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Comparative analysis of mitigation pledges under the UNFCCC and the Kyoto Protocol and underlying efforts for selected countries

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Executive Summary

Scope of the study

For **32 selected countries**[1], this report analyzes what **effort** is implied by their **mitigation pledges for 2020** under the UNFCCC and the Kyoto Protocol. Where these efforts are considerable, we compare them to the effort required for Switzerland to reach its own -20% (unconditional) or -30% (conditioned) reduction targets by 2020 in relation to 1990.

Effort is largely defined in terms of **abatement costs,** e.g. in % of national GDP or consumption, **in addition to already existing policies**. We also consider **supplementary institutional efforts**, which can be particularly relevant for some emerging economies. This second kind of effort is, however, clearly different from effort defined in terms of abatement costs only.

We do not intend to judge the adequacy of the countries´ efforts. The Convention has the principle of "common but differentiated responsibilities and respective capabilities", which has led to extensive discussions about national circumstances and equity in international climate policy. Our approach avoids these difficult discussions by restricting itself to an analysis of efforts, leaving it to the reader to undertake further considerations.

Finally, it is important to note that this is **not an evaluation of overall climate policies of the countries,** but only of the additional efforts implied by the current pledges relative to already existing trends.

Method

In each case, we first assess the **significance of the country's pledge**. This is intricate, because the pledges are formulated in different ways, sometimes with unclear or uncertain accounting principles (especially for land use change and forestry) or reference numbers (concerning business as usual or base year emissions). We consider a pledge to be significant when it is sufficiently clear and implies considerable emission reductions relative to realistic business as usual scenarios and also relative to long-term emission and efficiency trends.

Only for the countries that do have significant or at least potentially significant pledges, we gather cost figures and other indicators to facilitate effort comparisons with Switzerland.[2] Ultimately, the effort assessments consist of a **qualitative and integrated appraisal** of available information, not just of particular cost figures. This approach reflects the complexity of greenhouse gas abatement economics and policy and the lack of dependable and comparable quantitative studies. For methodological details, please consult chapter 2.

[1] The countries selected for this analysis have a global emissions share larger than 0.9% and belong thus to the 22 largest emitters, or they are particularly interesting to Switzerland, e.g. because they are similar to Switzerland in income level or economic structure. More information on the selection process and criteria is available from the authors on request.

[2] We also analyze in more depth several EU Member States which either have significant national reduction targets outside the UN framework or have had especially active mitigation policies, or both.

Main findings

The **additional efforts** that are implied by the GHG abatement pledges for 2020 as presented to the UNFCCC are **unimpressive on a global level**. And they are, according to current scientific knowledge, likely to be **incompatible with the 2 degree warming objective**.

None of the major GHG emitters China, USA, EU, Russia, India, and Japan have submitted and adhered to a pledge that would be likely to imply considerable positive total abatement costs. Due to existing no regret potentials, pledges imply minor reductions nevertheless, at least in China, and the EU, and possibly in India, Japan and the USA. The **weak international pledges** by the major GHG emitters, but **also by many other countries**, mirror the current difficulty in achieving an ambitious global climate agreement.

There are **notable exceptions** to this general picture, including some European Annex I countries (**Norway, Sweden, Switzerland**) and some major non-Annex I countries (**Republic of Korea, Mexico, South Africa**).

Regarding the pledge of **Switzerland**, we take into account that the Swiss CO_2 Law stipulates that the abatement target of -20% from 1990 level has to be met with domestic measures in 2020. With this restriction in place, the effort related to the Swiss pledge is one of the higher ones among the pledges that we investigated. Nevertheless, the implied direct costs are moderate, and ancillary benefits counteract these direct costs and could lead to overall welfare gains. Hence, reaching the targets remains economically feasible.

Norway's pledged abatement is impressive, and the related effort will probably be higher than for Switzerland, if most of the abatement is achieved domestically. However, Norway intends to also purchase emission certificates from abroad, which would reduce the direct costs of meeting the pledge.

Sweden´s pledged abatement under the EU Effort Sharing Decision seems unimpressive. It could still induce some positive direct costs given the limited low cost abatement potentials that remain in Sweden. At the national level, Sweden has formulated a much more ambitious abatement target for 2020. Also at the national level, Denmark has put forward an ambitious abatement objective for 2020 and is about to further tighten this target.

South Korea's pledge requires an effort that may even be somewhat higher than for Switzerland's unconditional pledge. The Koreans are currently putting related policies into place, including a very comprehensive emissions trading system.

Mexico and **South Africa** both have to overcome high institutional and political barriers to efficient climate policy implementation, which makes their ambitious pledges particularly challenging. Although South Africa embarks on this journey with poor CO_2 efficiency and widespread use of coal, the target will require direct abatement costs to be paid for. Mexico, in contrast, has no-regret abatement potentials that are probably large enough to imply negligible direct costs of abatement.

For countries other than the few exceptions mentioned above, some institutional effort will be needed in most cases, but abatement costs implied by the pledges are unlikely to be appreciably positive. Thus, **despite the neglect of important ancillary benefits** (such as reduced health costs due to fewer air pollution), the **additional costs are around zero or possibly even negative for 28 of the 33 countries**.

This is in spite of some minor emission reductions under the pledges of e.g. China and the EU and possibly of some further countries. For example, some countries could enhance their pledges by new clarifications for reference numbers (e.g. business as usual emission trajectories) and accounting principles (e.g. for land use and forestry). This is especially relevant for Australia, Brazil, Canada, New Zealand, and the USA. For some non-Annex I countries, much is going to depend on the specific implementation of Nationally Appropriate Mitigation Actions (NAMAs), e.g. in Indonesia and Singapore. Finally, it is remarkable that **some of the major emitters have no pledge** under the UNFCCC **at all**. This concerns **Iran**, **Saudi Arabia** and **Turkey**.

Chapter 4 provides a more comprehensive summary of country results and includes a table (table 3) with qualitative results for all 33 countries. Please observe the footnotes and disclaimers that apply to the table when reading it. **For full appreciation of the results, it is strongly recommended to read the individual country analyses in chapter 3** and possibly draw own conclusions**.** Additional facts and indicators are provided in the country fact sheets in Appendix B.

A remark on zero cost for positive abatement

With efficient policy design, abatement costs can be zero (or even negative) for positive (and in some countries even for significant) abatement. Many **bottom-up studies** suggest that most countries have **large potentials of no regret measures**, which pay-off for the investor. Typically, potentials for no regret measures – measured in percent of future BAU emissions – are reported in the range of high one-digit to low two-digit numbers for 2020. Balancing cost savings of no regret measures with costs of low-cost measures, break even points (i.e. the point where aggregate abatement costs are zero) are usually two-digit and in some cases can go up to around 40% below BAU emissions (e.g. in McKinsey´s cost curve for Australia). These numbers need to be interpreted with caution, because many alleged “no regret” measures require behavioral changes or the overcoming of **barriers** to implementation. On the other hand, bottom-up studies do usually not consider the efficiency potentials that can be reaped by recycling revenues connected to abatement policies (e.g. a CO_2 tax). Top-down studies consider these potentials, but deny technical no regret potentials. Nevertheless, with efficient policy design and moderate reductions, many **top-down studies** find **low or even negative economic costs** of mitigation policies. In most cases, this does not even include ancillary benefits of abatement.

Important caveats of the analysis

We consider the period of the last decade up to the pledges for **2020** only and thus identify ***additional*** **efforts** needed in this period to meet the pledges, which is different from appreciating a country´s climate policy in general. If a country´s pledge does not require policies and measures that are additional to the (possibly substantial) existing ones, the *additional* effort for meeting the pledged target is zero. **This approach insufficiently recognizes the cumulative climate policy efforts of early movers**, who have significantly invested into the mitigation of climate change over the last two decades (e.g. the United Kingdom, Germany, some Scandinavian countries).

Ancillary benefits, such as lower health costs due to reduced air pollution, compensate and often even overcompensate for direct abatement costs from a social welfare point of view. Positive impacts of GHG abatement on public health are especially high in urban areas of developing countries. Lamentably, quantitative information on ancillary benefits for the selected countries do not allow for a systematic and comprehensive inclusion in the results of this study. Hence, the cost and welfare indicators presented **exclude ancillary benefits** in most cases, which makes pledges appear to be more costly than they are for society as a whole.

As we report cost indicators, the **benefits from the mitigation of climate change are not considered**, although global welfare improvements through mitigation are to be expected.

We consider pledges under the UNFCCC and the Kyoto Protocol. The EU Member States Denmark, Germany, Sweden and the United Kingdom have domestic targets for 2020 that go beyond the pledges they have announced in the international arena. For more information on these and other **domestic targets not included** in this analysis, see table in Appendix A.

Business as usual emission trajectories from different sources are hardly comparable and anyway subject to uncertainties. **Comparability** of cost studies is even more questionable.

We **assume that announced targets will be met**, irrespective of whether related policies are currently implemented or whether the pledge is legally binding or not.[3]

We regard the required effort to meet a target as independent of any **conditions** that might apply to the pledge, e.g. regarding properties of a global agreement. We also neglect conditions of foreign financing or other foreign support for mitigation actions, which are usually added to pledges by non-Annex I countries – including Mexico and South Africa.

The analysis in this report is merely a **snapshot of the current situation**: Things change over time. Growth rates change, and as a consequence BAU emission trajectories are revised. Also, pledges can be reviewed or clarified.

[3] This disregards the fact that an unconditional and legally binding pledge is rooted much stronger in international law than voluntary action that is contingent on conditions that might be unlikely to materialize. Our approach thus tends to underrate the commitments by countries that have put forward an unconditional and legally binding pledge which at the same time is likely to lead to real emission reductions compared to business as usual. At this moment, this applies to Australia, EU-27, Norway and Switzerland only, and also for these countries, ratifications of the pledges are still pending.

1 Introduction

For 32 selected countries, this report explores the effort that is implied by their mitigation pledges under the UNFCCC and the Kyoto Protocol. Where these efforts are considerable, we compare them to the effort required for Switzerland to reach its own -20% (unconditional) or -30% (conditioned) reduction targets by 2020 in relation to 1990.

"Effort" is largely defined in terms of abatement costs, e.g. in % of national GDP or consumption. In general, only a qualitative assessment is possible. This is due to data constraints and the lack of comparability of relevant studies. Where studies provide cost numbers and information on ancillary benefits (such as reduced health costs and mortality due to improved air quality), we include these in the respective country analyses in chapter 3, with some brief information on the underlying methodologies.

Next to abatement costs, the term "effort" includes the notion that considerable institutional advancement may be needed for implementing the policies that are required to meet a particular emission reduction target. Such type of effort, which clearly differs from effort defined in terms of abatement costs only, can be especially relevant for some emerging economies with rather weak public institutions and law enforcement.

The analysis in this report is merely a snapshot of the current situation: Whether a pledged target will be difficult or easy to achieve depends a lot on macroeconomic conditions, especially on economic growth and on fuel prices. Some countries which have been especially affected by the financial crisis had thought to have made ambitious pledges, but the crisis has made them easy to achieve according to current scenarios. However, we do not know where we go from here, and change is the only thing that is certain. As a result, today´s conclusion on an effort that is related with a particular pledge may be challenged by future macroeconomic surprises.

To keep the task manageable, we narrowly delimit the scope of this investigation. We refer the reader to chapter 2.1, which explains this delimitation in adequate detail. Briefly, these are the most important aspects of the delimitation:

- We neglect whether existing or announced policies will allow the respective country to achieve its target.
- We regard the required effort to meet a target as independent of any conditions that apply to the pledge, e.g. regarding foreign support or properties of a global agreement.
- Following a similar logic, a legally binding pledge is not per se harder to achieve than a non-legally binding pledge. However, this approach tends to underrate the commitments by countries which – like Switzerland – have put forward a significant, unconditional and legally binding pledge.
- Considering the period up to the pledges for 2020 only, we search for *additional* efforts needed in this period to meet the pledges. This is fundamentally different from appreciating a country´s past and current climate policy in general.

The GHG reductions that have been pledged globally clearly fall short of achieving a global emissions level that would be in line with the 2 degree warming target. Despite this, we do not intend in this report to judge whether the effort of any particular country is adequate. According to the

Convention, “Parties should protect the climate system (…) on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities”. Reasons for differentiations can be differing per capita emissions in the past or present as well as differences in economic well-being and social indicators. All kinds of national circumstances can be enlisted to argue in favor of further differentiations. Numerous interpretations of the principle of “common but differentiated responsibilities” exist, leading to just as many views on what equitable international climate policy should be like. We avoid the difficult discussions about equity and adequacy by analyzing the effort only, leaving it to the reader to undertake further considerations.

The countries that have been selected for this analysis have a global emissions share larger than 0.9% and belong thus to the 22 largest emitters, or they are particularly interesting to Switzerland, e.g. because they are similar to Switzerland in income level or economic structure. The resulting list of 32 countries is: Australia, Austria, Belgium, Brazil, Canada, China, Denmark, European Union, France, Germany, India, Indonesia, Iran, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Poland, Russia, Saudi Arabia, Singapore, South Africa, Republic of Korea, Spain, Sweden, Turkey, Ukraine, United Arab Emirates, United Kingdom, United States of America. Information on the selection process and criteria is available from the authors on request.

Chapter 2 describes the methodology used for assessing the efforts. It also provides a brief overview of the most important sources of information. In chapter 3, we analyze first the Swiss pledge followed by the 32 selected countries in alphabetical order, with EU Member States allocated to an EU sub-chapter. For each country, the initial focus lies on the significance of the pledge, which is used as guidance for how elaborate the country is discussed. Efforts are assessed for significant pledges only. Appendix B contains fact sheets with additional information on the 33 countries (pledge, historical and BAU emissions, indicators and trends, policies and measures). Chapter 4 summarizes the results of the assessment. Chapter 5 provides some conclusions from this assessment.

2 Methodology

2.1 Delimiting the scope

This report attempts to answer **two main questions**:

1. *What is the effort underlying the selected countries' mitigation pledges for 2020 under the UNFCCC and the Kyoto Protocol?*

2. *How do the assessed efforts compare to the effort of Switzerland connected to the 20% or 30% reduction target by 2020 in relation to 1990?*

To keep this task manageable, we delimit the scope of this investigation in several ways:

- **We do not investigate or presume the likelihood of the pledges being met.** Some countries may be putting many policies in place to safeguard compliance with the pledge, while others may show no sign of such endeavor. Some pledges are legally binding, while others are not. Some pledges are unconditional, while others are subject to conditions such as a greatly ambitious global climate agreement or foreign financial support for domestic mitigation actions. All of this will not influence the efforts stated in this report, because we only investigate the effort needed for complying with the pledge, if it is met, irrespective of who is going to pay for the effort. This arguable assumption is necessary, because any assumptions about amounts of foreign financing in the respective countries would be entirely hypothetical. Our approach largely disregards the fact that an unconditional and legally binding pledge is rooted much stronger in international law than voluntary action that is contingent on conditions that might be unlikely to materialize. We thus tend to underrate the commitments by countries that have put forward an unconditional and legally binding pledge which at the same time is likely to lead to real emission reductions compared to business as usual. At this moment, this applies to Australia, EU-27, Norway and Switzerland only, and also for these countries, ratifications of the pledges are still pending. Where conditional pledges exist next to unconditional pledges, we put slightly more emphasis on the unconditional pledge. In general, we tend to presume that – where a range has been pledged or several pledges have been put forward – the less ambitious end of the pledge(s) could be more policy relevant than the more ambitious end.
- **We consider the period up to the pledges for 2020 only and thus identify *additional* efforts needed in this period to meet the pledges**, which is different from appreciating a country´s climate policy in general. If a country´s pledge does not require policies and measures that are additional to the (possibly substantial) existing ones, the *additional* effort for meeting the pledged target is zero. This approach may be disputable, because it disregards past achievements in greenhouse gas abatement. Even worse: past achievements raise the bar for abatement measures to qualify as additional effort. There is, however, no practicable alternative: In many countries, climate policy measures have influenced greenhouse gas emission trajectories and technological progress since the 1990s. As a consequence, it has become im-

possible to define today baselines until 2020 that could represent a hypothetical world without climate policy measures.

- We consider pledges under the UNFCCC and the Kyoto Protocol. The EU Member States Denmark, Germany, the Netherlands, Sweden, and the United Kingdom, for example, have domestic targets for 2020 that go beyond the pledges they have announced in the international arena. Although we do analyze these targets in chapter 3.6, they are out of scope for the effort comparisons. For more information on these and other **domestic targets not included** in this analysis, see the table in Appendix A.
- The analysis in this report is merely a **snapshot of the current situation**: Things change over time. Growth rates change, and as a consequence BAU emission trajectories are revised. Also, pledges can be reviewed or clarified.
- **We do not intend to judge the adequacy of the countries´ efforts.** The Convention has the principle of "common but differentiated responsibilities and respective capabilities", which has led to extensive discussions about national circumstances and equity in international climate policy. Our approach avoids these difficult discussions by restricting itself to an analysis of efforts, leaving it to the reader to undertake further considerations.

In summary, this is **not an evaluation of overall climate policies of the countries, but only of the additional efforts implied by the current pledges relative to already existing trends.**

2.2 Quantitative information and qualitative appraisal

Countries´ efforts can be assessed from many perspectives using a variety of facts and indicators such as

- the required emission reductions (in absolute terms, per capita, relative to business as usual, relative to long-term trends, and compared to existing economical abatement potentials),
- required changes in emissions intensity (compared to the current level and relative to long-term trends),
- abatement costs (marginal and total costs, in absolute terms or as a proportion of GDP, taking into account or neglecting external/ancillary benefits of abatement), and
- welfare implications (measured as change in total surplus or Hicks Equivalent Variation, taking into account or neglecting environmental benefits).

While studies exist for many – although not for all – relevant countries, they often investigate other quantitative objectives or are not fully up to date. It is an even greater issue that the existing studies differ in methodologies and that in many cases these methodologies are poorly documented. While individual cost studies provide important evidence, it is necessary to add other relevant information on national circumstances. These include e.g. economic structure and existing capital (e.g. types of power plants), available energy sources and potential of renewable energy, climate and topography, and whether the country intends to buy emission reductions abroad.

Ultimately, any meaningful assessment of efforts in this report consists of a qualitative and integrated appraisal of the information that is available at the time of writing.

This approach reflects the complexity of greenhouse gas abatement economics and policy and the lack of dependable and comparable quantitative studies. The main disadvantage of the approach is that qualitative appraisals by experts remain subjective where positive results are desired. However, we regard this to be more reliable than pretending exactness. Hence, we present results in categories that are just explicit enough to allow for conclusions. For each country, a sub-chapter of chapter 3 provides details which explain how the particular conclusions for this country are deduced. Studying these country analyses also allows the reader to draw own conclusions.

For full appreciation of the results, it is thus **strongly recommended to read the analyses in chapter 3.** Additional facts and indicators are provided in the country fact sheets in Appendix B.

2.3 Assessing the significance of pledges

As this report covers a large number of countries, the amount of potentially relevant information sources could become unmanageable. Under these circumstances, rather than attempting completeness, **we structure the field of pledges into those that are especially worth investigating and those that are not**. Thus, in the sub-chapters of chapter 3, we begin for each country by assessing whether the pledge is (or the pledges are) significant.

A pledge can be deemed significant if it implies considerable emission reductions relative to the country's business as usual (BAU) emissions path. For graphical representations of the pledges and of existing BAU projections, see the country fact sheets in Appendix B. Two main difficulties arise when assessing the significance of the pledges:

- Some countries have formulated pledges in such a way that the absolute quantitative emissions target under the pledge remains unclear. In other cases, the quantitative emissions target is clearly stated, but it has been left open how total greenhouse gas emissions are calculated. The accounting rules for land use, land use change and forestry (LULUCF) emissions are especially influential in this respect, particularly for countries whose pledges have not been made under the Kyoto Protocol, because the latter leaves much less room for alternative accounting methods. Pledges can be unclear with respect to coverage, reference, conditions of foreign support, or concerning the potential use of flexible mechanisms (quality of the offsets). If one country´s pledge includes international transactions of emission rights or under a linked emissions trading system, while another country´s pledge excludes them, even double counting of emission reductions is possible. While the Kyoto Protocol provides clear accounting rules that avoid double counting, pledges that do not explicitly refer to Kyoto accounting rules may deviate from these rules in many ways (LULUCF is, again, a critical sector in this respect), at the cost of reduced transparency and comparability of pledges. If a pledge is vague to an extent that it remains unclear whether it implies emission reductions at all, the pledge has to be deemed insignificant.[4]

[4] Although there are some evident criteria for clarity versus vagueness of pledges, such a verdict will to a certain extent also be based on subjective appreciations of vagueness, and for many pledges much will depend on future clarifications by the respective governments. Consequently, different academic and NGO appraisals of the pledges have led to different evaluations of the significance of many pledges. We have inspected these appraisals and drawn conclusions to the best of our knowledge.

- None of the existing studies covers BAU projections even for the majority of the investigated countries. Hence, it is difficult to make BAU projections from different sources comparable. Often, government BAU emissions projections are higher than the BAU projections by international organizations. Clearly, there is an incentive for governments to overstate their BAU emissions to let the pledge appear more ambitious. If the pledge is expressed as a reduction relative to BAU, even the very emissions depend on the official BAU projection. On the other hand, some of the other BAU projections could be too low. They often include existing policy measures and in some cases, these measures can already be connected to the pledges made by the country under the UNFCCC. One way to test the plausibility of a BAU projection is to check whether its emissions path is a continuation of previous trends. If it is not, there must be a traceable and legitimate reason for the deviation from previous trends. In contrast to this, many BAU projections by governments exhibit unmotivated kinks at the point where historical emissions meet projected emissions. Clearly, such BAU projections must be discarded as unrealistic. In other cases, however, the evaluation of existing BAU projections is more difficult. In the end, BAU projections have a tremendous influence on the appraisal of the pledges. Hence, we try to consider all of the most relevant aspects when evaluating BAU trajectories, to the extent that time and resources allow. It has to be emphasized, however, that we can only take a snapshot at the time of writing. Every few months, the accuracy of BAU projections is altered by business cycle changes and diverging economic growth rates around the world. In some cases, even the BAU projections themselves will be revised.

In summary, when evaluating the significance of pledges as an intermediate step to assessing efforts, we check for **unambiguousness** of the pledges and focus on the **abatement** which the pledge implies **relative to BAU**. We check whether available BAU projections are plausible, e.g. with a view on **historical long-term emission trends**.

2.4 Selecting the countries for a further investigation of efforts

Investigating the effort implied by a pledge is only worthwhile when a pledge is significant to an extent that it has a considerable likelihood to imply costs that are fundamentally different from zero. Several categories of pledges do not exhibit this property, and for the respective countries our analysis ends with the assessment of the significance of the pledge. This concerns the following cases:

- Some countries do not have an international pledge under the UNFCCC to reduce greenhouse gases. They may have policies in place that enhance energy efficiency or promote fuel switch to less carbon intensive fuels, but as they do not have a pledge, their pledge-based effort is zero.

- A number of countries have internationally pledged emission reductions that follow existing trends. Depending on the respective country, these trends may or may not reflect already existing mitigation efforts. In any case, the pledges do not require intensified mitigation efforts, which means that the connected effort – as defined in this study – is also zero. The same applies to countries with pledges that are unclear to an extent that some interpretations of the pledge make it unnecessary to intensify abatement efforts. For another group of countries, the pledges may imply some reductions, but this is not certain, and the emission reductions under the pledges would only be minor. As any country has enough no-cost – or at least very low cost – potentials to achieve minor GHG emission reductions, these countries are unlikely to require any considerable effort to meet their pledges.

- Some countries issued pledges that – with high likelihood – imply emission reductions relative to business as usual. However, the reductions are likely to be minor in relative terms and are thus still in a range where any country can be expected to have abatement potentials at negative, zero or at least very low cost, especially when efficient abatement policies are assumed and ancillary benefits such as improvements of (urban) air quality are taken into account. Hence, we can safely assume for these countries that their pledges do not imply considerable efforts under current circumstances and projections. This holds at least in terms of incremental costs compared to already existing climate-related policies. Adopting and implementing the policies that are needed to reap these potentials may still require a political and institutional effort, which is hardly quantifiable in terms of economic cost.

For all the above categories of countries, we conclude that the efforts implied by their pledges are either zero or at least much lower than for Switzerland. The qualifications presented in 2.1 apply. **We take further steps to assess the efforts implied by the pledges only for those countries that have put forward international pledges which imply medium if not substantial reductions compared to business as usual and long-term trends**. For these countries, we take a closer look at existing information about costs, ancillary benefits and welfare impacts of abatement policies and measures. We do this in order to assess the efforts implied by the pledges and to compare them with Switzerland's effort.

2.5 Abatement costs, ancillary benefits and welfare

Sources of information

In this study, we are unable to thoroughly investigate – or even less simulate – national costs and welfare effects of the abatement implied by all significant pledges. We have to rely on existing studies and other available information.

After the climate conference in Copenhagen, many comparisons of the pledges were published, e.g. Buhr et al. 2012, Climate Action Tracker, Dellink et al. 2010, den Elzen et al. 2011, EEA 2012, Höhne et al. 2010, Höhne et al. 2012, Jotzo 2010, Kartha & Erickson 2011, Levin & Bradley 2010, PEW Center 2011, Rogelj 2010, Saveyn et al. 2011, Schleich et al. 2010, Stern & Jotzo 2010, UNFCCC 2012, Vazhayil & Balasubramanian 2010.

These **existing studies differ widely with respect to country coverage, methods, rigor and extensiveness**, which makes it difficult to compare their results. Furthermore, the bulk of this literature was published in 2010 and 2011 and may thus not be fully up to date in some respects. A notable exception is the Climate Action Tracker maintained by Ecofys, Climate Analytics, and PIK. Ecofys, together with PBL and IIASA also published a policy brief (Höhne et al. 2012) which summarizes information on the pledges of 19 countries.

However, these two publications have in common with the majority of the existing pledge appraisals that they concentrate on two aspects: (1) stringency of the pledge, (2) likelihood that the pledge will be met. In this report, we neglect the second aspect and search for information on the effort in terms of costs that is related to the pledges.

The following sources are the most relevant with respect to assessing the effort that is connected to significant pledges:

- marginal abatement cost curve information (e.g. McKinsey cost curves),
- modeling studies that assess economic impacts of the implementation of the pledges, e.g. Saveyn et al. 2011, den Elzen 2011, Dellink et al. 2010, McKibbin et al. 2010. The simulations are at a high level of aggregation, so only major countries are analyzed explicitly.
- information that we have gathered for the fact sheets (see Appendix B), especially indicators and their trends and information on policies,
- national studies for important countries (and to the extent that time allows) and other additional studies (see bibliography),
- information and documents provided by Swiss Embassies and the Swiss Federal Office for the Environment.

Methodological considerations

Effort comparisons are severely complicated by the fact that the available studies base themselves on different methodologies and assumptions. In many cases, e.g. for a majority of abatement cost curves, the underlying assumptions even remain intransparent. To complicate things further, different methodological approaches use **different concepts of total cost or welfare effects**:

Pure **bottom-up studies** calculate total costs by integrating the marginal abatement cost curve. In such studies, total costs are usually low or even negative for rather modest abatement targets. This is for the following reason: Many bottom-up studies suggest that countries have large potentials of **no regret measures**, which pay-off for the investor (e.g. LED lighting and insulation of old buildings). Hence, total costs of abatement measures are negative as long as the net revenues from no regret measures are larger than the net costs from measures with positive costs that are needed to reach the abatement objective. Only as an ambitious abatement target requires more expensive measures, we pass the break-even point and total costs become positive.

The existence of no regret measures has been subject to debate. They are overestimated when

- transaction costs – such as information, search and planning costs – are insufficiently included,
- assumed potentials insufficiently consider social, cultural and environmental restrictions,
- a discount rate has been assumed which is lower than the actual discount rate of the decision-maker.

Bottom-up modelers are aware of these points and usually try to consider them as much as possible. Still, benefits from reaping no regret potentials have to be interpreted with caution, because many of the related measures require behavioral changes or the overcoming of barriers. In fact, some of these potentials have proven to be very hard to exploit through policy instruments for many years or even decades. The examples given above, lighting and insulation, are no exception in this respect.

While bottom-up studies tend to be on the optimistic side regarding no regret measures, they do usually not consider the efficiency potentials that can be reaped by recycling revenues connected to abatement policies. **Top-down studies** consider these potentials, but usually deny technical no regret potentials.

Rather than calculating total costs, top-down studies present changes in welfare measures (usually Hicks Equivalent Variation, HEV), which are based on changes in household consumption evaluated at market prices.

In top-down studies, much depends on policy design in the scenarios. With efficient policy design and moderate reductions, many top-down studies find mildly negative or even positive welfare effects of mitigation policies, even without considering climate and ancillary benefits. While some top-down modelers use results from bottom-up simulations to calibrate abatement costs in their models, the encouraging results are mainly due to something completely different: **Remaining efficiency potentials in the tax system can be exploited when designing climate policy instruments which generate public revenues**. Similarly to efficient technical measures considered in bottom-up models, these efficiency potentials of public policy reforms are often hard to achieve, because they can face fierce opposition by those who lose (or suspect to lose) under the reform. Nevertheless, reaping these potentials is an opportunity that can be exploited by well-designed GHG abatement policies.

In between bottom-up and top-down, there are partial economic analyses of GHG abatement policies, for example when bottom-up models include demand modules or a macroeconomic module. These models typically present welfare effects in terms of total surplus (i.e. an aggregate of consumer and producer surplus), which is yet another welfare measure.

Clearly, the diverging methodologies that are used in the studies cited in this report transfer into a lack of comparability of results and a need for cautious interpretation. We translate the available information into an **integrated qualitative appraisal to the best of our knowledge**. Our work experience includes many modeling projects for national and international clients with different kinds of climate policy and energy economic models: top-down, bottom-up, coupled, and partial. Yet, comprehensive methodological appraisals of all the cited studies are impracticable due to time constraints and due to a lack of methodological transparency of many studies.

Ancillary benefits

Ancillary benefits of climate policy measures are positive effects of GHG mitigation other than the reduction of GHG emissions itself. There are not only ancillary benefits, but also ancillary costs. However, many studies in the international literature indicate that by including ancillary effects in the analysis, the net economic cost of climate policy measures decrease considerably (e.g. Van Vuuren et al. 2004, Riekkola et al. 2011). The following examples illustrate the vast array of possible effects of GHG abatement (Krupnick et al. 2000, Davis et al. 2000):

Some examples of ancillary benefits:

- Improved air quality by reducing emissions of air pollutants associated with combustion of fossil fuels,
- reduced safety risks due to a decrease in coal mining,
- better opportunities for recreation through reforestation measures,

- protection of biodiversity due to prevented deforestation,
- efficiency gains through adopting new technologies,
- reduced hazards from road transport and less traffic congestion through modal shift,
- time savings in rural households when the use of wood for fuel is replaced by electricity from renewable sources,
- positive employment effects from GHG abatement projects in developing countries with low levels of employment.

Some examples of ancillary costs:

- Higher concentrations of air pollutants in households when higher electricity prices lead to replacement of electricity use by wood, manure or fossil fuel combustion,
- Higher air pollution from promotion of diesel fuels,
- Negative employment effects from GHG abatement policies which affect economic growth.

While the benefits of GHG abatement on the mitigation of climate change unfold globally, independently from the location of the abatement, most of the ancillary benefits take effect on the local or regional level only.

Ancillary benefits from health improvements represent the bulk of the positive benefits (Davis et al. 2000). For the greater part, they originate from improved air quality. In developing countries with less regulation concerning air quality, GHG abatement usually implies much larger reductions in air pollution and thus has much greater positive impact on public health than in developed countries.

It comes as no surprise that **the international literature on ancillary benefits predominantly concentrates on air pollutants. Benefits in this field are substantial** and can be assessed in variations of the number of premature deaths due to local air pollution. For example, Bollen et al. 2009 analyze a reduction in worldwide CO_2 emissions relative to a baseline by 73% in 2050 (-50% relative to 2005 levels). They estimate the related ancillary benefits as a 40% reduction of premature deaths, i.e.: of 13 Mio. premature deaths that occur in 2050 in the baseline, more than 5 Mio. lives are saved in the GHG abatement scenario in the year 2050 alone.

Unfortunately, restricted availability and insufficient comparability of quantitative information on ancillary benefits from greenhouse gas abatement targets for the selected countries do not allow for a systematic and comprehensive inclusion of these substantial benefits. Hence, **the cost and welfare indicators presented in this study exclude ancillary benefits in most cases**. We add information on ancillary benefits in some cases only and in the form in which this information is available. From a welfare perspective, ancillary benefits are, however, fully relevant and would deserve better attention, even if they are external to those who bear the investment cost of the measure.

2.6 Effort

Based on the appraisal of the available information on economic structure, the energy system, abatement costs, simulated welfare effects, and ancillary benefits, we comment on the efforts that are required in order to comply with the significant pledges. The meaning of effort is largely congruent with the **approximate magnitude of cost of abatement relative to national GDP or consumption**. Yet, it also includes a second notion: In some cases, even if abatement costs may be low, considerable institutional advancement is required for the implementation of the policies that can achieve significant GHG reduction targets. In principle, any country that implements effective climate policy measures has some **institutional effort**. This effort is, however, especially relevant for some emerging economies, particularly when public institutions and law enforcement are generally weak.

For countries with significant pledges, we provide **bilateral effort comparisons with Switzerland** to the best extent possible, even if comparability may be limited for some countries that are very different from Switzerland. For an assessment of the effort which is connected to the Swiss pledge, please refer to chapter 3.1.

3 Analysis of mitigation pledges and related efforts by country

In this chapter, we investigate the international pledges under the UNFCCC and the Kyoto Protocol of Switzerland and 32 selected countries with regard to the underlying efforts needed to meet the pledges until 2020. We start with Switzerland. The other selected countries follow in alphabetical order with one exception:

The European Union has communicated a pledge for the Union as a whole. Its Member States have agreed on an Effort Sharing Decision and participate in the EU Emissions Trading System. With this setup, it makes sense to deal with the selected EU Member States under an EU sub-chapter. Within this sub-chapter, the selected Member States appear in alphabetical order.

For each country, we begin with a short description of the pledge. Here, we concentrate on the aspects of the pledge which are relevant for the assessment of the effort connected to meeting the pledge. We also provide rough information on major conditions that apply and indicate the cases where pledges are legally binding. **For more comprehensive presentations of the pledges, please refer to the fact sheets in Appendix B.** The literal formulations of the pledges can be consulted in the UNFCCC documents FCCC/SB/2011/INF.1/Rev.1 and FCCC/SBI/2013/INF.12/Rev.2.

We assess the significance of each pledge and, where we can consider a pledge to be significant, we investigate the underlying effort. **For details and caveats of the methodology that is applied in these assessments, please consult chapter 2.** We also take a closer look at those EU Member States which have ambitious policies in place or announced significant domestic reduction targets that go beyond their less ambitious commitments under the EU Effort Sharing Decision (ESD). A significant pledge is sufficiently clear, implies considerable emission reductions relative to business as usual and also relative to long-term emission and efficiency trends. However, for the majority of the countries under investigation, pledges are not significant in this sense, implying an effort in terms of additional costs induced by the pledge of zero or close to zero.

We add qualitative effort comparisons with Switzerland only for the few countries with pledges that, if adhered to, definitely imply more than just minor GHG reductions until 2020 relative to BAU and existing long-term trends.

3.1 Switzerland

Short description of the pledge: Switzerland pledges a 20%-reduction of GHG emissions relative to 1990 and would consider a -30% target conditional on comparable commitments by other developed countries and adequate contribution from developing countries according to their responsibilities and capabilities in line with a 2˚C target. The pledge is legally binding under the Kyoto Protocol, but ratification is pending to date.

Significance of the pledge: Given that current BAU projections, which include existing measures, see Swiss GHG emissions in 2020 close to 1990 emissions, the -20% (-30%) targets relative to 1990 translate into similar reductions relative to baseline emissions. It can thus be concluded that Switzerland's pledge implies **significant reductions** of GHG emissions.

Underlying Effort: Ecoplan 2009 provides estimates of welfare changes associated with achieving the targets under the pledge. These estimates are based on simulations with a computable general equilibrium model (dynamic, single country). The -20% (-30%) targets relative to 1990 result in welfare losses of 0.36% (0.58%). In this study, welfare is household consumption discounted to the base year 2005. GDP reductions in 2020 relative to business as usual are 0.69% (0.94%). For several reasons, these numbers need to be interpreted with caution:

- The scenarios comprised the option to realize 50% of the reduction abroad through flexible mechanisms. Achieving the entire reduction domestically may be more expensive. This is reflected in the scenario Climate Initiative ("Klimainitiative") in Ecoplan 2009, which is also based on the 30% target, but without use of the flexible mechanisms. The simulated welfare loss for this scenario is 0.83% and the GDP loss relative to BAU in 2020 is 2.04%.

- On the other hand, the estimates do not include ancillary benefits of the abatement, such as reduced health costs due to the reduction of air pollutants. Ecoplan 2012, which simulates scenarios for the Swiss energy perspectives, suggests that for nearly the same magnitude of CO_2 reductions as under the Swiss pledge, welfare changes turn positive when ancillary benefits are considered.[5] Bottom-up techno-economic models that neglect external benefits, however, calculate positive direct economic costs for very similar scenarios (Prognos 2012).

On the basis of the aforementioned studies, the effort needed in Switzerland to reach the targets under the pledge can be subject to debate. **Reaching the targets is economically feasible as the direct costs are moderate. Secondary effects counteract these direct costs and might lead to overall welfare gains.** The more ambitious the target, the higher the direct costs, but the higher also the ancillary benefits.

Welfare gains do not imply that no effort is required: Policies need to be implemented that lead to private and public investments that, on aggregate, incur additional costs for the investor. This is an effort, even if external benefits outweigh the additional cost. If we define effort in a way that regards ancillary benefits as external (although these are benefits to the Swiss population), the Ecoplan 2009 study suggests that the welfare loss is going to stay below 1% until 2020, given that the welfare loss in the most ambitious scenario with domestic reduction is 0.83%.

3.2 Australia

Short description of the pledge: Australia commits unconditionally and legally binding under the Kyoto Protocol to a 5 % reduction in GHG emissions in 2020 relative to 2000. Ratification of the pledge is pending to date. Furthermore, Australia has proposed non-legally binding reductions from 15% up to 25%. They depend on a global agreement under which major developing economies commit to substantially restrain emissions and advanced economies take on commitments comparable to Australia's and which falls short of securing atmospheric stabilization at 450 ppm CO_2-eq (-15% target) or which is capable of stabilizing GHGs in the atmosphere at 450 ppm CO_2-eq or lower (-25% target).

[5] The study calculates a welfare gain of 0.19% in 2020 for the scenario "New Energy Policy", which comprises a 15% CO_2 reduction and a 5% reduction in electricity demand relative to business as usual in the same year.

Significance of the pledge: With reference to BAU projections by the Government, which include existing measures, the pledge – at first glance – implies substantial emission reductions in 2020. However, depending on decisions by Australia regarding the inclusion of voluntary activities, the pledge could be connected to land use, land use change and forestry (LULUCF) accounting rules that loosen the target considerably (see also Climate Action Tracker). A study at Australian National University, which was funded by Greenpeace, estimates that potential LULUCF offsets could outweigh the mitigation requirement of the -5% pledge completely (Macintosh 2011). Against this background, even the conditional -15% target would have to be considered as implying a minor reduction only. This would be different for the -25% target, but this target is contingent upon conditions that are more than unlikely to materialize. Summing up, the Australian pledge **could imply minor reductions**, but this requires less favorable LULUCF accounting rules or moving to the -15% target, which could have become less likely with the Abbott Government inaugurated in Sept. 2013.

Underlying effort: According to the McKinsey cost curve for 2020, all three targets would be reachable at negative total cost (McKinsey&Company 2008a). For the -5% and -15% targets, we consider this to be realistic, given the high per capita emissions (no. 1 among the 22 highest emitters) and energy efficiency potentials in Australia. For the -25% pledge, well-known barriers to the exploitation of no regret potentials make it necessary to put a question mark.

The new Government of Prime Minister Abbott is currently repealing the carbon tax. As a consequence, reaching any given target will become more costly. The announcement to launch an Emissions Reduction Fund endowed with Australian Dollars 2.55 bn. (= € 1.84 bn.), which will be designed to buy emission credits from projects in different sectors including industry (Australian Government 2014), confirms that policy instruments with less coverage and higher transaction costs are about to emerge.

For the purpose of this report, we abstract from costs that are due to inefficient GHG abatement policies (although the respective policies may be efficient for other policy objectives than GHG abatement). Thus, we can conclude that with efficient GHG abatement policies, at least **Australia's unconditional pledge, if it implies GHG reductions at all, could probably be met at negative cost**.

3.3 Brazil

Short description of the pledge: Brazil anticipates its mitigation actions to reduce GHG emissions in 2020 by 36.1-38.9% compared to business as usual. Actions are voluntary and depend on financial support by developed Parties.

Significance of the pledge: While the percentage reduction seems impressive, much about this pledge is unclear. Pledges that are based on BAU projections are inherently uncertain, because BAU emissions may be subject to change, especially when they have not been communicated under the UNFCCC. Brazil has not put forward a BAU in its 2nd National Communication to the UNFCCC. Shortly thereafter, decree no. 7390 (available at http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2010/Decreto/D7390.htm) specified a number for BAU GHG emissions in 2020 of 3.236 Gt CO_2-eq. This is an extremely high number given that the EDGAR data base, which includes e.g. emissions from forest fires, gives a number of 1.621 Gt CO_2-eq for 2010. Of the 3.236 Gt CO_2-eq BAU emissions specified in the decree, 2.134 Gt CO_2-eq are from land use and agriculture. The decree does not specify the accounting methodologies, but gives some details that can in part explain the very high emissions total. For example, BAU emissions from deforestation in the Amazon forest are higher than they were in 2005. On the basis of decree 7390, and given the methodological uncertainties around LULUCF emissions, it is rather doubtful that the pledge is going to require significant mitigation efforts, unless future clarifications by Brazil regarding methodological approaches and BAU emissions lead to a revision of the above assessment. In its current form, the pledge has to be described as **insignificant**.

3.4 Canada

Short description of the pledge: Canada proclaims a 17% reduction target relative to 2005 emissions which is conditional to the passing of a federal law in the USA creating a "final economy-wide emission reduction target".

Significance of the pledge: Due to the large forest areas in the country and their potential CO_2 uptake, the target is sensitive to LULUCF accounting rules. For example, Levin and Bradley 2010 calculate the pledge using the year 1990 as basis and conclude that if LULUCF is included, it is consistent with a considerable increase in emissions. Uncertainty arises, because Canada does not participate in the 2nd Commitment Period of the Kyoto Protocol, which rules for LULUCF accounting have been established for. Depending on the LULUCF accounting rules that will be applied, the Canadian pledge **could imply minor GHG emission reductions**.

Underlying effort: Provided that LULUCF accounting does not transform the pledge into an allowance for a rise of emissions, Canada's high per capita emissions (rank 3 among the 22 highest emitters) and high energy efficiency potentials indicate that large no regret abatement potentials are present. Furthermore, required reductions for energy-related CO_2 are likely to be minor due to abundant LULUCF options. With efficient GHG abatement policies, any minor reductions which the pledge might imply **could probably be achievable at negative cost**.

3.5 China

Short description of the pledge: China pledges for 2020 to reduce CO_2 emissions per unit of GDP by 40–45% relative to 2005. Two complementary targets concern an increase of the share of non-fossil fuels in primary energy to around 15% and an increase of forest coverage by 40 million hectares. All three targets are voluntary and conditional of effective implementation of developed Parties commitments in relation to financial resources and technology.

Significance of the pledge: China is still a fast growing country. Consequently, GDP projections as well as BAU emissions projections vary considerably. Furthermore, there is considerable uncertainty regarding data of historical emissions (Guan et al. 2012), which translates into uncertainty concerning the reduction target. In addition, the pledge (almost entirely) neglects greenhouse gases other than CO_2. Anyway, an efficiency target does not set an absolute limit on emissions.

On the other hand, an efficiency target is going to result in emission reductions relative to BAU, if it is more ambitious than current efficiency trends. This case can be made for China: Based on CAIT emissions data – and keeping in mind the uncertainty about historical emissions data for China – CO_2 intensity of GDP declined by nearly 20% between 1998 and 2008. Such progress is common for a fast growing developing country, but following up on and accelerating this improvement to a decline of 40 to 45% between 2005 and 2020 is likely to require an effort.

China's 12th Five Year Plan (March 2011) formulates targets for carbon and energy intensity of GDP (reductions of 17% and 16%, respectively, by 2015 relative to 2010). According to IEA data, CO_2 emission intensity from energy-related emissions decreased by 14.6% between 2005 and 2010. In conjunction with the objectives for 2015, this would imply that, to reach its target under the pledge, China will have to decrease its CO_2 intensity in the period 2015-2020 by 15.4% or 22.4% (for the -40% and -45% targets, respectively).

However, different BAU and pledge scenarios for absolute CO_2 emissions draw very different pictures and suggest that the reduction could be anywhere between almost negligible and substantial. For example, Fekete et al. 2013 display an average baseline derived from various sources and present a range from 13.3 to 13.8 Gt of CO_2-eq for total GHG emissions in 2020. In the same study, the pledge is translated into a range for total GHG emissions in 2020 between 11.2 and 13.7 Gt of CO_2-eq, which means that the BAU scenario is located close to the upper end of the range calculated for the pledge. Similarly, the Climate Action Tracker regards the pledge as close to business as usual, although they see potential for China to go beyond its pledge on the basis of the current Five-Year Plan. However, views on the pledge differ widely. In contrast to the Climate Action Tracker, Stern & Jotzo 2010 conclude that "China is likely to need to adopt ambitious carbon mitigation policies in order to achieve its stated target". Similarly, McKibbin et al. 2010 translate China's pledge into a 22% reduction relative to BAU.

Ancillary benefits related to the mitigation of air pollution are a major motivation for China to invest into GHG abatement. In fact, it is likely that ancillary benefits overcompensate for any abatement costs that China could have under the pledge. This prospect is supported by Vennemo et al. 2009 who conduct a comprehensive study on environmental co-benefits of GHG emission reductions in China. Applying a general equilibrium model, they calculate the impact of improvements in public health for the period 2006-2020. For this period, the baseline scenario includes an annual decline of CO_2 intensity by 4.7%. According to the study, a decrease of CO_2 intensity by 30% beyond this level in 2020 can be reached without positive total cost, i.e. ancillary benefits fully compensate for abatement costs.

All in all, it can be concluded that the Chinese pledge is likely to imply **emission reductions relative to business as usual that are at least minor**.[6] Due to major data uncertainties it is difficult to conclude that the pledge would imply higher reductions than this, although it is well possible that it does.

3.6 European Union

Short description of the pledge: The EU-27[7] pledges to reduce total GHG emissions by 20% in 2020 relative to 1990. The pledge is legally binding under the Kyoto Protocol, but ratification is pending to date. Under the Kyoto Protocol budget approach, this unconditional EU pledge was translated into an

[6] Since China is the largest GHG emitter on earth, minor reductions in relative terms are not minor in absolute terms. On the other hand, "minor reductions" imply that the remaining absolute emissions still have a major detrimental impact on climate.

[7] In July 2013, Croatia became the 28th Member State of the European Union.

amount of QUELROs (Quantified Emission Limitation and Reduction Obligations) that imply an effective emissions reduction in 2020 of -21% relative to 1990 levels, or -24% relative to the Kyoto Protocol´s base years, which differ for certain emissions. A -30% target is conditional on comparable commitments by other developed countries and adequate contribution from developing countries according to their responsibilities and capabilities.

Significance of the pledge: Compared to the European Environmental Agency´s BAU scenario for the EU-27, which includes existing measures, the unconditional target implies GHG emission reductions of 1%, which can only be described as minor. The macroeconomic repercussions of the financial crisis have rendered the EU´s pledge much less ambitious than originally intended. Under the prevailing macroeconomic conditions, the 20% target does not imply reductions that would go much beyond the trend.

Despite this, **minor reductions** are likely to result, mainly because of the way the target has been distributed between sectors and among Member States. EU Member States participate in the EU-27 pledge in two ways:

(1) About 45% of EU GHG emissions are integrated into the **EU Emissions Trading System** (EU ETS). Emission allocations in the EU ETS will be 21% below 2005 levels in 2020. As the EU ETS offers full flexibility regarding the location of reductions, it is not clear, which Member States the reductions are mainly going to occur in.

(2) For the remaining EU GHG emissions, an **Effort Sharing Decision** (ESD) determines which country has to reduce how much. On average, GHG emissions that are included in the ESD decline by 10% between 2005 and 2020. Table 1 presents the ESD commitments of the EU Member States that were selected for this analysis.

Also in table 1, the column “ETS-adjusted ESD target” provides a percentage number for total emission reductions in each selected EU country under the simplifying assumption that reductions in the ETS are spread across EU-27 proportionally to ETS emissions, i.e. each EU country reduces its domestic ETS emissions by 21% relative to 2005. The resulting percentage can be used as a first proxy for emission reductions in the individual EU countries under the EU pledge.

The target for the ETS (-21% relative to 2005), which covers about 45% of total GHG emissions in the EU, is likely to result in some reductions, at least if EU growth rates recover in the years to come. The ESD targets for non-ETS emissions imply reductions in some of the Member States. As a result, a minor reduction can be expected also for the EU-27 as a whole.

Underlying effort: The current low prices of allowances in the EU ETS are an indication of the ease with which targets are achievable under the current macroeconomic conditions, although it should be noted that energy and climate policies both on the EU and the Member State level have helped to keep allowance prices low (e.g. feed-in tariffs for electricity from renewable sources, energy efficiency programs such as e.g. white certificates, recently: price floor for allowances in the UK). It is important to state that due to the long history of climate policy in the EU, many implemented measures are already incorporated in the current BAU path. As a consequence, a target that is congruent with such a BAU is not achieved without any effort. In this report, however, we investigate only the effort in addition to existing policies and measures which is implied by the pledge.

Table 1: GHG reduction commitments under the EU Effort Sharing Decision (ESD)

	commitment according to ESD (2020 w.r.t. 2005)	ETS-adjusted ESD target (2020 w.r.t 2005)
Austria	-16%	-17,9%
Belgium	-15%	-17,7%
Denmark*	-20%	-20,4%
France	-14%	-16,0%
Germany*	-14%	-17,6%
Italy	-13%	-16,4%
Netherlands	-16%	-18,1%
Poland	14%	-5,7%
Spain	-10%	-15,2%
Sweden*	-17%	-18,4%
United Kingdom*	-16%	-18,1%

* Countries that have formulated national GHG emissions targets for 2020 which go beyond the reductions pledged under the ESD. For additional information, please consult the table in Appendix A.

Furthermore, a study by the European Environment Agency (EEA 2006) detects substantial ancillary effects of climate policy measures for the EU-25. In a scenario with a 40% reduction target for GHG emissions in 2030 from 1990 levels, air quality in Member States is found to be improved to a degree that would cost € 12 bn. if achieved through air pollution policies only. Within the EU, the ancillary benefits are especially high in the eastern European Member States.

Another way to find out about the required effort is to look at the individual countries. Among the selected countries for this report, we have assessed eleven EU Member States (see below), including the most important economies and emitters. Of the EU Member States that pledge reductions, many have **opportunities to achieve their reductions at negative cost**. For none of the individual EU countries that we investigated, we found significant positive costs implied by the EU's pledge (this is different for national targets that are not pledged under the UNFCCC), Sweden being the only investigated EU country with "possibly positive" costs. This holds as long as efficient abatement policies are assumed. This picture could change if the EU moved to the 30% target, because reductions would then be somewhat more than minor.

In the following, we investigate efforts for eleven selected EU Member States on the assumption that the ETS-adjusted ESD target can be interpreted as something that is similar to a pledge. For those Member States that have put forward national GHG reduction targets for 2020, we also assess the efforts connected to these national targets. The EU Member States are special cases: Some of them are major emitters, they are sovereign countries and Parties to the UNFCCC in their own right, yet choose to put forward quantitative pledges only for the EU as a whole. Agreeing on effort sharing in the EU is a difficult process which is not repeated too often. As a consequence, individual countries that want to increase their climate policy ambition, rely on the announcement of national targets.

Even if these are not rooted in international law, they do constitute important declarations of intent which are worth investigating.

3.6.1 Austria

The ETS-adjusted ESD target of Austria for 2020 implies a 17.9% reduction of greenhouse gas emissions relative to 2005. Comparing this target with the BAU projections by the European Environmental Agency, which include existing measures, Austria reduces GHG emissions by 10%. Given the overall EU-ETS target of -21% w.r.t. 2005, most of these reductions are attributable to the ETS.

Underlying effort: Despite a lack of reliable studies, we roughly estimate costs without ancillary benefits to be around zero. Austria has already achieved improvements in energy efficiency. It can thus be assumed that further abatement measures in the order of magnitude necessary for meeting the pledge will hardly be available at negative cost. On the other hand, the required rather **minor reductions might not imply a positive total cost** either, at least when efficient policies are employed. Hypothetically, including ancillary benefits could result in negative costs.

3.6.2 Belgium

The ETS-adjusted ESD target of Belgium for 2020 implies a 17.7% reduction of greenhouse gas emissions relative to 2005. Compared to the EEA's BAU scenario, which includes existing measures, the Belgian target translates into reductions of -17%. However, the EEA's BAU path deviates from the downward sloping emissions trajectory that has been present after 1996 (especially after 2004) as a result of policy implementation since the 1990s. The ETS-adjusted ESD target, in turn, is very close to what would result from the continuation of the long-term emissions trend. In recent years, emissions have continued to follow this long-term trend, in part because of low economic growth in the aftermath of the 2008 financial crisis.

Underlying effort: It is doubtful, whether the fulfillment of the target will effectively need a substantial effort which would be additional to the one already being made. It is important to highlight that by stating this, we do not intend to let any successful climate policy activity appear small, just because it happened in the past, nor do we deny that adhering to such a downward emissions trajectory requires a continuing effort. However, the scope of our analysis covers only the effort which might be necessary to accomplish reductions relative to business as usual, even if the BAU path entails existing climate policy measures. For Belgium, a McKinsey study shows energy savings potentials that could result in about 40 Mt of CO_2-eq emission reductions in 2030 (about 30% of emissions). This might be prudently taken as an indication that **direct costs for a minor reduction** in 2020 **could be zero or negative** even without considering ancillary benefits (McKinsey&Company 2009e).

3.6.3 Denmark

The ETS-adjusted ESD target of Denmark for 2020 implies a 20.4% reduction of greenhouse gas emissions relative to 2005. With respect to the BAU scenario of the latest National Communication for 2020, the ESD-target is consistent with a reduction of 6% and would amount to an abatement of 3.3 Mt of CO_2-eq for that year. More recent BAU numbers, which next to existing measures also incorporate the outcome of the financial crisis, estimate the reduction needed to meet the pledge at

3% or 1.6 Mt of CO_2-eq in 2020 (EEA 2012).[8] Judged by this, it seems **unlikely that Denmark will need more than minor reductions to fulfil its international target**.

Additional national target: In May 2012, a new Energy Agreement, which was supported by a large majority in Danish Parliament, proclaimed the long term goal of 100% coverage of energy supply with renewables in 2050, including electricity, heating, industry and transport (Ministry of Climate, Energy and Building 2012). For 2020, the targets were set at a share of 35% renewable energy in final energy consumption and 50% of electricity consumption being supplied by wind energy. These targets imply a 34% GHG reduction relative to 1990 or -16% relative to the EEA BAU, which is clearly more ambitious than the ETS-adjusted ESD target. Lately, a majority in Parliament has agreed to increase the ambition even further and formulate a GHG reduction target of -40% relative to 1990. The new target is to be translated into a national law which is scheduled to enter into force in January 2015. The law shall also contain a procedure for establishing future national GHG reduction targets and create an independent, academically based Climate Council.

These **more ambitious national targets** and Denmark's long record of implementation of mitigation measures render it useful to have a closer look on the Danish effort in climate policy, notwithstanding the fact that the international target is estimated to be close to BAU.

Underlying effort: Denmark has already implemented many policies to reduce GHG emissions. It started its way to a low carbon economy rather early, albeit not in the course of climate policy, but as a means of securing energy supply. Since the oil crises in the 1970s, energy efficiency and the promotion of alternatives to fossil fuels in electricity supply were part of the political agenda. Due to geographical conditions, there is no potential for hydropower in Denmark, and nuclear technology was banned in 1985. Consequently, this led to the development of wind power, which in 2011 covered 28% of domestic electricity demand (Ministry of Climate, Energy and Building 2012). CHP plants are widespread in Denmark, too, although especially the large scale facilities are fuelled by coal and natural gas. According to the Danish Energy Agency, the renewable energy share in total electricity consumption reached a remarkable 43.1% in 2012. The share of renewable energy in total energy consumption was 25.8%.

Regarding CO_2 abatement, the cheapest and most effective potentials have already been exploited to a large extent, which means only the more costly options are left. For example, wind turbines were built at the most promising onshore positions first and late projects have to face suboptimal conditions or need to switch to offshore locations. The best locations are currently occupied by older facilities with low efficiency. Replacing them is costly when the old facilities have not reached the end of their technical life-time yet.

There are no studies in the international literature which estimate costs specifically for the Danish pledges. However, in an analysis of future low carbon energy systems by the Technical University of

[8] For consistency, this reduction w.r.t the EEA BAU was calculated from total 2020 pledged emissions derived from EEA's historical GHG data. In Appendix B, the graph on the Danish fact sheet conveys a slightly different message, because the historical GHG data in this graph, which also serve as a basis for the pledged emissions in 2020, are taken from CAIT. As CAIT data displays slightly higher historical emissions, the 2020 total emissions of the pledge end up to be very close to the EEA BAU.

Denmark, several studies which calculate abatement costs are compared (Larsen and Sonderberg 2008). These studies differ in many respects, e.g. regarding the specified period, the magnitude of the reduction and whether total GHG or only CO_2 emissions are involved (see table 2). None of these scenarios match the Danish pledges and except for the Danish Energy Authority (DEA), they examine more ambitious targets. Roughly speaking, they have in common that the objectives could be achieved at a rather low cost or – according to some studies – even negative costs. This is a surprising result against the background of the history of Danish climate policy briefly described above. Even a reduction of total GHG emissions of 80% by 2050 relative to 1990 would burden the economy with no more than 0.5% of GDP.

Table 2: Conclusions of, and assumptions behind, six Danish energy system scenario studies

Title of study	A Visionary Danish Energy Policy 2025	IDA Energy Plan	Danish GHG Reduction Scenarios	Cutting CO² Emissions	Scenarios for Danish GHG Reduction	The Future Danish Energy System
Commissioned for	Danish Government	IDA	DEPA/DEA	Greenpeace	DEPA/DEA	Danish Board of Technology
Prepared by	DEA	Aalborg University	EA Energy Analyses, Risø DTU	ECO Consult	Cowi A/S	EA Energy Analyses, Risø DTU, DONG Energy, Energinet.dk
Published	Jan 2007	Dec 2006	Feb 2008	Jan 2008	Feb 2008	Apr 2007
Time perspective	2025	2030	2020, 2050	2020, 2030	2020	2025
GHG/CO_2 reduction compared to 1990	GHG: –15%	CO_2: –60%	GHG: –40%, -80%	CO_2: –40%, –50%	GHG: –50%	CO_2: –50%
Renewable share (%/net)	30%	44%	30%, 100%	30%, 45%	NA	46%
Savings (%/year)	1.25-1.5%	1.8%	1.9%	1.5-2%	NA	2.8%
Oil price (USD/barrel)	50	68	57, 75	123, 140	50	50
CO_2 quota price (€/ton)	24	20	24	N.A.	40	20
Growth parameters (GDP, private consumption, demand for transport)	Exponential (2.)	Exponential (saturation in transport)	Exponential (1.)	Saturation	Exponential (1.)	Exponential (2.)
Interest rate (%)	6%	6%	6%	5%	6%	6%
Cost (% of GDP)	?	< 0%	0.1%, 0.5%	< 0%	0.5%	~ 0%

Comment (1.) Economic growth projections from The Danish Energy Authority, Jan 2008
Comment (2.) Economic growth projections from The Danish Energy Authority, Jan 2007

Source: Larsen and Sonderberg 2008.

These findings might lead to the conclusion that meeting the Danish pledges implies a rather low effort. Even the more ambitious national pledge demands an abatement of GHG emissions that is far below those depicted in the table for most studies. Costs could thus be expected to be very low. However, it has to be considered that the more ambitious national pledges would have to be met mostly with policies and measures that concern emissions outside the EU ETS, as the latter are largely subject to EU regulations. A study by COWI asserts that a large part of the most cost-efficient measures are covered by the EU ETS. Among those needed to achieve reductions in a range of 30% to 50% of total GHG emissions by 2020 (relative to 1990) between two thirds and three quarters of the most efficient are located within the EU ETS sectors (COWI 2008). This means that the Danish Government is challenged by the need to attain mitigation in the non-ETS-sectors or via channels of international trading of emissions certificates or AAUs.

According to Danish Energy Agency 2011, more than 70% of the emissions outside the ETS arise in transport and agriculture (estimate of average emissions 2008-2012). Emissions in the non-ETS sectors – quite contrary to the ETS-sectors – have decreased only slightly in the past (Danish Energy Agency 2011). This indicates that mitigation here is more difficult and costly. The transportation sector largely depends on fossil fuels. Alternatives which are competitive in terms of technology and price are not yet available. In the rather short period until 2020, only gradual improvements are possible, particularly by promoting the already established hybrid technology and by further promotion of fuel efficient combustion engines. However, in much the same way as Switzerland, Denmark has to rely on technological development efforts by the main actors of the automotive industry, which are located abroad. Also, fuel standards are decided on in Brussels, not Copenhagen.

Agriculture is the second largest contributor to GHG emissions among the non-ETS sectors, although especially non-CO_2 emissions from agriculture have declined over the past decades. For example, the reduction of methane and nitrogen oxide has been an ancillary benefit of a vast array of policy measures aimed at the improvement of the aquatic environment since the 1980s. In comparison with transportation, marginal abatement costs are lower for a number of measures with substantial potential. Among them are changes in cattle feeding to reduce methane emissions from livestock and the use of slurry for biogas production (Danish Commission on Climate Change Policy 2010). It has to be considered, however, that agricultural policies are largely set at the EU level.

3.6.4 France

The ETS-adjusted ESD target of France for 2020 implies a 16.0% reduction of greenhouse gas emissions relative to 2005. On the basis of EEA's BAU projections, the target is equal to an abatement of GHG emissions in 2020 of 6%.

Underlying effort: Although we have not found figures on the cost of the French pledge in the international literature, **it can be presumed that France is able to achieve its minor reduction at a low or even negative total cost**. This is appropriate despite France's low abatement potential in its largely nuclear-based electricity sector, because of no regret potentials that exist, e.g. in the buildings sector. Hypothetically, adding ancillary benefits to the picture would result in negative costs.

3.6.5 Germany

The German ETS-adjusted ESD target for 2020 implies a 17.6%-reduction of greenhouse gas emissions relative to 2005. Germany has issued various climate policy measures since the 1990s. In combination with some other factors, notably the decline of brown coal based inefficient industries in former East Germany, the country was able to initiate a downward emissions trend, which is the basis for current BAU projections. Following the scenarios in EEA 2012, which includes existing measures, the additional effort for meeting the pledge would be negligible, because the required level of emissions is close to the BAU scenario. However, German GHG emissions have been a few percentage points above the EEA's BAU scenario in recent years, which could indicate that some additional mitigation actions will be required to meet the target.

Additional national target: Germany has formulated national objectives that go beyond the ESD pledge. The emission targets are expressed relative to 1990 levels (-40% for 2020 and -80% for 2050) and imply reductions compared to the EEA baseline scenario (-8% in 2020). They are complemented by requirements for the share of renewables in energy consumption (18% in 2020) and electricity generation (35% in 2020) and by demands for energy saving (KfW 2011). Germany plans to achieve its emission targets 100% domestically. However, the role of installations regulated under the EU ETS, which cover roughly 60% of total emissions, in the target definition has so far remained unclear (OECD 2012b).

Underlying effort: For meeting the national 2020 target, we have not found suitable cost estimates in the literature. However, research was done on former objectives. The German Government (BMU 2008) calculated a negative cost of EUR -38/t CO_2-eq for reaching a -34% target in total GHG emissions relative to 1990 level in 2020, assuming technological progress to move forward at a high pace. A McKinsey study of 2007 conducted a bottom-up analysis of more than 300 measures in all sectors and concluded that a reduction of 26% can be achieved at a marginal cost of EUR 20/t CO_2-eq (McKinsey&Company 2007a). According to McKinsey, a further decrease of emissions would require much higher investments, because of the need to considerably raise the share of renewables in the energy mix and to establish biofuels in the transport sector. The reason for the relatively steep marginal cost curve of McKinsey 2007 is the nuclear phase-out, which has been in effect since 2001 and which has induced the construction of new coal-fired and gas-fired electricity generation plants. Although some of these capacity additions are currently not profitable, this is going to increase emissions in the electricity sector from 2010 to 2020 between 4% and 13%, depending on the technologies used (CDC 2011). Consequently, the McKinsey 2007 baseline scenario predicted an end to the decreasing emissions trend prevailing since the 1990s and a slight increase in the forthcoming years. The German Government accelerated the nuclear phase-out after the Fukushima accident.

Replacing nuclear in the energy mix by other low carbon technologies, which still need to be developed further, comes at a cost. The overall cost for the so called “Energiewende”, which might be translated with “energy change”, has been estimated at € 25 bn. per year until 2020 (KfW 2011), which – assuming a 2% GDP growth rate – would equal about 0.9% of GDP on average.

The German effort can also be appreciated through studying two of the most important policy measures:

- In 1999, Germany issued an ecological tax reform which introduced taxes or additions to existing taxes on fuel, electricity, heating oil and natural gas.
- The Renewable Energy Sources Act (EEG), originally adopted in 2000 and repeatedly amended since, established feed-in tariffs for electricity from renewable sources. They are differentiated with respect to type of energy source and decline annually, in order to account for cost degression and to promote technical progress. The objectives of the EEG, which proclaimed a share of 12.5% for renewables in electricity generation in 2010, were already achieved in 2007 (2012: 23.5%, BMU 2013). Feed-in tariffs are a model of success of international climate policy: They have been introduced by about two thirds of EU Member States and by several other countries around the world. With its elevated feed-in tariffs, Germany has considerably contributed to creating economies of scale for wind power and photovoltaics. The resulting cost degression per unit of installed capacity is a beneficial spillover to CO_2 mitigation anywhere on earth. The costs for Germany, however, have been substantial, too. In Germany, the burden is passed onto electricity customers by means of an apportionment. This has led to a significant rise of electricity prices. In 2011, the annual cost was € 19 bn. In 2014, the apportionment is 6.24 Eurocent per kWh. This is more than 20% of a typical household electricity bill (Mayer & Burger 2014). 2 098 energy intensive companies are exempted from the regime. It should be noted that the promotion of renewables in Germany, which at the same time takes part in the EU ETS, will induce additional reductions in Germany, but not in the EU as a whole, because the EU emissions cap remains unchanged. Despite this, the German feed-in tariffs are likely to have an overall climate mitigating effect

due to the described spillovers through cost degression mainly for wind power and photovoltaics.

Again, the above findings help to illustrate an important point: If a country (like Germany) has been rather active in implementing policies to reduce greenhouse gas emissions in the past (see also Appendix B), the BAU path includes these existing policies. If the current targets do not go far beyond this BAU, it can still not be concluded that no effort is being made. A more appropriate formulation would be that these **targets do not imply large efforts in addition to the ones that are already being made**.

3.6.6 Italy

The ETS-adjusted ESD target of Italy for 2020 implies a 16.4% reduction of greenhouse gas emissions relative to 2005. The Italian target is equal to a reduction of 10% relative to the EEA's BAU scenario (BAU includes existing measures). Much will depend on Italy's ability to rise from the current economic crisis. **The ongoing economic downturn makes the target look like business as usual.** Only with an economic recovery, the higher BAU that has been estimated by the EEA could become relevant again.

3.6.7 The Netherlands

The ETS-adjusted ESD target for the Netherlands implies a reduction of 18.1% relative to 2005. According to the EEA's BAU scenario, which includes existing measures, the pledge of the Netherlands adds up to a substantial reduction of -20% in 2020. However, the EEA BAU does not seem to provide a reliable baseline for the purpose of this report. It breaks sharply with the downward emissions trend of the years between 1995 and 2010, because of an expected rise in the emissions from energy supply, which are mainly covered by the EU ETS and therefore can be considered of minor relevance to the domestic target. The continuation of the historical trend would lead roughly to meeting the pledge. However, if this trajectory should be realized in the future, this may not be the result of additional efforts, but of a relatively long history of climate policy in the Netherlands.

Underlying effort: In a recent research study for the Government, the effects of Dutch Climate Policy were evaluated (Tweede Kamer der Staten-Generaal 2013). The Climate Policy Implementation Plan of 1999 and 2000 set the strategy for meeting the obligations of the Kyoto Protocol and represented the first comprehensive political framework after less stringent propositions in the previous years. Between 1999 and 2003 policies had a cost, from a national perspective, of € 44–100 per ton of avoided CO_2-eq. For 2003, the effect of domestic climate policies was calculated for a GHG reduction of 5% (11.4 Mt CO_2-eq) relative to a baseline scenario without any measures. In the years after this, annual government expenditure on climate and energy policy increased sharply. It amounted to € 1.0 to 1.5 bn. in the years from 2003 to 2007. Looking back at the years before the mid 2000s, climate policy proved to be more expensive than expected by ex-ante analyses of costs and benefits. The main reason for this was that the focus was not on improving energy efficiency, which can achieve abatement at a relatively low cost. Instead, renewable energy was promoted, which proved to be more expensive than calculated previously (about € 300 per ton abated). For the following years, abatement cost projections are difficult, because we did not find any studies with results for the

Dutch economy as a whole. While Dutch climate policy actually grew more expensive after 2005, abatement costs may have declined in some areas, because renewable energy has become cheaper due to economies of scale with rising installed capacities worldwide. Abatement measures in transport and agriculture are dominated by the promotion of biofuels, which is currently not a particularly cheap option.

It is interesting to note that when actual policies are analyzed ex-post, costs are much higher than necessary, because of a selection and design of policy measures that fail to minimize total abatement costs. The Netherlands are not an exceptional case in this respect. The sources we found stress the cost of existing climate policy in the Netherlands and the limited low cost potentials that are left. On the other hand, no regret potentials e.g. in the buildings sector exist, and **required reductions for the international pledge are minor at best**. Thus, we conclude that **direct costs could be around zero** with some uncertainty attached to it. Considering ancillary benefits would likely result in negative costs implied by the pledge.

3.6.8 Poland

The ETS-adjusted ESD target for Poland implies a reduction of 5.7% relative to 2005. This is close to the EEA BAU scenario. On the other hand, Polish GHG emissions have been a few percentage points above the EEA's BAU scenario (includes existing measures) in recent years, which could indicate that some mitigation action will be required. It is **unlikely**, however, **that any prominent additional effort is needed** to achieve the target. If a possible gap to the target can be closed with least-cost policies, it is **possible that the direct costs** of these measures **are negative**.

3.6.9 Spain

The ETS-adjusted ESD target for Spain implies a reduction of 15.2% relative to 2005. This target is close to business as usual, although the latest National Communication tells a slightly different story, because the BAUs described therein would imply reductions under the ESD of 13%. However, BAU numbers from the more recent study by the European Environmental Agency (EEA 2012), which include existing measures, suggest that the Spanish **target does not require reductions relative to BAU**. In Spain, like in many European countries, the financial crisis has made the attainment of the ESD targets much easier.

3.6.10 Sweden

The ETS-adjusted ESD target for Sweden implies a reduction of 18.4% relative to 2005. Relative to the EEA's BAU scenario, this translates into an 8% abatement in 2020. However, the EEA BAU does not continue the decreasing long term emissions trend, but allows for a much slower reduction trajectory, whereas the Swedish ETS-adjusted ESD **target is close to a prolongation of the downward sloping tendency since the mid 1990s** (see Appendix B).

Additional national target: In addition to its commitment to the ESD target, Sweden proclaimed an **aspiring national objective to reduce GHG emissions by 40% relative to 1990 in 2020**. This would amount to a total abatement of 29 Mt CO_2-eq. Data for 2011 underlines the ambition of this objective, because nearly four fifths of the reduction were still lying ahead. Relative to the BAU scenario by the EEA, which includes existing measures, the Swedish domestic target implies a substantial reduction, too: For 2020, it calls for 27% fewer emissions than in the BAU projection. Furthermore, the target covers only emissions outside the ETS, and two thirds of the reduction shall be realized domestically. In summary, the Swedish national target implies substantial reductions.

Underlying effort: Per capita emissions in Sweden have been declining since the 1970s. Today, the country combines economic growth and decreasing GHG emissions. Without any appreciable fossil fuel resources at its disposal, Swedish energy policy aimed at securing energy supply early, by which it made a continuous impact on CO_2 emissions, too. The country introduced an energy tax in 1957 and promoted nuclear and hydropower, the latter being facilitated by favorable geographic conditions (Ministry of Environment Sweden 2009). Various environmental regulations supported by a nation who saw environmental policy as a part of social modernization helped reducing emissions further (Jewert 2012). Today, per capita emissions are among the lowest in OECD countries and in terms of the share of renewables in total energy consumption, Sweden belongs to the top level group in the OECD (47.9% in 2010, according to EEA data).

Because of rising energy bills in the 1970s, municipalities built an extensive system of district heating facilities, which often serve as combined heat and power plants (CHPs). With climate policy coming into view, these sites could easily be adapted to burn natural gas and biofuels. As a consequence of this, GHG emissions from individual heating in households and commercial premises dropped by 70% between 1990 and 2007 (Ministry of Environment Sweden 2009). This development is also due to the impact of the carbon tax, which was introduced in 1991 and is – in the light of numerous exemptions for the industrial sector – to a large part paid by private households. Currently, the tax rate is fixed at SEK 1 050 (EUR 115) per ton of CO_2.

An energy tax on electricity consumption in the industrial sector was implemented in 2004. Companies receive energy tax rebates in exchange for establishing certified energy saving programs. Due to a ban on landfilling of combustible and organic waste and a tax on deposited waste, GHG emissions in the waste sector declined by 38% between 1990 and 2007, albeit household waste increased by 35% during the same time period (Jewert 2012).

Being a country with a long history of climate policy, Sweden is faced with the situation that there are no cheap mitigation options left to achieve the national target for 2020. The McKinsey study sees **only few no regret potentials** (McKinsey&Company 2008b), although McKinsey are usually known to be rather optimistic about such potentials. **Possibly**, even the less ambitious internationally communicated target will induce **positive direct costs of abatement**.

In contrast to successful mitigation efforts in electricity generation, heating, waste management and the industrial sector (e.g. in the pulp and paper industry), total emissions in the transport sector have increased almost continuously (OECD 2011c). Between 1990 and 2007, the share of total GHG emissions from the transport sector climbed from 26% to 32%. In order to achieve the national target, this sector needs to be tackled, which is not going to come at a particularly low cost.

There are several studies on ancillary benefits of CO_2 abatement in Sweden, mostly confined to air pollutants like SO_2, NO_x and PM2.5 (Riekkola et al. 2011, Östblom 2009). Although the level of policy action on this field has been already high in the past, Riekkola et al. 2011 reach the conclusion that ancillary benefits can reduce the overall cost of achieving the -40% Swedish national target for 2020 substantially. The benefits of the reduction in air pollution are highest in the scenario where the CO_2 mitigation is completely domestic (6.1% to 32.0% of the overall abatement cost). These numbers suggest, however, that in the case of Sweden, ancillary benefits may not be high enough to turn positive into negative abatement cost numbers.

3.6.11 United Kingdom

The ETS-adjusted ESD target for the UK implies a reduction of 18.1% relative to 2005. This target is close to the Government's BAU projections and even 8% above the BAU provided by EEA 2012.

Additional national target: Next to its commitment under the ESD, the United Kingdom pursues a national GHG reduction target for 2020 of 34% relative to 1990. This second target is complemented by a long term target for 2050 of an 80% reduction relative to 1990. Both these targets are set in national legislation and are translated into carbon budgets for 5-year periods. So far, Parliament has approved the budgets for the first four periods, implying e.g. a legally established greenhouse gas emissions reduction of 50% by 2027 (relative to 1990). This statutory underpinning of the targets is remarkably special. The same applies to the Committee on Climate Change, which is an independent body, legally responsible for the suggestion of the carbon budgets and the assessment of the Government's progress in pursuing them (Committee on Climate Change 2009 and 2010).

Underlying effort: The GHG emissions under the national target for 2020 are about 6% lower than under the ETS-adjusted ESD target. This more stringent target is thus very close to the BAU given by EEA 2012 (includes existing measures), which implies that the target as such might not require any additional mitigation effort.

On the other hand, the UK looks back to a long history of climate policy action and has established a comprehensive set of policy measures, which are responsible for a downward sloping trend in emissions since the 1990s. Important policies have also been implemented in the past few years (see Appendix B). In recent years, the emissions trajectory has also mirrored the decline of economic activity in the wake of the economic turmoil of the financial crisis, followed by the current economic recovery. It should thus not be concluded that a continuation of the emissions trend implies no effort. While it can be achieved by simply executing the measures taken in the past, the continuation of such policies does constitute an effort. Nonetheless, the current targets do not require an effort that would be additional for the investigated period until 2020, unless Britain's current economic recovery expands into a veritable boom.

The downward slope of the greenhouse gas emissions trend in the UK dates back to the early 1990s when the Government privatised the electricity sector, which led to the use of improved technology and lower domestic prices for natural gas. The so called "dash for gas" was initiated and provoked a substitution of coal and oil for cleaner energy sources. Another cause for declining GHG emissions in the 1990s were policies aimed at the protection of the environment through improving waste and landfill management, which led to a decrease of methane emanation. These one-off factors were complemented by climate policy measures which targeted energy efficiency and emission reductions following the Climate Change Programme in the year 2000. Examples are the Climate Change Levy (2001) and the Renewables Obligation (2002) in electricity supply (OECD 2011b).

The Climate Change Act (2008) provided the framework for the legally binding carbon budgets and was followed by an array of related policy measures addressing e.g. household energy savings, biofuels in transport, and feed-in tariffs for small scale electricity generation. In 2012, the UK founded a Green Investment Bank with a capital of £3 bn. (EUR 3.8 bn.).

Since April 2013, a floor price for EU ETS Allowances (EUAs) is in effect in the electricity sector. It is set at a price of £16 (EUR 20) and is scheduled to increase gradually until 2030. It aims to encourage additional investment in low-carbon power generation by providing greater certainty given the high volatility and current low level of the carbon price in the EU ETS. The stimulus has been deemed necessary, because investments in the electricity sector are not sufficient for fulfilling the mitigation duties of the carbon budgets (Sandbag 2012). The use of the revenues has not been specified yet. Apart from the fact that the floor price will create windfall profits for existing low carbon capacity, it is unlikely that the intended security for investors can be achieved, because of the continued need for Parliamentary support on an annual basis. Furthermore, the floor price will induce additional reductions in the UK, but not in the EU as a whole, because the EU emissions cap is not altered.

We have not found any suitable cost estimates for the climate policy packages as a whole. A comprehensive, comparative study by the OECD (OECD 2013), which includes the United Kingdom, provides for the year 2010 a snapshot of the net cost to society of policy measures which cause reductions in GHG emissions. Any measures which lead to an abatement are included, regardless whether the policies where primarily introduced with the aim of limiting GHG emissions or not. Revenue recycling is assumed, and a no-policy-scenario serves as baseline. The study calculates cost figures for different sectors and offers interesting insights into the costs of climate policy in the United Kingdom: the total cost to society of GHG abatement in the electricity sector in 2010 amounts to 0.08-0.1% of GDP, whereas policy measures in road transport account for total costs of 0.2-0.5% of GDP.

A study with a much different purpose is the analysis by Marden and Gough 2011, who add up revenues of environmental taxation in the UK. In 2010, this amounted to a total of 2.7% of GDP. However, this number includes all kinds of transport related levies. Thus, only a smaller part of it could be attributed to climate policy. According to the same article, mandate spending related to mitigation by the private sector, mainly energy companies, was about 0.1% of GDP in 2010 and spending for direct Government programs to reduce CO_2 emissions from households was about 0.05% of GDP. With the Green Investment Bank in operation, these numbers are set to further increase. However, they should not be confused with economic cost estimates, because spending and economic cost are fundamentally different: In the intended case, spending leads to investments that are worthwhile, e.g. because they considerably increase energy efficiency. They will thus lead to energy savings and other ancillary benefits such as improved air quality, increased energy security etc. Taxation generates revenues, which can be recycled such that the excess burden of other taxes is reduced.

In summary, **the UK's targets for 2020 – whether under the ESD or under the national carbon budgets – do not imply *additional* costs against the background of the existing climate policy**.

3.7 India

Short description of the pledge: India´s pledge is formulated in terms of emissions intensity of GDP (-20% to -25% in 2020 relative to 2005) and conditional on financial support by developed Parties.

Significance of the pledge: While the emission intensity improvement under the pledge sounds ambitious, the long-term trends of emission intensity improvements need to be considered to assess the pledge from a meaningful perspective: India´s CO_2 emission intensity of GDP fell by 16% between 1998 and 2008. A drop of 20% in 15 years is thus not too ambitious, given that large parts of Indian industry still exhibit large efficiency potentials. This statement is supported by the business as usual paths for India of both the International Energy Agency (IEA) and the US Energy Information Administration (EIA), which project CO_2 emission intensities that are lower than under the pledge.

On the other hand, both these BAU projections tend to include existing policies and measures, which need to be effectively implemented to reach the related emission levels. India's Interim Report on Low Carbon Strategies for Inclusive Growth (Planning Commission – Government of India 2011), which was commissioned to provide solutions for meeting the pledge, points in a similar direction: It has computed a Determined Effort Scenario to achieve a 23-25% emissions intensity reduction over 2005 levels by 2020 through effective implementation of existing mitigation policies and additional policies contemplated by the Government. There is also an Aggressive Effort Scenario with a 33-35% emissions intensity reduction by 2020 over 2005 levels.

It is hard to judge whether the less ambitious "-20%" end of the pledge requires much action. Considering long-term trajectories, it looks more like a continuation of existing trends. However, Indian documents indicate that sustaining past efficiency improvement trends to keep per capita emissions low requires effective policy implementation and even some additional measures. Hence, the Indian **pledge could imply reductions, which are probably going to be minor**. In the case of India, which is among the main global emitters in absolute terms, minor reductions in relative terms can be sizeable in absolute terms.

As the pledge is formulated in terms of emissions intensity of GDP, unexpected changes in the growth trend would not change our conclusion much, except maybe for a major economic downturn. In general, higher growth rates accelerate the replacement cycle for capital and thus facilitate improvements in emission intensities.

3.8 Indonesia

Short description of the pledge: Indonesia intends to implement voluntary Nationally Appropriate Mitigation Actions (NAMAs) that reduce GHG emissions by 26% by 2020 in relation to a business as usual (BAU) scenario.

Significance of the pledge: Although this seems ambitious at first glance, much depends on the BAU scenario. Pledges that are based on BAU projections are inherently uncertain, because BAU emissions may be subject to change. In its 2nd National Communication to the UNFCCC (2010), Indonesia presents a business as usual scenario with more than a doubling of GHG emissions between 2010 and 2020. This is an impressive increase: Even at the current GDP growth rates of around 6%, emissions in this BAU scenario increase faster than economic activity. For comparison: In the decade between 1995 and 2005, Indonesian GHG emissions increased by less than 50%. Based on the BAU scenario from the National Communication, a 26% reduction follows this trend and is probably not going to require additional policy efforts. Despite this conclusion on emissions trajectories, it should be noted that the **NAMAs, if implemented, can be expected to have an effect on abatement, at least if realistic sectoral baselines are defined**.

In 2009, Indonesia communicated a range of 26% to 41% reduction relative to BAU, depending on the amount of international support. A 41% reduction relative to the communicated BAU could be considered a reasonable achievement, if economic growth continues at current rates. However, the official pledge submitted under the UNFCCC does not mention the more ambitious end of the range.

3.9 Iran

Iran is ranked 9th in terms of CO_2 emissions excluding LULUCF in 2010. Until today it **has not issued an international or national reduction target**.

3.10 Japan

Short description of the pledge: Until COP 19 in Warsaw in November 2013, Japan pledged a reduction of 25% of total GHG emissions relative to 1990 (premised on the establishment of a fair and effective international framework in which all major economies participate and on agreement by those economies on ambitious targets). The pledge was officially kept under revision by the new Abe Government since 2012 and finally abandoned in Warsaw in favor of a new target of -3.8% compared with fiscal year 2005, which corresponds to plus 3.1% relative to 1990.

Significance of the pledge: Under its new pledge, Japan allows for an emissions trajectory which is at the upper end of earlier business as usual projections. However, the notion of “business as usual” is difficult to maintain for Japan after the Fukushima accident, and in recent years emissions have increased more than had been expected. The Government put forward the shutdown of the Japanese nuclear power plants (for safety reasons in the aftermath of the Fukushima accident) as reason for the revision of the pledge. However, the Abe Government intends to revive nuclear power. Furthermore, energy scenarios by Climate Action Tracker 2013 indicate that electricity supply issues cannot plausibly motivate a delta of 28.1% of 1990 emissions between the two pledges. In conclusion, **some emission reductions under the new pledge may be necessary, but minor**. Large emission reduction potentials in the building sector suggest that the effort needed will be negligible in cost terms, although not necessarily in policy terms.

Japan’s effective opt out of quantitatively meaningful international commitments to reduce global GHG emissions is especially relevant, because the original pledge had been among the very rare post-Kyoto cases of a substantial international pledge by a major emitter. Japan was the sixth largest emitter in 2011 and accountable for a global emissions share of roughly 3%.

3.11 Korea, Republic of

Short description of the pledge: The pledge of the Republic of Korea is expressed as a reduction of 30% in total GHG emissions relative to business as usual emissions in 2020.

Significance of the pledge: Absolute emission levels for pledges that are based on BAU projections are inherently uncertain, because BAU emissions may be subject to change. The BAU projections from Korea's latest National Communication appear to be quite well in line with existing trends and reasonable growth projections and include some efficiency improvements. Recently, actual emissions have been higher than projected in this BAU scenario.

The GHG emissions in the Republic of Korea have grown strongly since 1990, due to the fast industrial development. The growth has flattened in recent years (see Appendix B). The pledge would reverse the trend and result in a decrease of emissions until 2020. Thus, the 30%-target, which was set after a comprehensive political and societal discussion process, demonstrates ambition and would result in **considerable emission reductions**.

Underlying effort: The bottom-up analysis by den Elzen et al. 2011 calculates total abatement costs for achieving Korea's national pledge. It includes revenues (or costs) from emissions trading and other measures, but excludes any macroeconomic costs or side effects. The model merges the Republic of Korea and North Korea to one region, which leads to an underestimation of the South Korean pledge. The total cost to meet the pledge is estimated at 12.2 billion US$. This is approximately 1 % of GDP of the Republic of Korea in 2011.

Some of this cost could be compensated by ancillary benefits. Joh et al. 2001 investigate the ancillary benefits of CO_2 mitigation for the South Metropolitan Area, which covers about half of the South Korean population. The bottom-up analysis is restricted to PM_{10} and excludes health effects of other important air pollutants like SO_2 and NO_x. Despite the limited scope with respect to area and pollutants, Joh et al. find a cumulated value of avoided health effects of 1 bn. US$ (1999 US$) for an only mildly ambitious GHG abatement scenario.

For effective abatement, changing the energy mix is both crucial and challenging. A comparative OECD 2013 study on effective carbon prices states that, in the year 2010, Korea's CO_2 abatement in the electricity sector was below 1% of counterfactual emissions of a no-policy-scenario and came at a net cost to society of 0.03% of GDP. On the one hand, this indicates that the existing abatement potentials can still be exploited. On the other hand, it also reflects the challenges: Since domestic resources of natural gas are scarce and the potential for hydropower is limited due to geographical conditions, other more costly or more disputed options, such as solar and nuclear energy, come into focus. In the past, emissions in the transport sector decreased mostly as a consequence of fuel taxation. Also, public transport is well organized, often with gas buses, and traffic jams have been reduced with traffic management. In the year 2010, total abatement in road transport added up to 13-34% of emissions of the no-policy-scenario, the net cost to society being 0.11-0.33 % of GDP (OECD 2013). Further mitigation needs to be accomplished by various measures such as promotion of natural gas as fuel, introduction of biofuels, and support for more efficient engines. These measures could be more costly than the policies that are already in place. Regarding the building sector, a ban of incandescent light bulbs is a way to reduce CO_2 emissions that is associated with negative costs. This often also applies to insulation requirements for buildings.

Concerning industry, costs are going to depend on the success of the Emissions Trading Scheme (ETS), which is scheduled to start in January 2015. It is not fully developed yet, but the far advanced legislative procedure indicates that around 70% of total GHG emissions will be covered. The countries' largest 500 emitters will be obliged to take part in the scheme as well as more than 4 000 installations with annual CO_2 emissions above 25 kt and an energy assumption above 100 TJ. This broad coverage can – cautiously – be taken as a sign for a rather efficient way to achieve emission reductions in industry. In the first three year period, all certificates will be allocated for free; in the second phase (2018-2020) the free allocation rate will be at 97%.

Comparison to Switzerland: The relevant studies are difficult to compare. Furthermore, the Korean pledge depends on BAU emissions, which may be subject to change. The above analysis suggests, however, that Korea's pledge could imply an effort that may well be somewhat higher than for Switzerland's pledges, at least when it comes to Switzerland's unconditional "-20%" pledge.

3.12 Mexico

Short description of the pledge: Mexico pledges a reduction of up to 30% in total GHG emissions relative to the BAU scenario, subject to the provision of adequate financial and technological support from developed countries as part of a global agreement.

Significance of the pledge: Targets which are formulated relative to a BAU scenario are uncertain in absolute terms, because BAU scenarios may be subject to change under future economic and political developments. The BAU scenario which has been communicated in Mexico's National Communication projects GHG emissions in line with long-term trends. On the basis of this BAU, the -30% pledge clearly **implies considerable reductions** in GHG emissions.

Underlying effort: According to a study by the World Bank (Johnson 2010), Mexico could abate 477 Mt of CO_2-eq in 2030 (or 42% of baseline GHG emissions) at a negative total direct cost. Even though abatement potentials will be much lower in 2020 than in 2030, this likely implies that total direct costs of the pledge could be close to zero from a bottom-up perspective. The World Bank locates the most cost-effective mitigation measures in the transport sector. About 18 % of total Mexican emissions are generated by transport, especially road transport. A large reduction at a rather low economic cost could be realized by an improvement of public transport and bus systems, whose current inefficiency induces demand for private cars. A revitalising of urban centres to make them places for living with access to jobs, schools etc. can reduce the volume of traffic, too. Another measure with a high benefit would be an optimization of road freight logistics, which are characterized by a structure with many small businesses. The creation of cooperatives with specialized terminals and information systems could reduce emissions by avoiding frequent empty trips. The emissions from the private car fleet could be reduced by issuing fuel economy standards for new cars. The large amount of imported cars from the USA, which are often more than 10 years old, could be tackled by tighter pollution standards, albeit with a social cost for lower middle class households. On the other hand, the study emphasizes the many ancillary benefits of GHG emission reductions, which are particularly high in the transport sector. Most important among these are the lower health costs by reducing air pollution and time savings due to less traffic congestion in urban areas. Considering these ancillary benefits of abatement leads to negative abatement costs.[9]

On the energy supply side, the carbon intensity of the Mexican electric power sector, which is currently dominated by coal and natural gas, can be reduced by promoting renewable sources. Wind power has a high potential in some regions. Electricity demand is another key factor for the abatement of greenhouse gas emissions in Mexico. Since air conditioning, refrigeration and electronics are areas that are expected to grow further, enacting efficiency norms is considered an effective and economical measure. The industrial sector consists by and large of the subsectors cement, iron and steel, chemicals and petrochemicals. It is characterized by efficient large-scale facilities on the one hand and a high number of small and medium enterprises with substandard technologies on the other hand. Improving energy efficiency of these processes would achieve emissions reductions by a relatively low cost, although tackling financing and other barriers will be crucial for success in this area. At Pemex, the national gas and oil company, there are large potentials for low cost interventions with high return on investment, especially for combined heat and power (CHP) projects at the facilities and for reducing oil and gas leakage. However, the high indebtedness of the company and its important role as contributor to the federal budget account for the fact that this potential has not been taken advantage of.

Much in line with the suggestions of the World Bank study, the National Climate Change Strategy relies on measures such as new standards in the transport sector, the suspension of energy subsidies, and the promotion of renewable energy sources, amongst others.

Comparison to Switzerland: Mexico and Switzerland differ in almost any respect. Costs and potentials provided above suggest that the Mexican **target could be achieved approximately at zero cost**, or – if ancillary benefits are considered – negative costs. However, the Mexican effort cannot primarily be measured in abatement costs. The difficulty for Mexico consists in overcoming the **many institutional barriers** on the way to a less carbon intensive economy. In this sense, meeting the Mexican target requires an institutional effort that will be larger than the effort for Switzerland to meet its pledge, even if a pure cost comparison might suggest something else.

3.13 New Zealand

Short description of the pledge: New Zealand pledges a reduction within a range of 10% to 20% relative to 1990, subject to several conditions that call for – among other things – a global agreement suitable to set the world on a pathway to limit temperature rise to not more than 2 degrees and full recourse to a broad and efficient international carbon market. In September 2013, New Zealand added an unconditional pledge of -5% from 1990 levels.

[9] Another recent study on ancillary benefits of climate change policies (Crawford-Brown et al. 2012) confirms the importance of ancillary benefits of abatement in Mexico. It investigates the impact of a significant CO_2 abatement on premature death and risks of non-fatal diseases due to exposure to ozone and PM. The time horizon considered lasts from 2010 to 2050, and the reduction of CO_2 is at 77% below the baseline in 2050. For this scenario, the authors depict a substantial improvement in public health due to lower concentrations of ozone and PM, mostly in Mexican urban areas. They calculate the positive health effects at a yearly average of 0.6 bn. US$ of 2020 (sic!).

Significance of the pledge: Knowing that New Zealand's GHG emissions (excluding LULUCF) rose by almost 20% between 1990 and 2010, a 5%-20% reduction by 2020 relative to 1990 is substantial. However, the difficult issue of LULUCF emissions and removals is a major factor for assessing New Zealand's effort. At COP 19 in Warsaw New Zealand announced that it will follow the LULUCF accounting rules of the Kyoto Protocol framework. While this greatly reduces uncertainty related to accounting, the rules for the 2nd Commitment Period, which were approved in Durban, could hand over emission reductions to New Zealand in an order of magnitude of 30% of 1990 emissions (see, for instance, Grassi et al. 2012). According to this estimation, the unconditional pledge would be ineffective. We can conclude that, depending on LULUCF policies and on the particular percentage objective that will be chosen, New Zealand's pledge **could result in minor GHG reductions**.

Underlying effort: Uncertainty about the stringency of the pledge transfers into uncertainty about costs. Furthermore, the formulation of the pledge suggests that New Zealand might intend to use international carbon markets for a part of the required abatement. The New Zealand Ministry for the Environment 2013 reports abatement potentials in the energy sector at negative costs for 2013-2020 (annual average) of about 3.5 Mt (about 5% of current emissions). They report other considerable potentials in agriculture and forestry. This indicates that **direct costs could be positive or negative, depending on the actual domestic reduction required** under the pledge relative to BAU.

3.14 Norway

Short description of the pledge: Norway commits to reducing total GHG emissions by 30% (or 40%, conditional to a global agreement in line with 2˚C warming) in 2020 relative to 1990. The pledge is legally binding under the Kyoto Protocol. Ratification of the pledge is pending to date.

Significance of the pledge: The Norwegian pledge is likely to imply **substantial reductions**. Taking into account BAU emissions as communicated by the Government (see Appendix B), this adds up to the following mitigation (in absolute terms):

- unconditional pledge: 22 Mt CO_2-eq
- conditional pledge: 26 Mt CO_2-eq

Norway has commented their pledge by stating: "An important feature of Norwegian climate change policy is the flexible and cost-effective Kyoto Protocol based approach", which can be seen as a hint that Norway intends to purchase parts of the required reduction abroad.

Underlying effort: In 2008, the Norwegian Government established a research group (Klimakur) that was assigned with the task to propose tools and measures to achieve the 2020 emissions target. The target was translated into a domestic reduction of 12 to 14 Mt CO_2-eq, excluding the CO_2 uptake by forests, and the remainder potentially being subject to emissions trading and other available mechanisms. A bottom-up-assessment of a comprehensive list of measures came to the conclusion that mitigation of 12 Mt CO_2-eq can be reached at a marginal cost between 1 100 and 1 500 NOK per ton of CO_2-eq (135-185 €/t).

Furthermore, a macroeconomic model, which had a discount rate of 5% and included some side effects of the implementation of measures and instruments, was employed to compute "annual socio-economic cost" of the abatement. One of the results is that a reduction of 12 Mt CO_2-eq in 2020 can be achieved with an "annual socio-economic cost" of 5 billion NOK or 0.2% of GDP.

However, it is stated that the **estimates of socio-economic cost "involve considerable uncertainty"** (Climate Cure 2010).

To put these results into perspective, we take a somewhat closer look at the Norwegian energy sector and economic structure: According to data from the European Environmental Agency, more than 60% of final energy consumption originates from renewable sources. This is due to the fact that electricity supply in Norway is almost entirely based on hydropower. Further development of hydropower is, however, only possible by expanding small scale plants. The transport sector is the country's largest emitter of greenhouse gases, due to the fact that Norwegian topography and low population density imply a high importance of transportation. Extraction industries, especially for oil and gas and foreign trade constitute the base of the Norwegian economy and add to the high importance of transportation.

Policy measures have been issued in the last years, including a CO_2 tax on fuel. Norway has the highest motor fuel prices among the 33 countries analyzed in this report. In consequence, emission reductions resulting from these policies are already incorporated in the BAU scenario. Hence, further and potentially more costly measures need to be taken in the transport sector to reach the target. Among the less costly policies are improvements of energy efficiency by promoting the use of low carbon vehicles and the partial substitution of fossil fuels by biofuels. Higher costs apply to measures which aim to influence the modal split in passenger and freight transport.

The Norwegian pledge is the pledge that at first glance looks most ambitious among all the unconditional pledges analyzed in this report. The Norwegian studies mentioned above suggest, however, that the actual effort to reach the target will be low in terms of economic cost, especially when carbon uptake by forests and the probable use of flexible mechanisms are taken into account. As Norway seems to intend to purchase some of the reduction abroad, overall costs are going to depend also on international prices for allowances and certificates. At current prices, the related purchasing price hardly matters, which would change in a future with more ambitious international climate policy. Furthermore, the analysis above shows that moving to the conditional target and/or doing the entire pledged reduction domestically would require a much more considerable effort from Norway.

Comparison to Switzerland: The relevant studies are difficult to compare. It is well possible that the Norwegian pledges would require slightly higher efforts than Switzerland's respective pledges (i.e. comparing the two unconditional and the two conditional pledges), provided that the reduction was 100% domestic. However, it is clear from the above that Norway is unlikely to do 100% of the abatement at home.

3.15 Russia

Short description of the pledge: Russia pledges a reduction of 15-25% by 2020 relative to 1990. The range depends on appropriate accounting of the potential of Russia's forestry and on major emitters adopting legally binding obligations.

Significance of the pledge: **Russia´s pledge is in the range of business as usual projections**, the -25% pledge at their lower end, the minimum pledge of -15% at their upper end. According to the conditions that Russia has put forward, a pledge that is stricter than -15% is considered only when all major emitters take legally binding obligations and in the event of “appropriate accounting of the potential of Russia’s forestry”. While no one would want to object to “appropriate accounting”, experience from the Kyoto Protocol´s 1st Commitment Period would seem to suggest that this condition is going to mean that a Russian pledge that is stricter than -15% in substance is unlikely. However, Russia has translated the -25% pledge relative to 1990 into national legislation by Presidential Decree without referring to any of the conditions that apply to the pledge under the UNFCCC. In relation to the Decree, an implementation plan and a GHG accounting system are being developed. The relevance of the Decree’s target is going to depend to a large extent on the rules that are going to be set at this technical stage.

Russia has sizeable amounts of surplus Assigned Amount Units (AAUs) from the Kyoto Protocol´s 1st Commitment Period (2008-2012). These could be in an order of magnitude of 5.8 Gt (Pointcarbon 2012). Use of these surplus AAUs could make the Russian target entirely toothless. However, as Russia does not participate in the 2nd Commitment Period (2013-2020) of the Kyoto Protocol, it has little leverage to lobby for the eligibility of its surplus AAUs.

By 2020, business as usual projections expect Russian GHG emissions between 75% and 85% of 1990 levels, which is also the range that has been pledged. Russia’s -25% target, which has translated into a Presidential Decree might require some additional efforts if the currently weak economic growth resumes in the second half of the decade and if the accounting rules that will be chosen do not water down the objective.

In summary, it can be concluded that Russia´s target is **unlikely to require additional efforts, unless economic growth becomes much higher than expected**.

3.16 Saudi Arabia

Until now, Saudi Arabia **has not pledged a GHG emissions reduction target under the UNFCCC**. In terms of CO_2 emissions excluding LULUCF, Saudi Arabia is ranked 11th in 2011. Per capita GHG emissions are particularly high, e.g. higher than in the USA.

3.17 Singapore

Short description of the pledge: Singapore pledges Nationally Appropriate Mitigation Actions (NAMAs) that reduce GHG emissions by 16% below business as usual in 2020, contingent on a legally binding global agreement.

Significance of the pledge: Singapore’s GHG emissions have risen sharply. In recent years (since 2009), they have clearly exceeded even the upward trend of the previous decade. The BAU scenario which the Government provided in 2012 corresponds roughly to a continuation of this latter, long-term upward sloping trend. A 16% reduction from this BAU would thus imply noteworthy reductions.

On the other hand, pledges that are based on BAU projections are inherently uncertain, because BAU emissions may be subject to change, especially when they have not been communicated under the UNFCCC. In the case of Singapore, a BAU emissions number for 2020 has been provided in a National Climate Change Strategy document (Republic of Singapore 2012), but to this date cannot be found in a National Communication to the UNFCCC (in contrast to, for instance, Mexico and South Korea).

Furthermore, the aforementioned National Climate Change Strategy document lacks data on actual and past absolute emissions, which renders the exact meaning of the BAU number given for 2020 a matter of interpretation. The effectiveness of NAMAs to achieve real and measurable emission reductions remains unclear, as long as an international agreement on the guidelines for this instrument is pending. Summing up the **uncertainties**, it is **difficult to evaluate** Singapore's pledge and denote it as significant. Despite this and depending on future clarifications by Singapore, the pledge could imply emission reductions relative to the steeply rising emissions path of recent years.

While Singapore is a non-Annex I country, its per capita CO_2 emissions are more than twice as high as Switzerland´s, and its GDP per capita is higher than, for instance, Germany´s. Nevertheless, Singapore has formulated at the international level only a goal conditioned on a legally binding global agreement, which to date has not been achieved and is not likely to come into effect before 2020.

In its National Climate Change Strategy (Republic of Singapore 2012, p. 11), Singapore sets out the following ambition independent from the condition formulated for its international goal:

"Singapore has nonetheless started to implement mitigation and energy efficiency measures which should reduce our emissions by 7% to 11% from the 2020 BAU level. This pledge is not contingent on international financing and Singapore will utilize our domestic resources."

While this latter pledge has not been communicated to the UNFCCC, it seems to better reflect Singapore's actual domestic level of ambition regarding climate change mitigation than its international pledge. The use of the word « should » indicates a certain degree of flexibility concerning the actual numbers.

Singapore faces particularly high potential risks of carbon leakage, as its neighbours are developing countries with no, in the case of Malaysia, or rather weak, in the case of Indonesia, international pledges.

In summary, Singapore's international **pledge does not send clear signals of climate policy ambition**. Should a stable link between the pledge and the National Climate Change Strategy be established, it **could still help to dampen the accelerating increase in GHG emissions**.

3.18 South Africa

Short description of the pledge: South Africa pledges Nationally Appropriate Mitigation Actions (NAMAs) for a 34% deviation from business as usual by 2020 (42% by 2025), dependent on financing, capacity building support and technology transfer from developed countries as well as an "ambitious, fair, effective and binding multilateral agreement under the UNFCCC and its Kyoto Protocol".

Significance of the pledge: Quantitatively, the pledge is **rather considerable** at first glance, although pledges that are based on BAU projections are inherently uncertain, because BAU emissions may be subject to change. In its 2nd National Communication, South Africa provided a graphical representation of its BAU scenario without giving an exact number for 2020. This BAU scenario seems to be rather high in relation to the long-term emissions trend, but especially when compared to the actual emissions trajectory of recent years. The BAU scenario is assumed to follow an economic growth path at annual rates between 3% and 6% up to 2050 (Department of Environmental Affairs Republic and Tourism, South Africa, 2007a), while in the last five years, the average annual growth rate has been below 2 %.

Underlying effort: Thus, low economic growth in recent years has facilitated the possible achievement of a target that looked very ambitious when it was announced. Usually, references to NAMAs in pledges imply that foreign financing is expected for mitigation actions to become reality. Although this is further emphasized by the addition "dependent on financing, capacity building support and technology transfer", South Africa does already implement, or in other cases consider to implement, polices that can achieve the objective of the pledge, including e.g. a carbon tax (see Appendix B).

The country's economy is driven by large mining and related industries and relies heavily on coal as the predominant fuel source. Coal use, which also dominates in electricity generation, accounted for about 85% of South Africa's CO_2 emissions in 2008. Coal-to-liquid fuel (CTL) technology is widely used and even further developed in the BAU scenario. The share of CTL in total GHG emissions is expected to be around 9% in 2020 (Department of Environment Affairs and Tourism, South Africa, 2007b). Due to the very high emission intensity of CTL, it is arguable whether such a technology should be incorporated in a baseline scenario even in a non-Annex I country. The inclusion of CTL in the South African BAU scenario is only one of the indications for the fact that the BAU is constructed very clearly without climate policy measures. In principle, this is the very idea of a BAU scenario. On the other hand, this contrasts with many of the BAU scenarios at present from countries that have a longer history in climate policy implementation.

In contrast to the BAU given in South Africa's National Communication, the representation of the BAU scenario according to Department of Environmental Affairs 2011 shows a range rather than a single emissions trajectory, to reflect uncertainties. Consequently, den Elzen et al. 2011 calculate absolute reductions for the 34%-target in 2020 of 135 Mt of CO_2-eq at minimum and 198 Mt of CO_2-eq at maximum. Fekete et al. 2013 compile South Africa's mitigation potential as identified and described in the international literature. They do not conduct accurate cost evaluations of the policies and measures, but arrange them into three groups: in 2020 an abatement of 66 Mt of CO_2-eq can be realized with no-regret projects, 42 Mt of CO_2-eq at costs which are overcompensated by positive side effects, and about 46 Mt of CO_2-eq mitigation are categorised as ambitious. In total, a potential of about 154 Mt of CO_2-eq is determined. Given the uncertainty associated with these figures, it can be concluded cautiously that **South Africa might not be able to achieve its target entirely at a low cost**. Current plans for new coal-fired power generation add to the challenge.

Den Elzen et al. 2011 calculate the abatement costs of meeting the pledge following a bottom-up approach. The model includes revenues (or costs) from emissions trading and other measures, but excludes any macroeconomic costs or side effects. For Non-Annex I countries the total mitigation has to be domestic. CDM projects are assigned fully to the purchasing country. The total abatement cost for South Africa is summed up to 810 million US$, which equals 0.12 % of projected GDP in 2020.

Highly inefficient economies usually have substantial low cost mitigation potentials, which can be exploited once an effective climate policy is put on track. For comparison: South Africa's per capita CO_2 emissions are higher than Switzerland's, while Swiss GDP is more than ten times higher than South Africa's. Considerable opportunities for low cost abatement are present in South African industry. The generation of synthetic fuels out of coal could be substituted by imported crude oil, although high world market prices let this option appear unattractive. This is totally different, however, if ancillary benefits are considered, because of the environmental effects of CTL, e.g. the high water consumption in a country with constrained water supply. Wind power and photovoltaics offer high potential in South Africa, albeit not at an especially low cost.

While there is substantial potential in the mid-term, meeting the 2020 pledge is probably going to require immediate and effective actions, which will be difficult to implement without the consent of the main South African companies and without international support. Exploiting the potentials in a minimum cost fashion is going to be more than difficult due to institutional barriers and political considerations. To provide two examples: (1) Private financing for mitigation projects is largely unavailable. (2) Policy measures with potential negative employment effects for the mining sector are difficult to initiate, because with high inequality in income distribution, employment opportunities for the poor matter for social cohesion.

Comparison to Switzerland: Effort comparisons between South Africa and Switzerland are difficult as the two countries differ in almost any respect. While large low cost potentials exist in South Africa, especially if ancillary benefits are considered, the effort needed for South Africa to meet its target is very considerable in policy terms, at least if the baseline given in the 2nd National Communication remains determinant. It can be concluded for South Africa that meeting the target will probably induce **direct costs**, although these will be **lower per unit of GDP than in** the case of **Switzerland**. On the other hand, the necessary institutional effort is large enough to permit the view that, **in policy terms**, South Africa's **effort** for meeting its pledge **will be higher than Switzerland's**.

3.19 Turkey

In terms of CO_2 emissions excluding LULUCF in 2011, Turkey is the 20th largest emitter. It is an Annex I country, although it was deleted from Annex II of the Convention and did not have a target for the first Commitment Period according to Annex B of the Kyoto Protocol. **Turkey has not presented a pledge** under the UNFCCC.

3.20 Ukraine

Short description of the pledge: Ukraine pledges a 20% emission reduction by 2020 relative to 1990, subject to several conditions such as – among other things – the perpetuation of Ukraine's status as an economy in transition and the settlement of 1990 as the single base year. The pledge is legally binding under the Kyoto Protocol, but ratification is pending to date.

Significance of the pledge: With the latest political developments, the integrity of the Ukrainian territory is in danger. Under these circumstances, the prospects for the pledge and its interpretation are unclear. Anyway, the target had been at the upper end of business as usual projections already before the current conflict and the weak economic performance in the last few years. Thus, it can be concluded despite the political uncertainties that **the pledge is not going to require any additional effort**. Furthermore, Ukraine has available Assigned Amount Units (AAUs) from the Kyoto Protocol´s 1st Commitment Period (2008-2012). The amount is estimated at 2.6 Gt (Pointcarbon 2012).

3.21 United Arab Emirates

The United Arab Emirates **has not issued an emission reduction target** under the UNFCCC, despite per capita GHG emissions (excl. LULUCF) which in 2011 were the highest of any country investigated in this study.

3.22 United States of America

Short description of the pledge: The USA pledges an abatement in the range of 17% of total GHG emissions relative to 2005, in conformity with anticipated energy and climate legislation.

Significance of the pledge: The US Government revised the underlying LULUCF data two times since 2009. The influence on the resulting target for the industrial emissions can be described as follows: Relative to 1990, the target initially accounted for an *increase* of 3 %. After the first revision of the LULUCF data in 2010, the target called for a *decrease* of the same amount. In 2011, another revision took place which moved the objective for the industrial GHG emissions close to the 1990 level (see Climate Action Tracker). The USA announced to use comprehensive land-based LULUCF accounting. Depending on how the exclusion of non-anthropogenic natural disturbances will be calculated, the pledge could be up to approximately 10% less stringent in terms of 2005 greenhouse gas emissions, which would leave the pledge within the range of existing BAU projections for 2020. In summary, **the pledge could imply minor emission reductions** relative to business as usual, **but** a reliable assessment of the pledge and the associated effort is delicate as long as the **rules for LULUCF accounting are not sufficiently and sustainably clarified**.

It is noteworthy that the USA lack a legal framework at the federal level for the use of international carbon credits. This makes the pledge almost purely a domestic target, except that individual States may purchase international carbon credits.

High per capita emissions and large energy efficiency potentials, e.g. in the buildings sector, suggest that the USA exhibit very substantial no regret abatement potentials.

Furthermore, there are studies that indicate substantial ancillary benefits of GHG abatement scenarios for public health. For example, Groosman at al. 2009 investigate the ancillary effects of GHG mitigation in the US transport and electric power sectors, taking into account six major air pollutants including NO_x, SO_2 and $PM_{2.5}$. For the period 2006 to 2030 they conclude that improvements in public health sum up to 90 – 725 bn. US$ (2006 US$) depending on three scenarios with varying abatement figures. The ancillary benefits per ton of GHG abated range from 1.4 US$ to 12.0 US$.

As the USA is the second largest GHG emitter in absolute terms, it is worth noting the attractive abatement opportunities that exist. The current pledge does not appear to aspire reaping these potentials and is **unlikely to imply any considerable cost** to US society as a whole.

4 Summary of the country analyses regarding efforts implied by pledges

Table 3 summarizes our findings from the country analyses in chapter 3. While the table provides a useful overview, it needs to be interpreted in conjunction with the respective country analyses. They present a more comprehensive, balanced and hence more relevant picture than the simple labels that fit into the table. Studying the country fact sheets in Appendix B also helps for appreciating the results, mainly because of the importance of projected business as usual emissions paths for the results. Finally, it is fundamental to consider the footnotes to the table before drawing any conclusions. They contain the most important methodological indications that need to be kept in mind. More detailed information on the methodology and related caveats is provided in chapter 2.

In its right half, table 3 gives some basic information on the pledges: How do the targets compare to realistic (but not necessarily official) business as usual projections? Is the target subject to conditions on foreign financing? For more detailed information on the pledges, please refer to chapter 3 and to the fact sheets in Appendix B. The right column indicates whether the country has set additional national targets which have not been communicated under the UNFCCC. Further information on these national targets is available in Appendix A. They are not considered further in the rest of this table, although national targets for 2020 can be very ambitious, notably in the cases of Sweden and Denmark. In the following, we concentrate on pledges under the UNFCCC and the Kyoto Protocol.

The two remaining columns on the left each refer to a particular notion of effort:
(1) effort in terms of cost of the additional abatement which is required to meet the pledge, and
(2) institutional effort that is needed to implement the additional policy measures that are needed to secure effectively that the pledge will be met.

We do not investigate whether the pledges are adequate or likely to be met, but simply assume that they will be met. *Additional* means that the efforts connected to previously implemented mitigation policies, however substantial they may be, do not count towards the additional effort implied by the pledge. Thus, this table is not to be confused with an overall appraisal of climate policies of the selected countries, because the latter would largely depend on the stringency and effectiveness of policy measures that have been implemented over the last two decades or so.

Additional cost implied by pledge excluding ancillary benefits:

The additional costs assessed in this column neglect the ancillary benefits of abatement, e.g. health improvements from reduced air pollution, because appropriate studies which would allow us to systematically include them are missing for many of the selected countries, especially studies that would refer to the investigated pledges under the UNFCCC. Nevertheless, ancillary benefits are known to be very substantial. For example, Bollen et al. 2009 analyze a reduction in worldwide CO_2 emissions relative to a baseline by 73% in 2050 (-50% relative to 2005 levels). They estimate the related ancillary benefits as a 40% reduction of premature deaths, i.e.: of 13 Mio. premature deaths that occur in 2050 in the baseline, more than 5 Mio. lives are saved in the GHG abatement scenario in the year 2050 alone. Ancillary benefits will thus often turn positive costs, where applicable, into negative overall costs, especially in developing countries.

Table 3: Additional effort necessary to meet the pledge under the UNFCCC/KP for 2020[°]

	Additional cost excluding ancillary benefits[◊§]	Additional institutional effort	Reduction compared to BAU?[^]	Condition of foreign financing	Additional national GHG target (year)[#]
Australia[Δ]	possibly negative	positive	possibly minor	no	2050
Austria	around zero	positive	yes, minor	no	none
Belgium	possibly negative	positive	possibly minor	no	none
Brazil	none	positive	none	yes	none
Canada	possibly negative	positive	possibly minor	no	none
China	around zero	positive	yes, minor	yes	none
Denmark	around zero	positive	possibly minor	no	2020
EU-27[Δ]	negative	positive	yes, minor	no	none
France	possibly negative	positive	yes, minor	no	2050
Germany	around zero	positive	possibly minor	no	2020
India	around zero	positive	possibly minor	yes	none
Indonesia	none	positive	possibly none	yes	2020
Iran	no pledge	no pledge	no pledge	n.a.	n.a.
Italy	possibly negative	positive	possibly minor	no	none
Japan	around zero	positive	possibly minor	no	2050
Korea, Rep. of	positive	positive	yes	no	2030
Mexico	around zero	high	yes	yes	2050
Netherlands	around zero	positive	possibly minor	no	none
New Zealand[Δ]	around zero	positive	possibly minor	no	2050
Norway[+Δ]	positive	positive	yes	no	2030
Poland	possibly negative	positive	possibly minor	no	none
Russia	none	positive	possibly none	no	none
Saudi Arabia	no pledge	no pledge	no pledge	n.a.	n.a.
Singapore	around zero	positive	possibly yes	no	none
South Africa	probably positive	high	yes	yes	2025
Spain	none	positive	possibly none	no	none
Sweden	possibly positive	positive	possibly minor	no	2020/2050
Switzerland[~Δ]	positive	positive	yes	no	none
Turkey	no pledge	no pledge	no pledge	no	none
Ukraine	none	none	none	no	none
United Arab Emirates	no pledge	no pledge	no pledge	n.a.	n.a.
United Kingdom	none	positive	possibly none	no	2020/2027/2050
United St. of America	possibly negative	positive	possibly minor	no	none

° If a country´s pledge does not require measures that are additional to the (possibly substantial) existing ones, there is no *additional* effort for meeting the pledge. It has not been investigated whether pledges will actually be met.
◊ Literature suggests that ancillary benefits such as health improvements from reduced air pollution turn total abatement costs negative in many cases. However, appropriate studies which would allow us to systematically include them are missing for many of the selected countries, especially studies that would refer to the pledges under the UNFCCC.
§ Assignments to cost categories suffer from considerable methodological difficulties and need to be interpreted with caution. For details please refer to the analyses for the individual countries in chapter 3.
^ BAU scenarios are from various sources and not fully comparable. BAU emissions may have been lowered by earlier or existing climate policy measures. We base our assessment on BAU scenarios that we consider realistic, i.e. not necessarily the BAU scenario which has been suggested by the respective Government.
# Beyond the international pledge, if for 2020. For more information on the national targets, see Appendix A.
Δ Multiple pledges (an unconditional pledge and one or two conditional pledges). This table considers mainly the unconditional, i.e. least ambitious pledge. Refer to chapter 3 for information on efforts connected to additional pledges.
+ Assuming that Norway does not intend to do all abatement domestically.
~ Assuming that all abatement will be done domestically.

As we report a qualitative cost indicator, the benefits from the mitigation of climate change are also not considered, although global welfare improvements through mitigation are to be expected.

Despite this neglect of important benefits, the additional costs are zero, around zero or negative for 28 of the 33 countries. However, this does not come as a surprise when we realize that most countries have pledges that are very close to BAU or long-term trends, while some countries even have no pledge at all. In total, the pledges clearly fail to be compatible with a global emissions path which could achieve the 2 degree warming target.

Furthermore, we assume that countries do not apply clearly inefficient policies. If they do, even pledges that are insignificant can be connected to significant costs. However, these are not attributable to the pledge, but rather to policies that fail to minimize abatement costs, because they aim at other objectives than efficient GHG abatement. This will especially be the case when carbon taxes and emissions trading systems are avoided or abandoned in favor of policy instruments with less extensive coverage and less ability to equalize marginal abatement costs. Further pertinent examples of cost increasing policies are the high German feed-in tariffs for electricity from renewable sources and the floor prices for EU Allowances in the UK. In this report, we qualitatively assess the costs implied by the pledges, not the costs of inefficient policy design.

With efficient policy design, abatement costs can be low even for significant abatement. Many bottom-up studies suggest that most countries have large potentials of no regret measures, which pay-off for the investor. Typically, potentials for no regret measures – measured in percent of future BAU emissions – are reported in the range of high one-digit or low two-digit numbers (e.g. in the McKinsey cost curves that concern 2020). Balancing cost savings of no regret measures with costs of low-cost measures, break even points (i.e. the point where aggregate abatement costs are zero) are usually two-digit and in some cases can go up to around 40% (see for instance McKinsey´s cost curve for Australia). These numbers need to be interpreted with caution, because many measures that are listed as "no regret" require behavioral changes or the overcoming of barriers.

On the other hand, bottom-up studies do usually not consider the efficiency potentials that can be reaped by recycling revenues connected to abatement policies. Top-down studies consider these potentials, but usually deny technical no regret potentials. In top-down studies, much depends on policy design in the scenarios. With efficient policy design and moderate reductions, many top-down studies find low or even negative economic costs of mitigation policies, even without considering ancillary benefits.

The IPCC´s 4th Assessment Report concludes on this matter: "Both bottom-up and top-down studies indicate that there is high agreement and much evidence of substantial economic potential for the mitigation of global GHG emissions over the coming decades that could offset the projected growth of global emissions or reduce emissions below current levels."

The studies cited in this report differ in methodologies, which transfers into a lack of comparability and a need for cautious interpretation. Rather than relying on quantitative model results alone, we processed the different types of available information in an integrated qualitative appraisal to the best of our knowledge (for more information, see chapters 2 and 3). Despite the IPCC statement above, some studies do report positive costs. Therefore, we are not fully confident about the differentiations between countries with positive and negative direct costs. This is also indicated by the fact that we assign costs for many countries as “around zero”. This concerns China, Japan, Mexico, New Zealand, Singapore, and several European countries. Even if overall direct costs could be zero, the underlying effort is not negligible, because policies and measures are required which are going to involve positive costs for some economic agents.

For some other countries, notably in the EU, North America and Australia, no regret abatement potentials are large enough to probably permit negative overall direct costs for the pledged minor abatement. Where pledges are quantitatively insignificant, it can be safely assumed that the pledge implies no cost.

Only few countries have pledges that are likely to imply positive costs neglecting ancillary benefits of abatement. These countries are the Republic of Korea, Norway, South Africa, Sweden, and Switzerland. For Switzerland, this appraisal is based on the pertinent studies e.g. by Ecoplan and Prognos. It should be added that the Ecoplan 2012 study suggests that total costs turn negative for Switzerland when ancillary benefits are considered, for abatement of almost the same magnitude as under the Swiss unconditional pledge.

The effort for South Korea´s pledge matches Switzerland´s. Possibly, it is even somewhat higher, i.e. in comparison with Switzerland´s unconditional pledge. This could also apply to Norway. In the case of Norway, however, an important factor is the intended purchase of emission certificates from abroad, which has the potential to strongly reduce overall abatement costs under the pledge. This contrasts with Switzerland, which intends to achieve its entire emission reduction domestically in 2020.

Starting from a baseline with poor CO_2 efficiency and widespread use of coal, South Africa pledges substantial abatement, which might not entirely be achievable at low cost. In contrast, Sweden´s pledged abatement under the EU Effort Sharing Decision seems unimpressive. It could still induce some positive direct costs given the limited low cost abatement potentials that remain in Sweden.

Mexico may not need to bear positive direct overall costs of abatement despite significant pledged emission reductions. For Mexico, a World Bank report (Johnson 2011) suggests vast no regret abatement potentials.

Additional institutional effort for meeting the pledge:

In this category, two countries stick out with the label “high”: Mexico and South Africa. Both have ambitious pledges and need considerable institutional advancement to be able to meet these pledges. Countries with pledges below BAU have been labeled “positive”. This also concerns countries whose pledges are close to or just above BAU: They have to make an effort in monitoring and for being ready to implement measures in case that emissions become higher than expected, e.g. because of unanticipated economic growth. Similarly, countries that base their pledges on Nationally Appropriate Mitigation Actions (NAMAs) need to build up an institutional setting for this, even if capacity building is going to be supported by international institutions. We lack the information and confidence to differentiate countries into more than the three groups “high”, “positive”, and “none/no pledge”.

5 Conclusions

The additional efforts that are implied by the GHG abatement pledges for 2020 as presented to the UNFCCC are unimpressive on a global level. And they are, according to current scientific knowledge, likely to be incompatible with the 2 degree warming objective.

International comparisons of these efforts are difficult for many reasons: For example, the pledges are formulated in different ways, sometimes with unclear or uncertain accounting principles or reference numbers. Cost studies use different and often poorly documented methodologies.

Yet, it can be concluded that none of the major GHG emitters China, USA, EU, Russia, India, and Japan has submitted and adhered to a pledge that would be likely to imply considerable positive total abatement costs. Due to existing no regret potentials, this holds in spite of the minor reductions that the pledges imply, at least in China and the EU, and possibly in India, Japan and the USA. The weak international pledges by the major GHG emitters, but also by some other countries, mirror the current difficulty in achieving an ambitious global climate agreement.

There are notable exceptions to this general picture, including some European Annex I countries (Norway, Sweden, Switzerland) and some major non-Annex I countries (Republic of Korea, Mexico, South Africa).

Regarding the Swiss pledge, we take into account that the Swiss CO_2 Law stipulates that the abatement target has to be met with domestic measures in 2020. With this restriction in place, the effort related to the Swiss pledge is one of the higher ones among the pledges that we investigated. Nevertheless, the implied direct costs are moderate, and ancillary benefits counteract these direct costs and could lead to overall welfare gains. Hence, reaching the targets remains economically feasible.

South Korea's pledge requires an effort that may even be somewhat higher than for Switzerland's unconditional pledge. The Koreans are currently putting related policies into place, including a very comprehensive emissions trading system.

In the case of Norway, the pledged abatement is impressive and the related effort will probably be higher than for Switzerland, if most of the abatement is achieved domestically. However, Norway intends to also purchase emission certificates from abroad, which could strongly reduce the direct costs of meeting the pledge.

South Africa has to overcome high institutional and political barriers to efficient climate policy implementation, which makes the country's ambitious pledge difficult to achieve. Although South Africa embarks on this journey with poor CO_2 efficiency and widespread use of coal, the target will require some direct abatement costs to be paid for.

Mexico's pledge is in a similar range of ambition, and equally difficult issues for policy implementation apply, which implicates a high institutional effort for meeting the target. On the other hand, Mexico has large no regret abatement potentials, which could mean that the total direct costs of abatement will be negligible.

In contrast, Sweden´s pledged abatement under the EU Effort Sharing Decision seems unimpressive. It could still induce some positive direct costs given the limited low cost abatement potentials that remain in Sweden.

At the national level, Sweden has formulated a much more ambitious abatement target for 2020. Also at the national level, Denmark has put forward an ambitious abatement objective for 2020 and is about to further tighten this target.

In many ways, international pledges to the UNFCCC and domestic climate policy are two different things. At the national level, there are more countries that set important goals, e.g. for renewable energy, and put some climate policies into effect. However, this report focuses on the international pledges, simply assuming that they will be met, and not on national climate policies in general.

Also, we focus on additional efforts implied by the pledges in the decade before 2020. This is a reasonable restriction, but it comes at the disadvantage of an insufficient recognition of the cumulative climate policy efforts of early movers, who have significantly invested into the mitigation of climate change over the decades. Examples of early movers are again the Scandinavian countries, but also the United Kingdom and Germany. Most of these countries have also been highly committed to the promotion of renewable energy.

Our qualitative appraisal of the efforts is based on the information available at the time of writing, and it has been performed to the best of our knowledge under the applicable time restrictions. The country analyses in chapter 3 and the country fact sheets in Appendix B may lead the reader to own and possibly different conclusions.

Especially, we want to leave to the reader any judgements of adequacy of individual countries´ efforts. As a point of reference, the Convention has the principle of "common but differentiated responsibilities and respective capabilities", which has led to extensive discussions about national circumstances and equity in international climate policy. As an even more concrete point of reference, the Parties to the Convention have agreed on the 2 degree target, which can thus not be neglected when discussing the adequacy of pledges.

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Appendix A: Overview of national targets other than those pledged under the UNFCCC*

	National GHG target 2020#	National GHG target other years	Other national targets	Remarks
Australia		-80% w.r.t. 2000 by 2050	20% renewables in electricity supply by 2020	renewables target currently under revision
Austria			34% renewables in gross final energy consumption by 2020	
Belgium			-18% in total energy consumption w.r.t. PRIMES 2007 baseline	
Brazil				
Canada				
China			11.4% renewables in energy consumption by 2015; 16%-reduction of energy per unit of GDP w.r.t. 2010 by 2015; 17%-reduction of CO_2 emissions per unit of GDP w.r.t. 2010 by 2015	
Denmark	-40% w.r.t. 1990		>35% renewables in final energy consumption by 2020; 50% wind power in electricity consumption; -7,6% w.r.t. 2010 in gross energy consumption; 100% renewables in energy consumption by 2050	emission target binding in national law
EU-27			20% renewables in energy consumption by 2020, improve energy efficiency by 20% until 2020	
France		-75% w.r.t. 1990 by 2050	23 % of renewables in energy consumption by 2020	renewables target binding in national law
Germany	-40% w.r.t. 1990	-80% w.r.t. 1990 by 2050	35% renewables in electricity supply by 2020, 50% by 2030, 65% by 2040, 80% by 2050	
India			20 GW of solar power installed by 2020, various targets for energy efficiency, waste management, afforestation etc.	
Indonesia	-41% rel. to business as usual		25% renewables in primary energy mix by 2025, supplying 5% of energy demand with biofuels	-41% target originally announced as upper end of range of international pledge, conditional on international support
Iran				
Italy			17% renewables in energy consumption, 10% renewable energy in transport by 2020	
Japan		-80% w.r.t. 1990 by 2050	10% renewables in total energy supply by 2020	currently under revision
Korea, Rep. of			11% renewables in energy supply by 2030, 46% reduction in energy intensity compared to 2007 by 2030	
Mexico		-50% w.r.t. 2000 by 2050	35% renewables in energy supply by 2024, 40% in 2030, 50% in 2050	conditional on international financing
Netherlands			14% of total energy consumption by 2020, 2% annual energy savings until 2020	renewables target binding in national law
New Zealand		-50% w.r.t. 1990 by 2050	90% renewables in electricity generation by 2025	
Norway		-100% by 2030		conditional on ambitious international agreement
Poland				
Russia	-25% w.r.t 1990		4.5% renewables in electricity generation, excluding large hydro, by 2020	unconditional Presidential Decree
Saudi Arabia			10% renewables in electricity generation by 2020, 23% by 2030	
Singapore	-7% to -11% rel. to business as usual		20% increase from 2005 levels in energy efficiency by 2020, 35% increase by 2030	

	National GHG target 2020#	National GHG target other years	Other national targets	Remarks
South Africa		-42% w.r.t. BAU by 2025		conditional on financial and technical support
Spain				
Sweden	-40% w.r.t. 1990 outside ETS	-100% by 2050	50% renewables in final energy consumption by 2020; 10% renewable energy in the transport sector by 2020; 20% increase in energy efficiency by 2020; vehicle fleet independent of fossil fuels by 2030	
Switzerland				
Turkey				
Ukraine				
U. Arab Emirates				
United Kingdom	-34% w.r.t. 1990	-50% w.r.t. 1990 by 2027, -80% w.r.t. 1990 by 2050	15% renewables in energy supply by 2020	emission targets binding in national law
US of America				

* We are unable to guarantee completeness of this table. Other national targets could exist which we have been unable to find despite a thorough search that included the relevant websites of national authorities.

These national targets imply GHG emission reductions relative to business as usual in the following way:
Denmark: Target implies reductions;
Germany: Target implies minor reductions;
Indonesia: Target implies reductions;
Russia: Target could imply minor reductions;
Singapore: Target implies minor reductions;
Sweden: Target implies reductions;
United Kingdom: Target is a continuation of the trend.

Appendix B: Fact sheets on the world's largest carbon dioxide (CO_2) emitters and other countries of particular interest

Commissioned by: Federal Office for the Environment (FOEN), International Affairs Division, CH-3003 Bern
The FOEN is an agency of the Federal Department of the Environment, Transport, Energy and Communications (DETEC).

Contractor: Econability F. Vöhringer

Authors: Frank Vöhringer, Sophie Maire, Wolfgang Knoke

Note: This study/report was prepared under contract to the Federal Office for the Environment (FOEN). The contractor bears sole responsibility for the content.

Disclaimer

These fact sheets illustrate currently available information on the current international emission reduction commitments or goals of the world's largest CO_2 emitters and other countries of particular interest to Switzerland. The information has not been approved by the respective Governments. It is drawn from various sources and may include arguable or incomplete assumptions. Furthermore, the pledged goals of some Parties have uncertainties around the real expected emission reductions as the current international regime is lacking common rules. The fact sheets have been produced by *Econability F. Vöhringer* with support provided by the Swiss Federal Office for the Environment FOEN. The content of the fact sheets has not been approved by the Swiss Government and does not prejudge the Swiss position in international climate negotiations.

The 22 world's largest emitters, each responsible for at least 0.9% of total world CO_2 emissions, are: China, United States of America, European Union, India, Russia, Japan, Germany, Republic of Korea, Iran, Canada, Saudi Arabia, Mexico, United Kingdom, Indonesia, Brazil, Italy, Australia, South Africa, France, Turkey, Poland, and Ukraine. Other countries, with less than 0.9% of total world CO_2 emissions, considered in this analysis are: Spain, United Arab Emirates, Netherlands, Belgium, Austria, Singapore, Sweden, Denmark, Switzerland, Norway, and New Zealand.

The analysed international commitments or goals form part of the international climate regime under the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol[1]. They have been pledged by the Parties to the UNFCCC in the following to the Copenhagen Climate Summit (2009) as part of the Copenhagen Accord[2] and anchored under the UNFCCC through the Cancun Agreements[3] (2010) and the adoption of the legally binding second commitment period under the Kyoto Protocol in Doha[4] (2012). The current international climate regime includes all the Parties, however, the level of mitigation ambition is currently not sufficient, including because some large emitters are not contributing.

[1] EU member States have a joint commitment at international level.
[2] http://unfccc.int/meetings/copenhagen_dec_2009/items/5262.php
[3] http://cancun.unfccc.int/mitigation/
[4] http://unfccc.int/files/kyoto_protocol/application/pdf/kp_doha_amendment_english.pdf.

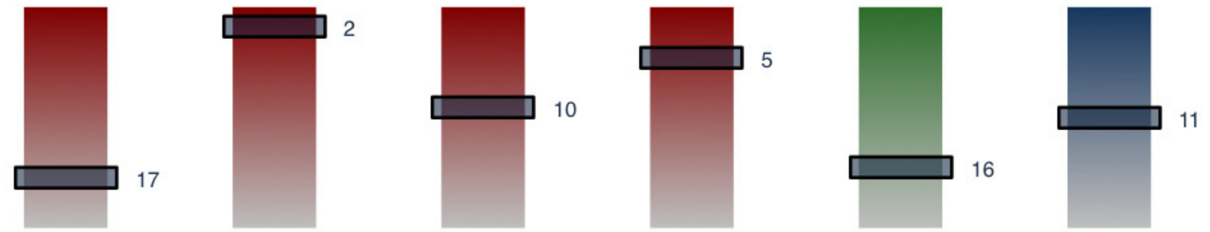
AUSTRALIA

	Value°	Rank *
Population:	23 mio	22
Annual population growth:	1.4 %	2
GDP per capita:	60’979 US$/capita	1
Fossil fuel resources:	2’478 tC/capita	1

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	402 Mt	21.3 t/cap	0.44 toe/1000 US$ **	91.1 %	19 %	1.25 US$/l
Change		-25%	-13%	-0.5%	-0.7%	
Rank	17	2	10	5	16	11



Legend: Ranking among the 22 largest emitters

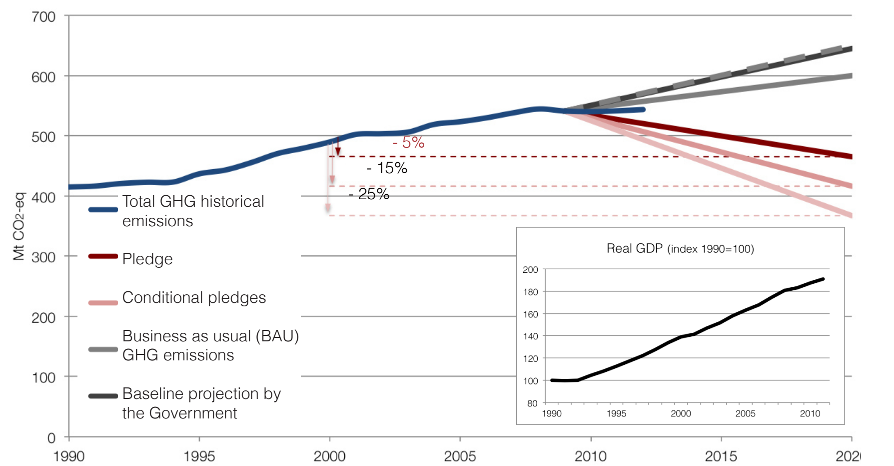
% increase/decrease over the last decade
(in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections from Ecofys et al. 2012. Baseline projection from the Government includes existing policies and measures. For Australia, the fact that the land use, land use change and forestry (LULUCF) sector is a large sink and uncertainties around LULUCF accounting methods imply that the pledge could be less stringent than it appears here.

Pledge (legally binding):
Reduction of GHG emissions of 5% from 2000 levels by 2020.
Conditional pledges (non-legally binding):
Reduction of GHG emissions by up to 15% from 2000 levels by 2020 if there is a global agreement under which major developing economies commit to substantially restrain emissions and advanced economies take on commitments comparable to Australia’s and which falls short of securing atmospheric stabilisation at 450 ppm CO_2-eq. Reduction of GHG emissions by 25% on 2000 levels by 2020 in case of a global deal capable of stabilising levels of greenhouse gases in the atmosphere at 450 ppm CO_2-eq or lower.

DOMESTIC POLICIES

Australia introduced a carbon tax for large emitters (> 25‘000 t CO_2-eq/year) of 23 Australian Dollars (about EUR 17) per ton of CO_2 equivalent starting July 2012, rising by 2.5% per year in real terms. This tax was to be replaced by an emissions trading scheme (ETS) in 2015 that was scheduled to be linked to the European ETS no later than 2018. However, the Australian Government is currently repealing the carbon tax and the ETS.

As replacement for the carbon tax, an Emissions Reduction Fund endowed with AUD 2.55 bn.= EUR 1.84 bn. for its first three years of operation is being discussed at the present. It is designed to buy CO_2 emissions reduction credits from companies of different sectors including industry.

Australia aims at raising the share of renewable sources in electricity supply from 7% to 20% between 2011 and 2020. Since 2010, electricity retailers need to purchase renewable energy certificates. A ban for conventional light bulbs started in 2009. A Green Buildings Programme involving tax exemptions was adopted in 2012.

The Carbon Credits Act offers opportunities for farmers, landowners and forest growers to receive marketable carbon credits for storing carbon or reducing emissions. In addition, a biodiversity fund of 1 billion Australian Dollars exists.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

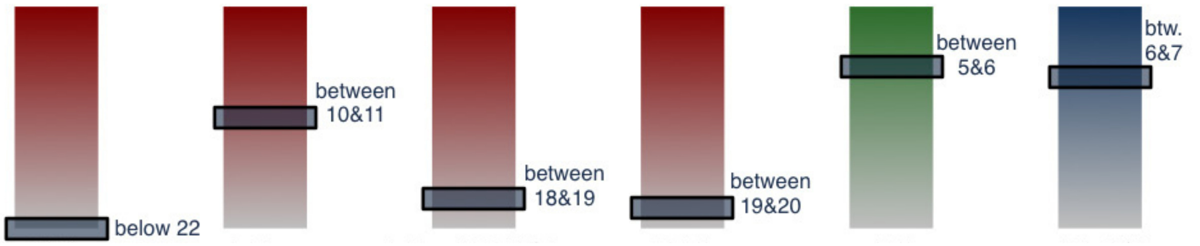
AUSTRIA

	Value°	Rank *
Population:	8 mio	below 22
Annual Population growth:	0.3 %	between 16&17
GDP per capita:	49'609 US$/capita	between 2&3
Fossil fuel resources:	2 tC/capita	between 20&21

* ranked against the 22 largest emitters (this country is not one of them)

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	71 Mt	9.4 t/cap	0.17 toe/1000 US$ **	32.9 %	47 %	1.59 US$/l
Change		+12%	-14%	+5.6%	+0.6%	
Rank	below 22	between 10&11	between 18&19	between 19&20	between 5&6	btw. 6&7



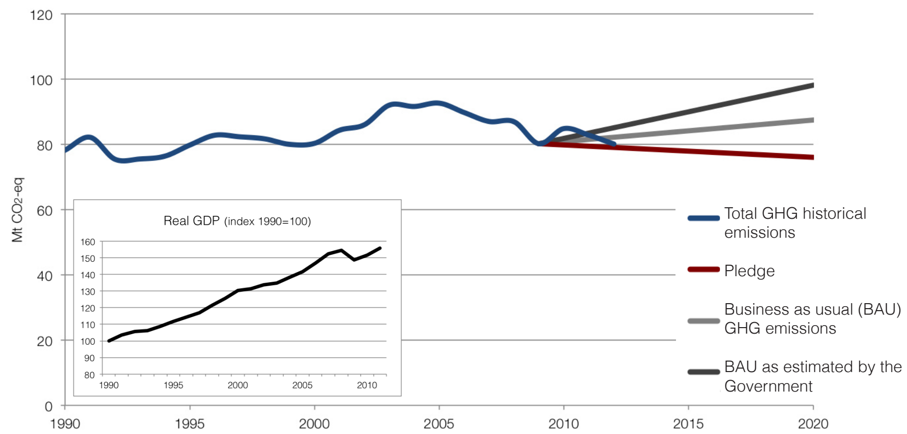
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections (Gov., and EEA 2012) include existing measures. Assuming equal percentage reductions in all EU Member States for emissions included in the EU emissions trading system (EU ETS), Austria´s GHG emission reduction in 2020 w.r.t. 2005 is -18%. As in an emissions trading system some countries may reduce more than others, the actual domestic emission reduction may deviate from the pledge as represented in the graph.

Pledge:

Austria participates in the legally binding EU commitment (ratification pending). The EU as a whole pledges a 20% GHG emission reduction in 2020 w.r.t. 1990 (conditional pledge: -30%).

In an EU-wide effort sharing decision, Austria has committed itself to a reduction of -16% w.r.t. 2005 by 2020 (EU average: -10%). This commitment concerns only emissions that are not included in the EU emissions trading system (EU ETS) or approximately 61% of total emissions in Austria. In the EU ETS, the EU-wide emission reduction w.r.t. 2005 is 21%.

DOMESTIC POLICIES

As an EU Member State, Austria takes part in the EU Emissions Trading System (EU-ETS). The ETS entered its 3rd phase in 2013, which introduced a single, EU-wide cap on emissions by ETS installations. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method, with more than 40% of allowances auctioned already in 2013.

The Austrian Climate Change Strategy was established in 1999/2000 to secure the achievement of the Kyoto targets and was revised in 2005-2007. The Climate Protection Law of 2010 sets emissions ceilings for 2020 for six sectors, including energy and industry outside the ETS, agriculture, housing, transport, waste and fluorinated gases. Since 2004, the Klima-aktiv initiative promotes the introduction of energy saving technologies in various sectors (e.g. housing and transport). In the housing sector, strong construction and renovation standards for public buildings add to the subsidy schemes.

The National Renewable Action Plan of 2010 issued a target of 34% renewables in gross final energy consumption in 2020. This overall target is complemented by objectives in heating and cooling, transport, and electricity generation (e.g. 71% of electricity from renewables in 2020). A feed-in tariff scheme to promote renewables was established by the Green Electricity Act in 2003 (latest revision in 2012). The feed-in tariffs are subject to alignment on a yearly basis. For 2014, they were significantly reduced.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

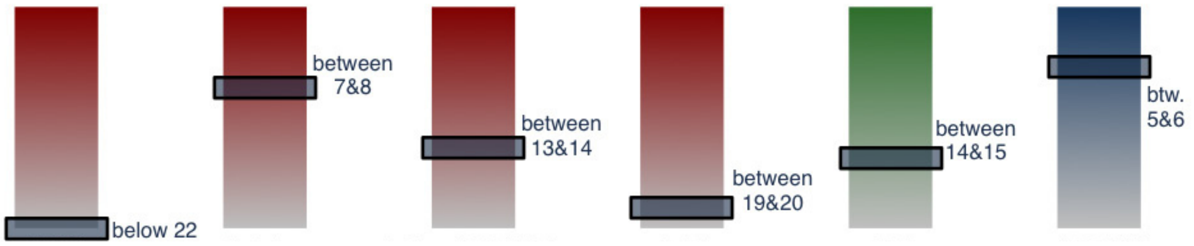
BELGIUM

	Value°	Rank *
Population:	11 mio	below 22
Annual Population growth:	1.0 %	between 8&9
GDP per capita:	46'663 US$/capita	between 3&4
Fossil fuel resources:	0 tC/capita	below 22

* ranked against the 22 largest emitters (this country is not one of them)

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	113 Mt	10.8 t/cap	0.30 toe/1000 US$ **	40.3 %	22 %	1.75 US$/l
Change		-23%	-21%	+0.7%	+0.4%	
Rank	below 22	between 7&8	between 13&14	between 19&20	between 14&15	btw. 5&6



Legend: Ranking among the 22 largest emitters

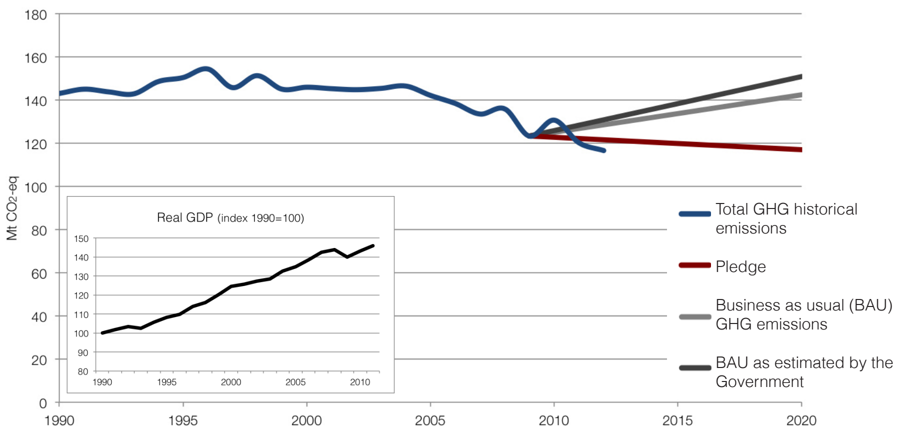
% increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections (Gov., and EEA 2012) include existing measures. Assuming equal percentage reductions in all EU Member States for emissions included in the EU emissions trading system (EU ETS), Belgium´s GHG emission reduction in 2020 w.r.t. 2005 is -18%. As in an emissions trading system some countries may reduce more than others, the actual domestic emission reduction may deviate from the pledge as represented in the graph.

Pledge:

Belgium participates in the legally binding EU commitment (ratification pending). The EU as a whole pledges a 20% GHG emission reduction in 2020 w.r.t. 1990 (conditional pledge: -30%).

In an EU-wide effort sharing decision, Belgium has committed itself to a reduction of -15% w.r.t. 2005 by 2020 (EU average: -10%). This commitment concerns only emissions that are not included in the EU emissions trading system (EU ETS) or approximately 55% of total emissions in Belgium. In the EU ETS, the EU-wide emission reduction w.r.t. 2005 is 21%.

DOMESTIC POLICIES

As an EU Member State, Belgium takes part in the EU Emissions Trading System (EU-ETS). The ETS entered its 3rd phase in 2013, which introduced a single, EU-wide cap on emissions by ETS installations. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method, with more than 40% of allowances auctioned already in 2013.

In Belgium, climate policy is predominantly a task of the three regions Flanders, Wallonia, and Brussels, not of the federation. Regional measures include e.g. tax deductions for energy saving expenditures and the implementation of EU Directives on building standards. A settlement between the regions on the distribution of non EU-ETS mitigation obligations for 2013-2020 has not been reached yet. So far, Wallonia is the only region to have a GHG emissions target for 2020 (-30% relative to 1990 levels), but does not distinguish between ETS sectors and non-ETS sectors.

Green certificates for renewable energy and combined heat and power have been established, but not coordinated among regions and the federal state. On the federal level, a nuclear phase out from 2015 to 2025 has been decided.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

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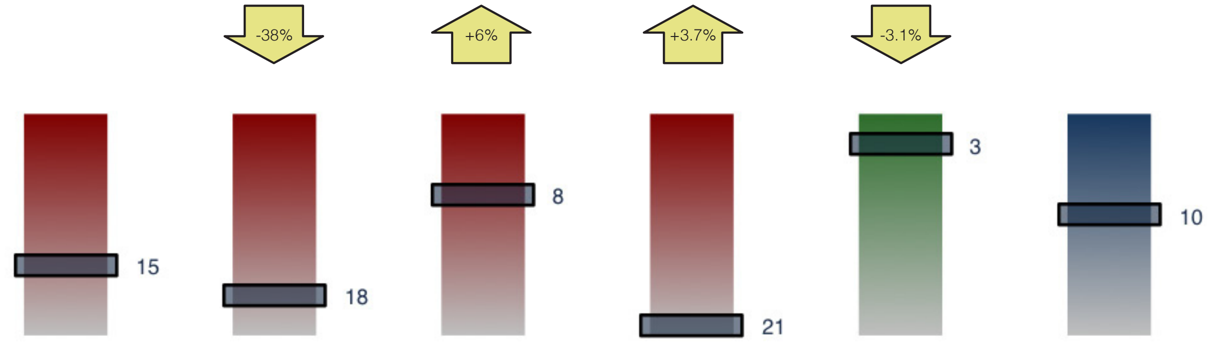
BRAZIL

	Value°	Rank *
Population:	197 mio	6
Annual population growth:	0.9 %	10
GDP per capita:	12'594 US$/capita	14
Fossil fuel resources:	27 tC/capita	15

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	443 Mt	7.2 t/cap	0.68 toe/1000 US$ **	12.4 %	61 %	1.36 US$/l
Change		-38%	+6%	+3.7%	-3.1%	
Rank	15	18	8	21	3	10



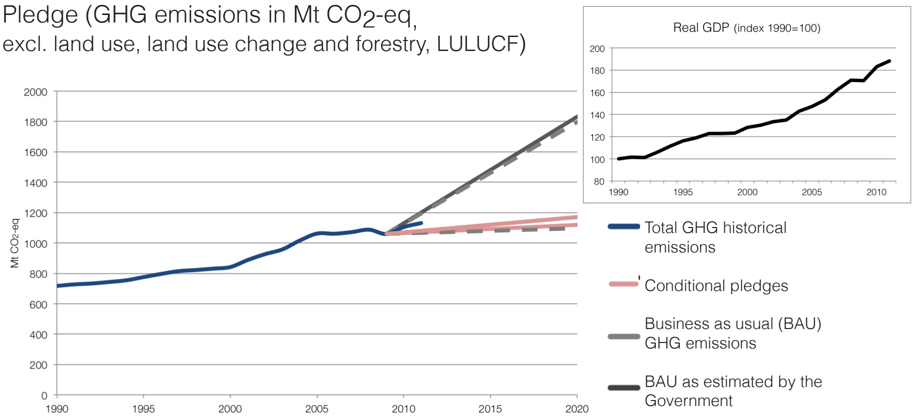
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry, LULUCF)



Comments: Emissions from LULUCF are crucial for understanding Brazil's pledge. However, due to data uncertainties, our graphs do not include LULUCF emissions. In National Decree n°7390, 2010, Brazil defined a BAU scenario with very high LULUCF emissions. Ecofys et al. 2012, depicts a BAU range including LULUCF emissions. We subtracted the 2020 LULUCF emissions from Decree 7390 from all BAUs. We calculated the absolute emissions that the pledges represent as 36.1% and 38.9% emission reduction from the BAU as estimated by the Government. Absolute emissions for pledges that are based on BAU projections are inherently uncertain, because BAU emissions may be subject to change.

Pledge (non-legally binding):

Brazil anticipates its mitigation actions to lead to emission reductions of 36.1-38.9% by 2020, compared to business as usual.

Actions are voluntary in nature and dependent on financial support to be provided by developed Parties.

DOMESTIC POLICIES

Brazil generates more than 80% of its electricity from renewable sources and aims at keeping this share until 2030. Hydropower is traditionally of great importance, but other renewable sources are projected to increase their share. Brazil is a key player in the development of biofuels. In 2008, bioethanol demand exceeded petrol demand. A biodiesel target is set at 20% for 2020.

Energy efficiency policies include mandatory efficiency labels, energy efficiency standards for buildings and equipment, and energy efficiency programs targeting electricity and fossil fuels. Utilities are obliged to invest 0.25% of their revenues into measures to improve energy efficiency.

Avoiding deforestation and reducing other net emissions from land use and land use change are other main issues of Brazilian climate policy, since the related net emissions amounted to 61% of total GHG emissions in 2005. The National Plan on Climate Change from 2008 sets the goal to reduce deforestation by 80% until 2020. Due to the vastness especially of the Amazon forests, nationwide enforcement of forest conservation laws is a major challenge. A reform of the forest code in 2012 has earned criticism by environmental NGOs for weakening forest protection.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

CANADA

	Value°	Rank *
Population:	34 mio	20
Annual population growth:	1.0 %	8
GDP per capita:	50'345 US$/capita	2
Fossil fuel resources:	778 tC/capita	4

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	539 Mt	22.6 t/cap	0.37 toe/1000 US$ **	24.2 %	34 %	1.15 US$/l
Change		+5%	-7%	-2.5%	±0.0%	
Rank	10	1	11	20	7	13

Legend: Ranking among the 22 largest emitters

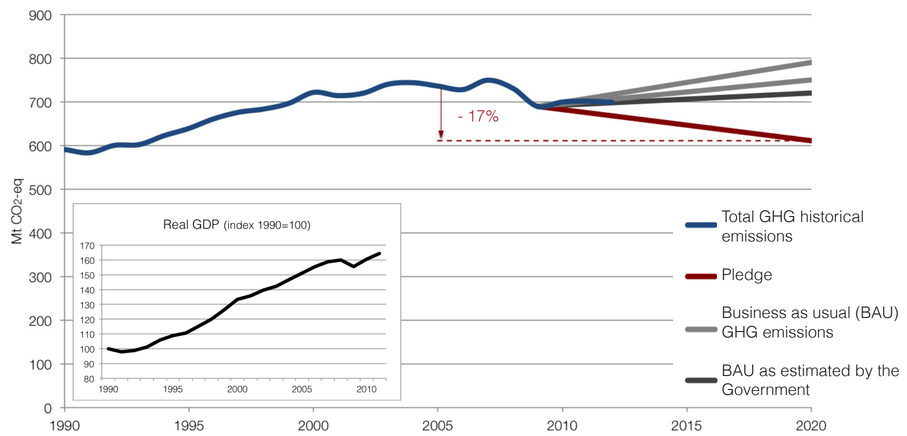
% increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU taken from Ecofys et al. 2012. BAU as estimated by the Government contains existing measures. For Canada, the fact that the land use, land use change and forestry (LULUCF) sector is a large sink and uncertainties around LULUCF accounting methods imply that the pledge could be less stringent than it appears here.

Pledge (non-legally binding):

17% emission reduction by 2020 compared with 2005 levels, to be aligned with the final economy-wide emission reduction target of the United States of America in enacted legislation.

DOMESTIC POLICIES

In December 2011, Canada withdrew from the Kyoto Protocol (KP) and repealed the Act that had been setup to implement the KP targets. Attempts to pass new comprehensive climate legislation had no success. Canada harmonizes its regulatory framework with the United States to avoid competitive disadvantages in the North American Free Trade zone.

Since 2010, Canada requires a minimum average renewable fuel content of 5%. In 2012, it implemented performance standards on coal-fired power plants. It is estimated that, as a consequence, 75% of coal-fired power plants will need to retrofit CCS to continue operations after 2025. Recently, tighter regulations for new heavy duty trucks, aligned with the US emission standards, have entered into effect.

Several Canadian Provinces introduced more ambitious climate legislation: There is a cap-and-trade emissions trading scheme in the three Provinces Ontario, Quebec, and British Columbia, which encompass about 75% of the Canadian population. British Columbia and Quebec also have a carbon tax and vehicle fuel efficiency standards that are aligned with Californian regulations. Ontario passed a Green Energy and Green Economy Act that promotes energy efficiency and renewables (through a feed-in tariff) with the targets to reduce emissions by 15% in 2020 and 80% in 2050 w.r.t. 1990. Alberta has set a target of reducing emissions intensity by 50% by 2050 by improving energy efficiency, introducing CCS and renewable energy. Nova Scotia has an absolute cap on emissions from electricity generation.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"
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CHINA

	Value°	Rank *
Population:	1'344 mio	1
Annual population growth:	0.5 %	16
GDP per capita:	5'445 US$/capita	18
Fossil fuel resources:	65 tC/capita	12

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	9035 Mt	7.6 t/cap	0.79 toe/1000 US$ **	79.7 %	22 %	1.08 US$/l
Change		+113%	-27%	-2.4%	+3.2%	
Rank	1	17	6	9	15	14

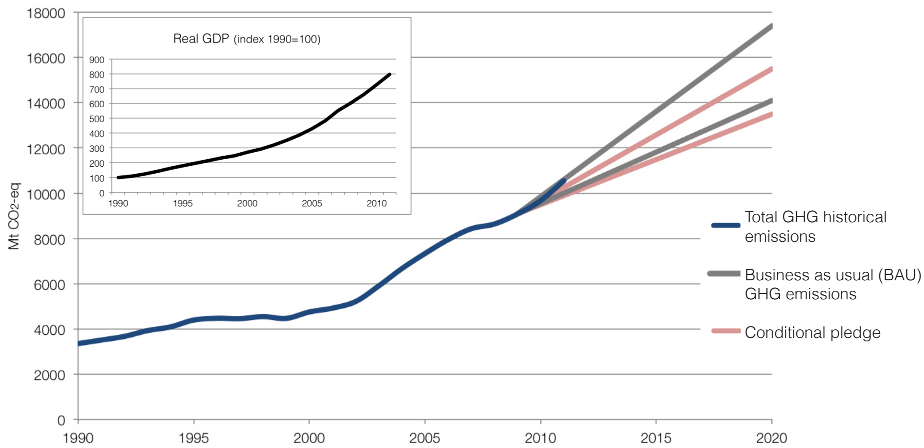
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: Information on historical emissions differ depending on the sources. BAU projections and pledge estimations come from Ecofys et al. 2012. The absolute emissions under the pledge are uncertain and depend on GDP projections, because the pledge is defined in CO_2 emissions intensity.

Pledge (non-legally binding):

Reduce CO_2 emissions per unit of GDP by 40–45% by 2020 compared to the 2005 level, increase the share of non-fossil fuels in primary energy consumption to around 15% by 2020 and increase forest coverage by 40 million hectares and forest stock volume by 1.3 billion cubic meters by 2020 from the 2005 levels.

These actions are voluntary in nature and dependent on financial support to be provided by developed Parties.

DOMESTIC POLICIES

China adopted a National Climate Change Programme in 2007 and a Climate Change Resolution in 2009. Despite this, a comprehensive climate change law is expected to pass the National Peoples' Congress only in 2015. Existing climate-related laws focus on energy efficiency to enable China to continue its strong economic growth.

China's 12th Five Year Plan (March 2011) formulates targets for carbon and energy intensity of GDP (reductions of 17% and 16%, respectively, by 2015 relative to 2010). According to IEA data, CO_2 emission intensity from energy-related emissions decreased by 14.6% between 2005 and 2010. To reach its target under the pledge, China will have to decrease its CO_2 intensity in the period 2015-2020 by 15.4% or 22.4% (for the -40% and -45% targets, respectively).

The intensity targets of the Five Year Plan have been broken down to Provincial and Municipal levels. In 2012, the Shenzhen Special Economic Zone was the first in China to pass local legislation to reduce GHG emissions. Several Provinces have launched pilot emissions trading systems in 2013.

The 12th Five Year Plan also calls for an increase of non-fossil energy (from 8.3% in 2010 to 11.4% by 2015) as well as an extension of the forested area.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"
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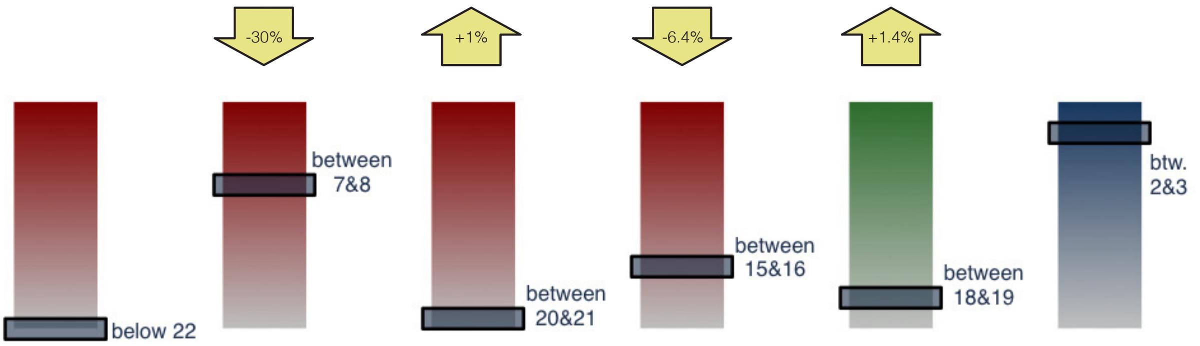
DENMARK

	Value°	Rank *
Population:	6 mio	below 22
Annual Population growth:	0.5 %	between 14&15
GDP per capita:	59'852 US$/capita	between 1&2
Fossil fuel resources:	25 tC/capita	between 15&16

* ranked against the 22 largest emitters (this country is not one of them)

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	43 Mt	9.9 t/cap	0.13 toe/1000 US$ **	66.1 %	13 %	1.90 US$/l
Change		-30%	+1%	-6.4%	+1.4%	
Rank	below 22	between 7&8	between 20&21	between 15&16	between 18&19	btw. 2&3



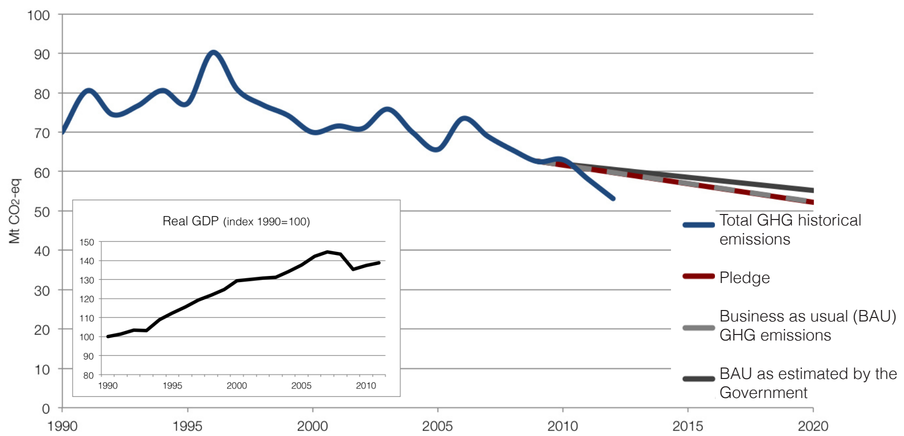
Legend: Ranking among the 22 largest emitters; % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections (Gov., and EEA 2012) include existing measures. Assuming equal percentage reductions in all EU Member States for emissions included in the EU emissions trading system (EU ETS), Denmark´s GHG emission reduction in 2020 w.r.t. 2005 is -20%. As in an emissions trading system some countries may reduce more than others, the actual domestic emission reduction may deviate from the pledge as represented in the graph.

Pledge:

Denmark participates in the legally binding EU commitment (ratification pending). The EU as a whole pledges a 20% GHG emission reduction in 2020 w.r.t. 1990 (conditional pledge: -30%).

In an EU-wide effort sharing decision, Denmark has committed itself to a reduction of -20% w.r.t. 2005 by 2020 (EU average: -10%). This commitment concerns only emissions that are not included in the EU emissions trading system (EU ETS) or approximately 57% of total emissions in Denmark. In the EU ETS, the EU-wide emission reduction w.r.t. 2005 is 21%.

DOMESTIC POLICIES

The Danish Climate Policy Plan of 2013 proposes a national GHG emissions target of -40% in 2020 relative to 1990 levels. In 2014, the Government decided to establish a procedure for setting national GHG reduction targets and an independent Climate Council which shall assess climate policy and compliance with climate goals on an annual basis. These provisions are expected to be implemented in early 2015.

As an EU Member State, Denmark takes part in the EU Emissions Trading System (EU-ETS). The ETS entered its 3rd phase in 2013, which introduced a single, EU-wide cap on emissions by ETS installations. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method, with more than 40% of allowances auctioned already in 2013.

A carbon tax was introduced in 1992 in addition to existing energy taxes on coal, oil, natural gas, and electricity. In 2008, the tax was set at EUR 20 per ton CO_2 and is raised by 1.8% annually. The revenue is partly redistributed to households and industry by subsidies for improvements in energy efficiency.

Electricity generation from renewable sources is promoted by feed-in premiums and exemptions from energy and carbon taxes. Since 1979, electric heating in buildings is prohibited, if access to district heating or natural gas is available. Today, more than 75% of all households are connected to district heating. Denmark aspires to reach 100% renewables in energy consumption by 2050.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

This fact sheet has not been approved by the respective Government.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

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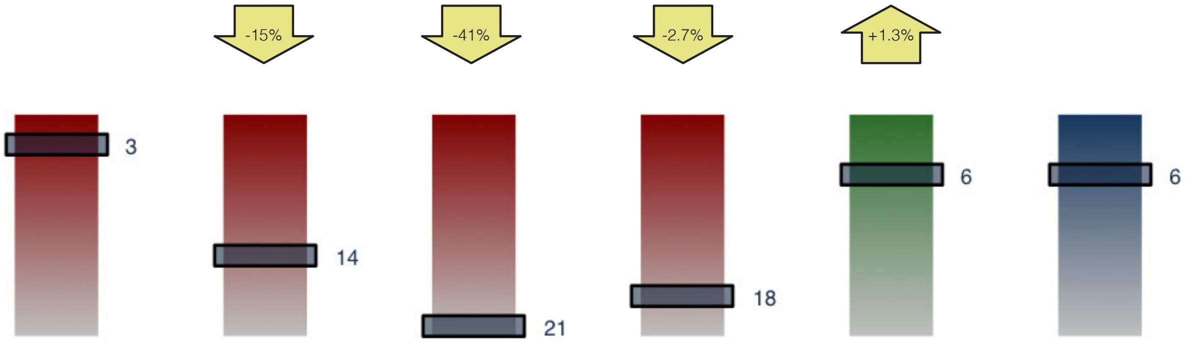
EU-27

	Value°	Rank *
Population:	504 mio	3
Annual population growth:	0.3 %	18
GDP per capita:	34'892 US$/capita	9
Fossil fuel resources:	85 tC/capita	11

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	3667 Mt	8.5 t/cap	0.11 toe/1000 US$ **	51.2 %	38 %	1.66 US$/l
Change		-15%	-41%	-2.7%	+1.3%	
Rank	3	14	21	18	6	6



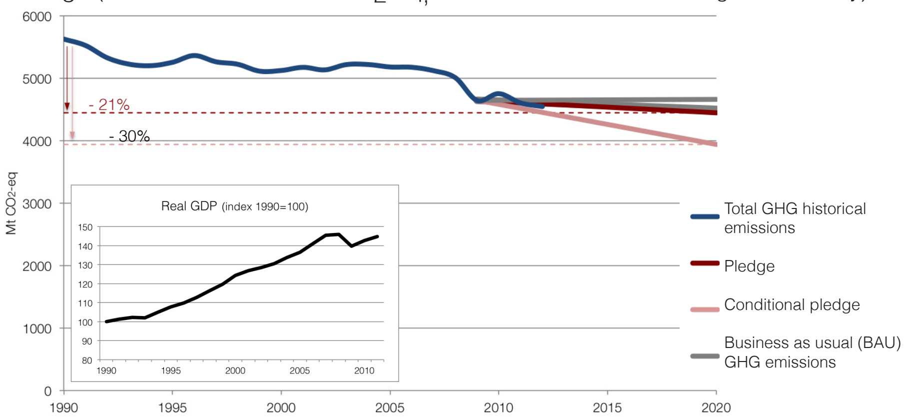
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: Under the Kyoto Protocol budget approach, the EU pledge was translated into an amount of QUELROs (Quantified Emission Limitation and Reduction Obligations) that imply an effective emissions reduction in 2020 of -21% relative to 1990 levels. The lower bound of the BAU projections was taken from European Environment Agency 2012 and takes into account existing measures. The upper bound of BAU projections was taken from Peterson Institute for International Economics 2007. In the EU, the land use sector is a considerable sink. However, the EU does not account for this sink in its unconditioned pledge of -21% by 2020.

Pledge (legally binding, ratification pending):

20% reduction of GHG emissions by 2020 relative to 1990 unilaterally.

Conditional pledge (non-legally binding):

30% reduction of GHG emissions by 2020 relative to 1990 as part of a global and comprehensive agreement for the period beyond 2012 and provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities.

DOMESTIC POLICIES

The EU Emissions Trading System (ETS) entered into force in 2005. The current third phase of the EU ETS (2013-2020) sets an EU-wide cap for emissions from large industrial sources, including among others the power sector and airlines. The EU ETS covers about 45% of total GHG emissions in the EU. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method (rather than given away for free on the basis of harmonised allocation rules), with more than 40% of allowances auctioned already in 2013. With the exception of aviation, the share of auctioned allowances will be between 70% and 100% in 2020, depending on the respective sector. Since allowance prices have been low, the EU Commission postponed the auctioning of 900 million allowances until 2019-2020.

For non-ETS emissions, the Member States made quantitative reduction commitments for 2020 under an Effort Sharing Decision (ESD).

The EU´s Climate and Energy Package established "20-20-20" targets for 2020: 20% GHG emission reduction w.r.t.1990, 20% energy consumption from renewables, and 20% increase in energy efficiency. The EU issued legal frameworks to promote renewable energy and sustainability of bioenergy supply. The EU regularly tightens emission performance standards for new passenger cars and light commercial vehicles. Energy efficiency policies focus on public transport and building sectors.

Support has been provided by the Swiss Federal Office for the Environment FOEN.
This fact sheet has not been approved by the respective Government.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

Econability
Sustainable Economics in Research and Practice

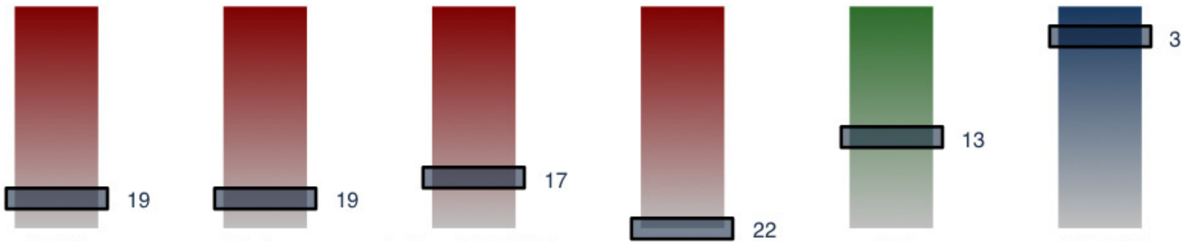
FRANCE

	Value°	Rank *
Population:	65 mio	13
Annual population growth:	0.6 %	14
GDP per capita:	42'377 US$/capita	6
Fossil fuel resources:	0 tC/capita	22

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	338 Mt	7.0 t/cap	0.18 toe/1000 US$ **	9.9 %	29 %	1.85 US$/l
Change		-19%	-11%	+0.7%	+1.1%	
Rank	19	19	17	22	13	3



Legend: Ranking among the 22 largest emitters

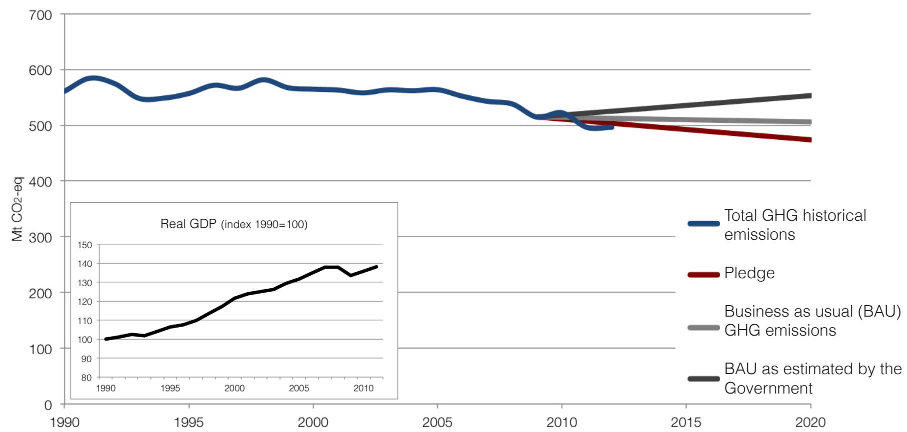
% increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections (Gov., and EEA 2012) include existing measures. Assuming equal percentage reductions in all EU Member States for emissions included in the EU emissions trading system (EU ETS), France´s GHG emission reduction in 2020 w.r.t. 2005 is -16%. As in an emissions trading system some countries may reduce more than others, the actual domestic emission reduction may deviate from the pledge as represented in the graph.

Pledge:

France participates in the legally binding EU commitment (ratification pending).
The EU as a whole pledges a 20% GHG emission reduction in 2020 w.r.t. 1990
(conditional pledge: -30%).

In an EU-wide effort sharing decision, France has committed itself to a reduction of -14% w.r.t. 2005 by 2020 (EU average: -10%). This commitment concerns only emissions that are not included in the EU emissions trading system (EU ETS) or approximately 71% of total emissions in France. In the EU ETS, the EU-wide emission reduction w.r.t. 2005 is 21%.

DOMESTIC POLICIES

As an EU Member State, France takes part in the EU Emissions Trading System (EU-ETS). The ETS entered its 3rd phase in 2013, which introduced a single, EU-wide cap on emissions by ETS installations. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method, with more than 40% of allowances auctioned already in 2013.

France has feed-in tariffs for electricity from renewable sources. Utilities are obliged to reach saving standards through their customers and take part in a White Certificates Program.

Use of renewable energy in the buildings sector is promoted by a wide array of measures including tax deductions and a loan program. In 2013, the RT2012 regulation tightened the energy standards for new buildings (50 kWh of primary energy consumption per sqm). After 2020, only "zero energy" new buildings will be allowed, i.e. they may not use more primary energy than they generate themselves from renewable sources.

The Government provides support for biofuels (target: 10% in 2020). A bonus-malus system is intended to further improve the CO_2 efficiency of new cars, which is already second best in Europe.

France claims that its policies will permit a CO_2 emission reduction of close to -23% in 2020 compared to 1990 levels. It intends to cut its CO_2 emissions by four until 2050.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

Econability
Sustainable Economics in Research and Practice

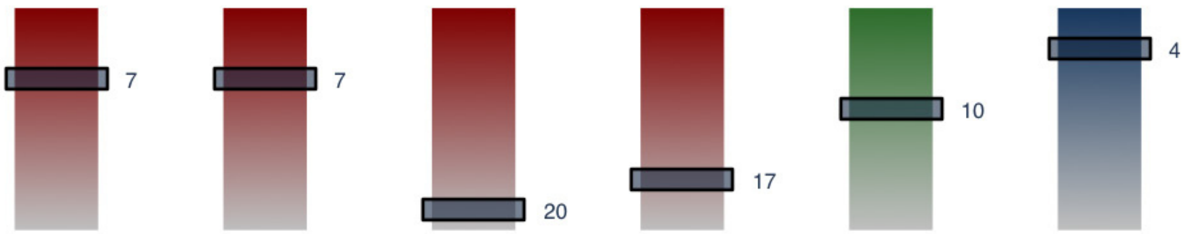
GERMANY

	Value°	Rank *
Population:	82 mio	10
Annual population growth:	- 0.1 %	21
GDP per capita:	44'060 US$/capita	5
Fossil fuel resources:	363 tC/capita	9

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	766 Mt	11.3 t/cap	0.13 toe/1000 US$ **	59.3 %	32 %	1.79 US$/l
Change		-9%	-19%	-3.9%	±0.0%	
Rank	7	7	20	17	10	4



Legend: Ranking among the 22 largest emitters

% increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)

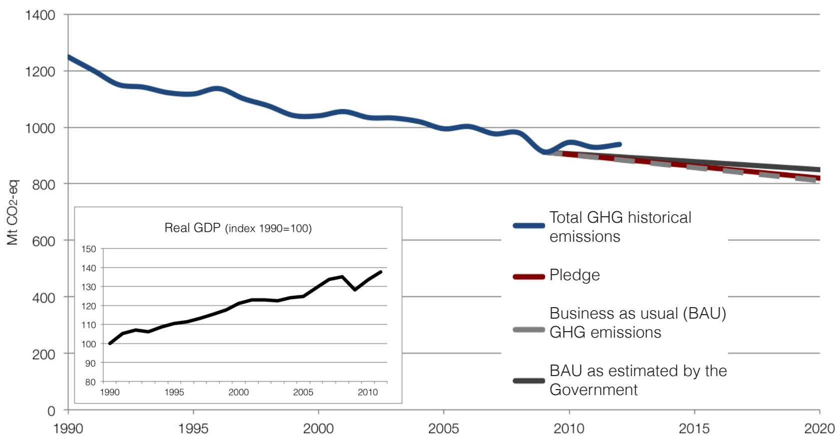
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price

** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections (Gov., and EEA 2012) include existing measures. Assuming equal percentage reductions in all EU Member States for emissions included in the EU emissions trading system (EU ETS), Germany´s GHG emission reduction in 2020 w.r.t. 2005 is -18%. As in an emissions trading system some countries may reduce more than others, the actual domestic emission reduction may deviate from the pledge as represented in the graph.

Pledge:

Germany participates in the legally binding EU commitment (ratification pending). The EU as a whole pledges a 20% GHG emission reduction in 2020 w.r.t. 1990 (conditional pledge: -30%).

In an EU-wide effort sharing decision, Germany has committed itself to a reduction of -14% w.r.t. 2005 by 2020 (EU average: -10%). This commitment concerns only emissions that are not included in the EU emissions trading system (EU ETS) or approximately 49% of total emissions in Germany. In the EU ETS, the EU-wide emission reduction w.r.t. 2005 is 21%.

DOMESTIC POLICIES

Germany has formulated national GHG abatement targets of -40% in 2020 and -80% in 2050 with respect to 1990 levels, which are more ambitious than the international pledge and, for 2020, imply emissions that are somewhat below BAU.
As an EU Member State, Germany takes part in the EU Emissions Trading System (EU-ETS). The ETS entered its 3rd phase in 2013, which introduced a single, EU-wide cap on emissions by ETS installations. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method, with more than 40% of allowances auctioned already in 2013.
Electricity generation, traditionally dominated by coal and nuclear, has become an important field of German climate-related policies. Germany plans to generate 35% of its electricity from renewable sources in 2020. This is also related to the nuclear phase-out, which will be completed in 2022. A feed-in tariff for electricity from renewables has been boosting renewables capacity. A major impediment to the further growth of electricity generation from wind power has been the lagging expansion of the transmission grid. As a consequence, grid expansion, including additional storage facilities, has become a Government priority.
The Integrated Climate and Energy Programme includes 29 measures that address a wide range of energy issues such as energy efficiency, energy-related requirements for new and renovated buildings, renewable energy for heat, and carbon capture and storage. 400 million Euros of revenues related to the EU ETS will be channelled towards low carbon projects. Regarding transport, the Programme includes measures such as an increased road toll for trucks, energy labelling for passenger cars, and a CO_2-based reform of the vehicle tax. Germany aims at a biofuel share of 17% by 2020.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

INDIA

	Value°	Rank *
Population:	1'241 mio	2
Annual population growth:	1.4 %	3
GDP per capita:	1'489 US$/capita	22
Fossil fuel resources:	37 tC/capita	13

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	1861 Mt	1.9 t/cap	1.12 toe/1000 US$ **	83.1 %	23 %	0.99 US$/l
Change		+44%	-29%	-0.1%	+1%	
Rank	4	22	4	7	14	15

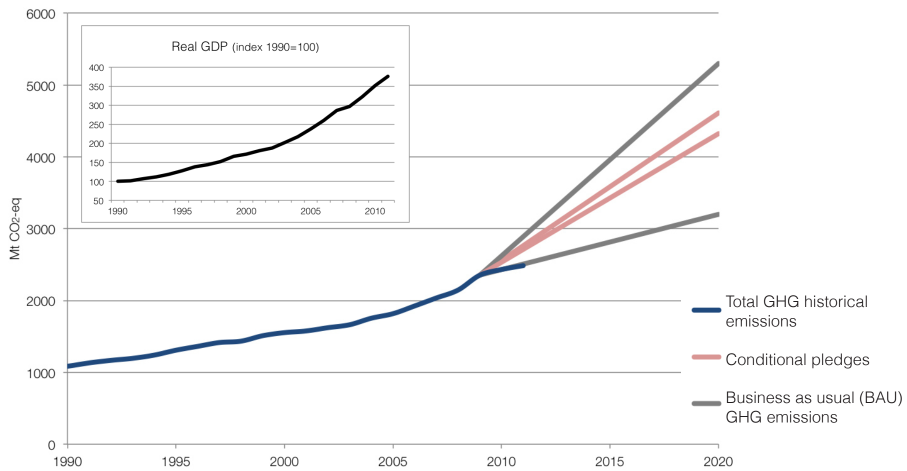
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections from Ecofys et al. 2012. As the pledge is set in emission intensity, we estimated the absolute GHG emissions assuming a growth rate of 8% from 2005. The Indian Government assumes GDP growth projections of 8-9%, which seems rather high given current GDP growth rates in India.

Pledge (non-legally binding):

Reduce the emissions intensity of GDP (excluding agriculture) by 20-25% by 2020 relative to 2005.

Actions are voluntary in nature and dependent on financial support to be provided by developed Parties.

DOMESTIC POLICIES

The National Action Plan on Climate Change (NAPCC) from 2008 is structured into eight National Missions to be accomplished until 2017 including missions on Solar (increase photovoltaic capacity by 1 GW per year), Enhanced Energy Efficiency, Green India (increase forest cover from 23% to 33% of the territory), and Strategic Knowledge (research fund). India has announced a blending target for bio-diesel and bio-ethanol of 20% by 2017. In electricity generation, there are capacity targets for renewables of 72 GW by 2022 (22 GW of which are envisaged to be solar) and for nuclear energy of 20 GW by 2020.

Regulations and/or tax incentives address a number of relevant areas such as energy conservation in buildings, solar and wind power. The State Electricity Regulatory Commissions (SERCs) are obliged to purchase a minimum share of electricity from renewable sources. A trading system with Renewable Energy Certificates has been introduced to minimize the costs of these obligations. In 2010, India introduced a coal tax of 50 Rupees per ton (roughly 1 US$/t) with the revenues earmarked for a National Clean Energy Fund.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

Econability Sustainable Economics in Research and Practice

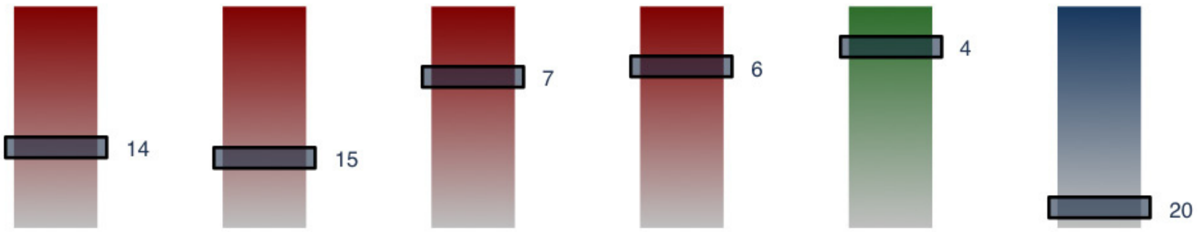
INDONESIA

	Value°	Rank *
Population:	242 mio	5
Annual population growth:	1.0 %	9
GDP per capita:	3'495 US$/capita	21
Fossil fuel resources:	29 tC/capita	14

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	447 Mt	8.5 t/cap	0.70 toe/1000 US$ **	84.0 %	52 %	0.65 US$/l
Change		+15%	-2%	±0.0%	-2.7%	
Rank	14	15	7	6	4	20



Legend: Ranking among the 22 largest emitters

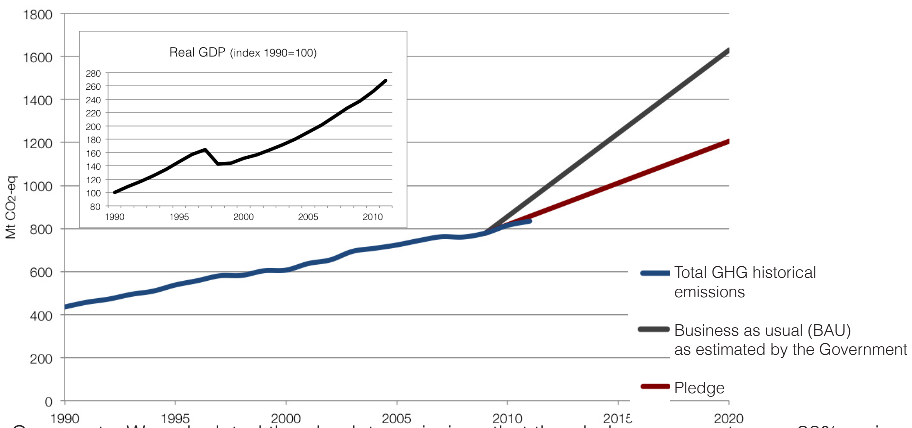
% increase/decrease over the last decade
(in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: We calculated the absolute emissions that the pledge represents as a 26% emission reduction from the BAU as estimated by the Government. Absolute emissions for pledges that are based on BAU projections are inherently uncertain, because BAU emissions may be subject to change. Indonesia has sizeable land use, land use change and forestry net emissions (approximately 150% of GHG excl. LULUCF), which are not included in the graphic above. Including LULUCF emissions, Indonesia would be the 5th largest emitter in the world.

Pledge (non-legally binding):

Indonesia's voluntary nationally appropriate mitigation actions (NAMAs) will reduce GHG emissions by 26% by 2020 in relation to business as usual scenario.

The related national action plan would be equipped with a measurable, reportable and verifiable system in order to ensure that each action receives the necessary level of funding.

DOMESTIC POLICIES

Next to its 26% pledge, Indonesia has set a more ambitious national reduction target for 2020 of 41% relative to business as usual, conditional on adequate international support.

Deforestation and forest degradation is the main source of GHG emissions in Indonesia. Net emissions from land use, land use change and forestry accounted for 60% of GHG emissions in 2000. The majority of logging activities are illegal. In many cases, deforestation occurs on carbon-rich peat lands, leading to further carbon release, methane emissions and peat fires. Norway pledged US$1 billion to help GHG reduction from deforestation and forest degradation, conditional to project monitoring. Both countries agreed to put a halt to the allocation of new forestry licences and peat land development for two years starting May 2011.

Indonesia has set a renewable energy target of 25% by 2025. Increasing the capacity of geothermal energy is one important means to meet this target. The other is an objective to supply 5% of energy demand with biofuels in 2025. Opposition to these initiatives is coming from the potential conflict with forest conservation objectives: 80% of geothermal sources are located in conservation forests; In many cases, lands are deforested for palm oil plantations.

Indonesia grants tax exemptions and other fiscal incentives for imports of energy saving equipment. It also provides loans with reduced interest rates on investments in energy conservation. Further initiatives deal with restructuring prices, tariffs and taxes for various energy sources.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

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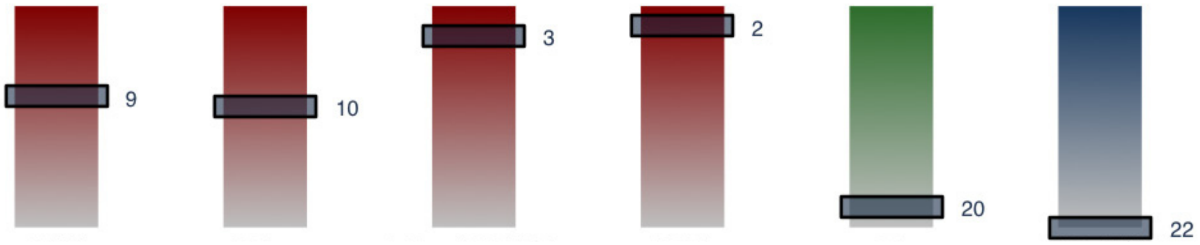
IRAN

	Value°	Rank *
Population:	75 mio	11
Annual population growth:	1.1 %	7
GDP per capita:	4'526 US$/capita	19
Fossil fuel resources:	528 tC/capita	7

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	579 Mt	9.5 t/cap	1.47 toe/1000 US$ **	95.8 %	7 %	0.06 US$/l
Change		+36%	-18%	-1.1%	±0.0%	
Rank	9	10	3	2	20	22



Legend: Ranking among the 22 largest emitters

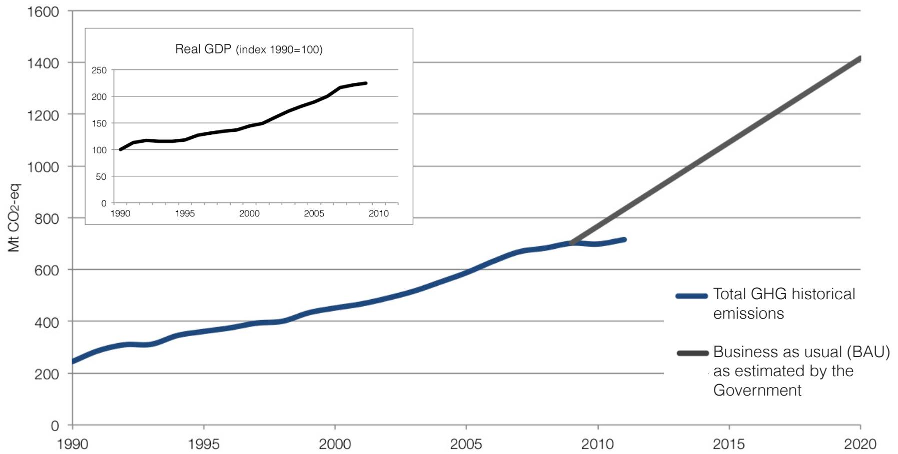
% increase/decrease over the last decade
(in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Pledge:

No pledge.

DOMESTIC POLICIES

Iran encourages fuel substitution from oil to natural gas. It has the second largest natural gas reserves in the world.

Domestic energy prices are generally below world market prices, although recently some fuel prices have almost doubled. The Government plans to reform energy prices, but at the same time refers to difficulties that this can create concerning “household welfare”.

Iran´s Climate Change Office enables Iran to prepare its National Communication to the UNFCCC.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

This fact sheet has not been approved by the respective Government.

° Generally 2011 data.
For details, see: “Sources for country fact sheet information”

Econability Sustainable Economics in Research and Practice

ITALY

	Value°	Rank *
Population:	61 mio	15
Annual population growth:	0.5 %	15
GDP per capita:	36'103 US$/capita	8
Fossil fuel resources:	2 tC/capita	21

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	410 Mt	7.7 t/cap	0.20 toe/1000 US$ **	73.3 %	31 %	1.78 US$/l
Change		-18%	-2%	-7.4%	+2.6%	
Rank	16	16	16	12	11	5

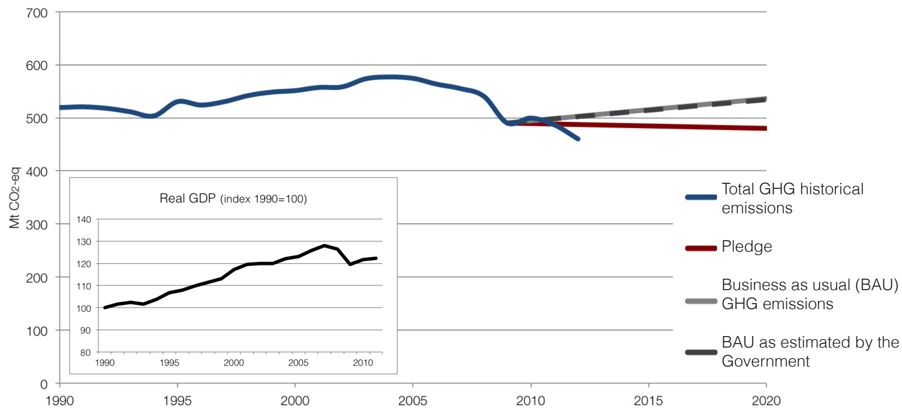
Legend: Ranking among the 22 largest emitters; % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections (Gov., and EEA 2012) include existing measures. The current recession is not taken into account in the BAU. Assuming equal percentage reductions in all EU Member States for emissions included in the EU emissions trading system (EU ETS), Italy´s GHG emission reduction in 2020 w.r.t. 2005 is -16%. As in an emissions trading system some countries may reduce more than others, the actual domestic emission reduction may deviate from the pledge as represented in the graph.

Pledge:

Italy participates in the legally binding EU commitment (ratification pending).
The EU as a whole pledges a 20% GHG emission reduction in 2020 w.r.t. 1990
(conditional pledge: -30%).

In an EU-wide effort sharing decision, Italy has committed itself to a reduction of -13% w.r.t. 2005 by 2020 (EU average: -10%). This commitment concerns only emissions that are not included in the EU emissions trading system (EU ETS) or approximately 57% of total emissions in Italy. In the EU ETS, the EU-wide emission reduction w.r.t. 2005 is 21%.

DOMESTIC POLICIES

As an EU Member State, Italy takes part in the EU Emissions Trading System (EU-ETS). The ETS entered its 3rd phase in 2013, which introduced a single, EU-wide cap on emissions by ETS installations. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method, with more than 40% of allowances auctioned already in 2013.
A preexisting carbon tax was abrogated in 2002. Italy´s strategy for GHG emission reduction has relied heavily on emission reductions from abroad through EU emissions trading and the flexible mechanisms of the Kyoto Protocol.
A reforestation plan had been announced, but with only rudimentary implementation so far. The same applies to the Climate Change Action Plan that was announced in 2007.
Energy efficiency issues are addressed via several measures such as fiscal incentives and funds, adopting EU legislation (e.g. on the performance of buildings), as well as by a white certificates trading scheme that was put into place in 2005 to help customers save energy. Under this scheme, all electricity and gas distributors trade white certificates of certified energy savings to meet their saving targets.
A Green Certificates System was adopted to increase the share of energy supply from renewable sources. Italy also introduced a feed-in tariff for electricity from photovoltaic systems. More incentives for renewables exist at a regional level. Austerity measures following the economic crisis have led to distinct cuts in subsidies.
In 2007, a national target of 5.75% of biofuels by 2010 was established. Italy has incentives for car sharing, and city governments are reimbursed up to 65% of the cost of adding environmentally friendly vehicles to their fleet.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

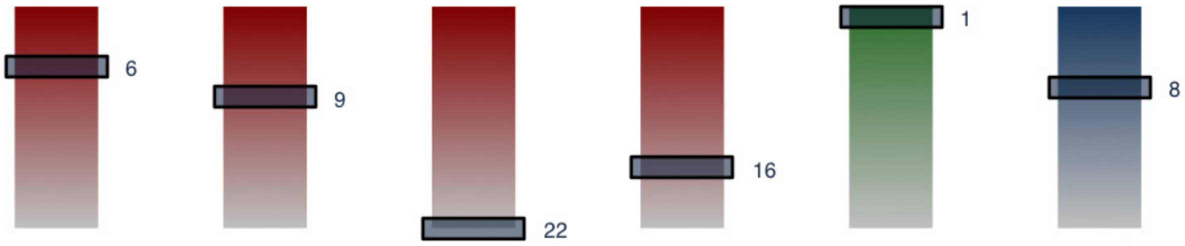
JAPAN

	Value°	Rank *
Population:	128 mio	8
Annual population growth:	0.3 %	17
GDP per capita:	45'903 US$/capita	4
Fossil fuel resources:	2 tC/capita	19

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	1212 Mt	9.6 t/cap	0.09 toe/1000 US$ **	61.8 %	69 %	1.49 US$/l
Change		±0%	-23%	+5.8%	+0.3%	
Rank	6	9	22	16	1	8



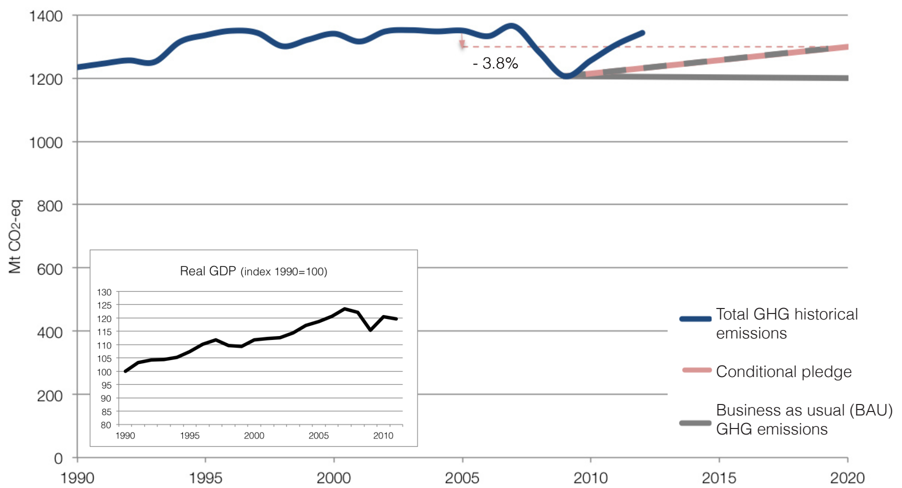
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections taken from Ecofys et al. 2012 do not include the nuclear phase out. The higher projection coincides with the pledge.

Pledge (non-legally binding):

3.8% reduction by 2020 compared with fiscal year 2005.

DOMESTIC POLICIES

In 2012, a carbon tax was established. It adds to the pre-existing tax regime on crude oil and coal imports. The design provides gradually increasing tax rates for three and a half years, beginning in October 2012. Eventually, it will increase up to JPY 289 (EUR 2.1) per ton of CO_2. It is intended to dedicate the revenue to measures aimed at reducing energy related CO_2 emissions.

A feed-in tariff scheme to promote electricity generation from renewable sources came into effect in July 2012. A mandatory emissions trading scheme for GHG emissions in the Tokyo Metropolitan Area was launched in 2010. Participation in an existing nationwide cap and trade system is voluntary.

The Energy Conservation Act of 1979 stipulated efficiency standards for vehicles, appliances, houses and buildings. The legal framework was revised and strengthened in 2008. The Low Carbon City Promotion Act went into force in 2012 and aims at classifying buildings with respect to CO_2 emissions in order to provide incentives for energy savings.

In the aftermath of the 2011 earthquake, most nuclear power plants were shut down. In 2014, the Abe Administration announced a plan to reinstate nuclear power generation to the former level, beginning in 2015.

Support has been provided by the Swiss Federal Office for the Environment FOEN.
This fact sheet has not been approved by the respective Government.
° Generally 2011 data. For details, see: "Sources for country fact sheet information"
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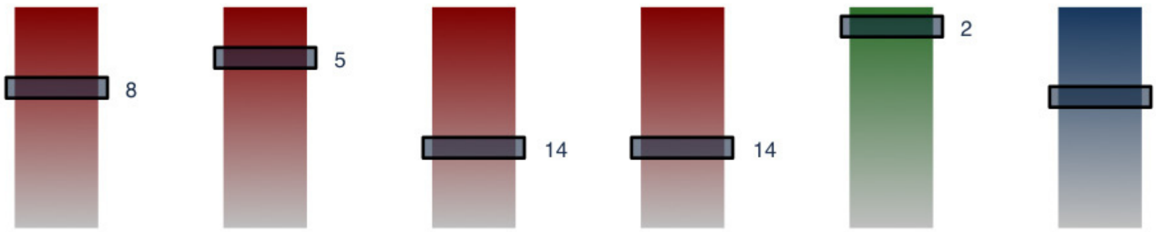
KOREA, REP. OF

	Value°	Rank *
Population:	50 mio	17
Annual population growth:	0.7 %	11
GDP per capita:	22'424 US$/capita	10
Fossil fuel resources:	2 tC/capita	20

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	612 Mt	13.2 t/cap	0.24 toe/1000 US$ **	68.7 %	64 %	1.44 US$/l
Change		+24%	-35%	21.3%	+0.4%	
Rank	8	5	14	14	2	9



Legend: Ranking among the 22 largest emitters

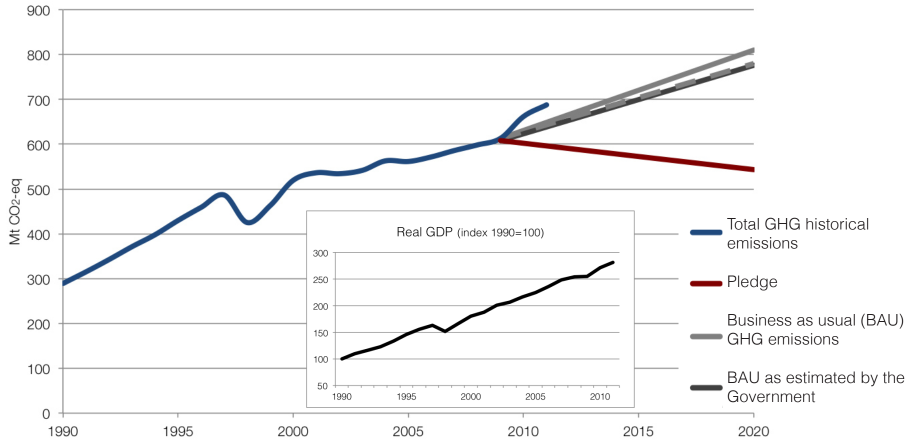
% increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections taken from Ecofys et al. 2012. The lower projection coincides with the BAU estimated by the Government. We calculated the absolute emissions that the pledge represents as a 30% reduction from BAU as estimated by the Government. Absolute emissions for pledges that are based on BAU projections are inherently uncertain, because BAU emissions may be subject to change.

Pledge (non-legally binding):

Reduce GHG emissions by 30% from the 'business as usual' emissions in 2020.

DOMESTIC POLICIES

The Energy Vision 2030 formulates the objectives to reduce energy intensity by 46% compared to 2007 and to achieve a renewable energy share of 11%. The Republic of Korea has fuel efficiency standards based on engine size. Policies included mandatory emission cuts for large emitters under the threat of penalties.

In 2012, the National Assembly decided to launch a domestic cap-and-trade emissions trading scheme (ETS) that follows the EU model. The start of the scheme is scheduled for January 2015.

In January 2014, the Ministry of the Environment announced the GHG Emissions Reduction Roadmap 2020, which includes reduction policies and measures in seven sectors (industry, transportation, buildings, public sector, agriculture, waste, and power generation).

09 Sept. 2014

Support has been provided by the Swiss Federal Office for the Environment FOEN.

This fact sheet has not been approved by the respective Government.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

Econability Sustainable Economics in Research and Practice

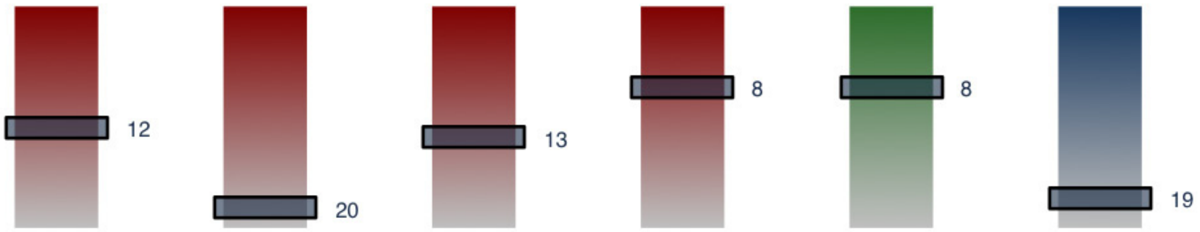
MEXICO

	Value°	Rank *
Population:	115 mio	9
Annual population growth:	1.2 %	5
GDP per capita:	10'047 US$/capita	16
Fossil fuel resources:	21 tC/capita	17

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	458 Mt	6.3 t/cap	0.30 toe/1000 US$ **	80.2 %	33 %	0.77 US$/l
Change		+10%	+10%	+4.2%	-1%	
Rank	12	20	13	8	8	19

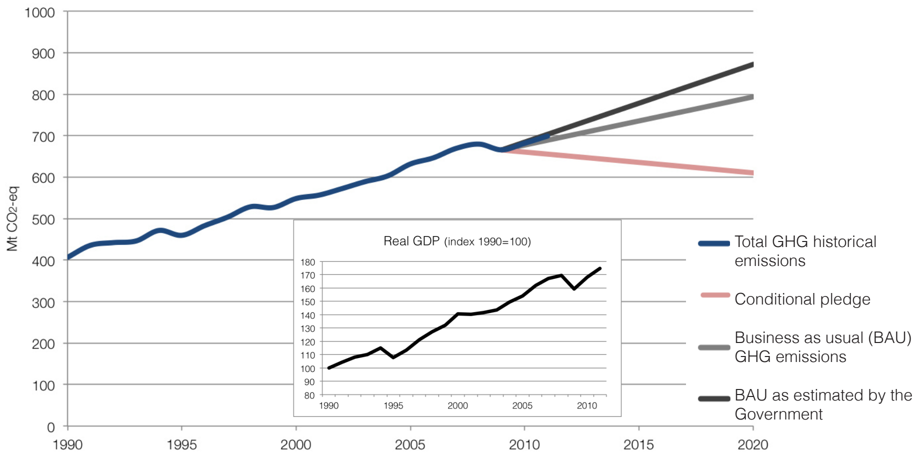


Legend: Ranking among the 22 largest emitters; % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF
\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projection comes from the Climate Action Tracker 2011. We calculated the absolute emissions that the pledge represents as a 30% reduction from BAU as estimated by the Government. Absolute emissions for pledges that are based on BAU projections are inherently uncertain, because BAU emissions may be subject to change.

Pledge (non-legally binding):

Up to 30% emissions reduction compared with the 'business as usual' scenario by 2020.

Full implementation of its Special Climate Change Programme, adopted in 2009, would achieve a reduction in total annual emissions of 51 Mt CO_2-eq by 2012, compared with the 'business as usual' scenario.

The achievement of the target is subject to the provision of adequate financial and technological support from developed countries as part of a global agreement.

DOMESTIC POLICIES

The General Law on Climate Change was adopted in 2012. It entails institutional reforms and emphasizes adaptation. In terms of mitigation, the first step, which precedes the implementation of mitigation activities, is to strengthen capacities. The 2013 National Climate Change Strategy formulates a 10-20-40 vision which sets goals for the next 10, 20 and 40 years. Objectives for the next 10 years include 35% electricity generation from clean sources.

In 2007, a law was passed to promote bioenergy. In 2009, a renewable energy fund of 3 billion Mexican Pesos (about 225 million US$) was created. The Special Climate Change Program 2009-2012 provided a large number of objectives and actions that are necessary to achieve the long-term goal of reducing GHG emissions by 50% in 2050 relative to 2000.

Mexico has created a framework to prevent deforestation and forest degradation. The concept of Environmental Services Payments to forest owners is central in this respect, and it is connected to the international REDD+ mechanism, which Mexico has prepared itself for. Emphasis is made on the principle "who conserves is paid".

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"
Econability
Sustainable Economics in Research and Practice

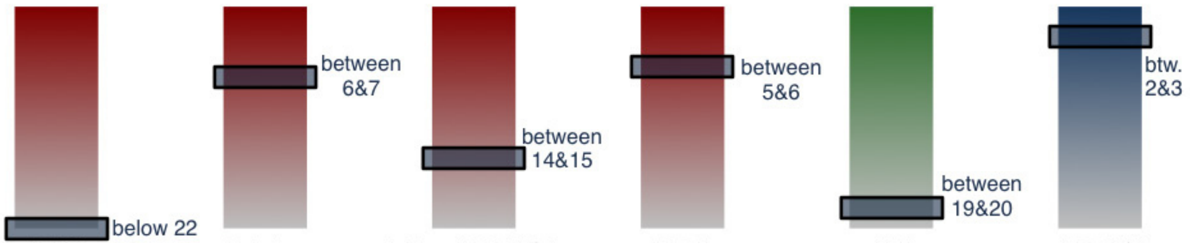
NETHERLANDS

	Value°	Rank *
Population:	17 mio	below 22
Annual Population growth:	0.5 %	between 14&15
GDP per capita:	50'076 US$/capita	between 2&3
Fossil fuel resources:	50 tC/capita	between 12&13

* ranked against the 22 largest emitters (this country is not one of them)

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	176 Mt	11.9 t/cap	0.22 toe/1000 US$ **	85.7 %	11 %	1.92 US$/l
Change		-12%	-22%	-5%	+0.2%	
Rank	below 22	between 6&7	between 14&15	between 5&6	between 19&20	btw. 2&3



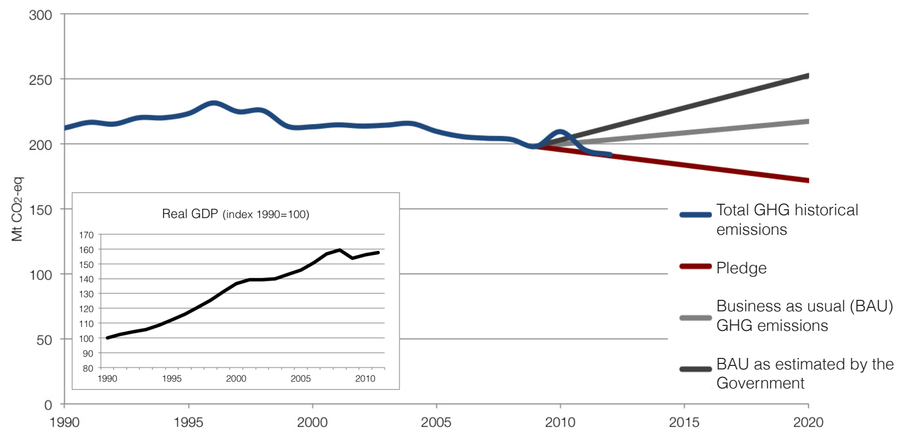
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections (Gov., and EEA 2012) include existing measures. Assuming equal percentage reductions in all EU Member States for emissions included in the EU emissions trading system (EU ETS), the Netherland´s GHG emission reduction in 2020 w.r.t. 2005 is -18%. As in an emissions trading system some countries may reduce more than others, the actual domestic emission reduction may deviate from the pledge as represented in the graph.

Pledge:

The Netherlands participate in the legally binding EU commitment (ratification pending). The EU as a whole pledges a 20% GHG emission reduction in 2020 w.r.t. 1990 (conditional pledge: -30%).

In an EU-wide effort sharing decision, the Netherlands have committed themselves to a reduction of -16% w.r.t. 2005 by 2020 (EU average: -10%). This commitment concerns only emissions that are not included in the EU emissions trading system (EU ETS) or approximately 59% of total emissions in the Netherlands. In the EU ETS, the EU-wide emission reduction w.r.t. 2005 is 21%.

DOMESTIC POLICIES

As an EU Member State, the Netherlands take part in the EU Emissions Trading System (EU-ETS). The ETS entered its 3rd phase in 2013, which introduced a single, EU-wide cap on emissions by ETS installations. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method, with more than 40% of allowances auctioned already in 2013.

Support for electricity generation from renewable sources is granted by a fixed premium on top of the wholesale price. The level and the duration of the premium varies with different technologies. Voluntary commitments to improvements in energy efficiency, often with penalties for non-compliance, are encouraged by the Government in all sectors. In transport, the vehicle sales tax depends upon fulfilment of emissions standards of the vehicles. A road pricing system which allows for discrimination of emissions is currently under discussion.

The Netherlands announced a national target of 14% renewables in total energy consumption by 2020 and 16% by 2023 (2010: 4%) and pursue the goal to achieve energy savings of 2% each year until 2020. The shutdown of five coal fired power plants until 2017 has been decided.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

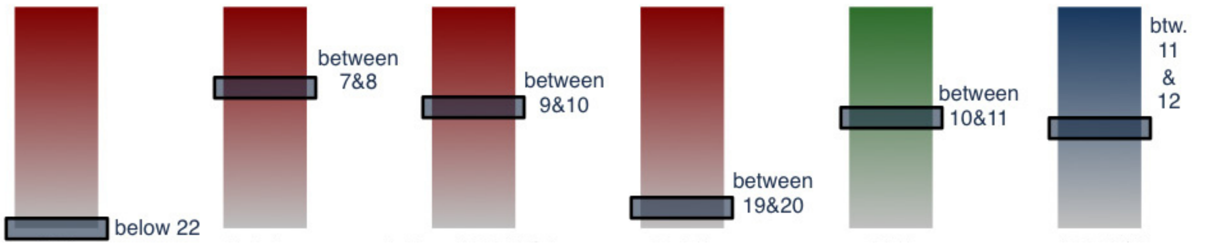
NEW ZEALAND

	Value°	Rank *
Population:	4 mio	below 22
Annual Population growth:	0.9 %	between 10&11
GDP per capita:	36'254 US$/capita	between 7&8
Fossil fuel resources:	101 tC/capita	between 10&11

* ranked against the 22 largest emitters (this country is not one of them)

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	31 Mt	10.2 t/cap	0.46 toe/1000 US$ **	26.6 %	31 %	1.22 US$/l
Change		-7%	+20%	-1.7%	± 0.0%	
Rank	below 22	between 7&8	between 9&10	between 19&20	between 10&11	btw. 11 & 12



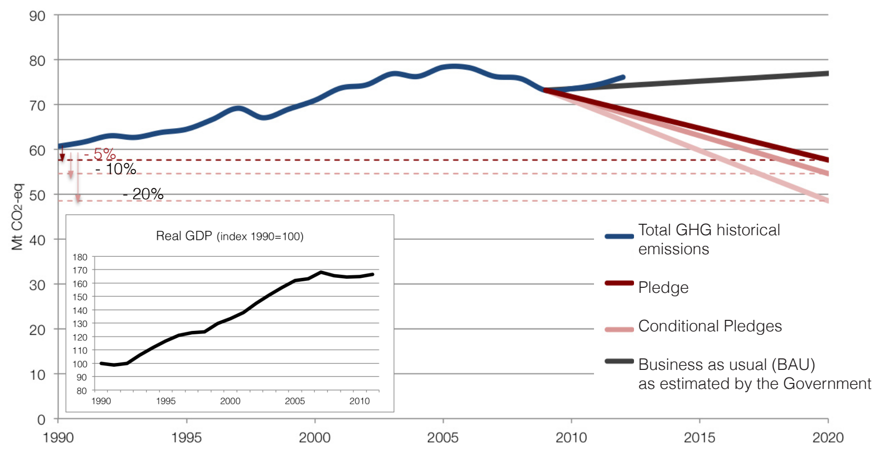
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: For New Zealand, the fact that the land use, land use change and forestry (LULUCF) sector is a large sink and uncertainties around LULUCF accounting methods imply that the pledge could be less stringent than it appears here.

Pledge (non-legally binding):

Emissions reductions of 5% below 1990 levels by 2020 unconditionally, and of 10 - 20% if there is a comprehensive global agreement. This means:
- The global agreement sets the world on a pathway to limit temperature rise to not more than 2°C;
- Developed countries make comparable efforts to those of NZ;
- Advanced and major emitting developing countries take action fully commensurate with their respective capabilities;
- Effective set of rules for land use, land-use change and forestry (LULUCF); and
- Full recourse to a broad and efficient international carbon market.

DOMESTIC POLICIES

New Zealand proclaimed a national target for 2050 of a 50% reduction in GHG emissions relative to 1990 and pursues to generate 90% of its electricity generation from renewable sources in 2025 (2011: 76.8%).

In 2008, an Emissions Trading Scheme (ETS) was started. Today, it covers the sectors of forestry, transport fuels, stationary energy, industrial processes, synthetic gases, agriculture and waste. While the original aim to include virtually all of the country's GHG emissions in the system has been abandoned, coverage is exceptionally high. Carbon credits can be obtained from forest sinks, and they can be imported without limit from Kyoto markets (ERUs, CERs, RMUs) and potentially other markets that will be linked in the future. Under the prevailing low prices, importing international carbon offsets has become the most common method of compliance for entities regulated under New Zealand's ETS. Free allocations of emission units have been made to eligible businesses with exposure to foreign trade. Since 2013, however, electricity generation, liquid fossil fuels, waste or synthetic gases businesses are not eligible anymore.

Promotion of renewable energy is mostly confined to regulatory measures and support for research. Energy efficiency is tackled via common labelling and energy standards for consumer products with Australia. An insulation program for residential homes ended in 2013 after paying shares of retrofitting costs for about 230 000 homes.

09 Sept. 2014

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

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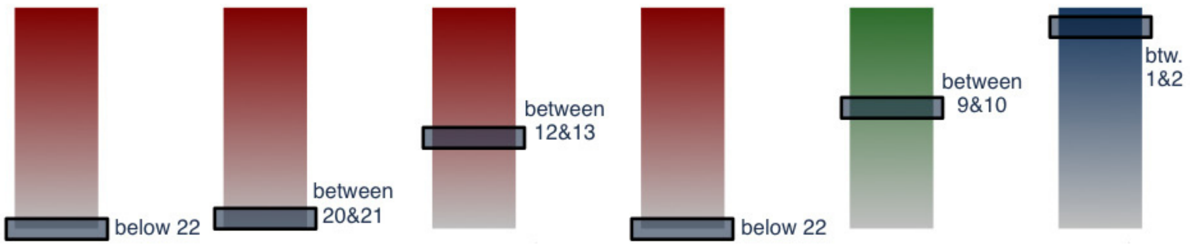
NORWAY

	Value°	Rank *
Population:	5 mio	below 22
Annual Population growth:	1.3 %	between 3&4
GDP per capita:	98'102 US$/capita	above 1
Fossil fuel resources:	381 tC/capita	between 8&9

* ranked against the 22 largest emitters (this country is not one of them)

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	40 Mt	5.2 t/cap	0.33 toe/1000 US$ **	4.0 %	33 %	2.07 US$/l
Change		-20%	-23%	+3.8%	+2.4%	
Rank	below 22	between 20&21	between 12&13	below 22	between 9&10	btw. 1&2



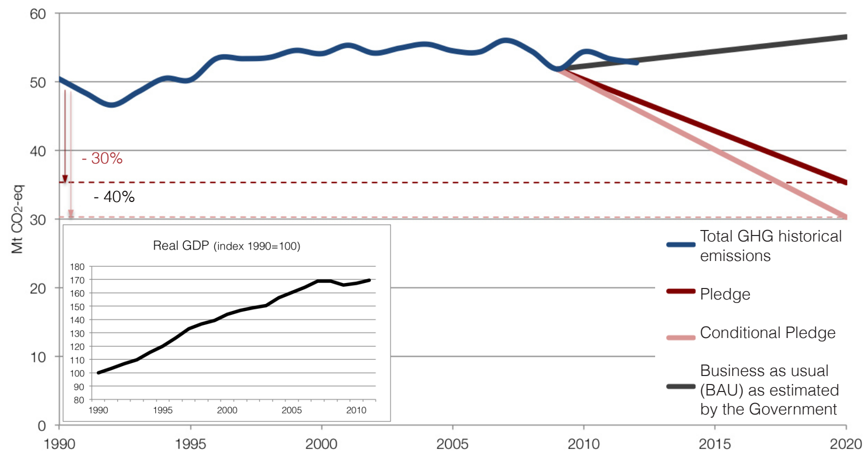
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: Norway has commented its pledge by stating: "An important feature of Norwegian climate change policy is the flexible and cost-effective Kyoto Protocol based approach". The LULUCF sector is a sizeable sink, which approximately halves Norway's total emissions. Depending on LULUCF accounting, the actual ambition of the pledge may vary.

Pledge (legally binding):

30% emission reduction by 2020 compared with 1990 levels.

Moving to 40% reduction as part of a global and comprehensive agreement for the period beyond 2012 where major emitting Parties agree on emissions reductions in line with the 2 degrees Celsius target.

DOMESTIC POLICIES

Norway pursues to become a 100% carbon neutral economy in 2030. The objective is conditional on an ambitious international agreement.

In 2005, Norway started an Emissions Trading System, which is designed similarly to the EU-ETS. Since 2008, both are linked, and full harmonization was put into force in 2013. In its second phase (2008-2012), the Norwegian ETS covered about 40% of the country's projected GHG emissions. Free allocations of allowances were reduced to 39% of total allocations.

A green certificate system promotes renewable electricity generation, which is already very high in Norway due to well developed hydropower. In 2012, Norway and Sweden established a common market for green certificates.

A carbon tax is raised since 1991. Petroleum activities on the continental shelf are covered by the tax, too. A carbon capture and storage (CCS) project, which had been designed to capture 1 million tons of CO_2 per year, was cancelled in 2013 because of high costs.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

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POLAND

	Value°	Rank *
Population:	38 mio	19
Annual population growth:	0.1 %	19
GDP per capita:	13'463 US$/capita	12
Fossil fuel resources:	110 tC/capita	10

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	309 Mt	9.7 t/cap	0.34 toe/1000 US$ **	92.9 %	31 %	1.54 US$/l
Change		±0%	-69%	-5.2%	+0.9%	
Rank	21	8	12	4	12	7

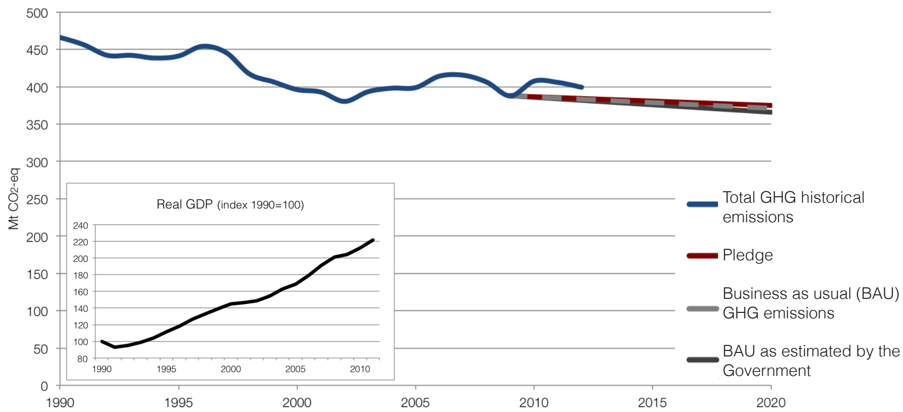
Legend: Ranking among the 22 largest emitters; % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections (Gov., and EEA 2012) include existing measures. Assuming equal percentage reductions in all EU Member States for emissions included in the EU emissions trading system (EU ETS), Poland´s GHG emission reduction in 2020 w.r.t. 2005 is - 6%. As in an emissions trading system some countries may reduce more than others, the actual domestic emission reduction may deviate from the pledge as represented in the graph.

Pledge:

Poland participates in the legally binding EU commitment (ratification pending).
The EU as a whole pledges a 20% GHG emission reduction in 2020 w.r.t. 1990
(conditional pledge: -30%).

In an EU-wide effort sharing decision, Poland has committed itself to a reduction of +14% w.r.t. 2005 by 2020 (EU average: -10%). This commitment concerns only emissions that are not included in the EU emissions trading system (EU ETS) or approximately 44% of total emissions in Poland. In the EU ETS, the EU-wide emission reduction w.r.t. 2005 is 21%.

DOMESTIC POLICIES

As an EU Member State, Poland takes part in the EU Emissions Trading System (EU-ETS). The ETS entered its 3rd phase in 2013, which introduced a single, EU-wide cap on emissions by ETS installations. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method, with more than 40% of allowances auctioned already in 2013.

Poland aims at reaching the EU-15 level in energy intensity by 2030 and to keep primary energy demand constant after this. It intends to introduce nuclear energy and to promote renewable energy including biofuels. An action plan has been adopted.

In 2011, Poland introduced a scheme with tradable white certificates. Utilities have energy efficiency obligations. White certificates originate from tendered energy efficiency projects and can be used to avoid a fee. Another existing program targets energy efficiency in industry.

Subsidies for renewable energy were supposed to take effect as of January 1, 2013, but as of spring 2014 are still in the status of a draft law.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

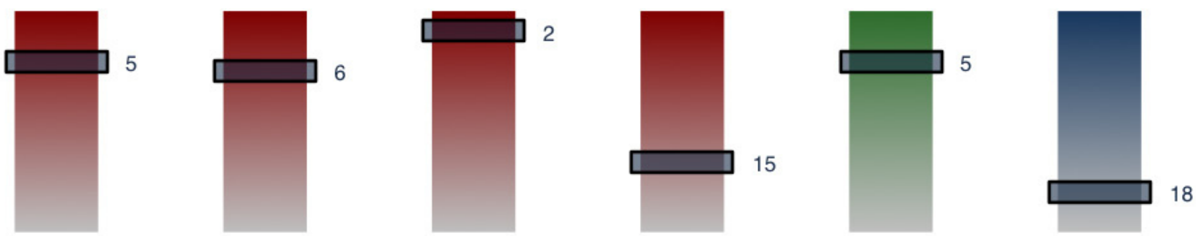
RUSSIA

	Value°	Rank *
Population:	142 mio	7
Annual population growth:	0 %	20
GDP per capita:	13'089 US$/capita	13
Fossil fuel resources:	1'060 tC/capita	3

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	1712 Mt	12.1 t/cap	1.89 toe/1000 US$ **	67.1 %	49 %	0.78 US$/l
Change		+11%	-32%	+1.2%	±0.0%	
Rank	5	6	2	15	5	18



Legend: Ranking among the 22 largest emitters

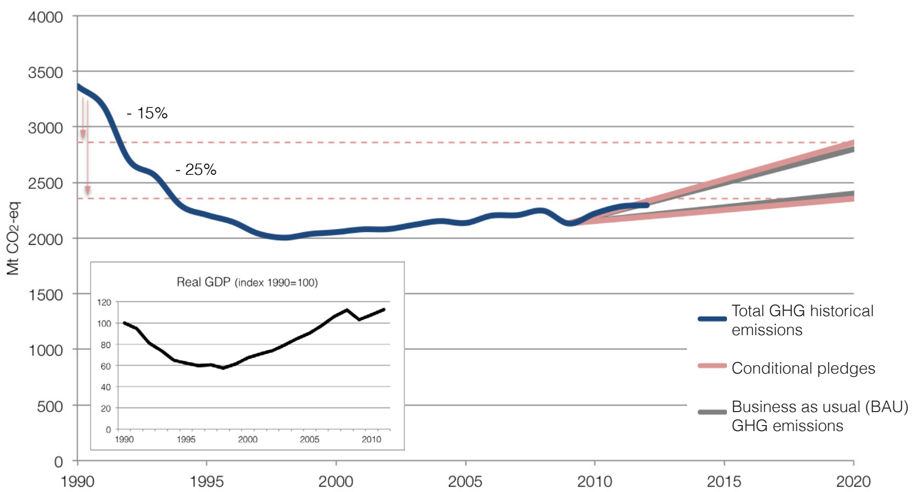
% increase/decrease over the last decade
(in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections were taken from Ecofys et al. 2012. The graph excludes emissions from the land sector, which is a considerable sink in Russia.

Pledge (non-legally binding):

Reduction of 15-25 % by 2020 compared to 1990 levels.

The range of the GHG emission reductions will depend on the following conditions:
1) Appropriate accounting of the potential of Russia's forestry;
2) Undertaking by all major emitters of the legally binding obligations.

The Russian Federation intends to fulfil such commitments by participating in a new comprehensive legally binding agreement, which should be developed before the end of the first commitment period of the Kyoto Protocol.

DOMESTIC POLICIES

The Climate Doctrine from 2009 is not a bill, but a declaration on strategic guidelines in Russian climate policy. It calls for research as well as measures for mitigation and adaptation and recognizes the importance of participating in international efforts. Stated objectives of the Climate Doctrine are to put a price on CO_2 emissions, to (mildly) reduce the share of natural gas in primary energy supply (mostly by increasing the share of nuclear energy, but also of renewable energy), to increase energy efficiency, and to incentivise technology development and deployment.

Government Decree No.1-r from 2009 sets a target share for renewables in electricity generation, excluding large hydro, of 4.5% in 2020. Several laws and regulations have been implemented to improve energy efficiency and conservation, notably the Thermal Performance of Buildings Code in 2003 and the Federal Energy Efficiency Law 261-F3 in 2009. Russia is the world´s largest CO_2 emitter from flaring in the world. In 2009, limits for gas flaring have been established.

In September 2013, a Presidential Decree established a legally binding and unconditional national target of -25% relative to 1990 emissions. Translation of the new target into sectoral objectives and implementation of a national GHG accounting system is still pending as of spring 2014.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

This fact sheet has not been approved by the respective Government.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

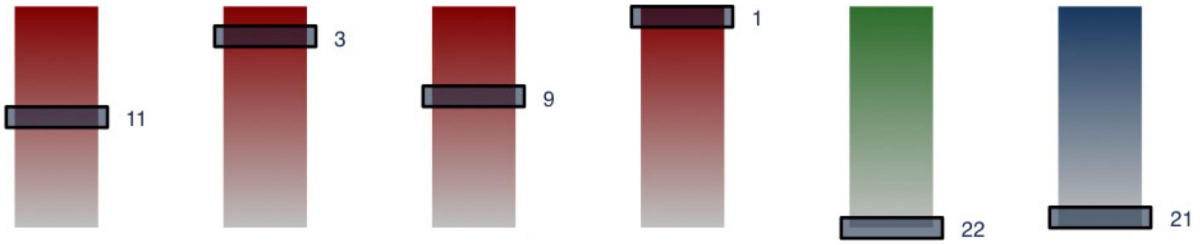
SAUDI ARABIA

	Value°	Rank *
Population:	28 mio	21
Annual population growth:	2.3 %	1
GDP per capita:	20'540 US$/capita	11
Fossil fuel resources:	1'325 tC/capita	2

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	481 Mt	19.0 t/cap	0.66 toe/1000 US$ **	100.0 %	0 %	0.11 US$/l
Change		+26%	-22%	±0.0%	±0.0%	
Rank	11	3	9	1	22	21



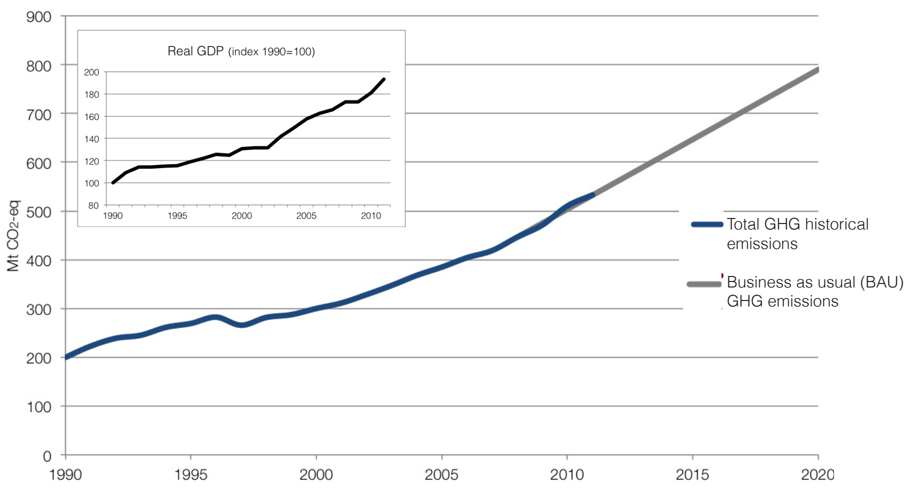
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projection from Ecofys et al. 2012.

Pledge:

No pledge.

DOMESTIC POLICIES

In 2011, Saudi Arabia announced plans to build 16 nuclear power stations over the next 20 years. The first two are scheduled to produce energy after 10 years, followed by two more every year until 2030. Saudi Arabia has the objective to achieve a share of renewable energy in electricity generation of 23% in 2030 (10% in 2020), starting from 0% in 2009.

Saudi Arabia strives to diversify its economy to reduce dependence of fossil fuel exports. The National Energy Efficiency Programme (NEEP) combines many activities and measures to enhance energy efficiency. Saudi Arabia is a member of the Global Gas Flaring Reduction Partnership, which is led by the World Bank.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

This fact sheet has not been approved by the respective Government.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

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SINGAPORE

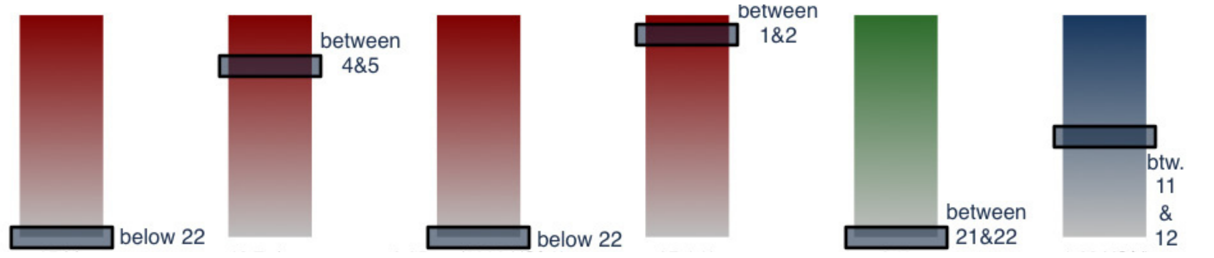
	Value°	Rank *
Population:	5 mio	below 22
Annual Population growth:	2.1 %	between 1&2
GDP per capita:	46'241 US$/capita	between 3&4
Fossil fuel resources:	0 tC/capita	below 22

* ranked against the 22 largest emitters (this country is not one of them)

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	65 Mt	13.7 t/cap	0.05 toe/1000 US$ **	97.4 %	3 %	1.23 US$/l
Change		+8%	-35%	-1%	-0.1%	

Rank



Legend: Ranking among the 22 largest emitters

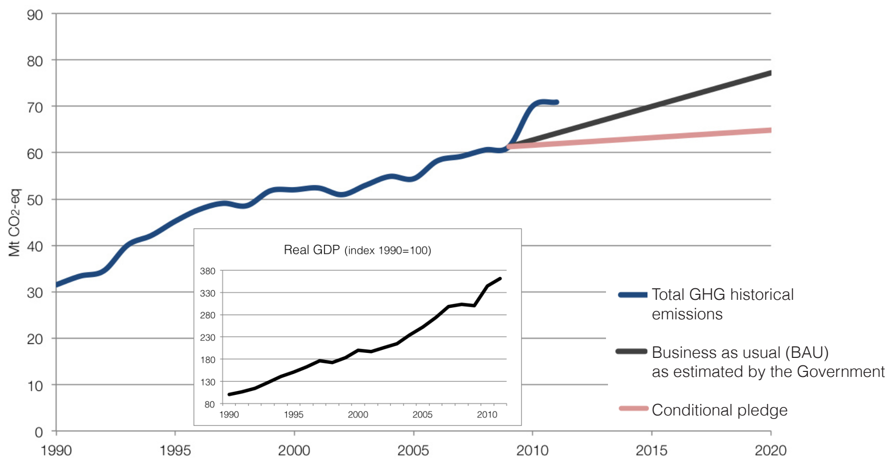
% increase/decrease over the last decade
(in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: The Singapore Government put forward a BAU in its National Climate Change Strategy 2012, thus published after its National Communication to the UNFCCC. This BAU excludes measures taken after 2005.

Pledge (non-legally binding):

Nationally appropriate mitigation actions leading to a reduction of GHG emissions by 16% below Business as Usual levels in 2020, contingent on a legally binding global agreement in which all countries implement their commitments in good faith.

DOMESTIC POLICIES

According to its National Climate Change Strategy 2012, Singapore "has embarked on policies and measures that will reduce our emissions by 7% to 11% below 2020 BAU levels". The 2009 Sustainable Singapore Blueprint sets a national target for improving energy efficiency by 20% from 2005 levels by 2020 (and by 35% in 2030).

Singapore switched its dominant fuel for electricity generation from coal to natural gas. Consequently, the share of natural gas in electricity generation raised from 19% in 2000 to 80% today. Renewables are promoted through support for research and development. The 2013 Energy Conservation Act obliges large industrial energy consumers to establish energy efficiency plans. In the building sector, efficiency standards are in force.

The size of the vehicle fleet is regulated by quota since 1990. Today, the annual growth rate of the quota is 0.5%. Vehicle registration fees are extremely high, but since 2013 owners of new and imported used cars with CO_2 emissions of no more than 160 g/km receive rebates of SGD 5 000 to 20 000 (Singapore dollars), which approximately corresponds to EUR 3100 to 12 300; moreover, for cars emitting more than 210 gCO_2/km, a surcharge of equal amount must be paid.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

Econability
Sustainable Economics in Research and Practice

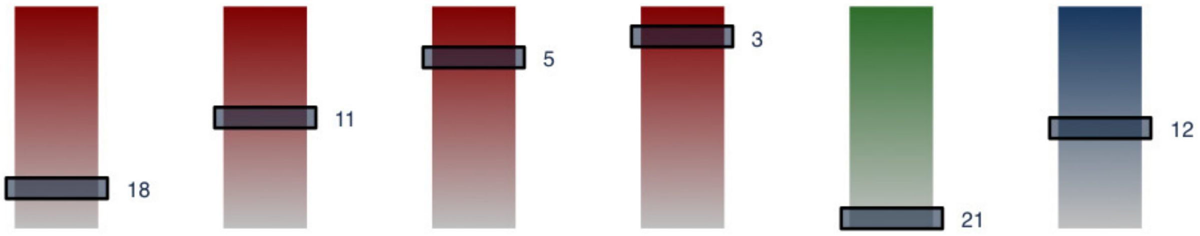
SOUTH AFRICA

	Value°	Rank *
Population:	51 mio	16
Annual population growth:	1.2 %	6
GDP per capita:	8'070 US$/capita	17
Fossil fuel resources:	432 tC/capita	8

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	374 Mt	9.0 t/cap	0.80 toe/1000 US$ **	94.3 %	5 %	1.17 US$/l
Change		+13%	-21%	+1.3%	-1%	
Rank	18	11	5	3	21	12

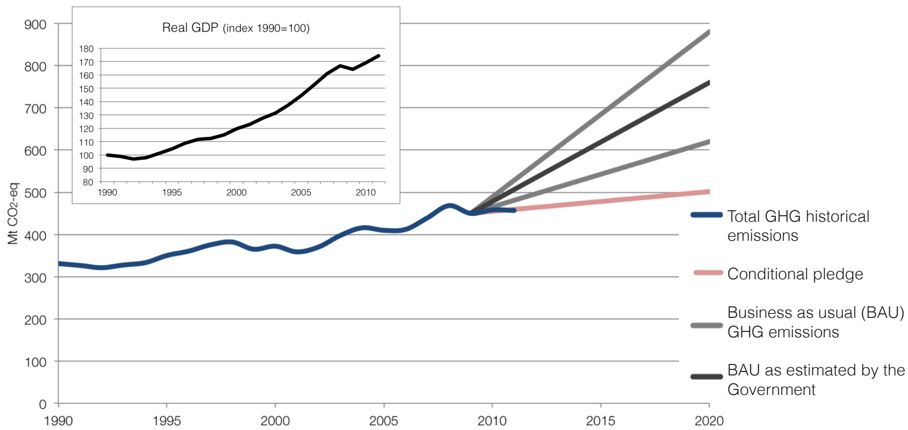


Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF
+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU spread from Department of Environmental Affairs of the Republic of South Africa as cited by Ecofys et al. 2012. We calculate the absolute emissions that the pledge represents as a 34% reduction from the BAU given by the Government. The BAU scenario provided by the Government in its National Communication to the UNFCCC is only put forward graphically for 2020, which makes our representation of the pledge somewhat imprecise. Absolute emissions for pledges that are based on BAU projections are inherently uncertain, because BAU emissions may be subject to change.

Pledge (non-legally binding):

Nationally appropriate mitigation action for a 34% deviation from business as usual by 2020 and 42% by 2025.

The extent to which this action will be implemented will depend on the provision of financial resources, the transfer of technology and the capacity-building support provided by developed countries and therefore requires the finalization of an ambitious, fair, effective and binding multilateral agreement under the UNFCCC and its Kyoto Protocol.

DOMESTIC POLICIES

South Africa pursues to let emissions peak between 2020 and 2025, stabilize for about a decade, and then begin to decline. The National Climate Change Response Policy from 2011 established a general framework for domestic climate policy. The emissions target was incorporated in the latest update of the Integrated Resource Plan for Electricity in 2013, which anchored mitigation in energy policy more firmly.

In 2010, a CO_2 tax on passenger vehicles was introduced, adding 75 Rand (about 8 US$) to the vehicle price for every gram of CO_2 per kilometre the vehicle emits over 120 g/km.

The Government plans to introduce a carbon tax of 120 Rand (about 14 US$) per ton starting in January 2016. A 60 percent tax-free threshold could be set on annual emissions until 2020, as proposed by the Treasury. Higher tax-free thresholds could apply to emission-intensive and trade-exposed industries like cement, iron and steel, aluminium and glass. Increases in the tax-free threshold will also apply to companies that invest into external green projects.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

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SPAIN

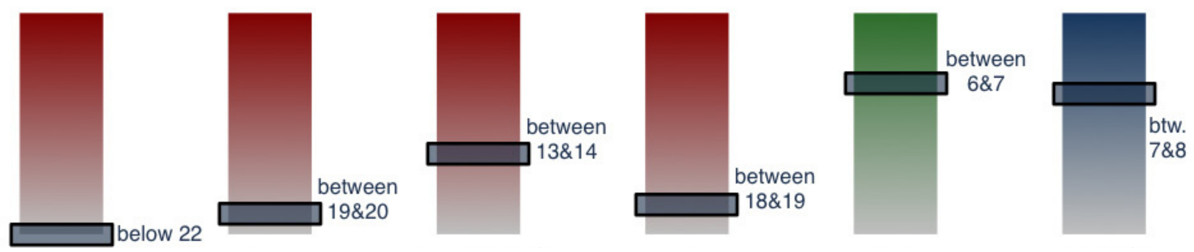
	Value°	Rank *
Population:	46 mio	between 17&18
Annual population growth:	0.4 %	between 16&17
GDP per capita:	31'943 US$/capita	between 9&10
Fossil fuel resources:	9 tC/capita	between 18&19

* ranked against the 22 largest emitters (this country is not one of them)

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	280 Mt	6.8 t/cap	0.26 toe/1000 US$ **	46.5 %	36 %	1.52 US$/l
Change		-20%	-6%	-9.1%	+2.4%	

Rank



Legend: Ranking among the 22 largest emitters

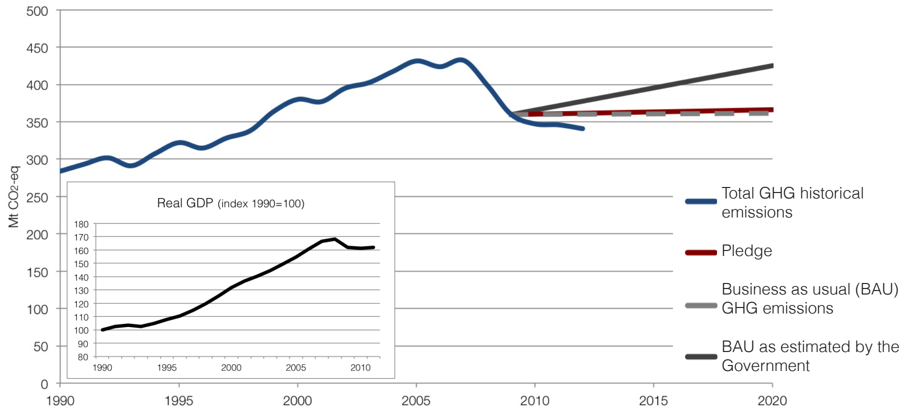
% increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections (Gov., and EEA 2012) include existing measures. The current recession is not taken into account in the BAU. Assuming equal percentage reductions in all EU Member States for emissions included in the EU emissions trading system (EU ETS), Spain´s GHG emission reduction in 2020 w.r.t. 2005 is -15%. As in an emissions trading system some countries may reduce more than others, the actual domestic emission reduction may deviate from the pledge as represented in the graph.

Pledge:

Spain participates in the legally binding EU commitment (ratification pending).
The EU as a whole pledges a 20% GHG emission reduction in 2020 w.r.t. 1990
(conditional pledge: -30%).

In an EU-wide effort sharing decision, Spain has committed itself to a reduction of -10% w.r.t. 2005 by 2020 (EU average: -10%). This commitment concerns only emissions that are not included in the EU emissions trading system (EU ETS) or approximately 53% of total emissions in Spain. In the EU ETS, the EU-wide emission reduction w.r.t. 2005 is 21%.

DOMESTIC POLICIES

As an EU Member State, Spain takes part in the EU Emissions Trading System (EU-ETS). The ETS entered its 3rd phase in 2013, which introduced a single, EU-wide cap on emissions by ETS installations. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method, with more than 40% of allowances auctioned already in 2013.

The National Climate Strategy covers the period until 2020. Policies and measures concentrate mainly on the energy sector. A feed-in tariff scheme for renewable electricity is in place which, since 2009, includes a cap for wind and solar technologies. Electricity from renewable sources already covers more than one third of total electricity demand. Feed-in tariffs also exist for combined heat and power generation. There are obligations to use solar energy in new and retrofitted buildings. In transport, there are partial tax exemptions for biofuels.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

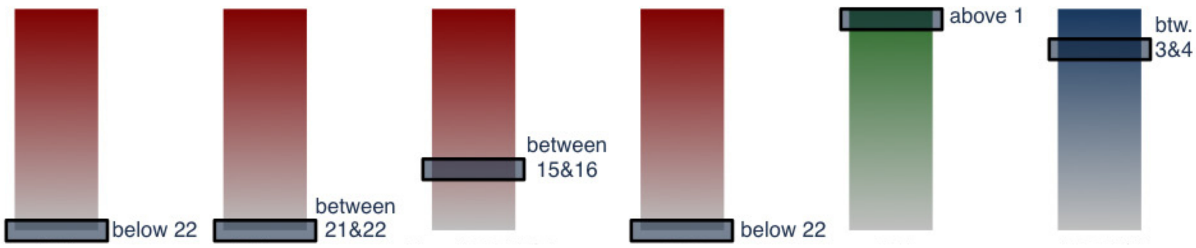
SWEDEN

	Value°	Rank *
Population:	9 mio	below 22
Annual Population growth:	0.8 %	between 10&11
GDP per capita:	57'091 US$/capita	between 1&2
Fossil fuel resources:	0 tC/capita	below 22

* ranked against the 22 largest emitters (this country is not one of them)

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	46 Mt	2.7 t/cap	0.21 toe/1000 US$ **	4.5 %	69 %	1.85 US$/l
Change		-17%	-38%	+1.4%	+2%	
Rank	below 22	between 21&22	between 15&16	below 22	above 1	btw. 3&4



Legend: Ranking among the 22 largest emitters

% increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)

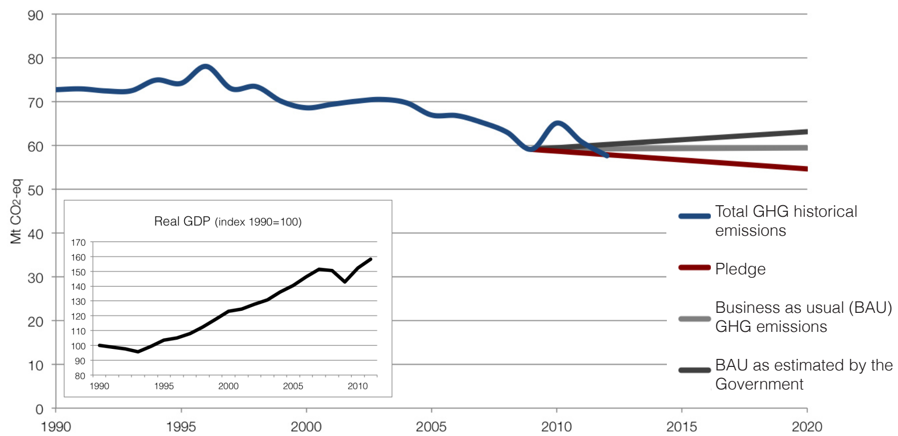
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price

** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections (Gov., and EEA 2012) include existing measures. Assuming equal percentage reductions in all EU Member States for emissions included in the EU emissions trading system (EU ETS), Sweden´s GHG emission reduction in 2020 w.r.t. 2005 is -18%. As in an emissions trading system some countries may reduce more than others, the actual domestic emission reduction may deviate from the pledge as represented in the graph.

Pledge:

Sweden participates in the legally binding EU commitment (ratification pending). The EU as a whole pledges a 20% GHG emission reduction in 2020 w.r.t. 1990 (conditional pledge: -30%).

In an EU-wide effort sharing decision, Sweden has committed itself to a reduction of -17% w.r.t. 2005 by 2020 (EU average: -10%). This commitment concerns only emissions that are not included in the EU emissions trading system (EU ETS) or approximately 65% of total emissions in Sweden. In the EU ETS, the EU-wide emission reduction w.r.t. 2005 is 21%.

DOMESTIC POLICIES

Sweden pursues a national GHG reduction goal of -40% in 2020 relative to 1990.

As an EU Member State, Sweden takes part in the EU Emissions Trading System (EU-ETS). The ETS entered its 3rd phase in 2013, which introduced a single, EU-wide cap on emissions by ETS installations. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method, with more than 40% of allowances auctioned already in 2013.

A tax on carbon was introduced in 1991 and is currently fixed at around SEK 1050 (EUR 115) per ton of CO_2. Due to numerous exemptions, it is primarily paid by private households. Electricity consumption in the industrial sector is taxed since 2004. Companies can receive tax rebates for enacting certified energy saving programs.

Electricity supply is almost carbon free, because of hydro and nuclear power. Renewable energy sources are promoted by a green certificate system in order to reduce carbon intensity further. In 2012, Sweden and Norway enabled cross border trading of the certificates. In the transport sector, CO_2 emissions are tackled via exemptions from energy and fuel taxation for biofuels and a vehicle tax that is based on CO_2 emissions. Sweden aims at phasing out fossil fuels in heating by 2020 and in transport by 2030.

09 Sept. 2014

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SWITZERLAND

	Value°	Rank *
Population:	8 mio	below 22
Annual Population growth:	1.0 %	between 8&9
GDP per capita:	83'383 US$/capita	above 1
Fossil fuel resources:	0 tC/capita	below 22

* ranked against the 22 largest emitters (Switzerland is not one of them)

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	42 Mt	6.1 t/cap	0.07 toe/1000 US$ **	1.7 %	31 %	1.72 US$/l
Change		-19%	-13%	±0.0%	+1.2%	
Rank	below 22	between 20&21	below 22	below 22	between 11&12	btw. 5&6

Legend: Ranking among the 22 largest emitters

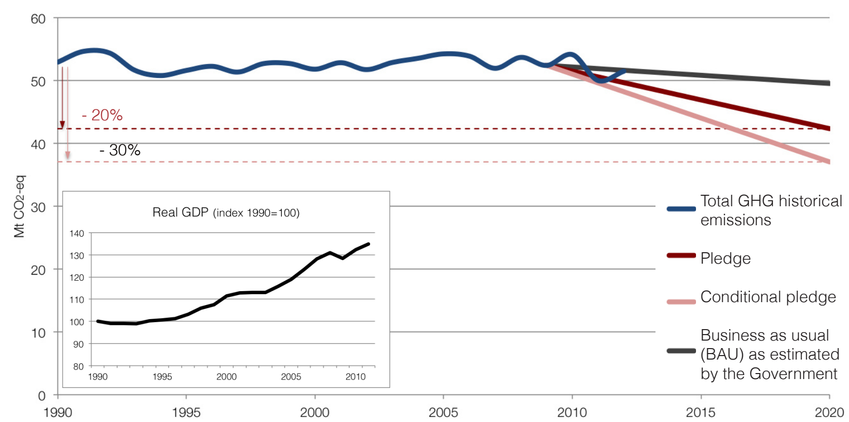
% increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU as included in the national communication to the UNFCCC includes existing measures.

Pledge (legally binding, ratification pending):

20% emission reduction by 2020 compared with 1990 levels.

Conditional pledge (non-legally binding):

Switzerland would consider a higher reduction target up to 30% by 2020 compared to 1990 levels subject to comparable emission reduction commitments from other developed countries and adequate contribution from developing countries according to their responsibilities and capabilities in line with the 2° C target.

DOMESTIC POLICIES

On 23 December 2011, the Swiss Parliament approved a revised CO_2 Act, which constitutes the legal framework for Switzerland's climate policy from 2013 to 2020. On 30 November 2012, the Federal Council approved the new CO_2 Ordinance, which entered into force along with the revised CO_2 Act on 1 January 2013. The revised CO_2 Act takes over from the previous CO_2 Act in force since 2000.
The CO_2 Act stipulates that by 2020, domestic GHG emissions must be reduced by 20% compared to 1990 levels.
The main instruments and measures are:
- CO_2 levy on thermal fuels, with an exemption being offered to companies that make specific CO_2 reduction commitments;
- Emissions trading scheme (ETS) for energy intensive companies, designed with a view to linking up with the EU ETS;
- Buildings programme to channel a third of the revenues from the CO_2 levy, with a maximum of 300 million Swiss francs per year;
- Obligation for fossil motor fuel importers to partially compensate for related emissions;
- Binding CO_2 emission target value of an average of 130 gCO_2/km by 2015 on new cars;
- Obligation for operators of fossil fuel thermal power plants to compensate in full for the CO_2 emissions, with a minimum of 50% to be offset domestically.

The CO_2 Act allows the Federal Council to increase the reduction target to 40% at most in accordance with international agreements. A maximum of 75% of the additional reductions in GHG emissions may be achieved through measures carried out abroad.

09 Sept. 2014

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

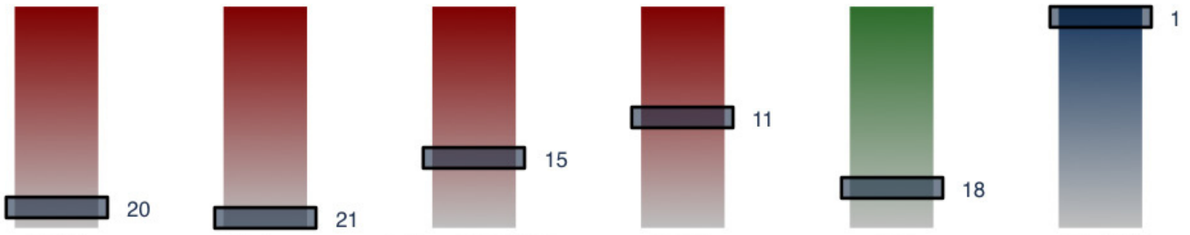
TURKEY

	Value°	Rank *
Population:	74 mio	12
Annual Population growth:	1.2 %	4
GDP per capita:	10'524 US$/capita	15
Fossil fuel resources:	24 tC/capita	16

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	317 Mt	4.9 t/cap	0.22 toe/1000 US$ **	73.6 %	15 %	2.28 US$/l
Change		+40%	-42%	-1.5%	+1.5%	
Rank	20	21	15	11	18	1



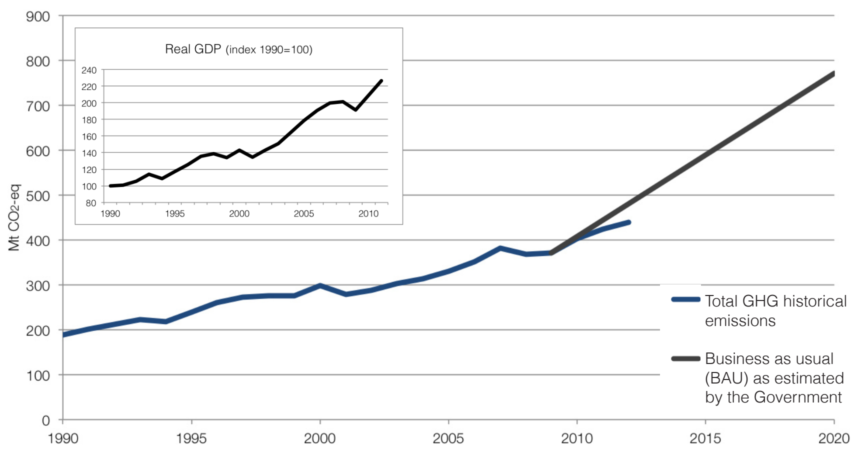
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: Turkey is formally an Annex I country, but did not have a reduction target according to Annex B of the Kyoto Protocol for the first Commitment Period. The BAU put forward in the National Communication to the UNFCCC (2007) entails only CO_2 emissions. We scaled it up assuming a constant ratio between CO_2 and total GHG emissions.

Pledge:

No pledge.

DOMESTIC POLICIES

The National Climate Change Strategy 2010-2020 lists intended policies measures for greenhouse gas emission control in the areas energy, transportation, waste, and land use. They are structured into short, medium and long term measures.

The Renewable Energy Law from 2005 promotes electricity generation from renewable sources. It obliges retailers to purchase a certain ratio of their electricity from renewable sources. It also promotes renewable sources in other ways, e.g. by facilitating the use of state-owned land and by securing grid connection priority.

Turkey has the highest motor fuel prices among the 22 top CO_2 emitters.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

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UK

	Value°	Rank *
Population:	63 mio	14
Annual population growth:	0.7 %	13
GDP per capita:	39'038 US$/capita	7
Fossil fuel resources:	11 tC/capita	18

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	448 Mt	8.9 t/cap	0.15 toe/1000 US$ **	76.4 %	12 %	1.95 US$/l
Change		-24%	-11%	+1.9%	+0.4%	
Rank	13	12	19	10	19	2

Legend: Ranking among the 22 largest emitters

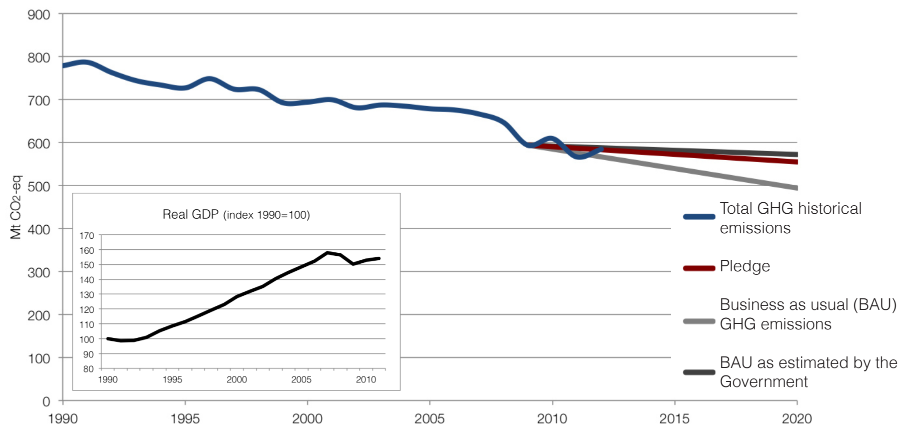
% increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
# incl. LULUCF

+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections (Gov., and EEA 2012) include existing measures. Assuming equal percentage reductions in all EU Member States for emissions included in the EU emissions trading system (EU ETS), the UK´s GHG emission reduction in 2020 w.r.t. 2005 is -18%. As in an emissions trading system some countries may reduce more than others, the actual domestic emission reduction may deviate from the pledge as represented in the graph.

Pledge:

The United Kingdom participates in the legally binding EU commitment (ratification pending).
The EU as a whole pledges a 20% GHG emission reduction in 2020 w.r.t. 1990
(conditional pledge: -30%).

In an EU-wide effort sharing decision, The UK has committed itself to a reduction of -16% w.r.t. 2005 by 2020 (EU average: -10%). This commitment concerns only emissions that are not included in the EU emissions trading system (EU ETS) or approximately 57% of total emissions in the United Kingdom. In the EU ETS, the EU-wide emission reduction w.r.t. 2005 is 21%.

DOMESTIC POLICIES

With the Climate Change Act from 2008, the UK possesses a long-term climate policy framework. It sets carbon budgets for 5-year periods. So far, Parliament has approved the budgets for the first four periods, implying e.g. a legally established greenhouse gas emission reduction of 50% by 2027 relative to 1990 (which may include the purchase of foreign carbon credits). The respective target for 2020 is -34%, which is somewhat more ambitious than the international target and supported by a broad set of measures.
As an EU Member State, the UK takes part in the EU Emissions Trading System (EU-ETS). The ETS entered its 3rd phase in 2013, which introduced a single, EU-wide cap on emissions by ETS installations. The cap is tightened by 1.74% per year until 2020. Increasingly, the system relies on auctioning as an allocation method, with more than 40% of allowances auctioned already in 2013.
In 2012, the UK founded a Green Investment Bank with a capital of £3 billion. A climate change levy applies to fossil fuels and electricity for lighting, heating and power in business and the public sector. Energy intensive firms earn an 80% discount on the levy if they meet predefined targets. A floor price for carbon of £16 per ton was introduced by 1 April 2013 in the electricity sector. It is to be gradually increased to £30 in 2020 and £70 in 2030.
The Energy Efficiency Scheme is a trading scheme for emission allowances covering organisations that are below EU ETS thresholds, but have an annual electricity consumption above 6´000 MWh. The Green Deal provides loans for energy saving measures in UK real estate properties. The Community Energy Saving Programme targets energy efficiency in low-income households.
The UK has the target of 15% of energy coming from renewable sources by 2020. Policies that work toward this goal include renewable obligations for licensed electricity suppliers, feed-in tariffs for small scale low-carbon electricity, a heat-related Bio-energy Capital Grants Scheme and a Renewable Transport Fuels Obligation.
In late 2012, an Energy Bill was introduced into Parliament, which, when adopted, establishes tighter emissions performance standards for fossil fuel-based power plants (with the goal to prevent new coal-fired power plants without carbon capture and storage) and more attractive conditions for renewables.

Support has been provided by the Swiss Federal Office for the Environment FOEN.

This fact sheet has not been approved by the respective Government.

° Generally 2011 data. For details, see: "Sources for country fact sheet information"

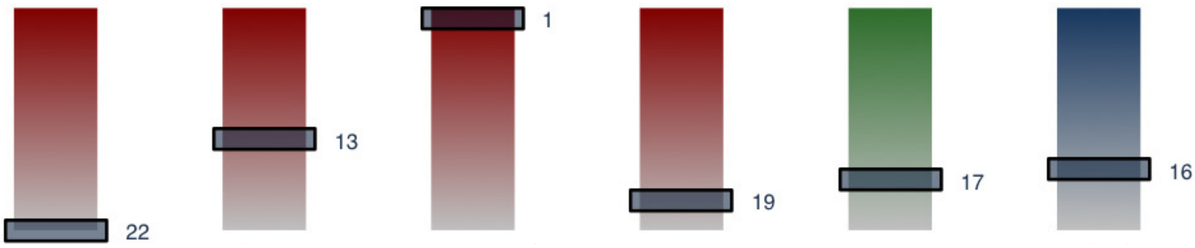
UKRAINE

	Value°	Rank *
Population:	46 mio	18
Annual population growth:	- 0.4 %	22
GDP per capita:	3'615 US$/capita	20
Fossil fuel resources:	553 tC/capita	6

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	291 Mt	8.8 t/cap	3.28 toe/1000 US$ **	45.6 %	17 %	0.97 US$/l
Change		+14%	-61%	-2.7%	+0.3%	
Rank	22	13	1	19	17	16



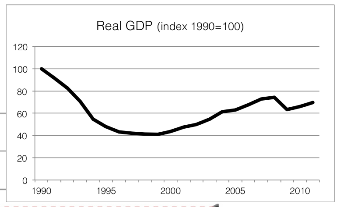
Legend: Ranking among the 22 largest emitters; % increase/decrease over the last decade (in percentage points if the indicator is in percent)

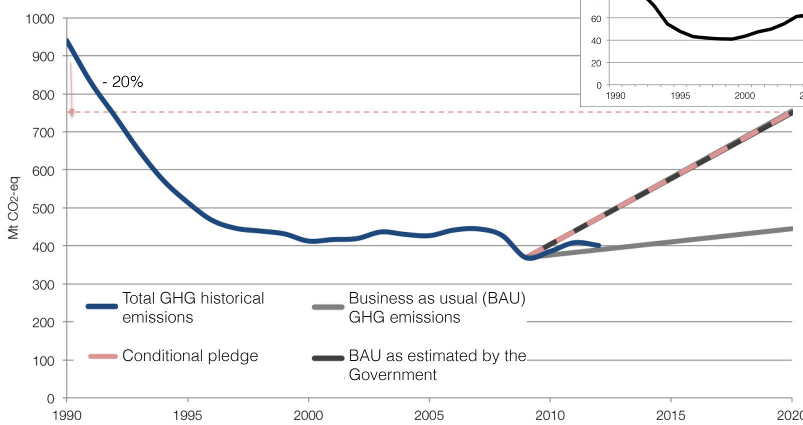
~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)





Comments: BAU projections taken from Ecofys et al. 2012. The current recession is not taken into account in the BAU. BAU as estimated by the Government, the upper bound of the BAU from Ecofys et al., 2012 and the pledge are all roughly at the same level and are, thus, not fully visible.

Pledge (legally binding, ratification pending):

20% emission reduction by 2020 compared with 1990 levels.
Conditions:
- Developed countries have an agreed position on the quantified emission reduction targets of Annex I Parties;
- Ukraine maintains its status as a country with an economy in transition and the relevant preferences arising for such status;
- Flexibility mechanisms under the Kyoto Protocol are kept;
- 1990 is kept as the single base year.

DOMESTIC POLICIES

Ukraine targets to decrease energy intensity by 50% between 2005 and 2030. Several energy efficiency programs have been implemented with foreign financing, e.g. for banks, institutions in education, and public buildings in Kiev. In 2008, the Government established feed-in tariffs for renewable electricity.

In 2011, the UNFCCC suspended Ukraine from carbon trading because of failure to meet the reporting requirements.

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° Generally 2011 data. For details, see: "Sources for country fact sheet information"

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UNITED ARAB EMIRATES

	Value°	Rank *
Population:	8 mio	below 22
Annual Population growth:	4.9 %	above 1
GDP per capita:	45'653 US$/capita	between 4&5
Fossil fuel resources:	1974 tC/capita	between 1&2

* ranked against the 22 largest emitters (this country is not one of them)

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	176 Mt	26.7 t/cap	1.13 toe/1000 US$ **	100.0 %	4 %	0.59 US$/l
Change		-28%	-46%	±0.0%	+0.1%	
Rank	below 22	above 1	between 3&4	between 1&2	between 21&22	btw. 20 & 21

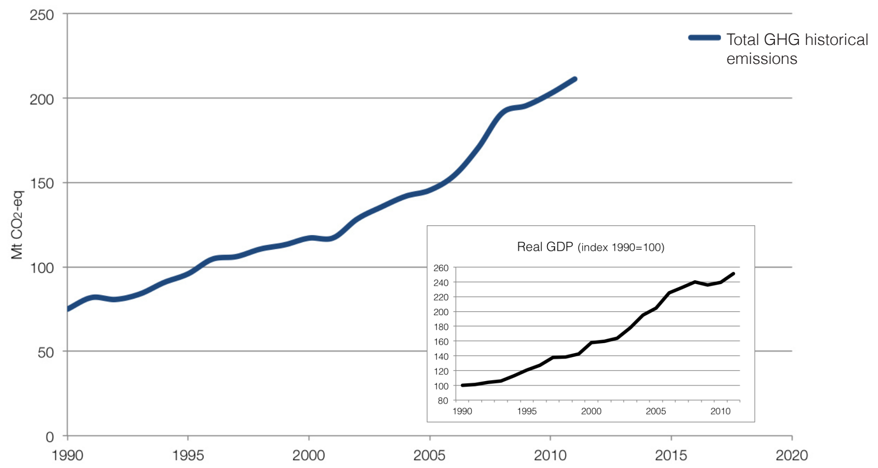
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: No BAU was put forward in the United Arab Emirates' second National Communication to the UNFCCC. We did not find BAU scenarios from other sources.

Pledge:

No pledge.

DOMESTIC POLICIES

In 2014, two nuclear power reactors are under construction and two more are planned for the near future. All four 1400 MW power plants are expected to operate in 2020.

The Masdar City Initiative plans to build the largest carbon-neutral city in the world.

A revision of the energy subsidy scheme, which covers almost 85% of the energy bills of Emiratis (50% for foreigners), is currently under discussion.

USA

	Value°	Rank *
Population:	312 mio	4
Annual population growth:	0.7 %	12
GDP per capita:	48'112 US$/capita	3
Fossil fuel resources:	576 tC/capita	5

* among the 22 largest emitters

INDICATORS°

	Total CO_2 emissions~	GHG emissions# per capita	Energy intensity in manufacturing	Electricity from coal, gas & oil	Forest area	Motor fuel price+
Value	5333 Mt	18.5 t/cap	0.18 toe/1000 US$ **	70.3 %	33 %	0.80 US$/l
Change		-15%	-27%	-1.3%	+0.5%	
Rank	2	4	18	13	9	17

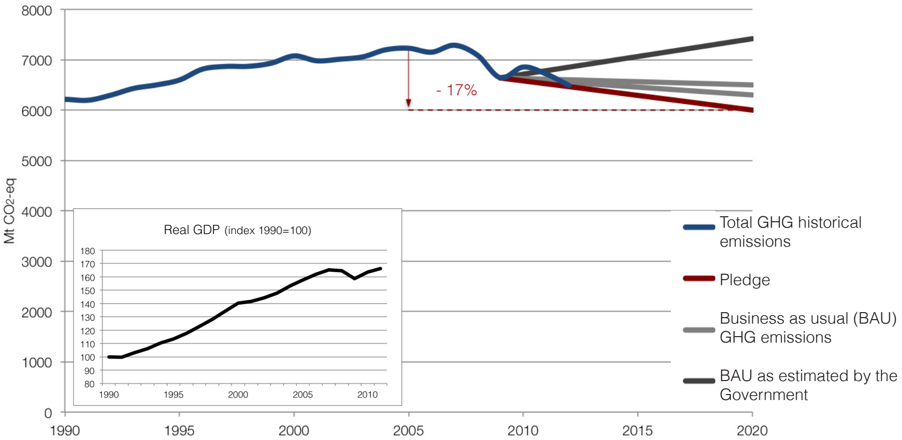
Legend: Ranking among the 22 largest emitters. % increase/decrease over the last decade (in percentage points if the indicator is in percent)

~ excl. land use, land use change and forestry (LULUCF)
\# incl. LULUCF

\+ Average of 50% diesel and 50% gasoline. Rank1=highest price
** of value added

INTERNATIONAL PLEDGE

Pledge (GHG emissions in Mt CO_2-eq, excl. land use, land use change and forestry)



Comments: BAU projections were taken from Ecofys et al. 2012. For the USA, the fact that the land use, land use change and forestry (LULUCF) sector is a large sink and uncertainties around LULUCF accounting methods imply that the pledge could be less stringent than it appears here.

Pledge (non-legally binding) :

Emission reduction by 2020 in the range of 17% from 2005, in conformity with anticipated US energy and climate legislation.

DOMESTIC POLICIES

So far, comprehensive climate change bills have failed to pass Congress. However, there are policies on renewable energy and energy efficiency such as incentives for energy savings and for the development of clean energy technology. For example, the American Recovery and Reinvestment Act of 2009 allocated US$ 94 billion for research and development as well as incentives to renewable energy technologies, smart grids, low emission vehicles, public transport, and energy efficiency.

In 2009, the US Environmental Protection Agency (EPA) issued an “endangerment finding” under the Clean Air Act requiring the EPA to take action concerning certain sources of GHG emissions that together amount to more than half of total US GHG emissions. The first regulations that have been developed by the EPA concern large sources such as power plants, industrial sources and (non-agricultural) methane sources as well as standards for mobile sources.

In 2013, the Obama Administration declared the Climate Action Plan, which aims to cut GHG emissions with a focus on electricity generation, transportation, and energy efficiency. In June 2014, President Obama announced a 30% national reduction target for CO_2 emissions from power plants in 2030 (relative to 2005 levels). On this basis, the EPA issued the Clean Power Plan, which aims to cut carbon emissions from power plants providing flexibility on the State level. Also in June 2014, the Supreme Court confirmed the legal right to address GHG emissions from large power plants, refineries and chemical factories via the Clean Air Act.

There are many policies on climate change at the State level, the most salient example being California, which has ambitious long-term State level targets for GHG emissions and a cap-and-trade system. More than 35 States have set renewable energy targets; more than 25 pursue energy savings targets.

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° Generally 2011 data. For details, see: “Sources for country fact sheet information”

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SOURCES FOR COUNTRY FACT SHEET INFORMATION

INDICATORS

Population (in millions): World Development Indicators (http://data.worldbank.org/indicator/all, retrieved Feb. 2013), data for 2011.

Annual population growth (in %): World Development Indicators, data for 2011.

GDP per capita (in US$ per capita): World Development Indicators, data for 2011.

Fossil fuel resources (in tons of carbon per capita): Calculated from: "Proven crude oil reserves in 2012", "Proven natural gas reserves in 2012" and "Recoverable coal in 2008" from the US International Energy Statistics (EIA), Population from World Development Indicators, and conversion factors from the Swiss "Gesamtenergiestatistik" and IPCC.

Total CO_2 emissions (in Mt, excl. land use, land use change and forestry (LULUCF)): CAIT (http://cait2.wri.org, retrieved July 2014), data for 2011. For Switzerland, 2011 data comes from: Swiss Greenhouse Gas Inventory, Submission April 2014.

GHG emissions per capita (in tons per capita, incl. LULUCF): GHG emissions from UNFCCC and CAIT (when UNFCCC data is unavailable) divided by population from World Development Indicators, data for 2011. CAIT methodology states: "*LULUCF data are useful as reference only and may not coincide with LUCF emissions reported by countries to the UNFCCC [...] More generally, users should note that the errors and uncertainties associated with these (and other LUCF) estimates may be significant.*". Change in % over the last decade concerns the period 2001 to 2011 with identical sources used for 2001 and 2011 data in each country.

Energy intensity in manufacturing (in toe per 1000 US$ of value added): UNIDO, data for 2008. Aggregation for the European Union was not available. Thus, the EU-27 energy intensity of manufacturing was calculated using the final energy use for industry by Eurostat and value added in manufacturing from the World Development Indicators. Change in % over the last decade: Data for 1998 was calculated as a linear regression between data for 2000 and 1990. This might incur inaccuracies especially for Poland and Ukraine.

Electricity from coal, gas & oil (in % of total electricity generation): World Development Indicators, data for 2010. Change in percentage points taken between data for 2010 and 2000.

Forest area (in % of land area): World Development Indicators, data for 2010. Change in percentage points taken as difference between data for 2010 and 2000.

Motor fuel price at the pump (in US$/l): World Development Indicators, data for 2010. Average of 50% diesel and 50% gasoline.

INTERNATIONAL PLEDGE

Historical data: For Annex I countries, historical GHG emissions (excl. LULUCF) from UNFCCC (http://unfccc.int/ghg_data/ghg_data_unfccc/time_series_annex_i/items/3841.php). For non-Annex I countries, GHG emissions (excl. LULUCF) from CAIT (data retrieved from website http://cait2.wri.org on 28 July 2014). Data exclude Land Use, Land Use Change and Forestry (LULUCF), because of severe uncertainties for many countries, particularly developing countries. Countries for which inclusion of LULUCF data would draw a distinctively different picture (e.g. concerning emissions trajectory or emissions totals) are Brazil, Indonesia and, to a lesser extent, Mexico, Australia, Canada and Russia.

Business as usual (BAU) emissions:
- International Energy Agency (IEA). "World Energy Outlook 2012".
- US Energy Information Administration (EIA). "International Energy Outlook 2011".
- European Environment Agency (EEA). "Greenhouse gas emission trends and projections in Europe 2012; Tracking progress towards Kyoto and 2020 targets" (EU-27).
- Peterson Institute for International Economics (PIIE), Cline, W.R., 2007. "Baseline Emissions under Business as Usual. In Carbon Abatement Costs and Climate Change Finance. Policy Analyses in International Economics", pp. 7–18.
- Ecofys et al., 2012. "Greenhouse gas emission reduction proposals and national climate policies of major economies".

For the few BAU projections that are set in a different accounting, absolute emissions were scaled to match the latest historical data point, keeping the growth rate until 2020 constant. For improved readability, 2020 BAU projections are connected with the historical data point for 2009 by a straight line, irrespective of the BAU's year of publication. Consequently, BAU lines do not follow the actual BAU trajectories, but illustrate the BAU emission values for 2020.

Business as usual emissions as estimated by the Government: National Communications to the UNFCCC. For improved readability, the 2020 BAU projection is connected with the historical data point for 2009 by a straight line, irrespective of the BAU's year of publication. Consequently, the BAU line does not follow the actual BAU trajectory, but illustrates the BAU emission value for 2020.

Pledges (formulation): UNFCCC (FCCC/SB/2011/INF.1/Rev.1, FCCC/SBI/2013/INF.12/Rev.2, and FCCC/KP/CMP/2012/13/Add. 1)
Pledges (absolute GHG emissions for the graphs): Where necessary, because pledges are formulated relative to BAU or in efficiency terms, own calculations and estimates from Ecofys et al. 2012 and National Communications to the UNFCCC. For the EU-27 countries, to reflect the share of each country in ETS emission (reductions), adjusted 2020 ESD target emissions were taken from the European Environment Agency´s (EEA) "Greenhouse gas emission trends and projections in Europe 2012; Tracking progress towards Kyoto and 2020 targets". 2020 targets are connected with the historical data point for 2009 by a straight line.

GDP: World Development Indicators (GDP in real terms, i.e. constant US$), index normalized to 100 in 1990.

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SOURCES (2/2)
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Center for Climate and Energy Solutions: c2es.org

Climate Policy Tracker: http://www.climatepolicytracker.eu

Climate Policy Watcher: climate-policy-watcher.org

Ecofys et al., 2012. “Greenhouse Gas Emission Reduction Proposals and National Climate Policies of Major Economies.” Policy Brief.

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PV Magazine: http://www.pv-magazine.com/news/details/beitrag/new-solar-subsidies-in-poland-delayed

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Wikipedia: http://de.wikipedia.org/wiki/Bioethanol

Word Nuclear Association: http://www.world-nuclear.org/info/Country-Profiles/Countries-O-S/Saudi-Arabia/

World Bank: http://www.worldbank.org

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