IRENA POLICY BRIEF

IRENA
International Renewable Energy Agency

EVALUATING POLICIES IN SUPPORT OF THE DEPLOYMENT OF RENEWABLE POWER

About IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation dedicated to renewable energy.

In accordance with its Statute, IRENA's objective is to "promote the widespread and increased adoption and the sustainable use of all forms of renewable energy". This concerns all forms of energy produced from renewable sources in a sustainable manner and includes bioenergy, geothermal energy, hydropower, ocean, solar and wind energy.

As of November 2012, the membership of IRENA comprised 158 States and the European Union (EU), out of which 102 States and the EU have ratified the Statute.

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Key lessons for policy-makers

Renewable power deployment policies principally aim to increase the installed capacity of renewable energy technologies and the generation of renewable electricity. In achieving this, they may target a range of other outcomes, such as technology cost reductions; a more sustainable, secure energy system; enhanced public awareness and social acceptance of renewable energy; job creation; and a sustainable level of domestic production and market share in renewable energy technologies.

Such policies should be regularly evaluated. In part, this is because policies involving significant financial support need to be carefully monitored and controlled. Globally, spending on renewable power is projected to grow from USD 44 billion to USD 175 billion between 2010 and 2030. In addition, an on-going evaluation can help identify opportunities to adapt and improve policies. This is particularly important for long-lived support policies, as conditions can be expected to change in unanticipated ways over time.

This brief summarises common criteria and indicators that policy-makers can use to conduct evaluations. Five commonly assessed criteria are: effectiveness; efficiency; equity; institutional feasibility; and replicability. Under each criterion, it is important to establish measurable indicators that can be used to assess performance. This brief only looks at policy performance with respect to deployment, and not at the broader impacts of renewable energy technologies, such as environmental, economic, energy security or technological impacts.

The type and complexity of analysis will depend on purpose and context. For example, various simple methods exist under most criteria for the evaluation of policy performance within a single country; whereas evaluations using country comparisons may require more technical and financial resources. Similarly, countries with established policies are likely to conduct different kinds of evaluations compared to those planning support mechanisms for the first time.

Evaluations that have been conducted to date imply the following general conclusions for policy design:

1. **Effective support must be comprehensive, sustained and set against a background of firm but plausible targets, as well as minimise investment risks.** No decisive conclusions can be drawn about which policy type can achieve this most consistently. Though many studies find that feed-in tariffs often perform well in this respect, most state that the data sample for other policies is small, and successful examples of non-feed-in tariffs policies exist. There is consensus that interventions which focus on only one support mechanism, but fail to address the broader context of non-economic barriers, are unlikely to perform well.

2. **Effective and efficient support must balance stability with adaptability.** Stability is vital to create investor confidence in support mechanisms, otherwise, investments may fail to take place or be more expensive due to higher risks. Nevertheless, policies must be able to adapt to changing circumstances and respond to as many signals from the market as possible. Experience suggests that performing various degressions and regular reviews can work effectively. Retroactive policy changes, by contrast, are highly damaging to investor confidence.

3. **Desired equity impacts can be achieved through policy design.** The type of policy in use does not usually determine the exact mechanism by which it is funded and how these costs are shared. For example, feed-in tariffs are often funded through electricity tariffs and can be combined with lifeline electricity tariffs to protect poor consumers, or funded through alternative mechanisms entirely, such as tax revenues. Evaluations can help identify equity impacts and identify opportunities for improvement.

4. **Assessing institutional feasibility can inform policy choices.** In order for a policy to operate successfully, countries must have the requisite capacities to implement any given policy tool. Evaluations of institutional feasibility can help inform the choice of policy tool and the investments that are needed to enlarge policy options.

5. **Evaluating replicability can help tailor policies to country conditions.** Some factors that have led to success in one country may not be present in another. This type of analysis can help identify investment policy adaptations that are important to good performance. It can also help set realistic expectations of policy outcomes.

Introduction

Renewable energy technologies (RETs) for large-scale electricity generation have made significant progress in recent years. Some RETs have become cost-competitive with conventional energy generation, such as hydropower and biomass, as well as wind and geothermal power on favourable sites. If recent cost reductions continue, this will soon include some applications of solar energy technologies. In many cases, however, support policies are still the main driver of deployment.

Typically support policies aim to promote deployment in order to achieve a number of objectives, including: improving technology cost-competitiveness; creating jobs; promoting a sustainable level of domestic production and increasing market share; and moving towards a more sustainable, secure energy system. In some countries, support policies have existed for over 15 years, and considerable experience has now accumulated worldwide on how best they can be designed.

Given the importance of promoting renewable power deployment, and the high financial costs often associated with support, it is essential for governments to know how policies are performing in a given situation. An evaluation can help identify potential adaptations and allocate scarce financial resources as efficiently as possible.

There are two broad approaches to evaluating these policies: assessing their immediate effects on deployment and renewable power generation; or using a more comprehensive impact analysis approach to assess performance in light of broader impacts, such as the costs and benefits related to the environment, economy and energy security. This policy brief focuses on the first of these approaches as being the most easily and commonly conducted assessment. In doing so, it seeks to answer three questions:

1. What are the policy mechanisms that support the deployment of renewable power?

2. What criteria and methodologies can be used to assess their performance?

3. What broad conclusions have been found by assessments using these criteria?

1. What are the policy mechanisms used to support deployment?

Different policy challenges and responses are relevant at different stages in a technology's development: early research and development; demonstration and scale-up; commercial roll-out with economic support; and fully competitive diffusion and maturity (World Economic Forum (WEF), 2010). This brief considers mainly the policy responses at the stage of commercial roll-out — also referred to as 'deployment'.

Deployment policies are commonly classified into four categories: fiscal incentives; public finance; regulations; and access policies (Mitchell et al., 2011). These policy types are summarised in Table 1 below.

Table 1. Policies to Encourage Deployment of Renewable Electricity Generation

Policy	Definition
Fiscal incentives	
Grant	Monetary assistance that does not have to be repaid and that is bestowed by a government for specified purposes to an eligible recipient. Usually conditional upon certain qualifications as to the use, maintenance of specified standards, or a proportional contribution by the grantee or other grantor(s). Grants (and rebates) help reduce system investment costs associated with preparation, purchase or construction of renewable energy (RE) equipment or related infrastructure. In some cases, grants are used to create concessional financing instruments (e.g., allowing banks to offer low-interest loans for RE systems).
Energy production payment	Direct payment from the government per unit of RE produced.
Rebate	One-time direct payment from the government to a private party to cover a percentage or specified amount of the investment cost of a RE system or service. Typically offered automatically to eligible projects after completion, not requiring detailed application procedures.
Tax credit (production or investment)	Provides the investor or owner of qualifying property with an annual income tax credit based on the amount of money invested in that facility or the amount of energy that it generates during the relevant year. Allows investments in RE to be fully or partially deducted from tax obligations or income.
Tax reduction/ exemption	Reduction in tax—including but not limited to sales, value-added, energy or carbon tax—applicable to the purchase (or production) of RE or RE technologies.

Policy	Definition
Public finance	
Investment	Financing provided in return for an equity ownership interest in a RE company or project. Usually delivered as a government-managed fund that directly invests equity in projects and companies, or as a funder of privately managed funds (fund of funds).
Guarantee	Risk-sharing mechanism aimed at mobilising domestic lending from commercial banks for RE companies and projects that have high perceived credit (i.e., repayment) risk. Typically a guarantee is partial, that is, it covers a portion of the outstanding loan principal with 50 - 80% being common.
Loan	Financing provided to a RE company or project in return for a debt (i.e., repayment) obligation. Provided by government, development bank or investment authority usually on concessional terms (e.g., lower interest rates or with lower security requirements).
Public procurement	Public entities preferentially purchase RE services (such as electricity) and/or RE equipment.
Regulations	
Quantity-driven	
Renewable Portfolio Standard/Quota obligation or mandate	Obligates designated parties (generators, suppliers, consumers) to meet minimum (often gradually increasing) RE targets, generally expressed as percentages of total supplies or as an amount of RE capacity, with costs borne by consumers. Building codes or obligations requiring installation of RE heat or power technologies, often combined with efficiency investments RE heating purchase mandates. Mandates for blending biofuels into total transportation fuel in percent or specific quantity.
Tendering/ Bidding	Public authorities organise tenders for given quota of RE supplies or supply capacities, and remunerate winning bids at prices mostly above standard market levels.
Price-driven	
Fixed payment feed-in tariff (FIT)	Guarantees RE supplies with priority access and dispatch, and sets a fixed price varying by technology per unit delivered during a specified number of years.
Premium payment FIT	Guarantees RE supplies an additional payment on top of their energy market price or end-use value.
Quality-driven	
Green energy purchasing	Regulates the supply of voluntary RE purchases by consumers, beyond existing RE obligations.
Green labelling	Government-sponsored labelling (there are also some private sector labels) that guarantees that energy products meet certain sustainability criteria to facilitate voluntary green energy purchasing. Some governments require labelling on consumer bills, with full disclosure of the energy mix (or share of RE).
Access	
Net metering (also net billing)	Allows a two-way flow of electricity between the electricity distribution grid and customers with their own generation. The meter flows backwards when power is fed into the grid, with power compensated at the retail rate during the 'netting' cycle regardless of whether instantaneous customer generation exceeds customer demand.
Priority or guaranteed access to network	Provides RE supplies with unhindered access to established energy networks.
Priority dispatch	Mandates that RE supplies are integrated into energy systems before supplies from other sources.

Source: Mitchell et al. (2011)

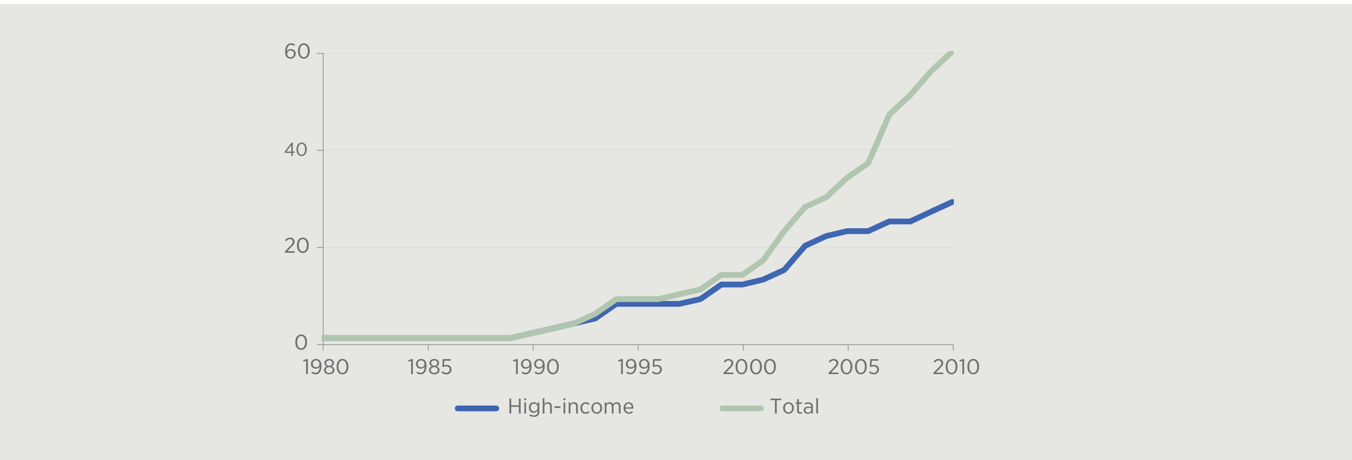
The usual justification for economic support is that it seeks to correct market and/or regulatory failures. Various external costs do not appear in the financial calculations surrounding the viability of RETs. In the case of renewable power generation, the most commonly recognised market failure is the costs that arise from damages caused by climate change and other environmental impacts, such as local air pollution. Market failures occur in other areas too, which, while less commonly recognised, may be a bigger driver behind government support for RETs. These include externalities related to capturing the full benefits of innovation; power market structures, such as barriers to market entrants and infant industries; subsidies for other energy technologies; financial market failures; and externalities related to energy security.

In addition to economic support, some policies also address "non-economic" or "non-cost" barriers such as lengthy administrative processes, barriers to grid access, the need for professional training and the unrealistic perceptions of costs and impacts (ECORYS, 2008; IEA, 2010). These barriers mostly result from fragmented or poorly defined governmental responsibility for RE, as well as the lack of national policy alignment. ECORYS (2008) identifies best practice in overcoming some of the most important of these barriers, namely: the establishment of administrative one-stop shops; unambiguous permitting conditions; and, as referred to in the final row of **Table 1**, above, policies to ensure grid access.

The choice of which deployment policies to use will reflect a country's specific barriers, ambitions and capacities. The Renewable Energy Policy Network of the 21st Century (REN21) makes an annual review of policy across the world, including public financing, fiscal incentives and regulatory policies (REN21, 2012). There are some interesting trends. Most countries employ several types of policy mechanisms, indicating that a combination of support mechanisms is favoured. The number of policies in use per country is also correlated with income: high-income countries employ an average of 4.8 different policy types, whereas in low-income countries it is only 2.2. Most countries use tax concessions, though capital grants are mainly found in high-income countries. There are fewer regulatory policies in low-income countries. Feed-in tariffs (FITs) have been the dominant regulatory instrument in developed and developing countries alike and by early 2012, 65 countries worldwide used them.

The temporal trends show rapid growth of intervention globally and a strong commitment in recent years from developing countries. By early 2012, 109 countries had some type of policy to support renewable power generation, up from 48 countries in 2005. More than half of these countries are developing countries or emerging economies. **Figure 1** shows the total number of countries with FITs in place and the number in high-income countries by year. From 1980 to about 2000 the curves track each other very closely, but from 2000 onwards the contribution from developing countries takes off strongly. This clearly illustrates the growing involvement of low-income countries.

Figure 1. Number of countries using feed-in tariffs, 1980–2010



Source: REN21 (2012).

Within each type of policy mechanism, it is important to recognise that there are many options for the design of specific policies. For example, any policy can differentiate support according to certain technologies, but countries may choose to do so in different ways, with direct consequences for the type of generation they promote. Other common variants of policy design include how risks and costs are borne by different actors. In some instances, such design features can mean that two policies with the same name are very different in their operation (see **Box 1**), reflecting specific country contexts and ambitions. A recent review of support schemes in the European Union, for example, shows great heterogeneity across the policy range (Canton and Lindén, 2010).

Box 1

WHAT'S IN A NAME? DESIGN OPTIONS FOR A FEED-IN TARIFF

A policy genus contains many options for policy design. This can be illustrated by considering some of the main design parameters for FITs.

Stepped or flat tariff: With a flat tariff, the same unit payment is made to all generators, regardless of the type of installation. With a stepped tariff, payments are differentiated by criteria such as technology, size of the installation and the nature of the site. In this way, stepped tariffs aim to avoid over- or under-compensating installations with different characteristics that make them more or less cost-competitive.

Fixed or premium tariff: A fixed tariff guarantees a fixed price, giving generators certainty about remuneration rates. A premium tariff guarantees a fixed bonus on top of electricity market prices, allowing generators to benefit when energy prices are high, but exposing them to the uncertainty of price fluctuations. Some EU countries offer both fixed and premium tariffs, with generators able to choose their preference (Canton and Lindén, 2010). Premiums can also be combined with sliding tariffs using a cap and floor on prices to limit risk.

Adjustment mechanisms: As time passes, tariff levels must change to reflect changes in generation costs. Options include automatic degression (scheduled tariff reductions), flexible degression (tariff reductions linked to the market growth of a particular technology), ad hoc tariff reviews, scheduled tariff reviews, or a combination of the above. Various options exist for how and when tariff revisions come into effect. In some countries, spending caps are also used to control costs.

Duration of support: A longer duration offers greater remuneration to investors but comes at greater cost to consumers. Most FITs guarantee tariffs for 10–20 years (Klein et al., 2010).

The exact design chosen by a country will be influenced by national conditions such as policy goals, the income of consumers, the maturity of financial markets, the availability of suitable sites and the prevailing prices for electricity. For a fuller discussion of design options for FITs, see Klein et al., (2010), Ragwitz et al., (2012) and Mendonça et al., (2010). Consultations conducted by authorities considering FITs can also provide a useful source of information (UK DECC, 2009; Robert et al., 2009).

2. **How can** countries assess performance? What has been found to date?

There are many reasons to assess the performance of deployment policies. One is the considerable resources needed to promote deployment of renewable power. According to the International Energy Agency (IEA) (2011a), subsidies for RE in 2010 were equal to USD 66 billion, of which USD 44 billion was for power generation. By 2030, the IEA anticipates that renewable power generation subsidies will increase to around USD 175 billion per year. The commitment of such a large amount of resources, especially at a time of budgetary constraints, should be carefully monitored and controlled. This is especially the case for very long-lived support policies, which may need to be adapted and improved across their lifetimes. In addition to the financial burden, ineffective policies will also take longer to achieve their objectives — meaning slower progress in providing important societal benefits related to climate change mitigation and improved energy security, among others. Governments therefore have a strong interest in analysing policy performance and acting to improve policies.

This section outlines the various criteria and methods that can be used to conduct such evaluations. These are summarised at the end of this section, in **Table 2**.

2.1. CRITERIA AND INDICATORS

Assessment of performance should be made against the objectives of the policy and in particular against predefined criteria and indicators of success. A criterion is the rule or principle on which a judgement is made, while an indicator is a property that can be measured either as a physical unit or by some other measure of quality that can show whether the criterion is met.

Five criteria are commonly used to judge the success of renewable deployment policies:

» Effectiveness;
» Efficiency;
» Equity;
» Institutional feasibility;
» and replicability.

The first four were addressed by the Special Report on Renewable Energy Sources of the Intergovernmental Panel on Climate Change (IPCC) (Mitchell et al., 2011). The criterion is also broadly consistent with the advice of the Multilateral Development Banks, as expressed for example in the guidelines of the Clean Technology Fund (Climate Investment Funds (CIF), 2009). This brief outlines options for assessing performance against each of the five, along with a summary of the main findings of evaluations to date.

For each, it is important to keep in mind the objectives of the evaluation: to assess the performance of an existing policy in an individual country; or to assess a number of existing policies, and derive general rules about their application. The relevance and specific application of different criteria will also depend on the context of evaluation. For example, a simple cost-effectiveness analysis may focus on policy outputs, such as increased capacity and energy generation; whereas an impact analysis approach might consider performance in terms of a country's most highly valued policy outcomes, such as long-term competitiveness, greenhouse gas emission reductions, economic benefits and energy security.

As it is the simplest and most commonly employed approach, this policy brief focuses on methods that seek to assess performance against the objective of increasing deployment of RETs.

2.1.1. EFFECTIVENESS

Effectiveness is "the extent to which intended objectives are met, for instance the actual increase in the output of renewable electricity generated or shares of renewable energy in total energy supplies within a specified time period." (Mitchell et al., 2011).

If the main policy objective is to deploy RETs, then suitable indicators are the installed capacity and the amount of electricity generated. Taken alone, however, they convey little about the success of a policy, because there is no comparison with intent. One approach is to measure the extent to which a pre-defined national goal has been achieved in an allotted period. This is straightforward and useful for individual countries. It may be of less value for cross-country comparison, because results will be influenced according to country conditions, such as resource intensity or level of ambition.

Cross-country comparison requires a method to levelize such differences. The exact differences to be levelized will depend upon the explanatory factors being investigated. The European Commission (EC) and the IEA have used an indicator that relates additional annual growth with a country's "realisable potential" for growth, estimated by economic modelling that takes into account resource availability, technological limits, economic factors and time.[1] More recently, the IEA has changed its benchmark from realisable potential to using the World Energy Outlook's (WEO) projections for renewable electricity generation by 2030 (IEA, 2011b).

Effectiveness indicators can also be used to establish a time series of annual effectiveness, indicating whether a policy effort is sustained.

These measures can only indicate whether or not an effect has taken place, and assume the cause to be government policy. In order to establish the extent to which a policy has caused an effect, and to establish why a policy is effective or not, it is necessary to investigate the contextual factors that contribute to or detract from effectiveness in any given case. This requires more in-depth analysis, which might touch upon factors such as the type of policy in use, policy design, non-economic barriers, country ambitiousness, resource intensity and other energy prices.

Studies on effectiveness to date suggest that the most important factors in policy effectiveness are the extent to which support comprehensively addresses barriers to deployment, in a manner that is sustained and set against a background of firm but plausible commitments. Certainty for investors is also vital. The higher risks that are perceived to exist — such as risks in the policy and regulatory environment, risks related to prospects for market revenue, risks related to technical and project-specific issues — the less investment will take place (Kleßmann, 2012).

Among the different types of policy tools available, fiscal incentives and particularly public finance, such as loans and loan guarantees are generally thought to promote deployment most effectively when linked to production rather than investment. This creates the incentive to use plants more effectively and ensures that energy is actually generated, though offers less certainty to investors (Dijk et al., 2003).

Much literature has focused on the effectiveness of regulatory policies such as FITs, quotas, certificate markets and tendering. Most studies find that well-designed FITs operate more effectively than the other policy types, but caution that data is insufficient to draw decisive conclusions: the sample of non-FIT policies is small and policies may operate differently as they age (EC, 2008; IEA, 2008; IEA, 2011b). In addition, it may be difficult to compare different policy types if they have different objectives, for example, quotas systems are often designed to promote only low-cost technologies, as opposed to a full portfolio of RETs. The main rationale for supposing higher effectiveness from FITs is that a fixed price for electricity will increase investor confidence, reducing project risk and allow cheaper access to finance (Mitchell et al., 2011; Jager et al., 2011). Not all FITs have been highly effective and in some cases, such as quota

[1] *Information on the methodology for calculating potentials in Europe can be found in EC (2008), IEA (2008), EC (2005), and Jager et al. (2011).*

policies in Sweden and North America, other policy types have performed well (Mitchell et al., 2011). According to recent analysis by the IEA (2011b), greater differences in performance are witnessed between the same policy types rather than between countries with different policies.

Poor effectiveness is often attributed to a failure to address non-economic barriers such as lengthy administrative processes and obstacles to grid access. Numerous studies argue that such barriers must be addressed if other deployment policies are to be effective and efficient (Gouchette et al., 2002; EC, 2008; IEA, 2008). Other studies argue that some instruments are more or less effective at different points in development of the deployment market. A recent EC-commissioned report concluded that capital and project grants are most appropriate if targeted at pre-commercialisation, start-up and construction; and FITs, premiums, quota obligations and incentives at commercialisation and operations and maintenance (Jager et al., 2011).

2.1.2. EFFICIENCY

Efficiency is "the ratio of outcomes to inputs, for example, renewable energy targets realised for economic resources spent, mostly measured at one point of time (static efficiency), and also called cost-effectiveness. Dynamic efficiency adds a future time dimension by including how much innovation is triggered to improve the ratio of outcomes to inputs" (Mitchell et al., 2011). As with effectiveness, efficiency can be measured relative to capacity (USD per kW) or electricity generation (USD per kWh), and should be qualified by technology type, given significantly different RET cost profiles.

In the case of fiscal incentives and public finance, an important indicator is the extent to which public expenditure has leveraged private funding (London School of Economics (LSE) Grantham Research Institute, 2009). For other policies, a simple indicator is expenditure for each unit of capacity or generation deployed.

As with effectiveness, it is necessary to levelise the differences in order to conduct cross-country comparisons. The EC evaluates efficiency by comparing the total support for renewable electricity (including the value of the electricity) with the estimated generation cost for each technology in a given country (EC, 2008; Jager et al., 2011). Taking into account an adequate return on investment, the closer the support to the generation cost, the more likely the mechanism is to be cost-efficient. The IEA (2011b) has recently updated its evaluation methodology to establish a Remuneration Adequacy Indicator (RAI), which operates by a similar principle. This is complemented by a range of minimum and maximum estimates in which adequate remuneration should be expected to fall.

Efficiency can also change through time due to technological innovation and the forces of competition. Such dynamic efficiency can be tracked by a time series of efficiency evaluations or indicators of competitiveness, such as market diversity or surveys with project developers (Borenstein et al., 1999; Butler and Neuhoff, 2008). Such indicators can be useful in helping to assess the long-term efficiency of policies, also termed 'market conformity': the extent to which a sector or technology will be economically sustainable without support, in a fully competitive, demand-driven market (Dijk et al., 2003).

Furthermore, it is important to understand contingent factors that explain why a policy is more or less efficient. The literature on efficiency suggests that the same basic principles hold true: in order to perform well, policies must be comprehensive, sustained and set against a background of firm but plausible targets. Certainty for investors also continues to play an important role, as the lower the investment risk, the cheaper it is to raise finance for RET deployment. In addition to this, the extent to which deployment policies have been successfully differentiated by technology can play a large role in ensuring that costs are reasonable. Efficient policies must also be adaptable. As generation costs can change in unanticipated ways over time, subsidies must avoid over-compensating generators and over-heating markets, while continuing to incentivise deployment. Balancing these two poles is one of the central challenges to creating a policy that is both effective and efficient (see **Box 2**).

With regard to specific policy tools, studies show that the efficiency of fiscal incentives and public finance will vary according to different institutions and countries, though various benchmarks can be found. The World Bank estimates that each dollar spent in its energy efficiency and RE programmes will leverage five dollars of private capital (World Bank, 2006). The Norwegian Public Finance Mechanism (NorFund) aims to achieve an approximate ratio of 10:1 (Norwegian Agency for Development Co-operation (NORAD), 2008). In a review of public finance mechanisms for climate change, United Nations Environment Programme-Sustainable Energy Finance Initiative (UNEP-SEFI; 2008) estimated that ratios of 3–15:1 could be achieved, noting the importance of technical assistance programs in maximising leverage.

Studies on the efficiency of regulatory policies generally find FITs to be highly efficient (Ecofys, 2008; Butler and Neuhoff, 2008). In a wide review of literature, the IPCC found with some reservations that "FITs have consistently delivered a new supply, from a variety of technologies more effectively and at lower cost than alternative mechanisms" (Mitchell et al., 2011). The IEA (2011b) finds that feed-in systems tend to perform better on cost-effectiveness than quota trading systems, noting, however, the high efficiency that has been achieved by the certificate scheme in Sweden. Although quota-based policies should in theory minimise surplus spending, this depends upon adequate differentiation of support by technology and impacts of transaction costs (Jager et al., 2011; Verbruggen and Lauber, 2009).

One challenge for efficiency assessments can be fully capturing costs. For example, a comparison of two FITs may prove misleading if supplementary support mechanisms (such as grants, loans and tax credits) are omitted. As with effectiveness, non-economic barriers may be a factor that is particularly important to good performance, given they can increase direct costs and project risk (IEA, 2010; IEA, 2008). The IEA (2011b) also argues that learning may play an important role in explaining why some countries are able to offer less financial support and yet achieve higher impacts: "once markets are functioning well and have become mature, deployment faces fewer barriers. [...] countries that show high impact with high cost-effectiveness tend to be also those with a very long track record of policy support".

2.1.3. EQUITY

Equity is defined as "the incidence and distributional consequences of a policy, including dimensions such as fairness, justice and respect for the rights of indigenous peoples" (Mitchell et al., 2011). At a basic level, this can focus on whether policies are fairly designed, for example allowing some actors to bear less of the costs or favouring some developers over others. At a more complex level, it can estimate the actual incidence and specific impacts of policies.

The first step in evaluating equity is to track how costs are shared between different actors. In the case of policies that are funded through higher electricity prices, increases in household and industry expenditure can be estimated relatively easily with existing data sets. The incidence of policies funded through spending or foregone revenue depends on assumptions about how funds might have been used instead. Other costs might be considered too, such as financial and non-financial impacts on communities near generation facilities, taking into account any associated compensation or spill-over benefits.

It is then necessary to evaluate the fairness of how costs are shared. This can introduce a number of complex ideas. The welfare value of USD 1 is greater to a poor person than a rich one and it is possible to estimate equity 'weights' to reflect this. This has been noted in an analysis of United Kingdom climate change programmes, where it was estimated that welfare impacts were 2.5 times higher for poorer households (Owen, 2008). Intergenerational equity and equity among countries can also be considered, though this requires complex and controversial thinking about appropriate discount rates and equity weightings within global welfare functions. Simple indicators can also be used. For example, policies that affect energy prices are often tracked by estimating how energy expenditure will change as a percentage of total household expenditure for different income-groups in a population (Bacon et al., 2010).

An alternative interpretation of equity from a more social or political angle is the extent to which the decision-making process allows the participation of a wide range of different stakeholders. This participation is not easy to achieve because there are several criteria for choice and different stakeholders will have different preferences. A useful but cumbersome tool for identifying a wide range of stakeholder preferences and consolidating them in a manner that can be digested by decision-makers is multi-criteria decision analysis (MCDA). Such an MCDA was performed under the EC's New Energy Externalities Developments for Sustainability (NEEDS) project (NEEDS, 2009). This required the development of a decision-support tool to reveal and record the preferences and choices of individual consumers regarding electrical generating technologies, and in particular the choice of RE technology.

A number of studies have considered the extent to which policies are fairly designed. Tax credits for companies have been criticised because they are likely to concentrate benefits among developers with larger profits. This creates barriers to entry for players that have little or no tax liability and for non-taxable entities such as cities, counties, states and non-profit organisations (Batlle et al., 2011; Farrell, 2009). Quota systems with certificate trading have also been criticised for creating barriers to market entry for smaller players, due to their higher transaction and administrative costs compared to policies that use FITs (Mitchell et al., 2011).

Fewer studies have considered distributional impacts in detail, though concern is commonly reported over operation support that is funded through increased electricity prices. Such consumer charges are generally thought to be regressive, as lower-income groups dedicate a greater percentage of household expenditure to energy needs. They have also been criticised by energy-intensive industries, who argue that the charges make them less competitive. In this context, the financing of support through government budgets is considered more equitable, because better-off groups contribute more to general tax revenues. In many cases, however, equity impacts need not be pre-determined by policy type and may be more a question of policy design. In the Netherlands, for example, FITs have been designed to be funded through taxpayers and not through consumer charges (Lensink, 2009). In a number of developing countries, such as Thailand and Kenya, cross-subsidised life-line electricity tariffs exist for small consumers, effectively shielding low-income households from the costs of FITs (Mitchell et al., 2011; CIF, 2011). Similarly, countries design policies such that energy-intensive industries are exempt from paying the full costs of supporting renewable electricity.

2.1.4. INSTITUTIONAL FEASIBILITY

Institutional feasibility is "the extent to which a policy or policy instrument is seen as legitimate, able to gain acceptance and able to be adopted and implemented" (Mitchell et al., 2011). It depends on the complexity of the policy being considered and the pre-existence of the necessary institutional and implementation arrangements, including administrative capacity, economic realities and political feasibility.

Indicators for institutional feasibility can be based on the presence or absence of resources, the institutions required for implementation and an assessment of their capacities. Evidence that the policy is sustainable could also be taken into account. This might be demonstrated by evidence of commitment to the policy objectives and clear and appropriate ownership, together with arrangements for long-term support (CIF, 2009). For example, an assessment of countries in the Middle East and North Africa considered issues such as the existence of RE ministries and regulators; their competency and resources; and existing strategies, laws and activities on RE (Regional Centre for Renewable Energy and Energy Efficiency (RCREEE), 2010). Economic realities and political feasibility can best be assessed qualitatively, by taking into account the resources that can be justified for the support of renewable electricity and the potential opposition that might surround different options for financing support schemes.

Among policy types, for example, fiscal incentives are relatively straightforward to implement: all countries have taxation and budgetary policies. Problems may exist in ensuring that money intended to support RE ends up where it was intended. In 2010, for example, individuals in Italy were arrested and charged with setting up false wind power companies to access EU funds, allegedly trying to launder up to EUR 30 million (PriceWaterhouseCoopers (PWC) Belgium and PWC Netherlands, 2011). To some extent this is a problem with any subsidy policy and a degree of institutional rigour is a pre-requisite regardless of the tool.

FITs are widely thought to have lower administrative costs than quotas (Haas, 2011) and are easier to implement. The main challenges in designing a FIT is to establish an appropriate tariff level, especially in the context of rapid technological development and mechanisms to ensure that resources end up where they are intended. A review of policies for RE in the Middle East and North Africa concluded that apprehension over setting tariffs was a strong obstacle to adoption of FITs (RCREEE, 2010).

Tradable certificates can be more difficult to implement because of the complexity involved in creating an efficient secondary market for certificates. This may strain the capacity of even some developed countries and create market barriers to small market actors. Technical capacity is also required to set quotas and to establish penalties for non-compliance. Like fiscal incentives, tendering is a relatively common practice and most countries have experience in the process. A study of the Middle East and North Africa region, for example, showed an inclination to use tendering over other mechanisms, but reported no evidence of significant success (RCREEE, 2010).

2.1.5. REPLICABILITY

Replicability is the extent to which a successful policy can be reproduced by another country. This can only be judged by an analysis of the factors that made a policy successful in a given context and what this might imply under different conditions.

Box 2

A DELICATE BALANCE? STABILITY AND ADAPTABILITY

If a performance-related support mechanism is to work well, investors need to be confident that it will remain in place long enough to develop a project that qualifies for support, and that once guaranteed, will not change. At the same time, policies must grant projects a level of support that reflects the cost profile for a technology being installed at any given time, or risk over-compensating developers.

Adaptation mechanisms will depend on the policy type in place. Quotas should in principle set the lowest price for the desired volume, but where they differentiate support by specific technologies, adaptations in the differentiation system will be required. FITs often incorporate fixed tariff reductions called 'degression', either by fixed amounts on set dates or linked in some way to an index of technical change.

All policy systems need provisions setting out how and when changes to policy can take place, such as schedules for periodic review, mechanisms for price discovery and procedures for fast-track review in the event of unexpected changes (DB (Deutsche Bank) Climate Change Advisors, 2009). Germany is generally considered to have balanced adaptation well with stability. It provides a predetermined annual degression rate in support for all RETs, with the exception of solar PV, for which it introduced a 'responsive' degression schedule, indexed to the volume of installations in a given year. This maximises stability for technologies with relatively stable cost changes and allows for more adaptability with a technology whose costs are declining less predictably (Kreycik et al., 2011).

Where sudden changes are required, it is generally agreed that these should not be retroactive, as this can be deeply damaging to future investor confidence. Spain, for example, has retrospectively reduced tariffs for solar power because of falling capital costs, resulting in significant market impacts and legal controversy (Freshfields Bruckhaus Deringer, 2011).

The extent to which a policy will be replicable will depend on the degree to which factors that were important to success can be recreated. In most cases, some will be under the control of policy-makers and others will not, or at least only over the medium- to long-term. For example, a country might find itself able to copy another country's policy type, policy design and strategy for the removal of non-economic barriers; but find it hard to recreate the same determinants of energy demand and electricity infrastructure, and impossible to enjoy the same resource availability.

Assessing replicability can help policy-makers identify how successful strategies in other countries can be best adapted to their own context. For example, capacity limitations might need to be overcome to enable similar policy design; or higher resource availability may imply the potential for exceeding the deployment achieved elsewhere. An analysis of this kind was conducted by Sovacool et al. (2008), on whether the Danish model was replicable in the United States. The example showed how replicability cannot be associated with a policy instrument, but is a consequence of the compatibility of a range of issues. However, Denmark and the US, for example, both have significant financial and institutional capacity to dedicate to the creation and monitoring of support policies. However, Denmark enjoyed advantages that would be hard or impossible to recreate: its electricity infrastructure, for example, was well placed to manage the variability of significant wind power generation; and its relatively small energy-intensive industry meant its economy was less sensitive to changes in the cost of electricity generation.

Therefore, in some cases, technological innovations such as smart grid development might offer options to recreate conditions that might not be easily replicable. In other instances, such as a country's natural climate, policy must adapt to country conditions.

2.2. SUMMARY TABLE OF CRITERIA AND INDICATORS

The following table summarises the criteria and indicators discussed in the previous section, as well as identifies major sources that can be turned to for each kind of evaluation. It should be noted that the availability of good data is important to the feasibility of all such exercises. To facilitate policy evaluations, it is good practice for governments to monitor and report in a transparent way on the costs and impacts of deployment policies.

Table 2. Summary Table: Criteria, Indicators and methodologies for Evaluating Policies

Criterion	Indicators	Methodologies
Effectiveness	» Growth in capacity/ generation vs. ambition » Growth in capacity or generation vs. realisable or projected potential by a given date	Measuring growth against targets is simple and useful for individual countries. Country comparisons require data and analysis to levelize country and policy differences. The EU's method, based on estimates of 'realisable potential', is described in de Jager et al., (2011). See EC (2008) and IEA (2008) for examples of how to create indicators. Alternatively, IEA (2011b) uses World Energy Outlook (WEO 2010) projections to benchmark growth potential.

Criterion	Indicators	Methodologies
Efficiency	Fiscal incentives and public finance: » USD spending per USD private investment leveraged	Leverage can be assessed by accounting studies of projects. See for examples LSE Grantham Research Institute (2009), UNEP (2008), UNEP and BNEF (2010), UNEP-SEFI (2008) and NORAD (2008).
	Other policies: » Total USD per unit of capacity or generation » Total USD per unit of generation vs. cost of generation » Time series of the above, to track dynamic efficiency	Comparing support to generation or the cost of generation requires good data on support levels, production costs and system costs. As with effectiveness, country comparisons require levelization of policy differences and are more technical than individual country studies. Much detail on efficiency evaluation can be found in EC (2005) and (2008), and Jager et al., (2011). The approach has been used in modified form by the IEA (2008) and recently refined by Steinhilber et al., (2011). Recently, the IEA (2011b) has developed a new indicator, though using a similar approach.
	» Competitiveness indicators, e.g. market diversity, judgements of developers	Competitiveness can be a useful supplementary indicator for efficiency. This requires analysis of market players or consultation through surveys and questionnaires.
Equity	» Fair access to support policies	Access to instruments (e.g. tax credits) may favour some actors more than others. This can be assessed through abstract policy analysis, surveys and interviews.
	» Incidence of support costs » Incidence of costs, with welfare weights » Change in spending on electricity as a percentage of total household spending, broken down by income-group	Reporting the incidence of support costs requires good data and may involve estimates regarding opportunity costs and impacts on communities. There is considerable experience with estimating welfare weights from studies on rural electrification and other economic development studies (Independent Evaluation Group (IEG), 2008).
	» Participation of stakeholders	Multi-criteria decision analysis can elucidate and consolidate stakeholder preferences, though it is a cumbersome exercise. See NEEDS (2009).
Institutional feasibility	» Policy complexity » Existence of required institutions » Capacity of required institutions » Clear and appropriate ownership and commitment	These indicators can be assessed by detailed case-studies to identify obstacles and provide road-maps to implementation. A methodology would include identification of objectives, economic analysis of potential, institutional analysis of capacity, preparation of options and consultation. See RECREE (2010) for an assessment of Middle East and North African (MENA) countries.
Replicability	There is no single indicator of replicability. Any instrument has to be analysed in the context of the possibilities of the country concerned	Requires analysis of the factors that made the policy successful elsewhere and verification that they exist in the country to which it is transferred. It also requires analysis of factors in the recipient country that might impede transfer.

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