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Markets for GHG emission reduction from wastewater sludge treatment

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Preface

This unpublished report has been written by Henrik Wiig, senior researcher in NIBR-Oslomet. The study is based on literature review and interviews with key informants within state institutions, NGOs, companies, and agents involved in the carbon markets during autumn 2022.

January 2023

Kristian Tronstad
Research Director

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Summary

Global warming is a threat to human prosperity. A key to reduce greenhouse gas (GHG) emissions it to produce more carbon efficient technologies both in production and consumption. By treating municipal wastewater and biowaste properly, biological material that was previously disposed as waste inducing methane gas emissions can be converted to renewable energy and biological fertilizers instead.

This report is a commissioned analysis by the Norwegian company Cambi AS on the forefront in developing wastewater sludge treatment technologies to be installed worldwide. It analyses the potential for being paid for the GHG emissions reducing effect of their technology under different governments' climate policies and regulations. Identified profitable markets are (i) LBG as road transport fuel in Germany under EU RED-II regulation with carbon premium of 350 Euro/mtCO2eq today, (ii) fulfilment of NDC under UNFCCC Paris agreement through international trade and (iii) voluntary payments by companies. Replacing current landfill practices with modern wastewater treatment technologies in developing countries will induce large scale GHG emissions reduction that can be certified and sold in the two latter markets.

1 Introduction

Global warming is a treat to humanity. World leaders hence signed an agreement in the COP21 meeting under UNFCCC in Paris in 2015 (hereafter Paris agreement) to reduce greenhouse gases (GHG) in the atmosphere, stating "Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial level" (UNFCCC, 2015, §2)[1].

However, there has been considerable focus on global warming by governments, consumers, businesses, and others over several decades with strategies, monetary incentives, and regulations designated to reduce GHG emissions. This report commissioned by the Norwegian company Cambi AS intends to map diverse ways that the company can profit from the GHG reducing effect of their THP technology for wastewater sludge treatment, responding to the follow three tasks:

- How to establish and det formal verification (certification) of GHG emission reductions from wastewater sludge treatment?
- How to monetize these GHG reductions in each case, i.e. sell certificates?
- Identify most profitable type of certificate and market for GHG emission reductions from use of Cambi THP technology.

Regulations that create an incentive for reducing GHG emissions as well as the market for trade in such GHG emission reduction (joint denominated *carbon market* hereafter) is highly diversified since regulations and measurement methodologies differ between countries, sectors, feedstocks, actors, etc. This creates an N-dimensional matrix of possible payoffs for a company like Cambi that "produces" GHG emission reductions. This report identifies and recommends especially three possible carbon markets where Cambi can profit from starting a certification process:

Biogas: Maximum GHG content in road transport requirement in some European countries (e.g. Germany), has induced an implicit price of 350 Euro/mtCO2eq for reductions in GHG emissions in biogas. ISCC certification of GHG content in liquid biogas (LBG) from all Cambi facilities for road transport energy that does not require additionality[2]. Several wastewater/bio sludge facilities have such ISCC certification already.

NDC trade: The Paris agreement allows international trade in GHG reductions to comply with national emission target. The KliK foundation[3] of Switzerland signal willingness to pay about 30 USD/mtCO2eq for GHG reductions in wastewater sludge treatment installed in their in their partner developing countries.

Voluntary: Some companies voluntarily reduce their net GHG emissions by financing reductions elsewhere. The market price is still low, indicated 1-10 USD/mtCO2eq, but volumes are high. Verra/GS certification of future facilities in some developing countries with huge potential to reduce GHG emissions due to poor handling.

The first stage in all three processes is that Cambi submits a 3-4 page proposal describing GHG emission effects in exemplified projects sites and our calculations of GHG emission levels/reductions in these sights. The cost of such first step are minimal, and rough figures is sufficient to start the process to get useful feedback from the certifiers and organisations on how to proceed and what volume and financial outcome to expect.

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[1] https://unfccc.int/sites/default/files/english_paris_agreement.pdf

[2] Additionality means that only actions that reduces GHG emissions compared to the counterfactual situation of not taking the action is reward.

[3] Stiftung Klimaschutz und CO2-Kompensation KliK

2 General description of carbon market

2.1 Supply of GHG emission reductions

One and the same GHG emission reduction might serve both compliance (i.e. regulations) and voluntary market, depending on rules set by actors.

Certification of GHG emission reductions can be verified applying various types of methodologies, created by the following types of agencies:

Methodologies:

- International crediting mechanisms (CDM, Paris agreement §6.2 and §6.4)
- Independent mechanisms (VCS, Gold Standard)
- Domestic mechanisms (California, EU-ETS)

Certificate issuer:

- Organisations
- Governments
- International agencies

The certificate issuer decides what methodologies they accept. Most got their own specific methodologies while at the same time accepts using some international methodologies.

Purchasers of certificates:

- Companies
- Individuals
- Nations

Accounting rules:

- International compliance (NDC, CORCIA)
- National compliance (EU-ETS)
- Governments' voluntary policies (result-based contributions)
- Private voluntary targets and commitments (net-zero)

In the end, the purchasers decide what certificate to buy with the set of methodologies that the certificate issuer and/or regulators to which the purchaser what to satisfy accept.

The UNFCCC Kyoto protocol opens for CDM methodology certified GHG emission reductions in developing countries to be included in developed countries' carbon accounting to achieve their emission reductions targets, i.e. country to country. Different issuers are delegated the right by UNFCCC to issue CDM certificates.

Each system/agent is free to set their own accounting rules. The first three accounting rules are normally set by governments, while the fourth is up to individual company or person to decide rule as they please.[4]

Voluntary systems normally require that the payment induces GHG emissions reductions that otherwise would not have taken place, e.g. the additionality requirement.

[4] Although the companies might be influenced by decisions made by others, e.g. financing institutions give cheaper loans to net-zero companies or consumers prefer their products. It is hence vital to choose issuer/methodologies these groups find trustworthy.

The compliance systems have several forms. In cap-and-trade systems where users buy rights to emit, GHG emission rather than emission reduction certificates are traded. In the Nationally Determined Contributions (NDC) of the Paris agreement each country sets a maximum emission volume and are free to choose the means to reach this goal. Additionality is hence not relevant and not required. However, as the Paris agreement now allows for international trade will additionality be a requirement for the emission reductions in the host country that encompass sectors not included in their own NDC.

3 Voluntary market

3.1 Market pricing

Especially companies that intends to signal climate responsibility towards consumers of their products or their own employees buys carbon certificates in the voluntary market. However, such positive image normally requires reductions in their own emission as much as economically "reasonable" regarding costs and then cover the remains by carbon permits now priced at about 90 Euro/mtCO2eq.

Ecosystem marketplace, an NGO supporting the trade in GHG emission reduction to the private sector based on self-reported trades, indicate a price level between 3 and 10 USD/mtCO2eq, although considerably higher prices can be reached for smaller volumes where co-benefits, i.e. technology development, poverty assistance, etc, are valued characteristics of the GHG emission reduction.

Also, commercial market intelligence providers like Platts that collect information by calling traders and market actors directly, report rather low prices, on average 5-10 USD/mtCO2eq. So-called nature-based reductions like afforestation projects that induces the higher valued *carbon removals* to comply with the *net-zero* definition compared to *carbon emission reductions* that is defined as *climate financing*, implies that wastewater sludge treatment will be priced at in the lower end, e.g. 1 USD/mtCO2eq in one reported trade shown in the Platts publication tables in appendix 10.4.

3.2 Gold standard

3.2.1 Organization and standards

The Gold Standard[5], established by WWF and other NGOS, issue "Gold Standard for the Global Goals (GS)" which is "a standard that sets requirements to design projects for maximum positive impact in climate and development -- and to measure and report outcomes in the most credible and efficient way".

They founded an independent stand-alone organization called SustainCERT[6] that use digitization to disrupt the carbon verification industry. It is a certification body for Gold Standard and does not formulate the methodologies themselves.

The GS certificates for GHG emission reductions (avoid GHG entering the atmosphere) differentiate between *Verified Emission Reductions* (VERs) for voluntary climate action and Labels for *Certified Emission Reductions* (CERs) for meeting compliance targets.

[5] https://www.goldstandard.org/
[6] https://sustain-cert.com/

GS has in addition methodologies to certify co-benefits (by-products) of GHG emission reductions in achieving other SDGs, defining energy as renewable[7], water benefit certificate (water sustainably supplied, purified or conserved, e.g. Target 6.3. - Wastewater treatment projects), gender and health impacts.

3.2.2 Certification existing GS methodology og others' methodologies already accepted

GS and SustainCERT differentiate processes by methodology applied, involving a step for existing GS accepted methodologies, being their own or set by others, e.g. CDM:

- Project developer present application (Cambi)
- Verification of claims (sustainCERT)
- Issue certificates (sustainCERT)

When the project developer proposes new GS methodology is the process as follows:

- Methodology developer (Cambi) submit application
- GS secretariat review and selection of internal/external reviewers
- Internal/external review
- Stakeholder consultation
- Technical advisory committee (TAC) review and decision
- Project developer present application with now accepted GS methodology

Certification with others' methodologies like CDM not already accepted (fast track) is as follows:

- Project developer submit request to GS to access eligibility of methodology
- GS secretariat review and selection of internal/external reviewers
- Internal/external review
- Stakeholder consultation
- Technical advisory committee (TAC) review and decision
- Project developer present application with others' methodology now accepted by GS

3.2.3 Relevant CDM methodology for Cambi

GS accepts both their own developed methodologies to measure GHG reductions as well as several types of CDM methodologies, see list in appended excel file "427_V2.1_List-of-eligible-CDM-GS-methodologies (2).xlsx". There are no relevant GS methodologies, but the CDM methodology "AMS-III.H Methane recovery in wastewater treatment" seems to be the most relevant for wastewater treatment facilities with Cambi THP technology.

3.3 Verra

Verra responds in email communication that they do not have any accepted methodology to measure and certify GHG emissions from processing bio-sludge. However, they welcome proposals.

The proposal system is given in appended file "Verra VCS-Methodological-approval-process - v1.pdf" and the according fees in "Verra Program-Fee-Schedule_v4.1.pdf". A methodology applicant must first pay a Verra account opening fee of 500 USD, and then a fee of 2,000 USD

[7] One Megawatt hour (MWh) of electricity from renewable energy created and delivered to the electricity grid from renewable sources is certified

when submitting the methodology concept note. If accepted by the reviewers, there is an additional 13,000 USD in processing fee.

4 Low GHG emission biofuel in non-ETS sector road transport market

4.1 EU regulations

The European Union has spearheaded policies to reduce GHG emission reduction. Acting unilaterally without requiring similar reduction in other parts of the world, The Renewable Energy Directive – Recast to 2030 (RED-II) sets targets for use of renewable energy and limit GHG reductions in the member countries, as well as defines requirements as well as methodologies for how to calculate the GHG emissions (see appendix 10.2). The agreed overall target for the whole EU area is to reduce GHG emission by an overall 55% by 2030 relative to 1990 levels in their 'Fit for 55' policy package and then become net-zero emitters by 2050.[8] RED-II applies the following two regulatory approaches.

First, the EU Emission Trading System (ETS) issues rights to emit and auction off a specific volume of GHG emissions denominated in metric tons of carbon dioxide equivalents (mtCO2eq) annually. The overall ambition is a 61% reduction by 2030 for the ETS sectors. All companies within these sectors, e.g. power generation, industry and aviation, must buy such permits for all their emissions. The equilibrium price will hence depend on aggregated demand from all EU countries since supply of permits is fixed by the EU parliament. This 'one market' approach implies that some countries are allowed to emit more than their 'fair' share if they buy more certificates.

Second, each country is obliged to reduce GHG emissions with a certain percent within their own territory for other sectors like transport, agriculture, waste, industrial emissions outside the EU ETS and the municipal and housing sector with buildings, small sources, households, services, etc. The countries are then to some degree free to define exactly how they will regulate each market, although restricted by definitions, calculation methodologies, etc. set in EU RED-II. Some countries set targets for each sector separately, while others set an overall target for several sectors jointly, hence allowing for disproportional reductions between them. This implies that taxes, quotas, subsidies and public investment in infrastructure differs between countries for the same sector and same GHG emission reduction, and hence similarly the cost/income from complying with these regulations between each country. Cambi AS that provides wastewater treatment will hence experience that countries will reward the service of their technology differently and can hence chose to canalize its efforts towards the most rewarding market, e.g. LBG for Germany as discussed below.

4.2 LBG for German/Swedish transport fuel market

Germany exercises a 600 euro/mtCO2eq fine for GHG emissions that exceeds the allowed GHG emission level pr energy unit for the energy mix used in road transport. The similar fine in Sweden is 4 SEK/kgCO2eq, where the allowed emission level is set to constitute no more than 60% of the emission level in fossil fuels by 2030. The requirement in Germany is probably at the same level.

[8] https://www.consilium.europa.eu/en/press/press-releases/2022/06/29/fit-for-55-council-reaches-general-approaches-relating-to-emissions-reductions-and-removals-and-their-social-impacts/

This effect is that the price of biofuel increases proportional to the reduction of GHG emissions per energy unit. The GHG quality of biogas is typically measured as grCO2eq/MWh. Using crops as feedstock the number is 30 grCO2eq/MWh, food 10 grCO2eq/MWh and manure (minus) -100 grCO2eq/MWh.[9]

The German regulation implies that energy companies optimize the combination of biomethane and natural gas to minimize total costs (aggregation level not known). The market equilibrium hence prices GHG emissions in Liquified Biogas (LBG) at 350 euro/mtCo2eq[10], e.g. the same volume unit for a product that reduces one mtCO2eq more, receives a market premium of 350 euro compared to the lesser product.[11]

International Sustainability and Carbon Certification (ISCC) is the commonly accepted certifier of GHG emission levels in road transport fuels. Their filing valid certificates on their homepages[12], include 8 Biogas facilities using sewage sludge as feedstock, 35 biogas facilities using municipal solid waste as feedstock and 277 biogas facilities using food waste as feedstock.

ISCC provides large amounts of information about their certification system[13], but request us to start the process by approaching a ISCC recognised certification body[14]. A quick approach to be informed about the process would be to contact one of the eight certified biogas facilities that use sewage sludge after reading the available online documentation, i.e. certificate and audit reports that include contact information to the companies as well as verifiers and auditors.

4.3 Biofuel volume regulated markets

However, it is more common that other EU, and non-EU, countries to require a certain volume of biofuels with a maximum GHG emission level in road transport, for example 40% biofuel by 2030 in Norway. However, this system does not differentiate between biofuels with lower GHG emissions. Any biofuel that reduces GHG emission by more is hence not rewarded with an additional markup.

However, some “advanced” fuels double count, e.g. one physical energy unit is counted as two energy units in the accounting. It seems like sewage sludge double counts as listed in the EU RED II annex IX, part A, point “(f) animal manure and sewage sludge”.[15] It is furthermore unclear how the double counting of energy units from advanced feedstocks is done under Swedish/German regulations setting maximum carbon emission pr energy unit of road transport fuels (see discussion in appendix 10.1)

Whether the LBG should be sent to Germany with direct GHG regulation or other markets with double counting, will depend on the competition. The less GHG content, the more profitable will the German market be compared to the double counting market.

[9] Information from Vitol trader
[10] Information from Vitol trader
[11] It seems reasonable to assume that it is not possible to both sell certified biofuels with premium for low GHG content and certify GHG emission reductions in the same system to another carbon market at the same time.
[12] Valid Certificates › ISCC System (iscc-system.org)
[13] ISCC EU 202-5 – Wastes and Residues; ISCC EU 203 – Traceability and Chain of Custody; ISCC for Energy › ISCC System (iscc-system.org)
[14] Recognised CBs › ISCC System (iscc-system.org)
[15] https://lexparency.org/eu/32018L2001/ANX_IX/

5 National NDC targets under Paris agreement

5.1 International trade

The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris in 2015, organised by the United Nations Framework Convention on Climate Change (UNFCCC). Each country commits GHG emission reductions by signalling their own targets in so-called Nationally Determined Contributions (NDC), but chapter 6 allows for international trade.

However, EU countries has so far restricted themselves from buying such GHG emissions from developing countries where the cost is lower. The Norwegian government have an even more restrictive approach that the overall 55% GHG emission shall take place within our own borders rather than on EU territory as ETS opens for. The strategy of Switzerland is opposite. A Swiss-Peruvian agreement signed in October 2020 is the pioneering example of how internationally transferred mitigation outcomes (ITMOs) to fulfil their NDC can take place.[16]

The cooperation between Peru and Switzerland takes place in sectors that are additional to the existing and planned measures in Peru to reduce GHG. This implies that Peru is responsible for meeting their 40% GHG reduction target by implementing policies in some defined sectors, that do not include the two sectors sustainable energy to small and medium enterprises and rural cooking stoves that are financed by Switzerland and hence the GHG reductions accrues to the Swiss NDC.

If wastewater treatment is included in the NDC of the host nation, financing by other nations will count as “international climate finance” and can’t be filed in the NDC of the financing nation. However, if not included, then the financing nation can file the reduction in their NDC. If we assume that the willingness to pay is highest in the developed countries, will it be important to establish what developing countries do not include wastewater treatment in their efforts to fulfil their NDC.

With reference to being very ambitious, the EU (including EØS) member states so far agree that NDCs shall be fulfilled by GHG reductions within their territory. However, Switzerland intends to buy 25% of their NDC target of halving GHG emissions by 2030 from partner countries in developing. This trade is organised by the KliK foundation[17] that represents the road transport fuel distributors in Switzerland. My contact informs that the current target is to buy a total of 20 million mtCO2eq reductions by 2030, but they expect that the target soon will be adjusted upwards to 40 million mtCO2eq. They have so far signed collaboration agreements with smaller developing countries like Thailand, Senegal, Ghana, Peru, Georgia, Dominica, Morocco, and Malawi.

KliK hence buys certified GHG emission reductions and is also able to mobilize loans and capital for investment in technology and measures leading to these GHG emission reductions. As of today, are they not buying certificates from, or in any form involved in, the wastewater treatment sector. So they welcome any initiative from Cambi as they perceive our sector to be most interesting also due to other co-benefits like improved health and reduced environmental damage, as well as easy to copy and hence scale up. The indicate a willingness to pay about 30 USD/mtCO2eq certified GHG emission reduction. They hence invite Cambi to send a 3–4-page description in a Main Activity Idea Note (MAIN) indicating how and why our technology will bring GHG emission reductions and calculate the GHG volume reduction according to what we perceive is the right

[16] https://www.carbon-mechanisms.de/fileadmin/media/dokumente/Publikationen/CMR/CMR-4-2020-barrierefrei.pdf
[17] https://www.klik.ch/en

calculation methodology. Once received and analysed by KliK, will they invite us to a meeting to discuss how to proceed described in their process wheel (see appendix 10.3) in the following steps:

1. Mitigation Activity Idea Note (MAIN) four pages
2. pre-approval KliK
3. Letter of intent (LoI) between the two countries
4. Final approval KliK
5. Mitigation Activity Design Document (MADD)
6. “Definitive approval”

KliK indicate they will assist and follow up business partners like Cambi closely in the certification process as well as assist in acquire investment capital and local partners to install Cambi technology. There is no cost of submitting the initial MAIN, and KliK indicate they are willing to fund the development of the technical documentation MADD with USD 200,000[18].

KliK does not have a pre-defined list of methodologies for calculating GHG emission reductions as the acceptance of such will also depend on the partner host country. KLIK propose methodology for each programme which is then reviewed by the Swiss government. It is most common to use CDM, GS, VCS and other independent certifiers for the voluntary carbon market. Switzerland accepts accredited validators such as SGS, AENOR, Carbon Check and others. They inform that Morocco as so far not indicated which validators they accept, while the government of Ghana requires the validators to be accredited under CDM, Gold Standard or VCS.

5.2 National markets

Many developing nations must fulfil their own NDC. This represents both an opportunity and a threat for Cambi. Wastewater, and wastewater sludge, treatment can be a cost minimizing way also for developing countries to comply with NDC and hence spur investment in such processing. On the other hand, certified GHG emissions reductions require acceptance by the national government to be traded internationally for NDC compliance in other nations even if such positive effects are due to investment by private or subnational businesses and organisations. It is reasonable to expect that conflict of interest will arise post-investment leading and might lead to “confiscation” of such GHG reduction by the national government to comply with their own NDC target.

6 Renewable energy requirements

Some countries have regulations imposing use of renewable energy. According to 3Degrees trader is this a rather large market today, giving two price examples

- UK and Germany pay 30-80 euro/MWh biogas certificates, tradable in mass balance, possibly change in Greenhouse Gas protocol, new draft coming
- Taiwan pays 90-200 USD/MWh for best practise RE100 in scope 2 (electricity) according to 3Degrees trader.

Cambi employees have more examples.

[18] This “gift” is probably considered and files statistically by the Swiss government as development aid.

The renewable energy must be certified as such by methodologies accepted by the given national regulator. This report has not investigated relevant certification system for renewable energy requirements.

7 Upcoming international markets

The NDC will reduce GHG emission within national borders. There are two initiatives to reduce GHG emissions from cross border transport.

The International Civil Aviation Organisation (ICAO) has initiated the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) where signatories will jointly have to limit GHG emission to their total in 2020. This can be achieved by introducing more carbon efficient technologies by reducing the airplanes' use of energy, or that the aviation companies will have to substitute fossil aviation fuel with biofuels or other low emission fuels certified by ISCC or another certification organisation to be defined.

The international maritime organisation (IMO) is similarly developing regulations to limit GHG emission from seaborn transport.

8 Conclusion and recommendation

This report has identified promising carbon markets, and hence recommends Cambi to start certification processes in the following categories:

- Verra/GS certification for voluntary business sector, despite low price are volumes of GHG emission reductions potentially huge in some developing countries
- ISCC certification of GHG content in liquid biogas from Cambi facilities, huge premium on bioenergy with low emission levels if transported to Germany
- Switzerland Klik foundation process for NDC trade, will later imply certification with methodology and issuer still to be defined.

The first stage in all three processes is that Cambi submits a 3-4 page proposal describing GHG emission effects in exemplified projects sites and our calculations of GHG emission levels/reductions in these sights. The cost of such first step are minimal, and rough figures is sufficient to start the process to get good feedback from the certifiers and organisations on how to proceed and what result to expect. The potential of modern wastewater treatment including Cambi THP technology to reduce GHG emission reduction is especially large if there is no treatment at all today or if the sludge is put stored on landfills without methane capture. Payment for GHG emission reductions will then reduce technology costs considerably and can especially in development countries be decisive for whether poor governments/municipalities will investment in wastewater and sludge treatment facilities. Introducing the true cost of GHG emissions will replace exchange ethane producing landfills with THP technology, enriching poor economies with biofertilizer and biogas that substitute fossil alternatives in addition to the direct GHG emissions reductions.

9 Appendix

9.1 Double counting of advanced biofuels

The interpretation of EU RED II double counting of advanced biofuels is to literally count the energy content in each volume twice. In nations that chose biofuel volume regulations we will then have the following formula:

X% biofuel in fuel mix= (2*kJ biofuel)/(2*kJ biofuels+ kJ fossil fuels).

However, it is unclear how double counting is interpreted under Swedish/German regulation that rather set a maximum amount of CO2 emission pr energy unit, one possible formula is:

X grCO2eq/kJ in fuel mix = (grCO2/kJ in biofuels * (2*kJ biofuel) + grCO2/kJ in fossil * kJ fossil fuel)) / (2*kJ biofuel + kJ fossil fuel)?

9.2 EU RED-II methodology

The EU RED-II applies the following model to calculate the GHG emissions in biofuels for road transport, including biogas in Annex V, C. Methodology**:**
https://lexparency.org/eu/32018L2001/ANX_V/

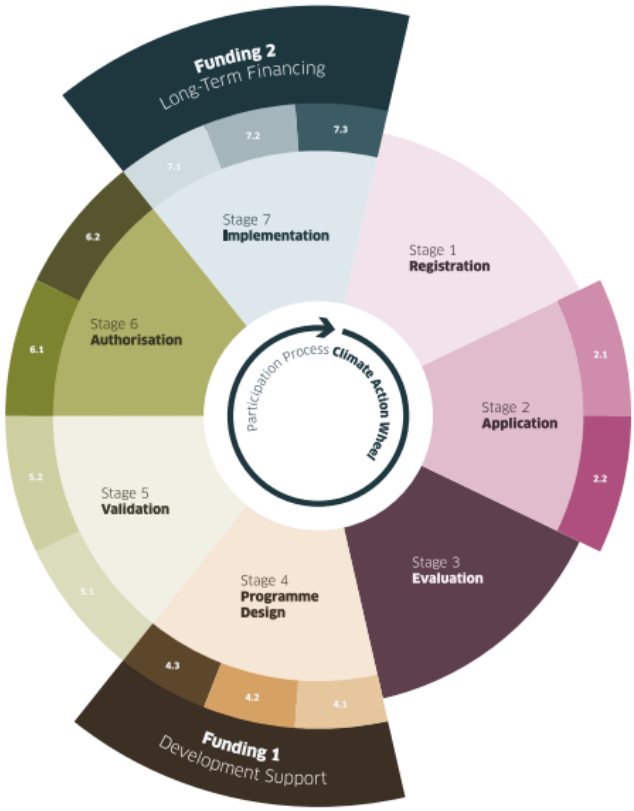
$E = e_{ec} + e_{l} + e_{p} + e_{td} + e_{u} – e_{sca} – e_{ccs} – e_{ccr}$,

where

E	=	total emissions from the use of the fuel;
e_{ec}	=	emissions from the extraction or cultivation of raw materials;
e_{l}	=	annualised emissions from carbon stock changes caused by land-use change;
e_{p}	=	emissions from processing;
e_{td}	=	emissions from transport and distribution;
e_{u}	=	emissions from the fuel in use;
e_{sca}	=	emission savings from soil carbon accumulation via improved agricultural management;
e_{ccs}	=	emission savings from CO_2 capture and geological storage; and
e_{ccr}	=	emission savings from CO_2 capture and replacement.

Emissions from the manufacture of machinery and equipment shall not be taken into account.

9.3 KliK process wheel



9.4 Platts price report voluntary carbon market certificates

PLATTS AVOIDANCE-BASED CREDITS ($/mtCO2e)

	Symbol	Price	Change
Platts CAC 2022	ACACA00	6.55	-0.10
Platts CAC 2023	ACACB00	6.90	-0.10
Platts Household Devices 2022	CNHDD00	9.55	+0.05
Platts Household Devices 2023	AHDVA00	10.20	+0.05
Platts Industrial Pollutants 2022	APOLA00	6.55	-0.10
Platts Industrial Pollutants 2023	APOLB00	6.90	-0.10
Platts Nature-Based Avoidance 2022	ANBAA00	12.55	+0.20
Platts Nature-Based Avoidance 2023	ANBAB00	13.25	+0.20

~~PLATTS CARBON: GS certified Methane Collection (Landfill gas) credits 40k mt heard bid at $5.40/mtCO2e; vintage: 2014; delivery: 2022; co-benefits: unspecified; region: Turkey; source: developer.

~~PLATTS CARBON: GS certified Methane Collection (Landfill gas) credits heard $1.00/mtCO2e premium to VCS certified Methane Collection (Landfill gas) credits; source: developer.

~~PLATTS CARBON: GS certified Methane Collection (Landfill gas) credits heard indicative value at $6.50/mtCO2e; vintage: 2020; delivery: 2022; co-benefits: unspecified; region: Turkey; source: developer.

~~PLATTS CARBON: [Heard before close]: GS certified Renewable Energy (Solar) credits heard bid at $4.50-$4.75/mtCO2e; vintage: 2019; delivery: 2022; co-benefits: unspecified; region: Vietnam; source: trader.