The comparison of national methane emissions with (semi-) independent scientific database results can contribute to verification of the emission inventories and to the reduction of the uncertainty in the emission estimates. In the national communications, however, only summaries of emissions are published. The transparency of the emissions inventory is thus reduced, since not all data are made available for third-party review. Reference is often made to a background report, containing the more complete emission inventory. These background documents are crucial in a review procedure, but they are not always readily available. It is therefore important that background documents are also made freely available. It is recommended that countries publish standard data tables for reporting and that they improve their reporting on emission factors and activity data in their national communications.

When comparing national inventories and EDGAR data for 1990, the net large differences are 29 Tg. This may be interpreted as the uncertainty in the methane emission inventories. The world total methane emissions, estimated from national data, US country studies, using EDGAR to fill in the missing countries, fall short of the IPCC budget as published in 1994. This may mean that IPCC default emission factors and emission factors used in national communications are generally too low.

For more information, please contact:
André van Amstel
Wageningen Institute for Environment and Climate Change Research
P.O. Box 9101
NL-6700 HB Wageningen,
The Netherlands
Tel.: +31 317 484815
Fax: +31 317 484839
Email:
Andre.VanAmstel@algemeen.cmkw.wau.nl

The Interactive Scenario Scanner (ISS): A Tool to Support the Dialogue between Science and Policy on Scenario Analysis

• by Marcel Berk and Marco Janssen

Workers at the Dutch National Institute of Public Health and the Environment (RIVM) have recently developed a new computer tool called the Interactive Scenario Scanner (ISS). The tool enables users to interactively construct global greenhouse gas emission scenarios and evaluate their likely climate change impacts. In this way, the tool can be used to support a dialogue between scientists and policy makers on scenario development and help in selecting scenarios to be analysed with more sophisticated modelling tools, like RIVM's IMAGE 2 model.

Aim

The ISS was developed to involve policy makers in the development of emission scenarios. World-wide greenhouse gas emission scenario are being developed to explore the climate implications of possible future socio-economic and technological developments. This scenario analysis should help policy makers to gain a feeling for the nature and extent of the climate problem and to develop insights into possible options for control.

However, most emission scenarios are created by energy and climate scientists and frequently do not meet the needs of policy makers. The ISS offers policy makers a tool that enables them to design and select scenarios that do reflect their perceptions and policy goals. Thus the policy relevance of (subsequent) scenario analysis by the scientific community, using more complex and comprehensive models, can be enhanced. Moreover, by "playing around" with a fast modelling tool, policy makers can also gain a better understanding of relationships, climate system behaviour, important uncertainties and policy trade-offs in the climate change debate.

Background

ISS was developed as a result of a series of science–policy dialogue workshops, organised in Delft, The Netherlands, in the period 1995–1997. During these meetings policy makers engaged in the FCCC/AGBM climate negotiations met with scientists involved in the development and use of the integrated climate change model IMAGE 2 (see CHANGE 35, p. 8). One of the main outcomes of this dialogue was the development of the Safe Landing Analysis (see CHANGE 35, p. 5, CHANGE 38, p. 3 and CHANGE 39, p. 10). This is a tool that calculates the ranges of short-term global and developed countries' emissions compatible with various sets of intermediate and long-term climate goals. The ISS has been developed as a complementary tool, using the same climate impact indicators, but focusing on the long term implications of climate protection goals for socio-economic and technological developments in both developed (Annex-1) and developing countries (non-Annex-1).

Set-up of the ISS

The Interactive Scenario Scanner consists of two parts:

(a) a system to construct future emission profiles of global CO_2-equivalent emissions for the period 1990–2100; and
(b) a system that evaluates the climate impacts of these profiles using the indicators of the safe landing analysis.

In order to construct global emission "scenarios", profiles of future CO_2 emissions are calculated for both Annex-1 and non-Annex-1 countries using the so-called Kaya identity. This states that CO_2 emissions are the product of the number of people (population), income per capita (welfare), energy use per unit of GDP (energy intensity), and CO_2 emissions per unit of energy use (carbon intensity).

To calculate CO_2 equivalent emissions, energy-related CH_4 and N_2O emissions are added as a ratio of the energy-related CO_2 emissions. Land use emissions for CO_2, CH_4 and N_2O are exogenous inputs, with default values based on the IMAGE 2 medium baseline scenario, but they may also be specified by the user.

A global averaged climate model is used for the evaluation of the emission scenarios. The short runtime of this scenario allows the model to be used interactively. The model is a modified version of the CYCLES model, developed earlier at RIVM. Its results generally agree reasonably well with those of the IMAGE 2 model at a global level. Another feature of the ISS is its ability to analyse the sensitivity of scenario results for uncertainties with respect to the climate sensitivity and future global sulphur emissions.

The emission profiles constructed are directly evaluated on the basis of the set of values chosen for three indicators:

- the rate of temperature change (in deg C/decade);
- cumulative temperature change (1990–2100); and
- sea level rise (1990–2100).

This is shown by colouring the profiles: the profile is green if none of the indicator values set is violated. It turns red when at least one of the limits is exceeded by more than 20%. Yellow is used to indicate a zone of uncertainty (of 20%). Colours are also allocated to each individual indicator to see which indicator(s) make(s) the profile change colour. In addition, the calculated atmospheric CO_2 concentrations are shown.

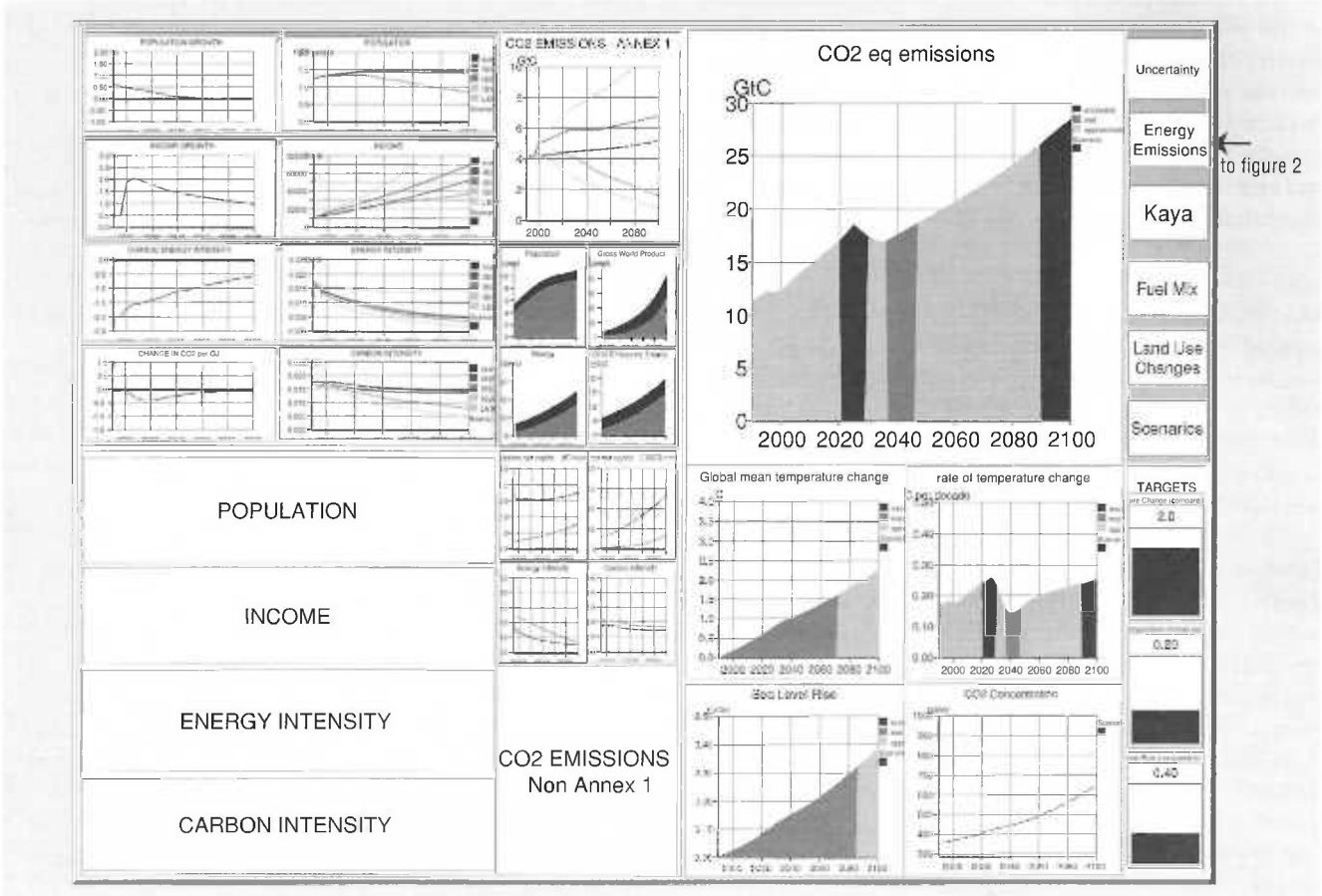
ISS screen views and user options

The main screen of the Interactive Scenario Scanner is depicted in Figure 1. All components of the screen can be opened, closed or zoomed into, as desired by the user. To the left one can see the user input for the emission scenarios for Annex 1 and non-Annex-1, indicated by specifying the growth rates of the indicators in the Kaya identity. To get a feel for the order of magnitude one can immediately compare the constructed values of the Kaya identity with those of existing scenarios (e.g. IPCC IS92 scenarios). In addition, one can compare Annex-1 and non-Annex-1 values. Absolute figures are given for Population, GDP, Energy use and CO_2 emissions. To evaluate equity dimensions, regional values for income per capita and CO_2 emissions per capita are also shown.
On the right-hand side of the screen, one can assess the consequences of the emissions. Depending on the policy targets selected (lower right corner), the scenario constructed may lead to a violation of one or more climate change indicator values. The graph of CO_2 equivalent emissions aggregates the performance of the climate change indicators.

The right upper corner of the screen contains various buttons to switch to specialized views:

- Uncertainty: this view allows an assessment of the sensitivity of the results for assumptions regarding the climate sensitivity and global sulphur emissions;
- Energy Emissions: this view allows the user to directly enter and evaluate energy-related CO_2 emission profiles (e.g. to evaluate proposals for emission reduction schemes) (Figure 2);

Figure 1: The main screen of the Interactive Scenario Scanner.



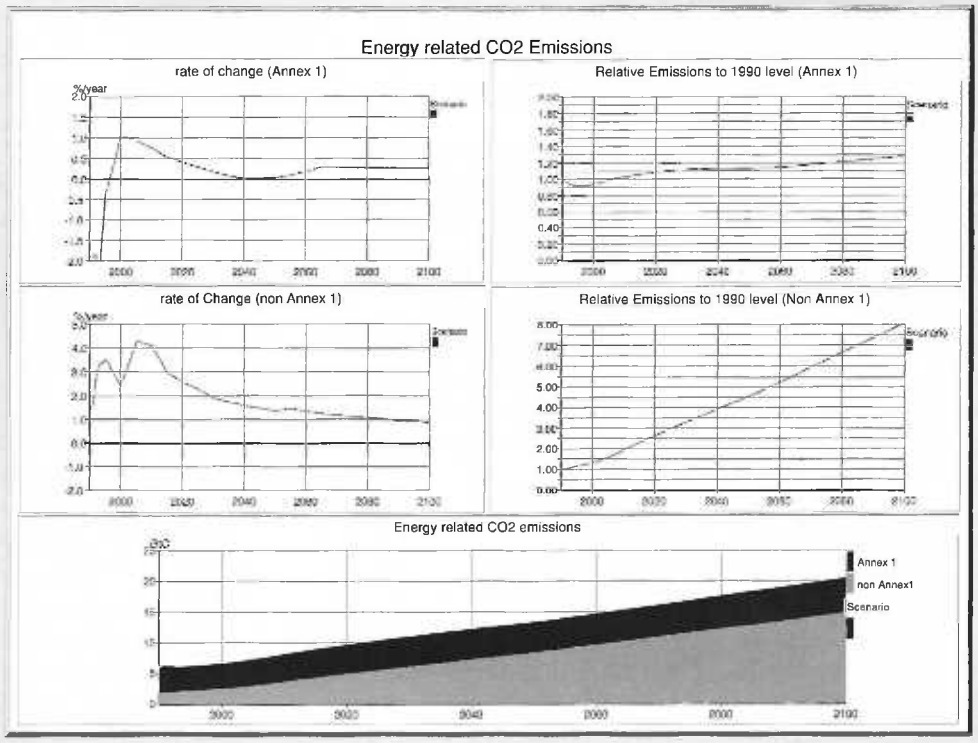


Figure 2: This view allows the user to directly enter and evaluate energy-related CO_2-emission profiles

- Kaya: this view allows the user to select settings of the parameters of the Kaya identity that would lead to the same emission profiles as entered with the "Energy Emissions" view;
- Fuel Mix: this view allows one to specify the fuel mix of Annex-1 and non-Annex-1 countries;
- Land Use Changes: this view allows one to review and change default emissions from land use changes;
- Scenarios: this view allows comparison of the impacts of the constructed scenario with those of other (IPCC IS92) scenarios.

Applications of the ISS

The ISS can be used to facilitate a dialogue between scientists and policy makers, and between policy makers and scientists, on scenario development and analysis. Using the ISS allows various questions regarding scenarios to be easily addressed. To mentions some examples:

- What are the climate implications of various assumptions for future socio-economic and technological developments?
- What are the technological implications of meeting particular climate goals?
- What are the simultaneous implications of meeting social goals, in terms of increased global equity?
- At which point in time do developing countries have to start contributing to global GHG emission control in order to meet certain climate protection goals?
- What is the effectiveness of various policy proposals for limiting GHG emissions in protecting the climate?

The ISS has been demonstrated to various groups of scientists, policy analysts and policy makers. For example, it was used for a scenario exercise with policy makers during the last Delft Dialogue workshop (June 1997), at which both likely and desirable futures were explored. The ISS was also demonstrated to climate scientists and policy makers in Canada at Environment Canada (July 1997) and presented and used during an IPCC Scenario workshop at RIVM (September 1997). The tool has also been used to quickly assess the climate implications of the various protocol proposals for the European Commission. In the future it is envisioned that the tool will be used during an NRP policy dialogue/assessment project on Climate Options On the Long-term (COOL) planned to start in 1998.

Limitations

It should be stressed that the ISS is not a fully integrated climate change model and it is not intended to replace the use of comprehensive integrated models like the IMAGE 2 model. As its name indicates, it is just a scanning device to quickly assess and select proto-scenarios or emission profiles to be further explored and assessed with comprehensive models. Our experiences with the use of the ISS has also taught us that, when using the ISS, policy makers are best supported by scientists in making realistic assumptions and receiving additional scientific background information. For that reason we have decided not make the tool freely available. However, those interested are always welcome to contact us if they are interested in using the tool for policy or educational purposes.

Reference

Berk, M.M. and Janssen, M.A.: 1997, The Interactive Scenario Scanner: a Tool to Support the Dialogue between Science and Policy on Scenario Development, RIVM Report No. 481508005, Bilthoven, The Netherlands.

• ***Marcel Berk*** and ***Marco Janssen*** *are researchers in the Global Environmental Assessment Division of the Dutch National Institute for Public Health and the Environment (RIVM), P.O. Box 1, 3720 BA Bilthoven, The Netherlands. E-mail: Marcel.berk@rivm.nl or Marco.Janssen@rivm.nl.*