900
	240 VDC	Includes Charge Regulator	BWC Excel-R/240	$21,900
10 kW	240 VAC, 60 Hz	Single-Phase, Includes Inverter	BWC Excel-S/60	$27,900
	220 VAC, 50 Hz	Single-Phase, Includes Inverter	BWC Excel-S/50	$27,900

Installation of a 10 kW turbine is likely to cost about another $10,000.

A new 50 kW turbine has been developed by Bergey. Some of these units on 36 metre high towers have been installed at Wal-Mart supermarkets.

Like Proven Energy in Scotland, the manufacturing of the larger Bergey turbines is very labour intensive. Bergey is very keen to maintain their independence and not rely on outside funding to grow expansion. They are proud of the fact that most of their components are sourced within the United States. The extrusion process used to produce their blades has developed new technologies which are now being applied in other fields.

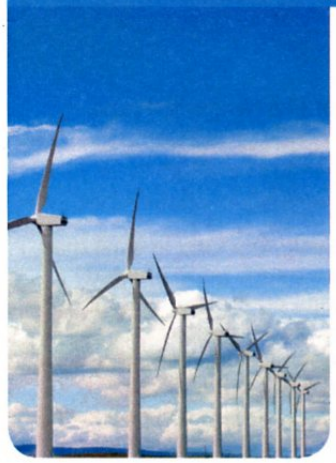
Bergey Windpower Plant

The future for small wind generation in USA looks very positive with new investments in research and increased production facilities and the development of many new and radical designs.

Net metering regulations are likely to be rationalised and incentive schemes to help States achieve renewable obligations.

The American Wind Energy Association has produced background information to help promote 'Small Wind'. An example is the fact sheet reproduced over.

Frequently Asked Questions About Small Wind



For many people, the term "wind energy" conjures up an image of utility-scale wind farms, large arrays of industrial-sized 750-kW turbines with 150-foot rotors mounted on 200-foot tall towers. But wind energy systems come in small packages as well. A typical residential wind energy system includes a 10-kW turbine, with rotors measuring perhaps 23 feet in diameter, mounted on an 80-foot tower. Such a system is suitable for meeting the electricity needs of a household or small business. Turbines as small as 400 watts, with rotors only 46 inches in diameter, may be employed for specific purposes, such as pumping water (for stock or irrigation) or running lights and appliances in a remote cabin or recreational vehicle. Wind energy may be used to complement a solar photovoltaic (PV) system, or by itself. It may be set up as a stand-alone system, or it may be interconnected with the utility grid.

Commercially proven U.S. equipment providers include:

Abundant Renewable Energy
www.abundantre.com

Bergey Windpower Co.
www.bergey.com

Entegrity Wind Systems
www.entegritywind.com

Energy Maintenance Service
www.energyms.com

Lorax Energy
www.lorax-energy.com

Northern Power Systems
www.northernpower.com

Solar Wind Works
www.solarwindworks.com

Southwest Windpower Co.
www.windenergy.com

Wind Turbine Industries Corp.
www.windturbine.net

American Wind Energy Association

Is small wind an economical option?

Although small wind systems involve a significant initial investment, they can be competitive with conventional energy sources when you account for a lifetime of reduced or avoided utility costs, especially considering escalating fuel costs. The cost of buying and installing a small wind energy system typically ranges from about $3,000-5,000 per kilowatt for a grid-connected installation, less than half the cost of a similar solar electric system. The length of the payback period (or, the time it takes to "break even") depends on the system you choose, the wind resource at your site, your power provider's electricity rates, and financing and incentives available. Many states have rebate or tax credit programs in place to encourage small wind and other renewable energy applications. Small wind owners with strong average wind speeds who can take advantage of rebate programs can usually recoup their investments within fifteen years. A 10-kW grid-connected residential-scale system generally costs $35-40,000 to install. A 3-kW turbine, including 60-80 foot tower, utility-tie inverter, batteries for back-up system, utility switch box, battery system box, hardware and installation components, costs about $15,000. A homeowner using $60-100 per month of electricity can save 30-60% off the electric bill with a 3-kW turbine, given strong wind resources.

Do Small Wind Systems Kill Birds?

Reports of residential-scale wind turbines killing birds are very rare. Statistically, a sliding glass door is a greater threat to birds than a small, unlighted wind turbine. (The Federal Aviation Administration does not require lighting on towers less than 200 feet tall.)

Are Small Wind Systems Noisy?

Most of the sound that comes from a residential sized wind turbine is aerodynamic noise caused by the blades passing through the air. The noise level of most modern residential turbines measures close to the ambient noise levels under average wind conditions. It is audible, if you are out of doors and listening for it, but no noisier than your average refrigerator. Most residential turbines do not begin turning until a certain threshold, or "cut-in" wind-speed is reached - typically about 7 miles per hour. So, on a calm, windless day (or night), the turbine is still and silent.

U S Department of Energy

While there is support for research and development of wind small wind turbines photovoltaic (PV) is the primary focus of the US Department of Energy's (DOE's) energy work. Their objectives for PV are:

- Electricity Cost - goal is 6c/kWh by 2020
- Manufacturing Cost - $1.50/Watt by 2010
- Conversion Efficiency –
  - 16% for crystalline silicon and 14% for thin films by 2010
  - 20% for crystalline silicon and 18% for thin films by 2020

DOE is spending 30 times as much on solar technologies than they are on small wind. The expectation is that PV has the potential for much greater utilisation than other small forms of renewable generation.

Alternative Wind Turbine Technology

The majority of wind turbines sold are of the propeller type with a horizontal axis.

Developers are striving to always improve technology and a number have gone back to the vertical axis machine to try and develop a quiet, vibration free unit.

An example of this is the Aerotecture Company in Chicago which is combining the Darrieus design (These are the "eggbeater" turbines) with Savonius scoop drag-type blades to provide the starting torque. The turbine is claimed to be able to be mounted vertically or horizontally. A prototype is presently being installed in Chicago.

More extreme designs include the vision of 4 kW Magenn lighter-than-air tethered devices that rotate about a horizontal axis or the high flying Australian designed Roberts Rotorcraft designed to operate at a height of 15,000 feet

While such technology is the subject of some ridicule from the main-stream manufacturers there maybe some possibility that such devices play a part in future small-scale generation.

EDUCATION/PROMOTION

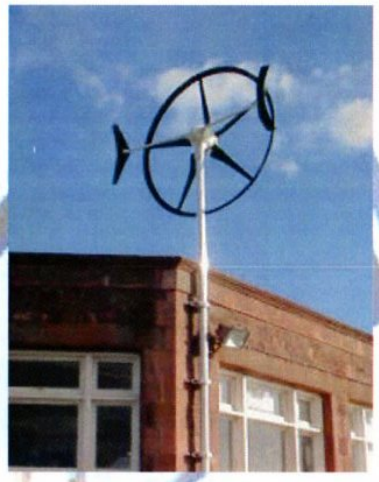
Green Energy Powering the Scottish Seabird Centre

Scottish Seabird Centre

The Scottish Seabird Centre has installed a wind energy device (called the SWIFT) to raise awareness of renewable energy and generate clean power for the Centre. The SWIFT is located on the side of the Environment Zone building.

The SWIFT is the world's first silent rooftop-mountable wind turbine, capable of providing cost effective renewable energy for domestic, community and industrial use. The SWIFT was designed by Midlothian based company, Renewable Devices.

Mini wind turbines, solar panels and other small scale renewable technologies could provide a substantial portion of the UK's energy needs by 2050, according to the Energy Saving Trust which funded the project which cost in total £5,800.



The Swift at the Scottish Seabird Centre

The benefits of generating your own clean energy are both financial and environmental. On average, a single rooftop system installed in the UK will save 1.6 tonnes of CO_2 emissions per year providing a net financial benefit of up to £440 per year.

The SWIFT has been designed to be environmentally sustainable. The SWIFT produces more energy in its lifetime than is incorporated in the materials and processes used to manufacture it. The SWIFT is therefore "harm neutral".

For more information:

- Renewable energy technologies and grants: Energy Saving Trust www.est.org.uk
- The SWIFT: Renewable Devices www.renewabledevices.com
- Approved SWIFT installer: Scottish Hydro Contracting www.hydrocontracting.co.uk

Scottish Seabird Centre, The Harbour, North Berwick, East Lothian EH39 4SS
Tel: 01620 890202 email: info@seabird.org

www.seabird.org

Small wind turbines are being used as education tools at schools and prominent sites such as the Scottish Sea Bird Centre. Such installations raise the awareness of the public to the potential of local renewable generation. The exposure of children to the technology and their hands-on involvement helps educates a new generation and raises awareness of sustainability concerns.

Companies wishing to be seen as ecologically friendly are also using turbines and other forms of renewable energy as very visible means to promote this image.

In the UK many of the large supermarket chains such as Sainsbury's, and Tesco are installing wind turbines and PV on new stores.

Tesco has announced a programme which will see planning applications submitted for wind turbines between 3 MW - 850 kW to be installed at twelve sites across the country. Seven sites will benefit from 225 - 850kW turbines and turbines smaller than 225 kW will be put in place at a further 24 stores.

Tesco promotes its commitment to Renewable Energy and plan to find cost effective ways to reduce emissions by generating its own energy through renewable and low carbon technology.

In 2006/07, Tesco established a £100 million fund to enable them to develop wind turbines, solar panels, gasification, tri-generation and combined heat and power.

Tesco is working with the Carbon Trust and Brunel University to develop tri-generation combined heat and power (CHP) technology for stores and distribution centres with the aim of saving over 10,000 tonnes of CO_2. Tesco is also supporting the construction of a biodiesel plant on the east coast of England to allow for the production of biodiesel using UK grown crops.

The largest retailer in USA, Wal-Mart has introduced an extensive sustainability programme and has developed two experimental stores each with a 50 kW Bergey wind turbine.

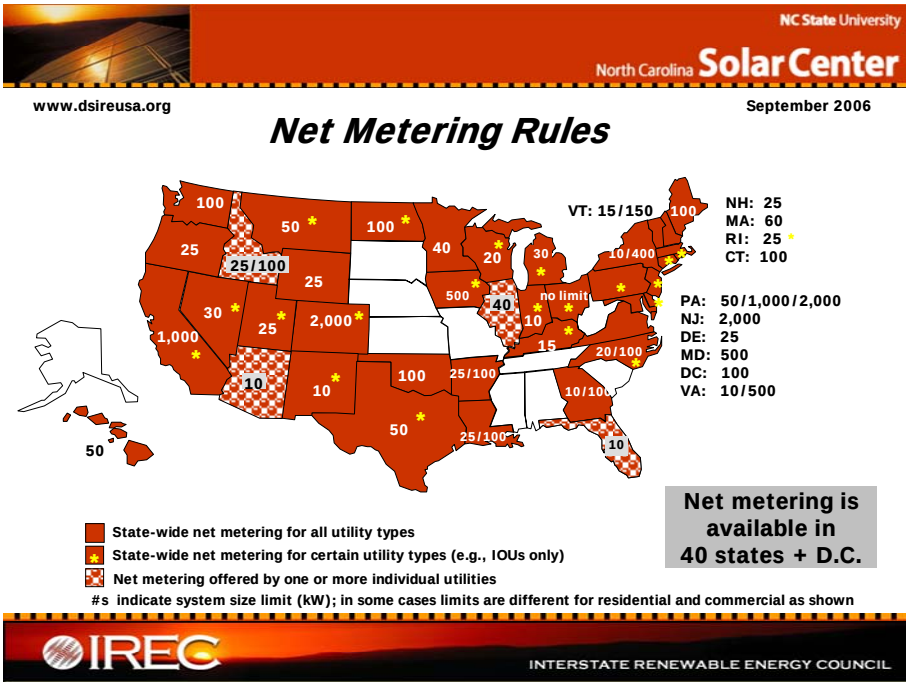
In 2005, one hundred and eighty four schools in England, Wales and Northern Ireland were operating small-scale renewable technology installations. While most were PV installations, 25 wind turbine projects had been funded by the Clear Skies programme which was the predecessor to the LCBP.

Net Metering

A suitable Net Metering programme should be in place for grid connected small-scale generation to be successful. Net metering may not, by itself, be enough to encourage increased renewable generation. However if New Zealand is to increase renewable generation it is important that a net metering system be part of the suite of measures in place

What is net metering?

"Net-metering" is a simplified method of metering the energy consumed and produced at a home or business that has its own renewable energy generator, such as a wind turbine. Under net metering, excess electricity produced by the wind turbine will spin the existing home or business electricity meter backwards, effectively banking the electricity until it is needed by the customer. This provides the customer with full retail value for all the electricity produced. There are likely to be some costs such as line charges related to being connected to the grid



Currently, in USA, 40 states require at least some utilities to offer net metering for small wind systems, although the requirements vary from state to state. Most state net metering rules were enacted by state utility regulators, and these rules apply only to utilities whose rates and services are regulated at the state level. In recent years many states have enacted net metering laws. In most of the states with net metering statutes, all utilities are required to offer net metering for some wind systems, although many states limit eligibility to small systems. The differences in programmes across States are so

great that there are presently calls for Federal regulations to require a common standard.

Canada has an ongoing net metering project and in the United Kingdom Ofgem has been consulting on the need for net metering.

In Ontario, Canada, small unlicensed generators—less than 500 kilowatt capacity—using renewable sources are able to send electricity to the distribution system in return for credits toward their energy costs.

For more information visit:
http://www.energy.gov.on.ca/index.cfm?fuseaction=renewable.netmetering

The Ontario Ministry of Energy has filed a net metering regulation which allows electricity customers who install their own renewable generation equipment to return electricity to the grid for credit. The new regulation eliminates inconsistencies across the province and requires that distributors permit net metering for all eligible projects that produce up to 500 kilowatts. Projects that produce electricity from clean sources such as water, wind, solar power and farm biomass are eligible. While the costs of generation and connection remain, there are no licensing fees and the metering requirements are less onerous.

The retailer will not pay for electricity injected into the system that is more than the amount of electricity imported into a household over a billing period. In short, you can reduce your bill, or even cut the electricity-use portion to zero, but you won't get paid for any "excess" electricity you produce.
Net metering is for reducing your electrical bill from the utility, not for selling a net amount of electricity to the grid.

In New Zealand, Contact Energy has reached an agreement with the NZ Photovoltaic Association (now the Sustainable Electricity Association New Zealand (SEANZ)) that it will credit NZPA members with any electricity exported into the grid at the retail price. This is not net metering but is close to it.

It is hoped that other electricity retailers will enter into similar arrangements.

The work being carried out by the New Zealand Ministry of Economic Development to develop regulations to encourage distributed generation should ease the connection of small-scale renewable generation.

Small Wind in New Zealand

In spite of the media coverage of the Scottish micro-turbines, it is probable that most turbines of this size coming to New Zealand in the future will be from China. They will be cheaper and while our wind conditions are more vigorous than in China the technology can be adapted to suit. There are already a number of Chinese turbines being imported. Remember that Bergey, one of the world's largest manufacturers of turbines, is having their 1 kW model built in China.

You can already buy a 200 watt, 2.1 metre diameter, DC turbine complete with a 4.5 metre mast off the shelf in New Zealand for less than NZ$600. There would be additional costs to convert this to provide 240v AC electricity which are likely to be more than the cost of the turbine but this shows that micro-wind is becoming cheaper and more cost competitive.

In Taranaki, EcoInnovation are using reconditioned Smart Drives from Fisher & Paykel washing machines to build their Smart wind turbines. They are also developing a larger turbine which is a combination of Chinese and N Z components.

Community and lifestyle ownership of medium sized turbines up to 20 kW has the potential to make a larger impact on our power needs than micro-turbines (under 1 kW) and there is likely to be increasing interest from rural landowners in these. The government or regional trusts should subsidise turbines as demonstration sites in schools and rural communities.

Meridian Energy Ltd has just released a report 'Options Choices Decisions' which looks at future generation options for New Zealand. The section reporting on small wind is repeated below. Meridian has reviewed the micro-wind turbines listed to establish their Long Run Marginal Costs (LRMCs) and to assess their economic potential. Refer to the report for more details.

Government incentives could work to overcome some of the cost disadvantages outlined by Meridian.

OPTIONS**CHOICES**DECISIONS

Micro Wind Turbines

Commercially available micro wind turbines range in scale from a few hundred watts up to 20 kW size units.

Information gathered from potential large-scale, grid connected, wind farm sites shows that wind speed in

New Zealand is significant and offers some of the best wind to energy conversion prospects per installed capacity in the world. Micro wind turbines aim to capture this wind energy on a much smaller scale with connections at either residential, including rural applications, or commercial levels.

In terms of the likely market for these products, there are similarities between the micro wind market and the solar water heating market, due particularly to the capital costs associated with the turbines. The highest uptake for micro turbines is likely to be in a market segment that includes high income earners, and is located in areas where wind energy offers higher energy conversion rates. Micro turbines are also likely to have higher uptake in rural or lifestyle locations, where consenting requirements and visual objections from neighbours are likely to be less than in urban areas.

It should also be noted that none of the turbines assessed can produce electricity at lower rates than grid connected generation and in a national benefit sense all appear to be uneconomic.

The economics of micro wind turbines improve as the scale increases. This is consistent with Meridian Energy's experience with grid connected wind farms. However, once a micro wind farm becomes a net injector of electricity, its cost effectiveness from an installer's perspective changes from being based on avoiding a higher (18-20 c/kWh) variable electricity tariff to a substantially lower (6-8 c/kWh) energy only sales price.

We do not consider that micro wind turbines will provide a material contribution to demand reduction for a number of years. This conclusion is based on the high capital costs and unit price of the technology and the range of practical issues associated with installation and ongoing maintenance of the units.

MICRO WIND TURBINE MODELS AND LRMCS

Micro Turbine Type	Cost per kWh ($)	Total output p.a. (kWh)	Rated output (kW)
Rutland 503	1.12	175	0.1
WindSwift	0.4	3,285	1.5
Skystream	0.43	3,942	1.8
Unitron Whisper 3.3 kW	0.4	7,227	3.3
Breeze 5000	0.48	10,950	5
Green Power 10 kW	0.29	21,900	10
Bergey Excel 10 kW	0.3	21,900	10
Green Power 20 kW	0.25	43,800	20

Meridian Energy

OBSERVATIONS and CONCLUSIONS

The main conclusion of this research is that small-scale renewable generation can play an increasingly important part in meeting New Zealand's energy needs. This will require the removal of barriers and the size of this impact will be in proportion to the support and incentives coming from Central and Local Government and businesses.

In the countries visited I found a widespread awareness of the need to increase the use, and rate of uptake, of renewable energy for the generation of electricity.

Drivers for the increased use of renewable generation include the need to:

- reduce or slow the increase in carbon dioxide emissions.
- reduce the reliance on imported fossil fuels.
- broaden the sources of generation.
- protect the reducing supplies of indigenous fuel.
- shut down old and inefficient thermal plants.

New Zealand shares these same needs so we should be taking similar actions.

Electricity Generation Reaches Record Level

Tuesday, 5 December 2006, 11:04 am
Press Release: Statistics New Zealand

In the September 2006 year a record level of 39,920 gigawatt hours was recorded for electricity generation, the highest for any 12-month period since records began. Thermal generation was the biggest contributor to this increase. Hydro and wind generation provided 57 percent of the total electricity generation, the lowest proportion ever recorded for a September year. The highest proportion ever recorded was 87 percent in 1980.

Renewable generation can make a significant impact on a country's energy needs but this worth is usually greater to the country as a whole than it is to the individual. The recognition of this national worth is driving the incentive and support schemes that are in place in many countries.

There are few occasions when renewable generation can compete against gas or coal fired generated electricity on a straight cost basis. Only by national and regional governments providing financial incentives or passing regulations will there be an increase in the use of small-scale renewable generation.

Micro-generation is not yet cost effective but as technology improves and costs drop some forms may become competitive in an on-grid situation. It can play an important part in our energy future and warrants special consideration. Given innovation, incentives and other forms of support demand will grow and prices drop. It is important that a mix of renewable energy technologies be encouraged.

Although not covered in this research, Ground Source Heat Pumps (GSHP) and Combined Heat and Power (CHP) are forms of renewable energy use that are likely to make much larger impacts on the micro-generation market than wind. In New Zealand, micro-hydro in rural applications will also be a viable alternative.

New Zealand is fortunate that 60 to 70% of our electricity is normally generated from renewable sources (but only 57%in the last September year). But if we are serious about breaking our increasing dependence on thermal fuels for new and replacement electricity generation the Government needs to be proactive and invest directly or indirectly in future renewable generation.

While investment in large-scale generation such as wind farms, marine energy or geothermal plant may produce more immediate results the long-term need for localised generation means that there must still be incentives for the small end of the market.

There will be money to be spent but this will be an investment in the future.

Incentives

My research has highlighted the need for incentive schemes to speed the uptake of renewable generation. In the countries visited a wide range of schemes are in place for both large and small-scale generation. Each type of incentive scheme should be studied in depth to identify those which would be the most suitable for New Zealand.

Recent reports by the Parliamentary Commissioner for the Environment, Meridian Energy and produced for EECA have addressed the potential for renewable generation and this work is to be encouraged and continued. These reports have reinforced the need for action.

The New Zealand political voice is continually making noises about sustainability and renewable energy but, to date, there has been very little action. The Carbon Credit scheme which helped in the development of wind farms in the 2002 – 2005 periods is no longer available.

Recently the NZ Government has announced an increase to $500 for the assistance it will give to installation of solar water heating (SWH). This assistance is in the form of paying the interest on a loan rather than a grant reducing up front costs and it may not be sufficient to drive the uptake rate that the Government wishes. The theory is that this support will help those who must borrow money to install SWH rather than those who can afford to pay the full purchase price.

The experience in the United Kingdom is that reducing installation costs with grants towards purchase is very effective especially when linked with the need to have carried out energy efficiency improvements first. Those who can afford to install renewable generation still require it to be cost effective and a grant is often the trigger point to make the decision to purchase.

The successful incentive schemes are those that offer one or more of:

- A reduction in capital cost,
- Tax reductions or credits,
- On-going income from targeted feed-in tariffs, or
- Research and development assistance to help reduce manufacturing costs.

The obligation for new government developments to provide a percentage of electricity supply from renewable sources is an effective instrument to drive increased investment in these technologies.

The successful Australian Government's Mandatory Renewable Energy Target (MRET) is an example of how the setting of targets can encourage investment.

The huge international incentives for photovoltaic have resulted in large investments in production facilities, a lowering in costs and huge increases in sales. The same is starting to happen with small wind with much smaller incentives.

Large investment in companies such as Proven, Southwest, Windsave and Swift shows that there is increasing confidence in the future of these technologies. This investment comes on the back of increased sales fuelled by incentives. The move to new

factories and manufacturing processes which are following will result in increased availability and lower costs.

As in other countries, large-scale renewable generation such as multi-megawatt wind farms, geothermal and, in time, marine energy provide the most cost effective options. There are, however, resultant problems in getting the power to where it is wanted with transmission losses and increased pressure on infrastructure. These problems do not exist with local micro-generation.

Although prices of micro-generation plant are dropping there is still the need for incentives for small-scale renewable generation to make an impact on New Zealand's electricity needs.

The greatest benefit of small, domestic sized wind turbines is that they generate power exactly where it is to be used. Due to their visibility, they are a great advertisement for renewable energy and when installed at a suitable site and supplying to an energy efficient house a turbine can significantly reduce a household's energy costs.

Research and Development

New Zealand's wind and marine resources provide a unique opportunity for research and development of these energy sources to be carried out in our country.

Testing sites for wind are established in the Northern Hemisphere and marine energy test sites are being developed. These are often in relatively inaccessible and remote sites like Prince Edward Island and the Orkney Islands where winters are extremely cold and working conditions can be very unpleasant but do reflect the regional environment. New Zealand could

develop similar sites to allow development and testing where the wind, wave and tide resources are as good as anywhere in the world yet work can be carried out in relative comfort for 12 months of the year.

Development of such test sites would require some government investment but the potential gains are considerable. There is no need for New Zealand to just be a follower in the development and use of renewable generation technology.

A major incentive for the development of test sites in other countries is the benefits which accrue for local manufacturers and research organisations. These benefits would also accrue in New Zealand and are good reasons while we should not just sit back and become technology followers. Our country has a justifiable reputation for initiative and imagination in the development of technology and renewable energy provides us with a unique opportunity to enhance this reputation.

A major contributor to the uptake of solar hot water systems in New Zealand has been the development of locally designed smart controllers. There is the opportunity for New Zealand to develop world leading controls, metering and other ancillary equipment for other forms of renewable generation.

Where does New Zealand want to go?

The question must be asked as to what impact New Zealand wishes to have in reducing greenhouse gas emissions and slowing climate change.

Delays in hearings for consents and expensive appeals have been recognized as barriers to development of renewable energy in many countries. In particular Scotland and England have recognized this problem and have taken steps to make the obtaining of approvals easier. New Zealand will need to address this same problem here and decide whether any changes to the present rules are required.

Recent headlines suggest that the percentage of New Zealand's electricity generated from renewable sources is likely to continue to fall.

"A gas-fired power station at Huntly to generate 385 mega watts expected to commence commissioning in late 2006."

"The selection of Port Taranaki as the preferred site for a LNG import terminal was all about preserving future options."

"The construction of a 400MW combined cycle gas turbine power station has proceeded to the tendering stage. The resource consents required to construct the power station are already held."

The draft New Zealand National Energy and National Energy Efficiency Strategies which have just been released recommend increased requirements for renewable generation.

The outcome of my research supports these moves and shows that New Zealand is following the trends in most developed countries.

Like NZ Post the author believes that New Zealand has a positive and renewable future!

For myself I am an optimist - it does not seem to be much use being anything else.

Sir Winston Churchill,