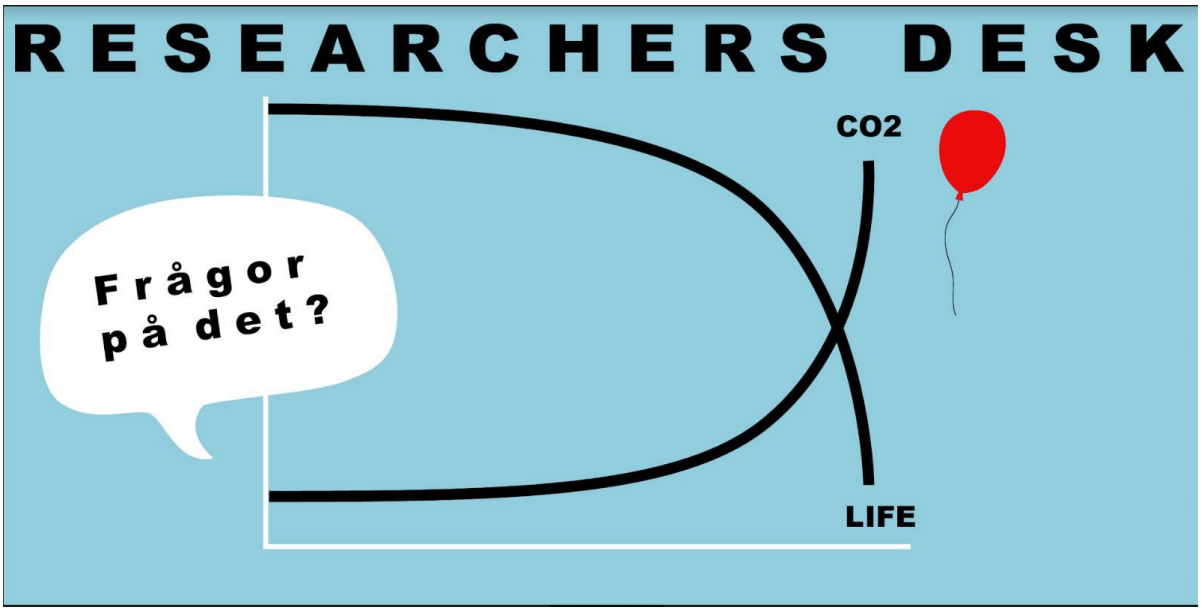
Independent Assessment of 7 (8) Swedish Political Parties' Climate Policies by Climate Scientists

Version 6.4 – 8 July 2022



Researchers' Desk

Carbon budgets

Analysis by Alasdair Skelton and Paul Glantz with an introduction by Kimberly Nicholas

Introduction

- Warming will not stop until humans completely stop adding carbon dioxide to the atmosphere, and emissions of other greenhouse gases are decreasing (IPCC, 2021)
- Humanity has a "carbon budget" which is the tons of carbon dioxide and other greenhouse gases we can add to the atmosphere and stay within a given level of warming, e.g., the Paris Agreement targets of 1.5°C or well below 2°C.

Human-caused climate change is already dangerous, with billions of people and much of nature worldwide already experiencing harm (IPCC, 2022). Avoiding severe, irreversible harm requires urgent, radical reduction of climate pollution within the next few years. At least half of global emissions must be eliminated by 2030 (at current rates, the global carbon budget for 1.5°C will be exhausted in July 2029, just 84 months from now). According to the IPCC, failure to reduce emissions at the rapid rate required in the next few years will "miss a brief and rapidly closing window to secure a livable future."

The Paris Agreement specifies that the necessary emissions reductions should be done in a fair and just manner following a principle of "common but differentiated responsibilities and respective capabilities". What this means in practice is that historically high-emitting and relatively wealthy countries such as Sweden should reduce emissions first and faster (Stoddard and Anderson, 2022).

Survey

Parties were asked the following question concerning carbon budgets:

1. What budget and pace of emissions reductions does your party want to see?

Parties were invited to select between the following responses:
a. Carbon budget for 1.5 degrees which accounts for climate justice.
b. Carbon budget for 1.5 degrees shared equally globally per capita with climate justice accounted for by a combination of bio-CCS and climate aid.
c. Sweden's current target.
d. Another quantifiable emissions budget target for Sweden (specify).
e. We don't have a target for emissions reductions.
f. Don't know.

Parties were also asked if they supported the EU directive that Sweden should increase its nature-based (LULUCF) CO_2e uptake by 2030.

Parties were then asked a number of more specific questions concerning actions whereby their chosen target could be achieved.

The following analysis concerns parties stated ambitions and a preliminary assessment of feasibility based solely on the parties' own responses.

Notes

Option (a) assumes a carbon budget for Sweden from 2022 of 170 million tons CO_2 for fossil fuels and industry (with emissions from cement productions considered as a global overhead). This equates to a linear reduction trajectory (for CO_2) of ca. 12% annually or an exponential reduction trajectory starting at ca. 21% in 2022 (Stoddard and Anderson, 2022).

Option (b) assumes a carbon budget (excluding LULUCF) from 2022 of ca. 400 million tons CO_2 for territorial emissions in Sweden. This equates to a linear reduction trajectory (for CO_2) of 5.5% annually or an exponential reduction trajectory starting at 9.4% in 2022 (FAIRTRANS).

Option (c) does not specify a carbon budget. Instead net zero is to be achieved by 2045 with a maximum of 15% complementary measures. This equates to a linear reduction trajectory (for CO_2e) of ca. 4.2% per year. The corresponding "best case" carbon budget for CO_2 only from fossil fuels and industry (excluding cement production) is 385 million tons CO_2. After subtracting 30 million tons CO_2 for cement production, we calculate that this is ca. 2.1 times more than Sweden's share of the global carbon budget presented by Stoddard and Anderson (2022) which accounts for climate justice by "allowing" developing countries a later (2025) peak in emissions. Another way of considering climate justice is for high emitters to take responsibility for their historical emissions. In this respect, the "best case" carbon budget for Sweden's current target is equivalent to Sweden taking responsibility for its historic emissions back to the early-1990s and no further (Morfeldt et al. 2022).

Responses

In response to our survey:

SD stated support for Sweden's current target (net zero in 2045 with 15% complementary measures). SD did not state support for the EU directive concerning CO_2 uptake by forests.

C's stated ambition was net zero in 2040. C did not state support for the EU directive concerning CO_2 uptake by forests.

V's stated ambition was real zero in 2035. V stated not only support for the EU directive concerning nature-based (LULUCF) CO_2e uptake but also an ambition for a doubling of LULUCF CO_2-uptake (compared with 2017) by 2030.

S stated support for Sweden's current target (net zero in 2045 with 15% complementary measures). S did not state support for the EU directive concerning CO_2 uptake by forests.

L stated support for Sweden's current target (net zero in 2045 with 15% complementary measures). L had not committed itself to the EU directive concerning CO_2 uptake by forests. L also stated an ambition to implement complementary measures (CCS) of 10 Mton-CO_2 annually by 2030 and 20 Mton-CO_2 annually by 2035.

KD stated support for Sweden's current target (net zero in 2045 with 15% complementary measures). KD did not state support the EU directive concerning CO_2 uptake by forests.

MP's stated ambition was a carbon budget of 210 million tons CO_2. MP stated not only support for the EU directive concerning CO_2 uptake by forests but also an ambition of achieving LULUCF uptake of 70 Mton-CO_2.

M chose not to respond to the survey. M stated elsewhere that it supports Sweden's current target.

Analysis

In the following analysis, we begin with a summary of what each party's stated ambitions means in terms of its required carbon budget and how this budget compares with one that accounts for climate justice. These carbon budgets are then shown graphically in figures 1 (excluding complementary measures) and 2 (including complementary measures). Figures 3-8 show corresponding emissions trajectories for different scenarios. Scenarios are paired to show trajectories excluding (figures 3, 5 and 7) and including (figures 4, 6 and 8) complementary measures. Figures 3-6 show linear trajectories for carbon dioxide and other greenhouses gases (figures 3-4) and for carbon dioxide only (figures 5-6). Figures 7-8 show trajectories which are based on a scenario which takes into consideration major changes in emissions from industry (Naturvårdsverket 2021/80). Figures 5-6 and 7.8 can be viewed as "end-member" scenario pairs. The real emissions trajectory for each party is likely to fall between these end members.

To make a like-for-like comparison of the parties' answers with the reference fair budget, we must make interpretations and recalculate in some cases. This is because various targets and budgets are expressed

in different ways in terms of which greenhouse gases (carbon dioxide only, or carbon dioxide and others, e.g. methane) that are considered; whether budgets are territorial or consumption-based; whether production emissions from cement are included; and whether complementary measures are included or not. This is why some figures may look different than graphs shown elsewhere.

Summary

KD, M, S and SD's stated ambitions are in line with Sweden's current target. This requires a "best case" carbon budget (fossil fuels and industry) of 385 million tons CO_2 for scenario 2021/80 (Naturvårdsverket, 2021). After subtracting 30 million tons CO_2 for cement production, we calculate that this is ca. 2.1 times more than Sweden's share of the global carbon budget accounting for climate justice (Stoddard and Anderson, 2022).

L's stated ambitions are also in line with Sweden's current target. However, L also states an ambition to implement complementary measures (CCS) of 10 Mton-CO_2 annually by 2030 and 20 Mton-CO_2 annually by 2035. This could generate 330 million tons CO_2 of negative emissions by 2045. This action (arguably*) "compensates" for L's ambition to use more than Sweden's share of the global carbon budget accounting for climate justice.

C's stated ambition is "net zero by 2040". This requires a "best case" carbon budget (fossil fuels and industry) of 341 million tons CO_2. After subtracting 30 million tons CO_2 for cement production, we calculate that this is ca. 1.8 times more than Sweden's share of the global carbon budget accounting for climate justice.

V's stated ambition is "zero emissions by 2035". This requires a carbon budget (fossil fuels and industry) of 247 million tons CO_2. After subtracting 30 million tons CO_2 for cement production, we calculate that this is ca. 1.3 times more than Sweden's share of the global carbon budget accounting for climate justice. However, V also states an ambition to double LULUCF CO_2-uptake by 2030 (compared with 2017). This could generate 595 million tons CO_2 of negative emissions by 2045. This action (arguably*) "compensates" for V's ambition to use more than Sweden's share of the global carbon budget accounting for climate justice.

MP's stated ambition is "a carbon budget of 210 million tons CO_2". This equates to achieving "zero emissions" for CO_2 by 2034. After subtracting 30 million tons CO_2 from MP's carbon budget for cement production, we calculate that this is ca. 1.1 times more than Sweden's share of the global carbon budget accounting for climate justice. However, MP also states an ambition of achieving LULUCF uptake of 70 Mton-CO_2. If achieved by 2030, this could generate 610 million tons CO_2 of negative emissions by 2045. This action (arguably*) "compensates" for MP's ambition to use more than Sweden's share of the global carbon budget accounting for climate justice.

It is good that the stated ambitions of all parties are in line with (or better than) Sweden's target of "net zero in 2045" (including 15% complementary measures**). It is encouraging that, of the 4 parties, whose ambitions are better than Sweden's current target, MP and V have ambitions which (excluding complementary measures) are nearly in line with a budget equal to Sweden's share of the global carbon budget accounting for climate justice. On the other hand, parties' stated ambitions concern territorial emissions meaning that emissions in other countries which arise because of consumption in Sweden are not included. According to Naturvårdsverket, consumption-based emissions were 80% higher than territorial emissions in 2019.

* It is important to bear in mind that it is not really possible to compensate for emissions from fossil fuels and industry with carbon uptake from LULUCF. This is because CO_2 emissions from fossil fuels and industry belong to the slow carbon cycle whereas carbon uptake from LULUCF occurs in the fast carbon cycle. The capacity of the fast cycle is both finite and reaching saturation (Fig. SPM. 7) This means that it cannot be expected to take care of a vast amount of fossil carbon which originates from the slow carbon cycle. Instead, this fossil carbon must ultimately be taken care of within its own cycle. This occurs naturally, but on timescales of hundreds of thousands of years. In some cases, CCS can be used to compensate for emissions from fossil fuels and industry. However, production of biomass for BECCS can delay nature-based CO_2 uptake, effectively reducing negative emissions.

** Anderson et al. (2020) question strongly a reliance on complementary measures. The IPCC takes a similar standpoint in its 2018 Special Report on Global Warming of 1.5 °C.

Carbon budgets

Figures 1 and 2 show carbon budgets (fossil fuels and industry) which are in line with Sweden's current and parties' stated ambitions. These are compared with a climate justice budget (Stoddard and Anderson, 2022) in figure 1. In figure 2, complementary measures (nature-based and bio-CCS) are also shown but no comparison is made with the climate justice budget because a part of this budget is non-reliance on complementary measures. Data used to construct this figure are shown in figures 7 and 8.

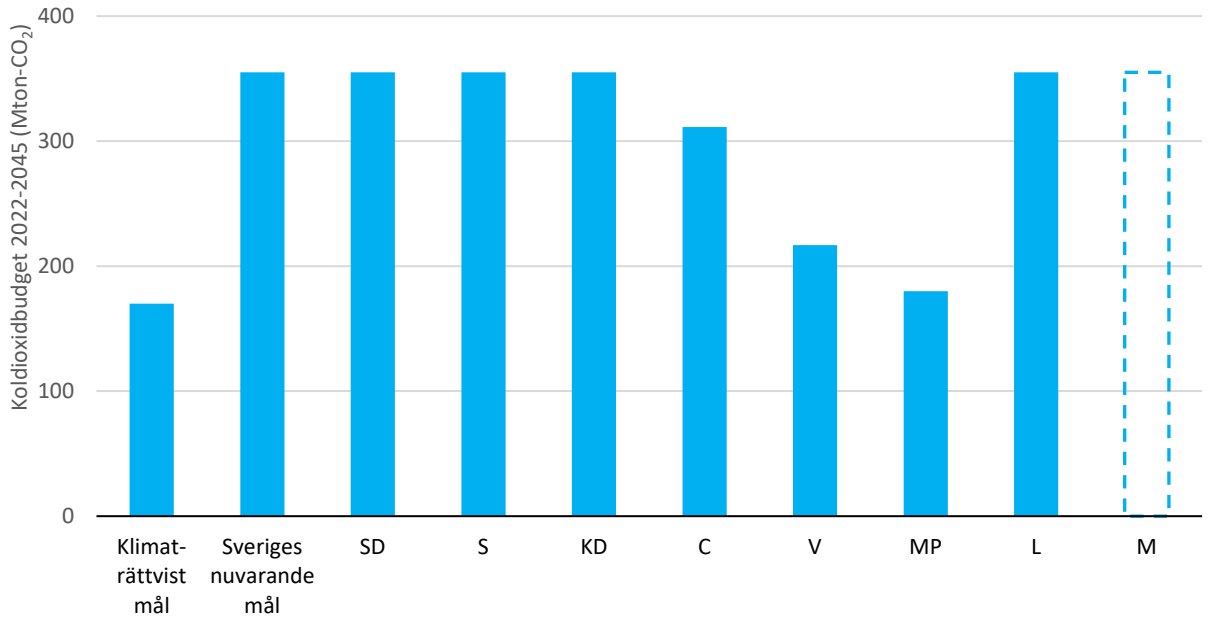


Figure 1. Comparison of carbon budgets which are in line with Sweden's current and parties' stated ambitions, compared with a climate justice budget (Stoddard and Anderson, 2022). Because, parties' carbon budgets are territorial (not consumption-based), they should be seen as "best case" estimates. **Note that no attempt has been made to assess the feasibility of parties' stated ambitions.**

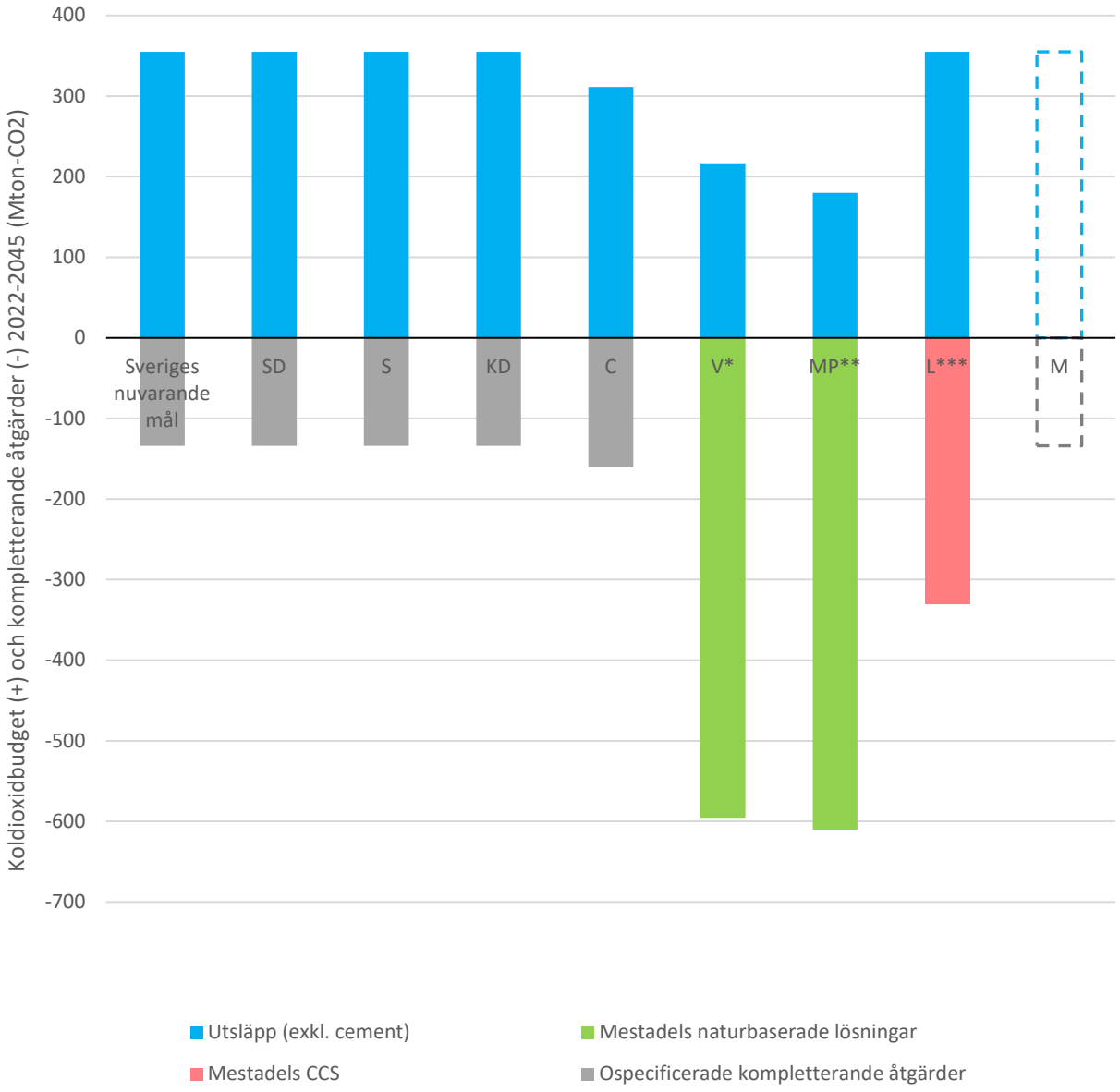


Figure 2. Comparison of carbon budgets which are in line with Sweden's current and parties' stated ambitions. This figure also shows stated ambitions for use of complementary measures. Because, parties' carbon budgets are territorial (not consumption-based), they should be seen as "best case" estimates. **Note that no attempt has been made to assess the feasibility of parties' stated ambitions.**

* V states an ambition to "double nature-based CO_2e (2017 values) by 2030". This results in the negative emissions shown assuming that this action is <u>additional</u> to their stated zero emissions target of 2035.
** MP states an ambition to "increase nature-based CO_2 uptake to 70 Mton-CO_2 annually". This results in the negative emissions shown assuming that this action is <u>additional</u> to their stated 210 Mton-CO_2 carbon budget. It is also assumed that this will be accomplished by 2030.
*** L plans extensive use of complementary measures (presumably bio-CCS). This results in the negative emissions shown assuming that this action is <u>additional</u> to their stated net zero emissions target of 2045.

Emissions trajectories

Figures 3 and 4 compare parties' ambitions for emissions reductions in Mton-CO_2e (carbon dioxide and other greenhouse gases), assuming linearity, excluding (figure 3) and including (figure 4) complementary measure with Sweden's current target.

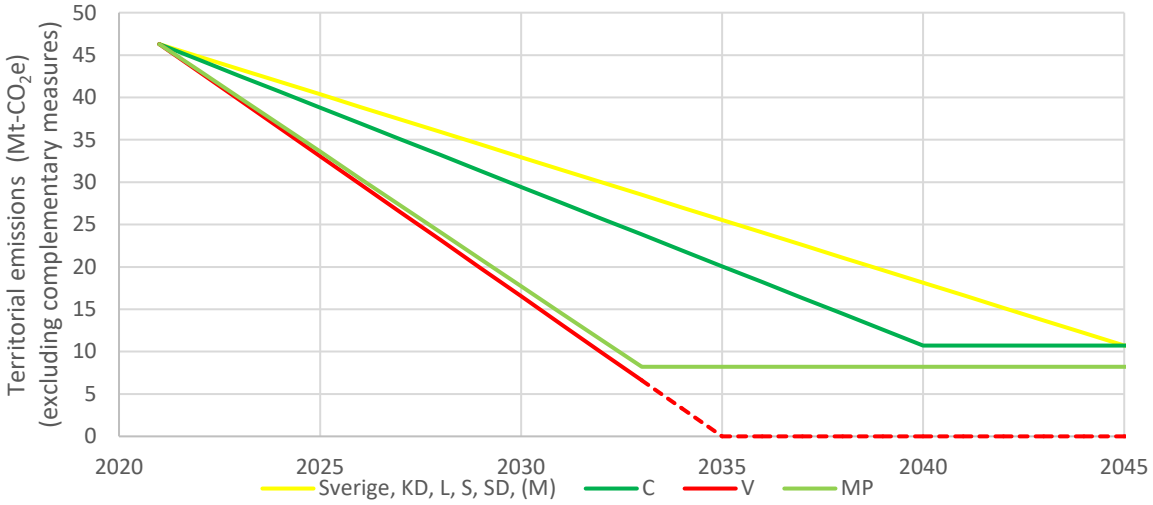


Figure 3. Comparison of parties' ambitions for emissions reductions in Mton-CO_2e (carbon dioxide and other greenhouse gases), assuming linearity, excluding complementary measures with Sweden's current target. *Note*: V's stated ambition is "real zero" for CO_2e. It is unclear if this can be achieved for all non-CO_2 emissions. If not, V's trajectory will be similar to MP's trajectory. **Note that these are hypothetical trajectories because no attempt has been made to assess the feasibility of parties' stated ambitions.**

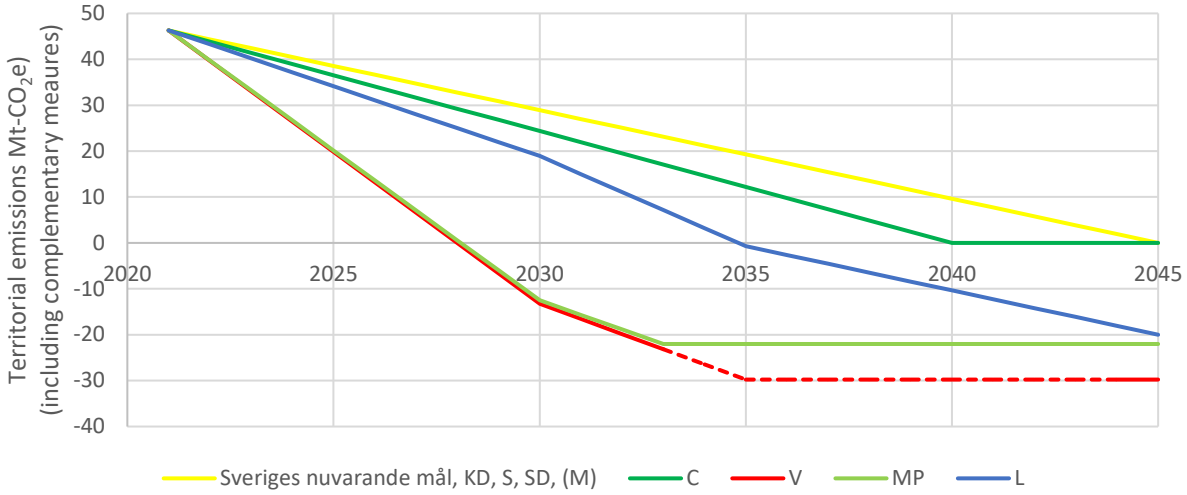


Figure 4. Comparison of parties' ambitions for emissions reductions in Mton-CO_2e (carbon dioxide and other greenhouse gases), assuming linearity, including complementary measures with Sweden's current target. *Note*: V's stated ambition is "real zero" for CO_2e. It is unclear if this can be achieved for all non-CO_2 emissions. If not, V's trajectory will be similar to MP's trajectory. **Note that these are hypothetical trajectories because (with the exception of the aforementioned concern) no attempt has been made to assess the feasibility of parties' stated ambitions.**

Figures 5 and 6 compare parties' ambitions for emissions reductions in Mton-CO_2 (carbon dioxide only) for fossil fuels and industry (excluding international travel), assuming linearity, excluding (figure 5) and including (figure 6) complementary measures with Sweden's current target and climate just trajectories (S&A-22).

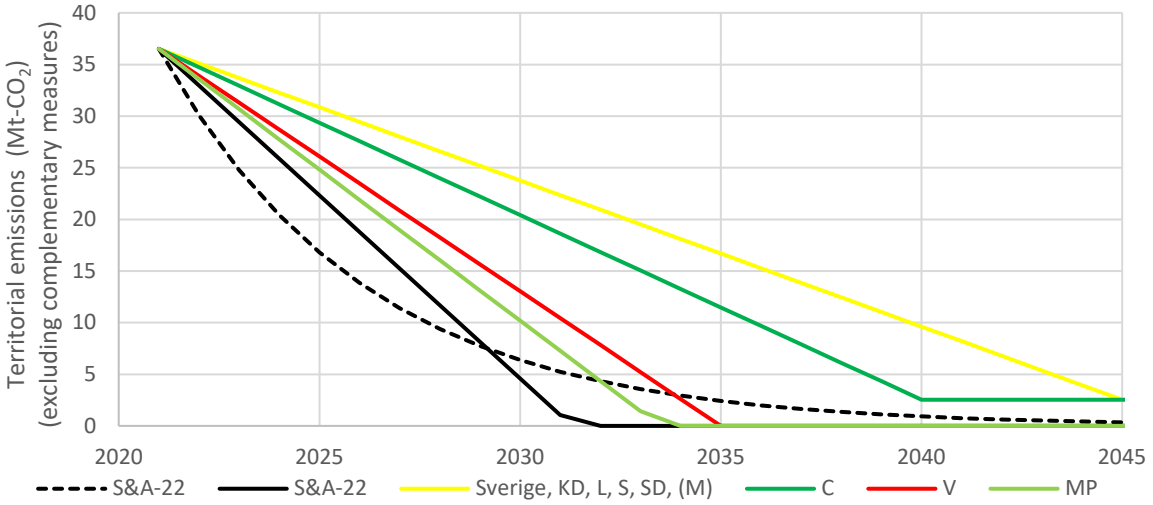


Figure 5. Comparison of parties' ambitions for *linear* emissions reductions in Mton-CO_2 (carbon dioxide only) for fossil fuels and industry (excluding international travel) excluding complementary measures with Sweden's current target (yellow line) and exponential (dashed black line) and linear (solid black line) climate just trajectories (S&A-22). **Note that this is a hypothetical "end-member" scenario in which parties are assumed to follow linear trajectories to a baseline of 2.5 Mton-CO_2 in 2045 (Naturvårdsverket, 2021). Also, no attempt has been made to assess the feasibility of parties' stated ambitions.**

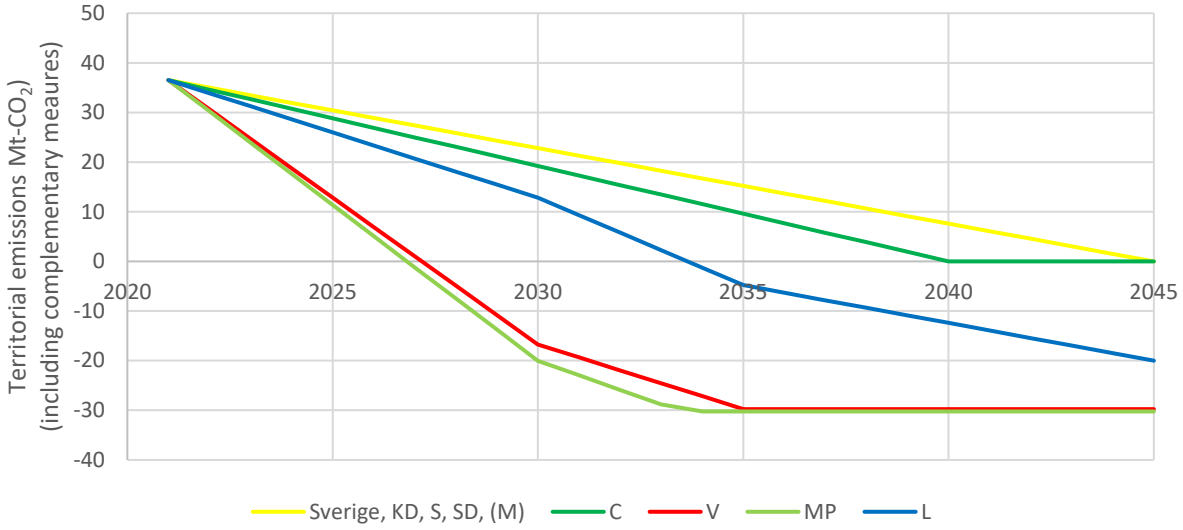


Figure 6. Comparison of parties' ambitions for *linear* emissions reductions in Mton-CO_2 (carbon dioxide only) for fossil fuels and industry (excluding international travel) including complementary measures with Sweden's current target (yellow line). **Note that this is a hypothetical "end-member" scenario in which parties are assumed to follow linear trajectories. Also, no attempt has been made to assess the feasibility of parties' stated ambitions.**

Figures 7 and 8 compare parties' ambitions for emissions reductions in Mton-CO_2 (carbon dioxide only) for fossil fuels and industry (excluding international travel), excluding (figure 7) and including (figure 8) complementary measure with Sweden's current target and climate just trajectories. Scenario 2021/80 (Naturvårdsverket, 2021) is used for Sweden's current target and to calculate parties' trajectories.

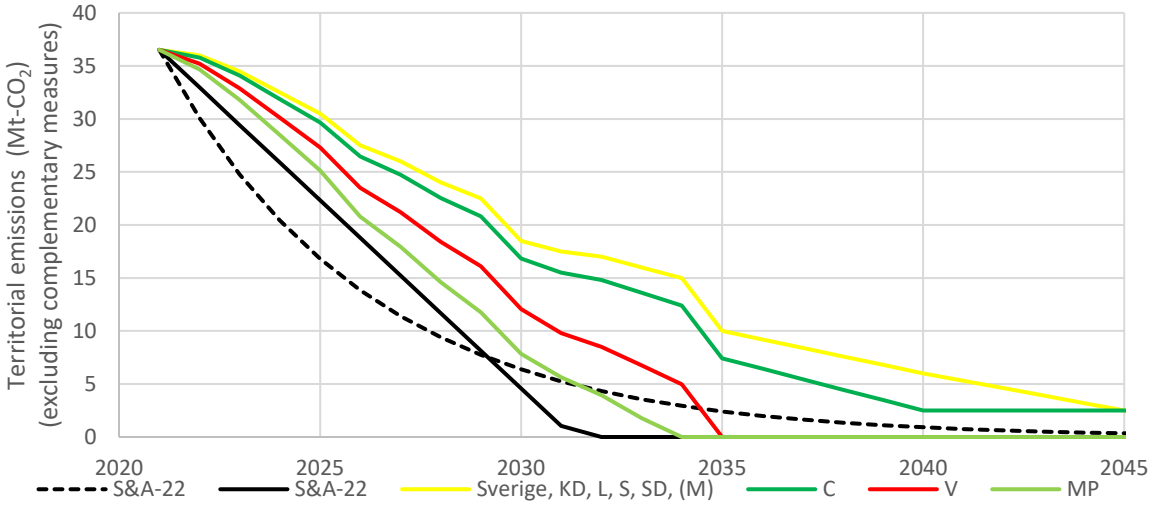


Figure 7. Comparison of parties' ambitions for emissions reductions in Mton-CO_2 (carbon dioxide only) for fossil fuels and industry (excluding international travel), excluding complementary measures with Sweden's current target (yellow line) and exponential (dashed black line) and linear (solid black line) climate just trajectories. **Note that this is a hypothetical "end-member" scenario in which parties are assumed to follow trajectories similar to Scenario 2021/80 (Naturvårdsverket, 2021). Also, no attempt has been made to assess the feasibility of parties' stated ambitions.**

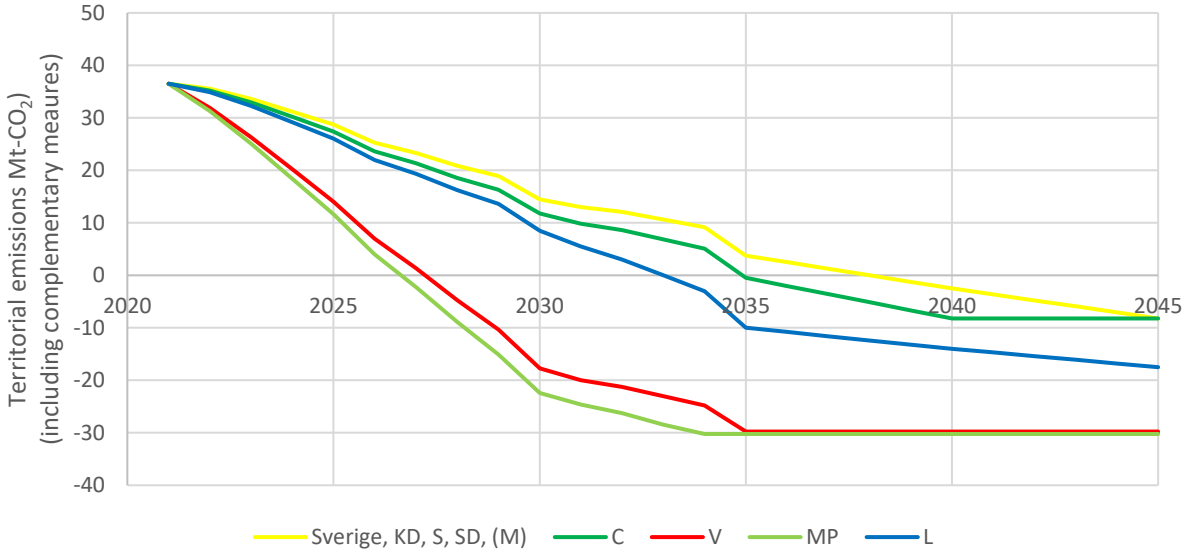


Figure 8. Comparison of parties' ambitions for emissions reductions in Mton-CO_2 (carbon dioxide only) for fossil fuels and industry (excluding international travel), including complementary measures with Sweden's current target (yellow line). **Note that this is a hypothetical "end-member" scenario in which parties are assumed to follow trajectories similar to Scenario 2021/80 (Naturvårdsverket, 2021). Also, no attempt has been made to assess the feasibility of parties' stated ambitions**.

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