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MEMO
2021-01-29

Methodology paper for evaluation of the Climate Leap (SA.49001 (2020/EV))

1 Introduction

In accordance with the terms of the European Commission's decision on the 30th June 2020 (SA.49001 (2020/EV)) the Swedish Authorities will submit a methodology paper by the 31 December 2020. This methodological paper focus on the most applicable methods to measure the direct effect on the beneficiaries (referred as main area 1) and complement and update the evaluation plan the European Commission approved by decision on the 30th June 2020 (SA.49001 (2020/EV)). How to evaluate indirect effects (referred as main area 2) and proportionality and appropriateness (referred as main area 3) of the aim has previously been answered in the approved evaluation plan.The European Commission's (2014) guidelines for state aid evaluation have been used as a basis for the report. The guidelines point out the importance of creating evaluation criteria that can isolate the causal effect of the funding and show examples of how to do this. The report and its conclusions are based on text, findings and recommendations made by WSP Advisory.

In this report, the possibilities of using one of the recommended methods are analysed, given how the Climate Leap initiative has been implemented and available data to statistically estimating the effect on investment decisions and emissions.

This introduction is followed by Chapter 2, on evaluation methods where we go through what an evaluation should include and describe the difficulties that exist when examining the effects of the aid. The chapter also provides an overview of some statistical methods that may be relevant to isolate the causal effect and whether these can be used in the evaluation of the Climate Leap.
Thereafter follows Chapter 3 with a review of the available data regarding the Climate Leap, both from its documentation, surveys to applicants and official statistics on emissions from certain industries.
Chapter 4 describes granted as well as rejected applications from 2016-2018, what types of measures have received support and how the climate benefit ratio is distributed among rejected and approved applications.

Chapter 5 draws conclusions on the possibilities for conducting a study for some of the measure categories in accordance with one of the methods proposed by the European Commission.
Finally, in Chapter 6, we give some recommendations regarding continued work with the evaluation.

2 Evaluation methods

2.1 What should be evaluated

The overall aim of the evaluation according to the European Commission (2014) is to assess the relative positive and negative effects of the Climate Leap ('Klimatklivet' in Swedish) support funding. The evaluation should answer whether the original purpose of the support has been achieved and if it has had any negative effects on the market and competition. The Commission emphasizes that the evaluation should assess if the grant has created an incentive for the receiver of the grant to change their behaviour or decision and if so, the impact of the incentive.

The evaluation will attempt to measure effects in three main areas, as previously presented in the evaluation plan:

1. **Direct effects on the beneficiary**. Has the grant affected how the beneficiary has acted, e.g. changed the investment decision? Did the grant have the expected effects when it comes to cutting greenhouse gas emissions?
2. **Indirect effects.** Did the grant have spill-over effects or displacement effects that affected anyone other than the beneficiaries? Has the grant had effects on employment? Does the aid influence the competition in the markets in which the beneficiaries operate?
3. **The proportionality and appropriateness of the aim**. Was the aid given to projects that deliver the biggest reduction in greenhouse gas emissions per krona invested? Has the Climate Leap provided the necessary support, at the required level of support, for the implementation of the measure? Has the Climate Leap been effective in speeding up the pace of achieving the environmental quality objective "limited climate impact"?

The aim of the Climate Leap initiative is to decrease emissions by providing grants for investments. For the grant to contribute to reduced greenhouse gas emissions it must increase the probability of investments being made and these investments must contribute to lower emissions. Although a full evaluation should provide answers to questions in all three areas, the direct effects of receiving funding are often easiest to evaluate. In this case, a support grant where the direct effect, i.e. the impact on investment decisions, is small means that the desired result has not been achieved. Instead, the grant has probably had negative indirect effects that were not offset by the desired direct effects.

2.2 Effects on investment decisions and emissions

Some of the investments that have received support from the Climate Leap have a direct impact on greenhouse gas emissions emitted by the organisation that applied for funding. This applies, for example, to certain energy conversion measures where the heating system of a building has been changed. For other types of investments, the emission reduction takes place by increasing the opportunities for others to reduce their emissions. This applies, for example, to investments in filling stations for biofuel cars or charging stations for electric vehicles.

This means that it is only relevant to assess the change in emissions from the applicants for a small share of the investments made. For the main part of the evaluation, we need to instead analyse the extent to which the Climate Leap has contributed to investments being made. However, the fact that investments have been made is not enough for the goal of the Climate Leap to be achieved. The investments also need to have at least increased opportunities to reduce emissions in Sweden. One way to approach this issue is to analyse to which extent the investments were delivered in accordance with the statements in the applications, e.g. volumes of biofuels or amounts of energy charged.

However, in the statistical analysis, we will need to focus on the question of the extent to which the Climate Leap has enabled investments that otherwise would not have taken place. For a few categories, it might be possible to directly assess the change in emissions. However, the question of possibilities to isolate causal effects is central.

2.3 Distinguishing causal effects

The evaluation must be able to isolate the causal effect of receiving a grant, i.e. the contribution of receiving funding. What would have happened in the absence of the grant and how does this differ from the current situation with the presence of the grant? The problem with these types of evaluations is that we cannot observe both a situation with a grant and a situation without a grant for the same groups. In short, we do not live in parallel realities - either support has been paid or it has not been paid. Therefore, we need to create comparison groups where one group has received funding while the other group has not. Other than this, the groups should be as similar as possible. To some extent, it is possible to control for differences between the groups by taking into account observable characteristics, for example in a regression model, but there might be differences between beneficiaries and those who have not received support that we cannot observe. In particular, difficulties arise when the fact that an entity has applied for and received a grant also signifies that it differs from others, e.g. only those who are facing an investment decision might apply for a grant from the Climate Leap. The very fact that a company is considering a certain type of investment means that their emissions are likely to change differently than for those companies that are not considering any investment.

Finding a relevant comparison group is central for carrying out a true evaluation, which have been foundto be difficult thus far.

The European Commission mentions a few methods for identifying causal effects. Randomized experiments are preferable, but not possible in the evaluation of the Climate Leap as the funding has not been, and shall not be, distributed randomly since aid shall be granted based on facts (climate investment with the most cost effective reduction of GHG) and not by chance. The option to introduce randomness is further prohibited by a strong principle of equal treatment. Instead, the relevant methods for this evaluation are quasiexperimental. Below we provide a brief summary of these methods and present the consultants analysis of how they could be used for an evaluation of the Climate leap. Structural estimation is also mentioned as a possible method in the European Commission (2014) guidelines, but we do not consider it feasible for the evaluation of the Climate Leap. It is our perception that the Commission shares our assessment.

2.3.1 Difference in difference

The idea is to compare two groups before and after the grant has been given and control for differences between the groups that are constant over time. For the Climate Leap, Difference in Difference (DiD) can be a possible method for monitoring how emissions have developed for a group that has received funding and a control group. The question, however, is how the control group should be defined. If you choose other companies / organisations that have not received funding, then these have not faced the same type of investment decision that those who have applied for funding from the Climate Leap. The very fact that funding is only sought by those who are considering a certain type of investment means that it can be misleading to compare the difference in development before and after the grant has been provided / not provided in the way that is done in a DiD. This suggests creating a control group instead of companies that applied for but did not receive support from the Climate Leap. For this to give correct results, however, it is required that the factors that mean that the funding has not been given have not at the same time affected the outcomes that are of interest, such as emissions or whether an investment has been made. Another question is which time span is relevant. If the Climate Leap primarily accelerates investments (e.g. changing heating systems), the time perspective can be decisive for the evaluation result.

2.3.2 Instrumental variables

An instrumental variable is a variable that is correlated with the explanatory variable that we are interested in, in this case, whether an entity has received support from the Climate Leap, but on the other hand is not correlated with any of the factors that are unobservable and that affect the outcome variable, ii.e. whether an investment has been made or the size of the emissions. Through an instrumental variable approach (IV) these non-observable factors can be accounted for. For the method to work, however, it is necessary to find instrumental variables that both have a fairly strong correlation with the explanatory variable we are interested in but also are completely uncorrelated

with the non-observable factors. Finding valid instrumental variables is often difficult.

One option the EPA would like to disucuss further, is the prerequisites for commitment of the County administrative boards. This is important both for how many applications are received from different counties and the quality of the applications and thus the extent to which these are granted. This can possibly be used in an instrumental variable approach where the county affiliation can be used as an instrumental variable for support from the Climate Leap. However, this requires that the Swedish Environmental Protection Agency can identify the commitment from the County administrative boards in a structured way and for a sufficient number of counties and years. It could for instance be based on numbers of employers at, and/or informative activites made by, the county administrative board for different types of measures.

2.3.3 Regression Discontinuity Design

Regression Discontinuity Design (RDD) is a method that uses discontinuities in how a variable affects the probability of being granted funding from the Climate Leap. For climate change, the calculated quota for climate benefit could function as such a variable, where the climate benefit ratio is a continuous variable but where there have been threshold values for whether funding has been granted. The idea behind RDD is to compare observations on each side of such a threshold value, where the important assumption is that observations that have a climate benefit ratio that are close to each other, are very similar and that coincidences determine on which side of the threshold value the individual application ends up. With RDD, it is therefore not a problem that the climate benefit ratio is correlated with these non-observable characteristics, which also affect the probability that the investment will take place as long as these non-observable characteristics do not also have discontinuities in the same place as the breaking point to provide funding based on the climate benefit ratio. The assumptions behind RDD are thus not as demanding as for IV, but the disadvantage is that the relation between funding and investments is only estimated on basis of the applications that are very close to the limit for receiving funding. It is conceivable that the relation between funding and investments looks significantly different for potential investments with climate benefits that are either very high or very low.

For RDD to be possible to implement for the Climate Leap, it is required that there is a sufficiently large number of applications that are either slightly above or slightly below the breaking point to receive funding. As we will see in section 4, the distribution of applications varies based on the climate benefit ratio between different types of measures. The turning point has also varied, both between different application periods and between different types of measures.

In cases where the climate benefit ratio alone has not decided whether an application for funding has been granted, a "sharp" RDD cannot be used. WSP Advisoryound some granted measures in the dataset provided by the EPA and

therefore also presents an alternative to the sharp RDD, a so-called "fuzzy" RDD, which could be relevant for the evaluation. In a "fuzzy" RDD, the breakpoint is used as an instrumental variable to estimate the impact of being granted funding, on the probability of investments being made. Regardless, the EPA believes that the “faults” in the dataset is due to inaccuracies when entering data in the data system or wrong reference to denial in the same system, rather then wrongfully granting aid. This can be controlled for in the data set. The fuzzy RDD-method is though described in more detail in section 5.1 to provide an understanding to an alternative evaluation method. But again, the EPA don’t believes this alternative method will be of interest once the dataset has been uppdated.

2.4 How have the investments affected the emissions?

For the Climate Leap initiative to contribute to lower greenhouse gas emissions, it is required both that receiving funds has affected the investments made but also that these investments, in effect, have made it easier for the beneficiaries to the initiative to reduce their emissions. The mechanisms behind the emission reductions look a little different and, therefore, different variables need to be examined for different types of investments. Support from the Climate Leap can also displace investments from other actors who are not eligible for receiving support. This is relevant for some but not all types of investments that have received grants. Below are suggestions on how to look at both the use of the investment and eventual crowding-out effects for some of the measure categories.

2.4.1 Production facilities for biofuels

For production facilities, i.e. for biofuels, it is relevant to look at whether they have succeeded in producing such large volumes as forecast in the application. If production is significantly lower than the calculation made at the time of application, the climate benefit of the investment will also be lower. Displacement effects that can occur are, for example, if increased demand for biomass for production displaces other uses of the same biomass and thus can lead to increased use of fossil fuels in other sectors.

2.4.2 Filling stations and charging stations

For investments in filling stations for biofuels as well as charging stations, the delivered volumes of energy have a crucial impact on the climate benefits. This is relatively easy to check afterwards. However, the evaluation should keep in mind that support for service stations and charging stations can also be justified by positive network externalities.

Both filling stations for biofuels, mainly HVO100, and charging stations are also built on commercial grounds. An evaluation should also analyse whether there has been a significant displacement of investments made by other actors. Has the

Climate Leap pushed out investments in filling stations for HVO100 at the regular fuel distributors and has support for fast charging made commercial players refrain from investing?

3 Available data

3.1 Data from the application database

At the time of application, the Swedish Environmental Protection Agency requests certain information from the applicants. Applicants must, among other things, provide information on expected estimated emission reductions as a result of the investment, investment costs and the amount applied for. To control that grants are not approved for investments that are economically profitable even without any grant, applicants must also submit a profitability calculation. If support is granted, the actual investment costs and a new calculation of the emission reduction must be submitted in the final reporting. The Swedish Environmental Protection Agency controls the calculations in the application and can adjust the profitability calculation as well as the estimated emission reductions if necessary.

For all applications, there is thus information on the estimated climate benefit ratio at the time of the application. For completed investments, an updated climate benefit ratio can be calculated, considering the actual investment cost. An application can be rejected either because the climate benefit ratio is too low or for other reasons, such as that the investment has already been made or that the investment is assessed to be economically profitable even without a grant from the Climate Leap.

The relevant information from the application database (‘KlivIT’ in Swedish) where all funding applications are registered can be seen in the table below.

Table 1. Variables from the application database (’KlivIT’)

Variable	**Provides information about**
Registration number	To differentiate the application period and different rules regarding, for example, acceptable climate benefits
Status	Granted, denied, stopped, fully paid out
Organisation type	Other Housing society Business Non-profit association Municipality or Association of municipalities Municipal company

	County council or Association of county councils Foundation
Measure category	Waste Energy efficiency Energy conversion Vehicles Gas emissions Information efforts Infrastructure Charging stations Biogas production Transport Other
Start date	From 2016 until now
End date	From 2016 until 2023
Total costs	Investment costs
Granted amount	Amount granted from the Climate Leap
Corrected emission reduction	Adjusted by the Swedish Environmental Protection Agency at time of application
Corrected life span	Adjusted by the Swedish Environmental Protection Agency at time of application
Grounds for rejection	Depreciation, profitable measure, not a sufficiently big and lasting effect in relation to the investment sum, lack of funds.
SNI code	Available at the 5-digit level (SNI signifies the Swedish Standard Industrial Classification code)
Total emission reduction	Calculated by the Swedish Environmental Protection Agency
Quota	Total costs divided by Total emission reduction

For the approved measures that also have been implemented and where a final report has been submitted, the following information is also available:

Table 2. Variables from completed measures from the application database

Variable	**Provides information about**
Total investment cost	From final report

- of which eligible costs for support	From final report
Total amount of investment grant	From final report
Annual emission reduction (kg CO2e)	From final report

3.2 Data from the survey

A survey was conducted in early 2020 among applicants who were granted or denied an investment grant from the Climate Leap. Applicants who received a grant were asked if they would have made the same investment even without receiving funding. Those who did not receive a grant were asked if they had made the investment anyway. Just under half of the respondents who did not receive any grant stated that the investment has not been made at all. The response rate for this group was only 47%.

Table 3. What has it meant that the measure has NOT received funding from the Climate Leap? The measure has…

	Number of respondents	Percentage of respondents
… not been implemented at all	220	47%
… implemented per the application but to a lesser extent*	67	14%
… carried out per the application and to the same extent*	88	19%
… implemented per the application but to a greater extent*	8	2%
… instead replaced with another technical solution, namely:	14	3%
Plan to implement measure or similar measure in the future	71	15%
Total	**468**	**100%**

Source: (WSP, 2020)

The organisations that have been granted support have responded whether the organisation has chosen to implement the measure for which they received funding (yes / no) as well as what would have happened if the grant had not been approved, as seen in Table 4 below. The response rate for those who have been granted support is 65% and of these, 54% state that they probably did not complete the investment without the support. The vast majority of granted measures are charging stations.

Table 4. What do you think it would have meant if the measure had NOT received funding for the Climate Leap? The measure had…

	Number of respondents	Percentage of respondents
... not been implemented at all	662	54%
… implemented per the application but to a lesser extent*	391	32%
… carried out per the application and to the same extent*	137	11%
... implemented per the application but to a greater extent*	7	1%
... instead replaced with another technical solution, namely:	21	2%
Total	**1218**	**100%**

Source: (WSP, 2020)

To be able to analyse the impact that the Climate Leap has had on the probability of making the investments, the available data originates from the survey. The survey provides information on whether investments have been made in the organisations that have been rejected.

However, the response rate for the rejected organisations is only 47%, which raises questions about the respondents' representativeness and implies that the number of observations is quite small, especially when analysing the Climate Leap separated by measure categories or application periods.

Another question is how to handle the response alternatives that involve completing the investment to a lesser extent, with another technical solution or planning to implement the investment in the future. Is it only those who answered that they made the investment to the same or greater extent than what they applied funding for, who is to be considered to have made the investment even without receiving funding? This is something the evaluator will need to deal with in their methodology.

3.3 Available official statistics

For those investments that have direct effects on the applicants' energy use or in other ways affect the applicants' emissions, statistics on industrial energy use can be used to some extent. This is mainly relevant for energy conversion measures in companies. Microdata is available from Statistics Sweden (SCB) for industrial companies and mining companies with over 10 employees. It is probably possible to link data from industry energy statistics (ISEN) to the application database via the organisation number. In this way, it would be possible to track emissions per company from at least the early 2000s, both for the companies that received support from the Climate Leap and companies that applied for support but were rejected, as well as other companies in the same industry based on the Swedish Standard Industrial Classification (SNI) code.

However, the statistics cannot distinguish between different types of energy uses for the same fuel and only contain fuels for stationary use; fuels for work machines and vehicles are not included. The statistics include both companies

that do and do not participate in the Emissions Trading System (EU-ETS). Since the Climate Leap only grants funding to companies outside EU-ETS, it is important to be able to distinguish between these two groups, which is possible via data on organisation and facility numbers.

To be able to use this data in model estimates, access to microdata is needed. For researchers, SCB can probably provide this data, but confidentiality testing is required. On the other hand, it is probably not possible for the Swedish Environmental Protection Agency to offer direct access to the microdata for consultants or own staff outside the statistics unit. This may not be a problem if the EPA can provide the data from Klivit and the SCB can carry out the analysis themselves.

It may also be possible to link other information about the companies. Data on the number of employees is in principle complete, while data on turnover only is available for a subset of companies. The advantage of using energy statistics is that you get information about the emissions and do not have to settle for examining how the Climate Leap has affected the investment decisions. Also, one can look at three groups, those who received funding, those who applied but did not receive any grant and the companies that did not apply for Climate Leap funding at all.

4 Description of applications

To be able to assess the possibility of static analysis, the data material in the Climate Leap application database ('KlivIT' in Swedish) for the years 2016-2018 has been compiled. This has been supplemented with a compilation from the survey that was sent out to applicants, both with rejected and approved applications, for the period 2016-2018.

In the application database, the applications are divided into different measure categories, which in turn are divided into measure types. The investments are of different types and the evaluation consequentially needs to look separately at how the Climate Leap has affected the different types of investments. The table below gives some examples of investments in the various measure categories.

Table 5. Measure categories and types, including examples of related investments

Measure category	Measure type and examples of related investments
Waste	Includes measures that aim for increased recycling and/or reuse of different products and materials, for example a more thorough separation of plastic materials or facilitating the recycling of lithium-ion batteries in a facility where batteries for electric cars are produced.
Energy efficiency	Approved measures often relate to efficiency improvement in heating (either as a measure in itself or combined with a conversion measure). Measures that are rejected include for example measures linked to energy efficiency improvements in lighting.
Energy conversion	**Industry** (Processes of different types), **Agriculture** (Replacing fossil fuels related to processes in agriculture, such as grain dryers), **Heating of buildings** (Replacing fossil fuels for heating of all types of buildings, and connection to the district heating network), **Surplus heat** (Utilising surplus heat emanating from the organisation's own operation instead of using fossil fuels) and finally **District heating** (small scale production in the district heating network; not part of the Emission Trading System)
Vehicles	This category predominantly includes heavy vehicles fuelled by biogas, either in liquid or compressed form. Additionally, a few simulators and an electric aircraft can be found in this category. Both the simulators and the electric aircraft are for educational use.
Gas emissions	Destruction of nitrous oxide (laughing gas) at dental and healthcare clinics and a couple of measures linked to landfill gas emissions.
Information efforts	Different types of behavioural measures, principally addressing groceries (food waste / food spoilage) and transport.

Infrastructure	Bicycles, bicycle paths and transloading terminals.
Charging stations	This category is geared almost exclusively towards light electric vehicles, except for one approved application for a charging station for electric heavy-duty trucks. The category is subdivided by two types of charging: Normal charging AC and Fast charging DC. Both types are further subcategorised in restricted and public use, respectively.
Biogas production	Production plants for biogas as well as liquefaction plants.
Transport	Filling station for biogas (CBG/ LBG), HVO100, and in a few cases ED95 (for non-public use). (Applications for HVO100 gas stations are not accepted anymore). In addition, two production plants for biofuels made from residual products of biomass (wood chips and lignin).
Other	Other types of measures.

Table 6 (below) shows the number of approved applications and the number of rejected applications due to a too low climate benefit separated in different categories. We can see that Charging stations are by far the largest category in terms of both the number of rejected and approved applications, followed by Energy conversion. In some categories, there are less than 100 applications.

Applications that were granted aid, but then were withdrawn by the applicant are not included in the table. However, these need to be included prior to the evaluation.

Table 6. Number of applications from the application database 2016-2018, subdivided by measure category.

Measure category	Number of approved applications	Number of denied applications as the emission reduction per invested sum was not sufficiently large or permanent
Waste	9	27
Energy efficiency	39	164
Energy conversion	617	240
Vehicles	49	105
Gas emissions	18	15
Information efforts	49	166
Infrastructure	34	36
Charging stations	1 916	403
Biogas production	32	7
Transport	157	78
Other	2	47
Total	**2 922**	**1 288**

Information on investment costs and estimated reductions in emissions can be sourced from the application database. Nevertheless, the database does not provide information about whether investments linked to denied applications were made anyway. To estimate models of how the Climate Leap affects the probability of an investment to occur or not we therefore need to use the information provided by the survey that has been sent out. However, this means a substantially reduced number of observations. In the table below the number of responses and non-responses to the survey are presented. Please note that the total number in the table below (with data from the survey) does not correspond fully to the table above (with data from the application database).

Table 7. Survey responses and non-responses separated by measure category.

	Number of approved applications		Number of denied applications as the emission reduction per invested sum was not sufficiently large or permanent	
Measure category	**Response**	**Non-response**	**Response**	**Non-response**
Waste	6	3	13	7
Energy efficiency	23	16	67	82
Energy conversion	309	157	94	88
Vehicles	27	11	39	41
Gas emissions	11	5	7	8
Infrastructure	20	10	13	17
Charging stations	812	552	77	168
Biogas production	18	9	2	5
Transport	45	27	8	19
Other	1	1	8	18
(blank)				
Total	**1272**	**791**	**328**	**453**

A higher rate of those that received approvals on their applications responded to the survey, compared to those whose applications were denied (when focusing on measure categories with many applications). For the measure category named Charging stations 60% of those whose application was approved responded to the survey, but only 31% responded of those whose applications were denied (due to low CO_2 emission reduction impact).

To be able to conduct a Regression Discontinuity Design (RDD) analysis a prerequisite is to be able to compare applications slightly below the limit for approval to those slightly above. In the table below, the number of applications is shown separated by intervals of climate emission reduction impact and further subcategorised by application approval or denial (due to low greenhouse gas reduction impact). The data source is the application database, and it should be noted that the number of observations in the survey is considerably lower. However, the table at least indicates to what degree it is possible to use the RDD analysis method. To be able to use RDD, observations must exist in proximity of

the threshold value for application approval. In the table below, the measure categories are shown that altogether include at least 100 observations with a climate benefit ratio between 0,5 and 1,5 (the “floor climate benefit ratio” have varied between 0,6 and 1,00) belonging to either the Energy conversion or the Charging stations measure category.

Table 8. Number of applications by climate benefit ratio interval, further subcategorised by approved and denied applications. (For denied applications, only those applications that were denied due to have a greenhouse gas reduction impact deemed to be too low are included.)

Climate benefit ratio	Energy conversion measure category		Charging stations measure category	
	Approved	Denied	Approved	Denied
0,00-0,25		53		60
0,25-0,50		65	1	186
0,50-0,75	2	79	149	131
0,75-1,00	162	27	815	24
1,00-1,25	156	6	554	1
1,25-1,50	112	2	201	1
1,50-1,75	43	1	103	
1,75-2,00	33		52	
2,00+	109	7	41	
Total	**617**	**240**	**1916**	**403**

It can be deduced that there is no complete conformity between the quota of an application and whether that application is approved. Reasons for this discrepancy include that the quota threshold has been changed between one application period and another, and that because other considerations have been made in addition to the climate benefit ratio.

Energy conversion and charging stations are those measure categories that have the greatest potential for RDD estimation. However, these two categories correspond to less than half of the funding distributed from the Climate Leap; in the years from 2016 to 2018 the charging stations corresponded to 8% of the funding, and the energy conversion measures 30%. Hence, more than 60% of the funding is excluded from the analysis. Corresponding, only 4% respective 20% of the GHG reduction is due to the funding of charging stations respective energy conversions. Hence, more the 75% of the GHG reduction occurs through other granted measures.

Both categories (energy conversion and charging stations) include applications of rather different kinds as well as applicants from a diverse set of fields. To be able to analytically compare more homogenous applications it would be preferable to perform the analysis on a finer scale than on the level of measure categories; the level of measure types could be a suitable scale for this purpose. For the measure category of Charging stations there are four measure types divided into two axes: firstly, normal or fast charging, and secondly internal or public use. In the table below applications are presented from 2016 through 2018, separated by those applications that were approved, and those that were

denied because they had a too low impact on reducing greenhouse gas emissions. Please note that approved applications that have not been implemented in practice are not included in the table below but should be considered in a future evaluative analysis.

Table 9. Number of denied and approved applications (2016-2018) for the measure category Charging stations separated by measure type.

Climate benefit ratio	Normal charging – public use		Normal charging – internal use		Fast charging – public use		Fast charging – internal use	
	Den.	App.	Den.	App.	Den.	App.	Den.	App.
0,00-0,25	10		6		40		5	
0,25-0,50	35		25	1	111		18	
0,50-0,75	44	6	39	75	39	35	10	33
0,75-1,00	10	117	6	441	6	167	3	91
1,00-1,25	1	96		346		54		58
1,25-1,50		15		163		6	1	19
1,50-1,75		8		80		4		12
1,75-2,00		4		42		2		4
Above 2		5		31		4		1

For the measure category Energy conversion it is mainly the measure types change of fuel type and agriculture that potentially can be used with the RDD analysis method – within these two measure types there are many applications with quotas slightly below as well as slightly above the approval limit.

Table 10. Number of denied and approved applications (2016-2018) for the measure category Energy conversion separated by measure type. ”Den.” = Denied; ”App.” = Approved.

Climate benefit ratio	Change of fuel type, property, building		Industry		Agriculture		Surplus heat		District heating	
	Den.	App.	Den.	App.	Den.	App.	Den.	App.	Den.	App.
0,00-0,25	36		5		18		5		9	
0,25-0,50	42		3		19		7		6	
0,50-0,75	52	1	6		21	1	3	2	4	
0,75-1,00	11	86	6	8	7	62	1	1	2	11
1,00-1,25	2	85		22	1	43		1	2	12
1,25-1,50		65	1	16	1	29	1			4
1,50-1,75		22		10		8		1		4
1,75-2,00		15		13		5	5			3
Above 2	2	46		33	4	25	7			7

5 Proposal for the Evaluation plan

The key to an evaluation is to be able to isolate causal effects, i.e. the impact of the Climate Leap on investments and emissions. If funding was approved in higher proportions to companies that would have made the investment irrespective of receiving the funding or not, a direct comparison between the share of those who was granted aid and completed the investments and those whose applications were denied would not be able to isolate the effect of the Climate Leap on the completion of the investments. In section 2.3 possible methods were considered to separate causal effects of the Climate Leap, of which the Regression Discontinuity Design (RDD) method was evaluated as the most feasible for this evaluation.

5.1 RDD analysis on the probability to carry through an investment

In the Climate Leap a threshold value for the climate benefit ratio has been used to decide whether applications should be granted or not. However, based on the data in the dataset, it seems that the decision has not in all cases been entirely decided only based on the threshold value; in the dataset, applications can be found with a ”too low” climate benefit that were granted anyway, as well as applications that had a climate benefit ratio over the threshold that nevertheless were denied, with a too low climate benefit as the reason stated for denial. As mentioned above, the EPA believes this has to do with inaccuracies when entering data reather the incorrectly granted aid. Regardless, the EPA would like to provide the consultants suggestions how to evaluate the aid with a fuzzy RDD.

If the climate benefit ratio does not function as a sharp boundary that separate approvals and denials of applications. Instead, the design is “fuzzy”, i.e. the climate benefit ratio affects the probability to be granted funding discontinuously, but the quota does not fully determine the grant decision.

In a “fuzzy” RDD a supposition of type IV is used, where the side of the threshold value an application is evaluated at (lower or higher) is used as an instrumental variable to project whether an application is granted. The figure below shows such a projection for charging stations, i.e. the relation between the climate benefit ratio and whether applications are approved or denied for this measure category.

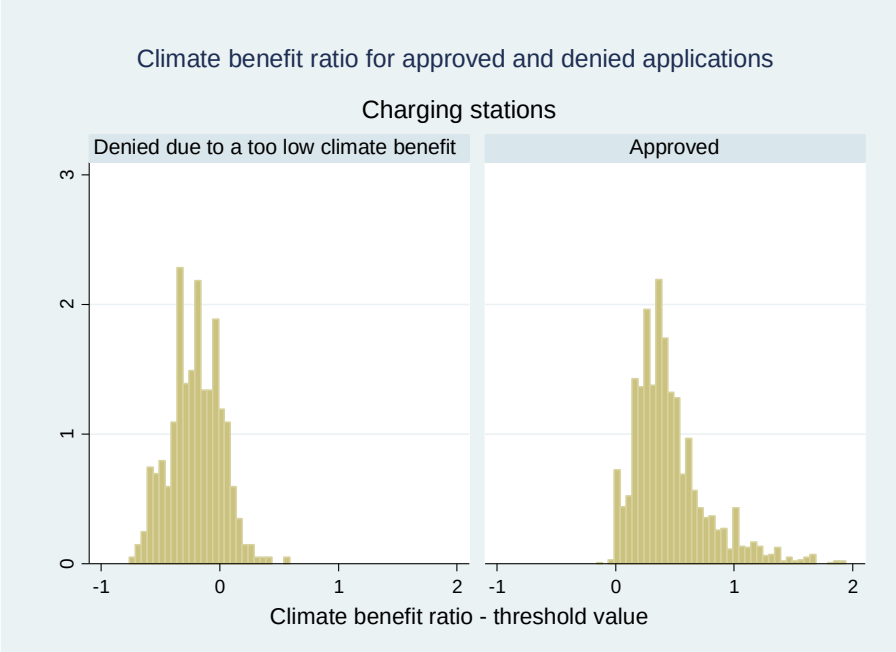

Figure 1. Histogram showing "Climate benefit ratio – Threshold value" for the measure category Charging stations

Together, the left side and the right side of the figure illustrate how the climate benefit ratios of the applications differ from the quota threshold, that during the full application period for charging stations was 80% of the standard threshold value. An application that has a zero value in the figure above thus has a quota exactly on the threshold value for approval, while a value over zero means a higher climate benefit and a value below zero signifies an estimated climate benefit that is below the current threshold for application approval.

As can be observed from the figure above, some applications have been denied although having a quota above the threshold value, meanwhile, there also are a few applications that have been approved despite a climate benefit ratio slightly below the threshold value. The threshold value has thus not been fully decisive for approval/denial, which means that we need to employ a “fuzzy” design. When the same type of comparison is made in the figure below for the measure category Energy conversion an in principle sharp limit can be found for approved applications (the right side of the figure below). However, for denied application (the left side of the figure below) there are a number of denied applications with a high climate benefit. These denied applications might not have been implemented and could subsequently have been classified in the incorrect denial category. If this were the case, it would be possible to use a “sharp” RDD in this case, after rectifying the incorrect classification.

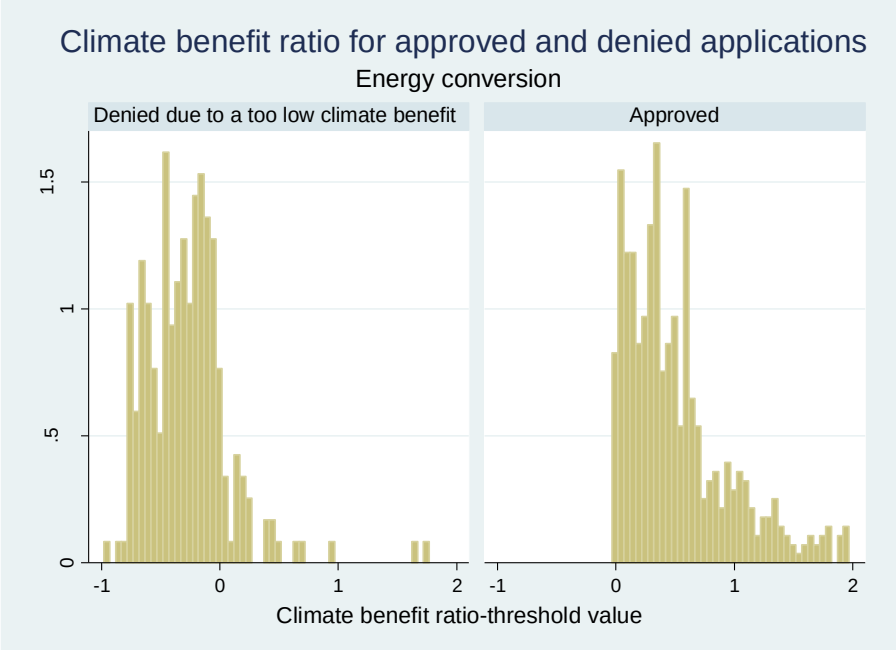

Figure 2. Histogram showing "Climate benefit ratio – Threshold value" for the measure category Energy conversion

Altogether, there are many measures both in the Charging stations and in the Energy conversion measure categories with climate benefit ratios on both sides of the threshold value for the years 2016-2018. This points towards that RDD can serve as a functioning method for both these measure categories. Yet, we have not studied how many observations that remain for analysis after imposing a limitation to only those applications for which we also have survey data. On the other hand, the number of observations is increased as we add applications from additional years. As Energy conversion and Charging stations are those measure categories where there seems to be a sufficient quantity of both approved and denied applications with climate benefit ratios near the threshold for approval, the evaluation will focus on these two measure categories for the statistical RDD analysis. Hopefully, RDD estimations can be performed for some measures from both the Energy conversion and the Charging stations measure categories, depending on available data.

The overall picture demonstrates that a “fuzzy” RDD approach can be suitable, as the climate benefit ratio not fully seems to have determined whether an application has been granted or not. In those cases, in the data material where applications that have been rejected due to a too low projected climate benefit – notwithstanding a climate benefit above the threshold – a “sharp” RDD approach can be used instead. A “sharp” RDD approach can also be applicable in later calls for proposals in those cases that the climate benefit ratio has fully determined the funding decision. In a “fuzzy” RDD approach to estimate how the Climate Leap has affected investments the variables (listed below) are in focus.

Dependent variable: Whether an investment has been carried out. This variable is extracted from survey data, as data is missing in the application database about whether applications that were denied anyhow have been carried out. Binary variable.
Treatment variable: Dummy variable for whether an application has been granted. Here, approved applications are compared with applications that were denied due to a too low climate benefit ratio. Applications that were denied as the investment had already been implemented at the time of application, or where the investment is economically viable without being subsidised are thus removed from this analysis.
Instrumental variable: To instrument the approval of a grant for an application, the climate benefit ratio of the application is studied in relation to the climate benefit ratio threshold value valid in that call.

Generally, a critical assumption for RDD is that the applicants are not able to control on what side of the climate quota threshold value their application will be situated. This would be the case if the quota is calculated by the Swedish Environmental Protection Agency, and the applicants do not understand how their data on climate benefit and investment costs will be used. However, it is not a requirement for the method to provide correct results that the climate benefit ratio in itself is uncorrelated with other variables that affect whether the investment will be carried through. Another misgiving is if more professional applicants to a larger extent have apprehended how the climate benefit ratio is calculated and what limit is applicable, compared to more novice applicants.

Neither the climate benefit ratio nor its current threshold value have been communicated to the applicants during the call for applications, but through studying the reports of anterior years it is possible to grasp how the threshold value is calculated and thereby adapt data to receive a quota on the right side of the threshold value. There are a few applicants with many applications, that almost exclusively have a climate benefit ratio over 1, but there are also a few applicants where the climate benefit ratio varies from low to high between their applications. When the evaluation is made this question needs to be analysed more thoroughly based on the data that is available at that point.

Above, we have only addressed the two measure categories that each have a sufficient number of observations near the threshold value for approval in order to plausibly estimate statistical models. If it is possible to fuse other measure categories into a joint model the evaluation could be expanded to include also these categories. However, this requires that it is possible to assume that grants from the Climate Leap have had the same influence on the investment decisions for all measure categories that constitute the analysis. Is that a reasonable assumption? Is it possible to control for important differences between the measures through consideration of variables from the application database and the survey, e.g. investment costs?

5.2 Other methods to analyse emission effects

The method outlined above for estimating how the funding from the Climate Leap has impacted investment decisions of applicants can only provide answers as to whether the Climate Leap contributed to investments being made, not how these investments affected Sweden's greenhouse gas emissions. In section 2.4, it was suggested to analyse the volume of fuel sold from filling stations and the amount of transferred electricity at charging stations to study how the investments have been used. The beneficiaries approve to share information to the EPA regarding sold volumes or used energy in the granting decision if they are asked to do so.

For energy conversion measures, it may be possible to use industry emissions statistics to analyse the use of fossil fuels in companies that applied for and received funding, companies that applied but did not receive grants, and companies in the same industries that did not apply for funding from the Climate Leap. It is too early to determine whether this is a possible method because the availability of needed microdata is uncertain. If the EPA can get access to relevant microdata, we also need to choose a suitable method. RDD can probably be used to compare applications that have just been granted and applications that have a quota just below the limit value. A key question, however, is which time span to choose for the analysis. When are emissions expected to decrease due to grants from the Climate Leap?

A way to more qualitatively reach knowledge about how the Climate Leap is used and viewed by companies can be to interview environmental strategists, both in companies that have and have not applied for funding from the Climate Leap. Have those companies that did not choose to apply for funding not considered the type of investments that the grant supports, or have they followed through with investments without funding that could have been funded by the Climate Leap? Why did they in this case refrain from applying for funding? This qualitative analysis can supplement the quantitative components of the evaluation.

5.3 Analysis of crowding-out effects

A state aid scheme can have crowding-out effects if the investments receiving grants prevents other investments to take place or undermine opportunities for other companies and activities. The risk of crowding out probably varies between the types of measures. It is most relevant to analyse possible crowding-out effects for investments that include offering products that are already offered without the support from the Climate Leap, such as filling stations and charging stations. This analysis is mainly made using a qualitative approach aiming to identify those investments that amount to the highest risk for crowding-out effects to learn lessons towards future support programmes. The Brittish Ministry of Finance has guidelines regarding how to identify markets and which questions to ask to be able to evalute crowding-out effects.

For other types of measures, such as nitrous oxide destruction facilities, the crowding-out effects are likely to be negligible.

5.4 Evaluation Type per measure category

For several categories, it is not possible statistically analyse the impact of the funding on the investment because there are too few applications. For these categories, a more qualitative analysis of the possibilities of making investments without aid is suggested. For example, a large part of funds has been paid out to biogas production facilities, but the number of investments is low. Here it is possible to analyse the extent to which investments have been made without funding to be able to draw conclusions about the extent to which the Climate Leap has contributed to the investments.

For some investments, it is possible to follow up volumes to assess how large emission reductions they have contributed to. This applies to biofuel production facilities, filling stations and destruction facilities for nitrous oxide.
Other categories have too few applications and lack indicators for climate benefit that are easy to follow up. This applies to categories such as waste, where grants have been given to investments for improved waste sorting and recycling, or infrastructure, where investments have been granted to cycle paths. For these categories, it is only possible to describe the different types of measures and discuss how this has contributed to emission reductions.
The table below shows how the measure categories could be evaluated. Since there are many type of measures, the EPA would like to discuss the possibility to evalute only some of the measure categories/ measure types.

Table 11. Suggested analytical methods for measures supported by the Climate Leap.

Measure category	**Analysis method**
Waste	Qualitative discussion
Energy efficiency	Qualitative discussion
Energy conversion	RDD approach for statistical analysis of investment decisions
Vehicles	Qualitative discussion
Gas emissions	Follow-up on quantities of residual gas at for example maternity clinics and dental clinics.
Information efforts	No analysis planned
Infrastructure	Qualitative discussion
Charging stations	RDD approach for statistical analysis of investment decisions; Analysis of crowding-out effects regarding commercial charging stations.
Biogas production	External outlook on Swedish investments in production facilities outside the realms of the Climate Leap. Follow-up on production volumes. Analysis of crowding-out effects on other biomass uses.
Transport	For filling stations for biogas (CBG/LBG) and HVO100, the implemented investments that have not received Climate Leap grants are analysed. Also, pre-sold fuel volumes can be followed up. Two production facilities for biofuels made from biomass residue (wood chips and lignin) are also included in this measure category. An analysis is also made on if similar production facilities would have been constructed even without funding from the Climate Leap, production volumes are followed up and possible crowding out effects are analysed.
Other	No analysis planned

6 Similarities and differences between this methodology paper and earlier versions of the evalutation plan

This method paper presents a suggested outline for the methodology that can be used to answer the evaluation questions for direct effects that have previously been presented in the evaluation plan (section 2.2).

Priority in the analysis of the grant is still the market where the majority of funds are employed or where there is particular risk of market distortion, eg. Filling stations, charging stations and energy conversions.

The method choices in this report are based on being able to perform a counterfactual approach as described in the evaluation plan (paragraph 33). The issues of finding and choosing an appropriate control group have been raised in this paper. Some of these issues can be controlled for during an RDD.

As pointed out in the evaluation plan (paragraph 34) the Climate Leap is a very broad aid scheme and thus requires the use of several complementary methods for analysis, the consultant has presented options for several methods for the different measure categories. As discussed in the evaluation plan (paragraph 36) the option of using RDD has been further assessed in this report and at this point it seems the most viable option for analysis of energy conversions and charging stations.

The consultant has in this paper begun work investigating the possibility to use the *additional* data sources (disscused in chapter *5.2 Other methods to analyse emission effects* in this paper) identified in the evaluation plan (paragraph 37-39). For most of these sources the material will be possible to use for the evaluation, in some cases the data will only partly be applicable or will only be available with some difficulty (eg. the data from SCB).

The possibility to review distribution of ex ante IRRs as suggested in the evaluation plan (paragraph 40) have not been further investigated in this method paper, as undertaking that analysis was too large for the scope of the paper due to the time consumption it would take to download and review the separate files. A new part introduced in this paper is the analysis of crowding out effects as a part of the market analysis and impact of the aid on the markets where beneficiaries are present or affect.

The methods suggested in this paper would not alter the proposed timeline in the evaluation plan and are adaptable to extension of the aid scheme. This methodology paper, building upon the possibilities brought up in the evaluation plan, provides us and the future evaluator with a stable base for moving forward with the evaluation. However, as pointed out in the evaluation plan (paragraph 33) an iterative approach will still be needed as the evaluation progresses.

7 Conclusions

This paper complement and update the evaluation plan the European Commission approved by decision on the 30th June 2020 (SA.49001 (2020/EV)). The European Commission's (2014) guidelines for state aid evaluation are used as a basis for the report. The guidelines point out the importance of creating evaluation criteria that can isolate the causal effect of the funding and show examples of how to do this.

Several of the methods that are proposed by the European Commission are based on the addition of a random element in the application process. The current process does not include this type of random element, which complicates the possibility to evaluate the program in the manner which is required by the European Commission.

The EPA has identified the quasi-experimental method RDD as the best applicable method to evaluate the Climate Leap and will apply this method to evalute the aid regarding measures referred as charging stations and energy conversions. There are plenty of approved and rejected applications close to what is called the climate benefit ratio that the EPA uses as a threshold for approval. The EPA will use this method in an analysis during 2021 for the categories mentioned to see if the method is as applicable as we consider it to be. If we, however, encounter obstacles, we will need to review other evaluation options. It is our understanding that it is the best way forward.

For RDD to produce correct results, it is a prerequisite that the applicant cannot influence whether the climate benefit ratio of their application is situated slightly above or below the threshold value. The climate benefit ratio is not calculated by the applicants as part of the application process, nor has it been conveyed to them by the Swedish Environmental Protection Agency. However, the threshold values from preceding years can be found in the reports about the Climate Leap from the agency, and the threshold value of an application is easy to calculate on basis of the data that the applicant submits. Therefore, more professional applicants can with little effort work out which climate benefits and investment costs they should state to obtain a climate benefit ratio on the right side of the threshold value. A typical set of robustness checks will be applied including controling for self-selection.

Other measures than charging stations and energy conversions require more of a qualitative approach since there are too few observations in the program. Examples of evaluation methods are in-depth interviews, market analysis and surveys. The answers given by applicants in the surveys might provide useful insights on the overall impact of the aid as well. As the Climate Leap continues a few more years, new measure categories can be added, for which RDD methodology possibly could be used for estimation. As part of the final evaluation, an analysis is needed on whether it is feasible to treat the Climate Leap as a homogenous type of support during the full support period, where the same type of effects can be presumed for all years.

This methodology paper has focused on the most applicable method to measusre the direct effect on the beneficiaries (referred as main area 1). How to evaluate indirect effects (referred as main area 2) and proportionality and appropriateness (referred as main area 3) of the aim has previously been answered in the approved evaluation plan.

Regarding the Commissions conserns on collecting and handling sufficient, consistent and accurate data (stated in the Evaluation of Interim report), the EPA believes there has been a missunderstanding in the communication between the Commission and the EPA. The uncertainties regarding data collection mentioned in this methodology paper, only conserns *additional* collection (disscused in chapter *5.2 Other methods to analyse emission effects* in this paper) of microdata from Statistics Sweden (SCB) to enable the DiD-method.