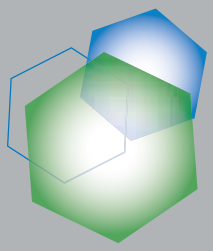

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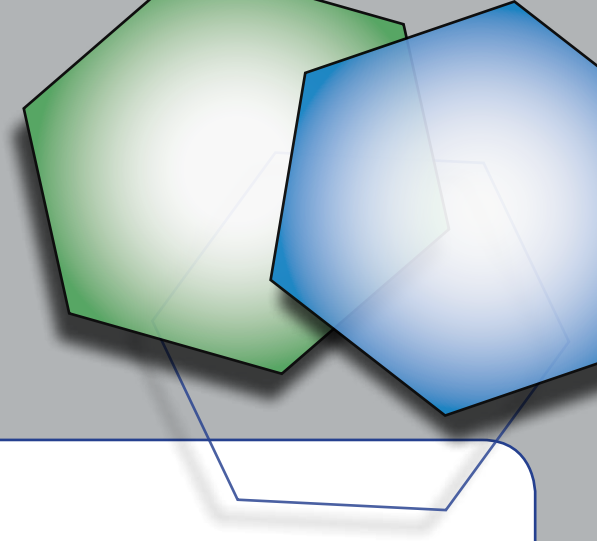

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NO SUCH THING AS THE COST OF RENEWABLES? THE SIGNIFICANCE OF SYSTEM AND RESOURCE COSTS

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The Energy Policy Institute of Australia is an independent and apolitical energy policy body.

The Institute advocates that Australia must maintain a secure investment climate and be internationally competitive, whilst moving towards and contributing as much as it can to global efforts to build a low-carbon society.

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Key Points:

- Governments across the world are supporting renewable energy but the programmes are often controversial.
- In particular, the costs are contentious, with advocates arguing that renewables are competitive; opponents arguing that support for renewables is increasingly expensive.
- One reason for the differing views is that the cost structure of most renewable electricity sources is very different from that of conventional generation.
- The cost depends on the amount and type of renewable energy in a system as well as on the technology used.
- The level and form of government support for renewables should be based on a robust understanding of these costs and the implications for the wider electricity system.
- Where the costs are uncertain, the emphasis should be on limiting total costs, providing incentives for innovation and cost reduction, and removing market barriers.

Countries across the world are responding to the challenge of climate change in various ways and one of the most widespread measures is support for renewable energy and electricity sources – indeed in some cases supporting renewables seems to have become an end in itself.

But the programmes have often been controversial. Some of the disagreement is an understandable part of the normal political process – difficult trade-offs are involved between, for instance, local and global environmental impacts; given all the uncertainties, views can reasonably differ. But there has also been a polarised debate around the issue of costs (which should in principle be ascertainable). Advocates argue that the cost of renewables is falling; that many are now more or less competitive; and that in future they will be below the cost of conventional generation. Opponents of renewables believe that the cost of renewables support is rising and that they are unlikely ever to be competitive. Can both these positions be true – can the cost of renewables be both falling and rising? Paradoxically, the answer is "yes".

The reason is that there is really no such thing as "the cost of renewables". Particular renewable sources, in particular locations, at particular times, within particular electricity systems, all have different costs. Renewable energy depends on natural forces. These forces are stronger at some locations than others and at some times than others so that the cost of, say, wind or solar power will depend on where the plant concerned is built and what time of the day or year it is generating.

The costs of electricity generation from different sources are often compared on the basis of what are known as "levelised costs". These represent the average costs per unit generated during the lifetime of the plant concerned after factoring in (and discounting) all capital, fuel, operating and other costs; they encapsulate all these costs in a single number – eg 5c/kWh. This approach has the advantage of simplicity but can be misleading, particularly when it comes to **non-dispatchable** plants – ie plants which cannot be called on to produce electricity when the system needs that power. Because electricity is difficult to store, supply and demand have to be kept in balance at all times, so it is vital to have generation capable of adjusting to changes in demand. Most "new" renewable sources are non-dispatchable, because of their reliance on natural forces; they generate when those forces are active and not at other times.

As a consequence most "new" renewables lead to an increase in **system costs** (ie the costs incurred elsewhere in the electricity system to ensure continuing security of supply); the higher the penetration of these renewable sources, the higher the costs imposed on the rest of the power system so, the higher the renewable target a government sets, the more important it is to take full account of these costs. Furthermore, renewable generation has to be sited where the resource is available, rather than where the power is needed, often increasing transmission costs.

A further consequence of the reliance on natural forces is a tendency for **resource costs** to increase with the penetration of renewable sources. The cost of renewable generation depends on location. Even within a particular country, and even where there is a good natural resource, there will still be geographical variations in the quality of the resource, closeness to demand centres and transmission infrastructure, environmental sensitivity and so on. For obvious reasons, there is a tendency to use the best and easiest sites first. This produces a rising cost curve – at any particular point in time the cost of any particular renewable depends on how much of that resource is already being exploited. Levelised costs for renewables (which have generally been falling as the technologies improve) give only a part of the overall picture, which is much more complex.

In short, increasing the volume of renewables is not just a matter of substituting one sort of generation for another. As the OECD Nuclear Energy Agency emphasised in its 2012 study '*Nuclear Energy and Renewables: System Effects in Low-carbon Electricity Systems*', the integration of variable renewables profoundly affects the structure, financing and operational mode of electricity systems.

These interactions can lead to unintended consequences if governments do not think through their policies carefully. For instance, in a number of European countries, fixed price support was introduced for solar power at a time when the cost of solar panels was falling fast, leading to overwhelming and unmanageable demand for the schemes (and windfall profits for some). On the other hand, in countries like the UK and Germany, the unit cost of renewables support is increasing as the emphasis moves to offshore wind (in the UK) and solar (in Germany) leading to huge policy costs and significant burdens on consumers.

As will be apparent, the implications vary between countries. Australia, for instance, presents a number of special characteristics. Electricity demand is getting peakier (ie less smooth across the day or year) because of the growth of air conditioning; in addition, the cost structure of supply is somewhat untypical – network costs (at 50%) are a significantly higher share of total costs than in most systems, because of the low fuel input prices and the geography. These factors tend to increase the importance of the system cost issue.

On the other hand, solar PV is closer to being economic in Australia than in, say, northern Europe. Solar output is also somewhat more consistent than wind power, which is the main option in Europe – though, as a 2012 report from the CSIRO on *Solar Intermittency* pointed out, there are a number of major issues involved in integrating large volumes of solar power into the rest of the system, many of which are at present only imperfectly understood.

Governments should give careful thought to all these factors before introducing schemes of support for renewables, to ensure that their objectives are being met at minimum cost. Where, as is often the case, costs are uncertain, they should consider capping the overall cost for consumers and providing incentives for cost reduction and innovation (for instance by using quantity schemes and not trying to pick technology winners). They also need to consider the wider financial and structural implications of changing the composition of electricity systems; an important first step should be to remove the barriers which currently exist in many wholesale market structures (not in general well adapted to the cost structure of low carbon sources).

The easiest way to show whether renewables are competitive or not is to allow them to compete on a level playing field.

Malcolm Keay *is currently Senior Research Fellow at the Oxford Institute for Energy Studies, working mainly on electricity and climate change. He has had an extensive career in the energy sector, including the positions of Director, Energy Policy in the UK Department of Trade and Industry, and Director of Study on Energy and Climate Change for the World Energy Council. He is also currently acting as an expert reviewer for the Intergovernmental Panel on Climate Change's Fifth Assessment Report.*