

Greenhouse gas mitigation scenarios for major emitting countries

Supporting information on emission projections:
Update November 2016

DRAFT: DO NOT CITE

Project number
15032

© NewClimate Institute 2016



PBL Netherlands Environmental
Assessment Agency



Science for
Global Insight
www.iiasa.ac.at

Authors

Lead authors:

Takeshi Kuramochi, Niklas Höhne, Sofia Gonzales-Zuñiga, Frederic Hans, Sebastian Sterl, Markus Hagemann (NewClimate Institute)

Michel den Elzen, Mark Roelfsema, Heleen van Soest (PBL Netherlands Environmental Assessment Agency)

Nicklas Forsell, Olga Turkovska (IIASA)

Contributing authors:

Erika Hernandez Legaria (NewClimate Institute), Annemiek Admiraal (PBL), Petr Havlik (IIASA), Michael Obersteiner (IIASA)

Argentina

NDC

Argentina ratified the Paris Agreement on 21st of September 2016. Given that the country has not yet officially submitted its NDC to the UNFCCC, our analysis is based on the country's INDC presented in October, 2015. Argentina's INDC includes an unconditional target to reduce GHG emissions by 15% (including LULUCF) and a conditional 30% GHG reduction (including LULUCF) by 2030, compared to 2005 levels. The latter is conditional on international financial support and innovation & technology development. All sectors including LULUCF and six GHGs (CO₂, CH₄, N₂O, HFCs, PFCs, SF₆) are covered.

According to the official estimate that has been included in the INDC document, Argentina's INDC would equate to emissions levels of about 570 MtCO₂e by 2030 with its unconditional target and 469 MtCO₂e by 2030 if its conditional target is realised. The unconditional and conditional INDC translate to 5% above and 27% above 2010 levels, respectively.

The IIASA projections of the net LULUCF emissions for Argentina under the INDC is based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level of net emissions from Argentina's 3rd National Communication (Government of Argentina, 2015).

Current policies

The current policies projections were developed by NewClimate Institute (all sectors) and IIASA (LULUCF). GHG emissions in 2030 including LULUCF are projected to be about 610 MtCO₂e or 36% above 2010 levels. Argentina is not on track to meet its unconditional INDC.

NewClimate Institute calculations are based on its analysis for the Climate Action Tracker.¹ The current policies projection by NewClimate Institute are developed based on the BAU scenario from the 2015 National GHG Inventory Report, which uses 2012 as base year (Ministry of the Environment and Sustainable Development, 2015). In addition to the policies covered in the aforementioned BAU scenario, the GHG mitigation impacts of the following policies implemented in recent years were also quantified:

- Biofuels Law (2016, no.26093), which requires a minimum 12% of bioethanol blend in transport fuels;
- Renewable Energy Law No. 27191 (2015), which aims to increase the share of renewables (including hydro smaller than 50 MW) in total power generation to 20% by 2025.

Upon quantifying the impact of Renewable Energy Law no. 27191, there was lack of data on the share of hydro smaller than 50 MW. World Energy Council (2013) reports that the cumulative capacity of plants smaller than 30 MW is 377 MW (75 plants), while the total hydropower capacity is 10 GW. Based on this, we made a crude assumption that the current cumulative capacity of hydropower plants smaller than 50 MW is around 1 GW and accounts for 10% of total hydropower generation.

The current policies projection of LULUCF emissions and removals for Argentina was estimated by IIASA, based on updated G4M estimates, and were harmonized to the Argentina's 3rd National Communication (Government of Argentina, 2015).

¹ <http://climateactiontracker.org/countries/argentina.html> (accessed 3 November, 2016)

Australia

INDC

Australia intends to reduce GHG emissions by 26–28% from 2005 levels including land use, land use change and forestry (LULUCF) by 2030. Australia's target covers all sectors (energy, industrial processes and product use, agriculture, LULUCF, and waste) and gases (CO₂, CH₄, N₂O, HFCs, PFCs, SF₆ and NF₃).

The four modelling groups in UNEP (2015), including PBL and NewClimate (Admiraal et al., 2015, CAT, 2015), which estimated the INDC scenario in 2030 all agree on the impact of Australia's INDC on its emissions in 2030. As an official estimate is not available in Australia's INDC itself, an alternate official country-specific data source was used (Australian Government, 2015b). All studies demonstrate a significant difference between current policy trajectories and the INDC trajectory in 2030.

The IIASA projections of the net LULUCF emissions for Australia under the INDC were based on scenarios presented in Admiraal et al. (2015), and updated with harmonized historical level for 2010 of net emissions from Australia's 2014 GHG Inventory Submission to the UNFCCC.

Current policies

Under current policies, Australia's GHG emissions (including those from LULUCF) are estimated to be approximately 600 MtCO_{2e} by 2020 (7% to 8% above 2010 levels) and 595 to 695 MtCO_{2e} by 2030 (6% to 24% above 2010 levels). The projections by NewClimate Institute show increasing emissions through 2030, whereas the PBL projections show an emission peak in 2020 and declining emissions thereafter. PBL results for Australia are based on the calculations for the Oceania region (including Australia and New Zealand). It is assumed that Australia has a constant share of Oceania's regional emissions, based on the year 2010 (about 85%). Besides Australia, New Zealand is also located in this region and the current policies scenario includes The New Zealand Energy Strategy, which aims for a 90% share of renewable electricity by 2025. The current policies projections by NewClimate Institute are developed based on the Climate Action Tracker analysis.³ Future projections are based on Australian Government (2015b) for all emissions excluding LULUCF and Climate Change Authority (2014) for LULUCF emissions. Historical emissions are taken from the 2016 GHG inventory submissions to the UNFCCC (2016b), converted to SAR GWP terms by the Potsdam Institute for Climate Impact Research (PIK) for the Climate Action Tracker project. The government projections reflect currently implemented policies and measures, but do not consider the emissions reduction impact of the Emissions Reduction Fund (ERF).

The ERF⁴ is the main instrument in the Australian Direct Action plan and plays a major role in achieving the INDC target (Australian Government, 2015a). Since the start in 2015, two auctions were held resulting in 92 MtCO_{2e} committed reductions aggregated over the period 2015 and 2024 (average contract period observed for the first two auctions was around 9 years). Almost 95% of the reductions can be found in the AFOLU sector (including waste). The total committed funding is \$AUD 2.55 billion, and if the average auction price is assumed to apply for the remaining period until 2024, approximately 100 MtCO_{2e} aggregated reductions over the period 2015 to 2024 can be expected on top of current commitments. Therefore, the annual reductions in this period are estimated at 21.5 MtCO_{2e}. It is not clear yet to what extent the ERF is continued after this period. The ERF also includes the former Carbon Farming Initiative. Besides the ERF, Australia's Renewable Energy Target (RET) Scheme aims to achieve a 23.5% share of renewables in electricity production. Next to these two policies, Australia also introduced fuel taxes of \$AUD 0.3814 per litre, on gasoline and diesel. These taxes also apply to liquefied petroleum gas (LPG) and heating and process use, but this was not taken into account in our assessment.

The current policy projections of the net LULUCF emissions developed by IIASA, which supplements the PBL projections, are based on the forest harvest projection levels from the SSP2 database (Fricko et al., 2016), and harmonized for 2010 to historical level of net emissions from Australia's 2014 GHG Inventory Submission to the

² For the purpose of this report, greenhouse gas emissions (unless otherwise specified) are the sum of the basket of greenhouse gases listed in Annex A to the Kyoto Protocol, expressed as carbon dioxide equivalents assuming a 100-year global warming potential.

³ <http://climateactiontracker.org/countries/australia/2015.html> (accessed 3 November, 2016)

⁴ Details about the ERF are available at: <http://www.cleanenergyregulator.gov.au/ERF/Pages/default.aspx>

UNFCCC. Under current policies, net LULUCF emissions are projected to increase slightly over time. The increase in net emissions is mainly related to soil emissions from historical deforestation events. While the national deforestation rate is expected to slightly decrease over time, the reduction in emissions from deforestation is lower than the expected emissions from historically deforested areas.

DRAFT

Brazil

NDC

The Brazilian NDC establishes an absolute target relative to 2005, reducing GHG emissions by 37% in 2025 and indicating further reductions by 43% in 2030. These percentage reductions are relative to reported emissions of 2.1 GtCO₂e in 2005, corresponding respectively to emission levels of 1.3 GtCO₂e in 2025 and 1.2 GtCO₂e in 2030, using IPCC AR5 GWP-100. Brazil's NDC is economy-wide, covers all IPCC sectors and six gases (CO₂, CH₄, N₂O, HFCs, PFCs and SF₆), and is unconditional. Actions to achieve the targets focus mainly on the forest sector and on increasing the share of biofuels and renewable electricity in the Brazilian energy mix.

Modelling group estimates of UNEP (2015) (including NewClimate and PBL) of emission levels in 2025 and 2030 are similar to national estimates as they also used official NDC projections.

The NewClimate Institute estimates of emissions under the NDC are based on the Climate Action Tracker analysis.⁵

The IIASA projections of the net LULUCF emissions for Brazil under the NDC targets is based on scenarios presented in Admiraal et al. (2015), but has been updated since. The analysis is based on the recent REDD-PAC project report (REDD-PAC Brazil, 2015), which provides a BAU projection and a scenario with reduction measures for the LULUCF sector that are comparable with the Brazilian NDC submission. The LULUCF projections presented in the REDD-PAC project report has for this study been harmonized for the year 2010 net emissions reported in the Brazilian First Biennial Update Report submitted to the UNFCCC (UNFCCC, 2015a), taking into account the same pools and sources of emissions and sinks.

Current policies

Under current policies, Brazil is expected to reduce emissions by about 6% to 17% below 2010 levels, by 2020, thereby achieving its pledged emission level. Policies on the forestry sector have a significant impact on total emissions; in particular, the enforcement of the Brazilian Forest Code and efforts to reduce deforestation in the Amazon and Cerrado regions. The impact of the proposed measures outside of Amazon strongly depend on the success of policy enforcement. If all implemented policies are successful, emissions (including those from LULUCF) may reach 7% to 25% below 2010 levels by 2030.

The current policy projections by NewClimate Institute are based on Fekete et al. (2015) and the Climate Action Tracker analysis.⁵ The projections for energy-related emissions are based on IEA WEO 2015, which account for energy-related policy measures formally adopted as of mid-2015, and the projections for non-CO₂ emissions are based on US EPA (2012). The current policies projections of PBL are based on updated energy model calculations.

The IIASA current policy projection of net AFOLU emissions accounts for both land use and agriculture related policies, and is based on the REDD-PAC project report (REDD-PAC Brazil, 2015). The projection presented in the REDD-PAC project is based on full implementation of the Brazilian Forest Code, including rules such as the recovery of Legal Reserves (LR), Small Farm Amnesty (SFA), and Environment reserve quotas (CRA). These policies are expected to have a significant impact on future land use emissions in Brazil as of 2030. Projections presented in REDD-PAC Brazil (2015) estimate that the implementation of the Forest code could potentially reduce emissions by roughly 340 MtCO₂e by 2030. The current policy projection was harmonized to net AFOLU emissions in 2010 presented in the Brazilian First Biennial Update Report (UNFCCC, 2015a). The harmonization of projections to historical data from the Brazilian First Biennial Update Report is different from the approach used in Den Elzen et al. (2015), where projections were harmonized to historical data from FAOSTAT (FAO, 2014). It should be noted that there are large differences between the reported value for 2010 in FAOSTAT (788 MtCO₂e) and in the Brazilian First Biennial Update Report (402 MtCO₂e), related to differences in methods, pools and subcategories covered, as well as data being used.

⁵ <http://climateactiontracker.org/countries/brazil/2015.html> (accessed 3 November, 2016)

Canada

NDC

Canada submitted its NDC on the 5th of October, 2016. In the NDC, Canada proposes an economy-wide target to reduce its GHG emissions by 30% below 2005 levels in 2030. Canada's NDC is said to include all sectors and GHGs. However, there is some uncertainty on the treatment of LULUCF (Grassi and Dentener, 2015). Although the country declares its target to include all IPCC sectors (excluding emissions from natural disturbances), the LULUCF sector does not appear to be included in the base year (based on the information presented in the NDC). For that reason, it is possible that the LULUCF sector will be treated separately from the other sectors. The modelling groups that contributed to the UNEP INDC analysis largely agree on the impact of Canada's NDC on its emissions, with main difference arising from the land use credits assumptions. The NewClimate Institute emission levels after implementation of the NDC are based on the Climate Action Tracker analysis⁶ and assumes net-net accounting and 125 MtCO_{2e} land use credits by 2030, whereas PBL also assumes net-net accounting but no land-use credits. The result is a NDC emission range between 525 and 640 MtCO_{2e} or 8% to 25% below 2010 levels excluding LULUCF.

The IIASA projections of the net LULUCF emissions for Canada under the NDC target is based on scenarios presented in Admiraal et al. (2015), taking into account projections provided in the 6th National Communication to the UNFCCC. The LULUCF projections were harmonized for the year 2010 according to GHG inventory data for the same year presented in the 6th National Communication (Government of Canada, 2014) and taking into account that Canada does not include natural disturbances in the projections. The exclusion of natural disturbances has been done according to fixed estimates of 156 MtCO_{2e} from 1990 through 2005, and 255 MtCO_{2e} from 2005 onwards.

Current policies

Under current policies, Canada's GHG emissions are projected to be about 690 to 760 MtCO_{2e} by 2020 and 680 to 800 MtCO_{2e} by 2030 excluding LULUCF, which is lower compared to the 760 and 815 MtCO_{2e} by 2020 and 2030, respectively, projected in an official study (Government of Canada, 2014). Canada's policy with the largest projected effect is that on the fuel efficiency standard for passenger vehicles, which is harmonised with US standards and will be introduced in two phases. Another policy is the carbon standard for newly built coal-fired power plants. This standard is projected to have only a small effect on 2020 emission levels, as it does not affect existing power plants. Under current policies, Canada will not achieve its Copenhagen pledge of 610 MtCO_{2e} by 2020 (excluding land-use emissions).

The current policy projections by NewClimate Institute (excluding LULUCF) are based on the Climate Action Tracker analysis.⁶ The historical dataset is based on the Common Reporting Format (CRF) tables submitted to the UNFCCC. The projections up to 2020 were obtained from Canada's Emissions Trends report (Environment Canada, 2014) and the growth rates for 2020-2030 from Canada's Sixth National Report on Climate Change (Government of Canada, 2014) were then applied to project emissions up to 2030. The current policies projections of PBL are similar to den Elzen et al. (2015), but based on updated energy model calculations.

The current policy projection of net LULUCF emissions developed by IIASA is based on the forest harvest projection levels from the SSP2 database (Fricko et al., 2016), and harmonized to historical data sets as presented in Canada's 6th National Communication to the UNFCCC (Government of Canada, 2014). Under current policies, net LULUCF emissions are projected to remain stable until 2030, this in part because the projections do not consider emissions associated with natural disturbances in line with Canada's decision to exclude natural disturbances in LULUCF accounting. Natural disturbances were excluded from the current policy projections based on the same approach as for the IIASA NDC LULUCF projection.

⁶ <http://climateactiontracker.org/countries/canada/2015.html> (accessed 3 November, 2016)

Chile

INDC

Chile submitted its Intended Nationally Determined Contribution (INDC) on 29 September, 2015 (Government of Chile, 2015). It includes two emission mitigation targets for 2030, which cover all emissions from all sectors except for LULUCF. The unconditional target is a GHG emissions-intensity (tCO_{2e}/GDP) reduction target of 30% below 2007 levels by 2030. The conditional target is 35% to 45% reduction of GHG emission intensity, subject to international financial support in the form of grants: “An international monetary grant shall be deemed any grants which allow to implement actions having direct effects on greenhouse gas emissions within adequate time frames.”

For the LULUCF sector, Chile has committed to the sustainable development and recovery of 100,000 hectares of forest land, which will account for GHG sequestrations and reductions of around 0.6 MtCO₂ in 2030. This commitment is subject to the approval of the Native Forest Recovery and Forestry Promotion Law. Moreover, Chile has agreed to reforest 100,000 ha, which will lead to sequestrations of about 0.9–1.2 MtCO₂/year in 2030, conditioned to the extension of Decree Law 701 and approval of a new Forestry Promotion Law.

The GHG emission levels in 2030 under Chile’s INDC estimated by NewClimate Institute are based on its analysis for the Climate Action Tracker.⁷ It is estimated that the GHG emissions excluding LULUCF will increase from 92 MtCO_{2e} in 2010 to 162 MtCO_{2e} by 2030 under the unconditional INDC and to 127 MtCO_{2e} under the conditional INDC.

The IIASA projections of the net LULUCF emissions for Chile under the INDC target projects an increase in net sequestration within the land use sector by roughly 4 MtCO_{2e} from 2010 until 2030, mainly related to increasing forest area and reduction of deforestation. The calculations are based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level of net emissions in 2010 from the 2014 national GHG inventory report (Ministerio del Medio Ambiente, 2014).

Current policies

Current policies pathways for Chile excluding LULUCF are calculated by NewClimate Institute and are based on its analysis for the Climate Action Tracker.⁷ The latest historical data up to 2010 from the National Inventory report were used (Ministerio del Medio Ambiente, 2014). For GHG emissions projections up to 2030, the scenario “Energías Renovables No Convencionales” from the MAPS Chile Project (2014) was used, which incorporates all measures that include non-conventional renewable energy targets, considering solar, geothermal, wind power, biomass and small hydroelectric plants. The scenario was adapted, subtracting the estimated impact of the adopted carbon tax of 5 USD/tCO₂, starting from 2017, according to Law 20780 (5 MtCO_{2e} reduction).

One of the most significant implemented policies is the Non-Conventional Renewable Energy Law (NCRE) Law 20698, which aims to achieve a 20% renewable energy target in 2025 by committing 45% of the installed capacity between 2014-2025 to come from non-conventional renewable energy sources. Another key policy is the Energy Efficiency Action Plan, which aims for a 12% reduction of the final energy demand below BAU by 2020.

Under current policies, NewClimate Institute estimates a 10% GHG emissions reduction by 2030 below 2007 levels, i.e. 161 MtCO_{2e}, excl. LULUCF.

The IIASA current policy projections of net LULUCF emissions sees a relatively stable development of the net emissions over time. The current policy projection of LULUCF emissions and removals have been estimated by IIASA based on updated G4M estimates and harmonized to the 2014 national GHG inventory report (Ministerio del Medio Ambiente, 2014). Under current policies, it is projects that the net LULUCF sink would increase by roughly 8 MtCO_{2e} from 2010 until 2030, mainly driven by an increased carbon uptake from afforestation efforts. The current policy scenario includes the National Forest and Climate Change Strategy as well as National

⁷ <http://climateactiontracker.org/countries/chile.html> (accessed 3 November, 2016)

Reforestation programs, which jointly are expected to increase the annual afforestation rate as well as a build-up of the forest carbon stock over time.

Policies such as the National Strategy on Forest and Climate Change (2013) aim to link Chile's forestry initiatives with the existing carbon market, specifically through the generation and commercialization of emission reduction certificates (carbon credits) and, at the same time, to attract foreign investment and financial support for the reforestation and forest protection activities through the REDD+ mechanisms. However, these policies are currently not accounted for in the current policy scenario due to undefined measures and to the vague wording of the law, which gives room to forest agents to take advantage of loopholes in the law.

DRAFT

China

INDC

On 30 June, 2015, China submitted its INDC to the UNFCCC secretariat. It includes an intention to peak CO₂ emissions around 2030, making best efforts to peak earlier, to reduce the carbon intensity of GDP by 60-65% from 2005 levels by 2030, to increase the share of non-fossil fuels in primary energy consumption to around 20% by 2030, and to increase the forest stock volume by around 4.5 billion m³ from 2005 levels by 2030. Although China's INDC is framed in terms of CO₂, the discussion text also implies action on other gases. China's INDC also includes a comprehensive list of actions. The GHG targets cover CO₂, but the sectors to which the targets apply are not specified.

The studies assessed in UNEP (2015), including the PBL and NewClimate estimates, give a wide range of potential impacts of China's INDC on national emissions (varying from 12.8-15.2 GtCO₂e by 2030), from different assumptions on GDP growth rate, different base year data (varying from 9.1-11.3 GtCO₂e) and different estimates on emissions other than CO₂ emissions from the energy sector (and cement), etc. The higher estimates of LSE, CROADS and Climate Advisers in UNEP (2015) are based on the INDC intensity target calculations only, and are therefore excluded here.

An official estimate is not available, but two national estimates for CO₂ emissions from the energy sector (and cement) are available from NCSC (Sha et al., 2015) and updated calculations from Energy Research Institute (ERI) (Jiang et al., 2013). Three studies (Climate Action Tracker, IEA and PBL) that estimated both China's current policy trajectory and the INDC scenario, demonstrate a further reduction from current policy trajectories to the INDC in 2030 (den Elzen et al., 2016). Only NCSC's estimate of 15.2 GtCO₂e adjusts for the effect of including energy statistics from the 2014 economic census, which leads to a much higher estimate for China's CO₂ emission in 2030 (around 1 GtCO₂e higher than the pre-adjustment estimate) (Sha et al., 2015). A study of LSE (Green and Stern, 2016), taking into account recent changes in China's economy and energy system, concludes that energy CO₂ emissions are likely to peak before 2025.

The NewClimate Institute estimates on the emission levels under the INDC are based on its analysis for the Climate Action Tracker analysis.⁸

The IIASA projections of the net LULUCF emissions for China under the INDC expects an increase in the sequestration of carbon from the land use sector, and are based on scenarios presented in Admiraal et al. (2015). China's INDC states that the forest stock in China will be increased, and the mitigation potential of these policies is estimated by IIASA at about 165 MtCO₂e in 2030, compared to 2005 levels (den Elzen et al., 2016). For comparison, JRC (Grassi and Dentener, 2015) estimated the mitigation potential to be about 250 MtCO₂e in 2030.

Current policies

National policies from China's 12th Five-Year Plan (FYP) and 12th FYP for Renewable Development are projected to lead to approximately the same emission levels as would be required to achieve the pledge for 2020 (11.9 – 13.6 GtCO₂e, about 17% – 34% above 2010 levels). The expected emission levels under current policies strongly depend on future economic growth and will range around 13.4 – 14.5 GtCO₂e by 2030 (including LULUCF), which is about 32% to 43% above the 2010 level. The emission targets of China's pledge and its national policies are coupled to GDP, implying that the absolute emission target is very uncertain.

The current policy projections by NewClimate Institute are based on Fekete et al. (2015) and its analysis for the Climate Action Tracker.⁸ Energy-related CO₂ emissions projections are largely based on the Current Policies Scenario of the IEA WEO 2015 (IEA, 2015c), which takes into account the energy-related policy measures formally adopted as of mid-2015 as well as the cap on coal consumption set for 2020. The projections for non-CO₂ emissions are based on US EPA (2012). China has committed to strengthen its efforts to reduce HFC emissions (White House, 2014), but this is not taken into account in our current policy projections.

Both PBL and NewClimate calculations were supplemented with the IIASA projections on LULUCF emissions. The LULUCF current policy projections by IIASA have been harmonized to the 2nd National Communication (The

⁸ <http://climateactiontracker.org/countries/china.html> (accessed 3 November, 2016)

People's Republic of China, 2012) estimates of net LULUCF emissions in 2005 and are based on land use and forestry related policies, particularly afforestation measures and the development of tree plantations. However, current policies to promote afforestation and increase of the forest stock volumes are projected to only lead to relatively minor net emission savings by 2030 as policy targets are expected to already be achieved within current implemented policies.

The current policies projections of PBL are similar to den Elzen et al. (2015), and based on updated energy model calculations. Industry and building policies were not implemented in the PBL TIMER model.

DRAFT

Colombia

INDC

Colombia submitted its Intended Nationally Determined Contribution (INDC) on the 7th of September 2015. The unconditional target is to reduce its GHG emissions by 20% from BAU level by 2030, and the conditional target commits to raise the target level to a 30% reduction below BAU level, subject to provision of international support.

The coverage of the LULUCF sector is unclear. On the one hand, the INDC document explains that the AFOLU (agriculture, forestry and other land uses) sector is included in the targets. On the other hand, it also explains that the estimation of BAU emissions includes carbon emissions and removals from forest plantations and permanent crops but excludes removals from natural forests that remain as natural forests, which is a very large net sink of 263 MtCO_{2e}/yr in 2010 (IDEAM et al., 2015).

Colombia's BAU emissions pathway from 2010 represents a level of 278 MtCO_{2e} by 2020 and 335 MtCO_{2e} by 2030. Therefore, the unconditional and conditional targets translate to 235 MtCO_{2e} and 268 MtCO_{2e} in 2030, respectively, including carbon emission and removals from forest plantations and permanent crops.

The IIASA projections of the net LULUCF emissions for Colombia under the INDC target is based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level of net emissions from Colombia's 1st Biennial Update Report (IDEAM et al., 2015).

Current policies

The current policies projection estimates a range of 290 to 325 MtCO_{2e}/yr in 2030, or 29 to 45% below 2010 levels. The results indicate that Colombia will not yet achieve its unconditional INDC target (268 MtCO_{2e}/yr in 2030) with existing policies. This is largely attributable to the expected reduction of net LULUCF emissions. When LULUCF is excluded, the current policy projection is roughly on track to meet the unconditional INDC.

NewClimate Institute estimated the current policies projection for other sectors. Calculations were based on the historical emissions data reported in the 1st Biennial Update Report (IDEAM et al., 2015), and future emissions were based on a list of mitigation measures proposed by Universidad de los Andes,⁹ which the MAPS Colombia Project cited upon formulating Colombia's INDC. The list considered mitigation measures that are aligned with the National Development Plan and that are currently planned for each sector. For the INDC formulation, 71 mitigation measures were evaluated (55 with negative cost-efficiency and 15 with specific mitigation cost below 20 USD/tCO_{2e}). Among these, a more restrictive scenario proposed by MAPS Colombia Project did not consider measures that are deemed not viable by governmental institutions or sectoral unions, resulting in 58 mitigation measures (46 with negative cost-efficiency and 12 with specific mitigation cost below 10 USD/tCO_{2e}). From this second scenario, our current policies projection considered the measures scored with a 5/5 and 4/5, which indicate high probability of being implemented and high probability of achieving the intended mitigation levels. Moreover, only the measures planned to be implemented either by the end of 2016 or already implemented were considered. The upper end projection included 5 measures with 5/5 score and the lower end projection also included 8 additional measures with 4/5 score. The total GHG reductions in 2030 for the two projections amounted up to 9 MtCO_{2e}/yr and 45 MtCO_{2e}/yr, respectively. It should be noted that the aforementioned mitigation measures are not directly linked to implemented policies.

The current policies projection of LULUCF emissions and removals for Colombia as developed by IIASA is based on updated G4M estimates that have been harmonized to historical data sets as presented in Colombia's 1st Biennial Update Report (IDEAM et al., 2015). The projections include not only carbon emissions and removals from forest plantations and permanent crops but also removals from natural forests that remain as natural forests. The current policy projection sees a decrease of the net LULUCF emissions over time, mainly driven by efforts to reduce the annual deforestation rate, as well as reforestation of forest areas that previously have been deforested. The current policy projection includes the National Development Plan of Colombia, which aims to reduce the yearly deforestation rate from 121.000 ha/year in 2013, to 90.000 ha/year by 2018. This expected

⁹

https://www.minambiente.gov.co/images/cambioclimatico/pdf/colombia_hacia_la_COP21/Fichas_portafolio_meditadas.pdf (accessed 20 July, 2016)

reduction of the yearly deforestation rate is achieved as of the current policy projection, while on the other hand, the target of zero net deforestation by 2020 as of the Amazing Vision Program is not accounted for. The Amazing Vision Program was adopted as of 2016 but it is still uncertain how the target of zero net deforestation by 2020 would be achieved. Therefore, the policy is not included in the IIASA current policy scenario. Still, it is projected that under the Current Policy scenario for Colombia, the net LULUCF sink would be enhanced by as much as 48 MtCO_{2e} by 2030 as compared to levels in 2010. If such as on decrease of emissions and increase of sinks within the land use sector would be achieved, the land use sector would provide a net sink as of 2030 in the range of 311 MtCO_{2e}.

DRAFT

Democratic Republic of the Congo

INDC

The Democratic Republic of Congo submitted its INDC on the 18th of August, 2015, which aims to reduce its GHG emissions (including LULUCF) by 17% below BAU by 2030. The targeted GHG emissions reduction corresponds to 73 MtCO_{2e} in 2030 including LULUCF compared to a BAU scenario. The country's target is conditional on international financial support of USD 12.5 billion. In the emission trajectories depicted in the INDC document, LULUCF emissions, which represent over 80% of the country's emissions, would increase from 190 MtCO_{2e} in 2010 to 300 MtCO_{2e} in 2030. The INDC states that the reduction in LULUCF emissions for reaching the INDC target will mainly be achieved through afforestation and reforestation measures.

Current policies

Due to the lack of data, the current policies projection for the non-LULUCF emissions assumes that the emission growth rate observed between 1990 and 2010 will continue up to 2030. The current policy projection for the LULUCF sector is developed by IIASA, based on the recent REDD-PAC project report for the Democratic Republic of Congo (REDD-PAC DRC, 2016). In that report, the GLOBIOM model was applied to provide a BAU projection taking into account current forestry and agriculture policies that have been implemented and legislated within the country. One of the policies with the largest impact on the projections of net LULUCF emissions is the enforcement of protected areas and prohibiting the expansion of agriculture into forest concessions.

After the harmonisation with the historical emissions data of FAO (2014), LULUCF emissions are projected to increase from 169 MtCO_{2e} in 2010 to 384 MtCO_{2e} in 2030. This means the Democratic Republic of the Congo is currently not on track to achieve its INDC in the LULUCF sector.

The historical emissions data were taken from the WRI CAIT database (WRI, 2015), with the LULUCF emission data originally from FAO (2014).

Ethiopia

INDC

Ethiopia submitted its INDC to the UNFCCC secretariat on the 10th of June 2015 (Government of Ethiopia, 2015). The country aims to limit its GHG emissions including LULUCF to 145 MtCO_{2e} or lower by 2030. This constitutes a total reduction of at least 255 MtCO_{2e} or 64% compared to the 'business-as-usual' (BAU) scenario projection. Excluding LULUCF, the targeted emission level is 40% below BAU or 185 MtCO_{2e}. The INDC implementation is partially conditional on the support of an unspecified combination of domestic and international financial resources.

The IIASA projections of the net LULUCF emissions for Ethiopia under the INDC target is based on scenarios presented in Admiraal et al. (2015), with an updated harmonization using the 2010 emission estimate by the 2nd National Communication (SNC). The INDC projections are based on the projections included in the INDC, which directly provides LULUCF emission projections up to 2030 for the INDC scenario. The mitigation measures proposed by the Ethiopian government include protection of forest areas, re-establishment of forests, and an increase of carbon stocks.

Current policies

The current policies projections were calculated by IIASA for the LULUCF sector and by NewClimate Institute for other sectors. The results show that Ethiopia is likely to emit 254 MtCO_{2e} excluding LULUCF and 309 MtCO_{2e} including LULUCF in 2030. This means that the country would need to strengthen its mitigation effort to achieve its INDC, especially in the LULUCF sector where the gap is particularly large. The emission gap is estimated to be 70 MtCO_{2e} excluding LULUCF and 164 MtCO_{2e} including LULUCF.

The current policies projections excluding LULUCF are significantly lower than the BAU scenario in the INDC document (310 MtCO_{2e} in 2030) because of the differences in the historical emissions data used as well as the downward revision of the BAU emission growth projection in Ethiopia's Second National Communication (Federal Democratic Republic of Ethiopia, 2015).

NewClimate Institute calculations are based on its analysis for the Climate Action Tracker.¹⁰ The projection for non-LULUCF sectors is developed based on the BAU scenario reported in the SNC. It is not clear from the SNC which existing or planned policy measures are considered in the BAU scenario, but the SNC notes that "the exponential growth of emissions will resume from 2018" without focused implementation of policies. By contrast, the other scenario presented in the SNC, i.e. "CRGE scenario", assumes full implementation of the Climate Resilience and Green Economy Strategy (CRGE), which identifies and prioritizes more than 60 potential climate change mitigation and adaptation initiatives until 2030 (Federal Democratic Republic of Ethiopia, 2011). In this analysis, NewClimate Institute assumed that most of the currently implemented policies are taken into account in the "BAU scenario", although to varying extent. This means that most of the measures implemented under the Growth and Transformation Plan (GTP) phase I (2010-2015), which defines Ethiopia's medium term strategic framework for the five-year period and also includes some initiatives under the CRGE (Federal Democratic Republic of Ethiopia, 2010), are considered in our analysis. The GTP I also encompasses the National Biogas Programme (NBP) (Ethiopia Rural Energy Development and Promotion Centre (EREDPC), 2007) and the Scaling-Up Renewable Energy Program for Ethiopia (SREP) (Federal Democratic Republic of Ethiopia - Ministry of Water and Energy, 2012), but these are not considered in our analysis, as the SNC suggests there is no project plan beyond the stage of a feasibility study. Intra-Urban Electric Rail NAMA is also excluded due to its uncertain development status.¹¹

A second phase of the GTP (GTP II) defines the medium-term strategic framework for the five-year period between 2016 to 2020. Published in May 2016, the GTP II aims for the full implementation of Climate Resilience

¹⁰ <http://climateactiontracker.org/countries/ethiopia.html> (accessed 3 November, 2016)

¹¹ As of 13th of July 2016, the UNFCCC NAMA database only lists an Ethiopia's National Railway Network and Addis Ababa Light Rail Transit (LRT) NAMA under 'NAMA for recognition' comprising both the extension of the national railway network as well as the construction of the Light Rail Transit (LRT) system in Addis Ababa. Source: <http://www4.unfccc.int/sites/nama/layouts/un/fccc/nama/NamaForRecognition.aspx?ID=108&viewOnly=1> (accessed 13 July, 2016)

and Green Economy Strategy (CRGE) until 2025 (Federal Democratic Republic of Ethiopia, 2016). However, the GTP II neither specifies on the basis of which specific policies the full implementation of the CRGE shall be achieved until 2025 nor on how international funding will contribute to its full implementation, in particular the additional reduction of 147 MtCO_{2e} until 2025 (Federal Democratic Republic of Ethiopia, 2016, page 212). For this reason, the GTP II is not included in the present current policy scenario of Ethiopia, but the process will be closely followed and the CRGE's implementation regularly revisited.

For the LULUCF sector, the IIASA current policy scenario development of the net LULUCF emissions considers full implementation of the Comprehensive Mitigation Analysis Program as well as the Afforestation and Reforestation actions. However, it is uncertain to what extent these measures will be fulfilled and the scenario only assumes that the target of 7 million hectares of afforestation and reforestation will be met by 2040.

The historical dataset is based on the UNFCCC GHG inventory data for 1990 and 1994 and the GHG inventory provided in the SNC for 1994-2013. CO₂ equivalent emissions of CH₄ and N₂O were recalculated with the Global Warming Potentials (GWPs) of the IPCC 2nd Assessment Report (SAR). For the current policies projection, emission growth rates between 2010 and 2030 projected in the BAU scenario of the SNC were applied to the 2010 historical data in a first step to account for AR4 GWP values used in the BAU projections. In a second step, linear interpolation is applied between the last inventory emission data for 2013 and the harmonized baseline projections for 2020 as well as the harmonized emission data between 2020-2025 and 2027-2029. F-gases are only partially reported and their contribution is negligibly small. As a consequence, F-gases are not included in the reported historical emissions for 1994-2013.

India

INDC

India submitted its INDC for the period 2021 to 2030 on 1 October, 2015. It included the following intentions: “[...] to put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation; to adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development; to reduce the emissions intensity of its GDP by 33 to 35% by 2030 from 2005 level; to achieve about 40% cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF); to create an additional carbon sink of 2.5 to 3 GtCO_{2e} through additional forest and tree cover by 2030” (UNFCCC, 2015b). The sectors and gases covered by the intensity target are not specified.

An official estimate of emissions under the INDC is not available. National estimates for CO₂ emissions from the energy sector (and cement) are available from Dubash et al. (2014), which are not included here. From Damassa et al. (2015), there are national ‘all GHG’ projections including land-use for India based on a relatively large range of GDP assumptions (6.3-7.4% average GDP growth for the period 2005-2030), resulting in emissions of 5.7-7.5 GtCO_{2e} in 2030.

NewClimate Institute, PBL and IIASA estimate that the emission levels under the Cancun Pledge for 2020 (reduction of emissions intensity per GDP by 20–25% compared to 2005 levels) and the INDC to be between 3.3 to 4.1 GtCO_{2e} by 2020 and 4.2 to 6.7 GtCO_{2e} in 2030 including LULUCF. The large range in estimates is mainly due to the large uncertainty on future GDP growth rates.

The NewClimate Institute estimates on the emissions under the INDC are based on the Climate Action Tracker analysis.¹² The estimation assumes a 7.2% GDP growth per year in real terms as in IEA WEO2015 for both the targets and current policy projections.

PBL assumes the CO₂ intensity target to apply to total GHG emissions excluding AFOLU, and if adding non-mitigated AFOLU emissions, this could lead to projected GHG emission levels of 5.8 - 6.7 GtCO_{2e}. If the intensity target is assumed to apply to total GHG emissions excluding LULUCF, the range would increase to 7.0 GtCO_{2e}, but this is not included in the results. The range in INDC projections is based on GDP growth rates taken from the IEA World Energy Outlook (WEO) 2014 (IEA, 2014) and the SSP2 database (2015), which is respectively 6.4% and 7.4% annual growth between 2005 and 2030. The Planning Commission (2014) from India assumes an annual growth equal to the IEA WEO 2014. The upper-end of the emission range based on the intensity target is used as maximum PBL estimate. As minimum estimate, we used the combined effect of emission intensity targets, non-fossil targets and afforestation targets. These were calculated using the PBL TIMER energy model. Based on these calculations, greenhouse gas emissions in 2030 (including LULUCF) are projected at 4.2 GtCO_{2e} for India.

The IIASA projections of the net LULUCF emissions for India under the INDC is based on the scenarios presented in Admiraal et al. (2015) and are in-line with statement concerning the land use sequestration potential in India within The Planning Commission (2014). Projections have furthermore been harmonized to historical levels of net emissions from India’s 2nd National Communication.

Current policies

Under current policies, the latest calculations by PBL and NewClimate Institute estimate India’s emissions (incl. LULUCF) to be between 3.3 and 4.0 GtCO_{2e} by 2020 (42 to 70% above 2010 levels) and 4.6 to 5.8 GtCO_{2e} by 2030 (97% to 148% above 2010 levels). For 2020, we project that India is likely to achieve its pledge, with policies consisting of renewable energy targets and the market-based mechanism Perform Achieve and Trade (PAT) scheme for energy efficiency. Also for 2030, India is roughly on track to achieve its INDC but it is not possible to make definitive conclusions because emission projections for current policies also highly depend on future economic growth.

¹² <http://climateactiontracker.org/countries/india/2015.html> (accessed 3 November, 2016)

For the PAT scheme, the PBL projections took into account the impacts expected in the post-2015 Cycle II period in current policy projections, while the NewClimate Institute projections only considers the first Cycle which ended in 2015.

For renewables, The Indian government has recently revised its solar PV deployment target from 20GW in 2022 to 100GW in 2022 (Government of India, 2015). It is, however, difficult to assess whether the existing support schemes are sufficient to achieve the revised target. Therefore, we reviewed the recently published forecasts to estimate the total solar PV capacity up to 2030. From Table 1, we conclude that under current policies, the total solar PV capacity would reach 30GW by 2020 and then increase by 5GW on average up to 2030, resulting in 80GW installed in 2030. This is a conservative assumption compared to the government target, but is significantly more ambitious than the projections made in the Current Policies Scenario of the IEA WEO 2015 (IEA 2015).

Table 1 Short-term forecasts for solar PV deployment in India.

Reference	Total capacity forecast	Annual installation rate and other information
Bridge to India (2015)	31GW in 2019	Annual installation: 2016: 3.92GW, 2017: 4.85GW, 2018: 6GW, 2019: 6.9GW
Deutsche Bank (2015)	34GW in 2020	"In the short term, India will likely add 3-5GW per annum (5-9% of global market) from the existing 1GW market size. It is expected to continue to grow at a healthy pace (...)" (p.7)
Institute for Energy Economics and Financial Analysis (2015)	75GW by 2021-22	"IEEFA notes how China stepped up solar installs from 2GW in 2011 to 5GW in 2012 to 13GW in 2013, and then raised it higher national target further, to 17.8GW in 2015, with 5GW installed in 1Q2015 alone. A rapid ramp-up in India over several years is just as feasible." (p.12)
Mercom Capital Group (2016)	About 43 GW in 2020	Annual installation: 2016: 4.054GW, 2017: 8.178GW, 2018: 8.97GW, 2019: 9.5GW, 2020: 10.5GW
Ministry of New & Renewable Energy ¹³	Around 19GW by March 2017	Annual installation: FY2015-16: 4.3GW, FY2016-17: 10.8GW
World Energy Outlook 2015 (IEA, 2015c)	Current Policies Scenario: 15GW in 2020, 50GW in 2030 New Policies Scenario: 28GW in 2020, 100GW in 2030	(WEO 2015 CPS is used as the basis for NewClimate Institute calculations)

The current policy projections by NewClimate Institute including LULUCF are based on Fekete et al. (2015) and the Climate Action Tracker analysis.¹² The projections for energy-related CO₂ emissions are largely based on the Current Policies Scenario of the IEA WEO 2015 (IEA, 2015c), which takes account of energy-related policy measures formally adopted as of mid-2015, with additional calculations performed to account for the recent renewable energy developments described above. LULUCF emission projections are based on Planning Commission (Planning Commission Government of India, 2014). The current policies projections of PBL are similar to Den Elzen et al. (2015), and based on updated energy model calculations.

PBL calculations were supplemented with the IIASA projections on LULUCF emissions. The IIASA current policy projections of LULUCF emissions and removals are similar to Den Elzen et al. (2015) and based on updated G4M estimates taking into account FAO FRA (2015), 2015, data of historical deforestation trends. Current policy targets for increased national forest area are achieved through afforestation efforts, reaching the targeted 5 million hectares by 2030. The projections of net LULUCF emissions have also been harmonized to the 2nd National Communication estimates of historical net LULUCF emissions to provide a consistent starting point with national projections.

¹³ <http://solarlove.org/india-likely-add-10-8-gw-solar-power-capacity-2016-17/> (accessed 25 April, 2016)

Indonesia

INDC

Indonesia's INDC states that the country "[...] has committed to reduce unconditionally 26% of its greenhouse gases against the business as usual scenario by the year 2020. Indonesia is committed to reducing emissions by 29% compared to the business as usual (BAU) scenario by 2030". Furthermore, "Indonesia's target should encourage support from international cooperation, which is expected to help Indonesia to increase its contribution up to 41% reduction in emissions by 2030" (UNFCCC, 2015b). Indonesia defines its baseline emissions as 2,881 GtCO_{2e} in 2030; the emission targets can be derived from this baseline using the reduction targets. The INDC covers all sectors and CO₂, CH₄, and N₂O.

The NewClimate Institute estimates on the emissions under the INDC are based on its analysis for the Climate Action Tracker.¹⁴

The IIASA projection of the net LULUCF emissions for Indonesia under the INDC is based on the scenarios presented in BAPPENAS (2015) and described in Admiraal et al. (2015). The projection includes emissions related to peat fires and peat oxidation from deforestation, and has for this work been harmonized with historical estimates of 2010 net emissions using the 2010 GHG inventory data for the same year.

Current policies

A significant share of Indonesia's emissions originates in the forestry and land use sector, due to deforestation, peatland destruction, and land-use change. At the same time, there is a large uncertainty in LULUCF emissions, particularly related to peat oxidations (not including peat fires), which can be in the order of 30% to 50% of total LULUCF emissions. Uncertainty concerning emissions from peat fires is also high and it is well known that these emissions vary significantly between years. This has made it difficult to develop emission projections for Indonesia and to assess whether the 2020 pledge and 2030 INDCs are expected to be achieved with current policies. As a result, Indonesia's emission reductions resulting from the policies assessed in our analysis are projected to be smaller than the uncertain amount of emissions from land-use changes and forestry. Therefore, emission projections that assume the implementation of these policies are mainly illustrative. Successful implementation of policies to reduce deforestation and forest degradation can lead to significant emission reductions. If all implemented policies are successful, Indonesia would reduce emissions from LULUCF (including peat oxidation from deforestation, but excluding peat fires) by 51% below 2010 levels by 2030. For the energy sector, the renewable energy and biofuel targets set for 2025 are projected to lead to emission reductions, compared to BAU projections; however, emissions are still projected to increase further.

Overall, current policies are projected to lead to total GHG emission levels (including LULUCF) of 2% below to 8% above 2010 levels by 2020, and 7% to 40% above 2010 levels by 2030.

The current policies projections by NewClimate Institute including LULUCF are calculated based on several sources. Energy-related CO₂ emissions are projected by combining the UNFCCC inventory data up to 2000, historical growth rates observed for 2000-2012 estimated from the 1st Biennial Update Report (Republic of Indonesia, 2015) and future projections up to 2030 from the IEA World Energy Outlook Special Report on South East Asia (IEA, 2015b). LULUCF emission projections are assumed to be consistent with Indonesia's official BAU from the National Action Plan on Greenhouse Gases Emission Reduction (Government of Indonesia, 2011). LULUCF emissions are based on the BAU projection from Sekretariat RAN-GRK (2015).

PBL calculations were supplemented with IIASA projections on LULUCF emissions. The LULUCF current policy projections by IIASA take into account reduction of deforestation driven by implementation of the Forest Law Enforcement National Strategy (FLENS).

Illegal logging is one of the major sources of GHG emissions in Indonesia. The country has made efforts to control the problem through national law enforcement and trade-based measures such as FLEGT-VPA. Although only a fraction of the volumes logged illegally are likely to be curbed, FLENS and FLEGT-VPA policies are still estimated to have a notable impact on reducing CO₂ emissions by 2030, ranging from 70 MtCO_{2e} (national

¹⁴ <http://climateactiontracker.org/countries/indonesia.html> (accessed 3 November, 2016)

estimates based on Ministry of Finance, 2009) to 130 MtCO₂e (IIASA estimate (Den Elzen et al. (2015))). The large difference between the estimates derives from the very uncertain figures in both the CO₂ sequestration estimates of the IIASA baseline (especially for peatland), and the anticipated impacts of policies that are largely due to varying estimates of the forests affected by illegal logging. The current policy scenario by IIASA takes into account emissions from peat oxidation caused by deforestation and peat fires. However, emissions from peat fires were kept constant over time at the 2010 level of 314 MtCO₂e as reported by BAPPENAS (2015), due to the high uncertainty of future developments. The projection has also been harmonized to historical 2010 levels of emissions based on 2010 GHG inventory data.

DRAFT

Japan

INDC

Japan proposes in its INDC to reduce GHG emissions by 26% by 2030 compared to 2013 levels, equivalent to a 25.4 % reduction from 2005 levels and 3% increase from 2010 levels. All sectors and all GHGs (CO₂, CH₄, N₂O, HFCs, PFCs, SF₆ and NF₃) are covered and 100-year GWPs from the IPCC AR4 are used (UNFCCC, 2015b). Japan applies a gross-net accounting approach, meaning that the removals in the LULUCF sector are only accounted for in the target year.

According to the official estimate that has been included in the INDC document, Japan's INDC would equate to emissions levels of about 1,040 Gt CO₂ in 2030 (based on GWPs from the IPCC AR4). The modelling groups of UNEP (2015), including the PBL and NewClimate estimates, largely agree on the impact of Japan's INDC on its emissions. The NewClimate Institute estimates on the emissions under the INDC are based on its analysis for the Climate Action Tracker.¹⁵ The potential impact of the JCM is not considered in our assessment because it is not included in the bottom up calculation of the INDC target level and also because the future development of the scheme toward 2030 is uncertain.

The IIASA projections of the net LULUCF emissions for Japan under the INDC target was based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level for 2010 of net emissions from Japan's 2014 GHG Inventory Submission to the UNFCCC. Net LULUCF emissions in Japan are as of the INDC expected to be reduced by about 37 MtCO₂e as of 2030. According to Japan's INDC, approximately 75% of this reduction will be based on forest carbon sinks measures while the remaining 25% will be the result of cropland management, grazing land management, and revegetation. This enhancement of the net LULUCF sinks corresponds to 2.6% reduction of total emissions in 2013.

Current policies

Under current policies, the latest calculations by PBL and NewClimate Institute estimate Japan's emissions (excluding LULUCF) to be between 1,160 to 1,260 MtCO₂e by 2020 (0% to 7% below 2010 levels) and 1,070 to 1,180 MtCO₂e by 2030 (6% to 15% below 2010 levels). The current policy emission projections indicate that meeting its current 2020 pledge (3.8% below 2005 levels by 2020) would be overachieved even with full nuclear phase-out. For 2030, however, our results also show that Japan will need to strengthen mitigation policies to achieve the INDC target (26% below 2013 levels) as restarting existing nuclear fleets would not provide sufficient mitigation impact.

The large range of projections is caused by the uncertainty about the phase-out of nuclear energy, as it is not yet fully clear whether this will occur and which energy carriers will replace nuclear electricity capacity. The upper end of the range basically assumes a full phase-out of nuclear energy, while the lower end assumes that most, if not all, of the existing nuclear reactors applied for restart as of September 2016 be reconnected to the grid before 2020 and complete their 40-year lifetime.

The projection by the NewClimate Institute used the Current Policies Scenario (CPS) of the IEA World Energy Outlook 2015, which took into consideration the policy measures that had been formally as of mid-2015, as starting point for the analysis. With regard to the uncertainty related to the restart of existing nuclear reactors, we considered two cases: (1) all existing nuclear reactors that applied for restart to the Nuclear Regulation Authority as of September 2016 will be reconnected to the grid before 2020 and complete its 40-year operational lifetime, (2) no nuclear reactors will be in operation up to 2030. For the first case, the difference in nuclear power generation compared with the original CPS is proportionally balanced by coal and gas power. The resulting electricity mix in 2030 (21% renewables, 31% coal and 30% gas) is found to be nearly identical to that in WEO 2015 Current Policies Scenario. For the second case, the difference is proportionally balanced by renewables, coal and gas power. As a result, the share of renewables in total electricity generation in the second case reaches 26% in 2030, exceeding the target set in the 4th Strategic Energy Plan (22-24%), but the share of fossil fuel-fired power generation also increases significantly (37% coal and 36% gas).

¹⁵ <http://climateactiontracker.org/countries/japan.html> (accessed 3 November, 2016)

The projections of all GHGs other than energy-related CO₂ by NewClimate Institute are based on the Central Environment Council, Ministry of the Environment (MOEJ, 2012a); among various scenarios we took projections from “low mitigation effort scenario – moderate economic growth variant”, the definitions of which are very similar to those for the IEA WEO Current Policies Scenario. Moreover, the expected mitigation impact from the Act on Rational Use and Proper Management of Fluorocarbons (2013) was also considered. We assumed the additional mitigation impact in 2030 to be about 10 MtCO₂e/yr based on (MOEJ, 2012b, MOEJ and METI, 2014, Government of Japan, 2015). Historical emissions are taken from the 2016 GHG inventory submissions to the UNFCCC (2016b), converted to SAR GWP terms by the Potsdam Institute for Climate Impact Research (PIK) for the Climate Action Tracker project.

The current policies projections of PBL are similar to Den Elzen et al. (2015), and based on updated energy model calculations. Building policies were not implemented in the PBL TIMER model. Emission levels including the impact of F-gas regulations were based on Velders et al. (2015). IIASA projections of LULUCF emissions and removals are similar to Den Elzen et al. (2015) but have been harmonized for 2010 to Japan’s 2014 GHG Inventory Submission to the UNFCCC (UNFCCC, 2014). For 2030, the results indicate that Japan could achieve its INDC (20% below 2010 levels including LULUCF) can already be achieved with current policies and without the accounting of LULUCF removals if all the nuclear reactors that applied for restart as of April 2016 are approved.

Kazakhstan

INDC

The Republic of Kazakhstan submitted its INDC on 28th September 2015, pledging an unconditional emissions reduction target to reduce GHG emissions including LULUCF by 15% below 1990 levels by 2030. Conditional on additional international investments, access to the low carbon technologies transfer mechanism, the green climate fund, and flexible mechanisms for countries with economy in transition, Kazakhstan aims to reduce its GHG emissions including LULUCF by 25% below 1990 levels by 2030.

Under 'Fair and ambitious targets, taking into account national circumstances', the INDC furthermore states that "under a revised and conservative business as usual scenario which takes into account potentially lower GDP growth rates the target proposed by Kazakhstan amounts to a 22% reduction in GHG emissions by 2030 compared to BAU projected emissions. Under favourable economic conditions and an increase in oil prices, the unconditional target proposed by Kazakhstan would amount to a 34% reduction in GHG emissions by 2030 compared to BAU projected emissions."

The INDC emission levels projected by PBL and NewClimate Institute are approximately 265–300 MtCO_{2e} including LULUCF.

In addition, in the INDC document, Kazakhstan pledged an updated pre-2020 contribution of a 7% reduction below 1990 levels by 2020, including LULUCF. The previous 2020 pledge enshrined in the Copenhagen Accord and the Cancun Agreements is a 15% reduction below 1990 levels by 2020, including LULUCF.

The IIASA projections of the net LULUCF emissions for Kazakhstan under the INDC target were based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level of net emissions for 2010 (Ministry of Environment and water resources of the Republic of Kazakhstan, 2013).

Current policies

The current policies projection by PBL and NewClimate Institute indicate that Kazakhstan's GHG emissions including LULUCF in 2030 range between 365 and 390 MtCO_{2e}. Under our current policies projections, Kazakhstan would clearly fail to achieve its unconditional INDC target by 2030 including LULUCF by about 65 – 90 MtCO_{2e}.

NewClimate Institute calculations are based on its analysis for the Climate Action Tracker.¹⁶ The current policy scenario uses projected emissions under the Without Measures (WOM) scenario provided by the 2nd Biennial Report CTF submission workbook (UNFCCC, 2016a) as the scenario's baseline. In addition, it considers the Action Plan for the development of alternative and renewable energy in Kazakhstan for 2013 – 2020 (hereinafter, "Action Plan") (Ministry of Energy of the Republic of Kazakhstan, 2016). Based on the most recent information on problems with the Action Plan's implementation by 2020¹⁷, the current policy analysis considers two alternate scenarios. In the optimistic scenario, 50% of the planned energy installation under the Action Plan will be developed by 2020, whereas only a 25% implementation rate will be achieved by 2020 in the pessimistic scenario.

The current policies projections by PBL are based on the IMAGE SSP2 baseline, but additionally account for the Action Plan's wind capacity target, assuming 37.5% of the capacity target will be installed (average of the optimistic and pessimistic scenario assumed by NewClimate Institute). All other targets considered in the current policies scenario are met or exceeded in the business-as-usual scenario, including other renewable capacity targets under the Action Plan. The feed-in-tariffs of the Support scheme for renewable energy are assumed to support the Action Plan targets and thus not quantified separately in the TIMER model. Building policies were also not quantified in the TIMER model. The Kazakhstan region in the TIMER model includes other countries, besides Kazakhstan. The results were downscaled based on 2010 emissions.

The Concept for Kazakhstan's Transition to Green Economy: Energy efficiency targets of 2015 is considered as being an overarching strategy without substantial plan for implementation as of today. Therefore, it is not

¹⁶ <http://climateactiontracker.org/countries/kazakhstan.html> (accessed 3 November, 2016)

¹⁷ http://kazeurope.com/wp-content/uploads/2016/04/Renewable_Energy_Opportunities_in_Kazakhstan.pdf (accessed 6 July, 2016)

considered in the current policy scenario of the analysis. Moreover, Kazakhstan's ETS is not considered in the current policies scenario as its ETS phase (2016-2020) was announced to be suspended until 2018.¹⁸

The historical dataset is based on most recent national inventory submissions published by the UNFCCC CTF in 2016 for 1990 and 2014 (UNFCCC, 2016b).

The IIASA current policy projections of LULUCF emissions and removals were based on updated G4M estimates and were harmonized for 2010 to historical estimates (Ministry of Environment and water resources of the Republic of Kazakhstan, 2013).

DRAFT

¹⁸ <https://icapcarbonaction.com/en/news-archive/387-kazakhstan-ets-suspended-until-2018> (accessed 6 July, 2016)

Mexico

NDC

Mexico submitted its NDC on 21st September, 2016. Mexico's NDC aims to reduce GHG emissions by 22% (unconditional) and by 36% (conditional) from BAU by 2030. The NDC provides the resulting 2030 emission levels in MtCO₂e. The target covers all sectors (energy, industrial processes and product use, agriculture, LULUCF, and waste) and six greenhouse gases (CO₂, CH₄, N₂O, HFCs, PFCs and SF₆).

The studies assessed adopted the official estimate of 2030 emissions from the NDC, and therefore agree on this figure. The 2020 pledge presented here is calculated from a different baseline compared to the one presented in the NDC (Fransen et al., 2015). The NewClimate Institute estimates on the emissions under the NDC are based on its analysis for the Climate Action Tracker.¹⁹

The IIASA projections of the net LULUCF emissions for Mexico under the NDC is based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level of net emissions from Mexico's 5th National Communication (Government of Mexico, 2012). The IIASA scenarios is thus in line with the national scenario with measures as presented in the 5th National Communication, which leads to a reduction of net LULUCF emissions by roughly 35 MtCO₂ in comparison to 2010 levels.

Current policies

Mexico has recently published a new Energy Transition Law (24/12/2015)²⁰ that provides a framework for clean energy, energy efficiency and greenhouse gas emissions reductions. The law contains a clean energy targets for the years 2018 (25% of generation), 2021 (30%) and 2024 (35%). An assessment of the new Law's target done by the NewClimate Institute, reveals that this target is less ambitious compared to what was proposed by previous renewable energy laws as well as the Secretariat of Energy (SENER) projections. This is due to the fact that the clean energy target definition used by Mexico includes not only renewable energies but also other energy sources, which include among others fossil based cogeneration .

The latest Energy Outlook published by the Mexican government suggests that fossil based cogeneration could reach a share as high as 9% of total electricity generation in 2030. This is a substantial share, especially considering that in 2012 the share of co-generation was 0%. As a result, the share of zero emission energy sources might be lower than what the target suggests: for 2024 the Energy Outlook suggest that the share of cogeneration could be as high as 6%, which could potentially reduce the share zero emission energy sources to 29% under the clean energy target.

The NewClimate Institute projections for GHG emissions under current policies are therefore based on the numbers published on the 5th National Communication adjust to the most recent SENER projections. The current policies projections of PBL are similar to den Elzen et al. (2015), and based on updated energy model calculations.

Both PBL and NewClimate calculations were supplemented with the IIASA projections on LULUCF emissions. The IIASA projections of LULUCF emissions and removals are based on the G4M SSP2 projections (Fricko et al., 2016) and have been harmonized to the 5th National Communication estimates of historical net LULUCF emissions(Government of Mexico, 2012). The current policy scenario includes the fulfilment of the targeted reduction of the annual deforestation from the Sustainable Forestry Management Program, which aims to reduce the yearly deforestation rate from 0.24% of total forest area in 2010, to a yearly loss of 0.2% in 2018. This represents a reduction of the annual deforestation rate by roughly 18%.

¹⁹ <http://climateactiontracker.org/countries/mexico.html> (accessed 3 November, 2016)

²⁰ <http://www.diputados.gob.mx/LeyesBiblio/pdf/LTE.pdf> (accessed 5 August, 2016)

Morocco

NDC

Morocco submitted its NDC on 19th of September 2016, which aims to limit its GHG emissions including LULUCF emissions by 17% below BAU by 2030.²¹ This targeted GHG emissions reduction corresponds to total emissions of 141 MtCO₂e in 2030 including LULUCF. Conditional on international financial support of USD 35 billion, Morocco would decrease GHG emissions including LULUCF emissions further by 42% below BAU by 2030.²² This targeted GHG emissions reduction corresponds to total emissions of 99 MtCO₂e in 2030 including LULUCF, which represents a reduction of 72 MtCO₂ in comparison to the assumed BAU emissions of 171 Mt CO₂ including LULUCF. The IIASA projection of the net LULUCF emissions for Morocco under the NDC target is based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level of net emissions from Morocco's first Biennial Update Report (Kingdom of Morocco, 2016).

Current policies

The current policies projection indicates that Morocco's GHG emissions in 2030 range from 151 to 157 MtCO₂e or 61-67% above 2010 levels, including LULUCF. These results show that the country's current emissions pathway would allow to achieve the unconditional NDC emissions target of 141 MtCO₂e in 2030 including LULUCF.

NewClimate Institute calculations based on its analysis for the Climate Action Tracker.²³ The current policies projections use the BAU scenario provided by the 3rd National Communication as basis. In addition, it considers several sectoral policies that are currently being implemented. For each of these policies, the 1st Biennial Update Report provides emissions reduction estimates, which were used to model the current policy emissions projections. Due to uncertainty regarding the full implementation of the Morocco Solar Plan and the extension of the Morocco Hydro-Electric Plan, the current policy analysis considers two different scenarios. In the optimistic scenario, all five power plants in the Morocco Solar Plan (Ouarzazate, Ain Bni Mathar, Fom Al Ouad, Boujdour and Sebkhah Tah) with a total capacity of 2,000 MW are assumed to be under operation by 2020 and the entire capacity extension of 775 MW under the Morocco Hydro-Electric Plan is assumed to be developed by 2020. In the pessimistic scenario, only two power plants currently under operation/ construction in the Morocco Solar Plan (Ouarzazate and Ain Bni Mathar) with a total capacity of 920 MW are assumed to be under operation by 2020 and only two power plants currently under construction in the Morocco Hydro-Electric Plan (El Menzel and Station de Transfert d'Énergie par Pompage (STEP) Abdelmoumen) with a total capacity of 475 MW are assumed to be developed by 2020.

The Moroccan Climate Change Policy (MCCP) coordinates and aligns various sectoral and cross-sectoral national policies against climate change. Therefore, this policy is not additionally considered in the current policy scenario of the analysis. Moreover, the current status of eight policies listed as "under implementation" in the 3rd National Communication and 1st Biennial Update Report could not be confirmed by external sources.²⁴ For this reason, none of these policies are considered in the current policy analysis by NewClimate Institute.

²¹ Excluding emissions reduction contributions from agriculture, forestry and other land use (AFOLU), Morocco targets to unconditionally reduce GHG emissions by 13%.

²² Excluding emissions reduction contributions from agriculture, forestry and other land use (AFOLU), Morocco targets to conditionally decrease GHG emissions by 34%.

²³ <http://climateactiontracker.org/countries/morocco.html> (accessed 3 November, 2016)

²⁴ These excluded policies are the following ((Kingdom of Morocco, 2016), pages 84-105):

- Programme d'implantation de système DES GESTION de l'énergie et de la productivité (SGEP) et de la norme ISO 50001 dans l'industrie
- Programme Biomasse - Inventaire, organisation et valorisation de la filière
- Programme de remplacement des grands taxis par des véhicules 7 places à faible facteur d'émission (g.CO₂/km)
- Programme de modernisation du parc automobile de l'état vers véhicules électriques
- Valorisation des cendres volantes dans l'industrie des matériaux de construction
- Augmentation du recyclage de PVC
- Valorisation des émanations DES GES en provenance des décharges contrôlées

The historical dataset is based on inventory emissions data for 1994 until 2012 provided by Morocco's 1st Biennial Update Report (Kingdom of Morocco, 2016).

LULUCF emission projections were also provided by IIASA. Current policy projections of LULUCF emissions and removals were based on updated G4M estimates and were harmonized to historical estimates provided in Morocco's 1st Biennial Update Report (Kingdom of Morocco, 2016).

DRAFT

-
- Valorisation des émanations DES GES en provenance des stations de traitement des eaux usées

Philippines

INDC

The Philippines submitted its Intended Nationally Determined Contribution (INDC) on 1st October, 2015. It includes a conditional GHG reduction target of 70% below BAU levels by 2030. The target covers all emissions from all sectors, including LULUCF. The INDC states that the target is conditional on “the extent of financial resources, including technology development & transfer, and capacity building, that will be made available to the Philippines.”

The future emission levels under the INDC are based on NewClimate Institute analysis for the Climate Action Tracker analysis that used current policy projections (see the next section) to represent BAU projections, because the INDC does not specify the BAU pathway.²⁵ NewClimate Institute estimates the 2030 emission level under the INDC to be 38% below 2010 levels excluding LULUCF. The INDC emission level excluding LULUCF is estimated to be about 95 MtCO_{2e} in 2030.

Current policies

The GHG emission levels projected under current policies in this study are 215 MtCO_{2e} by 2020 and 315 MtCO_{2e} in 2030, respectively, excluding LULUCF. Here we do not judge if the Philippines is on track to meet the INDC because of the definition of ‘BAU’ we applied for the calculations and the uncertainty related to LULUCF emissions

Current policies pathways for the Philippines were calculated by the NewClimate Institute and are based on its analysis for the Climate Action Tracker.²⁵ Total energy-related CO₂ emissions and the power sector CO₂ emissions are based on the BAU scenario from the 2016 APERC Energy Demand and Supply Outlook (APERC, 2016), which is an update compared to the Climate Action Tracker analysis. The BAU scenario of APERC (2016) ‘reflects current policies and trends with in the APEC energy sector; thus, its projections largely extend the past into the future.’ We therefore assume that most, if not all, of the current policies presented in the main report are considered. To estimate CO₂ emission projections for sectors other than the power sector, the composition of CO₂ emissions from the 2013 APERC report (APERC, 2013) were applied. World Bank (2010) also produced reference scenarios for transport and electricity production that project a steeper growth in emissions than the APERC report. These higher transport and emissions from electricity are included in the maximum range of the current policy projections.

The historical dataset is based on the IEA CO₂ Emissions from Fuel Combustion (IEA, 2015), and other CO₂ and non-CO₂ and non-energy CO₂ emissions are based on EDGAR (JRC/PBL, 2012). Historical LULUCF emissions data is taken from FAO (2014). Projected growth rates from US EPA (2012) are used to estimate the growth in non-CO₂ emissions, while other CO₂ emissions were assumed to grow proportionally to the projected energy-related CO₂ emissions.

²⁵ <http://climateactiontracker.org/countries/philippines.html> (accessed 3 November, 2016)

Republic of Korea

INDC

The Republic of Korea put forward an economy-wide target to reduce its GHG emissions by 37 % from BAU by 2030. The Republic of Korea intends to achieve a 30 % emissions reduction from BAU domestically. The INDC covers energy, industrial processes and product use, agriculture and waste, and states that “[...] a decision will be made at a later stage on whether to include greenhouse gas emissions and sinks of the land sector as well as the method for doing so” (UNFCCC, 2015b). The target applies to five sectors (energy, industrial processes and product use, agriculture, LULUCF and waste) and six gases (CO₂, CH₄, N₂O, HFCs, PFCs and SF₆).

For 2020, the Republic of Korea’s Cancun Pledge is to reduce its GHG emission by 30% from BAU by 2020, but this target has been replaced by the 2030 target in the amended Green Growth Act (Presidential Decree no.27180, 24 May, 2016; The Law National Information Center, 2016), the 2020 pledge was replaced by the 2030 INDC target. There is no report to date that the Republic of Korea abandoned its 2020 pledge communicated to the UNFCCC.

The Republic of Korea provides an official estimate in its INDC document, which would equate to emission levels of about 535.9 MtCO_{2e} in 2030. Modelling groups in UNEP (2015) agree on the emission levels in 2030 since they use the emission level taken from the INDC document.²⁶ The NewClimate Institute calculations that are based on the Climate Action Tracker (CAT, 2015) also projects an upper level of GHG emissions resulting from the possible use of carbon credits from international market mechanisms.

The IIASA projection of the net LULUCF emissions for the Republic of Korea under the INDC is based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level of net emissions from the Third National Communication (Republic of Korea, 2012).

Current policies

South Korea introduced a green growth strategy to stimulate green technologies and industries. Based on this strategy, South Korea pledged to reduce emissions unconditionally by 30%, compared to BAU levels, by 2020, implying an emission target level of about 545 MtCO_{2e}, excluding LULUCF. The green growth strategy is supported by renewable energy targets for 2020 and 2030, specified in the Basic Plan on New and Renewable Energies and 7th Basic Plan for Long-term Electricity Supply and Demand. South Korea launched a national emissions trading system (ETS) in January 2015. According to our assessment, the ETS and the renewable energy target could result in stabilisation of South Korea’s emission levels (excluding LULUCF) at 730 to 805 MtCO_{2e} by 2020 and 720 to 835 MtCO_{2e} by 2030. Range is due to the assumptions on the ETS in 2030 (currently the plan is laid out until 2025) and its possible overlap with the impact of renewable portfolio standards. This is a deviation from the historical trend of strongly increasing emissions and is an important step towards achieving the pledge. However, it is not expected to be sufficient to achieve the pledged emission level by 2020. Whether South Korea will achieve its unconditional pledge depends on the enforcement of its emissions trading system.

The current policy projections by NewClimate Institute are largely based on (den Elzen et al., 2015) and the Climate Action Tracker analysis.²⁶ The projections for energy-related CO₂ emissions are developed based on the Reference Scenario of the EIA International Energy Outlook 2013 (EIA, 2013), which “generally assume that current laws and regulations are maintained throughout the projections”. The estimation of mitigation impacts from key policies implemented after 2013 and described in the main report largely follows the approach taken in the Climate Action Tracker analysis (2015).

The IIASA current policy projections of LULUCF emissions and removals have been developed based on the scenarios presented in Den Elzen et al. (2015), but have been updated taking into account the Act on Sustainable use of Timber and Act on the Management and Improvement of Carbon Sink. Overall, these two policies are expected to lead to a stable development of the net LULUCF sink over time.

²⁶ <http://climateactiontracker.org/countries/southkorea/2015.html> (accessed 3 November, 2016)

The Korea Emission Trading System (ETS) is not expected to result in additional emission reductions. The ETS is divided into three phases and the first phase until 2017 is not stringent enough to bring South Korea on track to meet the 2020 pledge. A much stronger annual decrease of the cap is needed after 2017.

The renewable electricity targets from the Basic Plan on New and Renewable Energies and 7th Basic Plan for Long-term Electricity Supply and Demand need to be achieved by effective implementation of the Renewable Portfolio Standard (RPS). The 10% target by 2024 linked to this policy instrument is implemented in the bottom-up model from NewClimate and the PBL TIMER model. This standard covers around 90% of electricity emissions. The RPS aims to increase the share of new energy, so also including Integrated Gasification Combined Cycle (IGCC) plants and gas generated as by-product. We do not consider IGCC as renewable energy source, and it is unclear whether gas as by-product refers to renewable biogas from waste or agriculture or from non-renewable processes in oil production or industry. Based on the scenario from the South Korean Long-term electricity plan we have determined an upper and lower limit by including and excluding the 'gas as by-product' in the renewable target. South Korea has implemented a subsidy program for renewable electricity in the buildings sector. Therefore, we assume that together with the RPS, the 10% renewable target by 2024 holds for total electricity production. NewClimate further assumed that the 2030 target for renewable energy share in total primary energy supply would be met through the RPS and other policies including the support for one million green homes project.

One modification for the NewClimate calculations is the estimation of the mitigation impact of the 2014 fuel efficiency standards for light duty vehicles, for which it was assumed that the fuel efficiency for new light duty vehicles in the baseline case remains at the level set under the 2009 fuel efficiency standards until 2030 instead of referring to the baseline projections by the ICCT (2012); the vehicle stock model was taken from ICCT (2012) as in the Climate Action Tracker analysis. The PBL results are based on implementation of the fuel efficiency standards in the TIMER transport model (Girod et al., 2012) by adjusting the efficiencies and costs for new gasoline and diesel cars.

Russian Federation

INDC

The INDC of the Russian Federation states that “Limiting anthropogenic greenhouse gases in Russia to 70-75% of 1990 levels by the year 2030 might be a long-term indicator, subject to the maximum possible account of absorbing capacity of forests”. This statement implies a reduction target of 25-30 % below the 1990 level (UNFCCC, 2015b). It is an economy-wide target and includes all greenhouse gases. Study estimates in UNEP disagree significantly on future emission trends under the current policy trajectory and under the INDC. The CAT and PBL estimates cover the full range of the UNEP estimates for the INDCs. This is due primarily to different assumptions on accounting of LULUCF emissions; the NewClimate Institute estimate, which is based on the Climate Action Tracker analysis,²⁷ assumed that LULUCF is included in both the base year and the target year emissions whereas the PBL estimates assumed that LULUCF is excluded.

The IIASA projection of the net LULUCF emissions for Russia under the INDC is based on scenarios presented in Admiraal et al. (2015), and is built on the information as provided in the 6th National Communication of the Russian Federation (Government of the Russian Federation, 2013). The projection of net LULUCF emissions therefore uses the forest management intensification scenarios as provided in the 6th National Communication of the Russian Federation and projected carbon sequestration potential in forests with changes in forest management intensity. IIASA projections of net LULUCF emissions have furthermore been harmonized to historical 2010 levels estimate of net LULUCF emissions based on reported national GHG inventory data (Government Russian Federation, 2010).

Current policies

Under the Copenhagen Accord, the Russian Federation pledged an emission reduction of 15% to 25%, relative to 1990 levels, by 2020. In September 2013, the Russian Government committed to the higher end of the target. This is projected to be achieved with already implemented policies. The Russian State Programme includes targets for energy efficiency and renewable electricity generation. Russia’s gas flaring policy could lead to additional emission reductions, but it is unclear whether this policy will be fully implemented. The current policies analysed in this assessment could lead to an emission level of 2,360 to 2,440 MtCO_{2e} by 2020 (6% to 10% above 2010 levels) and 2,560 to 2,635 MtCO_{2e} by 2030 (15% to 19% above 2010 levels), excluding LULUCF.

The current policy projections by NewClimate Institute are based on Fekete et al. (2015) and the Climate Action Tracker analysis.²⁷ Energy-related CO₂ emissions projections are largely based on the Current Policies Scenario of the IEA WEO 2015 (IEA, 2015c), which take account of energy-related policy measures formally adopted as of mid-2015, with additional calculations performed to account for the impact of the renewable energy target (2.5% by 2020, excluding hydro larger than 25MW). The latest NewClimate Institute projections indicate that Russia will fail to meet the energy intensity target, i.e. 26.5-40% reduction in energy intensity (in total primary energy supply terms) per GDP by 2020 compared to 2007 level and 44% by 2030 compared to 2005 level, only achieving 9% reduction below 2007 level by 2020 and 37% below 2005 level by 2030. These results are in contrast with our previous studies (den Elzen et al., 2015; Fekete et al., 2015), which projected that the targets would be achieved under current policies. One of the main reasons for the obtained results is the latest GDP growth projections used in the IEA WEO 2015, which were revised significantly downward from the previous WEOs. GDP projections in the TIMER model are based on higher GDP growth assumptions from the SSP2 database²⁸ and therefore the intensity target is achieved in the PBL current policy scenario.

The current policy projection by IIASA concerning the development of the net LULUCF emissions has been developed based on the National Strategy of Forestry Development. National forest harvest projection levels are based on the SSP2 database (Fricko et al., 2016) from which policies for intensification in forest harvest levels (National Strategy of Forestry Development, 5.8% yearly increase in harvest) has been analysed to estimate the impact on net LULUCF emissions. Overall, the intensification in forest management is not expected to lead to a significant change of the net LULUCF emissions which are expected to remain relatively stable over time.

²⁷ <http://climateactiontracker.org/countries/russianfederation/2015.html> (accessed 3 November)

²⁸ <https://secure.iiasa.ac.at/web-apps/ene/SspDb> (accessed 3 November)

Saudi Arabia

INDC

In its INDC submitted on 22nd of October 2015, the Kingdom of Saudi Arabia seeks to achieve mitigation co-benefits of up to 130 MtCO_{2e} avoided by 2030 annually through actions, and plans outlined to contribute to economic diversification and adaptation. The country has not yet defined a baseline, however the INDC states that this will be determined based on differently weighted combinations of two scenarios, which differ by assumptions on allocation of oil produced for either domestic consumption or export (KSA, 2015). The achievement of this goal is not conditional on international financial support, but is contingent on the continuation of economic growth, and robust contribution from oil export revenues to the national economy". Additionally, the country highlights the important role of technology cooperation and transfer as well as capacity building for INDC implementation arguing technical assistance and sustained capacity building in order to be successful will be required for a successful implementation (KSA, 2015).

NewClimate Institute calculations are based on the Climate Action Tracker (CAT, 2016). Relating to two different BAU scenarios, the NewClimate Institute quantifies Saudi Arabia's INDC target with emissions levels of 840–1042 MtCO_{2e} excl. LULUCF by 2030, a 70–110% increase above 2010 levels. This wide range of by 202 MtCO_{2e} illustrates the uncertainty surrounding Saudi Arabia's INDC target. As of October 2016, Saudi Arabia has not provided the BAU scenario to quantify its INDC target. For this reason, the present analysis quantifies the target based on two estimates of the BAU. To estimate the lower end of the BAU scenario projections, Saudi Arabia's historic emissions between 2005-2010 are extrapolated until 2030. The lower bound BAU estimate for 2030 is 970 MtCO_{2e}. The upper end of the BAU scenario projections represents the baseline projections assuming no further expansion of renewable and nuclear power generation. This lower-bound scenario is based on adjusted projections from KAUST (2014) for energy-related emissions, complemented by US EPA (2012) projections for non-CO₂ emissions and extrapolation of the historic trend for other CO₂ emissions. The lower bound BAU estimate for 2030 is 1,172 MtCO_{2e}.

The IIASA projections of the net LULUCF emissions for Saudi Arabia under the INDC target is based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level of net emissions from 2nd National Communication.

Current policies

The range of current policies projections shows that Saudi Arabia's GHG emissions will reach between 1,091-1,153 MtCO_{2e} by 2030.

The current policies projections by NewClimate Institute are based on the Climate Action Tracker analysis.²⁹ Given the current policy framework in the energy supply sector, Saudi Arabia is projected to follow baseline levels using fossil fuels to supply its energy needs. However, since 1970 the government has developed ten 5-year national development plans to guide the development process. The main focus of these plans is the policy of economic diversification (K.A. CARE), designed to diversify the country's sources of national income and reduce dependence on revenues from a single source by increasing the share of other productive sectors in gross domestic product (KSA, 2015). Announced in 2013, the K.A. CARE represents the government's plan to build 54GW of renewable power and 17GW of nuclear power by 2032 to cover 40-45% of future electricity production (Al-Ghabban, 2013). In 2015, the government announced that the implementation of this policy has been delayed by eight years. Moreover, the "Vision 2016" published in 2016 revises the renewable electricity downward to 9.5 GW for an initial phase until 2023 without specifying any additional capacity extension targets for the time after 2023 (Kingdom of Saudi Arabia, 2016). It also does not mention the nuclear energy capacity extension target anymore (Borgmann, 2016). The current policy projections reflect this range of uncertainty around the development of both renewable and nuclear power up to 2030.

²⁹ <http://climateactiontracker.org/countries/saudi-arabia.html> (accessed 3 November, 2016)

South Africa

INDC

South Africa's INDC submission consists of a peak, plateau and decline (PPD) greenhouse gas emissions trajectory range, thus moving away from a 'deviation from business-as-usual'. The PPD trajectory gives a range of 398–614 MtCO_{2e} by 2025 and 2030, with a peak between 2020 and 2025, a plateau for the following decade, and absolute declines thereafter (Republic of South Africa, 2015, Energy Research Centre, 2015). It includes all sectors and gases. No unconditional target is presented. Uncertainties are noted in relation to AFOLU emissions and trace gases, with the intention of reducing uncertainty over time and moving to a comprehensive accounting approach for land-based emissions and removals.

The IIASA projection of the net LULUCF emissions for South Africa under the INDC is based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level of net emissions from the Department of Environmental Affairs (Department of Environmental Affairs, 2014a).

Current policies

The National Development Plan (NDP) of South Africa provides a 2030 vision on sustainable development, eliminating poverty and reducing inequalities. The National Climate Change Response Policy (NCCRP) of 2011 further elaborates this 2030 vision. Various sectoral plans exist, of which the Integrated Resource Plan (IRP) for electricity is South Africa's main policy affecting greenhouse gas emissions (Department of Energy South Africa, 2011, Department of Energy South Africa, 2013).

The IRP sets targets for new installed renewable electricity generation capacity. It is supported by the Renewable Energy Independent Power Producers Programme (REIPP), which funds new generation capacity via bidding rounds. The IRP's 2013 update "is intended to provide insight into critical changes for consideration on key decisions in the interim" (Department of Energy South Africa, 2013). Among other things, it includes lower electricity demand projections than the IRP 2010, thus requiring less additional generation capacity (see Table 2 in Department of Energy South Africa, 2013). However, the IRP 2010 remains the official government plan for new generation capacity until it is replaced after a full policy iteration (Department of Energy South Africa, 2013).

The total capacity targets of the IRP 2010 are therefore used in the current policies scenario: 8.4 GW solar PV (equal to the additional capacity to be built between 2010 and 2030), 11.4 GW nuclear (9.6 GW new-build between 2010 and 2030), and 9.2 GW wind (8.4 GW new-build and 800 MW committed capacity) (Table 4 in Department of Energy South Africa, 2011). The IRP 2013 update states that the nuclear decision might be delayed: "The revised demand projections suggest that no new nuclear base-load capacity is required until after 2025 and that there are alternative options, such as regional hydro, that can fulfil the requirement and allow further exploration of the shale gas potential before prematurely committing to a technology that may be redundant if the electricity demand expectations do not materialise (especially in the face of widespread embedded photovoltaic generation)" (Department of Energy South Africa, 2013). However, as the IRP 2010 remains the official government plan, the 11.4 GW nuclear target is used in the current policies scenario. Only for CSP, the 2013 update is used, because it accounts for the latest ministerial determinations (see Table 1 in Department of Energy South Africa, 2013): 1 GW additional capacity to build between 2010 and 2030 (equal to the total capacity by 2030). Targets for hydropower are excluded from the current policies scenario, as they concern imports.

PBL implemented these renewable electricity generation capacity targets in TIMER. However, the solar PV target is already achieved in the baseline, with 9.4 GW installed solar PV by 2030.

The Biofuels Industrial Strategy mandates a biofuel blending of 2%-10% for bio-ethanol and minimum 5% for biodiesel from 2015 onwards, which falls under the Petroleum Products Act. PBL implemented this in TIMER as a 5% biofuel blending target, with no distinction between biodiesel and ethanol. The current policies scenario did not reach this target from 2015 onwards, but resulted in 3% biofuel in 2015, increasing to 7% by 2020 and further growing afterwards.

The carbon tax that is under consideration was not included in the current policies scenario, because the status is unclear. The INDC submission (Republic of South Africa, 2015) mentions that the instrument is under

development. The draft bill indicates a start date of 1 January, 2017, but the implementation has been delayed a few times (The Carbon Report, 2015).

NewClimate Institute calculations based on the Climate Action Tracker (CAT, 2015).³⁰ The NewClimate Institute projections for GHG emissions under current policies are based on the “With Existing Measures (WEM)” scenario developed for South Africa’s Greenhouse Gas Mitigation Potential Analysis Report of the Department of Environmental Affairs. This scenario takes into account the effects of all implemented policies, including the latest renewable energy plan also referred to as IRP (Department of Environmental Affairs, 2014b). However, it must be noted that the WEM scenario assumes relatively high rates of economic growth, ranging between 3.8% and 5.4% per annum by 2050. As a result, emissions projections for 2030 under the current policies scenario of NewClimate Institute are higher than those estimated by PBL.

Both PBL and NewClimate calculations were supplemented with the IIASA projections on LULUCF emissions. The IIASA estimated current policy projections of LULUCF emissions and removals were based on updated G4M estimates, particularly taking into account afforestation policies, and were harmonized to historical estimates of net LULUCF emissions from the Department of Environmental Affairs (Department of Environmental Affairs, 2014a).

³⁰ <http://climateactiontracker.org/countries/southafrica.html> (accessed 3 November, 2016)

Thailand

NDC

Thailand's NDC (Office of Natural Resources and Environmental Policy and Planning of the Kingdom of Thailand, 2015b) includes an unconditional GHG emissions reduction target of 20% in 2030 compared to BAU levels excluding LULUCF. This percentage reduction is relative to the projected BAU GHG emissions in 2030 of approximately 555 MtCO_{2e}, corresponding to emission levels of 444 MtCO_{2e} in 2030. Conditional on "adequate and enhanced access to technology development and transfer, available financial resources and capacity building support", Thailand pledges an economy-wide GHG emissions reduction of 25% in 2030 compared to BAU levels excluding LULUCF. This conditional target corresponds to an emission level of 416 MtCO_{2e}. If LULUCF emissions will be included in Thailand's NDC targets will be decided at a later point in time.

For pre-2020, Thailand pledged a CO₂ emission reduction contribution in the energy and transport sectors of 7% – 20% below BAU levels by 2020 as its Copenhagen Pledge. As total BAU emissions in the energy and transport sectors are projected to be 358.6 MtCO₂ by 2020 (Office of Natural Resources and Environmental Policy and Planning of the Kingdom of Thailand, 2015a), intended CO₂ emissions in the energy and transport sectors range from 287 – to 333 MtCO₂ by 2020.

The IIASA projections of the net LULUCF emissions for Thailand under the NDC is based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level of net emissions from the 1st Biennial Update Report (Office of Natural Resources and Environmental Policy and Planning of the Kingdom of Thailand, 2015a).

Current policies

Under the current policy pathway, Thailand is likely to emit 520 MtCO₂ in 2030 excluding emissions from LULUCF. These projected emissions imply that Thailand should strengthen policy implementation with additional 76 Mt CO_{2e} reductions to meet the unconditional NDC target. The current policy scenario considers Thailand's Integrated Energy Blueprint (TIEB), which consists of five pillars:

- Alternative Energy Development Plan (AEDP) (2015-2036)
- Energy Efficiency Plan (EEP) (2015-2036)
- Power Development Plan (PDP) (2015-2036)
- Oil Plan (2015-2036)
- Gas Plan (2015-2036)

Over the course of 2015, the Thai government revised and updated all five pillars of the TIEB and their respective sub-sectoral targets to be achieved by 2036 (Ministry of Energy of the Kingdom of Thailand, 2016). Besides the TIEB, the current policy scenario includes the Environmentally Sustainable Transport System Plan of 2012, the Building Energy Code of 2009, the Energy Conservation and Promotion Act of 1992 (updated in 2007) as well as the Minimum Energy Performance Standards (MEPS) and High Energy Performance Standards (HEPS) as currently implemented policies. Thailand's Climate Change Master Plan (2015-2050) is considered an overarching climate change strategy, which critically builds upon the before mentioned sectoral policies for its implementation. As a consequence, the Climate Change Master Plan is not separately considered in the current policy analysis to avoid double-counting. Furthermore, the Waste Management Roadmap is not considered in the current policy scenario as this policy does not provide quantifiable mid- and long-term targets for 2020 and beyond.

The current policies projections for Thailand by NewClimate Institute are based on new country-level analysis as Thailand has not been analysed by the Climate Action Tracker. The projections of energy-related CO₂ emissions are based on the BAU scenario from the APEC World Energy Demand and Supply Outlook 6th edition of 2016 (APERC, 2016), which accounts for energy-related policy measures in the energy, buildings, industry and transport sectors formally adopted by the end of 2015 (APERC, 2016). The projections of non-energy CO₂ emissions are based on the latest official inventory data for 2011 provided in the 1st Biennial Update Report (BUR1) (Office of Natural Resources and Environmental Policy and Planning of the Kingdom of Thailand, 2015a); Thailand's non-energy CO₂ emissions 2011 were predominantly from the cement manufacturing process and it was assumed to remain so up to 2030. Future cement production growth rates between 2012 and 2030 were taken from IEA (2015) for non-OECD region, and the CO₂ intensity for cement production was assumed to remain constant as in the 6DS scenario in IEA (2015a). In a similar approach, the projections of non-CO₂ GHG emissions build on the latest official inventory data for non-CO₂ GHG emissions in 2011 reported in the BUR1, which were extrapolated with the projected growth rates provided by USEPA (2012)(2012).

The historical GHG emissions data is taken from the BUR1 (Office of Natural Resources and Environmental Policy and Planning of the Kingdom of Thailand, 2015a) for years 2000 – 2011 and from the UNFCCC inventory data between 1994 and 2000. Historical LULUCF emissions data is taken from BUR1 for years 2000 – 2010.

The current policy projection for the development of net LULUCF emissions by IIASA were based on the national policy for Enhancement of the forest cover. The share of forest area was 31.8% in 2010 (FAO FRA, 2015), and is targeted to increase through afforestation and reforestation projects and reach 40% by 2030.

DRAFT

Turkey

INDC

In its INDC submission, Turkey established an economy-wide greenhouse gas reduction target of up to 21% below business as usual (BAU) in 2030. The INDC covers 5 sectors (energy, industrial processes and product use, agriculture, waste and land use land-use change and forestry), and applies to six gases (CO₂, CH₄, N₂O, HFCs, PFCs, SF₆ and NF₃). The country provides a BAU scenario in the INDC, against which the target is estimated to result in a reduction of 246 MtCO₂e. NewClimate Institute estimates of the emissions under the INDC are based on the Climate Action Tracker (CAT, 2015) analysis³¹, which is based on adjusted INDC numbers to exclude the LULUCF sector.

The IIASA projection of the net LULUCF emissions for Turkey under the INDC target is based on scenarios presented in Admiraal et al. (2015), updated with harmonized 2010 historical level of net emissions from Turkey's 2014 GHG Inventory Submission to the UNFCCC.

Current policies

Although Turkey has not made a 2020 pledge, it has a renewable electricity share target and an energy intensity target. Turkey further has renewable capacity targets, outlined in the Renewable Energy Action Plan (Ministry of Energy and Natural Resources, 2014). If effective policies are implemented to achieve these targets, they could lead to emission levels of 27% to 65% above 2010 levels (including LULUCF) by 2020 and 51% to 204% above 2010 levels by 2030. The actual emission level resulting from the energy intensity target strongly depends on the future development of GDP and is thus surrounded by large uncertainties. The renewable capacity targets for 2023 are 34 GW hydropower, 20 GW wind, 5 GW solar, 1 GW geothermal, and 1 GW biomass (in total 61 GW). The current policy projections by NewClimate Institute are based on the Climate Action Tracker (CAT, 2015) analysis. According to this analysis, policy instruments are in place to achieve the renewable capacity targets, most notably the feed-in-tariff law. However, the wind capacity target may be considered ambitious (Campbell, 2015, O'Brian, 2015). PBL assumed the capacity targets would be fully met in the current policies scenario, but also assumed full implementation of the wind capacity target.

The National Climate Change Action Plan (Ministry of Environment and Urbanization, 2011) contains various targets for the transport sector. In the PBL TIMER model, the target to decrease the share of highways in freight transportation was already met in the baseline. The (interlinked) targets to increase the share of railroads and decrease the share of highways in passenger transportation were assumed to be met in the current policies scenario.

³¹ <http://climateactiontracker.org/countries/turkey.html> (accessed 3 November, 2016)

United States of America

INDC

The USA intends to reduce net GHG emissions by 26–28 % from 2005 by 2025, including LULUCF. The target covers all IPCC sectors and seven GHGs.

The IIASA projections of the net LULUCF emissions for the USA under the INDC target is based on scenarios presented in Admiraal et al. (2015), updated with harmonized 2010 historical level of net emissions from the 2014 GHG Inventory Submission to the UNFCCC. The estimates by NewClimate Institute is based on its analysis for Climate Action Tracker.³²

Current policies

Current policies in the United States are likely not yet sufficient to reduce emissions as pledged to the UNFCCC for both 2020 (17% below 2005 levels by 2020 including LULUCF; corresponding to 6% to 11% below 2010 levels, based on the Second Biennial Report (U.S. Department of State, 2016)) and the 2030 INDC. The emissions under current policies (excluding the Climate Action Plan, which is considered as planned policies) are estimated to reach about 0% to 3% below 2010 levels by 2020 including LULUCF, and 2% to 4% below 2010 levels by 2025. Recent US policy assessments show that emissions could stabilise or even increase between 2010 and 2020. Full implementation of all additional planned policies covered by the Climate Action Plan is expected to reduce emissions close to the level needed to achieve the pledge by 2020.

The current policy projections by NewClimate Institute are based on its analysis for Climate Action Tracker.³² The projections for energy-related emissions are based on the EIA Annual Energy Outlook 2016 (EIA, 2016), which considers not only federal policies but also state-level policies as presented in Table A - 1. The current study did not consider the impact of the Clean Power Plan because its legal status is uncertain (Bloomberg, 2016). Industrial process CO₂ emissions were projected by applying the future growth rates observed for industrial process GHG emissions in the 2nd Biennial Report to the latest inventory data (UNFCCC, 2016c). Third, other GHG emission projections were taken from the “Current Measures only” case in the Second Biennial Report (U.S. Department of State, 2016) after conversion to SAR GWP terms. For HFCs and PFCs, the values were converted to SAR GWP terms by applying a correction factor derived from 2010 data reported in the 2014 inventory report (using SAR GWPs) and 2016 inventory reports (using AR4 GWPs).

The current policies projections of PBL is similar to den Elzen et al. (2015), and based on updated energy model calculations. Building policies were not implemented in the PBL TIMER model. Emission levels including the impact of F-gas regulations are based on Velders et al. (2015).

Both PBL and NewClimate calculations were supplemented with the IIASA projections on LULUCF emissions. IIASA projections of LULUCF emissions and removals are the same as in Den Elzen et al. (2015), but have been harmonized for 2010 to the national GHG inventory data submitted to the UNFCCC in 2014 (UNFCCC, 2014).

Table A - 1: Main state-level policies implemented in the United States.

Current policies		
Sector	Policies (marked with “(+)” when mentioned in the INDC document)	Description
State-level policies	<ul style="list-style-type: none"> State renewable energy targets (REN) State renewable portfolio standards (29 states) ETS California Regional Greenhouse Gas Initiative (RGGI) (9 states) Energy Efficiency resources standards (26 states) 	<ul style="list-style-type: none"> Aggregate 16% REN share in electricity generation by 2020 Aims to reduce to 1990 levels by 2020 RGGI is a market based regulatory program that caps emissions until 2015 for 9 US states

³² <http://climateactiontracker.org/countries/usa.html> (accessed 3 November, 2016)

In June, 2016, leaders of Canada, Mexico and the United States announced their cooperation on climate and energy. It includes pledges to strive for 50% clean power generation by 2025, to reduce methane emissions from oil and gas by 40–45% by 2025, and to align fuel efficiency standards for light-duty vehicles by 2025 and for heavy-duty vehicles by 2027 (Adams et al., 2016). Although these targets were not considered in the current policies scenario because of their status, they may become important in meeting these countries' INDC targets.

DRAFT

Ukraine

NDC

Ukraine submitted its NDC on 19th September, 2016, which aims to limit its GHG emissions to less than 60% of 1990 GHG emissions level in 2030. The approach to LULUCF is not clarified, stating that “the land use, land-use and forestry in the climate change mitigation structure will be defined as soon as technical opportunities emerge, but no later than 2020”. In our analysis, it was assumed that the NDC target excludes LULUCF. PBL and NewClimate Institute estimate that the emission levels in 2030 would be 510-530 MtCO_{2e} (33-38% increase from 2010 levels) including LULUCF.

The IIASA LULUCF pathway under the NDC target is based on scenarios presented in Admiraal et al. (2015), updated with harmonized historical level of net emissions from 2014 GHG Inventory Submitted to UNFCCC.

Current policies

The current policy pathways calculations by PBL and NewClimate Institute indicate that Ukraine is on track to achieve its NDC, with estimated emission levels of 455-550 MtCO_{2e} (19-44% increase from 2010 levels) in 2030 including LULUCF. The current policies projection by PBL was based on the IMAGE SSP2 baseline for Ukraine, which is at the lower end of the range of emission projections in the main report. No current policies are included because of the political circumstances as well as administrative and bureaucratic barriers in the country, leading to uncertainties about the policy implementation status. The SSP2 projection is based on the UN medium population projection, showing a decreasing population for the period 2000-2100, and the GDP growth projections from the SSP2 scenario. The IMAGE SSP2 emission projection is lower compared to the “with measures” scenario from Ukraine’s Sixth National Communication.³³ This could be the result of the decreasing population projections, and/or the lower GDP growth projection. It is unclear which population and GDP projections have been assumed in the “with measures” scenario.

The current policy projections by NewClimate Institute are partly based on the Climate Action Tracker analysis.³⁴ Historic emissions data up to 2012 are based on most recent national inventory submissions to the UNFCCC (CRF, 2014). The projections are based on the ‘with measures’ scenario from Ukraine’s Sixth National Communication (NC6) (Government of Ukraine, 2013); the emission growth rates from 2012 levels are applied to the historic 2012 emissions data. The ‘with measures’ scenario from the NC6 is described as the most realistic scenario, taking into account the likely changes in technical and economic indicators of production technology and resource consumption, and includes all commercially reasonable measures. The ‘with measures’ scenario also implies that the development of wind and solar energy is economically and environmentally unjustified for Ukraine, thus resulting in increased consumption of gas for power generation. Moreover, the ‘with measures’ scenario was used as the baseline for GHG emissions projection in Ukraine’s draft INDC.³⁴ Unlike the CAT analysis, we did not consider the ‘without measures’ scenarios as a baseline because it makes an unrealistic assumption of a frozen emission intensity per GDP up to 2030. While it is uncertain whether Ukraine will implement all the policy measures included in the ‘with measures’ due to the current political instability, it is also extremely unlikely that the emission intensity remains constant under the assumed economic growth (on average 3.7% per year between 2010 and 2030).

The IIASA current policy projection of net LULUCF emissions were based on the policy for Enhancement of forest cover. The share of forest area was 16.5% in 2010 (FAO FRA, 2015), and is set to increase through afforestation projects to reach 17% by 2020.

³⁴ <http://climateactiontracker.org/countries/ukraine/2015.html> (accessed 3 November, 2016)

References

- ADAMS, S., LIGHT, A. & FRANSEN, T. 2016. "Three Amigos" Summit Can Spur North American Climate Action [Online]. World Resources Institute. Available: http://www.wri.org/blog/2016/06/three-amigos-summit-can-spur-north-american-climate-action?utm_campaign=wridigest&utm_source=wridigest-2016-07-05&utm_medium=email&utm_content=learnmore [Accessed 18 July 2016].
- ADMIRAAL, A., DEN ELZEN, M. G. J., FORSELL, N., TURKOVSKA, O., ROELFSEMA, M. & VAN SOEST, H. 2015. Assessing Intended Nationally Determined Contributions to the Paris climate agreement – what are the projected global and national emission levels for 2025–2030? Bilthoven, the Netherlands: PBL Netherlands Environmental Assessment Agency, http://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2015-assessing-intended-nationally-determined-contributions-to-the-paris-climate-agreement_1879.pdf.
- AL-GHABBAN, A. 2013. Saudi Arabia's Renewable Energy Strategy and Solar Energy Deployment Roadmap, King Abdullah City for Atomic and Renewable Energy. Retrieved from: <https://www.irena.org/DocumentDownloads/masdar/Abdulrahman%20AI%20Ghabban%20Presentation.pdf>.
- APERC 2016. World Energy Demand and Supply Outlook 6th edition. Tokyo, Japan: Asia Pacific Energy Research Centre, Institute of Energy Economics, Japan.
- AUSTRALIAN GOVERNMENT 2015a. Australia's abatement task: tracking to 2020. <http://www.environment.gov.au/climate-change/publications/factsheet-emissions-projections-2015-16>: Department of the Environment, Australia.
- AUSTRALIAN GOVERNMENT 2015b. Australia's emissions projections 2014 –15. Canberra: Department of the Environment, Australian Government. <http://www.environment.gov.au/climate-change/publications/emissions-projections-2014-15>.
- BAPPENAS 2015. Sekretariat RAN-GRK: BAU Baseline Emisi Indonesia (Hasil Kaji Ulang). Available at: <http://ranradgrk.bappenas.go.id/ranrkr/component/content/article/92-bahasa/informasi-sektoral/193-hasil-indc>.
- BLOOMBERG. 2016. *Obama's Clean Power Plan Heads to Court: What to Know* [Online]. Available: <http://www.bloomberg.com/news/articles/2016-09-23/obama-s-clean-power-plan-heads-to-court-what-to-know> [Accessed 30 October 2016].
- BORGMANN, M. 2016. *Potentially Game-Changing Saudi Arabian Government Restructuring Bolsters 9.5 GW Renewable Energy Target by 2023* [Online]. Available: <http://www.apricum-group.com/saudi-arabia-announces-9-5-gw-renewable-energy-target-new-king-salman-renewable-energy-initiative/> [Accessed 24 October 2016].
- BRIDGE TO INDIA 2015. *India Solar Handbook 2015*. New Delhi, India: Bridge to India.
- CAMPBELL, S. 2015. *Turkey downplays wind's contribution to COP21* [Online]. <http://www.windpowermonthly.com/article/1367467/turkey-downplays-winds-contribution-cop21>: Windpower Monthly. Available: <http://www.windpowermonthly.com/article/1367467/turkey-downplays-winds-contribution-cop21> [Accessed 26 April 2016].
- CAT. 2015. *Rating countries (update March-December 2015)* [Online]. Climate Action Tracker. Available: <http://climateactiontracker.org/countries.html> [Accessed 3 November 2016].
- CAT. 2016. *Rating countries* [Online]. Climate Action Tracker. Available: <http://climateactiontracker.org/countries.html> [Accessed 3 November 2016].
- CLIMATE CHANGE AUTHORITY 2014. *Reducing Australia's Greenhouse Gas Emissions—Targets and Progress Review final Report*. Melbourne: Climate Change Authority.
- CRF. 2014. *Flexible GHG data queries* [Online]. UNFCCC. Available: <http://unfccc.int/di/FlexibleQueries/Event.do?event=go> [Accessed 13 June 2016].
- DEN ELZEN, M. G. J., FEKETE, H., ADMIRAAL, A., FORSELL, N., HÖHNE, N., KOROSUO, A., ROELFSEMA, M., VAN SOEST, H., WOUTERS, K., DAY, T., HAGEMANN, M. & HOF, A. F. 2015. Enhanced policy scenarios for major emitting countries. Analysis of current and planned climate policies, and selected enhanced mitigation measure. Bilthoven, the Netherlands, http://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2015-enhanced-policy-scenarios-for-major-emitting-countries_1631.pdf: PBL Netherlands Environmental Assessment Agency.
- DEN ELZEN, M. G. J., FEKETE, H., HÖHNE, N., ADMIRAAL, A., FORSELL, N., HOF, A. F., OLIVIER, J. G. J., ROELFSEMA, M. & VAN SOEST, H. 2016. Greenhouse gas emissions from current and enhanced policies of China until 2030: Can emissions peak before 2030? *Energy Policy*, 89, 224-236.
- DEPARTMENT OF ENERGY SOUTH AFRICA 2011. *Integrated Resource Plan for Electricity 2010-2030 - Revision 2 - Final Report*. http://www.doe-irp.co.za/content/IRP2010_promulgated.pdf: Department of Energy.
- DEPARTMENT OF ENERGY SOUTH AFRICA 2013. *Integrated Resource Plan for Electricity (IRP) 2010-2030 - Update Report 2013*. http://www.doe-irp.co.za/content/IRP2010_updatea.pdf: Department of Energy.
- DEPARTMENT OF ENVIRONMENTAL AFFAIRS. 2014a. *GHG National Inventory Report for South Africa (2000 – 2010)* [Online]. Available: https://www.environment.gov.za/sites/default/files/docs/greenhousegas_inventoriesouthafrica.pdf [Accessed 28 July 2016].
- DEPARTMENT OF ENVIRONMENTAL AFFAIRS 2014b. *Mitigation Report - South Africa's Greenhouse Gas Mitigation Potential Analysis*. Pretoria: Department of Environmental Affairs, Government of South Africa & Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) GmbH.
- DEUTSCHE BANK 2015. *India 2020: Utilities & Renewables. Make way for the Sun*. Hong Kong: Deutsche Bank.

- DUBASH, N. K., KHOSLA, R., RAO, N. D. & SHARM, K. R. 2014. Informing India's Energy and Climate Debate: Policy Lessons from Modelling Studies. Centre for Policy Research, Climate Initiative, Research Report (New Delhi: Centre for Policy Research, April 2015), http://cprindia.org/sites/default/files/Informing%20India's%20Energy%20and%20Climate%20Debate_CP_R-IIASA.pdf.
- EIA 2013. International Energy Outlook 2013. Washington, D.C.: U.S. Energy Information Administration.
- EIA 2016. Annual Energy Outlook 2016. U.S. Energy Information Administration.
- ENERGY RESEARCH CENTRE 2015. Technical background information to support the development of the mitigation component of South Africa's intended nationally determined contribution, including supported required for mitigation. Cape Town, South Africa.: Energy Research Centre, University of Cape Town.
- ETHIOPIA RURAL ENERGY DEVELOPMENT AND PROMOTION CENTRE (EREDPC). 2007. *National Biogas Programme, Ethiopia: Brief Programme Profile* [Online]. Available: <http://www.bibalex.org/Search4Dev/files/284294/116537.pdf> [Accessed 4 August 2016].
- FAO. 2014. *FAOSTAT Emissions Database* [Online]. Rome, Italy: Food and Agriculture Organization of the United Nations. Available: http://faostat3.fao.org/download/G2/*E [Accessed 5 August 2016].
- FAO 2015. *FAO Global Forest Resource Assessment 2015*.: FAO Forestry. UN Food and Agriculture Organization.
- FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA - MINISTRY OF WATER AND ENERGY. 2012. *Scaling - Up Renewable Energy Program Ethiopia Investment Plan (Draft Final)*. [Online]. Available: <http://www.epa.gov.et/Lists/News/Attachments/17/SREP%20Ethiopia%20Investment%20Plan%20-%20Version%20for%20External%20Review%20-%20January%202012.pdf> [Accessed 4 August 2016].
- FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA. 2010. *Growth and Transformation Plan* [Online]. Available: <https://www.imf.org/external/pubs/ft/scr/2011/cr11304.pdf> [Accessed 4 August 2016].
- FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA. 2011. *Ethiopia's Climate-Resilient Green Economy. Green economy strategy* [Online]. Available: <https://www.undp-aap.org/sites/undp-aap.org/files/Ethiopia%20CRGE%20Strategy%20Final.pdf> [Accessed 4 August 2016].
- FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA. 2015. *Ethiopia's Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC)* [Online]. Available: <http://unfccc.int/resource/docs/natc/ethnc2.pdf> [Accessed 4 August 2016].
- FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA. 2016. *Growth and Transformation Plan II (GTP II) (2015/16-2019/20)* [Online]. Available: http://dagethiopia.org/new/docstation/com_content/article/100/gtpii_english_translation_final_june_2_1_2016.pdf [Accessed 24 October 2016].
- FEKETE, H., ROELFSEMA, M., HÖHNE, N., DEN ELZEN, M. G. J., FORSELL, N. & BECERRA, S. 2015. The impact of good practice policies on regional and global greenhouse gas emissions. Cologne, Germany, <http://newclimate.org/2015/07/29/the-impact-of-good-practice-policies-on-regional-and-global-greenhouse-gas-emissions/>: NewClimate Institute, PBL Netherlands Environmental Assessment Agency and the International Institute for Applied Systems Analysis.
- FRANSEN, T., FRANCKE, E., DAMASSA, T., ALTAMIRANO, J., GE, M., MARTINEZ, J. & RAMOS, L. 2015. *Climate Change Mitigation in Mexico's Intended Nationally Determined Contribution (INDC): Preliminary Analysis and Recommendations.* Working Paper. Washington, D.C., Open Climate Network.: World Resources Institute.
- FRICKO, O., HAVLIK, P., ROGELJ, J., KLIMONT, Z., GUSTI, M., JOHNSON, N., KOLP, P., STRUBEGGER, M., VALIN, H., AMANN, M., ERMOLIEVA, T., FORSELL, N., HERRERO, M., HEYES, C., KINDERMANN, G., KREY, V., MCCOLLUM, D. L., OBERSTEINER, M., PACHAURI, S., RAO, S., SCHMID, E., SCHOEPP, W. & RIAHI, K. 2016. The marker quantification of the Shared Socioeconomic Pathway 2: A middle-of-the-road scenario for the 21st century. *Global Environmental Change*, In Press.
- GIROD, B., VAN VUUREN, D. P. & DEETMAN, S. 2012. Global travel within the 2°C climate target. *Energy Policy*, 45.
- GOVERNMENT OF ARGENTINA. 2015. *Tercera Comunicación Nacional del Gobierno de la República Argentina a las Partes de la Convención Marco de las Naciones Unidas sobre Cambio Climático* [Online]. Secretaría de Ambiente y Desarrollo Sustentable de la Nación. Available: <http://unfccc.int/resource/docs/natc/argnc3s.pdf> [Accessed 4 August 2016].
- GOVERNMENT OF CANADA 2014. *Canada's Sixth National Report on Climate Change*. http://ec.gc.ca/cc/16153A64-BDA4-4DBB-A514-B159C5149B55/6458_EC_ID1180-MainBook_high_min%20FINAL-s.pdf.
- GOVERNMENT OF CHILE. 2015. *Intended National Determined Contribution (INDC) for Paris Agreement 2015* [Online]. Available: <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Chile/1/Chile%20INDC%20FINAL.pdf>.
- GOVERNMENT OF ETHIOPIA. 2015. *Intended Nationally Determined Contribution (INDC) of the Federal Democratic Republic of Ethiopia* [Online]. UNFCCC. Available: <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Ethiopia/1/INDC-Ethiopia-100615.pdf> [Accessed 4 August 2016].
- GOVERNMENT OF INDIA. 2015. *Revision of cumulative targets under National Solar Mission from 20,000 MW by 2021-22 to 1,00,000 MW - India surging ahead in the field of Green Energy - 100 GW Solar Scale-Up plan* [Online]. Government of India, Ministry of New and Renewable Energy. Available: <http://pib.nic.in/newsite/PrintRelease.aspx?relid=122567> [Accessed 29 April 2016].

- GOVERNMENT OF INDONESIA 2011. Rencana Aksi Nasional Gas Rumah Kaca (RAN-GRK) – National Action Plan on GHG Emission Reduction. Jakarta: Government of Indonesia.
- GOVERNMENT OF JAPAN 2015. Japan's Second Biennial Report under the United Nations Framework Convention on Climate Change. Tokyo: Government of Japan.
- GOVERNMENT OF THE RUSSIAN FEDERATION 2013. Sixth National Communication. http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/6nc_rus_final.pdf: UNFCCC.
- GOVERNMENT OF UKRAINE. 2013. *Sixth National Communication* [Online]. UNFCCC. Available: http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/6nc_v7_final_1.pdf.
- GOVERNMENT OF MEXICO 2012. Mexico. México quinta comunicación nacional ante la Convención Marco de las Naciones Unidas sobre el Cambio Climático.: <http://unfccc.int/resource/docs/natc/mexnc5s.pdf>.
- GOVERNMENT RUSSIAN FEDERATION 2010. Fifth National Communication on Climate Change of the Russian Federation. http://unfccc.int/resource/docs/natc/rus_nc5_resubmit.pdf.
- GRASSI, G. & DENTENER, F. 2015. Quantifying the contribution of the Land Use sector to the Paris Climate Agreement. Joint Research Centre (JRC), <https://ec.europa.eu/jrc>, EUR 27561; doi 10.2788/096422.
- GREEN, F. & STERN, N. 2016. China's changing economy: implications for its carbon dioxide emissions. *Climate Policy*, 1-15.
- ICCT 2012. Model Documentation and User Guide: ICCT Roadmap Model Version 1-0. The International Council on Clean Transportation.
- IDEAM, PNUD, MADS, DNP & CANCELLERÍA 2015. Primer Informe Bienal de Actualización de Colombia. Bogotá D.C.: Colombian Government.
- IEA 2014. *World Energy Outlook 2014*, Paris, France, International Energy Agency.
- IEA 2015a. *Energy Technology Perspectives 2015*. Paris, France: International Energy Agency.
- IEA 2015b. *Southeast Asia Energy Outlook 2015 - World Energy Outlook Special Report*. Paris, France: OECD/IEA.
- IEA 2015c. *World Energy Outlook 2015*, Paris, France, International Energy Agency.
- IEEFA 2015. *India's Electricity-Sector Transformation*. Institute for Energy Economics and Financial Analysis.
- JIANG, K., ZHUANG, X., MIAO, R. & HE, C. 2013. China's role in attaining the global 2°C target. *Climate Policy*, 13, 55-69.
- KAUST 2014. *Appraisal and Evaluation of Energy Utilization and Efficiency in the Kingdom of Saudi Arabia (Vol. 2)*.
- KINGDOM OF MOROCCO. 2016. *Premier Rapport Biennal Actualisé du Royaume du Maroc* [Online]. Available: <http://unfccc.int/resource/docs/natc/marbur1.pdf> [Accessed 4 August 2016].
- KINGDOM OF SAUDI ARABIA. 2016. *Vision 2030* [Online]. Available: www.vision2030.gov.sa/download/file/fid/417 [Accessed 24 October 2016].
- KSA 2015. The Intended Nationally Determined Contribution (INDC) of the Kingdom of Saudi Arabia under the UNFCCC. Retrieved from <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Saudi%20Arabia/1/KSA-INDCs%20English.pdf>.
- MAPS CHILE 2014. *Opciones de mitigación para enfrentar el cambio climático: resultados de Fase 2*. Santiago, Chile: Ministerio del Medio Ambiente.
- MERCOM CAPITAL GROUP 2016. *India Solar Quarterly Market Update: March 2016*. Indian Solar Market Picks Up Speed With More Than 4 GW Forecasted in 2016. Austin, Texas, USA: Mercom Capital Group.
- MINISTERIO DEL MEDIO AMBIENTE. 2014. *Chile's National Greenhouse Gas Inventory, 1990–2010* [Online]. Santiago, Chile: Climate Change Office, Ministry of the Environment of Chile. Available: <http://unfccc.int/resource/docs/natc/chlnire.pdf> [Accessed 21 July 2016].
- MINISTRY OF ENERGY AND NATURAL RESOURCES 2014. *National Renewable Energy Action Plan for Turkey*. Ankara: Ministry of Energy and Natural Resources.
- MINISTRY OF ENERGY OF THE KINGDOM OF THAILAND. 2016. *Thailand Integrated Energy Blueprint*. *EPPO Journal*, (Special Issue 2016) [Online]. Available: http://www.eppo.go.th/images/Information_service/journalissue/ISSUE-SPECIAL2559.pdf [Accessed 4 August 2016].
- MINISTRY OF ENERGY OF THE REPUBLIC OF KAZAKHSTAN. 2016. *The Second Biennial Report of the Republic of Kazakhstan submitted in accordance with the Decision 1/CP.16 of the Conference of the Parties to the United Nations Framework Convention on Climate Change* [Online]. Bonn, Germany: United Nations Framework Convention on Climate Change. Available: http://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/application/pdf/br-text_eng_kz.pdf [Accessed 28 July 2016].
- MINISTRY OF ENVIRONMENT AND URBANIZATION 2011. *National Climate Change Action Plan*. Ankara: Ministry of Environment and Urbanization.
- MINISTRY OF ENVIRONMENT AND WATER RESOURCES OF THE REPUBLIC OF KAZAKHSTAN. 2013. *The III-VI National Communication of the Republic of Kazakhstan to the UN Framework Convention on Climate Change* [Online]. Astana: Ministry of Environment and water resources of the Republic of Kazakhstan, United Nations Development Program in Kazakhstan, Global Environment Facility. Available: http://unfccc.int/files/national_reports/annex_i_natcom/application/pdf/kaz_nc3,4,5,6_eng.pdf [Accessed 4 August 2016].

- MINISTRY OF FINANCE 2009. Ministry of Finance Green Paper: Economic and Fiscal Policy Strategies for Climate Change Mitigation in Indonesia. Jakarta: Ministry of Finance and Australia–Indonesia Partnership.
- MINISTRY OF THE ENVIRONMENT AND SUSTAINABLE DEVELOPMENT. 2015. *Inventario general de GEIs en Argentina* [Online]. Available: <http://ambiente.gob.ar/tercera-comunicacion-nacional/> [Accessed 4 August 2016].
- MOEJ 2012a. 2013 nen ikou no taisaku sesaku ni kansuru houkokusho (Heisei 24 nen 6 gatsu). chikyuu ondankataisaku no sentakushi no gen-an ni tsuite (Report on the global warming countermeasures beyond 2013. Proposal of options. June 2012). In Japanese. Global Environment Committee, Central Environment Council, Ministry of the Environment, Japan.
- MOEJ 2012b. Projections of non-energy GHGs. Material No.2 of the 14th meeting of the formulation of the post-2013 mitigation target, Global Environment Committee, Central Environment Council. 28 March, in Japanese. Tokyo, Japan: Ministry of the Environment, Japan.
- MOEJ & METI 2014. Mitigation measures for F-gases. In Japanese. Material No.4 of the 2nd meeting of the MOE/METI joint advisory council working group on the INDC formulation. Tokyo, Japan: Ministry of Economy, Trade and Industry (METI) and Ministry of the Environment, Japan (MOEJ).
- O'BRIAN, H. 2015. *Analysis: Turkey outlines ambitious wind target* [Online]. Available: <http://www.windpowermonthly.com/article/1335068/analysis-turkey-outlines-ambitious-wind-target>. Available: <http://www.windpowermonthly.com/article/1335068/analysis-turkey-outlines-ambitious-wind-target> [Accessed 26 April 2016].
- OFFICE OF NATURAL RESOURCES AND ENVIRONMENTAL POLICY AND PLANNING OF THE KINGDOM OF THAILAND. 2015a. *Thailand's First Biennial Update Report under the United Nations Framework Convention on Climate Change* [Online]. Bangkok, Thailand. Available: <http://unfccc.int/resource/docs/natc/thabur1.pdf> [Accessed 4 August 2016].
- OFFICE OF NATURAL RESOURCES AND ENVIRONMENTAL POLICY AND PLANNING OF THE KINGDOM OF THAILAND 2015b. Thailand's Intended Nationally Determined Contribution (INDC). Bangkok, Thailand: http://www4.unfccc.int/Submissions/INDC/Published%20Documents/Thailand/1/Thailand_INDC.pdf: Office of Natural Resources and Environmental Policy and Planning. .
- PLANNING COMMISSION GOVERNMENT OF INDIA 2014. The Final Report of the Expert Group on Low Carbon Strategies for Inclusive Growth. http://planningcommission.nic.in/reports/genrep/rep_carbon2005.pdf: Planning Commission, Government of India.
- REDD-PAC BRAZIL 2015. Modelling Land Use Changes in Brazil: 2000-2050, http://www.redd-pac.org/reports/lucc_brazil_folder.pdf.
- REDD-PAC DRC 2016. Modelling Future Land Use Changes in the Democratic Republic of Congo: 2000-2030. <http://redd-pac.org/reports/DRC-E.pdf>: REDD-PAC.
- REPUBLIC OF INDONESIA 2015. Indonesia First Biennial Update Report (BUR) Under the United Nations Framework Convention on Climate Change. Directorate General of Climate Change, Ministry of Environment and Forestry, Republic of Indonesia
- REPUBLIC OF KOREA 2012. Korea's Third National Communication under the United Nations Framework Convention on Climate Change. Low Carbon, Green Growth. Government of South Korea. Available at: <http://unfccc.int/resource/docs/natc/kornrc3.pdf>
- REPUBLIC OF SOUTH AFRICA. 2015. *South Africa's Intended Nationally Determined Contribution (INDC)* [Online]. UNFCCC. Available: <http://www4.unfccc.int/submissions/INDC/Published%20Documents/South%20Africa/1/South%20Africa.pdf> [Accessed 12 July 2016].
- SHA, F., JI, Z. & LINWEI, L. 2015. An Analysis of China's INDC. Beijing, China: China National Center for Climate Change Strategy and International Cooperation.
- THE CARBON REPORT. 2015. *How will the draft carbon tax bill affect your business?* [Online]. The Carbon Report. Available: <http://www.thecarbonreport.co.za/the-proposed-south-african-carbon-tax/> [Accessed 12 July 2016].
- THE LAW NATIONAL INFORMATION CENTER. 2016. *Presidential Decree 27180 of 24 May, 2016 (enforced 1 June, 2016); partial amendment of the Enforcement Decree of the Framework Act on Low Carbon, Green Growth. The Law National Information Center, Korea* [Online]. Ministry of Government Legislation. Available: <http://www.law.go.kr/lsInfoP.do?lsiSeq=183314&efYd=20160601#AJAX> [Accessed 16 October 2016].
- THE PEOPLE'S REPUBLIC OF CHINA 2012. The second national communication on climate change of the People's Republic of China.: National Development and Reform Commission, <http://unfccc.int/resource/docs/natc/chnnc2e.pdf>.
- U.S. DEPARTMENT OF STATE. 2016. *Second Biennial Report of the United States of America Under the United Nations Framework Convention on Climate Change* [Online]. Washington DC, U.S.A.: U.S. Department of State. Available: https://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/application/pdf/2016_second_biennial_report_of_the_united_states_.pdf [Accessed 3 November 2016].
- UNEP. 2015. *The Emissions Gap Report 2015: A UNEP Synthesis Report* [Online]. United Nations Environment Programme (UNEP), Nairobi. Available: <http://www.unep.org/emissionsgapreport2015/>.

- UNFCCC. 2014. *GHG data from UNFCCC (Old Reporting Requirements)* [Online]. Bonn, Germany: United Nations Framework Convention on Climate Change. [Accessed 26 October 2016].
- UNFCCC 2015a. Biennial Update Reports http://unfccc.int/national_reports/non-annex_i_natcom/reporting_on_climate_change/items/8722.php.
- UNFCCC 2015b. Intended Nationally Determined Contributions (INDCs), <http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx>.
- UNFCCC. 2016a. *2nd Biennial Report CTF submission workbook* [Online]. Bonn, Germany: UNFCCC. Available: http://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/application/pdf/kaz_2016_v2.0_resubmission.pdf [Accessed 28 July 2016].
- UNFCCC. 2016b. *National Inventory Submissions 2016. Common Reporting Format* [Online]. Available: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/9492.php [Accessed 18 October 2016].
- UNFCCC 2016c. UNFCCC AWG-KP Submissions 2016. Common Reporting Format. Bonn, Germany: United Nations Framework Convention on Climate Change.
- US EPA 2012. *Global Mitigation of Non-CO2 Greenhouse Gases*. Washington, D.C., USA: The United States Environmental Protection Agency.
- US EPA. 2012. *Global Anthropogenic Non-CO2 Greenhouse Gas Emissions: 1990-2030: Revised Version 2012* [Online]. Available: http://www.epa.gov/climatechange/Downloads/EPAactivities/EPA_Global_NonCO2_Projections_Dec2012.pdf [Accessed 9.12.2013].
- VELDERS, G. J. M., FAHEY, D. W., DANIEL, J. S., ANDERSEN, S. O. & MCFARLAND, M. 2015. Future atmospheric abundances and climate forcings from scenarios of global and regional hydrofluorocarbon (HFC) emissions. *Atmospheric Environment*, 123, 200-209.
- WHITE HOUSE 2014. U.S.-China Joint Announcement on Climate Change. Beijing, China, available at: <http://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change>.
- WORLD ENERGY COUNCIL. 2013. *World Energy Resources. Chapter 5: Hydro. World Energy Council* [Online]. Available: https://www.worldenergy.org/wp-content/uploads/2013/10/WER_2013_5_Hydro.pdf [Accessed 4 August 2016].
- WRI. 2015. *CAIT Climate Data Explorer: Historical Emissions* [Online]. Washington D.C., USA: World Resources Institute. Available: <http://cait.wri.org/historical> [Accessed 5 August 2016].



NewClimate – Institute for Climate Policy and Global Sustainability gGmbH

Cologne Office

Am Hof 20-26
50667 Cologne
Germany

T +49 (0) 221 999833-00

F +49 (0) 221 999833-19

Berlin Office

Brunnenstraße 195
10119 Berlin
Germany

E info@newclimate.org

www.newclimate.org