

Annual Report
Mistra Carbon Exit

2020



MISTRA
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EXIT ▶

Summary by the program management

The fourth year of Mistra Carbon Exit was the last of Phase 1 and consisted mainly of completing research tasks and communicating program results. The program produced a number of scientific papers, policy briefs and seminars and continued to be visible in the public debate, with many appearances in national radio, TV and opinion pieces in the largest daily newspapers (see pages 6 to 10 for more information).

This annual report is shortened since it will be followed by an extensive publication presenting key messages from Phase 1. The key-message report will summarize the main conclusions from the large body of research results produced in Phase 1 (around 80 pages) and is scheduled to be issued in October 2021. The report targets end-users and decision-makers. The report builds on the scientific publications from the programme. As for academic exams of the PhD students in the programme, three of our PhD students, Ida Karlsson, Alla Toktarova and Ella Rebalski have completed their licentiate degrees and are continuing their work toward PhD exams in Phase 2. Their dissertations are entitled “Decarbonization of construction supply chains”, “The low-carbon steel industry” and “Are We There Yet?: Combining qualitative and quantitative methods to study the introduction of CAVs in Sweden, and potential travel demand effects”, respectively. Thus, these works are in the core of the programme and have already attracted attention from different stakeholders.

In Year 2020, we prepared a proposal for a second phase of the program. The proposal was submitted to Mistra on 1st of July and approved by Mistra in December. We are very pleased by the positive feedback from our end-users and the evaluation committee and the decision by Mistra. The evaluation committee confirms that we are on the right track; that the program has a relevant focus, adds value to our end-users and has produced scientific results of high quality.

In Phase 2, we will refine and deepen the research focus of Phase 1, working more towards implementation to support the Swedish transition to net zero greenhouse gas emissions. We will maintain a supply chain perspective which we think has been a successful approach. We will continue to focus on the supply chains for buildings, transport infrastructure and transport, including upstream impacts from the production of materials and electricity.

We will further develop the analysis of technical assessments, policy instruments and the role of behavior, as well as perform sustainability assessments of the transition of key components in the transition of the three value chains. A new feature will be a set of implementation projects, with the objective to make use of our research in implementation. We have also streamlined the organization, reducing the number of work packages from nine to five. In Phase 1, we have established collaboration across work packages and tasks. As recommended by the Evaluation panel, we will start Phase 2 by mapping these linkages and identify mechanisms for enhanced collaboration.

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In 2020 the program was, of course, affected by the covid-19 pandemic, but the effect was rather minor. Some experiments involving physical participation needed to be postponed, but apart from that, most projects continued as planned. Because of the pandemic, several physical meetings and conferences were cancelled in Spring 2020 which, in fact, provided more time for us to prepare the proposal for Phase 2. Meetings throughout 2020 were held as planned, but digitally.

The program conference (“the Mistra Carbon Exit Week”), held in March 2021, was also organized digitally, and allowed us to invite and engage more people than had it been a physical meeting. The conference gathered over 400 participants which would hardly have been the case if it had been a physical meeting. We will take these experiences with us for our future planning. It is likely that we will continue having digital meetings and seminars to save time and reduce the climate impact from travels. However, digital meetings cannot replace all physical meetings. Such will of course take place when we find them appropriate and effective and when the pandemic allows.

Strengthened by the positive feedback from our end-users and the decision by Mistra to fund a second phase, we are very glad and excited to continue this program with our research colleagues and partners in industry and municipalities into a second phase.

Lars and Filip, September 2021



*Lars Zetterberg,
Programme manager*



*Filip Johnsson,
Vice programme manager*

About Mistra Carbon Exit

The Mistra Carbon Exit programme addresses and identifies the technical, economic and political challenges that Sweden will encounter when it attempts to reach the net zero greenhouse gas emissions target by 2045. This target will require transformative pathways in virtually all industrial processes and their associated products and services. Mistra Carbon Exit takes a novel approach in addressing this problem by focusing on opportunities and barriers for mitigating carbon emissions along industry supply chains – from the input of raw materials, through primary and secondary activities, to final products and services demanded by the end user.

In three industrial case studies we assess the buildings, transportation infrastructure and transportation supply chains. These supply chains allow us to identify around 75 per cent of Sweden's carbon dioxide emissions. The programme examines and identifies pathways and policies that will enable Sweden and Swedish companies to become frontrunners when it comes to rapidly transforming society and industries – providing low carbon products and services while simultaneously addressing market risks. This will make Sweden an important international example for other countries to follow in a holistic perspective that embraces multiple technical, social and policy points of view.

We have divided our efforts into four case studies (energy carriers, buildings and transportation infrastructure, transportation and local arenas), five academic work packages and a communication package. The academic work packages investigate and define transformative pathways, technology assessments along supply chains, changing market institutions and attitudes towards commonly held Swedish leadership principles, policies and governance, and integration and sustainability implications.

The Mistra Carbon Exit consortium embraces a broad representation of researchers and actors: four universities: Chalmers University of Technology, University of Gothenburg, Linköping University and the Royal Institute of Technology (KTH), four research institutes: IVL Swedish Environmental Research Institute, Resources for the Future (RFF), The German Institute for Economic Research (DIW), The Centre for European Policy Studies (CEPS) and some 20 nonacademic partners.

Scientific publications

Year 2020/2021 was a year of harvest, when many research tasks have been completed and have communicated their results through scientific papers, policy brief and other publications, see below.

- Camuzeaux, J., Sterner, T. and Wagner, G. (2020). "India in the coming climate G2?". *National Institute Economic Review*, 251, R3-R12. DOI: <https://doi.org/10.1017/nie.2020.2>
- Carlsson, F., Kataria, M., Krupnick, A., Lampi, E., Löfgren, Å., Qin, P., Sterner, T., and Yang, X. 2021. "The Climate Decade: Changing Attitudes on Three Continents", forthcoming in *Journal of Environmental Economics and Management*.
- Chiappinelli, O., and M. Arve (2020), "The Role of Budget Constraints in Sequential Elimination Tournaments", forthcoming in *Scandinavian Journal of Economics*
- Coria, J., Hennlock, M., & Sterner, T. (2021) Interjurisdictional Externalities, Overlapping Policies and NOx Pollution Control in Sweden. *Journal of Environmental Economics and Management*. <https://doi.org/10.1016/j.jeem.2021.102444>
- Damania, R., Sterner, T. & Whittington, D. (2020). Environmental policy instruments and corruption. *China Economic Journal*, DOI: 10.1080/17538963.2020.1751454
- Gerres, T., Haussner, M., Neuhoff, K. and A. Pirlot, (2020), "Can Governments Ban Materials with Large Carbon Footprint? Legal and Administrative Assessment of Product Carbon Requirements", forthcoming in *Review of European, Comparative & International Environmental Law (RECIEL)*
- Habla, W., V. Huwe and M. Kesternich. (2021) Electric and Conventional Vehicle Usage in Private and Car Sharing Fleets in Germany (joint with), *Transportation Research Part D: Transport and Environment*, Volume 93, 2021
- Hagem, C., Hoel, M., & Sterner, T. (2020). Refunding Emission Payments: Output-Based versus Expenditure-Based Refunding. *Environmental and Resource Economics*, volume 77, pages 641–667 (2020)
- Löfgren Å., Burtraw D, Keyes A. 2020. Decarbonizing the Industrial Sector - The Potential for Ambitious EU Member States to Use Flexible Performance Standards to Strengthen Carbon Price Signals, *Resources for the Future Report 20-03*.
- Sterner, T., Carson, R., Hafstead, M., Howard, P., Carlsson Jagers, S., Köhlin, G., Parry, I., Rafaty, R., Somanatan, E., Steckel, J. C., Whittington, D., Alpizar, F., Ambec, S., Aravena, C., Bonilla, J., Daniels, R. C., Garcia, J., Harring, N., Kacker, K., Kerr, S., Medhin, H., Khanh Nam, P., Romero, G., Johansson Stenman, O., Toman, M., Xu, J. & Wang, M. (2020). Funding Inclusive Green Transition through Greenhouse Gas Pricing. *ifo DICE Report*, 18(1), 03-08.
- Wilson, C., Kerr, L., Sprei, F., Vrain, E., & Wilson, M. (2020). Potential Climate Benefits of Digital Consumer Innovations. *Annual Review of Environment and Resources*, 45, 113-144.
- Yeh, S., Burtraw, D., Greene, D. L., & Sterner, T., 2020, Tradable performance standard as a hybrid regulatory-market policy instrument: case studies in transport. *RFF Working Paper 20-18*. <https://www.rff.org/publications/working-papers/tradable-performance-standards-transportation-sector/>
- Coria, J., Hennlock, M., Sterner, S. (2021) Interjurisdictional externalities, overlapping policies and NOx pollution control in Sweden. *Journal of Environmental Economics and Management*, Volume 107.
- Wilson, C., Kerr, L., Sprei, F., Vrain, E., & Wilson, M. (2020). Potential Climate Benefits of Digital Consumer Innovations. *Annual Review of Environment and Resources*, 45, 113-144.
- Johnsson, F., Karlsson, I., Rootzén, J., Ahlbäck, A., Gustavsson, M. 2020, The framing of a sustainable development goals assessment in decarbonizing the construction industry – avoiding "Greenwashing". *Sustainable and Renewable Energy Reviews* 131 (2020).

- Eloffsson A., Johansson D.J.A., Larsson J., 2020, Biofuel Blending Mandate for Aviation: Analysis of a Swedish policy proposal and its' interaction with CORSIA and EU ETS, submitted to Journal of Air Transport Management.
- Münzel, C., Plötz, P., Sprei, F., Gnann, T., 2019, How large is the effect of financial incentives on electric vehicle sales? – A global review and European analysis. *Energy Economics*, (84), 104493. <https://doi.org/10.1016/j.eneco.2019.104493>.
- Sprei, F., Hult, C., Hult, Å., & Roth, A., 2020, Review of the Effects of Developments with Low Parking Requirements. *Sustainability*, 12(5), 1744.
- Hänsel M.C., Drupp M.A., Johansson D.J.A., Nesje F., Azar C., Freeman M.C., Groom B., Sterner T., 2020, How climate economics supports the UN climate targets, *Nature Climate Change volume 10, pages 781–789*.
- Zetterberg, L., Johnsson, F., Möllersten, K. Incentivizing BECCS – a Swedish case study, submitted to *Frontiers in Climate* in 2021.
- Johansson D.J.A., Azar C., Lehtveer M., Peters G.P., 2020, The Paris Climate Agreement and the need for negative carbon emissions, *Environmental Research Letters* 15 124024.
- Fischer, C., Reins, L., Burtraw, D., Langlet, D., Löfgren, Å., Mehling, M., van Asselt, H., Weishaar, S., Zetterberg, L., Kulovesi, K., 2020, The Legal and Economic Case for an Auction Reserve Price in the EU Emissions Trading System. *Columbia Journal of International Law*, Spring 2020.
- Christian Flachsland, Michael Pahle, Dallas Burtraw, Ottmar Edenhofer, Milan Elkerbout, Carolyn Fischer, Oliver Tietjen, Lars Zetterberg, 2020, Avoid history repeating: The case for an EU ETS price floor revisited, *Climate Policy*, Vol. 20, Issue 1, p. 133–142. <https://doi.org/10.1080/14693062.2019.1682494> .
- Hennlock, Löfgren, Wollbrant, 2020, Prices versus Standards Evidence from an Artefactual Field Experiment on Managerial Investment Behavior, For submission to a peer-reviewed journal in Spring 2021.
- Benulic, K.-S., Kropf, M., Linnér, B.-O. & Wibeck, V., (2020), The meaning of leadership in subnational climate action. Submitted for journal publication containing the results from the Swedish focus groups.
- Schäfer, A. W., & Yeh, S., 2020, A holistic analysis of passenger travel energy and greenhouse gas intensities. *Nature Sustainability*. <https://doi.org/10.1038/s41893-020-0514-9>
- Johnsson, F., Normann, F., Svensson, E., 2020, Marginal abatement cost curve of industrial CO2 capture and storage – a Swedish case study, *Front. Energy Res.*, 11 August 2020 (A Special Issue on CCS).
- Karlsson, I., Rootzén, J., & Johnsson, F., 2020, Reaching net-zero carbon emissions in construction supply chains – Analysis of a Swedish road construction project. *Renewable and Sustainable Energy Reviews*, Vol. 120, 109651. <https://doi.org/10.1016/J.RSER.2019.109651>

Roadmaps, reports and policy briefs

- Technical roadmap - Steel Industry
- Technical roadmap - Cement Industry
- Technical roadmap - Buildings and transport infrastructure
- Policy brief: Can the EU ETS weather the impact of Covid-19?
- Policy brief: Decarbonizing the Industrial Sector
- SDG Impact Assessment of Mistra Carbon Exit pathways One plus 16 dimensions of sustainability
- The Climate Decade - Changing Attitudes on Three Continents

Books

- Elkerbout, M., Zetterberg, L, 2020. EU ETS – Reform needs in the light of national policies, book for European Liberal Forum, published by FORES, available on fores.se



Roadmaps, reports and policy briefs 2020

Communication

Being the final year of Phase 1, the program has had many interesting results to share. The case study workshops/webinars organized by Johan Rootzén on a regular basis has been a successful format for dialogue with stakeholders while also being a way to bring novel ideas and innovation into the research.

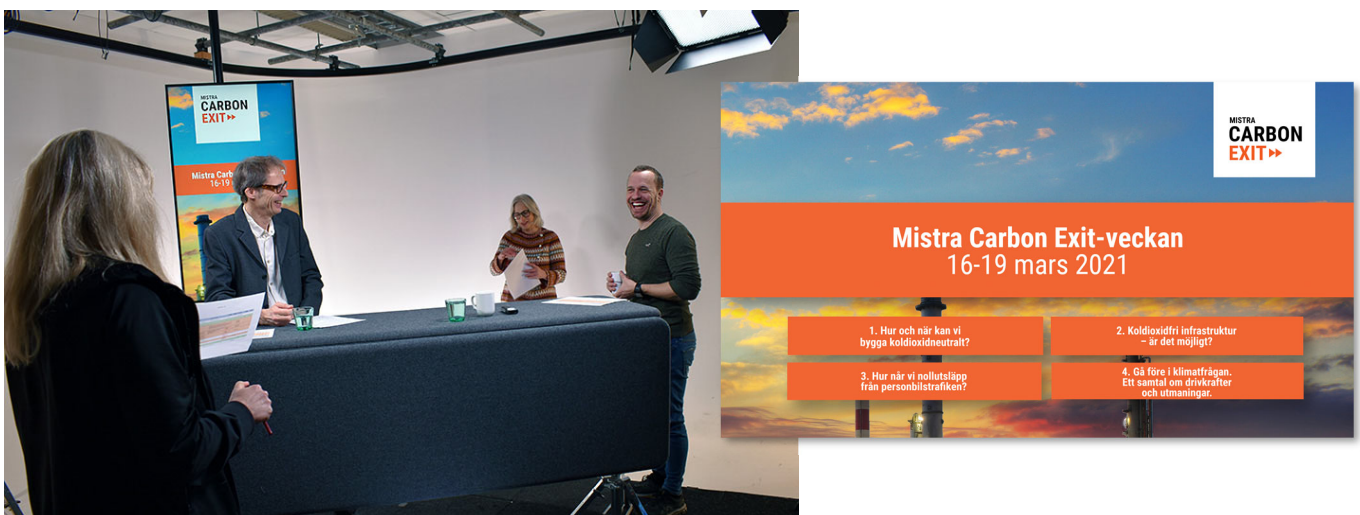
In mid-March 2021 we organized *Mistra Carbon Exit Week*, a fully digital breakfast webinar broadcasted live from a studio in Gothenburg. The event was organized in four separate, yet interlinked thematic seminars, with both guest speakers and project researchers, starting off with buildings and infrastructure, followed by transportation and wrapping up with policy and leadership perspectives.

The *Mistra Carbon Exit Week* gathered over 400 viewers out of which a majority attended several seminars. From direct feedback as well as a digital survey we received all in all very positive reviews.

The program has also received a lot of media exposure over the year, both through pro-active activities such as opinion pieces and press releases but more so from media's own coverage of program related topics. The listed articles below is a selection.

Case study workshops and webinars

- Apr 2, 2020: Buildings and infrastructure new
- Apr 16, 2020: Sustainable procurement within the civil engineering and construction sector
- Jun 4, 2020: Allmännyttans klimatinitiativ
- Oct 14, 2020: *Mistra Carbon Exit* – Lessons from Phase I and plans for Phase II
- Nov 12, 2020: Propelling the Commercialization of 'Novel Cements'
- Nov 26, 2020: Experiences from building and construction in Uppsala Climate Protocol
- Dec 10, 2020: Policy mixes in sustainability transitions
- Dec 10, 2020: *Mistra Dialog*: Global climate implications of the US elections
- Mar 11, 2021: Carbon Contracts for Difference (CCfD) and product carbon requirements
- Mar 14-18, 2021: *Mistra Carbon Exit Week*



Mistra Carbon Exit Week

Key media exposure

- May 3, 2020: "Utmaningen är ekonomisk och politisk, inte teknisk", Göteborgs-Posten
- May 9, 2020: Pris för utsläppsrätter stiger, Dagens ETC
- Jul 1, 2020: Skärp EU:s utsläppshandel i spåren av Corona, TT
- Jul 14, 2020, Hårdare klimatpolitik bäst för ekonomin, TT
- Aug 19, 2020: Svårt att nå de svenska klimatmålen, TT
- Sep 7, 2020: Storföretags hållbarhetsmål leder för sällan till handling, Dagens Nyheter
- Sep 7, 2020: Ny studie: Företag gömmer sig bakom luddiga hållbarhetsmål, Dagens Industri
- Sep 13, 2020: Med el i tankarna, Sydsvenskan
- Sep 16, 2020: Dags att klimatsäkra verksamheten, Aktuell Hållbarhet
- Oct 7, 2020: Expert: Så funkar koldioxidinfångning, SVT Aktuell
- Oct 11, 2020: Miljöekonom: Styr om tillväxten för klimatet, TT
- Oct 26, 2020: Så olika är presidentkandidaternas klimatplaner, SVT Aktuellt
- Dec 17, 2020: "Vi behöver en större robusthet i elsystemet", Ny Teknik
- Jan 20, 2021: Ökat stöd för en kraftfull klimatpolitik, Svenska Dagbladet
- Feb 4, 2021: Professorn om Musks plan: "Hoppas inte på för mycket", Ny Teknik
- Mar 11, 2021: Orealistiska kärnkraftsförslag tar fokus från viktigare frågor, Dagens Nyheter
- Mar 18, 2021: Sverige har satsat mindre än andra länder på grön omstart, Svenska Dagbladet

Programme management

During the first 6 months of 2020, the a progress report for Phase 1 and a proposal for Phase 2 was developed. An external committee evaluated the proposal and held a hearing in November with the program management, five of our stakeholders and three of our PhD students. In December, the Mistra board decided to fund Mistra Carbon Exit for a second phase.

The programme board met four times in 2020-2021, due to Covid-19 only in digital meetings. The board consists of Peter Nygårds, Chair for the Foundation of Stiftelsen IVL, Birgitta Resvik, Sameko, Erik Eriksson, Formas, Stefan Nyström, Swedish Environmental Protection Agency, Anna Denell, Vasakronan and Kristina Sundin Jonsson, Municipality of Skellefteå. Four new projects, financed by the strategic reserve, were approved by the board. In total, eight projects have been funded by the reserve.

Five management group meetings were held in 2020/2021.

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WORK PACKAGE 3: CHANGING MARKET INSTITUTIONS AND BEHAVIOURS TOWARDS SWEDISH LEADERSHIP

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WORK PACKAGE 5: INTEGRATION AND SUSTAINABILITY ASSESSMENT

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