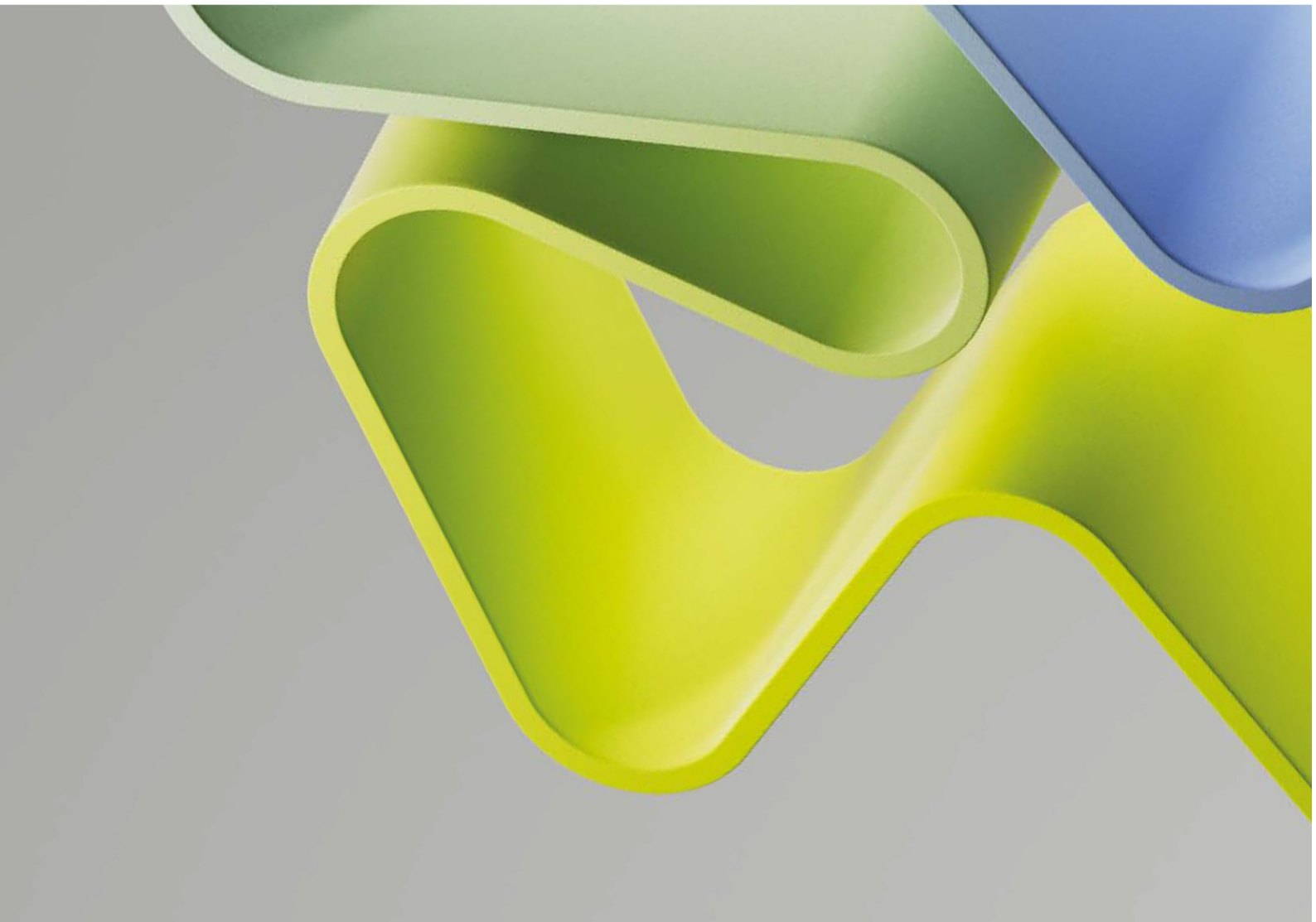


# Evaluation of Natural Sciences 2022-2024

## Evaluation report CICERO

January 2024

Evaluation of Natural Sciences 2022-2023



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## Statement from Evaluation Committee – Institute II

The members of this Evaluation Committee have evaluated the following administrative units at the research institutes within natural sciences in 2022-2023 and submitted a report for each administrative units:

- CICERO Centre for Climate Research
- Norwegian Meteorological Institute – Weather and Climate (MET)
- Norwegian Institute for Sustainability Research (NORSUS)
- Norwegian Research Centre (NORCE) – Climate and Environment
- Norwegian Institute for Air Research (NILU) – Environmental Chemistry Department
- Norwegian Institute for Air Research (NILU) – Atmospheric and Climate Research Department
- Norwegian Water Resources and Energy Directorate (NVE)
- Nansen Environmental and Remote Sensing Centre (NERSC)

The members of the Evaluation Committee are in collective agreement with the assessments, conclusions and recommendations presented in this report. None of the committee members has declared any conflict of interest.

The Evaluation Committee has consisted of the following members:

Professor **Mat Collins**, (Chair)

University of Exeter, United Kingdom

Professor **Dorthe Dahl-Jensen**,

Niels Bohr Institute, Denmark

Professor **Hayley Fowler**,

Newcastle University, United Kingdom

Professor **Martin Siebert**,

Imperial College London, United Kingdom

Professor **Thomas Jung**,

Alfred Wegener Institut, Germany

## Description of the administrative unit

In 2021, CICERO had a total of 99 employees: 68 research staff, ten in administration, seven in communication, five in leadership and two described as other. CICERO organizes the research in two Research Departments, one with primarily social scientists and the other mostly natural scientists. The Department Directors have the total responsibility for the department, contributing to strategic management, follow-up research groups/thematic research groups, and ensure cooperation between the groups.

CICERO currently has two research departments with a total of seven research groups: (1) Atmospheric sciences, (2) climate system, (3) Climate impacts, (4) Climate mitigation, (5) Climate policy, (6) Climate economics, (7) Local solutions.

In their self-assessment report and in the overarching goals in the strategy document 2021-2025, CICERO list a number of strategic goals including: (1) to hold high scientific quality and high international standards in research and dissemination, (2) to be a leading interdisciplinary climate research institute in Europe and conduct innovative and forward-looking research, (3) to be a leading research and collaborative partner for decision-makers in the spheres of politics, administration, business, industry, and civil society in issues concerning climate change and climate policy, (4) to create value for society by developing the interaction between basic research, applied research and solution-oriented commissioned research, (5) to be an attractive partner for worldleading climate research communities, and to promote international collaboration in climate research, (6) to be an attractive workplace and have a sound financial base. To achieve some of these strategic goals, CICERO has been working to increasing their publications and is currently consistently among the institutes with the highest publication in Norway.

In their self-assessment form, CICERO state that they are working at the intersection between basic and applied research. They contribute to the knowledge base through publications in high impact journals and towards more concrete challenges in the field of climate change through applied research projects, commissioned research, and outreach. Additionally, they state their research on anthropogenic drivers of climate change has fed into IPCC reports and has since been used by CICERO and others to help sectors such as transport, agriculture and industry understand their emissions impacts and design more efficient measures. In their self-assessment, CICERO report that they participate extensively in national and international research collaborations and is increasingly strengthening collaborations with public and private sector actors.

In their self-assessment form, CICERO report strengths that include (1) a good reputation and a high publication rate per FTE, (2) A strong contributor to IPCC reports and attractive collaboration partner for other research entities and (3) A high success rate in RCN and EU calls. However, they do report that a lack of capacity, funding sources that are not sufficiently diversified and limited interaction and collaboration between groups might limit the position of CICERO in the future.

## Overall assessment

CICERO is a highly active group working on research questions which are highly policy relevant at the international level. They have excellent involvement in relevant international bodies and are producing excellent scientific outputs. The benchmarks given reflect the status of the group rather than some parameters set as a target but, nevertheless, the group is high achieving. The only concerns are those around their contribution to the training of the next generation of scientists and their contribution to Norwegian research infrastructure and culture. Otherwise, it is recommended that the group continue with their excellent programme of research.

CICERO is an interdisciplinary climate research institute which conducts research on climate policy, local solutions, climate economy, emission reductions, climate impacts and the climate system. CICERO aim for collaborations across research groups and departments in ideas exchange and proposal development. CICERO has a rather generic research strategy which must be common to several similar organisations. Their research strategy would benefit from increased focus towards priorities or gaps in well-known research challenges and, specifically, linking to medium- and longterm challenges related to the climate area for Norway.

CICERO are a large research organisation and organize their research into two research departments, one with primarily social scientists and the other mostly natural scientists, CICERO identify a lack of capacity from core funding as a weakness. The ambition of the opportunities identified is somewhat weak and could be strengthened by thinking more strategically about the USP or unique strengths of CICERO. This could be used to address key policy goals or societal challenges. It was not obvious from the SWOT that CICERO understood its role in the Norwegian research ecosystem, with links to other organisations not really considered.

CICERO has an outstanding record of funding for its research activities, with a very large proportion coming from external funders as competitive funding. They have managed to significantly increase their EU funding and success in competitive tenders. CICERO researchers are sought after as collaborators and participate in numerous projects lead by others. The evaluation committee noted that they recently won a prestigious Centre for Advanced Studies (CAS) from the Norwegian Academy of Science and Letters. The evaluation committee assess their reliance on competitive funding as a threat, with the reductions in research funding being seen in Norway and other countries, as is the increasing reliance on funding from the EU.

CICERO produces large numbers of high-quality scientific publications and high impact policyrelevant research and is engaged in international efforts to contribute to society. Work on the Global Carbon Budget is of note. However, there are too few PhD students and post-docs in the research unit in relation to the size of the unit. The evaluation committee note that given that much of the work of CICERO is inter-disciplinary, it is surprising that the bibliometric Interdisciplinary Score is rather modest or 'mid table' in comparison to other institutes in Norway. It is not clear how CICERO uses collaboration, nationally and internationally, to advance its strategy and produce high-quality research, although many outputs are co-authored and there are many collaborations.

Although the gender balance in CICERO seems good, there was scant detail on EDI policies in the self-assessment. It is good that CICERO strive to achieve an equal gender pay distribution for the various job categories at all levels. They have international recruitment processes and at the time have 20 nationalities.

CICERO works in the intersection between basic and applied research. Their work is relevant to a wide range of stakeholders and has fed into the IPCC reports and been used by the transport, agriculture, and industry to understand their emissions' impacts and design more efficient measures.

The evaluation committee notes that there is an opportunity to increase the co-creation of research projects with industry and policy – to ensure their impact and relevance. There is also an opportunity to increase research commercialisation – this is quite low now and could be expanded significantly, contributing to national policies and strategies, and provide diversification of income stream.

CICERO is a highly active group working on research questions which are highly policy relevant at the international level. They have excellent involvement in relevant international bodies and are producing excellent scientific outputs. To distinguish themselves they should have more specific research strategies and explore increasing opportunities in transdisciplinary research to better contribute to Norwegian research infrastructure and culture and strategic policy priorities. While there is a high volume of societally relevant publications, reports and social media engagement, the evaluation committee felt that this could be even better. For example, they could speak directly to policy makers and involve them more in the design of their research questions. Their interactions could be more two-way.

## Recommendations

The group should continue its successful track record, seek new opportunities, and address new scientific challenges to foster a leading role in Norway. The evaluation committee recommends that the group seek out more opportunities to supervise PhD students and that they produce a strategy for the medium and long-term.

CICERO has a rather generic research strategy which must be common to several similar organisations. It would benefit from a more specialised strategy based on priorities or gaps in wellknown research challenges and specifically linking to medium- and long-term challenges related to the climate area for Norway. Part of this might be thinking about how to better showcase its interdisciplinary work. It is not obvious what exactly is happening in this area and how the physical science links to the social/economic aspects; a strength of the organisation is that it contains both.

As CICERO work is so close to the policy interface, it would be beneficial to think strategically about what that interface will look like in 5-10 years' time, including the need for investment into new areas of science, new modelling tools etc., to remain competitive in the future.

Two areas of concern were raised by the evaluation committee:

The first is that of how CICERO contributes to the development of many of the tools (e.g. models) used in their research. How do they fit in with the bigger picture of sustaining the research environment and infrastructure in Norway and internationally?

The second is ECR and career development opportunities and strategies. This is not clear in the CICERO self-assessment. The evaluation committee recommends that the group seek out more opportunities to supervise PhD students and that they produce a strategy for the medium and longer-term. This should include a strategy to enable increased research mobility as this seems to be low currently.

The table below presents the specific aspects of the evaluation the administrative Unit requested the evaluation explore and indicated where these are addressed in more detail in the subsequent report.

<b>Specific Request from the Unit's Terms of Reference</b>	<b>Where it is addressed in the report</b>
Research dissemination	Sections 1.5, 2, 4 and 5
Interdisciplinary climate research	Sections 1.1, 4 and 5

# 1. Strategy, resources, and organisation of research

The CICERO 'Department 1' is organised into four research groups, all of which are performing at a high level - Atmospheric Sciences, Climate System, Climate Impacts and Climate Mitigation. The strategic plan omits planning around the key overlaps, and it might be strategic to think about the key overlaps between these areas and particularly links to social/economic science and policy/industry needs, which are growing in importance. Their SWOT analysis recognises the climate area as growing, which provides an opportunity for increased funding but also a threat of staff shortages. This must be planned for, and CICERO might need to produce an improved and more detailed strategy to compete in this changing research landscape. This may be focussed, in the next decade, towards great policy- and solutions-oriented research for example. The cocreation of new research groups or cross-cutting areas, to take advantage of these changes would put CICERO in an even better position internationally.

## 1.1 Research Strategy

CICERO is an interdisciplinary climate research institute which conducts research on climate policy, local solutions, climate economy, emission reductions, climate impacts and the climate system. CICERO's mission is to develop and disseminate knowledge to address climate problems through several objectives. Their strategy is followed up in annual action plans. They aim for collaborations across research groups and departments in ideas exchange and proposal development. The allocation of resources is decided by the leadership group (Director and department directors) based on proposals from department directors and following consultations with Research Directors (Research group leaders). This includes final decisions on recruitments/positions and co-funding of project proposals (e.g. EU)

CICERO has a rather generic research strategy which must be common to several similar organisations. Their research strategy would benefit from increased focus towards priorities or gaps in well-known research challenges and, specifically, linking to medium- and long-term challenges related to the climate area for Norway. The evaluation committee recommend that part of this strategy might consider how to better showcase its excellent interdisciplinary work, as it is not clear how the physical science links to the social/economic aspects; a key strength of CICERO is that it contains both. As CICERO work so close to the policy interface, the committee recommend that they consider in their strategic planning what that interface will look like in 5-10 years' time, including the need for investment into new areas of science, new modelling tools etc., to remain competitive in the future.

## 1.2 Organisation of research

In 2021, CICERO had a total of 99 employees: 68 research staff, ten in administration, seven in communication, five in leadership and two described as other. CICERO organizes the research in two research departments, one with primarily social scientists and the other mostly natural scientists, with a total of seven research groups: (1) Atmospheric sciences, (2) climate system, (3) Climate impacts, (4) Climate mitigation, (5) Climate policy, (6) Climate economics, (7) Local solutions. The Department Directors have the total responsibility for the department, contributing to strategic management, follow-up research groups/thematic research groups, and ensuring cooperation between the groups. All employees must cooperate across CICERO and participate in activities to secure funding for projects, and to fulfil the goals in the strategic plan.

CICERO identify their strengths, weaknesses, threats, and opportunities well, including lack of capacity from core funding as a weakness: thought should be given to how this can be addressed.

The ambition of the opportunities is somewhat weak and could be strengthened by thinking more strategically about the USP or unique strengths of CICERO and this could be used to address key policy goals or societal challenges. It was not obvious from the SWOT that CICERO understood its role in the Norwegian research ecosystem, with links to other organisations not really considered.

### 1.3 Research funding

CICERO has an outstanding record of funding for its research activities, with a very large proportion (>80%) coming from external funders as competitive funding. The largest share comes from the Research Council of Norway (RCN), with success rates increasing steadily over 2017-2021 (36% success rate). Since 2017, CICERO have prioritised funding from the EU, significantly increasing their funding and now coordinating (leading) two Horizon projects. Alongside this, increased success in competitive tenders has led to a 5-fold increase in national commissioned research at CICERO since 2017 to 10.5M NOK in 2021. CICERO researchers are sought after as collaborators and participate in numerous projects lead by others. The evaluation committee noted that they recently won a prestigious Centre for Advanced Studies (CAS) from the Norwegian Academy of Science and Letters.

The evaluation committee assess their reliance on competitive funding as a threat, with the reductions in research funding being seen in Norway and other countries, as is the increasing reliance on funding from the EU. All CICERO's funding goes to research, or to facilitate research activities.

### 1.4 Use of infrastructures

CICERO does not host any national research infrastructures but is a participant and user of some, including E-INFRA and ICOS Norway. CICERO is involved in several projects that contribute to the development of the CO<sub>2</sub> Monitoring and Verification Support (CO<sub>2</sub>MVS), which will be a component of the European Union's Copernicus Atmosphere Monitoring Service (CAMS). It also contributes to IPCC, CMIP6/7 and WMO activities.

CICERO's infrastructure use is mainly HPC and data, which they use well. The main support from the University of Oslo is in IT, which seems adequate.

### 1.5 National and international collaboration

It is not clear how CICERO uses collaboration, nationally and internationally, to advance its research strategy and to produce high-quality research, although many outputs are co-authored and there are many collaborations. A stronger presence of collaboration within the research strategy and how it is used to enhance research outputs and impact would be beneficial.

In CICERO's publications, there are 71.5% with international co-authorships, which is high. The University of Oslo is the national partner co-authoring most publications with CICERO. Internationally, there are particularly strong collaborations with UK institutions.

### 1.6 Research staff

CICERO's leadership group had three men and two women in 2021. The group leaders (Research



Director) were three women and four men in 2021. For the category Senior Research Fellow I (Forsker I or equivalent to Research Prof.) there were nine men and six women, for Senior Research Fellow II (Forsker II) there were 17 men and 23 women. There are five Professors connected to CICERO in part-time positions, with four men and one woman. In 2021 there were five PhD students – four women and one man and one research assistant (a woman). In total CICERO had 58 % women and 42 % men in 2021 (including administrative staff); the evaluation committee assess the balance between genders to be very good.

## 2. Research production, quality and integrity

CICERO produces large numbers of high impact policy-relevant research and is engaged in international efforts to contribute to society. Their scientific publications are of high quality and have a broad appeal outside of climate change science, particularly to policy makers. Work on the Global Carbon Budget is of note. Publication levels are very high and in top journals. CICERO is consistently among the institutes with the highest publication rate in Norway.

However, there are too few PhD students and post-docs in the research unit in relation to the size of the unit. The evaluation committee note that given that much of the work of CICERO is interdisciplinary, it is surprising that the bibliometric Interdisciplinary Score is rather modest or 'mid table' in comparison to other institutes in Norway.

### 2.1 Research quality and integrity

#### **Research group overall assessment**

Grades reflect an overall international excellence of the research group. Strengths include staff with international reputations, high levels of funding, high impact publications, and policy-relevance of the work. Weaknesses identified are mainly in engagement with training the next generation and lack of a clear strategy of how they will develop and fit in with the research landscape in Norway.

*CICERO's approach to ensuring research integrity is in line with international best practice.*

### 2.2. Open Science

CICERO has a good open science policy with research made openly available through open access publication channels and/or by depositing accepted manuscript versions in their institutional repository. CICERO follows national, international, and funding agency guidelines and regulations for open access to research publications, research data and implementation of FAIR principles. Internal policy and guidelines for research data management offer principles and best practice for CICERO staff, and researchers are advised and supported in implementing data management and open science practices.

CICERO has extensive collaborations with user partners and stakeholders, in the development, implementation, and dissemination of relevant research. Systemising collaboration with user partners through their portfolio of services and deliverables is an important part of CICERO's strategy.

CICERO takes action to fulfil the FAIR-principles in data and has good open access policies. CICERO is working towards an open science model and provides as much open, data, models, and science as possible within data constraints etc to the community.

### 3. Diversity and equality

The description of the EDI policies in the self-assessment is brief. In the interview CICERO described their specific equality statement, their ethical guidelines for employee co-ownership, and their language policy. CICERO strive to achieve an equal gender pay distribution for the various job categories at all levels. In recent years, they have improved the gender balance in both the board and the leader group to 50/50 male and female. They have international recruitment processes and at the time have 20 nationalities.

### 4. Relevance to institutional and sectorial purposes

CICERO works in the intersection between basic and applied research, contributing to both the knowledge base in general through publications in high impact journals, and towards more concrete challenges in the field of climate change through applied research projects, commissioned research, and outreach. Their work is relevant to a wide range of stakeholders and has fed into the IPCC reports and been used by the transport, agriculture, and industry to understand their emissions' impacts and design more efficient measures.

The evaluation committee notes that there is an opportunity to increase the co-creation of research projects with industry and policy – to ensure their impact and relevance. There is also an opportunity to increase research commercialisation – this is quite low now although there is an example of a project called Green Shades. This could be expanded significantly, contributing to national policies and strategies, and provide diversification of income stream.

### 5. Relevance to society

The group is producing high impact, policy-relevant research and is engaged in international efforts to contribute to society. Their scientific publications are of high quality and have a broad appeal outside of climate change science, particularly to policy makers. Work on the Global Carbon Budget is of note. The evaluation committee believes that CICERO could engage more directly with policymakers to further increase the impact of their research. The integration of physical and social/economics would also play a role here and should be explored within a revised research strategy. The societal impact of the group is mainly via national assessments and international bodies and projects such as GCP and IPCC. The group is highly active in these areas and the evaluation committee felt that this was a strength of the group.

CICERO works closely with government agencies and other end-users in disseminating research results relevant for society.

While there is a high volume of societally relevant publications, reports and social media engagement, the evaluation committee felt that this could be even better. For example, they could speak directly to policy makers and involve them more in the design of their research questions. Their interactions could be more two-way.

### Comments to impact case 1

The research unit contributed strongly to the Global Carbon Budget (GCB). Data from GCB is extensively used in the international IPCC reports, various UN, WMO and CEOS reports and services.

CICERO's role in the GCB has been to estimate fossil CO<sub>2</sub> emissions and was used in preparing graphical material to help communicate and disseminate the research.

CICERO has had responsibility for a core component of the GCB, which is also the part that receives the most media attention and user interactions.

This is a very important and strong part of the CICERO's research.

### Comments to impact case 2

CICERO's Department 1 has worked for over two decades studying the effects of household air pollution on human health in China. The underpinning research provides evidence that the burning of solid fuels for cooking and heating is a major contribution to exposure to harmful air pollutants by developing a novel approach to exposure assessment, bringing ambient air pollution (AAP) and household air pollution (HAP) together. It has been applied in separate papers led by partner university in China. This has led to development of Chinese policies on air pollution, for example, replacement of household coal in China is now a permanent policy objective and a key component of the Chinese Air Pollution Prevention and Control Plan.

### Comments to impact case 3

CICERO has done extensive research on emission metrics used to measure short lived climate forcers using a modelling framework. Novel metrics have included the development of the Global Temperature Potential, regional and sector specific metrics for non-CO<sub>2</sub> emissions. These have been used in several IPCC and WMO/UNEP reports as well as in Norway in the evaluation of incorporating GTP (10) in the Norwegian Environment Agency's (NEA) reporting. This metric is now used in their calculations of emissions in the short term.

### Comments to impact case 4

Several staff members have contributed substantially to the IPCC reports as RE, CLA, LA and CA, also Vice Chair. Work has fed through from CICERO into the IPCC reports.

## List of research groups at the Administrative Unit

Institution	Administrative Unit	Research Groups
CICERO	Department 1	Department 1

## Methods and limitations

The evaluation is based on documentary evidence and online interviews with the representatives of Administrative Unit.

The documentary inputs to the evaluation were:

- Evaluation Protocol (see appendix 3 Evaluation Protocol) that guided the process
- Terms of Reference
- Administrative Unit's self-assessment report
- Administrative Unit's impact cases
- Administrative Unit's research groups evaluation reports
- Bibliometric data
- Personnel and funding data
- Data from Norwegian student and teacher surveys

After the documentary review, the Committee held a meeting and discussed an initial assessment against the assessment criteria and defined questions for the interview with the Administrative Unit. The Committee shared the interview questions with the Administrative Unit two weeks before the interview.

Following the documentary review, the Committee interviewed the Administrative Unit in an hourlong virtual meeting to fact-check the Committee's understanding and refine perceptions. The Administrative Unit presented answers to the Committee's questions and addressed other follow-up questions.

After the online interview, the Committee attended the final meeting to review the initial assessment in light of the interview and make any final adjustments.

A one-page summary of the Administrative Unit was developed based on the information from the self-assessment, the research group assessment, and the interview. The Administrative Unit had the opportunity to fact-check this summary. The Administrative Unit approved the summary virtually without adjustments.

### **Limitations**

The Committee judged the information received through documentary inputs and the interview with the Administrative Unit sufficient to complete the evaluation.

## Appendices (link to website)

1. Description of the evaluation of EVALNAT
2. Invitation to the evaluation including address list
3. Evaluation protocol
4. Self-assessment administrative units
5. Grading scale for research groups

Website: <https://www.forskningsradet.no/tall-analyse/evalueringer/fag-tema/naturvitenskap/>

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