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How Do Countries Regulate to Support Renewable Energy?

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.

5.1 THE SELECTION OF REGULATORY SUPPORT 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; Reinhart 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 Ottlinger, Lily Mathews 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) subject to competitive bidding via an auction or endogenous (i.e. subject to market fluctuations due to trading of an instrument)?⁷

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://nri.org/download/2011-17-when-renewable-energy-policy-objectives-conflict/#>>; Ottlinger et al., above n 2, 193–9; Reinhard Haas et al., ‘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, 264–5, 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 Río, ‘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
11. Is the country a member of the Energy Charter Treaty or another bilateral or multilateral agreement that may impact upon the design, implementation, or any subsequent amendment to, their national renewable energy law?

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.

⁸ Verbruggen et al., 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, 12–13.

⁹ *PreussenElektra AG v. Schleswag AG* (C-379/98) [2001] EUECJ 160; European Commission, 'State Aid: Commission Opens In-depth Inquiry into Support for Energy-intensive Companies Benefiting 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 <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) <<https://ustr.gov/about-us/policy-offices/press-office/press-releases/2011/june/china-ends-wind-power-equipment-subsidies-challenged>>; B. Olmos Giupponi, 'Mapping Emerging Countries' Role in Renewable Energy Trade Disputes' (2015) 12(3) *Transnational Dispute Management* 1; Timothy Meyer, 'Explaining Energy Disputes at the World Trade Organization' (2017) 17 *International Environmental Agreements* 391; Rafael Leal-Arcas and Andrew Filis, 'Renewable Energy Disputes in the World Trade Organization' (2015) 12(3) *Transnational Dispute Management* 1.

5.1.1 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 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.

5.1.2 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 et al., 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 without significant load losses from the west of China, where it was generated, to the east of China, where there was substantial demand.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, at least temporarily, ‘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 significant intermittent generation.¹⁷ This issue of countries installing additional capacity that is neither distributed generation nor grid-connected has been so problematic that in the past it prompted REN-21

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’, *Financial Times* (online), 19 September 2011 <www.ft.com/cms/s/2/83fef47e-e2cc-11e0-93d9-0014feabdc0.html#ixzz1dy6binoo>.

¹⁶ Kat Cheung, *Integration of Renewables - Status and Challenges in China* (Working Paper, IEA/OECD, 2011).

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

to alter the way that they calculated and reported renewable energy statistics.¹⁸ As a result, the use of this basis of classification without the addition of further distinctions or refinements seems flawed.

5.1.3 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

There is some disagreement between scholars as to whether 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

¹⁸ REN21 Secretariat, ‘Renewables 2013 Global Status Report’ (Report, Renewable Energy Policy Network for 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.

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.

distinguishes the most common mechanisms on this basis and also on whether they are generation based (that is, focus on kWh or MWh) or capacity based (that is, focus on kW or MW installed).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 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.

5.1.4 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 eminent 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 et al. have drawn upon the work of Menanteau, Finon and Lamy²⁸ to classify the commonly adopted primary and secondary regulatory support mechanisms using these distinctions, as shown in Table 5.1. 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.

²³ See, TERI (ed.), above n 22, 4.

²⁴ Menanteau et al., above n 1.

²⁵ Verbruggen et al., 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 et al., above n 1.

TABLE 5.1 *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 Connection 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 programmes Contribution programmes		
Voluntary	Generation based	Green tariffs		Voluntary agreements

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

5.1.4.2 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

²⁹ Haas et al., ‘A historical review of promotion strategies’, above n 1, 1011–2.

³⁰ See e.g. Menanteau et al., above n 1; Haas et al., ‘Promoting electricity from renewable energy sources’, above n 3, 424–5.

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) achieves 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.

5.1.4.3 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 project³² or, alternatively, to pay a volumetric premium for electricity generated from renewable energy sources. The latter mechanism is often called a ‘green power scheme’, ‘green marketing’ or a ‘green tariff’ in the literature.³³

5.1.4.4 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

³¹ Ibid.

³² Haas et al., ‘Promoting Electricity from Renewable Energy Sources’, above n 3, 425.

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.

5.2 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), net metering, subsidies, loans, rebates, investment tax credits, production tax credits, green power schemes, grants, research and development support and other indirect mechanisms.

One of the difficulties in comparing these support mechanisms is that while each type of mechanism possesses some common characteristics, their design and implementation differs 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.

5.2.1 Feed-in Tariffs

Once the most commonly adopted regulatory support mechanism, feed-in tariffs (FITs)³⁶ have recently been surpassed by competitive tendering as the

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.

tool of choice to support the accelerated deployment of renewable energy.³⁷ FITs 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 Historically, they were often coupled with priority dispatch to the grid and a binding purchase obligation upon electricity supply companies,³⁹ though these conditions are now less common in modern FITs. Where conditions are available, they 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 such as Austria use budgetary caps to control the costs of their FIT, with other countries such as Cyprus and Portugal using caps on the amount of production as a means of exercising

³⁷ REN21 Secretariat, ‘Renewables 2018 Global Status Report’ (Report, Renewable Energy Policy Network for the 21st Century, 2018) 64–7.

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 <www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Browse_by_Topic/ClimateChange01/governance/domestic/national/feed>.

³⁹ Ottinger et al., above n 2, 192; Van der Linden et al., above n 34, 11; Lincoln L Davies, ‘Incentivizing Renewable Energy Deployment: Renewable Portfolio 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 et al., *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 et al., above n 7, 637; Frässe-Ehrlfeld, above n 13, 264; Kate Loynes, *Overview of Feed in Tariffs: A Quick Guide* (1 April 2014) Parliament of Australia <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 et al., above n 7, 637.

⁴² Miguel Mendonça, ‘FIT for Purpose: 21st Century Policy’ (2007) 8(4) *Renewable Energy Focus* 60, 61.

budgetary restraint.⁴³ Budgetary control over feed-in tariffs remains a key issue, with a number of countries including China, Spain, Italy, Bulgaria and the Czech Republic recently having to either reduce their tariffs or close schemes early due to budget overrun.

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

1. different sources of renewable energy in order to achieve diversity of supply;
2. 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.⁴⁴ This practice operates in countries such as Germany, Malaysia, Slovakia and Turkey, 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.⁴⁵ 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

⁴³ RES Legal, *Compare Support Schemes* (2018) <www.res-legal.eu/compare-support-schemes/>; Lena Kitzing, Catherine Mitchell and Poul Erik Morthorst, ‘Renewable Energy Policies in Europe: Converging or Diverging?’ (2012) 51 *Energy Policy* 192, 194.

⁴⁴ 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.

⁴⁵ See e.g. *Gesetz für den Ausbau erneuerbarer Energien (Erneuerbare-Energien-Gesetz – EEG 2017)* [Renewable Energy Sources Act 2017] [German Federal Ministry for Economic Affairs and Energy translation from German], §§40–53; Sustainable Energy Development Authority Malaysia, *Feed-in Tariff Dashboard* (2018) <<http://seda.gov.my/>>; Vyhláška N°18/2017 Úradu pre reguláciu sietových odvetví z 8. februára 2017, ktorou sa ustanovuje cenová regulácia v elektroenergetike a niektoré podmienky vykonávania regulovaných činností v elektroenergetike [Decree N° 18/2017 of the Regulatory Office for Network Industries dated 8 February 2017 establishing price regulation in the electricity sector and certain conditions for the implementation of regulated activities in the electricity sector], §10 (Slovakia); Council of Ministers Decision No. 2013/5625 published in the Official Gazette No. 28842, dated 5 December 2013 (Turkey).

renewable energy sources and technologies were supported.⁴⁶ 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;

3. 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;
4. the quality of the resource. There are historical examples of some countries such as Germany and Switzerland offering higher tariffs to projects located in areas with poorer renewable energy resources.⁴⁷ This practice continues to occur in China, with the National Energy Administration dividing the country into three regions based on their suitability for solar generation, which are then offered differential regional tariffs.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 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. It can also help to address issues of grid constraint and connection issues by directing deployment to unconstrained regions. 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

⁴⁶ IRENA, *Evaluating Policies in Support of the Deployment of Renewable Power* (IRENA, 2012) 10.

⁴⁷ Couture et al., above n 37, 955.

⁴⁸ Liu Bin, *China Solar Industry Struggles Through Sudden Subsidy Cuts* (15 August 2018) Climate Home News <www.climatechangenews.com/2018/08/15/china-solar-industry-struggles-sudden-subsidy-cuts/>.

5. the location of the project. This can encourage projects to be located in a diverse range of areas in order to achieve a good geographical spread and 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

5.2.1.1 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 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 This approach has been adopted in the Japanese FIT. 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.

⁴⁹ Ibid; Verbruggen et al., above n 7, 637.

⁵⁰ Couture et al., above n 37, 956.

⁵¹ Ibid.

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.

The fixed feed-in price will be retained for the 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 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

5.2.1.2 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, which is used in countries such as the Czech Republic and Hungary, 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 revenue generated will be 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 obtain 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

⁵⁴ Couture et al., above n 37, 956.

⁵⁵ Ibid 956–7.

⁵⁶ Menanteau et al., above n 1, 807.

⁵⁷ Couture et al., above n 37, 957.

⁵⁸ Ibid.

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

5.2.1.3 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 An example of this model is found in the Belarusian FIT, which has a high initial FIT multiplier for the first ten years of the project, before stepping down the multiplier at the ten-year anniversary date and then again at the twenty-year anniversary date for the remaining life of the contract.⁶¹ 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. 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.

5.2.1.4 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 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 determination is normally made in accordance with the principles of the national renewable energy

⁵⁹ Ibid 958.

⁶⁰ Haas et al., ‘A Historical Review of Promotion Strategies’, above n 1, 1014.

⁶¹ Resolution of the Council of Ministers of the Republic of Belarus of 07.08.2015 №45 ‘On the tariffs for electricity produced from renewable energy sources on the territory of the Republic of Belarus by individual entrepreneurs and legal entities who are not members of the State Electricity Production Association “Belenergo”, and released to supply companies of this association’.

⁶² Kitzing et al., above n 44, 194.

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 those who pay for the feed-in tariff and those who benefit 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

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, prior to the suspension of its FIT in 2016 due to corruption concerns, the feed-in tariffs were 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 Hungary and the Ukraine have differentiated tariffs for their renewable energy

⁶³ Couture et al., above n 37, 959.

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

⁶⁵ Couture et al., above n 37, 959.

⁶⁶ Ibid.

⁶⁷ Kitzing et al., above n 44, 194.

based on the time of day and whether the electricity is being consumed during a peak or off-peak period.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 it exemplifies the innovative structuring of regulatory support mechanisms within the sector.

5.2.1.5 The Advantages and Disadvantages of Using Feed-in Tariffs

Feed-in tariffs were historically 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 offer 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, they may be effective at putting pressure to lower costs.⁷² A further advantage is that FITs are usually simple to administer and have comparatively low transaction costs.⁷³ However, their success depends on the tariffs being set at a sufficiently high level to encourage investment,⁷⁴ a stable and predictable regulatory environment for the FITs⁷⁵ 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

⁶⁸ RES Legal, *Compare Support Schemes* (2018) <www.res-legal.eu/compare-support-schemes/>.

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 et al., above n 37, 955; Davies, ‘Incentivizing Renewable Energy Deployment’, above n 40, 56; Peng Sun and Pu-yan Nie, ‘A Comparative Study of Feed-in Tariff and Renewable Portfolio Standard Policy in the Renewable Energy Industry’ (2015) 74 *Renewable Energy* 255, 261.

⁷¹ Hans-Josef Fell, ‘Feed-in Tariff for Renewable Energies: An Effective Stimulus Package Without New Public Borrowing’ (2009) Deutscher Bundestag 20.

⁷² Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 23–5.

⁷³ Davies, ‘Reconciling Renewable Portfolio Standards and Feed-in Tariffs’, above n 2, 343–4; Parliamentary Library of the Commonwealth of Australia, above n 39.

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.

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 blowouts, which have led to FITs being cancelled early or even amended retrospectively.⁷⁸ Further, international experience has repeatedly shown that it can be time consuming and difficult to adjust tariff levels quickly. When a tariff is amended retrospectively or cancelled, confidence in the stability of the market diminishes and it becomes a more risky investment proposition. It is for these reasons that the EU State Aid Guidelines have stated that feed-in tariffs are no longer to be supported as an eligible form of state aid by Member States, with a preference for competitive tendering and feed-in premiums instead.⁷⁹

5.2.2 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’)⁸⁰ 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 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.⁸¹ As with FITs, FIPs are usually guaranteed for a period of ten to twenty years.⁸² However, Lithuania and Hungary uses pre-determined production caps for each technology to prevent cost blowouts.⁸³

⁷⁶ Parliamentary Library of the Commonwealth of Australia, above n 39.

⁷⁷ Wüstenhagen et al., above n 53, 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 <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 <www.solarchoice.net.au/blog/news/western-australia-announces-retroactive-feed-in-tariff-cuts-090813>.

⁷⁹ European Commission, *Guidelines on State Aid for Environmental Protection and Energy 2014–2020*, (2014) C200/1, 28.6.2014, Section 3.3 Aid to energy from renewable sources.

⁸⁰ Fräse-Ehrfeld, above n 13, 264.

⁸¹ Haas et al., ‘A Historical Review of Promotion Strategies’, above n 1, 1011.

⁸² Fräse-Ehrfeld, above n 13, 264.

⁸³ RES Legal, *Compare Support Schemes* (2018) <www.res-legal.eu/compare-support-schemes/>.

5.2.2.1 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 being, on average, more costly per kWh than FITs.⁸⁶ The additional cost for FIPs has been 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

5.2.2.2 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

⁸⁴ Couture et al., above n 37, 960–2.

⁸⁵ Ibid 960.

⁸⁶ 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, 304.

⁸⁷ Couture et al., above n 37, 960.

⁸⁸ Ibid.

⁸⁹ IRENA, above n 47, 10.

⁹⁰ Kitzing et al., above n 44, 195.

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 is beyond the control of the renewable electricity generator.⁹¹

Contracts for difference, which are used in the United Kingdom and some of the Australian states, are variants on the fixed premium price model. Unlike standard FIPs, which relate to the actual supply of electricity, CFDs are derivatives, whereby the renewable generator is paid the difference between the contractually agreed guaranteed rate of revenue or ‘strike-price’, and the market price for electricity. The strike-price is often set through a reverse auction. CFDs can be unilateral hedges. However, they are more commonly bilateral hedges, with the generator receiving payment when the market price is less than the strike price but also having to pay either all or some of the difference between the market price and the strike price when the market price is higher.⁹²

5.2.2.3 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 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 the renewable energy sector.⁹³

5.2.3 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

⁹¹ Couture et al., above n 37, 961.

⁹² Melbourne Renewable Energy Project, ‘Which Model Is the Right Model? A Guide to Renewable Energy Procurement’ 6 <<http://melbourne.vic.gov.au/mrep>>; See generally Phillip Wild, ‘Determining Commercially Viable Two-way and One-way “Contract-for-Difference” Strike Prices and Revenue Receipts’ (2017) 110 *Energy Policy* 191.

⁹³ Ibid.

electricity from renewable energy generators.⁹⁴ The quota is often set nationally to encourage least cost deployment of renewables, however, India uses different quotas for each state, and China has proposed the adoption of provincial quotas in their draft RPS.⁹⁵ 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. Renewable portfolio standards are currently used in thirty countries around the world.⁹⁶

As with many of the regulatory support mechanisms, RPS programmes 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 certificate⁹⁷ ('TGC') for each MWh⁹⁸ of their quota of renewable electricity.

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.⁹⁹ 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:

⁹⁴ See generally Leon et al., 'Designing the Right RPS', above n 3; Berry et al., above n 3; Ellingson, above n 76; Davies, 'Incentivising Renewable Energy Deployment', above n 40; Sawin, above n 3.

⁹⁵ 国家能源局综合司关于征求《可再生能源电力配额及考核办法（征求意见稿）意见的函》[Draft Letter from the General Department of the National Energy Administration on the Opinions on Soliciting the Renewable Energy Power Quota and Assessment Measures, National Energy Board, 23 March 2018].

⁹⁶ REN21 Secretariat, 'Renewables 2018 Global Status Report', above n 38, 64–7.

⁹⁷ 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.

⁹⁸ 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.

⁹⁹ Leon et al., 'Designing the Right RPS', above n 3, 10, 30–1; Berry et al., above n 3, 267; The Energy and Resources Institute, *Renewable Energy Credits*, above n 95, 10; Grace et al., above n 3, 16.

geographical or physical limitations (such as resource availability), time-scale (such as seasonal availability or mismatch between supply and demand) or financial limitations associated with the supply of renewable sources.¹⁰⁰

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.¹⁰¹

Under a traditional RPS, the quota is technology neutral, with each MWh of electricity generated from an eligible renewable energy source 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, and use the most commercialised technologies.¹⁰² 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 failed to provide them with a sufficient diversity of supply to meet their energy security needs.¹⁰³ As a result, a variant (the 'modern RPS') was devised which 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.¹⁰⁴ 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 its own eligibility criteria and rules.¹⁰⁵

A more common approach seems to be the use of technology banding with credit multipliers. As stated above, under a traditional RPS, 1MWh of renewable electricity is assigned one TGC. Under a credit multiplier approach this is varied with 1MWh 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

¹⁰⁰ Mitchell, *The Political Economy of Sustainable Energy*, above n 4, 19.

¹⁰¹ Leon et al., 'Designing the Right RPS', above n 3, 10; The Energy and Resources Institute, *Renewable Energy Credits*, above n 98, 9.

¹⁰² Mitchell, *The Political Economy of Sustainable Energy*, above n 4, 12–13.

¹⁰³ Verbruggen et al., above n 7, 638–40.

¹⁰⁴ Leon et al., 'Designing the Right RPS', above n 3, 40–1.

¹⁰⁵ *Renewable Energy (Electricity) Act 2000* (Cth).

commercialisation.¹⁰⁶ For example, in the 2018 obligation period in South Korea, 1MWh of electricity generated from landfill gas was credited 0.5 Renewable Energy Certificates (RECs) (their equivalent of a TGC), whereas hydrogen fuel cells and tidal power which were less commercialised were credited two RECs per MWh.¹⁰⁷

There are commonly three different strategies (which may either be used in isolation or in combination) that licensed electricity suppliers can 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 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.

In most countries, 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. In South Korea, the buy-out price is calculated as 150 per cent of the average annual REC transaction price for their REC shortfall.¹⁰⁸ 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.¹⁰⁹ 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.¹¹⁰

At the end of each obligation period, the government entity responsible for managing the buy-out fund normally distributes it (along with 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

¹⁰⁶ Leon et al., 'Designing the Right RPS', above n 3, 41–2.

¹⁰⁷ Korean Energy Agency, *Renewable Portfolio Standards* (2018) <www.energy.or.kr/renew_eng/new/standards.aspx>.

¹⁰⁸ Ibid.

¹⁰⁹ Penelope 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).

¹¹⁰ Ibid.

entity.¹¹¹ 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 compliant suppliers.¹¹² 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 power purchase agreement (PPA).¹¹³ 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.¹¹⁴

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.¹¹⁵

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.¹¹⁶ TGC borrowing permits electricity suppliers who have a TGC shortfall in a given obligation period to defer the shortfall to the following year.¹¹⁷ 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.¹¹⁸ 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’.¹¹⁹ While TGC banking is arguably to the advantage of renewable energy

¹¹¹ Ibid.

¹¹² Ibid.

¹¹³ Ibid.

¹¹⁴ Ibid.

¹¹⁵ Ibid.

¹¹⁶ Leon et al., ‘Designing the Right RPS’, above n 3, 32–3.

¹¹⁷ Ibid 33–4.

¹¹⁸ Ibid 34–5.

¹¹⁹ Ibid 34.

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 waivers rather than complying with their obligation and increase the administrative burden on the responsible government entity.¹²⁰

5.2.3.1 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 the 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’.¹²¹

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.¹²² This reflects that in the case of both the traditional and modern RPS, the lack of ongoing

¹²⁰ Ibid 32–5.

¹²¹ Verbruggen et al., above n 7, 642.

¹²² Julieta Schallenberg-Rodriguez, ‘Renewable Electricity Support Systems: Are Feed-in Systems Taking the Lead?’ (2017) 76 *Renewable and Sustainable Energy Reviews* 1422; Peng Sun and Pu-yan Nie, ‘A Comparative Study of Feed-in Tariff and Renewable

certainty over the price to be paid increases the risk and uncertainty for investors.¹²³ 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’.¹²⁴

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.¹²⁵

5.2.4 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 (kW), a specific volume of generation (kWh) or announces a set budget.¹²⁶ Depending on the desired outcomes of the country, the RFP can be technology-neutral (least cost of deployment but may also lead to windfall profits for highly commercialised sources) or technology-specific.¹²⁷ During the RFP process, applicants are required to submit a comprehensive ‘sealed-bid’ proposal that details the technical, economic, environmental and financial details of the proposed project.¹²⁸ Applicants may also be required to show that they have met certain pre-qualification requirements such as having

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 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 et al., above n 37, 955; Lakshmi Alagappan, Ren Orans and Chi-Keung Woo, ‘What Drives Renewable Energy Development?’ (2011) 39 *Energy Policy* 5099, 5099.

¹²³ 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.

¹²⁴ Benjamin K Sovacool, ‘A Comparative Analysis of Renewable Electricity Support Mechanisms for Southeast Asia’ (2010) 35 *Energy* 1779, 1786.

¹²⁵ Mir-Artigues et al., above n 5, 434.

¹²⁶ Pablo del Río, ‘Designing Auctions for Renewable Electricity Support. Best Practices from Around the World’ (2017) 41 *Energy for Sustainable Development* 2.

¹²⁷ See e.g. Erik Gawel et al., ‘Rationales for Technology-specific RES Support and Their Relevance for German Policy’ (2017) 102 *Energy Policy* 16.

¹²⁸ CESA, *Developing an Effective State Clean Energy Program: Competitive Grants* (CESA, 2009) 1.

obtained planning permission, preliminary licences or other technical requirements. The RFPs are then reviewed by the programme managers in accordance with a competitive framework to determine whether the project will be supported and the level of funding to be provided.¹²⁹

An alternative method of allocating competitive grants is a reverse 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’.¹³⁰ 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.¹³¹ 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 is reached’.¹³² At the conclusion of the auction, each of the successful bidders is 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 the United Kingdom in 1989.¹³³ 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 2000.¹³⁴ 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 energy technologies in the form of a reverse auction.¹³⁵ Those project developers awarded contracts were given long-term contracts of up to fifteen years’ duration, with:

¹²⁹ Ibid.

¹³⁰ Menanteau et al., above n 1, 802.

¹³¹ Vasilios Anatolitis and Marijke Welisch, ‘Putting Renewable Energy Auctions into Action – An Agent-based Model of Onshore Wind Power Auctions in Germany’ (2017) 110 *Energy Policy* 394, 395.

¹³² Menanteau et al., above n 1, 802–3.

¹³³ Mitchell, *The Political Economy of Sustainable Energy*, above n 4.

¹³⁴ Haas et al., ‘Promoting Electricity from Renewable Energy Sources’, above n 3, 441.

¹³⁵ Sawin, above n 3, 6–7.

... 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.¹³⁶

Five bidding rounds were conducted in England and Wales under the NFFO, with 880 contracts being awarded.¹³⁷ Over this period, the average price per kWh of renewable energy dropped considerably. In particular, in Scotland, the price paid for wind power per kWh dropped to a point at which it was lower than that for electricity generated from coal, oil, nuclear and even some natural gas sources.¹³⁸ These price reductions may be related to a number of factors such as declining technology costs, improved site selection, learning experience of operators, better economies of scale and improved technical performance.¹³⁹

Despite this apparent success, the general consensus among scholars is that the NFFO was profoundly flawed.¹⁴⁰ 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.¹⁴¹ 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 secure a contract.¹⁴² The lack of effective penalties for non-delivery meant that there were no real costs involved in not fulfilling their contractual obligation.¹⁴³ A further problem was that at the time of bidding, project developers were not required to seek prior planning consent, leading to

¹³⁶ Haas et al., 'Promoting Electricity from Renewable Energy Sources', above n 3, 441–2.

¹³⁷ Ibid 442.

¹³⁸ Menanteau et al., above n 1, 807–8; Haas et al., 'Promoting Electricity from Renewable Energy Sources', above n 3, 442.

¹³⁹ Menanteau et al., above n 1, 808.

¹⁴⁰ 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 et al., above n 1; Lesser et al., above n 70, 983.

¹⁴¹ Lesser et al., above n 70, 983; see also Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22.

¹⁴² Ottlinger et al., above n 2, 109; Alagappan et al., above n 124, 5101; Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22.

¹⁴³ Mitchell et al., above n 141, 1937; Haas et al., 'Promoting Electricity from Renewable Energy Sources', above n 3, 442; Lesser et al., above n 70, 983; Menanteau et al., above n 1, 806–7.

some projects being subsequently denied planning permission, while other project developers had problems trying to interconnect to the transmission lines.¹⁴⁴ As a result, the NFFO programme was closed and replaced in April 2002 by a renewable portfolio standard or quota obligation scheme, the Renewables Obligation Order.¹⁴⁵ 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.¹⁴⁶ Most of these schemes were abandoned in the early 2000s.¹⁴⁷

Similar issues were also experienced in the early rounds of the Chinese wind power concession auctions in 2003–4. These auctions were characterised by inexperienced bidders bidding at levels below marginal investment costs and thus the non-fulfilment of some of the contracts issued. Rather than scrapping the scheme, the Chinese Government learnt from its previous successes and failures. It adjusted the auction design for each subsequent round, including by introducing, and subsequently adjusting the weighting on, strict prequalification criteria and imposing penalties for non-performance of contracts issued to winning bidders.¹⁴⁸

Many countries have now adopted this approach, with auctions viewed as an attractive option for both high-income countries and low-income countries due to their flexibility and promise of least cost deployment. Modern competitive tendering schemes are now designed to overcome many of the earlier problems. In particular, appropriate penalties are often now included to prevent non-delivery of projects.¹⁴⁹ Further, most countries have now changed their national planning policy and laws to give renewable energy project developers greater certainty that their planning application will be approved.¹⁵⁰

This has prompted a resurgence in competitive tendering schemes. They are now the most common regulatory support mechanism, with eighty countries, including Brazil, France, Mexico, Indonesia, Russia, Thailand, South Africa and the United States having adopted competitive tendering or auction

¹⁴⁴ Haas et al., ‘Promoting Electricity from Renewable Energy Sources’, above n 3, 442, 444.

¹⁴⁵ Mitchell et al., above n 141.

¹⁴⁶ Haas et al., ‘Promoting Electricity from Renewable Energy Sources’, above n 3, 441. See also Menanteau et al., above n 1, 802.

¹⁴⁷ Ibid.

¹⁴⁸ Xiaodong Wang et al., ‘Promoting Renewable Energy Through Auctions: The Case of China’ *Livewire World Bank Group* (2014/14), 888697.

¹⁴⁹ European Commission, *Guidance for the Design of Renewables Support Schemes*, SWD (2013) 439 Final (5 November 2013) 6.

¹⁵⁰ See e.g. Department of Energy and Climate Change, ‘National Policy Statement for Renewable Energy Infrastructure’ (Paper, United Kingdom Parliament, July 2011).

processes by early 2018.¹⁵¹ Competitive tendering is also now the preferred regulatory support mechanism for EU Member States, with the current State Aid Guidelines specifying that:

Market instruments, such as auctioning or competitive bidding process open to all generators producing electricity from renewable energy sources competing on equal footing at EEA level, should normally ensure that subsidies are reduced to a minimum in view of their complete phasing out. However, given the different stage of technological development of renewable energy technologies, these Guidelines allow technology specific tenders to be carried out by Member States, on the basis of the longer-term potential of a given new and innovative technology, the need to achieve diversification; networks constraints and grid stability and system (integration) costs.¹⁵²

Competitive tendering is seen as an effective regulatory support mechanism in terms of both its cost effectiveness¹⁵³ and its fiscal responsibility, as the costs of running such a scheme are passed on to electricity consumers.¹⁵⁴ Further, del Río has stated that ‘auctions mitigate the information asymmetry problem when setting remuneration levels, [and auctions] are particularly suitable to control costs, expansion and technology mix and they are more likely to lead to allocative efficiency’.¹⁵⁵ The efficiency argument has also been made by Leon, who has argued that reverse auctions can 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’.¹⁵⁶ This has been the experience in the wind sector in Brazil, where the use of reverse auctions coupled with long-term power purchase agreements led to a cost reduction of 42 per cent when compared to the previously used FIT rates.¹⁵⁷ However, experience suggests that if no specific provision is made for different technologies, competitive tendering will not support the development of less-established technologies that may potentially provide more

¹⁵¹ REN21 Secretariat, ‘Renewables 2018 Global Status Report’, above n 38, 64–7.

¹⁵² European Commission, *Guidelines on State aid for environmental protection and energy 2014–2020*, (2014) C200/1, 28.6.2014, Section 3.3 Aid to energy from renewable sources, paragraphs 109–10.

¹⁵³ Ottlinger et al., above n 2, 199; Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22; The Energy and Resources Institute, above n 22, 11.

¹⁵⁴ Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22–3.

¹⁵⁵ Pablo del Río, ‘Designing Auctions for Renewable Electricity Support. Best Practices from Around the World’ (2017) 41 *Energy for Sustainable Development* 1.

¹⁵⁶ Leon et al., ‘Designing the Right RPS’, above n 3, 52.

¹⁵⁷ OECD, *OECD Policy Guidance for Investment in Clean Energy Infrastructure* (OECD, 2013) 20.

efficient and cost-effective delivery of renewable energy in the future.¹⁵⁸ This point is identified by Sovacool, who has argued that competitive tendering lacks static efficiency, does not encourage dynamic efficiency and is also inequitable.¹⁵⁹ He argues that competitive tendering schemes usually favour large incumbent players in the market, including state-owned enterprises (SOEs) (where they still exist) without profit motives.¹⁶⁰ For example, independent power providers and small firms may choose not to participate if they believe that their chance of submitting a winning bid is much lower because they cannot show a strong track record or the economies of scale.¹⁶¹ 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).’¹⁶² A further problem occurs where private firms are forced to compete with SOEs that may not have the same profit motives, and can therefore commit to unreasonably low prices.¹⁶³ del Río and Linares have also identified that depending on the structure, size and lead times of the auctions, they can also be beset by high transaction and administrative costs if these factors are not appropriately managed.¹⁶⁴

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

5.2.5 Net Metering

Net metering is another popular regulatory support mechanism that has been adopted by fifty-five countries by 2018, including Denmark, Latvia, Sri Lanka and Tanzania. 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 solar cells, connecting it

¹⁵⁸ Ibid.

¹⁵⁹ Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22.

¹⁶⁰ Ibid.

¹⁶¹ Leon et al., ‘Designing the Right RPS’, above n 3, 52.

¹⁶² Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 22.

¹⁶³ Ibid.

¹⁶⁴ Pablo del Río and Pedro Linares, ‘Back to the Future? Rethinking Auctions for Renewable Electricity Support’ (2014) 35 *Renewable and Sustainable Energy Reviews* 42, 50.

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.

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 (that is, 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 credited this amount as against their next electricity bill.¹⁶⁵ 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.¹⁶⁶ 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.¹⁶⁷ 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)’.¹⁶⁸

A further challenge to net metering is the disruptive nature of the new energy storage technologies currently being developed and commercialised.¹⁶⁹ As energy storage technologies become more cost-competitive and commercially available, net metering is likely to decline as the amount paid for electricity exported to the grid is often significantly less than the 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

¹⁶⁵ Ernest E Smith, ‘US Legislative Incentives for Wind-Generated Electricity: State and Local Statutes’ (2005) 23 *Journal of Energy & Natural Resources Law* 173, 180.

¹⁶⁶ Sawin, above n 3, 5.

¹⁶⁷ Verbruggen et al., above n 7, 637.

¹⁶⁸ Ibid.

¹⁶⁹ UBS, ‘We Love a Sunburnt Country’ (Report, UBS Utilities Sector, 17 May 2014) 2.

periods.¹⁷⁰ In these circumstances, it may become more cost-effective to store excess electricity generated and then use it when renewable energy cannot be generated, such as at night time (for photovoltaic solar) or when wind is not blowing (for wind energy).

5.2.6 Renewable Energy Targets

Renewable energy targets (RETs) are commitments or goals set by 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. The targets set for the percentage of electricity to be generated from renewable sources vary significantly. For example, RETs for 2030 range from 5 per cent for Bahrain (up from 0.2 per cent of installed generating capacity in 2015) to 100 per cent in Costa Rica, Fiji, Papua New Guinea, Samoa and the Solomon Islands.¹⁷¹ The targets may be legislated or established under policies set by the relevant ministries or energy authorities.

RETs are currently the most popular form of policy intervention within the renewable energy sector, existing in 146 countries in early 2018.¹⁷² There are many variations of the key features of RETs, including whether:

1. the targets are legally binding or non-binding aspirational goals;
2. the targets focus on renewable electricity generation alone or are focused on the heat and transport sectors either individually or through a combined target;
3. 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
4. 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.

¹⁷⁰ 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.

¹⁷¹ REN21 Secretariat, ‘Renewables 2018 Global Status Report’, above n 38, 189–91.

¹⁷² Ibid 53.

A number of countries that were relatively early movers with RETs have reviewed their RETs in recent years to decide whether they should continue to operate in their current form. In the United Kingdom, the government has 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.¹⁷³ The EU-wide target of at least 32 per cent of energy to be generated from renewable sources by 2030 will continue to apply. However, unlike the 2020 target that was enforceable for each Member State, the 2030 target will not be binding on individual Member States, with the target being for the EU as a whole.¹⁷⁴ There has already been speculation that this means that in the EU after 2020 ‘there will be no meaningful renewable energy target’.¹⁷⁵ In 2014, Australia reviewed its national RET with the Review Panel chaired by Dick Warburton, the former Chairman of Caltex Oil in Australia. This Review recommended that the LRET be changed from a volumetric target of 41,000GWh of electricity from large-scale renewable energy by 2020 to a market share target of 20 per cent of electricity generation by 2020.¹⁷⁶ This reflected industry concerns 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 would have been derived from renewable energy sources if the RET were to be met.¹⁷⁷ This was significantly higher than the 20 per cent originally intended when the RET was designed. The Review recommended that, to protect existing generators, the RET be revised to a ‘real 20 per cent target’ for large-scale renewable generation (equivalent to approximately 33,000GWh), rather than using the current 41,000GWh production target. The Review

¹⁷³ Department of Energy and Climate Change, United Kingdom, ‘A 2030 Framework for Climate and Energy Policies: UK Government Response to Commission Green Paper’ COM(2013) 169 final, 1 July 2013, 8–9. Fiona Harvey, ‘Loss of renewable target is backward step in fight against climate change’, *The Guardian* (online), 23 January 2014 <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 <www.independent.co.uk/news/world/europe/eu-admits-it-has-no-power-to-enforce-its-binding-2030-renewable-energy-targets-9078390.html>.

¹⁷⁴ European Council, *Conclusions on 2030 Climate and Energy Policy Framework*, SN 79/14 (23–4 October 2014).

¹⁷⁵ Bawden, above n 175.

¹⁷⁶ Renewable Energy Target Scheme, *Report of the Expert Panel* (August 2014) <www.aph.gov.au/DocumentStore.ashx?id=17008e4b-e2f3-4ea3-9d53-fb3fb0cd4d85&subId=351098>.

¹⁷⁷ Ibid.

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.¹⁷⁸ On 23 June 2015, these changes were adopted through legislative amendments to the existing RET scheme.¹⁷⁹

Where RETs are binding on a country, they have proven to be highly effective at encouraging accelerated deployment of renewable energy. This is particularly the case where the RETs have set technology-specific targets as a signal to investors and project developers. However, as shown above in Chapter 4, countries often seek to achieve multiple, and at times conflicting, objectives through their renewable energy laws. In this environment, for a RET to be successful, first the baseline position must be understood, and second, the target must be appropriate for the national political, economic, social and institutional context.¹⁸⁰

5.2.7 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.¹⁸¹ 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.¹⁸² Since then, 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 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.

¹⁷⁸ Ibid.

¹⁷⁹ *Renewable Energy (Electricity) Amendment Act 2015* (Cth).

¹⁸⁰ See e.g. IRENA, *Renewable Energy Target Setting* (IRENA, Abu Dhabi, June 2015) 9.

¹⁸¹ *Agreement on Subsidies and Countervailing Measures*, WTO Doc 1869 UNTS 14 (15 April 1994) Arts 1, 1.1.

¹⁸² 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.

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. There have been recent efforts by the OECD, World Bank, IEA¹⁸³ and the Group of Twenty (G20)¹⁸⁴ to advocate for the reduction and eventual removal of subsidies to the conventional fossil fuel sector. However, for as long as these subsidies exist, they will provide a rationale for the provision of subsidies to the renewable energy sector to enable them to compete.

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. Each of these is 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 \$AUD50,000 to support the installation of solar panels,¹⁸⁵ and Finland providing up to 40 per cent of eligible project costs for renewable energy projects with a fixed asset investment above €5,000,000.¹⁸⁶

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'.¹⁸⁷ 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 programme. First, all existing subsidies directed at

¹⁸³ 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).

¹⁸⁴ See e.g. the G20 Pittsburgh and Toronto Commitments.

¹⁸⁵ Energy Matters, *Australian Solar Schools Program* (2012) <www.energymatters.com.au/renewable-energy/solar-power/grid-connected-systems/solar-for-schools.php>.

¹⁸⁶ Valtioneuvoston asetus uusiutuvan energian ja uuden energiateknologian investointitulen myöntämisen yleisistä ehdosta 25.02.2016/145 [Government Decree No. 145/2016 on Granting Investment Aid for Renewable Energy and New Energy Technologies] (Finland), §5, §10.

¹⁸⁷ Pershing et al., above n 185, 15.

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’.¹⁸⁸ 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 programme (if the country introducing it is a member of the WTO), is whether the programme will comply with the Agreement on Subsidies and Countervailing Measures.¹⁸⁹ As will be shown in Chapter 6, 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 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.

¹⁸⁸ Ibid 14.

¹⁸⁹ *Marrakesh Agreement Establishing the World Trade Organization*, 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.

5.2.8 Clean Energy Loans

As discussed in Chapter 3, 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.¹⁹⁰

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.¹⁹¹ This can add significant costs to renewable energy projects.

In an attempt to address these challenges, ninety-nine countries use clean energy loans as one of their secondary regulatory support mechanisms to promote the accelerated deployment of renewable energy.¹⁹² To establish a clean energy loan programme, governments provide the initial loan pool, which then operates as a revolving loan facility. The Clean Energy Finance Corporation of Australia, which has its investment pool funded by grants from consolidated revenue totalling \$AU10 billion, is an example of a clean energy loan programme.¹⁹³ Some international institutions such as the World Bank or the Asian Development Bank also provide clean energy loans to developing nations.

Clean energy loan programmes 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’.¹⁹⁴ Common features of clean energy loan programmes are that they offer:

- lower interest rates than would be available on the private lending market;

¹⁹⁰ Sawin, above n 3, 20; CESA, *Developing an Effective State Clean Energy Program*, above n 130, 1.

¹⁹¹ Ibid.

¹⁹² REN21 Secretariat, ‘Renewables 2018 Global Status Report’, above n 38, 64–7.

¹⁹³ Clean Energy Finance Corporation, *Annual Report of the Clean Energy Finance Corporation 2016–7* (CEFC of Australia, 2013).

¹⁹⁴ CESA, *Developing an Effective State Clean Energy Program*, above n 130, 1.

- longer amortisation periods, with repayment terms often reflecting a conservative estimate of the anticipated life of the project (that is, 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.¹⁹⁵

The loans granted under a clean energy loan programme vary considerably but common types include: direct loans,¹⁹⁶ matching loans¹⁹⁷ and interest rate buydowns.¹⁹⁸

Clean energy loan programmes have a number of benefits for governments. First, it provides the government with certainty as to the cost of the programme 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.¹⁹⁹ Second, clean energy programmes are relatively easy to administer²⁰⁰ and, if run successfully, may actually generate substantial private sector investment, which in turn will increase acceptance amongst other lenders in regard to the financing of renewable energy projects.

Malaysia's Green Technology Financing Scheme is an example of a successful scheme which has provided preferential loans worth \$US855 million borrowed for up to fifteen years at interest rates two basis points lower than commercial market rates. In addition, this scheme provides a credit guarantee for 60 per cent of the loan and other capacity building support.²⁰¹ Between 2010 and 2017, the scheme supported 272 projects operated by Malaysian companies. It is said to have led to market stimulation of twice the value of the loans, built partnerships with twenty-six financial institutions,

¹⁹⁵ Ibid; Ellingson, above n 76, 44.

¹⁹⁶ Direct loans are where the government acts as both loan underwriter and servicer: CESA, *Developing an Effective State Clean Energy Program*, above n 130, 1–2.

¹⁹⁷ 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.

¹⁹⁸ 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.

¹⁹⁹ Mir-Artigues et al., above n 5; Ellingson, above n 76, 44.

²⁰⁰ Mir-Artigues et al., above n 5.

²⁰¹ Sopitsuda Tongsopit et al., Designing Renewable Energy Incentives and Auctions: Lessons for ASEAN, USAID Clean Power Asia, 4 September 2017, 119–28.

and created 4,000 jobs.²⁰² Indeed, the Malaysian Government viewed the scheme as so successful that it has extended it for a further five-year term until 2022.²⁰³

Indeed, the only downside to adopting a clean energy loan programme 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 healthcare or education that need to be addressed first. It is likely that this explains why almost two-thirds of the countries with clean energy loan programmes are high income countries or upper-middle income countries.²⁰⁴

5.2.9 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'.²⁰⁵ As such, rebate programmes 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 existing market trends.²⁰⁶ Ellingson has stated that usually rebate programmes seek to cover 20 to 50 per cent of total project costs.²⁰⁷ 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.²⁰⁸ Instead, they advocate

²⁰² Ibid 126.

²⁰³ Ibid.

²⁰⁴ REN21 Secretariat, 'Renewables 2018 Global Status Report', above n 38, 64–7.

²⁰⁵ CESA, *Developing an Effective State Clean Energy Program*, above n 130, 1.

²⁰⁶ Ellingson, above n 76, 53; CESA, *Developing an Effective State Clean Energy Program*, above n 130, 1.

²⁰⁷ Ellingson, above n 76, 52.

²⁰⁸ Sawin, above n 3, 20; Haas et al., 'How to Promote Renewable Energy Systems Successfully and Effectively', above n 8; CESA, *Developing an Effective State Clean Energy Program*, above n 130, 1.

providing a fixed dollar amount per watt of installed generating capacity.²⁰⁹ 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.

Some countries provide rebates as an upfront payment to purchasers of renewable energy technologies.²¹⁰ Others only provide rebates to the project owner upon project completion.²¹¹ Where the rebate is paid upfront, rebate programmes can be particularly effective during periods of high interest rates and limited capital availability because they reduce the total amount of funds that need to be borrowed.²¹² 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.²¹³

There are a number of downsides associated with the use of rebate programmes. Unlike tax credits, rebate programmes require direct funding from central government. They may, therefore, be subject to instability and uncertainty if the budget levels are frequently altered. In addition, where the level of the rebate 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.²¹⁴ 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.²¹⁵

5.2.10 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.

²⁰⁹ Ibid.

²¹⁰ CESA, *Developing an Effective State Clean Energy Program*, above n 130, 1.

²¹¹ Ellingson, above n 76, 52.

²¹² CESA, *Developing an Effective State Clean Energy Program*, above n 130, 1.

²¹³ Sawin, above n 3, 20.

²¹⁴ Ellingson, above n 76, 52–3; CESA, *Developing an Effective State Clean Energy Program*, above n 130, 2.

²¹⁵ Ibid.

Indeed, tax incentives are used in 108 countries to promote renewable energy.²¹⁶ Countries use a range of investment tax credits and production tax credits, as well as tax deductions and exemptions,²¹⁷ to provide:

- Full or partial relief from income or corporate tax for renewable electricity. Income tax relief is directly available in France, with deductions available at the rate of 30 per cent of the cost of PV solar equipment installed at a taxpayer's principal residence.²¹⁸ Income tax relief is also indirectly available in some countries through favourable depreciation rules and enhanced capital allowances²¹⁹ or, in the case of Greece, stabilisation of the income tax coefficient.²²⁰
- Exemptions for qualifying renewable energy generators from energy, pollution or carbon taxes such as in the Ukraine and United Kingdom.
- Lower rates of value added tax (VAT) applied to sales of qualifying renewable energy technologies such as in France, Indonesia and Italy.²²¹
- Property tax reductions for land used to locate renewable energy projects such as in Italy.²²²
- Many countries also provide a 'reduction or elimination of import duties for renewable energy technologies or components'²²³ to reduce the high initial capital costs of renewable energy projects. This is especially valuable in countries without a strong domestic manufacturing industry.²²⁴

²¹⁶ REN21 Secretariat, 'Renewables 2018 Global Status Report', above n 38, 64–7.

²¹⁷ Tax deductions permit either the full or a partial amount of qualifying expenses to reduce the gross amount of tax owed. Alternatively, they may operate to exclude the operation of, or reduce the level of, sales taxes, VAT, energy or carbon taxes from eligible projects.

²¹⁸ *Code Général des Impôts, version consolidée au 1 septembre 2018* [General Tax Code, version consolidated to 1 September 2018] [Legifrance (Government of France) translation from French], Art 200, quarter par. 1c, 5.

²¹⁹ Kitzing et al., above n 44, 195; Van der Linden et al., above n 33, 12.

²²⁰ Νόμος 4399/2016 – Νόμος 4399/2016 Θεσμικό πλαίσιο για τη σύσταση καθεστώτων Ενισχύσεων Ιδιωτικών Επενδύσεων για την περιφερειακή και οικονομική ανάπτυξη της χώρας – Σύσταση Αναπτυξιακού Συμβουλίου και άλλες διατάξεις [Law 4399/2016 Institutional Framework for the Establishment of Private Investment Aid Schemes for the Regional and Economic Development of the Country – Establishment of a Development Council and Other Provisions] (Greece) [Start-up Greece (Government of Greece) translation from Greek], Art 66.

²²¹ *Code Général des Impôts, version consolidée au 1 septembre 2018* [General Tax Code, version consolidated to 1 September 2018] [Legifrance (Government of France) translation from French], Art 279; Res Legal, *Compare Support Schemes* (2018) <www.res-legal.eu/en/compare-support-schemes>; Sopitsuda Tongsopit et al., above n 204, 111.

²²² Res Legal, *Compare Support Schemes* (2018) <www.res-legal.eu/en/compare-support-schemes>.

²²³ Sawin, above n 3, 19.

²²⁴ Ibid.

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.²²⁵ 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.

5.2.10.1 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 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.²²⁶ They are also beneficial in supporting dynamic efficiency as they can be specifically targeted to support less mature technologies.²²⁷

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.²²⁸ 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.²²⁹ The design of investment tax credits also does not provide an incentive to drive down the costs of renewable energy technologies.²³⁰ 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.

²²⁵ Kitzing et al., above n 44, 195.

²²⁶ Sawin, above n 3, 18; The Energy and Resources Institute, above n 22, 19.

²²⁷ Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 20.

²²⁸ Ibid.

²²⁹ Ibid.

²³⁰ Ibid.

5.2.10.2 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, the American Wind Energy Association claims that the US Federal Production Tax Credits were instrumental in spurring investment and driving ‘US wind power costs down by 67% in the last seven years’.²³¹ This far exceeds the predicted benefits from a 2007 study, which estimated 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 \$US380 per installed kW over the period.²³² 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.²³³ 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 the role of supporting small-scale projects.

5.2.11 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.²³⁴ The funds collected under these programmes 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.²³⁵ These funds tend to be used in three different ways to:

²³¹ American Wind Energy Association, *Tax Policy* (September 2018) <www.awea.org/policy-and-issues/tax-policy>.

²³² 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.

²³³ Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 21.

²³⁴ Ellingson, above n 76, 23–4.

²³⁵ Ibid.

1. target investment in renewable energy programmes 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 aiding research and development, providing technical assistance, consumer education and financing demonstration projects.²³⁶

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

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.²³⁷ 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.²³⁸ Despite this, questions have been raised as to whether public benefit funds promote efficacy, cost-effectiveness and equity.²³⁹ 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.²⁴⁰ Further, because public benefit funds tend to provide lump sum support, there is little incentive to innovate over time.

5.2.12 Research and Development Support

It is often said that there are five stages to technological innovation: research and development; demonstration; deployment into niche markets; diffusion; and 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.

²³⁶ Ibid.

²³⁷ Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 19–20.

²³⁸ Ibid.

²³⁹ Ibid.

²⁴⁰ Ibid.

Research and development support is a supply-side mechanism designed to encourage the development of new renewable energy technologies and reduce the cost of existing technologies through technological improvements. This mechanism is quite commonly adopted as a secondary instrument. All ten jurisdictions²⁴¹ 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.²⁴² 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) or renewable portfolio standards/quota obligations (five out of ten jurisdictions).²⁴³ 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).²⁴⁴

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’.²⁴⁵ The impact of these reductions in expenditures is heightened because countries already diverge widely in their level of commitment depending on whether they view the renewable energy sector as critical to their industrial policy and economic development, or are technology laggards. Grafström et al. have found that there is a significant divergence of practice even within the EU with ‘innovation activities in the renewable energy sector [...] typically concentrated [in] a few leading economies’, while other Member States engage in free-riding behaviour.²⁴⁶ Further, Mitchell has expressed a concern that

²⁴¹ 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).

²⁴² Fischer and Preonas, above n 7, 60.

²⁴³ Ibid.

²⁴⁴ Ibid.

²⁴⁵ Ottinger et al., above n 2, 195.

²⁴⁶ Grafström et al., ‘Knowledge Accumulation from Public Renewable Energy R&D in the European Union: Converging or Diverging Trends?’ (UFZ Discussion Papers, Department

despite research and development support being provided in the United Kingdom, it is yet to materially change the nation's energy outlook.²⁴⁷ 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 device'.²⁴⁸ 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.²⁴⁹ 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.²⁵⁰ 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.²⁵¹ 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.²⁵²

5.2.13 Green Power Schemes

Green power schemes or 'green marketing' are voluntary programmes, which provide consumers with the option to purchase all or a portion of their electricity from guaranteed sources of 'green' power for a premium.²⁵³ 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.

of Economics 5/2017, Helmholtz-Zentrum für Umweltforschung GmbH-UFZ, September 2017) 4, 18.

²⁴⁷ Mitchell, *The Political Economy of Sustainable Energy*, above n 4, 51.

²⁴⁸ Ibid.

²⁴⁹ Ibid.

²⁵⁰ Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 18.

²⁵¹ Ibid 19.

²⁵² Ibid.

²⁵³ See generally Rosemary Lyster and Adrian Bradbrook, *Energy Law and the Environment* (Cambridge University Press, 2006) 155–63.

Two key factors affect the successful implementation of green power schemes. First, as these are voluntary programmes, 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).²⁵⁴ 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 generated or used from renewable energy sources with low or no environmental impacts … [that] goes above and beyond what is otherwise required by mandate or requirement – it is voluntary or surplus to regulation’.²⁵⁵ They further stipulate that due to their environmental impacts, large scale hydropower and municipal solid waste are generally not deemed to be green power despite being defined as renewable energy sources.

A second variable that will affect the ultimate success of any green energy programme 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.²⁵⁶ The US EPA has reported that between 2006 and 2015, the average tariff for green power products for a residential consumer was \$US0.02 per kWh above the standard electricity tariff.²⁵⁷ For the average American household, this equates to an annual premium of \$US216.²⁵⁸ Ottinger et al. have reported that in most

²⁵⁴ Law on Alternative Energy Sources (Ukraine) 20 February 2003, No. 555-IV, Art 1 [Linguistico Translations translation from Ukrainian].

²⁵⁵ United States EPA Green Power Partnership Glossary (21 December 2017) <www.epa.gov/greenpower/green-power-partnership-glossary>.

²⁵⁶ Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 17.

²⁵⁷ United States EPA, Green Power Pricing (21 December 2017) <www.epa.gov/greenpower/green-power-pricing>.

²⁵⁸ Ibid.

countries with green power schemes, approximately 1 per cent of electricity consumers are willing to pay the higher prices involved in joining a green power scheme,²⁵⁹ while Sovacool has stated that participation rates rarely exceed 5 per cent.²⁶⁰ In 2016, 3.21 per cent of electricity in the United States was purchased under green power schemes.²⁶¹ This may change over time, with the Netherlands (whose population express higher levels of environmental awareness and concern) displaying uptake rates of approximately 13 per cent of all electricity customers.²⁶² 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’.²⁶³

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.²⁶⁴ Despite this, these schemes are seen as 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.²⁶⁵

5.2.14 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 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;²⁶⁶
2. providing improved transmission planning using anticipatory transmission planning processes. Most transmission planning occurs on

²⁵⁹ Ottinger et al., above n 2, 198.

²⁶⁰ Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 16.

²⁶¹ Office of Air, United States Environment Protection Agency, *Guide to Purchasing Green Power: Renewable Electricity, Renewable Energy Certificates, and On-Site Renewable Generation* (September 2018) vii <www.epa.gov/greenpower/guide-purchasing-green-power>.

²⁶² Ottinger et al., above n 2, 198.

²⁶³ Van der Linden et al., above n 34, 12.

²⁶⁴ Bradbrook, above n 3, 23–4; Sovacool, *Renewable Electricity for Southeast Asia*, above n 3, 17.

²⁶⁵ Bradbrook, above n 3, 23.

²⁶⁶ Ottinger et al., above n 2, 202–3.

a reactive basis, which 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 for 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 under consideration by the authorities before approval was finally granted.²⁶⁷ 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,²⁶⁸

3. encouraging the use of renewable energy in government procurement to foster demand for renewable energy.²⁶⁹ 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;²⁷⁰
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’.²⁷¹ Many countries such as Australia²⁷²

²⁶⁷ Kristy Dorsey, ‘Beauly-Denny: Shock to the System’, *Scotland on Sunday* (Edinburgh) (online), 9 January 2010 <www.scotsman.com/business/beauly-denny-shock-to-the-system-1-1363889>.

²⁶⁸ Alagappan et al., above n 124, 5101–3.

²⁶⁹ Ottinger et al., above n 2, 200; Ellington, above n 76, 96–7.

²⁷⁰ United States Environmental Protection Agency, *Clean Energy Lead by Example Guide* (2009) 10 <www.epa.gov/sites/production/files/2015-08/documents/state_lead_by_example_guide_full_report.pdf>.

²⁷¹ Ottinger et al., above n 2, 200.

²⁷² New South Wales Department of Education and Communities, *Sustainability: Learning Across the Curriculum* (2018) New South Wales Government <<https://education.nsw.gov.au/teaching-and-learning/curriculum/learning-across-the-curriculum/sustainability>>.

and Germany²⁷³ 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 programmes utilising electronic and print media, radio advertising, exhibitions and outdoor advertising to disseminate information on renewable energy and promote its uptake;²⁷⁴

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 programmes by introducing micro-finance and leasing schemes to support small-scale renewable energy projects.²⁷⁵ 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 small loans.²⁷⁶ 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 programme 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.²⁷⁷

The use of these policy-based strategies in combination with the regulatory support mechanisms outlined above to target particular market failures and

²⁷³ Gerhard De Haan, ‘The BLK “21” Programme in Germany: A “Gestaltungskompetenz”-based Model for Education for Sustainable Development’ (2006) 12 *Environmental Education Research* 19.

²⁷⁴ Ministry of New and Renewable Energy, *Support programmes* (2014) Government of India <<https://mnre.gov.in/support-programmes>>.

²⁷⁵ United Nations Development Programme and United Nations Capital Development Fund, *Clean Start: Microfinance opportunities for a clean energy future* (2013) UNCDF <www.uncdf.org/sites/default/files/Documents/cleanstart_publication.pdf>.

²⁷⁶ 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.

²⁷⁷ Eric Martinot et al., ‘Renewable Energy Markets in Developing Countries’ (2002) 27 *Annual Review of Energy and the Environment* 309, 318–19.

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.

5.3 EVALUATING THE SUCCESS OF REGULATORY SUPPORT MECHANISMS

There is strong evidence that the primary factor encouraging accelerated deployment of renewable energy is the presence of national level regulatory and policy intervention.²⁷⁸ Given the range of regulatory support mechanism options available to countries seeking 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,²⁷⁹ 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:

- *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);

²⁷⁸ See e.g. Sanya Carley et al., 'Global Expansion of Renewable Energy Generation: An Analysis of Policy Instruments' (2017) 68 *Environmental Resource Economics* 397, 399 and 438.

²⁷⁹ Ottinger et al., above n 2, 205.

- *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, predictable and likely to be accepted by the industry and the general public.²⁸⁰

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). Nicolini and Tavoni have found that in Europe these policies were effective in promoting renewable energy, and led to increased production of incentivised energy in the short-term and, in the longer-term, greater installed capacity.²⁸¹ Others have noted the numerous empirical studies that have shown that regulatory support mechanisms, particularly FITs, have placed downwards pressure on electricity prices due to the merit-order effect, while positively impacting on innovation, competitiveness and employment.²⁸² In the past few years, there has been a noticeable shift away from using renewable portfolio standards and, more recently, a few countries have begun to remove their feed-in tariffs. In their place, many countries have implemented competitive tendering due to their ability to achieve deployment at lowest cost.²⁸³

5.3.1 Combining Regulatory Support Mechanisms

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 in all countries.²⁸⁴ The vast majority of countries now use a combination of different regulatory support mechanisms.²⁸⁵ They will often adopt a primary

²⁸⁰ Catherine Mitchell et al., 'Policy, Financing and Implementation' in Ottmar Edenhofer et al. (eds.), *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation* (IPCC, 2011); Verbruggen et al., above n 7; IRENA, above n 47.

²⁸¹ Marcella Nicolini and Massimo Tavoni, 'Are Renewable Energy Subsidies Effective? Evidence from Europe' (2017) 74 *Renewable and Sustainable Energy Reviews* 412.

²⁸² Margarita Ortega-Izquierdo and Pablo del Río, 'Benefits and Costs of Renewable Electricity in Europe' (2016) 61 *Renewable and Sustainable Energy Reviews* 372, 375.

²⁸³ Jenny Winkler et al., 'Effectiveness and Efficiency Auctions for Supporting Renewable Electricity – What Can We Learn from Recent Experiences?' (2018) 119 *Renewable Energy* 473; IEA and IRENA, *Perspectives for the Energy Transition: Investment Needs for a Low-Carbon Energy System* (OECD/IEA and IRENA, 2017) 32.

²⁸⁴ Ottlinger et al., above n 2, 206.

²⁸⁵ REN21 Secretariat, 'Renewables 2018 Global Status Report', above n 38, 64–7.

mechanism, commonly competitive tendering, though in some cases still a feed-in tariff, feed-in premium, a renewable portfolio standard or net metering 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, tradeable green certificates and renewable portfolio standards have been developed.²⁸⁶ Interestingly, the complexity of a country's national support scheme for renewable electricity is strongly correlated to their income level. High-income countries employ an average of 3.6 different policy types, whereas, in low-income countries, it is only 1.5.²⁸⁷ Not surprisingly, the high-income countries were also much more likely to adopt feed-in tariffs, renewable portfolio standards, tradeable green certificates, net metering, subsidies and soft loans than the low-income countries. In contrast, low-income countries were comparatively more likely to use tendering and tax concessions. This reflects the reality that high-income countries have greater budgets to dedicate to accelerating deployment in the sector, while low-income countries are more likely to select a reduction in their consolidated revenue rather than direct spending.

One of the issues with the growing use of combinations of regulatory support mechanisms is that there is little research available on how different mechanisms interact when used in concert and the impact of this interaction.²⁸⁸ 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. By considering regulatory support mechanisms in isolation, rather than in a regulatory and policy context where different support mechanisms interact with each other, the extent of the interaction and the resultant impact is not known. Research is not only needed where a country has adopted multiple regulatory support mechanisms but also in circumstances where the mechanisms adopted by one country have cross-border implications for the mechanisms of other countries, such as within the European Union. Until these issues are better understood, it is difficult to know which combinations of regulatory support mechanisms might best address the market failures that exist within the sector. In particular, Mir-Artigues and del Río have expressed concerns that 'the

²⁸⁶ Davies, 'Reconciling Renewable Portfolio Standards and Feed-in Tariffs', above n 2, 313; Davies, 'Incentivizing Renewable Energy Deployment', above n 40, 81; Van der Linden et al., above n 34, 61.

²⁸⁷ Author's own calculations from data contained in Table 2, REN21 Secretariat, 'Renewables 2018 Global Status Report', above n 38, 64–7.

²⁸⁸ Mir-Artigues et al., above n 5, 430; Fischer et al., above n 7.

interaction between instruments has been shown to lead to conflicts, resulting in inefficiencies, redundancies, double coverage or double counting'.²⁸⁹ Similarly, Fischer and Preonas have warned that a lack of coordination between mechanisms will increase the burden on consumers and taxpayers, and possibly lead to the overcompensation of renewable energy generators.²⁹⁰ Zhao et al. have reported that their research shows that 'as the number of policy instruments increases, especially when the strength of policy instruments reaches a certain level, the policy effects plateau or even decline'.²⁹¹ This situation requires close attention where a renewable energy source or technology may benefit from more than one regulatory support mechanism.²⁹²

5.4 CONCLUSION

Countries have adopted diverse combinations of regulatory support mechanisms to 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 to better understand the impact of combining different mechanisms on the operation and development of the renewable energy sector. 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.

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

²⁸⁹ Mir-Artigues et al., above n 5, 431.

²⁹⁰ Fischer et al., above n 7.

²⁹¹ Yong Zhao, Kam Ki Tang and Li-li Wang, 'Do Renewable Electricity Policies Promote Renewable Electricity Generation? Evidence from Panel Data' (2013) 62 *Energy Policy* 887, 892.

²⁹² Ottinger et al., above n 2, 192.

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.