ENERGY IMPACT PARTNERS

2022 Impact & ESG Report Technical Appendix

Part One: Carbon Impact Measurements for Directly-Measurable Companies

Directly-measurable carbon savings are estimated using best practices for carbon accounting and energy analysis. These estimates are gross savings from the material changes enabled by our portfolio companies compared to business-as-usual. Impact estimates do not include emissions from operations or facilities where there is not a known material difference compared to industry norms. In cases where the inputs needed to achieve these savings have material effects, we include emissions from these inputs in order to fairly assess each company's net contribution to energy and carbon benefits.

Many of our portfolio companies have developed technologies that reduce consumption of electricity, in which case we estimate the electricity savings multiplied by grid emission factors provided by EPA's current eGRID database (eGRID 2022). Other companies enable savings of gasoline and other fossil fuels, which reduce combustion emissions applied from the EPA's emission factor database (EPA 2022).

This appendix includes general references that are useful for multiple companies, with specific methodologies described for each company.

General References

1) EIA [United States Department of Energy, Energy Information Agency (EIA). 2021. "Electric Sales, Revenue, and Average Price"]
2) EPA eGRID [United States Environmental Protection Agency (EPA). 2022. "Emissions & Generation Resource Integrated Database (eGRID), 2020"]
3) EPA GHG Emission Factors [United States Environmental Protection Agency (EPA). 2022. "GHG Emission Factors Hub, 2022" Washington, DC]
4) GHG Protocol [Greenhouse Gas (GHG) Protocol, World Resources Institute (WRI)]
5) GRI [Global Reporting Initiative]
6) IPCC AR6 [Intergovernmental Panel on Climate Change (IPCC). Sixth Assessment Report.]
7) NREL Solar Output by State [National Renewable Energy Laboratory (NREL). 2016. "Solar Photovoltaic Technical Potential in the United States: A Detailed Assessment"]
8)SASB [Sustainable Accounting Standards Board]
9) WattTime [WattTime. "Marginal Emission Factors for the U.S. Electricity System"]

Assumptions for Company-specific Annual Carbon Savings

Carbon savings are measured using company activity data that includes sensitive and proprietary information. We have access to this data for our carbon calculations but have agreed to not disclose non-public confidential information. Our descriptions below refer to this data in general terms, as well as the methodology, references, and results of our calculations.

AddEnergie

AddEnergie is a North American electric vehicle charging network operator and a provider of smart charging software and equipment. In conjunction with its subsidiary FLO, AddEnergie enables more than half a million charging events every month, thanks to over 60,000 high-quality EV charging stations deployed at public, commercial and residential installations.

Carbon savings for AddEnergie were determined by comparing the company's EV charging to the baseline of avoided internal combustion engine (ICE) vehicle travel. The company provided data for charging station energy transferred by Canadian province and U.S. state, which is assumed to yield 3.5 miles of EV travel per kilowatt-hour (kWh) and associated emissions from charging using grid emissions intensities from Environment and Climate Change Canada, "Fuel LCA Model" (2022). The avoided baseline of ICE cars is assumed to consume gasoline at an average rate of 24.4 mile per gallon (mpg) from the U.S. Federal Highway Administration that emits 8.8 kg CO_2e per gallon. Net avoided emissions for 2021 were estimated to be 93,000 metric tons of CO_2e, the equivalent of taking 20,000 cars off the road for a year.

Aeroseal

Aeroseal provides air sealing technology for heating, ventilation, and air conditioning (HVAC) ducts and building envelopes, installed through a network of partners for residential and commercial buildings.

Carbon savings for Aeroseal were determined by comparing building energy savings after Aeroseal treatment to the baseline building energy consumption. This comparative analysis is done at a project-level using measured leak rates before and after air sealing, and additional performance data has been compiled from multiple studies by the U.S. Department of Energy (DOE), EPA Energy Star, Energy Information Agency, and Lawrence Berkeley National Laboratory. Avoided emissions for 2021 were estimated to be 340,000 metric tons of CO_2e, the equivalent of taking 74,000 cars off the road for a year.

Arcadia

Arcadia provides renewable energy attributes directly to retail utility customers in 50 states by purchasing renewable energy certificates (RECs) matched to the electricity use of each customer.

The company also offers shares in physical community solar projects. Under carbon accounting rules the purchase of RECs on a short-term basis does not meet the test of additionality. To adhere to these rules, we measure carbon savings from renewable energy displacing grid power only from the community solar projects, which are clearly additional.

Carbon savings for the community solar projects subscribed by Arcadia were determined by evaluating all projects subscribed by Arcadia in each state. Output of projects installed throughout 2021 was measured on a partial-year basis, with full-year operation for 2022 and onwards. For each project, Arcadia estimated the actual clean energy output of each kW of installed capacity, with a result of 175,000 MWh of clean energy generated in 2021 (enough to power 16,000 households). This clean energy is assumed to displace non-baseload grid energy, including assumed net transmission and distribution grid losses of 5%. Using eGRID emission factors for each project location, the resulting avoided emissions are 104,000 metric tons of CO_2e, equivalent to planting 1.7 million tree saplings that grow for 10 years.

Cimcon

Cimcon provides smart city solutions including street lighting management that provides intelligent controls such as adaptive dimming. Carbon savings result through energy efficiency from dimming as well as from fuel savings due to reduced maintenance "truck rolls."

Carbon savings for Cimcon were calculated by analyzing the energy consumption of the baseline of fully-on LED streetlights compared to Cimcon's adaptive dimming, with 50-60% dim rates for 5 hours nightly according to company sources. Cimcon saves 20% of the energy of already-efficient 45-55W LED fixtures, which equates to 34,000 MWh of energy savings. In addition, maintenance alerts cut truck rolls by 2/3 compared to traditional streetlights. Compared to typical urban utility truck rolls with rates, distances, and fleet data sourced from Cimcon and Utilimarc, Cimcon saves 60,000 gallons of fuel annually. Electricity and fuel savings yield a total of 21,000 metric tons of avoided CO_2e emissions in 2021. Note that due to its recent acquisition by Quantela, updated information was not provided by the company, so these estimates are based on the prior year's activity, conservatively assuming no growth.

Derive

Derive creates solutions to optimize vehicle performance, fuel efficiency, and safety.

Carbon savings for Derive were estimated across Derive's active fleet customers. Customer case studies and third-party testing show 6-10% improved fuel efficiency; 6% savings was used as a conservative value. Baseline mileage assumptions include 15 miles per gallon (mpg) for fleet vehicles, which include vans, light trucks, and passenger cars, traveling an average of 18,000 miles per year. Total savings for 2021 are estimated to be 4.5 million gallons of fuel and 39,000 metric tons of CO_2e.

Ecobee

Ecobee sells Wi-Fi enabled smart thermostats that save energy for heating and cooling. By automatically adjusting thermostat set-points, heating and cooling systems run for less time, directly saving on consumption of electricity, natural gas, and other fuels.

Carbon savings for Ecobee were determined using actual company data on reduced runtime of heating and cooling systems for each location, based on company studies. The runtime savings were applied to the energy consumption rate of typical heating and cooling systems, including efficiency losses. For emissions calculations purposes, heating systems are assumed to use natural gas, although in some regions, fuel oil, electricity, and other energy sources are used. This is likely to be a conservative assumption, as fuel oil emits more carbon per unit of heat than gas, and is the predominant alternative to gas heat in most of the U.S. Cooling systems use electricity for typical air conditioners. To convert energy savings to carbon emissions avoided, EPA and eGRID emission factors for each state are applied based on the location of Ecobee customers. The energy savings for 2021 are 2.2 million MWh of electricity (enough to power 205,000 U.S. households for a year), and for fuels such as natural gas, equivalent to the energy in 196 million gallons of gasoline.

Enchanted Rock

Enchanted Rock provides onsite backup power and distributed energy generation for commercial customers, primarily through natural gas-powered generators. These generators save carbon by displacing dirtier diesel gensets, as well as by selling cleaner energy back to the grid during peak periods, which often produce higher emissions.

Carbon savings for Enchanted Rock were calculated by evaluating periods of both backup power and distributed energy generation. During 2021, Enchanted Rock units generated natural gas-powered backup power in place of diesel generators. These diesel generators typically require routine testing under load, resulting in additional emissions to be avoided by Enchanted Rock. Using heat rate (Btu/kWh) data from the U.S. EIA as well as emission factors from the EPA, avoided emissions of nitrogen oxides (NOx) and CO_2e were calculated.

Distributed energy generation provided greater savings, since Enchanted Rock's systems run more often in this mode. This energy generation was compared to eGRID non-baseload emission factors for Texas (ERCOT) and MISO, the location of Enchanted Rock's customers, again using factors from the EIA and EPA. Total carbon emissions were reduced by 730 metric tons, as well as 8 metric tons of avoided NOx emissions.

EV.Energy

ev.energy is a global provider of electric vehicle (EV) charging software. The software platform wirelessly connects to a range of electric vehicles and L2 chargers and intelligently manages EV charging in line with utility and network signals while keeping customers engaged and rewarded through a mobile app.

Carbon savings for ev.energy were determined by comparing the company's EV charging to the baseline of avoided internal combustion engine (ICE) vehicle travel. The company provided data for charging station energy transferred, which is assumed to yield 3.5 miles of EV travel per kilowatt-hour (kWh) and associated emissions from charging using an average grid emissions intensity for the UK, US, Europe, and Australia. The avoided baseline of ICE cars is assumed to consume gasoline at an average rate of 24.4 mile per gallon (mpg) from the U.S. Federal Highway Administration. As part of the company's enabled carbon savings, ev.energy shifts charging to cleaner grid periods instead of the time of connection, which may be a period with a higher emissions rate, resulting in incremental carbon savings from smart charging calculated directly within ev.energy's carbon-aware platform. Net avoided emissions for 2021 were estimated to be 18,000 metric tons of CO_2e, the equivalent of taking 4,000 cars off the road for a year.

EVmo
EVmo is a technology-enabled fleet management and rental company, connecting gig drivers with electric, hybrid and delivery vehicles.

Carbon savings for EVmo were determined by comparing the fuel and energy consumption of the company's efficient fleet to the baseline fleet of average U.S cars. The company provided fleet data including vehicle model and time of service, with an average annual distance traveled of 16,400 miles. For each vehicle, fuel economy was sourced from the U.S.
Department of Energy (www.fueleconomy.gov) compared to the avoided baseline of gasoline consumption at an average rate of 24.4 mile per gallon (mpg) from the U.S. Federal Highway Administration Avoided emissions for 2021 were estimated to be 1,100 metric tons of CO_2e, the equivalent of taking 247 cars off the road for a year.

HopSkipDrive
HopSkipDrive is a youth transportation solution for schools, districts, government agencies and families. HopSkipDrive operates in 16 major markets across nine states and Washington D.C., and has contracts with 300+ school districts and county government agencies.

Carbon savings for HopSkipDrive were determined by comparing the fuel and energy consumption of the company's efficient fleet to the baseline fleet of average U.S cars. The company provided fleet data including the mix of vehicle type, distance traveled, completed trips, and completed rides. For each vehicle, fuel economy was sourced from the U.S. Department of Energy (www.fueleconomy.gov) compared to the avoided baseline of gasoline consumption at an average rate of 24.4 mile per gallon (mpg) from the U.S. Federal Highway Administration Avoided emissions for 2021 were estimated to be 160 metric tons of CO_2e, the equivalent of taking 34 cars off the road for a year.

Manus Bio
Manus Bio uses biotechnology to produce complex natural products used as flavors, fragrances, food ingredients, cosmetics, vitamins, pharmaceuticals and agricultural chemicals. Carbon savings for ManusBio were determined by comparing the company's citrus oil produced through biotechnology powered by carbon-free nuclear energy to the baseline of traditional citrus oil extracted from citrus peels. Avoided impacts are estimated using company data together with published LCA data (including Teigiserova (2021), "*Circular bioeconomy: Life cycle assessment of scaled-up cascading production from orange peel waste under current and future electricity mixes*"). Avoided emissions for 2021 were estimated to be 2,800 metric tons of CO_2e, the equivalent of taking 590 cars off the road for a year.

Mosaic
Mosaic offers financing for solar energy systems, enabling home improvement and solar companies to install more solar projects for homeowners. These solar power systems reduce carbon emissions by providing clean energy in place of grid power that is still dominated by fossil fuel-based generation. While Mosaic is one of many players in the supply chain, financing is a critical requirement of solar project development.

Carbon savings for the solar projects financed by Mosaic were determined by evaluating all projects financed by Mosaic by location. To calculate clean power production, projects installed during 2021 were prorated by date of installation. For each location, solar output factors were applied to estimate the actual clean energy output of each kW of installed capacity, with a result of 1.6 million MWh of clean energy generated (enough to power 145,000 households). This clean energy is assumed to displace non-baseload grid energy, while also avoiding transmission loss of approximately 5%. Using eGRID emission factors for each project location, the resulting avoided emissions total 870,000 metric tons of CO_2e, the equivalent of planting 14.4 million tree saplings that grow for 10 years.

Opus One
Opus One's GridOS Platform offers electric distribution utilities tools to optimize energy planning, operations, and market management. Opus One's technology enables many benefits for utilities, including reduced power grid losses.

Carbon savings were estimated on the basis of a study by the Bloom Centre for Sustainability ("Environmental Benefits Initial Report for Opus One Solutions' GridOS" 2017), which quantified potential environmental benefits. For 2021, Opus One served feeders in multiple locations with an average 10-MW peak load per feeder, with an assumed 50% load factor over the year. Based on the Bloom study, we assumed that energy savings averaged 1.5% from improved voltage management and power factor correction. This resulted in 63,000 MWh in energy savings for 2021, with carbon savings of 13,000 metric tons of CO_2e using location-specific emission factors.

Palmetto
Palmetto provides services to support the deployment of residential solar power systems. These solar power systems reduce carbon emissions by providing clean energy in place of grid power.

Carbon savings for Palmetto's solar projects were evaluated on a state-by-state basis for all projects completed. Output of projects installed prior to 2021 were fully counted for 2021, whereas projects installed during 2021 were prorated by month of installation. For each state, solar capacity factors were applied to estimate the actual clean energy output of each kW of installed capacity, with a result of 66,000 MWh of clean energy generated (enough to power 6,000 households). This clean energy is assumed to displace non-baseload grid energy, while also avoiding transmission losses of approximately 5%. Using eGRID emission factors for each project location, the resulting avoided emissions are 39,000 metric tons of CO_2e, equivalent to planting 650,000 tree saplings that grow for 10 years.

Powin

Powin designs and manufactures battery energy storage solutions. Carbon savings for Powin were determined by comparing to the baseline applications without Powin's energy storage technology. Based on installed storage capacity of 4,532 MWh, 1,284,795 hours of runtime, and 97.6% average fleetwide uptime availability, the company's technical staff estimate avoided emissions for 2021 to be 23,948 metric tons of CO_2e, the equivalent of taking 428 cars off the road for a year. This estimated savings was provided by the company using proprietary methodology that is not fully documented due to staff changes at the company.

Project Canary

Project Canary is a data analytics and environmental assessment company focused on methane emissions measurement and reduction, freshwater use, and community impacts for energy-intensive industries. Project Canary scores responsible operations, delivering independent emission profiles via high-fidelity continuous monitoring technology to provide actionable environmental performance data. The company's sensor portfolio includes high-fidelity spectroscopy-based methane detection and emissions quantification for the oil and gas sectors, plus laser-based gas analyzers covering other emissions.

Carbon savings for Project Canary were determined by comparing Canary-certified natural gas that has reduced methane emissions versus baseline average onshore natural gas production. The company provided data for volumes of certified gas in 2021, and an average methane leak rate of 0.28% compared to the U.S. onshore production average methane leak rate of 0.454% (National Energy Technology Laboratory, "Industry Partnerships & Their Role in Reducing natural Gas Supply Chain Greenhouse Gas Emissions"). Avoided methane emissions are converted to CO_2 equivalents using a 100-year global warming potential (GWP) factor of 25, which is a conservative value used by the EPA. Avoided emissions for 2021 were estimated to be 1,900,000 metric tons of CO_2e, the equivalent of taking 400,000 cars off the road for a year.

Sense

Sense provides tools for customers to track energy use and identify opportunities for energy savings. Based on a study done for Alliant Energy, this technology is assumed to reduce carbon emissions by saving an estimated 6% of energy usage, therefore reducing marginal grid power and emissions.

Carbon savings for Sense were estimated by analyzing all Sense devices by state or province of installation. For each location, average household energy consumption was collected (EIA 2021) and factored by the number of sense devices in each location. Savings were then calculated for each location using an average savings rate of 6%, determined from the pilot study described above. Energy savings for 2021 are estimated at 50,000 MWh, enough to power 4,500 households for a year. For each location carbon emission factors from eGRID were applied to calculate a carbon savings of 17,000 metric tons of CO_2e.

SmartRent

SmartRent is an enterprise smart home automation company developing software and hardware that empower property owners, managers, and homebuilders to effectively manage, protect, and automate daily operational processes.

Carbon savings were measured for the deployment of smart thermostats across SmartRent's portfolio. Baseline energy consumption for an average 900-square-foot apartment was estimated for each thermostat location (EIA Electric), with associated carbon emissions using EPA emission factors. Smart thermostat energy savings were assumed to be 10%, based on DOE estimates (www.energy.gov/energysaver/thermostats). Total energy savings for 2021 are estimated to be 55,000 MWh, 5.5 million gallons of gasoline equivalent (primarily in the form of natural gas for heating), with a net carbon savings of 68,000 metric tons of CO_2e. Note that due to its recent public listing, updated information was not provided by the company, so these estimates are based on the prior year's activity, conservatively assuming no growth.

Sparkfund

Sparkfund provides energy services to commercial customers. These services include energy efficiency projects — such as lighting, heating and cooling, and other projects — that reduce carbon emissions through avoided energy consumption.

Every Sparkfund project develops its own bespoke annual and lifetime energy savings estimate. Total energy savings, in kWh, were applied, along with non-baseload emission factors from the EPA eGRID database for each project location to determine estimated carbon savings.

Urbint

Urbint offers AI solutions for utilities, including gas distribution system safety and risk management. One of these solutions includes damage prevention technologies that reduce GHG emissions by decreasing damages to distribution lines and the resulting associated leaks. Since natural gas is primarily methane, which has many times the global warming potential (GWP) per ton compared to CO_2, avoided leaks have a more significant benefit to GHG reduction. The estimation of GWP is a complex scientific exercise considering direct and indirect effects, radiative efficiency, and lifetime, and for methane the values range from 25 (EPA) to 28 (IPCC AR5+) to 36 (IPCC AR5+ w/ climate-carbon feedback and oxidation) over a 100-year period, or even higher GWP – 72 to 87 from the same sources – over a 20-year period. For Urbint, a central GWP value of 28 was used to convert methane reductions into CO_2 equivalents.

Carbon savings from the application of Urbint's technologies were estimated through damage prevention rates reported from users of Urbint's solutions, compared to historical rates, with an average reduction of 15% of damages from a 1% intervention rate (Urbint). For each avoided damage incident, the average avoided emissions were 22 metric tons of CO_2e, based on an analysis of leaks published by the EPA (“Inventory of U.S. Greenhouse Gas Emissions and Sinks,” Chapter 3 Annex 36, 2021) and California Air Resources Board (“Analysis of the Utilities' June 16, 2017, Natural Gas Leak and Emission Reports”). In addition to damage prevention, Urbint estimates avoided leaks from their asset integrity product, Optimain. The company prioritizes pipeline replacement, avoided leaks based on rates estimated by the EIA. Total avoided emissions enabled are estimated at 340,000 metric tons of CO_2e.

ViriCiti

ViriCiti provides monitoring solutions for commercial electric bus and truck fleets. These services include smart charging, vehicle monitoring, smart driving, and maintenance status monitoring. The company enables carbon reductions by extending electric vehicle range and improving driving efficiency.

Carbon savings for ViriCiti were calculated using company-provided data for 2021, including distance travelled in each city for both electric and diesel vehicles. Electric vehicle travel was assumed to displace diesel vehicle travel, and ViriCiti was credited for a 40% increase in range (based on company studies). The diesel baseline was assessed at an average fuel efficiency of 5.3 mpg (NREL 2018) with a diesel emission factor of 10.21 kg CO_2e per gallon (EPA 2022). By comparison, the electric vehicles have zero tailpipe emissions but do require grid energy for charging. Electric vehicle energy consumption was calculated using an average efficiency rate of 1.5 kWh per km (NREL 2018). For each fleet location, local grid emission factors (EU JRC, US eGRID) were applied to determine the carbon footprint of the charging energy for electric vehicles. The overall net benefits include fuel savings of 4.6 million gallons, with carbon savings of 21,000 metric tons of CO_2e (which represents the net savings including the grid emissions for battery charging).

Volta

Volta delivers free electric charging stations to property owners and free power to electric vehicle drivers with advertising-supported services. The company enables carbon reductions by providing charging services across a network of stations.

Carbon savings for Volta were calculated using company provided data for 2021 distance traveled for electric cars in the U.S. Electric vehicle travel was assumed to displace gasoline vehicle travel. The gasoline baseline was assessed at an average fuel efficiency of 24.4 mpg (US FHA) with a gasoline emission factor of 8.8 kg CO_2e per gallon (US EPA). By comparison, electric vehicles have zero tail pipe emissions but do require grid energy for charging. Electric vehicle energy consumption was calculated using an average efficiency rate of 0.3 kWh per mile (per Volta). Average U.S. grid emission factors (EPA eGRID) were applied to determine the carbon footprint of the charging energy for electric vehicles. The overall net benefits include fuel savings of 1.5 million gallons, with carbon savings of 10,500 metric tons of CO_2e (which represents the net savings including the grid emissions for battery charging).

Zolar

Zolar offers easy access to solar energy for residential customers to lease or buy solar PV systems with online tools for planning, advice, and installation services.

Carbon savings for Zolar's solar projects were evaluated by location for all projects completed. Output of projects installed prior to 2021 were fully counted for 2021, whereas projects installed during 2021 were prorated by date of installation. For each location, solar capacity factors were applied to estimate the actual clean energy output of each kW of installed capacity, with a result of 11,500 MWh of clean energy generated (enough to power 1,100 households). This clean energy is assumed to displace non-baseload grid energy, while also avoiding transmission losses of approximately 5%. Using emission factors for each project location, the resulting avoided emissions are 4,500 metric tons of CO_2e, equivalent to planting 75,000 tree saplings that grow for 10 years.

Lifetime Savings

All of the companies in our portfolio sell products that, once installed, reduce environmental impacts throughout their installed and operating lifespan. Accordingly, for carbon savings only, we have computed the emissions savings we help enable over the life of the installed measures. In calculating lifetime savings, we have assumed that grid carbon intensity declines linearly from current levels to zero by 2050. The assumed life span of each company's primary technology is shown in the table below:

Companies	Lifespan
AddENERGIE	10
Aeroseal	30
Arcadia	30
Cimcon	20
Derive	7
Ecobee	15
Enchanted Rock	20
EV.Energy	5
EVMo	10
HopSkip	5
Manus Bio	10
Mosaic	30
Opus One	10
Palmetto	30
Powin	5
Project Canary	5
Sense	10
SmartRent	10
Sparkfund	10
Urbint	5
Viriciti	10
Volta	10
Zolar	30

Part Two: Carbon Impact Measurements for Frontier DM Companies

Boston Metal Carbon Savings Projection

Baseline: Blast Furnace/Basic Oxygen Furnace

Boston Metal makes steel from iron ore and electricity via molten oxide electrolysis ("MOE.") The baseline is current steelmaking, which is approximately two-thirds from the Blast Furnace/Basic Oxygen Furnace ("BF/BOF") or integrated steelmaking method. The remaining one third is primarily electric arc furnace ("EAF".)[i] Under the IEA's 2050 BAU scenario BF/BOF steel is 50% of production. Furthermore, it is unlikely that MOE would displace EAFs, which are already electric – at least for the foreseeable future.

Boston Metal has assembled a wide variety of sources on the current carbon intensity of steelmaking and these sources agree with the World Steel Association ("WSA") which reports 1.85MT CO_2/MT steel.[ii] This number is a conservative estimate because the average includes EAF steel which has a CO_2 intensity that will decline as the grid decarbonizes. In addition, the WSA average CO_2 intensity and steel manufacturing company POSCO's steel's data show that average industry CO_2 intensity has flattened out in the last five years, so we assumed a static baseline over time.

Carbon Savings Measurement

Both MOE and BF-BOF steel use approximately the same iron ore input, resulting in similar embodied energy inputs between the two processes. MOE does not use coking coal, but the baseline BF/BOF does, so CO_2 emitted by coking coal is included in the baseline. Therefore, the difference in emissions between the two processes is in the energy needed for MOE and the emissions associated with the BF-BOF process.

Boston Metal provided data that shows the current and future MOE steel energy requirements, as we expect the energy to decline over time. To complete the carbon savings calculation, we estimated:

a) the amount of BM MOE steel expected to be sold in each region of the world (l) in each year (t) up to 2031, or MOE(l,t)
b) the average emissions intensity of the grid in each region and year in MT per kWh, or EI(l,t)

The formula for savings in any one region l and year t is:
Savings (l,t) (MT CO_2e) = MOE MT(l,t) summed over regions and years 2022-31 results in carbon savings of 17 million MT CO_2e.

Electric Hydrogen

Baseline: Steam Methane Reformers

This impact calculation compares Scope 1 and 2 carbon emissions differences between Electric Hydrogen and baseline H_2 production technology. Scope 3 emissions differences are unlikely to be material (or for many Scope 3 categories, nonexistent), with the possible exception of energy for manufacturing capital goods for Electric Hydrogen and baseline technologies.

Electric Hydrogen's electrolyzers make hydrogen from electricity; they are designed specifically to make 100% green hydrogen from 100% wind or solar energy, operating intermittently (unfirmed) and therefore generally at a low overall capacity factor.

Hydrogen can be used in many applications to replace fossil fuels. Electric Hydrogen estimates that, in the next ten years, its initial addressable market will be the replacement of hydrogen produced by steam methane reformers ("SMR"). SMR is the predominant method for making hydrogen today for industrial uses, including the two largest use cases, ammonia production and oil refining.

We choose SMR H_2 production as the baseline technology. H_2 produced by the Electric Hydrogen process and SMR is identical and used identically in all further processing. Therefore, the only differences in emissions involve the production of the H_2 itself, ie. SMR process versus Electric Hydrogen production process. There is no need to assess the downstream processes, as they are identical. Upstream differences should be considered if they are material.

The upstream difference in the two production processes for H_2 come from inputs – capital, labor, and consumed/changed material inputs. We don't have the data to measure differences in life cycle capital goods, which would be part of Scope 3 or an LCA, nor labor inputs. In general, these differences should not be material for long-lived capital devices and low-labor processes. The input differences are significant; one process uses only water and the other natural gas. There is some embodied energy in water, but a much larger amount in the natural gas.

The RMI study cited in the bibliography provides a range of 8-12 kg CO_2e/kg H_2 from SMR. Unpublished data from Electric Hydrogen indicates that consideration of the life cycle impacts of H_2 production (e.g., methane leaks in production and delivery to the reformer) add 2-3.9 kg CO_2e/kg H_2. In this case, life cycle should mean largely upstream carbon emissions related to SMR, which will differ from Electric Hydrogen upstream carbon, so we include them. Taking the midpoint of both of these ranges, we use a baseline H_2 carbon intensity of 13 kg CO_2e/kg H_2.

Carbon Savings Measurement

Electric Hydrogen provided data to build a calculation model to show the MW capacity of Electric Hydrogen production over time. To be conservative, we have assumed that Electric Hydrogen achieves 50% of its production targets each year. Since the GHG footprint of Electric Hydrogen is zero, the GHG savings/impact figure for Electric Hydrogen is the product of the H_2 created by Electric Hydrogen electrolyzers multiplied by its carbon intensity.

Form Energy

Baseline: Natural Gas Generation

We assumed that the baseline that natural gas generation would be the marginal resource displaced by multiday storage (MDS.) Therefore we utilized an emissions factor of 0.412 MT CO_2/Mwh from EIA

Carbon Savings Measurement

Form calculated the total CO_2 emissions reductions associated with their iron-air technology over the ten-year period from 2022 to 2031. We assumed a total number of megawatts of multi-day storage in each year of the analysis period based on their projected manufacturing schedule. These volumes of battery storage are assumed to charge from surplus zero-carbon renewable energy that would have otherwise been curtailed. The number of megawatt-hours of electricity discharge in each year from the iron-air batteries was calculated using a capacity factor of approximately 11%, which is the average capacity factor that has resulted from other analyses done in Formware™, Form's proprietary optimization and production cost tool. Total annual MDS discharge was multiplied by an emissions factor of 0.412 metric tons per megawatt-hour. Annual emissions were summed, resulting in a total of approximately 17 million metric tons of CO_2 emissions avoided between 2022 and 2031.

Nitricity

Baseline: Ammonia Fertilizers

Globally nitrogen fertilizers support much of the agriculture industry, and fertilizer production is powered by the Haber-Bosch process. The Haber-Bosch process utilizes hydrogen and nitrogen to produce ammonia, which can then be used to produce multiple fertilizer compounds. Depending on the source of the fossil fuels that are used to generate the hydrogen, this can result a range of carbon intensity for the Haber-Bosch process. In addition to production emissions, current fertilizers also volatilize N_2O emissions.

The 2021 total fertilizer market was estimated as was the expected growth of the market through 2050Green Haber-Bosch, made using green hydrogen, was also estimated to be 4% of the fertilizer market by 2031, based on Department of Energy Energy Earthshots Initiative focused on hydrogen and fuel cell technologies.

Carbon Savings Measurement

Nitricity can manufacture fixed nitrogen, with comparatively much lower associated CO_2 emissions and volatilized N_2O emissions per pound of nitrogen than the baseline. Nitricity provided growth projections which enabled estimates of their future market share of the global nitrogen fertilizer market.

Using these assumptions and conservative estimates, which included assuming the maximum carbon emissions from the Nitricity process, minimum carbon emissions from the traditional process, and the shifting of the market towards green Haber-Bosch, it was projected that by

2031 Nitricity will capture 1.4% of the global fertilizer market and generate 16 million MT of CO_2e emissions.

Zap Energy

Baseline: Business as usual electric power systems

The baseline for this calculation is the electric power systems of the US and EU expanding and operating without Zap Energy's reactors. Our baseline assumes that the US power system has carbon emissions that decline linearly to zero between now and 2050.

As Zap Energy provides small amounts of baseload power and is presumed to sit at the bottom of the dispatch order, it will displace power that would otherwise be provided by other baseload sources. The major options and comments on them are shown in the table below.[iii]

Baseload Fuel Type	2020 % U.S. Baseload-power	Comment
Coal without CCS	24.6%	We project that coal plants will be steadily displaced by carbon-free fuels. Zap Energy replacing coal energy would be the most impactful and beneficial.
Natural gas plants without CCS	43.5%	Natural gas plants are likely to remain more expensive as baseload options than coal plants and therefore are on the dispatch margin, with or without CCS
Wind and solar firmed by batteries	0	This option will become the equivalent of baseload energy only when seasonal storage is widely available at approximately a 100x cost reduction.
Current nuclear plants	21.3%	Current nuclear plants will retire on fixed schedules. It is unlikely that Zap's tech will replace all 1000 MW nuclear plants, either from the size or timing standpoint, but it is possible.
Gas or coal with CCS	0	Gas or coal with CCS will compete directly with Zap Energy and almost certainly be the marginally dispatched (most expensive to operate) baseload plant.

Note this table does not include hydro (7%), which we do not think will be displaced, nor biomass and geothermal (3.5%) because they are too small.

Carbon Savings Measurement

Zap Energy's plants are small modular fusion reactor-generators. These generators operate within the larger electric power system, much like other power plants. They are designed to operate at full power continuously when they are not limited by operating constraints of one form or another, including forced and maintenance outages. As a new technology, we assume a prorated annual availability of 75% of their rated capacity, in consultation with Zap Energy, for the first decadal units; with the addition of operational experience, the units are projected to achieve capacity factors closer to 90%. We also assume that Zap Energy's reactors will be treated as must-run; in addition, Zap Energy believes its fuel costs will be much lower than fission fuel costs, which are the lowest after zero-cost wind and solar. This would put zap near the bottom of the dispatch order, as is the case now for current-day nuclear generators.

To assess the projected carbon impacts of Zap Energy we need to answer two key questions: (1) What market penetration do we expect for Zap Energy's reactors through 2031, and (2) how do we measure the reductions in grid carbon resulting from this level of Zap Energy market share?

To answer the first question, we use a projection of sales in the next ten years. The company's own internal product timeline has 50 MW pilot plants starting operation in 2030; we assume two such pilots start in 2030. This is consistent with the 2030 market entry scenarios in Spangher, Vitter, and Umstattd, *Energy Strategy Reviews* 26 100404 (Nov 2019), which show zero to 1221 MW installed in 2030-2035 under the 10% to 50% market penetration scenarios.

To determine carbon savings from these pilot plants we use a simplified approach that does not require knowledge of precisely where these installations will occur nor require a simulation of the power system to determine changes in the operation and carbon emissions of the grid. From the baseload fuel displacement choices and the initial assumption that Zap Energy reactors are able to successfully enter the market on schedule we estimated Zap's carbon savings.

Among fossil-generated power choices it is more conservative and probably more realistic to assume that Zap Energy displaces baseload natural gas generation than coal. Gas is the largest fraction of baseload power today, and we believe coal will be phased out regardless of Zap Energy's market entry. In addition, gas plants are far more numerous, tend to be smaller, and need not operate in baseload mode and therefore may be partially displaced rather than eliminated entirely. For all these reasons, we therefore assume Zap Energy additions over the next ten years displace gas combined-cycle power generators. In terms of the GHG protocols, this is equivalent to assuming that Zap Energy affects both the build and operating margins, but in both cases the generation that is eliminated comes from average gas combined cycle plants. As pilot plants are running for 2030-2031, the estimated carbon savings indicates the significant potential of fusion as a possible replacement for gas-fired baseload power.

Part Three: Footprint of EIP and Portfolio Companies

EIP Footprint

Business Travel

Air Travel

Each flight booked in 2021 was calculated individually and then summed for total Air Travel emissions. To calculate the emission of each flight, the distance between departure and arrival locations was found in miles[iv] and each flight was classified as Short Haul, Medium Haul, or Long Haul as defined by Environmental Protection Agency (EPA) GHG Emission Factors Hub[v]. Locations were on a city level, thus the most frequented airport for any city with more than one airport was used to calculate distance (e.g., LaGuardia International Airport was used for all flights to/from New York City). CH_4 and N_2O emissions were considered immaterial.

Rail Travel

Each train trip booked in 2021 was calculated individually and then summed for total Rail Travel emissions. To calculate the emission of each trip, the distance between departure and arrival location was found in miles and trips were classified as being either one-way or round trip. Different emissions factors were used for each service provider. Trips taken on the Deutsche Bahn were considered emission-free due to Deutsche Bahn's reported <1 kgCO_2e per passenger-mile emissions[vi]. For trips taken on Amtrak, an emissions factor was calculated using an article published in the *Journal of the Air & Waste Management Association* by C. Andrew Miller[vii]. The same emissions factor was used for MTA Metro North trains in consideration of their similar age and operating region. Emissions factors for Eurostar trains were found on the Eurostar website[viii], and the average emission rate per passenger-mile was assumed to be the same for a trip from Amsterdam to Paris and a trip from London to Paris.

Hotel Stays

Each hotel stay booked in 2021 was calculated individually and then summed for total Lodging emissions. To calculate each emission, stays were classified by location and number on nights. The UK Government GHG Conversion Factors for Company Reporting[ix] were used to find emissions factors for each country (measured in kgCO_2e per room-night). Information was unavailable for Norway, Finland, Sweden, and Puerto Rico. The factor for Germany was used as an estimate for Norway, Finland, and Sweden, and the United States factor was used an estimate for Puerto Rico.

Building Energy

Office Buildings

In 2021, EIP had office spaces in New York City, Palm Beach, San Francisco, London, and Cologne. A location-based approach was used to calculate emissions for each space using average commercial energy utilization per square foot, assuming all buildings used electricity and natural gas for their respective locations. For buildings in the United States, average utilization figures for electricity and natural gas were from the EIA Commercial Building Energy Consumption Survey (CBECS)[x]. For buildings in Europe, utilization was assumed to be the average of all U.S.-based offices due to lack of specific location-based data. Electricity and natural gas emissions factors for buildings in the United States were found using the EPA GHG Emission Factors Hub. For European locations, electricity emissions factors were calculated using data from the European Environment Agency[xi] and the same natural gas emissions factor was used for Europe as was used for the United States. Results were then reduced by 11% to account for the reduction in building energy use that resulted from the Covid-19 pandemic. This factor was extracted from an article that observed an 11% decrease in commercial building emissions in 2020 compared to previous years.[xii]

Work from Home

EIP had 59 full-time employees (FTEs). For employees based in the United States, average monthly electricity consumption was from the EIA at the state level and average monthly natural gas consumption was from the AGA, also at the state level. Emissions factors for electricity and natural gas were found using the EPA GHG Emission Factors Hub. For employees based in the United Kingdom and Germany, average monthly resource consumption was calculated using a mix of government and independent data and electricity emissions factors were calculated using data from the European Environment Agency[xiii] [xiv] [xv] [xvi] [xvii]. The same natural gas emissions factor was applied for employees located outside of the United States. Results were then multiplied by a common factor of 0.138 to account for the portion of home energy used for business purposes. This factor was calculated using an article[xviii] which analyzed the change in commercial and residential building energy in New York City before and after the Covid-19 pandemic.

Other

Employee Commute

Employee commute was calculated on a per-employee basis using past-year commuting emissions adjusted for the present number of employees. The per-employee commute emissions for 2018 and 2019 were averaged (2020 was excluded due to an abnormally low emissions level through the Covid-19 pandemic) and the result was multiplied over all FTEs in 2021 and reduced by 80% to account for infrequent commute through the coronavirus pandemic. The reduction factor was based on a Bloomberg article[xix]. Office occupancy was used to estimate commuting workforce.

Historic Emissions

Historic emissions were calculated using the 2019 per-employee average of 7.8 $MTCO_2e$. The results are summarized below:

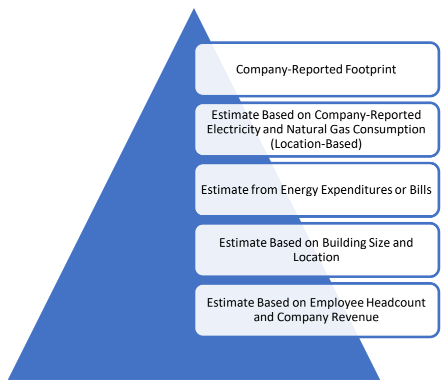
Year	Employees	Per-Employee Average Emissions ($MTCO_2e$)	Total Emissions ($MTCO_2e$)
2015	4	7.8	31.2
2016	6	7.8	46.8
2017	12	7.8	93.6
Total			**171.6**

Portfolio Scope 1 & 2 Footprint

Companies were considered part of EIP's 2021 financed emissions if they were in our portfolio for more than half of the year.

Contending with a myriad of diverse—and in some cases, missing—data was a prominent hurdle to finding a number we felt was an accurate representation of our portfolio footprint. In some cases, sacrificing accuracy was a necessary for getting this effort off the ground. The graphic below represents our approach to supplement the missing information in descending order of accuracy and precision based upon the available data.

Hierarchy of Calculation Data (Descending)



Company-Reported Footprint

Some of our portfolio companies calculated their own footprints either independently or with the aid of third-party consultants. In these cases, since our measurement only encapsulates Scopes 1 and 2, any Scope 3 emissions were subtracted from these company-reported footprints, and this was used as the most accurate available data for that company.

Estimate Based on Company-Reported Resource Consumption

The next level was estimated emissions based on company-reported resource usage. This includes aggregate consumption of electricity and either natural gas or propane at a company-specific level. A location-based approach was taken to calculate emissions using the average emissions factor from the EPA eGrid[xx] and the EIA. For companies with buildings in more than one state, the average state emissions factor was applied, and international emissions factors were sourced or calculated on an individual basis.

Estimate Based on Company-Reported Expenditure/Bills

In some cases, aggregate annual resource consumption was unavailable, but electricity and gas bills were available. In these cases, usage was either summed for the entire year if an entire year of expenditure was available or the available data was extrapolated over an entire year using the average monthly consumption. Again, a location-based approach was taken to calculate emissions using the average emissions factor from the EPA eGrid and the EIA. For companies with buildings in more than one state, the average state emissions factor was applied, and international emissions factors were sourced or calculated on an individual basis.

Location-Based Estimate Using Building Area

In cases where building location and floorspace was the only available information, a location-based calculation was conducted. Each company was assumed to be using electricity and natural gas, and floorspace was then multiplied by average consumption data from the EIA. Then, the appropriate emissions factor was applied based on a company's location using data from EPA eGrid and the EIA. For companies with buildings in more than one state, the average state emissions factor was applied, and international emissions factors were sourced or calculated on an individual basis.

Estimate Based on Employee Headcount and Company Revenue

The approach taken in cases where not enough information was available to take a more accurate approach was to utilize the CoolClimate Network Business Calculator made available through the University of California, Berkeley. The most recent available company revenue and number of full-time employees (FTEs) were inputted along with the following assumptions:

- U.S. Average emissions
- No specified sector
- One facility
- 100 square feet of facility space per FTE

Offsets by Portfolio Companies

Some companies within our portfolio are taking steps to lower their carbon and other environmental impacts. The following companies purchased offsets to reduce their Scope 1 and 2 footprints during 2021:

Company	**Amount Offset**
Electric Hydrogen	150 $MTCO_2e$
Measurabl	29 $MTCO_2e$
Picnic	141 $MTCO_2e$
Total	**320 $MTCO_2e$**

Total Net Portfolio Footprint

Our total 2021 portfolio footprint is summarized below:

Calculated Scope 1&2 Emissions	74,000 $MTCO_2e$
EIP's Ownership Allocated Share	10,500 MT CO_2e
Offsets	320 $MTCO_2e$
Net Financed Scope 1&2 Emissions	**10,200 MT CO_2e**

Company-Specific Methodology

42Crunch	Footprint Provided
AddEnergie	Estimate from Size/Location
Aeroseal	From DDQ Data
Arcadia Power	Estimate from Size/Location
Attivo	Cool Climate Business Calculator
Boston Metal	From DDQ Data
Celerity	Cool Climate Business Calculator
ChargerHelp!	Cool Climate Business Calculator
Quantela (acq Cimcon)	Cool Climate Business Calculator
Construction Resources	Cool Climate Business Calculator
Corelight	Cool Climate Business Calculator
Derive Systems	Estimate from Size/Location
Dragos	Cool Climate Business Calculator
Ecobee	Cool Climate Business Calculator
Electric Hydrogen	From DDQ Data
Enchanted Rock	Estimate from Bills
eSmart	Estimate from Size/Location
EV.Energy	Cool Climate Business Calculator
EVmo	Estimate from Size/Location
Finite State	Cool Climate Business Calculator
Form Energy	Estimate from Size/Location
BHI	Estimate from Size/Location
GridX	Cool Climate Business Calculator
Hippo Harvest	From DDQ Data
HopSkipDrive	Estimate from Size/Location
Innowatts	Estimate from Size/Location
Manus Bio	Cool Climate Business Calculator
Marketing Evolution	Cool Climate Business Calculator
Measurabl	Footprint Provided
Mimeo	From DDQ Data
Moxion Power	From DDQ Data
Nitricity	Estimate from Size/Location
Noetic	From DDQ Data
NS1	Cool Climate Business Calculator
Urbint	Cool Climate Business Calculator
Opus One Solutions Energy Corporation	Cool Climate Business Calculator
Palmetto Solar	Cool Climate Business Calculator
Particle	Cool Climate Business Calculator
Picnic	Footprint Provided
Power Factors	Cool Climate Business Calculator

Powin Energy	From DDQ Data
Project Canary	Estimate from Size/Location
RangeForce	Estimate from Size/Location
RapidSOS	Estimate from Size/Location
Scythe	Cool Climate Business Calculator
Sense Labs	Estimate from Size/Location
Sibros	Estimate from Size/Location
Sitetracker	Estimate from Size/Location
Smallhold	From DDQ Data
SmartRent	Cool Climate Business Calculator
Solar Mosaic	Estimate from Size/Location
Sparkfund	Estimate from Size/Location
Spire Power Solutions	From DDQ Data
Studytube	Cool Climate Business Calculator
Swimlane	Estimate from Size/Location
Tenere	Cool Climate Business Calculator
TESCO	Estimate from Size/Location
Trifacta	Cool Climate Business Calculator
ViriCiti Group	Cool Climate Business Calculator
Volta	Cool Climate Business Calculator
Williams Industrial Services Group	Cool Climate Business Calculator
Zap Energy	From DDQ Data
Zitara	Estimate from Size/Location
Zolar	From DDQ Data

[i] Global crude steel production by process route and scenario, 2019-2050, International Energy Agency, October 2020. https://www.iea.org/data-and-statistics/charts/global-crude-steel-production-by-process-route-and-scenario-2019-2050
[ii] Climate change and the production of iron and steel, World Steel Association, 2021. https://worldsteel.org/publications/policy-papers/climate-change-policy-paper/
[iii] Energy Information Administration and Ella Chao, National Renewable Energy Laboratory, April, 2022.
[iv] https://www.airmilescalculator.com/
[v] https://www.epa.gov/climateleadership/ghg-emission-factors-hub
[vi] https://gruen.deutschebahn.com/en/measures/environmental-mobility-check
[vii] https://www.tandfonline.com/doi/full/10.1080/10962247.2020.1837996
[viii] https://www.eurostar.com/rw-en/carbon-footprint
[ix] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021
[x] https://www.eia.gov/consumption/commercial/data/2012/index.php?view=consumption#c13-c22
[xi] https://www.eea.europa.eu/data-and-maps
[xii] https://www.cleanenergyeconomymn.org/blog/how-pandemic-driving-commercial-building-energy-use
[xiii] https://www.iea.org/fuels-and-technologies/electricity
[xiv] https://www.destatis.de/EN/Themes/Society-Environment/Housing/_node.html
[xv] https://www.eea.europa.eu/data-and-maps/daviz/co2-emission-intensity-9/
[xvi] https://www.ovoenergy.com/guides/energy-guides/how-much-electricity-does-a-home-use
[xvii] https://www.eea.europa.eu/data-and-maps/indicators/overview-of-the-electricity-production-3/assessment

[xviii] https://www.mdpi.com/2071-1050/13/21/11586/htm (The difference in Residential Energy Consumption shown in Figure 3 was attributed completely to working from home)
[xix] https://www.bloomberg.com/news/articles/2021-07-12/nj-transit-lirr-metro-north-are-empty-as-people-skip-nyc-commute
[xx] https://www.epa.gov/egrid