

Project Frame
Methodology
*Evaluating Greenhouse Gas
Impact for Early-Stage Investments*

Contents

1 Acknowledgements

2 Foreword

5 Section 1: Introduction and Scope

6 Scope of Analysis

6 *Purpose*

8 *Classification System for Climate Solutions*

10 Section 2: Frame GHG Impact Methodology Roadmap

12 Methodology Chapters, At a Glance

13 Section 3: The Methodology

14 Market Sizing and Segmentation

15 *Market Sizing*

15 *Market Segmentation*

17 Net Unit Impact

18 *Phase 1: Solution Effects Analysis*

21 *Phase 2: Net Unit Impact Quantification*

24 Volumes

25 *Top-Down: From TAM to SAM to SOM*

25 *Bottom-Up: From Business Plans*

25 *Bottom-Up: From Historical Volumes*

26 GHG Impact

26 *Potential Impact*

27 *Planned Impact*

27 *Realized Impact*

28 *Selecting and Integrating Approaches*

29 New Considerations

29 *Optional Adjustment Factors*

35 *Rebound Effects*

36 *Action and Reaction Across Systems*

37 Section 4: Additionality

39 Section 5: Impact Reporting

40 Pre-Investment Reporting

41 Post-Investment Reporting

42 Section 6: Final Reflections

44 What's Next

Project Frame is not a regulatory body, nor should its content be considered financial advice. Methodology guidance produced by Project Frame represents our contributors' consensus and no one singular entity. Our work is intended for readers to review and use their best judgment to accelerate GHG mitigation with transparency and accountability.

Acknowledgements

Project Frame would like to thank the following individuals and organizations for their expert contributions to this iteration of our shared methodology.

Key Contributors and 2023-24 Content Working Group Members

- ▶ Roberta Benedetti, *Deep Transitions*
- ▶ Keri Browder, *Prime Coalition**
- ▶ Sophie Bruusgaard Jewett, *MoreScope*
- ▶ Yi Jean Chow, *Clean Energy Ventures*
- ▶ Chloe Coates, *Zero Carbon Capital*
- ▶ Joanna Cohen, *Builders Vision*
- ▶ Jean-Baptiste Curien, *Nysnø Climate Investments*
- ▶ Rick Cutright, *Climate Investments**
- ▶ Anjali Deshmukh, *Prime Coalition**
- ▶ Laura Di Bonaventura, *MUUS*
- ▶ Emre Gencer, *Sesame*
- ▶ Aurora Ginzburg, *Rho Impact*
- ▶ Anna Goldstein, *Prime Coalition*
- ▶ James Hicks, *Bridges Fund Management*
- ▶ Peter Hirsch, *2150*
- ▶ Leslie Kapin, *Astanor Ventures*
- ▶ Claudia Leon, *Prime Coalition*
- ▶ Irina Markina, *Ara Partners*
- ▶ Emily Mellor, *Set Ventures*
- ▶ Natalie Milde, *Future Energy Ventures*
- ▶ Dan Miller, *The Roda Group*
- ▶ Carol Moreno, *Ceres*
- ▶ Kavita Patel, *MUUS*
- ▶ Adam Ross, *Morgan Stanley*
- ▶ Miriam Roure, *Kara*
- ▶ Liza Rubinstein Malamud, *Carbon Equity*
- ▶ Richard Searle, *Just Climate*
- ▶ Morgan Sheil, *World Fund*
- ▶ Seth Sheldon, *Rho Impact*
- ▶ Michael Solomentsev, *Prime Coalition*
- ▶ Tobias Thorleifson, *ClimatePoint*
- ▶ Daniel Valenzuela, *World Fund*

**Lead Author*

External Reviewers

- ▶ World Business Council for Sustainable Development
- ▶ Venture Climate Alliance
- ▶ AEFDi

Project Frame Steering Committee

- ▶ Autodesk Foundation
- ▶ BCG
- ▶ Bridges Fund Management
- ▶ Carbon Direct
- ▶ Clean Energy Ventures
- ▶ Climate Investment
- ▶ Emerald Technology Ventures
- ▶ Energy Impact Partners
- ▶ Green Artha
- ▶ Nysnø Climate Investments
- ▶ Prelude Ventures
- ▶ Prime Coalition
- ▶ The Roda Group
- ▶ World Fund

Prime Coalition Team

- ▶ Sarah Kearney
- ▶ Kelsey Litwin
- ▶ Sultan Zelei
- ▶ Jenny Zhang
- ▶ Riya Choudhury
- ▶ Suryadipta Das
- ▶ Hunter Dudley

Focus Group

2150, Alberta Ecotrust Foundation, Anglet LLC, Astanor, Autodesk Foundation, Azolla Ventures, Boston Consulting Group, Blackhorn Ventures, Blue Earth Capital, Bridges Fund Management, Carbon Equity, Clean Energy Ventures, Climate Dividends Association, Climate Investment, Climate Technology Group LLC, Emerald Technology Ventures, Galvanize Climate Solutions, GLIN Impact Capital, Green Angel Ventures, Green Artha, Impact Frontiers, Just Climate, MoreScope, Nysnø Climate Investments, Prime Coalition, Rho Impact, SK CSES (Center for Social value Enhancement Studies), Starshot Capital, The Roda Group, Vidia Equity, Zero Carbon Capital

Additional thanks to Genaesis Creative for graphic design.

Foreword

Global investment in climate finance has been on the decline since its peak in 2022 despite the increasing threat that climate instability poses to our lives, communities, and businesses.

Energy majors are shifting away from cleantech, a trend likely to be further exacerbated by shifting political landscapes.^{1, 2}

Over my years supporting Project Frame, it has become evident that while many participants join out of a drive to secure a livable climate, the majority see greenhouse gas (GHG) impact analysis as key to their portfolio success. In our most recent survey, over 90 percent of respondents reported seeking above-market rate returns and indicated that aside from climate concerns, their primary motivator was firm competitiveness. It has also been my experience that limited partners and growth equity are becoming increasingly aware of the need for GHG impact analysis to mitigate further risk and exposure to their existing assets. Even with these trends, investment isn't transitioning fast enough to

reach emissions reduction targets in time to avert significant harm within our lifetime. As climate disasters become more frequent and intense, forward-looking emissions assessment will be essential to remain relevant amidst evolving market demands in our new climate reality.

In response, Project Frame has grown to over 900 participants within three years, representing more than 360 firms with \$670.1 billion in venture capital and private equity assets under management. The 2023 methodology has been viewed more than 7,500 times, including over 1,200 downloads. Powered by Prime Coalition's philanthropic support and volunteer participation, the rapid increase in enthusiasm highlights investors' demand for actionable approaches to assessing GHG impact.

"I am overwhelmed with gratitude for the community of investors and thought leaders dedicated to accountable and transparent climate investing that Project Frame has fostered. The need for impactful, transformative climate solutions is more pressing than ever and I believe deeply that Project Frame's guidance will help many make the most impactful investment decisions they're able to make."

SARAH KEARNEY
Executive Director
Prime Coalition

1 <https://www.ctvc.co/32bn-and-30-drop-as-market-hits-pause-in-2023/?ref=ctvc-by-sightline-climate-newsletter>

2 <https://www.ctvc.co/fuel-disclosure-from-energy-majors-earnings-221/?ref=ctvc-by-sightline-climate-newsletter>

This is further exemplified by Project Frame’s recognition from Ceres, Global Financial Alliance for Net Zero, Global Impact Investing Network, World Business Council for Sustainable Development, and most recently, the Government of Japan. Looking forward, we are encouraged to see Project Frame’s learnings embedded into emissions impact assessment tools like Climate Point, CRANE, Koi, and MoreScope, while we continue to iterate improvements within our newest working groups composed of more than 50 investors across 4 continents.

This latest iteration of the Project Frame methodology—along with a new library of accompanying case studies and supplemental materials— demonstrates that GHG impact forecasting and reporting is both an art and a science. Those who practice it are vanguards, competing to find and support necessary solutions for a carbon-constrained future. That is why we have designed the methodology to be practical, built and implemented by investors alongside climate experts who understand the importance of transparency and accountability for industry credibility.

We extend our deepest gratitude to our philanthropic supporters, steering committee, working groups, community members, and team Prime for their unwavering dedication to our mission and the development of this publication. Now more than ever, it is vital for philanthropy and the private sector to commit to driving the transformation needed for our businesses, communities, and planet to thrive.

Keri Browder
Director of Project Frame & Impact Accountability
Prime Coalition

“Mitigating climate change is non-negotiable; it is therefore critical that we leverage the most robust, material, scientific and precise measurement practices to meaningfully measure and articulate the impact of our/our portfolio’s work. We deeply respect Project Frame’s considered approach in this regard and are privileged to be supporting it and its members on this important mission.”

MAYA CHANDRASEKARAN
Co-Founder & Managing Partner
Green Artha

“For climate investment, GHG impact quantification is absolutely key for our opportunity screening. This Frame methodology update provides further standards to help us refine and improve our approach.”

MATTHEW HARWOOD
Chief Strategy Officer
Climate Investments

About Project Frame

Project Frame (Frame) is a nonprofit program, convened by Prime Coalition, built to organize investors around forward-looking emissions impact methodology and reporting best practices. Our mission is to mitigate climate change by demystifying climate investing and improving Impact Measurement & Management (IMM) to drive capital towards the best possible climate solutions while galvanizing a network around transparency, accountability, and collaboration.

Our goals include:

- 1 Helping investors efficiently identify investments with the highest potential to achieve GHG mitigation.
- 2 Demystifying the process to encourage consistent procedures for including forward-looking GHG impact assessment in investment decision-making, centering transparency in order to discourage bad actors and greenwashing.
- 3 Facilitating collaboration to develop common terminology and best practices to encourage a shared understanding that aligns efforts across different stakeholders, fostering a more coordinated approach to addressing climate change.

About Prime Coalition

Prime Coalition is a non-profit organization on a mission to unlock catalytic capital and change the future of climate finance.

Since 2015, Prime has mobilized over \$317MM in catalytic capital with 430 partners to back 39 early-stage ventures. Through its steering capital strategy, including Prime Impact Fund, Azolla Ventures, and Trellis Climate, Prime builds and implements impact-first investing teams toward acute gaps in climate finance that commercial capital cannot fill.

With its influencing capital strategy, Prime offers a range of field-building resources, including Project Frame, the [open-source CRANE tool](#), and the [Catalytic Capital Intermediation Resources Library](#).

“Investing wisely to accelerate the energy transition is more important than ever. The Project Frame methodology guides investors in evaluating the climate impact of climate solutions companies, which makes the impact investing process more efficient and effective.”

DAN MILLER
Managing Director
The Roda Group

“This report makes a significant contribution towards improving impact assessment throughout our sector and is another example of Project Frame’s contribution towards better impact practices.”

ADAM JAMES
Partner, Head of Customer Experience & Impact
Energy Impact Partners



SECTION 1

Introduction and Scope

At its simplest, greenhouse gas (GHG) impact is **net unit impact** multiplied by **volumes of the solution**. The analyst identifies the difference in emissions between a solution and its incumbent at the most granular replicable unit (net unit impact); then, they multiply this difference in emissions by a total number of units of the solution in a market (volumes).

Project Frame was established by a group of investors who recognized the need for a new system of assessment around this core calculation, which is designed to evaluate the GHG impact of proposed climate solutions as they scale to replace a status quo technology contributing to climate change. They also recognized that early-stage solutions, which lack extensive operational data, faced particularly difficult assessment challenges.

The core of our work is the development of a standardized, robust, and transparent methodology to assess the GHG impact of emerging climate solutions. By standardizing the way GHG impacts are assessed, Project Frame also facilitates greater transparency and comparability across investments.

In this section, we establish two essential structures driving the Project Frame methodology: standards for the **scope of analysis** and a **classification system for climate solutions** that ground most calculations.

SCOPE OF ANALYSIS

PURPOSE

Project Frame’s methodology is designed to help investors assess the GHG impact of climate solutions. It is meant to align investors with solutions from pre-seed stage into growth equity that are on a path to sustainable, scalable impact. It also seeks to establish common language to help investors, entrepreneurs, and NGOs communicate transparently about the GHG impact of their solutions.

The current version of the methodology is written for investors who have moved beyond early learning in GHG impact assessment, building upon Frame’s original [2023 methodology](#), [“Pre-Investment Considerations: Diving Deeper Into Assessing Future Greenhouse Gas Impact.”](#)

What Is and Is Not Analyzed	
Greenhouse Gases (GHGs)	The Frame methodology focuses on GHG metrics alone and does not currently provide recommendations on other environmental or social metrics. However, it can accommodate other dimensions guided by the investor.
Comparing a Solution to its Incumbent(s)	The methodology is designed to compare GHGs of a solution and the appropriate incumbent or status quo. For example, the solution unit is the smallest replicable instance of a solution sold, such as a heat pump, while the incumbent unit is the equivalent product it would displace. This is the basis of our definition of “impact” and distinct from GHG footprinting, which typically assesses absolute amounts of past GHGs emitted by a product, solution, or company. The GHG impact formula can also meet the needs of investors assessing climate solutions that do not have an incumbent, such as in carbon removal. For more, read “Classification System for Climate Solutions.”
Scalability	The methodology is meant to help investors decide whether to invest in a proposed climate solution that achieves GHG impact by scaling, and thus taking market share away from the incumbent. However, scalable technologies can also cause rebound effects that have no or negative impact. We discuss this in “Rebound Effects.”
Assessing the Past & Future	The current Frame methodology covers both forward and backward looking GHG impact assessment. As solutions evolve, methodologies must evolve. Frame’s methodology is meant to help investors achieve the most accurate analysis possible based on the available data for the solution stage and use historical data when it is available to inform investment decision-making and reporting.

Critical Workflows

Assessing for Materiality

An analyst may encounter a material source of difference at any life cycle stage. Frame emphasizes that a cradle-to-grave system boundary is essential in qualitative analysis.

But investors in early-stage solutions must parse through dozens, if not hundreds, of solutions to deploy capital in a short period of time. How can they efficiently review all stages of the life cycle, knowing that it is unrealistic to quantify every single potential source of difference between a solution and incumbent and that some sources of difference massively outweigh others?

What sources of unit emissions are material, or “worth quantifying?”

This question forms the basis of a step in net unit impact analysis, meant to help analysts think through which sources of unit emissions are material before spending time quantifying sources that are unlikely to prevent the solution from clearing a firm’s GHG impact targets. Depending on investor feedback, we may apply the concept of materiality to other steps in the assessment process. This use of materiality is different from others often heard in the investing context, such as whether environmental or social factors are material to a company’s financial performance.

Downselection

There are plenty of proposed climate solutions. Among them, fewer have a significant unit impact and far fewer of those have the realistic potential to scale. Even within that smallest pool, there are not enough investment dollars available to support all. How do investors efficiently filter—or downselect—solutions to drive capital towards solutions that have the highest probability of clearing both impact and business targets?

The Frame methodology starts with market segmentation and overall business analysis to ground impact analysis in business realities, meshing with traditional downselection processes.

CLASSIFICATION SYSTEM FOR CLIMATE SOLUTIONS

Frame describes a climate solution as an intervention, product, or service that intends to and shows evidence it can achieve GHG impact. Project Frame defines impact as a real-world change caused or enabled by an organization (based on the goods or services produced). Impact can be positive or negative; intended or unintended; direct or indirect; or incremental or systemic.

GHG impact is a change in GHG emissions caused by an organization. Frame defaults to GHG impact implying a “positive” outcome unless otherwise stated. In addition, since Frame’s focus is early-stage, an organization may represent a single solution. Frame currently classifies climate solutions by impact and pathway types.

Impact Types: How the Solution Broadly Achieves GHG Impact

Avoiding Emissions	Avoids future emission by replacing or taking market share over time from an incumbent responsible for higher emissions. Most climate solutions today fit within this category.
Removing Emissions	Removes carbon from the atmosphere. In this case, there might not be an incumbent to compare the solution to, but that doesn’t automatically imply that its impact will be positive. All new sources of emissions must be considered, as well as potential ways in which such technologies could trigger consequences elsewhere in the system. See “ Action and Reaction Across Systems ” for more.

Pathway Types: How a Solution Functions Within a System of Integrated Solutions

Direct	<p>In direct solutions, the positive GHG impact would not occur without them.</p> <ul style="list-style-type: none"> ▶ Product: Complete solutions that can be purchased and used to directly achieve GHG impact. Examples include an electric vehicle (EV), heat pump, or sustainably produced food. ▶ Component: Critical parts of an overall solution that contribute significantly to its GHG impact. The overall impact depends on how the product containing the component is used. Examples include an EV battery, more efficient motor, or recycled materials
Facilitating	<p>Facilitating solutions enable or improve the effectiveness of direct solutions. They do not directly achieve GHG impact on their own, but enhance direct solutions. Facilitating solutions may:</p> <ul style="list-style-type: none"> ▶ Affect the unit impact of a direct solution, such as software that significantly improves the efficiency of renewable energy technologies or reduces waste or energy use in manufacturing processes. ▶ Affect volumes of a direct solution, such as a green marketplace that accelerates the deployment of electric vehicles by connecting consumers with suppliers or financing.

Why Does Classification Matter?

To achieve GHG impact, no solution works entirely on its own. Even direct product solutions—the solution pathway upon which the Frame methodology is built—achieve GHG impact through components and an ecosystem of suppliers, marketplaces, policies, and more. Frame’s classification system is meant to help investors systematically structure quantification for every combination of solution impact and pathway type, typically by focusing first on the most proximate source of impact: the direct product. From there, investors modulate unit impact, volumes, or adjustment factors according to the solution they may be considering for investment.

ADDITIONAL RESOURCES

[Scope of Analysis Worksheet](#)

A scope of analysis clearly defines what is and is not the focus of analysis. This worksheet helps investors clarify their own scopes as they communicate with investors and LPs regarding their methodologies.

[Investor Profiles](#)

Through Investor Profiles, investors share their impact assessment approaches in a consistent way. While investors conform to Frame’s definition for GHG impact, we welcome them to share approaches to other forms of assessment that are not within Frame’s current scope of analysis, such as on other environmental, social, and governance topics.

[Case Studies](#)

Frame’s growing library of emissions impact assessment case studies showcase our methodology in action.

[Assessing Environmental Impact: A Framework Comparison](#)

Wondering how GHG impact is different from GHG footprinting? This article gives a comparison at a glance.



SECTION 2

Frame GHG Impact Methodology Roadmap

The Frame GHG Impact Methodology is built around three types of analyses: **potential impact**, **planned impact**, and **realized impact**. Each serves a distinct purpose and requires a different amount of information. Together, they form a comprehensive framework to help investors and companies better understand the long-term implications of their decisions.

Potential GHG Impact

Potential GHG impact estimates the impact a proposed climate solution could have based on a standardized growth trajectory that assumes the proposed solution takes over the Serviceable Obtainable Market (SOM).

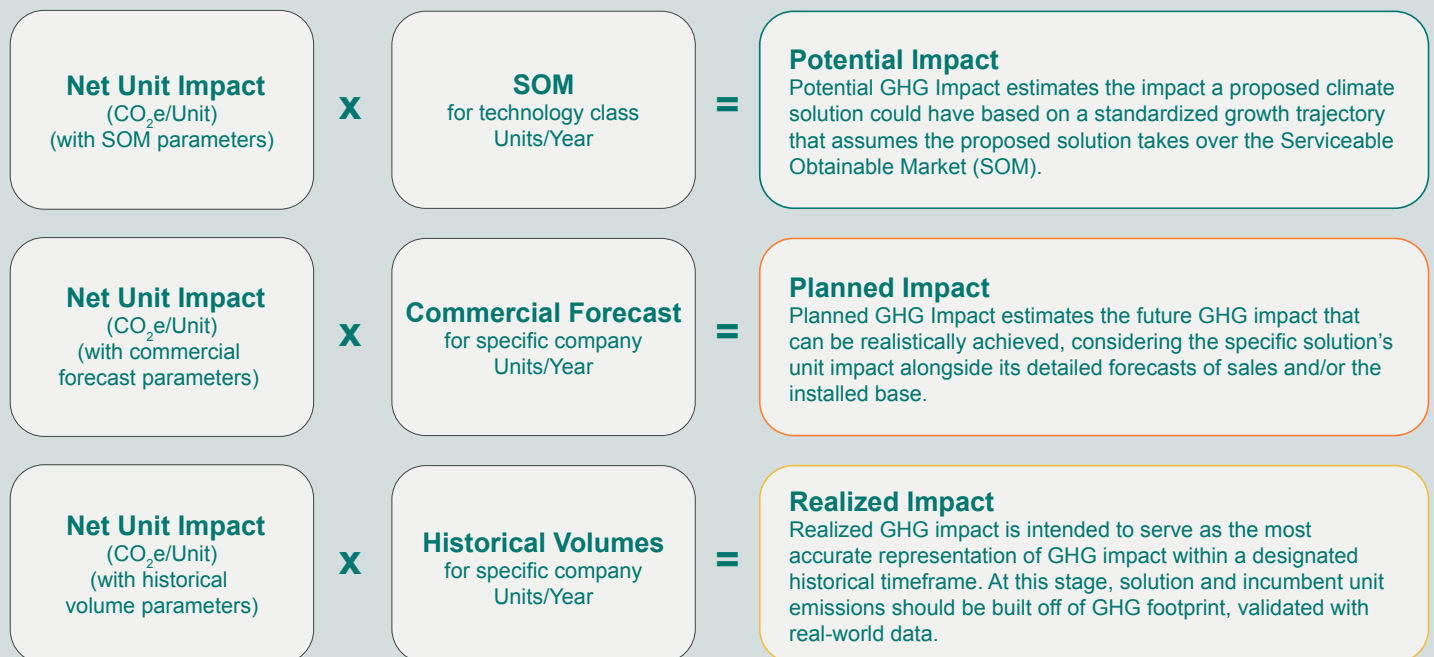
This analysis is valuable for early-stage solutions that could alter emissions patterns and is most applicable when looking at early-stage solutions with limited information. Potential impact analyses are longer-term and often align with global scenarios by [the International Energy Agency \(IEA\)](#). Potential impact analyses carry a wide band of uncertainty.

Planned GHG Impact

Planned GHG impact estimates the future GHG impact that can be realistically achieved, considering the specific solution’s unit impact alongside its detailed forecasts of sales and/or the installed base. It is more applicable to companies with realistic business plans that reflect the solution’s specific market segments and incorporate fleet effects for solutions with long operational lifespans. Planned impact analyses typically align with timeframes established by business plans.

Realized GHG Impact

Realized GHG impact is intended to serve as the most accurate representation of GHG impact within a designated historical timeframe. At this stage, solution and incumbent unit emissions should be built off of GHG footprint, validated with real-world data. It is calculated by multiplying the most up-to-date measure of unit impact by historical volumes, such as sales and/or the installed base, assuming sales have occurred. This analysis provides a critical feedback loop by comparing actual data with planned forecasts, enabling both the company and investment analyst to refine their strategies and improve future projections.



METHODOLOGY

CHAPTERS,

AT A GLANCE

Market Segmentation

Volumes and unit impact are not isolated variables. For example, where the solution is sold or how it is used affects its unit emissions. In this chapter, we discuss how investors integrate GHG analysis into due diligence, including market sizing and segmentation. This helps to drive better investment decisions. This also reflects the downselection process, which typically begins with assessing scalability and market context.

Net Unit Impact

Net unit impact, or “unit impact,” measures the difference in emissions between a solution and an incumbent across their life cycles and in alignment with the market segments. These differences, called Solution Effects, are summed to a net unit impact value. Assumptions in net unit impact calculations change over time. We encourage analysts to think qualitatively through the materiality of Solution Effects before quantifying them.

Volumes

In this chapter, we go deeper into volumes, which represent an annual number of solution units over a specified time frame, such as number of sales or units in operation. Sizes of markets and market segments can be quantified from top down or bottom up.

GHG Impact

In this chapter, we provide further detail on the three approaches to assessment—potential, planned, and realized impact—and explain how volumes combine with net unit impact to visually represent the anticipated GHG impact of a solution over time.

New Considerations

The GHG impact equation covers all variables that directly affect solution unit emissions, incumbent unit emissions, and solution volumes. But investors have raised the following additional considerations for further incorporation and future guidance:

- ▶ **Optional Adjustment Factors:** Adjustment factors are variables of GHG impact that are separate from and shouldn't be blended into any underlying variables associated with the unit impact or volumes of the direct product solution being analyzed. They are considered optional at this time. In each section below, we also discuss challenges with the current assessment methods.
 - ▶ *Value Chain Attribution:* With this adjustment, investors attribute portions of GHG impact to multiple direct component solutions along the value chain.
 - ▶ *Capitalization Attribution:* With this adjustment, investors apportion GHG impact among owners of the solution they have invested in.
- ▶ **Rebound Effects:** Rebound effect refers to the ways in which technology that increases efficiency through the use of a resource, such as energy, can cause the resource to be used more. In theory, this can lessen or cancel out the positive environmental benefits of efficiency.
- ▶ **Action & Reaction Across Systems:** In this category, we consider how and/or why investors may need to take into account the impact of their solution on another part of the system, such as a different solution or service.



SECTION 3

The Methodology

Market Sizing and Segmentation

Business forecasts are typically based on financial metrics like revenue, expense, and assets. To project revenue, analysts multiply unit price by the volume of the unit—typically sales—associated with different market sizes and segments that they think they will reach. This helps clarify business potential and strategies.

Frame’s methodology seamlessly integrates into traditional business planning and is built on the assumption that every stage and type of business planning can and should integrate GHG impact assessment in lockstep. It does so by enhancing business planning with two additional layers of data.

First, it considers volumes beyond sales, such as units in operation, depending on the nature of emissions across the solution’s life cycle. This further tracks how the solution operates across its lifespan and how emissions are not exclusively tied to the moment of sale.

Secondly, it integrates net unit impact and associated projections. Thus, the solution and incumbent unit(s) selected for unit impact analysis should be the same in detail and type as those used in company and investor decision making, including how you target market segments. Although there will be fewer market details at earlier stages, Frame advocates that investors always use the most realistic market context for unit impact and volumes based on reasonable interpretations of the information available.

Impact assessment integrates skills in both unit impact assessment, such as life cycle analysis, and business and investment analysis. While the skills required for market sizing and segmentation analysis may not be held by the same person that analyzes unit impact, investment firms should continually build common skills across all team members in order to ensure that everyone comes with a critical eye on what achieves impact, especially as impact management comes to the forefront among portfolio companies.

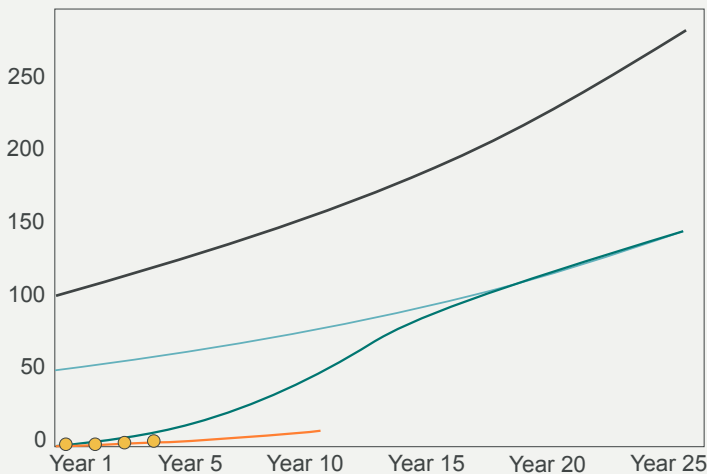
MARKET SIZING

At the broadest level, investors start by clarifying the size of the overall market from the top down. From Total Addressable Market (TAM), the analyst seeks to narrow to the Serviceable Addressable Market (SAM), the portion of TAM that can realistically be served by a company’s products and services.

They then define the Serviceable Obtainable Market (SOM): the portion of the Serviceable Addressable Market (SAM) you can capture after taking into account market entry points and the speed of adoption.

The more time it takes for a solution to reach scale or begin

scaling, the smaller the cumulative GHG impact is, in theory. SOM factors in this volume curve—usually an S-shape—as a function of competition, regulation, resources, market theory, and more. SOM should eventually overlap with SAM.



- Total Addressable Market (TAM)**
Size of entire market for type of solution offered
- Serviceable Addressable Market (SAM)**
Portion of TAM that can realistically be served by a company's products and services
- Serviceable Obtainable Market (SOM)**
Portion of SAM that is likely to be captured based on a modulated S-curve adoption rate
- Projected Commercial Volumes or Units in Operation**
Portion of SOM based on realistic company business plan or installed base/fleet
- Historical Volumes or Units in Operation**
Historical company sales or installed base/fleet

MARKET SEGMENTATION

Within any broad market, there are many market segments. These non-mutually exclusive categories offer ways to slice and dice data to reveal patterns in unit volumes and unit impact. Some broad market segments can be seen from top-down, while others require granular or bottom-up analysis tied to a company’s strategic decisions.

Unit Impact (U.S.)	X	Volume (U.S.)	=	GHG Impact (U.S.)
Unit Impact (Sweden)	X	Volume (Sweden)	=	GHG Impact (Sweden)
Unit Impact (China)	X	Volume (China)	=	GHG Impact (China)
				Total GHG Impact

Both unit impact and volumes vary by market segment, and a company’s market focuses and associated impacts in those areas can significantly affect overall GHG impact. Different segments thus require separate and corresponding unit impacts and volumes. In other words, for any market segment you consider, you

should also quantify GHG impact and treat unit impact with the same level of detail that you treat volumes by market segment.

Following, we share examples of factors that influence unit impact during market segmentation. Accordingly, they can lead to unique and/or multiple GHG impact values.

Geography

Assessments may differ by region, due to varying local market dynamics, regulatory environments, natural conditions, and customer preferences.

Examples of key considerations include:

- ▶ **Grid intensity:** The feasibility and impact of solutions can vary significantly depending on grid intensity. For example, an electric vehicle may have a higher impact in a region with a cleaner grid compared to one with a coal-dominated energy mix.
- ▶ **Resource availability:** Resources vary by region, such as the presence of materials that affect the way in which you make the solution and how energy can be produced. For example, solar solutions are more effective in sunnier regions, while wind solutions might be better suited for windy areas.
- ▶ **Temperature dynamics:** The GHG impact of products like furnaces and air conditioners will differ based on climate. Cold climates demand more heating, while warm climates require more cooling, affecting overall emissions.

Different Incumbents

Different markets may have different incumbents. For example, a heat pump may replace both natural gas furnaces and electric baseboard heaters. Similarly, an electric vehicle (EV) might replace both gasoline-powered cars and hybrid vehicles, each with distinct emissions profiles.

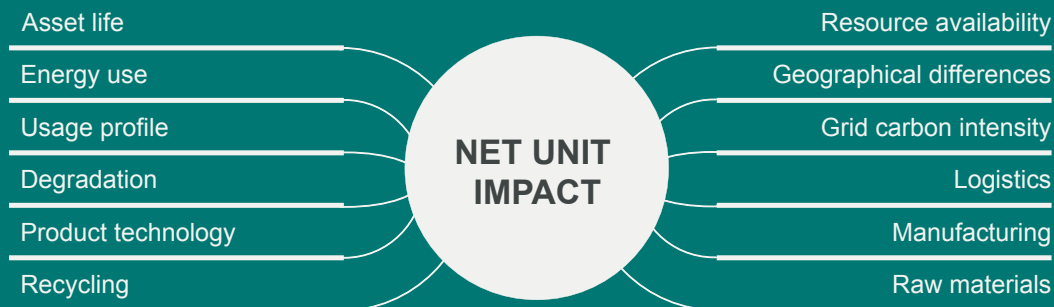
Usage Profiles

Many climate solutions have distinct usage profiles, or ways of being used, depending on duration, intensity, or frequency of use. For example, an electric truck might be used both as a personal vehicle and within commercial fleets. Personal use might involve shorter, less frequent trips, while commercial fleet use could mean longer, more frequent journeys with higher loads.

Product Variations

Products can vary by size, how they are packaged to be sold—such as standard and deluxe product—and other important configurations. For instance, a standard model might appeal to cost-conscious consumers, while a deluxe version might target premium segments with higher performance expectations.

Net Unit Impact



Net Unit Impact At a Glance

Formula

$$\sum_{1}^n (C_i - S_i) = \text{Net Unit Impact}$$

This formula describes the process of adding the differences in emissions of all Solution Effects. The summation (Σ) of unit emissions is calculated by adding up the difference in emissions between the solution (S) and incumbent (C) for each Solution Effect in a series (from 1 to n). The reader should understand which, if any, Solution Effects were excluded from quantification and why.

Net unit impact, often called unit impact, describes the overall difference in GHG emissions when comparing a solution to its incumbent counterpart over a specified period of time, assuming the solution would eventually displace the incumbent. Impact analysis, as defined by Frame, focuses on the differences in emissions, rather than absolute values, excluding GHG sources that are "equal" between the two.

The ultimate goal of analysis is to quantify unit impact over time, described here as **net unit impact quantification**. But to get to that end goal, analysis can be phased to **first qualitatively filter out less material sources of difference**, thus narrowing the scope of quantification for investors reviewing dozens or hundreds of solutions.

What Are Solution Effects?

In the context of the Frame’s GHG impact methodology, Solution Effects refer to the various positive and negative factors that contribute to differences in GHGs when comparing units of a solution and incumbent. These effects may occur at any life cycle stage of the solution, such as from raw material extraction to end-of-life disposal or recycling.

Frame designed a phased process to ensure that analysis is efficient, transparent, and consistent and does not exclude important sources of difference as analysts balance time, resources, and access to data.

TARGET MARKETS & CONTEXT	SOLUTION EFFECTS ANALYSIS	NET UNIT IMPACT QUANTIFICATION
<p>Market information drives both unit impact and volumes. Visit Market Sizing and Segmentation for details.</p>	<p>Solution Effects analysis helps the analyst, qualitatively or with light quantification, filter out immaterial sources of difference when comparing the solution to the incumbent. Only material effects advance to quantification.</p>	<p>Analysts calculate the yearly impact from each effect over a specified timeframe. Net unit impact is represented as an array of annual values. Each value corresponds to a specific year of the analysis period.</p>

PHASE 1

SOLUTION EFFECTS ANALYSIS

In Solution Effects Analysis, analysts qualitatively evaluate emissions from both the incumbent and solution to isolate significant life cycle differences without fully quantifying every effect, as typically occurs in traditional Life Cycle Assessment (LCA). By focusing on significant differences early, analysts can streamline the process to serve decision-making.

A solution effect can emerge by market segments, such as by geography or incumbent differentiations, and according to different stages of the solution’s life cycle. Considering all dimensions demonstrates the potential complexities of analysis. Analysis is further complicated when factoring in changes over time.

Potential Sources of Difference, by Life Cycle Stage

- ▶ **Pre-Use Emissions**
GHG emissions associated with extraction, production, manufacturing, transport, installation, and solution construction, up until its use, can be a source of Solution Effects. Pre-use emissions are equivalent to “cradle-to-gate” or “upstream emissions.” Pre-use emissions can be further segmented to distinguish the “design phase,” including production and assembly, from extraction and other activities furthest upstream stream.
- ▶ **Operational Emissions**
Solution Effects are often associated with GHGs of a product or solution when it is in-use or operations. For example, products with longer lifespans may have lower annual emissions because their embodied emissions are spread over a more extended period. Energy use, product usage differences (discussed in [market segmentation](#)), and processes of degradation also affect operational emissions.
- ▶ **End of Life Emissions**
GHG emissions associated with a product or solution’s end-of-life, including the disposal, de-installation, or recycling of a product after use, can be a source of Solution Effects.

5 Steps of Analysis

Solution Effects analysis is structured into five steps intended to produce a narrowed down set of material effects that advance to quantification of net unit impact.



Step 1

List Solution Effects

- ▶ **Solution Effect (narrative):** Name or summarize each source of difference in emissions between the solution and incumbent, and explain why they are different.
- ▶ **Life Cycle Category (limited choice):** Identify the stage of the life cycle relevant to the effect (e.g., production, use, disposal).
- ▶ **Emissions Source (narrative):** Detail the specific source of emissions (e.g., fuel combustion for ICE vehicles, charging emissions for EVs).
- ▶ **Sector (limited or multiple choice):** Provide context by identifying the primary industry or sector involved (e.g., transportation, energy).
- ▶ **Geography (limited choice):** Define where the emissions occur and note differences between the incumbent and the new solution.
- ▶ **Emissions Type (limited choice):** Identify which GHGs are affected (e.g., CO₂, CH₄, NH₃) and note any other relevant environmental impacts. This is essential for clarifying whether and how to incorporate different global warming potential (GWP) values.
- ▶ **Frequency (limited choice):** Classify the emissions effect as one-time, intermittent, or recurring to understand the regularity and predictability of the emissions.

Step 2

Analyze the Associated Incumbent

Isolate and further evaluate emissions of the incumbent as it relates to the solution effect, including estimated amounts of emissions associated with the effect, trends, and rationales for the incumbent.

- ▶ **Estimated Emissions Amount (value):** Estimate the amount of GHGs associated with each effect. At this stage, calculation will be imprecise.
- ▶ **Trend (limited choice):** Evaluate whether emission associated with the effect could change over time. Consider structuring this as a set of limited choice options.
- ▶ **Trend-Rationale (narrative):** Explain why conditions might change, providing insights into the factors driving these changes.

Step 3

Analyze the Associated Solution

Isolate and evaluate emissions of the solution on its own, including estimated amounts of emissions associated with the effect, trends, and rationales for the solution.

- ▶ **Estimated Emissions Amount (quantitative):** Estimate the amount of GHGs produced by each effect. At this stage, it will be imprecise.
- ▶ **Trend (limited choice):** Evaluate whether conditions, such as worse emissions, could change over time due to the incumbent effect. Consider structuring this as a set of limited choice options.
- ▶ **Trend-Rationale (narrative):** Explain why conditions might change, providing insights into the factors driving these changes.

Step 4

Compare the Solution and Incumbent

Conduct a final comparison between the solution and incumbent over time for each solution effect.

- ▶ **Better or Worse Today? (narrative):** Assess whether the solution results in better or worse conditions when compared to the incumbent today.
- ▶ **Better or Worse in the Future? (narrative):** Evaluate whether the solution results in better or worse conditions compared to the incumbent in the future, considering trends.
- ▶ **GHG Impact (narrative):** Compare the emissions estimates of the solution and the incumbent.
- ▶ **Estimated GHG Impact (quantitative):** Quantify the estimated difference in emissions between the solution and incumbent if the information is available.

Step 5

Assess for Materiality

For each effect, determine if there is enough difference to carry it forward to detailed quantification.

- ▶ **Emissions Significance:** Advance towards assessing the materiality of each solution effect by rating the emissions impact on a scale or estimating its percentage of total estimated impact. Estimated emissions, while imprecise, should improve judgment in considering this question.
 - ▶ *Rating:* This enables investors to begin assessing solution effects relative to one another in broader strokes. For example, a rating scale may be from 0 to 5 (with 5 representing the highest impact, either positive or negative). Establish internally what rating values mean for significance.
 - ▶ *Percentage:* The analyst may be able to apply a percentage of total estimated impact instead to qualify materiality. For example, allocations of 0-1%; 1-4%; 4-7%; 7-10%; 10-20%; 20-30%; and so forth, may help analysts see where impact is clustering. If they consistently find that solution effects often cluster on the very low and very high end, then effects less than 10% may not be material. In contrast, if there are many effects in the 10% range, then they must be treated as material if their total may be significant.
- ▶ **Carry Forward? (limited choice):** Determine if there is enough difference to carry the effect forward into detailed analysis, considering both the current differences and potential future differences. (Eg, Yes, No, Unsure). If the analyst is not yet sure that the effect should be carried forward, they should cycle through analysis again. If they continue to remain unsure, the effect should move to thorough quantification.
- ▶ **Materiality Rationale (narrative):** Provide a brief description of why the effect is or is not carried forward, including what the significance of the differences identified are and how much it affects overall analysis.

PHASE 2

NET UNIT IMPACT QUANTIFICATION

In net unit impact quantification, analysts add up the unit impact of each solution effect today and over time.

Unit emissions associated with both the solution and incumbent will change overtime, and many factors affect them both. Solution effects may also show up in the future that don't exist today. While initial quantification is based on current parameters, such as the current year, projections require evaluating how emissions associated with the solution and incumbent will evolve over time and under different circumstances.

Quantification requires deep research and meticulously organizing calculations to achieve high data accuracy, avoid basic errors, and display data to serve analysis, such as by applying different [Global Warming Potential \(GWP\)](#) values. The final result is a projection of the net unit impact for each year in the period of analysis, often under different scenarios of the future. Analysts should always document the timeframe over which unit impact will be considered. This should conform with the timeframe over which you will project GHG impact overall.

What is a “baseline?”

Baseline broadly refers to the status quo world, including changes to the status quo over time. At Frame, consider these rules of thumb:

- ▶ **Baseline is often synonymous with incumbent unit emissions:** Where incumbents exist, baseline often refers to their unit emissions and how they change over future years. We avoid using the term baseline here when we can be precise.
 - ▶ *Dynamic baseline:* When the incumbent unit emissions changes over time.
 - ▶ *Static baseline:* When incumbent unit emissions are held constant over time. Unit emissions are never constant, but analysts sometimes choose to simplify certain parameters where change can't be reasonably projected.
- ▶ **Baseline scenario:** This term refers to a general narrative of what may happen to the incumbent or status quo, including incumbent unit emissions, incumbent volume considerations and adjustment factors. Because unit emissions and volumes affect each other, baseline scenarios are often generally discussed in volume analyses or as part of an overall GHG impact story.

4 Steps of Analysis

Quantification is structured into four steps intended to produce a net unit impact curve or array that illuminates how unit impact will change over time. This includes considering changes in both solution and incumbent unit emissions.

**COLLECT UNIT
EMISSIONS DATA
(TODAY)**

**QUANTIFY NET
UNIT IMPACT
(TODAY)**

**PROJECT NET UNIT
IMPACT CURVE
(OVER TIME)**

**RECALCULATE
PERIODICALLY**

Step 1

Collect Unit Emissions Data (Today)

Calculate emissions associated with the incumbent and solution in the first year for each solution effect. To do this, analysts collect relevant current data, such as emissions factors, associated with each effect. Emission factors are coefficients that quantify the emissions per unit of activities. These factors convert activity data into emissions, usually expressed as CO₂e. This provides a starting point for future quantification.

Step 2

Quantify Net Unit Impact (Today)

Quantify the unit impact for each solution effect. Then sum all unit impacts for all solution effects for the current year to calculate today's net unit impact.

Step 3

Project Net Unit Impact Curve (Over Time)

Repeat calculations for each future year, projecting emissions from the incumbent and solution over time. This includes modulating unit emissions according to market segment as appropriate. The result is a curve representing net unit impact for each year over the analysis timeframe.

Frame recommends analysts calculate net unit impact year-by-year, from year one to the final year of the timeframe over which assessment is occurring. It is possible to apply "top-down" approaches, such as by setting rates of change over time, where granular data is unreliable.

There are also many techniques to incorporate variability and unpredictability in projections, such as scenario analysis and sensitivity analysis. While Frame does not provide guidance on these topics, we believe the methodology lends itself well to integrating them.

Step 4

Recalculate Periodically

Unit impact is not static. As companies evolve, the granularity of information available to quantify unit impact increases. By recalculating, the model reflects how evolving factors influence the net unit impact. Eventually, unit impact should be based on actual and detailed data on solution unit emissions.

Common Sources of Change in Unit Impact Over Time

- ▶ **Grid Emissions:** As more renewables are brought online, the carbon intensity of the grid will decrease. This will reduce unit impact over time for solutions with effects that stem from reliance on electricity.
- ▶ **Technological Advancements:** Improvements in technology, such as increased efficiency of EV batteries or enhanced production methods, can affect the net unit impact over time.
- ▶ **New Solution Effects:** Future developments may introduce new Solution Effects not present today.
- ▶ **Policy and Regulatory Changes:** Anticipate potential future regulations that might impact emissions.
- ▶ **Market Dynamics:** For example, trends like ride-sharing could impact the use case and market growth for vehicles.

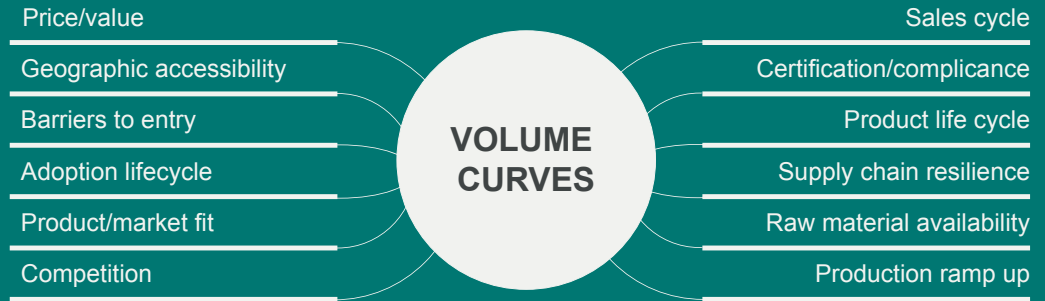
ADDITIONAL RESOURCES

Foundational Best Practices

What are emissions factors? What is global warming potential (GWP)?

What are common errors made as analysts move through the quantification process? Get a refresher on essential components of quantification that every analyst should know.

Volumes

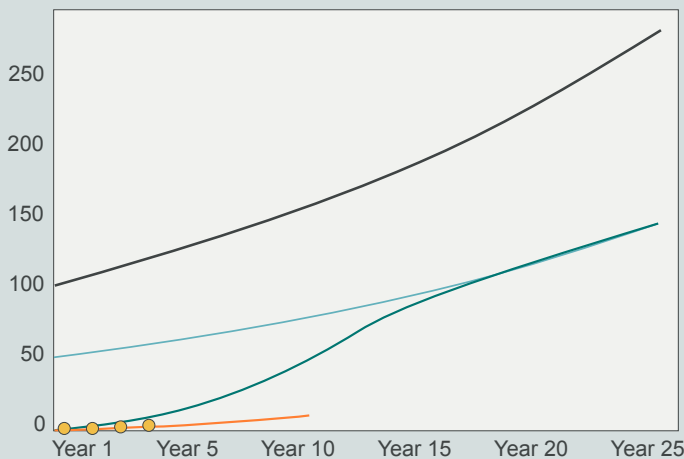


Volumes refer to the projected quantities of solution units over a defined period of time.

To quantify GHG impact, analysts multiply a solution’s unit impact by a specific volume of solution units.

In the Frame methodology, volumes should be represented as an array, with a volume for each year. Volume arrays may be represented as units annually

produced, sold, or in operation, such as the installed base or fleet of units. Analysts should choose the volume metric that best reveals emissions patterns. The amount of data shapes two basic approaches to quantifying market sizes: from top-down and bottom-up.



- Total Addressable Market (TAM)**
Size of entire market for type of solution offered
- Serviceable Addressable Market (SAM)**
Portion of TAM that can realistically be served by a company's products and services
- Serviceable Obtainable Market (SOM)**
Portion of SAM that is likely to be captured based on a modulated S-curve adoption rate
- Projected Commercial Volumes or Units in Operation**
Portion of SOM based on realistic company business plan or installed base/fleet
- Historical Volumes or Units in Operation**
Historical company sales or installed base/fleet

TOP DOWN
↓
↑
BOTTOM UP

TOP-DOWN: FROM TAM TO SAM TO SOM

In the absence of granular volume data, analysts quantify units based on high-level patterns associated with the sector or market that the solution represents. In the top-down approach, analysts move from understanding the Total Addressable Market (TAM), to the Serviceable Available Market (SAM), to the Serviceable Obtainable Market (SOM), which factors in the rate of adoption or volume curves. The volume curve, typically an “S,” is quantified based on how a solution could achieve scale over time.

BOTTOM-UP: FROM BUSINESS PLANS

An investor can look at a market from the bottom up to understand a company’s projected volumes, based on detailed company information and a realistic business plan. The bottom-up approach accounts for the company’s go-to-market strategy, product development, and supply chain realities.

BOTTOM-UP: FROM HISTORICAL VOLUMES

An investor can look at actual volumes from bottom up, based on detailed company reports of results. Volumes are reported in extensive detail, such as by market segments.

Facilitating Solutions

Direct solutions, like electric vehicles and batteries, are essential for GHG impact. Facilitating solutions, however, are responsible for *improving* unit impact or volumes of direct solutions. For example, a software may significantly improve the efficiency of renewable energy technologies or an online EV marketplace can accelerate the deployment of electric vehicles.

When an analyst is considering a facilitating solution for investment, how should it isolate the impact attributed to it? While Frame does not currently offer formal guidance, the example below characterizes how the analyst modulates volumes for the direct product solution, where the focus of final analysis for investment is the facilitating solution. A similar process can take place on the unit impact side.

1. Quantify the GHG impact of the representative direct product upon which the facilitating solution operates. For example, if the EV marketplace is meant to accelerate adoption of electric vehicles, the analysts may establish the unit impact of the electric vehicle.
2. Quantify volumes for the direct solution as it would have otherwise occurred in the absence of the marketplace. Quantify the direct solution’s GHG impact.
3. Using realistic market data based on the stage of the facilitating solution, quantify how volumes for the direct solution would accelerate if the facilitating solution successfully scaled. Quantify GHG impact in the presence of the facilitating solution.
4. The facilitating solution’s own GHG impact is the difference between the direct solution’s GHG impact and GHG impact in the presence of the facilitating solution.

Challenges

Integrating the ecosystem-level thinking into GHG impact introduces questions about what analysts believe is essential for solutions to achieve GHG impact. For example, many direct solutions rely on marketplaces to sell their products. However, values can mislead readers on how collective or systemic impact works. Frame recommends documenting the investors assumptions about the systemic impact of their solution and revisit those assumptions on an ongoing basis.

GHG IMPACT

Impact assessment techniques in investing often hinge on a simple challenge; the amount of reliable data you have affects the types and quality of assessment.

The earlier a solution is or further into the future you look, the less reliable the data is on both unit impact and volumes. We classify assessment types in order to ensure that readers understand differences in reliability and why they exist. This is essential to avoid greenwashing.

In this chapter, we discuss three approaches to impact assessment classified in Frame, mapped broadly to the information that is available at the different stages of a solution's development and how far into the future the analyst is projecting.

Overall, the expectations of impact assessment should gradually increase as a company develops, eventually leading to detailed life cycle assessments (LCAs) that quantify GHGs, among other environmental factors, on an absolute basis across all company operations. Such assessments go well beyond Frame's methodology, which focuses on GHG impact of narrowly defined solutions. LCA and ESG reporting already cover these topics more fully, and investor should move portfolio companies towards them with intention as they evolve. The same applies to investors themselves as their own firms grow.

As we referenced in [Chapter 2](#), progression in impact assessment is best managed by always lining it up with the company's business reporting and planning, starting from day one. This includes presenting impact metrics alongside market segments, volumes, and

units selected for assessment. GHG reporting can thus steadily graduate in lockstep with overall company data over time.

POTENTIAL IMPACT

In potential GHG impact, volumes are represented as SOM. To calculate potential GHG impact, the net unit impact array quantified for the solution at its stage of development is multiplied by the SOM volume array for each year of the analysis period. Potential impact can then be rolled up to a total number over the measured time horizon by adding the annual impact values. It also takes into account the operational lifespan of solutions. Potential impact focuses on the long-term transformative potential of technology or solution class in the absence of comprehensive information about the company. For impact-focused investors where the primary goal is to address climate change rather than achieve profits, copycat solutions are also a form of success.

Just as net unit impact is more theoretical in potential impact, so is SOM. It carries a wide band of uncertainty and is most relevant when seeking to understand how early-stage solutions could significantly alter emissions patterns if they succeed in scaling in the next 15 to 30 years. Nonetheless, investors in early-stage solutions should have some market segmentation information available to blend unit impacts as appropriate.

PLANNED IMPACT

To calculate planned impact, the latest net unit impact array for the solution is multiplied by appropriate project volumes, such as the sales or installed base, for each year of the analysis period. Volumes are represented by realistic annual sales projections or number of units in operation, while net unit impact values are based on the more granular data available at the solution stage. Planned impact can then be rolled up to a total number over the measured time horizon by adding the annual impact values.

Planned impact should be based directly on a realistic estimate of net unit impact alongside company business plans—which typically project no more than 5 to 7 years—demonstrating what the company can realistically achieve with its actual resources, capabilities, and focus.

Planned impact is only applicable to solutions that have business plans. If business plans are available, investors should seamlessly integrate planned impact analysis into business planning to help companies communicate and manage impact as they evolve. The net unit impact for associated market segments is thus multiplied by the company's forecast for those segments in each year of the analysis period.

REALIZED IMPACT

Unlike potential and planned impact, realized GHG impact is backward-looking, not forward-looking. To calculate it, the analyst multiplies the net unit impact by the appropriate solution volume each year of the analysis period. At this point, the company should begin collecting granular life cycle data on the solution, based on actual business practices, and re-evaluate unit impact according to the latest market context and segments, including their associated incumbents.

Net unit impact should begin overlapping more with traditional GHG footprinting, while still focusing on the comparison between the solution and incumbent. No longer theoretical, it should be validated with observations on how the solution is actually being built, sourced, used, and retired. The analyst uses past monthly, quarterly, and/or annual values for the appropriate volume as they are typically reported alongside up to date net unit impact data and lifespan data.

As soon as actual unit impact and sales data becomes available, investors should start tracking it in order to best understand where and how forward-looking models diverge from or align with the solution in the real world. This includes following up with consumers to reasonably confirm that the units sold are being used and are operating as expected.

Realized impact values should be fully integrated with financial statements by presenting calculations alongside sales figures and including units in operation as appropriate to emphasize operational emissions over the lifespan of the solution or end of life impacts.

SELECTING AND INTEGRATING APPROACHES

The three approaches to GHG impact are intended to clarify the limitations of analysis when data is scarce and unreliable; investors should mix methods according to the information available and to best mirrors business planning. For example, top-down approaches are the only option for early-stage solutions. On the other hand, bottom-up approaches

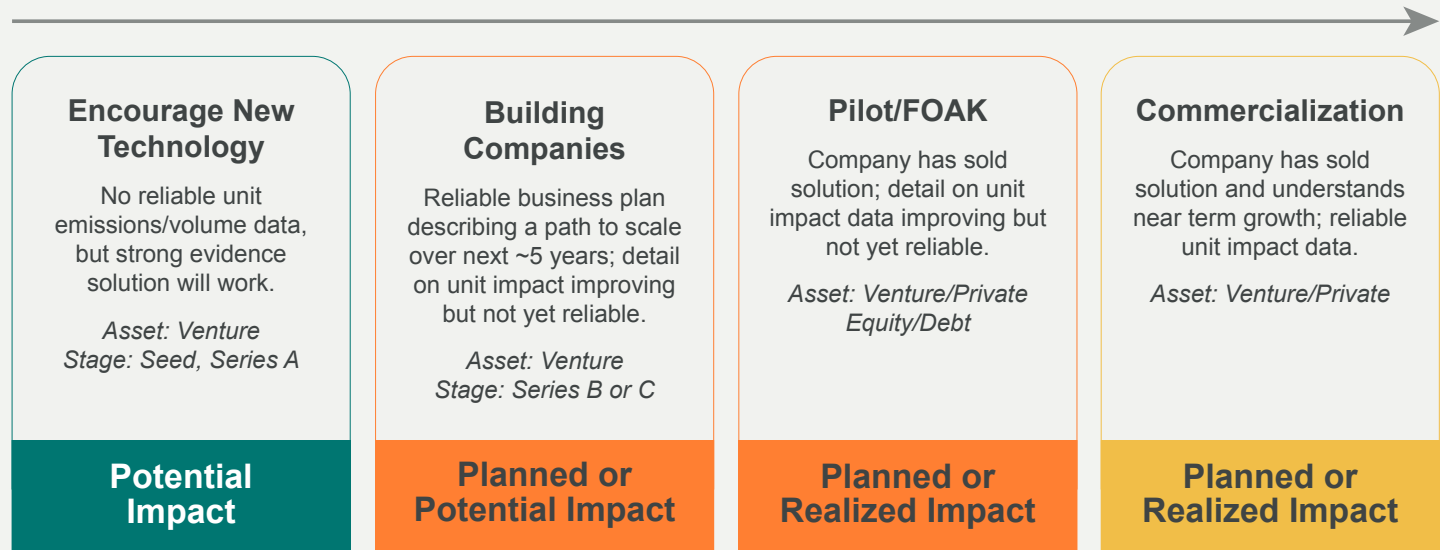
are both possible and essential when the appropriate granular business data exists. The level of detail in GHG impact analysis should always mirror the level of detail available in financial and organizational information.

By combining the top-down perspective with bottom-up sales forecast and results,

decisionmakers can develop a more accurate and realistic market strategy. For example, business plan projections should hew closely to projected SOM, but they are often smaller. As a solution moves beyond the earliest stages, investors should compare business plans or sales to their original estimates to improve the quality of assessment overall.

Early-Stage

Growth Stage



ADDITIONAL RESOURCES

[GHG Impact Methodology Comparison Chart](#)

Visit here for further detail on differences between potential, planned, and realized impact.

NEW CONSIDERATIONS

The GHG impact equation comprehensively covers all variables that are applicable to solution unit emissions, incumbent unit emissions, and solution volumes. However, there are a variety of topics around which investors have not achieved

full consensus or have not yet established how they fit within the core GHG impact formula. In this chapter, we discuss two associated topics: **optional adjustment factors, rebound effects and actions and reactions across systems.**

OPTIONAL ADJUSTMENT FACTORS



There are GHG impact variables, called adjustment factors, that sit outside of unit impact and volumes and shouldn't be mathematically blended into their underlying variables. These factors broadly fall into two categories: how various solutions work together to achieve GHG impact and how capital comes together to enable a solution or solutions.

Basic Procedures

Key considerations that broadly apply to all adjustment factors and their presentation in analysis and reporting are described below.

Validate that the factor cannot be clearly accounted for through unit impact or solution volumes
Before treating a variable as an adjustment factor, the analyst should validate that it cannot and should not be quantified as a part of unit emissions or solution volumes. Examples of factors that do not necessarily need to be folded into adjustment factor are below.

- ▶ **Reevaluating incumbents over time:** If EVs become more affordable, they may divert resources away from public transportation. If the analysts excluded public transportation among incumbents or may not have considered the longer-term implications of divestment from public transportation systems in areas where they seek to pursue market share, they can reevaluate that decision by considering a wider set of incumbents in quantifying net unit impact.
- ▶ **Considering negative effects of increasing resource efficiency:** For example, efficiency improvements may result in EVs being used more than ICE vehicles are today. This dynamic can be factored into the GHG impact formula in specific ways.

Distinguish GHG impact from adjusted GHG impact

Adjustment factors are considered a layer of analysis that is distinct from the core GHG impact formula. Analysts should distinguish adjustment factors from unit impact and volumes where they are applied and transparently show the final adjusted GHG impact value if it affects investment decisions or strategy. Reporting should distinguish values for GHG impact and adjusted GHG impact.

Document and share use cases

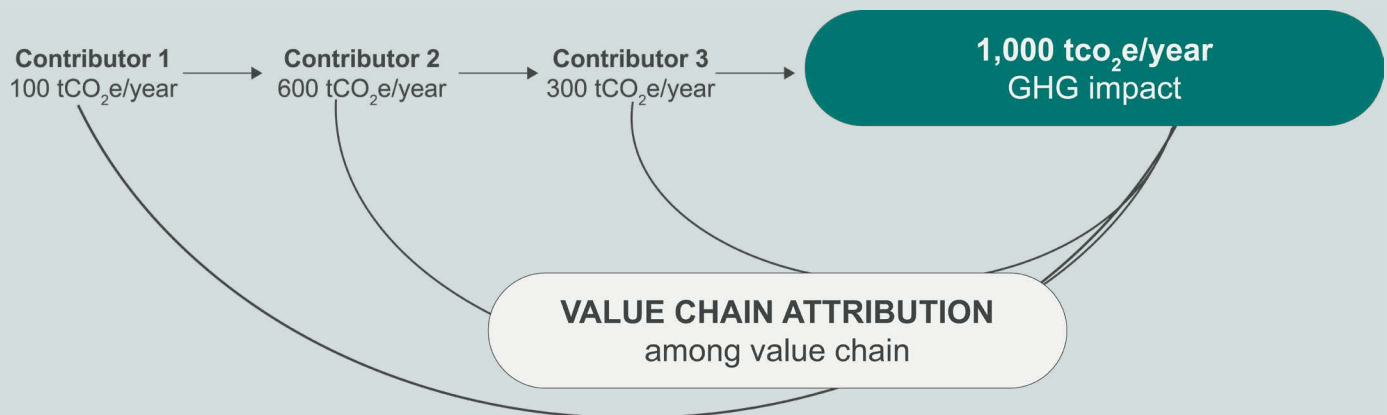
Investors should maintain records of where and how the core GHG impact equation limits the quality of analysis in our efforts to address climate change. Frame is committed to advancing methodological guidance when the existing guidance falls short in real world situations.

A Note On Impact Attribution

The 2023-24 Content Working Group revisited the topic of attribution and while it continues to be hotly debated, the group developed the following updates to help with clarity. The Project Frame methodology guidance does not provide a recommendation as to whether or not investors should attribute impact in their reporting. However, this iteration provides terminology and a new framework for articulating attribution if the investor chooses to do so.

According to Frame’s 2022 Focus Group feedback, 40 percent of respondents listed attribution as a factor in pre- or post- investment reporting. Interestingly, when asked the same question in 2024, only 35 percent reported attribution as a factor in pre-investment diligence and 32 percent listed attribution as part of their post-investment reporting.

Value Chain Attribution



Previously introduced as Horizontal Attribution, Value Chain Attribution is an adjustment factor that apportions emissions impact across contributors along the value chain. The core Frame formula focuses on GHG impact attributed to a direct product solution being analyzed. However, direct component

solutions contribute to the impact of the whole product.

The value chain refers to how these direct components relate to the direct product. For example, if an investor is looking at an EV battery, rather than the whole vehicle, how should they approach quantification?

While Frame does not currently have guidance for quantification, the following steps are common:

- 1. Quantify the GHG impact of the whole product**, such as the EV. If the battery is meant to replace an existing incumbent EV battery, the analysts should consider multiple incumbents as defined by market profiles.
- 2. Map out each of the solution components** in the EV solution system.
- 3. Distribute percentages to each component** according to the investor's own process.
- 4. Apply the component's percentage as an adjustment factor to the total GHG impact value.** In other words, if the investor believes that the battery is responsible for 50% of the GHG impact, then the adjusted impact will be half of the total GHG impact.

2024 Project Frame Focus Group

Project Frame's 2024 Focus Group

helped develop consensus in areas where our Content Working Group was challenged to find resolution. Their feedback informed how Frame approached its new considerations, including the renaming of value chain and capitalization attribution and updated definitions for impact and additionality.

Challenges

Introducing value chain adjustment into the decision making process can invite analysts to look at how climate solutions work together and inspire coordinated investments across solutions. But impact in complex systems cannot be discreetly segmented by individual parties. For example, if you remove the battery, the EV does not have 50 percent less impact; it may have none at all! The same is also arguably true for the drive motor, converters, and the steering wheel, which are not considered climate solutions.

Without detailed qualitative explanation, values can mislead readers on how collective or systemic impact works and unintentionally disincentivize investment in essential components. In the absence of consensus on how to quantify it, Frame recommends investors focus first on qualitatively and transparently documenting the value chain around the solution they are considering for investment, including which components are core to GHG impact and why.

The reader should also fully understand when the data used is tied to a different solution. For example, it should be clear when the direct product solution is the foundation of analysis but not the solution being considered for investment.

Capitalization Attribution

Previously introduced as Vertical Attribution, Capitalization Attribution apportions GHG impact or carbon footprint impact across the capitalization stack of a company. Investors use this to report on impact attributable to their firm to LPs and determine impact linked compensation amounts for investment managers. There is no consensus on how to apply it.



Reporting to LPs

LPs may seek to understand the “impact per dollar” to compare their investments. The most commonly discussed method to answer this need is apportioning percentage by ownership share. However, equity alone doesn’t represent all the financial interests, such as government grants, bank loans, and customer capital. These are all part of the solution. Ownership for late-stage companies may also underrepresent the role of early-stage capital without which many new solutions would not materialize.

Impact Linked Compensation

In impact linked compensation, investors might use this factor to reward investment managers for taking a higher ownership share in companies that ultimately have

bigger impacts. In this case, investors should be transparent that the primary use case is for investment managers in relation to their direct peers in the firm. For example, while forms of capitalization like debt or catalytic capital are essential, they may not be applicable if that firm itself does not deploy multiple forms of capital and accordingly apply the same compensation incentives across the team. As such, capitalization attribution might be tied only to equity ownership amounts.

Designing for Purpose

Examining how quantitative data incentivizes and disincentivizes decisions is important when designing methodologies. For example, how could oversimplified capitalization attribution steer capital away from critical needs? Should investors who have led

bigger investments for high impact companies benefit more in comparison to investors who have led smaller investments for companies with even higher impact? And where do impact analysts fit in, if they are different from investors?

In the absence of consensus on approach to quantification, Frame does not advocate that investors claim a share of credit in public reports, due to the ways it can mislead audiences regarding the roles that investors play in achieving impact. We also recommend that teams consider scenarios in which the data could incentivize unintended outcomes and involve impact focused decision-makers in the process to ensure that financial motivations do not influence outcomes.

ARGUMENTS AGAINST SPECIFIC ATTRIBUTION

Attribution, whether along the value chain or among capital providers, may offer clarity in carbon footprinting, but it falls short in the context of forecasting and fostering future GHG impacts. It oversimplifies the intricate and interdependent nature of environmental solutions, potentially masking the real impact of investments and diverting focus from the most effective solutions. Attribution, focused on individual parts rather than the whole, could lead to fragmented investment strategies that fail to capture the essential interactions and synergies crucial for holistic emissions reduction.

Project Frame's commitment to a broader approach, one that embraces the collective dynamics of technologies, industries, and consumer actions, is critical for catalyzing meaningful and widespread environmental progress.

Overcoming Limitations of Single-Component Focus

- **System-Level Challenges and Opportunities:** By moving away from attributing emissions reductions to single components, investors can focus on larger, system-level challenges. For example, the integration of renewable energy sources with EV charging networks requires a holistic view that transcends individual technologies or companies. This approach allows investors to recognize and contribute to the interconnected solutions needed for substantial emissions reductions.
- **Encouraging Collaborative Solutions:** Avoiding strict attribution fosters a collaborative environment where different sectors and industries can work together on integrated solutions. This collaboration is crucial for addressing complex challenges like the transition to a low-carbon economy, where success depends on the interplay of various technologies and infrastructures.

Encouraging Comprehensive Innovation Across the Value Chain

- **Spurring Innovation Across Sectors:** Broad investment across the value chain encourages innovation in all sectors involved in emission reduction solutions. For instance, investment shouldn't just focus on EV battery technology but also consider the power grid enhancements necessary to support the widespread adoption of EVs. This ensures that the entire system evolves in harmony, preventing potential bottlenecks or

infrastructure limitations.

- **Balanced Investment Distribution:** A non-attribution approach promotes balanced investment across different components of the value chain. It prevents over-concentration of capital in certain areas while neglecting others, ensuring a more uniform development of the entire ecosystem.
- **Adaptability to Emerging Technologies:** This approach allows investors to be more adaptable and responsive to emerging technologies and market shifts. It offers the flexibility to support new and innovative solutions as they arise, which might be critical in the rapidly evolving landscape of emission reduction technologies.

Simplifying Investment Decisions and Broadening Investor Appeal

- **Reduced Complexity in Investments:** By avoiding strict attribution, the investment process becomes less complex and more accessible, especially for investors who may not have deep technical expertise in every component of a solution.
- **Attracting a Diverse Range of Investors:** A holistic approach can appeal to a wider range of investors by emphasizing the broader impact potential of their investments rather than intricate details of specific emission reductions. This can lead to increased capital flow into sustainable technologies and solutions.

Moving away from strict attribution of emissions reductions allows investors to address broader, system-level challenges and opportunities. This approach encourages investment across the entire value chain, supporting comprehensive innovation and collaboration. It simplifies the investment process, making it more accessible and appealing, and ensures that capital is evenly distributed across various sectors and technologies. Ultimately, this holistic approach is more aligned with the multifaceted nature of the challenges posed by climate change and is likely to be more effective in achieving significant emissions reductions.

While Project Frame does not endorse attribution as a primary method in its guidance for estimating future GHG emissions impact, it acknowledges the diverse needs and perspectives of different stakeholders.

For those who deem attribution necessary, Project Frame provides guidance on implementing correct

factors to address these concerns. In such instances, the fundamental analysis—determining the unit impact and commercial volumes—remains consistent. A correction factor is then applied to the final planned or potential GHG impact result. This approach allows for the generation of two distinct values: a planned GHG impact reflecting the initial analysis, and an adjusted planned GHG impact that incorporates the attribution adjustment factor. This dual-value system ensures maximum transparency, catering to a range of stakeholders while maintaining the integrity of the underlying emissions reduction analysis. It represents a balanced solution, accommodating those who choose to incorporate attribution without compromising the core principles of Project Frame’s methodology.

ADDITIONAL RESOURCES

[Adjustment Factors: Value Chain Attribution](#)

A look at potential options for quantification of different components within the value chain of a direct product solution.

REBOUND EFFECTS

Rebound effect generally refers to the ways in which technology that increases efficiency in use of a resource, such as energy, can cause the resource to be used more in total. This can lessen or cancel out the positive environmental benefits of efficiency. It can even make things worse. This topic continues to be one of the most hotly debated areas amongst the content working group and will be revisited.

[Rebound effects are well known phenomena](#), though often overlooked. The Frame community fully agrees that rebound effects should be considered in assessing GHG impact. However, the community has not yet achieved consensus on how to integrate it into our methodology.

An in-depth discussion of the rebound effect (including a methodology for estimating rebound effects) is included in Chapter 2 and Annex 1 and 2 of the report by the European Council for an Energy Efficient Economy, titled “[Energy Sufficiency and Rebound Effects](#).”

Given that Frame’s goal is to use analysis to make better investment decisions for the planet, when analysis reveals a significant rebound effect, what should the investor do, especially given that efficiency-based solutions are a significant focus in climate investing?

While we don’t have formal guidance, rebound effects illuminate three insights that should and can directly inform

how climate investors think about their work and engage in system change:

- 1. Focus on solutions that contribute to fully shutting down top polluters and pollution sources:** The priority must remain doing everything we can to get off of coal, oil, and gas. Efficiency improvements may be a necessary byproduct of this focus, without being the primary goal.
- 2. Climate investors should actively support policies that regulate markets:** Rebound effects from efficiency improvements can be minimized when efficiency improvements come in response to regulations or policies, such as carbon pricing.
- 3. Rebound effects and reaction across systems are not instantaneous:** Depending on lag times, there may be times where a short term efficiency solution is valuable as long as broader efforts to regulate markets and decarbonize the energy system are simultaneously in motion.

As a best practice, Frame recommends considering potential and actual rebound effects during pre- and post-investment reporting. If a rebound factor is included in the impact calculation, it should be clearly stated and the rationale for the factor should be explained.

Rebound Effect *Origins*

Rebound effect is also often referred to as [Jevons paradox](#). This naming goes back to 1865, when economist William Stanley Jevons observed that increasing the efficiency of coal use in James Watt’s steam engine led to a dramatic increase in coal consumption. Efficiency encouraged more coal use, not less, as the unit price effectively went down.

ACTION AND REACTION ACROSS SYSTEMS

GHG impact involves an orchestra of human systems and behaviors. While value chain attribution accounts for climate solutions that work in sync, not all systems or behaviors are in coordination or work towards the same goals. In complex systems, climate investors who seek to make intentional changes are also working against forces that seek to maintain or advance the status quo. Uncoordinated human and institutional behaviors resulting from market forces, including climate solutions, may also have an overall negative effect on GHGs.

Challenges

Considering broad systemic factors is extremely complex and can take a great deal of time. Added complexity also does not necessarily imply greater accuracy and integrating nuanced feedback loops inherent in human decisions increases the opacity and reproducibility of modeling. Any forms of added complexity and opacity can increase the risk of greenwashing.

But Frame's responsibility is to uncover where quantitative values can ultimately lead to decisions that fail to address—or worsen—climate change. Systems analysis helps demonstrate the complexity of markets,

Opposition and behavioral economics are also often related.

Investors seeking to go deeper in systemic analysis may look to consequential LCA (CLCA) for inspiration. Consequential LCA considers the system's potential changes in response to decisions or how impacts change as a consequence of a decision or policy. For example, in CLCA, the assessment of a new type of electric car would consider how this car might influence electricity demand, shifts in resource extraction, and changes in the transportation market.

where markets may not be the answer to the climate crisis, and how markets can be manipulated to work against the intentions of climate solutions. It is essential for investors to consider these dynamics.

In the absence of consensus on how to approach quantification, Frame recommends investors begin considering qualitative reflections on potential consequences of decisions in investment memos and provide real world examples to Project Frame. These narratives will spark critical discussions that may inform strategy, even if they may not ultimately be integrated into modeling.

Examples of Potential Action/Reaction Effects

- ▶ **Opposition:** There is extensive evidence that carbon removal technologies, such as carbon capture, could lead to higher fossil fuel production or stymie its phase-out. Analysts may choose to use adjustment factors to explore how these technologies could lead to increased oil and gas production and to account for any additional emissions that might result.
- ▶ **Policy:** Having a robust voluntary carbon market with strong standards or protocols could make it easier for policy to expand the mandatory market or adopt carbon pricing. Conversely, having cheap, affordable point source capture technology may also slow policy mandates to shift to more sustainable production processes that are low-carbon without carbon capture.
- ▶ **Infrastructure:** Increased vehicles, including cheaper EVs, could lead to more and bigger roads at the expense of green space. Through adjustment factors, can the analyst consider GHGs associated with fewer trees and more roads as important to analysis?



SECTION 4

Additionality

Project Frame’s updated definition of additionality is: “An attribute of impact requiring an investor or company’s thoughtful and reasonable articulation of the degree to which its support causes a change in an outcome that would have not otherwise happened (in a no-intervention or business as usual baseline scenario).”

Applications of additionality vary significantly depending on the focus of assessment. To begin distinguishing applications, Frame currently describes two classes and associated sub-classes of additionality in the following table.

Additionality is among the most debated topics, in part for its subjectivity. Today, Frame does not provide specific methodological guidance. Instead, our goal is to develop a common language within the Frame community that enables investors to advance their strategic approach. [Prime Coalition’s white paper on additionality](#) recommends, “To demonstrate additionality, a project description generally includes the following: A narrative that describes the types of additionality present, supported by information that demonstrates the judgment based on market knowledge and/or available information.”

	Investor-Level <i>What if a specific investor did not fund this company?</i>		Enterprise-Level <i>What if this specific enterprise (company or project) did not exist?</i>	
	Financial Additionality	Value Add Additionality	Performance Additionality	Adoption Additionality
Description	<p>Avoids future emission by replacing or taking market share over time from an incumbent responsible for higher emissions. Most climate solutions today fit within this category.</p>	<p>Impact that would not have happened without unique non-financial value an investor provides to a portfolio company.</p>	<p>Impact that would not have happened without the company creating or improving a solution with a unit impact that is superior to alternatives.</p>	<p>Impact that would not have happened (in the same timeframe) but for the increased adoption of a solution.</p>
Example: Early-stage Investments	<p>An impact investor steps in to lead the round for a company that has been attempting to raise for more than two years, but has been rejected by other investors due to high technical risk.</p>	<p>An impact investor makes the strategic decision as a board member to allocate R&D resources towards developing a product with higher climate impact.</p>	<p>A company develops a novel chemistry for metal extraction that has lower emissions than existing technology.</p> <p>In early-stage companies, enterprise-level additionality can be thought of as “solution-level.”</p>	<p>A company produces green methanol at lower cost than existing green methanol producers, reaching cost parity with fossil methanol and growing the market for green methanol.</p>
Example: Later-Stage Investments	<p>An impact investor agrees to join the syndicate and fill out a large round that otherwise would not have been completed.</p>	<p>An impact investor leverages its network to help the portfolio company secure off-takers for its products with green premium.</p>	<p>A battery recycling company improves the established process to further reduce emissions.</p> <p>In later-stage, company-level additionality may not be “solution-level” when it accounts for competition between solution providers</p>	<p>A solar developer expands its operation into a new geography that currently has low solar adoption.</p>



SECTION 5

Impact Reporting

Monitoring and reporting are critical for accountability. Currently, the best practice is to internally report during pre-investment diligence and to set a regular cadence of internal and external reporting post-investment that can be audited by a third-party every five years.

PRE- INVESTMENT REPORTING

1 Define the Scope and Objectives

- ▶ **Objective Setting:** Clearly define what the organization aims to achieve through its investment activities.
- ▶ **Scope of Analysis:** Determine the boundaries of the report. Will it cover the entire organization, specific projects, or particular investments? Identify the stakeholders who will be impacted.

2 Select Relevant Impact Metrics and Frameworks

- ▶ **Impact Metrics:** Choose quantifiable indicators that align with the organization's objectives. These could include metrics like GHG emissions reduced, jobs created, or the number of people reached by a program.
- ▶ **Frameworks:** Utilize established frameworks and standards, if any, to guide the selection of metrics and reporting methodology.

3 Data Collection and Analysis

- ▶ **Data Sources:** Gather data from internal systems, surveys, third-party assessments, or publicly available information. Ensure data reliability and accuracy through validation processes. Note maturity of the company and describe the availability of reliable data based on the the stage of the technology or company.

- ▶ **Baseline Setting:** Establish a baseline for comparison to assess the progress or impact over time.
- ▶ **Impact Assessment:** Analyze the data to understand the extent of the impact. Use the theory of change to assess the impact.

4 Adjustment Factors and Rebound Effects

- ▶ Determine the degree to which the observed impacts can be attributed to the organization's activities versus external factors. This helps in understanding the direct influence of the organization's actions.
- ▶ Evaluate how the organization's contributions compare to those of other entities or factors in achieving the impact.
- ▶ Contemplate potential rebound effects and develop system to evaluate rebound effects or other unintended consequences post investment

POST- INVESTMENT REPORTING

5 Reporting and Communication

- ▶ **Report Structure:** Structure the report to clearly communicate the impact based on the intended audience.
- ▶ **Stakeholder Engagement:** Engage stakeholders throughout the reporting process to ensure the report meets their needs and expectations. This can involve consultations, feedback sessions, and transparent disclosure of methods and assumptions.
- ▶ **Verification and Assurance:** Consider third-party verification to enhance the credibility of the report. This can involve auditing by an independent body or adherence to recognized standards.

6 Continuous Monitoring and Improvement

- ▶ **Monitoring:** Implement systems to continuously monitor impact over time. This allows for tracking progress against goals and making adjustments as needed and revisit assumptions around rebound effects.
- ▶ **Feedback Loops:** Use the findings from the impact report to inform future strategies and improve organizational practices. Continuous learning and adaptation are key to maximizing positive impact. Frame also recommends using third-party verification.

New Reporting for Realized Impact

Project Frame recommends that for external impact reporting, investors and companies should use tCO₂e/year (distinguishing between emissions type by reviewing Global Warming Potential).

Using a common metric and timescale will encourage comparability and transparency. If an investor chooses to publish cumulative reporting, it should be clearly defined for previous realized emissions and marked separately from any potential impact forecasting, which can be misleading if taken out of context.

For example:

100 tCO₂e / year avoided
 - 72 tCO₂ / year
 - 1 tCH₄ / year



SECTION 6

Final Reflections

Stage Analysis and Document Associated Procedures

While the GHG impact formula is simple, it requires investors to perform iterative analysis that serves efficiency, comprehensiveness, and the practical realities of an investment down selection process. Frame recommends investors detail each step of their procedures. For example, where investors are not comprehensively quantifying emissions associated with the solution and incumbent, they should clarify steps taken, such as materiality assessment, to ensure that qualitative forms of analysis are applied where quantification is difficult or unreliable.

Deepen Analysis to Match Amount and Reliability of Data

The goal of analysis is to produce the most accurate analysis you can based on the reliable data you have. Early-stage solutions tend to rely on higher-level estimates of both unit impact and volumes due to limited data. As more detailed information becomes available, analysts should shift towards more thorough analysis. The same principles apply to assessment of unit impact and volumes.

Use Quantification As A Narrative Tool

Quantification should serve a strategic purpose which, in the case of Frame, is making an investment decision. The goal is not to amass data for its own sake but to reveal a true story that can guide actions. Too much data can obscure the critical insights needed for effective decision-making. Investors should produce clear narratives to contextualize data, ensure that the data serves a clear purpose, and communicate the significance of the findings.

Think Creatively About The Future

Trends, in unit impact and volumes, should be viewed as exercises in creative thinking rather than predictions. They visualize and explore the implications of possible futures. This helps us anticipate challenges and opportunities that may not be immediately apparent.

Avoid Interpretations That Incentivize Bad Decisions

Quantification methods incentivize or disincentivize different decisions. For example, if we assume a net zero grid in 2050, and accordingly assign less GHG impact to solutions that reduce electricity demand, are we in fact stymieing a promising and effective means of reducing GHG emissions?

Reduced unit impact overtime should not necessarily deter investors from making an investment. A single investment may be one of many unquantifiable or indirect actions that contributed to ecosystem change that would not have occurred without all of them. Think about the potential long-term consequences of data on behaviors and how your interpretation of the data could work against the reality you actually want.

Contribute to Ongoing Learning

There is no perfect analysis, especially when attempting to forecast into the future with limited access to data. However, it is clear that through knowledge sharing and community we are improving our investment strategies together. We invite those who wish to both learn and lead the next chapter of Project Frame's work to consider contributing to future [case studies](#) or refining our ongoing library of supplemental materials.

WHAT'S NEXT

Case Studies

Project Frame will continue expanding its [library of case studies](#), which are developed to advance the practice of forward-looking emissions impact assessment by showcasing how Frame's methodology can be applied to a range of climate solutions.

Inspired by real investments, these case studies lift the veil on challenges analysts face during the assessment process and encourage readers to explore where analysis can go deeper for smarter climate investing.

Expanding Methodology For Later Stages

To better serve investors supporting climate solutions, Project Frame will expand its methodology beyond guidance for early-stage companies and investors.

Frame's objective is to ensure that all—regardless of asset class, maturity or industry—can navigate best practices for forward-looking emissions assessment to ensure we are allocating capital towards the most impactful solutions to avoid future and/or unnecessary emissions.

Considerations Around Adaptation & Resilience

Project Frame understands that addressing the critical urgency of climate change requires more than mitigating GHG emissions, particularly for those already living with the consequences of the crisis, such as those in the Global South who are disproportionately impacted.

Frame will continue the conversation on considerations around adaptation and resilience to better understand how those co-benefits can be articulated in a structured manner alongside forward-looking emissions impact assessments.

Additional Resources Library

Project Frame's new [additional resources](#) are designed to complement each section of the guidance, bringing readers deeper into the what, why, and how behind GHG impact assessment. The supplemental readings, to be released periodically, invite the community to think critically about their impact assessment process so they may get the most comprehensive picture possible of the solution they are evaluating.

Support Project Frame

Project Frame is a nonprofit program convened by [Prime Coalition](#), a nonprofit 501(c)(3), catalytic investor, and co-creator of [the CRANE tool](#).

Project Frame does not require a membership fee. Rather, it operates through donations provided to Prime Coalition. We thank those who wish to [make a donation](#) to support Prime's work and join our shared mission to advance impact accountability in climate investing.

PROJECT
FRAME

Convened by Prime Coalition

projectframe.how