WHITEPAPER

INFLATION REDUCTION ACT

Focus on Clean Energy and Manufacturing

June 2023

Author: Dr. Roland Domann (Director of Research)

Abstract

The Inflation Reduction Act ("IRA") marks one of the country's largest investments in infrastructure in recent memory and may offer substantial opportunities for middle market companies in relevant supply chains. In this report we identify specific themes related to the decarbonization of the U.S. economy that may particularly benefit from growth driven by the IRA. The paper aims to cover the following aspects and implications for businesses and lenders:

1) An overview of tax credits available for clean energy production, manufacturing, and efficiency enhancements, including specific incentives for domestic manufacturing and alterations to credit monetization options.
2) A summary of industries that benefit from IRA support, including well-established sectors like renewable energy production, battery manufacturing, and building energy efficiency, along with emerging technologies projected to accelerate in the near future.
3) An analysis of opportunities for middle market businesses across the supply chain of specific themes, covering (1) Clean Transportation, (2) Building Energy Efficiency, (3) Clean Hydrogen and (4) Energy Transmission & Storage.

This review confirms the acceleration of the transition towards a low-carbon economy, with significant structural changes occurring in both energy supply and demand. As a result, a range of activities and sectors are seeing and will continue to experience considerable impact, thereby presenting multiple opportunities for companies and investors alike.

Inflation Reduction Act

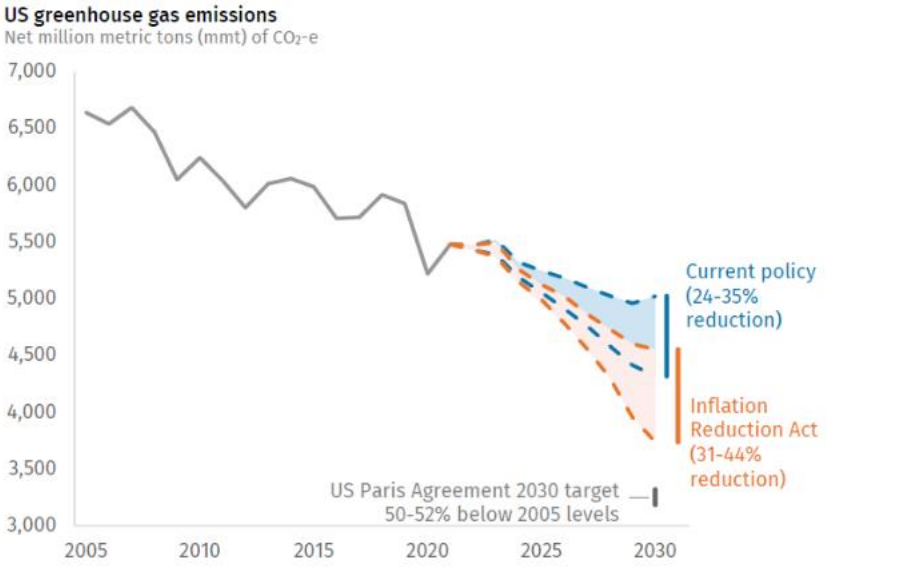
The Inflation Reduction Act (IRA) of 2022 is a United States federal law which aims to curb inflation by reducing the deficit, lowering prescription drug prices, and investing into domestic energy production while promoting clean energy. It was passed by the 117th United States Congress and signed into law on August 16, 2022.

The IRA includes the following key objectives:

- *Domestic Energy Production and Manufacturing*. The IRA will invest $369 billion in clean energy production and manufacturing, including c.$270 billion in tax incentives and $27 billion for a green bank created by amending the Clean Air Act.
- *Prescription Drug Price Reform:* The IRA includes a number of reforms to prescription drug prices, including allowing Medicare to negotiate drug prices and capping out-of-pocket costs for seniors.
- *National Deficit Reduction:* The IRA aims to reduce the national deficit by $1.5 trillion over the next 10 years. This will be accomplished through a number of measures, including raising taxes on corporations and high-income individuals.

In terms of clean and efficient energy initiatives, the IRA aims to reduce carbon emissions by c.40% by 2030 (Figure 1). The legislation provides new funding to accelerate the growth of clean energy and support consumer rebates for home electrification and EVs, and dedicates significant resources to support American-made products to boost domestic manufacturing (*see Appendix A*).

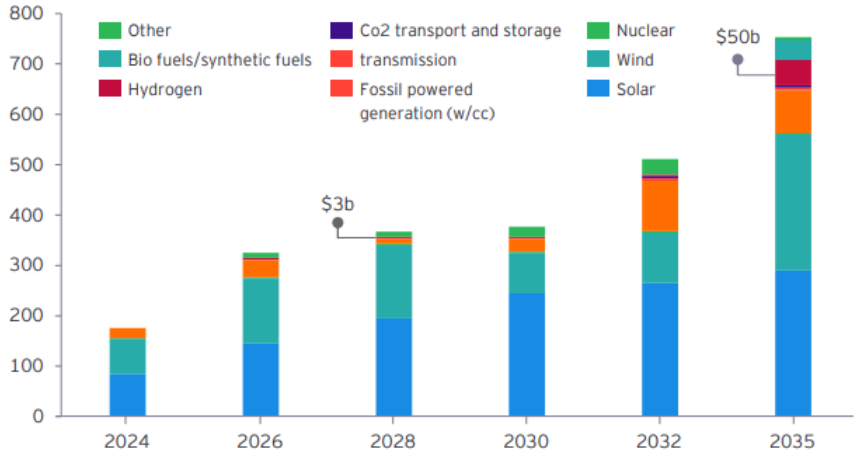
Figure 1



Source: Rhodium Group. The range reflects uncertainty around future fossil fuel prices, economic growth, and clean technology costs. It corresponds with high, central, and low emissions scenarios detailed in Taking Stock 2022. Under the central scenario (not shown), the IRA accelerates emissions reductions to a 40% cut from 2005 levels.

The IRA's revised clean electricity tax credits ($62 billion new credit capacity, in addition to $65 billion existing/extended credits) will become "technology-neutral" in 2025 – driving the expansion of all zero-carbon electricity sources. These include wind, solar, geothermal, existing nuclear facilities, electricity storage technology and the transmission grid. The IRA provides the first-ever 10-year runway for energy tax incentives, giving investors, manufacturers, utilities and developers additional certainty when planning and building new manufacturing facilities and projects into the 2030s (Figure 2). The deployment of clean energy options will be further bolstered through a $250-billion expansion of financing authority in the U.S. Department of Energy's Loan Programs Office.

Figure 2



U.S. annual capital investment in energy supply related infrastructure [USD bn p.a.]
Source: Princeton University ZERO lab estimates, EY analysis

The IRA supports U.S. manufacturing by expanding production tax credits for the manufacture of solar panels, wind turbines, batteries and critical minerals processing by $30 billion. It includes an additional investment tax credit for clean energy manufacturing, with nearly $6 billion allocated to help existing

heavy manufacturing — such as steel and cement —reduce emissions. Furthermore, the IRA introduces tax credits for carbon capture and creates a new 10-year incentive for clean hydrogen production.

In addition to industry targeted incentives, the IRA provides $35 billion of direct incentives for individuals to decarbonize homes through the installation of heat pumps, rooftop solar panels and energy-efficient retrofits of residential property.

The IRA continues with the EV infrastructure investments covered by the IIJA and provides EV tax credits for the purchase of both new and used cars. For vehicles to qualify, they need to be assembled in North America, and to obtain full credit greater than 50% of the battery's components must either (1) be manufactured or assembled in North America or in countries with which the U.S. has a free trade agreement, or (2) the minerals must be recycled in North America. By 2027, this threshold increases to greater than 80%. Starting in 2025, no credit can be granted if the vehicle's battery contains critical minerals that were extracted, processed or recycled by a foreign entity of concern (e.g., China).

Tax Incentive Structure

Most new and existing clean-energy and energy-efficiency tax credits are structured as two-tiered incentives with a 'base rate' and a 'bonus rate.' Businesses can qualify for a bonus rate of up to **five times** the base rate if they meet certain requirements, such as:

- *Prevailing Wages:* Businesses must use prevailing wages when hiring workers to construct or install the qualified energy property.
- *Apprenticeship Programs:* Businesses must provide apprenticeship opportunities for workers who are installing or constructing the qualified energy property.

Some tax credits offer additional 10% bonus rates to facilities meeting certain criteria, such as:

- *Domestic Manufacturing* requirements for steel, iron, or manufactured components.
- Projects located in *Energy Communities* (defined as brownfield sites or fossil fuel communities).

The specific requirements for the bonus rate vary depending on the type of tax credit and the type of qualified energy property.

Tax Credit Monetization (direct-pay options and transferability)

The bill allows certain taxpayers (e.g. tax-exempt entities, state and local governments) to elect to be treated as having made a payment of tax equal to the value of the credit and receive an equivalent refund under the following credits *(see Appendix A for descriptions*):

§48	§45	§45W	§45Q (all taxpayers)
§48C	§30C	§45Y	§45V (all taxpayers)
§48E	§45U	§45Z	§45X (all taxpayers)

Taxpayers that are ineligible for the direct-pay election can opt to transfer any applicable credit to another taxpayer. This transfer may be for all or a portion of a credit, but any credit (or portion thereof) could be transferred only once. This provision, while available to more taxpayers than the direct-pay provision, is less valuable since the buyer of the credits requires a margin.

Tax Credit Collateral Structuring

The inclusion of an option to transfer tax credits covered by the IRA enhances the flexibility in structuring collateral arrangements.

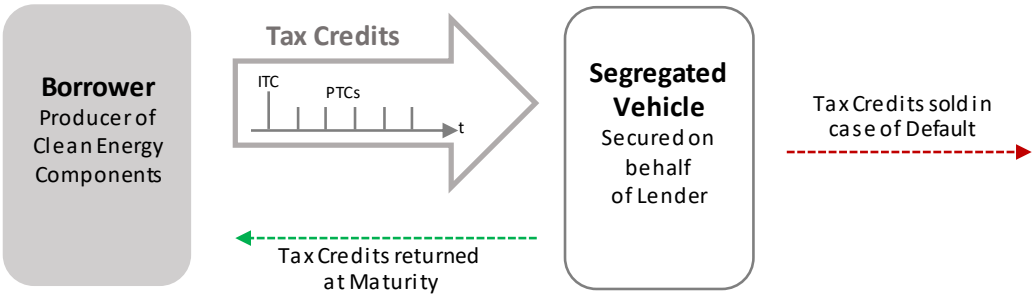
As an example, a middle market producer of certain clean energy components that is entitled to credits under §48C *(tax credit for investments in projects that reequip, expand, or establish certain energy manufacturing facilities)* and §45X *(production tax credit that could be claimed for the domestic production and sale of qualifying solar and wind components)* will be able use these credits as collateral for secured financing. A possible structure can consist of

a) transferring any credits, as they arise, into a segregated vehicle, where security interest (general intangible) is granted to the lender, *and*

b) returning the credits to the borrower at maturity of the financing.

In case the borrower would not be in a position to repay the loan, the lender can sell the collateral in the market. Possible advantages could include (i) reduced friction costs vs. continuous monetization of credits in the market and (ii) the possibility to capture collateral value for future stream of production credits.

Figure 3



Impact on Industrial Landscape

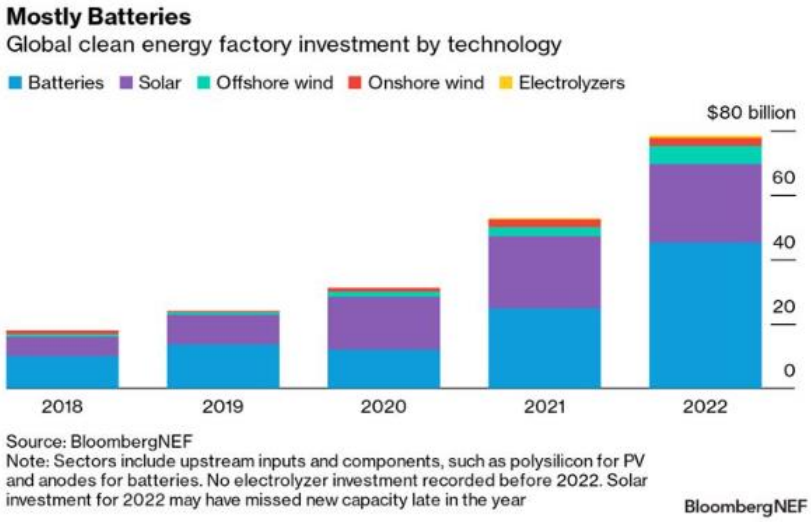
Energy transition investment exceeded $1.1 trillion dollars in 2022, and for the first time, equaled investment in unabated fossil fuel-based power generation[1]. While the cleaner-burning natural gas has a role to play in the transition to zero carbon energy (e.g. covering peak demand or periods where renewables are in short supply) it does emit GHG and is expected to phased out over time.

One aspect of the energy transition that is growing particularly fast is investment in factories producing solar modules, wind turbines, batteries, and electrolyzers that are installed in grids and networks worldwide. Investment in clean technology factories reached just under $80 billion in 2022, up 44% year on year, and a four-fold increase since 2018.

Today's clean energy manufacturing investment is concentrated in two products (Figure 4), batteries and solar modules, where 88% of total investment in 2022. Offshore wind investment has grown from $800 million to $5.8 billion in five years while electrolyzers from zero in 2020 to $800 million in 2022, but these sectors cover a very small share of capacity expansion investment.

[1] "Energy transition's new industrial landscape"; BloombergNEF; April 2023

Figure 4



Technology manufacturing is even more concentrated by geography and focused on a single market – China. Five years ago, China took in more than 77% of total manufacturing investment dollars; last year, it received more than 90% of investment in a four times larger market.

While the IRA continues to provide strong support for infrastructure investments in clean energy (§48E, §45Y) for the next 10 years, it also includes significant incentives (e.g. 10% ITC bonus) for adhering to domestic content thresholds by using American-sourced iron and steel, as well as other domestically manufactured goods.

Figure 5: U.S. Census Bureau, Total Construction Spending: Manufacturing in the United States; Federal Reserve Bank of St. Louis; June 12, 2023

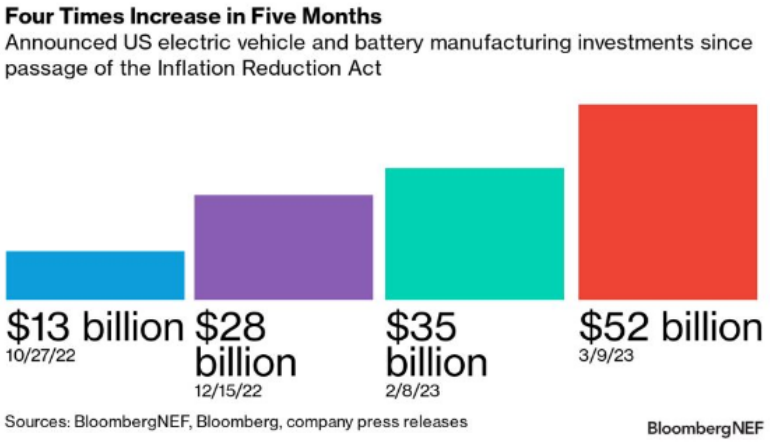
Such domestic content incentives form part of a wider initiative to onshore manufacturing and build more robust supply chains, which includes the CHIPS and Science Act (Aug-2022) aimed at enhancing US competitiveness in semiconductors. Both the IRA and CHIPS acts have changed where, and how, companies invest. The long timelines of the IRA's support mechanisms have given manufacturers confidence to expand on multi-year timelines (Figure 5), while structural growth of the total addressable markets for clean power generation equipment, hydrogen electrolyzers and batteries supports major expansion.

In addition to domestic content targets embedded in clean electricity infrastructure investment and production credits, the IRA creates the new Advanced Manufacturing Production Credit (§45X, $30 billion capacity) that provides incentives for the domestic production of clean energy technology components.

Eligible components include solar panels, inverters, trackers, wind turbines, and batteries. These credits represent c.40% of the current cost for solar panels, 20%-50% for inverters (depending on specifications), and 15%-20% for trackers[2].

Following the passage of the IRA there have been multiple announcements from solar and storage suppliers to build new US capacity, adding up to >20GW of additional module and cell manufacturing capacity according to PVTech.

Figure 5



Domestic battery production and assembly in North America are particularly positioned to benefit from the credits through combination of §45X advanced manufacturing incentives and the domestic battery component requirement of the §30D clean vehicle credit for EVs. Accordingly, the US automotive and battery sectors have announced $52 billion in planned new factories since the IRA passed in August 2022 (Figure 5), with half of that outlay for battery production alone[3].

In addition to accelerating the growth of established clean energy infrastructure and component manufacturing (i.e. wind, solar and batteries) the IRA also provides support for emerging technologies, including

- *Clean Hydrogen Production*

  The §45V production tax credit ($13 billion capacity) can prove transformational for clean hydrogen economics (both green and blue), bridging the cost differential vs. grey hydrogen. Hydrogen has a wide range of applications, including as industrial process feedstock (e.g. 60% oil refining, 30% fertilizer production) with potential to replace coal in steel production as well as an envisaged use for energy storage (seasonal).

  Goldman estimates[1] that an US energy path consistent with reaching net zero by 2050 would call for $500 billion cumulative investments in the US hydrogen value chain, driven predominantly (>50%) by the development of electrolysis capacity.

[2] "Carbonomics - The corporate ecosystem of the Inflation Reduction Act and the US renewable revolution"; Goldman Sachs Equity Research; May 2023

[3] "Energy transition's new industrial landscape"; BloombergNEF; April 2023

- *Carbon Capture, Utilization and Storage Technologies (CCUS)*

  Besides pilot/research projects, CCUS have been largely under-invested over the past decade yet the extended §45Q tax credit ($3 billion capacity) for carbon sequestration from industrial sources presents an opportunity for scaling such technologies.

  Goldman estimates[1] carbon capture volume will increase fourfold by 2032 to c.100m tons of $C0_2$ p.a., driven by adoption in power generation, hydrogen production and the chemical industry. In particular industrial gases producers with existing grey hydrogen capacity can earn either the §45V or the §45Q tax credit by adding carbon capture to their facilities to produce blue hydrogen.

Despite their already established status, energy-efficient home improvements and the installation of clean energy systems remain pivotal in the transition towards sustainability. These measures play an important role in both residential and commercial properties given that buildings currently contribute to c.40% of the final energy consumption in the United States. The energy mix is presently dominated by electricity and natural gas, primarily utilized for heating purposes.

Key building decarbonization technologies are readily available, including heat pumps (air and ground source), residential solar, geothermal, and bioenergy. However, the comparatively high cost of retrofitting residential buildings makes the switch largely dependent on homeowner's choices.

The IRA significantly contributes to reducing the price of carbon abatement for properties by enhancing tax credits for residential clean energy (§25D, $22 billion capacity), energy-efficient home improvement (§25C, $12 billion capacity) and the energy efficient commercial buildings deduction (§179D)

Specific technologies highlighted are heat pumps and biomass heating (e.g. wood pellets). Accordingly, equipment producers and installation businesses are considering capacity expansion (e.g. acquisition of German heat pump manufacturer Viessmann Climate Solutions by Carrier Global Corporation for $13.2 billion in Apr-2023)

Opportunities for Middle Market Businesses

The goal of net-zero GHG emissions by 2050 with the respective new set of regulations, rules and constraints is forcing a rethink of the traditional energy business model.

Accelerating technological change and adjusted economic incentives have the potential to radically remaking a number of sectors (e.g. power grid, transportation) while industry participants are experimenting with and integrating new approaches.

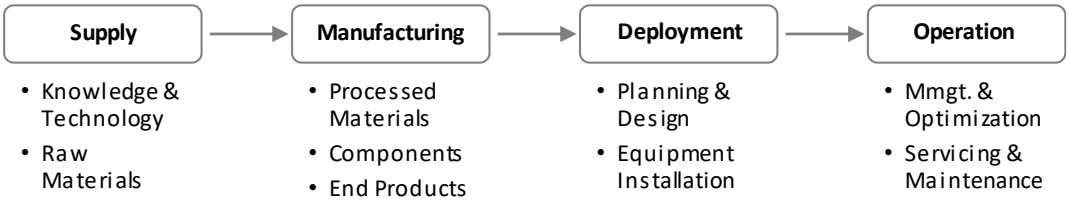
With its broad range of specific incentives, the IRA forms one of the cornerstones of the framework supporting the transition to net-zero. Middle market companies across a range of technologies and services are well positioned to capture ensuing growth opportunities.

About half the volume of tax incentives provided by the IRA is dedicated to clean energy infrastructure investment and production credits (§45/45Y and §48/48E, $137 billion total), mainly focused on construction and operation of wind parks and solar farms. Financing of such projects is well established and covered by infrastructure equity firms and institutional investors in long term debt.

Phoenix maintains a deliberate approach when it comes to engaging in energy infrastructure projects, including options such as development bridge loans or HoldCo debt. However, our primary emphasis lies in delivering dedicated financing solutions to core middle market businesses that face capital and liquidity

constraints. Our objective is to support such businesses, which operate within the decarbonization supply chain, and have the potential for substantial growth.

We use a value chain framework to classify growth opportunities identified within clean energy transition themes.



The following tables highlight selected structural business themes that Phoenix believes will benefit from the tax credit incentives offered by the Inflation Reduction Act.

	Clean Transportation
Theme	**Lithium-Ion Battery Recycling**
Category	Supply: Raw Materials
Rationale	Continued electrification of the transportation sector is set to create increasing demand - possibly shortages - of specific material and a sizeable repository of recyclable components. Raw and refined materials such as cobalt- and nickel-sulphates and lithium salts account for >30% of battery cell costs, while recycled material currently makes up only 5% of the battery supply chain. However, the increasing supply of end-of-life batteries and growing demand will enable ~15% of lithium, ~7.5% of nickel and ~43% of cobalt from recycled sources to be used in new batteries by 2030[4]
Market	The Lithium-Ion battery recycling market in the U.S. is estimated at $1.0 billion[5] in the year 2022 and expected to grow by >25% CAGR, reaching more than $5 billion by 2030. The IRA supports growth of the battery recycling market via specific provisions in §48C (production or recycling of renewable energy property) and §30D (domestic critical mineral requirement)
Private Company Examples	• **Ascend Elements,** founded 2015, offers battery recycling services incl. collection and processing, recovery of critical metals and re-manufacturing of battery components. • **Nth Cycle,** founded 2017, offers metals refining technology and electro-extraction solutions for the recovery of critical minerals from a variety of sources incl. end-of-life batteries. • **Battery Solutions,** founded 1992, provides end-to-end battery recycling and management services, collecting, process, and recycle batteries from a variety of sources. • **OnTo Technology,** founded 2004, develops and licenses advanced battery recycling technologies, incl. direct recycling and cathode healing. • **EnergyX,** founded 2018, focuses on efficient access to sustainable lithium production using proprietary Direct Lithium Extraction (DLE) technology.

[4] "Battery Recycling Industry Poised for Substantial Growth as Number of Batteries Reaching Their End of Life to Increase Seven-Fold by 2030"; IHS Markit; December 2020

[5] "Lithium-Ion Battery Recycling: Global Strategic Business Report"; Allied Market Research; January 2023

	Clean Transportation
Theme	**Electric Vehicle Charger Infrastructure**
Category	Deployment: Equipment Installation Operation: Servicing and Maintenance
Rationale	Backed by tailwinds of consumer interest, buy-in from vehicle manufacturers and government incentives, the U.S. EV market share for new vehicles is likely to reach 40% by 2030[6]. With up to 7.8 million vehicles in operation by 2025, rapid development of charging infrastructure is required. The main value pools of the EV Supply Equipment market include hardware development and manufacturing, software products and services, installation services and charge point operators (CPOs). As the infrastructure matures, CPOs are expected to account for the bulk of the market's value, however, with significant initial capital expenditure.
Market	The U.S. electric vehicle charging systems and equipment market is expected to reach to $16-19 billion by 2025[7] and continue growing to ~$100 billion by 2040, with CPOs finally covering ~2/3 of the value pool. The installation of charging infrastructure is specifically supported by the IRA provisions in §30C (alternative fuel refueling property) and benefits from the clean vehicle credits in §30D, §25E and §45W
Private Company Examples	• **AmpUp,** founded 2018, offers an EV charging operating system that enables drivers, hosts, and fleets to manage multiple charge stations and locations in one platform. • **SparkCharge,** founded 2017, specializes in portable and modular EV charging units that can be easily deployed and used for mobile on-demand charging services. • **FLO,** founded 2009, designs and operates EV charging systems (hardware, software, and services) with 90,000 charging stations in service and +220k members. • **FreeWire Technology,** founded 2014, specializes in the development and manufacturing of advanced ultrafast and scalable electric vehicle (EV) charging solutions. • **Span.IO,** founded 2018, develops smart electrical panels to manage home electrification, including real-time usage optimization and EV charging

	Building Energy Efficiency
Theme	**Heat-Pump and HVAC Upgrading**
Category	Manufacturing: Components, End Products Deployment: Equipment Installation
Rationale	Heat pumps are increasingly recognized as a critical technology for heat decarbonization that can supply useful heat with ~1/4 of the electricity used by conventional equipment. However, heat pumps still meet only ~10% of global heating need in buildings - less than half of what's needed to reach NZE by 2050[8].

[6] "EV Chargers: How many do we need?"; S&P Global Mobility; January 2023
[7] "The US electric vehicle charging market could grow nearly tenfold by 2030: How will we get there?"; PWC; H1 2023
[8] "Heat Pumps – Technology deep dive"; International Energy Agency; September 2022

	Emerging business models, such as heat & cooling as a service – renting out heat pumps and ensuring proper operation – are helping to accelerate adoption, offering benefits both for consumers (reduced upfront cost) and companies, that benefit from predictable longer-term revenues.
Market	In 2022, the fairly fragmented heat pump market in the U.S. is estimated to be valued at $11 billion - - led by air source technology. With a projected[9] CAGR of 9.4%, it is anticipated to exceed $18 billion by 2027. The IRA strongly supports energy efficiency improvements for residential buildings via the provisions in §25C and §25D (incl. 30% ITC for geothermal and air source heat pump installations).
Private Company Examples	• **EarthLinked Technologies,** founded 2008, manufactures geothermal HVAC systems using patented technology that offers a more versatile design and shorter installation times. • **Maritime Geothermal,** founded 1983, is a dedicated producer of heat pumps offering heating, cooling and hot water solutions for residential/ commercial applications. • **Rheem Manufactuirng,** founded 1925, produces a range of HVAC equipment, including air-source and geothermal heat pumps as well as heat pump water heaters. • **Climate Control Group,** founded 2002, is a private holding company that owns six unique HVAC businesses, including ClimateMaster a world leading heat pump manufacturer. • **WaterFurnance Intl.,** founded 1983, is a leading producer of geothermal and water source heat pumps, owned by NIBE Industrier AB of Sweden.

	Clean Hydrogen
Theme	**Build-out Green Hydrogen Supply Chain**
Category	Supply: Knowledge & Technology Manufacturing: Components, End Products
Rationale	North America stands as the second-largest hydrogen consumer globally, accounting for c.17% (around 15 Mt p.a.) of total demand. This significant need primarily stems from the chemical and refining sectors, which rely on gray hydrogen. However, the region benefits from abundant wind and solar resources, creating strong potential for low-cost green hydrogen. Total electrolyzer manufacturing capacity announced in the US by 2026 is 8 GW[10] with an additional 14GW likely to be required by 2030 on a net zero path. The gap between the demand and announced capacity has led to a supply shortage while the production capacity scales up.

[9] "United States Heat Pump Market Size & Share Analysis – Growth Trends & Forecasts (2023 – 2028)"; Mordor Intelligence; H2-2022

[10] "Hydrogen Insights 2023"; Hydrogen Council - McKinsey; May 2023

Market	The hydrogen electrolyzer market in the U.S. is estimated at ~$100 million in the year 2022 and expected to grow by >30% CAGR, reaching more than $5 billion by 2030[11], driven by clean hydrogen demand, the declining equipment cost and government support. The IRA supports developing the green hydrogen economy via the incentives of §45V (production of clean hydrogen) as well as the technology neutral §45Z (clean fuel production).
Private Company Examples	• **Ohmium International,** founded 2019, produces hydrogen electrolyzers for industrial, mobility and power-to-X applications as well as offering O&M field servides. • **GenCell Energy,** founded 2011, develops and manufactures fuel cell systems (not electrolyzers) for backup power, telecom, and other mission-critical applications. • **Nel ASA,** founded 1927, Norwegian public company currently building a gigawatt-scale electrolyzer manufacturing facility in Michigan U.S. • **Hydrogen Optimized,** founded 2017, develops innovative large-scale green hydrogen production systems using renewable electricity, based on their RuggedCell™ electrolyzer. • **Electric Hydrogen,** founded 2020, pioneer the use of alkaline water electrolysis in low-cost, high-efficiency, hydrogen systems for steel, ammonia and freight transport application

	Energy Transmission & Storage
Theme	**Smart Grid and Renewables Integration**
Category	Operation: Management & Optimization
Rationale	Smart grid technology enables the effective management of renewable energy sources by connecting a variety of distributed energy assets to the power grid. It leverages the internet of things to collect production/consumption data, allowing utilities to resolve service issues through continuous self-assessments (i.e. self-healing capability) Key technologies include (i) monitoring of distributed energy generation, (ii) advanced consumption metering, (iii) energy storage systems, (iv) power electronics and (v) production forecasting. Real time processing of data streams allows optimized grid control systems to incorporate variable renewable energy sources.
Market	The market for smart grid technology in the U.S. is estimated at ~$14 billion in the year 2022 and expected to grow by >17% CAGR, reaching more than $36 billion by 2028[12][13], driven by decarbonization of the energy generation network. Other than in §48C (advanced energy project credit), the IRA does not explicitly cover grid modernization. However,.smart grid investments indirectly benefit from the IRAs support for clean energy infrastructure investment and production.
Private Company Examples	The integration of renewable sources into the energy grid covers a range of businesses, examples include: • **Uplight,** founded 2019, offers software solutions for utilities to optimize the integration of renewable energy and manage customer engagement.

[11] "Hydrogen Electrolyzer Market Analysis and Forecast to 2031"; Global Insight Services; January 2023
[12] "Market value of smart grids worldwide from 2017 to 2023, by region"; Statista; 2023
[13] "Global Smart Grid Market Size, Share & Industry Trends … 2022-2028"; KBV Research; February 2023

	• **Budderfly,** founded 2015, provides energy efficiency as a service helping customers reduce energy consumption. Customers include restaurants, retail stores, schools, and hospitals. • **S&C Electric Company,** founded 1911, provider of switching, protection, and control solutions for electric power systems incl. wind, solar, geothermal and biomass sources. • **Aclara Technologies,** founded 2000, provider of smart infrastructure solutions to water, gas, and electric utilities. Products include smart meters, sensors and controls. • **FlexGen Power Systems,** founded 2010, manufactures energy storage systems for utilities and industry. Products store renewable energy and provide backup power for outages. • **Leap Energy,** founded 2017, platform that allows to aggregate distributed energy resources into a single virtual power plant, which can participate in energy markets • **Sentient Energy,** founded 2008, provides grid sensors and software solutions to utilities. Its products include smart meters, outage detection sensors, and transformer monitoring.

Conclusion

With c.$270 billion of tax incentives for clean energy production and manufacturing, the Inflation Reduction Act represents a major investment in the decarbonization of the U.S. economy, offering a compelling prospect for middle market businesses operating in energy efficiency and production sectors. The inclusion of several domestic manufacturing incentives within the IRA will particularly benefit businesses across the clean energy supply chain, which is already becoming evident in investment statistics.

We believe that growth driven by the IRA creates significant financing opportunities within the clean energy economy. Lenders with the capacity to devise and deliver bespoke solutions for such middle market businesses stand to particularly benefit from this government incentive framework.

This whitepaper highlights some of the structural themes associated with the objective of achieving net-zero greenhouse gas (GHG) emissions by 2050. While not intended to be an exhaustive list, it serves as an invitation to explore the numerous opportunities that can be leveraged with the support of the Inflation Reduction Act.

Appendix A

Clean Energy Tax Incentives in the Inflation Reduction Act of 2022[1]

Investments	Section	Amount (2023-2031)	Description
Clean Electricity and Reducing Carbon Emissions			
Existing tax credits for wind and solar power	§45 §48	PTC $51bn ITC $14bn	Extends current system of technology specific tax credits through 2024
Tax credit for carbon capture and storage	§45Q	$3bn	Extends the tax credit for carbon capture and direct air capture and increases the credit amount
Tax credit for existing nuclear reactors	§45U	$30bn	**New** nuclear power PTC for facilities in service in 2024
New tax credits for emission-free electricity	§45Y §48E	PTC $11bn ITC $51bn	**New** technology-neutral clean electricity credit for facilities coming online from beginning of 2025
Clean Fuels			
Existing incentives for biodiesel, renewable diesel, and alternative fuels		$5.5bn	Extends current system of alternative fuel tax credits through 2024
Credit for production of clean hydrogen	§45V	$13bn	**New** 10-year clean hydrogen PTC for facilities put in service by 2033
Clean fuel production tax credit	§45Z	$3bn	**New** technology neutral 2-year tax credit for low-carbon transportation fuel
Clean Energy and Efficiency Incentives for Individuals			
Energy efficient home improvement credit	§25C	$12n	Extends credit for qualified energy-efficiency improvements through 2032
Residential clean energy credit	§25D	$22bn	Extends the credit for installation of clean energy generating equipment through 2034
Energy efficient home credit	§45L	$2bn	Extends the energy efficient new home credit through 2032

[1] "Tax Provisions in the Inflation Reduction Act of 2022 (H.R. 5376)"; Congressional Research Service; August 2022

Clean Vehicles			
Clean vehicle credit	§30D	$7.5bn	Extends up-to $7,500 consumer credit for purchase of new EV, plug-in hybrid, and hydrogen vehicles (through 2032)
Pre-owned electric vehicle credit	§25E	$1.3bn	**New** up-to $4,000 tax credit for the purchase of used clean vehicles (through 2032)
Commercial clean vehicle credit	§45W	$3.6bn	**New** up-to $7,500 tax credit for qualified commercial vehicles (through 2032)
Alternative fuel refueling property credit	§30C	$1.7bn	Extends the investment tax credit for qualified alternative fuel refueling properties through 2032
Investment in Clean Energy Manufacturing and Energy Security			
Advanced energy project credit	§48C	$6bn	Extends investment tax credit to clean energy projects to strengthen domestic energy manufacturing
Advanced manufacturing production credit	§45X	$31bn	**New** production tax credit for clean energy (wind, solar batteries) technology components in the United States

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