Oxera

Agenda

Advancing economics in business

Coming clean: the challenges of the EU's renewable energy target

The European Council has reaffirmed the Community's long-term commitment to the development of renewable energy. But what are the economics behind the burden sharing and delivery of the EU renewables target? Given the relative costs, supply constraints and overlap with existing measures, the mechanisms chosen could have significant ramifications for political acceptability

What has been agreed, and why?

Earlier this year, the presidency conclusions of the European Council reaffirmed the Community's long-term commitment to the development of renewable energy.[1] It claimed that, when used in a cost-effective way, such energy generation contributed to security of supply, competitiveness and sustainability. To that end, the following binding targets were announced:

– a target of a 20% share of renewable energy in overall EU energy consumption by 2020;
– a 10% minimum target share of biofuels in overall EU transport petrol and diesel consumption, subject to sustainability and cost-effectiveness.

From the overall renewable energy target, different national allocation targets are to be negotiated among Member States, taking into account starting points and potential for future growth in renewables before 2020. The sector-specific targets of the shares of electricity, heat and fuel are left up to each Member State to decide.

The objective is a challenging one, since the average renewable energy share in the EU is currently around 7%.[2] Meeting the target will require substantial statutory efforts from most Member States. Given its more advanced state compared with other sources of energy, the renewable electricity industry may have to shoulder the largest proportion of the burden. Analysis by the European Renewable Energy Council suggests that this is likely to mean that approximately 25% of heat, and 35% of electricity production, will have to come from renewable sources.[3]

Considerations for target setting in the electricity sector

In 2005, the proportion of gross electricity consumption from renewable sources among the EU 15 was 14.5%; the share among the countries that now make up the EU 27 was only slightly lower at 14%.[4] This points to a shortfall of around 20% that constitutes the basis for burden-sharing negotiations. Country targets above or below this could be determined by a number of factors, depending on the overall objective:

– carbon abatement can be maximised by undertaking renewable build in countries where it replaces carbon-intensive conventional thermal generation, particularly coal;

– security of supply can be enhanced through replacement of gas-fired generation and ensuring that individual states are not over-reliant on interruptible renewables;

– cost minimisation can be achieved by building renewable projects in order of cost, without regard to location;

- equity or fairness could be improved by setting higher targets for countries more able to pay.

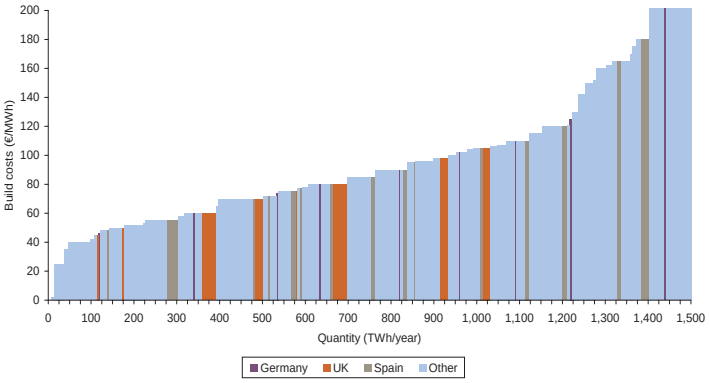
In practice, however, these issues are not clear-cut, and each possible policy decision available involves trading off the above objectives against each other.

How much might it cost?

Estimating the costs of renewable technology projects across Europe is a process subject to considerable uncertainty. The Green-X project at the Vienna University of Technology is one of few sources providing forecasts of costs and volumes.

Modelling based on the Green-X data may influence the Commission's decision on any aspect of target-setting that relates to cost allocation and maximisation of efficiency. Oxera has taken the estimates of high,

Figure 1 Supply curve of additional renewable generation by country



Source: Green-X data and Oxera modelling.

median and low costs and weighted the estimated capacities for each technology at these costs. Of the potential capacity, 15% was assumed to be available at the cheapest cost, 70% at the median, and 15% at the upper bound of the cost range.

Figure 1 indicates that the cost order of projects does not appear to be dominated by any particular Member State. The potential for increasing the share of renewable electricity generation is widely spread across the Continent.

Potential supply constraints

Biofuel

Producing energy crops for biofuel requires a large area of arable land, which for some countries in the EU is a problem. As Figure 2 shows, with current conventional crops such as rapeseed, the task of growing sufficient volumes domestically to meet the 10% target appears to be effectively impossible, as it would require most of, or more than, the arable land area available. In order for the targets to be met, it is likely that a large amount of the biofuel will need to be imported.

Heat

The UK government has appointed the Biomass Taskforce to examine the potential for renewable heat. It has found that several barriers to entry exist, including:

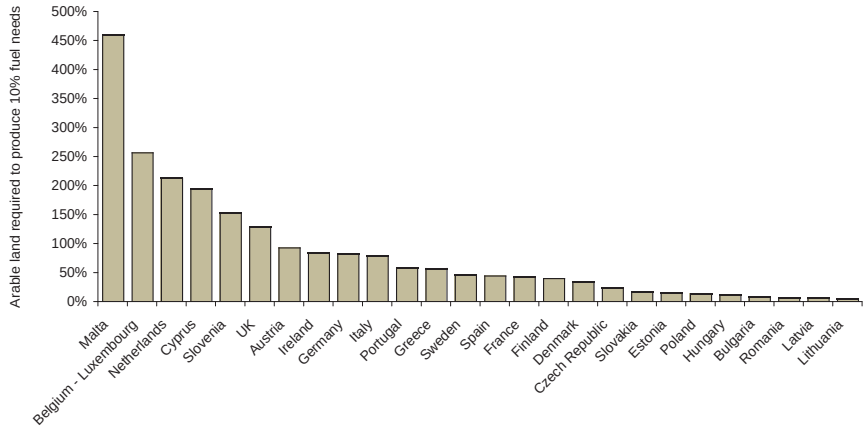
- the lack of a carbon price;
- low investor confidence;
- lack of awareness in the construction and supply sectors;
- fragmented supply chains.[5]

Were these problems to be overcome, the taskforce has estimated that renewable heat could make up only 7% of total UK supply by 2015, a significant shortfall from the estimated EU-wide average of 25% required to meet targets.

Electricity

Meeting the 2020 electricity generation target will require a large volume of build in a comparatively short time. It is unclear at the present time what annual constraints exist on the building of renewable infrastructure.[6] Wind farms require a large number of steel turbines, currently made by a limited number of manufacturers; an EU-wide run on orders of these turbines could lead to backlogs. In addition, new infrastructure may require a new grid connection involving a significant amount of electrical equipment and switchgear.

Figure 2 Proportion of native arable land required to grow 10% of 2005 petroleum consumption equivalent biodiesel from rapeseed oil



Note: Assumes planting of rapeseed oil with extraction efficiency of 1,000kg/ha of oil with 90% of calorific value of equivalent petrodiesel volume.
Source: Eurostat, European Environment Agency, and Oxera modelling.

Sharing the burden: who should pay?

A key decision to be made within the framework of the European Commission's planned renewables Directive is determining the appropriate 'burden-sharing' mechanism—ie, the allocation of new renewable build targets across Member States.

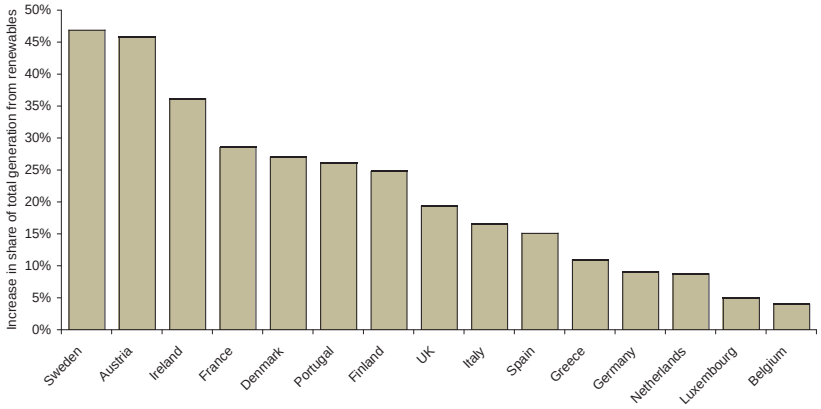
Burden-sharing options

For the purpose of the costs estimated in this article, the likely trade-offs between electricity generation and heat and fuel for individual Member States have been simplified, and it is assumed that the renewable sector will be required to contribute an extra 20% to generation levels over and above its current share.

Equal share

The most straightforward way of setting targets would simply be to allocate the required increase

Figure 3 Possible burden allocation of an additional 20% of generation between EU 15 Member States on a least-cost basis



Source: Green-X data and Oxera modelling.

equally—ie, if 7% of EU-wide energy supply is currently generated from renewable sources, and the requirement is 20%, each Member State should contribute an extra 13%. This method has the advantage of simplicity; moreover, if it is assumed that countries' existing renewable capacity was built because it was economically viable, it has an aspect of equity to it.

Least cost

From a public policy perspective, any burden-sharing criteria need to be economically efficient, while at the same time being equitable and fair. The concept of economic efficiency that may be considered here is that of productive efficiency. In the traditional sense of production of a good, productive efficiency is said to come about when, given a particular level of output, firms minimise their costs of production. One way in which productive efficiency might be attained is by minimising the costs of new renewables build, by ordering the country-specific targets of new renewables such that they correspond to the lowest-cost projects suggested by the supply curve. Figure 3 shows the targets that might arise from a least-cost allocation suggested by Oxera's interpretation of Green-X data.

Favouring nuclear generation

Negative externalities—ie, costs of an economic transaction between market participants that fall on third parties—can be corrected by 'Pigouvian' taxes. By placing such a tax on the externality—in this case carbon emissions—a socially efficient level of output may be produced.

Nuclear power, carbon capture and storage (CCS) and next-generation clean coal technologies emit low levels of carbon, although only nuclear is, or will be by 2020, a significant source of power generation. The targets could therefore be adjusted to favour nuclear generation in order to increase carbon savings.

The country in the most advantageous position under this kind of regime would be France, which in 2005 generated 78% of its power from nuclear plants.[7] Lithuania also has a high nuclear share, with 70% of its power generated by nuclear plants in 2005.[8] Of the 27 Member States, 12 had no nuclear generation in 2005.

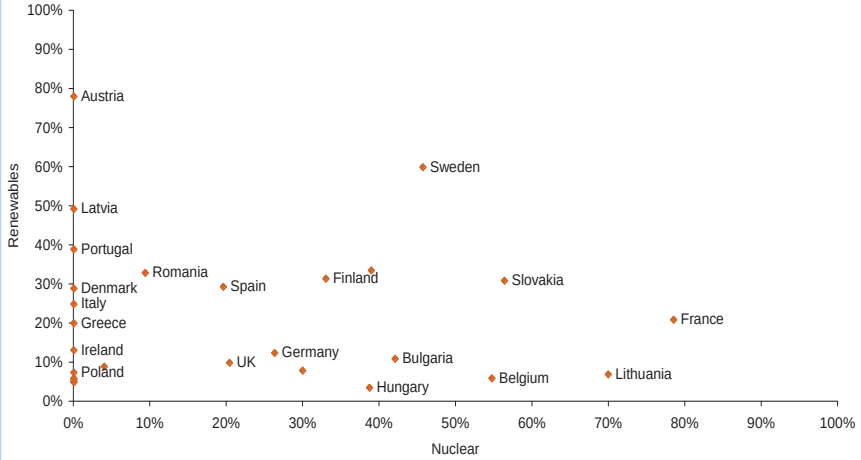
An underlying problem with this methodology is determining the proportion of nuclear power on which to base the target. Using 2005 levels considers neither any new nuclear build that may come onstream before 2020 (largely in France and Finland), nor any reduction in nuclear output from plant closure, expected to be significant in Germany and the UK.

Early action rewarded

Similarly, Member States that have already undertaken significant renewables build may be considered comparatively lighter polluters and rewarded with a smaller target. Such a regime would move towards convergence of final contribution and might be politically favourable. However, countries taking early action may have done so because of an abundance of opportunity to build renewable sources cheaply; by reducing the future targets for such countries, the regime may be ignoring some of the greatest potential for economically competitive renewable generation.

Figure 4 shows the position of Member States in nuclear and renewable output in 2005.

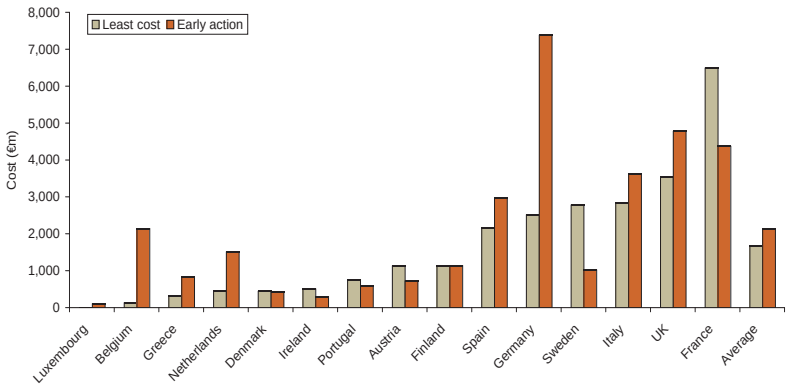
Figure 4 Share of generation from nuclear and renewable sources in 2005



Note: Several country names have been removed for clarity.
Source: Eurostat.

An extension of this approach is to classify nuclear/CCS generation as renewable. In the event of significant capital cost reductions in these technologies, they might prove to be a more cost-effective method of delivering the greenhouse gas (GHG) reductions. However, such a mechanism might be unpopular among countries such as Germany, where there is currently strong anti-nuclear sentiment.

Figure 5 Indicative costs to Member states of delivering required generation under different regimes



Note: Based on possible targets using weightings to be in the range 15–25% of current demand.
Source: Eurostat, Green-X data and Oxera modelling.

GDP-weighted

While efficiency may be achieved irrespective of the initial allocation of renewables build requirements, the establishment of the initial allocation does have distributional implications, which could lead to political wrangling and negotiation over its suitable form.

Outcome-based criteria attempt to achieve fairness in terms of the welfare changes resulting from the burden-sharing arrangements. This leads to the question of choosing the appropriate criteria of welfare change. While the theoretically valid answer would involve considering the three factors—security of supply, competitiveness and climate change mitigation—changes in national income as a proportion of GDP have been used as a proxy in the climate change literature.

Possible costs

Applying the theory to an actual target for Member States carries the additional complexity that, due to the variation in electricity demand among Member States, adjusting the target by 1% for a large country (eg, Germany) may require larger changes from several other countries. Oxera's interpretation of the cost data and application of theory yield a set of illustrative costs under two possible regimes—ie, least cost and early action—as shown in Figure 5.

How can we get there?

Certificate trading mechanism

An intermediate solution between these two extremes may have advantages. For example, it could be that although the country targets were set according to emissions, the actual build could take place in the economically cheapest location, and countries could fulfil their obligation by either building renewables resources themselves or purchasing a trading certificate from another country. Theoretically, this would produce the target amount of generation at least cost and paid for by the largest polluters, but with the distinct disadvantage that less carbon abatement would occur than if the build replaced the polluting conventional generation in the certificate purchaser's country.

However, establishing a market for renewable electricity certificates would be an additional administrative cost. If the scheme were applied across all energy forms, an agreement on an implied 'exchange rate' between electricity and fuel and heat forms of energy would have to be reached upfront.

A facilitative measure for Member States facing serious difficulties in reaching their target could be that they pay a buy-out penalty for each unit under their obligation into a fund that is then used to support other renewable energy elsewhere. This would provide a mechanism for capping the costs to Member States and reducing some uncertainty, but care must be taken to ensure that the penalty is sufficient for this not to cut actual renewable build more than necessary.

Overlap with existing measures

EU Emissions Trading Scheme

The Commission aims to reduce GHGs by 20% from their 1990 levels by 2020, and has set emissions limits for Member States that are projected to deliver this. Emission permits are then traded, with the value of the permit, determined by the excess of pollution over the allowance. It is hoped that, over the medium to long term, the carbon price will stabilise and provide sufficient economic incentives to develop new technology such as CCS and clean-coal technology, as well as nuclear build if desired.

However, were the targets from the renewables obligation met, this would make a large contribution to the overall decrease of GHG emissions, and thus make the carbon allowance easier to meet. This might significantly depress the carbon price and undermine investment in cleaner technologies.

Conversely, if the mechanisms were harmonised such that their carbon effects were treated separately, this

would effectively raise the EU GHG target beyond 20%, which may be politically unpopular with Member States that view the existing targets as binding and expensive

UK Renewables Obligation

In the UK, the primary mechanism for encouraging renewable build is the Renewables Obligation (RO), which compels suppliers to source a proportion of their energy from renewable sources or face a buy-out penalty. Currently, it is hoped that this mechanism will deliver sufficient build to reach a national target of 20% of total supply by 2020. Were a larger target to be imposed, a logical step might be to increase the obligation size and buy-out penalty accordingly to encourage additional volumes. However, the existence of the buy-out option means that additional build will take place only if there are sufficient potential volumes available at an economical cost, which is not necessarily the case. Furthermore, the existing scheme is perceived to be expensive, as all renewable projects are given the support of the most costly. Meeting a target of 30% or more may be viewed in some quarters as prohibitively expensive.

Feed-in tariffs

A number of Member States favour a feed-in tariff system to increase renewable levels, whereby projects are given a set subsidy in order to make them economical to build. Such systems have proved effective in delivering volumes at reasonable cost, and some Member States may choose to extend their existing tariff systems should their requirement for volumes increase.

Conclusion

The Commission's renewables target appears at this stage to be ambitious. In each sector (electricity, heat and fuel), the expected contribution is significantly above what has been put into place previously for most Member States. Furthermore, there are significant cost and other constraints that may render targets infeasible or the cost prohibitively high.

Therefore, there is a strong possibility of shortfall for some or all Member States. The implications of this depend on the burden-sharing regime chosen, the delivery methods, and the legal status of the individual and overall targets. Whatever economic instrument is chosen to fulfil the task, it will have a large impact on the level of shortfall and the political acceptability of the outcome.

A system focused around feed-in tariffs, where the price is set but the volumes are variable, may simply fail to meet the required volume and be subject to whatever penalties were imposed by the Commission, which would in turn depend on how binding the target is. However, should a cap-and-trade system be put in place, where the volume is forced to reflect the target level, the costs of building sufficient volumes of electricity, heat and fuel may become unacceptably high.

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[1] Council of the European Union (2007), 'Brussels European Council 8/9 March 2007: Presidency Conclusions', 7224/1/07, May 2nd.
[2] Eurostat. See http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,39140985&_dad=portal&_schema=PORTAL&screen=detailref&language=en&product=Yearlies_new_environment_energy&root=Yearlies_new_environment_energy/H/H2/H23/en024.
[3] See Professor Arthouros Zervos's opening speech at the seminar, 'Renewables 2020: Towards 20%', Lisbon, July 11th 2007; http://www.erec-renewables.org/fileadmin/erec_docs/Documents/Press_Releases/Zervos_Lisbon_Statement_July_2007.pdf.
[4] Eurostat.
[5] Department of Trade and Industry (2006), 'The Energy Challenge: Energy Review—A Report', July.
[6] An annual constraint is the largest amount of renewable volume that can be built in a year, due to, for example, the shortage of engineering firms. This differs from the overall constraint on volume that arises from lack of space for wind farms, or limited river capacity on which to build hydro plant.
[7] Eurostat. See http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,39140985&_dad=portal&_schema=PORTAL&screen=detailref&language=en&product=Yearlies_new_environment_energy&root=Yearlies_new_environment_energy/H/H2/H23/ebc18704.
[8] Ibid.