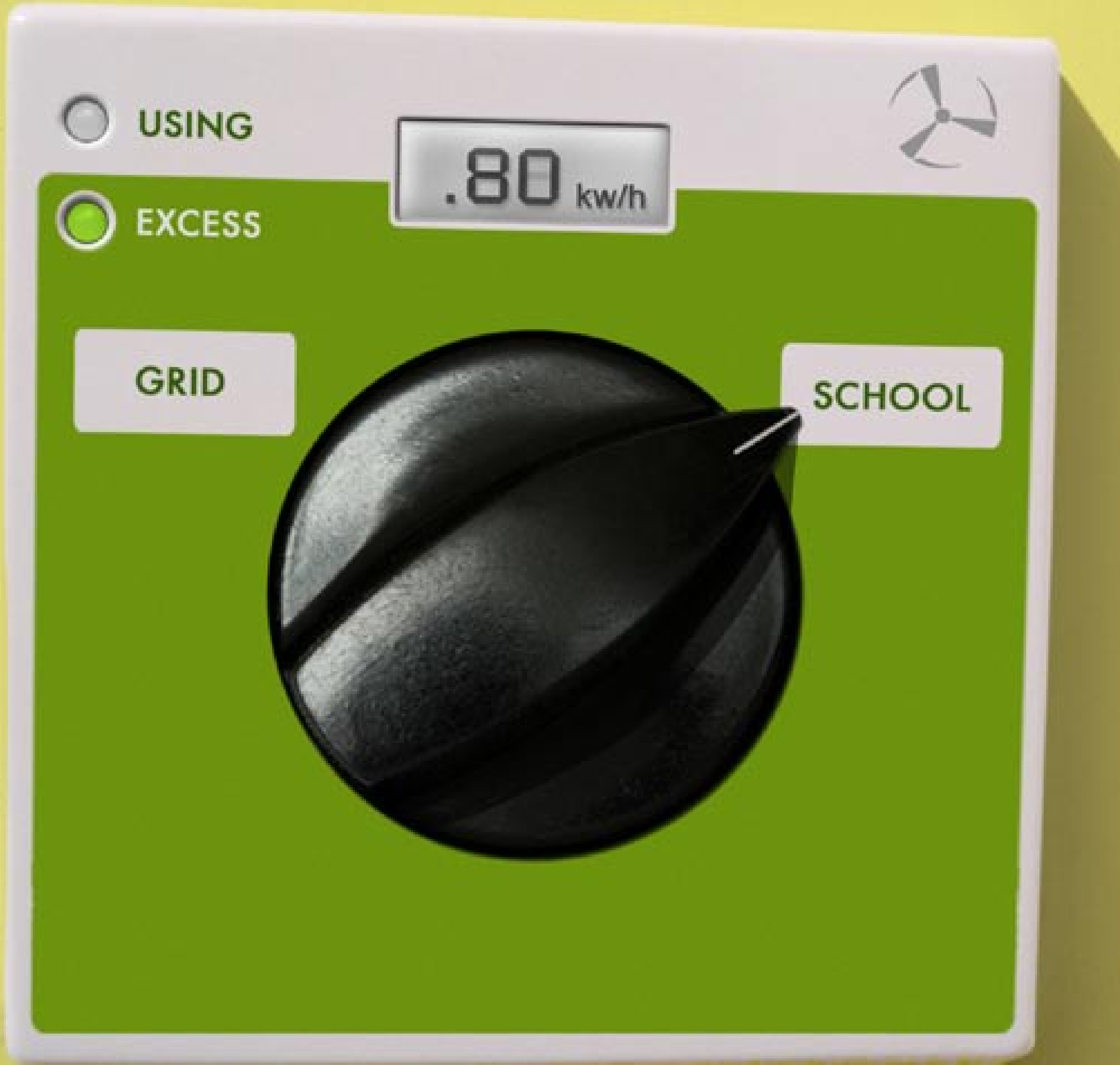
A Microgeneration Strategy for Canada:
Discussion Paper



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Yuill Herbert

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Discussion Paper: Starting the conversation

This paper outlines the potential benefits of microgeneration technologies to Canada, and the possible policies and strategies to realise those benefits. The paper should not be viewed as the final report of a completed project, but as a starting point for discussion about the potential for an integrated microgeneration policy for Canada. The project team welcomes constructive and critical feedback.


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A vision for Canada in 2050: "Solar heating and power systems are viewed as the norm, with one in three single family homes using a solar water heating system and one in 10 using photovoltaics."

National Round Table on Energy and the Environment, 2006.

1. Microgeneration in the transition to a low carbon society

Canada's greenhouse gas emissions are rising sharply, with energy use in buildings accounting for around 30% of emissions (CETC 2006). While Canadians are concerned about climate change, many people feel helpless to act alone (Pynn 2006), and often do not connect their day-to-day behaviour with climate change. Even in a time of rising energy prices, most consumers find it difficult to link their always-on standby lights with the monthly energy bill, let alone with carbon emissions. It is not surprising that government exhortations to conserve energy appear to be largely ineffective, and successive government programs have still failed to engage people in the fight against climate change.

At the same time, growth in Canada's renewable energy lags far behind other nations (REN21 2005). Despite some of the world's most abundant renewable resources, and a population that overwhelmingly supports their use (Anon 2003), Canada's renewable energy industry receives far less government support than that in Germany, the US, Spain or Japan. As a result, Canada's renewable energy companies, some of them world leaders, often rely principally on exports because domestic markets are held back by limited government support, red tape, and ineffective policy.

Most of Canada's electricity is generated in large, centralized plants, often some distance from the centres of population where most energy is consumed. While this creates some efficiencies through scale economies, more than 7% of Canada's electricity is lost just moving it around (1999 figure; World Bank 2002). Since Canada's electricity-related greenhouse gas emissions in 2004 were 117 million tonnes (Office of Energy Efficiency 2006), transmission and distribution losses imply a substantial carbon penalty. With a huge, renewables rich land mass and geographically dispersed population, Canada is ideally placed to become a leader in developing a small scale, distributed renewables, or 'microgeneration'.

This paper provides an overview of the potential for microgeneration policy in Canada. It does not provide a detailed analysis of existing or recommended policy options. The purpose is rather to draw attention to the opportunities that microgeneration represents, and to show how that opportunity is being taken by other jurisdictions while Canada lags behind.

What are Microgeneration technologies?

Microgeneration includes renewable energy technologies that produce heat or power, including solar air and water heaters, solar photovoltaics, small wind turbines, ground and air source heat pumps, biomass heating, and micro-hydro. For electricity generating technologies, microgeneration includes both grid-connected and off-grid systems. Typically, microgeneration refers to technologies on a scale of less than around 100kW – a scale that involves meeting energy needs for single buildings or developments. Microgeneration is about enabling efficiencies, bringing renewable energy production close to the people who consume it, and empowering Canadian businesses and families to make sustainable choices.

The report is based on a review of relevant literature, and on interviews with stakeholders involved in the microgeneration industry.

The paper starts by making the case for microgeneration technologies as part of a transition to a low carbon economy. Section two explores the way in which microgeneration has captured the imagination of the public and policy-makers in the UK. Section three discusses barriers to microgeneration in Canada, while section four outlines government initiatives to overcome those barriers. Section five draws some conclusions, and suggests elements for a microgeneration strategy for Canada.

Engaging the public

For most of us, energy use is largely invisible and unconscious. We simply are not aware of stand-by lights, the power ratings of our toasters and lightbulbs, and the efficiency of the furnace. Exhorting the public with campaigns to conserve energy has had poor results in the past, and although most Canadians are concerned about climate change (Bueckert 2006), many feel helpless to make any positive changes in their own lives. Environment Canada's evaluation of the One-Tonne Challenge program found that many people remain unaware of how they can make changes in their own lives to reduce emissions (Environment Canada 2006). Encouraging sustainable energy consumption is not straightforward. Canadian energy prices are relatively low, and do not reflect the true environmental and social costs of energy production and consumption. In any case, despite recent price hikes, many consum-

'I see micropower in terms of a battle for hearts and minds, really, as much as the more mundane but very important fact that it can be part of the energy supply'.

UK Energy Minister, Malcolm Wicks (DTI 2006)

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"I tell people all the time that I generate my own electricity.. I love it.. I think its fascinating"

Homeowner in Lancashire, with wind turbine. (Dobbyn & Thomas 2005)

ers find it hard to link the monthly bill with their day-to-day behaviour. But however difficult it may be, failing to engage with consumer behaviour is not an option if Canada is serious about cutting emissions. Microgeneration provides an opportunity to engage Canadians in the fight against climate change with a positive and empowering approach.

Enabling people to generate clean, affordable energy in their own homes and businesses allows them to see and understand their own energy use, and to be proactive in reducing their emissions. Microgeneration technologies help people to see the bigger energy picture, and help to make people more aware of their energy choices and use at home. This sets apart residential-scale energy from larger alternatives – it is a real way of engaging people with the origins and impacts of energy and the implications of consumption, and combating the apathy that so often accompanies climate change concern.

A recent study in the UK found that households in which microgeneration technologies have been installed are generally more aware of energy use in their home, and adapt their behaviour accordingly. This was even true of microgeneration in social housing, where the residents had not themselves chosen to install the technologies. These residents had never thought of themselves as environmentalists (Dobbyn & Thomas 2005). In the US, experience from the Sacramento PV Pioneers program demonstrated how homeowners felt benefits from the satisfaction felt, and status acquired, in being a leader in sustainable energy (Smiley 2003). Microgeneration is a visible reminder to the whole community of climate change solutions and self-sufficiency.

It is not only in people's homes that microgeneration makes a difference – schools in particular can reduce their energy bills while educating a new generation about society's options for a clean, low carbon future.

Reducing Greenhouse Gas Emissions

Canada's deployment of renewable energy technologies such as wind and solar is well behind that of many other countries, while Canada's greenhouse gases continue to skyrocket. Canada is not even keeping up, let alone providing the progressive leadership that the international community has come to expect of Canadians.

Microgeneration technologies can help achieve a reduction in Canada's greenhouse gas emissions. Many microgeneration technologies are zero carbon renewables: micro wind power, solar PV and solar thermal, and biomass heating. These directly offset energy from carbon emitting sources. Others use renewable energy to supplement traditional sources: ground and air source heat-pumps use a small amount of electricity to extract heat and cooling from the earth and air.

Canada is blessed with prodigious renewable energy resources suitable for microgeneration. Throughout the prairies, and across Newfoundland and Prince Edward Island, wind speeds even at low (30m) elevations are sufficient for small wind turbines to generate significant power in farms and communities. A recent report for Natural Resources Canada estimated that "Realisation of the full market potential would result in the installation of over 600 MW of small wind turbines and greenhouse gas emission reductions of over 300 kilotonnes CO_2e per year (equivalent to removing over 50,000 cars from the road)." (Marbek & GPCo 2005). The solar resource is also significant, again with the southern (populated) areas of the prairies particularly richly endowed, and also southern Ontario (Morris 2006). On a typical July day, Toronto receives more solar energy than Miami (McGonagle 2006). In Canada's forested areas, where wind resources are constrained, bioenergy represents an enormous opportunity (as long as it is carbon neutral). It is worth noting that the provinces that are most dependent on fossil fuels for electricity, such as Alberta and Saskatchewan, also have the richest microgeneration resources.

"A lot of parents seem to notice it and ask what we're doing. It's good for them to see new things going on in the school"

Teacher, Scottish primary school with solar panels. (Dobbyn & Thomas 2005)

Already, despite very limited deployment, microgeneration technologies are reducing Canada's greenhouse gas emissions. For example, currently operating active solar heating systems in Canada replace around 23,200 tonnes of CO_2 equivalent every year, while the solar thermal collectors sold during 2004 alone will replace, over their lifetime, 122,600 tonnes. (SAIC 2005).

It must be clear that microgeneration technologies alone are not a solution to Canada's energy policy needs. Microgeneration is unlikely ever to provide all of Canada's energy, but neither is the contribution of microgeneration vanishingly small. Modelling for the UK government, based on learning curve estimations of future costs, has suggested market penetration of small (< 50kW) wind and PV could reduce the UK's carbon emissions by 6% by 2050 if net metering tariffs are in place (EST et al 2005). While this would clearly be different for Canada, it demonstrates that the gains from microgeneration are small but potentially significant.

There is an urgent need for analysis to assess the potential for market penetration of microgeneration in Canada to reduce emissions.

Providing clean, affordable power to Canada's Remote Communities

> *"Global demand for small, environmentally friendly power systems is rapidly accelerating. In Canada, there is a huge potential market among homeowners and small business operators….the micropower market could provide thousands of jobs and billions of dollars in revenue."*
>
> Micropower Connect, 2006.

It is in Canada's many remote communities that micro-scale renewable energy technologies are frequently the most cost effective energy choice. Most remote communities rely on diesel generators for their power. These are dirty, carbon-intensive, and expensive to run because of the costs of fuel. Microgeneration technologies in these communities are not only a clean and carbon-free alternative, they also reduce the day-to-day living costs for some of Canada's most vulnerable communities. Remote communities already represent a vibrant unsubsidised market for solar PV technologies, with a cumulative installed capacity of 11.67MW in 2003, representing a nearly 10-fold increase in PV over the preceding decade (Ayoub & Dignard-Bailey 2003), but there are many more that could benefit from cost-effective renewable power.

Reducing infrastructure needs and enhancing system robustness

Electricity in Canada is produced far from the point of consumption, and the system requires substantial investments in transmission networks to move power around the country. As electricity demand rises over the coming years, costly upgrades to transmission systems will become necessary. Indeed, the Canadian Electricity Association notes that investment in transmission has lagged behind that for generation, leading to inefficiencies through 'congestion' of transmission grids (CEA 2006). In any case, long distance transmission brings inefficiencies into the system, with around 7-8% of generated electricity lost in Canada's transmission and distribution system (World Bank 2002). Microgeneration reduces or delays the need for increased transmission capacity, by meeting demand close to the point of use. This is an economic benefit of microgeneration that is not captured in many cost comparisons, which typically represent generated, rather than delivered, electricity costs. This fails to represent the costs of infrastructure and the efficiency losses of long-distance transmission (WADE 2005).

Microgeneration technologies can also enhance system robustness, and help to prevent black-outs. Through meeting some electrical load locally, less strain is placed on long-distance transmission lines. Studies after the 2003 black-outs in Eastern Canada and the US found evidence that a few 10s of MW of distributed PV could have prevented the black-outs (Perez and Collins, 2004). Canada's electricity transmission infrastructure is inefficient and stressed, and distributed renewables can provide an important part of easing this pressure (CanREA 2006). The National Energy Board recently concluded that "Alternative and renewable resources and demand management are becoming more important in addressing … supply adequacy" (National Energy Board, 2005).

Finally, microgeneration renewables provide a hedge against shortages and price hikes in traditional fossil fuel energy supplies. While debate rages about the likely date of 'peak oil' or 'peak gas', microgeneration provides a buffer for homeowners against price rises in heating fuel and electricity.

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Providing Opportunities for Canadian Business

Canada already has world-leading companies in microgeneration technologies. In BC, Carmanah Technologies is a leader in both off-grid and on-grid solar systems, while Xantrex technologies is a leader in low-voltage power inverters essential for grid connection. Canada has international strengths in small wind (Marbek & GPco 2005), and other power technologies (Umedaly 2005). However, while global markets for microgeneration technologies are growing, Canada's domestic markets lag behind. Supporting microgeneration in Canada will provide opportunities for Canadian companies to develop and compete globally.

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2. Capturing the public imagination: microgeneration in the UK

The leader of the opposition wants to install a wind turbine on his roof (Clover, 2006). The Mayor of London believes that his measures to foster distributed generation in London will be one of the most important parts of his legacy (Livingstone, 2006). Major privatised utilities are buying significant stakes in emerging microgeneration companies (Scottish & Southern Energy, 2006). Over the last few years, small energy has become a big deal in Britain.

The explosion of interest in microgeneration has come about as a result of sustained concern about climate change in energy policy circles, together with concerns about rising energy costs and the need to make a transition to a sustainable, low carbon energy system. The context in the UK is of course very different from that in Canada, with liberalised electricity markets for over 15 years, rather than the near monopoly situations that exist in many Canadian provinces, and substantially higher electricity prices. However, many of the issues are the same – interconnection, codes and standards, rewards for generation, local planning issues, and high up-front costs faced by consumers. The experience in the UK illustrates how microgeneration can become an empowering and positive way to engage the public in energy and climate change issues.

Microgeneration on the policy agenda

Several stages have enabled the UK to move towards a main-streaming of microgeneration. Interest in microgeneration arose from an awareness that distributed power could reduce dependence on imported energy supplies, reduce the stress on overloaded transmission lines, reduce greenhouse gas emissions, and bring down energy bills for homeowners. In 2000, the government established a working group to address the barriers to increased distributed generation. As a result, in 2003, a uniform set of codes and standards for microgeneration installation and interconnection was established, providing installers with a single set of rules. This enabled a change in regulations to allow customers to install microgeneration equipment and connect to the grid without having to ask permission from the local distribution network operator, greatly easing the administrative and regulatory burden on customers and installers. This was a key step in enabling microgeneration to establish a respectable niche in energy markets. Also in 2003, government incentive programs were introduced to provide up-front grants to homeowners and communities buying and installing accredited microgeneration systems, often up to 50% of installed system costs.

In its Energy Act in 2004, responding to increasing enthusiasm for microgeneration among lobbyists and policy analysts, the UK government committed to developing a ‘Microgeneration Strategy’ by the end of 2005. As the national government was developing the strategy, others began to join together to support the emerging microgeneration agenda. Green groups and thinktanks advocated in favour of small scale renewables, with Green Alliance publishing a ‘Microgeneration Manifesto’ in 2004 (Collins, 2004). This laid out the potential benefits of microgeneration for the UK, and suggested elements for the government’s Microgeneration Strategy.

Industry stakeholders with an interest in microgeneration also grouped together, forming the Micropower Council in 2004. The Micropower Council includes renewable energy companies and industry associations, and five of the UK’s six biggest utilities. Since then, the Micropower Council, along with the Renewable Power Association, has played an important role in providing a link between policy-makers and the industry.

The Microgeneration Strategy itself, published in 2006, came with £30m in deployment funding through a ‘Low Carbon Buildings Program’ (DTI 2006). This program also provides lists of accredited installers and retailers of microgeneration equipment, and information on available grants and incentives for communities and homeowners interested in installing microgeneration. Later in 2006, HM Treasury announced a further £50m of support for microgeneration, and Parliament passed the Climate Change and Sustainable Energy Act, which included additional measures for supporting microgeneration. These included a requirement for utilities to provide customer-generators with compensation for power exported to the grid, and requires the government to explore making microgeneration technologies exempt from planning permission requirements.

Local governments lead the way

Perhaps just as important as the development of the national strategy has been the quiet microgeneration revolution sweeping through town halls around Britain. In 2003, The London Borough

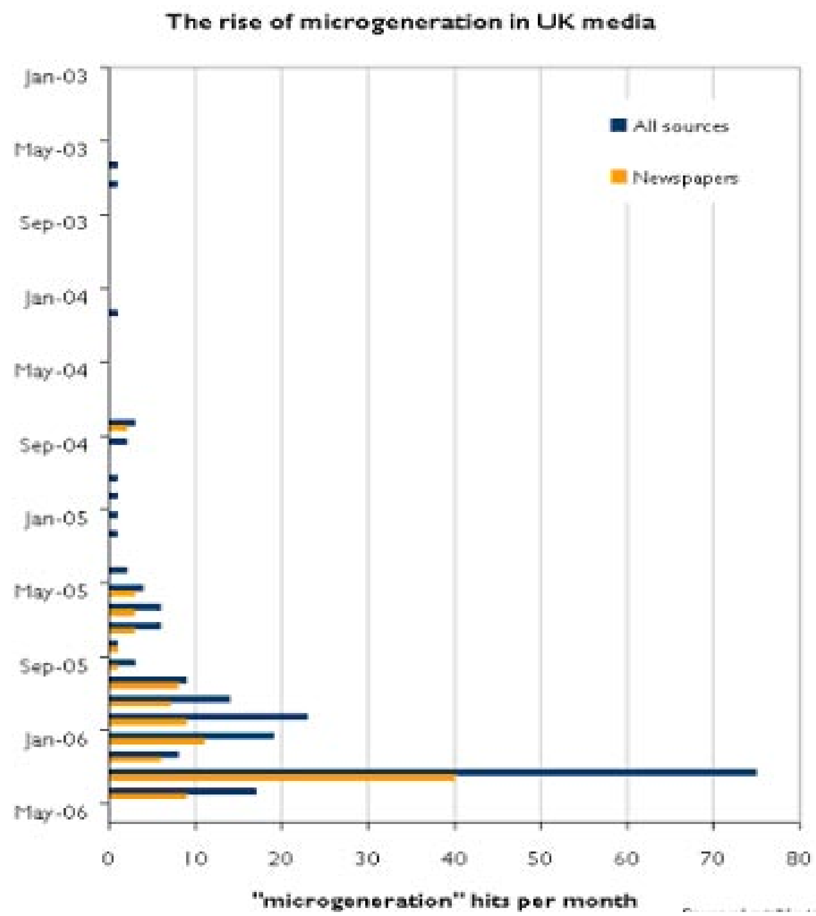

Figure reproduced from Keirstead, 2006

of Merton announced a new planning policy, which required any new development above 1000m2 to provide 10% of its anticipated energy needs from on-site renewable energy equipment. Part of the rationale for the policy was based on greenhouse gas reductions, but it was also intended to reduce energy bills in new homes and businesses in the borough, providing a long-term competitive advantage (LBM 2006).

The national government planning office, which was at first sceptical of the policy, eventually allowed it, and in 2004 issued policy guidance on renewables that explicitly supported such measures (Planning Policy Statement 22). By this time, several other councils had adopted the policy, and by 2006, more than 100 councils were actively developing policies that have come to be called “the Merton Rule”. In June 2006, the Minister for Housing and Planning made clear the extent to which the government now supported the Merton Rule, by saying that “In particular, the government expects all planning authorities to include policies in their development plans that require a percentage of the energy in new developments to come from on-site renewables, where it is viable."

When the policy was announced, there was a general expectation that the development industry would be vigorously opposed, but this has turned out not to be the case. Planning officers from boroughs that have introduced the policy describe how developers have generally been co-operative.

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Microgeneration captures the public imagination

By the time the Microgeneration Strategy was launched, there was real enthusiasm from the public, politicians, and the media. The diagram below indicates the way in which the British press responded to the public interest in microgeneration around the time of the publication of the Strategy. Many believe that the enthusiasm is because microgeneration is a positive way of engaging citizens with climate change, rather than a negative 'nagging' approach.

Moving towards mass markets?

Many of the important barriers for UK microgeneration have been overcome, but many still remain. However, the industry is united and has momentum, and there is a strong vision of what can be achieved that is driving developments.

The spread of municipal initiatives to promote microgeneration through the planning system are generating much of the current market, but this is restricted to new buildings. In 2006, Britain's biggest home and garden retailer started selling domestic roof-mounted wind turbines. With a rated power of 1kW, the turbines are being sold at $3000 CAD, including sales taxes and installation, putting microgeneration technologies within the reach of ordinary homeowners. Curry's, one of Britain's biggest electronic goods retailers, has also started selling solar PV equipment, at an installed cost of $14,000 for a 1kW system.

Lessons from the UK

- The national Microgeneration Strategy catalysed activities and created momentum and industry confidence
- Dynamism at the local level played a key role in fostering the devel-


© Renewable Devices

Urban Turbines

Building mounted wind turbines are relatively new – and controversial in the wind industry. Technical problems with vibration, turbulent air flows and noise have caused some wind experts to reject urban wind as a fundamentally bad idea. However, a recent technical appraisal of building mounted wind turbines suggested that their deployment could be substantial, and that most of the technical barriers can be overcome (Dutton et al 2005). There is still little experience with urban wind systems in practice, and it is difficult to get independent estimates of cost and performance. There is a real danger that 'hype' around immature technologies such as urban turbines could create a backlash against all small scale renewables. Policy support and advocacy for microgeneration must be based on sound analysis, and support should only be provided for technologies that meet clear performance standards.

opment of policy.

- National government leadership was essential to allow that local level progress to spread.
- Enabling straightforward grid connection is essential, and a pre-requisite if economic instruments such as capital grants are to work.
- The presence of a vocal industry association providing a voice for microgeneration issues was important.
- Microgeneration can capture the public imagination, and engage public debate around energy futures.

3. Barriers to microgeneration in Canada

This section is based on studies in the existing literature, and from interviews with representatives of Canadian companies developing and selling microgeneration technologies.

Cost barriers

Although they typically have very low running costs, most microgeneration technologies involve large up-front capital costs, and frequently have long pay-back times. This is particularly true in Canada, where electricity prices are very low. For many homeowners concerned about reducing their energy bills, upfront costs are a major disincentive, particularly given the difficulty of accessing the sort of financing mechanisms that are available to investors in large centralized energy systems. High upfront costs were cited as one of the principal barriers to increased microgeneration by most of the industry figures contacted, reflecting the results of recent surveys (e.g. Marbek & GPCo 2005).

It is often argued that the high upfront costs of microgeneration technologies are a reason to withhold support until costs have fallen through R&D. This is often a self defeating argument, given what we know about the relationship between cumulative installations and cost (see figure below). Removing barriers to microgeneration now will allow costs to fall, and for microgeneration technologies to establish self-supporting markets. This of course does not mean that microgeneration should be given a blank cheque, but rather that targeted support can create momentum for change.

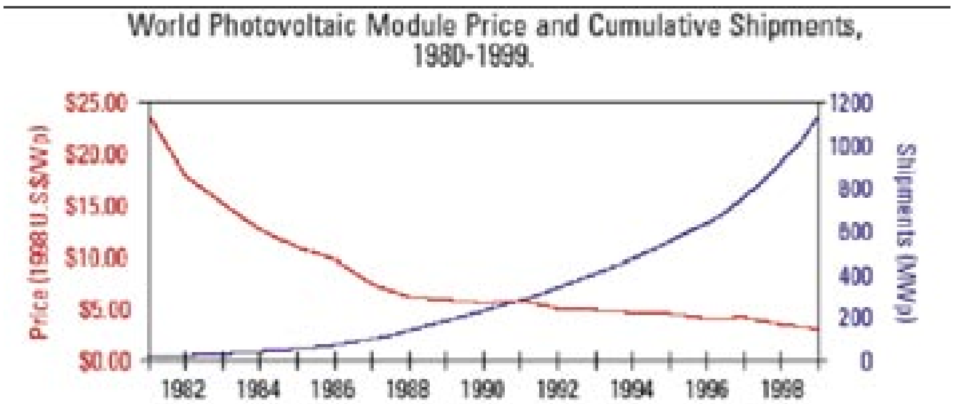

Figure reproduced from Ayoub et al, 2000.

Furthermore, current electricity prices benefit from existing infrastructures or "heritage assets," such as large hydro projects and other facilities where investment costs have been recovered. Cost comparisons need to be based on the incremental costs of meeting rising demands, which can be higher than electricity prices from existing installations. (National Energy Board, 2005).

Regulatory barriers and market structure

Cost alone is not the only barrier to increased uptake of microgeneration. Energy systems and markets are structured and regulated in such a way as to exclude small producers unfairly, by barring entry into energy markets, failing to compensate small producers for their generated energy, and a host of issues associated with codes and standards, building regulations, and permitting.

"The structure of most electricity markets in Canada is not conducive to distributed generation... The deployment of low-impact renewable electricity applications is still largely up to the discretion of regulated monopolies, which have little incentive to do so". REEEP, 2003.

Canadian energy markets have developed around large, centralized generating plants, such as large hydro installations and coal-fired power stations. The institutions, regulatory frameworks, and habits that govern the market have considerable inertia, and help to 'lock-in' often inefficient systems. This is increasingly known as 'carbon lock-in' by scholars of technological change, and implies that economic instruments and public persuasion campaigns alone are unlikely to change consumption behaviour and purchase decisions. Institutional and regulatory barriers also need to be tackled (Unruh 2000).

Access to the grid and compensation for electricity generators

Some renewable energy technologies are unpredictable in output because of the intermittency in sunshine and wind, and output does not always match domestic demand. When a microgeneration system produces more electricity than the homeowner is using, the excess power 'spills' into the local distribution grid, and is used by neighbours. These neighbours are billed by the utility for this power exactly as if it had been produced centrally, but unless systems have been put in place, the producer receives no compensation. 'Net metering' arrangements, in which customer-generators are compensated for their exported power at the retail electricity rate, are one way of restructuring the market so that the customer-generator receives a fair price.


courtesy of Riomay Ltd UK www.riomay.com

Net metering is an important step in enabling microgeneration. However, as the experience of Manitoba demonstrates, a broad range of additional barriers can act to prevent widespread take up of microgeneration even when net metering is in place. Manitoba Hydro operated a net metering scheme for more than 10 years, but the numbers of customers signing up to the scheme was disappointing (NewEra 2006). Net metering does not automatically mean that it is straightforward for customers to install and connect microgeneration technologies, and straightforward interconnection may be more important in enabling microgeneration than rewards for energy exports. While several Canadian utilities have introduced net metering policies, it is frequently a time consuming and difficult process to get connected, not least because the utility has little incentive to do so. Getting connected was cited as a major factor by owners of grid-connected renewable energy systems in a recent survey, even where net metering systems exist (Henderson & Bell 2003).

The process of getting connected to the grid needs to be carefully regulated to ensure safety and reliability, but the process of interconnection is often overly complex, and some observers have suggested that the lack of uniform interconnection standards across the country has been 'the number one interconnection barrier for small renewable systems'. Furthermore, 'it is a problem of many utilities not having any standards at all for small grid-tied systems'. (Micropower connect, 2006). This means that many customers wishing to connect microgeneration to the grid must go through a complex, time consuming and expensive case-by-case inspection and approval process, or through a standard process designed for much larger generators. Standards are essential to provide safety, and maintain system and power quality, but they are also essential in facilitating straightforward grid connection.

Codes & Standards

As well as the interconnection standards discussed above, product safety and performance standards, and building, electrical, and plumbing codes form an important part of the regulatory environment for microgeneration technologies. The process of testing and certifying products, and adapting codes, can be costly and time-consuming, and present a significant barrier to the diffusion of new technologies.

Codes are vital for ensuring that products and buildings are safe and reliable, and they need to be updated as new technologies emerge. This has not always happened, as the example of the solar hot water industry demonstrates. The National Plumbing Code calls for all solar hot water systems to conform to a (now outdated) standard that was only ever intended to apply to a particular type of solar hot water system. No laboratory in Canada was certified to test systems to see if they met the standard, so it was impossible to get certified. As a result, in many areas it became difficult to get planning and plumbing permits or insurance. This has had a damaging impact on the Canadian solar thermal industry, and is only now being addressed, with NRCan and the Canadian Solar Industries Association working with the Canadian Standards Association to develop appropriate standards and testing facilities (McGonagle, 2006b).

Consumers are rightly cautious about trusting products that have not been certified as conforming to a recognised standard, but even where appropriate standards do exist, such as in the PV market, smaller manufacturers and importers cannot always afford the cost of CSA testing (CMHC 2006). Without support, product certification can be a further barrier for many emerging microgeneration technologies. Perceived and actual risks associated with relatively new technologies can be a major barrier to their adoption, particularly when technologies are seen by consumers as productive investments, rather than consumable luxuries. Standards can help deliver greater consumer confidence.

Skills & accreditation

Many microgeneration renewables take energy from the local environment: local solar, wind, earth energy and water flows are harnessed to provide for local needs. The result is that many systems are not simply ‘plug-and-play’, but need careful installation to perform properly.

Canada currently lacks straightforward training and certification systems for installers of many microgeneration technologies. This leaves potential consumers confused, cautious, and even vulnerable to poorly installed systems. As with product standards, certification is essential for consumer confidence in the industry.

The problem is particularly acute for the solar thermal and ground source heating markets. Both the Canadian Solar Industries Association and Canadian Geo-exchange Coalition have identified a pressing need to develop training programs and certification schemes. The Geo-exchange Coalition notes that “We receive phone calls everyday from desperate customers trying to decipher who does what and who is accredited by whom, under which authority, and so on. In many cases those customers finally decide not to proceed with an installation because of the lack of market cohesion. They are afraid and confused.” (Tanguay, 2006).


CanWEA Small Wind Website

Zoning and planning restrictions

Local by-laws and planning rules have usually been designed without consideration of micro-renewable technologies. As a result, permitting and planning processes can be expensive and time consuming, as no set procedures are in place. For example, zoning policies such as height restrictions frequently do not include small wind turbine towers in lists of exempt structures (such as silos, water towers, and church spires). A recent review suggested that “few if any municipalities, regions, provinces or other government structures possess an ideal package of policies governing small wind turbines.” (Rhoads-Weaver et al 2006).

In Ontario, other zoning problems have occurred where municipalities question the use of renewables in residential areas. Since the introduction of the Standard Offer Program, which provides guaranteed prices for renewably generated electricity, there has been at least one case where a resident in an areas zoned as ‘residential’ has been instructed not to install microgeneration equipment, as this has been seen as ‘commercial activity’ by the municipal authority (Ontario Power Authority, 2006).

Many municipalities do not have the capacity to develop renewable-friendly zoning and permitting policies, and are often unfamiliar with the technologies. Without support and direction from provincial governments and organisations such as the Federation of Canadian Municipalities, these local-level barriers will remain.

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Awareness and mindsets

In an energy system dominated for decades by large, centralized power generators and heating fuel providers, many homeowners, developers, and policy-makers simply do not know about or understand the alternatives.

The microgeneration industry consistently cites lack of awareness as a major barrier across a range of technologies, including small wind (Marbek & GPCo 2005), solar thermal (Ipsos-Reid 2002; SAIC 2005; where it was the single most frequently cited barrier), solar PV (Industry Canada 2003) and bioenergy (CanBIO 2004). Customers and developers are ignorant as to the costs, benefits, performance, and often even the existence of many microgeneration technologies. While industry associations and the federal government's CanREN website provide useful information to potential consumers, there is no single source of information for residential scale renewables, where homeowners would be able to find out what would or would not work for them.

A second part of the problem is misconceptions about microgeneration technologies. For example, many environmental NGOs have not been supportive of biomass combustion technologies, believing them to be a serious air pollution hazard. The Greater Vancouver Regional District prohibits biomass combustion unless emissions are less than natural gas combustion (Bradley 2005), even though certified clean burning stoves and fireplaces can reduce smoke emissions by 90% compared with conventional wood systems. (Government of New Brunswick, 2001).

However, it is not just among consumers and developers that inadequate knowledge and information is a barrier to the diffusion of microgeneration technologies. It is also in the mindsets of policy-makers and utilities, accustomed to a model of centralized generation and control. Challenging and broadening this mindset is one of the challenges for microgeneration policy.

4. Progress in Canada: removing barriers to microgeneration

Canadian governments have already recognised many of the benefits of public support for microgeneration technologies, and both the federal government and provincial governments have taken some important steps to remove barriers and enable growth in microgeneration markets. However, Canada does not yet have an integrated strategy for moving microgeneration renewables forward. Indeed, the existing mechanisms to support microgeneration renewables are fragmented, and Canada's flagship renewable energy support structures specifically exclude the microgeneration sector. While these policy measures have been carefully designed to foster some renewable energy technologies at least cost, they have missed opportunities to promote microgeneration.

Canada's principal federal mechanism for supporting wind power, the Wind Power Production Incentive, provides a guaranteed price, or 'feed-in tariff' for electricity produced from wind. The WPPI excludes wind installations of less than 500kW, although it does have a lower cut-off of 20kW for remote and northern communities. Similarly, while the current status of the Renewable Power Production Incentive, announced in the 2005 budget, is unclear, NRCan's September 2005 Discussion Paper on the RPPI suggested that it would only include technologies with a capacity of greater than 100kW (NRcan 2005).

The Renewable Energy Deployment Initiative (REDI) was established in 1998 to provide $51m over 9 years to solar air and water heating and biomass heating in commercial buildings. It provides up to 25% of the cost of these systems, and in 2002 support from REDI was extended to ground source heat. While it has provided much needed support for the development of the renewable heat industries in the commercial sector, and is considered to have been a successful program, it has not engaged with homeowners to bring renewable energies to the wider residential market. It is due to end in March 2007.

Similarly, the Class 43.1 Capital Cost Allowance tax incentive for the purchase of renewable energy equipment has been valuable for supporting the small wind market (Marbek & GPCo 2005), but it excludes most applications of renewable heat technologies, and there is a cut-off limit under 3kW for solar PV. This is above what most homes would choose to install.

Great Valley Center Image Bank

Canadian Tire, which has recently started selling small wind and solar PV technologies, advertises an on-grid solar system with a rated capacity of 2.8kW, just under the cut off. 98% of solar PV installed in Canada is below 3kW (CanSIA 2004).

In general, Provincial governments have been better at targeting support to micro-renewables, with PST exemptions or rebates on renewable energy purchases offered in PEI, BC, and Ontario. Several provinces have also developed grants for renewable equipment purchases: Nova Scotia provides a 10% rebate for solar water heating, and $200 for certified clean-burning woodstoves, while the Quebec Energy Efficiency Fund provides $400 towards solar wall installations, a form of active solar air heating. In BC, a project of the BC Sustainable Energy Association, partnered with provincial and federal governments, Vancity Credit Union, and BC Hydro, provided support for homeowners and communities to access rebates for solar hot water systems.

There are signs that the Federal government is considering some form of incentive for supporting microgeneration. In September 2006, Environment Canada issued a request for proposals for work assessing different possible economic instruments to provide incentives for small renewables in the home and farm sectors.

Progress for microgeneration has been made

Despite the lack of a federal incentive program or integrated strategy, work from NRCan and a range of industry associations and other stakeholders has made progress over the last few years in tackling some of the more systemic barriers. This is vital – incentives and financial support will not be sustainable if the regulatory frameworks and supporting institutions are not in place to allow the market to become self-sufficient. Poorly targeted incentives can create industries with a culture of dependency, with no incentive to drive down costs and build a more robust market.

Grid access and interconnection standards

For electricity generating technologies, the potential problems of interconnection to the grid have been addressed since 2001 by Micropower Connect, run by Electro-Federation Canada, and supported by NRCan and Industry Canada. Micropower Connect has worked to develop guidelines for interconnection of distributed electrical resources, and published a set of guidelines in 2003. This was followed with a review of the status of interconnection guidelines, codes and standards in Canada in 2006, which made recommendations for uniform interconnection standards to be adopted across Canada. Power generation and infrastructure are provincial responsibilities, and the report argued that "It is important that Provincial regulators understand the importance of adopting national or international standards, and enforcing consistency within their jurisdictions" (Micropower Connect, 2006). In 2006, a new National Standard of Canada was issued covering grid interconnection of microgeneration technologies, providing a basis for harmonised rules across Canada.


Society Promoting Environmental Conservation

While many provinces still need to develop effective interconnection rules, the models and standards now exist, with Micropower Connect having done much of the initial work, and providing a forum for interconnection guidelines to move forward.

Restructuring markets: export price agreements for microgenerators

The way in which utilities manage their energy resources, including microgeneration, is governed by provincial rules, resulting in a variety of different approaches across Canada. Around 8 major utilities now have net metering programs (Henderson & Bell, 2003), with some commentators reporting that the programs in BC and Ontario are particularly well designed (NewERA 2006). Several others have other grid-connection and compensation programs that are less generous than net metering, but that provide some payment for electricity exported to the grid (Henderson & Bell, 2003). Some net metering schemes also include non-renewable forms of distributed generation, such as gas-fired co-generation (in which the domestic furnace generates electricity as well as heat from gas, and is more efficient than conventional heat and power generation).

However, the most progressive policy specifically aimed at renewable distributed generation in Canada is the Ontario Power Authority's Standard Offer Program, which provides a guaranteed price for electricity generated from renewable resource installations under 10MW. This is a complementary program to Net Metering, which also operates in Ontario, and customer-generators can choose which program will suit them best.

Ontario's Standard Offer Program issues 20-year contracts, providing consumer-generators with a guaranteed income from their power system for 20 years. While it is too early to draw robust conclusions about the impacts of the program, the Canadian Solar Industries Association estimates a 400% increase in sales of grid connected PV in the first half of 2006 (CanSIA, 2006).

Supporting the industry: product codes and standards, training and accreditation, and the support of industry associations

New industries take time to build the institutional strength that supports the development of markets, and the capacity to address regulatory and other issues. Industry associations are one way in which industries can act together to overcome common barriers. The federal government has provided support to a number of Canadian industry associations representing the microgeneration industry, either with core funding or for specific projects. This includes the Canadian Geo-exchange Coalition, the Canadian Bio-energy Association (CanBIO), the Canadian Wind Energy Association (CanWEA) and the Canadian Solar Industries Association (CanSIA).

Some government support has been also been available for the development of product standards and training and certification programs. For example, NRCan has been working with CanSIA to provide 90% of the costs of certification for solar hot water systems. The Canadian Geo-exchange Coalition is also working with NRCan to develop both product standards and a training and certification system for installers.

Other support has been targeted at raising awareness of small scale renewables. This has included, for example, funding for the Canadian Wind Energy Association to develop a 'small wind' website, to provide information to potential customers, policy-makers and investors on the options for small wind power in Canada. NRCan's Canadian Renewable Energy Network (CanREN) website also provides information and case studies on microgeneration.

Clean power to Northern Communities

The Aboriginal and Northern Community Action Plan (ANCAP) was developed to help northern communities respond to the challenges of climate change, through adaptation and through greenhouse gas reductions. This includes supporting renewable energy projects, as well as resource estimation (through a Wind Assessment program), and community energy planning in remote communities across Canada.

Microgeneration in the planning system

This study is unaware of any clear examples of provinces or municipalities actively streamlining efforts to get micro-renewables through the planning system more quickly. However, there are many Canadian municipalities that have installed small scale renewable systems in their communities, often as part of initiatives to reduce the carbon footprint of civic buildings. Federal 'Green Municipal Funds', administered by the Federation of Canadian Municipalities, have been an important source of support for many of these communities. One example is the Drake Landing subdivision in the City of Okotoks, Alberta. A solar seasonal storage system will provide 90% of the heating needs for the 74 homes involved.

Schwarzerkater

Microgeneration offers a real opportunity for Canada. It can reduce greenhouse gases, provide opportunities for Canadian businesses, and engage the public in the fight against climate change. At the moment, that opportunity is being overlooked. However, some of most important barriers are being overcome, and there is real potential for an integrated microgeneration strategy to bring clean and reliable microgeneration within reach of Canadian homeowners and businesses, allowing microgeneration to move from niches into mainstream markets.


Yuill Herbert

5. Conclusions and Recommendations

A Microgeneration Strategy for Canada

The barriers to microgeneration are systemic, and efforts to support microgeneration must similarly involve federal, provincial and municipal governments in partnership with utilities, developers and the microgeneration industry. Any strategy must recognise the diversity of Canada's provinces, in terms of their environments and renewable resources as well as their differing energy systems and regulatory frameworks. A one-size-fits-all approach may not be appropriate, and federal activities need to focus on providing support for the development of the industry, along with promoting provincial actions that match the needs of each province. A Microgeneration Strategy for Canada would consider the following points:

Federal Actions

1. *Set ambitious targets for the uptake of microgeneration in Canada. Targets would be based on analysis of the potential market for microgeneration in Canada (similar to work carried out in preparation for the UK's Microgeneration Strategy; EST et al 2005). This would provide a clear signal of the government's intention to remove barriers to microgeneration, stimulate private sector support, and raise awareness of microgeneration.*

2. *Consult industry views on the establishment of a microgeneration industry association or forum, which would provide policy-makers, developers and customers with a single point of contact for the industry, and provide a space for discussing how best to move forward with support for microgeneration. Such a body should include utilities, as well as microgeneration technology companies.*

3. *Support a web-based information hub, possibly managed by industry associations, to enable customers and developers to access information on technologies, incentives, prices, and certified products and installers. This could build on the work of the existing CanREN website.*

4. *Provide support for industry to develop appropriate codes and standards, and accreditation schemes, including support for testing and certification facilities.*

5. *Provide support for training schemes for installers and technicians*

6. *Continue to invest in microgeneration-focused research and development*

7. *Establish a process for the harmonisation of interconnection and metering codes and standards across Canada, leading to uniform codes and standards across all Provinces. This would build on the work of Micropower Connect.*

8. *Lead by example, through a program of public procurement of microgeneration building on the Federal House in Order's On-site Generation at Federal Facilities program.*

Federal or Provincial Incentives

These measures to encourage consumer uptake could be funded through a 'public benefit charge' in energy bills, which is essentially a tax earmarked for microgeneration support.

9. *Feed-in tariffs, providing a guaranteed price for electricity generated by microgeneration. An Advanced Renewable Tariff, like that developed in Ontario, is the single most effective policy measure to support electricity microgeneration.*

10. *Tax incentives: Sales tax rebates, expansion of the federal Capital Cost Allowance class 43.1 to all microgeneration technologies.*

11. *Grant schemes or 'buy downs', to reduce the capital costs for microgeneration customers. Capital grant schemes must be carefully designed to ensure that incentives for cost reduction remain, and that a subsidy-dependent industry does not develop.*

12. *Low interest loans, or 'net financing' schemes, where loan repayments equal energy bill savings from the microgeneration installation. A program for farmers, who often have high energy costs and abundant opportunities for microgeneration, would be particularly valuable.*

Provincial actions

13. *Require utilities to provide fair export prices for customer-generators, such as net metering arrangements.*

14. *Support microgeneration through building codes, for example, by introducing a requirement for buildings to be 'solar retro-fit ready'.*

15. *Enable and encourage municipalities to develop innovative policies to promote microgeneration through the planning system. 'Merton Rule' style policies, which make the incorporation of renewable energy a requirement of development, would currently not be legal in most Canadian municipalities. Provincial legislation covering the powers of local governments could change to promote such policies.*

16. *Lead by example, through the public procurement of microgeneration technologies for public buildings.*

Municipal actions

Municipalities can take three broad approaches to supporting microgeneration renewables within their communities.

17. *'In-house' Microgeneration. Most municipal efforts to promote small scale renewables to date have focused on the development of renewable energy in municipal buildings. This provides examples of leadership within local communities, but municipalities can do much more beyond their own operations.*

18. *Enabling Microgeneration. Removing barriers to the installation of microgeneration is essential in fostering microgeneration markets. Municipalities can adopt streamlined permitting rules for renewables, such as the model zoning guidelines for small wind developed by the Canadian Wind Energy Association (Rhoads-Weaver et al 2006).*

19. *Promoting Microgeneration. Municipalities can go further than simply removing planning and zoning barriers by taking an active lead in promoting microgeneration through the planning system. Although 'Merton Rule' policies are not currently possible in most Canadian municipalities, other possibilities include reduced development permit fees, and making the inclusion of on-site renewables a consideration in re-zoning applications.*

The potential for municipal action to enable and promote microgeneration through the planning system should not be underestimated. The National Roundtable on Energy and Environment recently estimated that a third of the buildings that will be standing in Canada in 2050 have not yet been built (NRTEE 2006). This is a massive opportunity to change the way in which energy is produced and consumed.

Next Steps: A Policy and Research Agenda

This discussion paper is intended to foster dialogue about the potential for microgeneration policy in Canada. It does not represent the final report of a completed project, but a starting point for more research and policy work developing an integrated approach to renewable microgeneration. The work clearly suggests a need for more research and policy work, which would:

A. *Explore the possibilities for municipalities to lead the development of pro-microgeneration policy, as has happened in Spain and the UK.*

B. *Conduct economic modelling to assess the potential market and possible carbon reductions of microgeneration, as well as the potential impacts of policy. Such a modelling exercise could provide the basis for setting ambitious microgeneration targets.*

C. *Review the evidence on the cost-effectiveness of different economic policy instruments for supporting microgeneration (such as Advanced Renewable Tariffs, Capital Grants, Tax Incentives and so on).*

D. *Link together the community of stakeholders with an interest in microgeneration to create more effective co-ordination and networking.*

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