A North American definition for 'green electricity': implications for sustainability

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Abstract: This paper investigates the potential implications, for sustainability, of a North American standard for 'green electricity' (that is, electricity generated by environmentally-friendlier means). More specifically, four conceivable approaches to a North American standard are identified: namely, a continental standard with no local variation, a continental standard with 'objective' local variations, a continental standard with local interpretations and a set of continental norms with local priorities. For the first and last of these four approaches, potential sustainability impacts are highlighted and discussed. The paper concludes by arguing that further investigation is warranted: the particular approach taken at the continental level has the potential to be a powerful force, either positively or negatively, with respect to the sustainability of the North American electricity system.

Keywords: Canada; electricity markets; 'green' power; international trade; Mexico; sustainability; USA.

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1 Introduction

The purpose of this paper is to explore the sustainability issues associated with the way in which 'green electricity' (also known as 'green power') is defined in a North American context. (Given the relatively advanced nature of green electricity discussions in Canada and the USA, the specific examples in this paper are drawn from these two countries. Nevertheless, the questions raised and issues flagged apply equally to all three countries in the continent (including, that is, Mexico). For one of the few investigations into green electricity prospects in Mexico, see [1]). The paper is divided into six main parts.

Following this brief introduction, the context is set by examining the electricity supply structures of Canada, the USA and Mexico. The sustainability of these systems is commented upon and a future vision for a more sustainable electricity system is presented, drawing upon ideas about 'soft energy paths'. In the third section, some strategies for encouraging movement off our present 'hard path', onto an alternative 'soft path', are identified. It is argued that the success of each strategy is dependent upon an unambiguous definition of 'green electricity'. Thus, the importance of a clear understanding of this term is highlighted. This leads to the discussion in the fourth section, in which the alternative perspectives that people hold with respect to the relative 'greenness' of different energy resources are highlighted. Although the point is made that many different views exist, it is nevertheless also noted that some areas of consensus in North America regarding definitions for 'green electricity' are emerging. These are in the form of 'certification programs' that now exist within both Canada and parts of the USA. Potential pressures for a continent-wide standard for 'green electricity' are then identified in the fifth section and four models for such a standard are presented. In this section, the implications for sustainability of two of these different approaches are identified. Finally, in the sixth section, a summary of the main arguments is presented.

2 Context

Canada and the USA are both voracious consumers of many kinds of energy – electricity being one of the most prominent. In 1999, Canadians consumed 525.7 TWhr of electricity, while Americans consumed 3,212.8 TWhr – amongst the highest per capita consumers in the world [2, p.1]. Meeting the majority of the Canadian demand is hydropower (60% of total demand). Following this are coal (15%) and nuclear (13%); natural gas, oil/diesel and other sources make up the remainder (11%) [2, p.2]. In the USA, meanwhile, the main source of electricity is coal (52%), followed by nuclear (20%), natural gas (15%) and hydropower (8%); oil/diesel and other sources make up the remainder (5%) [2, p.3]. Mexico, though a modest per capita consumer of electricity, when compared to its two North American neighbours, is nevertheless still a significant consumer by global standards: of the 185.4 TWhr consumed in Mexico in 1999 [2, p.1], approximately 68% of that came from fuel oil, natural gas and diesel; the remainder from hydropower (14%), coal (10%) and either nuclear power, geothermal or wind (8%) [1, p.2].

Critics argue that the North American reliance on conventional, large-scale fossil, hydro and nuclear-powered generating facilities is not sustainable (see, for example, [3–5]). Such energy systems were characterised by Amory Lovins (in the wake of the first 'energy crisis' in the mid-1970s) as 'hard path', with "rapid expansion of centralised high technologies to increase supplies of energy, especially in the form of electricity" [6, p.65].

Many believe that a more sustainable future lies with 'soft path' energy systems, which Lovins [6, p.65] describes as "a prompt and serious commitment to efficient use of energy, rapid development of renewable energy matched in scale and in energy quality to end-use needs and special transitional fossil-fuel technologies." (See elements of 'soft path' principles, advanced as part of sustainable energy systems, in [7–11]).

In this work, we take a sustainable electricity system to be one that has many of these same 'soft path' characteristics, such as reduced demand (often called 'increased energy conservation') and new ('substituted') supply (often consisting of renewable, or green, sources). Indeed, since the late 1990s, there has been renewed interest in 'soft path' futures, stimulated by the increasing recognition that the atmosphere can only accommodate, in an ecologically-stable manner, a limited amount of greenhouse gas emissions. Today, 'distributed generation' is the term most often used to refer to proposals for a decentralised system of energy supply based largely upon renewable resources (e.g., [12,13]). The question that follows, of course, is how to get there?

3 Strategies for promoting green electricity

A number of different strategies exist for stimulating the development and use of green electricity [14]. For example, some communities have introduced renewable portfolio standards (RPS). An RPS is a "requirement that a minimum percentage of each electricity generator's or supplier's resource portfolio comes from renewable energy" [15, p.23]. Consider the following example. If a new energy company wanted to market electricity by building a 250 MW natural gas fired power plant – which might be expected to power approximately 200,000 homes – it would also have to build some kind of renewable energy facility, or purchase the electricity generated by the same. Should a '1% RPS' be in place in this jurisdiction, then that same energy company might build eight wind turbines, each rated at 1 MW, which would, in turn, power approximately 2,000 homes.

Supporters argue that an RPS would guarantee a portion of the electricity market for green electricity. But that part of the market would, itself, be competitive: entrepreneurs would work to offer renewable power to conventional electricity suppliers. As Nogee and colleagues argue: "Steady, predictable growth will enable the industry to reduce the costs by obtaining lower-cost financing, investing in research and development and developing infrastructure – from new manufacturing plants to maintenance, repair and marketing capacity" [15, p.25]. To date, a number of jurisdictions around the world are actively pursuing an RPS as part of their overall energy strategy [16,17].

Another means of encouraging the development of renewables in a community's electricity supply mix is to apply a charge to every unit of electricity. The revenue collected would then be used to promote the development of green electricity in the system. This could involve, for example, the provision of low-cost financing in order to accelerate the market-readiness of renewable energy technologies. Alternatively, such so-called 'systems benefits charges' (SBCs) might be used to develop a public awareness campaign citing the benefits of renewable technologies (e.g., [15, p.28]). In all cases, justification for such a charge is that this would be a means of providing a general 'public benefit' – that is, promoting green electricity. A number of jurisdictions in the USA have introduced SBCs (see [16,17]).

Another way to encourage greater use of green electricity is by use of 'ecolabels'. An 'ecolabel' is "a label which identifies overall environmental preference of a product or service within a particular product/service category based on life cycle considerations" [18, p.1]. By identifying products and services that are 'environmentally-superior', the intention is to make them more attractive to consumers. In terms of the product under examination in this article, certain kinds of electricity could conceivably receive an ecolabel. We return to this issue below, when we examine green power certification programs in Canada and the USA.

Regardless of the strategy or strategies selected, all are predicated upon some definition – either explicit or implicit – of 'green electricity'. For an RPS, for example, regulators will determine what energy resources qualify as part of the renewable portfolio. Similarly, with a systems benefits charge, regulators must determine which renewable resources will receive support. Finally, in terms of ecolabelling, the obvious question is which kinds of resources are permitted to use the term 'green' to their own market advantage.

Indeed, the importance of clearly defining 'green electricity' should not be underestimated [19]. Those who are able to define what is 'green' (or 'environmentally-friendly' or 'renewable' or 'sustainable') will effectively determine which kinds of energy resources are given special status in energy policy and marketing (by means of the strategies mentioned above and others). By 'privileging' some kinds of resources, the term 'green electricity' will continue to be widely perceived as shorthand for all that is desirable. Questions arise not only with respect to what should qualify as green (for that discussion, see [19]), but also at what scale is it appropriate to develop such qualifications (for example, the local, provincial/state, national or international level?). Consequently, explicit analysis of how the definition of green should be arrived at is vital.

4 Perceptions and emerging definitions of green electricity

It is important to recognise that there are differences of perception with respect to how 'green electricity' should be defined. In Waterloo Region (Ontario, Canada), for example, Rowlands and colleagues [20] found that there are a number of energy resources that are perceived differently, with respect to their environmental impact, by different people. Specifically, 94% of their close to 500 survey respondents in Waterloo Region thought that wind power should be able to use the label 'green'; a similar percentage of their respondents thought that solar power should be able to do the same. At the other end of the spectrum, only 1% of their respondents thought that coal should be able to call itself 'green'; the same percentage of respondents thought that oil should be able to also call itself 'green'. While these results are largely unequivocal, responses to queries about other resources were more ambiguous. For example, 57% of respondents thought that small hydro should be able to be labelled as 'green', while 43% thought that it should not. To take one final example, 30% thought that landfill gas should be called 'green', while 70% thought that it should not. A similar diversity of opinion has been found in other communities (for instance, for Colorado examples, see [21]).

It has also been recognised that there are differences of perception across communities. RPSs in different US jurisdictions, for example, use different definitions of 'renewable'. The RPS for Illinois does not include hydropower, while in Maine, any hydropower facility up to 100 MW qualifies. Florida does not include biomass in its RPS, but in Hawaii, biomass sources like landfill gas are eligible. The age of the facilities generating the renewable energy is also relevant, for a number of jurisdictions require a particular share of the green electricity to be sourced from 'new' facilities. 'New', however, is often defined by different cut-off dates. In the RPS in Massachusetts, 'new' means after 31 December 1997, while in Texas, it means something 20 months later – namely, after 1 September 1999 [17]. As a result of these differences, what is considered 'renewable' or 'green' in one jurisdiction may not be 'renewable' or 'green' in another.

In part motivated by such differences, there have been efforts within North America to standardise definitions for 'green electricity'. In the following sections, we introduce two such efforts – namely, the 'EcoLogo' program in Canada and the 'Green-e' program in the USA. By focusing upon these two programs, we do not mean to suggest that they are the only such programs in place. Others exist in North America, some being developed by the private sector (for example, Scientific Certification Systems [22]), some by groups of nongovernmental organisations (for example, the Power Scorecard [23]) and some by consortia of government, businesses and other groups (for example, discussions surrounding a standard for 'Green Electricity Ontario' [24]). Nevertheless, it is our contention that EcoLogo and Green-e are amongst the most influential certification schemes, continent-wide.

4.1 Canada: 'EcoLogo'

The Canadian program for green power certification is part of the country's 'Environmental Choice Program' (ECP), the Canadian ecolabelling program. The goal of the ECP is to encourage the manufacturing and supply of 'environmentally preferable products and services' by helping customers 'identify products and services that are less harmful to the environment' through use of the so-called 'EcoLogo' (ECP, 2000). ECP is an initiative of the federal government's Ministry of the Environment (Environment Canada), though it is administered, under licence, by a private company (TerraChoice Environmental Services Inc.). The EcoLogo is comprised of three intertwined doves that form a maple leaf, "representing consumers, industry and government working together to improve Canada's environment" [25].

In 1998, the ECP brought together a number of stakeholders – representing utilities and smaller power producers, consumers, nongovernmental organisations and various levels of government – to discuss guidelines for certification of 'renewable low-impact electricity'. A draft set of guidelines dated November 1999 emerged from those discussions and was submitted to the federal government (Environment Canada) in January 2000. On 8 December 2001, the draft was released and the public review announced in the *Canada Gazette*. Such public review periods last 90 days. By January 2002, it was anticipated that the release of the final guideline for 'renewable low-impact electricity' would occur in June 2002.

The self-declared goal of the Canadian EcoLogo program for renewable low-impact electricity is to certify products that: use 'renewable, more sustainable fuel sources'; reduce emissions contributing to 'global warming, smog, acid rain and air-borne particulate pollution'; reduce solid waste from mining and fossil fuel extraction; reduce ‘toxic metal emissions and nuclear wastes’; and reduce impacts on ‘aquatic, riparian and terrestrial ecosystems’ [26].

4.2 USA: ‘Green-e’

The US Green-e Renewable Electricity Branding Project is administered by the Center for Resource Solutions, a non-profit organisation based in San Francisco, California. The program was launched in November 1997 with criteria developed for California and then adapted in July 1998 for use in Pennsylvania. Standards have now been developed for states in the Mid-Atlantic region (New Jersey, Delaware and Maryland, in addition to Pennsylvania) and for the New England states (Vermont, New Hampshire, Maine, Massachusetts, Connecticut and Rhode Island), as well as Texas. Development of standards for New York, Illinois and Michigan is expected to come in 2001-2002 [27]. In each case, respective guidelines are developed by a Regional Advisory Committee, which includes representatives from ‘local environmental organisations, policy marketers, renewable developers, energy policy experts and other interested parties’ [28, p.13].

The self-declared goal of the Green-e program is to: ‘bolster consumer confidence’ in renewable energy; increase demand for renewable and new renewable energy; provide ‘clear information about retail ‘green’ electricity products’ for consumers; and encourage ‘electricity products that minimise air pollution and reduce greenhouse gases’ [28].

4.3 Comparing EcoLogo and Green-e

It is, at this point, worth highlighting some of the similarities and differences between the two main green electricity certification programs presently at work in North America. Given that the main purpose of this paper is to scope issues surrounding a potential continental standard, the extent to which these two national programs agree and/or differ is relevant.

In addition to the fact that both of these programs establish a standard – and hence have many processes and mechanics that are common to ‘ecolabelling schemes’ more generally (for example, granting the use of a particular logo) – the main similarities relate to many of those sources that do and do not qualify as ‘green electricity’. More specifically, although there are some differences in the detail, it is largely the case that solar and wind qualify as green electricity, while coal, oil, nuclear power and natural gas do not. Thus, many of the sources that are part of the electricity supply grids in both countries would not qualify for certification under either program.

In other areas, however, there are important differences between the Canadian EcoLogo and the American Green-e programs. Without elaborating details here (for those details, see [19]), there are differences in approach to the so-called ‘light green’ resources: hydropower is treated somewhat differently in each country, with national standards (which themselves are different) helping to determine which kinds of hydropower facilities can qualify for green electricity certification. Additionally, biomass generating facilities (for example, landfill gas and burning agricultural waste) are largely judged by their atmospheric emissions. But while Green-e focuses upon emissions of nitrogen oxides, EcoLogo uses a ‘load point’ system that takes into account emissions of carbon monoxide, particulate matter, volatile organic compounds, nitrogen oxides and sulphur oxides.

The two programs also have different responses in the face of the 'new' versus 'old' renewables debate (see, for example, [29]). In Canada, at least 50% of the EcoLogo-certified product must be from new (post 1 January 1991) certified generating facilities. By contrast, in the USA, the Green-e program requires at least 5% of the total product to be from new (post 1 January 1997, or post 1 January 1998, in New England) renewable energy in the first year, increasing to 10% the following year. The intention is to reach a total of 25% new renewable energy by increasing in increments of 5% per year. Hydroelectric facilities may not be counted as new renewables in the Green-e program and "new renewables must be met entirely by renewable generation over and above anything required by state or federal RPS requirements" [28, pp.17-18].

These differences, along with other differences about the governance and management of the two programs, their decision-making processes, their auditing processes and their respective positions on 'blended products' [19], highlight the fact that different approaches to the certification of green electricity presently exist within North America.

5 Prospects and possibilities for a continental definition of green electricity

The growth of globalisation, internationalisation and continentalisation make it imperative to examine green electricity in a North American context. Such an examination becomes even more critical given the North American agreements and institutions that exist, not to mention an international body that is studying this very issue.

More specifically, the Secretariat of the North American Commission for Environmental Cooperation (NACEC) has a major initiative on 'Environmental Challenges and Opportunities of the Evolving Continental Electricity Market'. (This initiative arises out of the NACEC Secretariat's ability, deriving from Article 13 of the North American Agreement on Environmental Cooperation, to "prepare a report for the Council on any matter within the scope of the annual program.")

The Secretariat – guided by the advice of an international advisory board – has prepared a draft report that examines

> "recent developments in the electricity sectors in Canada, Mexico and the USA, possible environmental quality impacts resulting from restructuring and other developments and also explores policy issues related to recent developments in the adoption of environmentally preferable electricity, including so-called 'green electricity' labelling and certification systems." [30]

A draft of the report was the subject of a public symposium, held in San Diego, California at the end of November 2001. After a period of public input (which drew to a close on 10 January 2002), the Secretariat was scheduled to produce a final report for the governments of Canada, Mexico and the USA.

During the process, the potential pressures for a continent-wide 'green electricity standard' were highlighted by both the CEC Secretariat and those participating in the broader debate facilitated by the Secretariat. In a recent document, for example, the Secretariat notes that although no formal trade issues have yet arisen among NAFTA parties around electricity issues, one that could generate concern is the

> "effects of nonuniform RPS standards between different jurisdictions, whether such differences can be used to condition market access and whether such conditioning may raise trade rule issues." [2, p.14]

Horlick and colleagues investigate this further, exploring the "possible relationship between NAFTA rules and environmental regulations or standards related to the electricity sector" [31, p.1].

Indeed, concerns about the impact of divergent electricity standards (including definitions of 'green electricity') within North America – and the potential for environmentally-damaging trade and/or investment disputes to arise – may be motivating some to call for some kind of harmonisation. Whatever the reason, calls are arising. The Canadian Electricity Association, for example, has stated that it believes that it is "critical for the Canadian government to develop a clear and consistent stance with respect to the definitional question of ... renewable 'green power'" [32, p.43]. Similarly, the Joint Public Advisory Committee (of the North American Commission for Environmental Cooperation) called upon the NACEC to promote "the adoption of similar criteria by the NAFTA parties for defining green power" [33]. Hence, an examination of the potential sustainability impacts of such a standard is timely.

Conceivably, there are at least four different ways in which a continental standard could be developed. We identify them as:

- continental standard with no local variation
- continental standard with 'objective' local variations
- continental standard with local interpretations
- continental norms with local priorities

(We use the terms 'continental' and 'local' loosely here. They are simply illustrative of the different kinds of scale we are referring to – they could equally be called 'international' and 'national', respectively, in other instances.) In the following paragraphs, we briefly identify each in turn.

In the UK, there exists a 'green electricity' certification program that is akin to a 'continental standard with no local variation'. Called 'Future Energy', it is administered by the Energy Savings Trust, a non-profit body that was set up by the UK government and major energy companies. The requirements for qualification are relatively rigid. For example, hydropower facilities under 10 MW generally qualify, while only new (post-1990) ones over 10 MW qualify. Similarly, biomass facilities (e.g., landfill gas and the combustion of agricultural and forestry wastes) qualify. Most importantly, however, the same criteria are applied throughout the UK [34].

Canada's 'EcoLogo' program (introduced above) is one of those we are identifying as analogous to a 'continental standard with 'objective' local variations'. For the most part, the Canadian program has nationally-set requirements, with limited regional exceptions. That exception which does occur, however, is 'objectively' defined. More specifically, biogas-fuelled and biomass-fuelled electricity facilities located in 'TOMAs' – that is, tropospheric ozone management areas as defined by the United Nations Economic Commission for Europe in the 1991 Geneva Protocol Concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes (namely, the Lower Fraser Valley in British Columbia and the Windsor to Quebec City Corridor in Ontario and Quebec) – have stricter atmospheric emissions limitations.

Third, a good example of a kind of 'continental standard with local interpretations' is the USA's 'Green-e' program (introduced above). In each case, respective guidelines are developed by a Regional Advisory Committee, which includes representatives from "local environmental organisations, power marketers, renewable developers, energy policy experts and other interested parties" [28, p.13].

The Green-e standard "may be modified upon recommendation of a Regional Advisory Committee to the Green Power Board, the governing body of the Green-e Program. In all cases, the definition applies unless and until more rigorous standards are adopted by the Board" [28, p.4]. The Green Power Board is made up of members from stakeholder groups that support renewable resources, consumer protection and environmental improvement [28]. The standards are therefore slightly different in each of the regions that have to date adopted Green-e requirements, with each state or region adding its own restrictions to the original definition. The incineration of municipal solid waste, for example, qualifies as 'green electricity' in California, but does not in the mid-Atlantic or New England regions.

Finally, an example of an approach similar to one of 'continental norms with local priorities' comes by way of Australia's 'Green Power' program. In this instance, representatives from five state government agencies – New South Wales, Victoria, Queensland, South Australia and the Australian Capital Territory – established the National Green Power Accreditation Steering Group (NGPASG) and the Sustainable Energy Development Authority (SEDA), a New South Wales government agency, was appointed Project Manager [35, p.1]. The NGPASG is now also 'in correspondence with' representatives from the federal government, Tasmania and the Northern Territory [36, p.2]. It is responsible for establishing common accreditation criteria, disseminating Green Power information within members' respective jurisdictions and enlisting a Project Manager to 'carry out the administration of the Program' [36, p.3].

Although guidance as to what does and does not qualify for certification is included in the 'national' documents, much of this is of a general nature. So instead of specific quantitative emission limits for landfill gas generators (as is the case in, for example, the Canadian EcoLogo process), it is noted that the use of "best practice NO_x control ... would assist the Project Manager in approving their use ..." [36, p.13]. The same document also highlights the importance of local voices: "Clearly these views [as to what qualifies for certification] are general and cannot take account of particular local factors that may concern potential participants" [36, p.12].

Taking this to the North American situation, we could envisage each of these variations (and others, no doubt). To launch discussion about the prospective impacts of such approaches for sustainability – namely the potential for developing an electricity system charactertised by many of the 'soft path' attributes identified in Section 2 of this article – we consider the two ends of this spectrum laid out above. (We recognise, however, that these four scenarios do not necessarily delimit the entire range of possibilities. There could, for instance, be no continental coordination of green power programs. Nevertheless, we use two of the four scenarios to stimulate discussion.)

We first consider the approach labelled above as 'continental standard with no local variation'. In this case, we are envisaging one standard to be applied across all of North America. In the following paragraphs, we identify some potential advantages associated with adopting this kind of approach.

In one sense, economies of scale would be created. Proponents of such an approach would argue that because a consistent definition for 'green electricity' had been adopted by such a large population (over 400 million people), product developers would only have to make one kind of product for this market. They would not, for example, have to install different kinds of emission reduction equipment on biomass generators, because of different rules in different locations across North America. This would serve to lower the unit production costs of renewable energy technologies and therefore increase the chances that green electricity becomes cost-competitive in the marketplace.

Additionally, entrepreneurs would be encouraged to develop renewable energy technologies, because they would be confident that if any kind of policy to support green electricity were to be introduced into any part of the continent, then they would benefit from it. They would not have to worry about local lawmakers excluding their technologies on what the entrepreneurs might perceive as some protectionist sentiment or other kind of patronage motivation. A continent-wide standard could preclude this from happening. The result could be that renewable energy developers are more willing to enter the marketplace, because they feel that the competition in the energy market will be based upon the quality of the technology rather than upon the political connections and lobbying skills of the technology's developer.

A continent wide standard for green electricity could also help to avoid a spiral to a 'brown' definition of 'green'. This could conceivably happen if competing jurisdictions were trying to attract new investment by loosening their respective definitions of 'green'. For example, one community might lessen the emission standards for landfill gas-fueled electricity facilities in order to attract the development of a new project (and the associated employment benefits, for instance). Mirroring larger debates about international environmental and social standards, the argument is simply that regulators might be willing to relax their respective standards for 'green electricity' if it meant that energy developers would be willing to invest in their economy. A continent-wide standard could prevent this.

Finally, Vaughan and colleagues [32, p.43] argue that "more definitional clarity in respect to renewable electricity ... could be a key to maximising environmental benefits." They elaborate:

> "Experience with 'green pricing' programs offered by utilities, for instance, has shown that the renewable message is more effective when it stays simple. Multiple definitions can lead to distrust among customers about competing claims and more generally to labelling or certification 'fatigue'."

Consumer confidence may thus be increased if there exists one common understanding, continent-wide, as to what qualifies as green electricity.

We consider next the other end of the spectrum that we have laid out above – namely, that which we called 'continental norms with local priorities'. In this instance, we envisage that broad intentions for green electricity standards have been laid out at the continental level. But these intentions are of a general kind – not so specific so as to preclude communities from making their own choices. It will then be left to the communities (however defined, geographically) to decide which specific resources to select and which to reject. Metaphorically, the continental authority will have laid out some boundaries, but it will be up to the individual community to decide where, upon the field, to play the ball.

Supporters would argue that this kind of 'regional' approach is preferable, largely because of the unique nature of electricity as a commodity. Unlike most products, electricity cannot be easily stored and it is costly to transport over long distances. Therefore, although there is increasing talk of national and international grids, one must not lose sight of the fact that electricity should still be thought of as a regional commodity. (Of course, others challenge this assertion. Not only do they point to existing long-distance sales of electricity – for example, from Canada to Mexico [32, p.48] – but they also suggest that by transporting hydrogen instead of electrons (for example, using Quebec's vast reserves of large-scale hydropower to generate hydrogen for small-scale electricity generators in Germany (e.g., [37]), electricity markets will soon become global).

Nevertheless, many still argue that, unlike markets for some other commodities, the scale of markets for electricity only extends so far. Additionally, many argue that, to increase the use of green electricity in any community, the 'bar' (that is, the dividing point determining what does qualify and what does not qualify as 'green electricity') should be placed very carefully. Although referring to debates about sustainable forestry, Gibson's remarks apply equally well to the challenge for proponents of green electricity:

> "A very high standard would reward the truly sustainable operations and set desirable goals for the rest. But it would leave certification far from the grasp of most forest companies in the world. Certified operations would serve isolated niche markets while most wood production and consumption would go on as before. A lower standard would encourage widespread if marginal improvements in industrial forestry. But the message would be misleading. Certified forestry would not be sustainable; it would just be somewhat less destructive and the basic characteristics of industrial forestry and global consumerism would remain." [38, p.1]

The challenge is simply this: how to strike the balance? Program designers want the definition to be sufficiently strict so as to encourage industry-wide improvement, but not so strict so as to make certified products virtually unobtainable.

Considering ecolabels generally, the Global Ecolabelling Network [18, p.7] has noted that, on average, "about 5-30% of products or services can initially meet the criteria and thus become eligible for certification." Moreover, a figure of 20% has been characterised as the 'current approach' in 'most programs' by the Network [18, p.79]. This, for many, is the level at which the proverbial bar should be placed – the way in which the balance should be struck.

If we agree with this assertion – that is, that some share of the electricity system (perhaps 20%) should be defined as 'green' – and if we agree that electricity markets are relatively restricted in scale (see above), then that means that different communities should have different requirements for what qualifies as green electricity.

In different communities, the 'top 20%' of the existing electricity system (in terms of environmental performance) will be made up of different kinds of power stations. In an electricity supply system that could be considered to be 'dark brown' (for example, the coal-dominated electricity systems in some parts of the USA mid-west), oil-fired power stations may well be part of this top 20%. Alternatively, in communities dominated by hydroelectric power (for example, British Columbia), all power stations in the top 20% may have close to zero emissions. Therefore, it may well be appropriate to define 'green electricity' broadly in the first, but narrowly in the second, in order to capture the 'top 20%' in each.

The same argument could be made with respect to communities' potential (in contrast with their 'existing') energy resources. Because different locations have different natural resource endowments (and therefore different near-term potential as to what could be part of that 'top 20%'), it may well be appropriate to have different standards for green electricity. So while California (in the USA) and Baja California (in Mexico) have a range of green electricity possibilities poised for development – for example, wind energy, solar energy, tidal energy and wave energy – Nunavut (in Canada) does not have as many options. Accordingly, more kinds of electricity resources should qualify as 'green' in Nunavut, as compared with Southern California and Baja California. Again, the justification is that we want to have, in the foreseeable future, the same share of each system (perhaps 20%) defined as 'green'.

Indeed, there is an argument that without some kind of regional approach, the only continental standard that could be developed would be the 'lowest common denominator' (arising from the required political negotiations). Accordingly, a relatively 'loose' continental standard for green might result, which would mean that large portions of the electricity system would qualify as 'green' in some parts of the continent. This might then mean that the 'green electricity' label loses all credibility in those locations and thus does little to advance sustainability.

Turning from locations' natural (or physical) systems to their social systems, we next consider the policy context. Should different parts of the continent continue to choose different kinds of policy strategies to encourage green electricity (see the discussion of some such options in Section 3 above), it may be that different definitions for green electricity are appropriate for different kinds of policies. Arguably, perhaps the definition for 'green electricity' in a SBC context should be restricted to those resources that show most promise for sustainability, but that also appear most cost-inefficient (for example, solar). While in an RPS context, all means of producing green electricity (including the most cost-efficient ones, such as wind) should be included, so that the resultant pool of power is as low-cost as possible.

Finally, in a system with ecolabelling, studies have revealed that 'perceived consumer effectiveness' is particularly important (for the general case, see [39]). In other words, "the extent to which a respondent believes that an individual consumer can be effective in pollution abatement" [40, p.21] will be an important determinant in an individual's decision to purchase green electricity (often at a premium-cost). Put most simply, those who feel that their purchase would have a positive impact upon their environment are more likely to actually make the purchase – that is, to buy green electricity. Wiser [41, p.116] supports this by arguing that there may be benefit to tying the purchase of green electricity to health benefits: "wherever possible, green marketers should make the environmental benefits of their products as personal as possible; for example, appealing to personal health rather than general reductions in air pollution levels." Regulators, therefore, may want to encourage the uptake of green electricity generated by local renewable energy facilities, so that many of the environmental benefits are captured by the local community. This may, in turn, encourage greater consumer purchasing of green electricity.

More generally, a 'regional' approach is supported by ideas about 'subsidiarity' (that is, the belief that actions should be taken at the 'lowest' possible level – for example, at the local level rather than the national level) and the apparent importance of 'local voices' in the promotion of sustainability (e.g., [42,9]). The argument is simply that those who live in a particular area are best able to judge what approaches are most sustainable.

For each of the two ends of the spectrum investigated here, only the benefits have been highlighted. This is largely because the benefits of one end of the spectrum equally serve as the drawbacks of the other end of the spectrum. Of course, many of these same issues would arise for those approaches identified as being between these two ends – that is, what we are calling 'continental standard with local interpretations' and 'continental standard with 'objective' local variations'.

6 Conclusions

The purpose of this paper has been to investigate the implications, for sustainability, of a continental-wide standard for green electricity. With growing interest in green electricity motivated by increasing environmental concerns and with the possibility for green electricity increasing as a result of electricity industry restructuring, it is timely to investigate the appropriate scale for standardisation. This article has highlighted some of the sustainability implications of two different ways in which a continental standard could be developed. Each appears to have a number of potential positive consequences for sustainability.

On the one hand, a continental standard with no local variation may provide the right environment for green electricity developers. Increased confidence in the investment climate may lead such developers to produce large quantities of renewable energy technologies for the continental market. A continental standard would also provide consumers with a simple and singular definition for green electricity. This may lead to greater trust and confidence in green electricity on the part of the general public. As a result, the general public may be more willing to support strategies advancing the use of green electricity. Finally, a continent-wide definition could prevent regional 'watering-down' of the definition of green electricity.

On the other hand, a set of continental norms with local priorities may provide communities across North America with the flexibility necessary to increase the sustainability of their own electricity supply system. By acknowledging and responding to regional differences in the resource content of electricity systems, in resource endowments and in health and environmental challenges, communities could develop different definitions of green electricity. In this way, each community could identify their own path for sustainability.

As we have reviewed in this article, there are strong arguments to support each position. As national and international bodies continue to consider the appropriate ways to manage our electricity systems, they would be well-advised to continue to examine the impacts of these – and other – kinds of approaches to green electricity regulation. Given the size and potential impact of the continental electricity industry, such an examination is critical to the prospects for North America's sustainability.

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