Know Your Impact

Our Approach to Emissions Reductions Measurement

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Summary

Our impact measurement methods are designed to allow our investors and other stakeholders to assess our performance in finding investments that lie on the efficient frontier of financial returns and clean energy impacts.

The complete clean energy transition involves more than swapping out carbon-producing facilities. It also involves changes in business and customer processes and supporting systems. Impact metrics should reflect this — it is too narrow to assess decarbonization solely by estimating carbon savings for directly measurable technologies. For some investments, other impact key performance indicators (KPIs) are better.

When reporting measured carbon savings, we strive to:

- Choose and document an alternative scenario (baseline) that is not static;
- Label our carbon savings as enabled because they are not typically “additional” according to the original definition discussed in this white paper;
- Claim enabled savings in proportion to our investment in the company;
- Not claim that all of the savings for the total addressable market are attributable to our investment or technology, or take credit for rivals copying our technologies (the so-called “Tesla effect”); and
- Compare our savings with the carbon emissions from our portfolio to better reflect net portfolio savings.

We believe these are best practices in the reporting of emissions reductions attributable to investment. We look forward to working with Project Frame and other stakeholders to continue to improve clean energy impact reporting.

Introduction

Investments made with the goal of realizing environmental or social impacts in addition to financial returns face a number of daunting impact measurement challenges. This white paper discusses a variety of practical and conceptual issues Energy Impact Partners (EIP) and other similar investment firms face when measuring the effects of their investments on greenhouse gas (GHG) emissions (for brevity, we refer to these as enabled carbon savings or clean energy impacts).

Beyond clean energy impacts, EIP also assesses many other environmental, social, and governance (ESG) factors, which also have measurement issues. However, measuring saved carbon is uniquely challenging and the focus of this discussion paper.

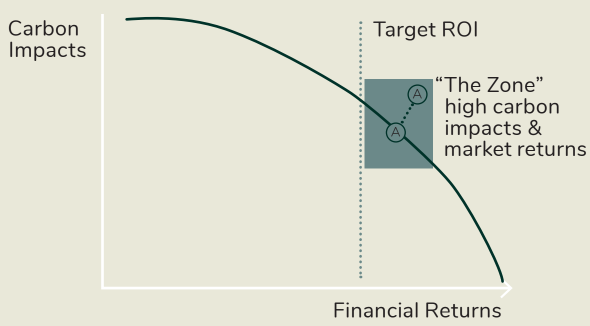
In the financial community there is an ongoing debate over the importance and purpose of ESG metrics, including reported carbon savings.[1] The fact that EIP voluntarily reports our own carbon emissions, enabled carbon savings, and other ESG metrics indicates that we believe this performance data conveys information that is useful and important to our investors (LPs) and other stakeholders. Like many others, we report annually to the Task Force on Climate-Related Financial Disclosures (TCFD) and the UNPRI and are active participants in **Project Frame**. We fully agree that impact information should be reported in a framework that is reasonably objective, standardized, and transparent. This white paper is intended to contribute to these objectives.

What if we could collect all GHG-reducing impacts into a single perfectly-quantified number for every company we invest in? An investor such as EIP, aiming to maximize both financial return and carbon savings, would seek the set of investments with the highest financial return and carbon savings i.e., the top right corner in Figure 1. If you are of the belief that there is typically a tradeoff between financial returns and carbon savings, the goal is better expressed as finding investments that are on the efficient frontier shown in Figure 2.[2] However, one chooses to show it, EIP strives to hit the zone with the highest combination of returns and impact.

Although we can't measure carbon impacts nearly as well in practice as we can in theory, this illustrates the overarching objective against which we assess impact measurement methods. The ultimate point of

FIGURE 1

FIGURE 2—THE ZONE



measurement and reporting is to give our LPs with impact objectives a tool to verify whether we are finding the target zone as well or better than other investment opportunities oriented toward the same goals. This aligns us with our LPs' own objectives to select fund managers who best meet their own investment objectives, which often mirror those shown in Figures 1 and 2. The test of any impact measurement approach, large or small, is whether it is the best of all reasonable alternatives to serve this objective. We believe that robust and transparent measurement also helps us iterate and refine future investment opportunity selection to remain on the efficient frontier of impact and financial return, which leads to further credibility and value add for portfolio companies and LPs.

We strongly support reporting carbon emissions and impact measurement. However, for climate mitigation it is tempting to think that tons-of-carbon-saved (or emissions reductions potential) should be the only metric for impact on the clean energy transition. This metric is clearly indispensable, but also incomplete because it does not always account for imperfect data or value of systemic change.

The first reason why tons-of-carbon saved alone is not best is that carbon measurements are estimates even in the best of circumstances, and they grow much more uncertain over long horizons. For many companies seeking to allocate capital to maximize impact, measuring carbon savings is well worth the effort; we have high confidence that the signal is larger than the noise, and the numerical results are a valid guide towards capital allocation.[3] For others, data is hard to define and quantify.

The second reason to go beyond tonnage estimates is that focusing only on the tons we can quantify masks uncertainties and important synergies that exist beyond our ability to gauge per-unit impacts. Our experience working with energy networks tells us that some investments support the broad technological, operational, and business model transformations that are integral, yet often hidden, elements of change. We call these investments foundational. Measuring the impacts of technologies using metrics other than tons requires careful attention to the underlying theory of change and the associated KPIs. This allows for an evaluation of the impact of these investments without the need to engage in a huge computational effort for carbon emissions whose results would not be reliable.

As a result, ranking investments solely by the assignable tons of carbon saved is not the best way to assure that one is selecting funds for their ability to accelerate the complete energy transition. A more holistic evaluation of impact gives a more complete picture of a fund's overall role as a large-scale climate solution.

A NOTE ON TERMINOLOGY

The impact measurement industry has not yet aligned on standard terms and definitions. Energy Impact Partners is a founding member of **Project Frame**, a non-profit coalition of climate investors working to build frameworks, methodological consensus, and a common impact language across our industry. In light of that ongoing work, a guide to help align Energy Impact Partners and Project Frame terminology is captured below.

Energy Impact Partners	Project Frame	Definition
Carbon Savings, Carbon Impacts, Hand Print	Realized Impact/ Emissions Reduction	The estimated impact that a proposed climate solution actually caused in terms of GHG emissions.
Carbon Savings Estimates	Planned Emissions Reduction	The impact expected from a company or a proposed climate solution based on a realistic analysis of its business model.
Ownership Weighting	Vertical Attribution	Attribute carbon savings among the investors in an innovation based upon ownership proportions.
Carbon Total Addressable Market	Potential Impact	The total sum of the impact a proposed climate solution could have based on a standardized growth trajectory that assumes the proposed solution reaches 100% market share.

Conceptual Challenges in Measuring Saved Carbon

Measuring carbon savings sounds like a straightforward task. In reality, a number of tough conceptual questions surround any approach to carbon savings assessment. These issues often also make calculations operationally difficult.

It is first important to understand that, while there are many similarities, there are also key differences between measuring past and present (current, actual, or realized) carbon savings, versus projected, forecasted, or expected forward-looking carbon saved. Most of the discussion in this white paper applies to both major categories, though the difficulties grow more challenging over longer horizons. Second, projections of forward-looking savings may be based on a variety of definitions of the market including total addressable market (TAM), serviceable available market (SAM), or serviceable obtainable market (SOM). This discussion does not concentrate on the application of these different measures, but a forthcoming paper from **Project Frame** dives squarely into the application of these metrics.[4]

BASELINES AND BOUNDARIES

Measuring avoided or saved emissions is inherently difficult because savings are defined only by comparison to a baseline, reference, or business-as-usual (BAU) scenario. With his ability to toggle between two realities, Neo would be the ultimate carbon impact modeler. Unfortunately, the rest of us have no ability to observe a future without the particular impact investments we've already made and thus must project what would have occurred in their absence. Baselines, boundaries, and additionality are all relevant to both current and forward carbon savings measurements.

There are many ways to research and choose baselines, and the care exercised in doing this is one of the strongest indicators of quality in carbon impact measurement. In some cases, especially when the time frame is very short, determining the baseline is straightforward and relatively certain. In other cases, uncertainty over the baseline is so large that several alternatives need to be considered.

There is no one baseline selection approach that applies to all types of carbon investments over all relevant time frames, but there is much to learn from adopting baselines repeatedly for similar or related technologies. For example, we have set baselines for many technologies that displace electricity from the grid now and over substantial periods into the future. Across all these technologies, we have adopted a standard practice of setting the baseline as the current and forecasted carbon emissions from grid power displaced by each installation of our technologies. The baselines are not identical because the technologies are installed in different regions of the world, have different patterns of displacement (e.g., peak versus off-peak power), different average intensities now, and different forecasted decarbonization trajectories. As grid carbon emissions measurement becomes more granular, partly through the use of tools such as those being developed by companies like our portfolio company Singularity, we expect to be able to refine our grid displacement baseline.

In all scientific research the measurement challenge is defined by a system boundary. In carbon impact measures, the system boundary is always the portion of the value chain the investee affects. Since we're comparing two scenarios, the boundary for the two scenarios should contain all of the parts of the chain that change with and without the carbon-saving investment. The portion of the value chain that does not change due to the investment, or changes so little that it is unlikely to be impactful, can be outside the system boundary.

ADDITIONALITY

Additionality is also important. Although other definitions of additionality are sometimes employed in impact measurement, we use the original definition of a change that "would not have occurred in the absence of the intervention being appraised" in the words of the UK Treasury.[6]

In our case, the intervention is our investment in a portfolio company. While in some cases it is reasonable to conduct an analysis that establishes additionality for fully commercial investments, or to conclude that additionality applies simply by nature of the markets and technologies involved, often this is not possible or practical. For investors in the blended finance or catalytic capital space additionality can be important, but for investors like EIP, this is not necessary.

Why should investors look at savings figures that might not be fully additional? The reason has to do with the key difference between private markets and public funding. Additionality is very important for publicly-funded projects because a government is well positioned to use its unique power to enable markets to succeed where they otherwise would not, or to provide funding for public goods that private markets will not. Under these circumstances, additionality is critical because it directs public funds towards the uses that only public capital can effectuate.[7]

> Our measure of impact is whether we win the race to decarbonize each sector we invest in. In contrast, the usual additionality test is whether anyone else will bother to run the course if you don't.

Investors in private, competitive markets face the opposite situation. If a private goods market has an unmet need, we should expect that numerous entrepreneurs will try to sell solutions for that need. It is not ordinarily defensible for an investment fund in a reasonably competitive space to argue that if they were to suddenly disappear no one else would fund their portfolio. This is not true for below-market philanthropic or catalytic capital, which is generally scarce and unique.

SPARKFUND: AN EXTENDED EXAMPLE

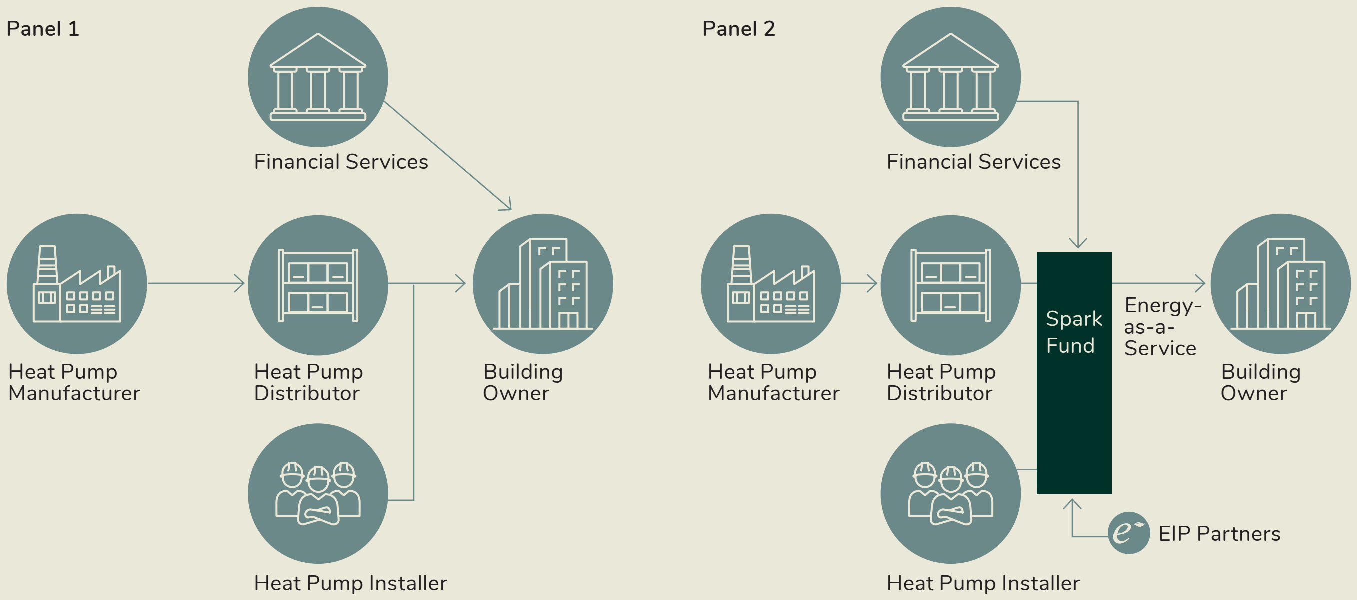
EIP has invested in Sparkfund, an innovative firm that was a pioneer in increasing building energy efficiency (EE) by providing efficiency-as-a-service (EAAS). For EIP and Sparkfund, our carbon impact measurement is based on the two value chains shown in Figure 3 below. Without Sparkfund (panel 1), the building owner who wants to install an EE measure (for example, a new heat pump) must pay the manufacturer and installer up front using their best available source of funds for this outlay. With Sparkfund, the owner can install and use the same EE measure and pay for it over its lifetime via the bill savings it creates.

It is usually not too difficult to compute the carbon saved by the installation of a specific efficiency measure. For most technologies we can access substantial data that compare real buildings with and without them. Building energy simulation software can also be used to generate accurate savings estimates. Sparkfund specializes in this quantification, and creates ongoing savings estimates for each measure it installs.

It is tempting to think that these measurements are all we need to report EIP's own impacts from its investment in Sparkfund, but it's not quite that simple. There are several assumptions in this baseline and boundary setup that have important implications for how we think about and report our impact.

Claiming all of the estimated savings from all of the measures Sparkfund installs as impact could be seen as assuming that none of these measures would have been installed by the building owner without Sparkfund. This of course is the key criteria for additionality applied to this situation. It isn't practical for either us or Sparkfund to attempt an analysis of building owner behavior in the absence of the company's EAAS offering. In this context, the definition of impact is explicitly not additional, it is simply a measurement of savings that occurred versus the status quo prior to Sparkfund. It is what Sparkfund changed about the building and its energy/carbon emissions.

FIGURE 3—SPARK FUND'S VALUE CHAIN AND SYSTEM BOUNDARY



When considering potential investments in EEAS, our task as investors is to find the companies like Sparkfund that are going to succeed most quickly and thoroughly in meeting an identified need, reduce EE market friction and thereby save the most carbon fastest. We measure our success not by assuming that no one else would have saved Sparkfund's carbon had they not done it, but rather by the fact that Sparkfund succeeded in beating out its rivals in the EE marketplace and playing its role in a value chain that changed the status quo. As private investors, that's what we're looking for, not proving a threshold for additionality. In other words, we want to win the race to decarbonize each sector we invest in; for additionality the question is whether anyone else will run the course at all.

This notion of impact also extends to EIP's own role in the value chain. When we choose investments in foundational and directly measurable companies we generally believe that we can help them perform on, near, or even beyond the efficient frontier shown in Figure 2. We are proud of our experience in doing exactly this, and we report on how much of it we have done in our annual impact report. Nonetheless, just as we cannot prove that no EE measures would have been installed without Sparkfund, we also cannot prove that no one would have provided capital to Sparkfund had we not been an early and sustained investor in their firm. We believe we have many competitive advantages versus other clean energy funds, but we cannot simulate the entire counterfactual world in which we did not invest in them.

These considerations help explain why EIP is careful to refer to its impact role as enabling savings. We use this term to signal transparently that we are talking about a different sort of metric than additionality. The enabled savings metric is explicitly intended to serve as a guidepost for venture capital and private equity investors. Many of our investors are looking for carbon savings impacts alongside market-or better financial returns, and they must evaluate which funds best match their objectives. Our impact measurements are intended to convey our success meeting these objectives relative to other private investment options that are also typically not additional.[8] As Professors Richard Barker and Robert Eccles, two longtime leaders of sustainability reporting, recently observed, "Companies also want to be able to compare themselves to their competitors on sustainability performance, just as they do for their financial performance. Such an approach is efficient also for users of corporate reporting, in comparing companies to one another."[9]

ALLOCATING ENABLED SAVINGS

Who should claim credit for having enabled the savings shown in the second panel of Figure 3? Unlike additionality, enabled savings aren't measured by a series of what-if exercises that removes Sparkfund (and all other actors in the value chain) one at a time to see how much carbon savings changes. Instead, every actor in the value chain plays a role in enabling the savings Sparkfund triggered — EIP, Sparkfund, the building owner, and the installer. Suppose that Sparkfund installed 100 identical heat pumps that saved 100,000 tons of CO2 in one year. Though perhaps counterintuitive, is it not incorrect for the heat pump manufacturer to say that their equipment enabled 100,000 tons of savings, for the installer to also say that they installed equipment that saved 100,000 tons, and for EIP and Sparkfund to also cite the same enabled savings number. While there is no consensus in the impact community on how to best address this, EIP has developed the methodology following.

Sparkfund's enabled savings are intentionally shared by every part of the value chain in the second panel of Figure 3. Our investment would hardly have yielded savings if there were no manufacturers of EE equipment or no installers available. Anyone essential to the value chain plays a role in enabling the savings to occur, and everyone who does so can legitimately claim that they helped to enable these savings versus the initial *status quo* — and sometimes even versus a fully projected forward looking baseline where additionality holds. For this reason, we report the enabled savings Sparkfund achieves to our investors and Sparkfund does the same to its stakeholders. For aggregate carbon savings accounting we would not want to double-count each of these figures, but that's not the purpose of these numbers.[10] These numbers are comparative investment signals to investors in each part of the value chain.

However, this reasoning does not apply to multiple actors within each part of the value chain. Using the 100 heat-pump example: what if ten companies each installed ten of Sparkfund's EAAS units? Each installer should not be claiming that it enabled 100,000 tons of savings — the correct enabled savings for each installer would be 10,000 tons. Similarly, if one installer did 90% of the work, they should get 90% of the credit for enabling these savings and the rest of the installers should share 10% of the credit. In this instance avoiding double-counting matters. The proper signal to stakeholders examining the market for heat pump installers would be to allocate the savings within each segment of the value chain among the participants in that segment in proportion to their enabling role.[11]

The same sort of reasoning applies to EIP's role in the value chain, which is providing our portfolio companies with investment capital, expert assistance, and access to our large LP collaboration network. For most of our portfolio companies, we do not provide 100% of the capital that enables our companies to save carbon and grow. Accordingly, we should be recognized as having enabled a share of the total savings commensurate with our share of total investments and support.

We have analyzed several different ways of attributing or allocating our enabled savings impact. There are multiple considerations that make this a difficult task. First, early capital carries much more inherent risk in most cases, so simply looking at the number of dollars invested after multiple rounds underweights the importance of early dollars. Second, funds that lead rounds typically do more work per dollar invested to unlock the full round of capital, and this is not reflected in raw dollar figures. Third, total dollars invested do not reflect the many other types of resources we provide to our portfolio companies, such as assistance with management challenges and marketing introductions. One of EIP's most valuable assets is our highly-engaged coalition of strategic partners, who provide extremely robust feedback and opportunities to rapidly scale our technologies.

These considerations have led us to an initial approach to "ownership-weighting" our impact and continued work on the topic. For companies in which we have only equity investments, we use the percentage of the company we own as the weighting factor for enabled savings. We use percentage ownership rather than dollars invested because it tends to give higher weight to early investments, when share prices are lower but the risks and work involved in growing the company are higher. In addition, most of these companies do not use other sources of capital such as debt, so the percentage of ownership usually aligns well with the percentage of total capital contributed.

For EIP in particular, this is a conservative measure of our share of enablement because it does not factor in our most unique comparative impact enabler: our network of diverse industrial and strategic partners. We believe that our coalition's ability to evaluate, pilot, and scale technologies is a very important value creator and is nowhere near fully captured in pure ownership share numbers. Part of our impact measurement philosophy is to report conservatively rather than trying to report the largest impacts possible for each of our investments, and this is a good example of this approach in action.

EIP also has funds that provide debt financing to portfolio companies at various stages of the business life cycle. For these investments, using percentage of equity ownership would yield the erroneous conclusion that the capital we provided did not enable any savings whatsoever. On the other hand, neither can we claim 100% of the enabled savings, as we did not put up 100% of the enabling capital. In this case we weight our savings by the total share of balance sheet capital we have contributed.

We recognize that these allocators are a work in progress, and we hope it is possible to develop more sophisticated and accurate weighting factors in the future. However, we believe that the relatively simple allocators we are using are vastly superior to claiming 100% of the enabled savings regardless of our proportionate role in our investee's financing and management. We hope that all investment funds that publish impact figures use some weighting of this basic form.

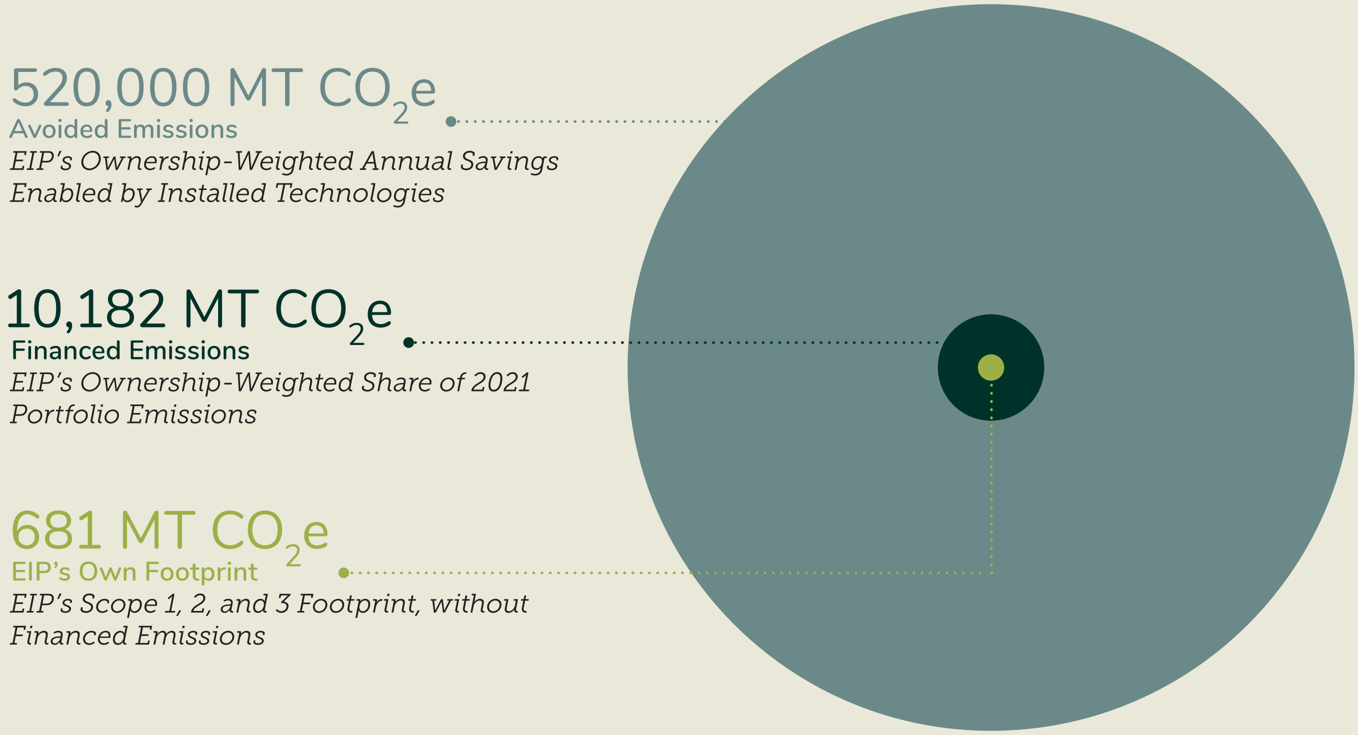
GROSS VERSUS NET SAVINGS

Just as it takes money to make money, it almost always takes carbon to save carbon. It takes energy to develop and install the hardware and software that our companies provide, and for now almost every production process causes some additional GHG emissions. To paint an accurate picture of enabled savings, we want to deduct production emissions from savings to determine the net impact of our technologies on the climate system.

We are doing this by measuring the GHG emissions (footprint) of our portfolio companies and deducting this from our enabled savings numbers. In our 2022 Impact Report, we measured the Scope 1 and 2 footprints of all our portfolio companies, as well as our own carbon footprint (Scope 1, 2 and 3), and deducted these emissions from our share of the enabled savings. As shown in Figure 4 below, our own 2021 footprint at EIP, inclusive of Scopes 1, 2 and 3, was 681 metric tons (MT) and our portfolio's Scope 1 and 2 footprint was 10,182 MT. Our estimated share of enabled 2021 savings is about 520,000 MTs, about 50x the carbon emitted to produce the savings.

This ratio is an excellent "return on invested carbon" and we are pleased to help our portfolio companies achieve results like this. We now are working to improve this approach by adding Scope 3 emissions to our portfolio companies' footprint, so we have a more complete picture of the carbon needed to provide the savings-enabling products. However, getting a full picture of "carbon ROI" requires that we include the footprint of all others in the value chain whose emissions change versus the baseline, including other providers of capital and other actors (such as equipment installers) not counted in our companies' Scope 1 and 2 footprints. Neither we nor any other single actor will be able to form a picture this complete until there is much more widespread and transparent reporting by our peers and everyone else in the value chain. We are watching this space to see how we can improve our calculation in this respect as additional data becomes available.[12]

FIGURE 4—EIP ALLOCATED GROSS AND NET IMPACT, 2022
Source: Energy Impact Partners 2022 Impact and ESG Performance Report



More Conceptual Challenges

There are several big-picture issues in carbon impact measurement beyond the challenges of setting up reasonably-bounded comparative calculations of changes in emissions. These new challenges introduce some ironic, counterintuitive twists to impact measurement.

THE TESLA EFFECT

Like most other VC investors, we at EIP hope that our investees' solutions become the dominant way to service demand in their technology or industry verticals. Ideally, our investees' technology is so good that all firms serving the market adopt it. In this case, one could say we enabled all of the carbon savings in this vertical. Most of the time, however, this sort of technology leadership inspires at least a few rivals to somehow achieve a solution competitive enough to capture a decent amount of market share.

In the unique realm of climate policy, creating a carbon-saving company or technology that directly begets a rival carbon-saving company is a welcome achievement. The faster we decarbonize each and every economic sector the better we will protect the climate and everything that depends on it. And commercially inspiring rivals to come after our market share is clearly something to be expected.

But can the original technology claim all of the enabled savings that its actions prompted its rivals to go after? In the impact world this is sometimes labeled the "Tesla Effect" in honor of the general perception that Tesla's success was a major factor in prompting nearly all global automakers to shift their long-term production from other fuels to BEVs. If we at EIP relied on the Tesla Effect in our impact accounting, we would attempt to compute whether our technologies are first movers that are inspiring other firms and investors to develop carbon-savings products they would not otherwise have thought to do.

For a variety of reasons, we do not quantify a Tesla Effect in our enabled savings numbers. While we acknowledge that the Tesla Effect is real — indeed, Joseph Schumpeter was onto it long before Tesla was a gleam in Mr. Musk's eye — the degree of causality in each case is too difficult to estimate to warrant inclusion in a numerical carbon impact. We certainly credit Tesla with accelerating the global shift to EVs, but are they responsible for the entire shift? Half of it? Twenty percent? Including the Tesla Effect in a carbon savings calculation also has large risks to bias the assessment in an overly rosy direction due to the uncertainties involved.

Without many assumptions about the dynamics of competition in each industry, the response of policymakers to these innovations, unpredictable influences like shifts in oil prices, learning curve effects, and so on, it is not possible to estimate the Tesla Effect in any one market, much less the many verticals in which we invest. We are certain that the technology leaders amongst our companies will inspire competitors, and that these competitors will also have a positive impact. Consistent with our philosophy of avoiding exaggeration, we measure our impacts only by the market shares and sales of our portfolio companies, not by adding in those of their rivals.

Our exclusion of the Tesla Effect adds an additional layer of context to our earlier discussion of the baseline and system boundary. The baseline used in all our calculations is not ever as simple as it seems. Any baseline implicitly embeds a projection of what the rest of the marketplace, including current and future competing technologies, will do to carbon emissions without our investment. In markets where we think there is a high Tesla Effect, our baseline implicitly reflects this. But we reflect it not in a way where we claim credit for the savings, but rather by assuming that the market is going to trend this way with or without us.

A good example of this occurs in the overall electric power grid. We are not sure exactly which companies deserve the credit for driving down the price of solar and wind energy, but we are quite sure that many competing companies are installing ever-increasing amounts of wind and solar products on the grid. Regardless of who might get credit for having inspired this change, we project that carbon emissions from the grid will decline about 3.4% a year until they hit net zero by 2050 or sooner. In other words, our electric grid baseline reflects the Tesla Effect from many past pioneers who helped move the grid's overall carbon trajectory towards zero.

SELF-ELIMINATION

One of the most curious features of carbon savings impacts is that long-run success will be marked by savings numbers going down, not up. As each subsystem of the global economy becomes less carbon intensive, the added savings from new carbon-savings technologies will be less. This is simply another way of saying that true success in the clean energy transformation is shifting the baseline itself to net zero.

Our position in the climate community regarding carbon savings is analogous to the global effort to completely eradicate deadly diseases such as malaria. The Gates Foundation's admirable campaign has as its goal the complete elimination of this disease. There are still 241 million cases of malaria a year, but over 1.7 billion cases have been prevented, and deaths from malaria have been cut in half since 2000.[13] As this campaign nears its immediate goal, the effort will undoubtedly shift from preventing malaria infections to preventing any resurgence of the disease, bolstering health systems, and other objectives that further public health in emerging economies. In a similar fashion, investors like EIP that invest in climate impact technologies and businesses will have to gradually shift away from eliminating baseline tons to correlate objectives such as replacing first- generation zero-emissions technologies with better second-gen tech that has even lower costs and better environmental and social attributes.

We see this already in our long-term impact estimates for electricity-generating technologies. The industry has already reduced its carbon emissions by almost 50% since its peak in 2007 and we project a relatively steady decline in grid GHG emissions to the point of approximate net zero by mid-century at the latest. According to our 2021 impact analysis, installing 1 gigawatt of new solar capacity on the grid displaces 89 mt of CO2 right now; by 2040 a gigawatt of new panels will displace only 33 mt of CO_2.[14]

However, we clearly want to incentivize and reward investment in solar capacity as much in 2040 as we do today. The answer to this conundrum is that we simply cannot, in the long run, count tons saved as the only measure of success in the clean energy transformation. Enabling systemic change, decarbonizing difficult verticals or geographies, and/or replacing decarbonized technology with better also-decarbonized technology will someday become equally critical KPIs for investors like EIP that strive to lead the transition to a sustainable energy future. However, until we wrestle global carbon emissions down to much lower levels, we will remain focused on overall tonnage reductions as well as long-term systemic change.

IMPACT PATHWAYS AND OUR THEORY OF CHANGE

In our impact reporting we categorize all portfolio companies across impact pathways which explain the impact theory of change for each investment. We further distinguish between portfolio companies that are directly measurable (DM) and those that are foundational (F). Foundational companies are those whose impacts on the carbon transition are not reasonably measurable using the baseline-vs-investment, two-scenario approach. Impact pathways have both DM and F portfolio companies, and are evaluated regularly to ensure we are adapting as our understanding of the clean energy transition evolves. Our portfolio companies fall into one of these nine categories.

One way to describe why the two-scenario approach does not work for F companies is that the two F scenarios require a system boundary that is so large that modeling differences becomes a combination of infeasible and too inaccurate. Unlike a heat pump installed in a known location, with highly predictable savings, F technologies act on a large part of the energy system — an entire utility, regional grid, or industry segment. Modeling that entire large system's differences with and without the F technology over a period of many years is an unrealistic task. This is partly because the effects of the F technology on the trajectory of the clean energy transition comes from a variety of often subtle and indirect, multi-stage developments that are difficult or impossible to predict and quantify. These effects are likely to be interwoven with the results of management decisions, policy shifts, and other exogenous and endogenous factors. Unlike the steady, computable effects of an added heat pump, or even a new way of making decarbonized steel, these effects have unpredictable timing and are often lumpy, all-or nothing changes. In this way, foundational technologies act more like public goods, whose impacts are often called non-rival and non-excludable.[15]

To illustrate these points, consider a cyber protection technology such as Dragos, one of EIP's portfolio companies. Dragos helps prevent a number of threats to the cybersecurity of the power grid. In view of the importance of the grid to the entire community's health, safety, and economic security there is little doubt that grid cybersecurity is a strong social good. However, even from the standpoint of accelerating the clean energy transition we believe that grid cybersecurity firms play a significant foundational role.

FIGURE 5—OUR PORTFOLIO COMPANIES FALL INTO ONE OF THESE NINE IMPACT PATHWAYS

Clean energy generation & storage technologies support expanding electrification, developing clean energy sources and enabling decreased reliance on fossil fuels

Clean energy delivery & infrastructure technologies connect end users to clean technologies, expand clean mobility and support clean infrastructure

Grid integration and optimization firms, which assist with integrating and managing distributed energy resources, and the creation of a digital, multidirectional, fully intelligent grid

Energy efficiency companies aim to reduce the adverse impact of GHG emissions through increased energy efficiency

Efficiency operations firms that increase efficiency and throughput to prevent pushback against a rapid clean transition and accelerate the clean energy transformation by expanding the use of clean electric power

Cybersecurity solutions which are critical to the reliability and safety of electric power systems and national security

Customer engagement companies that improve utilities' communication and interaction with customers, also facilitating greater clean electrification of the economy

Decarbonization measurement tool firms that support utilities and other companies on their decarbonization journeys, ensuring they can measure, analyze and improve their GHG emissions and other ESG KPIs

Decarbonizing food & agriculture companies which reduce carbon in product and agricultural supply chains through manufacturing, logistics, or low carbon technologies

Suppose we imagine a future without Dragos' protection. Many other cybersecurity firms will undoubtedly offer cyber protection to the grid, but if Dragos is uniquely effective there is an increased chance that a hacker will succeed in causing at least one more outage or ransomware attack without it.

We would need a genuine crystal ball to know the probability of this added future attack and its immediate effects on utilities and their customers. Moreover, even that magic knowledge would not capture the cascading or indirect effects of the incident. Policymakers could respond to this attack by acting to increase cybersecurity, indirectly causing changes in the operation of the power grid, or possibly shifting the mix of power sources, such as reducing immediate reliance on all low-carbon sources that use a type of software that has been compromised.

Through channels like these, many parts of the clean energy transition may be shifted by this cyberattack. While some of these changes may ultimately be helpful, our primary concern is that these shifts will slow rather than accelerate progress. It is precisely for this reason that we believe that investing in cyber protection has a positive — though not carbon-quantifiable — impact. We believe that the best route to net zero is one in which cyber protection is never a reason to delay any of the technology or business changes needed to reach net zero carbon as soon as possible.

Reasoning of this nature extends to each of the other types of foundational companies, shown in Figure 5. Grid integration and optimization is an infrastructure service that benefits all resources on the grid, especially distributed and flexible resources that are almost always carbon-negative. Electrification-enabling technologies are a different sort of infrastructure that allows companies to shift away from fossil fuels. Companies that increase operating efficiency lower the cost of electricity service, also facilitating the substitution of electricity for fossil fuels. Customer engagement investments enable customers to interact more effectively with the electricity grid; this in turn facilitates the deployment of distributed, end-use solutions. Decarbonization measurement tools help companies monitor their progress towards net zero. All of these types of companies play a supporting role in the clean energy transition that is not properly analyzed by trying to estimate tons of emissions reduction.

MAKING AND MEASURING FOUNDATIONAL INVESTMENTS

As an investment firm focused on innovations and technologies that positively impact the transformation of critical industries towards a decarbonized, more energy-efficient future, we could opt to eschew all foundational investments and never invest in a company whose impacts cannot be directly measured in tons of carbon saved. Whether this advances the clean energy transition faster than including such investments depends on your theory of change for this sector. If you believe that technologies that physically decarbonize industrial and commercial activities, which tend to be directly measurable, are the only investments needed for the clean energy transition then you would not be interested in foundational investments. We and many of our partners do not believe this to be true.

The full transition to clean energy is not merely a question of inventing and replacing technologies at the edge of the network — although there is an awful lot of this to do. The transition includes changing and expanding organizational structures, business processes, pricing approaches, customer engagement, and other dimensions of the entire power sector. Because this essential sector must maintain high reliability, resilience, and financial stability, technological improvements always go hand-in-hand with changes in rules, standards, and operational practices.[16]

All these factors tell us that foundational investments should be considered alongside those that are directly measurable. And while the nature of their impacts prevents us from computing saved tons, we should work to ensure that we are doing the best we can to maximize their impacts.

HOW WE MEASURE & REPORT FOUNDATIONAL IMPACTS

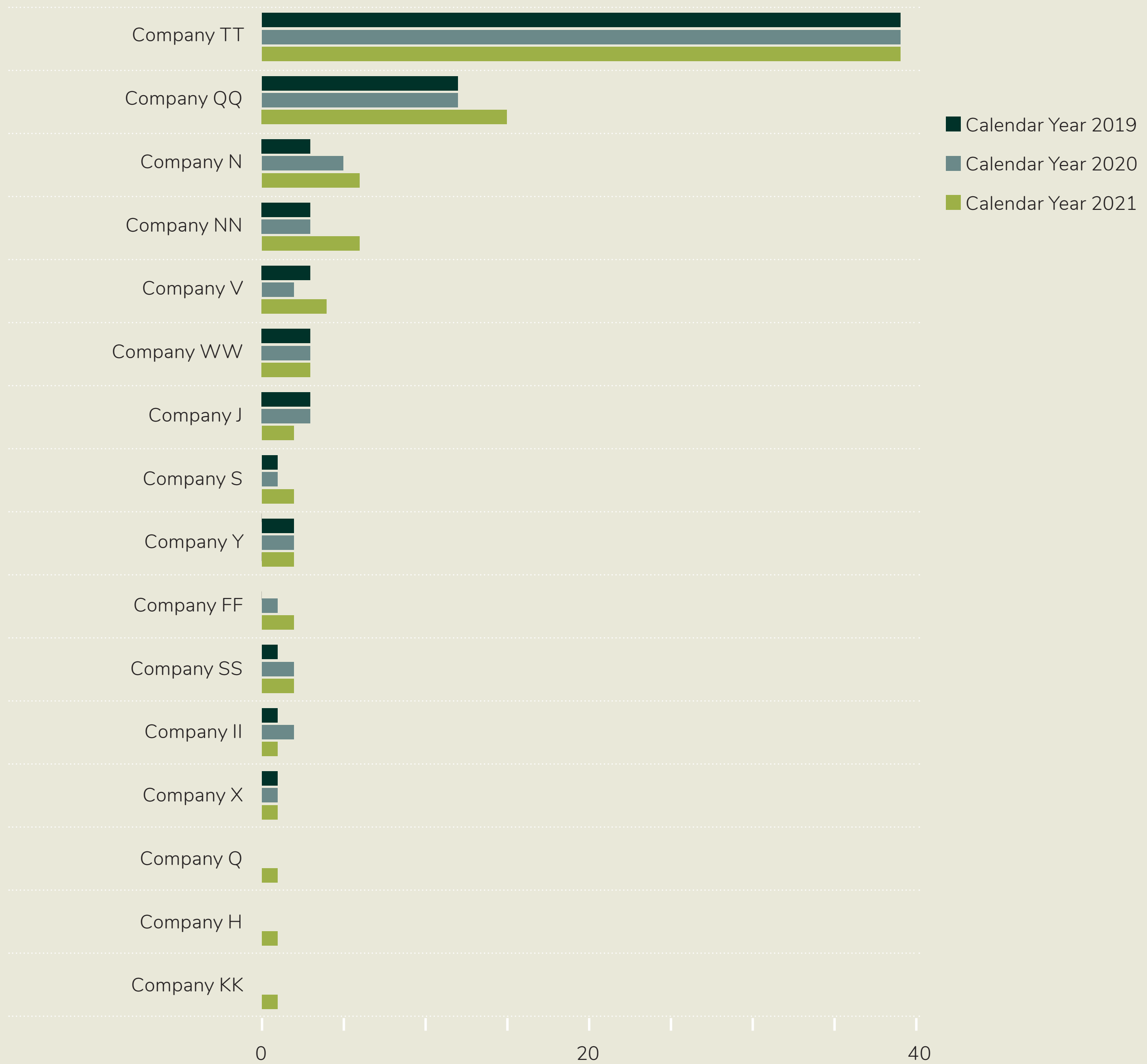
This leads us to approach impact measurement for these technologies in three steps. First, understand the exact foundational role this kind of technology plays in the clean energy transition and how this investment will affect the totality of the industry over time, not just its immediate surrounding. This is what led us to establish the aforementioned impact pathways.

The second step in our F impact measurement is to establish KPIs for the investment based on our understanding of its overall effects. These KPIs can be similar across many firms or specific to one kind of F company, and we are working on an ongoing basis with our F portfolio companies to test and refine impact KPIs.

The third and final step is to report KPIs and work with our portfolio companies to improve them. Each of our public annual reports shows impact KPIs for all F companies, and each year we try to improve the quality and depth of this reporting.

For example, the figure below displays data on the customer impact KPIs from a sample of portfolio companies that sell directly to utilities and other customers who are within EIP's strategic investor coalition. Tracking customer expansion within the EIP coalition across all reporting portfolio companies shows a 24% increase in customers from 2020 to 2021, and a total 40% increase since 2019. Of the 16 companies reporting, all but two reported increased sales into EIP's coalition, with a high of 39 coalition partners for Company TT.

FIGURE 6—EIP COALITION CUSTOMERS FOR FOUNDATIONAL COMPANIES 2019-2021



Conclusion

Climate change presents one of the greatest looming threats to worldwide health and economic progress as well as a once-in-a-lifetime opportunity to innovate and invest in low-carbon solutions. Though some of the benefits of carbon reduction are likely reflected in financial returns, financial information alone is not an adequate measure of an independent, parallel objective of reducing carbon. We and our investors with the objective of making investments that reduce carbon emissions use our carbon impact reporting to measure our performance against this objective.

Our performance measurement efforts have led us to the approach described in this white paper:

We divide our technologies between Directly Measurable and Foundational based on whether the nature of the technology allows for relatively certain carbon calculations in a two-scenario framework. We do not claim additionality for our enabled savings, but rather create a savings measure designed to benchmark us against other investment options;

We believe it is not appropriate to allocate **jointly-created carbon savings** among all segments of the value chain, but it is appropriate and important to allocate within each value chain segment in proportion to each segment members' contribution to enabled savings;

We invest in foundational technologies because they contribute to the infrastructure and organizational changes needed for the clean energy transition in important ways that are not best measured through carbon ton estimates. Instead, we consider the specific role each foundational technology plays and design KPIs to measure effectiveness in this role.

Our measurement philosophy is conservative and focused on providing meaningful analysis for investors with impact objectives rather than trying to report the largest impacts possible.

Although carbon emissions and savings have been measured at least since the early 1900s, measuring savings for the purpose of guiding fund investors with impact objectives is a very new undertaking. We will continue to search for improvements in our measurement methods and collaborate within Project Frame and other initiatives to improve and standardize impact reporting. We look forward to engaging with all of our stakeholders towards better carbon reporting and climate progress.

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About Energy Impact Partners

Energy Impact Partners (EIP) is a global venture capital firm leading the transition to a sustainable future. EIP brings together entrepreneurs and many of the world's most forward-looking energy and industrial companies to advance innovation. With over $3 billion in assets under management, EIP invests globally across venture, growth, credit, and infrastructure—and has a team of over 80 professionals in offices in New York, San Francisco, Palm Beach, Washington DC, London, Cologne and Oslo. For more information about Energy Impact Partners, please visit **www.energyimpactpartners.com**

Endnotes

1 For example, see K. Pucker and A. King, **ESG Investing Isn't Designed to Save the Planet**, *Harvard Business Review*, August 2022 and Hugh Whelan, **In Defense of ESG: A Response to the Economist**, Responsible Investor, 8.8.22.

2 This concept is also discussed in M. McCreless, "Towards the Efficient Impact Frontier," Stanford Social Innovation Review, Winter 2017.

3 There are many steps that we, as an industry, can take to standardize and improve carbon savings estimates. We are pleased to be working with the **Project Frame** coalition towards this goal, and we are making good progress together. Nonetheless, the outcome of this Project is not expected to yield a magic metric that will somehow solve all of the challenges of carbon savings assessment in one fell swoop, rather it is an opportunity for our community to coalesce along guidelines and best practices to estimate and articulate the emissions impact of our investments.

4 Similar to other applications, the TAM is the total sum of the carbon emissions that can be saved by the adoption of an innovation, the SAM is the portion of carbon emissions that can be reduced based on business model, geography, etc., of the innovation, and the SOM is the carbon savings that one particular firm/product/solution is expected to saved based on its projected market share. In simplified terms, the TAM is the size of the pizza pie, the SAM is the slice served and the SOM is the portion of the slice consumed.

5 Emissions from any part of the value chain left inside the system boundary and that are unaffected in the two scenarios cancel out when total emissions from the two scenarios are subtracted from one another. As a result, it isn't a problem if more of the value chain is left inside the system boundary than is absolutely necessary.

6 There are a growing number of definitions of additionality, extending its concept beyond the original meaning centered on public intervention to do something the private market would not otherwise do. As an example of this original meaning, The Impact Management Project's (IMP's) full definition of additionality is: *The extent to which desirable outcomes would have occurred without public intervention (the 'counterfactual'). There are different forms of additionality, namely: i) Input additionality — the extent to which intervention supplements or substitutes for inputs provided by other means, e.g., the market, or by other actors, e.g., firms' own resources. ii) Output additionality — the proportion of outputs that would not have been created without public intervention. iii) Behavioural additionality — the difference in behaviour of a target population from public intervention. The concept of behavioural additionality emphasises that programmes have wider and more sustained effects than those that are most obvious to measure and that persistence of effects is of high value. Behavioural additionality concerns itself less with inputs and outputs and more with sustained changes in the behaviour of target groups, induced by contact with any stage of a programme or policy.* For additional discussion, see **A. Gustafsson's short post** and the forthcoming **Project Frame** white paper.

7 An important corollary to this distinction is that private markets are not a substitute for sound public policies that enable markets and public enterprises (such as cities) to mitigate and adapt to climate impacts.

8 This metric will be useful for comparative purposes only if the quality and transparency of enabled savings estimates are comparable across all funds vying for fund investors' money. In addition to leading by example by providing the industry's highest level of transparency in our impact reporting, we are also strong supporters of efforts to make reporting more consistent and transparent, including Project Frame, NZVCA, PRI, TCFD, and the ESG Data Convergence Initiative.

9 R. Barker and R. Eccles, "Comments Letter in Response to the Consultation Paper on Sustainability Reporting," IFRS Foundation, December 2020.

10 To those who are upset by the possibility of double-counting, consider that carbon footprint accounting also intentionally built in overcounting in its conceptualization of Scopes, i.e. my scope 3 footprint is somebody else's Scope 2 footprint and someone else's Scope 1. See A. Luers, et al., "Make Greenhouse Gas Accounting Reliable — Build Interoperable Systems," Nature 28, July 2022, p. 653.

11 Those familiar with Kirchhoff's laws will recognize this as analogous to measuring current in an electrical circuit. In a series circuit all components are essential to carry all of the current. In a parallel circuit, parallel components all carry a share of the total current proportionate to their impedance.

12 Life cycle analysis (LCAs) is another way of measuring impacts. LCAs typically include the entire production chain creating a complete picture. However, LCAs do not change the need for baselines, system boundaries, or allocation of impacts and are therefore not a "silver bullet" for the issues in this paper.

13 Bill & Melinda Gates Foundation, **Malaria At a Glance**.

14 Our analysis uses grid carbon intensity factors of 1225 lbs. and 454 lbs. CO_2e/MWh in 2023 and 2040, respectively and this calculation assumes a 16% solar capacity factor.

15 For more explanation of public goods and their attributes, see **https://www.investopedia.com/terms/r/rival_good.asp**.

16 This thesis is discussed in more detail in *Smart Power and Power After Carbon* (P. Fox-Penner, Island Press 2015 and Harvard University Press 2020).

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