



PROJECT BRIEFING #1

# STRUCTURE OF PROJECT 1 WITHIN THE CLUSTER | NET-ZERO-2050

VERSION #2 | OCTOBER 2021

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### AUTHORS

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#### Centres involved:



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## AIM

Clarification of the work focus and the connection of the different elements of the Helmholtz Climate Initiative's Cluster I Net-Zero-2050, especially the relations within project 1 of the cluster.

## NET-ZERO-2050

“Netto-Null” is the synonym for net-zero CO<sub>2</sub> emissions, based on the following definition: Net-zero CO<sub>2</sub> emissions, also referred to as carbon neutrality, signify that anthropogenic CO<sub>2</sub> emissions in Germany are balanced by means of anthropogenic CO<sub>2</sub> removals over the period until 2050 (see IPCC, 2018).

In addition, we will consider the effects of other anthropogenic greenhouse gases and climate forcings.

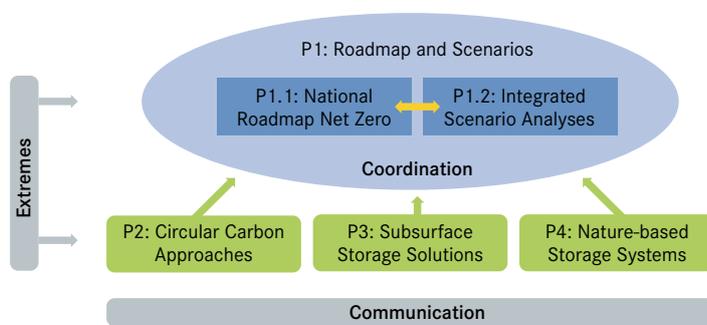


Figure 1 Structure of the cluster Net-Zero-2050 (proposal phase)

workflow.

Integrated scenario analyses, negative emission technologies assessment, and the development of a national net-zero roadmap are the topics addressed in project 1 (P1) of the cluster **Net-Zero-2050** (see figure 1). Additional assessment elements are also embedded in P2 (i.e. in regard to BECCS or the crowd oil concept). However, those topics need further adjustment for a coherent and efficient

Under the given restriction of time and resources, the premises for the definition of elements and interactions were (a) to take the concepts and the state of the art formulated by IPCC in the context of the Paris Agreement as a framework, which needs to be translated into a framework for Germany, (b) to build on available modelling and assessment elements, (c) clarify the gaps of the work, and (d) to build and provide knowledge on technologies, scenarios and road map elements for scientists and decision makers.

The resulting structure of P1 is given in figure 2. The different assessment topics are organised in a hierarchical way, starting with a technology assessment of Carbon Dioxide Removal (CDR) options organised in a technology assessment matrix. This will be further processed in CDR scenarios for Germany (which need to be developed) and also considered in combination with energy scenarios, using already existing models (which will generate scenarios for net-zero energy systems for Germany 2050). Additionally, the remaining action fields will be clarified in a *gap analysis*. All elements are discussed with stakeholders and contribute to the roadmap. Also,

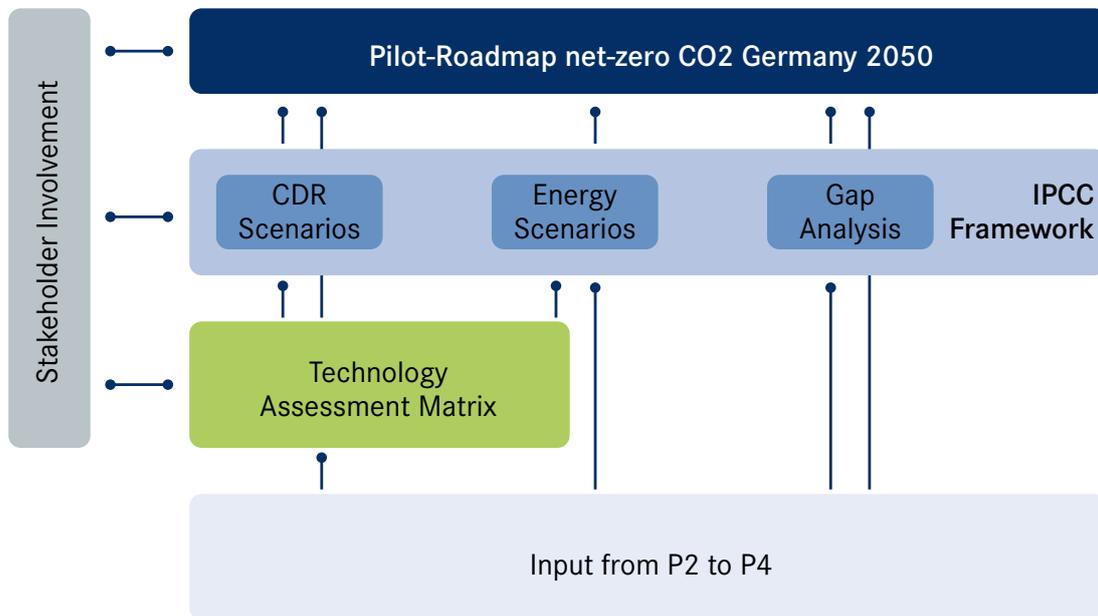


Figure 2 Structure of project 1 (working phase)

the expert knowledge from projects 2 to 4 contributes to the analyses, modelling and assessments.

## ELEMENTS OF PROJECT 1

### *Technology Assessment Matrix*

To describe the effort for the implementation of a certain CDR measure a holistic assessment approach is developed, which takes systemic, economic, technological, environmental, political, legal and social efforts into account. The matrix assesses model concepts with a traffic light system (based on ESYS 2019), including bioenergy with carbon capture and storage (BECCS), direct air capture (DAC) combined with carbon capture and utilisation (CCU) and carbon capture and storage (CCS), terrestrial so-called nature-based solutions (NBS), marine alkalinity enhancement and other marine methods, such as blue carbon concepts. For the definition of the concepts and the assessment, information is exchanged within P2 to P4. We will also name the missing approaches, i.e. CCS with fossil fuels.

*(Responsibility: UFZ with contributions from other P1-P4 partners)*

### *Energy Scenarios*

From the overall German carbon budget (see next section) a share is allocated to the energy system. The carbon budget of the energy supply for an interconnected Germany is translated into a target oriented transformation pathway of the energy system, including all energy demands (heat, power, transport). Based on a scenario approach this will provide information on remaining emissions and the demand of CDR/NET (negative emission technologies) measures, depending on the pace of the transformation. In a second step, the additional system and infrastructure demand in the energy system through the implementation of CDR technologies as well as the costs for avoided emissions are going to be assessed (*see Project Briefing #4 “Scenario Approach”*).

*(Responsibility: DLR with contributions from other P1 partners)*

### CDR Scenarios

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Using the IPCC framework as the guiding principle, the net-zero pathways will have to take the national carbon budget into consideration, which will be a guiding metric for the whole project 1 (see *Project Briefing #2 “Carbon Budget”*). The CDR scenarios are describing the effort for net-zero pathways for Germany. To inform the development of CDR scenarios, interlinkages, i.e. trade-offs and co-benefits, between individual CDR measures are taken into account to comprise possible CDR bundles (based on the results from the assessment matrix). In addition, the information for the energy demand of the CDR measures will be taken into account and fed back to the corresponding energy scenarios.

*(Responsibility: GEOMAR with contributions from other P1 partners, technology assessment matrix, energy scenarios and gap analysis)*

### Gap Analysis and Roadmap

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Based on the overall net-zero CO<sub>2</sub> definition of the project, we use the IPCC Guidelines to consider all relevant system components. In addition, exemplary national roadmaps and inputs from P2 to P4 are taken into account for developing the system. Subsequently, it is analysed in which parts of the system the Helmholtz Association and **Net-Zero-2050** are active and which parts of the system are not addressed (gap analysis). These results are used to identify external research partners working in the respective fields. Within this context, the central issues and topics relating to achieving carbon neutrality on a national level are combined and integrated into a pilot-roadmap. Serving the purpose of clarifying how CO<sub>2</sub> emissions in Germany can be reduced until a complete decarbonisation is realised, the roadmap encompasses tools and corresponding solutions (see *Project Briefing #8 “Roadmaps”*).

*(Responsibility: GERICS with contributions from other P1 partners)*

### Stakeholder Involvement

Different stakeholder formats are necessary for the different assessment categories (technologies, scenarios, roadmap). Further planning will be realised until Q3/2020 and might be presented in an additional Project Briefing.

*(Responsibility: Joint activity of GEOMAR and UFZ).*

## SYSTEM BOUNDARIES

In addition to the definition of net-zero CO<sub>2</sub> emissions (given at the beginning of this Project Briefing), the following system boundaries were agreed:

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- Temporal boundary: 2050 // 5 to 10 years steps
- Geographic boundary: Germany (with energy system interconnection to neighbouring countries)
- CO<sub>2</sub> emissions are understood as “waste streams”, which need to be avoided, recycled and disposed in a hierarchical way. All activities consider the distinction between avoided and removed CO<sub>2</sub> emissions, as defined in *Project Briefing #3 “CO<sub>2</sub> (avoided & removed)”*
- Carbon budget: 10 GtCO<sub>2</sub> (from 01.01.2018); as deduced in *Project Briefing #2 “Carbon Budget”*. The budget only assesses CO<sub>2</sub>, while non-CO<sub>2</sub> emissions (trends) are reported as side-effects or risks
- CCS is assessed only in combination with carbon removal approaches (bioenergy or DAC). Storage of fossil based carbon is out of the system
- Overall socio-economic development: Description only (relate to SSPs); for the quantification of the energy scenarios, one specific socio-economic pathway will serve as a reference (*German NECP; [https://www.bmwi.de/Redaktion/EN/Downloads/E/draft-of-the-integrated-national-energy-and-climate-plan.pdf?\\_\\_blob=publicationFile&v=5](https://www.bmwi.de/Redaktion/EN/Downloads/E/draft-of-the-integrated-national-energy-and-climate-plan.pdf?__blob=publicationFile&v=5)*)

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More results from the project Net-Zero-2050 are available here:

[www.netto-null.org](http://www.netto-null.org)

[www.helmholtz-klima.de/en/press/media-library](http://www.helmholtz-klima.de/en/press/media-library)

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## Centres involved:

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