POLICY FORUM

Definition of Business as Usual and Its Impacts on Assessment of Mitigation Efforts

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Abstract

Business as Usual (BaU) scenario in developing countries has been a debated issue in climate change negotiations. This paper analyzes different definitions of BaU and points out that the major difference among these definitions is how to set the starting point of BaU projections, that is the so called base year. Some international institutions use current policy scenarios to project a BaU trajectory of developing countries. Such definition will lead to an underestimation of BaU emissions of developing countries and thus an underestimation of mitigation efforts. This paper concludes with a suggestion to use a without policy scenario with a clear base year as definition of BaU. Such a definition will set an objective benchmark to assess mitigation efforts of developing countries.

Keywords: Business as Usual; baseline scenario; assessment of mitigation efforts


1 Introduction

Various parties agreed on the Cancun Agreement in Mexico, 2010, which is the initial result of the negotiations conducted in accordance with the Bali Roadmap. It is worth noting that the Cancun Agreement has for the first time proposed that developing countries will carry out emissions reduction under the framework of sustainable development and deviate from Business as Usual (BaU). At the beginning of 2011, the BaU of developing countries has become a point of contention between the various parties attending the seminar on nationally appropriate mitigation actions (NAMAs) in developing countries of the long-term cooperative (LCA) adhoc working group.

Some developing countries take the deviation from BaU to set their own mitigation actions, that is achieving a deviation from the BaU emissions path projected by the model. On the other hand, developed countries and some international institutions take the magnitude of the deviation from BaU as an important indicator to assess the mitigation efforts of major developing countries [Kartha and Erickson, 2011]. However, the parties do not have a clear understanding on how to define BaU and how to realize the deviation from BaU in a practicable way. This paper, by exploring the concept of BaU and its different definitions, tries to clarify the definitions and implicit assumptions of BaU and to analyze the impacts of the different assumptions and definitions on the mitigation efforts in developing countries.

2 Current aspects of the deviation from BaU

The range of the deviation from BaU is derived...
for intervention scenario.

In Table 1, a summary of the ranges of emissions reduction are given, as taken from relevant literature which have commonly adopted the pre-set allocation of emissions rights, including the contraction and convergence, the multi-stage convergence, the triptych approach, and the intensity target.

The literature cited in the IPCC AR4 gives different ranges of necessary emissions reduction as well as the shares of emissions reduction obligations by Annex I and non-Annex I countries. The lead author of Working Group III has proposed to set the range of deviation from the baseline for developing countries at 15%–30% based on the global target of $450 \times 10^{-6}$ $[\text{CO}_2]$-eq [den Elzen and Höhne, 2008], but this range does not appear in the IPCC AR4. The range of 15%–30% has become one of the main theoretical foundations for the European Union (EU) to require developing countries to take quantified low-carbon strategies. The range of developing countries’ deviation from the baseline depends primarily on global emissions caps, assumed allocation schemes, agreement honoring of developed countries in the first commitment period, and baseline assumptions of developing countries.

The criticism against the deviation from BaU is mainly based on two aspects. First, most of the emissions allocation schemes cited in the IPCC AR4 are based on a contraction and convergence or its variants, with no essential difference in the results and not taking full account of the fairness of allocation schemes. Secondly, the definitions of BaU in numerous studies are not consistent. In Table 2, the different definitions of BaU and allocation scheme are shown as cited in the primary literature according to the IPCC AR4. Obviously, the analysis results in IPCC are from the FAIR model of the Netherlands Environmental Assessment Agency, and the adopted scenarios are basically A1 and B1 scenarios of the IMAGE model in the six

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Region</th>
<th>2020</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: $450 \times 10^{-6}$ CO$_2$-eq</td>
<td>Annex I</td>
<td>−25% to −40%</td>
<td>−80% to −95%</td>
</tr>
<tr>
<td></td>
<td>Non-Annex I</td>
<td>Latin America, the Middle East, East Asia and Central Asia significantly deviate from the baseline</td>
<td>All regions significantly deviate from the baseline</td>
</tr>
<tr>
<td>B: $550 \times 10^{-6}$ CO$_2$-eq</td>
<td>Annex I</td>
<td>−10% to −30%</td>
<td>−40% to −90%</td>
</tr>
<tr>
<td></td>
<td>Non-Annex I</td>
<td>Deviation from the baseline is achieved in Latin America, the Middle East and East Asia</td>
<td>Deviation from the baseline is achieved in most regions, especially in Latin America and the Middle East</td>
</tr>
<tr>
<td>C: $650 \times 10^{-6}$ CO$_2$-eq</td>
<td>Annex I</td>
<td>−25% to 0</td>
<td>−30% to −80%</td>
</tr>
<tr>
<td></td>
<td>Non-Annex I</td>
<td>Baseline</td>
<td>Deviation from the baseline is achieved in Latin America, the Middle East and East Asia</td>
</tr>
</tbody>
</table>

Source: IPCC [2007] Box 13.7
<table>
<thead>
<tr>
<th>Literature source</th>
<th>Adopted emissions scenario</th>
<th>Research institute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groenenberg et al., 2004</td>
<td>IPCC SRES A1</td>
<td>Institute for Prospective Technological Studies</td>
</tr>
<tr>
<td>Höhne et al., 2005</td>
<td>IMAGE 2.2(FAIR)</td>
<td>Ecofys</td>
</tr>
<tr>
<td>den Elzen and Meinshausen, 2006</td>
<td>IMAGE B1 (FAIR)</td>
<td>Netherlands Environmental Assessment Agency</td>
</tr>
<tr>
<td>Höhne et al., 2007</td>
<td>IPCC SRES 6 scenarios (FAIR)</td>
<td>Ecofys</td>
</tr>
<tr>
<td>den Elzen et al., 2007</td>
<td>IMAGE, IPCC SRES 6 scenarios (FAIR)</td>
<td>Netherlands Environmental Assessment Agency</td>
</tr>
<tr>
<td>Baer et al., 2008</td>
<td>IEA WEO</td>
<td>Heinrich Boll Foundation</td>
</tr>
<tr>
<td>den Elzen et al., 2008b</td>
<td>IMAGE 2.3, IPCC SRES 6 scenarios (FAIR)</td>
<td>Netherlands Environmental Assessment Agency</td>
</tr>
<tr>
<td>Höhne and Moltmann, 2008</td>
<td>IMAGE 2.3, IPCC SRES 6 scenarios (FAIR)</td>
<td>Ecofys</td>
</tr>
<tr>
<td>den Elzen et al., 2008a</td>
<td>IMAGE 2.3, IPCC SRES 6 scenarios (FAIR)</td>
<td>Netherlands Environmental Assessment Agency</td>
</tr>
</tbody>
</table>

IPCC scenario families.

3 Existing different definitions of BaU

Although the concept of the baseline was used in the IPCC AR4, many researchers still use BaU, reference scenario, baseline scenario, and other different terms in their studies, with different assumptions implied in these definitions. The consequences of the mixed use of terminologies may be not self-evident for researchers, but in recent years, with the over-politicization of the climate change problem, the mixed use of these different terminologies has become a major reason for political confusion in current climate change negotiations. Therefore, it is necessary to study and clarify the various definitions of BaU and baseline. In the glossary of IPCC AR4, scenario is defined as “a plausible description of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces and relationships.” The IPCC also noted “…scenarios are neither predictions nor forecasts…” The IPCC defined baseline as “the reference for measurable quantities from which an alternative outcome can be measured, e.g. a non-intervention scenario is used as a reference in the analysis of intervention scenarios.” Thus in definition of IPCC, reference scenario or baseline is used as a benchmark to assess alternative scenarios. As the benchmark scenarios, reference scenario and baseline are based on the set of assumptions to drive the model. These assumptions may vary from model to model due to different base year setting, inclusion of policies and model structure. The following section explores the definitions and the implied assumptions of the above scenarios used by research institutes, major developed countries and major developing countries in their studies or reports.

3.1 Definitions of BaU and similar concepts given by major research institutions

The Energy Information Administration (EIA) of the USA Department of Energy gives emissions projections for reference cases in its annually published energy outlook. The EIA assumes that the control and policies affecting the energy sectors remain unchanged throughout the projection period in the reference case [EIA, 2010].

The International Energy Agency (IEA) also uses the concept of a reference scenario in its annually published world energy outlook [IEA, 2010] to estimate emissions trends for major states and regions. The reference scenario adopted by the IEA includes the projection of all the adopted and implemented policies and measures, including the policies and measures not fully implemented yet [IEA, 2010]. For example, it has taken into account the energy efficiency and renewable energy policies of China’s Eleventh Five-Year Plan (2006–2010) in the projection of the reference scenario. As the EU has already adopted the EU Energy and Climate Change Action Plan, the EU’s target of 20% has also been included in the reference scenario. The IEA updates those reference scenarios regularly in their annual publication to include most recent policy progress in targeted regions and countries. Thus the reference scenario defined by IEA is dynamic and has a moving base year. As the projected results of the IEA attract much attention, its definition of reference
scenario has caused much controversy. Since 2010, the IEA no longer uses reference scenario in its world energy outlook but takes the current policy scenario to describe the scenario.

3.2 Definitions of BaU and similar concepts given by developed countries in their national communications

In the guideline for national communications in Annex I [UNFCCC, 1999], the Annex I countries need to report their emissions projections under both with policy scenario and without policy scenario. The projection of emissions without policy has excluded all the policies and measures adopted or to be adopted after the starting point of the projection. The starting point could be 1995 or the years prior to it (for example 1990), or another appropriate base year. Thus there is no common base year in Annex I country communication. Parties are flexible to choose the appropriate base year they prefer.

The USA National Communications [USA, 2010] mix BaU with baseline scenario, and does not give a clear definition of these two terms. Japan has analyzed two with policy scenarios in its national communications [Japan, 2010]. One is the existing policy scenario taking account of the policies and measures in the Kyoto Protocol Target Achievement Plan released in April 2005. The other is the additional policy scenario, taking into account the new policies and measures in the Kyoto Protocol Target Achievement Plan that was updated in March 2008. The difference between those two scenarios is the different base year setting and different policy included.

United Kingdom has made projections for the emissions under existing policy and additional policy (including the measures already planned but not yet taken, and those already adopted but not yet implemented) in its national communications [UK, 2010]. The EU analyzes the emissions projections of the three scenarios, without policy, existing policy, and additional policy [EU, 2010].

Australia has made emissions projections with two scenarios in its national communications [Australia, 2010]. The two scenarios are the baseline emissions scenario and the BaU emissions scenario, corresponding to with policy and without policy, respectively. According to the description of the baseline emissions scenario in the national communications, Australia has made baseline emissions projections for various departments, and the projections include the impacts of existing policies and measures, and reflect possible net emissions levels. Australia’s description of the BaU emissions scenario in its national communications is as follows: referring to a projection that incorporates changes in activity levels and greenhouse gas emissions factors, but excluding any effects directly attributable to climate change mitigation policies and measures. It is also referred to as without measures. In its national communications, Australia further indicates that its BaU emissions scenario has excluded all emissions reduction policies and measures since 1990. Comparing the definition of baseline emissions scenario and BaU emissions scenario in the Australian national communications, its BaU emissions scenario does not include the impacts of existing policies and measures on greenhouse gas emissions.

Thus, the definitions of baseline scenario, reference scenario, and BaU are not consistent even in developed countries. Baseline scenario and reference scenario are more used to refer to existing policy scenarios that take current policy measures into consideration, while BaU is often used to refer to the without policy scenario with a fixed based year.

3.3 BaU defined by developing countries in their nationally appropriate mitigation actions

Developing countries have also announced their mitigation action targets before and after the Copenhagen Conference in order to contribute to the progress of the conference. South Africa, Brazil, South Korea, and Indonesia announced their emissions reduction targets in the form of deviations from BaU.

The BaU scenario in South Africa was developed by the Energy Research Centre of the University of Cape Town in 2005. The base year of the BaU scenario is 2003, because the latest available energy balances were from 2003 when this baseline scenario was
developed. Since then, South Africa has not updated its BaU projection, and takes the scenario as the main estimated basis for its emissions reduction targets announced before the Copenhagen Conference [UNFCCC, 2011].

In 2009, the Indonesian Government announced its mitigation targets: it will, through unilateral actions, reduce Indonesia’s emissions by 26% from the BaU scenario, and in the case of a full international support, it can further reduce emissions from the BaU scenario by 41% [UNFCCC, 2011]. The Indonesian Government did not specify the definition of BaU scenario in mitigation targets, but according to its projection of future emissions in the second national communications [Indonesia, 2011] (the projection is taken as the basis to determine the mitigation targets), its defined BaU scenario refers to the one that does not slow down policy interventions but includes energy efficiency improvement and implementation of policies.

Brazil and South Korea also announced their BaU projections, but did not provide further explanations for the definition of BaU in publicly available literature [UNFCCC, 2011]. If seen from the policy practices of various developing countries, the definitions and the starting years of BaU are not similar either.

4 Impacts of BaU’s definitions on China

Before the Copenhagen Conference, China, in order to promote the progress of climate change negotiations, announced with its voluntary mitigation actions target that it would reduce carbon dioxide emissions intensity per unit of GDP by 40%–45% in 2020 compared to 2005 levels. China’s mitigation action target takes the emissions intensity of GDP as an indicator. It regards 2005 as the base year and does not adopt the concept of deviation from the BaU used in IPCC AR4. Since China has proposed the intensity target, many countries and research institutions have assessed and interpreted the voluntary action targets. One main aspect is to convert the intensity to the magnitude of deviation from BaU.

In Table 3, the BaU emissions of China are presented as defined in different literatures and the magnitudes of the estimated deviation from this scenario. Different studies have very different results when converting the 40%–45% target into the deviation from BaU. The main reason lies in the different definitions of BaU. The major reason why the IEA and the USA Department of Energy make higher estimates of the changes in China’s annual emissions intensity in the BaU scenarios is that the BaU defined by the IEA and the USA Department of Energy has already included the energy saving measures. China will take according to the Twelfth Five-Year Plan, and they assume that these policy measures will be fully implemented. However, some studies [Stern and Jotzo, 2010] have pointed out that the change rate of China’s annual emissions intensity in the BaU scenario is slightly less than 2%, which is consistent with the historical trend of most developed countries. The BaU defined by these studies includes only the autonomous improvement in energy efficiency.

<table>
<thead>
<tr>
<th>Literature</th>
<th>Rate of annual changes in the emissions intensity under the BaU scenario</th>
<th>Estimation of deviation range from BaU</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Stern and Jotzo, 2010]</td>
<td>-1.8%</td>
<td>21.2%–27.7%</td>
</tr>
<tr>
<td>[IEA, 2010]</td>
<td>-3.3%</td>
<td>1.0%–9.0%</td>
</tr>
<tr>
<td>[EIA, 2010]</td>
<td>-4.9%</td>
<td>Above the baseline</td>
</tr>
</tbody>
</table>

Many studies have different assessment results of the efforts to reduce emissions made by developing countries. The main reason of these differences lies in the use of different definitions of BaU. The scenarios adopted by the IEA and the EIA of the USA Department of Energy are based on existing measures scenarios. It is not appropriate to take the emissions projections under the existing policy scenario or current policy scenario as BaU scenario and then take it as a baseline to assess the aspired efforts of developing
countries. First, the existing policy and measure scenario is not a relatively fixed emissions projection and will change over time. In addition, as a growing number of mitigation policies are adopted, the projected path of emissions will get steadily lower if the other assumptions remain unchanged, and therefore the efforts of developing countries will continue to be underestimated. Secondly, changing assessment criteria are not appropriate for developing countries which have taken positive actions. Many developing countries, including China, have taken mitigation measures, but these mitigation policies are included as part of BaU, and therefore lead to an underestimate on mitigation efforts. Figure 1 shows the impacts of different scenario definitions on future emissions projections and the estimates of deviations from BaU. In addition, the existing policy scenario in general assumes that existing policies will be perpetuated and the policies are fully implemented. All of these assumptions will underestimate the BaU of developing countries and thus underestimate the mitigation efforts of developing countries.

![Figure 1](image-url) Different scenario definitions and their effects on emissions projection

Compared with current policy or with policy scenario, without policy scenario with fixed base year is a more reasonable definition in comparing emissions reduction efforts. Without policy scenario fixes the starting point of the projection at one year in the past, and at the same time freezes the relevant policies and measures. Thus, in the case where the other assumptions remain unchanged, its emissions projection is relatively stable and can better reflect the efforts that developing countries have made to control greenhouse gases. The main problem of the without policy scenario is how to set the appropriate starting point of the projection. For example, it can refer to the base year that the Kyoto Protocol has set for emissions reduction target of developed countries, i.e., 1990 or 1995. The policy measures that developing countries have taken from then on should be treated as their efforts to reduce emissions.

5 Conclusions

Since deviation from the baseline was proposed in IPCC AR4, the definition of baseline and BaU has led to a series of controversies. Correspondingly, the definition of BaU affects the correct assessment of emissions reduction efforts in developing countries, and also has impacts on the adoption of the deviation from BaU to determine emissions paths of developing countries in terms of how to set benchmarks of their national emissions reduction targets.

The debate on the deviation from BaU reflects the currently widespread misunderstanding and misuse of scenario. The scenario is not a projection of a future emissions path, but only reflects the possible future based on expert judgment. The original intention to develop scenarios is to have a better understanding of the impact of uncertainty on decision-making, and to show more potential decision-making in different scenarios. The expert judgments embodied in the models are often very diverse. Therefore, no consistent benchmark for the comparison of reduction efforts exist, which is currently the major reason for the controversy about BaU.

In addition to the misunderstanding and misuse of scenarios, the current debate also reflects the differences in the definition of BaU scenario in various model groups and literatures. Some studies mix the use of BaU scenario, baseline scenario, and reference scenario. Other studies make strict distinctions of these above mentioned scenarios. In general, the definition of BaU includes at least the without policy scenario, the existing policy scenario, and the additional policy scenario. The debates about the definition of BaU are in fact concentrated on how to determine the starting point of the emissions projections, that is, the base year of the BaU. The existing policy scenario or the additional policy scenario implies that the base year of BaU is changing with the projection year.
Therefore, even if the other assumptions of the emissions projection model remain unchanged, emissions projections will still continue to be lowered due to the changes of the projection year as well as the introduction of new policies. The without policy scenario fixes the starting point of the projection at a specific year in the past, and at the same time freezes the relevant policies and measures. Thus, in the case where the other assumptions remain unchanged, its emissions projection is relatively stable and can better reflect the efforts that developing countries have made to control greenhouse gas emissions.

In order to avoid the confusion of its definition, BaU should specifically refer to the without policy scenario whose base year should be set in 1990 or 1995. The emissions reduction policies and measures taken after the base year should be excluded in the projection. It is recommended that a clear definition of reference scenario or baseline scenario should be given in the description of the scenario in order to avoid confusion and ambiguity. If these scenarios have considered the impacts of the recent reduction policies and measures, it should be clearly mentioned that these scenarios are with policy scenarios, and make further distinction of existing policy scenarios, additional policy scenarios, or other clearly defined scenarios, according to the specific conditions of the policies and measures being considered.

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