PBL Netherlands Environmental Assessment Agency

Greenhouse gas emission reduction proposals and national climate policies of major economies

Policy brief

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November 2012

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Summary

Since the climate negotiations in Copenhagen (2009), many countries have submitted quantitative economy-wide greenhouse gas emission reduction targets, proposals, and actions for 2020. This policy brief shows for the first time how much the most effective domestic climate policies in major emitting countries would contribute to reducing greenhouse gas (GHG) emissions and contribute to meeting these pledges. The emission reductions resulting from most important domestic policies were quantified and compared with the countries' reduction proposals.

The impact of domestic policies was calculated based on three basic methods: (i) the PBL FAIR policy model using business-as-usual (BAU) projections of the PBL TIMER energy model[1], (ii) bottom-up calculations by Ecofys for different subsectors, supplemented with calculations for land-use policies using the IIASA forestry model G4M, and iii) literature, including the Climate Action Tracker (CAT)[2] of Ecofys, PIK, and Climate Analytics, and various national studies. Especially for larger countries, implementation barriers, domestic legislation, and policy instruments are taken into account in the assessment of the impact of policies. The quantification of the pledges was performed with the FAIR model.[3]

Earlier work showed that most major economies have submitted quantitative economy-wide emission reduction proposals for 2020 to the UNFCCC, sometimes subject to conditions. Several countries, for instance Mexico, South Africa, South Korea, Brazil, Japan and Norway, have selected their targets in light of the ranges that are necessary to limit global temperature increase to 2°C[4]. However, aggregated pledges in total do not deliver 2020 emission levels which are needed to limit global temperature increase to the 2°C climate target[5].

Our assessment shows that the pledges have induced efforts in all countries to plan and implement national policies. The policies are likely to deliver emission reductions. We estimated some of these policies would deliver more emission reductions than expected from the country's international mitigation commitments. In other countries, further policies have to be implemented to demonstrate pledges will be met in 2020.

India, China and Russia are likely to achieve or overachieve their international pledge by implementing the policies portfolio we have assessed. The EU's nationally legally binding policy framework is likely to deliver its unconditional pledge and the EU is working on developing new policies which would deliver additional mitigation effects. For achieving its conditional pledge, new policies would have to be developed and implemented. We project that Australia's nationally legally binding framework would deliver its unconditional pledge. Additional policies would be needed to achieve the conditional pledge.

[1] As used in the OECD, 2012. OECD Environmental Outlook to 2050.
[2] http://www.climateactiontracker.org/
[3] Den Elzen et al., 2012, Analysing the emission gap between pledged emission reductions under the Cancún Agreements and the 2 °C climate target, www.pbl.nl/en
[4] http://www.climateactiontracker.org/
[5] UNEP, 2012, The Emissions Gap Report 2012, http://www.unep.org/publications/ebooks/emissionsgap2012/

The situation is rather unclear for Japan, South Korea, Brazil and Indonesia. The level of emission reductions of Japan depends to a large extent on the future energy plan, which is still under discussion. Whether South Korea will achieve its unconditional pledge depends on the final design and implementation of the agreed emission trading system. In Brazil and Indonesia, emissions from land use, land use change and forestry (LULUCF), which are very uncertain and difficult to project, play a dominant role. Without further clarification on these sectors, no valid assessment is possible.

We project that policies of Canada and USA have an effect on 2020 emission levels, but these countries will probably need to develop and implement additional policies to deliver their pledges in full. USA's expected emissions for 2020 are lower than expected previously due to economic decline, low gas prices and implementation of some policies, but the projected emission level by 2020 is still likely to be higher than what is needed to achieve the pledge.

There are some caveats with this assessment. First of all, it only includes the most effective national climate and energy policies and therefore does not provide a complete assessment of all policies. This has the risk of underestimating the total impact of all efforts in a country to reduce emissions. One example is Mexico, where our assessment of individual policies revealed limited reductions, but where other sources show that many smaller policies programmes are implemented, which could reduce emissions by around half of what is needed for the pledge. Another example can be found in the USA, where sub-national policies can contribute significantly to emission reductions. Secondly, existing policies may change and new policies may be implemented. This implies that all numbers are subject to change; this policy brief provides the current state of the art.

Table 1 gives an overview of the evaluation.

Table 1: Overview on individual country results

Country (2010 GHG emissions)	2020 pledge (calculated resulting emissions)	Mitigation actions with the highest impacts[6]	Result
China (11 $GtCO_2e$)	• 40%-45% decrease of CO_2 emissions per GDP below 2005 • 15% share of non-fossil energy • Forestry target (13.3-15.5 $GtCO_2e$)	• CO_2 / energy intensity targets • non-fossil target • renewable energy capacity targets	Likely to meet pledge (12.8 – 14.7 $GtCO_2e$) but rapid GHG increase up to 2020, due to higher than expected GDP growth in the last few years
USA (7 $GtCO_2e$)	• 17% below 2005 levels (6 $GtCO_2e$)	• CO_2 standard for new fossil power plants • Car standard • State renewable portfolio standards • California ETS	Emissions expected to be lower than estimated before, but still above pledge
EU (5 $GtCO_2e$)	• 20% below 1990 levels (unconditional) • 30% below 1990 levels (conditional)	• Comprehensive policy portfolio including emission trading system, renewable energy targets and support, energy efficiency policy	Likely to meet unconditional pledge

[6] Only the most important policies were analysed for most countries

Country (2010 GHG emissions)	2020 pledge (calculated resulting emissions)	Mitigation actions with the highest impacts[7]	Result
India (3 $GtCO_2e$)	• 20%-25% decrease of CO_2 emissions per GDP below 2005 (3.5 $GtCO_2e$)	• Renewable energy target • Efficiency in industry	Likely to meet pledge, huge uncertainty
Russia (2.5 $GtCO_2e$)	• 15-25% below 1990 levels (2.5-2.8 $GtCO_2e$)	• Energy efficiency plan • renewable target • reduction plan for flaring	Likely to meet pledge
Brazil (2.5 $GtCO_2e$)	• 36%-39% below BAU levels (2.0-2.1 $GtCO_2e$)	• Anchored pledge in national law, forestry policy • Grazing land management • Expanding fossil fuels • Renewable target	Uncertain whether pledge will be met
Indonesia (2 $GtCO_2e$)	• 26%-41% below BAU levels (1.3-1.6 $GtCO_2e$)	• Action on forestry • Renewable energy target	Uncertain whether pledge will be met, current emissions uncertain
Japan (1 $GtCO_2e$)	• 25% below 1990 levels (1.0 $GtCO_2e$)	• Feed-in-tariff for electricity from renewables • Nuclear will be phased out	Uncertain whether pledge will be met
Mexico (0.7 $GtCO_2e$)	• 30% below BAU levels (0.6 $GtCO_2e$)	• Framework climate law with pledge • Renewable target • Forestry target	Unlikely to meet pledge with currently implemented policies
Canada (0.7 $GtCO_2e$)	• 17% below 2005 levels (0.6 $GtCO_2e$)	• Car standards • State level renewable policies and industry policies • Power plant standard	Unlikely to meet pledge with currently implemented polices
South Korea (0.6 $GtCO_2e$)	• 30% below BAU level (0.6 $GtCO_2e$)	• ETS planned • Renewable target	Unclear whether pledge will be met
Australia (0.5 $GtCO_2e$)	• 5% below 2000 levels (unconditional) • 15-25% below 2000 levels (conditional) (0.4-0.5 $GtCO_2e$)	• Comprehensive carbon price mechanism • Renewable targets with strong fines • Forestry actions	Likely to meet unconditional pledge with currently implemented polices, but relatively high uncertainty
Saudi Arabia (0.5 $GtCO_2e$)		• Renewable target	If implemented, substantial impact; no pledge
South Africa (0.5 $GtCO_2e$)	• 34% below BAU level (0.5 $GtCO_2e$)	• Renewable target and respective support mechanism	Unlikely to meet pledge with currently implemented policies
Turkey (0.4 $GtCO_2e$)		• Energy intensity • Renewable energy targets	If implemented, substantial impact; no pledge
Ukraine (0.4 $GtCO_2e$)	• 20% below 1990 levels (0.7 $GtCO_2e$)	• Feed-in-scheme • Energy intensity target	Likely to meet pledge
Argentina (0.3 $GtCO_2e$)		• Renewable electricity target with tendering scheme	Some impact; no pledge
Malaysia (0.2 $GtCO_2e$)		• Energy intensity target • Renewable target	Some impact; no pledge

[7] Only the most important policies were analysed for most countries

Countries are implementing policies in various areas to a varying degree (see Table 2). A few trends emerge: All major countries have set renewable energy targets, many to be achieved by national support policies. Building codes and appliance standards are used widely. Several countries have recently implemented efficiency standards for cars (for instance the USA and Canada). Finally, new emission trading systems are emerging, for instance in Australia, South Korea and China.

Table 2: Overview of policy trends

	Energy efficiency	Renewables	Other
Energy supply			CCS
Industry			Material efficiency
Buildings			Urban planning
Transport			Modal shift
Agriculture			
Forestry			

High

Low

First order indication of impact of policies compared to respective potential

1 Australia

Australia has developed a portfolio of regulations. Our assessment indicates their combined effects could reduce emissions to the levels corresponding to demonstrating delivery of their unconditional pledge. The uncertainty in the effect of these policies on 2020 emission levels is large, however: according to our analysis, current policies would lead to an emission level ranging from 480 and 650 $MtCO_2e$ in 2020, the difference mainly depending on assumptions used in different studies [8]. This compares with an emission level of around 540 $MtCO_2e$ consistent with the least ambitious pledge.

Under BAU, Australia's emissions are projected to increase to around 620 to 650 $MtCO_2e$ by 2020, from 550 $MtCO_2e$ in 2010. Australia has pledged to decrease its emissions by 5%, 15%, or 25% below its 2000 emission level, depending on international action. This represents emission levels between 430 $MtCO_2e$ and 540 $MtCO_2e$, excluding land use, but including deforestation in the base year, as communicated by Australia.

According to the Climate Action Tracker country assessment report[9], the Clean Energy Future Plan has the potential to become the cornerstone instrument for low carbon development in Australia - but only with substantial enhancement it could lead to meeting the more ambitious pledges. Key features of the strategy include introduction of an emissions trading scheme (ETS) in 2012 with a fixed carbon price, followed by a flexible carbon price from 2015. The ETS will cover around 500 of the largest polluters in Australia and covers around 60% of national emissions. Not all sectors are directly involved; agriculture, landfill and emissions from light-road vehicles are excluded from the carbon pricing mechanism. The scheme is expected to have major impacts on energy generation and industry compared to BAU development, and can lead to reductions around the level of the unconditional pledge.

In the energy supply sector, which is the main source of CO_2 emissions in Australia, a 20% renewable electricity generation target is set for 2020. The policy instrument consists of a renewable portfolio standard with a high penalty for non-compliance. In order to be successful, some administrative barriers (such as spatial planning regulation) would need to be removed. The target of 20% in 2020 is likely to be achieved, but it is not expected to lead to additional emissions above implementation of ETS.

According to our preliminary analysis, only limited additional planned policies are in the planning phase, which are not expected to reduce emissions significantly beyond the implemented policies.

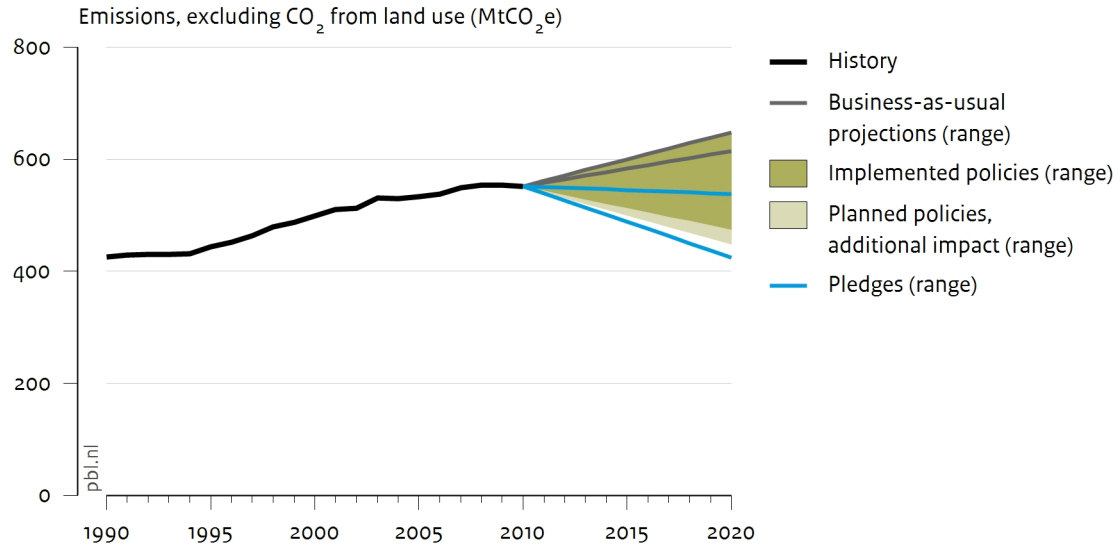
The total emission level in 2020 strongly depends on assumptions on Afforestation, Reforestation and Deforestation (ARD) in

[8] Australian Government (2010), Australia's emissons projections; Australian Government, department of Climate Change (2010), Australia's Fifth National Communication on Climate Change; Australian Government (2011) An overview of the Clean Energy Legislative Package; OECD (2012), OECD Environmental Outlook to 2050. OECD, Paris; Australian Government (2011), Treasury, Strong growth, low pollution.

[9] http://climateactiontracker.org/assets/publications/publications/CAT_ExecSummary_Australia_2011.pdf

2020, emissions of which influence meeting the pledge. Given the foreseen decline in emissions from ARD, this alone could achieve a minimum of 7% of 2000 emissions in total emission reductions by 2020, based on Australia's projections[10]. A further contribution of 3% of 2000 emissions is estimated from additional forestry actions.

Greenhouse gas emissions for Australia



Policies: Carbon price mechanism, renewable targets, forestry actions

[10] Grassi et al. 2012, The role of the land use, land use change and forestry sector in achieving Annex I reduction pledges, Climatic Change

2 Argentina

Argentina does not have an emission reduction pledge. In this policy brief, we discuss the projected impact of two existing policies and evaluate the reduction below BAU emissions – which are projected at 390 to 400 $MtCO_2e$ in 2020[11]. We estimate these two policies, a renewable energy target and biofuel quotas, would reduce emission levels to 385 $MtCO_2e$.

Argentina's renewable energy target consists of 8% renewable electricity generation by 2016, excluding large hydropower. This is supported by tendering a certain capacity of renewable energy each year and purchasing the produced quantity for the following 15 years. Achieving this target will lead to a reduction of about 10% against BAU of the electricity sector.

The biofuel quotas consist of a 5% quota for biodiesel and a 5% quota for ethanol in gasoline in 2020. Argentina established support mechanisms for producers of biofuels, such as tax exemptions and a fixed price for the fuels to support the targets. There are also incentives for external trade of biofuels, such as export and import tax exemptions. The impact on emissions of these quotas is projected to be small, however, as natural gas vehicles, which are not affected by the biofuel quota, have a large share in the Argentinean vehicle fleet.

[11] As no BAU is available for Argentina, we constructed a BAU from the IEA WEO 2011

3 Brazil

Brazil set itself an emission reduction target for 2020 of 36% to 39% below BAU in 2020, including emissions from forestry. Estimates of the effects of policies on projected 2020 emission levels, and in relation to the pledge are uncertain, as this target relates with uncertain emissions projections, especially for deforestation.

Brazil's BAU emission level, including forestry emissions, is projected between 2,500 and 3,200 $MtCO_2e$ in 2020. The upper end of this range is based on national projections[12], while the lower end results from the PBL/IIASA projection.[13] In 2011 Brazil updated their BAU projections, which lead to higher projections than previously reported. The updated BAU and the targets were turned into national law. This means that the target emission level form the pledges is between 1,980 and 2,070 $MtCO_2e$ in 2020. In its submission to the UNFCCC[14], Brazil announced as part of its pledge, specific emission reductions targets per sector. Most reductions are expected from the agriculture and forestry sector.

There are several policies that affect emissions in the agriculture and forestry sector of Brazil. Central to our analysis were the Action Plan for Deforestation Prevention and Control in the Legal Amazon (PPCDAm) and in the Cerrado (PPCerrado). The PPCDAm should result in a reduction of 80% of the annual deforestation surface in the Amazon, as compared to the historical average from 1996-2005. Assuming a constant biomass density, this would avoid about 760 $MtCO_2$ of emissions by 2020, based on the national projection. The PPCerrado calls for a reduction of 40% of the annual deforestation surface in the savannahs, compared to the historical average from 1999-2008. When assuming a constant biomass density in the savannah, this would avoid about 130 $MtCO_2e$ of emissions by 2020.

Apart from these action plans, Brazil announced policies to achieve a restoration of grazing land to increase productivity and carbon storage in grasslands, leading to a pledged reduction of 83 to 104 $MtCO_2eq$[15]. Assuming a constant sequestration rate, the national estimated range of emission reduction in the pledge would require additional management actions for approximately 15% to 25% of total Brazilian pastures. This is about twice the targeted area, implying that the average sequestration potential might be overestimated. We assume therefore that policies targeted at grassland restoration will only realize 50% of the expected emission reductions, which amounts to 40 to 50 $MtCO_2e$ in 2020.

[12] Brazilian Government. Decree No. 7390. December 9, 2010 http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2010/Decreto/D7390.htm

[13] Combination of PBL IMAGE/FAIR model projections contain all Kyoto GHG emissions (except CO_2 from land-use change) and IIASA G4M model projections for CO_2 emissions from land-use change (e.g. from deforestation).

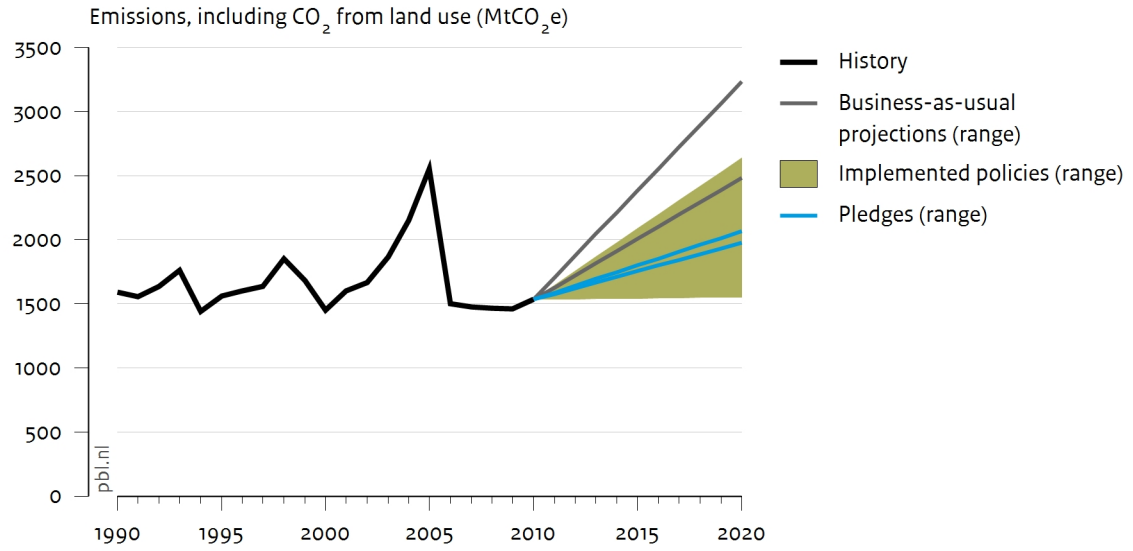
[14] FCCC/AWGLCA/2011/INF.1

[15] FCCC/AWGLCA/2011/INF.1

The total reduction of the above forestry emissions is about 890 $MtCO_2e$ in 2020, based on the updated national BAU projection of 1400 $MtCO_2e$. Taking into account the high uncertainty of agricultural and forestry emissions, we find the reduction caused by these action plans could be much lower, namely 560 $MtCO_2e$ in 2020, compared to the IIASA projection of 800 $MtCO_2e$.

Apart from measures in forestry, Brazil states in its ten-year plan that the country will triple its use of "new" energy, excluding hydro renewables, by 2020, and that much of that will be wind energy. The total share of electricity from new renewables (excl. large hydro) is targeted to reach 16% in 2020. If these targets are reached, 0-40 $MtCO_2e$ emissions would be cut.

Greenhouse gas emissions for Brazil



Policies: Anchored pledge in national law, grazing land management, renewable target

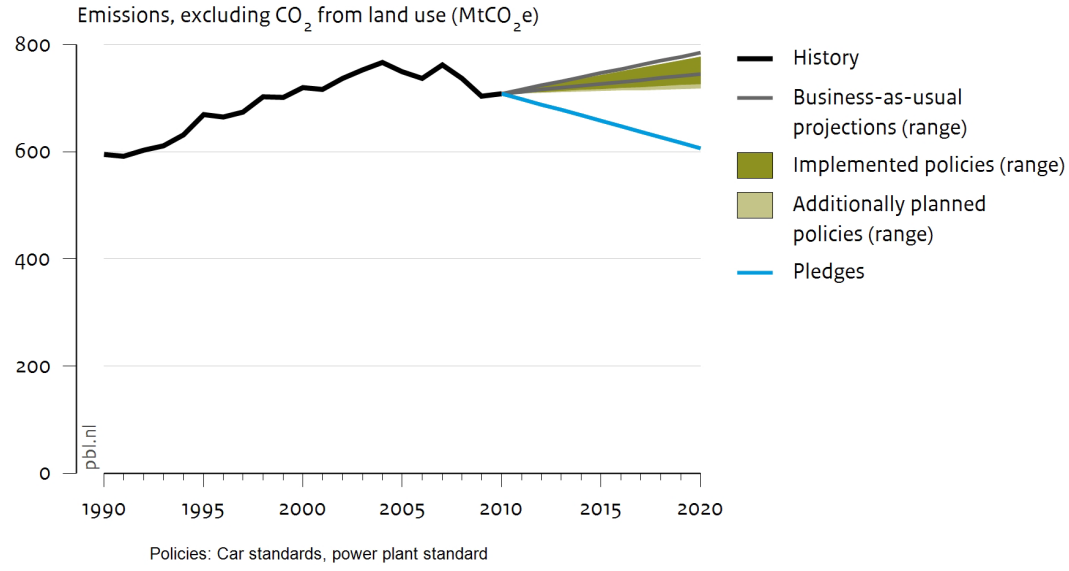
4 Canada

We project only minor effects of the major Canada's climate policies quantified, and hence our projections show an emission level for 2020 which is not far below the BAU projections, with a range of 730 to 780 $MtCO_2e$, excluding forestry emissions.

Canada pledged to reduce its GHG emissions by 17% below 2005 levels in 2020, which implies an emission target of 610 $MtCO_2e$ in 2020. According to Canada's 2011 Emission Trends Report, BAU emissions would reach 785 $MtCO_2e$ in 2020. This figure has been revised downwards to 720 $MtCO_2e$ in the 2012 Emission Trends Report, due to a stronger than expected effect of the recession, methodology updates, the accounting for forestry emissions and new policies.

The most important national climate policies include a fuel efficiency standard for light duty vehicles and a carbon standard for coal-fired power plants. The fuel efficiency standards are aligned with those of the USA and consist of two phases with increasing standards. The second phase will start in 2017. As the first phase of the efficiency standard is already incorporated in the national BAU development, the impacts on CO_2 emissions are projected to occur mainly after 2020. The effect is larger based on the PBL TIMER model, as it does not include this policy in BAU development, but the emissions end-level after implementation is not very different. The carbon standard for coal-fired power plants was published in September 2012. We project only a small effect on 2020 emissions levels, because the standard does not affect existing power plants, which can be in operation for another 50 years. Furthermore, CCS-ready power plants are exempt from the regulation.

Greenhouse gas emissions for Canada



5 China

With its national policies, China goes beyond what would be needed for reaching their pledge. However, the emission target level of the pledge largely depends on very uncertain economic growth

China's pledge includes reducing CO_2 emissions intensity (emissions per unit of GDP) by 40 to 45% in 2020 as compared to 2005 levels, increasing non-fossil energy to 15% in 2020, and increasing forest coverage by 40 million hectares. China's emissions would be between 13.5 and 15.5[16] $GtCO_2e$ in 2020 if it meets this pledge. The uncertainty in this level is due to differences in i) GDP projections, ii) historical emissions data, iii) the impact of the non-fossil target and non-CO_2 GHG emission projections. The low end of the range is based on an average annual GDP growth of 8% between 2010 and 2020, while for the high end of the range the growth rate is 9%. The BAU emission levels ranges from 14.1 to 17.4 $GtCO_2e$ in 2020.

National policies to implement the pledge are developing fast. We analysed the effect of planned renewable capacities, which have been increased more than twofold for some technologies in the June 2012 update of the 12th Five Year Plan compared to the previous version. The total targeted renewable capacity is now 700 GW in 2020, 420 GW of which consists of hydropower, 200 GW of wind energy, 50 GW of solar and 30 GW of biomass electricity. Additionally, targets for increasing solar thermal water heating, biogas and biofuels, which are included in the Medium and Long-term Plan for Renewable Energy (2007), are included in our analysis.

Our assessment of the effects of some policies in implementation in China on projected 2020 emission levels takes into account high data uncertainty. Historic emissions are unclear, as for example illustrated recently by Guan et al. (2012)[17]. Despite this uncertainty, it is known that emissions in China have increased faster than previously expected and have reached around 11 $GtCO_2e$ in 2010[18]. For BAU emission projections and the effect of the pledge, we rely on four data sources: the World Energy Outlook 2011, a report from the ERI from 2009[19], PBL TIMER energy model projections, and the Second National Communication[20] by China from 2012[21]. Taking into account these uncertainties, we can conclude that the new capacity targets would lead to a more ambitious level of renewable energy than the internationally pledged 15% non-fossil target, and to a lower emission level than is expected from the CO_2 emissions intensity target. Therefore, the planned renewable capacity targets are likely to result in overachieving the pledge.

[16] The emission level resulting from the pledge for China is now estimated by PBL at 15,200 $MtCO_2eq$, which is an increased of 2,000 $MtCO_2eq$ compared to our estimate in den Elzen et al. (2012). This is a result of a higher BAU estimate, since we moved our start year from 2005 to 2010 using EDGAR (2012) emission data, and growth in China between 2005 and 2010 was higher than they expected in 2005.

[17] Guan, D. et al. (2012). The gigatonne gap in China's carbon dioxide inventories in Nature Climate Change, published online 12 June 2012

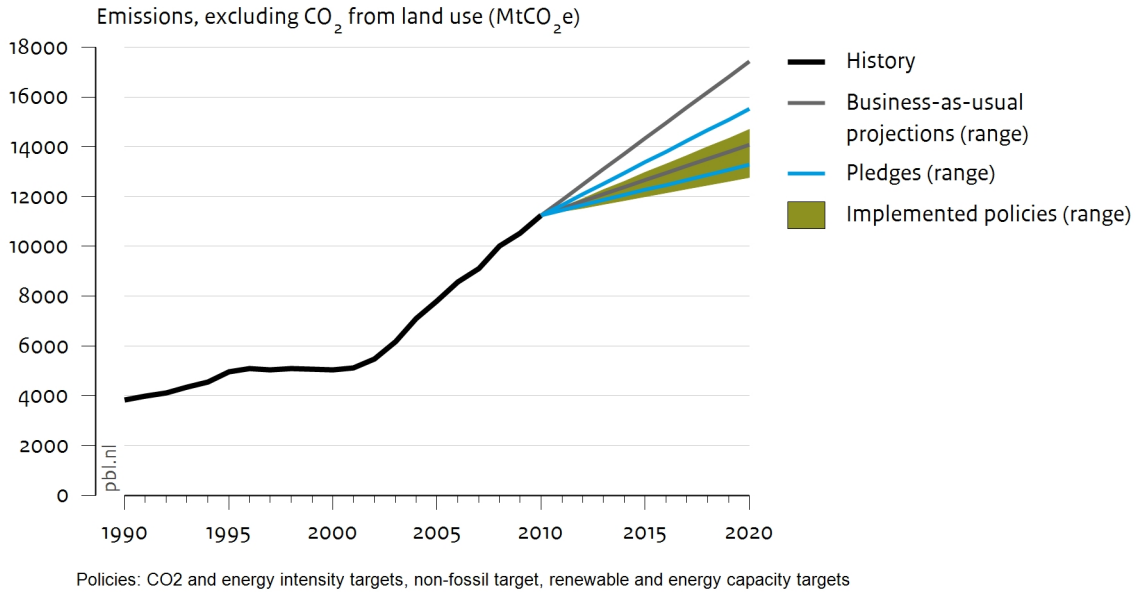
[18] EDGAR database 2012

[19] ERI (2009) China's Low Carbon Development Path by 2050: Scenario Analysis of Energy Demand and Carbon Emissions

[20] http://unfccc.int/resource/docs/natc/chnnc2e.pdf

[21] Supplemented with emissions trend of non-energy CO_2 and CH_4, N_2O and F-gases from PBL TIMER/IMAGE model

Greenhouse gas emissions for China



Policies: CO2 and energy intensity targets, non-fossil target, renewable and energy capacity targets

6 Egypt

Egypt does not have an emission reduction pledge but has a national renewable energy target of 20% electricity generation in 2020. According to our calculations, this target could reduce emissions from the electricity sector from 120 $MtCO_2e$ to 140 $MtCO_2e$ in 2020. To achieve this, Egypt would need to implement its planned feed-in tariff, which is not yet in place, as soon and as effectively as possible.

7 European Union

The EU is enforcing the nationally legally binding framework it established to deliver its unconditional 20% GHG reduction pledge by 2020 and is projecting to meet it. Currently planned policies would not yet be sufficient to meet the conditional pledge of 30% reduction below 1990 in 2020.

Projections of GHG emissions by the European Environment Agency of October 2012[22] show that the EU is close to meeting its 20% target (19% reduction or 4.5 $GtCO_2e$ in 2020) with currently implemented national measures.

These measures consist of a comprehensive policy portfolio, including an emission trading system, renewable energy targets and support, energy efficiency policies, and CO_2 standards for light-duty passenger cars. To deliver the conditional target of 30%, the EU would need to develop and implement additional policies and measures beyond the policies currently planned by Member States: all planned policies could result in an emission level of 4.2 $GtCO_2e$, while about 3.9 $GtCO_2e$ would be required for the 30% conditional pledge. The EU emission level was at approximately 4.6 $GtCO_2e$ in 2011 according to the EEA.

[22] http://www.eea.europa.eu/publications/ghg-trends-and-projections-2012

8 India

Projecting India's emission levels up to 2020 taking into account India's pledge depends on assumptions regarding GDP, and different assumption can either correspond to projecting considerable reductions or to emissions far above the current BAU projections. We project that the pledge is likely to be overachieved if the national policies we evaluated here are implemented.

India pledged an emission intensity reduction of its GDP by 20% to 25% by 2020 in comparison to the 2005 level (excluding emissions from agricultural sector) under the UNFCCC. India provided an official quantification of emissions as a result of this pledge, based on annual GDP growth projections of 8% and 9%.[23] The emission level resulting from the pledge depends on assumptions regarding GDP. Using the Indian national study, the pledge would result in an emission level between 3.6 and 4 $GtCO_2e$ in 2020, depending on GDP projections. The projections for future BAU emission development in India differ substantially among studies and range from 3.2 to 5.3 $GtCO_2e$ in 2020 (excluding forestry emissions).

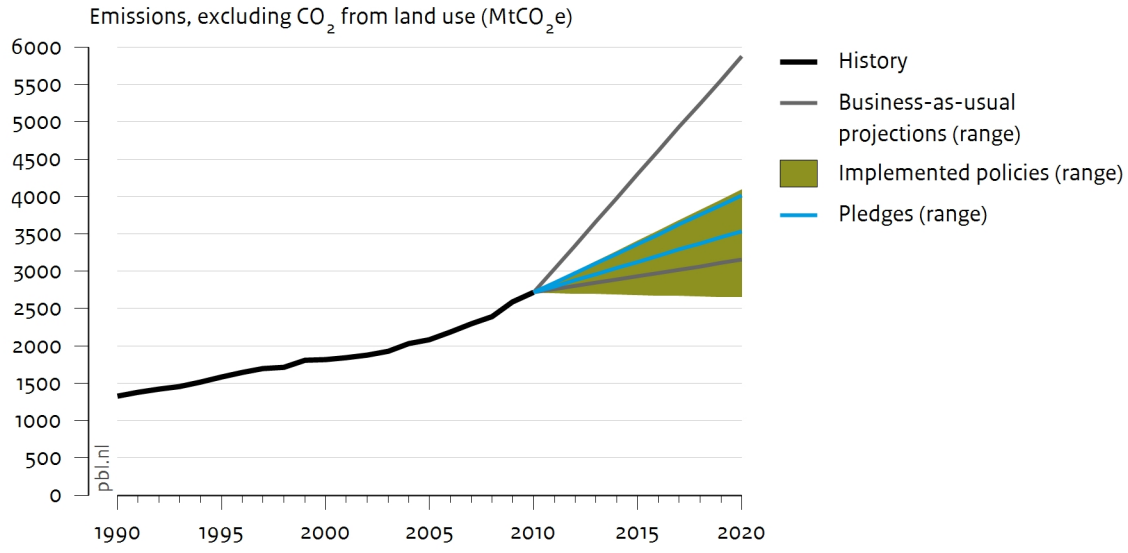
On federal level, India implements two major renewable energy targets. First, the 11th Five Year plan contains capacity targets for renewables by 2017 and 2012. India also committed to a renewable electricity generation target for 2020 of 15% from small hydro, wind, biomass, solar and geothermal. These targets can achieve an emission reduction of 57 to 140 $MtCO_2e$, if they are fully implemented.

Indian states have introduced several policies regarding renewable energy deployment which, as yet, are not being harmonized on a federal level. We did not look in detail into state policies, and recognize there could be large regional differences, which could impact overall emission reductions.

The Indian government agreed upon the Perform, Achieve and Trade (PAT) Mechanism on 30 March 2012. This energy efficiency cap-and-trade scheme covers the largest industry and power generation facilities, which in total cover more than 50% of the fossil fuel used in India. The target is to achieve a 4 to 5% reduction of energy consumption in 2015 of the participating facilities which are from the power sector (60%) and industry (40%). National studies estimated that the PAT Mechanism would reduce CO_2 emissions by 23 to 26 $MtCO_2e$ per year by 2015, which compares to 20 $MtCO_2e$ projected by PBL. The effect after 2015 heavily depends on the rules of the continuation of the scheme, which yet have to be decided. They could range from 100 to 300 $MtCO_2e$ in 2020.

[23] http://moef.nic.in/downloads/public-information/Interim%20Report%20of%20the%20Expert%20Group.pdf.

Greenhouse gas emissions for India



Policies: Renewable energy targets, efficiency in industry

9 Indonesia

Reductions from the policies assessed are smaller than the uncertainty around the emissions from land use changes and forestry (which also includes peat lands), so the remaining emissions after implementation of policies cannot be determined.

Indonesia submitted an unconditional pledge to reduce emissions by 26%, from its BAU emission projections. Indonesia also entered a high, conditional pledge of 41%, announced prior to the conference in Copenhagen. High uncertainty regarding emissions from forestry dominates the evaluation of Indonesia's pledges. The emission target, including land use changes and forestry emissions, resulting from the pledges would be between 1.3 and 1.6 $GtCO_2e$ in 2020, using the BAU projection of Indonesian Ministry of Finance[24], but it would be between 1.7 and 2.1 $GtCO_2e$ using the BAU projection of the Indonesia Second National Communication (SNC)[25]. This compares to BAU emissions ranging from 1.7 to 2.6 $GtCO_2e$ in 2020, about half of which from forestry and peat lands.

Indonesia has a target of 15% renewable energy sources in 2020[26]. The emission reductions from this target are relatively low, as according to the National Energy Policy, mainly oil (with lower emissions per kWh than coal) is replaced, while the share of electricity generated by coal-fired plants is not reduced. The renewable energy policies lead to emission reductions between 30 and 80 $MtCO_2e$ by 2020 compared to BAU.

One contribution to achieving the renewables target is the biofuel quota, which aims to achieve 15% biofuels of all fuels for transportation by 2025. The target is supported by the Biofuel Price Subsidy, which guarantees a certain price and obliges the national oil company to purchase the products of national biofuel producers. Today's transport emissions are expected to increase drastically, because of the very high demand expected for transportation in the coming decade. If the quota is enforced fully, this law reduces emissions of the transport sector to about 170 $MtCO_2e$ in comparison to a BAU of about 200 $MtCO_2e$ in 2020 (a reduction of 15%)[27]. As the renewable energy target includes assumptions on increase of biomass, the reductions from this policy is not additional.

Under the Forest Law Enforcement, Governance and Trade (FLEGT) programme, Indonesia has a "Voluntary Partnership Agreement" with the EU, guaranteeing to only export legally harvested timber to the EU. This is a step to stop illegal logging and to decrease emissions from land use and forestry.

[24] Ministry of Finance (2009). Green Paper: Economic and Fiscal Policy Strategies for Climate Change Mitigation in Indonesia, http://www.fiskal.depkeu.go.id/webbkf/siaranpers/siaranpdf%5CGreen%20Paper%20Final.pdf.

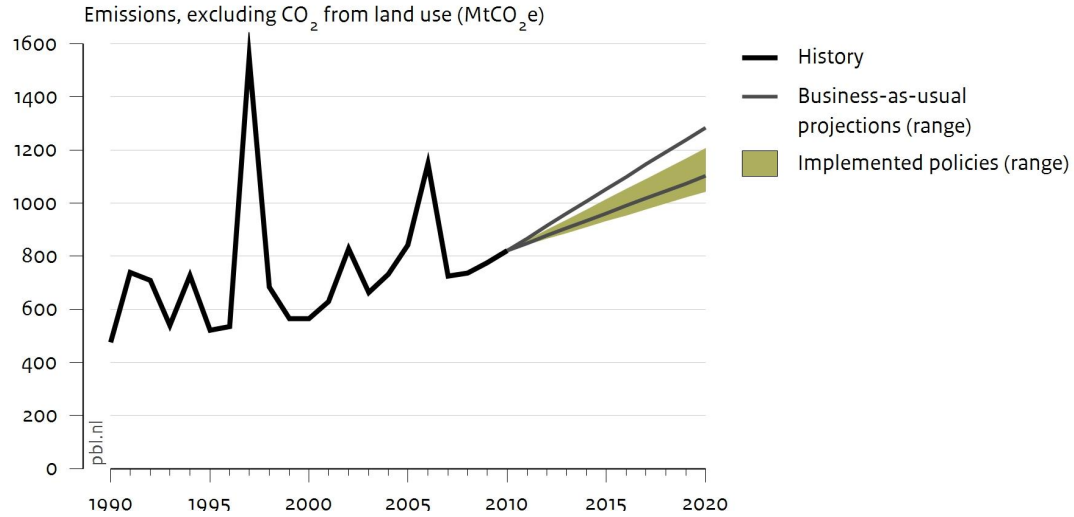
[25] http://unfccc.int/files/national_reports/non-annex_i_natcom/submitted_natcom/application/pdf/indonesia_snc.pdf

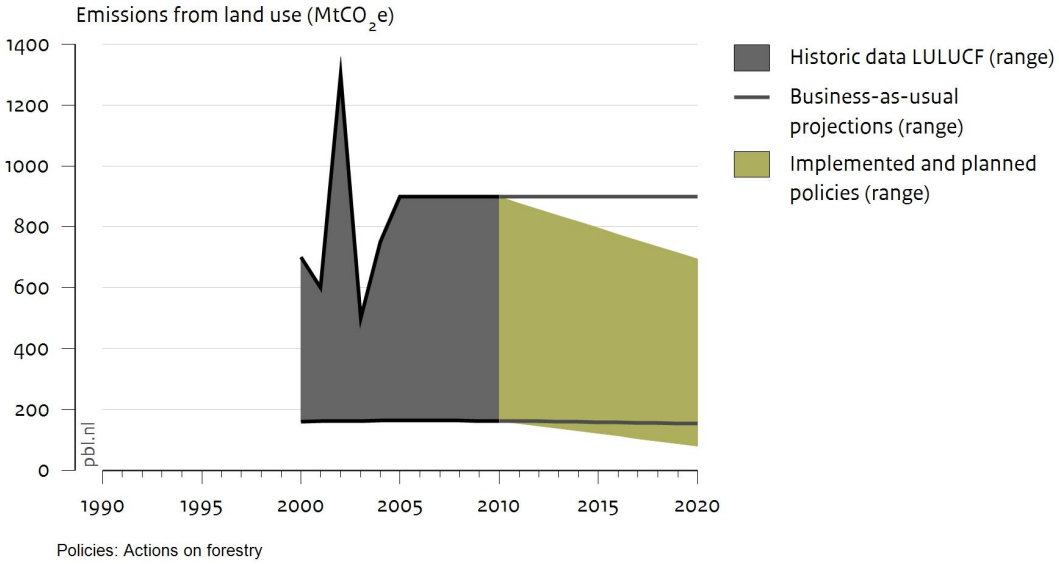
[26] "National Energy Policy" determined by the Presidential Regulation No5/2006. In the 2nd National Communication, Indonesia reaffirms the target, but for the year 2025. For our calculations, we looked at both possibilities: we assume that the target is either reached in 2020 or in 2025.

[27] The emission reductions depend heavily on the emission factor of biofuel production. For our own calculations, we assume a factor of 0% to 80% smaller than the average fossil fuel.

We find emission reductions of this programme to be between 70 and 130 $MtCO_2e$ in 2020, depending on emission factors and reference developments used.

Greenhouse gas emissions for Indonesia





Note that land use emissions are excluding peatland emissions of 0.45 $GtCO_2$

10 Japan

Japan pledged a conditional reduction of 25% in 2020 relative to 1990, which would result in a total emission level of 950 $MtCO_2e$ in 2020. This compares to an expected BAU emission level of around 1200 - 1300 $MtCO_2e$.

It is not possible to assess whether Japan will meet its pledge, as it depends to a large extent on the future energy plan, which is still under discussion. This plan should give insight how Japan will redesign its energy market, especially as Japan announced a phase out of nuclear power in its 'Revolutionary Energy and Environment Strategy', that would imply high investments to meet the pledge.

11 Malaysia

Malaysia does not have an international emission reduction pledge, but has two important national policies: the planned target of the "National Energy Efficiency & Conservation Master Plan" and the renewable energy capacity target. These would lead to an emission level of about 280 $MtCO_2e$ in 2020, compared to a BAU emission level of 330 $MtCO_2e$[28].

The renewable energy capacity target consist of reaching approximately 2 GW installed renewable capacity in 2020, which has only moderate impact on emissions. An installed capacity of 2 GW would imply a 5% increase in renewable energy generation, which only marginally contributes to the expected increase in power demand. Therefore, Malaysia is projected to add conventional energy capacity as well. The results from our own calculations confirm national Malaysian studies[29].

Malaysia aims to reduce final energy consumption by 10% until 2030, which – if implemented and backed up with supporting measures – could lead to significant emission reductions in comparison to the BAU. It could almost stabilize emissions at the present level in 2030. It is not clear from the available documentation whether the 10% reduction is against the final energy consumption level in 2011 or to the BAU level in 2030. We assumed the latter to be the case, which leads to a higher reduction than the first case.

[28] Own calculations based on data from Malaysia's 2nd National Communication.

[29] Ministry of Environment of Malaysia, 2010, http://www.egnret.ewg.apec.org/meetings/egnret34/Malaysia%20RE%20Development%20by%20Ministry%20of%20Energy.pdf

12 Mexico

Our findings indicate that with currently implemented polices, Mexico will achieve emissions reductions but not yet sufficient to meet its conditional pledge, which consist of 30% emission reductions relative to BAU (880 $MtCO_2e$[30]) in 2020. Mexico has established structures and framework policies, such as the General Law for Climate Change which alone have little impact on future emission levels. Mexico is translating those structures into concrete actions in its Low Emission Development Strategy (LEDS), which is being developed at this moment.

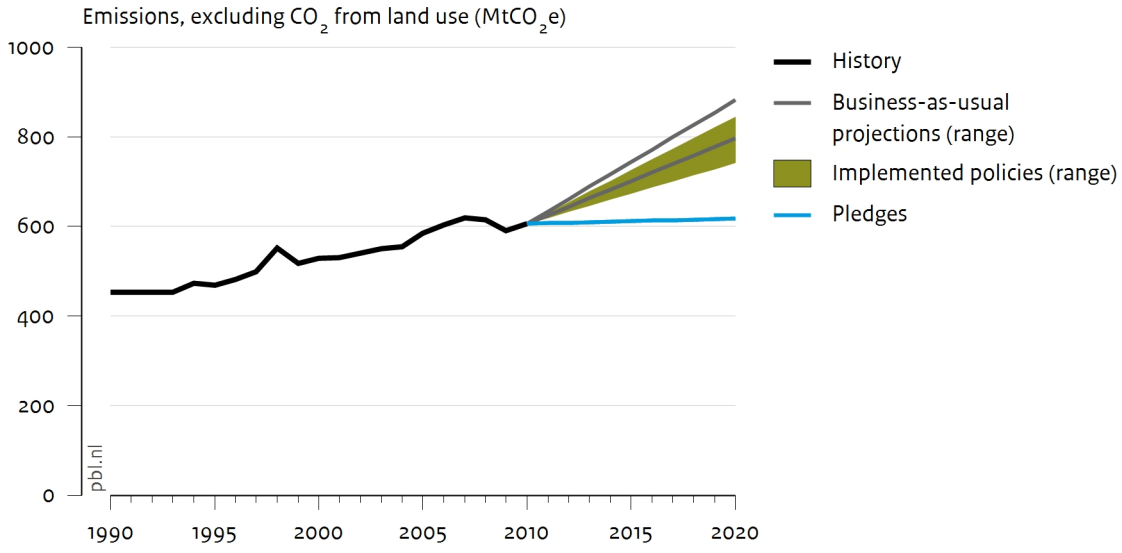
Two studies confirm that Mexico will achieve roughly half of the conditional pledge with currently implemented policies. First, according to a presentation by SEMARNAT[31], Mexico can achieve reductions of about 130 $MtCO_2e$ with current policies, which reflects about half of what is needed to meet its pledge and results in remaining emissions after policies of 740 $MtCO_2e$ in 2020. Most of these reductions result from measures in the forestry sector, from addressing fugitive emissions in the oil and gas sector and from the sustainable cities program that is targeting transport and waste. This conclusion is confirmed by the Climate Action Tracker's country report on Mexico.

With the General Law for Climate Change, Mexico also has set a renewable energy target of 35% of electricity to be generated via renewable technologies by 2024. Achieving 29% renewables by 2020 (which is on linear path towards 35% in 2024) has limited impact, because the carbon intensity of the Mexican electricity supply is projected to decrease substantially even without the law, which is mainly due to low gas prices. The renewable energy target is not yet translated in implementing decisions.

[30] Special Climate Change Program 2009-2012 Mexico: Executive Summary. pg.5-6 http://cc2010.mx/assets/001/5026.pdf

[31] Presentation of National Institute of Ecology (Mexico) at Workshop Enhanced Action Towards Effective Mitigation Goals: Issues & Strategies, Seoul, South-Korea, September 2012

Greenhouse gas emissions for Mexico



Policies: Framework climate law with pledge, renewable target, forestry target

13 Russia

Russia's pledge is not projected to lead to substantial reductions relative to BAU emissions. Implemented policies are expected to reduce emissions from 2.4-2.8 $GtCO_2eq$ to 2.1-2.5 $GtCO_2eq$ by 2020.

Russia committed to a reduction of greenhouse gas emissions from 15% to 25% relative to 1990 levels by 2020. This would result in an emission level ranging from about 2.5 to 2.8 $GtCO_2e$. This range compares with 2020 BAU projections of 2.4 to 2.8 $GtCO_2e$.

In June 2008, Russia committed to a reduction of the energy intensity of GDP by 40% by 2020. Without additional government support, the energy intensity of GDP is projected to reduce by about 26% by 2020 (by autonomous improvements, sector shifts etc.)[32]. This is assumed to be an implemented policy as it leads to additional reductions compared to the BAU considered here (i.e. WEO, PBL). Other implemented policies are Russia's renewable target and gas flaring measures, as described below. As there appear to be no additional measures taken or planned to achieve the remaining reduction to a decrease of 40% energy intensity, we considered this additional reduction as a planned policy.

In 2009, the government published guidelines for enhancing energy efficiency of renewables-based electricity through 2020, which called for the increase of the share of renewable energy sources to 4.5% by 2020. This target only leads to small emissions reductions, as this share of renewables is almost reached in the BAU. In 2010 and 2012 there were further discussions regarding additional state energy efficiency programs, but so-far, none have been implemented.

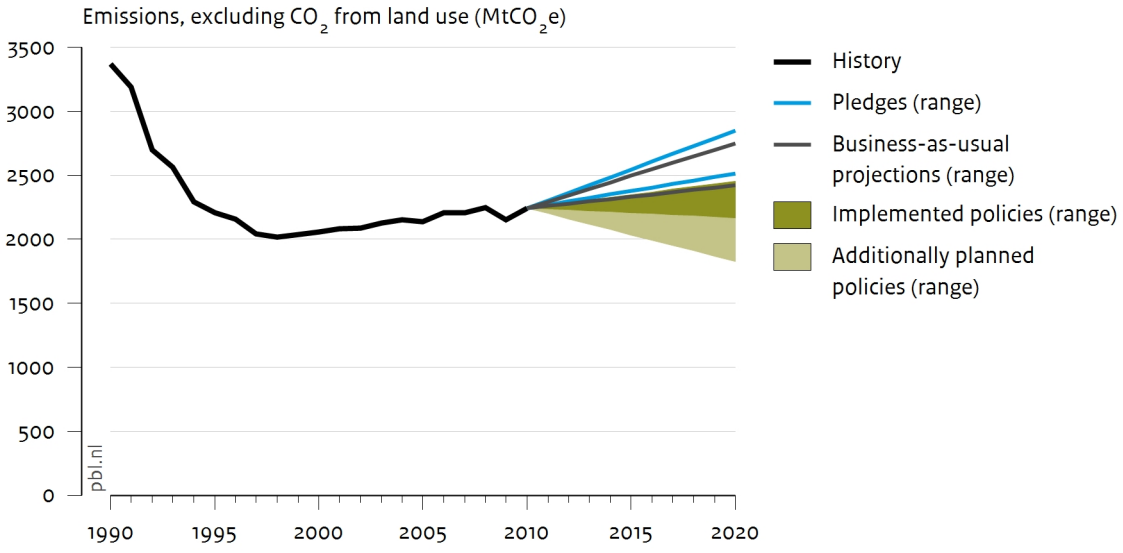
Another important policy area relates to emissions from flaring, as Russia is one of the most important oil and gas producers in the world. In January 2009, a government decree sought to reduce emissions from gas flaring. A 5% limit for gas flaring has been set for 2012 and subsequent years, with fines being imposed if this threshold is exceeded or if there is no monitoring equipment.
The full implementation of this law would result in reductions between 65 and 230 $MtCO_2e$ in 2020. However, some studies[33] question the likelihood of Russia reaching its 95% utilization goal within the next three to five years, because it is often cheaper to pay the fines than to decrease flaring.

The implemented policies that are analysed in our study could together lead to a total emission level of 2.1 to 2.5 $GtCO_2e$, depending on the chosen BAU. By implementing the full policy package relating to the decrease of 40% energy intensity, another 10% could be reduced.

[32] Personal Communication by the European commission

[33] E.g. Pöyry Management Consulting (Norway)

Greenhouse gas emissions for Russia



Policies: Energy efficiency plan (implemented and planned), renewable target, reduction plan for flaring

14 Saudi Arabia

Saudi Arabia has not pledged a reduction target under the UNFCCC climate negotiations. BAU emissions are expected to increase further, reaching 790 $MtCO_2e$ in 2020. [34]

Recently the Saudi Arabian government announced a goal to increase the share of renewable energy to 23% of electricity generation over the next 20 years (10% in 2020 and 23% in 2030). There was no electricity production from renewable sources in 2009. Some new implementation policies are under discussion, such as a feed-in-scheme as well as grant based scheme.

The announced renewable energy goal could, if fully implemented, reduce emissions from the electricity sector in 2020 to 2009 levels (which is 160 $MtCO_2e$).

[34] As no BAU is available for Argentina, we constructed a BAU from the IEA WEO 2011

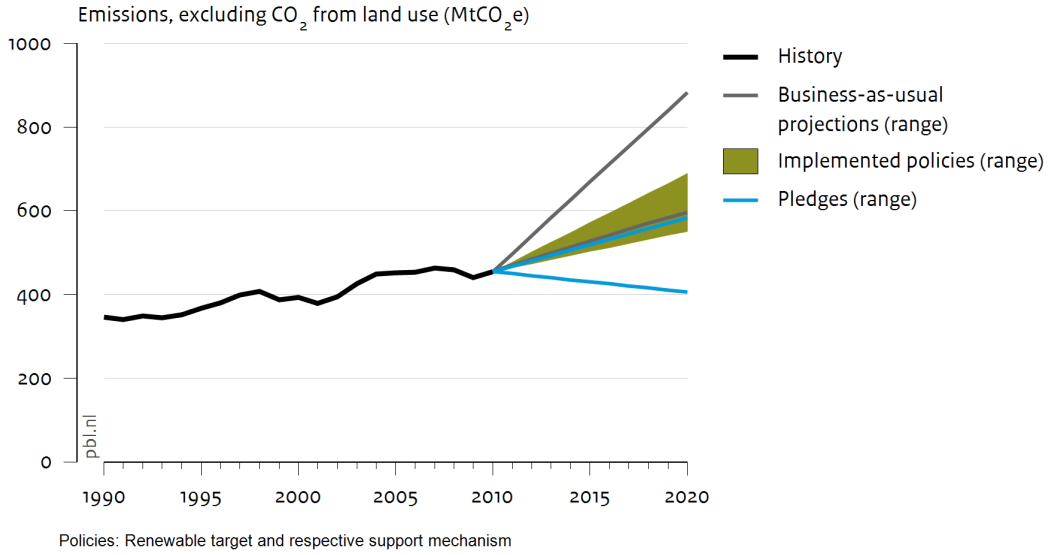
15 South Africa

South Africa has pledged to reduce its emissions by about 34% below BAU by 2020, conditional on adequate financial, technological and capacity-building support. Depending on the BAU emission projections (South Africa provided a range of from 620 – 880 $MtCO_2e$ by 2020[35]), the pledge would result in an emission range from 400 to 580 $MtCO_2e$ in 2020. The national policies, that are part of our analysis, will reduce emissions to 550 to 690 $MtCO_2e$ in 2020.

The effectiveness of South African climate policy strongly depends on implementation issues. For example: in 2009, South Africa implemented a promising feed-in-tariff, with rates for wind energy that were larger than those offered in Germany and those proposed in Ontario, Canada. However, the tariff has had no impact on the renewable deployment so far due to political circumstances and infrastructure characteristics like lack of sophisticated power distribution lines.

The government has announced plans for a bidding process to replace the feed-in scheme, which should lead to 10,000 GWh generated by renewable sources in 2013. In addition, there is also a new installed capacity target of 17.8 GW renewable energy for 2030. Both targets would lead to a reduction of 8 to 35 $MtCO_2e$ in 2020. Our assessment assumes that the short-term target will not fully be reached due to the lack of support policies. For the final electricity mix, we used the latest version of the integrated resource plan[36], which assumes 24.5 GW cumulative capacity of installed renewables in 2030.

Greenhouse gas emissions for South Africa



Policies: Renewable target and respective support mechanism

[35] Republic of S Africa Department of Environmental Affairs. http://www.climateaction.org.za/cop17-cmp7/sa-government-position-on-climate-change

[36] http://www.energy.gov.za/IRP/irp%20files/IRP2010_2030_Final_Report_20110325.pdf

16 South Korea

The two evaluated policy measures will have a significant impact on South Korea's GHG emissions. Achieving the target will depend on the final design and implementation of the emission trading system, or implementation of other policies..

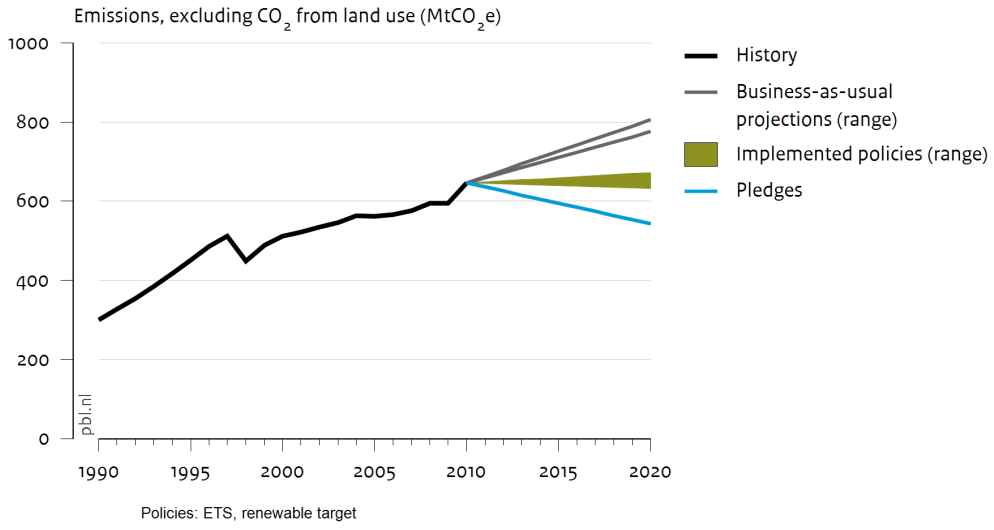
The BAUs used in the evaluation have 2020 emission levels ranging from 780[37] to 810 $MtCO_2e$, which compares to a pledged target emission level of 540 $MtCO_2e$.

South Korea introduced a "Target Management System" (TMS) in 2012, which is an instrument for preparing the national ETS system. Currently, 60% of total emissions are covered under the TMS.
The ETS scheme, which starts in 2015, will cover all installations in the industrial and power sectors with annual emissions higher than 25 $ktCO_2e$. The absolute emission cap of the ETS is expected to be in line with the international emission reduction pledge. However, it is not yet clear what percentage of total national emissions will be covered under the system, and therefore it is assumed to be the same as for the TMS.

Apart from the ETS scheme, South Korea has targeted a 6% renewable share in the primary energy mix for 2020 and 11% in 2030. The impact of this target, depending on the influence of other energy carriers, is between 30 and 50 $MtCO_2e$ by 2020, if fully implemented. We assume in the assessment that the share of nuclear will be the same as in 2009.

After full implementation of the above policies, the expected emission level is between 630 and 670 $MtCO_2e$ in 2020.

Greenhouse gas emissions for South Korea



[37] 2nd National communication of South Korea: http://unfccc.int/resource/docs/natc/prknc1.pdf

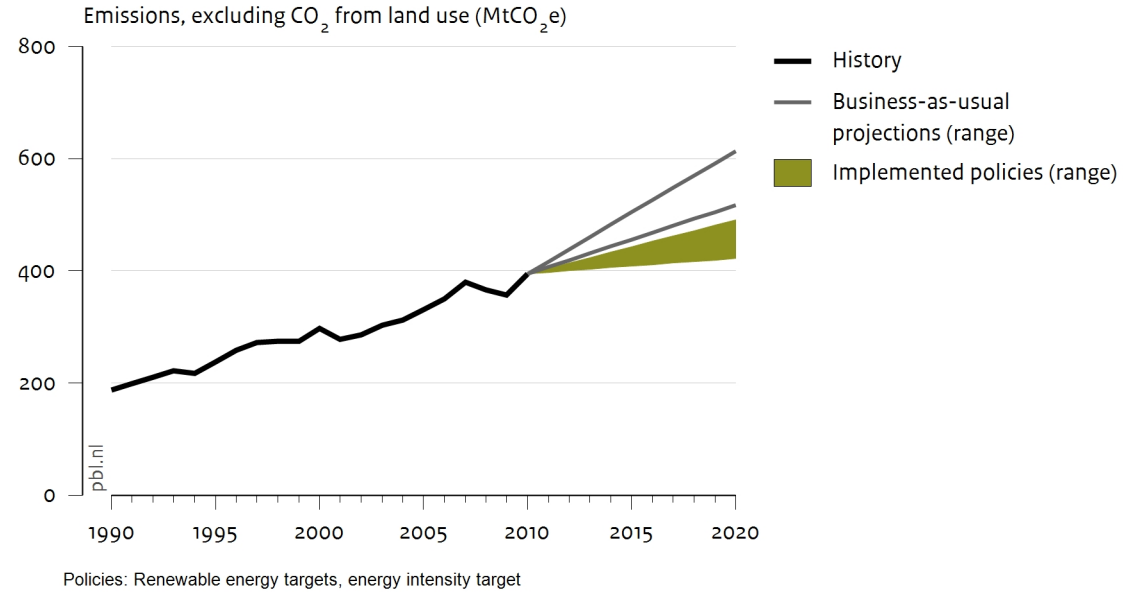
17 Turkey

Turkey does not have an emission reduction pledge. The policies assessed in this project will, if fully implemented, lead to an emission level of 420 to 490 $MtCO_2e$, compared to a BAU emission level between 510[38] and 610 $MtCO_2e$[39] in 2020.

The reduction is mainly driven by a renewable energy target. As part of the 2010 Energy Strategy Plan, Turkey plans to increase the renewable share of electricity generation to 30% in 2023. For the year 2020, this represents about 6% more renewables than under the assumed BAU development.

Further reductions are expected from the target to reduce primary energy intensity by 20%, as compared to the 2008 level, by 2023. This target is supported by the 2007 Energy Efficiency Law that established an institutional framework and allocated responsibilities, as well as by various programmes targeting different sectors. The actual emission reductions will depend on various factors such as GDP growth. If annual GDP growth is projected to be 5%, reductions are around 20 $MtCO_2e$ in the PBL calculations.

Greenhouse gas emissions for Turkey



Policies: Renewable energy targets, energy intensity target

[38] Results from PBL TIMER model
[39] According to most recent National Communication

18 Ukraine

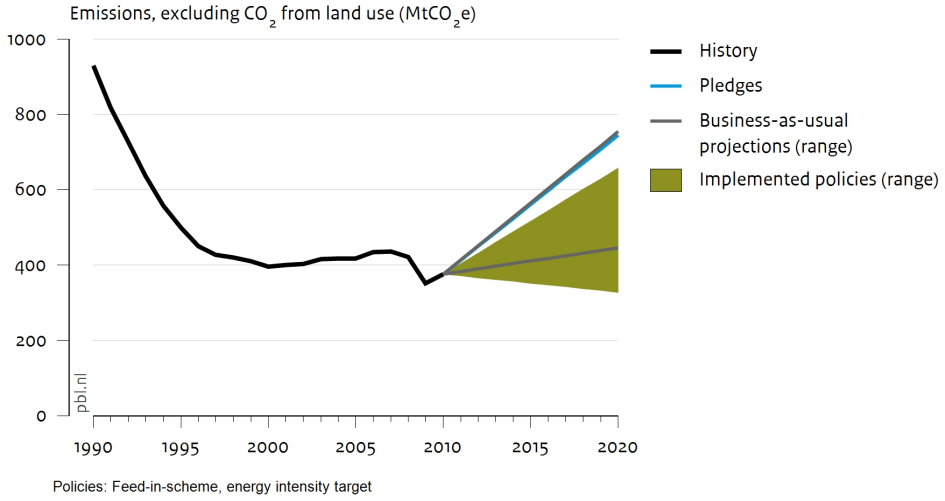
Ukraine's internationally pledged emission level of 745 $MtCO_2e$ for 2020 is on the upper limit of the BAU projections (446[40] to 755[41] $MtCO_2e$). The high end of the BAU range is taken from the 5th National Communication. This level would decrease to around 670 $MtCO_2e$ if more recent trends on demand policies and efficiency improvements would be used[42]. All implemented policies could reduce emissions to 350 to 650 $MtCO_2e$ by 2020, depending on emission in BAU.

In 2008, Ukraine introduced a feed-in-scheme with fixed prices, the so called "green" tariff for electricity. The green tariff also guarantees grid connectivity to all renewable power generated from the project. The feed-in tariffs are relatively high with 42c€/kWh for solar PV and 11 c€/kwh on average for wind. We expect that this leads to 8% renewable electricity in 2020, from 7.5% in 2009, which takes into account implementation barriers such as grid access.

Total installed capacity for PV in Ukraine was relatively low with only 3.2MW by the end of 2009. Moreover, all the solar power installed before 2009 is for private use and is not connected to the grid. Administrative and bureaucratic barriers coupled with political unrest are restricting growth of the industry.

In 2006, Ukraine introduced a target to decrease energy intensity by 50% below 2005 levels in 2030. This target will lead to low additional reductions, around 0 to 30 $MtCO_2e$ beyond BAU emissions, because emission intensity is relatively high in 2005 and therefore already a large decrease is achieved in the BAU.

Greenhouse gas emissions for Ukraine



Policies: Feed-in-scheme, energy intensity target

[40] PBL calculations
[41] 5th National Communication of Ukraine
[42] Ecofys calculations

19 United States

Current national climate policies in the USA will not be sufficient to decrease GHG emissions as pledged under the UNFCCC (17% below 2005 levels by 2020), unless accounting of land use and forestry would lead to significant additional reductions.

Official emission projections presented by the USA are now lower than previous estimates[43]. Major reasons include the economic crisis and structural developments in the energy market, leading to a shift from coal to natural gas, which is less emission intensive. These developments interact with policies that target more efficient use of energy, and therefore comparison with BAU development is not straightforward.

According to our assessment, which includes the most promising policies (fuel economy standard, 'New Source Performance Standard', energy efficiency programme 'Energy Star', state level renewable targets, the Californian emission trading system), the emission level with policies will result in the range of 6,3 $GtCO_2e$ to 6.5 $GtCO_2e$ in 2020 (excl. forestry emissions), which compares to a pledged emission target of 6.0 $GtCO_2e$. Including additionally planned policies such as a possible standard for existing power plants might get the US emission levels by 2020 closer to the pledge[44].

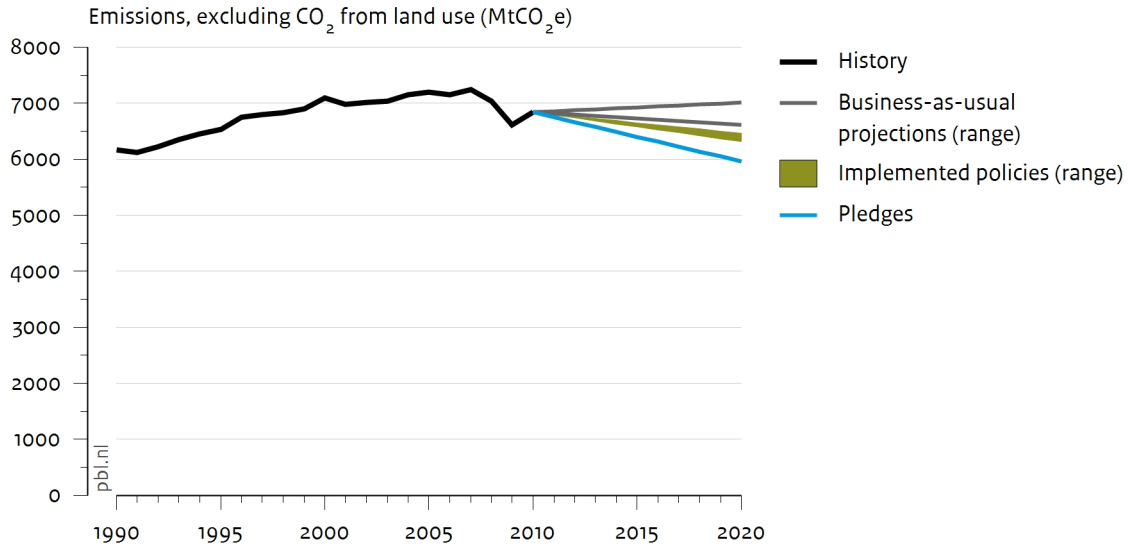
The fuel economy standard is divided in two phases, where the first phase starts in 2013 and the second phase in 2017. Out of all the recent policies examined, the second phase of the fuel economy standard is likely to have the largest overall impact in the long term, but has only limited impact by 2020, as it only affects new vehicles sold in 2017 and later. The first phase is already incorporated in the national BAU development.

The 'New Performance Standard,' which limits the emission intensity of new constructed power plants, will have hardly any effect on future emissions, according to our calculations and the US Environmental Protection Agency's own impact analysis[45]. This is because low gas prices already incentivise natural gas over coal fired power plants. Still, in the case of rising gas prices, the standard can "lock in" current emission projections of the power plant stock.

[43] https://unfccc.int/files/bodies/awg-lca/application/pdf/20120517_usa_0940.pdf

[45] EPA, 2012. Regulatory Impact Analysis for the Proposed Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electricity utility generating units

Greenhouse gas emissions for the USA



Policies: Power plant standards, car standards, state renewable portfolio standards, California ETS

Greenhouse gas emission reduction proposals and national climate policies of major economies

The Hague/Bilthoven, 2012

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Acknowledgements
The project was financed by the European Commission, Directorate General Climate Action, and the Dutch Ministry of Infrastructure and the Environment. This report has benefited from the comments of Ariane Labat and Tom van Ierland (European Commission, DG Clima), and Pieter Boot and Ton Manders (all PBL).

Graphics
Durk Nijdam (PBL)

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