Chapter 2

Overcoming the barriers to renewable energy deployment

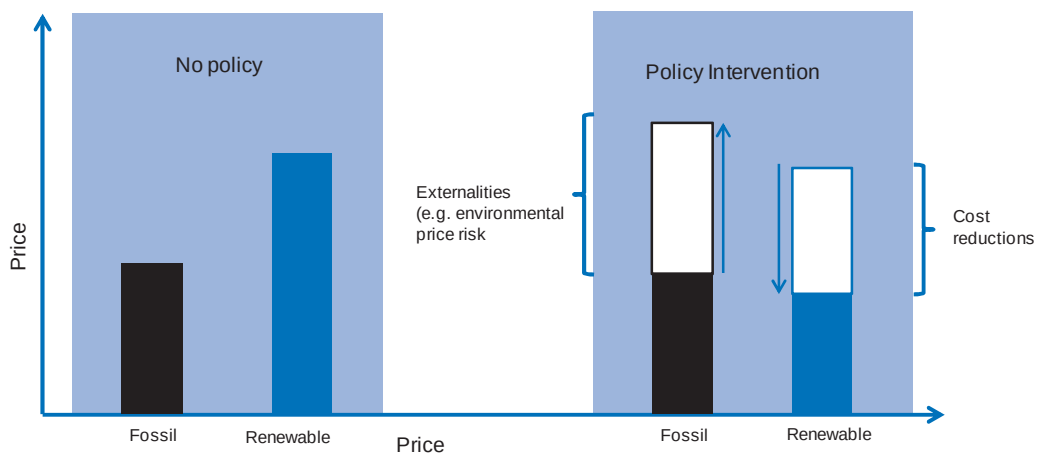
This chapter discusses how to overcome the main barriers to renewable energy deployment. It presents the main policies to deal with economic barriers, including investor security and high transaction costs. It also takes into account non-economic barriers such as lack of infrastructure and regulation, and ends with a discussion on the need for policy coherence within the renewable energy support framework.

Renewable energy (RE) technologies face several barriers that impede or even prevent their integration into an energy system primarily designed for the use of fossil fuels. Policy actions should remove these barriers if the share of RE in the energy supply mix is going to continue to rise. This chapter outlines the main barriers and puts forward some proposals for removing them.

Economic barriers

The key economic barrier to RE technologies is that they are not generally cost-competitive with conventional technologies under current pricing mechanisms (discussed in the section on "Can renewable energy compete with conventional energy?" in Chapter 1). The market expansion of RE technologies, however, has been accompanied by cost reductions in critical technologies, such as wind and, in part, solar PV, and such trends are set to continue. Where technologies are not yet competitive, short-term economic support such as through subsidies may be justified. This would help to use price to signal the environmental and energy security benefits of RE deployment when these are not reflected by current pricing mechanisms. Support is also justified to allow the newer RE technologies to mature enough to allow their cost to fall (Figure 2.1).

Figure 2.1. **Factors influencing renewable energy competitiveness and the role of policies**



Source: IEA (2011), *Deploying Renewables 2011: Best and Future Policy Practice*, OECD Publishing, Paris, *10.1787/9789264124912-en*.

Financial support policy options for the electricity sector

A number of policy options have been developed to address the economic barriers faced by RE technologies in the electricity market sector. These options include:

- **Feed-in tariffs (FITs).** These ensure the generator of renewable electricity is guaranteed a fixed purchase price per kWh for their electricity. The tariff is guaranteed at a fixed rate (sometimes indexed to inflation) over a long period, commonly 20 years. Although FITs were originally intended to be the only remuneration to generators, some more recent schemes instead offer a "feed-in premium" that is paid above the market price for electricity. Generators then have two sources of income: one from selling power directly on the market at the prevailing price, and an additional feed-in premium (FIP). To restrict the overall policy cost, some governments, including Spain,

the Netherlands, and Switzerland, have introduced annual caps on the amount of capacity that can benefit from FIT support in a certain time period, or have placed an annual limit on total expenditure.

- **Tradable green certificates (TGCs) or renewable energy certificates (RECs).** These systems are based on the idea of separating the actual power from its "greenness". The RE power is sold on the normal market but generators can also sell a certificate, representing a certain amount of renewable electricity, on a separate market established just for these certificates. Certificates are sold to large consumers or retailers of electricity who are obliged to buy a certain number of these certificates. Demand for certificates is ensured through quotas. The size of the quota obligation sets an upper bound for annual generation volume, because prices would drop sharply if there was to be an oversupply of certificates. TGC schemes can usually fine any entities who fail to buy sufficient certificates to meet their quota. In most cases, this penalty rate determines an upper bound for the value of certificates. In their original form, certificates did not differentiate by technology. Today some schemes encourage more expensive yet promising technologies by issuing more certificates for the same amount of electricity these technologies produce than to others (see Box 4.5).
- **Tenders.** These are used when a regulatory authority announces that it wishes to install a certain capacity of a given technology or suite of technologies. Project developers then apply to build the project and name the price at which they are willing to develop the project. Tenders commonly contain specific requirements (e.g. that manufacturing must be done locally, certain technological specifications, maximum price per unit of energy, etc.). The bidder with the lowest offer is selected to proceed with the project. Usually the parties sign a long-term contract (called a power purchasing agreement). Tenders are frequently used to meet government-set RE quotas in systems where there is no trading of certificates.
- **Tax incentives or credits.** These are particularly used in the United States to support RE technologies. An important prerequisite for this scheme to function is that tax credits can be traded. For example, if a wind farm operator generates USD 100 worth of tax deductions, the project owner can sell this deduction to companies, who can then deduct this amount from their taxes.
- **Direct cash grants/rebates.** These can be used to reduce investment costs and so improve returns for investors. The Section 1603 grant scheme works in the United States, for example, allows RE technology project developers to get back 30% of their investment costs in cash. This payment helps to make the technology more competitive. This measure was introduced after the market for tax credits (see previous bullet) collapsed due to the economic and financial crisis in 2009.

These mechanisms differ in the extent to which regulators can manage the rate and volume of RE deployment. They provide different opportunities to manage the prices paid to developers, and to control overall policy costs, and they provide different levels of security and certainty over the income that developers will receive. They also involve differing levels of bureaucracy, which make them more or less suited, for example, to small-scale deployment. The characteristics of the different systems are summarised in Table 2.1, and each is discussed in detail below.

Table 2.1. **Characteristics of electricity support mechanisms**

	FIT/FIP	TGC	Tender	Tax incentive	Capital grant
Deployment volume management	Difficult unless designed with capacity cap	Built-in but not technology specific	Good	None	Possible via cap on grant volumes
Price control	Very specific control possible; frequent reviews required	Price capped by buy-out fee and set by market; price floors can be introduced	Good	None	Possible by setting maximum grant levels
Investor security	High, some exposure to electricity market fluctuations for FIPs	Exposed to electricity and certificate market risks	High once concession is obtained, very low during bidding phase	High but susceptible to budget cuts	High but susceptible to budget cuts
Transaction costs/ complexity	Relatively simple if procedures streamlined and applicable to small developers	Complex, best for larger developers	Relatively straightforward but best for larger projects	Relatively simple as part of overall tax management	Relatively simple

Managing deployment volume

FIT systems can generate market distortions but are widely used and have proved effective at stimulating deployment and investment, since investors have a guaranteed income for the project lifetime. However, in most FIT systems, the market volume is unconstrained. This has proved problematic for a number of countries that have used FITs as a financial support instrument, particularly for solar PV. With fixed FIT tariffs and rapidly falling PV module prices, rates of return became highly attractive, leading to an explosion of capacity, and extremely high overall policy costs. The small and modular nature and short implementation schedules for PV reduced the extent to which regulators could foresee rapid deployment rates.

To avoid such situations, policies should be designed in a way that makes it possible to adapt tariffs to changes in system costs in a predictable way. For instance, by providing a clear schedule for regular review, by linking digression rates to deployment volumes, or by indexing support levels to globally-traded PV equipment prices, as far as transparent markets exist.

Such volume problems do not occur using the TGC, tendering and grant-based systems. These systems have built-in ways of controlling deployment volumes. For example, how the TGC cap is established can be controlled by tendering for set levels of capacity. The budget available for capital support can also be constrained. These systems also allow the overall rate of deployment to be managed, although, in the case of TGC schemes, the total volume, rather than levels of specific technologies, is influenced by the cap.

Ensuring investor security

Providing a secure environment for RE investors is particularly important in the early phases of market development. However, policy makers need to distinguish between risks arising from sub-optimal framework conditions on the one hand, and risks inherent to the sector on the other. The first type of risk needs to be mitigated as much as possible at all stages of market development. With increasing maturity of the RE market, stakeholders

should also be increasingly exposed to the second type of risk in order to ensure an efficient outcome. However, even in a mature market, effectiveness remains an equally important factor as efficiency.

Another important difference between FITs and TGCs is the risk exposure of RE generators. Under a classic FIT scheme, generators receive a fixed income for each unit of electricity and, therefore, are not exposed to market price fluctuations at all (except in some adapted versions, where a premium above the electricity rate is paid). In any case, FITs and FIPs do not expose generators to the price volatility of a certificate. Under a TGC scheme, generators are exposed to both electricity market and certificate market risk. Generators can mitigate this risk by securing long-term power purchase agreements (PPAs) covering the value of the electricity and certificates, but at some discount.[1] Investors may use conservative income values in preparing their investment cases, and so seek higher returns to mitigate these perceived higher risks. Tenders, when linked to secure PPAs at fixed or indexed power prices, provide a high level of security to developers and investors.

Another element of security relates to the longevity of the support schemes, which is important for building investor confidence that a viable overall market, not just a few projects, will be created. This is particularly important for the equipment supply industry. FITs and TGC schemes are usually promoted as long-running mechanisms that provide such security. The cost of a support scheme is usually funded by passing on the additional costs to all consumers. This arrangement insulates the project from public expenditure reviews and cuts.

Tenders, tax incentives and grant schemes offer less security in this sense, because they are usually of more limited duration. Tax breaks and capital grants are also dependent on public expenditure and budget uncertainties and are, therefore, vulnerable to cuts. These conditions are more likely to lead to stop-go patterns of deployment – not conducive to investment in the manufacturing facilities needed to support large-scale deployment. The US wind industry, which is principally stimulated by tax incentives, experiences these swings in deployment levels. Such boom-and-bust cycles can lead to spikes in equipment prices during a boom phase, because the high uncertainty prevents the development of a robust supply chain.

Transaction costs and complexity

The policy options in Table 2.1 also differ in their transaction costs and complexity. Under a FIT, the distribution grid operator is usually responsible for paying the generator. The contractual arrangements and procedures can be simplified. FITs are relatively easy to design at the central level, with limited information about the characteristics of local energy markets, and establish a low-risk environment that kick-starts markets and allows smaller players to come on board due to the relatively low bureaucracy that it is needed to handle them. With a TGC system, generators need to sell on both the certificate market and electricity power markets. The complexity and transaction costs associated with such systems are high and not as accessible as FITs to smaller investors. For similar reasons, tenders are best suited to larger-scale developers and investors, whereas tax-based incentives and grant schemes can be applied at different scales. TGC systems can however be adapted to make it easier for smaller generators, such as private households or small community projects, to take part. Guaranteed price floors, or giving for small-scale projects the option of selling certificates to government bodies are examples.

Other structural barriers to renewable energy deployment

There are a series of other barriers that are not related to the price of RE or to the form of incentives put in place. These include regulatory and policy uncertainty, institutional and administrative arrangements, and infrastructure designed with fossil fuels in mind that may be unsuited to more distributed energy supply or the high up-front capital demand of RE technologies:

- **Regulatory and policy uncertainty barriers:** Bad policy design, or discontinuity and/or insufficient transparency of policies and legislation.
- **Institutional and administrative barriers:** The lack of strong, dedicated institutions, lack of clear responsibilities and co-ordination among different sectors, and complicated, or non-transparent permitting procedures.
- **Infrastructure barriers:** These mainly centre on the flexibility of the energy system, e.g. the power grid, and its ability to integrate/absorb RE technologies efficiently and without risk of disruption and interruption.
- **Lack of awareness and skilled personnel:** Insufficient knowledge of the availability and performance of RE technologies as well as a lack of skilled workers.
- **Public acceptance and environmental barriers:** Linked to experience with planning regulations and public acceptance of RE technologies.

Even where the economic barriers have been addressed, the existence of these non-economic barriers can either prevent deployment altogether (no matter how high the willingness-to-pay) or lead to higher costs than necessary or distorted prices. The analysis of the effectiveness of policies carried out by the IEA (2011a) indicates that overcoming such barriers may be more important than deciding which financial support mechanism to use.

Getting the policy mix right nationally and regionally

An effective policy response would be to tackle the most significant of the non-financial barriers, while also putting appropriate financial support measures in place. In fact, tackling the non-financial barriers should reduce the need for financial support. This requires a balanced portfolio of measures that mutually reinforce each other, rather than interacting in a potentially undesirable way. Continual evaluation of policy interventions is also important, as a process of trial and error is inevitable when dealing with new sectors and new technologies like RE.

There is now a wealth of policy experience gained in the countries that have led the deployment of the technologies. In a recent analysis, the IEA (2011a) developed a number of quantitative policy indicators to help answer the following questions:

- Will national policies to stimulate growth in RE generation also lead to a sustainable energy future?
- Is a country paying a reasonable remuneration per unit of deployed RE technology?
- Is a country getting RE electricity generation in line with the remuneration that it allows for generators?

- Are the overall costs of support premiums in line with the technology's contribution to the country's electricity system?

The IEA developed a set of indicators to compare the effectiveness and cost effectiveness of policies developed for wind and for PV in OECD and BRICS[2] countries. The analysis indicates that there are some differences between the performances of the various financial support mechanisms. For example, FITs, for example, tend to be more cost effective than TGC schemes, although these differences are less important than the whole policy portfolio. The analysis identified a number of overarching principles for designing an effective RE policy portfolio:

- Provide a predictable and transparent RE policy framework, integrating RE policy into an overall energy strategy, taking a portfolio approach by focusing on technologies that will best meet policy needs in the short and long term, and backing the policy package with ambitious and credible targets.

- Take a dynamic approach to policy implementation, differentiating according to the current maturity of each individual RE technology (rather than using a technology-neutral approach), while closely monitoring national and global market trends and adjusting policies accordingly.

- Tackle non-economic barriers comprehensively, streamlining processes and procedures as far as possible.

- At an early stage, identify and address overall system integration issues (such as infrastructure and market design) that may become constraints as deployment levels rise.

The differences in deployment success between countries reflect the extent to which these principles have been applied. The experience with onshore wind developments, for example, demonstrates that those countries that have adhered to the principles outlined above have managed to induce a dynamic and stable market (Brown, *et al.* 2011). On the other hand, countries that lack a comprehensive and stable policy framework for RE deployment have seen boom-and-bust cycles in deployment and, accordingly, a less well-developed market, particularly in terms of the supply chain.

Another important policy principle is the need for close monitoring of market developments and adequate policy reaction. This is exemplified by developments in the solar PV market. In Germany, legislation required a regular policy review every two years (IEA, 2011a). In mid-2010, unscheduled tariff reductions were enacted following consultation with industry when markets were overheating. This approach avoided the problems experienced in Spain (see case study in Part II), where regulation was not flexible enough to respond to an overheating PV market in 2008/09, for instance. Experience shows that such retroactive changes to policies and support mechanisms can have long-lasting impacts on market confidence.

Finally, the success of policies depends on the objectives they are intended to meet. Consequently, setting realistic objectives is one important step in designing successful policies. If expectations are unrealistically high then it is no surprise when policies do not live up to them.

Ensuring policy coherence in the regions

Ultimately the objective of national policy is to achieve an appropriate balance among the three policy objectives of energy security, climate change mitigation and economic growth (Chapter 1). The current path emphasises expanding RE use through national policy support. But because different countries have different RE capabilities and different potential for RE to replace conventional energy there are clear differences in the extent to which RE has been adopted. In addition the level of subsidy has been a clear influence on RE deployment with countries providing larger incentives seeing faster adoption.

The impact of national policies can also vary significantly within countries. Ultimately every RE installation takes place in a specific region; regions can have widely diverging resource potential and relative costs between renewable and conventional energy. From a national perspective it may appear sufficient that an aggregate RE target is met irrespective of the particular mix of RE sources and their location. But in reality, how and where RE is produced and the price that users pay for it will have a major impact on economic activity.

The choice of national instruments and the level of support given to RE plays a large role in decisions about the size and type of RE installation. For example, while high FITs in place for long periods of time can stimulate rapid investment and rapid technological change, they can also lead to investments in places with limited resource potential, or to investments that may distort local economies by attracting too much land, labour and capital into the renewable sector, and thus causing damaging competition with other industries. Similarly the choice of instrument can bias investment to large *versus* small projects (Table 2.1).

Because RE policy is essentially decoupled from local market signals the resulting set of installations may not achieve local or national economic development objectives. This can happen because:

- too much or too little RE is produced in a given location;
- some types of RE are favoured over other types by national policy, even though some regions have clear strengths in the unfavoured alternatives; or
- relatively high priced RE sources are introduced in regions where conventional energy is inexpensive to provide, instead of in regions where conventional energy is expensive.

Because national strategies set the framework conditions for individual project decisions it is crucial to think about how the signals that policy provides influences action in different types of territory. This means that national policies not only have to be judged in terms of how well they reach aggregate goals for RE, but also in terms of how they alter regional economic development options. National mistakes in policy, such as the excessive investments in PV triggered by too high FITs, cause financial problems at the national level. But they leave an additional problem at the local level in the form of locked-in long-life investments that can limit future regional development options.

Notes

1. Quota obligations can exist in the absence of a certificate market. This is the case under some Renewable Portfolio Standards. In such cases, the party that is obliged to fulfil a certain quota can directly sign a PPA with a project developer. Examples even exist of using a FIT (paid by a party obliged to meet the quota obligation) to independent power producers (IPPs).
2. Brazil, China, India, Russia and South Africa.

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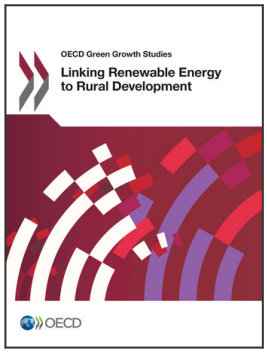

From:

Linking Renewable Energy to Rural Development

Access the complete publication at:
https://doi.org/10.1787/9789264180444-en

Please cite this chapter as:

OECD (2012), "Overcoming the barriers to renewable energy deployment", in *Linking Renewable Energy to Rural Development*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/9789264180444-6-en

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