



## Carbon pricing

### Key points

- **Carbon pricing – putting a price on greenhouse gas emissions – is an up-to-date policy mechanism for reducing emissions efficiently at the lowest cost possible in an ideal market situation.**
- **Different pricing measures have distinctive strengths and weaknesses, and this requires policy interventions in real market situations.**

### Carbon pricing explained

Carbon pricing is the general term for putting a “value” on reducing carbon emission reduction by putting a “price” on its emission. Carbon pricing internalizes the externalities by covering the cost of the damages from emissions in the production and consumption of a good or service. The carbon price provides a financial incentive for reducing CO<sub>2</sub> and other greenhouse gas emissions.

### Carbon tax and cap and trade

Two major carbon pricing mechanisms are carbon taxes and cap and trade.

A carbon tax is a direct fee imposed on fossil fuels and other primary products (such as refrigerators), based on the amount of greenhouse gases they emit.<sup>1</sup> Increasingly, carbon tax is becoming an important component of a country's carbon emission reduction scheme and part of broader environmental tax reforms.<sup>2</sup> Cap-and-trade schemes set a limit on greenhouse gas emissions by setting the maximum allowed amount by regulations for the sectors and facilities under its coverage.<sup>3</sup>

In an ideal market situation (in which the greenhouse gas reduction targets are set unanimously and based on agreed scientific facts, which is not the case in reality), economic and environmental impacts of the both measures should be similar. However, in the reality of imperfect market conditions, differences exist. The major differences between the two mechanisms are as follows:

<sup>1</sup> Tax credits on the activities removing GHGs from atmosphere are also included in this category. World Resource Institute, “Carbon Taxes”, *The Bottom Line on*, Issue 7, June 2008. Available from [http://pdf.wri.org/bottom\\_line\\_carbon\\_taxes.pdf](http://pdf.wri.org/bottom_line_carbon_taxes.pdf) (accessed 27 November 2011).

<sup>2</sup> For more details, see: Track 2 of this Roadmap for the fact sheet on environmental tax reform and environmental fiscal reform and a case study on Austria's carbon pricing scheme.

<sup>3</sup> World Resource Institute, “Carbon Taxes” *The Bottom Line on*, Issue 7, June 2008. Available from [http://pdf.wri.org/bottom\\_line\\_carbon\\_taxes.pdf](http://pdf.wri.org/bottom_line_carbon_taxes.pdf) (accessed 27 November 2011). For more details on cap-and-trade, see the fact sheet on cap-and-trade of this Roadmap.

**Table 1: Comparison of carbon taxes and a cap-and-trade scheme**

Key aspects	Carbon taxes	Cap-and-trade scheme	Measures to address
<b>1. Price certainty for investment</b>	 <p>A set tax rate provides a clear and stable long-term policy direction for investments.</p>	<p>Susceptible to market price volatility (for example, the European Union emissions trading system and Japan’s SOX).</p>	<p>Setting price floor and ceiling in a cap-and-trade scheme.</p>
<b>2. Certainty of environmental impacts</b>	<p>No guarantee to meet the reduction target.</p> <p>BUT: Broad-based carbon taxes can overshoot the targets.</p>	 <p>Capping, if stringent enough, guarantees achieving set emission reduction targets.</p>	<p>When cap-and-trade scheme is “grandfathered” (such as free allocation of emission allowances based on the participating entities’ historical emissions), it undermines cap-and-trade scheme’s effectiveness.</p>
<b>3. Flexibility to changing situation</b>	<p>Tax is obligatory to the target companies.</p>	 <p>Market-based pricing automatically adjusts to changing economic and climate conditions. Trading of allowances among over- and underachieving companies.</p>	<p>Companies may prefer a cap-and-trade scheme.</p>
<b>4. Cost efficiency (administration and implementation)</b>	 <p>When a country already has a well-functioning tax and fiscal structure, administration of carbon taxes would be minimal. (e.g. in Germany, the administrative costs of ETR are only 0.13% of the total tax revenue generated.)<sup>4</sup></p>	<p>Complexity of the mechanism may require higher administrative costs and human resource capacity (trading institutions, benchmarking (in “grandfathering” cases) and governance, enforcement and monitoring mechanisms.</p>	<p>Experience with previous cap-and-trade schemes indicates that the costs for trading institutions are not great.<sup>5</sup> In many developing countries with a less transparent and efficient fiscal structure, it is an open question whether introducing carbon taxes would be simple.</p>

<p><b>5. Coverage</b></p>	<p>😊</p> <p>A carbon tax can target carbon emissions in all sectors, including transportation, energy and industry.<sup>6</sup> Actual impacts on reduction in an economy would vary, dependent upon the tax rates as well as the extent of revenue recycling (such as research and development or low-carbon programmes, etc.)</p>	<p>Due to the vast number of “downstream” sources at the point of combustion and use (including households and small-sized companies), the coverage tends to focus on the heavy-emitting industries with high reduction potential only.</p>	<p>Cap-and-trade scheme tends to exempt the transportation sector whose carbon emission portion is significant in many countries.<sup>7</sup> Determining the coverage requires a bold political decision.</p> <p>Carbon tax rates should be significant enough to be effective in changing consumers’ demand and spur low-carbon technology innovation.<sup>8</sup></p>
<p><b>6. Economic efficiency</b>  <i>(* In the reality of an imperfect market, given the imperfect knowledge of marginal costs of carbon emissions abatement studies)</i></p>	<p>😊</p> <p>Studies and empirical evidence indicate that a carbon tax may lead to more economically efficient results (with five times higher gains in carbon emission reduction than the optimal cap-and-trade schemes, largely due to the allowance price volatility of the latter.<sup>9</sup></p>	<p>Volatility of the allowance price in the market is a major challenge. Miscalculated allowance rates (especially through grandfathering allowances) can result in a windfall profit for some businesses, leading to distributional inequity, less economic efficiency and extra costs.</p>	<p>In a hypothetical case of complete certainty about the degree of the climate change impacts and future mitigation costs, both a carbon tax and cap-and-trade scheme would result in nearly identical aggregate costs, consumer price impacts and reductions in carbon emissions.<sup>10</sup></p>
<p><b>7. Impact on technological innovation</b></p>	<p>😊</p> <p>Carbon taxes provide a clear price floor for carbon and thus a minimum return for any innovation.<sup>11</sup> This can incentivize broad-based technology innovation in energy efficiency and renewable energy throughout the economy.</p>	<p>😊</p> <p>Cap-and-trade scheme provides incentives to encourage technology innovation for reducing CO<sub>2</sub> emission.</p> <p>An invention (such as a breakthrough technology) that reduced the cost of cutting carbon emissions could push down the price of permits, reducing investors' returns.<sup>12</sup></p>	<p>Part of the proceeds of an auctioned allowance in cap-and-trade scheme can be invested in programmes that support low-carbon technologies and energy efficiency programmes that support innovations.</p>

<p><b>8. Revenue recycling</b></p>	<p>😊</p> <p>Tax provides a revenue-raising opportunity.</p>	<p>Grandfathering allowances to regulated entities often limits the revenues. However, in a pilot phase, auctioning may be difficult as it is intended to be a “learning-by-doing” phase to prepare businesses.</p>	<p>In theory, full allowance auctioning in cap-and-trade scheme can generate fiscal revenue as well as carbon taxes.</p>
<p><b>9. Distributional impacts</b></p>	<p>Income-regressive in general. Through revenue recycling to mitigate and compensate negative impacts on the most affected, the impacts can be addressed.<sup>13</sup></p>	<p>Depends on the ability of businesses to pass on the carbon price to their consumers. Impacts of the increased electricity price on low- and middle-income households may need to be eased by compensating from the revenue collected from auctioned cap-and-trade scheme allowances.</p>	<p>In principle, distributional impacts on affected businesses and households may be similar between carbon taxes and a cap-and-trade scheme, in which auctioning leads to the allowance price being similar to the tax rates.<sup>15</sup> Studies show in developing countries that the actual impacts (of introducing carbon taxes) may differ and the most affected may not be the most poor but the middle-income households (as in Indonesia and China).<sup>16</sup></p> <p>In both carbon tax and cap-and-trade schemes, effective revenue recycling to mitigate the distributional impacts is important.</p>
<p><b>10. Political feasibility</b></p>	<p>In general, public acceptance to introduction of taxes is difficult, partly due to (perceived) direct impacts on the livelihoods of the taxpayers.</p>	<p>😊</p> <p>Cap-and-trade may be more readily acceptable by the public with its explicit focus on the environment and due to perceived indirect nature of its impacts on the public.</p>	<p>Carbon tax needs to highlight and clearly communicate to the public its revenue neutrality and revenue recycling measures to address competitiveness and distributional concerns. In the context of ETR and EFR, its long-term economic and environmental benefits also need to be highlighted.</p>

Interaction of carbon taxes and a cap-and-trade scheme is also worth noting. The European Union set up a regional-based cap-and-trade scheme (EU Emissions Trading System, or EU ETS) but carbon and energy taxes are applied with different schemes and designs at the national levels.<sup>16</sup> As of 2012, Australia is introducing a carbon pricing scheme that combines the initial three years' carbon tax regime and switching to a cap-and-trade mechanism.<sup>17</sup>

Because each scheme differs in its strengths and weaknesses, each country should consider the options with careful detailed designs to address the expected challenges.

Carbon pricing alone will not reduce CO<sub>2</sub> emissions and needs to be supported by other policy measures. As the Stern Review findings conclude, other policies supporting innovation and the deployment of low-carbon technologies and removing barriers to behaviour change (regulation, information and financing policies) are also necessary to address climate change challenges.<sup>18</sup> In designing a carbon pricing scheme, setting the appropriate rates and coverage as well as designing revenue recycling in a way that spurs the greening of the economy will maximize the positive impacts. In the case of a cap-and-trade scheme, effective cost-constraint mechanisms and full auctioning, preferably regulated by a government body, need to be established.

NOTE: For more details of the measures of pricing carbon, see the fact sheets on cap-and-trade schemes and the case study on Australia's carbon pricing scheme.

<sup>4</sup> Organisation for Economic Co-operation and Development, *The Political Economy of Environmentally Related Taxes* (Paris, 2006). Available from [www.oecd.org/dataoecd/26/39/38046899.pdf](http://www.oecd.org/dataoecd/26/39/38046899.pdf) (accessed 10 October 2011). For more details of Germany's ETR, see Case Study of this Roadmap: European Experiences with ETR and Double Dividend.

<sup>5</sup> Robert N. Stavins, *A U.S. Cap-And-Trade System to Address Global Climate Change* (Washington, D.C., The Brookings Institution, 2007). Available from [www.hks.harvard.edu/m-rcbg/rpp/Working per cent20papers/RPP\\_2007\\_04.pdf](http://www.hks.harvard.edu/m-rcbg/rpp/Working%20papers/RPP_2007_04.pdf) (accessed 10 October 2011).

<sup>6</sup> "Carbon Taxes Address All Sectors and Activities Producing Carbon Emissions. Carbon taxes target carbon emissions in all sectors — energy, industry and transportation — whereas at least some cap-and-trade proposals are limited to the electric industry. It would be unwise to ignore the non-electricity sectors that account for 60 per cent of U.S. CO<sub>2</sub> emissions." For further information, Carbon Tax Centre website "Vs. Cap-Trade" (22 March 2009). Available from [www.carbontax.org/issues/carbon-taxes-vs-cap-and-trade/](http://www.carbontax.org/issues/carbon-taxes-vs-cap-and-trade/) (accessed 10 October 2011).

<sup>7</sup> IEA, *CO<sub>2</sub> Emission from Combustion 1971-2003* (Paris, OECD and IEA, 2005).

<sup>8</sup> World Resource Institute, "Carbon Taxes" *The Bottom Line on...* Issue 7, June 2008. Available from [http://pdf.wri.org/bottom\\_line\\_carbon\\_taxes.pdf](http://pdf.wri.org/bottom_line_carbon_taxes.pdf) (accessed 27 November 2011).

<sup>9</sup> Jason Furman and others, *An Economic Strategy to Address Climate Change and Promote Energy Security* (Washington, D.C., The Brookings Institution, 2007). Available from [www.brookings.edu/~media/Files/rc/papers/2007/10climatechange\\_furman/10\\_climatechange\\_furman.pdf](http://www.brookings.edu/~media/Files/rc/papers/2007/10climatechange_furman/10_climatechange_furman.pdf) (accessed 10 October 2011).

<sup>10</sup> *ibid.*

<sup>11</sup> A tax provides a clear price floor for carbon and hence a minimum return for any innovation. For further information, see *The Economist*, "Doffing the Cap: Tradable Emissions Permits Are a Popular, but Inferior, Way to Tackle Global Warming", June 14 2007. Available from [www.economist.com/node/9337630?story\\_id=E1\\_JPPSGPD](http://www.economist.com/node/9337630?story_id=E1_JPPSGPD) (accessed 10 October 2011).

<sup>12</sup> For further information *The Economist*, "Doffing the Cap: Tradable Emissions Permits Are a Popular, but Inferior, Way to Tackle Global Warming", June 14 2007. Available from [www.economist.com/node/9337630?story\\_id=E1\\_JPPSGPD](http://www.economist.com/node/9337630?story_id=E1_JPPSGPD) (accessed 10 October 2011).

<sup>13</sup> For more details, see Track 2 of this Roadmap and Factsheet: ETR and EFR.

<sup>14</sup> Robert N. Stavins, *A U.S. Cap-And-Trade System to Address Global Climate Change* (Washington D.C., The Brookings Institution, 2007). Available from [www.hks.harvard.edu/m-rcbg/rpp/Working per cent20papers/RPP\\_2007\\_04.pdf](http://www.hks.harvard.edu/m-rcbg/rpp/Working%20papers/RPP_2007_04.pdf) (accessed 10 October 2011).

<sup>15</sup> Studies suggest that a carbon tax may be progressive in some developing countries because higher-income groups (as in the case of China and Indonesia) tend to buy more carbon-intensive goods and energy-intensive sectors tend to employ skilled labour rather than low-paid informal workers. For more details refer to Track 2 of the Roadmap. M. Brenner and others, "A Chinese sky trust? Distributional impacts of carbon charges and revenue recycling in China", *Energy Policy* (2005), vol. 35, pp. 1771-1784; Arief Anshory Yusuf, *The Distributional Impact of Environmental Policy: The Case of Carbon Tax and Energy Pricing Reform in Indonesia* (Singapore, Economy and Environment Program for Southeast Asia, 2008).

<sup>16</sup> For details of the ETR measures in UK and the EU countries, see: Case Study of this Roadmap: the UK Climate Change Levy (CCL) and Case study: European Experience of ETR and Double Dividend.

<sup>17</sup> See: Case study of this Roadmap: Australia's Carbon Pricing Scheme.

<sup>18</sup> Nicholas Stern, *The Stern Review: The Economics of Climate Change* (Cambridge, Cambridge University Press, 2007).

## **Further reading**

*An Economic Strategy to Address Climate Change and Promote Energy Security*, by J. Furman and others (Washington, D.C., The Brookings Institution, 2007). Available from [www.brookings.edu/~media/Files/rc/papers/2007/10climatechange\\_furman/10\\_climatechange\\_furman.pdf](http://www.brookings.edu/~media/Files/rc/papers/2007/10climatechange_furman/10_climatechange_furman.pdf)

*The Stern Review: The Economics of Climate Change*, by Nicholas Stern (Cambridge, Cambridge University Press, 2007).