Sustainable Prosperity

Policy Brief December 2011

FOR A LOW CARBON ECONOMY

The Potential of Tradable Renewable Energy Certificates (TRECs) in Canada[1]

Sustainable Prosperity is a national research and policy network, based at the University of Ottawa. SP focuses on market-based approaches to build a stronger, greener, more competitive economy. It brings together business, policy and academic leaders to help innovative ideas inform policy development.

Key messages

- Tradable Renewable Energy Certificates (TRECs) are a non-tangible, tradable commodity that represent proof that one megawatt-hour (MWh) of electricity was generated from a renewable energy resource. Two main markets exist for TRECs: voluntary markets, in which consumers seek to demonstrate they are using "green" electricity, and compliance markets, in which energy suppliers need to provide a certain percentage of renewable power to meet the requirements of renewable portfolio standard (RPS) policies.
- Voluntary markets currently exist in Canada, facilitated by existing tracking and certification systems that ensure TRECs are not double counted and provide additional renewable capacity. However, unlike Europe and the United States, Canada does not have compliance markets for TRECs. Compliance markets are facilitated by state-level RPS policies in the US, and various national RPS policies in Europe (including green certificate obligation policies). Canadian policy-makers have tended to use other policy approaches to promote renewable energy.
- The variation between TREC systems and RPS policies across jurisdictions poses a challenge for a more integrated – and more liquid – TRECs market. In the US, differences between state-level programs have resulted in a fragmented and complex TRECs marketplace. Prices for TRECs have varied substantially over time, across jurisdictions, and are dependent on the specific attributes of an individual TREC (including the vintage, source, and location of the renewable resource).

Sustainable Prosperity
c/o University of Ottawa
555 King Edward Avenue
Ottawa, ON K1N 6N5
613-562-5800 x3342
www.sustainableprosperity.ca

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- Interactions between voluntary and compliance TRECs markets, and between TRECs markets and other renewable energy policy instruments, can be complex. Policy must be designed to avoid double counting and be transparent about the conditions under which renewable energy projects receive support from multiple policy instruments.

The Issue

Increasing renewable electricity generation is a critical step for the decarbonisation of the Canadian energy system. Tradable Renewable Energy Certificates (TRECs) – sometimes also known as green tags, alternative energy credits, tradable green certificates, or renewable energy credits[2] – are a key market-based tool to support increased development of renewable energy. TRECs have become increasingly important in the US because of the large number of state-level Renewable Portfolio Standards (RSP) policies that have been implemented in the last 10 years. Between 2004 and 2009, 16 states, as well as the District of Columbia, adopted RPS policies, and most of these policies include mechanisms for TRECs.[3] Recent federal policy proposals in the US have also included TRECs.

In Canada, however, TRECs have only a limited market. As this paper will note, Canadian jurisdictions are covered by tracking systems to monitor TRECs trading and certification systems to ensure credibility of TRECs generated from renewable projects. However, demand for TRECs within Canada generally only exists from voluntary markets. Canadian policy-makers have not implemented policies like renewable portfolio standards that would create compliance markets for TRECs. They have instead relied on other renewable policy mechanisms like feed-in-tariffs and standard offers to increase the proportion of energy generated from renewable sources. Consequently, the price of TRECs – and the corresponding incentive from TRECs sales for new renewable power projects – remains low.

Demand for TRECs within Canada generally only exists from voluntary markets. Canadian policy-makers have not implemented policies like renewable portfolio standards that would create compliance markets for TRECs.

This *Policy Brief* draws on international experience to explore the state of knowledge for TRECs and to assess TRECs in the context of Canadian policy. First, it takes a theoretical look at TREC systems, explaining their operation and benefits. It then provides a high-level overview of international TRECs systems. It then explores key issues in TREC systems, drawing on lessons learned from specific programs implemented in various international jurisdictions. Finally, it explores the implications of the current state of the knowledge on TRECs for Canadian policy-makers.

2 This *Policy Brief* consistently uses the term 'TRECs' to represent the mechanism, but refers to specific labels as required when discussing specific systems in specific jurisdictions. The *Brief* will use certificate(s) to refer to the instrument generally.

3 Center for Energy Economics (2009). *Harmonization of Renewable Energy Credit (REC) Markets across the US* Report for State Energy Conservation Office, Texas.

The Knowledge Base

This section explores TRECs' operation, benefits, and the design details that differentiate the various TRECs systems that have been implemented internationally.

What Are TRECs and How Do They Work?

Tradable Renewable Energy Certificates (TRECs) are a non-tangible, tradable commodity that represents proof that one megawatt-hour (MWh) of electricity was generated from a renewable energy resource. Each TREC typically must be certified by a third party organization, usually has a unique serial number, and is valid in a specific jurisdiction. Importantly, TRECs represent the renewability attribute of a MWh of electricity, not the electricity itself. As a result, TRECs can, in some cases, be bought and sold independently of electricity transactions, though they are often sold together (or "bundled") with the actual electricity as well.

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Figure 1, on the next page, graphically illustrates a typical structure in which TRECs are created, sold, and retired. This structure describes a system that certificates unbundled TRECs trading (that is, trading of TRECs independently from wholesale electricity). Key steps in this process are as follows:

1. The institution overseeing the market issues TRECs to renewable electricity suppliers based on the MWhs of electricity they generate using eligible technologies. Renewable suppliers must become accredited by providing proof of eligible generation.
2. Electricity suppliers sell electricity into the power market. This electricity can come from renewable and non-renewable sources. The power market does not distinguish between different kinds of generation; electricity is electricity.

Suppliers can also buy and sell TRECs on a separate TRECs market. Demand for TRECs – and consequently their value – derives from two different markets:

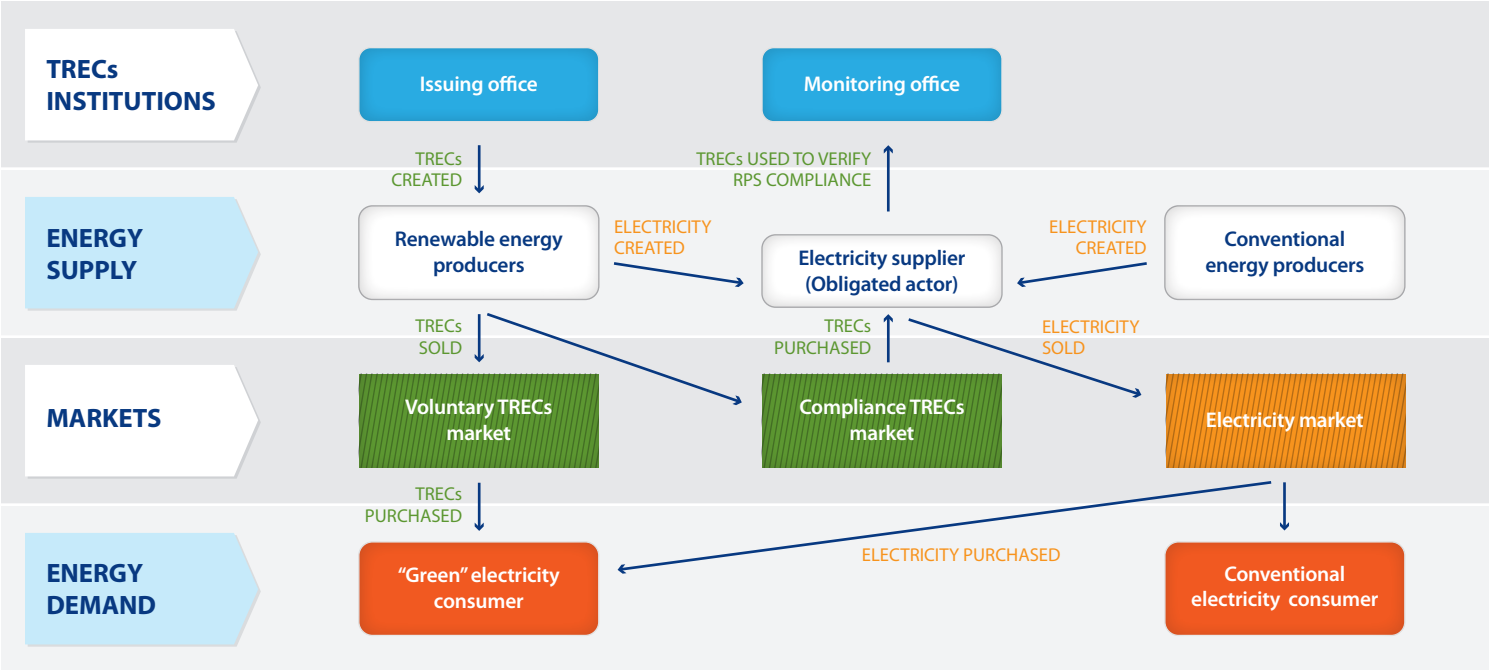
a. In *voluntary markets,* consumers purchase TRECs to demonstrate they are consuming renewable electricity. When a consumer purchases both electricity from the undifferentiated power market *and* a TREC, they have effectively purchased renewable electricity.

b. In *compliance markets,* the obligated actor (typically the supplier or distributor of energy) purchases TRECs to demonstrate compliance with government policies that mandate a minimum share of renewable electricity generation. These policies are called renewable portfolio standards (RPS).

3. The price of TRECs is determined by the TRECs markets. The higher the market price for TRECs, the greater the incentive to produce more renewable electricity. However, TREC prices can vary significantly, depending on factors like the renewable technology used to generate the power and the vintage of the generation (i.e., whether the generating capacity is new or old).

4. A TREC is retired either when used for compliance with an RPS or purchased by an electricity consumer. Retirement means that the TREC is removed from trading, so that its renewable attributes cannot be counted twice.

Figure 1: Key transactions and flows in a TRECs system



Source: Adapted from van der Linden, N.H. *et al.* (2005). *Review of International Experience with Renewable Energy Obligation Support Mechanisms.* Energieconderzoek Centrum Nederland, Netherlands; and Whitmore, Johanne and Bramley, Matthew. (2004). *Green Power Programs in Canada – 2003*. The Pembina Institute.

Why Use TRECs?

From the perspective of policy-makers looking to increase the amount of energy generated from renewable sources, TRECs offer several advantages, as outlined below.

- **TRECS can increases the cost-effectiveness of an RPS policy.** RPS policies are a policy tool to incent renewable energy technology by mandating increasing generation from renewable sources. The market for TRECs ensures that renewable generation with the lowest cost will be developed first. Firms with opportunities to produce more renewable electricity at a lower cost will do so in order to sell excess TRECs on the market. Firms with less opportunity have the choice to purchase certificates rather than building high cost renewable capacity. Unbundled TRECs are easier to trade than electricity. As a result, they can broaden the geographic scope of new renewable projects, and can also reduce transmission costs.[4]
- **TRECs provide a transparent mechanism for ensuring compliance with the RPS.** TRECs transactions provide a method of tracking renewable generation developments and a simple way of monitoring RPS compliance.
- **In voluntary markets, TRECs enable consumers to effectively consume renewable electricity by using electricity from conventional power grids.** By purchasing TRECs, consumers can support renewable electricity without actually connecting directly to a wind turbine or other renewable source. The flexibility of TRECs allows the renewable power to be generated anywhere.
- Finally, whether sold on the voluntary or compliance markets, **TRECS offer new revenue streams for renewable projects.** Sales of TRECs can incent new renewable development and can in some cases even be the difference in making projects economically viable. Effectively, the market price of TRECs sends a price signal to renewable developers. Even small renewables projects can reap the benefits of this incentive as TRECs brokers can bundle together multiple renewable projects.[5]

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4 Holt, Ed, and Wiser, Ryan (2007). *The Treatment of Renewable Energy Certificates, Emissions Allowances, and Green Power Programs in State Renewables Portfolio Standards.* Lawrence Berkeley National Laboratory, California.

5 Holt, Ed, and Bird, Lori (2005). *Emerging Markets for Renewable Energy Certificates: Opportunities and Challenges.* Lawrence Berkeley National Laboratory, California.

Which TRECs Design Details Matter?

Significant variation can exist in the design details of a TRECs system and RPS policies that establish compliance markets for TRECS. Table 1 identifies key design characteristics for a RPS and TRECs program.

Table 1: Key design characteristics in TRECs and/or RPS programs

DESIGN ISSUE	Details
Obligated actor	Usually, the obligated actor is the retail electricity supplier or distributor, but the obligation can also be placed on energy producers or consumers. The obligated actor must demonstrate that a certain percentage of electricity supplied comes from renewable sources by submitting sufficient TRECs. These firms can purchase TRECs to achieve their renewable energy quotas.
Issuing body or institution	Often a public body issues, registers, and redeems TRECs, providing oversight and monitoring compliance.
Eligible resources	Specific technologies can be excluded or targeted for additional support.
Banking and/or borrowing (temporal flexibility)	Although not typical in a TRECs market, banking or borrowing of credits (i.e. allowing their use outside of their "vintage" or date of issuance) can provide some flexibility.
Minimum and/or maximum TREC prices	A minimum price can be guaranteed by government to ensure support for renewables. A maximum price (which can also be implemented as cost of non-compliance) limits the costs of compliance. These measures are typically outlined in RPS legislation.
Use of penalty revenues	Revenue from non-compliance penalties can be devoted to general revenue, recycled back to actors, or devoted to additional support for renewable energy.
Treatment of existing plants	In some cases, existing renewable capacity is eligible for allocation of TRECs. But in general, only new capacity is included in order to focus incentives on building new capacity.
Technology Set-asides, tiers, or carve-outs	Some RPSs specify that a certain share of the renewable mandate must be achieved through a specific technology. For example, carve-outs for solar TRECs are increasingly common. This approach allows an RPS to target specific technologies or ensure support for a diverse set of technologies.
Credit multipliers	Considerations include whether every MWh of renewable energy generated is treated equally and awarded a single TREC, and if generation from specific renewable resources is provided more or less support by receiving multiple or fractional TRECs per unit of electricity generation.
Geographic considerations	The key question is whether TRECs from other jurisdictions and other tracking programs are accepted.

Source: Adapted from van der Linden, N.H. *et. al,* (2005). *Review of International Experience with Renewable Energy Obligation Support Mechanisms.* Energieconderzoek Centrum Nederland, Netherlands and Center for Energy Economics (2009) *Harmonization of Renewable Energy Credit (REC) Markets across the US* Report for State Energy Conservation Office, Texas.

International Experience

International experience with Renewable Portfolio Standards and TRECs provides insight as to how these mechanisms have worked in practice. Multiple jurisdictions have implemented RPS policies to drive compliance markets for TRECs, as well as tracking and monitoring institutions that enable TRECs trading more broadly. Extensive data and analysis paints a picture of TRECs markets in the US, both in terms of volume of trade and TRECs prices. An overview of Canadian TRECs markets puts international experience in a Canadian context.

Policies Enabling TRECs Compliance Markets

Internationally, several federal jurisdictions have implemented RPS policies with tradable certificates allowed, and select examples are shown in Table 2. Other similar programs exist in countries such as Italy, Belgium, Sweden, and Poland.

Table 2: Overview of Select National Compliance markets for with Tradable Renewable Energy Certificates or Equivalent

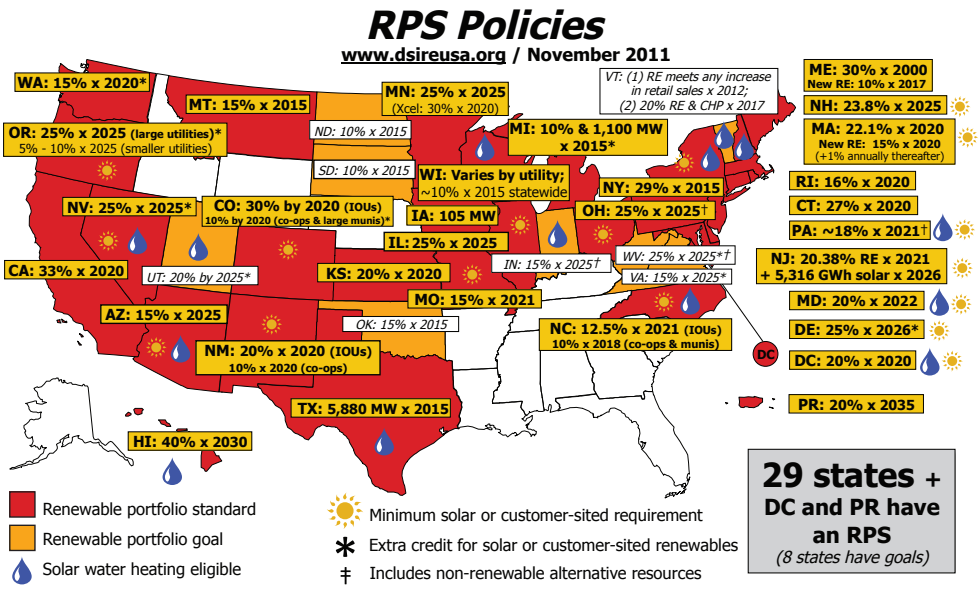
COUNTRY	Name	Details	Year established or updated
Australia	Renewable Energy Target (RET)	This program substantially increases the required renewable capacity from the previous Mandatory Renewable Energy Target program (by factor of four). The RET splits the market into two distinct programs, each with tradable certificates: 1) the Small-scale Renewable Energy Scheme (SRES) covers small-scale technologies; 2) the Large-scale Renewable Energy Target (LRET), which is expected to provide the bulk of the new renewable capacity. This split was introduced to explicitly provide incentives for both small- and large-scale renewables.	2010 (updated from 2001)
Japan	Green Power: Renewable Portfolio Standards	The amount of renewable energy electricity retailers are obliged to use each year is established according to retailed electricity quantities, to ensure the stability and suitability of energy supply based on the "Special Measures Law Concerning the Use of New Energy by Electric Utilities". Electricity retailers may choose to meet their obligations from the following options: 1. By generating electricity from renewable sources itself; 2. By purchasing the new energy electricity from another party; and, 3. By purchasing "New Energy Certificates" from another party. Energy included in the Renewable Portfolio Standard include solar, wind, biomass, medium and small-sized hydro, and geothermal generation.	2003 (building on 1996)
United Kingdom (UK)	Renewables Obligation Order	The UK mandates a national renewables target that will rise to 15% of generation by 2015. Renewable Obligation Certificates (ROCs) are awarded to accredited electricity suppliers that generate electricity from eligible sources. While ROCs are typically sold to an obligated utility through the power purchase agreement, they can also be sold to other suppliers. See below for more details.	2009 (updated from 2002)

Source: Adapted from data from the IEA Renewable Energy Policy Database http://www.iea.org/textbase/pm/?mode=re.

As illustrated in Figure 2 on the following page, 29 US states have also implemented RPS systems, and all but three programs allow for trading of TRECs.[6]

6 Database of State Incentives for Renewables and Efficiency (DSIRE) http://www.dsireusa.org. Accessed November 25, 2011, last updated November 2011.

Figure 2: Summary of US State-level Renewable Portfolio Standard Policies as of November 2011



Source: Database of State Incentives for Renewables and Efficiency (DSIRE) http://www.dsireusa.org. Accessed November 25, 2011, last updated November 2011.

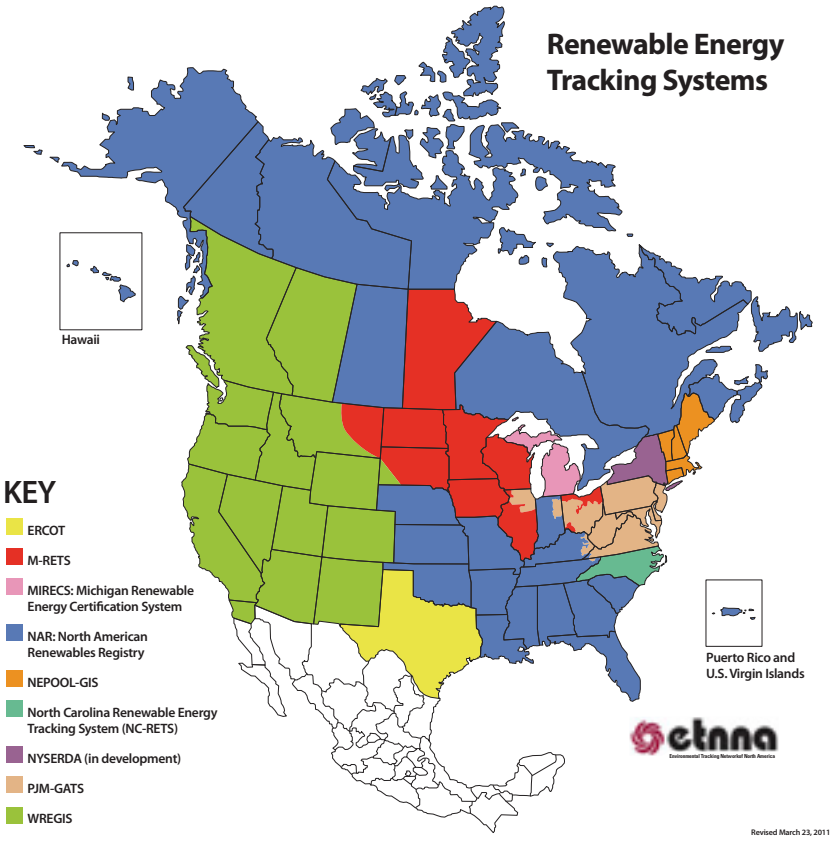
Institutions for Tracking, Monitoring and Certifying TRECs

Tracking and monitoring institutions oversee TRECs markets. They issue certificates to renewable energy installations, track certificates sales, and monitor the certificates through the transactions in order to provide a record of ownership. They also administer the retirement of a TREC when it is used to comply with RPS policy, or when a consumer buys and uses "green electricity", in order to prevent double-counting of certificates. Each TREC typically has a unique serial number, and is tracked through an internet database system in which all the attributes of a TREC (its location, source of generation, vintage, certificate issue data) are available for viewing. The data tracked varies somewhat from tracking system to tracking system.[7]

To support state-level RPS policies, electronic TRECs tracking organizations have evolved to support RPS policies and voluntary markets. Several regional tracking systems are in operation, with more in development. All of Canada and the US are now covered by tracking systems, as illustrated in Figure 3 on the next page.

7 Holt, Ed and Bird, Lori (2005). *Emerging Markets for Renewable Energy Certificates: Opportunities and Challenges.* Lawrence Berkeley National Laboratory, California.

Figure 3: North American Tracking Systems for Renewable Energy Certificates



Source: Environmental Tracking Network of North America (ETTNA) (2011) http://www.etnna.org/images/ETNNA-Tracking-System-Map.gif

Jurisdictions without compliance markets from RPS policies such as Canada are still covered by tracking systems because some state-level RPS policies allow for TRECs to be purchased from different jurisdictions, as long as the TREC can be tracked within a tracking system (or in some jurisdictions, between different tracking systems). As a result, for example, California energy suppliers can meet their RPS obligations by purchasing TRECs from a renewable project in Alberta or British Columbia (BC) because these provinces are part of the WREGIS tracking system.[8] Cross-border transactions are becoming increasingly common, especially for hydroelectricity. The impact of state-level (and potentially national) RPS systems on Canadian energy exports is a major factor in how much electricity Canadian provinces can export to the US – and on what terms.

Related to tracking, certification is the process by which independent organizations verify the type and quantity of renewable generation in order to provide assurance of credibility and meeting a minimum standard of quality for voluntary markets.[9] Certification can also ensure the attributes of a TREC are not double counted. Certification processes often use

8 For example, in June 2011, TransAlta in Alberta agreed to sell between 175,000 and 210,000 TRECs to the Pacific Gas and Electric Company in California. For details see: http://www.pacificgas.info/nots/rates/tariffs/tm2/pdf/ELEC_3862-E.pdf.

9 Holt, Ed., and Bird, Lori (2005). *Emerging Markets for Renewable Energy Certificates: Opportunities and Challenges.* Lawrence Berkeley National Laboratory, California.

The EcoLogo Certification Program in Canada

While no national compliance market for TRECs exists in Canada, Environment Canada's EcoLogo program established a system for certifying RECs that was finalized in 2010. This certification standard does enable voluntary markets for TRECs in Canada. Indeed, firms such as Bullfrog Power sell "green power" at a premium price, with credibility supported by EcoLogo tradable renewable certificates.

The published standard identifies two distinct products: 1) *Bundled Renewable Low-Impact Energy* which corresponds to a bundled unit of electricity and its renewable attributes; and 2) *Renewable Energy Certificates (RECs),* which is an "authorized electronic or paper representation of the environmental, social, and premium economic attributes associated with the generation of 1 MWh of low-impact electricity." This definition corresponds with how TRECs have been broadly defined in this report.

The standard clearly lays out the criteria for EcoLogo to certify electricity generation as low-impact to renewable produce. It identifies the renewable energy technologies that qualify and the processes that must be carried out, and it lays out rules for avoiding double-counting. It also establishes processes for verification that RECs and Bundled Renewable Low-Impact energy meet the standards described. To address issues of additionality, the standard establishes vintage benchmarks for when new renewable generation capacity can be considered valid for EcoLogo certification. For example, if a REC is sold in 2010, the renewable electricity generation must have been placed in operation after 1997.

Source: EcoLogo (2010). *CCD-003 Renewable Low Impact Electricity: Background Technical Document to Draft 3.0.* EcoLogo.

certificate tracking systems to verify compliance with renewable energy quotas, but also to substantiate voluntary claims of support for "green energy," and safeguard against trading abuses.[10] To be effective, certification must be independent from the TRECs market. In the US, the most widely used certification standard is the Center for Resource Solution's Green-e TRC Standard. Approximately 84% of TRECs in the US are certified by Green-e.[11] In Canada, the EcoLogo program is the main certifier of green power, though the EcoLogo label is also used in the US and elsewhere in the world. EcoLogo is the only program in North America that meets ISO 14024 standards for environmental labels. The two programs are not mutually exclusive; to qualify for green-e certification, for example, Canadian hydro-power projects must be EcoLogo certified.[12] The Canadian context is discussed in more detail below.

Impacts of RPS Policies and TRECs

Assessing the effectiveness of RPS policies is challenging, given that multiple factors can lead to increases in renewable energy capacity. Isolating one causation factor is not straightforward. Further, assessing the effect of the RPS requires determining how much capacity would have been developed even in the absence of policy. In the US, for example, states without RPS policies have also seen growth in renewable electricity in the last decade.

Use of TRECs to support RPS policies does not increase the effectiveness of an RPS. Instead, tradable certificates improve the cost-effectiveness of the policy.

Other experience from the US does however provide some evidence that RPS policies have led to increased renewable power. The Berkeley National Research Laboratory suggests that 50% of total wind additions in the US were motivated at least in part by state-level RPS policies.[13] Similarly, statistical analysis found that states with RPS programs have experienced larger growth in wind power than those without.[14] Mandating a quota for renewable power through an RPS does not, however, necessarily ensure that energy suppliers will meet the quota. Programs in both California and the UK did not achieve their targeted levels of renewables. Cost caps that limit the price of TRECs are one important factor in reducing the effectiveness of an RPS.

Importantly, use of TRECs to support RPS policies does not increase the effectiveness of an RPS. Instead, tradable certificates improve the cost-effectiveness of the policy, and allow suppliers to comply with an RPS at reduced cost.

10 Ibid.

11 Hendricks, Meg and Wheelock, Clint (2010). *Executive Summary: Renewable Energy Certificates.* Pike Research LLC.

12 Center for Resource Solutions (2011). *Energy: National Standard Version 2.1.* Center for Resource Solutions, California.

13 Wiser, Ryan *et al.* (2007). *Renewable Portfolio Standards: A Factual Introduction to Experience from the United States.* Ernest Orlando Lawrence Berkeley Laboratory, California.

14 Menz, Fredric, and Vachon, Stephan (2006). The effectiveness of different policy regimes for promoting wind power: Experiences from the states. *The Energy Journal* (34) 1786–1796.

Voluntary markets have typically experienced lower prices for TRECs, thus providing reduced incentives for increased renewable capacity. Whether or not voluntary TRECs markets have led to increased renewable capacity depends on how rigorous the program is in ensuring *additionality,* or the extent to which TRECs are only issued to new renewable power projects that would not been developed without added revenue from the TRECs. The issue of additionality is discussed in more detail below.

Outlook for TRECs Markets

The extensive data and analysis from US TRECs markets provides an indication of the outlook for TRECs markets overall. US markets are relevant for Canada given the integration between the Canadian and US electricity grids, the electricity trade that occurs across borders, and the fact that three TRECs tracking systems include both US states and Canadian provinces. The compliance market in the US has grown rapidly with the increase in state-level RPS policies. In 2012, around 46% of US electricity generation will be covered by RPS policies.[15] Over 65% of the total new wind power capacity built between 2001 and 2007 in the US was motivated, at least in part, by state RPS policies.[16]

Analysts also expect both voluntary and compliance TRECs markets in the US to continue to grow. A recent forecast of voluntary markets from the National Renewable Energy Laboratory suggests that voluntary demand for renewable energy in the US could increase by two to five times from 2009 to 2015, increasing from around 30 million MWh to between 63 and 157 million MWh in 2015, with even larger potential by 2020. The analysis assigns an important role to TRECs markets in promoting this growth.[17] A second forecast, from Pike Research, supports these findings, forecasting an average compound growth rate in US voluntary markets of between 8.6% and 17.2% per year, depending on overall economic growth. Similarly, Pike forecasts that the compliance market in the US will grow at 11% annually, but would grow at 16.7% annually if the federal government implemented a national RPS.[18]

Prices of TRECs have varied substantially across markets, jurisdictions, and over time. From 2003–2006, prices in US compliance markets have ranged from under $10 to around $200 for New Jersey Solar RECs.[19] Prices in some states are substantially higher than in others, and in almost all states, the market price has fluctuated substantially over the course

15 Wiser, Ryan and Barbose, Galen (2008). *Renewable Portfolio Standards in the United States: A Status Report with Data through 2007.* Lawrence Berkeley National Laboratory, California.

16 Ibid.

17 Bird, Lori, Holt, Ed, Sumner, Jenny, and Kreycik, Claire (2010). *Voluntary Green Power Market Forecast through 2015.* Lawrence Berkeley National Laboratory, California.

18 Hendricks, Meg and Wheelock, Clint (2010). *Executive Summary: Renewable Energy Certificates.* Pike Research LLC.

19 Wiser, Ryan and Barbose, Galen (2008). *Renewable Portfolio Standards in the United States: A Status Report with Data through 2007.* Lawrence Berkeley National Laboratory, California.

The Texas Renewable Portfolio Standard with tradable RECs

Texas implemented its Renewable Portfolio Standard with tradable Renewable Energy Certificates (RECs) in 2002. It is one of the oldest and most active programs in the US Retail electricity providers can comply with the standard by acquiring RECs based on their share of state-wide electricity sales. The Public Utility Commission of Texas has the authority to cap REC prices and also to suspend the RPS in order to protect the reliability of the electricity grid as a whole.

Because RECs were unbundled from electricity, retailers can meet their obligation through lowest cost renewable generation anywhere in the state without physically transmitting the power. High wind capacity in West Texas experienced most capacity increases. As a result, Texas has actually exceeded its required capacity and met its 2009 target four years early.

Despite the program's success, the state revised the program in 2005 and 2007 to address key issues. A 2009 paper surveyed Texan stakeholders to identify key lessons learned from the Texas RPS experience.

First, the increase in capacity and early achievement of targets led to a sharp collapse in REC prices, as insufficient demand for certificates was created from the RPS. Non-participation of some municipal utilities and electricity co-operators exacerbated this problem by limiting the size of the REC market. Hoarding of certificates under the banking mechanism may have also had an effect.

Second, most capacity built under the program was in wind energy, and there was some concern regarding lack of diversification. In 2005, Texas deepened its target for more renewables and instituted a non-binding requirement for non-wind capacity. Lack of diversification in solar, biomass, and other renewables remains a concern for many stakeholders.

Finally, and most importantly, insufficient transmission lines from wind-intense West Texas dampened the market for renewables and TRECs, limiting sales of physical electricity. In response, the Utility Commission devoted effort to increasing transmission capacity.

Sources: Center for Energy Economics (2009). *Lessons Learned from Renewable Energy Credit (REC) Trading in Texas.* Report for State Energy Conservation Office, Texas; Wiser, Ryan and Barbose, Galen (2008). *Renewable Portfolio Standards in the United States: A Status Report with Data through 2007.* Lawrence Berkeley National Laboratory, California.

of three years. Specific attributes of a TREC affect its value, including the kind of technology used to generate power, the vintage of the renewable generation, and the jurisdiction in which power has been generated.

Canadian Context

The Canadian experience with TRECs and renewable energy differs from that of the US and other jurisdictions. Less analysis and data are available for Canadian systems, largely because the Canadian TRECs market is almost exclusively a voluntary market. Government policies to promote renewable energy generally have not relied on tradable certificates.

Canadian voluntary markets from 2003 to 2007 for both bundled electricity and unbundled TRECs (see Table 3 for a summary) exist in various Canadian jurisdictions.[20] A report by Pembina found that green power generation in Canada increased by 82% from 2003 to 2007, though the green power accounted for in the report accounts for only 1% of total power in Canada. Several programs that used to offer TRECs, such as the Ontario Green Tags program, are no longer in operation. In terms of certification, the EcoLogo certification program has become widely used, and is now widely recognized almost as an industry norm for green power in Canada.[21]

Less analysis and data are available for Canadian systems, largely because the Canadian TRECs market is almost exclusively a voluntary market. Government policies to promote renewable energy generally have not relied on tradable certificates.

20 Weis, Tim *et al.* (2009). *Green Power Programs in Canada.* The Pembina Institute.
21 Ibid.

Table 3: Summary of bundled and unbundled renewable attribute trading in Canada in 2007

PROGRAM	Price	Sales in 2007 (MWh)	EcoLogo-certified product
Bundled Electricity and Environmental Attributes Programs			
ENMAX Greenmax	Did not disclose	549,000	Yes
SaskPower GreenPower	$25/MWh	30,000	Yes
Oakville Hydro Green Light Pact	$60/MWh	217	No
Maritime Electric Green Power	$2.5/MWh above market price	570	No
Select Power's Selectwind	$87/MWh	Not operational in 2007	No
Nova Scotia Power Green Power	$40/MWh	Not operational in 2007	No
Bullfrog Power	ON Res: $89/MWh	30,000	Yes
Energy Ottawa	‡	90,000	No
Ontario Power Generation Evergreen Green Power	‡	153,196	No
Direct Energy Green Plan	‡	‡	Yes
Alberta Energy Savings Green Energy Option	‡	‡	No
Ontario Energy Savings Green Energy Option	‡	‡	No
TransAlta Green Energy and RECs	Varies	550,000	Yes
Stand-alone Environmental Attributes Programs			
BC Hydro Green Power Certificates	Varies	67,084	No
Canadian Hydro Developers Renewable Energy Certificates	Varies	600,000	No
EPCOR Green Power	‡	3,000	No
Pembina Institute Green Power for Computers	$27/MWh (desktops) $12.50/MWh (laptops)	8,411	No
Bullfrog Power Renewable Energy Certificates	ON: $30/MWh AP: $20/MWh	176,750	Yes
Green Tags Ontario	‡	Not operational in 2007	No
Constellation New Energy	‡	Not operational in 2007	Yes
TOTAL		**~1,427,000**	

‡ Data not available
Source: Weis, Tim *et al.* (2009). Green Power Programs in Canada. The Pembina Institute.

While Canadian voluntary markets for TRECs are small but active, as indicated in Table 3 above, no significant Canadian compliance markets exist. As a result, while TRECs don't play as important a role in supporting renewable energy in Canada as they do in the US, several provinces such as Prince Edward Island and Nova Scotia have implemented renewable portfolio standards, and other provinces have renewable energy targets, though TRECs are not used for compliance. Instead, provinces have provided other kinds of support for renewable energy. Federal and provincial governments have played a role as voluntary purchaser of green power through procurement policies. Utilities like BC Hydro or Manitoba Hydro have put out RFPs to buy wholesale renewable power generation to achieve renewable targets. Ontario developed a standing offer program to purchase renewable power, and later developed its Feed-in Tariff policy that guaranteed purchases for different kinds of renewable generation at different rates.

Key Policy Issues for TRECs

A closer look at few of the TREC systems that various jurisdictions have implemented – and in particular how they have evolved over time – is instructive in identifying key issues in TREC systems. Drawing on TREC systems in the California, Texas, and the UK as examples, this section explores key policy issues pertaining both to the design of TREC systems directly, as well as to the design of Renewable Portfolio Standards to create compliance markets for TRECs.

Additionality and Interactions Between Voluntary and Compliance Markets

In voluntary TRECs markets, consumers pay a premium for the renewable energy attributes associated with TRECs. The implicit assumption is that purchasing the TREC leads to new additional renewable generation that would not have occurred in the absence of the TREC sale. This idea of incremental new capacity is called *additionality.* According to the Environmental Protection Agency in the US, "It is this additionality that gives voluntary green power purchases their environmental integrity and marketability and, thus, underpins an effective voluntary market."[22] The issue of additionality is critical for TRECs markets.

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To achieve their goal of increasing the amount of energy generated from renewable sources and address issues of additionality, TRECs in the voluntary market must represent new capacity, not existing renewables projects. The attributes of a TREC capture its vintage, or age, if tracking and certification systems are in place. TRECs buyers can therefore distinguish higher quality TRECs that represent new capacity from lower quality TRECs that may not represent additional renewable generation. Typically, higher quality TRECs sell at a higher price. Yet some stakeholders are concerned lower quality TRECs could come to dominate the market by virtue of their lower price.[23]

Additionality is also a potential issue in compliance markets when TRECs are traded between a jurisdiction that has an RPS and one that does not. TRECs could be generated, for example, in a state or province without an RPS, but used for compliance in a state with an RPS. In this case, because the jurisdiction without the RPS has no renewable energy quota to meet, ensuring the additionality of the renewable project behind the TRECs is important for the credibility of the renewable portfolio standard in the regulated jurisdiction.

Similarly, interaction and overlap between the two main markets for TRECs – voluntary markets from green consumers and compliance markets from renewable portfolio policies –

22 US EPA, "Comments of the US Environmental Protection Agency," in Project No. 31852, Rulemaking Relating to Renewable Energy Amendments, Public Utility Commission of Texas as cited in Holt, Ed, and Wiser, Ryan (2007) *The Treatment of Renewable Energy Certificates, Emissions Allowances, and Green Power Programs in State Renewables Portfolio Standards.* Lawrence Berkeley National Laboratory, California.

23 Barcott, Bruce (2007). "Green Tags: Making Sense of the REC-age." *World Watch Magazine, 20(4).*

is an important policy issue. Issues arise when a TREC is used *both* for compliance with an RPS and is sold in voluntary green power markets. In this case, the renewable attributes of the TREC have essentially been counted twice, and new, *additional,* renewable capacity has not been added to the grid as a result of both transactions. The same issue would occur if a TREC was used in two different compliance markets, for example as part of renewable portfolios for two different states. Many RPS policies, including for example, the RPS in California, explicitly do not allow energy suppliers to use voluntary renewable energy sales to comply with a portfolio standard, requiring the RPS to be additional to voluntary sales.[24] In California, recently adopted regulations state, "A renewable energy credit shall be counted only once for compliance with the renewables portfolio standard of this state or any other state, or for verifying retail product claims in this state or any other state."[25]

Yet allowing voluntary sales to count toward RPS compliance also has some advantages. First, some utilities argue that offering green power at a premium price is simply another way to achieve a renewable energy quota under an RPS. Further, if some customers are willing to pay this premium, it will lower the overall costs of the RPS to ratepayers as a whole.[26]

Market Liquidity and Barriers to Expanding TRECs Markets

Liquidity – the ease in which buyers and sellers can be found and transactions can be made – remains a challenge for many existing TRECs markets. Greater liquidity comes from larger markets, and results in more predictable prices and a more certain price signal for renewables developers.[27] TRECS markets like the UK Renewable Obligation Certificates markets have experienced liquidity issues due to an insufficient number of projects.[28] Evidence from the US TRECs markets suggests that a few factors play a role in limiting the liquidity of markets.

First, some state-level RPS compliance markets require that TRECs be sourced locally, or be accompanied by local electricity. This limitation reduces the availability of TRECs for compliance. Similarly, in voluntary markets, consumers purchasing TRECs are often more willing to pay a premium for green power if they know that the renewable generation is being developed locally and therefore has local benefits.[29]

24 For a detailed survey of US state RPS positions on including voluntary measures, see Holt, Ed, and Wiser, Ryan (2007) *The Treatment of Renewable Energy Certificates, Emissions Allowances, and Green Power Programs in State Renewables Portfolio Standards.* Lawrence Berkeley National Laboratory, California.

25 As cited in Holt, Ed, and Wiser, Ryan (2007) *The Treatment of Renewable Energy Certificates, Emissions Allowances, and Green Power Programs in State Renewables Portfolio Standards.* Lawrence Berkeley National Laboratory, California.

26 Ibid.

27 Center for Energy Economics (2009). *Harmonization of Renewable Energy Credit (REC) Markets across the US* Report for State Energy Conservation Office, Texas.

28 The UK ROCs policy features a compliance fine redistribution system, through which the fines that regulated utilities pay for non-compliance are then redistributed to renewable power generators. This acts as a compensation for low demand/low liquidity, and provides some predictability in the economics of renewable power projects.

29 Holt, Ed, and Bird, Lori (2005). *Emerging Markets for Renewable Energy Certificates: Opportunities and Challenges.* Lawrence Berkeley National Laboratory, California.

Second, insufficient transmission lines from renewable-intense regions, limits the sale of renewably-generated electricity. Even if TRECs can travel freely between jurisdictions, wholesale electricity must also find a buyer.[30] This issue was a significant barrier to growth of the Texas TRECs market, as insufficient transmission lines from wind-intense West Texas, dampened the market for TRECs and renewable electricity, as a result of limiting sales of physical electricity. In response, the Texas utility commission increased transmission capacity and established regional zones for new transmission.[31] This barrier is not unique to TRECs, and is an issue for renewable energy policy in general.

Broadening the TRECs market through trade between jurisdictions is one possible solution to these issues, though this approach is not necessarily straightforward. In the US, a national compliance market could be achieved either through a national RPS policy, or by reducing barriers to trade of TRECs between states. National RPS policies were discussed in the US House of Representatives in 2009, but did not become law.[32] Trading between regions faces significant barriers, given differences between systems. Different systems have different standards for resource eligibility; acceptability of hydropower, for example, varies extensively between state RPS programs depending on factors such as the effect on flow or fish habitat.[33] Systems also have different standards for vintage of new generation capacity, and vary as to whether TRECs are issued only to new, incremental renewable capacity. Some systems allow banking and borrowing of certificates, and some set maximum prices on TRECs. These differences can make harmonization complex.[34] Similarly, while an integrated, international TRECs market would have greater liquidity and would allow for further reduction of costs in increasing global renewable capacity, fragmentation in policy and institutional design is a barrier. Inter-jurisdictional voluntary markets exist, enabled by the tracking systems in North America and the RECS International system in Europe, which harmonizes principles and rules of operation.[35] Yet generally, harmonized international compliance markets have not developed, though notably Norway and Sweden are exploring a joint TRECs market.

While an integrated, international TRECs market would have greater liquidity and would allow for further reduction of costs in increasing global renewable capacity, fragmentation in policy and institutional design is a barrier.

30 Ibid.

31 Holt, Ed, and Bird, Lori (2005). *Emerging Markets for Renewable Energy Certificates: Opportunities and Challenges.* Lawrence Berkeley National Laboratory, California, and Center for Energy Economics (2009) Harmonization of Renewable Energy Credit (REC) Markets across the US Report for State Energy Conservation Office, Texas.

32 For examples, the proposed American Clean Energy and Leadership Act (ACELA) and American Clean Energy and Security Act (ACESA) bills in the House of Representatives both included national RPS programs.

33 Ibid.

34 Ibid.

35 Brick, Kerri, and Visser, Martine (2009). *Green Certificate Trading.* Energy Research Centre, University of Capetown, South Africa.

TRECs and Other Market-based Climate Policy Instruments: Complementarities and Interaction Effects

It is important to remember that TRECs and RPS policies are only one tool in the suite of possible policy mechanisms to increase renewable energy capacity and reduce greenhouse gas (GHG) emissions. The main issues are whether TRECs are a complement or a substitute for other policies, and how they interact with other policies, such as cap-and-trade systems and feed-in tariffs.

Issues of double-counting can again arise when multiple policy instruments are at work. Consider a jurisdiction which has both emissions trading and TRECs trading. A TREC embodies the renewable attributes of generation. But do these attributes include "avoided emissions?" While renewable generation might result in displacement of fossil-fuel generated power, and consequently reductions in emissions of SO_2 or greenhouse gases (GHGs), this reduction requires an assumption of a baseline.[36] The uncertainty as to whether emissions reductions are part of the TREC leads to uncertainty as to whether a renewable generation project can legitimately have value in both markets. To address this issue, policy-makers must be explicit about the attributes included in a TREC, and the acceptable methodologies for calculating them.[37]

A cap-and-trade system can also interact with TRECs systems in other ways. A renewable portfolio standard to support renewable energy will displace some fossil fuel generated electricity and reduce emissions. If an emissions cap is in place as well, this effect will result in a lower market price for carbon, and reduced incentives to move to low-carbon alternatives throughout the energy system. The interaction therefore reduces the cost-effectiveness of the carbon policy (cap-and-trade): the RPS mandates reductions from renewable energy specifically, rather than letting the carbon market drive least-cost reductions. Technologies such as combine cycled gas turbines might see reduced market penetration as a result.[38] Alternatively, cap-and-trade and RPS policies can be complementary, if the goal of the RPS is to promote renewable energy technologies in order to improve these technologies over time. Through learning by doing, the costs of renewable technologies can decline over time as more capacity is installed and design and installation is improved. Taking learning into account, policies to promote renewable energy could increase the cost-effectiveness of greenhouse gas abatement policies over the long-term.[39]

36 Holt, Ed, and Bird, Lori (2005). *Emerging Markets for Renewable Energy Certificates: Opportunities and Challenges.* Lawrence Berkeley National Laboratory, California.

37 Holt, Ed, and Wiser, Ryan (2007). *The Treatment of Renewable Energy Certificates, Emissions Allowances, and Green Power Programs in State Renewables Portfolio Standards.* Lawrence Berkeley National Laboratory, California.

38 Böhringer, C. and Rosendahl, K.E. (2009). *Green Serves the Dirtiest – On the Interaction Between Black and Green Quotas.* Discussion Paper No. 581, Statistics Norway, Research Department as cited in Philibert, Cédric (2011). *Interactions of Policies for Renewable Energy and Climate.* International Energy Agency Working paper.

39 Philibert, Cédric (2011). *Interactions of Policies for Renewable Energy and Climate.* International Energy Agency Working paper.

The UK Renewable Obligation and Renewable Obligation Certificates (ROCs)

The UK implemented its *Renewable Obligation* program in 2002. The program is regulated through the Office of Gas and Electricity Markets (OFGEM), and mandates a national renewables target that will rise to 15% of generation by 2015. Under the program, OFGEM awards Renewable Obligation Certificates (ROCs) to accredited electricity suppliers that generate electricity from eligible sources. These ROCs can then be sold to other suppliers. Suppliers are obligated to demonstrate compliance with their targets for an increasing share of electricity production from renewable sources, either by submitting sufficient ROCs to OFGEM, or by making a payment to OFGEM to cover any shortfall. This buyout option essentially sets a maximum price for the certificate market. This maximum price is indexed to inflation. In 2010–11, the buyout price is £36.99 per ROC. Revenue from the buyout is recycled back to energy suppliers.

A few lessons also emerge from the UK experience. First, the UK system has not achieved its targeted levels of renewable capacity, and is about one-third short of its own quotas. This shortfall is a result of the buyout mechanism. Policy uncertainty, given the changes to the program and increasing complexity of the system, has also contributed, with some firms choosing to manage risk by achieving compliance exclusively through the buyout mechanism and not through increased renewable capacity. Finally, the ROCs market has limited liquidity (that is, ROCs transactions are not always available or easy to make), given that the market is dominated by only a few main electricity suppliers and is not geared toward new market entrants.

Source: Office of Gas and Electricity Markets (OFGEM) (2011). *Renewables Obligation: Guidance for Generators.* OFGEM, London, UK Available at: http://www.ofgem.gov.uk/Sustainability/Environment/RenewablObl/Documents1/RO%20Generator%20Guidance%20May%202011%20final.pdf

Considering interactions between RPS policies and Feed-in Tariff (FiT) policies is also important to ensure an economically efficient policy. In a jurisdiction with both policies, a renewable generation project could theoretically reap benefits from both instruments, unless the market is designed to avoid this overlap. To avoid double counting, for example, TRECs might only be allocated for projects that do not benefit from the FiT. Another kind of interaction could result if TRECs can be traded between jurisdictions. In this case, TRECs could undermine a FiT's support for local technology and industry because they could encourage international investment in renewable power rather than domestic.[40]

The two instruments are similar in that both use market mechanisms to support renewable energy development. The difference is that a FiT establishes a fixed price for additional renewable power, while an RPS mandates a quantity of renewable power, and a price emerges through a TRECs market. In both cases, institutions to certify power as renewable and additional are required. In both cases, policy creates a premium for the renewable attributes of renewable electricity generation to supplement the value of the electricity itself.

The difference is that a FiT establishes a fixed price for additional renewable power, while an RPS mandates a quantity of renewable power, and a price emerges through a TRECs market.

The distinctions between the instruments can be further blurred. An RPS with TRECs can be designed to provide additional support for specific technology through credit multipliers,[41] or by mandating that part of a renewable portfolio be achieved through specific technologies (known as a carve-out). In this case, TRECs act like a subsidy, and starts to fill the same role as the Feed-in Tariff. Originally, the UK Renewables Obligation Certificate (ROC) scheme was not technology specific: one certificate was awarded for a single MWh of electricity from an eligible source. However, in 2009, the UK made changes to the ROC scheme in order to try to further promote a range of renewable energy technologies, including those with higher costs. Policy-makers established bands or tiers of different technologies, making the number of certificates allocated dependent on the technologies in use as well as the size and timing of the installation. For example, generation from tidal or wave power technology is awarded two ROCs for one MWh generated, while sewage gas power is awarded 0.25 ROCs for one MWh generated.[42] Early evidence suggests that this banding approach is leading to greater diversification of the UK renewable capacity.[43] However, allocating more certificates for high-cost renewable technologies adds a subsidy dimension to the policy. With these technology bands, the program begins to resemble a Feed-in-Tariff (FiT) policy that provides targeted support to specific

40 Wilsher, Daniel (2009). "Reducing Carbon Emissions in the Electricity Sector: a Challenge for Competition Policy Too? An Analysis of Experience to Date and Some Suggestions for the Future." *The Competition Law Review* (6)1 31–49.

41 A credit multiplier system would aware multiple TRECs to a single MWh of electricity generated by specific, targeted technologies. For example, in the UK Renewable Obligation, Offshore wind generation receives multiple ROCs. In other jurisdiction, extra credits are supplied to small solar to provide additional policy support.

42 For more details see: Office of Gas and Electricity Markets (OFGEM) (2011) *Renewables Obligation: Guidance for Generators.* OFGEM, London, UK Available at: http://www.ofgem.gov.uk/Sustainability/Environment/RenewablObl/Documents1/RO%20Generator%20Guidance%20May%20 2011%20final.pdf

43 Buckman, Greg (2011). The effectiveness of Renewable Portfolio Standard banding and carve-outs in supporting high costs of renewable electricity. *Energy Policy 39(7) 4105–4114.*

technologies, rather than a technology-neutral RPS at the market price of ROCs per unit of electricity.[44]

Transitioning from a FiT to a RPS may be politically challenging because of the differences in the two measures. In areas where successful Feed-in Tariff systems are operating (e.g., Germany, Denmark), wind power producers have resisted moving towards obligation systems. The Danish government, for example, initially planned to introduce an RPS system with TRECs system to replace its increasingly costly Feed-in Tariff system, but later withdrew those plans in part because of industry opposition[45] Under a FiT, producers receive a subsidy; government is providing the additional revenue required for renewables to be competitive, and government bears the costs directly. Under an RPS, energy suppliers face added costs to meet the RPS obligation, and must absorb these added costs or pass them on to energy consumers.

Transitioning from a FiT to a RPS may be politically challenging because of the differences in the two measures.

44 Gottstein, Meg (2011). *UK Renewable Energy Support: Past Experiences and Current Challenges.* The Regulatory Assistance Project, Brussels, Belgium.

45 Holt, Ed, and Bird, Lori (2005). *Emerging Markets for Renewable Energy Certificates: Opportunities and Challenges.* Lawrence Berkeley National Laboratory, California.

Implications for Canadian Policy-Makers

This *Policy Brief* is meant as an overview of the theory and experience in the use of Tradable Renewable Energy Certificates (TRECs). From the overview, Sustainable Prosperity believes that the following conclusions are of direct relevance to policy-makers engaged in the development of renewable energy policy in Canada:

1. TREC systems can provide incentives for increasing renewable energy generation by creating a market for the renewable attributes associated with renewable energy. By separating the renewable attributes from the electricity itself, TRECs provide both market and technical flexibility for increasing renewable capacity wherever it is least expensive to do so. TRECs can improve the cost-effectiveness of Renewable Portfolio Standards by using market forces to ensure lowest cost renewable options can be used to satisfy RPS requirements.

2. TREC systems operate successfully in many jurisdictions and the required institutional infrastructure (certification, tracking) is increasingly well-understood and has evolved over time, particularly over the last ten years. Still, TREC systems can be complex, and design details are very important in ensuring the system does not allow for double counting, incents new and additional renewable generation capacity, and can interface with other TREC systems.

3. Increasing the size and liquidity of TRECs markets is important in ensuring a predictable and robust TRECs price that can provide a strong incentive for renewables generators.

4. Policy-makers must consider how RPS and TRECs programs will interact with other climate change and renewable energy policies. More analysis is required comparing different kinds of policy mechanisms to support renewable energy, considering how they can complement and support each other, but also which mechanisms are effective and efficient under which circumstances.