BRIEFING

Energy&Climate INTELLIGENCE UNIT

Climate economics - Costs and benefits

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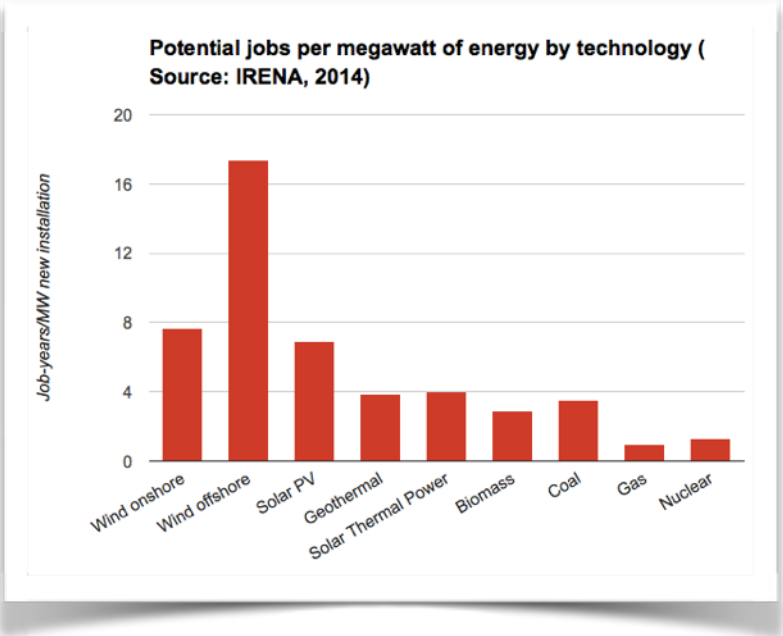
Economics can be used as a guide to decision-making on climate change. Economic models can estimate the costs of climate impacts such as flooding, and the economic benefits of preparing for them. Models can also estimate the costs and benefits of measures that reduce emissions.

The most recent major calculation of climate economics suggests that measures to curtail climate change are affordable, provided that governments act together and use the full range of technologies.

Climate change may affect economies in many ways, including through compromising water resources. Image: World Bank Photo, Creative Commons licence



Costs and benefits

Climate change can affect economic growth and prosperity in many ways. For example, increasingly variable weather may make crops more difficult to grow, and therefore make food more expensive. Coastal cities are likely to be flooded more frequently, incurring clean-up costs. Measures that help people adapt to these impacts also incur a cost – but the benefits may outweigh the cost.

Some climate impacts are inevitable, because greenhouse gases already in the atmosphere will continue to affect the climate for decades. Governments therefore have a choice between preparing for those impacts, or allowing them to happen and taking the economic penalty.

Building cleaner cities can save over $3 trillion in investment by 2030

Policies to combat climate change may also affect growth and prosperity. For example, low-carbon energy may be more expensive than burning fossil fuels. On the other hand, climate change policies may have economic benefits, such as reducing the health impacts of air pollution.

Policies that cut greenhouse gas emissions in the near term will benefit economies in future by reducing progressive impacts such as sea level rise, and by reducing the risk of triggering catastrophic and/or irreversible changes.

Models with limits

Economists try to evaluate the impacts of climate change and climate change policies through the use of computer models called Integrated Assessment Models (IAMs).

The models include projections of the physical aspects of climate change, such as how much the sea level will rise. They also include projections of factors such as economic growth, demographic change and technological progress.

New Climate Economy

A major report released on 16 Sept 2014 by the Global Commission on the Economy and Climate concludes that choosing between tackling climate change and boosting economic growth is a 'false choice'. Instead, it says, economic growth and reducing emissions are mutually beneficial.

Findings include:

- Innovation: Tripling R&D in low-carbon technologies to at least 0.1% of GDP can drive a new wave of innovation for growth
- Cities: Building cleaner cities can save over $3 trillion in investment by 2030 and improve quality of life
- Subsidies: Phasing out fossil fuel subsidies can improve growth. Currently $600 billion in subsidies goes to fossil fuel subsidies – six times the amount going to renewable energy
- Health: Damages to health from fossil-fuel burning cost over 4% of GDP in the 15 countries with highest emissions
- Land use: Restoring 12% of the world's degraded lands can feed 200 million people and store 1 billion tonnes of carbon by 2030
- Energy: Solar prices have fallen 80% since 2008. Over half of new electricity generation over the next 15 years is likely to be from renewables.

Fundamentally, models produce cost-benefit analyses of climate policies. However, details about the climate system's response to emissions and society's progress are deeply uncertain. Where data is scarce, modeling becomes more difficult. So model projections are inevitably sensitive to various assumptions.

The best models include a way of accounting for the profound uncertainties that exist around climate change. But some may underrate the risk of climate catastrophes, such as the possible collapse of the West Antarctic ice sheet.

They may also fail to capture the economic co-benefits of reducing emissions or developing low-carbon technologies. Models may not reflect ethical aspects of climate change. For example, allowing high emissions to continue on one continent may have damaging impacts on another. And the impacts of emissions today will fall most significantly on future generations.

Economists attempt to deal with the first factor by using 'equity weights', and the second by using a 'discount rate'. Conventionally, factors that affect people in the future are given less weight in calculations – their interests are 'discounted'.

The influential Stern Review, commissioned by the UK Treasury and published in 2006, took the approach adopted by the insurance market in the face of uncertainty and risk aversion. It discounted future generations' interests more in projections that forecast a prosperous future, but less in projections that forecast a less prosperous future.

Which discount rate to use is a choice that economic modellers make, and their choice has a significant effect on their conclusions. So do other issues, such as whether their model addresses endogenous growth.

The costs of climate change

Until mid-century, the impacts of climate change will largely be driven by greenhouse gases already in the atmosphere today. The World Bank estimates that the global costs of adapting to climate impacts until 2050 are around $70-100 billion per year. However, adaptation is not possible for all impacts: a certain proportion of 'residual damages' will remain. So the cost of impacts is larger than the cost of adaptation.

The cost of impacts is difficult to calculate. Many impacts, such as loss of human lives, biodiversity loss, or loss of culture or identity are difficult to value and monetise.

The Stern Review concluded that without near-term constraints on emissions, climate change impacts that are likely to materialise will be equivalent to reducing gross domestic product (GDP) globally by 5-20% per year.

The most recent assessment from the Intergovernmental Panel on Climate Change (IPCC) concludes that:

- global economic impacts from climate change are 'difficult to estimate'
- many studies 'do not account for catastrophic changes, tipping points, and many other factors'
- given these limitations, the 'incomplete estimates' of global annual economic losses for further global warming of about 2°C are between 0.2 and 2.0% of income. Losses are more likely to be greater than this
- the larger the eventual temperature rise, the greater the losses – and there are few estimates for losses incurred by warming of 3°C or more

Energy economics and decarbonisation

The other side of the climate economics question concerns the costs and benefits of reducing greenhouse gas emissions. A particular focus of modeling is to work out how governments can meet the target they have agreed of reducing emissions fast enough to keep the rise in global average temperature since pre-industrial times below 2°C.

The IPCC concludes that:

- it is feasible to reduce emissions quickly enough to make achieving the 2°C target likely
- the cost of this would lower consumption growth annually by 0.04-0.14% over the coming century
- this estimate applies if all countries implement mitigation strategies simultaneously, a global price is put on carbon emissions, and all key technologies are available
- delaying mitigation action increases the costs

Currently, there is no global price for emitting carbon dioxide; and technologies such as carbon capture and storage (CCS) are not in routine, commercial-scale use.

Decarbonisation has been shown to have important benefits. Research from Cambridge Econometrics shows that meeting the UK carbon targets will boost GDP and create an additional 190,000 jobs by 2030.

The IPCC cautions against comparing costs for adaptation and mitigation, for a number of reasons. Perhaps the most obvious is that costs for climate adaptation will inevitably be incurred in the next few decades because of climate change caused by past emissions, whereas mitigation choices will have most effect in future decades.