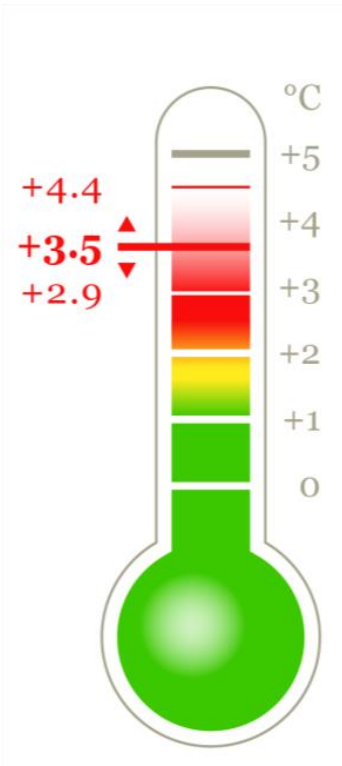
CLIMATE ACTION TRACKER

Country Assessment Methodology



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THIS ANALYSIS IS PART OF THE COUNTRY ASSESSMENT COMPONENT OF THE CLIMATE ACTION TRACKER PROJECT, A JOINT PROJECT OF ECOFYS, CLIMATE ANALYTICS AND PIK. THE COUNTRY ASSESSMENTS ARE CONDUCTED UNDER THE RESPONSIBILITY OF ECOFYS AND CLIMATE ANALYTICS.

This paper provides the technical background and rational for the methodology used to assess countries' climate performance and details on the method itself.

Methodology development will remain an on-going process. New scientific findings will need to be incorporated as well as adjustments and refinements from more experiences incorporated. Additionally each country will require a close check of all parameter values and may require adjustments based on national circumstances

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1 Introduction

Since its inception mid-2009, the Climate Action Tracker (CAT) has developed into a first class tool and information source for showing policy makers, the public and the press the consequences of national proposals for addressing climate change and how these relate to the achievement of global climate goals. At present the Climate Action Tracker focuses on quantifying emission intentions (pledges or commitments and partly domestic measures planned or in place) at the national level, accounts for rules and provisions under negotiation at the international level (leading to emission credits or debits) to calculate effective national emission targets, and aggregates these to a global emissions pathway. The Climate Action Tracker quantifies the stated intentions as they develop and thereby enables tracking of progress of the international negotiation process towards meeting specific global emission goals within a specific time frame such as 2020, 2030 or 2050.

The upgraded Climate Action Tracker that is now under development will move beyond evaluating intentions, by comparing and assessing national and global action against a range of different climate targets across all relevant time frames. It will focus as a top line message on producing an assessment of climatic consequences of the aggregated effects of national implemented actions.

This is one crucial area of measurement, reporting and verification (MRV) that is not included in the work programme of the UNFCCC and is unlikely to be added to it, given political pressures to avoid adding up the total sum of actions and projecting them to the global level, or even merely collecting pledges and actions by individual Parties into one common framework for comparison. The climatic targets which would be assessed include global temperature limits such as 1.5°C and 2°C, and global CO_2 concentration limits such as 450 ppm, 350 ppm or below.

The updated Climate Action Tracker will build on the achievements from the work in 2009/2010 to provide an end-to-end analysis of the potential of all options and actions on the table to meet climate targets, and account fully for potential loopholes in the accounting system to be agreed internationally. These loopholes include land-use, land use change and forestry accounting provisions (LULUCF) as well as hot air or surplus emission allowances. At a later stage it will also include the sectors outside of national accounting such as international aviation and marine emissions, REDD+ and an assessment of the additionality of actions undertaken in developing countries for credit by developed countries.

In summary it answers the questions:

- **Are countries' <u>commitments and pledged actions</u> as a whole for 2020 sufficient to meet 2°C or 1.5°C goals?** At a global level the climate action tracker focuses on quantifying emission intentions (pledges or commitments or domestic measures planned or in place) at the national and international sectoral level, to produce a global emissions pathway. This enables, with the use of a climate model, tracking of progress towards meeting specific global climate goals. In the future, CAT 2.0 also aims to quantify financial pledges and estimate mitigation consequences in close collaboration with other analysis teams. We also plan to add regional climate impacts, such as risk of heat waves, drought, water scarcity or coral reef bleaching to the visualization of the consequences of commitments and actions and compared to those that would result should global climate goals be realized.
- **Do countries <u>implement policies</u> to meet their own targets and approach targets that would be necessary for a global 2°C or lower pathway in 2020?** This requires some quantitative analysis of the effectiveness of policies. It will be driven by "deviation from reference" with all its complications: What is BAU before policies? What is the effect of action against this BAU? How are previous efforts factored in? The result of the evaluation can then be compared to stated national or international goals and targets, but it can also be assessed against requirements stated in scientific literature.

- **Do countries implement policies for a low carbon future (in e.g. 2050)?** This turns the focus to a “common endpoint” away from a “deviation from reference”. An example for such methodology is the “Climate policy tracker for the European Union” (Ecofys and WWF for ECF), where we focus on whether countries have policies in place to meet a common end point, that is the low carbon economy. Such method is independent of a BAU and can focus on the positive messages that some countries are progressing well in this direction (because of current *and/or* past actions).

The aim is to qualitatively evaluate policies for their ability to induce a paradigm shift towards reaching a low carbon world by 2050 and to estimate emission reductions induced by these policies by 2020 and 2030. These two elements should allow addressing the questions posed above. We will examine in detail whether appropriate, sufficiently ambitious and effective policy instruments cover all economic sectors responsible for greenhouse gas emissions. We analyze implemented policies with respect to their complementarity, also taking into account possible lock-in effects, and dealing with the question whether an ‘ideal path’ for the implementation of measures reinforcing each other can be described. In a further scenario we analyze planned policies and their potential impacts, with the need to carefully discuss and assess the probability of such plans being fully implemented.

The evaluation is on the basis of the desired maximum long-term impact on GHG emissions. We recognize, however, that policy making faces a wide range of - sometimes conflicting - interests. The final outcome of the political process is therefore often a trade-off between different elements. We have formulated the necessary policy direction in a way that allows actors to move in the right direction to a sustainable, long-term economic development. This will need significant long-term changes within the economy. Necessary supporting instruments to minimize social impacts of this change are not included in the analysis.

This document describes the methodology used to evaluate countries’ policies and to quantify their effects. The method is based on the “Climate Policy Tracker for Europe”, adapted to reflect a non-European context and extended to be able to quantify policy induces emission reductions.

2 Methodology

2.1 General approach

2.1.1 Elements of the evaluation

The assessment of progress of individual countries towards their national emission targets and pledges under the Copenhagen Accord will need to be based on probabilistic methods and expert judgment. Experience with the Climate Action Tracker indicates that assessing how country actions fit within global goals is very important to conveying to the general public and decision-makers alike how a country's actions compare with its own objectives and those of other members of the international community. Comparability of effort is an important part of the assessment process, but necessarily involves judgments that would be contested at national and international level, and which require independence of the analytical team from national and other sectoral pressures.

The basis of the analysis is the collection of data and information on policy and its effectiveness. Information and data gathering is organized along the segments described in section 2.1.2 below. The approach used for the subsequent policy evaluation strongly builds on the methodology developed for the "Climate Policy Tracker for Europe". It has been adjusted to fit the global context and the changed analytical requirements. The detailed methodology for the policy evaluation is described in section 2.2. The evaluation produces a qualitative assessment for the long and medium term, but also supports the quantification of policy impact, which then results in emissions pathways for implemented and planned policies.

For the calculation of emission pathways we use a simple and transparent Excel based book-keeping tool, which is described in detail in section 2.3. On the basis of a business as usual scenario we calculate the impact of already implemented policies as well as of planned policies until 2030. These scenarios provide the basis for assessing progress towards 2020 pledges and the overall trend towards 2030.

Figure 1 illustrates the different elements of the analysis and the different outcomes related to the time frames analyzed.

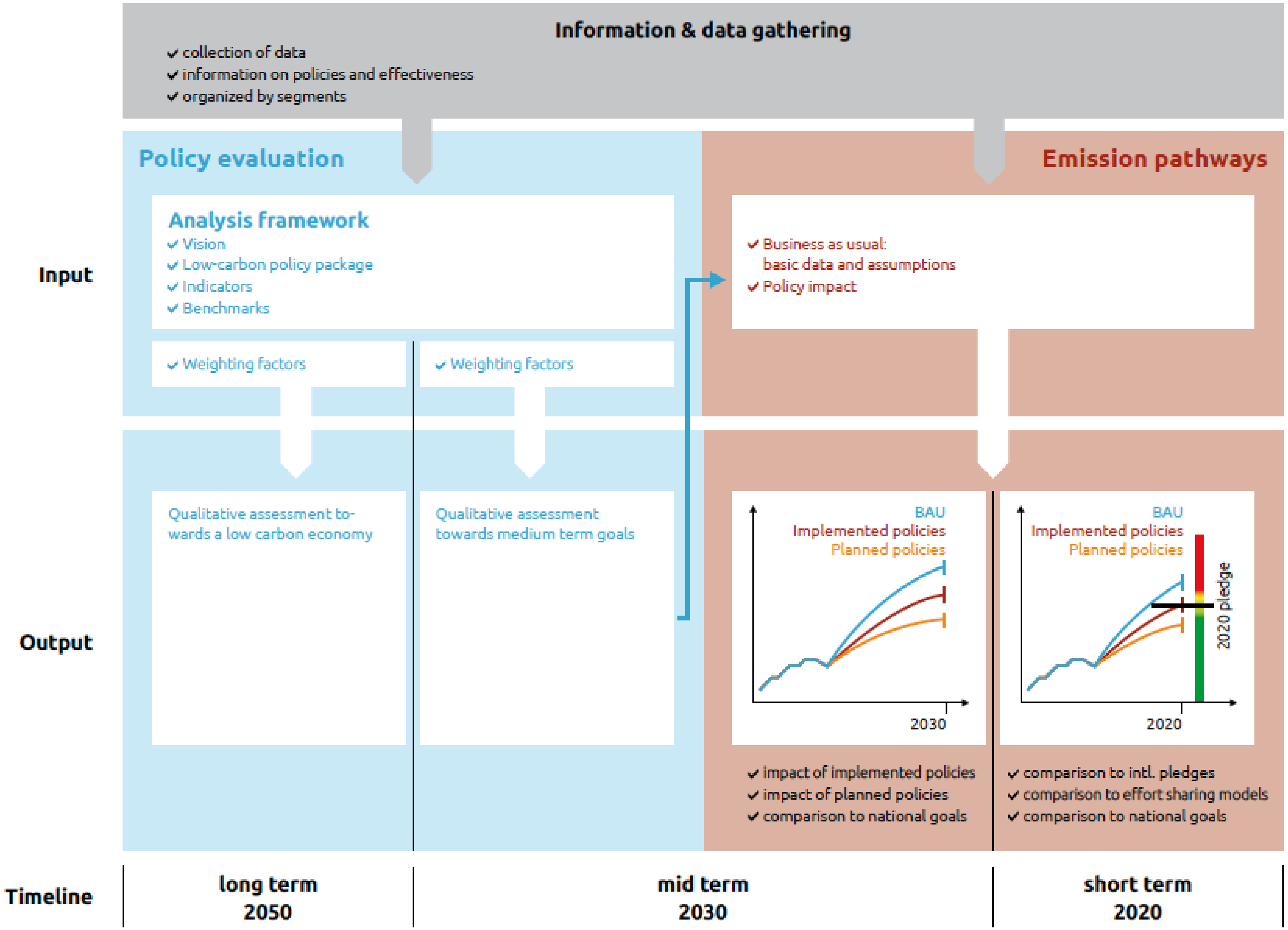

Figure 1 General approach for country analysis

2.1.2 Organising the evaluation

There are many different ways to look at a policy. The angle from which one looks at a measure can determine the outcome of an evaluation, the flexibility of analysis and the comparability to other policies or countries.

In the evaluation we categorise the analysis along **sectors** and **policy areas,** which together determine the individual **segments** of the analysis. Sectors are the economic sectors as defined below. Policy areas, such as 'activity', are defined to indicate the parameters of the GHG emissions calculation that are ultimately influenced by the policy (detailed description see section below). Results can potentially be aggregated for different economic sectors and be compared between different countries. They can also be aggregated for the different possible policy areas.

We are evaluating policy packages in these areas **independent of the choice of policy instrument**. For example, a support mechanism for electricity produced from renewables sources can be designed with different policy instruments: One country can use a feed-in-tariff; another can implement a renewable obligation. The method will give both countries a good mark if the policies are successfully increasing renewable electricity production.

Definition of sectors

Climate strategy: This "sector" groups cross-sectoral elements covered by comprehensive climate strategies

Electricity (heat) production: All central / public electricity and heat production

Industry: All industry sectors, including refineries, and the waste sector. Includes electricity generation for own use

Buildings: All energy consumed in residential, commercial and public buildings; energy use, fuel and electricity

Transport: All energy used in transport, including all modes. Includes also agricultural energy consumption as much of it is caused by transport.

AFOLU: Non-energy emissions from agriculture, forestry and other land use, which includes all land-based activities, e.g. non-CO_2 emissions from agriculture and CO_2 emissions from all forestry activities. The sector is further divided into the agriculture sector and land use, land use change and forestry (LULUCF) activities.

Definition of policy areas

Ultimately a policy will be successful if it reduces greenhouse gas emissions. These emissions are determined as below:

Equation 1 General emissions calculation

$$Emissions = (activity \times efficiency \times carbon\ intensity) + non\ energy - removals$$

Greenhouse gas emissions are derived from a certain activity level, e.g. tonnes of product, the energy used per unit of activity (efficiency) and the emissions per unit of energy (carbon intensity). Then non energy emissions, like for example CH_4 emissions from agriculture, need to be added. Finally removals of greenhouse gases from the atmosphere, e.g. through plant growth or CCS, need to be subtracted.

Carbon intensity can be developed as a function of the fuel mix between the different fuel types (fossil, renewables and nuclear):

Equation 2 Decomposition of carbon intensity by fuel type (i)

$$carbon\ intensity = \frac{Emissions}{Energy} = \sum_{i=1}^{n} \frac{Emissions_i}{Energy_i}$$

Policies can target individual elements of this equation or all elements at the same time. We chose to distinguish between 5 policy areas, embedded in the above equation, which are fundamental for the general change forwards a low carbon society:

Activity - we are looking at policies that have the intention to influence the demand side in different sectors. This also includes strategies for consumption of agricultural products and effects from land use change. Removals of GHG gases from land use activities are also covered in this policy area where they are triggered through land use change.

Energy efficiency – For the sectors involving energy use, policies can also target energy use per unit of activity.

Renewable energy – For the sectors involving energy use, other policies aim to reduce the emission factor and therefore are crucial to the analysis. We analyse the support for renewable energy sources across all relevant sectors.

Low carbon - For the sectors involving energy use, policies may aim to influene the carbon intensity of the fuel mix except renewables, i.e. the shares of differently emissions intensive fossil fuels, carbon capture and storage and nuclear power.

Non-energy - covers all emissions and removals from sources not directly linked to energy, especially emissions from processes in industry and from the land use sector. This category also includes all emissions from other gases, while the other areas mainly cover CO_2 emissions (except activity for AFOLU).

Together the sectors and policy areas form a matrix that defines the individual **segments** of the analysis. They represent to a large extent the focus of policy making:

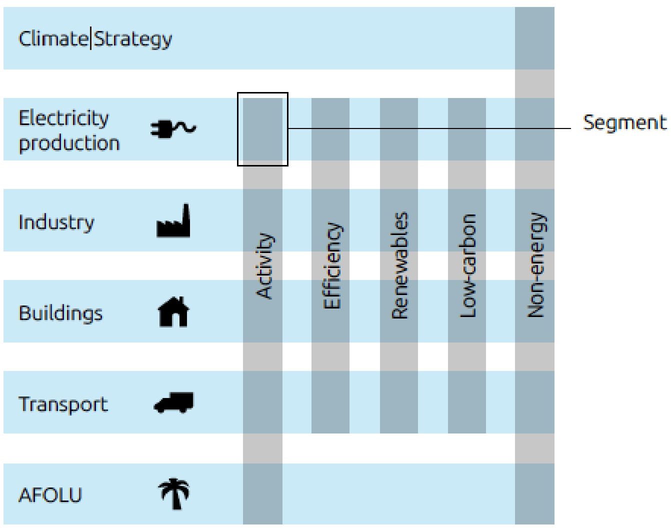

Figure 2 Dimensions of the analysis - definition of segments

2.2 POLICY EVALUATION

2.2.1 From vision to best practice

2.2.1.1 The vision

Since the IPCC Fourth Assessment Report of 2007, several low carbon scenarios have been published recently with broadly similar conclusions. These studies include:

- "The Energy report: 100% renewable Energy in 2050" ((WWF 2011))
- "World Energy Outlook 2010" and "Energy technology perspectives 2010" ((International Energy Agency (IEA) 2010))
- "The Economics of Low Stabilization: Model Comparison of Mitigation Strategies and Costs" ((Edenhofer 2011))
- "ADAM 2-degree scenario for Europe" ((Fraunhofer-ISI 2009))
- "Meeting the 2 degree target" ((PBL 2009))
- "International, U.S. and E.U. Climate Change Control Scenarios: Results from EMF 22" ((Clarke et al. 2009))
- "Energy [r]evolution scenario" ((Greenpeace International and European Renewable Energy Council 2008))
- "IMAGE and MESSAGE Scenarios Limiting GHG Concentration to Low Levels" ((Rao, Riahi et al. 2008))
- "Report on first assessment of low stabilisation scenarios" ((Knopf and Edenhofer 2008))

These studies confirm the conclusion of the IPCC Fourth Assessment Report that a global pathway to reach the 2°C target is **technologically feasible and economically viable.** It may mean halving global greenhouse gas emissions by the middle of the century, for developed countries reducing emission by 80% to 95%, enabling almost complete decarbonisation. This is the basis for the further work.

The studies come to the conclusion that it is in principle possible to achieve massive reductions in most areas with known technology. On going improvement of technology and the reduction of cost over time through economies of scale promote the adoption of low carbon technology. The challenge is how to make sure that all technologies are deployed at the **necessary scale**. The development of completely new technologies and materials will help to achieve this.

Technical solutions

Based on the review of low-carbon scenarios, we developed a framework vision of a low carbon future, constituting the benchmark for the Climate Action Tracker. The common major features of the scenarios are as follows:

- **Ambitious energy efficiency improvements:** A fully sustainable low-carbon future is only possible if all energy efficiency potentials are fully implemented in a very ambitious way.
- **100% carbon free energy supply by 2050:** The scenarios show that 100% carbon free energy supply is technically possible and economically feasible. We use two alternatives to reach this: A 100% renewable energy supply is technically possible and economically feasible. In this case significant adjustments to the electricity grid are necessary. Alternatively, also carbon capture and storage as well as nuclear energy can be used as low carbon technologies. The rational for these alternative scenarios is described in a separate section below.

- **Wide application of zero emission buildings:** Buildings need to be retrofitted to very high energy efficiency standards at least twice as fast as current practice. These renovated buildings and all new buildings need to be zero-emission buildings.
- **Paradigm shift in industrial production:** Not only energy efficiency is necessary; also material efficiency has to be significantly improved. Industrial production has to be redefined to move away from material-intensive products to long-lasting, almost 100% recyclable products.
- **Almost fully decarbonized mobility:** Provided a massive shift away from individual energy-based mobility, the remaining passenger car fleet must meet ambitious requirements both regarding efficiency and fuels used. Sustainably produced biomass will be used in areas where there are no technological alternatives, e.g. trucks, aviation and shipping. Hence, passenger cars have to use alternative technologies, e.g. run on electricity with suitable batteries or other storage options.
- **New options to reduce emissions in agriculture:** Major reductions in non-energy emissions in agriculture are necessary. Where there are currently no mitigation options, research has to be intensified.
- **Comprehensive land-use strategies:** Comprehensive land-use strategies need to be developed to solve the potential conflict in use of land. Land use can be optimised to reduce transport emissions. Agricultural products, forests and wood production compete for food production, as source of biofuels and for carbon storage, biodiversity and other ecosystem services. We do not determine whether carbon sequestration in biomass or bio-energy should be favoured. Additionally, a framework for sustainable biomass production must be in place to ensure biomass used for energy purposes is produced in a sustainable way that actually decreases emissions. Where biomass imports occur a framework to ensure the sustainability of these imports is required to ensure that leakage is minimised.
- **Halting deforestation:** global deforestation needs to be halted in the early half of this century.
- **Prompt action:** Global emissions need to peak no later than around 2020 to set the world on a pathway consistent with 2 and 1.5°C warming limits (UNEP 2010), but power plants, industrial investments, infrastructure and transport fleets have lifecycles of multiple decades. Hence, action has to start immediately to initiate a fast transformation. A participation and phase-in of all major emitting countries is required within the coming decade.

In most policy areas there is a general consensus on how a low-carbon economy can be achieved. Electricity generation will depend strongly upon renewable energy and zero-emission buildings will meet common standards. These points provide an initial premise upon which to formulate the necessary policies to enable the technological and behavioural changes to materialise. We use this '**low carbon scenario**' as the basis for all further analysis.

In some areas however, there are on-going controversial discussions on appropriate solutions. Questions of technical viability and potential conflicts with other technology solutions must be considered. This applies in particular to electricity generation with nuclear energy and with coal using carbon capture and storage. The arguments are as follows:

- ✓ Nuclear energy is considered by some *not* to be a long-term, sustainable solution for the energy sector, due to its safety concerns and unsolved waste disposal problem. Active support from governments for nuclear power would divert resources from the sustainable solutions, may lead to energy infrastructure lock-ins that prevent further penetration of renewable sources and is not considered best practice.
- ✓ Carbon capture and storage (CCS) needs to be differentiated by the source of emissions: Support for CCS for biomass is generally considered best practice because it is currently the

only option available to actively remove CO_2 from the atmosphere over long time spans. Support for CCS in industrial process emissions is considered best practice as there are currently no alternatives known for many of the processes and a full restructuring of material use to avoid these emissions will take time. Few technical options have moved beyond the initial research stages, and it is yet unproven whether recent innovations can be mobilised on a commercial scale. However, support for CCS from coal power plants is seen by some *not* to be a sustainable long-term solution, because such development would divert resources away from developing renewable energy, already today a viable option. Some would accept coal CCS if it is coupled with an emission performance standard of at least 350 g/kWh for all new power plants. Through this coupling to the emission performance standard, CCS becomes a means of accelerating decarbonisation rather than a means of competing for resources (including limits to carbon transportation and storage capacity) with other technical options.

- ✓ Some only consider electric transport to be best practice when the increased power demand increases installed renewable capacity and does not lead to direct or indirect lock-in effects of nuclear or fossil power.

Following this argumentation we additionally evaluate long-term effects towards a low carbon economy against a '**100% renewable scenario**'. We only assess **qualitative impact in the long-term** for this scenario. The question of nuclear electricity and CCS can potentially have an impact on the assessment of the electricity sector and associated required energy efficiency in electricity use. The impact of such an alternative vision would depend on the share of emissions of the electricity sectors, the support that a country has given to CCS, nuclear and renewables.

2.2.1.2 Policies to promote implementation

To make this happen fundamental changes in all sectors are needed. Policies need to be evaluated against how far they are able to trigger these fundamental changes. No single instrument can achieve this. It is essential to combine single policy measures into a coherent package both within each policy area, as well as between the different areas.

Our approach does not require an explicit representation of these elements of the low-carbon vision in policies and measures. The method is to assess if, ideally, a country is implementing a comprehensive and economy-wide integrated set of instruments that facilitate this development.

In other words, the policy packages need to form a coherent and consistent strategy to achieve a long-term low-carbon future, eliminate barriers to implementation and enhance incentives for stakeholders and sectors to ultimately make an economy-wide transition.

At the heart of the analysis is the definition of a '**low carbon policy package'** that contains the policies necessary to reach a low carbon economy.

We look at both positive and negative aspects of policy, i.e. those that support the low carbon goal and those that are barriers and need to be removed.

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- ➡ The **target** is defined as where we want to be in 2050 for each of the sectors related to the overall vision as defined above. For some sectors the target can even be reached before 2050.

  For the electricity supply sector the target would be, for example, an electricity generation system that is 100% emission free by 2050.

- ➡ This sectoral target provides the underlying assumptions on what **technical or behavioural options** need to be implemented in the sector, i.e. which technologies need to be promoted and to what extent or which changes in behaviour are necessary to achieve the desired 'zero carbon' development.

For electricity supply the technical solution is to provide 100% generation from carbon free sources by 2050, supported by appropriate grid infrastructure and system integration.

- On this basis we define in the **low carbon policy package** to reach the desired ambition in the required time frame. We identify policy elements that need to be covered to reach the intended target, while being **neutral on the instrument** that is used.

  For the electricity sector, this would include sufficient and stable support for renewable electricity generation for a diverse set of technologies. It would not prescribe whether this support would be generated through e.g. a feed in tariff or a renewable energy obligation.

Cross-cutting policies are incorporated in each sector where they are applicable. E.g. energy taxes are included in all sectors that use energy. This allows a true sector specific evaluation. Often these general policies are designed with sector specific differentiations, e.g. with differences in level or exceptions for individual sectors, which supports this approach.

	Changing activity	Energy efficiency	Low carbon			Other
			Renewables	With nuclear/CCS (low carbon vision)	Without nuclear/ CCS (100 % renewable vision)	
Climate Strategy	▸ Ambitious binding greenhouse gas reduction target, consistent with major effort sharing approaches ▸ Comprehensive and consistent long term strategy beyond 2020					
Electricity (heat) supply	(Electricity production is driven by the demand of the other sectors)	**Efficiency of fossil fuel power plants:** leading to average efficiency of 45 % (coal) and 60 % (natural gas) in 2030 or inventive is > 100 US$/t$CO_2$) **Combined heat and power production (CHP):** leading to 10 % additional share of electricity production in 10 years **Reduction of distribution losses:** leading to 4 % distribution losses in 2030	**General incentives for the production of electricity from renewable energy sources:** supporting at least 10 % points increase in share in 10 years **Support different technologies:** including sufficient support for 1-2 high price technologies (PV, geothermal power, biogas…) **Support for adapted electricity grids** **Sustainability standards for biomass use** **Removal of administrative and grid barriers**	**Policies that influence fuel choice:** taxes, emissions trading, emission performance standards in the order of 100US$/t$CO_2$e **Support for biomass CCS:** demonstration scale plants are supported **Support for coal CCS:** support for substantial increase in capacity **Support for substantial increase of nuclear capacity**	**Policies that influence fuel choice:** taxes, emissions trading, emission performance standards in the order of 100US$/t$CO_2$e **Support for biomass CCS:** demonstration scale plants are supported **Support for coal CCS is a *barrier* to renewable energy** **Support for substantial increase of nuclear capacity is a *barrier* to renewable energy**	Not applicable
Industry	**Restructuring industry towards high material efficiency:** leading to 0.5 % additional material efficiency improvement per year	**General incentives such as taxes, subsidies, ETS:** tax >100 % of energy price or leading to 0.5 % additional annual increase in energy efficiency	**General incentives:** energy taxes (> 100 % of energy price) and subsidies, ETS, overall leading to additional 5 % in 10 years **Sustainability standards for biomass use**	**Support for coal and gas CCS:** 10 % in 2030 **Support for CCS on biomass and process emissions:** 10 % in 2030	**Support for CCS on biomass and process emissions:** 10 % in 2030 **Support for coal and gas CCS is a *barrier* to renewable energy**	**Reduce N_2O process emissions:** to 10 % of historical maximum by 2030 **Reduce fugitive CH_4 from oil and gas production:** to 10 % of historical maximum by 2030 **Reduce CH_4 from waste:** by 20 % below BAU by 2030 **Reduce emissions of F-gases**
Buildings	**Urbanisation policy that leads to energy efficient development**	**Efficiency standards for new buildings:** zero energy by 2020 **Support to increase energy efficient retrofit rate:** 3 % per year **Incentives for efficient electrical appliances:** leading to 1-2 % less electricity use per year **General incentives:** taxes in the order of 100 % of the energy price **Removal of barriers, e.g. subsidies**	**Support for renewables in new and existing buildings:** increase in share of 10 % in 10 years **General incentives:** taxes in the order of 100 % of the energy price **Sustainability standards for biomass use:** national and imported	**Support for fossil fuel switching (to gas)**		Not applicable
Transport	**Strategies to avoid transport or to move to non-motorised transport:** 4 % avoided by 2020 **Strategies for modal shift:** 8 % increase of capacity by 2020 **General incentives:** e.g. tax of the order of 100 % of energy price	**Incentives for efficiency in light vehicles:** trajectory to reach 95g/km in 2020 for new cars **Incentives for efficiency in freight transport:** reduce specific emissions by 20 % by 2020 **General incentives:** e.g. tax of the order of 100 % of energy price	**Incentives for renewables in transport:** additional share of 10 % by 2020 **Sustainability standards for biomass use:** national and imported	**Support for fossil fuel switching (to gas) an other low carbon technologies** **Support for electro mobility (cars and infrastructure):** 5 % electric cars by 2020		Not applicable
Agriculture, Forests and other land use	**Incentives for sustainable consumption practices** **Consistent land use strategy exists and is implemented** **Land use register exists**	Not applicable				**Decrease livestock CH_4 and N_2O emissions:** by 3 % below BAU in 2030 **Decrease cropland and organic/peaty soils, all non-CO_2 emissions (including rice production):** 5 % below BAU in 2030 **Implement measures CO_2 on cropland**

Table 1 Low carbon policy package

2.2.2 Indicators for success

We measure how effective a policy package is by looking at whether we can prove the direct relationship between the political influence on the actors (e.g. taxes, regulations, incentives) and the policy's intended effect (reaching of target e.g. through sectoral change).

We only evaluate **policy packages**, i.e. all policies relevant within a segment, and not individual policies or measures. Often only the combination of a range of measures creates the desired impact.

The packages are designed to reflect the desired effect of policy instruments. We do not prescribe the use of specific policy tools and some will have effect on a range of segments, like tax incentives or carbon trading mechanisms.

The scoring system

If a policy does not deliver the expected results, it is not always easy to assess whether this is because the policy has not been driven properly, or because of existing barriers. We have developed an indicator for both incentives and barriers to allow for this.

For each indicator we defined a benchmark - on the basis of the defined vision. The benchmark is descriptive, but aims to include quantified expected results where possible.

Incentive scores: 0 to 4

Scale for scoring incentives

0 **1** 2 3 4

We evaluate incentives on a scale against the defined benchmarks, from 0-4, where 4 is excellent.

Barrier scores: -4 to 0

Scale for scoring barriers

-4 -3 -2 **-1** 0

We evaluate barriers on a similar scale, from -4 to 0, where 0 means that barriers have been addressed

This negative score counts against its related incentive.

We evaluate the impact of policies that have been adopted, i.e. the proven and future expected effects of measures that are **fully implemented**.

Where policies have already been in place for some time we evaluate both the past effectiveness and the expected effects of the policy.

Policies that have just recently been implemented are evaluated on the basis of their design and potential effectiveness.

We aggregate the individual scores per segment to an overall rating between 0 and 4. This segment rating is translated into a scale from A to G according to the matrix in table 2.

Assess-ment value >=	Rating	Interpretation
0	G	No or very limited policies
0.57	F	Few policies, ambition level low
1.14	E	Some policies with medium ambition level
1.71	D	Comprehensive package or good ambition level for a wide range of policies
2.29	C	Comprehensive policy package, ambition level good
2.86	B	Pathway is set, minor improvements required
3.43	A	Consistent with low carbon development

Table 2 Scoring matrix

2.2.2.1 Benchmarks

For each indicator a benchmark was defined on the basis of the vision. The benchmark is descriptive, but aims to include quantified expected results where possible. We aim to describe each possible score in detail, but this has not yet been implemented for all benchmarks. Work on refining the benchmarks will continue in the next phase of the project. As a minimum the benchmarks describe the extreme scores and in some cases also steps in between. Examples are given below:

The descriptions are intended to give a clear guidance which level of performance we expect. This required level of action is sometimes defined using the desired quantitative development (see first example in Table 3). In this case the experts need to evaluate how far implemented policies are able to deliver the defined effects.

In general the benchmarks are designed to represent a continuous line of development from no/negative action to the action needed for a low carbon development. We evaluate **incentives** per country on a scale from 0 (poor) to 4 (excellent) against the defined benchmarks. For **barriers** we used a scale from -4 (barriers are not addressed) to 0 (barriers are addressed). This negative score translates into a discount factor, which diminishes the achieved score for the related incentive policies (details see section 2.2.2.2). For both categories only integral scores can be given. This means the choice is between 5 possible values (e.g. for incentives: 0; 1;2;3;4) without the possibility to give in between values, like 1.5 or 2.7.

Indicator	**Benchmark**
Incentives	
Consistent land use strategy exists (including a strategy for forest management planning), minimizing emissions from land use change (under the given national circumstances), promoting stabilization or increase of forest, wetland and protected areas	4: a consistent land use strategy exists that includes all land uses, has a long term perspective, includes adaptation requirements and considers interrelations between uses 3: a consistent strategy covers all major land uses for the country, has a medium to long term perspective, includes adaptation requirements and/or considers interrelations between uses 2: a consistent strategy covers only selected land uses, and/or has a short to medium term perspective, and/or does not include adaptation requirements, interrelations between uses and/or emissions from land use change 1: strategy exists only on selected land uses and/or strategy is not consistent 0: no land use strategy exists
Policy tools are in place to secure implementation of strategy	4: policies covering **all** aspects of the strategy are implemented 3: policies covering **most** aspects of the strategy are implemented 2: policies covering **only few** aspects of the strategy are implemented 1: policies to implement the strategy are available but **not yet implemented** 0: no policy tools exist
Barriers	
Land use plan/register including a detailed forest inventory and protected areas exist	0: register classified by different **land use types** (min.: managed forest, unmanaged forest, cropland, grassland, wetlands, protected areas, other use) exists in form of **data and maps,** covers the **whole country** and is updated at least every **4 years** -1: register classified by different land use types (min see above), and protected areas exists in **some form,** covers more then **70%** of the country area and is updated at least every **10 years** -2: register exists for **some land uses** and more than **40%** of the country area 3: register exists for at least **one land use type** and the **whole country** or for **some land use types** and **less than 40%** of the country area -4: register not existent or only for parts of land uses and not organized

Table 3 Example for the definition of benchmarks

In one scenario we evaluate the impact of policies that have been adopted, i.e. expected effects of measures that are **fully implemented**: Where policies have already been in place for some time we evaluate both the past effectiveness and the expected effects of the policy. Policies that have just recently been implemented are evaluated on the basis of their design and its expected effectiveness.

For countries where major plans are in preparation, a further scenario additionally includes policies and measures that are planned by the government. Here we also evaluate on the basis of their design and its expected effectiveness.

2.2.2.2 Weighting factors and aggregation

Scores are aggregated to scores per segment on a scale from 0 (poor) to 4 (excellent). Other than the rating for individual scores, this aggregated (and thus calculated) score will be more detailed and is rounded to one digit after the comma. These scores are then translated to and displayed in seven categories 'A' (excellent) to 'G' (poor) equally distributed over the possible score from 0 to 4. The seven letters resemble the EU energy efficiency labelling for appliances. We are currently not aggregating to higher levels, e.g. to sector or country level. Aggregation the level of segments has the main merit in comparison to other countries. Once more country studies have been conducted the methodology for further aggregation will be refined and implemented.

The general principle of aggregating indicators into a final score is illustrated in the following graph:

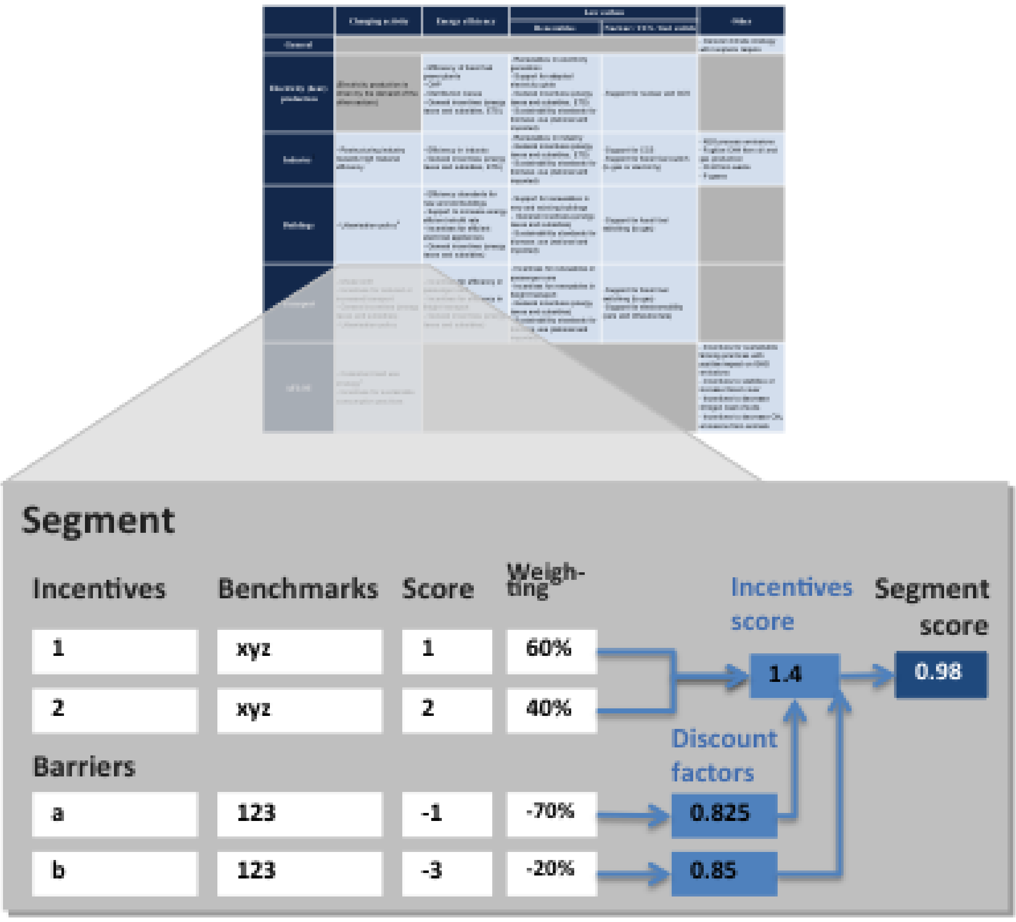


Figure 3 Principle of aggregation per segment

Each indicator is assigned an individual weight in line with the importance of the evaluated measure for the overall success towards the target defined in the vision for the segment. The weighting factors for all incentives within a segment add up to 100%. If all indicators are for example rated at a score of 4 the maximum impact could be achieved through the policy package. The equations are given below together with an example.

Equation 3 **Score for incentives with example calculation**

$$incentive_{segment} = \sum_{i=1}^{12} (score_i * weight_i)$$

with i = number of indicator

$$incentive = (1 * 0.6) + (2 * 0.4) = 1.4$$

The barriers reduce the impact of the incentives by a certain percentage. Therefore, they are added by multiplication. The barriers are also assigned with a “weighting” factor. That relates to the importance of a defined barrier, but not relative to other barriers, but in relation to the effectiveness of the policies evaluated in the incentives section. The factor represents the maximum decrease of impact of a given incentive package if it is not addressed. In the above example barrier a) would reduce the score by up to 70% if rated at -4 and with the shown evaluation of -1 reduces the score by 17.5%. The general calculation method is shown in the equations below and illustrated with the example from the figure above.

Equation 4 **Determination of discount factors with example**

$$discount\ factor_a = 1 + \frac{score_a * weight_a}{-4} = 1 + \frac{-1 * -0.7}{-4} = 0.825$$

Equation 5 **Overall segment score with example**

$$score_{segment} = incentive * discount\ factor_a * discount\ factor_b$$

$$score_{segment} = 1.4 * 0.825 * 0.85 = 0.98$$

2.3 EMISSIONS PATHWAYS

On the basis of the policy analysis we derived emissions pathways. This section describes the approach we took in more detail. The analysis starts with defining the business as usual scenario (BAU) (Section 2.3.2) in a simple “book keeping model”. Starting from the policy evaluation we use a set of impact factors that drive the change (Section 2.3.1) with the ultimate aim to arrive at a policy scenario that includes the planned measures in the country analysed (Section 2.3.3).

The development of emission pathways is based on a highly simplified, excel-based model, the “book keeping model”. The reason for choosing a simple model is to provide transparency, by avoiding a “black box” calculation. It allows discussions about the model, its assumptions and results also for people with little modeling or technical background.

The “book-keeping model” works at the level of energy and emission data and does not include activity data (e.g. kilometers driven per car and year). One exception is the LULUCF sector where we use area data and carbon content to calculate emissions. The output from the policies analysis directly affects energy consumption, greenhouse gas emissions or forest area. This calculation is illustrated in Figure 4.

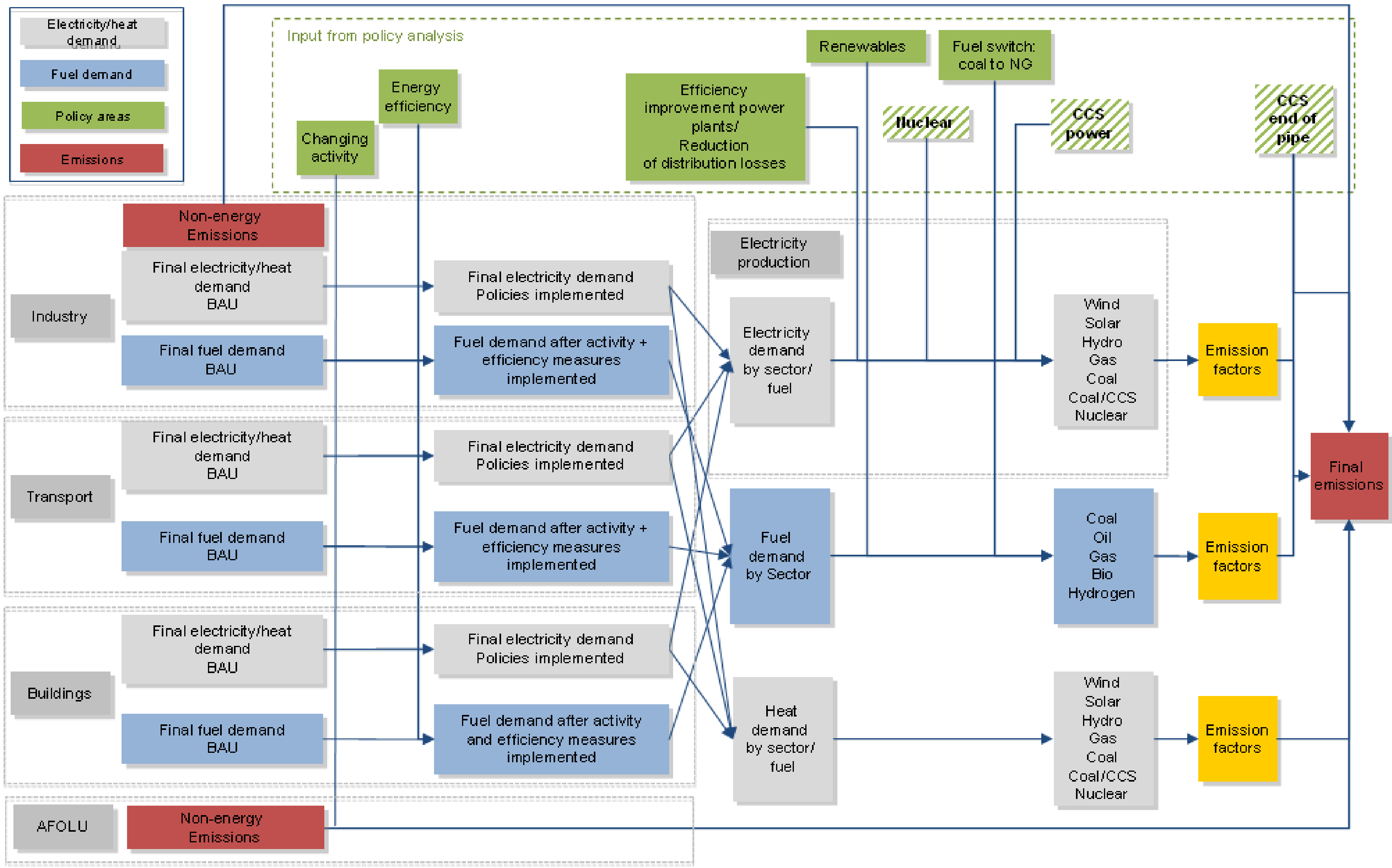


Figure 4 Schematic overview of flows in book-keeping model

2.3.1 Business as usual scenario

The basis for the calculation of the policy scenario is the business as usual (BAU) scenario. It consists of two parts:

1. Historic energy use and emissions
2. Projected energy use and emissions

An overview of the different steps in the calculation of the scenario is given in Figure 5.

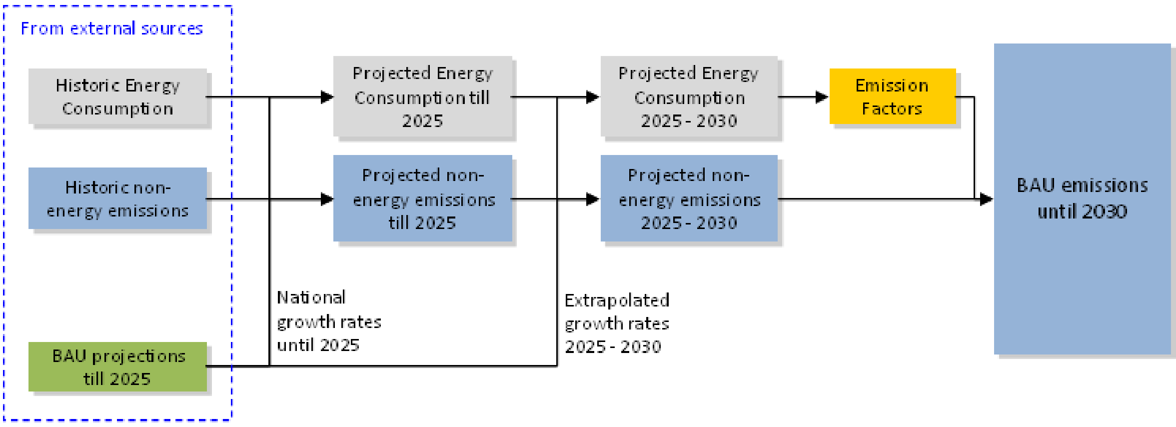


Figure 5 Flow Chart - calculation of the BAU scenario

The historical energy use and emissions are taken from official national sources if available, e.g. reports submitted to the UNFCCC or national energy statistics. If not available, they can be derived from inventories commonly available per country from other established international sources such as the IEA ((International Energy Agency (IEA) 2010)). This is more difficult with respect to non-CO2 emissions for non-Annex I countries, as there is no common reporting format for these within the UNFCCC framework. We have used other sources that have filled this gap, for example (Usepa 2006).

Deriving projected energy use and emissions is much more complicated. Alternatively two approaches can be taken:

1. Use of a pre-defined energy and/or emissions scenario from a trusted source, preferable an in-country institution.
2. Development of an own reference scenario based on the projections of activity data.

The second approach has the clear advantage over the first one that all assumptions underlying the scenario development are known, especially regarding which policies are included under the BAU. It also enhances comparability and consistency of baselines between different countries and across sectors. Still we used the first approach due to the limitation of the tool to energy and emission data.

Stepwise process to derive a BAU scenario

First we construct BAU scenarios for each ***energy demand sector*** (industry, buildings, transport, AFOLU). We use sector based data and aggregate it according to the sectoral definition. We limit the AFOLU sector to non-energy emissions. In many cases, a number of data sources are available for different sectoral and temporal resolutions. To form a common dataset from these sources we developed a hierarchy of sources with the preference for formally accepted data such as from governments (e.g. National Communications or emission inventories submitted to the UNFCCC). Further sources are data from recognized international sources such as the International Energy Agency (IEA) or the World Bank.

The absolute values from the data set highest in the hierarchy are used first. However, since this dataset contains only has a limited temporal coverage, the use of additional data sets becomes necessary. Since the absolute values reported by these data sources do not match the series highest in the hierarch, we apply growth rates from the second data set onwards in the hierarchy. Thereby, if possible, separate growth rates are used for each fuel and each sector. If no detailed data is available, the average growth rate from all fuels consumed in the sector is used.

The ***split of energy carriers*** is therefore determined by the selected data source for the future scenario. Additionally, we take our own assumption on the growth or renewable energy: We assume that renewable energy carriers grow at the average rate of the last years (1990 till 2008). The remaining energy demand is then split across the other energy carriers according to their base year's share. We chose this approach as in a non-carbon constrained world the future energy supply will most likely be matched by least cost supply options. Currently in many countries the only RE sources that could supply such cost efficient options are hydro-power and biomass. We assume that their contribution to the energy supply will grow rather according to their resource potential than the future energy demand. This is reflected better by the historical growth of these sources.

In a next step we construct the BAU scenario for the ***electricity production*** sector. The electricity demand in the demand sectors is added up and is used as input for the energy supply sector. In order to derive the primary energy demand we made assumptions on how the power plant efficiencies develop over time. We assumed that until 2050, the power plant efficiency has reached its technically possible limit. The option is given to decrease the maximum efficiency via a discount factor to be put into the "data – input" sheet in the model. We then increase the efficiency linearly towards that value starting at the base year's value.

To determine the future ***electricity mix*** under BAU development, we used data from external scenarios as a default approach. The calculation for the assessment of Mexico varies from this approach. For a more detailed description see Annex 1.

To calculate the resulting ***emissions from energy consumption***, the emission factors suggested by the IPCC are multiplied with the energy consumption for fossil energy carriers. Nuclear and renewable energy are assumed to be CO_2-neutral.

Additionally to the energy related emissions described above the tools also includes ***non-energy related emissions***. These only occur in the industry and in the AFOLU sector. They are directly taken from data sources, namely the UNFCCC ((UNFCCC 2009)), the USEPA ((Usepa 2006)) and the IEA Balances ((International Energy Agency (IEA) 2010)).

2.3.2 From policy evaluation to emission pathways

Before being able to quantify the emission pathways that result from the policy analysis, the results from the policy evaluation have to be translated into a format that can be used as an input in the 'book-keeping model'.

This requires a three step process which is summarized in Figure 7 and described below:

1. Aggregation and weighing of indicator scores and derivation of a ***'book-keeping model score'*** as described in section 2.2.2 above.
2. Definition of ***'maximum impact factors'*** for each book-keeping model score.
3. Calculation of ***'actual impact factors'*** through multiplying results from step 1 and 2.

Similar to the policy analysis the indicators scores have to be aggregated in order to be used in the book keeping model. The aggregation depends on the parameter defined in the book-keeping model and includes both incentives and barriers. For example all scores have to be aggregated that drive the share of renewables in a sector. Generally this aggregation is equal to the aggregation for segments as described above but sometimes differs due to differences in the structure of the sector and the book-keeping model (an example are the non-energy emissions in the industry, which are separated by gas and therefore have various impact factors). Furthermore the weighting factors might differ as indicators might be relevant for the long term goal but might not have any immediate effects on energy use and emissions, like for example the existence of a long term climate strategy in the country.

For each of the aggregated scores a 'maximum impact factor' was defined. The unit used for this factor needs to match the book-keeping model parameter it intends to change. In a last step the ***'maximum impact factor'*** is multiplied with its associated ***'book-keeping model score'*** to derive the ***'actual impact factors'.*** **We then use** the actual impact factor in the calculations for that segment, as described further in chapter 2.3.3.

In some cases, the benchmark according to which the policy package is rated already indicates an absolute value, thus already determining the maximum impact factor (see example below).

Indicator	Benchmark
Decrease in landfill gas emissions, by either less landfilling or CH4 capture	4: Reduce to 10% of historical maximum by 2030 0: no policies

While there is only one parameter that is directly linked to the policy evaluation and influenced through the 'maximum impact factor', there are usually other parameters that are used in the calculations, see Figure 5. Changes in these parameters are influenced indirectly by the main parameter, using assumptions on the relationship between the parameters. If for example the share of renewables is increased through a set of policies, the overall share available for other fuel types decreases. The split between other fuels is assumed to stay constant, so this split is then applied to the residual share of other fuels to calculate the absolute amount of each fuel type.

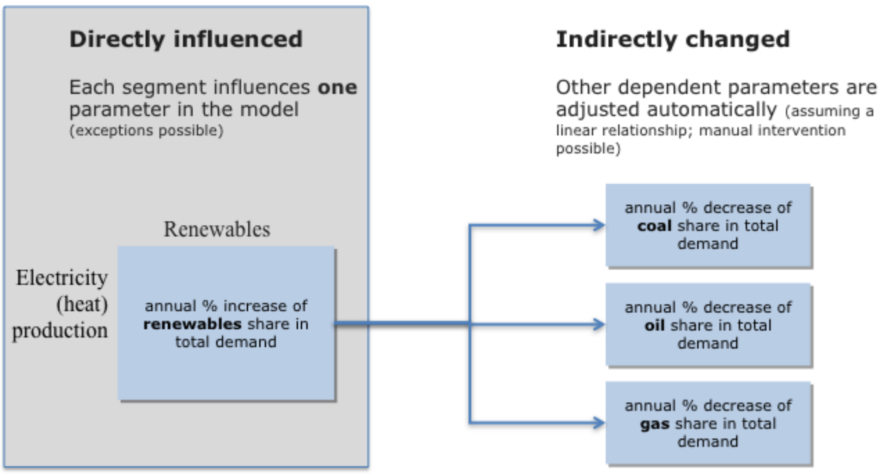


Figure 6 Example parameters for direct and indirect use of maximum impact factors

2.3.3 Implemented policy scenario

The development of the policy scenario can be divided into four policy areas as described above, according to how energy consumption and GHG-emissions can be influenced. The inputs to the calculation of the scenario with implemented policies are (compare Figure 7):

1. Results of the business as usual scenario
2. Actual impact factors from the policy evaluation.

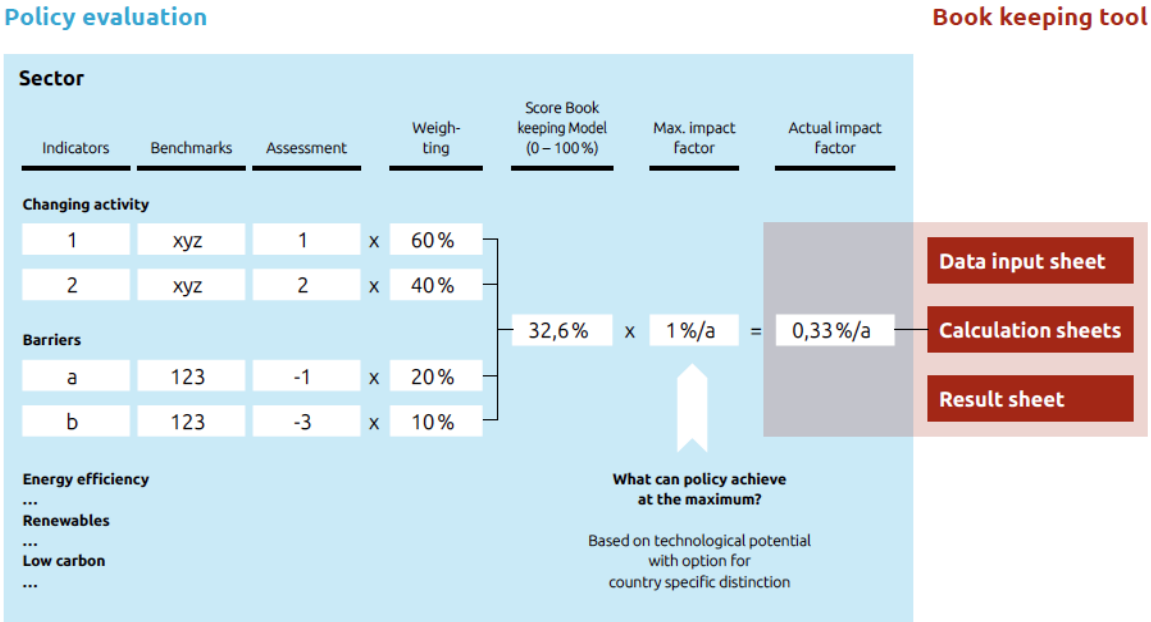


Figure 7 From policy evaluation to emissions pathways

To reflect the individual challenges of each segment, we developed several approaches on how to integrate the actual impact factors in the calculations. The choice of the method per segment depends on the way policies are expected to impact within this segment and on technical considerations related to the overall calculation method.

The table below shows possible approaches for the integration of the actual impact factors and gives an overview on the methods used for each of the segments. In the following paragraphs, we discuss specific issues arising in each of the areas and explain further the choice of the methods of integration of the actual impact factor.

Impact factor	Description	Influencing	Implications	Used in segments
%point increase p.a. of final consumption in base year, applied to the actual year's total consumption	The actual impact factor is added to the percentage share of the energy carrier in the previous year. The absolute value is calculated based on the new share and the total energy consumption of the actual year.	Energy use, emissions	- Coupled to BAU-development - Reflects high demand growth rates	- **RE all sectors** - **EE and LC in energy supply, industry (→ combined heat and power, carbon capture and storage)**
Decrease/increase of annual BAU-growth rates	The BAU-growth rates are calculated and decreased by the actual impact factor. Then, based on the absolute value of 2008, the policy development is calculated with the decreased growth rates. In case of a fuel switch, the difference to BAU is allocated to the energy carrier accordingly.	Energy use, emissions	- connected to BAU but leaves room for separate development of policy-scenario - Growth rates cannot be calculated if the absolute value at the beginning is 0 → infinite growth rate for the following year - No entry of new energy carriers possible (as a initial absolute value of 0 will never increase no matter how big the impact factor)	- **CA, EE and LC all sectors (→ general policies, fuel switch)** - **Non-energy emissions in industry and AFOLU** - **EE in buildings (incentives for retrofitting)**
Share of a maximum/minimum to be possibly reached ('impact directly used for calculations')	A maximum/minimum value which can technically be reached is set via the benchmark. The impact factor tells, how much of the difference between today and the maximum to be reached in 2030 can be achieved with the policies. Energy consumption grows linearly towards to calculated value in 2030.	Energy use, emissions	- Maximum/minimum must be known - Linear development → does not depend on BAU-development	- EE in energy supply (→ power plant efficiency) - Reduction of non-energy emissions in industrial sector - AFOLU 'non-energy' - Transport RE and LC

Table 4 Types of impact factors

Changing Activity

We expect changing activity to have a direct impact on the energy consumption of demand sectors (see section 2.3 Introduction). Changing activity does not have any impact on the energy supply sector in our model. For the calculations of impacts of this policy area, we use the actual impact factor "decrease/increase of annual BAU-growth rates" of energy consumption. This method was chosen to fit best due to two reasons:

1. We assume that future energy consumption even after changing activity is dependent on the BAU development and that activity changes will be adequately reflected in through changes in BAU growth rates.
2. Activity changes in one year also affect the activity in the next year.

For calculations, first, we determine the growth rates of the BAU-development of the total sector. Then, we reduce these annual growth rates by the actual impact factor. Finally, we apply the new, resulting growth rates to the base year's (2008) absolute value respectively the resulting absolute values of the following years. This leads to a new total energy consumption scenario for this sector. If a policy is only applicable to a share of the sector (e.g. modal shift in freight transport; road to rail), we consider this in the maximum impact factor.

We then distribute the resulting energy consumption to the energy carriers. We assume that changing activity decreases the energy consumption in all areas independently of the energy carrier used. We therefore decrease them equally according to their share (the energy carrier split remains the same).

The resulting energy demand and the fuel split are then passed on to the energy efficiency calculation.

Energy Efficiency

For the calculations on impacts of energy efficiency, we use the actual impact factor "decrease/increase of annual BAU-growth rates" for most sectors for the same reasons as mentioned in the changing activity area.

First, the growth rates after implementation of changing activity policies are reduced by the EE actual impact factor. Then, the new growth rates are applied to the base year's value resulting from the changing activity calculations. Again, the share of energy carriers is calculated as described in the paragraph on CA above.

The energy supply sector's efficiency calculations differ somewhat from the demand side sectors:

To calculate the efficiency improvements of power plants and the grid, we saw the actual impact factor as the share of a maximum/minimum to be possibly reached. According to the benchmark, we set a value for a certain year which is to be reached to reach climate protection targets. The actual impact factor then tells to which extent this value is achieved in the target year. The values for the remaining years are interpolated.

The energy carriers in the supply sector are reduced in the following order: 1. fossils, 2. nuclear energy 3. renewable energy. We justify this order of reduction with the energy production costs of power plants and their flexibility: Once installed, renewable energy has the cheapest costs per kWh produced seen from a macroeconomic view. Fossil power plants can be shut down easier than nuclear plants due to their size and their technical characteristics.

The resulting energy demand and the energy carriers' split is then passed on to the calculations on renewable energy.

Renewable Energy

To implement policies on renewable energy, we use the approach "%point increase p.a. of final consumption in base year, applied to the actual year's total consumption". We apply the actual impact factor to each year's total energy consumption. We then use the calculated value as the total RE-consumption for that year and allocate it to different renewable energy carriers according to their shares under BAU.

We chose this approach to assure a linkage between the energy demand and the renewable energy growth as quickly growing countries also have opportunities to build up renewable energy.

Finally we discount the additional amount of renewable energy consumption from the fossil fuels without CCS according to their share, then from fossil fuels with CCS, and last from nuclear energy.

Low-Carbon Technology

To describe the impact of policies on low-carbon technologies, the approaches "decrease/increase of annual BAU-growth rates" and ""%point increase p.a. of final consumption in base year, applied to the actual year's total consumption" were used, depending on the content of the policy. The first method was used to calculate implications of a fuel switch, orientating at the BAU-growth rate, whereas the second was taken to model the development of carbon capture and storage and nuclear energy in the energy supply sector, relying on the absolute value of the actual years.

In the calculations for CCS increase, an efficiency decrease is taken into account. Furthermore, because of the immature state of the CCS technology today, we chose to implement the possibility to delay the CCS policies. Both the efficiency decrease as well as the delay are to be put into the "input - data" sheet in the tool.

For the fuel switch, generally from coal and oil to gas, the growth rate of the gas according to the scenario after implementation of CA, EE and RE is determined. This growth rate is then increased by the actual impact factor and finally applied to the absolute value of the base year. The increased amount of gas is taken away from oil. Nuclear and renewable energy is not influenced.

Non-energy emissions

In the sectors AFOLU and industry, there is a substantial share of non-energy emissions which can also be subject to GHG-policies. These emissions are the aim of this area and the approach "Share of a maximum/minimum to be possibly reached" was chosen to reflect best impacts of policies.

We assume that the policies have a direct effect on the emissions. The calculation is as follows:

- The maximum reduction potential is given by the benchmark and the share of this potential to be exploited by the policies is given by the 'book-keeping model score'
- This reduction potential is then implemented in the future year mentioned in the benchmark.
- We assume the development until then to be linear. If the year mentioned in the base year is before 2030, we extrapolate the trend beyond this year until 2030.

CO2 emissions from cropland, grassland and afforestation are object to an approach based on area data. Instead of directly using emission data, policies affect the area on which a certain measure is implemented. The area is then transformed to CO2 via the carbon content. The carbon content varies for the different land types and can be adjusted in the input – sheet in the 'book-keeping model'.

2.4 Evaluation process

The evaluation of a country's policy requires a careful process including extended desk research as well as the incorporation of national and international expertise. We have therefore designed a process that aims to ensure both independent assessment and the involvement of national stakeholders and experts. The process aims to ensure robust results and maximize impact at the national and international level.

2.4.1 Structure for country assessment

The process of country assessments requires a project setup that is different from the other parts of the project. Each individual country assessment represents a work package in its own and needs to be carefully managed. We therefore set up a team for each country, depending on local expertise, language skills and existing in-country contacts. Each country team consists of an analysis team with a leader (consortium members) and a review team, which includes a team leader (consortium member from a different organization than the analysis team leader), a local consultant and the external review team (see Figure 8).

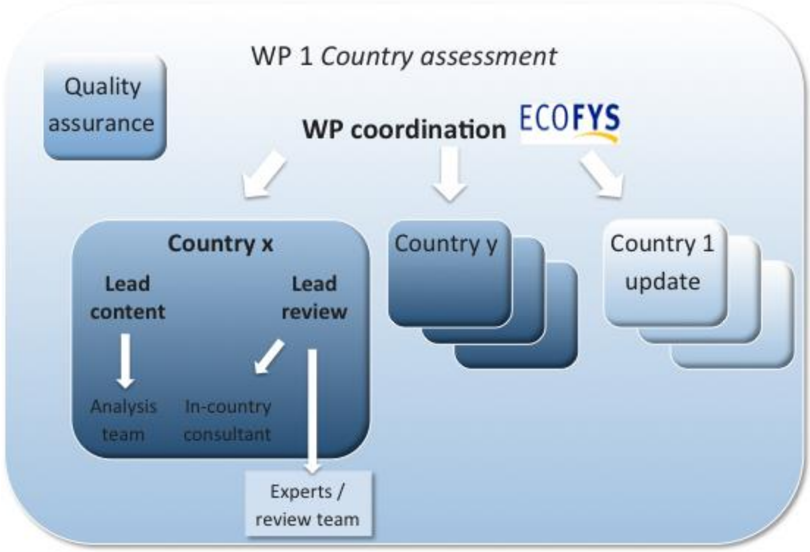


Figure 8 Structure work package 1

Within each country we will aim to work with a local consultant who can:

- Provide up to date insight into the country's relevant policies
- Establish contacts to key local stakeholders and serve as national focal point
- Provide on the ground administrative and organizational support
- Support the analysis team in identifying relevant information sources

The main task of the local consultant is to facilitate the review process and act as an independent focal point for the review process. The consultant also supports the analysis team by providing access to information, answering question and helping to understand and evaluate input received through the review process. The consultant thus is an active part of the project team.

To ensure the robustness of the analysis we will work to establish a team of national and international experts and stakeholders with profound knowledge of the relevant policies in the country. They will:

- Contribute to the analysis by providing information and evaluation
- Review results and provide further insights

The input from the review team will be critically examined by the project team, and will influence the final evaluation of the team. However, the experts participating in the review team are not active members of the project team and are not part of the final decision making process.

2.4.2 Process of country assessment

We will assess the effectiveness of implemented policies and measures to assess the likelihood of national goals being met. This involves expert judgment and will require contributions both from individual national and international experts and from national institutions and organizations to make a robust assessment. Country assessments will be reviewed using a network of experts nationally and internationally, and on a case-by-case basis may involve in country meetings and/or workshops depending on individual circumstances. Where possible the Climate Action Tracker will seek to cooperate with existing activities in this area. The process for conducting the national evaluations and reviewing the analysis will seek to:

- Engage relevant international and national experts and stakeholders
- Create understanding of the project, its goals and the methodology used
- Receive input on important information sources, recent developments, etc.
- Verify existing information
- Review results and provide advice

We aim to engage with a qualified local expert to support this process and ensure continuity and up to date information also for the regular update of country assessments.

Figure 9 Evaluation process

The analysis includes as a first step an in-depth desk analysis of available information and data sources. This will result in a first evaluation and identification of gaps. Parallel to this activity we will start engaging with experts and stakeholders in the country and establish an expert review team. The review team will receive a detailed introduction to the methodology to be able to fully understand the evaluation process and the related review needs. The team can then support the analysis by providing valuable input regarding missing information and data, potentially also on required country specific adjustments. It is, however not part of the evaluation team and will only point out additional sources of information and data where appropriate. The core project team will then elaborate a draft evaluation, incorporating all input received. The results will be discussed in with the review team. Crucial findings and assumptions will be presented and discussed and comments from the review team will be incorporated. The final report will be subject to another round of review before publication and outreach activities start

2.4.3 Review process

A crucial step to ensure a high quality, comprehensive evaluation is the review process. A key element of this is the selection of the review team. It needs to consist of a mix of different relevant stakeholders which should at least cover all sectors, as well as different stakeholder groups, i.e. government experts, research, NGOs and private sector. To enable reviewers to fully participate and contribute we will offer a number of internet-based presentations to introduce the project in detail and present the methodology.

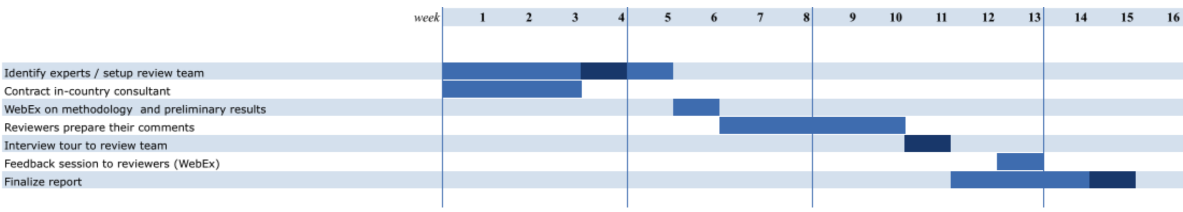
Key questions to be addressed by the reviewers are:

- Is the method appropriate for the national circumstances?
- Are all relevant policies covered?
- Is the evaluation, i.e. rating of the stringency of the policies appropriate?
- Is the overall assessment of the country a fair representation of the current situation?

After receiving the documentation on the preliminary analysis, the reviewers will have a few weeks to review the documents and prepare their comments following a standardized format and guidelines. Towards the end of the review phase experts from the project team will conduct personal interviews with the experts during an in-country review tour. Sector specific interviews will be conducted during the trip either as one-on-one meetings or with a group of sector experts. Additionally there will be cross-sectoral experts involved to ensure that overarching issues are addressed. After the trip the input will be processed and evaluated by the project team. We will document both inputs from the experts and how they were incorporated in a transparent way. The most crucial issues addressed in the review and the final results of the evaluation will be presented to the review experts before finalizing the report as internet presentation.

An example for the review timeline is shown in Table 5. The exact time available for each step will depend on a variety of factors and will be country specific.

Table 5 Example review timeline



A local consultant will support the analytical work of the core team. Within each country we aim to work with a local expert who can:

- Provide up to date insight into the country's relevant policies
- Establish contacts to key local stakeholders and serve as national focal point
- Provide on the ground administrative and organizational support for the review process
- Support the analysis team in identifying relevant information sources

3 Sensitivity and uncertainty analysis

To follow shortly - watch our website for updates!

4 First countries: challenges and lessons learned

Finding the right balance between a tool that is simple on the one hand and that reflects the complexity of the topic and countries' special situations as good as possible on the other hand has proven a challenging task. One element of this is to find the right level of detail, both regarding policy analysis and quantification. Linking qualitative policy analysis with a quantification of effects in a systematic, transparent way requires the setting of a range of assumptions. Each of these assumptions in setting parameters is crucial for the final outcome and needs to be carefully researched.

4.1 Policy evaluation

Apart from the 'right' level of detail, the most important lessons learned by developing and testing the methodology were that:

- Benchmarks need to be very **precise** to allow for comparable results. Each possible score needs to be defined individually and more general guidance needs to be provided on the intention behind each indicator to allow for robust and comparable scoring.
- The **scientific basis of parameters** for the evaluation, i.e. benchmarks and weighting factors is crucial for the credibility of the results. Where possible, these must be clearly linked to peer-reviewed scientific literature, and where this is not available the rational for setting a parameter must be made explicit.
- Information on policies is often **hard to find.**
- It is sometimes hard to find evidence if an announced/decided plan or strategy has been **really implemented**.
- **Effectiveness** is difficult to determine by desk research, as this requires more in-depth and in-country information which is often not available in published reports / documents

In developing countries it is often difficult to determine if / which part of a measure is externally funded. This has in general no influence on the evaluation of the effectiveness of a measure, but will be relevant information for the international context and is planned to constitute part of the finance tracking exercise.

4.2 Emissions pathways

For the calculation of emissions pathways a range of methodological, technical questions came up in the pilot phase, but more importantly a range of issues around data availability and reliability:

- Problems were encountered where multiple sources are available but do not span the **whole time series** evaluated (i.e. from 1990 – 2030), both for historic data, but even more so for projections. This requires to develop a 'hierarchy of sources' and where no information is available an extrapolation of given datasets.
- **Data at country level** is often not publicly available, not at the required level of detail, and not necessarily consistent and comparable with international data sets.
- **International data** is not necessarily at the required level of detail, especially for projections to the future (development of BAU). Many sources, such as the World Energy Outlook, provide data only on a regional level. Growth rates for a region however can differ largely from country specific growth rates. For instance, Mexico is included with North America, i.e. the United States and Canada. Given that Mexico is far less developed than the later two, their growth rates will most likely be higher. However we remedied this using a downscaling

approach developed by van Vuuren[1] ((van Vuuren, Lucas et al. 2007)). Additionally, some data sources only include data for the overall sector, not including a fuel split. When this is the case, assumptions have to be made. We then assume that all fossil and nuclear fuels will keep their 2008 share of total energy consumption during the time period looked at. The renewable energy sources on the other hand are expected to grow at their average growth rate from the years 1990 till 2008, as we assume that additional political action is necessary to change this trend.

- An important element in the analysis is the **uncertainty** of available data on future developments which are used to determine the business as usual pathway. This uncertainty pertaining to the BAU projections must be made explicit in the analysis.
- "**Maximum impact factors**" link the qualitative policy assessment with the emission pathways in the book keeping tool. The setting of these is therefore crucial for the outcome of the policy scenario. However, also other parameters and assumptions have an influence on the quantification of impacts. A sensitivity analysis regarding the most important elements of the analysis is required to make these impacts transparent.
- For the evaluation of policies against a **business as usual** it is important to know all underlying assumptions for used projection data. However, often it is not clear **which policies are included** under these scenarios and which are not.

[1] Convergence of growth rates over a certain range of years to the actual regional growth rate.

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6 Annex I: Details per sector

6.1 GENERAL

Policy evaluation

Indicators and benchmarks

General national strategy

Indicator	Additional information[2]	Benchmark	Rational for benchmark	ID
Does the country have a stringent and binding GHG target or budget until 2050?		4: Consistent with effort sharing in 2050 (developed countries: -80 to 95% in 2050 and binding; developing countries also indicative) 3: (developed countries: -80% - 95% in 2050 not binding or 70% to 80% binding target) 2: (developed countries: -70% - 80% in 2050 not binding) 0: no target	Effort sharing towards 2°C is the benchmark. For developed countries it has to be binding, to show the lead.	1
Does the country have an ambitious and comprehensive climate strategy towards a low carbon economy also beyond 2020?		4: comprehensive and consistent long term strategy beyond 2020 2: strategy covers not all sectors or comprehensive and not beyond 2020 0: no strategy exists	Cancun agreements request LCDPs	2
Does an integrated long term innovation strategy tailored towards a low carbon development exist, with sufficient resources for research and development?		4: Innovation strategy with sufficient resources for R&D 0: no strategy		3

[2] This column is intended to provide more details on what the indicator covers and the thinking behind the indicator. This information is currently provided for the transport and AFOLU sectors and will be updated for the other sectors in the next phase

Weighting factors

General national strategy

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Does the country have a stringent and binding GHG target or budget until 2050?	40%	No impact	Target is leading and provides long term direction. Impact on emissions in 2030 are assumed to only come from implemented policies to achieve the target	1
Does the country have an ambitious and comprehensive climate strategy towards a low carbon economy also beyond 2020?	30%	No impact	The strategy follows the target.	2
Does an integrated long term innovation strategy tailored towards a low carbon development exist, with sufficient resources for research and development?	30%	No impact	Research is equally important to ensure change in long term trends	3

6.2 Electricity and Heat

Policy evaluation

Indicators and benchmarks

Energy efficiency

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Incentive to increase efficiency of fossil fuel power plants (e.g. performance standards, energy and CO2 taxes, emissions trading …)		4: Leading to average efficiency of 45% (coal) and 60% (natural gas) in 2030 or inventive is > 100 US$/tCO2 2: Leading to halving the gap from current to above efficiency or 50 US$/tCO2 0: No incentive/support	Ultimately possible efficiecies, differentiated by coal and gas. 100 US$/t will have a meaningful effect on investment choices and operations in the electricity sector	4
Level of support for CHP sufficient for an increased share of CHP		4: Leading to 5% additional share of electricity production in 10 years 2: Leading to 2,5% additional share of electricity production in 10 years 0: No support existing	Relevant for all countries, most potential in industrial processes. 10% based on EU CHP directive	5
Policies to reduce distribution losses		4: Leading to 4% distribution losses in 2030 2: Leading to halving the gap from current to 4% losses 0: No incentive/support	4% is the technical lower limit at current technology	6
Barriers				
Subsidies applicable in the electricity sector		0: No subsidy -4: 100 US$/tCO2		7

Renewables

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Level of support for RES-E either direct or through energy and CO2 taxes, emissions trading		4: Support in upper half of cost range and unlimited or supports min. 10%points increase in RES-E production compared to future production in 10 years 2: ... 0: Lower support	Pathway towards global decarbonisation by 2050. More than EU and Chinese target	8
Support for different technologies		4: Support differentiated by technology including sufficient support for 1-2 high price technologies (PV, geothermal power, biogas …) 2: Support differentiated by technology 0: Based uniform price (e.g. renewable certificates without banding)	To incentivise various technologies	9
Is there a stringent framework for sustainable biomass import?		4: Stringent regulation beyond EU RED requirements 2: Meeting EU RED requirements 0: No legislation exists		10
Barriers				
Administrative environment		0: Project phase for renewable energy projects until approval extremely short -2: Project phase long -4: Project phase until approval inacceptable		11
Stability of support (policy environment and length of financial support)		0: Support scheme predictable and period of support long enough -4: Support scheme is unstable and support (once granted) is not long enough	Investment stability	12
Preferential grid access and congestion management for renewable electricity		0: Preferential access and preferential congestion management -2: Preferential access OR preferential congestion management -4: No preference		13
Investment & implementation strategy for RE oriented grid structures		0: Strategy decided, implemented and sufficient -4: No strategy		14

Low carbon

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Policies that influence fuel choice (taxes, emissions trading, emission performance standards)		4: Incentive is > 100 US$/tCO2 2: > 50 US$/tCO2 0: No incentive/support	To generatue fuel switch and incentivies; no new coal powerplants	15
Incentives for biomass CCS		4: Demonstration scale plants are supported for biomass CCS 2: Research is supported for biomass CCS 0: No support for biomass CCS	Biomass CCS is currently at most at the demonstration statge	16
Incentives for coal CCS		4: Support for substantial increase in capacity 2: Support for existing installations and/or waste disposal 0: No active support		17
Active support for nuclear energy		4: Support for substantial increase in capacity 2: Support for existing installations and/or waste disposal 0: No active support		18

Weighting factors

Energy efficiency

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Incentive to increase efficiency of fossil fuel power plants (e.g. performance standards, energy and CO2 taxes, emissions trading …)	70%	100%	Energy efficiency is leading in this sector as it presents the largets mitigation potential. Impact on emissions is taken directly	4
Level of support for CHP sufficient for an increased share of CHP	20%	100%	CHP is only one option to reduce emissions. Impact on emissions is taken directly	5
Policies to reduce distribution losses	10%	100%	Distribution losses present usually a small mitgation potential. Impact on emissions is taken directly.	6
Barriers				
Subsidies applicable in the electricity sector	-20%	-20%	Subsidies can increase emissions substantially	7

Renewables

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Level of support for RES-E either direct or through energy and CO2 taxes, emissions trading	80%	90%	Major share of the reduction potential	8
Support for different technologies	10%	10%	Important for the long run. E.g. if PV is not developed now it will be difficult to reach high RES levels in 2030	9
Is there a stringent framework for sustainable biomass production and import?	10%	No impact		10

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Barriers				
Administrative environment	-20%	-20%	Even if support is high, administrative barriers can lead to blocking implementation	11
Stability of support (policy environment and length of financial support)	-20%	-20%	Investment uncertainty can block progress significantly.	12
Preferential grid access and congestion management for renewable electricity	-20%	-20%	Lack if grid access can block progress significantly.	13
Investment & implementation strategy for RE oriented grid structures	-20%	-20%	An insufficient electricity block progress significantly when reaching higher rates of intermittent sources	14

Low carbon

Indicator	Weighting factors long term (low carbon)	Weighting factors long term (100% renewable)	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives					
Policies that influence fuel choice (taxes, emissions trading, emission performance standards)	50%	80%	100%	Most important factor. Considered separately for impact on emissions.	15
Incentives for biomass CCS	10%	20%	100%	Small but longterm option. Considered separately for impact on emissions.	16
Incentives for coal CCS	20%	-20%	100%	100% renewable: Investments in coal CCS can divert resources and attention away from other low carbon options	17
Active support for nuclear energy	20%	-20%	100%	100% renewable: Investments in nuclear can divert resources and attention away from other low carbon options	18

Maximum impact factors

Energy efficiency

Indicator	Maximum impact factor	Unit	ID
Incentives			
Incentive to increase efficiency of fossil fuel power plants (e.g. performance standards, energy and CO2 taxes, emissions trading)	1	Impact directly used for calculations	4
Level of support for CHP sufficient for an increased share of CHP	0.5%	p.a. increase of share of CHP power plants	5
Policies to reduce distribution losses	1	Impact directly used for calculations	6
Barriers			
Subsidies applicable in the electricity sector	*Included above*		7

Renewables

Indicator	Maximum impact factor	Unit	ID
Incentives			
Level of support for RES-E either direct or through energy and CO2 taxes, emissions trading	1.0%	%point increase p.a. of final consumption in base year, applied to the actual year's total consumption	8
Support for different technologies	*Included above*		9
Is there a stringent framework for sustainable biomass production and import?	*Included above*		10

Barriers		
Administrative environment	*Included above*	11
Stability of support (policy environment and length of financial support)	*Included above*	12
Preferential grid access and congestion management for renewable electricity	*Included above*	13
Investment & implementation strategy for RE oriented grid structures	*Included above*	14

Low carbon

Indicator	Maximum impact factor	Unit	ID
Incentives			
Policies that influence fuel choice (taxes, emissions trading, emission performance standards)	1	directly used in calculation	15
Incentives for biomass CCS	0.02%	CCS biomass % point increase p.a.	16
Incentives for coal CCS	0.1%	CCS coal% point increase p.a.	17
Active support for nuclear energy	0.19%	nuclear % point increase p.a.	18

Emissions pathways for electricity (heat) supply

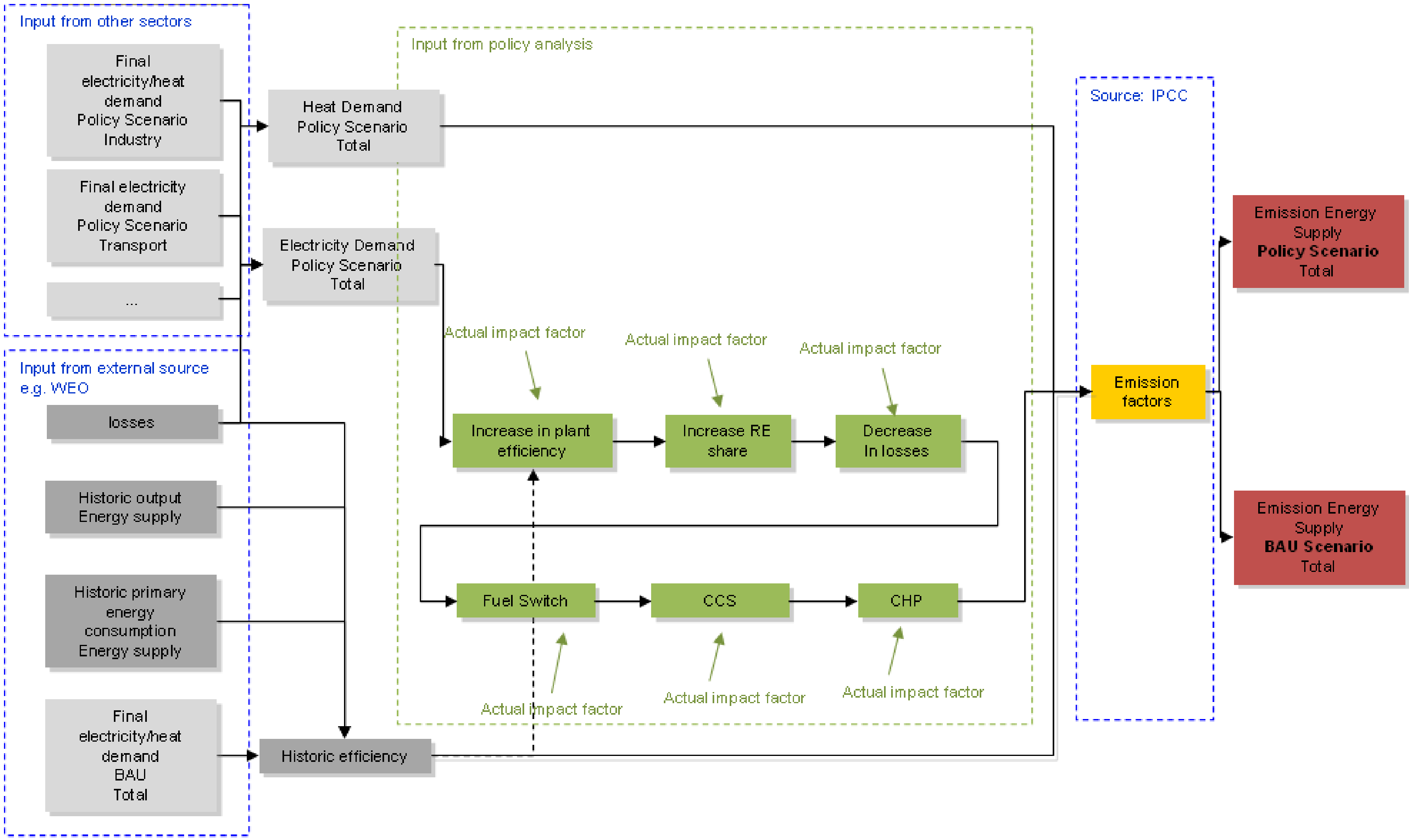

Figure 10 Flow chart emission pathway electricity (heat) supply

Calculation method BAU – electricity supply

Apart from the regular input data for this sector taken from the input sheet (losses, energy industry's own use, net imports, international marine bunkers, international aviation bunkers, stock changes, statistical differences), the energy supply sector needs the electricity and heat demand data from the demand sectors industry, buildings, transport (incl. energy consumption from agriculture) to determine the total need for energy production in the scenario. Furthermore, the historic efficiency is calculated via the total electricity output and the primary energy demand of the power plants.

To determine the future BAU-development of energy carriers, we use data from scenarios as default. For the country assessment for Mexico we chose a different approach because Mexico has been increasing the gas share of electricity production. We assume this trend to be BAU.

- We introduce a destruction rate for coal and oil-fired power plants which is dependent on the lifetime expectation of the power plants. This leads to a decrease of both the oil and the coal share.
- For the complete period till 2030, we increase the share of renewable energy at the average annual growth rate of the time period 1990 till 2008.
- Nuclear energy production is kept at a stable level.
- The remaining energy demand is covered by gas

To calculate the future development of the losses, own use etc. we assumed, that the ratio of losses/demand remains the same.

We implemented autonomous efficiency improvements of power plants: Efficiencies develop linearly towards best-practice efficiency in 2050, starting in the base year with the average efficiency of the previous five years.

Data availability in this sector is generally rather good, as the electricity sector is monitored well. Data can be found in the IEA Energy Balances. Statistical differences have been acceptable in the first country assessments (Mexico and Australia).

Calculation method policy scenario – electricity supply

The following table shows the different segments within the calculation for the implementation of policies in the energy supply sector. The indication shows if we used the "default" approach explained in chapter 2.3 or a different approach or if the default approached needed to be adapted for a certain purpose.

Segment	Approach
Changing activity	Not relevant in this sector
Energy efficiency - Losses	Actual impact factor as share of maximum difference to BAU to be possibly reached.
Energy efficiency - Power plant efficiency	Actual impact factor as share of maximum to be possibly reached. Maximum differs according to power plant type: Coal: 45 % Gas: 60 % Oil: 45 % Efficiency grows linearly
Energy efficiency - Combined heat and power	Actual impact factor as increase of CHP as share of BAU of actual year
Renewable Energy	Default
Low-Carbon - Fuel switch oil to gas	Default
Low-Carbon - CCS	Actual impact factor as increase of CCS as share of BAU of actual year
Low-Carbon - Nuclear	Actual impact factor as increase of nuclear as share of BAU of actual year

The sector specific assumptions we took are:

- We implemented efficiency losses due to carbon capture and storage.
- The best value to be reached reducing losses is a reduction of losses to 4 % of the total electricity consumption.
- The efficiency of combined heat and power plants is 80 %. Efficiency gains are completely accounted for on the electricity side, heat output is neglected.

Calculation method BAU –heat supply

Input to these calculations are the heat demand from the demand sectors and primary energy demand from the heat supply sector supplied by external data sources.

Furthermore, historic energy consumption from CHP plants as calculated in the electricity sector is included in the calculations: We allocate the difference between the primary energy consumption of CHP plants as taken from external statistics and the energy consumption calculated for CHP to the heat supply sector. Via the emission factors, we then calculate the emissions to be allocated to the heat sector.

With the heat demand from the demand sectors we then calculate specific primary energy demand per unit of heat consumed for each historic year and as an average of the five years previous to the base year. This average we then assume to remain constant for the future.

The projections of primary energy demand are based on the average specific primary energy demand and the development of the consumption of heat from demand sectors.

Calculation method policy scenario – heat supply

Due to the lack of data and relatively little importance of this sector in the first country assessment studies (Australia and Mexico), we have not implemented any policies in the heat sector.

6.3 INDUSTRY

Policy evaluation

Indicators and benchmarks

Changing Activity

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Policies that support the redesign of products to be less material intensive, long lasting, 100% recyclable		4: Comprehensive, ambitious and implemented, applicable to domestically produced and imported/exported products (1% pa extra material efficiency improvement) 0: No policies		19

Energy Efficiency

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Schemes that lead to sufficient additional improvements in energy efficiency in industry (e.g. support schemes, voluntary agreements, white certificates, emissions trading, energy and/or CO2 taxes)		4: Tax is > 100% of energy price or 0,5% annual increase in energy efficiency 0: No incentive	Target for Dutch EE schemes, in line with EU EE target	20
Policies that support the demonstration of breakthrough technologies		4: Comprehensive, ambitious and implemented 0: No policies	New technologies are necessary to reach longterm target	21
Barriers				
Subsidies, tax exemptions for energy intensive industry for conventional fuel supply and consumption (direct and indirect)		0: Short term (most in 2 years for all subsidies and tax exemptions) or no subsidies -2: Medium term / no all subsidies and tax exemptions -4: >50% of energy price	Inverse factor of incentive	22

Renewables

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Are policies in place that effectively lead to increasing the use of renewable energy in industry (support schemes, voluntary agreements, white certificates, emissions trading, energy and/or CO2 taxes)		4: Tax > 100% of energy price or leading to additional 5% in 10 year 0: No policies		23
Is there a stringent framework for sustainable biomass import?		4: Stringent regulation beyond EU RED requirements 2: Meeting EU RED requirements 0: No legislation exists		24
Barriers				
Subsidies, tax exemptions for energy intensive industry for conventional fuel supply and consumption (direct and indirect)		0: Short term (most in 2 years for all subsidies and tax exemptions) or no subsidies -2: Medium term / no all subsidies and tax exemptions -4: >50% of energy price	Inverse factor of incentive	25

Low carbon

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Incentives for coal / gas CCS development in industry		4: 10% in 2030 (elaborate further)		26
Incentives for biomass and process emission CCS development in industry		4: 10% in 2030 (elaborate further)		27

Non-energy

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Policies to reduce N2O emissions in industry		4: Reduce to 10% of historical maximum by **2020** 0: no policies	Almost all N2O emissions in industry can be abated at relatively low cost	28
Incentives to reduce fugitive CH4 emissions from oil and gas production		4: Leading to 10% of historical maximum in **2020** 0: Similar level expected in the future	Almost all fugitive CHE emissions in industry can be abated at relatively low cost	29
Decrease in landfill gas emissions, by either less landfilling or CH4 capture		4: Reduce to 10% of historical maximum by 2030 0: no policies	Mitigation options exist for all sources of emissions at relatively low cost	30
Policies to reduce F-gas emissions		4: Reduce to 10% of historical maximum by 2030 0: no policies	Mitigation options exist for all sources of emissions	31

Weighting factors

Changing Activity

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Policies that support the redesign of products to be less material intensive, long lasting, 100% recyclable	100%	100%		19

Energy Efficiency

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Schemes that lead to sufficient additional improvements in energy efficiency in industry (e.g. support schemes, voluntary agreements, white certificates, emissions trading, energy and/or CO2 taxes)	90%	90%	Most important option to reduce emissions.	20
Policies that support the demonstration of breakthrough technologies	10%	10%	Important for the long term only	21
Barriers				
Subsidies, tax exemptions for energy intensive industry for conventional fuel supply and consumption (direct and indirect)	-100%	-100%	Subsidies can have the inverse effect	22

Renewables

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Are policies in place that effectively lead to increasing the use of renewable energy in other industry (support schemes, voluntary agreements, white certificates, emissions trading, energy and/or CO2 taxes)	80%	100%	Most important option to reduce emissions.	23

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Is there a stringent framework for sustainable biomass production and import?	20%	No impact		24
Barriers				
Subsidies, tax exemptions for energy intensive industry for conventional fuel supply and consumption (direct and indirect)	-100%	-100%	Subsidies can have the inverse effect	25

Low carbon

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Incentives for coal / gas CCS development in industry	50%	100%		26
Incentives for biomass and process emission CCS development in industry	50%	100%		27

Non-energy

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Policies to reduce N2O emissions in industry	weighted by emissions	100%		28
Incentives to reduce fugitive CH4 emissions from oil and gas production	weighted by emissions	100%		29

Decrease in landfill gas emissions, by either less landfilling or CH_4 capture	weighted by emissions	100%	30
Policies to reduce F-gas emissions	weighted by emissions	100%	31

Maximum impact factors

Changing Activity

Indicator	Maximum impact factor	Unit	ID
Incentives			
Policies that support the redesign of products to be less material intensive, long lasting, 100% recyclable	0.5%	%point decrease of BAU growth rate of final energy demand	19

Energy Efficiency

Indicator	Maximum impact factor	Unit	ID
Incentives			
Schemes that lead to sufficient additional improvements in energy efficiency in industry (e.g. support schemes, voluntary agreements, white certificates, emissions trading, energy and/or CO_2 taxes)	1%	%point decrease of BAU growth rate of final energy demand	20
Policies that support the demonstration of breakthrough technologies	*Included above*		21
Barriers			
Subsidies, tax exemptions for energy intensive industry for conventional fuel supply and consumption (direct and indirect)	*Included above*		22

Renewables

Indicator	Maximum impact factor	Unit	ID
Incentives			
Are policies in place that effectively lead to increasing the use of renewable energy in other industry (support schemes, voluntary agreements, white certificates, emissions trading, energy and/or CO2 taxes)	1%	%point increase p.a. of final consumption in base year, applied to the actual year's total consumption	23
Is there a stringent framework for sustainable biomass production and import?	*Included above*		24
Barriers			
Subsidies, tax exemptions for energy intensive industry for conventional fuel supply and consumption (direct and indirect)	*Included above*		25

Low carbon

Indicator	Maximum impact factor	Unit	ID
Incentives			
Incentives for coal / gas CCS development in industry	1	Impact directly used for calculations	26
Incentives for biomass and process emission CCS development in industry	1	Impact directly used for calculations	27

Non-energy

Indicator	Maximum impact factor	Unit	ID
Incentives			
Policies to reduce N2O emissions in industry	1	Impact directly used for calculations	28
Incentives to reduce fugitive CH4 emissions from oil and gas production	1	Impact directly used for calculations	29
Decrease in landfill gas emissions, by either less landfilling or CH4 capture	1	Impact directly used for calculations	30
Policies to reduce F-gas emissions	1	Impact directly used for calculations	31

Emissions pathways

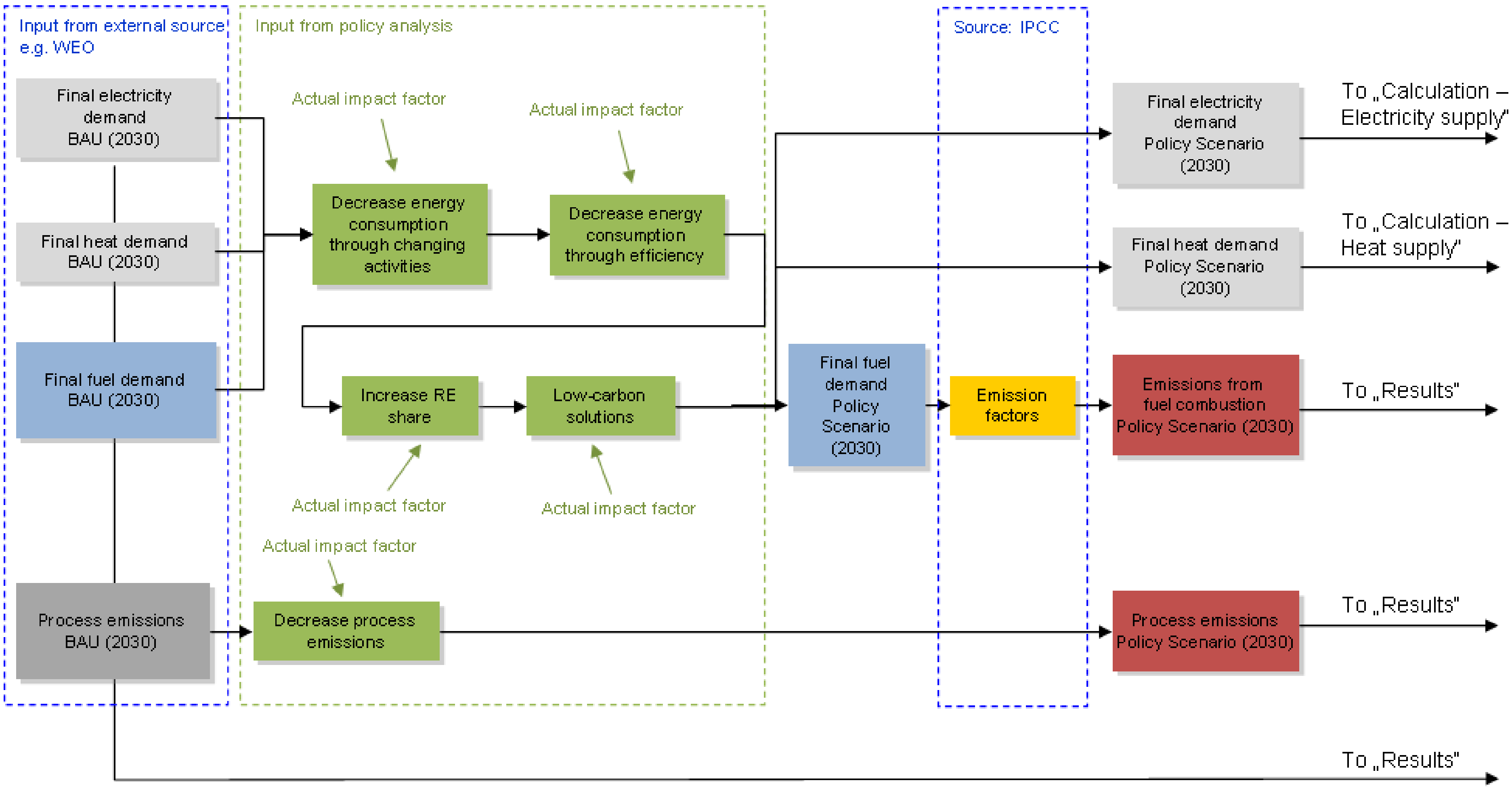

Figure 11 Flow chart emission pathway industry

Calculation method BAU

Input data for the industry sector are historic and projected electricity, heat and fuel demand data as well as historic and projected process (non-energy) emissions.

We calculated the BAU-scenario as described in chapter 2.3.1.

Calculation method policy scenario

The following table shows the different segments within the calculation for the implementation of policies in the industrial sector. The indication shows if we used the "default" approach explained in chapter 2.3 or a different approach or if the default approached needed to be adapted for a certain purpose.

Segment	Approach
Changing activity	Default
Energy efficiency	Default
Renewable Energy	Default
Low-Carbon - Fuel switch oil to gas, oil to electricity	Default
Non-energy	Default

There are no additional sector specific assumptions.

6.4 BUILDINGS

Policy evaluation

Indicators and benchmarks

Changing Activity

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Urbanisation policy that leads to energy efficient development		4: comprehensive, ambitious and implemented 0: no policies	Only consider this if relevant	32

Energy efficiency

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Sufficient incentive (regulation, support and information) for use of efficient appliances, including air conditioning		4: 1-2% per year 0: No incentive Method: fraction of appliance coverd and strincency of the standards (Japanese Top runner or ecodesign directive). If air conditioning is a major consumer, then buidling standards need to be considered)		33
Level of energy and/or CO2 taxes (applicable to electricity users in buildings)		4: tax is > 100% of energy price 0: no tax	Influencing day to day behaviour (not purchase of equipment)	34
Ambitious efficiency standards for new buildings for all types of buildings		4: zero energy buildings by 2020 0: No standards for new buildings	Necessary to reach very low levels by 2050 with turnoverrate	35

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Sufficient incentive for high retrofit rates for all types of existing buildings (for complete retrofit, i.e. full building envelope & upgrade supply system)		4: > 3% per year (average 2010-2020) and >2% afterwards 0: < 1 % per year	Necessary to rennovate all buildings by 2050	36
Policy for efficiency improvement for other than heating fuel uses (cooking, hot water use)		4: > 3% per year (average 2010-2020) and >2% afterwards 0: < 1 % per year		37
Level of energy and/or CO2 taxes (applicable to fuel users in buildings)		4: tax is > 100% of energy price 0: no tax	Influencing day to day behaviour (not purchase of equipment)	38
Barriers				
Subsidies, tax exemptions for electricity use in buildings (direct and indirect)		0: short term (most in 2 years for all subsidies and tax exemptions) or no subsidies -2: medium term / no all subsidies and tax exemptions -4: >50% of energy price	Inverse factor of incentive	39
Subsidies, tax exemptions for fuel use in buildings (direct and indirect)		0: short term (most in 2 years for all subsidies and tax exemptions) or no subsidies -2: medium term / no all subsidies and tax exemptions -4: >50% of energy price	Inverse factor of incentive	40
Solutions to the landlord tenant problem. E.g. regulation that allows costs for retrofitting of buildings to be included in the rent or be covered in contracting.		0: comprehensive, ambitious and implemented or not a barrier -4: no policies		41
Proper implementation and enforcement of new buildings standards		0: Regulation fully enforced with substantial penalties -2: Weak enforcement -4: no enforcement		42

Renewables

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Policy instrument on use of sustainable renewable heating/cooling in new buildings and existing buildings in place for all types of buildings,		4: comprehensive, ambitious and implemented allowing for an increase of min. 10% until 2020 0: no policies	PV is counted under electricity generation	43
Cooking and hot water supply with sustainable renewable fuels		4: comprehensive, ambitious and implemented allowing for an increase of min. 10% until 2020 0: no policies	Could be that policies are not split with RE cooling, but impact depends upon share in energy use	44
Level of energy and/or CO2 taxes (applicable to fuel users in buildings)		4: tax is > 100% of energy price 0: no tax	Influencing day to day behaviour (not purchase of equipment)	45
Is there a stringent framework for sustainable biomass import?		4: Stringent regulation beyond EU RED requirements 2: Meeting EU RED requirements 0: No legislation exists		46
Barriers				
Solutions to the landlord tenant problem. E.g. regulation that allows costs for retrofitting of buildings to be included in the rent or be covered in contracting.		0: comprehensive, ambitious and implemented or not a barrier -4: no policies		47

Low carbon

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Support for switching from oil/ coal to gas as heating/ cooking/ hot water use fuel		4: All fossil heating/cooking/hot water is gas in 2025 0: no policies	Gas technology is available and can be fully replaced in 15 years (average lifetime)	48

Weighting factors

Changing Activity

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Urbanisation policy that leads to energy efficient development	100%	100%		32

Energy efficiency

Indicator	Weighting factors long term	Weighting factor 2030 emissions	Rational for weighting factors	ID
Incentives				
Sufficient incentive (regulation, support and information) for use of efficient appliances, including air conditioning	40%	80%	Incentive to buy efficient application is leading (compared to incentives to operate equipment less)	33
Level of energy and/or CO2 taxes (applicable to electricity users in buildings)	10%	20%	Additional Incentive operate equipment less	34
Ambitious efficiency standards for new buildings for all types of buildings	20%	100%	Country specific	35
34Sufficient incentive for high retrofit rates for all types of existing buildings (for complete retrofit, i.e. full building envelope & upgrade supply system)	20%	80%	Country specific	36
Policy for efficiency improvement for other than heating fuel uses (cooking, hot water use)	5%	80%		37
Level of energy and/or CO2 taxes (applicable to fuel users in buildings)	5%	20%		38
Barriers				
Subsidies, tax exemptions for electricity use in buildings (direct and indirect)	-5%	-20%		39
Subsidies, tax exemptions for fuel use in buildings (direct and indirect)	-5%	-20%		40
Solutions to the landlord tenant problem. E.g. regulation that allows costs for retrofitting of buildings to be included in the rent or be covered in contracting.	-5%	-20%		41
Proper implementation and enforcement of new buildings standards	-10%	-50%		42

Renewables

Indicator	Weighting factors long term	Weighting factor 2030 emissions	Rational for weighting factors	ID
Incentives				
Policy instrument on use of renewable heating/cooling in new buildings and existing buildings in place for all types of buildings,	40%	90%		43
Cooking and hot water supply with sustainable renewable fuels	40%	90%		44
Level of energy and/or CO2 taxes (applicable to fuel users in buildings)	10%	10%		45
Is there a stringent framework for sustainable biomass production and import?	10%	No impact		46
Barriers				
Solutions to the landlord tenant problem. E.g. regulation that allows costs for retrofitting of buildings to be included in the rent or be covered in contracting.	-20%	-20%		47

Low carbon

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Support for switching from oil/ coal to gas as heating/ cooking/ hot water use fuel	100%	100%		48

Maximum impact factors

Changing Activity

Indicator	Maximum impact factors	Unit	ID
Incentives			
Urbanisation policy that leads to energy efficient development	0.5%	% point decrease BAU growth rate of final energy demand	32

Energy efficiency

Indicator	Maximum impact factors	Unit	ID
Incentives			
Sufficient incentive (regulation, support and information) for use of efficient appliances, including air conditioning	1.5%	% point decrease of growth rate of final energy demand	33
Level of energy and/or CO2 taxes (applicable to electricity users in buildings)	*Included above*		34
Ambitious efficiency standards for new buildings for all types of buildings	1	Impact directly used for calculations	35
34Sufficient incentive for high retrofit rates for all types of existing buildings (for complete retrofit, i.e. full building envelope & upgrade supply system)	2.4%	% decrease of final energy demand for space conditioning old buildings relative to base year	36
Policy for efficiency improvement for other than heating fuel uses (cooking, hot water use)	3.0%	% point decrease of growth rate of final energy demand	37
Level of energy and/or CO2 taxes (applicable to fuel users in buildings)	*Included above*		38
Barriers			
Subsidies, tax exemptions for electricity use in buildings (direct and indirect)	*Included in each of the above*		39
Subsidies, tax exemptions for fuel use in buildings (direct and indirect)	*Included in each of the above*		40
Solutions to the landlord tenant problem. E.g. regulation that allows costs for retrofitting of buildings to be included in the rent or be covered in contracting.	*Included in each of the above*		41
Proper implementation and enforcement of new buildings standards	*Included in each of the above*		42

Renewables

Indicator	Maximum impact factors	Unit	ID
Incentives			
Policy instrument on use of renewable heating/cooling in new buildings and existing buildings in place for all types of buildings,	1%	% decrease of final electricity demand and increase of RE demand	43
Cooking and hot water supply with sustainable renewable fuels	1%	%point increase p.a. of final consumption in base year, applied to the actual year's total consumption	44
Level of energy and/or CO2 taxes (applicable to fuel users in buildings)	*Included above*		45
Is there a stringent framework for sustainable biomass production and import?	*Included above*		46
Barriers			
Solutions to the landlord tenant problem. E.g. regulation that allows costs for retrofitting of buildings to be included in the rent or be covered in contracting.	*Included in each of the above*		47

Low carbon

Indicator	Maximum impact factors	Unit	ID
Incentives			
Support for switching from oil/ coal to gas as heating/ cooking/ hot water use fuel	1	Impact directly used for calculations	48

Emissions pathways

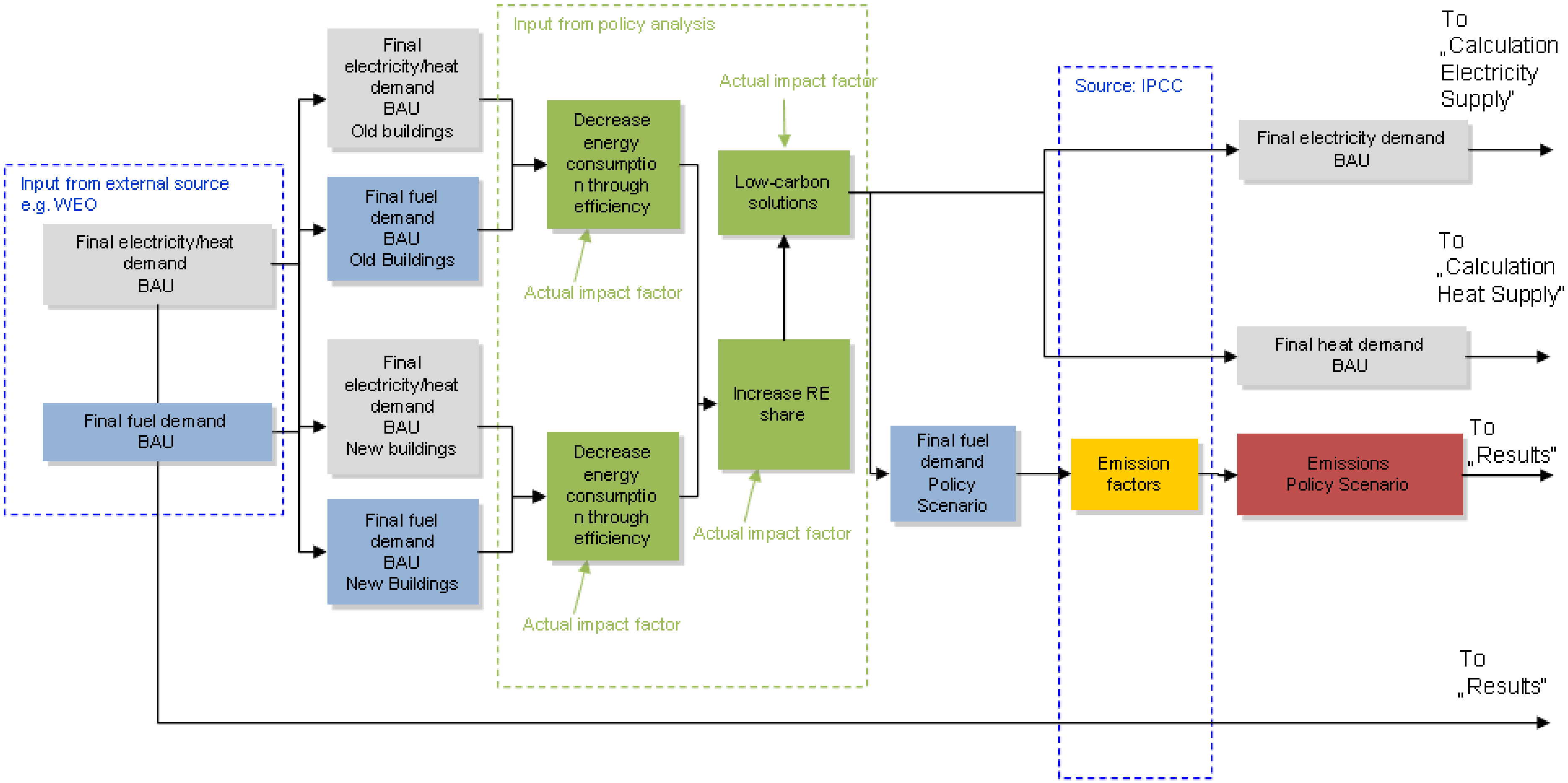

Figure 12 **Flow chart emission pathway buildings**

Calculation method BAU

Input data for the buildings sector are historic and projected electricity, heat and fuel demand data. In the case of using IEA data, we included the sectors "residential sector" and "commercial sector" within the buildings.

As old and new buildings are affected differently by certain policies, we split up the building stock: An autonomous demolition and energy efficiency rate is assumed for old buildings. Accordingly, we decrease the old buildings' energy consumption. The difference to the total energy consumption given by the projections we then assign to the "new buildings stock". Furthermore, the energy consumption is divided into different appliances according to country studies: Space conditioning (electricity), space conditioning (fuels), fuel appliances and electric appliances.

We implemented the following assumptions:

- Demolition rate + autonomous efficiency improvements in old buildings exists → Linear decrease
- Distribution of energy demand for different appliances in the building sector stays the same in the future
- No nuclear energy consumed in buildings

Calculation method policy scenario

The following table shows the different segments within the calculation for the implementation of policies in the building sector. The second column shows if we used the "default" approach explained in chapter 2.3 or a different approach or if the default approached needed to be adapted for a certain purpose.

Segment	Approach
Changing activity	Default
Energy efficiency	Default (separately for space conditioning old buildings, space conditioning new buildings, fuel appliances, electric appliances)
Renewable Energy	Default for fuel appliances. For space conditioning with electricity: we apply a conversion factor on decreased electricity and increased (renewable) fuel consumption
Low-Carbon - Fuel switch oil to gas, oil to electricity	Default
Non-energy	Default

The sector specific assumptions we took for policy implementation in the building sector are:

- Same efficiency for gas and oil combustion (→ Fuel switch)

- Changing activity (urban planning) influences old and new buildings

New and old buildings are affected in the same way by RE policies and efficiency improvements for appliances, but differently by improvements of building standards and air conditioning.

6.5 TRANSPORT

Policy evaluation

Indicators and benchmarks

Changing Activity

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Strategies to avoid traffic and to move to non-motorised transport	Strategies include amongst others: - urban planning (short distances to work and shopping) - traffic management systems to prevent traffic jams - route optimization tools for freight - promotion of walking and biking - investment in infrastructure for bik	4: 4% of emissions from passenger and freight transport is avoided or moved to non-motorised transport in 2020	Mitigation potential based on detailed study from Öko Insititute	49
Strategies for modal shift to low carbon transport modes (public transport, freight rail, freight ships)	Strategies include amongst others: - investment in public transport infrastructure (railway lines, trains, buses, bus lanes) - increasing frequency of public transport/ improvement of coverage (esp. bus lines) - pricing/other incentives for low carbon mod	4: investment planned for a 8% increase in capacity of carbon efficient modes of transport by 2020 0: stagnation or negative development	Mitigation potential based on detailed study from Öko Institute	50
Level of energy and/or CO2 taxes for transport fuels		4: tax is increased by 100% of energy price by 2020 0: no tax	Impact on emissions is detemined by the relative value of the tax, not absolute tax levels. Price elasticity of fuel is low, therefore the price incentive through the tax needs to be large to create an effect.	51
Barriers				
Fiscal or other incentives which promote	Barriers include:	0: no negative incentives		52

higher fuel use in transport (buy more cars, bigger cars or drive/fly more)	- subsidies/tax breaks on company cars - subsidies/tax breaks on commuting by car - car taxation that is not linked to emissions (in cases where this leads to bigger cars being favoured) - subsidies/tax breaks for airlines, flight kerosi	-4: strong incentives in various areas		

Energy Efficiency

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Incentives to reduce light vehicle emissions per kilometre	Incentives include: - regulation on maximum emissions for new cars - tax incentives - investment in research & development - voluntary agreements with car producers	4: trajectory to reach 95g/km in 2020 for new cars 1: implementation of EU directive (140g/km) for new cars	value based on EU regulation; applied globally for 2020; impact factor assumes a 30% reduction from current average of new cars applied as wedge 2010 to 2020. 10% results from fuel switch (biofuels), leaving 20% improvement for energy efficiency	53
Incentives to reduce heavy vehicle emissions per kilometre	Incentives include: - regulation on maximum emissions for new trucks - tax incentives - investment in research & development - voluntary agreements with truck producers	4: incentives to reduce specific emissions by 25% in 2020 0: no policies in place	Technically feasible	54
Level of energy and/or CO2 taxes for transport fuels		4: tax is increased by 100% of energy price by 2020 0: no tax	Impact on emissions is detemined by the relative value of the tax, not absolute tax levels. Price elasticity of fuel is low, therefore the price incentive through the tax needs	55

			to be large to create an effect.	

Renewables

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Sufficient incentives to increase renewable energy sources in transport (biofuels)	Incentives include: - regulation on minimum use of biofuels - tax incentives - information campaigns	10% until 2020	Most countries start at 0% biofuels in transport, 10% share in 2020 is realistic . Country that already have a higher share (e.g. Brazil) continue with BAU.	56
Is there a stringent framework for sustainable biomass import?		4: Stringent regulation beyond EU RED requirements 2: Meeting EU RED requirements 0: No legislation exists		57

Low Carbon

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Support for fuel switch from oil to natural gas or other low carbon technologies	Incentives include: - investment in infrastructure for gas mobility - tax incentives - information campaigns	4: facilitating 3% gas/low carbon vehicles in 2020 0: no plans	Switch to gas has short term effect on emsisions, but is not in line with long term sustainable development. Emission effects of other low carbon technologies are approximated using emission savings from gas.	58

Incentives for electric mobility	Incentives include: - investment in infrastructure for electric mobility - investment in research & development - cooperation agreements with producers of cars, batteries, etc. - tax incentives - information campaigns	4: facilitating 3% electric cars in 2020 0: no plans	Most ambitious targets by developed countries (e.g. France)	59

Weighting factors

Changing Activity

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Strategies to avoid traffic and to move to non-motorised transport (bike, walking)	40%	40%		49
Strategies for modal shift to low carbon transport modes (public transport - trains and buses, freight rail, freight ships)	30%	30%		50
Level of energy and/or CO2 taxes for transport fuels	30%	30%		51
Barriers				
Fiscal or other incentives which promote higher fuel use in transport (buy more cars, bigger cars or drive/fly more)	-30%	-30%		52

Energy Efficiency

Indicator	Weighting factors long	Weighting factors for	Rational for weighting factors	ID

	term	2030 emissions		
Incentives				
Level of incentive to reduce light vehicle emissions per kilometre (fuels only, not electricity)	60%	60%		53
Level of incentive to reduce heavy vehicle emissions per kilometre	20%	20%		54
Level of energy and/or CO2 taxes for transport fuels	20%	20%		55

Renewables

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Sufficient incentives to increase renewable energy sources in transport (biofuels)	80%	100%		56
Is there a stringent framework for sustainable biomass production and import?	20%	No impact		57

Low carbon

Indicator	Weighting factors long term	Weighting factors for 2030 emissions	Rational for weighting factors	ID
Incentives				
Support for fuel switch from oil to natural gas or other low carbon technologies	No impact	100%		58
Incentives for electric mobility	100%	100%		59

Maximum impact factors

Changing Activity

Indicator	Maximum impact factor	Unit	ID
Incentives			
Strategies to avoid traffic and to move to non-motorised transport (bike, walking)	0.8%	%point decrease of growth rate of final energy demand	49
Strategies for modal shift to low carbon transport modes (public transport - trains and buses, freight rail, freight ships)	Included above		50
Level of energy and/or CO_2 taxes for transport fuels	Included above		51
Barriers			
Fiscal or other incentives which promote higher fuel use in transport (buy more cars, bigger cars or drive/fly more)	Included above		52

Energy Efficiency

Indicator	Maximum impact factor	Unit	ID
Incentives			
Level of incentive to reduce light vehicle emissions per kilometre (fuels only, not electricity)	0.8%	% decrease of growth rate of final energy demand fuels	53
Level of incentive to reduce heavy vehicle emissions per kilometre	Included above		54
Level of energy and/or CO_2 taxes for transport fuels	Included above		55

Renewables

Indicator	Maximum impact factor	Unit	ID
Incentives			
Sufficient incentives to increase renewable energy sources in transport (biofuels)	1	Impact directly used for calculations	56
Is there a stringent framework for sustainable biomass production and import?	Included above		57

Low carbon

Indicator	Maximum impact factor	Unit	ID
Incentives			
Support for fuel switch from oil to natural gas or other low carbon technologies	1	Impact directly used for calculations	58
Incentives for electric mobility	1	Impact directly used for calculations	59

Emissions pathways

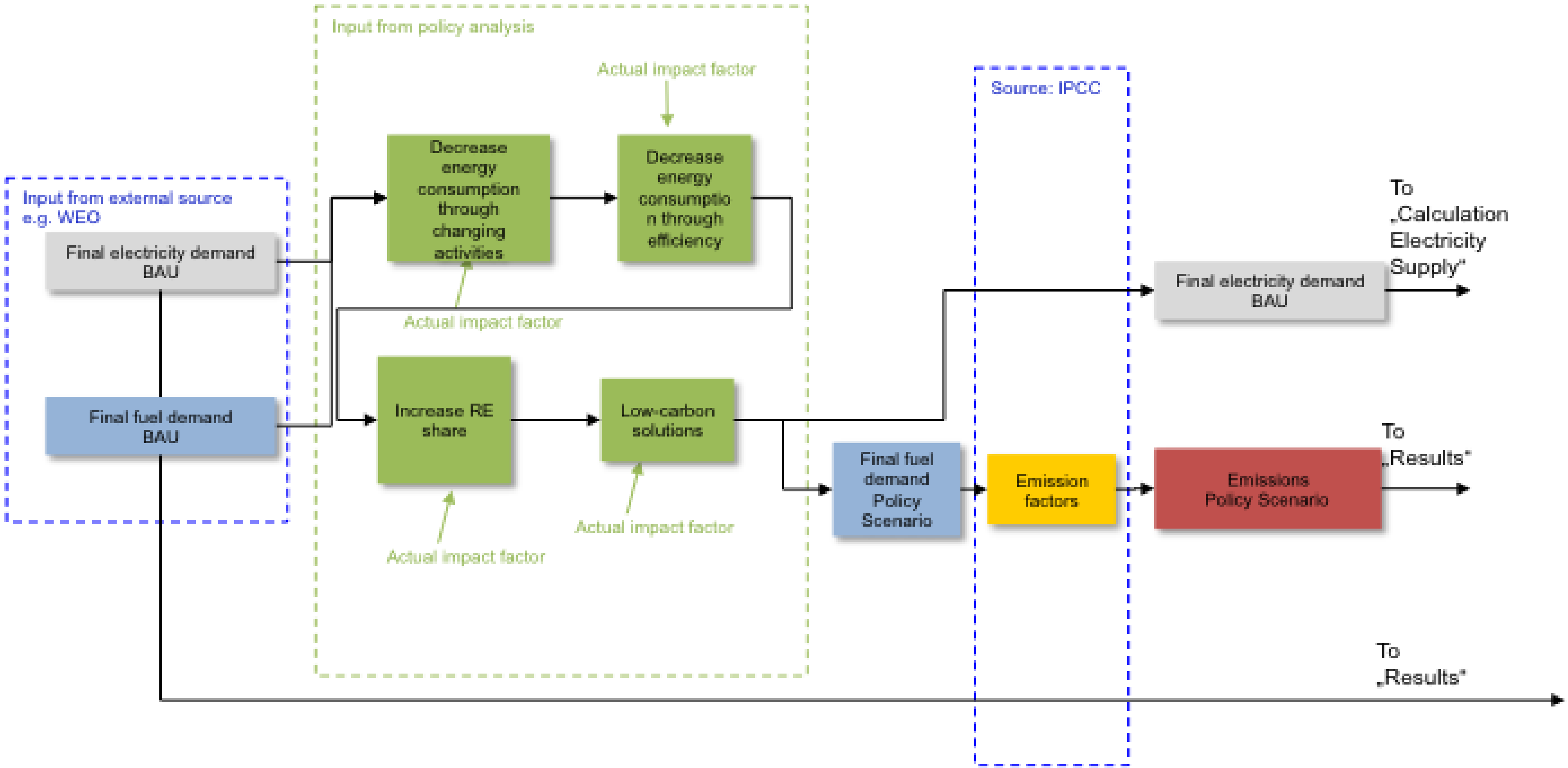

Figure 13 Flow chart emission pathway transport

Calculation method BAU

Input data for the transport sector are historic and projected electricity and fuel demand data for the regular transport sector but also for the agricultural sector, as we assumed that the energy use in agriculture is mainly for transport and that this is therefore influenced rather by transport policies than by AFOLU policies. Apart from that, we calculated the BAU-scenario as described in chapter 2.3.1.

Calculation method policy scenario

The following table shows the different segments within the calculation for the implementation of policies in the transport sector. The second column shows if we used the "default" approach explained in chapter 2.3 or a different approach or if the default approached needed to be adapted for a certain purpose.

Segment	Approach
Changing activity	Default
Energy efficiency	Default
Renewable Energy	Default
Low-Carbon - Fuel switch oil to gas, oil to electricity	Default, but with conversion factor applied to decreased oil and increased gas/electricity consumption
Non-energy	Default

The sector specific assumptions we took for policy implementation in the transport sector are:

- efficiency of fuel driven cars: 25 %
- efficiency of gas driven cars: 40 %
- efficiency of electricity driven cars: 80 %
- increase in renewable energy carriers is completely absorbed by biomass

6.6 AFOLU

Policy evaluation

Indicators and benchmarks

Changing Activity

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Activities to promote sustainable consumption practices (including labelling, information programs, etc.) are supported		4: targeted measures with the potential to reach 100% of the population, with sufficient funding allocated and including a variety of measures (labelling, information campaigns, etc.) is operational 3: targeted measures with the potential to reach 80% of the population, with sufficient funding allocated and including a variety of measures (labelling, information campaigns, etc.) is operational 2: measures with the potential to reach 60% of the population, with sufficient funding allocated and including only selected measures is operational 1: measures with the potential to reach less than 60% of the population, or with insufficient funding allocated is operational 0: no activities are supported		60
Consistent land use strategy exists (including a strategy for forest management planning), minimizing emissions from land use change (under the given national circumstances), promoting stabilization or increase of forest, wetland and protected areas	includes all gases including: - general spacial planning for agricultural and all other uses - afforestation - reforestation - prevention of deforestation - prevention of wetland drainage - wetland rehab	4: a consistent land use strategy exists that includes all land uses, has a long term perspective, includes adaptation requirements and considers interrelations between uses 3: a consistent strategy covers all major land uses for the country, has a medium to long term perspective, includes adaptation requirements and/or considers interrelations between uses 2: a consistent strategy covers only selected land uses, and/or has a short to medium term perspective, and/or does not include adaptation requirements, interrelations between uses and/or emissions from land use change 1: strategy exists only on selected land uses and/or strategy is not consistent 0: no land use strategy exists		61

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Policy tools are in place to secure implementation of strategy	measures: afforestation reforestation prevention of deforrestation prevention of wetland drainage wetland rehab Gases: mainly CO2 and N2O	4: policies covering all aspects of the strategy are implemented 3: policies covering most aspects of the strategy are implemented 2: policies covering only few aspects of the strategy are implemented 1: policies to implement the strategy are available but not yet implemented 0: no policy tools exist		62
Barriers				
Land use plan/register including a detailed forest inventory and protected areas exist		0: register classified by different land use types (min.: managed forest, unmanaged forest, cropland, grassland, wetlands, protected areas, other use) exists in form of data and maps, covers the whole country and is updated at least every 4 years -1: register classified by different land use types (min see above), and protected areas exists in some form, covers more then 70% of the country area and is updated at least every 10 years -2: register exists for some land uses and more than 40% of the country area -3: register exists for at least one land use type and the whole country or for some land use types and less than 40% of the country area -4: register not existent or only for parts of land uses and not organized	63	

Non-energy

Indicator	Additional information	Benchmark	Rational for benchmark	ID
Incentives				
Agriculture: Livestock, CH4 and N2O emissions	Measures that reduce enteric fermentation of livestock are promoted (e.g. improved feeding practices, use of specific agents and dietary additives, implementation of long-term management changes and animal breeding programs) Measures that lead to improved manure management are promoted (e.g. improved storage and handling, anaerobic digestion, etc.)	4: reduce emissions 3.2% below BAU in 2030 3: reduce emission 2.4% below BAU in 2030 2: reduce emissions 1.6% below BAU in 2030 1: reduce emissions 0.8% below BAU in 2030 0: no measures implemented	4.6% is 100% of the global technical mitigation potential for this activity 3.2% is 70% of the global mitigation potential	64
Agriculture: Cropland and organic/peaty soils, all non-CO2 emissions (including rice production)	Measures that lead to improved cropland management are promoted, including, among others, improved agronomic practices, tillage/residue management, water managment, rice management, set-asides, etc.	4: reduce emissions 5.1% below BAU in 2030 3: reduce emissions 3.8% below BAU in 2030 2: reduce emissions 2.5% below BAU in 2030 1: reduce emissions 1,2% below BAU in 2030 0: no measures implemented	7.3% is 100% of the global technical mitigation potential for this activity 5.1% is 70% of the mitigation potential	65
Agriculture: Cropland, CO2	Measures that lead to improved cropland management are promoted, including, among others, improved agronomic practices, tillage/residue management, agroforestry, set-asides, etc.	4: measures implemented on 100% of the area available for this purpose by 2030 3: measures implemented on 75% of the area available for this purpose by 2030 2: measures implemented on 50% of the area availabe for this purpose by 2030 1: measures implemented on 25% of the area available for this purpose by 2030 0: no measures in place/ no A/R achieved	Assumption: 70% of the available cropland area could be managed with new measures	70
Agriculture: Grassland, all non-CO2 emissions	Measures that lead to improved grazing management are promoted, including,	4: reduce emissions 7% below BAU in 2030 0: no measures implemented	7% is 70% of the global	66

Indicator	Additional information	Benchmark	Rational for benchmark	ID
	among others, improved grazing intensity, increased productivity, nutrient management, fire management, species introduction, etc		technical mitigation potential for this activity	
Agriculture: Grassland, CO_2		4: measures implemented on 100% of the area available for this purpose by 2030 3: measures implemented on 75% of the area available for this purpose by 2030 2: measures implemented on 50% of the area availabe for this purpose by 2030 1: measures implemented on 25% of the area available for this purpose by 2030 0: no measures in place/ no A/R achieved	Assumption: 70% of the available grassland area could be managed with new measures	71
Forestry: Deforestation	Measures of REDD+ are supported, including avoided deforestation, avoided forest degradation, improved forest management and enhancemet of forest carbon stocks	4: reduce emissions 34% below BAU in 2030 0: no measures in place/ no reduction of deforestation achieved	38 Mt CO_2e is maximum technical potential (based on 2006/07) Queensland deforestation 34% below BAU is 70% of technical maximum	68
Forestry: The conversion of non-forest land to forests is promoted through afforestation and reforestation (A/R)		4: measure leading to A/R on 100% of the area available for this purpose by 2030 3: measures leading to A/R on 75% of the area available for this purpose by 2030 2: measures leading to A/R on 50% of the area availabe for this purpose by 2030 1: measures leading to A/R on 25% of the area available for this purpose by 2030 0: no measures in place/ no A/R achieved		69

Weighting factors

Changing Activity

Indicator	Weighting factors long term	Weighting factor 2030 emissions	Rational for weighting factors	ID
Incentives				
Activities to promote sustainable consumption practices (including labelling, information programs, etc.) are supported	20%	20%		60
Consistent land use strategy exists (including a strategy for forest management planning), minimizing emissions from land use change (under the given national circumstances)	65%	65%	the strategy as such has no impact unless there are policies that implement the strategy (see indicator 55)	61
Policy tools are in place to secure implementation of strategy	15%	15%		62
Barriers				
Land use plan/register including a detailed forest inventory and protected areas exist	-25%	-25%		63

Non-energy

Indicator	Weighting factors long term	Weighting factor 2030 emissions	Rational for weighting factors	ID
Incentives				
Agriculture: Livestock, CH4 and N2O emissions	20%	100%		64

Agriculture: Cropland and organic/peaty soils, all non-CO2 emissions (including rice production)	10%	100%	65
Agriculture: Cropland, CO2	10%	100%	70
Agriculture: Grassland, all non-CO2 emissions	10%	100%	66
Agriculture: Grassland, CO2	10%	100%	71
Forestry: Deforestation	20%	100%	68
Forestry: The conversion of non-forest land to forests is promoted through afforestation and reforestation (A/R)	20%	100%	69

Maximum impact factors

Changing Activity

Indicator	Maximum impact factor	Unit	ID
Incentives			
Activities to promote sustainable consumption practices (including labelling, information programs, etc.) are supported	0.1%	%point reduction of growth rate of emissions	60
Consistent land use strategy exists (including a strategy for forest management planning), minimizing emissions from land use change (under the given national circumstances)	Included above		61
Policy tools are in place to secure implementation of strategy	Included above		62
Barriers			
Land use plan/register including a	Included above		63

Indicator	Maximum impact factor	Unit	ID
detailed forest inventory and protected areas exist			

Non-energy

Indicator	Maximum impact factor	Unit	ID
Incentives			
Agriculture: Livestock, CH4 and N2O emissions	3.2%	Reduction below BAU in 2030	64
Agriculture: Cropland and organic/peaty soils, all non-CO2 emissions (including rice production)	5.1%	Reduction below BAU in 2030	65
Agriculture: Cropland, CO2	1	Impact directly used for calculations	70
Agriculture: Grassland, all non-CO2 emissions	7.0%	Reduction below BAU in 2030	66
Agriculture: Grassland, CO2	1	Impact directly used for calculations	71
Forestry: Deforestation	34%	Reduction below BAU in 2030	68
Forestry: The conversion of non-forest land to forests is promoted through afforestation and reforestation (A/R)	1	Impact directly used for calculations	69

Emissions pathways

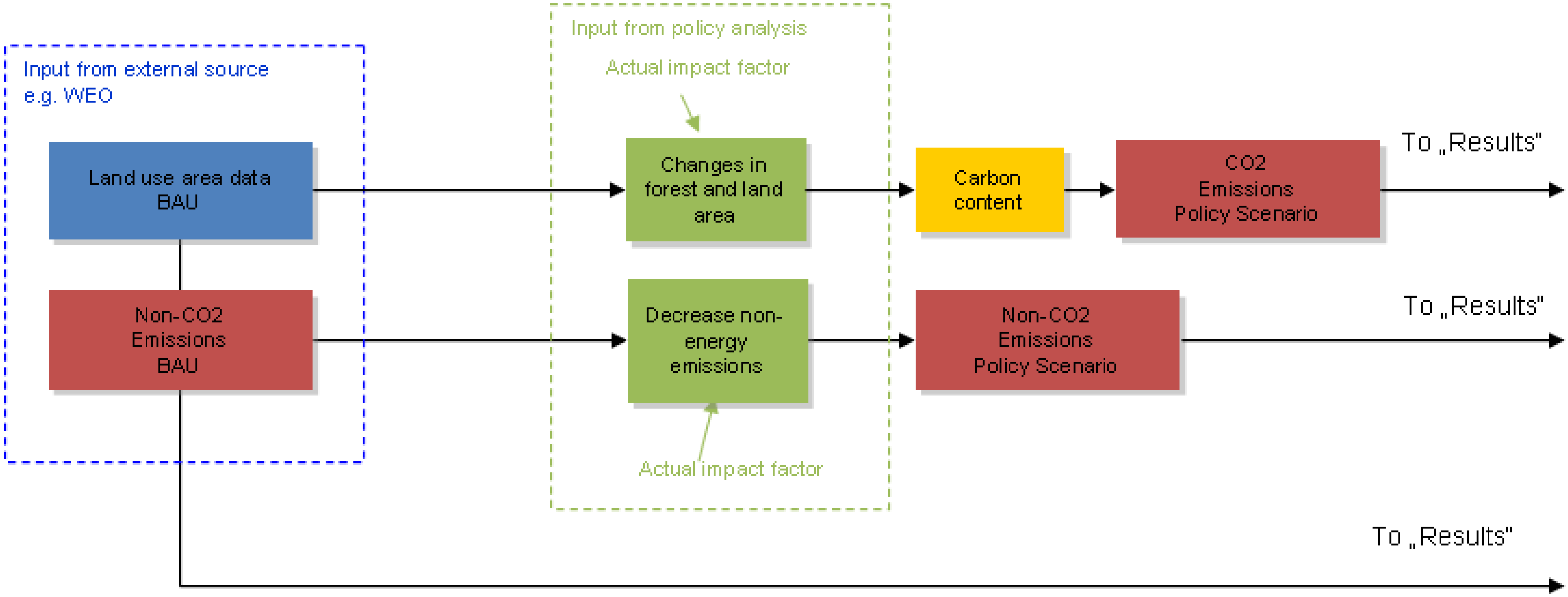

Figure 14 **Flow chart emission pathway AFOLU**

Calculation method BAU

Input data for the AFOLU sector are historic and projected non-CO2 emission data from the agricultural sector and land area for deforestation, afforestation and grasslands combined with factors for carbon content. The carbon content varies by land type and geographic location according to IPCC Guidelines for National GHG Inventories (V4 Agriculture, Forestry and other Land Use) and can be modified in the data input sheet.

We assumed that the energy use in agriculture is mainly for transport and that this is therefore influenced rather by transport policies than by AFOLU policies.

Non-CO2 emissions are projected according to external data. CO2 emissions from de- and afforestation and from grasslands are assumed to develop according to the historic (1990 until base year) trend.

Calculation method policy scenario

The following table shows the different segments within the calculation for the implementation of policies in the AFOLU sector. The second column shows if we used the “default” approach explained in chapter 2.3 or a different approach or if the default approached needed to be adapted for a certain purpose.

Segment	Approach
Changing activity	Default
Energy efficiency	Not relevant
Renewable Energy	Not relevant
Low-Carbon - Fuel switch oil to gas, oil to electricity	Not relevant
Non-energy	Default

There are no further sector specific assumptions.