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METHODOLOGY REPORT

Carbon accounting for the investment portfolio of Finnfund

Prepared for:

Finnish Fund for Industrial Cooperation Ltd.

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INTRODUCTION

Finnfund, the Finnish Fund for Industrial Cooperation, is a Finnish development finance company. Finnfund's mission is to build a better world by investing in responsible and profitable businesses in developing countries.

Finnfund provides long-term risk capital and the investment portfolio consists of both direct and indirect investments to private companies. Main investment criteria include profitability, sustainability and positive development impacts. Climate change mitigation is one of the key drivers in Finnfund's strategy, which is also reflected in four focus sectors: clean energy, sustainable forestry, agriculture and financial institutions. Finnfund's climate-related projects are also part of Finland's Official Development Assistance (ODA) climate financing, which aims to mitigate climate change and support adaptation.

The Finnish Ministry for Foreign Affairs requires Finnfund to report how its investments contribute to climate change mitigation. Since 2016, Finnfund has reported the expected emission reductions from its new investments in two key sectors: clean energy and forestry. Emission reductions refer to the expected avoided emissions of renewable energy and carbon sequestration of forestry.

Finnfund aims to develop and improve its activities and for these purposes desires to better understand the impacts of greenhouse gas (GHG) emissions of its investment portfolio. Ecofys, a Navigant company, energy and climate consultancy (the Consultant), was contracted to develop a tool that would allow for the calculation and reporting of:

a) The Carbon Footprint of Finnfund's portfolio
b) The Avoided Emissions of eligible Finnfund investments (e.g. renewable energy projects) and
c) The Carbon Sequestration of eligible Finnfund investments (e.g. forestry projects)

The following methodology report details the approach used by the Consultant, in the extent of the points (a-c) above and outlines the rationale and assumptions made during the process. The methodology takes into account the structure and complexity of Finnfund's portfolio as well as data availability, which is why the calculation approach of a portfolio differs from the methodologies used for a company, a project or product. The methodology also aligns, to the extent possible, with the world's leading methodologies on the topic, namely the Greenhouse Gas Protocol (GHG Protocol),[1] the Platform Carbon Accounting Financials (PCAF),[2] and International Financial Institution Framework for a Harmonised Approach to Greenhouse Gas Accounting.[3]

[1] Greenhouse Gas Protocol, http://www.ghgprotocol.org/ .

[2] In 2015, eleven Dutch financial institutions joined forces to improve carbon accounting through the Platform Carbon Accounting Financials (PCAF) by increasing transparency and uniformity in carbon footprinting and target setting. For more information, see http://carbonaccountingfinancials.com/.

[3] International Financial Institutions, *International Financial Institution Framework for a Harmonised Approach to Greenhouse Gas Accounting*, 2015, https://www.thegef.org/sites/default/files/file_attach/IFI-Harmonisation-Framework-GHG%20Accounting-2015.pdf.

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1. CARBON ACCOUNTING OF FINNFUND'S PORTFOLIO

The carbon accounting methodology developed for Finnfund's investment portfolio follows the most recent and commonly accepted guidelines and standards for carbon accounting. Finnfund's investments generate both greenhouse gas (GHG) emissions and climate benefits. The climate benefits are generated by renewable energy projects as avoided emissions and through carbon sequestration in forestry projects. Thus, the carbon accounting methodology and this respective document are divided into three parts:

1. Carbon Footprint
2. Avoided Emissions
3. Carbon Sequestration

The most relevant guidelines and standards, namely the GHG Protocol[4] and the Platform Carbon Accounting Financials (PCAF)[5] have been selected and used as the basis for Finnfund's carbon accounting. To the best of Consultant's knowledge, the GHG Protocol is the most widely used standard for GHG accounting and PCAF the most forward-looking and advanced initiative focusing on GHG footprinting for financial institutions. For calculations of avoided emissions, the IFI Harmonized framework (*International Financial Institution Framework for a Harmonised Approach to Greenhouse Gas Accounting*[6]*)* has been followed. The AFOLU Carbon Calculator of USAID[7] and its underlying methodology has been utilised to calculate carbon sequestration figures for forestry investments of Finnfund.[8]

Generally, Finnfund's investments are either direct or indirect and can further be classified into the following different investee types:

Direct investments:

1. Companies

Indirect investment:

2. Funds
3. Banks and financial institutions

In case of direct investments, disbursement is directly made to the final investee (e.g., company or project). Indirect investments, in contrast, are disbursed indirectly via a third party (e.g., fund or bank) to the final investee.

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[4] http://www.ghgprotocol.org/

[5] In 2015, 11 Dutch financial institutions joined forces to improve carbon accounting through the Platform Carbon Accounting Financials (PCAF) by increasing transparency and uniformity in carbon footprinting and target setting. For more information, see http://carbonaccountingfinancials.com/.

[6] International Financial Institutions, *International Financial Institution Framework for a Harmonised Approach to Greenhouse Gas Accounting*, 2015, https://www.thegef.org/sites/default/files/file_attach/IFI-Harmonisation-Framework-GHG%20Accounting-2015.pdf.

[7] Agriculture, Forestry and Other Land Use (AFOLU). The research team analysed and compared several publicly available carbon sequestration tools and concluded that the AFOLU Carbon Calculator of USAID is the most suitable for the goal of this study. The tool can be found here: http://afolucarbon.org/.

8 A variety of different carbon sequestration tools have been assessed for use at Finnfund. The AFOLU tool has been selected based on that review. More information is provided in the Appendix.

In addition to the investee type, each individual investment of Finnfund can be broadly classified according to the type of financing instrument, (i.e. the investment type):[9]

(1) Equity
(2) Debt
(3) Mezzanine
(4) Combination of the three above

In the calculations, mezzanine investments have been considered as debt.

It is important to note that Finnfund only invests in developing countries. Also, investments are only rarely made to publicly listed companies. Hence, both economic and environmental data are often not readily available and/or accessible in public domain, but instead need to be collected directly from each investee.

2. CARBON FOOTPRINT

Chapter 2 (Carbon footprint) focuses on describing the chosen methodology and methods for calculating carbon emissions generated by Finnfund's projects.

2.1 The Greenhouse Gas Protocol and the Platform Carbon Accounting Financials

The Greenhouse Gas (GHG) Protocol sets a clear framework for businesses, governments, and other entities to measure and report their GHG emissions, which is sometimes referred to as Project or Corporate Carbon Footprint. The GHG Protocol provides three guiding documents/standards for carbon footprinting: the GHG Protocol for Project Accounting, the GHG Protocol Corporate Accounting and Reporting Standard, and the GHG Protocol Value Chain (scope 3) Accounting Standard. For accounting purposes, the GHG Protocol defines and distinguishes between three emission scopes (see Figure 1):

- Scope 1 emissions: The direct emissions that occur from sources owned or controlled by the observed party (company, project etc.); for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.
- Scope 2 emissions: The indirect emissions from the generation of purchased electricity and heat consumed by the observed party (company, project etc.).
- Scope 3 emissions: An optional reporting category that allows for the treatment of all other indirect emissions occurring in the value chain of the observed party (company, project, etc.), but are not covered by scope 2 emissions. Upstream scope 3 emissions refer to the indirect emissions related to purchased goods and services, and downstream scope 3 emissions refer to the indirect emissions related to sold goods and services. In total, the GHG Protocol defines 15 different scope 3 emission categories including emissions from investments.

According to the GHG Protocol, it is mandatory to include scope 1 and 2 emissions of investees in the calculation of carbon footprint for investment. It also states that, if emissions are material (and available/possible to estimate), scope 3 emissions of investees should be included as well. It is important to note that the GHG Protocol states that for carbon footprinting of a financial portfolio, scope 3 emissions for investments (category no 15)[10] should be attributed to the investor based on the relative share of the investment in the investee. Further, only scope 1 and scope 2 emissions of investees need to be reported.

According to the GHG Protocol, GHG emissions cover carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PCFs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3) and are expressed in CO_2-equivalents (CO_2e).

In addition to the GHG Protocol, the methodology used for Finnfund is aligned with the Platform Carbon Accounting Financials (PCAF) initiative, which has been developed for harmonising the carbon footprint rules for financial institutions. PCAF uses the GHG Protocol as a starting point for detailing and aligning carbon footprinting rules. However, in contrast to the GHG Protocol, it does not focus on project or corporate carbon footprinting but instead provides a first-of-its-kind guidance to calculate the carbon footprint of a financial portfolio.

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[10] Category 15: Investments includes scope 3 emissions associated with the reporting company's investments in the reporting year, not already included in scope 1 or scope 2. For more information, see http://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf

Carbon footprinting of a portfolio is closely related to the corporate / project carbon footprinting approach as set in GHG Protocol because a portfolio consists of many individual investees (i.e., projects and/or corporates inter alia) all having an individual carbon footprint. The carbon footprint of a portfolio therefore corresponds to the sum of all investees' carbon footprints, weighted by the individual financing share in the respective investees. This means that the carbon footprint of an investee is attributed to the investor based on the relative share of the investment in the investee. While this approach was generally defined by the GHG Protocol, PCAF[11] goes into more detail on emission scopes to be covered, calculation of the financing share, potential data sources, and footprinting limitations for various financial asset classes (government bonds, listed equity, project finance, mortgages, commercial real estate, and corporate debt). In addition, it also provides example calculations per asset class. Similar to the GHG Protocol, PCAF recommends focusing efforts on scope 1 and 2 emissions reporting, while scope 3 emissions reporting is voluntary as scope 3 data typically has limited availability and lacks comparability, transparency and reliability.

Both GHG Protocol and PCAF serve as the fundamental baseline for developing the methodology for calculating the carbon footprint of Finnfund's portfolio.

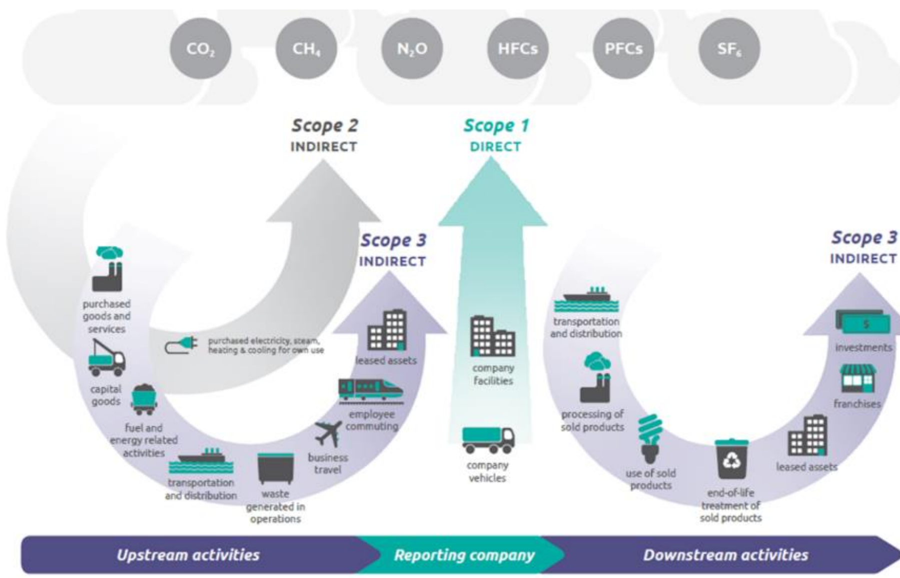

Figure 1: Scope 1, Scope 2, and Scope 3 Emissions According to the GHG Protocol

2.2 Carbon Footprint Methodology for Finnfund

As noted, the general idea of calculating the carbon footprint of Finnfund's investment portfolio is basically the same in all existing carbon footprint guidelines: the financing share of Finnfund (both equity and debt) in the investee *i*, is calculated, multiplied with the annual emissions of the project *i*, and finally all annual emissions are summed:

$$\boldsymbol{Carbon\ Footprint\ of\ Portfolio} = \sum_{i}^{n} \boldsymbol{financing\ share\ of\ Finnfund_i\ x\ carbon\ footprint_i}$$

[11] PCAF report is available at: http://carbonaccountingfinancials.com/wp-content/uploads/2018/02/PCAF-final-report.pdf

2.2.1 How to Obtain Finnfund's Financing Share (%) in the Investee?

Emissions are attributed to Finnfund based on the relative share of Finnfund's investment in the total capital of the investee, i.e., the total balance sheet value (equity plus debt) according to the investee's balance sheet. This is in line with PCAF and is applicable to all Finnfund investment types (equity, debt, mezzanine, and a combination of the three).

$$\boldsymbol{Financing\ share\ of\ Finnfund_i} = \frac{\boldsymbol{Finnfund\ investment_i}}{\boldsymbol{(investee\ equity + investee\ debt)_i}}$$

To derive the attribution of Finnfund's investments, the total outstanding non-written-off investment value according to Finnfund's books is used:

(a) For debt investments (including mezzanine),

this reflects Finnfund's actual financing share, i.e., there is no over or underestimation.[12]

(b) For equity investments,

in contrast, using the non-written-off investment value may result in overestimation of Finnfund's ownership share.[13] However, this is acceptable from a carbon accounting point of view as this approach never underestimates the ownership share.

However, especially in case of indirect investments such as banks and financial institutions, the calculation of the financing share of Finnfund is not always possible (e.g. if data for the final investee is unavailable). In case the total balance sheet of the final investee[14] is not available, a so-called proxy financing share is used instead. The proxy financing share is estimated by multiplying Finnfund's ownership share of the fund or financial institution with the fund's ownership share of their portfolio company. Of note, this share may overestimate the financing share of Finnfund as it neglects the debt level of the investee and therefore only accounts for the equity ownership. Nevertheless, this is acceptable from a carbon accounting point of view as this approach of calculating Finnfund's financing share never underestimate Finnfund's financing share.

The financing share calculated based on total balance value is always preferred over the proxy financing share. In case neither the financing share nor the proxy financing share can be derived, the carbon footprint of the respective investee is calculated using alternative approaches described in chapter "**Error! Reference source not found.** How to Calculate the Portfolio Carbon Footprint".

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[12] In general, the outstanding debt invested by Finnfund into an investee always remains on the balance sheet of the investee if the investee does not default. Consequently, the total balance sheet value of the investee is never affected by any write-offs in Finnfund's books. Using the non-written-off debt value according to Finnfund's books in the numerator while using the investee's total balance sheet value in the denominator would thus neither over nor underestimate the ownership share of Finnfund but instead provide the true ownership share.

[13] For instance, if an investee makes fewer profits, this is generally also reflected in the investee's equity value on the balance sheet, meaning that its total balance sheet value also reduces. Using the non-written-off investment value in the numerator of the ownership share calculation may thus overestimate Finnfund's ownership share. As avoiding such overestimation would require collecting a large amount of data on the total capital development of an investee, this potential overestimation is tolerated.

[14] The term, "final investee," refers to the investee that obtains the investment at the end of the financial value chain. When investing into a fund, for example, the final investee of Finnfund is not the fund but the company or project that obtains the investment from the fund.

2.2.2 How to Obtain the Carbon Footprint of Investees ($ktCO_2e$)?

According to PCAF, the best available option for Finnfund to obtain the carbon footprint of investees would be to estimate the carbon footprint top-down (i.e. using generic average emission intensities depending on the country and sector of the investee) instead of bottom-up (i.e. using verified activity and/or emission data from the investee). Bottom-up approach for calculating absolute emissions for direct and indirect investments would require independently verified carbon footprint data from the final investee (i.e. reported carbon footprint). For majority of Finnfund investees such data are typically not available as the companies are—in most cases—non-listed and often small- and medium-sized companies in developing countries.

A common top-down approach is to use a revenue-based modelling approach based on economic and environmental input-output models as it requires less granular data while at the same time being reliable and consistent. Input-output models estimate an emission intensity per Euro revenue of an investee per sector and per country/region. Hence, with data on revenue, investee's sector, and its region/country located, the carbon footprint can be estimated by multiplying the revenue of the investee by the respective emissions intensity from the model. Input-output models do not only allow Finnfund to estimate scope 1 emissions but also scope 2 emissions and upstream scope 3 emissions. This is also an advantage of the top-down revenue-based modelling approach over the bottom-up approaches, where it is difficult to either obtain consistently measured scope 3 emissions across investees (this is the case for the reported carbon footprint) or to distinguish between scope 1, 2, and 3 emissions (this is the case for the estimated carbon footprint). **Error! Reference source not found.** shows the data points provided by economic and environmental input-output models (data extract from Finnfund's tool).

Unique ID	Regions	Countries	Sectors per country	Sub-sectors per country	Scope 1	Scope 2	Scope 3 upstream
Indonesia_p01.a	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Paddy rice	5,615	4	59
Indonesia_p01.b	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Wheat	0	0	0
Indonesia_p01.c	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Cereal grains nec	2,123	332	2,713
Indonesia_p01.d	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Vegetables, fruit, nuts	10,581	143	1,594
Indonesia_p01.e	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Oil seeds	6,101	8	38
Indonesia_p01.f	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Sugar cane, sugar beet	816	0	2
Indonesia_p01.g	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Plant-based fibers	3	47	47
Indonesia_p01.h	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Crops nec	2,580	17	145
Indonesia_p01.i	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Cattle	29,722	1	4
Indonesia_p01.j	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Pigs	911	1	6
Indonesia_p01.k	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Poultry	2,540	943	2,258
Indonesia_p01.l	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Meat animals nec	2,776	1	6
Indonesia_p01.m	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Animal products nec	5	612	1,547
Indonesia_p01.n	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Raw milk	2,300	24	402
Indonesia_p01.o	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Wool, silk-worm cocoons	1	0	0
Indonesia_p01.w.1	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Manure (conventional treatment)	0	0	0
Indonesia_p01.w.2	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Manure (biogas treatment)	0	0	0
Indonesia_p02	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Products of forestry, logging and related service:	2,718	78	178
Indonesia_p05	Asia	Indonesia	Agriculture, hunting, forestry & fishing	Fish and other fishing products; services inciden	608	1,126	2,147
Indonesia_p40.11.a	Asia	Indonesia	Electricity, gas & water	Electricity by coal	88,218	11	57
Indonesia_p40.11.b	Asia	Indonesia	Electricity, gas & water	Electricity by gas	19,500	0	3
Indonesia_p40.11.c	Asia	Indonesia	Electricity, gas & water	Electricity by nuclear	0	0	0
Indonesia_p40.11.d	Asia	Indonesia	Electricity, gas & water	Electricity by hydro	1	9	37
Indonesia_p40.11.e	Asia	Indonesia	Electricity, gas & water	Electricity by wind	0	0	0
Indonesia_p40.11.f	Asia	Indonesia	Electricity, gas & water	Electricity by petroleum and other oil derivatives	32,449	45	175
Indonesia_p40.11.g	Asia	Indonesia	Electricity, gas & water	Electricity by biomass and waste	3	0	0
Indonesia_p40.11.h	Asia	Indonesia	Electricity, gas & water	Electricity by solar photovoltaic	0	0	0
Indonesia_p40.11.i	Asia	Indonesia	Electricity, gas & water	Electricity by solar thermal	0	0	0
Indonesia_p40.11.j	Asia	Indonesia	Electricity, gas & water	Electricity by tide, wave, ocean	0	0	0
Indonesia_p40.11.k	Asia	Indonesia	Electricity, gas & water	Electricity by Geothermal	1	6	29
Indonesia_p40.11.l	Asia	Indonesia	Electricity, gas & water	Electricity nec	0	0	0
Indonesia_p40.12	Asia	Indonesia	Electricity, gas & water	Transmission services of electricity	9	359	54
Indonesia_p40.13	Asia	Indonesia	Electricity, gas & water	Distribution and trade services of electricity	36	2,933	243
Indonesia_p40.2.a	Asia	Indonesia	Electricity, gas & water	Coke oven gas	0	0	0
Indonesia_p40.2.b	Asia	Indonesia	Electricity, gas & water	Blast Furnace Gas	0	0	0
Indonesia_p40.2.c	Asia	Indonesia	Electricity, gas & water	Oxygen Steel Furnace Gas	0	0	0
Indonesia_p40.2.d	Asia	Indonesia	Electricity, gas & water	Gas Works Gas	0	0	0
Indonesia_p40.2.e	Asia	Indonesia	Electricity, gas & water	Biogas	0	0	0

Figure 2: Use of input-output model's data for Finnfund

Based on the discussion above and to ensure consistency in the carbon footprinting methodology, three approaches to obtaining the carbon footprint of investees have been defined and prioritised in the following order:

(1) ExioBase Carbon Footprint

Carbon footprint based on ExioBase input-output tables[15].

(2) Reported Carbon Footprint

Carbon footprint based on reported emissions from investees, ideally with third party verification.

(3) Estimated Carbon Footprint

Carbon footprint based on primary activity data from investees. However, the availability of necessary input data – such as energy usage or output of materials, goods and services produced – is very limited as investees generally do not report such activity data publicly, the companies produce a variety of products or their output cannot be measured in simple units.

Of note, the quality of the data for options 2 and 3 above might differ as the footprint might be calculated using different standards. This could include, an own estimation of the investee, a third-party verified footprint or an estimation based on standardised form provided by Finnfund.

Due to data limitations and for consistency, the ExioBase Carbon Footprinting approach was prioritised and the two other approaches are only used if the former is not feasible. The prioritisation can be changed in the future if more data become available.

It is important to note that as economic and environmental input-output models such as ExioBase are only capable of estimating scope 1, scope 2, and upstream scope 3 emissions but not any of the downstream scope 3 emissions. This means, for example, that downstream emissions from forestry investments such as the further processing or use of wood are not covered in the carbon footprint when using ExioBase to estimate the portfolio emissions of Finnfund.

2.2.3 How to Calculate the Portfolio Carbon Footprint?

Figure 3 details how the portfolio carbon footprint is calculated by linking Finnfund's financing share in the investee with the carbon footprint of the investee.

[15] ExioBase is a global, detailed Multi-Regional Environmentally Extended Supply and Use/Input Output (MR EE SUT/IOT) database. It was developed by harmonising and detailing SUT for a large number of countries, estimating emissions and resource extractions by industry, linking the country EE SUT via trade to an MR EE SUT, and producing an MR EE IOT from this. See here: https://www.exiobase.eu/

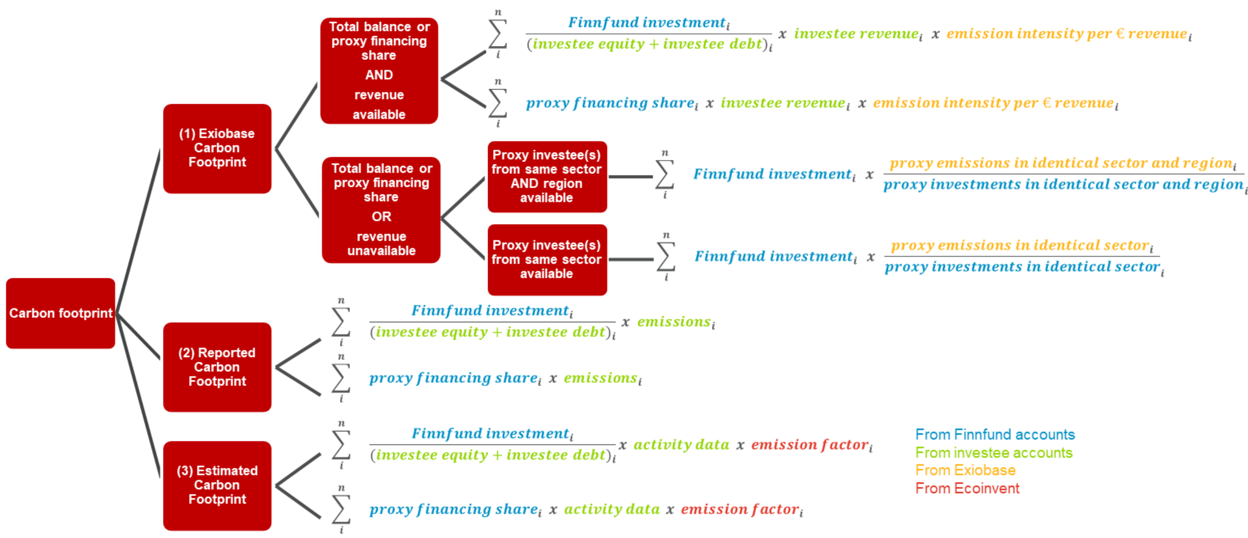

Figure 3: Approaches to Obtain the Portfolio Carbon Footprint

(1) ExioBase Carbon Footprint

In cases where the total balance sheet value or proxy financing share and the revenue of the investee are available, the carbon footprint of the respective investee is calculated by multiplying Finnfund's financing share with the revenue of the investee and the emissions intensity per Euro revenue of the investee's sector and region/country.
In cases where it is not possible to define the financing share of Finnfund (i.e. the total balance sheet value or financing share or the revenue of the investee is unavailable), a *proxy emission approach* is used. This means using an average emission intensity from other investments in the portfolio, for which the calculation approach was feasible, and which belong to the same sector classification and, if possible, from the same region / country. Please note the difference of the *proxy emission approach* from the *proxy financing share* (refer to section **Error! Reference source not found.**).

Limitations

As economic and environmental input-output models such as ExioBase are only capable of estimating scope 1, scope 2, and upstream scope 3 emission intensities per EUR revenue, all downstream scope 3 emissions are excluded.

There is a limited number of sectors for which economic and environmental input-output data is available. ExioBase provides 200 sectors while Finnfund's internal sector classification only consists of 86 sectors. In addition, ExioBase and Finnfund use a different sector classification system. For this reason, when sector linking/mapping of Finnfund's portfolio to ExioBase sector was not possible, a proxy sector was used instead.

There is a limited number of regions/countries for which economic and environmental input-output data is available. ExioBase provides 49 countries/regions while Finnfund's internal classification consists of 260 countries/regions, noting that Finnfund's investments are disbursed to less than 100 countries/regions. For this reason, when country/region mapping of Finnfund's portfolio to ExioBase regions is not possible a proxy region or country was used instead.

In case the final investee of indirect financial sector investment was not available, the sector of the investment was classified as financial services instead of the actual investee sector. Such assumption potentially underestimates investee's carbon footprint as Finnfund's final investee is likely to be more emission-intensive than the financial sector.

As ExioBase is based on emissions intensities per Euro revenue from 2011, the emission intensities of ExioBase could be different from today as sectoral and regional intensities might have changed due to technological advancement, regulatory changes, changes in electricity grid fuel mix, etc.

In addition, the inflation rate is likely to increase the denominator of the emission intensities. Consequently, the denominator would be higher today, meaning that the emission intensity from EXIOBASE is likely to be overestimated.

Conversely, a factor that affects the emissions intensity per Euro revenue is the currency exchange rate. This often has influence over developing countries, where currency fluctuations are quite common and often significant.

Whether the ExioBase emissions intensity is over or underestimated depends on the relative development of the local currency in comparison to the Euro from 2011 to 2016.
If the carbon footprint calculation is not possible based on ExioBase input-output tables, approach (2) is used.

(2) Reported Carbon Footprint

If the total balance sheet value or proxy financing share is available, the carbon footprint of the respective investee is calculated by multiplying Finnfund's financing share with the reported emissions from the investee. Both publicly available and emissions reported to Finnfund are used, noting that the data is not necessarily verified.

The data availability and quality of the reported carbon footprint is a major limitation. As Finnfund's investees are generally small to medium sized companies in developing countries and have limited resources and knowledge to calculate a carbon footprint. Their data is typically not third-party verified.

In cases where reported emissions cannot be used for carbon footprint calculation, approach (3) is used.

(3) Estimated Carbon Footprint

If the total balance sheet value or proxy financing share is available, the carbon footprint of the respective investee is calculated by multiplying Finnfund's financing share with the activity data (e.g. megawatt-hours of gas consumed, tonnes of steel produced, etc.) and the respective emissions factor (i.e. tonnes of CO_2e/MWh gas, tonnes of CO_2e/tonnes of steel produced). Emission factors are obtained from Ecoinvent,[16] which is a Life Cycle Inventory database used for many lifecycle assessment projects, ecodesign, and product environmental information.

Activity data completeness is generally low as many investees do not report activity data such as output volume publicly and/or are active in multiple sectors. Mapping emission factors from Ecoinvent to the respective activity data from the investee is therefore not always feasible.

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[16] https://www.ecoinvent.org/

If the carbon footprint calculation is still not possible with any of the three approaches above, the investee's carbon footprint cannot be calculated, and the respective investee is not included in the portfolio carbon footprint calculation of Finnfund.

3. AVOIDED EMISSIONS

Chapter 3 (Avoided Emissions) focuses on describing the chosen methodology and methods for calculating avoided emissions in Finnfund's renewable energy projects. Avoided emissions are emission reductions caused by an investment into renewable energy generation compared to the baseline situation in a particular country (emission intensity of the energy generation).

3.1 The IFI Framework for a Harmonised Approach to Greenhouse Gas Accounting

The note *"The International Financial Institution Framework for a Harmonised Approach to Greenhouse Gas Accounting"* was published in 2015 by 11 International Financial Institutions (IFIs).[17] The rationale for the note was to harmonise GHG accounting for project appraisal. The goal is to establish minimum requirements and to improve consistency and comparability in reporting, particularly for avoided emissions. As part of their harmonisation work, the IFIs published an *Approach to GHG Accounting for Renewable Energy Projects*[18] and an associated dataset of harmonised grid factors. IFIs shall use this dataset to estimate the avoided emissions from renewable energy projects in any country around the world (i.e. emissions per megawatt-hour of renewable electricity produced) to ensure for consistency.

The IFI approach is in line with the GHG Protocol for Project Accounting but also provides more guidance on how to calculate the grid factor, i.e. the avoided emissions achieved per renewable megawatt-hour produced. This guideline and dataset of the *International Financial Institution Framework for a Harmonised Approach to Greenhouse Gas Accounting* serve as a major input for the calculation of the avoided emissions of Finnfund's portfolio.

3.2 Avoided Emissions Methodology

The general idea of calculating the avoided emissions of eligible projects in Finnfund's portfolio is: the financing share[19] of Finnfund in the investee *i*, is calculated and multiplied by the annual avoided emissions of the investee *i*, and finally all avoided emissions are summed:

$$\boldsymbol{Avoided\ Emissions\ of\ Portfolio} = \sum_{i}^{n} \boldsymbol{financing\ share\ of\ Finnfund_i\ x\ aviodeded\ emissions_i}$$

[17] The International Financial Institutions (IFIs) included in this initiative are the African Development Bank (AfDB), the Agence Française de Développement (AfD), the Asian Development Bank (ADB), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Global Environment Facility (GEF), the Inter-American Development Bank (IDB), KFW Development Bank, the Nordic Development Fund (NDF), the Nordic Environment Finance Corporation (NEFCO), the Nordic Investment Bank (NIB), the UK Green Investment Bank, and the World Bank Group (WBG).

[18] The World Bank, "IFI Approach to GHG Accounting for Renewable Energy Projects," http://documents.worldbank.org/curated/en/758831468197412195/IFI-approach-to-GHG-accounting-for-renewable-energy-projects.

[19] The financing share is calculated in the same way as in the carbon footprint section. For more information, see section 2.2.1.

3.2.1 How to Obtain the Avoided Emissions (ktCO_2e) of Investees?

The IFI Harmonised Approach to Greenhouse Gas Accounting (i.e. Estimated Avoided Emissions) is preferred over reported avoided emissions. Because the avoided emissions data reported by investees may be independently verified, which would be the best option, and the methodology used by investees to calculate the avoided emissions is not harmonised. [20] In the Estimated Avoided Emissions approach, the activity data (e.g. megawatt-hour wind electricity produced in a particular country) is multiplied with the grid factor from the IFI dataset of harmonised grid factors for the respective investee country/region.

Therefore, to ensure consistency in the portfolio avoided emissions methodology, the Consultant has defined two approaches to calculate the avoided emissions of investees and prioritised these in the following order:

(1) Estimated Avoided Emissions

Avoided emissions based on activity data from investees and IFI harmonisation grid factors.

(2) Reported Avoided Emissions

Avoided emissions based on reported avoided emissions from investees, ideally with third party verification.

3.2.2 How to Calculate the Avoided Emissions?

Figure 4 below details how the avoided emissions of the eligible project in the portfolio are calculated by linking Finnfund's financing share in the investee with the avoided emissions of the investee.

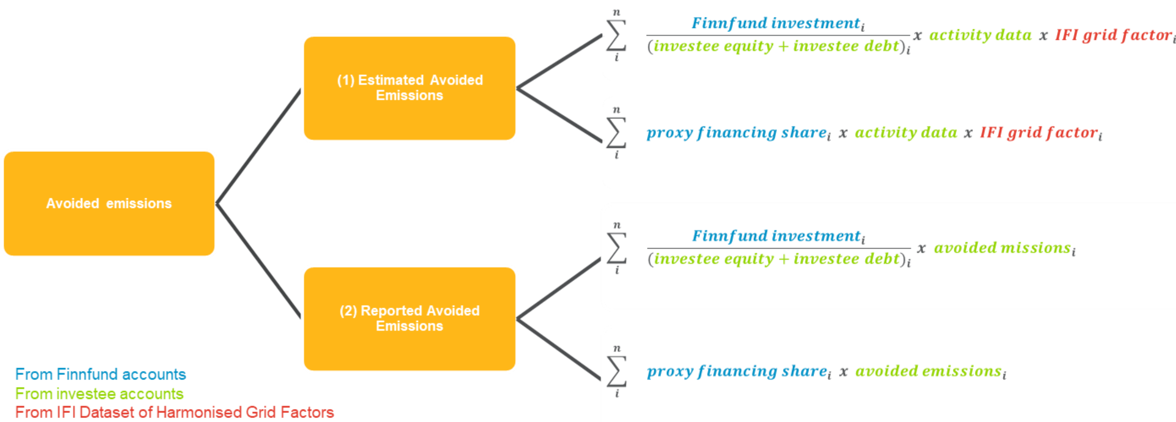

Figure 4: Approaches to Obtain the Portfolio Avoided Emissions

(1) Estimated Avoided Emissions

If the total balance sheet value or proxy financing share is available, the avoided emissions of an investee are calculated by multiplying Finnfund's financing share by the activity data (e.g. megawatt-hours of wind electricity produced) and the respective IFI harmonised grid factor (in tonnes of CO_2e/MWh).

[20] Note: It is important to apply a consistent methodological approach when calculating avoided emissions as inconsistency makes the comparison between different investees infeasible.

Activity data is not always provided in megawatt-hours, but instead in production capacity. In such cases, the simplified assumptions on the load duration curve of the respective renewable energy technology must be adopted, leading to potential inaccuracies. If the avoided emissions calculation is not possible based on estimated avoided emissions, approach (2) is used.

(2) Reported Avoided Emissions

If the total balance sheet value or proxy financing share is available, the avoided emissions of the respective investee are calculated by multiplying Finnfund's financing share by the reported avoided emissions from the investee.

All of Finnfund's investees that produce renewable electricity do not report their avoided emissions. In addition to data availability, a major limitation is the data quality and comparability of the reported avoided emissions, which are often not independently verified. How these avoided emissions are derived is not always transparently documented.

If the avoided emissions calculation is still not possible with either of the two approaches above, the investee's avoided emissions cannot be calculated, and the respective investee is not included in any calculations.

4. CARBON SEQUESTRATION

Chapter 4 (Carbon Sequestration) focuses on describing the chosen methodology and methods for calculating carbon sequestration in Finnfund's forestry projects. Carbon sequestration here refers solely to biological sequestration in trees.

4.1 The USAID AFOLU Carbon Calculator

Sustainable forestry is one of Finnfund's key strategic investment sectors, making it highly important for Finnfund to estimate the carbon sequestration of its forestry investment portfolio. Finnfund invests only in sustainable forestry and encourages the companies to become third party certified or manage the forests according to the forest certification criteria (e.g. FSC).

To identify and select an appropriate database and tool for calculating the carbon sequestration from forestry, a comparative analysis of eight publicly available carbon sequestration tools was conducted by the Consultant. Transparency (in terms of data and methodology) and applicability (in terms of data availability of Finnfund) were the most important criteria for the tool. An overview of the eight carbon sequestration tools compared is provided in Annex 5.1.

Developed by Winrock International, the U.S. Agency for International Development's (USAID's) Agriculture, the Forestry and Other Land Use (AFOLU) Carbon Calculator was selected as the most appropriate tool since it focuses on forestry, is based on transparent methodologies from IPCC (International Panel on Climate Change) and FAO (Food and Agriculture Organization of UN), and it has reasonable data input requirements such as number of hectares planted and species type. The AFOLU Carbon Calculator applies IPCC-based accounting methods that allow users to estimate the CO_2 benefits and potential GHG emission impacts of different types of land-based project activities, including afforestation/reforestation. The AFOLU Carbon Calculator as well as other publicly available tools such FAO EX-ACT account for both aboveground and belowground biomass when estimating the carbon sequestration of forests.[21] This is also in line with IPCC guidelines and other standards (e.g. Gold Standard, VCS and Climate, Community and Biodiversity Standards (CCB Standards): To be on the conservative side and avoid overestimating carbon sequestration, the research team decided to only account for carbon sequestration from aboveground biomass. The reason for this is twofold. Firstly, Finnfund's carbon sequestration is mostly a direct result of investments into forestry plantations with short to medium rotations (e.g. Eucalyptus with only 7 to 8 years of rotation), where only aboveground biomass is harvested at rotation end. This means that the belowground biomass is not necessarily increasing over time as when trees are harvested, the roots typically remain in the soil. Secondly, the uncertainty in calculating carbon sequestered of belowground biomass is much higher than for aboveground biomass. Focussing on aboveground carbon sequestration is therefore more robust and reliable.

It is important to note that only investments in: 1) afforestation / reforestation on formerly degraded land, and 2) forest conservation (e.g. REDD+ projects) are considered eligible for carbon sequestration accounting by Finnfund. Sustainable natural forest investments, even with selective and reduced impact

[21] Global Climate Change: Carbon Reporting Initiative, "The AFOLU Carbon Calculator," USAID, http://afolucarbon.org/static/documents/AFOLU-C-Calculator-Series_AR.pdf.

logging, are currently not included in carbon sequestration calculations by Finnfund due to the limited number of projects and methodological challenges.

The data underlying the AFOLU Carbon Calculator serves as a major input for calculating the carbon sequestration of Finnfund's portfolio.

4.2 Portfolio Carbon Sequestration Methodology

The general approach for carbon sequestration calculations for forestry projects is to multiply the financing share[22] of Finnfund in the investee *i* by the total figure of the annual carbon sequestered of the investee *i*. Finally, a sum of all the calculated carbon sequestration figures from forestry projects can be derived.

$$\textit{Carbon Sequestration of Portfolio} = \sum_{i}^{n} \textit{financing share of Finnfund}_i \ x \ \textit{sequestered carbon}_i$$

4.2.1 How to Obtain the Carbon Sequestration (ktCO$_2$e) of Investees?

The AFOLU Carbon Calculator is used to calculate the carbon sequestration for direct and indirect forestry investments due to the limited availability of primary data of all eligible investments, including the indirect investments. The methodologies used by investees to calculate carbon sequestration are not harmonised either. [23] In the best case, independently verified carbon sequestration data from the final investee would be used, however this is typically not available. Instead, activity data provided by Finnfund for each afforestation/reforestation investment (i.e. species type, hectares planted, rotation period, etc.) were linked with a carbon sequestration factor from the AFOLU Carbon Calculator, which provides the carbon sequestration in tonnes of CO_2. For each investee, a total amount of carbon sequestered was then calculated.

To ensure consistency in the portfolio carbon sequestration methodology, two approaches have been defined to obtain the carbon sequestration of investees and prioritised in the following order:

(1) Estimated Carbon Sequestration

Carbon sequestration based on activity data from investees and carbon sequestration factors from the AFOLU Carbon Calculator.

(1) Reported Carbon Sequestration

Carbon sequestration based on reported carbon sequestration from investees, ideally with third party verification.

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[22] The financing share is calculated in the same way as in the carbon footprint section. For more information, see section 2.2.1**Error! Reference source not found.**.

[23] Note: It is important to apply a consistent methodological approach when calculating carbon sequestration as inconsistency makes the comparability between different investees infeasible.

4.2.2 How to Calculate the Sequestered Emissions?

Figure 5 below details how the carbon sequestration of eligible projects in Finnfund's portfolio is calculated by linking Finnfund's financing share in the investee with the carbon sequestration of the investee.

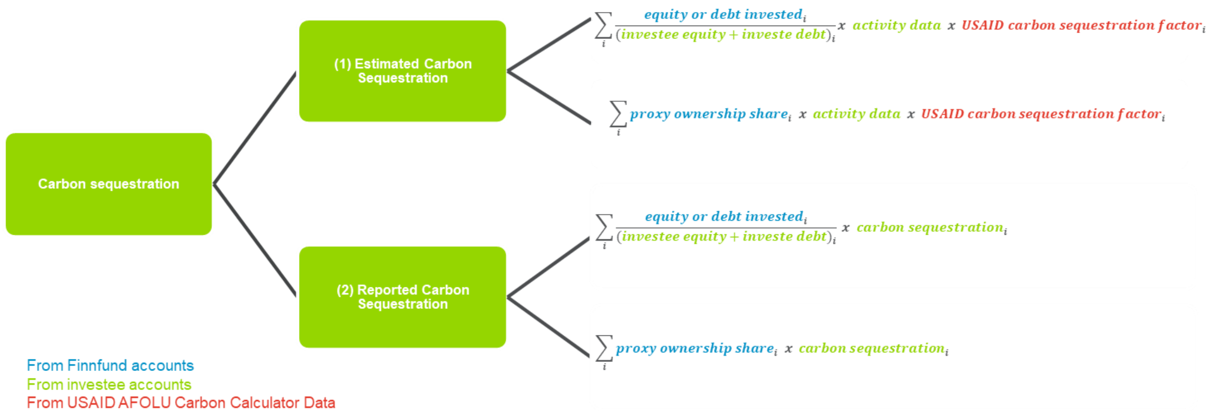

Figure 5: Approaches to Obtain the Portfolio Sequestered Emissions

(1) Estimated Carbon Sequestration

If the total balance sheet value or proxy financing share is available, the carbon sequestration of the respective investee is calculated by multiplying Finnfund's financing share by the activity data (e.g. hectares per species planted, rotation period) and the respective carbon sequestration factor (tCO_2 annually sequestered per ha of the particular species). While activity data is provided by the investee, the carbon sequestration factor is derived from the AFOLU Carbon Calculator[24].

Activity data on species, hectares planted, climate type, and rotation period may not always be available especially for indirect investments. In such cases, assumptions need to be adopted—e.g. from other investees where such activity data is available (this can be done for rotation, for example). If species and/or hectares planted are not available, then it is not possible to calculate the carbon sequestration.

It is important to note that only taking into account activity data such as species, hectares planted, climate type, and rotation period simplifies the approach of calculating carbon sequestration. The process of carbon sequestration is much more complex and highly dependent on local climate conditions, pests, and forest management practices. Further uncertainties to carbon sequestration are physical risks (fires, storms, diseases, etc.) that affect the carbon sink in the long-term. To be conservative, the calculated carbon sequestration is therefore typically discounted.

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[24] A detailed explanation of the methodology to arrive at these carbon sequestration factors is provided here (note that the name carbon sequestration factor cannot be found in the document. However, the methodology of calculating carbon sequestration is explained in detail): http://afolucarbon.org/static/documents/AFOLU-C-Calculator-Series_AR.pdf

To account for such uncertainties and avoid overestimating the carbon sequestration calculated using the AFOLU Carbon Calculator of USAID, the Consultant applied a 40% uncertainty discount rate to the estimated carbon sequestration, i.e. reduced the calculated carbon sequestration by 40%. Such an uncertainty discount is in line with the methodical guidance and recommendations document underlying the AFOLU Carbon Calculator[25], which assumes an uncertainty range for plantation forests to be at medium level (20 to 60%).

If the carbon sequestration calculation is not possible based on estimated carbon sequestration, approach (2) is used.

(1) Reported Carbon Sequestration

If the total balance sheet value or proxy financing share is available, the carbon sequestration of the respective investee is calculated by multiplying Finnfund's financing share by the reported carbon sequestration from the investee.

The major limitation is the comparability of the reported carbon sequestration data. As Finnfund's investees are generally small to medium enterprises in developing countries, carbon sequestration data might not be reported and is typically not independently verified.

If the carbon sequestration calculation is still not possible with either of the two approaches above, the investee's carbon sequestration cannot be calculated, and the respective investee is not included in any calculations.

[25] http://afolucarbon.org/static/documents/AFOLU-C-Calculator-Series_AR.pdf

5. APPENDIX

5.1 Comparative Analysis of Publicly Accessible Carbon Sequestration Tools for Afforestation and Reforestation

ID	Tool name	Organisation/ Developer	Description	Tool Format	Applicability to Finnfund
1	CoolFarmTool	Cool Farm Alliance (CFA)	The CoolFarm Tool quantifies on-farm GHG emissions and soil carbon sequestration.	Browser-based tool	The tool has a focus on agriculture commodities, not forestry, and is thus not applicable to Finnfund purposes.
2	Ex-Ante Carbon-balance Tool (EX-ACT) - v7.1.8g	FAO	EX-ACT is an appraisal system that provides estimates of the effect of agriculture and forestry development projects, programs, and policies on the carbon-balance. The carbon-balance is defined as the net balance from all GHGs expressed in CO_2e that were emitted or sequestered due to project implementation as compared to a business-as-usual scenario.	Standalone Excel tool	The tool has a focus on agriculture commodities not forestry and is thus not applicable to Finnfund purposes.
3	TARAM (V1.4)	BioCF and CATIE	Tool for Afforestation and Reforestation Approved Methodologies (TARAM).	Standalone Excel tool	The tool is too sophisticated and detailed for Finnfund as it requires many input data, which Finnfund does not have (e.g., MAI, DBH, root-to-shoot ratio, etc.). The tool is thus not applicable to Finnfund purposes.
4	Manual Carbon Stock Calculation Tool	Winrock International for USAID	This tool is part of the LEAF-produced Terrestrial Carbon Assessment Toolkit, which provides step-by-step requirements to estimate terrestrial carbon stocks and emissions factors for various land cover types; critical for any climate change mitigation effort.	Standalone Excel tool	The tool is too sophisticated and detailed for Finnfund as it requires many input data, which Finnfund does not have (e.g., MAI, DBH, root-to-shoot ratio, etc.). The tool is thus not applicable to Finnfund purposes.

5	AFOLU Carbon Calculator (ACC)	USAID	The ACC employs IPCC-based accounting methods that allow users to estimate the carbon sequestration and potential GHG emissions impacts of eight different types of land-based project activities: forest protection, forest management, afforestation/reforestation, agroforestry, cropland management, grazing land management, forest degradation by fuelwood, and support/development of policies. ACC uses sound and transparent science to produce yearly estimates of sequestered GHGs emissions, reported in tons of CO_2e.	Browser-based tool	The tool has a focus on forestry and is based on IPCC and FAO methodologies. It also requires only few data inputs. The tool is thus applicable to Finnfund purposes and is recommended to be used.
6	Tool for Sustainability Impact Assessment (ToSIA)	EFORWOOD project financed by the sixth Framework Program of the European Commission	ToSIA is a decision support tool for the forestry sector. With this tool, forest-based industry, national and international policymakers, and researchers can analyse the sustainability effects of changes due to deliberate actions (e.g., in policies or business activities) or due to external forces (e.g., climate change, global markets).	EFORWOOD software tool	The tool has no focus on carbon sequestration from forestry but rather focuses on sustainable forest management and is not applicable to Finnfund purposes.
7	CUFR Tree Carbon Calculator (CTCC)	USDA	The CTCC provides quantitative data on carbon sequestration and building heating/cooling energy effects provided by individual trees. CTCC outputs can be used to estimate GHG benefits for existing trees or to forecast future benefits. The CTCC is programmed in an Excel spreadsheet and provides carbon-related information for trees located in one of 16 U.S. climate zones.	Standalone Excel tool	The tool has a focus on forestry but is limited to the U.S. In addition, the tool is outdated. Thus, it is not applicable to Finnfund purposes.
8	Tool for the Demonstration and Assessment of Additionality in VCS AFOLU Project Activities, v3.0	VCS	The tool provides a step-wise approach to demonstrate and assess additionality for AFOLU project activities.	Standalone Excel tool	The tool is too sophisticated and detailed for Finnfund as it requires many input data, which Finnfund does not have (e.g., MAI, DBH, root-to-shoot ratio etc.). Thus, it is not applicable to Finnfund purposes.