PART THREE: WHAT ROLE DO REGULATORY SUPPORT MECHANISMS PLAY IN NATIONAL RENEWABLE ENERGY LAWS?
A CASE OF SUBSTANTIVE DIVERGENCE

The third part of this thesis examined the range of regulatory support mechanisms used by countries when they intervene in the markets to support the accelerated deployment of renewable energy (Chapter 7). It then considered whether these regulatory support mechanisms were likely to converge or diverge over time (Chapter 8). The research in this part concluded that there is already divergence in the regulatory support mechanisms but the full extent is not yet known due to a lack of research. This divergence is likely to continue for the foreseeable future, although soft convergence efforts such as those adopted by the EU may be successful.

The analysis in Chapter 7 showed that a diverse range of regulatory support mechanisms were available to countries to meet their legislative objectives. These regulatory support mechanisms include feed-in tariffs, feed-in premiums, renewable portfolio standards/quota obligations, green certificate trading/ renewable energy credits, competitive tendering (auction bidding), subsidies, loans, grants, net metering, green power schemes, investment tax credits, production tax credits, rebates, research and development support and other indirect mechanisms. While each type of regulatory support mechanism possesses some common characteristics, their design and implementation differ in every country.

When regulatory support mechanisms were first introduced to the sector, most countries made a choice between adopting a feed-in tariff (a price-based mechanism) and a renewable portfolio standard/quota obligations (a quantity-based mechanism). However, the general consensus from much of the research in this field is that there is no single 'best' regulatory support mechanism that will adequately support the development, and subsequent commercialisation, of all renewable energy sources, technologies and scales of renewable energy projects. The vast majority of countries now use a combination of different regulatory support mechanisms. This suggests that different combinations of regulatory support mechanisms may be better suited to meeting the market failures, market barriers and legislative objectives of different countries. Countries often adopt a primary mechanism, commonly either a feed-in tariff, a renewable portfolio standard or competitive tendering, usually supported with a number of secondary mechanisms such as tax incentives, research and development support.

Unfortunately, while it is known that there is divergence in the regulatory support mechanisms, the extent of this divergence and the full impact of using a number of mechanisms in combination are unknown. This research gap is often evident both where multiple mechanisms are used within a country, as well as, where one country's mechanism has cross-border implications for the mechanisms of other countries, such as within the European Union. This reflects the fact that much of the previous research has focused on a limited number of countries and regulatory support mechanisms operating in isolation from each other. This does not reflect the reality of regulatory support mechanisms contained within national renewable energy laws, and thus it is not presently known how the different regulatory support mechanisms interact with each other. Further research is required so that the impact of combining different mechanisms on the operation and development of the renewable energy sector is better understood.

Chapter 8 sought to understand how regulatory support mechanisms may develop in the future. There are said to be a number of benefits that are derived from laws becoming more similar across jurisdictions, particularly in terms of facilitating international trade, especially for multinational corporations operating across national boundaries. This is because when companies have to comply with the same laws or standards across jurisdictions, information costs and the barriers to entry to the market are lowered, while legal certainty and predictability are improved.

Over time, at least from a theoretical perspective, the regulatory support mechanisms should become more similar as countries seek to engage in either a 'race to the bottom' or a 'race to the top.' Unfortunately, other than in Europe, the degree of unification, harmonisation, convergence, divergence or regulatory competition within the regulatory support mechanisms in national renewable energy laws is not currently known and requires further research.

The starting position for most countries seems to be one of substantive divergence, with different regulatory support mechanisms being designed and implemented in different countries. This is a natural response to their different natural resources, legal traditions, governmental and socio-economic structures, and customs and norms, which in turn reinforces the legitimacy of their national laws. Meanwhile, there has never been an attempt to unify national renewable energy laws, and two harmonisation attempts by the EU have failed. Instead, two processes seem to be occurring in terms of the future development of regulatory support mechanisms. First, the regulatory support mechanisms contained within the laws of the EU Member States appear to be converging through a process of cooperation and coordination. An example of this process is the Joint Swedish-Norwegian Electricity Certificate Market. Further research is required to better understand the processes of cooperation and coordination between other countries, especially given the establishment of the IRENA, which facilitates this process. Second, a number of technology innovators appear to be intentionally encouraging divergence through the process of regulatory competition. This often reflects national industrial policy goals such as bolstering the domestic industry through the imposition of local content clauses or the provision of preferential subsidies to nationals of the country. The huge growth of the Chinese wind turbine manufacturing industry under both preferential subsidies and local content requirements, and the loss of market share by foreign firms suggest that adopting divergent regulatory support mechanisms can lead to substantial financial benefits for a country. The relative weight that should be attached to the process of soft convergence, as compared to the rise of regulatory competition in regulatory support mechanisms is not yet clear. However, what is clear is that substantive divergence currently remains the base position for regulatory support mechanisms in national renewable energy laws and that further research is required to better understand this area.

CHAPTER 7: HOW DO COUNTRIES REGULATE TO SUPPORT RENEWABLE ENERGY?

This chapter examines the common regulatory support mechanisms used to incentivise the accelerated deployment of renewable energy. Section 7.1 of the chapter will examine the criteria which countries can use to select an appropriate combination of regulatory support mechanisms to ameliorate their market failures and meet their legislative objectives. In addition, this section will also analyse the methods used to classify the different types of regulatory support mechanisms, such as: primary versus secondary instruments, investment support versus operating support, supply-side strategies versus demand-side strategies, and price-driven strategies versus quantity-driven strategies.

Once countries have selected the basic design features of their regulatory support mechanisms, they then have a number of common mechanisms from which to choose. The different types of regulatory support mechanisms are assessed in Section 7.2. These mechanisms include feed-in tariffs, feed-in premiums, renewable portfolio standards/quota obligations with green certificate trading, renewable energy targets, competitive tendering (auction bidding), subsidies, loans, grants, net metering, green power schemes, investment tax credits, production tax credits, rebates, research and development support and other indirect mechanisms.

Section 7.3 considers the implications of a number of regulatory support mechanisms being used in combination to achieve the legislative objectives. In particular, this section raises concerns about the paucity of research available on the impact of the use of regulatory support mechanisms in combination. This makes evaluating the relative success of the regulatory support mechanisms difficult. Much of the previous research has focused on which primary instrument is more efficient in achieving cost-effective and technologically diverse deployment. However, this does not consider how these instruments are used in reality by the vast majority of countries. That said, there are lessons to be learnt from the evidence that is available about how regulatory support mechanisms operate. This chapter will conclude in Section 7.4 with an analysis of the steps needed to ensure that whichever combinations of regulatory support mechanisms are selected, that they are implemented efficiently and effectively to accelerate the deployment of renewable energy.

7.1 THE SELECTION OF REGULATORY SUPPORT MECHANISMS

As with both the definition of renewable energy and the legislative objectives adopted, there is also considerable variation in the regulatory support mechanisms contained within the national renewable energy laws of different countries. This reflects the variety of domestic market barriers that exist within different countries (and even in some instances, regions) and the broad range of objectives that governments are seeking to achieve through these mechanisms.

A number of factors may be relevant when considering which regulatory support mechanisms should be adopted within a particular country, for example:

1. Is the regulatory support mechanism designed to target the price or quantity of renewable energy to be deployed?[1]
2. Is the regulatory support mechanism designed to target the supply side or demand side of the renewable energy market?[2]

[1] Philippe Menanteau, Dominique Finon and Marie-Laure Lamy, 'Prices versus quantities: choosing policies for promoting the development of renewable energy' (2003) 31 *Energy Policy* 799; Reinhard Haas et al, 'A historical review of promotion strategies for electricity from renewable energy sources in EU countries' (2011) 15 *Renewable and Sustainable Energy Reviews* 1003, 1011.

[2] Lincoln L Davies, 'Reconciling Renewable Portfolio Standards and Feed-In Tariffs' (2012) 32 *Utah Environmental Law Review* 311, 319-20; Richard L Ottinger, Lily Matthews and Nadia Elizabeth Czachor, 'Renewable Energy National Legislation: Challenges And Opportunities' in Donald N Zillman et al (eds), *Beyond the Carbon Economy: Energy Law in Transition* (Oxford University Press, 2008) 183, 192-200.

3. Is the regulatory support mechanism going to be compulsory or a voluntary approach?[3]
4. Is the regulatory support mechanism going to attempt to 'pick winners' or be technology neutral?[4]
5. Is the regulatory support mechanism going to be available on an industry-wide basis or will it target projects of a particular size or type?[5]
6. Is the regulatory support mechanism going to be capped by MW or GW *installed* (i.e. capacity), MW or GW *generated* or a *fixed budgetary pool* or some other means?[6]
7. If a price-based strategy is chosen, is the price to be fixed (e.g. such as a carbon price) or is it to be endogenous (i.e. subject to market fluctuations due to trading of an instrument)?[7]

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[3] See e.g. Robert C Grace, Deborah A Donovan and Leah L Melnick, *When Renewable Energy Policy Objectives Conflict: A Guide for Policymakers* (2011) National Regulatory Research Institute <http://www.nrri.org/pubs/electricity/NRRI_RE_Policy_Obj_Conflict_Oct11-17.pdf>; Ottinger, Matthews and Czachor, above n 2, 193-9; Reinhard Haas, Niels I Meyer, Anne Held, Dominique Finon, Arturo Lorenzoni, Ryan Wiser and Ken-ichiro Nishio, 'Promoting electricity from renewable energy sources – lessons learned from the EU, US and Japan' in Fereidoon P Siosanshi (ed), *Competitive Electricity Markets: Design, Implementation, Performance* (Elsevier Science, 2008) 419, 425; Haas et al, 'A historical review of promotion strategies', above n 1, 1012; Trent Berry and Mark Jaccard, 'The Renewable Portfolio Standard: Design Considerations and an Implementation Survey' (2001) 29 *Energy Policy* 263 264-265, 268; Simone Espey, 'Renewables portfolio standard: a means for trade with electricity from renewable energy sources?' (2001) 29 *Energy Policy* 557, 558; Adrian Bradbrook, 'Green Power Schemes: The Need for a Legislative Base' (2002) 26 *Melbourne University Law Review* 15, 20-30; Janet Sawin, 'National Policy Instruments: Policy Lessons for the Advancement & Diffusion of Renewable Energy Technologies Around the World' (Paper presented at the International Conference for Renewable Energies, Bonn, 2004) 2; Benjamin K Sovacool, *Renewable Electricity for Southeast Asia: Designing the Right Policy Architecture* (Lee Kuan Yew School of Public Policy, National University of Singapore, 2009) 16; Warren Leon and Clean Energy States Alliance, 'Designing the Right RPS: A Guide to Selecting Goals and Program Options for a Renewable Portfolio Standard' (Guide, State-Federal RPS Collective and the National Association of Regulatory Utility Commissioners, 2012).

[4] Catherine Mitchell, *Energy, Climate and Environment Series: The Political Economy of Sustainable Energy* (Palgrave Macmillan, 2010) 39-57.

[5] Pere Mir-Artigues and Pablo del Rio, 'Combining tariffs, investment subsidies and soft loans in a renewable electricity deployment policy' (2014) 69 *Energy Policy* 430.

[6] See e.g. New South Wales Auditor-General, *NSW Auditor-General's Special Report into the NSW Solar Bonus Scheme* (New South Wales Audit Office, 2011) 24.

[7] Carolyn Fischer and Louis Preonas, 'Combining policies for renewable energy: Is the whole less than the sum of its parts?' (2010 *International Review of Environmental and Resource Economics* 51, 69-70; Aviel Verbruggen and Volkmar Lauber, 'Assessing the performance of renewable electricity support instruments' (2012) 45 *Energy Policy* 635, 642; Carolyn Fischer and Richard G Newell, 'Environmental and technology policies for climate mitigation' (2008) 55 *Journal of Environmental Economics and Management* 142, 150-1.

8. Should the cost of the regulatory support mechanism be borne by conventional utility companies, end-consumers or taxpayers more broadly?[8]
9. Is the country a member of a regional organisation such as the EU that may place restrictions such as the State Aid rules on the use of regulatory support mechanisms?[9]
10. Is the country a member of the World Trade Organization (WTO) so subject to the Agreement on Subsidies and Countervailing Measures?[10]

Once these questions have been answered, governments have a range of regulatory support mechanisms to select from, and then modify, as appropriate. A number of studies have sought to present classification systems to help foster an understanding of the regulatory support mechanisms used in renewable energy laws.

7.1.1 PRIMARY INSTRUMENTS VERSUS SECONDARY INSTRUMENTS

The first basis for classification assesses the economic incentives contained in the instrument to determine whether a regulatory support mechanism is a primary or secondary instrument. Primary instruments are those that are

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[8] Verbruggen and Lauber, above n 7, 641; Steffen Jenner et al, 'What Drives States to Support Renewable Energy?' (2012) 33(2) *Energy Journal* 1, 4; Reinhard Haas et al, 'How to Promote Renewable Energy Systems Successfully and Effectively' (2004) 32 *Energy Policy* 833, 839; Mitchell, *The Political Economy of Sustainable Energy*, above n 4, 183; Sawin, above n 3, 12-3.

[9] *PreussenElektra AG v Schhleswag AG* (C-379/98) [2001] EUECJ 160; European Commission, 'State aid: Commission opens in-depth inquiry into support for energy-intensive companies benefitting from a reduced renewables surcharge' (Press Release, Brussels, 18 December 2013); Dave Keating, *Commission unveils overhaul of renewable energy subsidies* (9 April 2014) European Voice <http://www.europeanvoice.com/article/2014/april/commission-unveils-overhaul-of-renewable-energy-subsidies/80450.aspx>; Kim Talus, 'Treaty Law and the Energy Sector' in Kim Talus (ed), *EU Energy Law and Policy: A Critical Account* (Oxford University Press, 2013) 110; Angus Johnston et al, 'Rethinking the scope and necessity of energy subsidies in the United Kingdom' (2014) 3 *Energy Research & Social Science* 1, 3.

[10] *Marrakesh Agreement Establishing the World Trade Organisation*, opened for signature 15 April 1994, 1867 UNTS 3 (entered into force 1 January 1995) annex 1A ('Subsidies and Countervailing Measures'); Marie Wilke, 'Feed-in Tariffs for Renewable Energy and WTO Subsidy Rules: An Initial Legal Review' (Issue Paper No 4, Institutional Centre for Trade and Sustainable Development, November 2011); Office of the United States Trade Representative: Executive Office of the President, 'China Ends Wind Power Equipment Subsidies Challenged by the United States in WTO Dispute' (Press Release, 6 June 2011) <http://www.ustr.gov/about-us/press-office/press-releases/2011/june/china-ends-wind-power-equipment-subsidies-challenged>.

generally national in their scope and applicable to all technologies (although the incentives may be banded in recognition of their degree of commercialisation). In contrast, secondary instruments are much more limited in their scope, with restrictions on the size of qualifying projects and the technologies which qualify for support. On this basis, the following regulatory support mechanisms are typically characterised as primary instruments: feed-in tariffs, quota obligations with tradeable green certificates (TGC) and competitive tendering; while secondary instruments include investment subsidies, fiscal incentives and soft loans.[11]

This distinction has been adopted widely within the existing body of literature, although often under different names, as was recognised by Mir-Artigues and del Rio:

> The distinction between primary and secondary instrument is a widespread and classical one in the RES-E support literature, although with different names, "dominating instruments" in Ragwitz (2012), "main support schemes" in Klessmann and Lovinfosse (2012), Teckenburg et al (2012) and IEA/IRENA (2013) and "primary" and "secondary" instruments in Ragwitz et al (2012), Huber et al (2004) and Del Rio and Gual (2004).[12]

This classification system appears to be valid, as many of the primary instruments overlap in their coverage of legislative objectives so countries will tend to focus on only one or two primary instruments to avoid over-regulation and overcompensation of market participants. In addition to the primary instruments adopted, most countries also use a number of secondary instruments to provide targeted support to particular technologies or smaller projects.

7.1.2 SUPPORT FOR INVESTMENTS VERSUS OPERATING SUPPORT

An alternative basis for classification is propounded by Fräss-Ehrfeld, who suggests that government subsidies can be divided between those that support investment in renewable energy such as capital grants, tax exemptions, or rebates on equipment purchases, and those that support the operation of

[11] Mir-Artigues and del Río, above n 5.

[12] Ibid fn 2.

renewable energy projects.[13] Fräss-Ehrfeld states that the regulatory support mechanisms that fall within this latter category include 'price subsidies, green certificates, tender schemes, and tax exemptions or reductions on the production of electricity.'[14] This classification does not seem to add a lot of value to countries selecting between different regulatory support mechanisms, as arguably the ultimate aim of all regulatory support mechanisms is to accelerate the deployment of renewable energy projects that generate electricity. In distinguishing between investment support and operating support, this classification may not be sufficiently refined to differentiate between the support of projects that generate electricity, as opposed to simply installed capacity that may not be connected to the grid.

This issue of grid-connected projects versus installed capacity is a particular problem in some countries such as China. For example, in 2009 when the Chinese wind feed-in tariff was introduced, China had not constructed sufficient high voltage transmission lines to transport this power from the west of China where it was generated to the east of China where there was substantial demand without significant load losses.[15] Further, many areas where wind farms were constructed could not immediately be connected to the transmission grid without either the grid being upgraded or new transmission and distribution lines being installed.[16] This meant that a number of newly constructed wind farms became 'stranded assets' unable to generate electricity because it could not be transported to consumers. Indeed, in 2011 it was estimated that nearly 30 per cent of Chinese wind farms were not connected to the grid due to a lack of additional capacity on the transmission and distribution networks or the problems with frequency management which occur when rapidly bringing online

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[13] Clarisse Fräss-Ehrfeld, *Renewable Energy Sources: A Chance to Combat Climate Change* (Wolters Kluwer, 2009) 262-3.

[14] Ibid 263.

[15] Anthony Kim and Olio Wang, 'Sinovel legal Action Casts Shadow Over Potential Export Opportunities in China's Wind Power Industry', *The Financial Times* (online), 19 September 2011 <http://www.ft.com/cms/s/2/83fef47e-e2cc-11e0-93d9-00144feabdc0.html#ixzz1dY6B1noo>.

[16] Kat Cheung and International Energy Agency, 'Integration of Renewables – Status and Challenges in China' (Working Paper, Organisation for Economic Co-operation and Development, 2011).

significant intermittent generation.[17] This issue of countries installing additional capacity which is not either distributed generation or grid-connected has been so problematic that it has prompted REN-21 to alter the way in which they calculate and report renewable energy statistics.[18] As a result, the use of this basis of classification without the addition of further distinctions or refinements seems flawed.

7.1.3 SUPPLY SIDE STRATEGIES VERSUS DEMAND SIDE STRATEGIES

A third basis for classifying the existing regulatory support mechanisms is whether they target the supply side or the demand side of the renewable energy market. Davies has stated that supply-side or market 'push' mechanisms 'seek to promote the quantity of a given type of technology…to augment the amount of a resource or a technology that is available for commercial use.'[19] Examples of supply-side regulatory support mechanisms include: '(a) conducting basic applied research and development on energy technologies; (b) building large test or prototype facilities; (c) having the government procure large amounts of an experimental technology; and (d) investor tax credits that spur innovation on a given technology.'[20] In contrast, demand-side or market 'pull' mechanisms seek to foster increased demand for renewable energy technologies, which in turn should lead to more technologies coming to the market to meet that demand. Examples of demand-side regulatory support mechanisms include: '(a) creating markets for [renewable energy – sic] through production tax credits; (b) establishing rate-based or purchase-based incentives such as higher rates of return or tariffs; (c) promoting technologies through training or information and awareness campaigns.'[21]

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[17] Robert Crowe, 'China Calls on A123 to Aid Wind Integration', *Renewable Energy World* (online), 12 August 2011 <http://www.renewableenergyworld.com/rea/news/article/2011/08/china-calls-on-a123-to-aid-wind-integration>.

[18] REN21 Secretariat, 'Renewables 2013 Global Status Report' (Report, Renewable Energy Policy Network the 21st Century, 2013) 126-7.

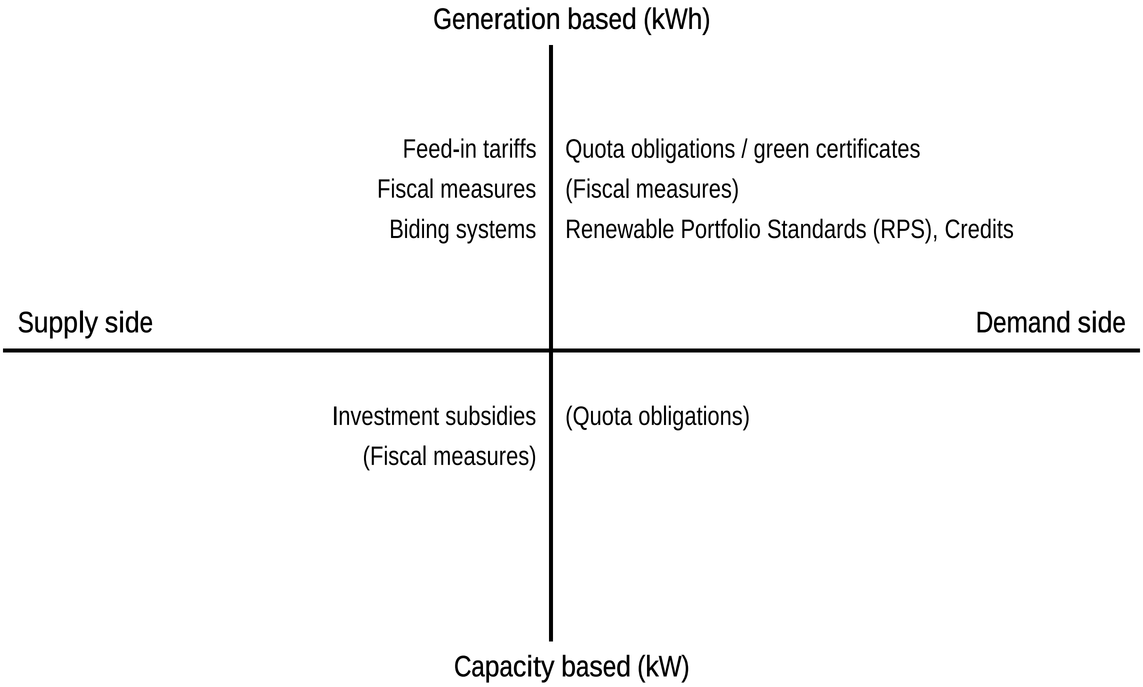
[19] Davies, 'Reconciling Renewable Portfolio Standards and Feed-In Tariffs', above n 2, 319.

[20] Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 13.

[21] Ibid.

There is some disagreement between scholars as to whether the two of the most commonly adopted regulatory support mechanisms, renewable portfolio standards/quota obligations/green certificate trading and feed-in tariffs, are in fact both demand-side strategies, or whether feed-in tariffs should be conceived of as a supply-side strategy.[22] The Energy and Resources Institute distinguishes the most common mechanisms on this basis and also on whether they are generation based (i.e., focus on kWh or MWh) or capacity based (i.e., focus on kW or MW installed):

FIGURE 7.1: CATEGORISATION OF REGULATORY SUPPORT MECHANISMS[23]



By classifying regulatory support mechanisms as targeting the supply side or demand side and focusing on whether the investment is focused on building generation or capacity, this approach overcomes the issues with Fräss-Ehrfeld's

[22] See e.g. Davies who advocates that both quantity-driven policies such as renewable portfolio standards and price-driven strategies such as feed-in tariffs are demand-side or market 'pull' mechanisms: Davies, 'Reconciling Renewable Portfolio Standards and Feed-In Tariffs', above n 2, 320. In contrast, The Energy and Resources Institute advocates that feed-in tariffs should be conceptualised as a supply-side mechanism, with quota obligations and renewable portfolio standards with green tradeable certificates thought of as demand-side mechanisms: The Energy and Resources Institute, 'International policy and regulatory regimes for promoting renewable energy based electricity generation' in The Energy and Resources Institute (TERI) (ed), *Policy & Regulatory Approaches for Promoting RE Power* (REEEP, Unknown) 4.

classification. Regardless of the characterisation of renewable portfolio standards/quota obligations/green certificate trading and feed-in tariffs, the classification of regulatory support mechanisms as supply-side and demand-side mechanisms is arguably a helpful one. This classification is one that is commonly used by countries when devising regulatory and policy strategies for accelerating technological development and innovation so there should be a degree of familiarity with this approach.

7.1.4 PRICE-DRIVEN STRATEGIES VERSUS QUANTITY-DRIVEN STRATEGIES

A fourth basis for classifying the existing regulatory support mechanisms is whether they are price-driven or quantity-driven. Once this initial distinction has been made, further distinctions are often made between regulatory and voluntary mechanisms, investment or generation focused, and direct and indirect mechanisms. These distinctions have also received significant support from scholars working in the field such as Menanteau, Finon and Lamy,[24] Verbruggen and Lauber,[25] Haas et al (2008)[26] and Haas et al (2011).[27]

Haas at al have drawn upon the work of Menanteau, Finon and Lamy[28] to classify the commonly adopted primary and secondary regulatory support mechanisms using these distinctions as follows:

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[24] Menanteau, Finon and Lamy, above n 1.

[25] Verbruggen and Lauber, above n 7, 637-8.

[26] Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 424-5.

[27] Haas et al, 'A historical review of promotion strategies', above n 1, 1011-2.

[28] Menanteau, Finon and Lamy, above n 1.

TABLE 7.1: FUNDAMENTAL TYPES OF PROMOTION STRATEGIES[29]

		Direct Price-driven	**Direct Quantity-driven**	**Indirect**
Regulatory	Investment focused	Investment incentives Tax credits Low interest/soft loans	Tendering system for investment grant	Environmental taxes Simplification of authorisation procedures Connexion charges, balancing costs
Regulatory	Generation based	(Fixed) Feed-in tariffs Fixed premium system	Tendering system for long-term contracts Tradable green certificate system	
Voluntary	Investment focused	Shareholder programs Contribution programs		
Voluntary	Generation based	Green tariffs		Voluntary agreements

This approach recognises that there are fundamentally four different ways of promoting electricity derived from renewable energy sources:

1. Regulatory price-driven mechanisms;
2. Regulatory quantity-driven mechanisms;
3. Voluntary mechanisms; and
4. Indirect mechanisms.

7.1.4.1 REGULATORY PRICE-DRIVEN MECHANISMS

The most commonly adopted regulatory support mechanism is the feed-in tariff, which is an example of a regulatory price-driven mechanism. Price-driven mechanisms do not set quantity goals or targets or quotas for the amount of renewable energy to be generated. Instead, these mechanisms provide renewable energy generators with either a fixed amount per kW of capacity

[29] Haas et al, 'A historical review of promotion strategies', above n 1, 1011-2.

installed or kWh generated or a premium on top of the electricity price for each kWh generated.[30]

7.1.4.2 REGULATORY QUANTITY-DRIVEN MECHANISMS

The main alternative to price-driven mechanisms for primary instruments is quantity-driven mechanisms. Quantity-driven mechanisms such as renewable portfolio standards, quota obligations and renewable energy targets work by establishing a quota (either in terms of MW or GW of renewable electricity to be generated or the percentage share of the electricity generation to be derived from renewable energy sources). Most quotas have a specific date by which the quota has to be achieved to ensure that electricity generated from renewable energy sources (or even following recent adaptions to quantity-driven mechanisms, specific emerging renewable energy technologies) achieve the desired amount of market penetration.[31]

The argument about whether regulatory price-driven or quantity-driven mechanisms are more effective has been the source of much academic debate and will be discussed further below.

7.1.4.3 VOLUNTARY APPROACHES

Not all support mechanisms are regulated, with a number of voluntary approaches also used to promote the accelerated deployment of renewable energy. Voluntary approaches are predicated on the willingness of investors either to make an upfront capital investment into the renewable energy project[32] or alternatively, to pay a volumetric premium for electricity generated from

[30] See e.g. Menanteau, Finon and Lamy, above n 1; Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 424-5.

[31] Menanteau, Finon and Lamy, above n 1; Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 425.

[32] Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 425.

renewable energy sources. The latter mechanism is often called a 'green power scheme', 'green marketing' or a 'green tariff' in the literature.[33]

7.1.4.4 INDIRECT MECHANISMS

The last distinction made under this system of classification is whether the mechanism is directly focused on the immediate stimulation of electricity generated from renewable energy sources or whether it is a more indirect mechanism. Indirect mechanisms are designed to make the market environment for renewable energy more attractive in the long term. Indirect mechanisms include strategies such as providing preferential permitting and siting, preferential grid connection, fast-tracked administrative approvals, the imposition of taxes or levies on brown electricity such as carbon taxes, sulphur taxes or pollution taxes and the removal of subsidies on conventional fossil fuels. These indirect mechanisms all aim to reduce the market barriers to new entry and transaction costs for market participants.[34]

7.2 TYPES OF REGULATORY SUPPORT MECHANISMS USED IN THE RENEWABLE ENERGY SECTOR

Once countries have decided the basic design features of their regulatory support mechanisms to encourage the accelerated deployment of electricity generated from renewable sources, they then have a number of common mechanisms from which to choose. These regulatory support mechanisms include feed-in tariffs, feed-in premiums, renewable portfolio standards/quota obligations, green certificate trading/ renewable energy credits, competitive tendering (auction bidding), subsidies, loans, grants, net metering, green power schemes, investment tax credits, production tax credits, rebates, research and development support and other indirect mechanisms.

[33] Bradbrook, above n 3; Nico H Van der Linden et al, *Review of International Experience with Renewable Energy Obligation Support Mechanisms* (Dutch Ministry of Economic Affairs, 2005) 12; Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 425.

[34] Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 425-6.

One of the difficulties in comparing these support mechanisms is that while each type of mechanism possesses some common characteristics, their design and implementation differ in every country. This is the case even within the EU, with the Member States able to decide on the design and implementation of their own regulatory support mechanisms within the framework of the EU Renewable Energy Directive.[35] There are a number of reasons for this, including the differences in the indigenous renewable and non-renewable energy sources in each country, the structure of the national energy markets, and the varying legislative objectives adopted in the national renewable energy laws. A further complicating factor is that because most countries use several regulatory support mechanisms in combination, the mechanisms and other policies interact with each other, making it difficult to isolate the precise impacts of each mechanism. For this reason, the common features of each regulatory support mechanism will be discussed below, before a discussion of the means of evaluating the relative success of the mechanisms and their use in combination.

7.2.1 FEED-IN TARIFFS

Feed-in tariffs (FITs)[36] are the most commonly adopted regulatory support mechanism, being used nationally by 69 countries to support the accelerated deployment of renewable energy.[37] They are price-based mechanisms, which in their most basic form offer fixed preferential prices for each kWh (or MWh) generated from renewable energy sources (a 'gross FIT') or for each kWh of renewable electricity transmitted to the grid (a 'net FIT').[38] FITs are often

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[35] *Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (Text with EEA relevance)* [2009] OJ L 140/16.

[36] 'Feed-in tariffs (FITs) are also known as Standard Offer Contracts, Feed Laws, Minimum Price Payments, Renewable Energy Payments, and Advanced Renewable Tariffs': Toby Couture and Yves Gagnon, 'An analysis of feed-in tariff remuneration models: Implications for renewable energy investment' (2010) 38 *Energy Policy* 955.

[37] REN21 Secretariat, 'Renewables 2013 Global Status Report', above n 18, 76-8.

[38] For a greater discussion of gross and net FITs, see: Parliamentary Library of the Commonwealth of Australia, *Feed-in tariffs* (21 December 2011) Parliament of Australia <http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Browse_by_Topic/ClimateChange/Governance/Domestic/national/tariffs>.

coupled with priority dispatch to the grid and a binding purchase obligation upon electricity supply companies.[39] These conditions are normally contractually guaranteed for a minimum period, which may range from eight to twenty years to provide long-term security for investors and market stability.[40] FIT prices are normally reviewed on an annual or bi-annual basis, with project developers benefiting from the rates assigned to that year's vintage for the life of the feed-in tariff contract.[41] This process is also sometimes referred to as 'grandfathering.' Grandfathering provides long-term security and stability in the market, as it ensures that renewable energy projects continue to be awarded the FIT rates of their vintage, even if the FIT rate for subsequent vintages has been reduced to reflect reductions in equipment and capital costs, or the benefits of new innovations and learning.[42] Some countries use budgetary caps to control the costs of their FIT,[43] with caps on the amount of production, such as those used in Denmark, being a less common means of exercising budgetary restraint.[44]

The design of FITs has changed over time and varies considerably around the world. Initially, FITs were set at a flat rate, which did not discriminate between different technologies, in order to provide deployment at least cost. However, many FITs have now been modified, to better encourage innovation and support

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[39] Ottinger, Matthews and Czachor, above n 2, 192; Van der Linden et al, above n 33, 11; Lincoln L Davies, 'Incentivizing Renewable Energy Deployment: Renewable Potfolio Standards and Feed-In Tariffs' (2011) 1 *KLRI Journal of Law and Legislation* 39, 54. Though note that Becker et al do not believe this is a necessary condition for a FIT: Bastian Becker and Doris Fischer, 'Promoting renewable electricity generation in emerging economies' (2013) 56 *Energy Policy* 446, 447.

[40] Arne Klein, Erik Merkel, Benamin Pfluger, Anne Held, Mario Ragwitz, Gustav Resch and Sebastian Busch, *Evaluation of different feed-in tariff design options – Best practice paper for the International Feed-In Cooperation* (Ministry for the Environment, Nature Conservation and Nuclear Safety, 2010; Verbruggen and Lauber, above n 8, 637; Frässe-Ehrfeld, above n 13, 264; Kate Loynes, *Overview of Feed in Tariffs: a quick guide* (1 April 2014) Parliament of Australia <http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp1314/QG/Tariffs>; Judith Lipp, 'Lessons for effective renewable electricity policy from Denmark, Germany and the United Kingdom' (2007) 35 *Energy Policy* 5481, 5482.

[41] Verbruggen and Lauber, above n7, 637.

[42] Miguel Mendonça, 'FIT for purpose: 21st century policy' (2007) 8(4) *Renewable Energy Focus* 60, 61.

[43] International Renewable Energy Agency, *Evaluating Policies in Support of the Deployment of Renewable Power* (IRENA, 2012) 10.

[44] Lena Kitzing, Catherine Mitchell and Poul Erik Morthorst, 'Renewable energy policies in Europe: Converging or diverging?' (2012) 51 *Energy Policy* 192, 194.

emerging technologies. There are a number of different ways this can be done, including by providing differentiated or stepped tariffs for:

- different sources of renewable energy in order to achieve diversity of supply;
- different renewable energy technologies in order to ensure that there is adequate demand for promising technologies that have not yet been commercialised or reached widespread deployment.[45] This practice operates in Germany, where the technologies are banded according to the relative degree of their commercialisation, with the FITs for each technology band reduced each year to account for improvements in the relative maturity of the technology.[46] The banding of technologies was implemented in order to ensure that the most commercialised technologies did not receive windfall profits under the FIT and that a diverse range of renewable energy sources and technologies were supported.[47] This reflects the fact that the primary objective for many countries regulating to accelerate the deployment of renewable energy is to improve their energy security and diversity of supply;
- the size of the installation to provide a means of supporting both small-scale and large-scale renewable energy projects. This can also be an important way of improving competition within the electricity market, removing market barriers and preventing the large-scale incumbents from dominating the emerging market;
- the quality of the resource. There are examples of some countries such as Germany and Switzerland offering higher tariffs to projects located in areas with poorer renewable energy resources.[48] The justification for providing additional support to these projects is that these projects are less efficient and therefore will be viewed by commercial lenders as riskier, leading to higher interest rates charged on project loans and

[45] The higher tariffs on offer to less developed technologies reflect the higher costs associated with establishing one of these projects both in terms of initial capital costs for equipment and installation but also the higher capital cost of borrowing. See also Fischer and Preonas, above n 7, 58.

[46] Frässe-Ehrfeld, above n 13, 264.

[47] International Renewable Energy Agency, above n 43, 10.

[48] Couture and Gagnon, above n 36, 955.

longer periods of time before the projects become profitable. This approach also means that regulators can set the average level of the feed-in price at a lower level, without the risk of overcompensating projects located at the sites with the highest resource quality or undercompensating project developers at sites with poorer resource quality. Despite this, this approach is likely to drive up the total costs of deploying renewable energy, while actively eschewing the basic principles of comparative advantage in site selection. These factors actively distort the renewable energy market in a manner contrary to basic economic principles. These costs need to be weighed up against the benefits that a tariff differentiated upon the quality of the resource may provide; and/or

- the location of the project to encourage projects to be located in a diverse range of areas in order to get a good geographical spread to encourage flexibility of siting to improve social acceptance, to improve energy security or for political reasons.[49]

In 2010, Couture and Gagnon conducted a comprehensive study of the different remuneration models used by countries with feed-in tariffs, and the implications of these remuneration models on investment in the renewable energy sector. Their study found that feed-in tariffs, which operate on a market-independent basis, are much more common than feed-in premiums, which are market-dependent.[50] They also identified four basic models used for feed-in tariffs around the world: the fixed price model, the fixed price model with full or partial inflation adjustment, the front-end loaded model, and the spot market gap model.[51]

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[49] Ibid; Verbruggen and Lauber, above n 7, 637.
[50] Couture and Gagnon, above n 36, 956.
[51] Ibid.

7.2.1.1 FIXED PRICE MODEL

The fixed price model establishes a fixed, minimum price, which is paid for each kWh of electricity generated from renewable energy sources over the contract period. The factors considered in determining the fixed feed-in price generally include: the level of maturity of the technology, the cost of equipment and installation, the cost of capital to finance the project, licensing fees, the costs of operation and maintenance, the costs of feedstocks (relevant in the case of biomass and biogas) and a fair rate of return for investors (profitability).[52] An alternative way of setting the fixed feed-in tariff price is to use a 'value-based' assessment as a means of internalising the value of the positive externalities associated with electricity generation from renewable energy sources. The use of this method aims to 'securitise long-term grid, public health, and environmental benefits that clean distributed generation provide to a specific geographic area and/or location on the grid.'[53] The 'value-based' assessment method has not been widely adopted, with most countries preferring to price their feed-in tariff using the 'cost' method.

The fixed feed-in price will be retained for the whole length of the contract. Under this model, the fixed feed-in price is quarantined to isolate it from other market variables such as the retail price of electricity, inflation, movements in the consumer price index and the price of feedstock of fossil fuels.[54] Indeed, the only variation in the feed-in price available under this model is that some countries provide higher tariffs to renewable energy sources/technologies that are less developed, to ensure that their fixed feed-in tariff adequately compensates project developers for their higher project costs. The design of this model of feed-in tariff encourages project developers to deploy their projects

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[52] Rolf Wüstenhagen and Emanuel Menichetti, 'Strategic choices for renewable energy investment: Conceptual framework and opportunities for further research' (2012) 40 *Energy Policy* 1, 6; Frässe-Ehrfeld, above n 13, 268-9.

[53] Pierre Bull, Noah Long and Cai Steger, 'Designing Feed-in Tariff Policies to Scale Clean Distributed Generation in the US' (2011) 24(3) *The Electricity Journal* 52, 53.

[54] Couture and Gagnon, above n 36, 956.

early in the contract period.[55] This is because the feed-in price is frozen, meaning that over the life of the contract its value in real terms declines relative to the project costs. The benefits of the fixed feed-in price model are that it provides investors with certainty and makes accessing finance easier as the feed-in tariffs to be paid over the life of the project are known in advance. It is also comparatively simple to administer.[56]

7.2.1.2 INFLATION ADJUSTED FIXED PRICE MODEL

The second remuneration model used in the feed-in tariffs is a variant on the fixed feed-in price model, which either fully or partially adjusts for inflation. The design of this model seeks to overcome the decline in real terms found in the basic fixed feed-in price model. This means that unlike the basic fixed feed-in price model, the inflation adjusted fixed price model is likely to provide higher levels of remuneration near the end of a project's life.[57] For most projects, this is the period in which their capital equipment and installation costs have been paid and thus, much of the revenues generated will be largely profit. Couture and Gagnon have argued that 'this puts an undue burden on the electricity ratepayer in the long-term, by requiring continually high payments until the end of the contract term.'[58] Despite this, the inflation adjusted feed-in price model presents three advantages to regulators. First, by linking the feed-in price to inflation, it removes some of the market risk and provides additional security to investors, making it easier overall to get project finance. Second, due to the fact that a lower feed-in price is paid at the beginning of the term of the contract, this model may increase the levels of social acceptance and be easier to implement politically. Third, the market standard for Power Purchase Agreements (PPAs) is that they will be indexed to the CPI. As a result, it is arguable that the fixed feed-

[55] Ibid 956-7.

[56] Menanteau, Finon and Lamy, above n 1, 807.

[57] Couture and Gagnon, above n 36, 957.

[58] Ibid.

in price model adjusted for inflation reflects market-standard contractual terms within the electricity industry.[59]

7.2.1.3 FRONT-END LOADED MODEL

The third model of feed-in tariff is the front-end loaded model. In this model, the feed-in price is subject to high prices at the start of the contract, which then decrease over the life of the contract.[60] The outcome of this model is similar to that of the basic fixed feed-in price model, but the effect may be more pronounced where the price decreases exceed the level of inflation. This model is beneficial as it provides greater levels of funding during the initial and highly capital-intensive phases of the project, enabling project developers to repay their project loans over a shorter period. Many of the countries that provide differentiated feed-in tariffs based on resource quality, such as Germany, Switzerland, France and Cyprus, do so on the basis of a front-end loaded model.[61] The use of this model for differentiated tariffs has the benefit of encouraging innovation and improvements in production performance projects in lower resource quality areas to make up for the declining tariff levels. However, the high upfront cost burden may make the introduction of a front-end loaded model politically more difficult than the other FIT models presented here.

7.2.1.4 SPOT MARKET GAP MODEL

The fourth feed-in tariff model is the spot market gap model, which is also sometimes referred to as the 'target price feed-in tariff'[62] model. The first step under this model, which is used in the Netherlands, is that the government must decide upon the desired level of generation from that technology class. This is then used to determine the required feed-in price for each class of technology in order to achieve the desired level of generation (the 'target price'). This

[59] Ibid 958.

[60] Haas et al, 'A historical review of promotion strategies', above n 1, 1014.

[61] Couture and Gagnon, above n 36, 958.

[62] Kitzing, Mitchell and Morthorst, above n 44, 194.

determination is normally made in accordance with the principles of the national renewable energy strategy. Once the target price has been determined, renewable electricity generators have to market their own power on the spot market (though in many cases, this model retains a purchase obligation). The feed-in tariff payment is calculated by subtracting the spot market price from the target price, with the government making up the shortfall from consolidated revenue.[63] As a result, this model has the benefit of shifting the cost of renewable energy deployment not to end-use electricity consumers like many models, but ultimately to the taxpayer on the basis of their income.[64] This means that unlike many other regulatory support mechanisms used to support the accelerated deployment of renewable energy, this is not a regressive model and does not directly impact electricity prices. This model does however create a disconnect between who is paying for the feed-in tariff and who is benefiting from its existence. This is because the most energy intensive industries, that are arguably receiving the greatest benefit from increased deployment of renewable energy through improved sector performance and energy security, do not necessarily bear the largest financial burden. It also arguably increases the risk for renewable energy project developers. This is because the spot market gap model is 'contingent on a specific budgetary allocation … which may be exhausted, or fail to be renewed, by the time a proposed project begins supplying electricity to the grid.'[65] A further challenge in this model is a requirement that electricity generators market their own power on the spot market. This requirement encourages the market integration of electricity generated from renewable energy sources into the conventional electricity market. However, the transaction costs and administrative burden associated with participating in the spot market may exclude smaller-scale renewable energy generators from the market.[66]

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[63] Couture and Gagnon, above n 36, 959.

[64] See Menanteau and Sawin for alternative ways of balancing the costs of a FIT between electricity consumers and taxpayers: Menanteau, Finon and Lamy, above n 1, 802; Sawin, above n 3, 5.

[65] Couture and Gagnon, above n 36, 959.

[66] Ibid.

In addition to the four basic models of feed-in tariffs detailed above, there have been numerous variations proposed and/or implemented in a number of countries to reflect their national priorities and renewable energy resource. For example in Latvia, the feed-in tariffs are linked to specific market indicators including the price of natural gas, and prior to 1 January 2014, the exchange rate of the Lats to the Euro.[67] Meanwhile other countries such as Spain and Hungary have differentiated tariffs for their renewable energy based on the time of day and whether it is a peak or off-peak period for electricity consumption.[68] In addition, Lesser et al have proposed the design of a 'two-part FIT,' consisting of a capacity payment determined by an auction process and an energy payment that is linked to the spot market price of electricity.[69] The 'two-part FIT' is yet to be adopted by any country, but exemplifies the innovative structuring of regulatory support mechanisms within the sector.

7.2.1.5 THE ADVANTAGES AND DISADVANTAGES OF USING FEED-IN TARIFFS

Feed-in tariffs are considered one of the most effective regulatory support mechanisms due to their ability to rapidly accelerate deployment of renewable energy generation in a cost-effective manner.[70] They possess a number of advantages including that they do not require government financial support,[71] they may be structured for large and small generators, different technologies and renewable energy sources through banding, and if the rates decline over time may be effective at putting pressure to lower costs.[72] A further advantage is that FITs are usually simple to administer, with comparatively low transaction

[67] Kitzing, Mitchell and Morthorst, above n 44, 194.

[68] Ibid.

[69] Jonathan A Lesser and Xuejuan Su, 'Design of an economically efficient feed-in tariff structure for renewable energy development' (2008) 36 *Energy Policy* 981.

[70] Couture and Gagnon, above n 36, 955; Davies, 'Incentivizing Renewable Energy Deployment', above n 39, 56.

[71] Hans-Josef Fell, *Feed-in Tariff for Renewable Energies: An Effective Stimulus Package without New Public Borrowing* (2009) 20.

[72] Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 23-5.

costs.[73] However, their success depends on the tariffs being set at a high enough level to encourage investment,[74] a stable and predictable regulatory environment for the FITs[75] and the electricity generated being able to access the transmission and distribution networks. FITs do present a number of disadvantages including the risk that the tariff will not be set at the correct level due to the difficulties associated with getting up-to-date information on generation costs using different energy sources and technologies.[76] It is also difficult to predict in advance how much energy will actually be generated under a FIT.[77] In a number of countries these two factors have led to significant cost blow-outs, which have led to FITs being cancelled early or even amended retrospectively.[78] When this happens, confidence in the stability of the market diminishes and it becomes a more risky investment proposition.

7.2.2 FEED-IN PREMIUMS

Feed-in premiums (FIPs) operate on a similar basis to feed-in tariffs, but are a market-dependent regulatory support mechanism rather than a market-independent one. FIPs provide either a fixed or variable premium (also sometimes called an 'environmental bonus')[79] above the spot price for electricity for each kWh of renewable electricity generated and fed into the grid. Theoretically, the premium is set at a level equal to the externalities associated

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[73] Davies, 'Reconciling Renewable Portfolio Standards and Feed-In Tariffs, above n 2, 343-4; Parliamentary Library of the Commonwealth of Australia, above n 38.

[74] Sawin, above n 3, 5.

[75] Ingmar Ritzenhofen and Stefan Spinler, 'Optimal Design of Feed-in-Tariffs to Stimulate Renewable Energy Investments Under Regulatory Uncertainty-A Real Options Analysis' (Research Paper, Social Science Research Network, 29 April 2013) 5; Maria Ellingson et al, *Compendium of Best Practices: Sharing Local and State Successes in Energy Efficiency and Renewable Energy from the United States* (REEEP/ACORE, 2010) 59-60.

[76] Parliamentary Library of the Commonwealth of Australia, above n 38.

[77] Wüstenhagen and Menichetti, above n 52, 7-8.

[78] Thomas Gerke, *Italy imposes retroactive changes to feed-in tariff for solar PV* (15 August 2014) RE New Economy <http://reneweconomy.com.au/2014/italy-imposes-retroactive-changes-feed-tariff-pv-38857>; Nilima Choudhury, *Spain announces retroactive FiT cuts* (19 February 2013) PV Tech <http://www.pv-tech.org/news/spain_announces_retroactive_fit_cuts>; James Martin, *Western Australia announces retroactive feed-in tariff cuts* (9 August 2013) Solar Choice <http://www.solarchoice.net.au/blog/news/western-australia-announces-retroactive-feed-in-tariff-cuts-090813/>.

[79] Frässe-Ehrfeld, above n 13, 264.

with conventional fossil fuel sources of generation. However, Haas et al have reported that due to the difficulties associated with pricing those externalities, in reality, many fixed premiums are based on the estimated production costs of renewable energy when compared with the electricity price rather than any environmental benefits.[80] As with FITs, FIPs are usually guaranteed for a period of ten to twenty years;[81] however, Denmark uses pre-determined production caps to prevent cost blowouts, in their case 12,000 full load hours.[82] Some countries such as Spain offer both a FIT and a FIP, with eligible generators of renewable electricity (except for photovoltaic solar) able to select which regulatory support mechanism they will use on their projects.[83]

7.2.2.1 FIXED PREMIUM PRICE MODEL

There are three different models of FIPs: the fixed premium price model, the variable premium price model and the percentage of retail price model.[84] Under the fixed premium price model, renewable electricity is sold into the spot market rather than under long-term power purchase agreements. As a result, renewable energy generators are remunerated by a combination of the variable market price and a fixed premium price. The fixed premium may be banded according to technology type and/or project size. The fixed premium price model has been criticised as imposing greater risks than other models 'that payment levels will either be too high, or too low, which can have negative consequences for market growth, investor security, and for society at large.'[85] In addition, many premium price schemes do not have a purchase obligation, putting added pressure on renewable electricity generators. These factors have led to FIPs on average being more costly per kWh than FITs.[86] The additional cost for FIPs has been

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[80] Haas et al, 'A historical review of promotion strategies', above n 1, 1011.

[81] Frässe-Ehrfeld, above n 13, 264.

[82] Kitzing, Mitchell and Morthorst, above n 44, 195.

[83] Julieta Schallenberg-Rodriguez and Reinhard Haas, 'Fixed feed-in tariff versus premium: A review of the current Spanish system' (2012) 16 *Renewable and Sustainable Energy Reviews* 293, 294.

[84] Couture and Gagnon, above n 36, 960-2.

[85] Ibid 960.

[86] Schallenberg-Rodriguez and Haas, above n 83, 304.

attributed to project developers needing additional compensation for the added risk and 'the greater likelihood of divergence between total remuneration and actual project costs.'[87] The fixed premium price model does, however, offer some benefits; for example, FIPs allow for renewable generation to be better integrated into competitive electricity markets. In addition, they provide an incentive for renewable electricity generators to generate during peak periods of demand in order to achieve higher prices.[88]

7.2.2.2 VARIABLE PREMIUM PRICE MODEL

The variable premium price model (also called the 'sliding price' model)[89] introduces both caps and floors to the prices in order to provide greater investor security when electricity prices decline markedly, and to prevent windfall profits in the event that electricity prices rise suddenly.[90] As electricity prices rise, the premium tails off until it reaches the cap, at which point the premium price is zero and the renewable electricity generator receives the electricity spot price. Couture and Gagnon argued that this model is significantly riskier than other regulatory support mechanisms due to the fact that the remuneration of the renewable electricity generator is subject to market volatility, including that resulting from the use of conventional fossil fuel sources, which are outside the control of the renewable electricity generator.[91]

7.2.2.3 PERCENTAGE OF THE RETAIL PRICE PREMIUM PRICE MODEL

The percentage of the retail price model is the last premium-price model to be considered. This model provides renewable electricity generators with a fixed percentage of the retail electricity price for the sale of their renewable electricity. The percentage can establish that the purchase price is either above, equal to or

[87] Couture and Gagnon, above n 36, 960.
[88] Ibid.
[89] International Renewable Energy Agency, above n 43, 10.
[90] Kitzing, Mitchell and Morthorst, above n 44, 195.
[91] Couture and Gagnon, above n 36, 961.

beneath the average retail price for electricity in a given market. This model is no longer used, with countries such as Germany switching to a fixed-price FIT as a way of increasing investor security and providing greater stability to be renewable energy sector.[92]

7.2.3 RENEWABLE PORTFOLIO STANDARDS WITH TRADEABLE GREEN CERTIFICATES

Renewable portfolio standards (also known as a 'quota obligation') operate on the basis of a quota system, creating a legal obligation on licensed electricity suppliers to supply a specified percentage or volume of their electricity from renewable energy generators.[93] Some countries such as Italy use a less common type of renewable portfolio standard (RPS), which focuses on electricity producers acquiring generating capacity rather than a specific percentage or volume of their electricity sales.[94] The quota generally increases over time, with specific targets to be achieved at regular intervals, and a final target to be achieved by the expiry date of the renewable portfolio standard.

As with many of the regulatory support mechanisms, RPS programs show significant variability in their design, compliance mechanisms, technologies supported and administration. A commonality is that most countries require that their licensed electricity suppliers prove that they have met their quota obligation by presenting one tradeable green certificate[95] ('TGC') for each MWh[96] of their quota of renewable electricity.

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[92] Ibid.

[93] See generally: Leon and Clean Energy States Alliance, 'Designing the Right RPS', above n 3; Berry and Jaccard, above n 3; Ellingson, above n 75; Davies, 'Incentivising Renewable Energy Deployment', above n 39; Sawin, above n 3.

[94] Van der Linden et al, above n 33, 10.

[95] TGCs are also sometimes referred to as renewable energy certificates (RECs), renewable energy credits, green tags, green credits, green electricity certificates or certificates of origin: The Energy and Resources Institute, *Renewable Energy Credits: Prevailing Practices* (Report No 2005RT24, REEEP Project, 2006) 1-2.

[96] Though it has been reported that in some TGC schemes one TGC is issued for each kWh: See e.g. Thomas P Lyon and Haitao Yin, 'Why Do States Adopt Renewable Portfolio Standards?: An Empirical Investigation' (2010) 31 *The Energy Journal* 131, 133.

TGCs are electronic certificates issued to certify that electricity was generated from renewable energy sources. They are a separate commodity, distinct from the renewable electricity generated. In many countries, TGCs are able to be traded separately from the actual electricity produced, although some countries insist that both the renewable electricity and the TGC are bundled together.[97] The advantage of allowing the TGCs to be traded separately from the physical electricity generated is that it provides more flexibility to electricity suppliers by removing:

> geographical or physical limitations (such as resource availability), timescale (such as seasonal availability or mismatch between supply and demand) or financial limitations associated with the supply of renewable sources.[98]

TGCs are often used as a means of tracking and verifying that the correct quantities of renewable electricity have been generated to meet an electricity supplier's obligation under the quota.[99]

Under a traditional RPS, the quota is technology neutral, with each MWh of electricity generated from an eligible renewable energy source being awarded one TGC. The theory behind not imposing conditions on the types of technologies to be supported is that it would mean that regulators were not involved in 'picking winners' and would therefore ensure that the quota obligation was met at least cost. This usually means that the quota is met by renewable electricity produced by large renewable generators that have economies of scale, using the most commercialised technologies.[100] Many countries that were early adopters of the RPS such as the United Kingdom, Italy and Belgium found that the technology neutral structure of the traditional RPS was not providing them with sufficient diversity of supply to meet their energy security needs.[101] As a result, a variant (the 'modern RPS') was devised which

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[97] Leon and Clean Energy States Alliance, 'Designing the Right RPS', above n 3, 10, 30-1; Berry and Jaccard, above n 3, 267; The Energy and Resources Institute, *Renewable Energy Credits*, above n 95, 10; Grace, Donovan and Melnick, above n 3, 16.

[98] Mitchell, *The Political Economy of Sustainable Energy*, above n 4, 19.

[99] Leon and Clean Energy States Alliance, 'Designing the Right RPS', above n 3, 10; The Energy and Resources Institute, *Renewable Energy Credits*, above n 95, 9.

[100] Mitchell, *The Political Economy of Sustainable Energy*, above n 4, 12-3.

[101] Verbruggen and Lauber, above n 7, 638-40.

uses carve-outs and/or technology banding with credit multipliers in order to give preferences to some technologies or project types over others. Carve-outs or set-asides are a means of setting different targets within an RPS for different technologies or project types.[102] An example of this is the large-scale renewable energy target (LRET) and the small-scale renewable energy target (SRET) in Australia, each of which has their own eligibility criteria and rules.[103]

A more common approach seems to be the use of technology banding with credit multipliers. As stated above, under a traditional RPS, one MWh of renewable electricity is assigned one TGC. Under a credit multiplier approach this is varied with one MWh of renewable electricity produced by specific renewable energy sources or technologies being credited a positive or negative multiple of one TGC, depending on its relative degree of commercialisation.[104] For example, in the 2014/2015 obligation period in the United Kingdom, one MWh of electricity generated from onshore wind is credited 0.9 Renewable Obligation Certificates (their equivalent of a TGC), whereas wave energy which is less commercialised is credited 5 Renewable Obligation Certificates (ROCs) per MWh.[105]

There are commonly three different strategies, which may either be used in isolation or in combination, by which a licensed electricity supplier may use to meet their quota of TGCs under the RPS:

1. They can generate the specified percentage or volume of electricity from renewable energy sources themselves (i.e. they themselves produce and keep sufficient renewable electricity and TGCs to meet their quota); and/or
2. They can purchase electricity generated by a third party from renewable energy sources. This electricity can then be used to meet the company's obligation under the RPS, with the electricity then on-sold to their final

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[102] Leon and Clean Energy States Alliance, 'Designing the Right RPS', above n 3, 40-1.

[103] *Renewable Energy (Electricity) Act 2000* (Cth).

[104] Leon and Clean Energy States Alliance, 'Designing the Right RPS', above n 3, 41-2.

[105] United Kingdom Department of Energy & Climate Change and Ofgem, *Calculating Renewable Obligation Certificates (ROCs)* (1 April 2013) <https://www.gov.uk/calculating-renewable-obligation-certificates-rocs>.

customers (i.e., they purchase sufficient renewable electricity and the accompanying TGCs from a third party to meet their quota); and/or

3. They can purchase TGCs to meet their obligation.

If the licensed electricity supplier fails to meet their quota obligation in the relevant obligation period, they must pay a specified amount per TGC 'the buyout price' into a buy-out fund. The buy-out price is usually re-assessed annually and in some countries, such as the United Kingdom, it is indexed to the Retail Prices Index.[106] Payment of the buy-out price effectively acts as a fixed penalty for each TGC shortfall and allows the electricity suppliers to discharge in whole or in part their obligations under the RPS.[107]

At the end of each obligation period, the government entity responsible for managing the buy-out fund normally distributes it (along with any interest earned on the principal) among all of the electricity suppliers who have complied, either in whole or in part, with the RPS by presenting TGCs to the responsible entity.[108] Each supplier is awarded a share of the funds proportionate to the ratio of TGCs it has produced compared to the total amount of TGCs received by the relevant entity over the obligation period. In this way, revenue from non-compliant suppliers is fed back to complaint suppliers.[109] In practice, it is usual for a large portion of the buy-out payment to be passed back to the renewable generator under the terms of the renewable PPA.[110] As TGCs are freely tradeable between renewable generators and licensed electricity suppliers their value is driven by the forces of supply and demand. The greater the shortfall between the quota obligation and actual renewable generation, the higher the TGC buy-out price becomes. As the TGC buy-out price increases, so does the incentive to invest in new renewable generation.[111]

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[106] Penelope J Crossley, Miles Curley and John Pickett, 'Legislación sobre energías renovables en el Reino Unido' in Fernando Becker et al (eds), *Tratado De Energias Renovables: Volumen II. Aspectos jurídicos* (Thomson Aranzadi/Iberdrola, 2010).

[107] Ibid.

[108] Ibid.

[109] Ibid.

[110] Ibid.

[111] Ibid.

Where the licensed electricity supplier has repeatedly failed to meet their quota of TGCs and has also failed to pay the buy-out price, this is likely to breach the conditions of their operating licence. Ultimately, if this situation is not rectified, the licensed electricity supplier may have their operating licence suspended, revoked or not renewed for future terms.[112]

Some countries do allow a degree of flexibility towards electricity suppliers to assist them in meeting their quota obligations under the RPS. There are three flexibility mechanisms that can be incorporated into an RPS: TGC banking, TGC borrowing and compliance waivers. TGC banking involves the purchase of excess TGCs in years when there is a surplus, which are then banked to use to meet their obligation in a future year.[113] TGC borrowing permits electricity suppliers who have a TGC shortfall in a given obligation period to defer the shortfall to the following year.[114] Compliance waivers are where an electricity supplier that is going to have a shortfall of TGCs, due to being unable to purchase sufficient renewable energy to meet their obligation, requests permission from the managing government entity to not have to comply with their obligation in that obligation period.[115] Compliance waivers are usually issued on a one-off basis in years where there is 'a significant shortage of renewable energy generation beyond the utilities' control.'[116] While TGC banking is arguably to the advantage of renewable energy generators, neither TGC borrowing nor compliance waivers operate to their advantage. The latter two flexibility mechanisms make the operation of the RPS less stable and provide less certainty as to the quantity of electricity generated from renewable energy sources in any given obligation period. This may lead to renewable energy generators seeking to defer their projects, electricity suppliers focusing their attention on seeking

[112] Ibid.
[113] Leon and Clean Energy States Alliance, 'Designing the Right RPS', above n 3, 32-3.
[114] Ibid 33-4.
[115] Ibid 34-5.
[116] Ibid 34.

waivers rather than complying with their obligation and increase the administrative burden on the responsible government entity.[117]

7.2.3.1 THE ADVANTAGES AND DISADVANTAGES OF USING RENEWABLE PORTFOLIO STANDARDS WITH TRADEABLE GREEN CERTIFICATES

The key advantage of a traditional RPS is that the government sets a quota for desired level of renewable generation within the country, but it is then left to market forces to decide the mix of renewable energy sources and technologies used to meet that quota, as well as the price paid. There is flexibility in this approach, as the licensed electricity supplier can use one of the three approaches detailed above to meet their obligation. If the licensed electricity suppliers are behaving rationally under an RPS they will select the cheapest form of renewable generation, which in turn will reduce the costs borne by the end-consumers. However, this approach has been criticised for ignoring the

> …qualification of RE supplies, promoting already mature and less sustainable RE supplies while neglecting more promising sources that are not quite as close to market-readiness.[118]

In the case of a modern RPS, the use of carve-outs and/or technology banding with credit multipliers, means that RPS are no longer technologically neutral and that governments are now engaged in 'picking winners.' While a diverse portfolio of renewable energy sources and technologies is beneficial in terms of ensuring energy security, its efficiency and cost-effectiveness is now dependent on the government being able to accurately select the correct mix for the market. Further, the complexity involved in the design of the modern RPS, may also make the implementation, and monitoring and compliance, more technically difficult and costly. Indeed, repeated studies have shown that RPS have failed to deliver the same quantities of deployment as FITs and that the average cost of that deployment has also been higher.[119] This reflects that in the case of both the

[117] Ibid 32-5.

[118] Verbruggen and Lauber, above n 7, 642.

[119] Peng Sun and Pu-yan Nie, 'A comparative study of feed-in tariff and renewable portfolio standard policy in renewable energy industry' (2015) 74 *Renewable Energy* 255; C G Dong, 'Feed-in tariff vs. renewable portfolio standard: An empirical test of their relative effectiveness in promoting wind capacity development' (2012) 42 *Energy Policy* 476; Haas et al, 'A historical

traditional and modern RPS, the lack of ongoing certainty over the price to be paid increases the risk and uncertainty for investors.[120] Concerns have also been expressed that the quota may act as an 'unintentional ceiling on renewable energy development, with little incentive to go beyond the minimum rate set by the policy.'[121]

Many of these problems can be overcome through properly designed RPS that provide long-term stability, yet for which compliance can be simply monitored. However, the challenges associated with RPS mean that they may not be suitable for all countries, which likely explains why the popularity of RPS has diminished in recent years in favour of FITs, FIPs and competitive tendering processes.[122]

7.2.4 RENEWABLE ENERGY TARGETS

Renewable energy targets (RETs) are commitments or goals set by a government that stipulate that either a specific percentage or volume of installed capacity or generation will be met from renewable energy by a future date. There is significant variation in the targets set for the percentage of electricity to be generated from renewable sources, with targets for 2020 ranging from 3.8 per cent for Malta (up from 0.8% in 2012) to 100 per cent in the Cook Islands, Niue, Tokelau and Djibouti.[123] The targets may be legislated or established under policies set by the relevant ministries or energy authorities.

review of promotion strategies', above n 1, 1026; Lucy Butler and Karsen Neuhoff, 'Comparison of Feed-in Tariff, Quota and Auction Mechanisms to Support Wind Power Development' (2008) 33 *Renewable Energy* 1854, 1858; Couture and Gagnon, above n 36, 955; Lakshmi Alagappan, Ren Orans and Chi-Keung Woo, 'What drives renewable energy development?' (2011) 39 *Energy Policy* 5099, 5099.

[120] Katrin Jordan-Korte, *Government Promotion of Renewable Energy Technologies: Policy Approaches and Market Development in Germany, the United States, and Japan* (Gabler Research, 2011) 138.

[121] Benjamin K Sovacool, 'A comparative analysis of renewable electricity support mechanisms for Southeast Asia' (2010) 35 *Energy* 1779, 1786.

[122] Mir-Artigues and del Río, above n 5, 434.

[123] REN21 Secretariat, 'Renewables 2014 Global Status Report' (Report, Renewable Energy Policy Network the 21st Century, 2014) 119-20.

RETs are currently the most popular form of policy intervention within the renewable energy sector, existing in 144 countries in early 2014.[124] There are many variations of the key features of RETs including whether:

- the targets are legally binding or non-binding aspirational goals;
- the targets focus on renewable electricity generation alone or are focused on the heat and transport sectors either individually or through a combined target;
- the target is based on the renewable share of primary energy, final energy, the installed capacity of particular renewable energy sources/technologies or their energy output; and
- there is a set date for the achievement of the target or no end date.

Where the RET is legally binding it will normally be coupled with a TGC scheme to make monitoring and compliance easier. However, many countries have non-binding targets. The success or failure of a RET depends on whether it has been appropriately designed in the context of the domestic market to which it applies.

A number of countries that were relatively early movers with RETs have recently reviewed their RETs to decide whether they should operate in their current form. In the United Kingdom, the government recently announced that there will not be a RET beyond 2020, with their domestic mix of low-carbon energy to be made up of a mix of sources including nuclear power, natural gas, and renewable energy to be decided on a technology-neutral basis by the market.[125] The EU-wide target of at least 27 per cent of energy to be generated from renewable sources by 2030 will continue to apply.[126] However, unlike the 2020 target that was enforceable for each Member State, the 2030 target is not expected to be

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[124] Ibid 75.

[125] Fiona Harvey, 'Loss of renewable target is backward step in fight against climate change', *The Guardian* (online), 23 January 2014 <http://www.theguardian.com/environment/2014/jan/22/no-renewable-target-climate-change>; Tom Bawden, 'EU admits it has no power to enforce its 'binding' 2030 renewable energy targets', *The Independent* (online), 22 January 2014 <http://www.independent.co.uk/news/world/europe/eu-admits-it-has-no-power-to-enforce-its-binding-2030-renewable-energy-targets-9078390.html>.

[126] European Council, *Conclusions on 2030 Climate and Energy Policy Framework*, SN 79/14 (23-4 October 2014).

binding on individual Member States, with the target for the EU as a whole.[127] There has already been speculation that this means that after 2020 'there will be no meaningful renewable energy target,'[128] in the EU. Australia has recently also been through a RET Review, which recommended that the LRET be changed from 41,000 GWh of electricity from large-scale renewable energy by 2020 to 20 per cent of electricity generation by 2020.[129] This reflects concerns by industry that, in the context of declining electricity demand and greater energy efficiency, the volumetric requirement of the RET meant that approximately 27 per cent of electricity generation had to come from renewable energy sources.[130] The Review Panel recommended that the revised 20 per cent target for large-scale generation should be achieved through a series of yearly targets set one year in advance that correspond to 50 per cent of growth in electricity demand.[131] However, the recommendations are yet to be passed by the Commonwealth Parliament due to considerable concerns about the impact of the change on the renewable energy industry in Australia.

7.2.5 COMPETITIVE TENDERING AND AUCTION BIDDING

Under competitive tendering processes, the government issues a request for proposal (RFP) for the installation of a specific capacity of electricity generated from renewable sources. During the RFP process, applicants are required to submit a comprehensive proposal that details the technical, economic, environmental and financial details of the proposed project.[132] The RFPs are then reviewed by the program managers in accordance with a competitive

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[127] European Council, *Conclusions on 2030 Climate and Energy Policy Framework*, SN 79/14 (23-4 October 2014).

[128] Bawden, above n 125.

[129] Renewable Energy Target Scheme, *Report of the Expert Panel* (August 2014) <https://retreview.dpmc.gov.au/sites/default/files/files/RET_Review_Report.pdf>.

[130] Ibid.

[131] Ibid.

[132] Clean Energy States Alliance, *Development an Effective State Clean Energy Program: Competitive Grants* (CESA, 2009) 1.

framework to determine whether the project will be supported and the level of funding to be provided.[133]

An alternative method of allocating competitive grants is a reverse auction conducted using an auction bidding process. Using this method, the government 'defines a reserve market for a given amount of [electricity generated from renewable energy sources] and organises a competition between renewable producers to allocate this amount.'[134] The reverse auction is usually conducted using a standard form contract, with a few terms that may be the subject of bidding such as the price, quantity, delivery dates and minimum performance standards. As with all government procurement, while the criteria against which the tenders may be judged will vary, in most cases the bids that best meet the government's requirements with the least cost proposed per kWh during the bidding process will be selected. In order to meet the required amount of renewable electricity under the reverse auction, 'the proposals are classified in increasing order of cost until the amount to be contracted use reached.'[135] At the conclusion of the auction, each of the successful bidders is then awarded a long-term contract on the terms of the standard contract to supply electricity generated from renewable sources at their bid price.

One of the first reverse auction processes for renewable energy was introduced in the United Kingdom under the Non-Fossil Fuel Obligation (NFFO). The NFFO was established on 1 October 1990 to provide a subsidy to the State-owned nuclear companies, following the privatisation of the rest of the electricity generation sector in United Kingdom in 1989.[136] The NFFO later came to be used by the renewable energy sector, with a plan to deliver 1500MW of installed capacity from renewable energy sources by 2000.[137] The NFFO tender process sought to support generation from a range of renewable energy technologies, with certain quantities of installed capacity to be realised by different renewable

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[133] Ibid.

[134] Menanteau, Finon and Lamy, above n 1, 802.

[135] Ibid 802-3.

[136] Mitchell, *The Political Economy of Sustainable Energy*, above n 4.

[137] Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 441.

energy technologies in the form of a reverse auction.[138] Those project developers awarded contracts were given long-term contracts of up to fifteen years' duration, with:

> … a guaranteed surcharge per unit of output for the entire contract period. The difference between the surcharge paid to NFFO generators (premium price) and a reference price (Pool Selling Price) was to be financed by a levy on all electricity sales of licensed electricity suppliers. The costs of this levy were to be passed on to consumers.[139]

Five bidding rounds were conducted in England and Wales under the NFFO, with 880 contracts being awarded.[140] Over this period, there were considerable price drops in the average price per kWh for renewable energy. In particular, in Scotland, the price paid for wind power per kWh dropped to be lower than that for electricity generated from coal, oil, nuclear and even some natural gas sources.[141] These price reductions may be related to a number of factors such as declining technology costs, better site selection, learning experience of operators, better economies of scale, and improved technical performance.[142]

Despite this apparent success, the general consensus among scholars is that the NFFO was profoundly flawed.[143] Many of the projects awarded contracts were never constructed, while others failed to meet their contractually agreed levels of installed capacity. Indeed, less than a third of the contracts awarded for wind power projects were ever realised.[144] Thus, across the range of renewable energy technologies there were shortfalls in the levels of installed renewable energy generation capacity to be achieved by the NFFO. This failure has been primarily attributed to bidders, under the pressure of stiff competition, submitting aggressive bids containing unrealistic bid prices in an attempt to

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138 Sawin, above n 3, 6-7.

139 Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 441-2.

140 Ibid 442.

141 Menanteau, Finon and Lamy, above n 1, 807-8; Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 442.

142 Menanteau, Finon and Lamy, above n 1, 808.

143 Catherine Mitchell and Peter Connor, 'Renewable Energy Policy in the UK 1990-2003' (2004) 32 *Energy Policy* 1935, 1936-8; Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 442, 444; Menanteau, Finon and Lamy, above n 1; Lesser and Su, above n 69, 983.

144 Lesser and Su, above n 69, 983; see also Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22.

secure a contract.[145] The lack of effective penalties for non-delivery meant that there were no real costs involved in not fulfilling their contractual obligation.[146] A further problem was that at the time of bidding, project developers were not required to seek prior planning consent, leading to some projects being subsequently denied planning permission, while other project developers had problems trying to interconnect to the transmission lines.[147] As a result, the NFFO program was closed and replaced in April 2002 by a renewable portfolio standard or quota obligation scheme, the Renewables Obligation Order.[148] This pattern seems to have been reflected in the experience of other countries, with similar schemes adopted during the 1990s in France, Ireland, Denmark, Scotland, Northern Ireland and many states in the United States.[149] Most of these schemes were abandoned in the early 2000s.[150]

In recent years there has been a resurgence in competitive tendering schemes, with 55 countries, including nine EU countries (Bulgaria, Hungary, Malta, Lithuania, Latvia, Italy, Portugal, France and Denmark)[151] having adopted competitive tendering or auction processes by early 2014.[152] This is a significant upwards shift from the nine countries that had adopted competitive tendering schemes in 2009.[153] These modern competitive tendering schemes have been designed in such a way as to overcome many of the earlier problems; in particular, appropriate penalties are often now included to prevent non-delivery of projects.[154] Further, most countries have now changed their national planning

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145 Ottinger, Matthews and Czachor, above n 2, 199; Alagappan, Orans and Woo, above n 119, 5101; Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22.

146 Mitchell and Connor, above n 143, 1937; Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 442; Lesser and Su, above n 69, 983; Menanteau, Finon and Lamy, above n 1, 806-7.

147 Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 442, 444.

148 Mitchell and Connor, above n 143.

149 Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 441. See also Menanteau, Finon and Lamy, above n 1, 802.

150 Haas et al, 'Promoting electricity from renewable energy sources', above n 3, 441. See also Menanteau, Finon and Lamy, above n 1, 802.

151 Mir-Artigues and del Río, above n 5.

152 REN21 Secretariat, 'Renewables 2014 Global Status Report', above n 123, 81.

153 Ibid.

154 European Commission, *Guidance for the design of renewables support schemes*, SWD(2013) 439 Final (5 November 2013) 6.

policy and laws to give renewable energy project developers greater certainty that their planning application will be approved.[155]

Competitive tendering is seen as an effective regulatory support mechanism in terms of both its cost effectiveness,[156] and its fiscal responsibility, as the costs of running such a scheme are passed on to electricity consumers.[157] Leon has argued that competitive tendering in the form of reverse auctions can also be an efficient way of delivering renewable energy because they enable 'the level of incentive to be set by the lowest-cost renewable projects, while not paying more than necessary.'[158] This can present a downside, though, as it does not support the development of less-established technologies that may potentially provide more efficient and cost-effective delivery of renewable energy in the future.[159] This point is identified by Sovacool, who has argued that competitive tendering lacks static efficiency, does not encourage dynamic efficiency and is also inequitable.[160] He argues that competitive tendering schemes usually favour large incumbent players in the market, including state-owned enterprises (SOEs) (where these still exist) without profit motives.[161] For example, independent power providers and small firms may choose not to participate if they believe that the chance of them submitting a winning bid is much lower due to not having the track record or the economies of scale.[162] Indeed, where these schemes have existed without penalties in place for non-delivery, there has been evidence that 'a small number of players have 'gamed' bid prices to block out competitors (but never intended to achieve complete projects).'[163] A further problem occurs where private firms are forced to compete with SOEs that may

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155 See e.g. Department of Energy and Climate Change, 'National Policy Statement for Renewable Energy Infrastructure' (Paper, United Kingdom Parliament, July 2011).

156 Ottinger, Matthews and Czachor, above n 2, 199; Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22; The Energy and Resources Institute, above n 22, 11.

157 Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22-3.

158 Leon and Clean Energy States Alliance, 'Designing the Right RPS', above n 3, 52.

159 Ibid.

160 Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22.

161 Ibid.

162 Leon and Clean Energy States Alliance, 'Designing the Right RPS', above n 3, 52.

163 Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22.

not have the same profit motives, and can therefore commit to unreasonably low prices.[164]

It is perhaps too early to be able to evaluate the effectiveness of the latest round of competitive tendering programs. However, due to their focus on the least cost delivery of renewable energy, if some of the other problems can be overcome, competitive tendering programs may be an effective method of rapidly deploying the technologies that are currently the least-cost option.

7.2.6 SUBSIDIES

Subsidies have been defined by the WTO as a financial contribution made by a government or any other public body within the territory of a member country that confers a benefit.[165] Subsidies have been used within the energy sector since the mid-1800s, when the United Kingdom government first provided subsidies for the use of coal in order to accelerate the Industrial Revolution.[166] Since this time, subsidies have been used to support a range of energy transitions, from supporting the development of oil and natural gas production and use, to more recently aiding the development of the nuclear energy industry. Many countries continue to provide subsidies either for the production or the use of conventional fossil fuels. The provision of these subsidies is problematic because subsidising energy prices distorts the market signals that govern supply and demand by masking the true cost of fossil fuel generation and leading to higher use. Ironically, it is the long-term and ongoing provision of these subsidies to conventional fossil fuels that has created a significant market barrier to the development of the renewable energy sector. Indeed, one of the strongest arguments supporting the provision of subsidies to the renewable energy sector is to enable competition with existing subsidised conventional fossil fuel sources.

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[164] Ibid.

[165] *Agreement on Subsidies and Countervailing Measures*, WTO Doc 1869 UNTS 14 (15 April 1994) Arts 1, 1.1.

[166] Jonathan Pershing and Jim Mackenzie, 'Removing Subsidies: Levelling the Playing Field for Renewable Energy Technologies' (Paper presented at the International Conference for Renewable Energies, Bonn, 2004) 1.

Despite recent efforts by the OECD, World Bank, IEA,[167] and the Group of Twenty (G20)[168] in advocating for the reduction and eventual removal of subsidies to the conventional fossil fuel sector, as long as these subsidies exist they will provide a rationale, in addition to all of the other existing market failures and barriers, for the provision of subsidies to the renewable energy sector.

Subsidies to the renewable energy sector take two main forms: investment subsidies and consumer subsidies. Investment subsidies may take a number of forms including rebates, clean energy loans, investment tax credits and production tax credits. These are each discussed in more detail below. Where these subsidies solely target investment, rather than production, they are seen as problematic as there is no incentive to operate the renewable energy project efficiently, innovate or lower costs. Consumer subsidies may take the form of direct payments, reduced prices, or low-interest loans to incentivise consumers to install or use renewable energy. Examples of these schemes include the National Solar Schools Program in Australia, which provided schools with a grant of up to $AUD 50,000 to support the installation of solar panels,[169] and the exemption from energy tax for green energy consumption in the Netherlands.[170]

Pershing and McKenzie have argued that subsidies for renewable energy should be directed towards: '(1) reducing technical barriers; (2) overcoming market impediments (including through internalising externalities); and (3) addressing administrative barriers and social and environmental constraints.'[171] However, due to the market-distorting effect of subsidies and their potential impact upon the government's budget, a number of considerations need to be taken into account prior to establishing and implementing a renewable energy subsidy

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[167] IEA, OPEC, OECD and World Bank, 'Joint report by IEA, OPEC, OECD and World Bank on fossil-fuel and other energy subsidies: An update of the G20 Pittsburgh and Toronto Commitments' (Paper prepared for the G20 Meeting of Finance Ministers and Central Bank Governors and the G20 Summit, France, October-November 2011).

[168] See e.g. the G20 Pittsburgh and Toronto Commitments.

[169] Energy Matters, *Australian solar schools program* (2012) <http://www.energymatters.com.au/renewable-energy/solar-power/grid-connected-systems/solar-for-schools.php>.

[170] Ottinger, Matthews and Czachor, above n 2, 199.

[171] Pershing and Mackenzie, above n 166, 15.

program. First, all existing subsidies directed at conventional fossil fuel generation and use should be decreased and eventually discontinued. The removal of conventional fossil fuel subsidies should prevent over-expenditure on energy subsidies, because renewable energy will no longer need to be subsidised to compete with subsidised conventional fossil fuels. Second, a cost-benefit analysis should be carried out prior to the introduction of a subsidy to ensure that the subsidy is warranted and is set at an appropriate level. Third, if renewable energy is to be subsidised, the subsidy should be appropriately targeted, transparent, provided for a limited time span, and provided through 'competitive mechanisms to ensure that excess 'rents' are dissipated.'[172] The requirement that subsidies are available only for a limited lifespan is particularly important. The provision of long-term and ongoing subsidies, particularly when they are linked to investment rather than performance, stifles innovation and competition within the sector. A further concern regarding the lifespan of energy subsidies is that it is often politically difficult to discontinue them. This is because of the immediate short-term economic impacts that the removal of energy subsidies would have on energy prices. Any sudden movements in energy prices will have particular impacts on the cost of living of those on low incomes and, as a result will be politically unpopular. A fourth concern that needs to be considered prior to the introduction of a subsidy program (if the country introducing it is a member of the WTO), is whether the program will comply with the Agreement on Subsidies and Countervailing Measures.[173] As will be shown in Chapter 8, there have been a number of referrals made to the WTO in respect of subsidies that have been designed, and then subsequently implemented, in contravention of these rules. This behaviour is particularly prevalent among countries that are trying to establish a foothold in the renewable energy market, as a common tactic is the inclusion of domestic content clauses in their subsidies in order to bolster their domestic renewable

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[172] Ibid 14.

[173] *Marrakesh Agreement Establishing the World Trade Organisation*, opened for signature 15 April 1994, 1867 UNTS 3 (entered into force 1 January 1995) annex 1A ('Subsidies and Countervailing Measures'); Yulia Selivanova, 'The WTO agreements and energy' in Kim Talus (ed), *Research Handbook on International Energy Law* (Edward Elgar, 2014) 275, 302-5; Anton Ming-Zhi Gao, 'Promotion of renewable electricity: Free trade and domestic industrial development' in Kim Talus (ed), *Research Handbook on International Energy Law* (Edward Elgar, 2014) 407.

energy technology manufacturing sector. Therefore, while the provision of subsidies can be an effective tool to accelerate the deployment of renewable energy, careful consideration must be given to avoiding the negative impacts associated with their use.

7.2.7 CLEAN ENERGY LOANS

As discussed in Chapter 5, one of the major barriers to the widespread deployment of renewable energy is the high initial capital costs involved with establishing new renewable energy projects. As a result, the cost and availability of debt and project financing have a major impact on the long-term viability of the renewable energy sector.[174]

One of the difficulties in seeking financing for renewable energy projects from private lenders is the risk profile associated with new and emerging renewable energy technologies. As these technologies are often unproven on a large scale, they may not be 'bankable', particularly if project financing is required. This is because the lender needs to ensure that the project will generate sufficient revenue to ensure that the loan will be repaid. However, even in circumstances where private lenders are willing to lend to renewable energy projects, the loans are likely to attract high interest rates and shorter loan terms, reflecting the perceived risk of lending to projects using new technologies.[175] This can add significant costs to renewable energy projects.

In an attempt to address these challenges, 65 countries use clean energy loans as one of their regulatory support mechanisms to promote the accelerated deployment of renewable energy.[176] To establish a clean energy loan program, governments provide the initial loan pool, which then operates as a revolving loan facility. The Clean Energy Finance Corporation of Australia, which has its

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174 Sawin, above n 3, 20; Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 1.

175 Sawin, above n 3, 20; Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 1.

176 REN21 Secretariat, 'Renewables 2013 Global Status Report', above n 18.

investment pool funded by five grants from consolidated revenue of $AU 2bn per annum for the first five years of its operation, is an example of a clean energy loan program.[177]

Clean energy loan programs may be either 'administered directly by a government agency or through a public-private partnership in which the program is administered by a private financial institution.'[178] Common features of clean energy loan programs are that they offer:

- lower interest rates than would be available on the private lending market;
- longer amortization periods, with repayment terms often reflecting a conservative estimate of the anticipated life of the project (i.e., ten years or more);
- simplified application and administrative processes, especially for smaller renewable energy projects; and
- loans without a debt service coverage requirement and without additional secured charges over property that is not the subject of the loan.[179]

The loans granted under a clean energy loan program vary considerably but common types include: direct loans,[180] matching loans,[181] and interest rate buydowns.[182]

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[177] Clean Energy Finance Corporation, *Annual Report of the Clean Energy Finance Corporation 2012-13* (CEFC of Australia, 2013).

[178] Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 1.

[179] Ellingson, above n 75, 44; Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 1.

[180] Direct loans are where the government acts as both loan underwriter and servicer: Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 1-2.

[181] Matching loans are where the government provides a share of the total figure to be borrowed at below market rates on the condition that the borrower must find a commercial lender to provide the balance of the loan amount: Ibid 1-2.

[182] Interest rate buydowns are where the government either (a) 'subsidises the interest rate offered by a private lender for a qualified loan'; or (b) 'provides a lump sum payment to the lender in exchange for the lender offering a below-market interest rate': Ibid 2.

Clean energy loan programs have a number of benefits for governments. First, it provides the government with certainty as to the cost of the program over time, as the value of the loan is known upfront and just as with private lenders, the default rate on the loans can be predicted and minimised with proper evaluation and monitoring processes.[183] Second, clean energy programs are relatively easy to administer[184] and, if run successfully, may actually generate substantial private sector investment, which in turn will increase acceptance amongst others lenders in regard to the financing of renewable energy projects.[185] Ottinger et al have reported that South Korea's largest wind farm was funded with the assistance of a clean energy loan that was coupled with an offtake agreement in which the agreed purchase price was double the price offered to coal-fired generation.[186]

Indeed, the only downside to adopting a clean energy loan program as one of the country's secondary regulatory support mechanisms is the need for the country to be sufficiently wealthy to be able to dedicate the funds to establish the initial pool of capital from consolidated revenue. This may be difficult to do in lower income countries, which may have more pressing problems such as health or education that need to be addressed first. It is likely that this explains why nearly half of the countries with clean energy loan programs are high-income countries,[187] and when upper middle-income countries are included the figure rises to two thirds of all countries with this regulatory support mechanism.[188]

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183 Mir-Artigues and del Río, above n 5; Ellingson, above n 75, 44.

184 Mir-Artigues and del Río, above n 5.

185 For example, 'In 2013, the CEFC's investments of $536 million mobilised on average $2.90 of private sector investment for every $1 of CEFC investment and will achieve abatement of 3.88 million tonnes of [carbon dioxide equivalent (CO2e)] per annum. These investments will deliver a positive return to the CEFC, with a cost of abatement in the order of negative $2.40 per tonne CO2e:' Clean Energy Finance Corporation, above n 177, 18-9.

186 Ottinger, Matthews and Czachor, above n 2, 195.

187 27 out of 65 countries with clean energy loan programs are deemed to be high income, which REN21 define according to GNI per capita as $US 12,476 or more: REN21 Secretariat, 'Renewables 2013 Global Status Report', above n 18, 77.

188 45 out of 65 countries with clean energy loan programs are deemed to be upper-middle income, which REN21 define as a GNI per capita in the range of $US4036 - $US12475: Ibid 76-7.

7.2.8 REBATES

Rebates are lump-sum payments paid to the owner of a renewable energy project to cover a portion of the initial capital cost of that project. They are designed to provide 'a temporary incentive to encourage investment until such time as prices decline to the point of becoming cost competitive in the marketplace.'[189] As such, rebate programs focus on reducing the high capital costs associated with purchasing and installing renewable energy projects, while increasing consumer awareness and creating a demand in the market for the new technology.

The proportion of the costs to be covered by the rebate is usually determined after an examination of the available funds, desired size of the market, the cost of alternatives, and a study of the existing market trends.[190] Ellingson has stated that usually rebate programs seek to cover 20 to 50 per cent of total project costs.[191] However, Sawin, Haas et al and the Clean Energy States Alliance have criticised the approach of providing a percentage of the total investment in the project, stating that this does not encourage investors to seek out the most cost-effective and efficient option.[192] Instead, they advocate providing a fixed dollar amount per watt of installed generating capacity;[193] these amounts can also be capped to provide a maximum amount per project or banded to provide different levels of support depending on project size.

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[189] Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 1.

[190] Ellingson, above n 75, 53; Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 1.

[191] Ellingson, above n 75, 52.

[192] Sawin, above n 3, 20; Haas et al, 'How to Promote Renewable Energy Systems Successfully and Effectively', above n 8; Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 1.

[193] Sawin, above n 3, 20; Haas et al, 'How to Promote Renewable Energy Systems Successfully and Effectively', above n 8; Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 1.

Some countries provide rebates as an upfront payment to purchasers of renewable energy technologies.[194] Other countries only provide rebates to the project owner upon project completion.[195] Where the rebate is paid upfront, rebate programs can be particularly effective during periods with high interest rates and limited capital availability, as they reduce the total amount of funds that need to be borrowed.[196] Rebates also have the additional advantage of providing the same benefit to all project developers regardless of their income. Sawin has argued that this not only means that rebates are more equitable than tax credits but ensures that they also result in smoother growth over time rather than encouraging people to invest towards the end of a tax year.[197]

There are a number of downsides associated with the use of rebate programs. Unlike tax credits, rebate programs require explicit funding from central government. This means that they are subject to potential instability and uncertainty if the budget levels are frequently altered. In addition, where the level of rebates granted is not linked to performance or generation of electricity, rebates can distort the market without adequate cost recovery. The use of rebates that provide a proportion of the investment costs rather than being linked to the level of performance also means that projects may be located in less favourable locations or use technologies which do not provide efficient levels of performance.[198] To counter these problems, rebates should be designed as performance-based incentives, linked to the measured output of the renewable energy project over a specified period. In addition, governments should ensure the long-term continuity and stability of the project by guaranteeing funding for five to ten years, with the rebate levels gradually declining to reflect the declining costs of the technology.[199]

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[194] Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 1.

[195] Ellingson, above n 75, 52.

[196] Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 1.

[197] Sawin, above n 3, 20.

[198] Ellingson, above n 75, 52-3; Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 2.

[199] Ellingson, above n 75, 52-3; Clean Energy States Alliance, *Developing an Effective State Clean Energy Program*, above n 132, 2.

7.2.9 TAX INCENTIVES

A wide range of tax incentives and concessions are available to participants in the sector to improve the competitiveness of investing in renewable energy. Indeed, tax incentives are used in 92 countries to promote renewable energy. The most common of these incentives are investment tax credits and production tax credits, but some countries also use tax deductions[200] to provide:

- Full or partial relief from income or corporate tax for renewable electricity. Income tax relief is directly available in Belgium and indirectly in the United Kingdom and the Netherlands through favourable depreciation rules and enhanced capital allowances.[201]
- Exemptions for qualifying renewable energy generators from energy taxes such as in Poland and Latvia.[202]
- Lower rates of value added tax (VAT) applied to sales of qualifying renewable energy technologies such as in France and Portugal.[203]
- Property tax reductions for land used to locate renewable energy projects such as in some American states.[204]
- Many countries also provide a 'reduction or elimination of import duties for renewable energy technologies or components'[205] to reduce the high initial capital costs of renewable energy projects. This is especially valuable in countries without a strong domestic manufacturing industry.[206]

Kitzing et al also note that by enabling consumers to engage in net metering, governments are also providing a degree of tax relief to consumers from the volumetric taxes that are applicable to electricity usage such as energy taxes, carbon taxes and VAT.[207] This is the case in Denmark for net metering

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[200] Tax deductions permit either the full or a partial amount of qualifying expenses to reduce the gross amount of tax owed.

[201] Kitzing, Mitchell and Morthorst, above n 44, 195; Van der Linden et al, above n 33, 12.

[202] Kitzing, Mitchell and Morthorst, above n 44, 195; Van der Linden et al, above n 33, 12.

[203] Kitzing, Mitchell and Morthorst, above n 44, 195; Van der Linden et al, above n 33, 12.

[204] Ellingson, above n 75, 62.

[205] Sawin, above n 3, 19.

[206] Ibid.

[207] Kitzing, Mitchell and Morthorst, above n 44, 195.

installations in small houses.[208] Another benefit for renewable energy generators is that they are not subject to some of the environmental and carbon taxes to which other conventional fossil fuel electricity generators are subject.

Tax incentives are a popular regulatory support mechanism as they are comparatively simple to administer, effective in lowering the investment and production risks associated with the sector and *prima facie* do not need to be funded out of consolidated revenue as they merely reduce the amount of tax collected.

7.2.9.1 INVESTMENT TAX CREDITS

Investment tax credits provide a full or partial tax credit for investments in renewable energy technologies. In some cases, the eligibility for these investment tax credits may also extend to the installation of these technologies. Investment tax credits work by reducing the high capital costs associated with investing in new renewable energy technologies and therefore reduce some of the risk of investment.[209] They are also beneficial in supporting dynamic efficiency as they can be specifically targeted to support less mature technologies.[210]

Sovacool has stated that despite these benefits, investment tax credits also have a number of disadvantages. He states that the investor still needs to be able to afford to make the high initial upfront payments and then must wait until their tax return has been processed before receiving the credit.[211] Further, because investment tax credits target investment in a technology rather than the comparative performance of the technology, they may send the market incorrect signals as to which technology to invest in.[212] The design of investment tax credits also does not provide an incentive to drive down the costs of renewable

[208] Ibid.
[209] Sawin, above n 3, 18; The Energy and Resources Institute, above n 22, 19.
[210] Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 20.
[211] Ibid.
[212] Ibid.

energy technologies.[213] Despite this, when coupled with production tax credits, there are clear market signals for selecting to invest in technologies that will, once the technology is installed and generating electricity, be both efficient and cost-effective.

7.2.9.2 PRODUCTION TAX CREDITS

Production tax credits provide the owner or investors in qualifying renewable energy projects with tax credits calculated on the basis of the number of kWh of electricity generated by the project and fed into the grid within the tax year. Production tax credits reward efficient performance and the cost-efficient production and supply of renewable energy into the grid. This is because the cheaper the cost of generating and supplying electricity, the greater the profit from the production tax credit. Indeed, one study calculated that the benefits of extending production tax credits to the wind industry in the United States for ten years would result in predicted cost savings for wind turbines of 22 per cent or $US 380 per installed kW over the period.[214] It should be noted that, due to their structure, production tax credits generally favour larger renewable energy projects rather than providing investment in smaller-scale projects.[215] However, this problem may be lessened when both production tax and investment tax credits are available to investors and owners, as, depending on the design of the investment tax credit, they are likely to fulfil this role of supporting small-scale projects.

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[213] Ibid.

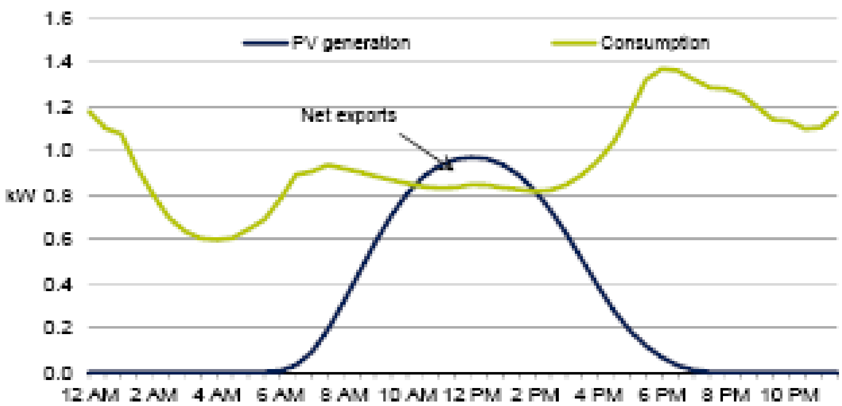
[214] Ryan Wiser, Mark Bollinger and Galen Barbose, 'Using the federal production tax credit to build a durable market for wind power in the United States' (2007) 20(9) *The Electricity Journal* 77, 84.

[215] Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 21.

7.2.10 NET METERING

Net metering is another popular regulatory support mechanism that has been adopted by 43 countries by 2014. It is most commonly used to encourage the deployment of small-scale renewable energy projects amongst residential and small business customers. Net metering involves customers who have a source of renewable energy generation installed (commonly photovoltaic (PV) solar cells) connecting it to the electricity distribution network using a bi-directional electricity meter. The bi-directional meter registers when the customers produce electricity that is surplus to their own needs and it gets exported to the grid, and also conversely, it registers when they have an electricity deficit and so have to import electricity from the grid. To illustrate this concept, the following diagram shows the average electricity consumption and PV solar generation of a customer in NSW, Australia over a 24-hour period to highlight the likely times of electricity export from PV solar generation and the times of electricity deficit:

GRAPH 7.1: AN ILLUSTRATIVE EXAMPLE OF ONE CUSTOMER'S ELECTRICITY CONSUMPTION AND PV SOLAR GENERATION IN NSW OVER A 24-HOUR PERIOD[216]



216 Independent Pricing and Regulatory Tribunal of New South Wales, 'Solar feed-in tariffs: Setting a fair and reasonable value for electricity generated by small-scale solar PV units in NSW, Energy' (Final Report, March 2012) 35.

The payment for the exported electricity is then credited against the cost of the imported electricity supplied by the utility company. At the end of each billing period, the customer is charged the net cost of the electricity (i.e. the cost of electricity imports less the cost of electricity exports). Where the net cost of the electricity used by the customer is negative, the customer is then credited this amount as against their next electricity bill.[217] The customer normally also retains the ownership of any environmental benefits attained through their generation of renewable electricity such as renewable energy credits/TGCs.

Sawin has stated that net metering offers advantages to both network operators and electricity generators by improving system load factors and offsetting the need for new peak load generating plants. However, drawing upon the experiences of Texas and California, she also notes that without other financial incentives, net metering alone will not advance market penetration of renewable energy.[218] Verbruggen and Lauber agree with this analysis, finding that because less competitive technologies such as small onshore wind turbines or PV solar currently have generation costs that exceed the retail electricity prices, providing remuneration at retail price levels will not be sufficient to stimulate growth in these technologies.[219] They argue that if the purpose of net metering is 'to stimulate technological development and learning, remuneration should be based on generated renewable energy quantities (irrespective of whether used on site or delivered to the grid).'[220]

A further challenge to net metering is the potentially disruptive nature of the new energy storage technologies currently being developed and commercialised.[221] As energy storage technologies become more cost-competitive and commercially available, net metering may suffer a decline as the amount paid for electricity exported to the grid is often significantly less than the

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[217] Ernest E Smith, 'US Legislative Incentives for Wind-Generated Electricity: State and Local Statutes' (2005) 23 *Journal of Energy & Natural Resources Law* 173, 180.
[218] Sawin, above n 3, 5.
[219] Verbruggen and Lauber, above n 7, 637.
[220] Ibid.
[221] UBS, 'We Love a Sunburnt Country' (Report, UBS Utilities Sector, 17 May 2014) 2.

cost of electricity imported. Further, with the increasing penetration of energy storage technologies, the advantages of price arbitrage will diminish, leading to a long-term diminution of the price spread between the peak and off-peak periods.[222] In these circumstances, it may become more cost-effective to store any excess electricity generated and then use it at those times when renewable energy cannot be generated, such as at night time (for PV solar) or when wind is not blowing (for wind energy).

7.2.11 PUBLIC BENEFIT FUNDS

Public benefit funds, also known as 'systems benefits funds' or' clean energy funds', involve charging customers a small tax per kWh of electricity used. In some countries, instead of being linked to electricity consumption, a small fixed fee is charged instead to customers as part of their electricity bill.[223] The funds collected under these programs are then used by countries to pursue a range of socially beneficial energy projects, such as removing the technical, regulatory and market barriers to emerging renewable technologies.[224] These funds tend to be used in three different ways to:

1. target investment in renewable energy programs through the provision of loans;
2. promote project development through the provision of competitive grants, rebates, and production incentives; or
3. support the development of the renewable energy industry by a supporting research and development, providing technical assistance, consumer education, and financing demonstration projects.[225]

Most countries use their public benefit funds to support a diverse portfolio of programs and incentives.

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[222] See, e.g. Bartholomäus Wasowicz et al, 'Evaluating regulatory and market frameworks for energy storage deployment in electricity grids with high renewable energy penetration' (Paper presented at the 9th International Conference on the European Energy Market, Florence, 2012) 2.

[223] Ellingson, above n 75, 23-4.

[224] Ibid.

[225] Ibid.

Public benefit funds appear to be most commonly found in some of the American states. They are thought to be fiscally responsible, as the funds are derived directly from ratepayers rather than through consolidated revenue.[226] Sovacool has also argued that they promote dynamic efficiency because they enable policymakers to support a broad array of technologies and projects, including those that may benefit low-income consumers.[227] Despite this, there have been questions raised as to whether public benefit funds promote efficacy, cost-effectiveness and equity.[228] This is because, while the funds may be used to support projects that benefit low-income consumers, the beneficiaries of these funds tend to be corporations or foundations that have the skills and capacity to put together proposals to access the funds.[229] Further, because public benefit funds tend to provide lump sum support, there is little incentive to innovate over time.

7.2.12 RESEARCH AND DEVELOPMENT SUPPORT

It is often said that there are five stages to technological innovation: (1) research and development; (2) demonstration; (3) deployment into niche markets; (4) diffusion; and (5) commercial maturity. The first two stages of technological innovation are highly capital-intensive, with significant risks of failure. This, coupled with the current cost differential between the renewable energy and fossil fuels (which have artificially low prices due to the subsidies given to conventional fossil fuels and the failure to internalise the costs of externalities), provides a justification for the support of research and development.

Research and development support is a supply-side mechanism that is designed to encourage the development of new renewable energy technologies and reduce the cost of existing technologies through further technological improvements. This mechanism is quite commonly adopted as a secondary instrument. All ten

[226] Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 19-20.
[227] Ibid.
[228] Ibid.
[229] Ibid.

jurisdictions[230] investigated by Fischer and Preonas in their study of policies promoting renewable energy in the electricity sector reported that they used it as a support mechanism.[231] This research also shows that research and development support, as a secondary instrument, is often used in combination with feed-in tariffs (eight out of ten jurisdictions), renewable portfolio standards/quota obligations (five out of ten jurisdictions).[232] It also often co-exists with other secondary instruments such as subsidies (three out of ten jurisdictions) and tax incentives (five out of ten jurisdictions).[233]

The bulk of the existing research and development support provided to the renewable energy sector is provided by governments, though private companies are also involved in providing this support, both on an individual company basis and through industry-wide partnerships with research institutions. Governments also have the ability to mandate that private companies dedicate a specified portion of their profits towards research and development. This mandatory approach for private companies is not often used, with governments preferring to offer substantial tax breaks to encourage voluntary participation instead.

Ottinger et al have noted that in recent years, 'corporations have significantly decreased their long-term research and development expenditures. Governments have done the same thing from budgetary concerns.'[234] Further, Mitchell has expressed a concern that despite research and development support being provided in United Kingdom, it is yet to materially change the nation's energy outlook.[235] She attributes this 'in part to the fact that similar funding to nuclear and fossil fuels has dwarfed that for renewables, but it also can be taken as a general indictment of research funding as a renewables promotion

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[230] The jurisdictions considered in the study were Canada, Denmark, Germany, Japan, the Netherlands, New Zealand, Norway, Spain, the United Kingdom, the United States of America (Federal) and the United States of America (states).

[231] Fischer and Preonas, above n 7, 60.

[232] Ibid.

[233] Ibid.

[234] Ottinger, Matthews and Czachor, above n 2, 195.

[235] Mitchell, *The Political Economy of Sustainable Energy*, above n 4, 51.

device.'[236] This is because even when adequate research and development support is provided, sufficient market demand must exist to support the commercialisation of technologies developed using this supply-side mechanism.[237] Sovacool has further expressed concerns that, while research and development support promotes dynamic efficiency by being flexible and enabling a wide range of projects and applications, it may not necessarily be efficient, cost-effective, equitable or fiscally responsible.[238] Many of these criticisms seem to be attributable to the fact that research and development support relies upon substantial government support and hence is subject to budgetary pressures.[239] Further, the projects selected for support may not necessarily be the most cost-effective, and will by necessity, tend to be located at bigger institutions or corporations that have the specialist equipment and support to conduct this research.[240]

7.2.13 GREEN POWER SCHEMES

Green power schemes or 'green marketing' are voluntary programs, which provide consumers with the option to purchase all or a portion of their electricity from guaranteed sources of 'green' power for a premium.[241] This premium often takes the form of consumers paying a higher rate for each kWh of green power consumed, reflecting the higher costs involved in generating green power. Green power schemes are used in a number of predominately higher income countries. However, due to the fact that they are run voluntarily by electricity supply companies, precise figures on the number of countries in which they are presently offered are not available.

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[236] Ibid.

[237] Ibid

[238] Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 18.

[239] Ibid 19.

[240] Ibid.

[241] See generally, Rosemary Lyster and Adrian Bradbrook, *Energy Law and the Environment* (Cambridge University Press, 2006, Melbourne) 155-63.

Two key factors affect the successful implementation of green power schemes. First, as these are voluntary programs, without the development of an industry standard, the definition of green power may vary significantly between different electricity supply companies. In particular, where the term 'alternative energy sources' has been used in renewable energy laws, often it does not just include renewable energy but may also include other sources of energy such as 'clean coal' (which is electricity produced using low greenhouse gas emitting supercritical coal-fired generators).[242] Therefore, it is important that the definition of green power used in green power schemes is clearly defined and reflects common understandings of that phrase: that is, only including renewable energy sources. This approach has been adopted in the United States, where the electricity industry uses the definition from the United States Environmental Protection Agency (US EPA) as its market standard. The US EPA defines green power as 'electricity produced from renewable sources which produce no man-made greenhouse gas emissions, have a superior environmental profile compared to conventional power generation, and were built after 1 January 1997.'[243]

A second variable that will affect the ultimate success of any green energy program is the willingness of electricity customers to pay a higher price for renewable electricity. Willingness to pay varies considerably by country, and is related to consumer awareness of environmental issues and specific market conditions. The level of price differential from electricity generated using conventional fossil fuel sources is also a relevant factor, leading to green power schemes generally supporting generation from the most commercialised sources of renewable energy in order to keep green power prices low.[244] Ottinger et al have reported that in most countries with green power schemes, approximately one per cent of electricity consumers are willing to pay the higher prices

[242] *Law on Alternative Energy Sources* (Ukraine) 20 February 2003, no 555-IV, Art 1 [Linguistico Translations translation from Ukrainian].

[243] United States Environmental Protection Agency, *Green Power Partnership Glossary* (22 August 2014) EPA <http://www.epa.gov/greenpower/pubs/glossary.htm>.

[244] Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 17.

involved in joining a green power scheme,[245] while Sovacool has stated that participation rates rarely exceed five per cent.[246] This may change over time, with the Netherlands (which has high levels of environmental awareness and concern) displaying uptake rates of approximately 13 per cent of all electricity customers.[247] Van der Linden has theorised that the low uptake levels in many countries may at least in part be due to 'consumer scepticism about the premium being used effectively to promote renewables.'[248]

With these low uptake levels and due to their voluntary nature, green power schemes cannot be relied upon as a primary mechanism for accelerating the deployment of renewable energy. Further, there is a tendency for the majority of consumers to be 'free-riders' and to not change their consumer behaviour.[249] Despite this, these schemes are seen as a valuable because they provide customers with a choice of purchasing electricity generated from renewable sources, increase customer awareness of the availability of electricity generated from renewable sources and create acceptance for other regulatory support mechanisms.[250]

7.2.14 OTHER STRATEGIES

In addition to the regulatory mechanisms that are often found in the primary renewable energy legislation detailed above, a number of other strategies exist to help promote the accelerated deployment of renewable energy. These include:

1. Internalising the externality costs associated with conventional fossil fuels through the introduction of carbon taxes, ETS and other pollution pricing mechanisms;[251]

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[245] Ottinger, Matthews and Czachor, above n 2, 198.
[246] Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 16.
[247] Ottinger, Matthews and Czachor, above n 2, 198.
[248] Van der Linden et al, above n 33, 12.
[249] Bradbrook, above n 3, 23-4; Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 17.
[250] Bradbrook, above n 3, 23.
[251] Ottinger, Matthews and Czachor, above n 2, 202-3.

2. Providing improved transmission planning using anticipatory transmission planning processes. Most transmission planning occurs on a reactive basis, this means that planning, reinforcement and/or construction of transmission and distribution lines does not occur until after a renewable energy project developer has made a request the transmission interconnection and service. Reactive planning can add considerable uncertainty and create delays for renewable energy projects. For example, the planning process for the Beauly-Denny transmission line in Scotland, which was urgently required to enable new renewable generation projects access to the transmission and distribution network, spent over six years being considered by the authorities before approval was finally granted.[252] Moving to anticipatory transmission processes, where transmission planning, and in some cases, construction, occurs prior to a formal request from a renewable energy project developer will lessen uncertainty by providing project developers greater clarity about how, when, and where transmission access and interconnection are likely to be granted;[253]

3. Encouraging the use of renewable energy in government procurement to foster demand for renewable energy.[254] The US EPA has recommended that state and local governments should consider aggregated purchasing of renewable energy, so that government agencies do not need individually to negotiate power purchase agreements and to enable access to bulk purchase discounts;[255]

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[252] Kristy Dorsey, 'Beauly-Denny: Shock to the System', *Scotland on Sunday (Edinburgh)* (online), 10 January 2010 <http://business.scotsman.com/business/BeaulyDenny-Shock-to-the-system.5969536.jp>.

[253] Alagappan, Orans and Woo, above n 119, 5101-3.

[254] Ottinger, Matthews and Czachor, above n 2, 200; Ellingson, above n 75, 96-7.

[255] United States Environmental Protection Agency, *Clean Energy Lead by Example Guide* (2009) 10 <http://www.epa.gov/statelocalclimate/documents/pdf/epa_lbe_full.pdf>.

4. Providing education and training is another common strategy used by countries to promote the accelerated deployment of electricity generated from renewable energy sources. Ottinger et al have argued that the general public, energy decision-makers and the private sector need to be educated about 'the external costs of fossil fuels, the need to reduce carbon dioxide emissions, and the available renewable energy options, applications, costs, and benefits.'[256] Many countries such as Australia[257] and Germany[258] now include energy issues, including those associated with renewable energy generation, as a core component of the school curriculum. Meanwhile, the Ministry of New and Renewable Energy of the Indian Government runs a number of programs utilising electronic and print media, radio advertising, exhibitions and outdoor advertising to disseminate information on renewable energy and promote its uptake.[259]

5. In developing countries, a number of non-governmental organisations (NGOs) have partnered with private sector enterprises to overcome the inability of governments in low-income countries to fund large clean energy loan programs by introducing micro-finance and leasing schemes to support small-scale renewable energy projects.[260] These schemes enable consumers either to purchase outright or lease small renewable energy systems (thereby removing the need for consumers to bear the high upfront capital equipment costs). The micro-finance loans issued under these schemes are often aggregated, with banks lending to a local community association to avoid the costs associated with servicing many

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[256] Ottinger, Matthews and Czachor, above n 2, 200.

[257] New South Wales Department of Education and Communities, *Teaching for sustainability* (2011) New South Wales Government http://www.curriculumsupport.education.nsw.gov.au/env_ed/teaching/index.htm>.

[258] Gerhard De Haan, 'The BLK '21' programme in Germany: a 'Gestaltungskompetenz'-based model for Education for Sustainable Development' (2006) 12 *Environmental Education Research* 19.

[259] Ministry of New and Renewable Energy, *Support programmes* (2014) Government of India <http://mnre.gov.in/schemes/support-programmes/>.

[260] United Nations Development Programme and United Nations Capital Development Fund, *Clean Start: Microfinance opportunities for a clean energy future* (2013) UNCDF <http://www.uncdf.org/sites/default/files/Documents/cleanstart_publication.pdf>.

small loans.[261] One of the other features of these micro-finance loans is that they can be tailored to reflect local social and economic conditions. For example, a key feature of a program that saw 140,000 small-scale wind turbines installed in Inner Mongolia and successfully producing power for more than 500,000 people was that the loan repayments were scheduled to coincide with harvest season and the future sales of cattle or wool.[262]

The use of these policy-based strategies in combination with the regulatory support mechanisms outlined above to target particular market failures and barriers provide a number of advantages. First, policies are often more flexible than regulatory support mechanisms and thus can be amended quickly in the event of sudden market shifts. Second, they can be more easily designed to target particular communities or geographic regions as they do not require the same level of political negotiations as legislation. For these reasons, though, policies are often considered to be less effective than legislation in providing stability and certainty as to the government intervention in the sector, as well as sometimes lacking in public legitimacy. Further, as with the regulatory support mechanisms, these interventions also impose costs and their impacts need to be closely evaluated and understood, particularly when they are used in combination with a number of regulatory support mechanisms.

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[261] See e.g. Ibid; P Sharath Chandra Rao, Jeffrey B Miller, Young Doo Wang and John B Byrne, 'Energy-microfinance intervention for below poverty line households in India' (2009) 37 *Energy Policy* 1694; Kadra Branker, Emily Shackles and Joshua M Pearce, 'Peer-to-peer financing mechanisms to accelerate renewable energy deployment' (2011) 1 *Journal of Sustainable Finance & Investment* 138.

[262] Eric Martinot et al, 'Renewable energy markets in developing countries' (2002) 27 *Annual Review of Energy and the Environment* 309, 318-9.

7.3 EVALUATING THE SUCCESS OF REGULATORY SUPPORT MECHANISMS

Given the range of options available for regulatory support mechanisms designed to accelerate the deployment of renewable energy, evaluating their relative success or failure within specific national contexts is an important task. As shown above, each regulatory support mechanism presents its own advantages and disadvantages. One of the greatest challenges for governments is deciding which regulatory support mechanisms are most appropriate for their national and local conditions, such that the regulatory support will garner sufficient public support. This process of evaluation ensures that the regulatory support mechanisms adopted within a country meet national and local needs,[263] are cost effective, have static and dynamic efficiency and are equitable.

Numerous criteria have been proposed in the academic literature against which regulatory support mechanisms should be evaluated. However, the approach that seems to have garnered the most support is a test based on the:

- *efficacy* of the mechanism in achieving its objectives in accelerating installed capacity or generation;
- *efficiency* of the mechanism relative to other alternatives (incorporating both static and dynamic efficiency);
- *equity* of the mechanism in terms of who is paying for the mechanism and who is benefiting; and
- *institutional feasibility,* which considers whether the mechanism is transparent and predictable and likely to be accepted by the industry and the general public.[264]

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[263] Ottinger, Matthews and Czachor, above n 2, 205.

[264] Catherine Mitchell, Janet L Sawin, Govind R Pokharel, Daniel Kammen and Zhongying Wang et al, 'Policy, Financing and Implementation' in Ottmar Edenhofer, Ramón Pichs Madruga, Youba Sokona, Kristin Seyboth, Patrick Matschoss et al (eds), *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation* (IPCC, 2011); Verbruggen and Lauber, above n 7; International Renewable Energy Agency, above n 43.

When regulatory support mechanisms were first introduced to the sector, most countries made a choice between adopting a feed-in tariff (a price-based mechanism) and a renewable portfolio standard/quota obligations (a quantity-based mechanism). However, the general consensus from much of the research in this field is that there is no single 'best' regulatory support mechanism that will adequately support the development, and subsequent commercialisation, of all renewable energy sources, technologies and scales of renewable energy projects.[265] The vast majority of countries now use a combination of different regulatory support mechanisms.[266] They will often adopt a primary mechanism, commonly either a feed-in tariff, a renewable portfolio standard or competitive tendering, but this will now be supported with a number of secondary mechanisms such as tax incentives, research and development support. In some countries, hybrid mechanisms combining elements of feed-in tariffs and renewable portfolio standards have been developed.[267]

7.3.1 COMBINING REGULATORY SUPPORT MECHANISMS

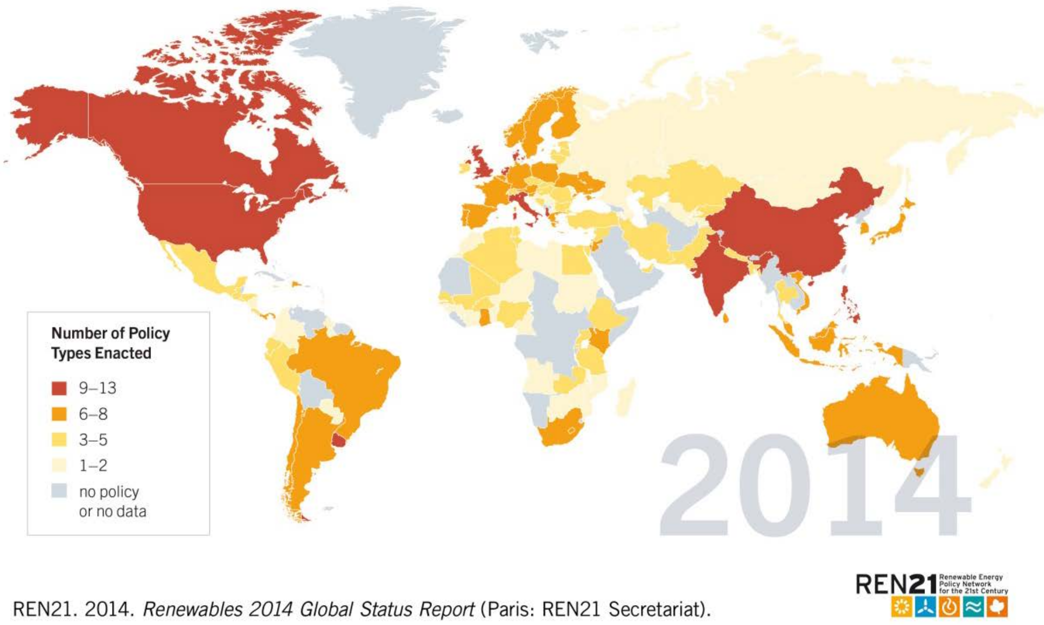
The popularity of using a combination of regulatory support mechanisms is highlighted by the following map produced by REN 21, which shows the number of policies enacted by different countries:

[265] Ottinger, Matthews and Czachor, above n 2, 206.

[266] REN21 Secretariat, 'Renewables 2014 Global Status Report', above n 123, 79.

[267] Davies, 'Reconciling Renewable Portfolio Standards and Feed-in Tariffs', above n 2, 313; Davies, 'Incentivizing Renewable Energy Deployment', above n 39, 81; Van der Linden et al, above n 33, 61.

FIGURE 7.2: COUNTRIES WITH RENEWABLE ENERGY POLICIES IN EARLY 2014[268]



The number of mechanisms used in combination is strongly correlated to the income of the country, with the IRENA reporting in 2012 that 'high income countries employ an average of 4.8 different policy types, whereas in low-income countries it is only 2.2.'[269] The specific combinations of mechanisms adopted (although no clarity is provided on whether they have been legislated or are merely policy initiatives) in different countries are contained in the table excerpted from the REN21 Report in Appendix 5.

One of the issues with the growing use of combinations of regulatory support mechanisms is there is little research available on how different mechanisms interact when used in concert and the impact of this interaction.[270] Much of the previous research has focused on which primary instrument is more efficient in achieving cost effective and technologically diverse deployment. However, this does not consider how these instruments are used in reality by the vast majority of countries. This makes it is difficult to know which combinations of regulatory support mechanisms might best address the market failures that exist within the

[268] REN21 Secretariat, 'Renewables 2014 Global Status Report', above n 123, 79.
[269] International Renewable Energy Agency, above n 43, 9.
[270] Mir-Artigues and del Río, above n 5, 430; Fischer and Preonas, above n 7.

sector. In particular, Mir-Artigues and del Río have expressed concerns that 'the interaction between instruments has been shown to lead to conflicts, resulting in inefficiencies, redundancies, double coverage or double counting.'[271] Similarly, Fischer and Preonas have warned that a lack of coordination between mechanisms will increase the burden to consumers and taxpayers, and possibly lead to the overcompensation of renewable energy generators.[272] This situation requires close attention where a renewable energy source or technology may benefit from more than one regulatory support mechanism.[273]

7.4 CONCLUSION

Countries have adopted a diverse array of combinations of regulatory support mechanisms to help accelerate their deployment of renewable energy. This suggests two conclusions. First, while many countries appreciate that government intervention is required to support the deployment of renewable energy, no one mechanism or combination of mechanisms will meet the needs of every country. Second, different combinations of regulatory support mechanisms may be better suited to meeting the market failures, market barriers and legislative objectives of different countries. Unfortunately, while it is known that there is divergence in the regulatory support mechanisms, the extent of this divergence and the full impact of using a number of mechanisms in combination are unknown. Further research is required so that the impact of combining different mechanisms on the operation and development of the renewable energy sector is better understood. The use of a combination of regulatory support mechanisms also increases the legislative complexity of the renewable energy sector and may make it more difficult for sectoral-wide soft convergence processes to effectively occur over time.

[271] Mir-Artigues and del Río, above n 5, 431.
[272] Fischer and Preonas, above n 7.
[273] Ottinger, Matthews and Czachor, above n 2, 192.

What is apparent, though, is that the mechanisms adopted in a country need to be tailored to the specific needs of that country in the context of their natural resource endowment, energy market structure, level of development and political and cultural context. Ideally, the mechanisms should set a clear target and be relatively simple to administer, which in turn should reduce the obligations of monitoring compliance and ensuring enforcement with the mechanism. Reducing complexity in the design and implementation of regulatory support mechanisms will also lower transaction costs and barriers to entry for market participants, making soft convergence easier in the future. Mechanisms that have a long life-span, with the grandfathering of support for existing participants and reductions in the incentive over time (coupled with a clear end date) to reflect learning effects and cost reductions in the technologies, also provide the market with certainty and stability. The mechanism should only be available to new installed capacity, so that existing renewable generation projects cannot benefit from super-profits. In addition, there seems to be consensus that it is appropriate to band the level of support that the mechanism provides in accordance with the level of commercialisation of the technology to ensure that a diverse range of energy sources and technologies are supported. However, the successful design, implementation and enforcement of compliance with mechanisms are not enough; renewable energy projects also require appropriate infrastructure so that they may connect to the transmission and distribution networks. Finally, a clear government commitment over the long term to correct the market failures in the renewable energy sector will decrease the perceived risk within the sector and potentially increase the available capital for investment.