Supplementary Information: Part C

A Global Roll-out of Nationally Relevant Policies Bridges the Emissions Gap

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COMMIT WP2&3 Scenarios for ratcheting up mitigation ambition

Protocol fourth round – 20 April 2020

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# ****Introduction****

**In response to the global stocktake under the UNFCCC, scenarios will be developed that represent a ratcheted up mitigation ambition level by Parties to the Paris agreement (hereafter: countries). The scenario suite described here consists of the following scenarios:**

* **baseline,**
* **current policy,**
* **nationally determined contribution (NDC),**
* **good practice policies,**
* **bridging, and**
* **2 ˚C mitigation scenarios.**

**The good practice policies and bridging scenarios, which aim to bridge the gap between the ambition levels set out by countries and the required ambition levels to meet the mitigation goals agreed to in the Paris Agreement, are new, and most important. All other scenarios are added for comparison – and could be taken from earlier modelling exercises (although we require consistent model versions).**

# ****Workflow and submission deadlines****

Protocol development and scenario submission will take place in two rounds.

In **Round 1**, the national modelling teams got an opportunity to respond to the proposed policies as mentioned in the draft bridging scenario protocol (attached spreadsheet). PBL/PIK/COPPE gathered all comments and used them to construct the final bridging scenario protocol.

In **Round 2**, the final bridging scenario protocol will be distributed to both the national and global modelling teams. This will ensure that a common protocol is followed.

Please use [this](https://db1.ene.iiasa.ac.at/COMMITDB/static/download/COMMIT_akaCD-LINKS_fasttrack_template_SD_20180816.xlsx) reporting template.

# Brief description of the scenarios

In line with the global stocktake, the ratcheting up mechanism has been applied in constructing the scenario protocol. This means that the scenarios build upon one another in terms of ambition and modelling assumptions. The Baseline scenario is the least ambitious and the 2 ˚C scenario is the most ambitious.

Table 1. Scenario descriptions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Scenario name | Scenario id | Builds upon | Novelty | National model implementation | Global model implementation |
| Baseline | BAU | None | None | Most likely socio-economic assumptions with no new climate policies after 2010 | SSP2 scenario with no new climate policies after 2010 |
| Current policy | CurPol | BAU | Possible update (new information available; old runs can be used) | As BAU scenario, but including implementation of current policies (cut-off date 1 July 2019) | As BAU scenario, but including climate policies based on CD-LINKS/NewClimate/PBL policy database (cut-off date 1 July 2019) |
| NDC-plus | NDCplus*Optional variants:**NDC\_2050convergence (global models)**NDCMCS (national models)* | CurPol | Update | As CurPol scenario including implementation of NDC until 2030, following the post-2030 extension guidelines thereafter  | As CurPol scenario including implementation of NDCs, following the post-2030 extension guidelines thereafter |
| Good practice policies | GPP | CurPol | New | As CurPol scenario, including implementation of commonly defined good practice policies until 2050 – taking the value either for developed or for developing countries, and taking the more stringent of the CurPol and GPP values | As CurPol scenario, including implementation of commonly defined good practice policies until 2050 - distinguishing between developed and developing countries, and taking the more stringent of the CurPol and GPP values |
| Bridging | Bridge | GPP | New | As GPP scenario including implementation of good practice policies until 2030 to transition to the low carbon budget scenario (2Deg2030) | As GPP scenario including good practice policies until 2030, as identified by national teams, transitioning to the 2 °C scenario (2Deg2030) |
| 2 ˚C 2020 | 2Deg2020 | CurPol | None | As CurPol with the Implementation of a CD-LINKS carbon budget from 2020 (2020\_low) | As CurPol with the implementation of a 2 ˚C / 2.6 Wm­-2 climate target from 2020, represented by the CD-LINKS carbon budget: 1000 Gt CO2 over 2011-2100, i.e. NPi2020\_1000. |
| 2 ˚C 2030 | 2Deg2030 | NDCplus | None | As NDCplus with the implementation of a CD-LINKS carbon budget from 2030 (2030\_low) | As NDCplus with the implementation of a 2 ˚C / 2.6 Wm­-2 climate target from 2030, represented by the CD-LINKS carbon budget: 1000 Gt CO2 over 2011-2100, i.e. INDC2030\_1000 |

The **Baseline (BAU)** scenario should be a middle of the road socio-economic conditions scenario (preferably SSP2) throughout the century with no additional climate policy.

The **Current policy (CurPol)** scenario assumes the same socio-economic conditions as the BAU scenario. However, it also assumes that climate, energy and land use policies that are currently ratified are implemented (cut-off date 1 July 2019). For global models, this can be based on the updated CD-LINKS protocol. A new version is attached – please refer to the spreadsheet *Input-IAM-protocol\_COMMIT\_December2019.xlsx*, tab “Protocol CurPol numerical” (note that not all tabs were updated). Note that this update is optional: also the previous current policy scenario (CD-LINKS) could be submitted if needed, if based on the same model version.

The **NDC-plus (NDCplus)** scenario builds further upon the CurPol scenario and assumes that the NDCs are implemented by 2030. After 2030, the scenario should reflect continuation (but not strengthening) of effort (see Post policy period for details). Specifically for China, please incorporate the ‘peak’ component of the NDC by ensuring that emissions do not increase above 2030 values.

*Optional, additional scenario variants:*

* ***NDC\_2050convergence*** *- for global models only. In order to explore the implications of a scenario narrative "if the 2050 MCS in all countries become similarly stringent as the NDC targets of OECD countries for 2030”, this scenario foresees a global convergence to a globally harmonized carbon price in 2050. See details under ‘Post policy period’.*
* ***NDCMCS*** *- for national models only.* *For those countries that have submitted one to the UNFCCC, the MCS target for GHG emissions is implemented by 2050.*

The **Good practice policies (GPP)** scenario builds upon the CurPol scenario and assumes that certain good practice policies as defined in the spreadsheet, which have shown to be effective in some countries, will be implemented globally until **2050. For the list of policies to be implemented, see the spreadsheet *Bridging Scenario GPP list 20 April 2020.xlsx.*** That spreadsheet also contains tabs categorising countries in low / high income or other tiers. A distinction is made between low/medium income (columns K and L of the first tab) and high income countries (columns I and J) in terms of timing and stringency (applied to all model regions). See also the fifth tab, ‘Country categorisation’, for a classification of all countries with their ISO codes: if the majority of countries in a region is classified as high income, the region can be considered high income (and vice versa for low/medium income). For some measures, we distinguish between three country tiers (columns M and N in the first tab, and see the third tab ‘7. CarbonPrice’ and ’16. Afforestation’ for the country tiers applying to these measures).

* If CurPol is more stringent than GPP in certain sectors, take that value.

The **Bridging (Bridge)** scenario builds upon the GPP scenario. For the list of policies to be implemented until 2030, see the spreadsheet *Bridging Scenario GPP list 20 April 2020.xlsx.* After 2030, the bridge scenario transitions to the 2 °C scenario (see chapter 5).

The **2˚C (2Deg2020 and 2Deg2030)** scenarios assume that a radiative forcing target of 2.6 Wm-2 is reached by 2100 in a cost-effective way. National modelling teams can work with a carbon budget derived from the global carbon budget of 1000 Gt CO2 in the period 2011-2100 (including 2011 emissions), as done in CD-LINKS (the ‘2020\_low’ budget for 2Deg 2020 and the ‘2030\_low’ budget for 2Deg 2030). Updated national carbon budget numbers for 2015-2050 are attached (*NationalCbudgetsCOMMIT.xlsx)*, including for the teams that did not participate in CD-LINKS, and distinguishing total CO2 and only CO2 from energy and industry for those models that do not represent land use. Global model teams can use the NPi2020\_1000 (2Deg2020) and INDC2030\_1000 (2Deg2030) scenarios.

# General specifications for all scenarios

## Naming

When uploading results to the IIASA database, scenario names as mentioned in the column Scenario id of Table 1 should be used with the extension of the version number, with \_V4 for this round. That means: please submit the following scenarios, regardless of whether you have submitted in previous rounds:

* BAU\_V4
* CurPol\_V4
* NDCplus\_V4
	+ *NDC\_2050convergence\_V4*
	+ *NDCMCS\_V4*
* GPP\_V4
* Bridge\_V4
* 2Deg2020\_V4
* 2Deg2030\_V4

## Time horizon

Models are requested to report five year intervals between 2000 and 2020 and 10 year intervals thereafter. Up to 2050 or 2100 based on model specifications. For models that do not have 5-year time steps, targets for e.g. 2035 should be implemented by the nearest (later) year, i.c. 2040. For base year values, use the provided 2015 value if needed.

## Post policy period

For the Current policy, NDC/MCS and Good Practice Policy scenarios, the ambition levels reached in the target year should remain at least constant throughout the rest of the century. This should be implemented by extrapolating the “equivalent” carbon price in 2030, using the GDP growth rate of regions. The equivalent carbon price represents the value of carbon that would yield in a region the same emissions reduction as the NDC policies. For most modelling teams this requires to run a set of (cost-optimal) sensitivity scenarios in order to derive the carbon price that would result in the same reductions as in the NDC cases. Importantly, if a region has a carbon price of zero while implementing the (I)NDC in 2030, please assume a minimum carbon price of 1 $/tCO2 in 2030 (= 8 $/tCO2 in 2100 with 3%/y GDP growth). If a region has a negative carbon price in 2030, offset the trajectory resulting from 1 $/tCO2 to your own 2030 starting point. For land use, a carbon price ceiling of $200/tCO2 should be applied.

*Optional, additional scenario for global models:* ***NDC\_2050convergence***

*In order to explore the implications of a scenario narrative "if the 2050 MCS in all countries become similarly stringent as the NDC targets of OECD countries for 2030”, this scenario foresees a global convergence to a globally harmonized carbon price in 2050, at the level of  the average carbon prices in OECD countries (which are increasing  from 2030 onwards with regional GDP growth rates). Exact calculation of carbon prices: Initially, regional carbon prices after 2030 are taken from the NDC scenario where they are determined by applying the regional GDP growth rate to the effective carbon price in the region in 2030. The "global" carbon price for all years > 2030 is then calculated as the GDP-weighted average carbon price of OECD regions. The regional carbon prices of all regions are then updated to converge from the effective carbon price in the region in 2030 (as in the NDC scenario) to this global level until 2050 (linear increase from regional 2030 carbon price to 2050 global carbon price). They are equal to the global trajectory for all timesteps 2050 and beyond. Only OECD regions with carbon prices higher than the "global" trajectory should stick to their original carbon price trajectory (maximum operator).*

## Regions

Apart from model specific regions, a mapping to the 5 RCP regions should be made by global models.

## Policy coverage in the model

If you are unable to implement the policy or target in the model, please adopt the provided proxy values instead. If that is not possible either, please indicate in the protocol spreadsheet which policies you were not able to capture. Proxy values are provided by IMAGE in the tab ‘Indicators’.

For global sectors such as international aviation and shipping, measure 18 is included for aviation (no distinction between countries). For shipping, take the baseline trends (as no current policies are included for that sector).

# Detailed specifications of scenarios

## Updated CD-LINKS scenarios

To a large degree, the scenarios developed in the CD-LINKS project can be used. A mapping between the scenarios can be found in Table 2. The third column indicates the novelty of the scenario. The fourth indicates the corresponding CD-LINKS protocol that can be used as reference. The table shows that, with the exception of the good practice policies / bridging and NDC-plus scenario, the protocols from CD-LINKS can be used for all scenarios. Figure 1 gives an example of what the increasing ambition emission profiles might look like.

Table 2. Scenario mapping to CD-LINKS protocol

|  |  |  |  |
| --- | --- | --- | --- |
| Scenario name | Scenario id | Novelty | Protocol (global / national models) |
| Baseline | BAU | **Update** | CD-LINKS NoPolicy / NoPOL |
| Current policy | CurPol | **Update** | CD-LINKS NPi / NPi |
| NDC-plus | NDCplus* *NDC\_2050convergence*
* *NDCMCS*
 | **Update** | New formulation (see this protocol) |
| Good practice policies | GPP | **New** | New (see spreadsheet) |
| Bridging | Bridge | **New** | New (see spreadsheet) |
| 2 ˚C 2020 | 2Deg2020 | **Update** | CD-LINKS NPi2020\_1000 / NPi2020\_low |
| 2 ˚C 2030 | 2Deg2030 | **Update** | CD-LINKS INDC2030i\_1000 / INDC2030\_low |



Figure 1. Example of emission profiles (note: the green ‘Bridge scenario’ actually represents the GPP scenario – the true Bidge scenario would be in between the green line and grey dashed line). The NDCMCS scenario is now optional (for national models) – instead, the NDCplus scenario would be more stringent than shown here.

## Good practice policies and Bridging scenarios

The list of policies to be implemented is given in the *Bridging Scenario GPP list 20 April 2020.xlsx* spreadsheet (they are based on previous studies as indicated in the sheet “underlying information”, which marks as *Kriegler*, *Fekete or* *Roelfsema).* Note that these ‘policies’ are mostly physical measures, without the policy instruments to implement them (given that those are context dependent).

By 9 September, national teams should indicate, for every entry in the spreadsheet, whether they:

1. Believe these policies would be feasible to implement in their country as stated,
2. Are able to implement an adjusted form of the policy (e.g. lower ambition, later implementation year), or
3. Are not able to implement the policy as denoted or an adjusted form of the policy.

Furthermore, teams are encouraged to add optional policies that might apply to their national circumstances. The comments and suggestions have been stored in the tab ‘Team comments’.

In the **good practice policies** scenario, the listed policies should be followed until 2030 and in many cases 2050. See ‘Post policy period’ for assumptions after the last target year.

In the **bridging** scenario, the listed policies should be followed until 2030, after which the scenario should transition smoothly to the 2 °C scenario by remaining within the carbon budget consistent with the 2 °C target (the 1000 GtCO2 for 2011-2100 for global teams / 2030\_low for national teams). This should be implemented via a carbon price: please converge from the regionally differentiated 2030 carbon prices listed in tab *7. CarbonPrice* in attached spreadsheet to a global carbon price in 2050 that is in line with the 2 °C carbon budget (in your model). If that implies the targets become infeasible, go for the latest convergence date possible that keeps the target in reach.

**The above implies that the GPP and Bridge scenarios should follow the same pathway until 2030.**