United Nations FCCC/TP/2013/8/Add.1

Framework Convention on Climate Change

Distr.: General
30 October 2013

English only

Updated compilation of information on mitigation benefits of actions, initiatives and options to enhance mitigation ambition

Technical paper

Addendum

Information on mitigation pledges, mitigation benefits of actions and initiatives to enhance mitigation ambition, and finance, technology and capacity-building to support implementation

Summary

This updated technical paper compiles information on the mitigation and sustainable development benefits of actions, initiatives and options to enhance mitigation ambition identified in the submissions by Parties and accredited observer organizations submitted to the secretariat under the Ad Hoc Working Group on the Durban Platform for Enhanced Action workstream 2 on pre-2020 ambition. This technical paper comprises three separate documents: the main text, contained in document FCCC/TP/2013/8, and two addenda, contained in documents FCCC/TP/2013/8/Add.1 and FCCC/TP/2013/8/Add.2. The main text contains a summary of the main findings, which are substantiated with more detailed information in the two addenda. Addendum 1 provides an overview of existing mitigation pledges by Parties and the emissions gap and summarizes information on the mitigation benefits of actions and initiatives to enhance mitigation ambition, on barriers to enhancing mitigation ambition and ways to overcome them, and on incentives for actions. It also covers options related to finance, technology and capacity-building for supporting implementation of mitigation action by developing country Parties.

Please recycle

Contents

I. Introduction

1. This second version of the technical paper on mitigation benefits of actions, initiatives and options to enhance mitigation ambition was requested by the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP) at the second part of its second session.[1] The first version of this technical paper was published on 28 May 2013 as document FCCC/TP/2013/4.

2. This technical paper comprises three separate documents: the main text, contained in document FCCC/TP/2013/8, and two addenda, contained in documents FCCC/TP/2013/8/Add.1 and FCCC/TP/2013/8/Add.2. The main text contains a summary of the main findings, which are substantiated with more detailed information provided in the two addenda. Addendum 1 starts with an overview of the existing emission reduction pledges made by developed and developing countries under the Cancun Agreements and the emissions gap (chapters II and III). It then provides a compilation of information on mitigation potential, benefits, barriers and incentives, and provides examples of national policies and cooperative initiatives grouped by thematic areas with high mitigation potential (chapter IV). This addendum also provides views on finance, technology and capacity-building to support implementation of mitigation action by developing countries (chapter V).

3. Addendum 2 provides an overview of the options to enhance mitigation ambition and next steps under workstream 2 of the ADP in advancing the workplan on enhancing mitigation ambition.

II. Existing mitigation pledges by Parties

4. Central to the Cancun Agreements adopted by Parties in 2010 is the decision to hold the increase in the global average temperature below 2 °C (the 2 °C goal), or below 1.5 °C above preindustrial levels.[2] In order to reach this goal, more than 90 Parties made conditional and unconditional emission reduction pledges by 2020 under the Cancun Agreements. For developed countries, these pledges encompass quantified economy-wide emission reductions targets under the Convention for all developed countries[3] and quantified emission limitation or reduction commitments under the second commitment period of the Kyoto Protocol for developed countries assuming commitments for this period.[4] For developing countries, these pledges are in the form of nationally appropriate mitigation actions (NAMAs).[5] Many Parties in their submissions elaborated on these pledges and their implementation.

5. The existing emission reduction pledges can be categorized into the following types:

(a) National quantified targets to reduce emissions: these targets state an end result and do not necessarily specify measures to achieve them, for example:

(i) Absolute emission reductions relative to a reference year; for example, to achieve a 20 per cent reduction in greenhouse gas (GHG) emissions by 2020 compared with 2000, to achieve carbon neutrality;

[1] FCCC/ADP/2012/3, paragraph 33, and FCCC/ADP/2013/2, paragraph 36(a).
[2] Decision 1/CP.16, paragraph 4.
[3] FCCC/SB/2011/INF.1/Rev.1.
[4] Decision 1/CMP.8, annex I.
[5] FCCC/SBI/2013/INF.12/Rev.1.

(ii) Emission reductions relative to the 'business as usual' scenario; for example, to achieve a 30 per cent reduction below the 'business as usual' scenario emissions by 2020;

(iii) Emission reductions expressed relative to another indicator; for example, to reduce carbon dioxide (CO_2) emissions per unit of gross domestic product (GDP) by 30 per cent by 2020 compared with 2005;

(b) Targets expressed in non-GHG terms with impact on emissions: these were expressed as absolute targets, for example "reduce net deforestation of primary forests to zero" or in relative terms, for example "reach a 15 per cent share of non-fossil fuels in primary energy consumption by 2020";

(c) Strategies: these encompass comprehensive plans of measures and actions undertaken by governments that aim to achieve long term mitigation objectives. They provide the overarching framework to undertake a set of mitigation measures;

(d) Programmes and policies: these encompass concrete measures undertaken by governments to achieve a specific objective that are linked to public budgets and legislative processes;

(e) Projects or portfolio of projects: these usually refer to specific investments undertaken by the private or public sectors with fixed project boundaries, clearly defined activities and a financial investment in services, infrastructure or machinery.

III. The emissions gap

6. There is a recognition that the full implementation of the pledges made by Parties under the Cancun Agreements can bring sizeable emission reductions and that rapid progress has been made by many Parties recently in taking action and implementing policies to underpin these pledges. However, a significant emissions gap remains between the expected aggregate emissions reduction effect of Parties' pledges in terms of global annual emissions by 2020 and aggregate emission pathways consistent with a likely chance of holding the increase in the global average temperature below 2 °C (the 2 °C goal) or 1.5 C above pre-industrial levels. The United Nations Environment Programme (UNEP), in *the Emissions Gap Report 2013*, quantified the gap to the 2 °C goal based on pledges and not on the total effect of all global climate action, to be between 8 and 12 billion tonnes of carbon dioxide equivalent (Gt CO_2 eq) in 2020.[6] This estimate is based on the evaluation of several modelling groups that estimated the expected emissions in 2020 assuming that Parties will implement their emissions reduction pledges under the Convention and its Kyoto Protocol and using least-cost emission reduction pathways. Since pledges were first analysed in 2009, the analysis presented in the *Emissions gap reports* indicate that the gap is getting larger, rather than smaller and that the global emissions total is increasing.

7. The window of opportunity to narrow the emissions gap by 2020 is closing. Although the estimations of the emissions gap in 2020 have not changed significantly, the available mitigation potential to close the gap is diminishing as time passes. This is because it takes time to incentivize further emission reductions and to overcome the numerous political and economic barriers to the fulfilment of the potential, which can only be done if the right policies and incentives are put in place. Once implemented, it takes time for such policies to fulfil their mitigation potential and achieve their objectives. Time to close the emissions gap is therefore running out and many Parties stress the need for urgent action.

8. Several developing Parties have emphasized that developed countries should take the lead in narrowing the gap by 2020. These developing Parties also expressed the view

[6] UNEP, 2013.

that Parties included in Annex I to the Convention (Annex I Parties) would increase their ambition to reduce emissions in line with the ranges referred to in the IPCC Fourth Assessment Report the gap could be almost closed by 2020.[7] However, it was also mentioned that the emissions gap assessments are uncertain owing to data uncertainties, the various assumptions used and a dependency on scenarios based on multiple emission pathways.

9. According to the UNEP *Emissions Gap Report 2012*, technical mitigation potential is available for the gap to be closed by 2020. The technical potential for reducing emissions by 2020 is estimated to be about 17 ± 3 Gt CO_2 eq, at marginal costs below United States dollars (USD) 50–100/t CO_2 eq reduced.[8] This would be enough to close the gap between the "business as usual" scenario emissions and emissions that meet the 2 °C goal.[9] The UNEP *Emissions Gap Report 2013* uses the latest scenarios developed for the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report.[10]

10. Limiting the warming caused by anthropogenic GHG emissions to less than 2°C will require limiting cumulative emissions from all anthropogenic sources to a quantity, which has been estimated for different degrees of certainty of staying under the warming limit for CO_2 emissions only, as well as factoring in other emissions.[10] More emissions today and in the past means fewer emissions in the future. This means that not closing the gap by 2020 and still meeting the 2°C goal is in theory possible (the temperature increase is determined by emissions accumulated over a period of time)[10] but with higher costs compared to the least-cost scenarios and with greater risks and serious consequences, such as the following:

(a) A need for much higher rates of global emission reductions in the medium term;

(b) A greater "lock-in" of carbon-intensive infrastructure;

(c) A limited choice of low-carbon technologies in the medium term;

(d) A greater risk of economic disruption owing to the need for more expensive policy and technological solutions in the medium and long term;

(e) A greater risk of irreversible climate impacts.[11]

11. In addition to the emissions gap, Parties highlighted other gaps such as the following:

(a) The ambition gap between the ultimate objective of the Convention to stabilize GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system and the agreed 2 °C goal, which, in the view of the proposing Party, is relevant, because the 2 °C goal is not sufficiently ambitious to ensure the objective of the Convention;

(b) The means of implementation or financing gap between the resources necessary to limit climate change and those that are being provided;

(c) The accountability gap describing the need for enhanced accountability and transparency.

[7] The IPCC Fourth Assessment Report provided a range of the differences between emissions in 1990 and emission allowances in 2020 for various greenhouse gas concentration levels for both Annex I Parties and Parties not included in Annex I to the Convention (non-Annex I Parties) as a group. For Annex I Parties the range is –25 per cent to –40 per cent by 2020, while for non-Annex I Parties there should be substantial deviation by 2020 from the baseline level of emissions (IPCC, 2007).

[8] All cost estimated presented in this paper are expressed in USD using market exchange rates.

[9] UNEP, 2012.

[10] IPCC, 2013.

[11] UNEP, 2013.

IV. Mitigation benefits of actions, initiatives and options to enhance ambition

12. This chapter focuses on thematic areas that were featured prominently in many submissions and at ADP workshops and round table discussions held in 2013. Parties and observers have highlighted the technical mitigation potential by 2020 in the thematic areas and emphasized the mitigation and adaptation benefits of actions and initiatives, including resilience to the impacts of climate change, as well as the sustainable development benefits resulting from such actions and initiatives that could help Parties to build national support for stronger action.

13. Based on the submissions, in presenting mitigation benefits of actions and initiatives, this technical paper follows a broad definition of such benefits, which include the following:

(a) Potential for emission reductions;

(b) Contributions to long term transformational change, for example technology developments that will enable deep emission reductions in the future;

(c) Mitigative capacity, which covers the social, political, institutional and economic structures and conditions that are required for effective mitigation;[12]

(d) Avoidance of need for adaptation, owing to a reduction in emissions.

14. In addition to mitigation benefits, there are other benefits of actions that contribute to sustainable development goals, including poverty eradication, economic development, environmental protection, reduction of local air pollution or increased energy security. In some cases these benefits, referred to as sustainable development benefits, are not really co-benefits, but are the main drivers of and incentives for the action, with mitigation effects being a co-benefit. Additional benefit of mitigation actions could also be motivation for political and substantive engagement of various stakeholders.

15. The submissions included some information, as reflected in this technical paper, on the adaptation benefits of actions and initiatives, related, for example, to food security, natural resources management and environmental protection.

16. Cost assessment is essential to any consideration of mitigation potentials and barriers and policies needed to overcome those barriers. However, considerable variation in national contexts makes direct and indirect mitigation cost assessment at a global level very challenging. Reliable data are not always available owing to variation in local factors and differences in economic structures. Moreover, costs vary widely between regions.

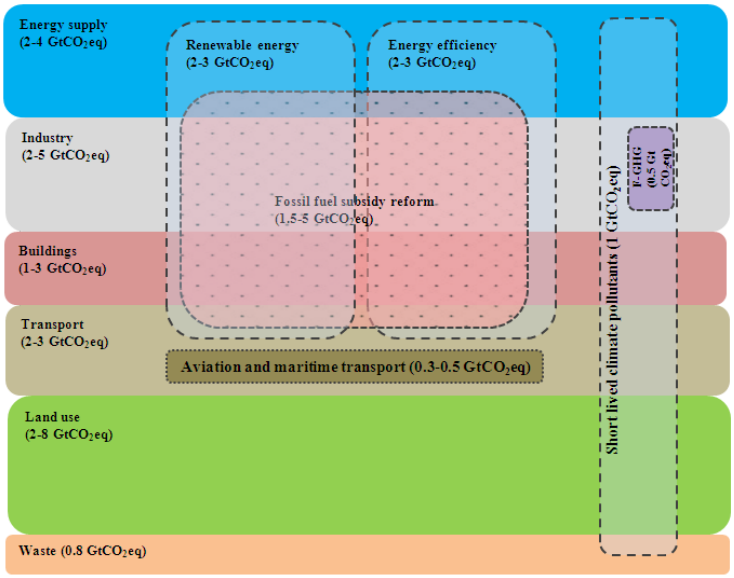
17. The thematic areas, and the actions and initiatives identified within them are overlapping as they address the challenge of reducing emissions from various perspectives. Hence, owing to an overlap in the coverage and uncertainty of estimations, the estimated emission reductions that could be possible in each thematic area cannot be simply added up. So far, only a few preliminary estimates of the potential mitigation impact of some cooperative initiatives are available in literature. These estimates suggest that the initiatives with the highest mitigation potential might trigger emission reductions of around 10 Gt CO_2 eq per year by 2020.[13] However, in most cases these initiatives do not necessarily generate emission reductions by themselves and their effects are accounted for in the national GHG inventories. In this sense there is little value in accounting for cooperative initiatives separately from national actions. Figure 1 provides an overview of thematic

[12] Yohe, 2001.

[13] Blok et al., 2012.

areas, their indicative mitigation potential as given in the sections that follow and illustrates areas of potential overlap.

Figure 1
Mitigation potential by 2020 and possible areas of overlap[a]



Abbreviations: Gt CO_2 eq = Gigatons of carbon dioxide equivalent, F-GHG = Fluorinated greenhouse gases

[a] Size of the boxes gives an indication of the mitigation potential provided in this paper.

18. Many Parties acknowledged in their submissions the barriers, such as political and economic barriers and those related to the access to information and capacity-building, as a major impediment to taking further action. They also acknowledged that putting in place suitable policies and providing financial, technological and capacity-building support for mitigation actions can address many of these barriers and can lead to stronger action at all levels. Examples of existing national policies, including best practices and success stories, were highlighted in the submissions and reflected in this paper for each thematic area.

19. Parties acknowledged that the access to market-based mechanisms and related offsets, such as clean development mechanism (CDM) and related certified emission reduction (CERs) could provide an added incentive towards pledges with higher ambition. In particular, the CDM provides Parties with an important tool to assess impact of mitigation actions, while engaging the private sector and promoting sustainable development. A group of Parties provided an estimate that current CDM projects could achieve approximately 6.5 Gt CO_2 eq of emission reductions and removals. One Party proposed to promote the voluntary cancellation of CERs arising from CDM projects as an option to increase short term mitigation ambition.

20. In their submissions, Parties and observers have identified many cooperative initiatives. These initiatives are very broad in terms of coverage of purpose (e.g. leading to political and technical dialogues and/or focused on implementation), participation (e.g. involving the public and private sectors, organizations and public-private partnerships, cities and/or local governments, etc.), geographical coverage (e.g. regional and/or international) and thematic coverage (e.g. energy efficiency or waste).[14] The initiatives can support emission reductions directly (e.g. by specifying emission reduction commitments

[14] Weischer and Morgen, 2012 and Blok et al., 2012.

for the participants) or indirectly (e.g. creating the enabling environment for increased action). There is still no agreed definition of what constitutes an initiative, although Parties provided a number of examples in their submissions.

21. Cooperative initiatives could help Parties to enhance actions and deliver greater emission reductions, as they engage a broad spectrum of stakeholders, such as central and local governments, private sector, industry and civil society, taking climate action at all levels. Since they are voluntary in nature, as emphasized by some developing country Parties, such initiatives should follow the principles of the Convention and not impose new or additional commitments on developing countries.

22. Preliminary assessment suggests that there are some thematic areas with an impressive number of such initiatives, for example energy efficiency, renewable energy and transport, in contrast to areas, such as waste, for which there are a few initiatives. To facilitate access to information on the initiatives, the secretariat has prepared an online portal, which includes a database of selected cooperative initiatives containing information on type, coverage, participation and other aspects of those initiatives.[15]

A. Energy supply

23. Energy supply represents a broad area of energy production and transformation, but the compilation of information in this section of the technical paper covers only fuel switching, carbon capture and storage (CCS) and methane from fossil-fuel production. In view of their significance for climate mitigation, energy efficiency and fossil-fuel reform are covered in a separate section as are renewable energy and biofuels (see chapters II.B, C and E below).

1. Mitigation potential and benefits

24. According to the UNEP *Emissions Gap Report 2012*, mitigation potential in the area of energy supply is estimated at around 2.2–3.9 Gt CO_2 eq. This includes potential from fuel switching (0.5–1 Gt CO_2 eq), renewable energy sources (1.5–2.5 Gt CO_2 eq) and CCS (0.2–0.4 Gt CO_2 eq).[16] Further mitigation potential is also available in the increased use of nuclear power and efficiency improvements in fossil-fuel power plants.

IEA suggests that gross domestic product-neutral mitigation (no macroeconomic costs) of 0.7 Gt CO_2 eq in limiting inefficient coal use and 0.6 Gt CO_2 eq in reducing methane emissions from fossil-fuel production is possible by 2020 with positive impact on local air pollution and energy security.

Source: IEA, 2013.

25. The International Energy Agency (IEA) sees CCS as a key technology for decarbonization of the energy sector in the long term, with the potential to contribute one sixth of CO_2 emission reductions in 2050 from the energy sector.[17] According to the Department of Energy and Climate Change of the United Kingdom of Great Britain and Northern Ireland,[18] CCS in the industrial sector could reduce emissions at a cost of USD 49–244/t CO_2 eq reduced in 2030. Other sources report emission reductions at a cost of USD 17–91/t CO_2 eq.[19]

[15] Portal will be made available at <http://unfccc.int/7785>.
[16] UNEP, 2012.
[17] IEA, 2012.
[18] DECC, 2012.
[19] Singh U., 2013.

2. Sustainable development benefits

26. In general, there are a number of sustainable development benefits associated with developing and implementing mitigation actions, such as sustainable access to energy for all, sustainable economic growth, job creation, poverty alleviation, cost savings, environmental protection, improved public health, etc. These benefits represent a major driving force behind a wide range of national actions that also bring sizeable mitigation benefits. More specifically, reducing inefficient use of coal and reducing methane emissions from fossil-fuel production has significant benefits for local air pollution and energy security. The diversification of the energy mix also increases economic diversity and resilience.

3. Barriers

27. Parties at the ADP round tables held in 2013 highlighted the barriers which they encountered as they sought to undertake more ambitious national actions in the area of energy supply. One such barrier is the lack of affordable alternatives to fossil fuels in some countries, which are essential to meet large increases in demand for electricity and dependency on energy resources to promote sustainable development. In addition, transition to market economy in some countries and price distortions through, e.g. fossil-fuel subsidies, create barriers to low-carbon technologies.

28. A number of specific barriers to implementation exist in relation to CCS. Firstly, demonstration plants are required in order to develop experience and bring costs down. Secondly, CCS requires market incentives which are currently lacking. Thirdly, industry is reluctant to invest in CCS owing to the lack of a market for the technology and a lack of public awareness of the benefits.

4. Examples of national policies

29. Countries are implementing many policies that impact GHG emissions from energy supply, a few of which are described in this section. More prominently, Parties highlighted experience with implementing carbon-pricing mechanisms (emissions-trading systems (ETS), offsets and carbon taxes) that cover energy supply. The World Bank recently surveyed ETSs and concluded that there are many new systems emerging.[20]

> Today, jurisdictions with carbon pricing mechanisms implemented and scheduled emit roughly 10 Gt CO_2 eq per year, equivalent to about 21 per cent of 50 Gt CO_2 eq emitted globally. If China, Brazil, Chile and the other emerging economies eyeing these mechanisms are included, carbon pricing mechanisms could reach countries emitting 24 Gt CO_2 eq per year, or almost half of the total global emissions.
>
> *Source*: World Bank, 2013.

30. In addition, some countries are implementing carbon standards for fossil-fuel power plants which incentivize low-carbon fuels or CCS. For example, as part of its recent President's Climate Action Plan aimed at reducing emissions by up to 17 per cent by 2020, the United States of America directed its Environmental Protection Agency to work closely with the States, industry and other stakeholders to establish carbon pollution standards for both new and existing power plants. Canada has already implemented an emission standard for new power plants.

31. Countries are also implementing policies to support research and development and demonstration plants for specific technologies, for example for piloting CCS to help remove the barriers to both public and private investment. Options for overcoming these barriers include securing public funding for demonstration plants, providing market

[20] World Bank, 2013.

incentives at a level comparable with that for renewable energy, addressing environmental concerns in relation to CCS, including CCS as a viable technology in international climate agreements, and undertaking public awareness-raising campaigns.

5. Cooperative initiatives

32. A large number of cooperative initiatives cover this thematic area, including intergovernmental political and technical forums as well as initiatives at subnational level. Here are a few examples: (i) the Secretary-General's Sustainable Energy for All initiative provides a platform for leaders from governments, businesses, finance and civil society aimed at doubling the rate of energy efficiency gains by 2030 along with ensuring universal access to modern energy services (e.g. household access to electricity and clean cooking facilities) and doubling the share of renewables in the global energy mix; and (ii) the Clean Energy Ministerial, that convenes economies representing over 80 per cent of global GHG emissions, was launched by the United States of America and has a mandate from the Major Economies Forum on Energy and Climate, which includes an action group on CCS.

33. At the 2013 Pacific Energy Summit, the European Union, the European Investment Bank and the African Development Bank agreed at the highest political level to reinforce a dialogue on sustainable energy investments in the Pacific region.

34. Parties highlighted a number of initiatives, which were presented at the ADP workshops held in 2013, such as the C40 Cities Climate Leadership Group on initiatives of cities, the Low Emission Development Strategies Global Partnership and the Carbon Sequestration Leadership Forum. Another example mentioned by a group of Parties is the work of the Covenant of Mayors in bringing together a network of more than 2,000 municipalities in Europe to boost integrated energy planning in cities in order to achieve 29 per cent emission reduction by 2020.

B. Energy efficiency

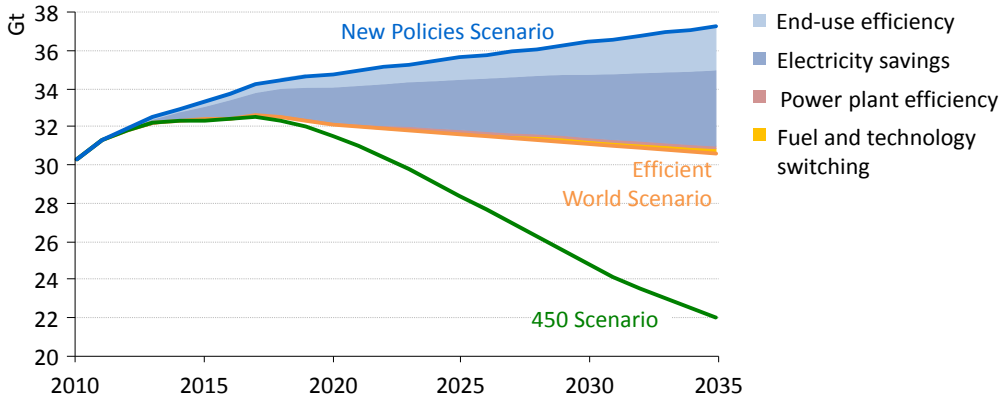
35. Energy efficiency covers a broad range of issues across practically all sectors of the economy, only some of which are addressed here. This section focuses specifically on energy efficiency in buildings, appliances and industrial processes. Energy efficiency in transport is covered in chapter I.D below.

1. Mitigation potential and benefits

36. Increasing energy efficiency is an area of significant mitigation potential. A number of Parties cited in their submissions the IEA *World Energy Outlook 2012*, which states that, globally, around 2 Gt CO_2 eq of emissions can be reduced by 2020 through additional energy efficiency improvements (see figure 2 below).[21] The IEA special report entitled *Redrawing the energy-climate map* highlights a slightly different set of energy efficiency measures that can be implemented quickly, which add up to 1.6 Gt CO_2 eq by 2020.[22] According to the UNEP *Emissions Gap Report 2012*, the total mitigation potential in 2020 for buildings alone, compared with the "business as usual" scenario, is within a range of 1.4–2.9 Gt CO_2 eq.[23] In the longer term, the estimate of the potential is higher.

[21] IEA, 2012.
[22] IEA, 2013a.
[23] UNEP, 2012.

Figure 2
Emissions savings from energy efficiency



Source: International Energy Agency, 2013a. World Energy Outlook Special Report 2013. Redrawing the Energy-Climate Map.

Abbreviation: 450 scenario = stabilization of the concentration of greenhouse gases in the atmosphere at 450 parts per million.

37. The 25 energy-efficiency measures published by the IEA in 2011, such as establishing market signals to motivate effective action, accelerating the introduction of new technologies, and strengthening the enforcement of minimum energy-performance standards for appliances, lighting, equipment and building energy codes could, if implemented straight away, save as much as 7.6 Gt CO_2 eq per year by 2030.[24]

> The IEA *World Energy Outlook 2012* assessed that by unlocking cost-effective energy-efficiency options, cumulative global economic output would increase by USD 18 trillion by 2035, resulting in the greatest GDP gains in India (3.0 per cent), China (2.1 per cent), the United States of America (1.7 per cent) and the European members of the Organisation for Economic Co-operation and Development (1.1 per cent). Additional investment of USD 11.8 trillion in efficient end-use technologies is more than offset by a USD 17.5 trillion reduction in fuel bills and a USD 5.9 trillion cut to supply-side investment.
>
> *Source:* IEA, 2012.

38. Overall costs of energy efficiency measures are generally low compared to other options. Many of these measures have low or negative net costs and often a very short payback time. Various studies found that energy savings of around 30 per cent were feasible with a payback time of less than 3–4 years.[25,26] For example, the marginal mitigation costs of energy efficiency in the industrial sectors is estimated to be less than USD 25/t CO_2 eq.[27] Another study notes that 90 per cent of mitigation potential could be achieved at less than USD 50/t CO_2 eq and the remaining 10 per cent at between USD 50–100/t CO_2 eq.[28]

2. Sustainable development benefits

39. Energy efficiency measures have multiple sustainable development benefits such as the following:

[24] IEA, 2011.
[25] IIASA, 2012.
[26] UN-Energy, 2009.
[27] McKinsey & Company, 2010.
[28] IPCC, 2007.

(a) Macroeconomic benefits and technological innovation: energy efficiency measures improve trade balances through increased competitiveness and reduce the burden on public budgets, for example through lower fossil-fuel import bills. They also enhance energy security and energy independence, and contribute to diversification of energy services and reduced need for investments in energy supply;

(b) Cost-effectiveness: upfront investment is generally more than compensated for by savings in energy costs and, hence, reducing energy bills of households and industry;

(c) Improvements in social wellbeing: energy efficiency measures can lead to energy affordability and contribute to addressing poverty alleviation, enhanced employment opportunities, access to reliable energy sources and increased disposable income and comfort of energy users;

(d) Reduction of air and water pollution: environmental quality improvements result in improved public health and reduced public health costs;

(e) Avoiding high carbon "lock-in" in technology and infrastructure at energy supply side with lifetime of more than 30 years;

(f) Climate adaptation: for example, improving building insulation to reduce energy consumption in winter can also reduce heat entering a building in the summer, thus reducing additional costs (and emissions) from air cooling.[29]

3. Barriers

40. Increases in energy efficiency face a wide range of barriers that are broadly common to all countries. Major barriers include:

(a) High project development costs relative to energy savings, high upfront capital costs and perceived capital risk, and high transaction costs;

(b) Lack of affordable energy efficiency technologies that are suitable to local conditions and capacity to maintain energy efficiency investments;

(c) Market organization, price distortions, split incentives and a large number of entities that could and need to implement energy efficiency measures;

(d) Information barriers and a lack of awareness of the benefits among financial institutions and consumers that prevent them from making informed consumer decisions;

(e) Institutional bias towards supply-side investment and energy tariffs that discourage energy efficiency investments;

(f) Increased efficiency can lead to increased consumption, in order to provide increased comfort levels, for example for heating (rebound effect).

4. Examples of national policies

41. Policies aimed at overcoming barriers to increased energy efficiency have been implemented widely. Minimum performance standards, regulations and labelling for buildings and appliances as well as for cars and trucks have been successfully used by governments around the world for decades. For example, minimum energy performance standards such as Japan's Top Runner Programme and the European Union Directive on Ecodesign of Energy-related Products are estimated to have so far led to energy savings from the residential sector of 11 per cent in Japan and 16 per cent in the European Union. Australia's phase-out of incandescent lamps between 2007 and 2010 is estimated to have reduced the country's emissions by around 0.14 per cent.

[29] IEA, 2012.