

Energimyndighetens titel på projektet – svenska Regionala kolbudgetar och snabb omställning till ett fossilfritt energisystem	
Energimyndighetens titel på projektet – engelska Regional carbon budget and rapid transition to a fossil-free energy system	
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Preface

The research described in this report was made possible through generous funding from the Swedish Energy Agency for the project Regional carbon budgets and rapid transition to a fossil-free energy system (project number 46532-1), which ran from 2019-10-01 until 2023-09-30. The interest in carbon budgets and their use in national to local climate and energy governance has grown significantly over this time. The project members have thus been fortunate to have an increasing set of actors and people contact us and are grateful for the interest shown in the research produced within the project. All those that in some way have contributed to our thinking and engaged with our research over this time are too many to mention by name here, so instead we extend a heartfelt thanks to all of you that we've crossed paths with over these past four years. A special thanks however, must go out to our friends and colleagues at Klimatsekretariatet who have been an invaluable partner in helping to build bridges between our research and the Swedish public sector at the local and regional level. A big thank you also to members of Klimatriksdagen and broader civil society in Sweden for your interest and informed engagement with our research. And finally, to the civil servants from across Sweden as well as research colleagues from around the world to the corridors of CEMUS, NRHU and Uppsala University, we extend our deepest appreciation for your contributions and time.

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Sammanfattning på Svenska

För att möta sina temperatur- och rättviseåtaganden i Parisavtalet så behöver Sverige en både snabb och djupgående omställning av sitt energisystem. Kort sagt skulle Sverige behöva upphöra med förbränningen av fossila bränslen inom 15 år; och det finns inga undantagna sektorer. Men även med denna hastiga förändring kvarstår livshotande konsekvenser för många fattiga och klimatutsatta samhällen.

I kontrast till den bekväma politiska retoriken om Sveriges framgångar på klimatområdet, berättar siffrorna en annan historia. Inkluderar man koldioxidutsläpp från import och export, samt från internationellt flyg och sjöfart, så har Sverige sedan 1990 minskat sina energi-relaterade utsläpp med mycket mindre än 1 % per år (baserat på data från Global Carbon Project). För att sätta detta i ett större sammanhang (baserat på IPCC-data), för 50% chans att inte överskrida 1,5°C uppvärmning, måste de globala utsläppen minska med 11 % varje år, från och med nu. För en god chans av "väl under 2°C" är minskningstakten globalt 5 % per år.

Detta projekt har utvecklat en tydlig och sekventiell logik för att skala ned globala klimatåtaganden, i form av så kallade koldioxidbudgetar, till Sverige och sedan vidare ner till regioner. Koldioxidbudgetar är ett vetenskapligt förankrat mått för att förstå hur snabbt utsläppen måste minskas och hur snabbt vi måste sluta använda fossila bränslen för att begränsa den globala uppvärmningen till en viss temperaturhöjning.

Under projektet hade vi ett pågående utbyte med lokala och regionala tjänstpersoner och medborgare, såväl som andra akademiker och forskare. Med deras inspel utvecklade vi en pragmatisk metod för att rättvist fördela Sveriges nationella koldioxidbudget (för 2°C) mellan regionerna. Dessa budgetar gav sedan en kvantitativ grund för att överväga scenarier för utsläppsminskningar, med hänsyn till lokala omständigheter. Dessa scenarier är inte prydliga blåkopior av exakt vad som behöver göras, utan snarare berättelser som målar upp en bild av den nödvändiga omfattningen, djupet och tidslinjen av förändringar som krävs för att hålla sig inom den regionala och övergripande nationella koldioxidbudgeten.

En annan viktig upptäckt från arbetet är att de förändringar som krävs påverkar alla delar av samhället, från bostäder till transporter, industri till tjänster, energi till handel. Detta är en konsekvens av åtaganden som gjorts i Parisavtalet samt det internationella samfundets och nationella regeringarnas misslyckande att på allvar ta itu med klimatutmaningen.

Efter att ha genomfört allt detta arbete är ett viktigt nästa steg att se till att resultaten på ett fruktbart sätt kan bidra till debatten om vad Sverige skulle behöva göra för att uppfylla sina Parisåtaganden. Det är viktigt att oberoende forskning är tillgänglig för alla som bidrar till debatten, från beslutsfattare till företagsledare, civilsamhället till journalister. Forskning om utmaningarna med att integrera koldioxidbudgetar i regional planering pågår redan i Sverige, vilket kan komma att belysa vilka konsekvenser vårt föreslagna tillvägagångssätt att skala ned globala koldioxidbudgetar till den regionala nivån kan få.

Ett tredjedels sekel sedan den första stora internationella rapporten om klimatförändringar står vi inför ett dilemma. Att fortsätta med fler fina tal men väldigt lite meningsfulla åtgärder och bevittna ökande nivåer av klimatförändringar. Eller att ta sig an utmaningen direkt, med ärlighet, tydlighet och med stöd av detaljerad och genomtänkt forskning. Vi hoppas att vårt arbete kommer att bidra till det senare.

Summary

Sweden needs a fundamental and rapid transformation of its energy system to meet the “well below 2°C” and equity commitments enshrined in the Paris Agreement. Put bluntly Sweden would need to cease the combustion of all fossil fuels within fifteen years; there are no exempt sectors. However, even this level of change will now impose life-threatening impacts on many poor and climate vulnerable communities.

In contrast to the comfy political rhetoric of Sweden’s mitigation successes, the numbers tell a very different story. Include carbon dioxide emissions from imports and exports, and those from aviation and shipping, then since 1990 Sweden has cut its energy-related emissions by much less than 1% each year (based on Global Carbon Project data). To put this in context (based on IPCC data), for a flip of a coin chance of not exceeding 1.5°C of warming, global emissions must reduce at 11% each year, from now. For a good chance of “well below 2°C”, the reduction rate globally is 5% per annum.

This project has developed a clear and sequential logic to downscale global climate commitments, in the form of what are termed carbon budgets, to Sweden and then

down to regions. Carbon budgets are a scientifically robust metric for understanding how fast emissions need to be cut, and how rapidly we need to cease using fossil fuels, to limit global warming to a particular temperature rise.

Throughout the project we engaged with a range of local civil servants and wider groups of citizens, as well as other academics and researchers. With their input we developed a pragmatic approach to fairly divide Sweden's national carbon budget (for 2°C) between the regions. These budgets subsequently provided a quantitative basis from which to consider scenarios of emission reductions, with consideration for local circumstances. These scenarios are not neat blueprints of exactly what needs to be done, but rather narratives giving a picture of the necessary scale, depth and timeline of change to stay within the regional and overall national carbon budgets.

Another important finding from the work, is that the changes required impact all elements of society, from housing to transport, industry to services, energy to commerce. This is a direct outcome of the commitments made in Paris and the long-term failure of the international community and national governments to seriously address the climate challenge.

Having undertaken all this work, an important next step is to ensure that the findings can fruitfully inform the debate about what Sweden would need to do to meet its Paris commitments. It is key that independent research is available for all those contributing to the debate, from policy makers to business leaders, civil society to journalists. Further research on the challenges of integrating carbon budgets in regional planning is also underway in Sweden, shedding important light on the implications our approach of downscaling global carbon budgets to the regional level may have.

A third of a century since the first major international report on climate change, we face a dilemma. To continue with more fine speeches but very little meaningful action, and witness increasing levels of climate change. Or to tackle the challenge head on, with honesty, clarity and informed by detailed and thoughtful research. We hope our work will contribute to the latter.

Introduction

Sweden is a signatory to the UN Framework Convention on Climate Change (UNFCCC) (United Nations 1992). As such, it has agreed to make its fair contribution to “avoiding dangerous anthropogenic interference with the climate system”. Two decades on from the UNFCCC, the Paris Agreement established a strong international consensus quantifying what constitutes “dangerous”. It was

agreed that signatory nations would reduce emissions sufficient to hold the rise in global average temperature to “well below 2°C”, and ideally no more than “1.5°C” (UNFCCC 2015).

The key to curbing global temperature rise is limiting the total cumulative amount of CO₂ released into the atmosphere, often referred to as the ‘carbon budget’. The Intergovernmental Panel on Climate Change (IPCC) has, over the past 10 years, provided estimates of the remaining global carbon budgets for a range of probabilities to remain below certain temperature thresholds (IPCC 2014, 2018, 2021). The IPCC’s latest Assessment Report, AR6 (IPCC 2021), sets out the scientific community’s most recent estimates of carbon budgets for a suite of different probabilities of not exceeding a range of temperature increases. For 1.5°C, the IPCC provides global budgets of between 300 and 900GtCO₂, but this is from the start of 2020. Fast forward to the start of 2024, and these values are set to reduce to 140 and 740GtCO₂, respectively; equivalent to less than 4 to 19 years of current global emissions. The smallest budget (140GtCO₂) is associated with an “83% or more” chance of staying below 1.5°C and the more generous budget (740GtCO₂) a much lower chance of just “17% or less”. The Paris commitments of curbing emissions sufficient to stay “well below 2°C” and “pursuing.. 1.5°C”, can reasonably be associated with budgets from within this range. Fortuitously, the IPCC budget for a 17% chance of staying below 1.5°C (i.e. 740GtCO₂ from January 2024), is the same as the budget for an 83% chance of staying below 2°C.

Another key feature enshrined in the 1992 UNFCCC and all subsequent Conference of the Parties (COPs), is the principle of Common but Differentiated Responsibilities and Respective Capabilities (CBDR–RC). Signatories to this principle acknowledge the necessity of many developing countries continuing to increase their emissions in the short term so as to provide for basic food and energy needs of their populations and bring their citizens’ quality of life closer to the global average. Consequently, wealthier nations (variously referred to as “Annex 1” or “developed country parties”) need to lead in cutting emissions, with less wealthy and poorer nations (non-Annex 1 and “developing country parties”) offered some leeway in driving the necessary decarbonisation rates. In short, Sweden, as a designated Annex 1 member, is obliged to cut emissions at a faster rate and deliver full decarbonisation ahead of non-Annex 1 nations.

Prompted by rapidly depleting carbon budgets and improved understanding of the severity of likely impacts at 1.5 and 2°C, mitigation scenario modelers have begun to assume increasing levels of future carbon dioxide removal (CDR). This takes the form of negative emissions technologies (NETs) and nature-based solutions (NbS), to the point that future planetary scale CDR has become ubiquitous across high

level emission scenarios (such as those in IPCCs WGIII reports), despite high uncertainties as to their feasibility, not least within the time frame dictated by the Paris Agreement (Anderson et al. 2023; Anderson & Peters 2016).

Outside of our own preliminary work (Anderson et al. 2017, 2018) there was at the start of the project, to our knowledge, no analysis of national level mitigation pathways for “developed country parties” required to deliver on their Paris equity and temperature commitments that did not rely – directly or indirectly – on the successful development and deployment of such planetary scale levels of CDR (increasingly packaged under the malleable concept of “net-zero”). It was to complement such net-zero analysis that this project has developed a pragmatic approach for downscaling global carbon budgets to the national and subnational level in Sweden within the constraints set by the Paris Agreement.

Against this backdrop the project’s overarching aim was to facilitate Sweden’s transition to a 100% fossil-free energy system, in line with its Paris commitments. Through collaboration with the county administrative boards of Sweden as well as other actors from the international to local level, an integrated perspective emerged on how Sweden is affected by global developments in the energy sector, but also opportunities and challenges for Sweden and its counties to lead the way in engendering a rapid and deep reduction in emissions.

Implementation

With this overarching aim in mind, the project had three main goal which are outlined below alongside descriptions of the activities and methods employed to reach each one. The members employed by the project (Kevin Anderson and Isak Stoddard) worked together on all three, with other participants contributing where appropriate.

1) To have developed a national carbon budget within the framework of the Paris Agreement’s temperature and equity targets for Sweden (focus on carbon dioxide). CO₂-emissions from other sources than energy will be calculated as global overheads in order to create an energy-focused budget.

A method to downscale the IPCC global carbon budgets to the national level was developed in collaboration with the Tyndall Centre for Climate Change Research, and based on the temperature and equity commitments of the Paris Agreement (UNFCCC 2015). This method was then used to estimate a Swedish ‘Paris-compliant’ carbon budget from January 2020 (Anderson, Broderick & Stoddard 2020). This calculation was updated on two occasions, to provide Swedish carbon budgets from January 2022, January 2023 (Anderson & Stoddard 2022) and January 2024 (Stoddard & Anderson 2023), based on the IPCCs latest estimates of remaining global carbon budgets (IPCC 2021) as well as Swedish emissions data.

All these calculations were focused on energy-related territorial fossil CO₂-emissions, including bunker fuel emissions from international shipping and aviation. Other CO₂-emissions (mainly from land use, land use change and forestry as well as process-emissions from cement) were considered as global overheads.

2) To have developed regional carbon budgets in collaboration with the country's county administrative boards (starting on Gotland and in Uppsala).

The project's start coincided with a nation-wide revision of most of Swedish counties' climate and energy strategies. At this time, carbon budgets were already on the radar of many of the counties in part due to earlier work (see e.g. Anderson et al. 2017, 2018). A continued dialogue with climate and energy strategists at the county-level (both directly and through their collaborative platform LEKS, as well as via Klimatsekretariatet) was facilitated by the project and contributed to the development of a set of provisional regional carbon budgets for all Sweden's 21 counties (Anderson & Stoddard 2023).

Challenges with finding appropriate ways to downscale a national carbon budget to the regional level were first explored through interviews with civil servants in the counties of Uppsala and Gotland. This was followed by a workshop (in March 2022) on the same theme with civil servants (from Blekinge, Gotland, Jämtland-Härjedalen, Stockholm, Södermanland, Västerbotten and Naturvårdsverket), civil society members (from Klimatriksdagen and WWF Sweden), Klimatsekretariatet and researchers (from Uppsala, Bergen and Manchester). Experiences from the U.K. context where one of the project members (Anderson) has been involved in similar processes and research was also drawn upon (Kuriakose et al. 2022), and compared to insights from the Swedish context. Consequences for regional energy transition that follows from the cumulative and emission-centric logic of carbon budgets - such as the accelerated pace of transition and importance of short-term action - were explored in more detail in Uppsala and Gotland through interviews with civil servants and document analysis of climate and energy strategies (Stoddard & Kuchler, forthcoming).

3) Through the new knowledge developed in the regional carbon budgets in collaboration with local and regional actors, review and propose adjustments in relation to existing roadmaps in order to facilitate rapid and deep reductions in energy use and emissions in accordance with the Paris Agreement.

There are a large number of barriers curtailing the ability to realize the rapid and comprehensive transitions to a fossil-free energy system that follow from the calculation of Paris-compliant carbon budgets (at the global, national or subnational level). As a backdrop and first step to work towards this third project goal, and with the projects' overarching aim in mind, a review of the past three decades of worldwide climate mitigation efforts was conducted, drawing on expertise and co-

written by a multidisciplinary and international team of 23 authors (Stoddard, Anderson et al. 2021). This was followed by in-depth interviews with civil servants who had been involved in developing climate and energy strategies in Uppsala and Gotland to see how attempts to mitigate have played out in the regional level in Sweden over the past decades. During the whole project there has also been an ongoing exchange with local, regional and national actors where adjustments to existing mitigation plans and energy transition pathways have been proposed and discussed (e.g. through presentations and other contributions to ongoing strategic/planning processes). Two conferences (in 2021 and 2022) organized in collaboration with Klimatsekretariatet and Klimatriksdagen provided another important arena where discussions and exchange of experiences around the (regional) carbon budget concept was enabled between actors from civil society, research, public and private sectors (see: www.Co2-budget.com). Lastly, a workshop (in November 2022) focused on developing visions and pathways that may keep Sweden's counties (and Sweden as a whole) within Paris-compliant budgets, brought together members of civil society (from Klimatriksdagen, WWF Sweden), civil servants (from Uppsala and Blekinge) and researchers (from Uppsala and Bergen universities). Informed by these activities and framed by the national and regional carbon budgets, a set of heuristic future scenarios for different societal sectors have been outlined. These are premised on Sweden being in the process of meeting its Paris-compliant carbon budget for 2°C, and are in the form of narratives rather than detailed blueprints (Anderson & Stoddard 2023).

Results

The first estimation of a Swedish Paris-compliant carbon budget range (for a 50% chance of not exceeding 1.7°C) was 270-370MtCO₂, from January 2020 (Anderson, Broderick & Stoddard 2020). With new global carbon budgets revised by the IPCC in 2021 (IPCC 2021), the latest update of the remaining Swedish carbon budget (for a 83% chance of not exceeding 2°C) is estimated at 285MtCO₂ from January 2024. This translates to less than 7 years of current territorial, fossil CO₂-emissions (including international bunkers), and an annual national mitigation rate over 13%. This can be compared to projected emissions based on a highly optimistic reading of the current climate policy framework in place (455MtCO₂) or if only existing measures are followed (775-1055MtCO₂) (Stoddard & Andersson 2023; Naturvårdsverket 2023). Staying within the Paris-compliant carbon budgets, in Sweden as well as in other industrialised countries, now implies full decarbonization of energy by 2035-2040. This would require a scale of change in physical infrastructure reminiscent of the post-Second World War Marshall Plan, bringing issues of values, measures of prosperity and socio-economic inequality to the fore (Anderson, Broderick & Stoddard 2020).

The calculation of a Swedish Paris-compliant carbon budget is the basis on which remaining regional carbon budgets have been developed. The latest estimate of remaining carbon budgets for Sweden's 21 counties result in required rates of mitigation that range from 11 to 17% per annum (exponential decline pathways) and zero-emissions dates that range from 2033 to 2040 (linear decline pathways) (see the report [Paris-compliant carbon budgets for Sweden's counties](#) by Stoddard & Anderson 2023, for details). The size of the regional carbon budgets is to a high degree determined by the emissions within the Swedish budget that are considered appropriate to downscale to the regional level and those that are kept as a national overhead, as well as which allocation principles that are used (Kuriakose et al. 2022). But whatever approach is preferred, the very challenging task of mitigating the energy-related emissions at the pace called for by the very small, and rapidly shrinking Paris-compliant national carbon budget, remains.

Discussion

Over the past three decades, despite political efforts and a wealth of research on the causes and impacts of climate change, more fossil carbon dioxide has been emitted into the atmosphere than previously throughout history, reaching levels today 60% higher than in 1990. Possible reasons for this inexorable rise in global emissions that were identified and explored in more detail in this project include: contemporary forms of climate governance, the fossil fuel industry and associated vested interest, geopolitics and militarism, dominant economic and financial systems, mitigation and energy modelling, energy supply systems and policy, inequity, high-carbon lifestyles and lastly the lack, in industrialised modern societies, of social imaginaries that aren't wedded to the carbon economy and narratives of progress reliant on perpetual economic growth. A common thread to emerge between these different explanatory factors is the central role of power, manifest in many forms, from influential vested interests to narrow techno-economic mindsets and ideologies of control. (Stoddard, Anderson et al. 2021) What became apparent as the project progressed is that the speed of a Paris-compliant energy transition poses new and very challenging questions concerning the role that technology and behavioral change alone can play, and that a fundamental shift away from dominant political framings and practices seems inevitable unless we renege on the commitments made in the Paris Agreement. This is particularly well illustrated in the scope and shape of the set of heuristic future scenarios developed for Sweden to stay within its Paris-compliant carbon budget (see the report [Paris-compliant emission reductions for Sweden](#) by Anderson & Stoddard 2023).

At the regional level, the lack of sufficient institutional agency, authority and capacity to drive the very rapid emissions reductions called for, often sailed up as

an important question during the project. Whilst there seems to be increasing understanding and widespread agreement that rapid annual emission reductions are important and climate change is a highly prioritized issue in regional governance, there is still a lack of implementation and uncertainty about appropriate responses and measures. This leads to delay and a sense of temporal desynchronization between what is seen to be necessary (e.g. through target-setting) and what actually is done. (Stoddard & Kuchler, forthcoming) Further attention should be paid to such temporal dynamics that are induced and reshaped by the urgency to accelerate climate mitigation, and their influence on regional energy planning and development pathways.

Publication list

Below is a chronologically ordered list, with short summaries of the of peer-reviewed research articles, reports, briefing notes, debate articles etc. made possible and informed by the research conducted within the project. All academic publications (and most others) are accessible for the general public, and can be reached either by following the hyperlinks or visiting the project's website: www.cemus.uu.se/carbon-budgets.

Publications in 2020

- [A factor of two: How the mitigation plans of 'climate progressive' nations fall far short of Paris-compliant pathways.](#)

Anderson, K., Broderick, J. & Stoddard, I.

An original research article published in the international peer-reviewed journal *Climate Policy*, that presents a new method for downscaling global carbon budgets to the national level. A Paris-compliant carbon budget for Sweden is estimated, highlighting how current plans and policy frameworks fall far short of the mitigation required by Sweden's and other industrialized nations' international commitments.

- [Beyond a climate of comfortable ignorance.](#)

Anderson, K. & Stoddard, I.

An opinion piece published in *The Ecologist*, building on the findings of the peer-reviewed article just described above.

- [Even climate progressive nations fall far short of adopting Paris-compliant pathways.](#)

Anderson, K., Broderick, J. & Stoddard, I.

A short summary of the peer-review article described above published in *Climate Strategies*.

- [Vilseledande och missvisande myter om klimatkompensation.](#)

Co-written by 23 authors, including Stoddard, I., Anderson, K.

A debate article in the Swedish daily newspaper *Dagens Nyheter* arguing against the use of offsetting as a way to deliver on the increasingly challenging emissions reductions implied by the Paris agreement.

- [10 myths about net-zero targets and carbon offsetting, busted.](#)

Co-written by 41 authors, including Stoddard, I., Anderson, K.

A translated and revised version of the above-mentioned debate article published in *Climate Home News*.

Publications in 2021

- [Three decades of climate mitigation: why haven't we bent the emission curves?](#)

Stoddard, I., Anderson, K. et al.

A review article with the project members as lead authors, engaging 21 other authors and published in the international peer-reviewed journal *Annual Review of Environment and Resources*. The article explores the last three decades of attempting to mitigate climate change and possible reasons as to why these have not been more successful.

Publications in 2022

- [We must disrupt Davos-culture to end decades of failure on climate.](#)

Stoddard, I. & Anderson, K.

An opinion piece published in *Climate Home News*, summarizing and expanding upon the findings outlined in the peer-reviewed article (from 2021) described above.

- [Carbon Budget Briefing Note 1: A new set of Paris-compliant CO2-budgets for Sweden.](#)

Anderson, K. & Stoddard, I.

A briefing note updating our estimates of a remaining Paris-compliant carbon budget for Sweden, based on new global carbon budgets as calculated by the IPCC.

- [What does the Paris climate change agreement mean for local policy? Downscaling the remaining global carbon budget to sub-national areas.](#)

Kuriakose, J., Jones, C., Anderson, K. et al.

A research article published in the international peer reviewed journal *Renewable and Sustainable Energy Transition*, outlining approaches and key considerations for downscaling global carbon budgets to national and subnational levels.

- [Fel att bara fokusera på Sverige när klimatmål diskuteras.](#)

Stoddard, I.

A response to a debate article in the Swedish daily newspaper *Dagens Nyheter* arguing that Sweden's current climate targets and policy framework could be considered to be in line with the Paris Agreement.

Publications in 2023

- [Report: Paris-compliant carbon budgets for Sweden's counties.](#)

(provisional, subject to updates)

Stoddard, I. & Anderson, K.

A report outlining the key findings of the research project, including an updated Paris-compliant carbon budget for Sweden as well as provisional budget for Sweden's 21 counties (all from January 2024). As was the case in 2020, current plans and pathways are still far from delivering mitigation that would keep Sweden within its estimated carbon budget.

- [Report: Paris-compliant emission reductions for Sweden: heuristic narratives for guiding energy policy.](#)

(provisional, subject to updates)

Anderson, K. & Stoddard, I.

A report building on the insights garnered throughout the research project, presenting heuristic scenarios for a set of different sectors of relevance to

enable a rapid transition to a fossil-free energy system in Sweden. The narratives embedded in the scenarios raise fundamentally challenging questions about the infrastructural, technological and social changes required should Sweden attempt to stay within a Paris-compliant carbon budget range.

Forthcoming publications

- [Carbon Budget Briefing Note 2: A new set of Paris-compliant CO2-budgets for Sweden.](#)

A briefing note summarizing the findings and conclusions of the report on regional carbon budget described above.

- [Carbon Budget Briefing Note 3: Paris-compliant emission reductions for Sweden](#)

A briefing note summarizing the findings and conclusions of the report with heuristic scenarios for a rapid energy transition described above.

- Scaling down and speeding up? The global mitigation imaginary and temporalities of regional energy transitions (manuscript)

Stoddard, I. & Kuchler, M.

An original research article that traces the impact of downscaling global mitigation ambitions in order to accelerate energy transitions at the regional level in Sweden, with an empirical focus on the counties of Uppsala and Gotland. Preliminary findings indicate the importance of paying attention to temporal dimensions of the envisioned transitions and how they inscribe particular views on sociotechnical change and which futures are imagined.

- Climate mitigation and the ‘need for speed’: reimagining the temporalities and politics of regional energy transitions in Sweden (draft)

Stoddard, I.

PhD thesis envisaged to be defended before the end of 2024. Three of the research articles drawing on research within the project are envisaged to be included in the compilation thesis. A fourth article with an empirical focus on the city of Uppsala and its expansion plans will be added to this.

Resources and other material

- The publications listed above as well as other material related to the project can be found at: www.cemus.uu.se/carbon-budgets.
- More information, including recorded presentations and discussions on the science and politics of carbon budgets can be found at: www.co2-budget.com
- The project has also worked closely with *Klimatsekretariatet* which is a non-profit organization specializing in the visualization, digitalization and use of local carbon budgets and other ways to bring research, the public sector and civil society together in responding to climate change: www.klimatsekretariatet.se.
- *Integration of regional carbon budgets in region climate politics*, is a 4-year research project (2021-2025) also funded by the Swedish Energy Agency, which builds on findings from the project reported on here: <https://mesam.se/projekt/koldioxidbudgetar/>

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Appendices

Administrativ bilaga till slutrapport

Ekonomisk slutredovisning