

GS SUSTAIN: Green Capex

US Inflation Reduction Act — What's transformational, what's supportive, what's underappreciated

The passage of the US Inflation Reduction Act (IRA) should provide tailwinds for the secular theme of Green Capex, impacting virtually every vertical in our Green Capex mosaic. While the incremental tax incentives provided by the bill — about \$265 bn over 10 years — is not an immediate panacea to fully fill the gap of what is needed globally to be on track with Net Zero pathway by 2050, it will likely accelerate both investment and innovation, in our view. In our report, we look at the products in which the bill will be most transformational vs. supportive — **we believe this will be most transformative for residential standalone and utility-scale battery storage, commercial building energy efficiency and green hydrogen, while accelerating investment in longer-term carbon capture projects.** While stocks of pure-play solar and battery storage companies have risen sharply since an agreement to pass the bill was announced on July 27, we see multiple verticals that we believe are underappreciated based on our analysts' views and weightings in ESG funds, including revenue beneficiaries among Industrials and Energy Services.

Brian Singer, CFA

+1(212)902-8259 | brian.singer@gs.com
Goldman Sachs & Co. LLC

Michael Hao Wu, CFA

+1(917)343-1137 | michael.h.wu@gs.com
Goldman Sachs & Co. LLC

Enrico Chinello, Ph.D.

+1(212)357-3398 | enrico.chinello@gs.com
Goldman Sachs & Co. LLC

Derek R. Bingham

+1(415)249-7435 | derek.bingham@gs.com
Goldman Sachs & Co. LLC

Brian Lee, CFA

+1(917)343-3110 | brian.k.lee@gs.com
Goldman Sachs & Co. LLC

Zoe Clarke

+44(20)7051-2816 | zoe.clarke@gs.com
Goldman Sachs International

Michael Lapidès

+1(212)357-6307 | michael.lapides@gs.com
Goldman Sachs & Co. LLC

Mark Delaney, CFA

+1(212)357-0535 | mark.delaney@gs.com
Goldman Sachs & Co. LLC

Nikhil Bhandari

+65-6889-2867 | nikhil.bhandari@gs.com
Goldman Sachs (Singapore) Pte

Umang Choudhary

+1(212)357-2642 | umang.choudhary@gs.com
Goldman Sachs & Co. LLC

Carly Davenport

+1(212)357-1914 | carly.davenport@gs.com
Goldman Sachs & Co. LLC

Neil Mehta

+1(212)357-4042 | neil.mehta@gs.com
Goldman Sachs & Co. LLC

Joe Ritchie

+1(212)357-8914 | joseph.ritchie@gs.com
Goldman Sachs & Co. LLC

Miguel De Jesus, CFA

+1(713)658-2689 | miguel.dejesus@gs.com
Goldman Sachs & Co. LLC

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PM Summary

The Inflation Reduction Act — signed into law by President Biden on August 16 — provides about \$386 billion in energy and climate spending over 10 years, with related tax incentives up about \$265 billion from the prior run rate. With annual investment needed globally this decade to be on path for Net Zero by 2050 +\$1.8 trillion vs. the annual run rate in 2016-20, the IRA is helpful but not an immediate panacea to put the world on track. Nevertheless, the stimulus of multiple technologies essential in the Green Capex mosaic is meaningful at the country and company level, providing opportunities for even further investment in equities across the supply chain. We see the IRA as most transformational for: Battery storage (residential standalone storage and utility-scale storage), Commercial building energy efficiency and Green hydrogen. We also see the IRA as a catalyst to accelerate investment in longer-term carbon capture utilization and storage projects. We see the IRA as supportive for solar, electric vehicles, residential clean energy and nuclear energy.

What's Transformational

- **Battery Storage — Utility-scale and Residential standalone** (i.e., backup batteries or EV chargers with storage not coupled with rooftop solar). This is due to inclusion in the 30% investment tax credit that materially improves competitiveness, including vs. natural gas peakers.
- **Energy Efficiency solutions in commercial buildings.** Deployers can earn up to \$5.00 per square foot in efficiency credits vs. the prior credit of \$1.80 per square foot.
- **Green Hydrogen.** This is due to a new credit that can provide up to \$3/kg for green solutions.
- **Long-term investment in carbon capture and storage.** The impacts of increases in stimulus and direct pay for capture projects and a new greater stimulus for direct air capture plants on cash flows in the shorter term are likely to be more modest, but we believe we will see a surge in new projects moving forward.

What's Supportive

- **Solar and wind.** Increased rate of investment tax credit for both solar/wind, greater clarity on longevity of credits and new option for solar to instead apply a production tax credit should provide for continued expansion. The increased longevity of the ITC could lead to greater generalist equity ownership (ESG funds are already overweight).
- **Electric vehicles.** Extension of prior credits for individuals are supportive of continued EV expansion, particularly for companies whose products can meet domestic content requirements. We see greater potential impact for commercial EV buyers, i.e., fleets.
- **Residential clean energy.** We see the extension — at a higher rate — of credits for the purchase of residential clean energy equipment (i.e., solar electric property, solar

water heating property, geothermal heat pump property, among others) as supportive for equipment providers.

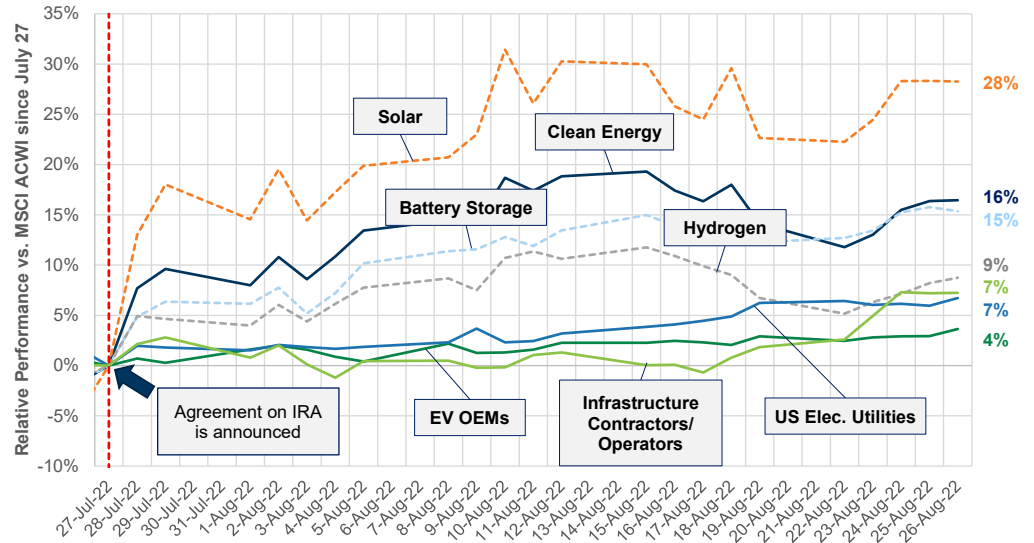
- **Nuclear — credit for existing facilities.** This provides stability of cash flow for utilities if we see normal or below-normal natural gas/power prices (less impactful at high prices as we have at present).
- **Low-emission fuels.** We believe the extension of blenders' tax credit for biofuels and the creation of a new sustainable aviation fuel credit included in the IRA will be supportive to the alternative fuel industry.

What's Underappreciated: Energy Infrastructure, Industrials, Battery Storage, Hydrogen

Battery Storage and Hydrogen among Clean Energy stocks. Clean Energy stocks — potentially the largest beneficiaries from the IRA — have generated the highest outperformance since the agreement on the bill was announced, but are still lagging other sectors with potential exposure since the beginning of 2021. Clean Energy stocks — primarily, Solar, Battery Storage and Hydrogen — have outperformed the MSCI ACWI by 16% since July 27, the date the agreement on the Inflation Reduction Act was first announced by Senate Democratic Leadership. The outperformance has primarily been driven by Solar, as Battery Storage and Hydrogen have resulted in lower outperformance (15% and 9%, respectively). When looking at performance vs. the MSCI ACWI since 2021, Solar stocks have seen modest outperformance ([Exhibit 3](#)) while Battery Storage has seen the greatest appreciation and Hydrogen the lowest. We believe the Clean Reliable Energy theme can continue to drive up valuations of Battery Storage and Hydrogen.

Exhibit 1: Since the announcement of the agreement on the IRA, Clean Energy stocks have generated the greatest outperformance vs. EVs and Utilities, driven by Solar stocks

Average relative stock performance vs. MSCI ACWI since the Inflation Reduction Act agreement was announced (July 27, 2022) for GIR-covered stocks levered to critical areas of the IRA: Clean Energy (Solar, Hydrogen, Battery Storage), EV OEMs and Utilities. Relative performance for the entire group and broken out by category.

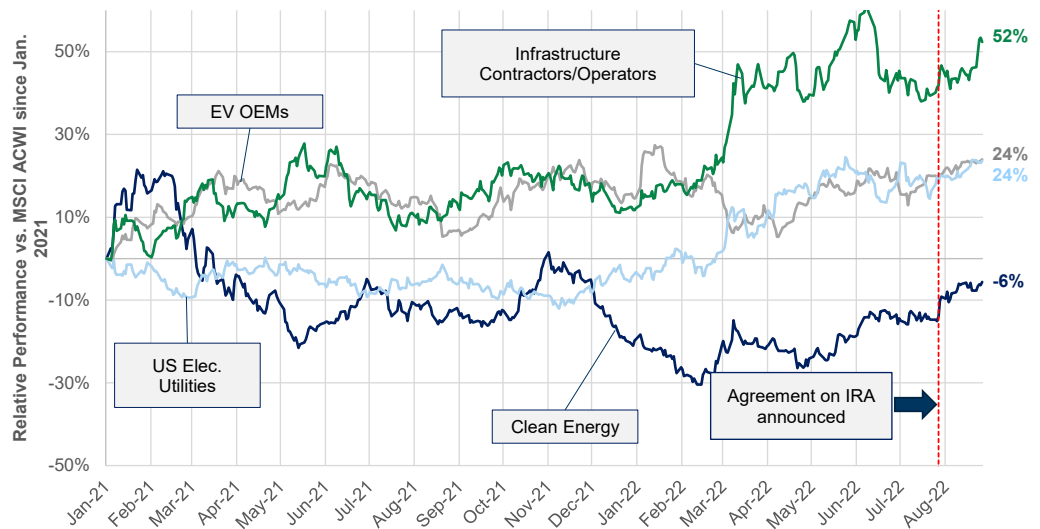


Data as of August 26. Companies may be included in more than one category.

Source: FactSet, Refinitiv Eikon, Goldman Sachs Global Investment Research

Exhibit 2: Despite relative outperformance since the agreement on the IRA was announced (July 27), Clean Energy stocks have underperformed vs. other areas impacted by the bill such as EVs and Utilities

Average relative stock performance vs. MSCI ACWI since the start of 2021 for GIR-covered stocks levered to critical areas of the IRA: Clean Energy, Electric Vehicles and US Electric Utilities with exposure to Renewables.

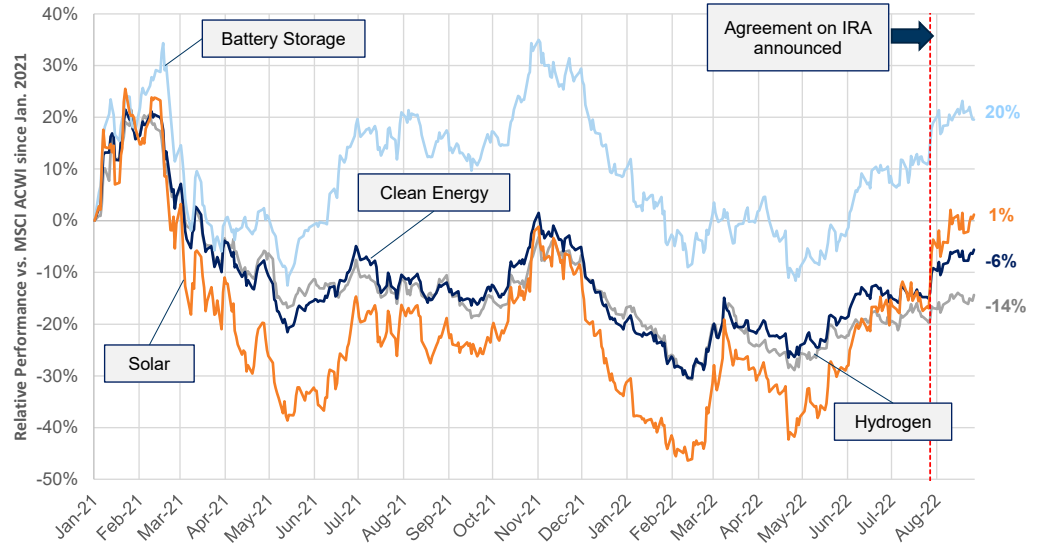


Data as of Aug. 26

Source: FactSet, Refinitiv Eikon, Goldman Sachs Global Investment Research

Exhibit 3: Stocks levered to Battery Storage have generated the greatest outperformance since the beginning of 2021, while Solar and Hydrogen stocks are still modestly lagging vs. Jan. 1, 2021

Average relative stock performance vs. MSCI ACWI since the start of 2021 for GIR-covered Clean Energy stocks levered to critical areas of the IRA: Solar, Hydrogen, Battery Storage. Relative performance for the entire group and broken out by category.



Data as of Aug. 26. Companies may be included in more than one category.

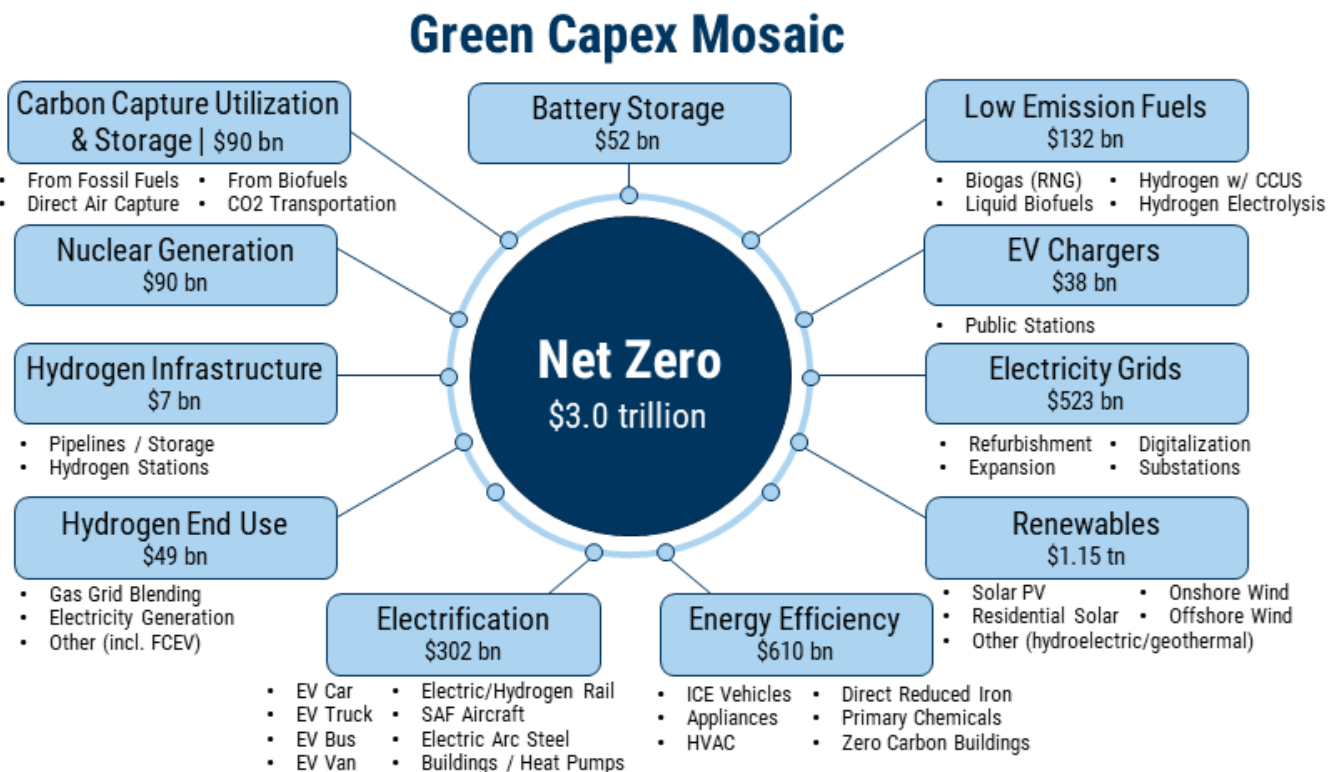
Source: FactSet, Refinitiv Eikon, Goldman Sachs Global Investment Research

Green Capex: What’s needed for Net Zero

We continue to believe Green Capex will be the multi-year secular theme driving the next wave of infrastructure investment as the focus to decarbonize the world intensifies. As detailed in our Green Capex: Making Infrastructure Happen report, Green Capex toward Net Zero needs would need to increase to \$3.0 trillion annually in the 2020s (about half of the broader investment needed to meet Net Zero, Clean Water and Infrastructure goals). Between 2016-2020, Green Capex towards Net Zero was about \$1.2 trillion annually, which represents about 15% of average global gross capital formation during this period. We see a need for \$1.8 trillion incremental annual investment this decade versus the 2016-20 average to be on track with a 2050 Net Zero objective.

Meeting the incremental Green Capex goal will require an all-in approach that involves multiple critical sectors, including renewable energy, energy efficiency, battery storage, clean hydrogen, and carbon capture Exhibit 4. As we discuss later, we believe we could see greater deployment of Energy Efficiency solutions due to higher commodity prices that may push consumers and corporates towards greater investment. Increased investment from both public and private companies, as well as legislative and regulatory support from governments, are also essential.

Exhibit 4: The Net Zero portion of the Green Capex Mosaic warrants \$3.0 trillion of annual investment globally this decade, +1.8 trillion vs. the \$1.2 trillion annual average in 2016-20; the Inflation Reduction act impacts virtually every vertical in the Net Zero portion of the mosaic



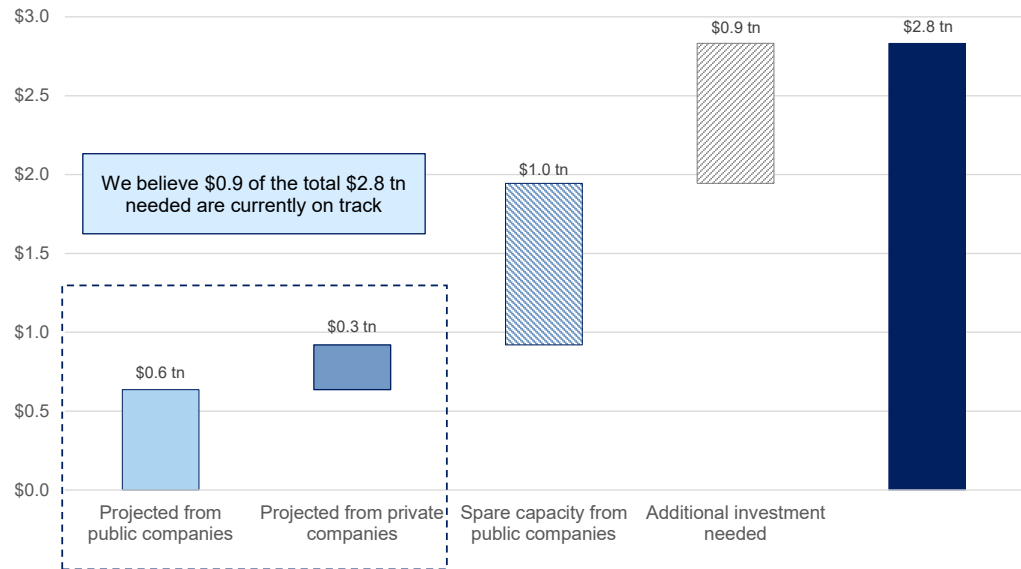
Source: IEA, McKinsey, OECD, Company data, Goldman Sachs Global Investment Research

We maintain our expectations for Green Capex spare capacity from publicly traded companies of \$1.0 trillion annually — calculated based on a scenario in which public

companies increased reinvestments of cash flows into Capex+R&D and leverage to the same historical levels of 2000 to mid-2010s. While spare capacity was already concentrated in oil & gas, metals & mining, semiconductors and software sectors, it has become even more concentrated in oil & gas as a result of the recent spike in prices and management focus on return of capital. Upward revisions to Oil & Gas operating cash flow have well exceeded the upward revisions to sector capex. Most other sectors are spending incrementally more in capex + R&D without a requisite increase in operating cash flow. We see an additional gap of \$0.9 tn needed (assuming corporate spare capacity is deployed) which could come from governments and/or individuals (Exhibit 5).

Exhibit 5: We believe the private sector is still on track for \$0.9 tn — despite a different public/private companies mix vs. prior reports — of the incremental \$2.8 tn Green Capex needed annually in the 2020s — with a greater mix from public companies, more than offset by a decline in our expectations from private equity funds. We see potential for \$1.0 tn of additional Green Capex from publicly traded companies based on estimated spare capacity

Components of incremental annual investment needed this decade to meet Net Zero, infrastructure and clean water goals, \$ trillion

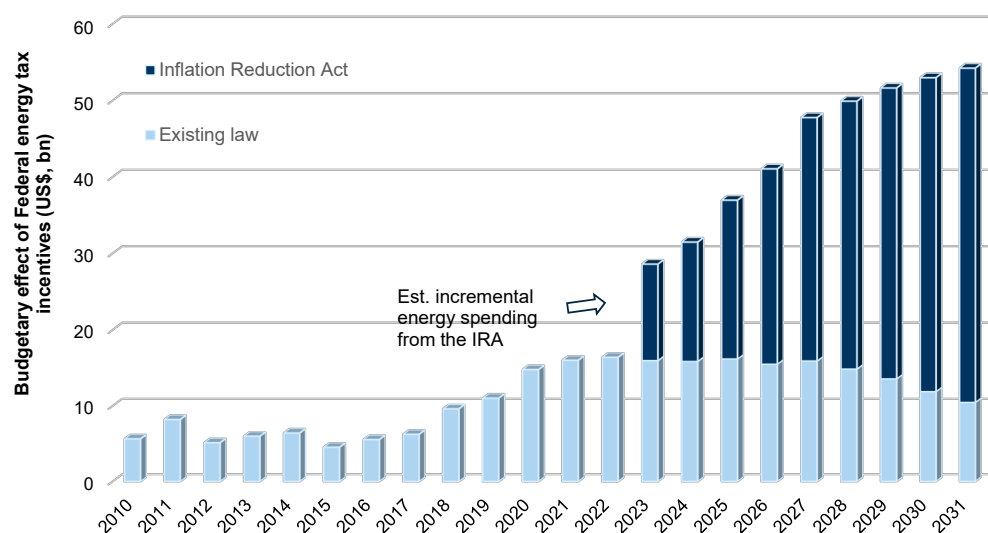


Source: IEA, OECD, McKinsey & Company, FactSet, Preqin, Goldman Sachs Global Investment Research

Inflation Reduction Act: What's new and what's improved

The Inflation Reduction Act (IRA) includes roughly \$386 billion in energy and climate spending over 10 years. About \$265 billion of which come in the form of tax credits that incentivize businesses to invest in and produce renewable energy and low emission fuels, and individuals to make purchases that improve the energy efficiency of their homes and transportation choices. The IRA would extend, and in many cases expand, existing clean energy tax incentives, making the dollar amounts larger and payment terms more favorable. A number of new programs would also be initiated, including tax credits that specifically promote clean hydrogen and clean nuclear power.

Exhibit 6: The IRA is estimated to triple the total US federal tax incentives on energy by 2031, representing about \$27 billion per year incrementally



Source: US Department of Treasury, Congressional Budget Office, Goldman Sachs Global Investment Research

We highlight four key focus areas of the green energy tax incentives in the IRA that will likely have the most impact on corporates and consumers:

(1) New and emerging renewable energy sources and decarbonization technologies

- Creates a new production tax credit (PTC) for hydrogen (45V) at a maximum rate of \$3 per kg multiplied by a percentage based on the lifecycle greenhouse gas emissions intensity of the gas produced.
- Increases the tax credit (45Q) applied to carbon capture, utilization and storage (CCUS) to \$85 per metric ton of sequestered carbon, \$60 per mt for enhance oil recovery (EOR) and other uses, and \$180 per mt for direct air capture. The deadline to construct CCUS facilities to earn this credit has been extended from 2026 to 2032.
- Includes battery storage technology, qualified biogas property, electrochromic glass and microgrid controllers as properties that would qualify for the existing ITC credit.

The tax credit rate has also been increased to 30% from 26% in 2022.

- Makes solar production facilities eligible for the renewable electricity production credit (45). The PTC for solar was previously discontinued in 2005.
- Creates a new PTC for zero-emission nuclear power (45U) at a maximum rate 1.5¢ per kWh of electricity produced, which would decrease when the price of electricity goes above 2.5¢ per kWh. This would essentially place a floor on nuclear-powered electricity prices.

(2) On-shoring of the renewable energy and clean vehicles supply chains

- Creates a new advanced manufacturing production credit (45X) for battery, solar and wind components that are produced domestically. Qualified components include battery cells (\$35 per kWh), thin film photovoltaic cells (4¢ per direct current watt), wafers (\$12 per m²), wind vessels (10% of sale price), and inverters (1.5¢-11¢ per watt).
- Modifies the renamed clean vehicles credit to apply only to vehicles that were assembled in North America. Vehicles that have battery components and critical minerals produced by a "foreign entity of concern" would no longer be eligible for the credit after 2024.
- Introduces a 10% "domestic content" bonus to the ITC and PTC for certified facilities that use domestically produced components including steel, iron, and manufactured products.

(3) Energy efficiency and decarbonization of consumers

- Increases the credit amount applicable to making energy efficient home improvements to 30% from 10%. The credit limit for each taxpayer was also lifted from \$500 lifetime to \$1,200 per year and \$600 per item (certain heat pumps and biomass stoves have credit limits of \$2,000). All of the taxpayer's dwellings would be eligible for the credit versus only primary residences previously.
- Increases the credit amount that incentivizes the building of energy efficient homes. Multifamily dwelling will also be eligible for this credit.
- Creates a new credit for both previously owned clean vehicles and clean vehicles for commercial use. Eligible vehicles for these two new credits and the existing credit for new clean vehicles will include both plug-in electric vehicles and fuel cell vehicles.
- Increases the credit rate for installing renewable energy property in residences to 30% for ten years from 26% in 2022. Standalone battery storage property will also be eligible for this credit.
- Increases the credit limit awarded to businesses for building alternative fuel charging stations from \$30,000 to \$100,000.

(4) Target-driven and more flexible incentives

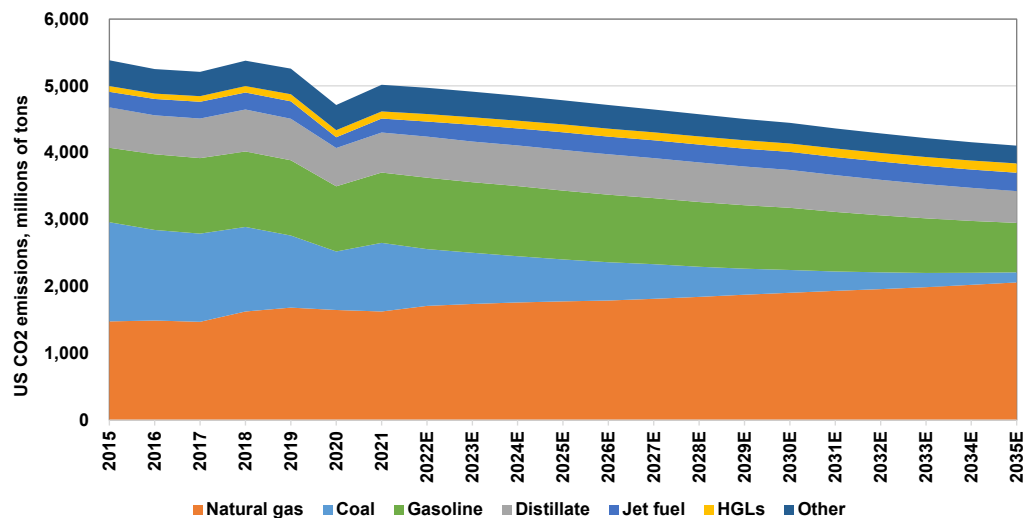
- Creates the clean fuel PTC to replace the existing incentives for biodiesel and other alternative fuels starting in 2025. Rather than setting the credit amount based on the

types of fuel produced, the new credits will be awarded based on their emissions intensity.

- Creates the clean electricity PTC and ITC that will replace the existing energy PTC and ITC starting in 2025. The new credits will only apply to domestically produced electricity that have zero or negative greenhouse gas emissions. Instead of ending on a predetermined date, the new credit will phase out when GHG emissions from the electric power sector have decreased 75% from 2022 levels.
- Allows companies to have a one-time transfer of the various tax credits they hold. This would essentially create a market for tax credits and allow corporates whose credit holdings are larger than their tax liability to generate additional cash flows.
- Allows companies to receive their PTCs for clean hydrogen, CCUS, and advanced manufacturing via direct pay during the first five years of a qualifying facility’s service life.

We continue to estimate US carbon dioxide emissions will fall by 37% by 2030 vs. 2005 levels. This compares to target set by President Biden for US net greenhouse gas emissions to fall 50%-52%. The key estimates we use in getting to this forecast include: 12 GW of annual coal retirements this decade; about 30-31 GW of annual additions of renewables generation capacity; and 6 million new electric vehicles sold in the second half of the decade. These views by our respective analyst teams could change which could drive changes to our forecast for US emissions. With the renewables ITC as mentioned set to expire at the later of 2032 or when US greenhouse gas emissions fall 75% from 2022 levels, our forecasts imply the credits will last more than a decade.

Exhibit 7: We expect US emissions to decline as renewables and natural gas take share from coal; however, our 2030 forecast does not fully meet President Biden’s target for a 50%-52% reduction vs. 2005
 US carbon dioxide emissions by source, 2015-35E, millions of tons



Source: EIA , EPA, Goldman Sachs Global Investment Research

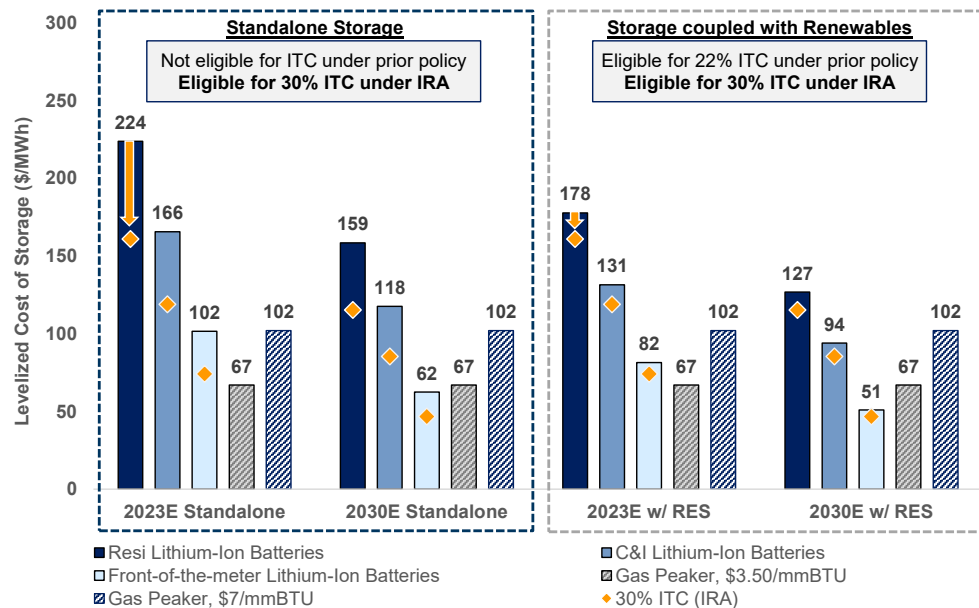
Residential Battery Storage: Transformational for Standalone Storage

What’s Transformational vs. Supportive

The inclusion of standalone Battery Storage in the residential clean energy credit could emerge as a key catalyst to drive residential battery installations. As shown in Exhibit 8, the levelized cost of storage (LCOS) — which includes capital costs and O&M expenses, but not charging costs — improves more significantly for standalone Battery Storage vs. Battery Storage coupled with renewables, when comparing the IRA’s provisions vs. prior policies. This is because the prior framework only allowed consumers to claim an investment tax credit (ITC) when deploying standalone batteries when they used renewable energy for charging for at least 75% of the time. We note the ITC rate was set to step down to 22% from 26% in 2023. **Under the IRA, Battery Storage can benefit from a 30% ITC regardless of co-location with renewables, potentially paving the way for acceleration in standalone deployments due to significant improvements in project economics.** We see residential standalone storage as a beneficiary of the provisions of the IRA, which could potentially drive an acceleration in behind-the-meter (BTM) installations. We address front-of-the-meter (FTM, i.e., utility-scale) storage and the implications from the IRA later in the report.

Exhibit 8: Revisions in the IRA to the investment tax credit is particularly transformative to standalone residential battery storage installations by reducing the levelized cost of storage by about 28%; the IRA modestly benefits storage coupled with renewables which were previously receiving a slightly lower tax credit

Levelized cost of storage (LCOS) of stationary Battery Storage, 2023E vs. 2030E, in \$/MWh. Left box: Standalone Battery Storage. Right box: Battery Storage coupled with a renewable energy source.



LCOS calculation considers capital and O&M costs over a 20-year lifespan. Arrows indicate the reduction in the levelized cost of storage for residential battery storage

Source: BNEF, Goldman Sachs Global Investment Research

IRA policy detail vs. prior policy, Build Back Better proposal

Exhibit 9: Inflation Reduction Act would change the name of the residential energy tax credit, extend it for 10 years and increase its rate

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	Residential energy tax credit	Residential clean energy credit	Residential clean energy credit
Synopsis	Provides a tax credit for the purchase of solar electric property, solar water heating property, fuel cells, geothermal heat pump property, small wind energy property, and qualified biomass fuel property	The credit would be extended and its rate increased; the credit would also be renamed	The credit would be extended and its rate increased; the credit would also be renamed
Maximum credit rate	26% in 2022, 22% in 2023, and expires thereafter.	<ul style="list-style-type: none"> • Extends the credit for 10-years at its pre-2020 rate of 30% • The credit rate would decrease to 26% for 2032 and 22% for 2033, and expires thereafter • Adds qualified battery storage technology to the list of eligible property 	<ul style="list-style-type: none"> • Extends the credit for 10-years at its pre-2020 rate of 30% • The credit rate would decrease to 26% <u>for 2033</u> and 22% <u>for 2034</u>, and expires thereafter • Adds qualified battery storage technology to the list of eligible property
Claim period	Expires on 12/31/2023	Expires on 12/31/2033	Expires <u>on 12/31/2034</u>
Payment	Nonrefundable	Refundable after 2022	Nonrefundable

Differences between the BBB and the IRA are underlined and italicized

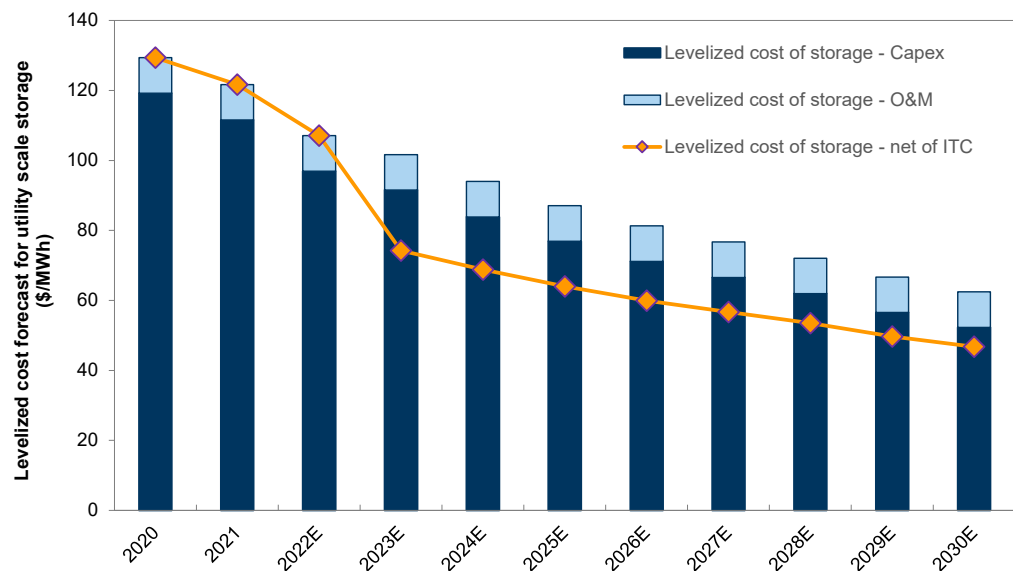
Source: Congressional Research Service, Goldman Sachs Global Investment Research

Clean Electricity: Transformative for Utility-scale battery storage, supportive for solar

What's Transformational vs. Supportive

The IRA's energy investment tax credit framework includes energy storage, a critical piece of the energy transition. The issue of intermittency has always been a critical weakness to renewables such as wind and solar as they cannot reliably supply energy throughout the 24 hours of day. But there was not a prior investment tax credit for utility-scale energy storage. The IRA now adds energy storage to its ITC and has raised the overall rate of the credit to 30% (previously 26% in 2022, 22% in 2023). This will incentivize project developers and utility companies to build storage sites alongside their wind and solar properties and receive tax credits for both. In turn, this should help mitigate at least partially intermittency issues related to wind and solar and increase the supply of electricity from renewable sources, making it more accessible and reliable to end users. According to estimates from our Clean Energy team, the levelized cost of utility-scale storage incorporating on a net basis the new ability to apply the ITC is expected to be \$74 per MWh in 2023. This represents a 43% reduction relative to 2020 costs, when there was no ITC for storage.

Exhibit 10: The levelized cost of utility-scale storage net of ITC in 2023 is expected to be 43% less than 2020, when there was no ITC for storage
 Innovation/cost deflation have also been contributing factors



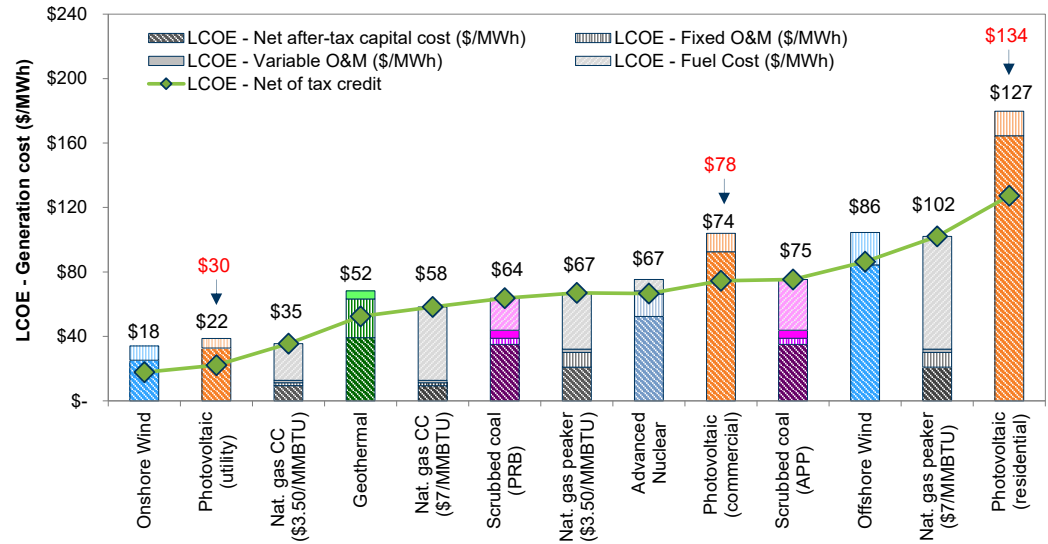
Source: BNEF, Goldman Sachs Global Investment Research

The IRA increased the credit rate for the ITC to 30% from 26% in 2022 (22% in 2023) under prior law. A 10% bonus is provided to projects that meet domestic content requirement or are located in an energy community. Other properties that are now eligible for the ITC include qualified biogas property, electrochromic gas and microgrid controllers.

The IRA extended the renewable energy production tax credit to solar, providing a boost for solar generation. The solar PTC expired and was replaced by the solar ITC in 2005, and now both will be available for solar for the first time (though both cannot be used together). The PTC meaningfully reduces the cost of renewable energy generation, making onshore wind and utility-scale solar potentially the cheapest forms energy in the US on a levelized cost basis (Exhibit 11). Specifically, the cost of utility-scale solar falls from \$30 per MWh with ITC to \$22 per MWh with PTC.

Exhibit 11: The reintroduction of the solar PTC would significantly reduce utility scale solar production costs

US levelized cost of electricity generation from various sources



Assumes that the PTC for onshore and offshore wind, utility solar, and geothermal energy will be available for ten years

Source: Goldman Sachs Global Investment Research

There is now much greater visibility for the longevity of the tax credit, at least until 2032. Starting in 2025, the IRA will replace the existing renewable electricity ITC and PTC with the new clean electricity ITC and PTC that are based on emissions intensity and focused on achieving specific targets. While the credit amounts of the two credit schemes are similar, the clean electricity ITC and PTC only provide credits to domestically produced electricity (or production and storage facilities for such electricity) that have zero or better greenhouse gas emissions. In comparison, the current PTC and ITC offered specific credit rates based on the type of electricity produced. In addition, the existing credits had to be renewed by Congress every few years, which increased political uncertainty that hindered investments in renewable energy projects. The clean electricity credit has no set expiration dates — it will run until the electric power sector achieves a 75% reduction in greenhouse gas emission versus 2022 levels, or after 2032, whichever comes later. According to the EIA, the electricity power sector produced 1.6 billion metric tons of CO₂ emissions in 2021, 59% of which came from coal, and 40% came from natural gas. To achieve 75% reduction in overall emissions, a significant percentage of coal and natural gas generation capacity would need to be replaced by renewable energy (or nuclear). For context, the electricity power sector achieved a CO₂ emissions reduction of 28% over the past decade. The increased longevity of the ITC

could lead to greater generalist equity ownership (ESG funds are already overweight). Our forecasts do not call for a 75% reduction in US GHG emissions by 2032 vs. 2022 levels, implying the credit could last beyond 2032.

IRA policy detail vs. prior policy, Build Back Better proposal

Exhibit 12: The Inflation Reduction Act would increase the renewable electricity ITC

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	Energy Credit	Energy Credit	Energy Credit
Synopsis	Tax credit for investment in renewable electricity	Extends and modifies the investment tax credit (ITC) for renewable electricity through the end of 2026	Extends and modifies the investment tax credit (ITC) for renewable electricity <u>through the end of 2024</u>
Maximum credit rate	<ul style="list-style-type: none"> • 26% and 22% in 2022 and 2023 respectively for investments in solar, fiber optic solar, fuel cells, offshore and small wind, and water energy recovery properties • 10% permanent rate for solar and geothermal energy • 10% for micro turbines, combined heat & power, geothermal heat pump through 2023 • 30% for offshore wind through 2025 	<ul style="list-style-type: none"> • Increases ITC rate to 30% for solar, fuel cells, waste energy recovery, and small wind property; and 10% for micro-turbine and combined heat & power property • ITC for geothermal heat pumps would be extended through 2031 and phased down after 2031 • Expand the list of qualifying properties to include energy storage technology, qualified biogas property, electrochromic glass, microgrid controllers at the 30% rate • A 10 ppt bonus is available for projects that 1) meet domestic content requirements or 2) located in an energy community 	<ul style="list-style-type: none"> • Increases ITC rate to 30% for solar, fuel cells, waste energy recovery, <u>combined heat and power</u>, and small wind property; and 10% for micro-turbine property • ITC for geothermal heat pumps would be extended <u>through 2034</u>, and phased down <u>after 2032</u> • Expand the list of qualifying properties to include energy storage technology, qualified biogas property, electrochromic glass and microgrid controllers at the 30% rate • A 10 ppt bonus is available for projects that 1) meet domestic content requirements or 2) located in an energy community
Eligible facilities		<ul style="list-style-type: none"> • For all projects except geothermal heat pumps: construction must begin before 1/1/2027 • For Geothermal heat pumps: construction must begin before 1/1/2033 	<ul style="list-style-type: none"> • For all projects except geothermal heat pumps: construction must begin before 1/1/2025 • For Geothermal heat pumps: construction must begin <u>before 1/1/2035</u>
Payment	Tax credit only	Direct pay option available	Direct pay option <u>available to certain tax-exempt entities</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Exhibit 13: Inflation Reduction Act would extend the renewable electricity PTC

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	Renewable electricity production credit	Renewable electricity production credit	Renewable electricity production credit
Synopsis	A production tax credit (PTC) for renewable electricity that varies in rate depending on the technology used.	Extends the PTC for wind, biomass, geothermal, solar, landfill gas, trash, qualified hydropower, and marine and hydrokinetic resources through 2026	Extends the PTC for wind, biomass, geothermal, solar, landfill gas, trash, qualified hydropower, and marine and hydrokinetic resources <u>through 2024</u>
Maximum credit rate	<ul style="list-style-type: none"> • 2.5¢ per kWh (full credit) in 2021 for electricity produced from wind, closed-loop biomass, and geothermal, adjusted for inflation thereafter • 1.3¢ per kWh (half credit) in 2021 for electricity produced from open-loop biomass, small irrigation power, municipal solid waste, qualified hydropower, marine and hydrokinetic current 	<ul style="list-style-type: none"> • Qualifying hydropower and marine and hydrokinetic renewable energy projects qualify for the full PTC instead of half-credit. • A 10% bonus would be provided to projects that 1) meet domestic content requirements or 2) located in an energy community. 	<ul style="list-style-type: none"> • Qualifying hydropower and marine and hydrokinetic renewable energy projects qualify for the full PTC instead of half-credit. • A 10% bonus would be provided to projects that 1) meet domestic content requirements or 2) located in an energy community.
Eligible facilities	Began construction before 1/1/2022	Began construction before 1/1/2027	Began construction <u>before 1/1/2025</u>
Claim period	First 10 years of production	First 10 years of production	First 10 years of production
Payment	Tax credit only	Direct pay option available	Direct pay option <u>available to tax-exempt entities</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Exhibit 14: Inflation Reduction Act would create a new tax credit for investing in zero-emissions electricity or energy storage technology

To take effect starting in 2025

	Build Back Better Act	Inflation Reduction Act
Name	Clean electricity investment credit	Clean electricity investment credit
Synopsis	Creates a new clean electricity ITC for investment in qualifying zero-emissions electricity generation facilities or energy storage technology.	Creates a new clean electricity ITC for investment in qualifying zero-emissions electricity generation facilities or energy storage technology.
Maximum credit rate	<ul style="list-style-type: none"> • 30% • 10 ppt bonus available for 1) electricity produced in energy communities or 2) facilities that meet the domestic content standard. 	<ul style="list-style-type: none"> • 30% • 10 ppt bonus available for 1) electricity produced in energy communities or 2) facilities that meet the domestic content standard • Projects located in a low-income community, on Indian land, or are part of a low-income residential building projects are eligible to be allocated the annual "environmental justice solar and wind capacity" credits, for which they would receive an additional 10-20 ppt bonus
Eligible facilities	Electricity need to be produced at a qualifying facility placed in service after 12/31/2026.	Electricity need to be produced at a qualifying facility placed in service <u>after 12/31/2024</u>
Phase out	Phase out would occur at the later of 1) when greenhouse gas emissions from the electric power sector are \leq 25% of its 2021 emissions, or 2) after 2031.	Phase out would occur at the later of 1) when greenhouse gas emissions from the electric power sector are \leq 25% of <u>its 2022 emissions</u> , or 2) <u>after 2032</u>
Payment	Direct pay option available	Direct pay option is available <u>only when domestic content requirements are met</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Exhibit 15: Inflation Reduction Act would create a new, emissions-driven tax credit for the electricity generation

To take effect starting in 2025

	Build Back Better Act	Inflation Reduction Act
Name	Clean electricity production credit	Clean electricity production credit
Synopsis	A new clean electricity PTC for the sale of domestically produced electricity with zero or less greenhouse gas emissions.	A new clean electricity PTC for the sale of domestically produced electricity with zero or less greenhouse gas emissions.
Maximum credit rate	<ul style="list-style-type: none"> • 2.5¢ per kWh in 2021 dollars, adjusted for inflation annually thereafter • 10% bonus is available for 1) electricity produced in energy communities or 2) facilities that meet the domestic content standard 	<ul style="list-style-type: none"> • 2.5¢ per kWh in 2021 dollars, adjusted for inflation annually thereafter • 10% bonus is available for 1) electricity produced in energy communities or 2) facilities that meet the domestic content standard
Eligible facilities	Electricity need to be produced at a qualifying facility placed in service after 12/31/2026	Electricity need to be produced at a qualifying facility placed in service <u>after 12/31/2024</u>
Claim period	First 10 years of operation	First 10 years of operation
Phase out	Phase out would occur at the later of 1) when greenhouse gas emissions from the electric power sector are ≤ 25% of its 2021 emissions, or 2) after 2031	Phase out would occur at the later of 1) when greenhouse gas emissions from the electric power sector are ≤ 25% of <u>its 2022 emissions</u> , or 2) <u>after 2032</u>
Payment	Direct pay option available	Direct pay option is available <u>only when domestic content requirements are met</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Energy Efficiency: Transformational for commercial buildings, supportive for residential homes

What's Transformational vs. Supportive

For commercial buildings, the tax incentive for energy efficiency improvements in the IRA is significantly improved versus prior law, both in the credit amount and the efficiency improvement threshold need to claim the credit. Energy efficiency improvements (relative to a "reference building") needed to claim the tax deduction is now 25%, down from 50% previously. Additionally, the base rate for the credit is now set at \$2.50 per square foot, with an additional \$0.10 per square foot can be earned for every percentage point of efficiency improvement above the 25% threshold. In total, commercial buildings can earn up to \$5.00 per square foot in efficiency credits. This compares to the prior credit of \$1.80 per square foot. Installations that are eligible for this tax credit include interior lighting, HVAC, hot water systems and building envelopes.

For residential home improvements, the IRA significantly expanded the tax credit for energy efficiency purchases by increasing the credit rate and broadening its scope. The newly renamed energy efficient home improvement credit offers a 30% credit rate, versus 10% previously, and the credit limit has been expanded to \$1,200 per year and \$600 per item, versus a \$500 lifetime limit previously. This energy efficiency home improvement credit excludes geothermal/air source heat pumps and biomass stoves, which now have a new per-item credit limit of \$2,000. The limit for windows and doors have also been increased, and the list of eligible purchases in which the energy efficient home improvement tax credit can be applied now expands to include items such as sealing insulation, panel boards, and branch circuits. Notably, under the IRA, taxpayers can earn the home improvement credit on all their homes, versus only primary residences previously.

For newly built homes, the IRA also provided additional support for energy efficiency in newly built homes by extending the relevant tax credit for 10 years and expanding the credit amount. New homes acquired after 2021 can earn a \$2,500 credit for meeting certain Energy Star efficiency standards. Homes that are certified as zero-energy ready under guidelines set by the US Department of Energy can earn a \$5,000 credit. The same level of credits would also apply to multifamily dwellings in both categories. Prior to IRA's passage, the credit for new energy efficient homes was \$2,000 for single homes and \$1,000 for manufactured homes.

IRA policy detail vs. prior policy, Build Back Better proposal

Exhibit 16: Inflation Reduction Act would modify the efficiency requirement for the commercial building tax credit

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	Energy efficient commercial building deduction	Energy efficient commercial building deduction	Energy efficient commercial building deduction
Synopsis	Permanent tax deduction available for certain energy-saving commercial building property installations	Temporarily modify the energy-efficient commercial building deduction for ten years	<u>Update the efficiency requirement for the energy efficient commercial building deduction</u>
Maximum credit rate	<p>\$1.80 per square foot</p> <p>Eligible installations include:</p> <ul style="list-style-type: none"> the interior lighting system the heating, cooling, ventilation, hot water system the building envelope 	<ul style="list-style-type: none"> Reduces the efficiency improvement threshold (relative to a reference building) needed to claim the deduction from 50% to 25%. the credit rate is set to \$2.50 per square foot and increases by \$0.10 for each percentage point increase in energy efficiency, up to a \$5.00 per square foot maximum The maximum credit amount can be claimed over a four-year period 	<ul style="list-style-type: none"> Reduces the efficiency improvement threshold (relative to a reference building) needed to claim the deduction from 50% to 25%. the credit rate is set to \$2.50 per square foot and increases by \$0.10 for each percentage point increase in energy efficiency, up to a \$5.00 per square foot maximum The maximum credit amount can be claimed over a four-year period
Claim period		Temporary modifications would expire on 12/31/2031	<u>No Expiration date</u>
Payment		Tax-exempt organizations can allocate the deduction to the designer of the building or retrofit plan	Tax-exempt organizations can allocate the deduction to the designer of the building or retrofit plan

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Budget Office, Goldman Sachs Global Investment Research

Exhibit 17: Inflation Reduction Act would extend, increase, and rename the energy efficient home improvement tax credit

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	Nonbusiness energy property credit	The energy efficient home improvement credit	The energy efficient home improvement credit
Synopsis	Provides credit for spending on energy-efficiency improvement in taxpayers' primary residence	The credit would be renamed, and its terms would be extended and increased	The credit would be renamed, and its terms would be extended and increased
Maximum credit rate	<ul style="list-style-type: none"> 10% tax credit for qualified energy-efficiency improvements and expenditures for residential energy property Subject to a \$500 per taxpayer lifetime limit 	<ul style="list-style-type: none"> Increase the credit rate to 30% Subject to an annual per-taxpayer limit of \$1,200 and a per item limit of \$600 This cap excludes geothermal and air source heat pumps and biomass stoves A 30% credit, up to \$150, is available for home energy audit 	<ul style="list-style-type: none"> Increase the credit rate to 30% Subject to an annual per-taxpayer limit of \$1,200 and a per item limit of \$600 <u>\$2,000 annual credit limit for geothermal and air source heat pumps and biomass stoves</u> A 30% credit, up to \$150, is available for home energy audit
Eligible dwelling	Credit can only be applied to primary residences	Credit can be applied to any dwelling unit by the taxpayer	Credit can be applied to any dwelling unit by the taxpayer
Claim period	Expired on 12/31/2021	Expires on 12/31/2031	Expires <u>on 12/31/2032</u>
Requirements		<ul style="list-style-type: none"> Required energy efficiency standards would be modified, and changed to update over time without additional legislation. Property upgrades that qualify for the credit would be modified 	<ul style="list-style-type: none"> Required energy efficiency standards would be modified, and changed to update over time without additional legislation. Property upgrades that qualify for the credit would be modified

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Exhibit 18: Inflation Reduction Act would extend and increase the new energy efficiency home credit

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	New energy efficient home credit	New energy efficient home credit	New energy efficient home credit
Synopsis	Available to eligible contractors for building and selling qualifying energy-efficient new homes	Extends and modifies the energy-efficient new home credit for ten years	Extends and modifies the energy-efficient new home credit for ten years
Maximum credit rate	\$2,000 for single homes and \$1,000 for manufactured homes	<ul style="list-style-type: none"> • For new homes and multifamily dwellings that meet certain Energy Star efficiency standards, the credit amount would increase to \$2,500 • For new homes and multifamily dwellings that are certified as zero-energy ready homes, the credit amount would increase \$5,000 	<ul style="list-style-type: none"> • For new homes and multifamily dwellings that meet certain Energy Star efficiency standards, the credit amount would increase to \$2,500 • For new homes and multifamily dwellings that are certified as zero-energy ready homes, the credit amount would increase \$5,000
Eligible homes		Credit applicable to homes acquired after 2021	Credit applicable to homes acquired after 2021
Claim period	Expired on 12/31/2021	Credit would expire on 12/31/2031	Credit would expire <u>on 12/31/2032</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Hydrogen: Transformational for Clean Hydrogen

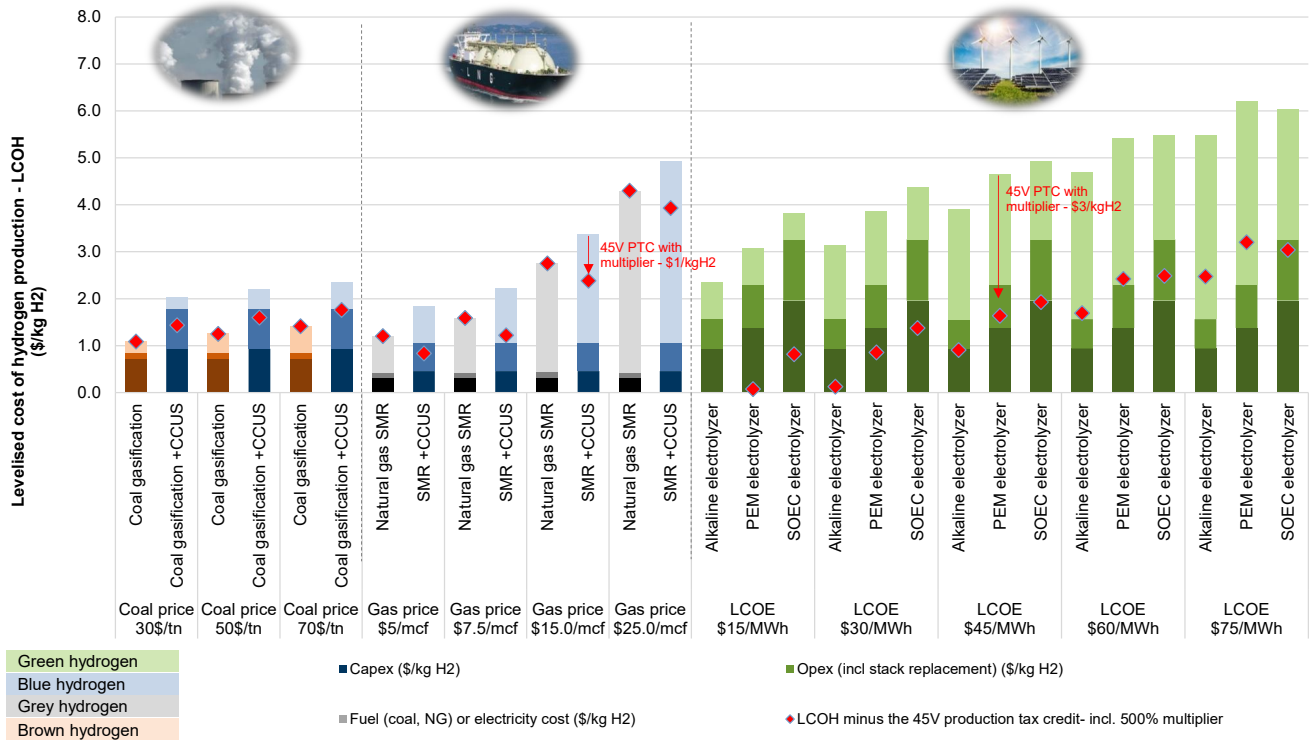
What's Transformational vs. Supportive

A new up to \$3/kg production tax credit could significantly increase hydrogen investment. The IRA introduces a production tax credit (PTC) for clean hydrogen of up to \$3/kg of hydrogen, provided lifecycle CO₂-equivalent emissions are not greater than 4 kgCO₂-eq/kg of hydrogen produced. The effective receivable credit decreases with increasing lifecycle emissions from the hydrogen generator: producers can receive the full \$3.00/kg of H₂ when lifecycle emissions are not greater than 0.45 kgCO₂-eq/kgH₂, and the IRA specifies decreasing rates down to 4 kgCO₂-eq/kgH₂, where generators can claim only 20% of the full credit. The clean hydrogen PTC is available even if the electricity used to generate the hydrogen comes from renewable energy sources claiming the existing renewable electricity PTC/ITC. However, a taxpayer cannot claim both the clean hydrogen PTC under Section 45V and the carbon capture credit under Section 45Q if the relevant facility includes carbon capture equipment and the taxpayer receives the 45Q credit.

As our EMEA Clean Technology team has highlighted, the clean hydrogen PTC significantly improves the economics of Green Hydrogen and, more modestly, Blue Hydrogen. See [Exhibit 19](#) for more details. A \$3/kgH₂ PTC for Green Hydrogen — and accounting for a levelized cost of renewable power of less than \$45/MWh — would make it already at cost parity with Gray and Blue hydrogen produced from natural gas at natural gas prices of c. US\$7.5/Mcf. **Potentially, the Clean Hydrogen PTC can fully bridge the gap between fossil fuel-based hydrogen production and hydrogen from renewable power. As our colleagues have written, this is of particular importance in the US, where Blue and Green Hydrogen appear economically attractive due to project economics and resource availability (i.e., lower-cost natural gas and renewable power).**

Exhibit 19: The 45V production tax credit could prove to be material for clean hydrogen economics (both green and blue), potentially entirely bridging the cost differential vs gray hydrogen

Levelised cost of hydrogen production - LCOH (\$/kgH2)



* LCOH figures based on current technology costs (ie. electrolyzers) and with a required return of 8% (IRR). **45V PTC includes the multiplier impact. ***For blue hydrogen we assume up to 95% of the CO2 is captured.

Source: Goldman Sachs Global Investment Research

IRA policy detail vs. prior policy, Build Back Better proposal

Exhibit 20: Inflation Reduction Act would create a new tax credit for the production of clean hydrogen

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Synopsis	Alternative fuel excise tax credit for hydrogen	Clean hydrogen production credit (45V)	Clean hydrogen production credit (45V)
Synopsis	Tax credit for alternative motor fuels, including natural gas, liquefied hydrogen, and propane	Creates a new credit for the qualified production of clean hydrogen	Creates a new credit for the qualified production of clean hydrogen
Maximum credit rate	\$0.50 per gallon of liquid hydrogen	\$3 per kg of hydrogen produced (indexed for inflation), multiplied by an applicable percentage based on lifecycle greenhouse gas emissions intensity: <ul style="list-style-type: none"> • 100%: < 0.45 kg of CO2e per kg of H2 • 33.4%: < 1.5 kg of CO2e per kg of H2 • 25%: < 2.5 kg of CO2e per kg of H2 • 20%: < 4.0 kg of CO2e per kg of H2 • 15%: < 6.0 kg of CO2e per kg of H2, applies only to facilities placed into service before 2027 	\$3 per kg of hydrogen produced (indexed for inflation), multiplied by an applicable percentage based on lifecycle greenhouse gas emissions intensity: <ul style="list-style-type: none"> • 100%: < 0.45 kg of CO2e per kg of H2 • 33.4%: < 1.5 kg of CO2e per kg of H2 • 25%: < 2.5 kg of CO2e per kg of H2 • 20%: < 4.0 kg of CO2e per kg of H2
Eligible facilities		<ul style="list-style-type: none"> • New facilities: must begin construction before 1/1/2029 • Existing facilities: could qualify after making modifications required to produce clean hydrogen 	<ul style="list-style-type: none"> • New facilities: must begin construction <u>before 1/1/2033</u> • Existing facilities: could qualify after making modifications required to produce clean hydrogen
Claim period	Expired on 12/31/2021	First 10 years of operation	First 10 years of operation
Payment	Tax credit only	Direct pay option available	<ul style="list-style-type: none"> • <u>Tax-exempt entities:</u> <i>direct pay option available</i> • <u>Non tax-exempt entities:</u> <i>direct pay option available for first 5 years of operation; allows for one-time transfer of tax credits</i>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Carbon Capture & Storage: Large increases in 45Q likely to accelerate investment in longer-term projects

What's Transformational vs. Supportive

The substantial increase in carbon dioxide sequestration credit (45Q) provided by the IRA is likely to have marginal impact on CCUS activity in the US in the near term, while its long-term impact remains to be determined. The IRA increased the 45Q credit to \$85 per metric ton for carbon sequestration, \$60 per metric ton for carbon sequestration with utilization such as enhanced oil recovery (EOR), and \$180 per metric ton for direct air capture (DAC). Under prior law, the credits would max out at \$50 per metric ton for sequestered carbon and \$35 per ton for sequestered carbon with EOR in 2026. The IRA also extended 45Q to facilities that began construction before the end of 2032 from 2026 previously. While significantly improved, the new 45Q is still not expected to make CCUS fully economic, but it should accelerate investment in projects that are or by companies seeking to build initial facilities with the goal of lowering costs through scale.

Cost curve suggests most impactful for fertilizer/petchem capture, select direct air capture opportunities. In [Exhibit 21](#), we show the estimated per metric ton cost ranges of CCS for different industries according to data from the Global CCS Institute. On a global basis, the median cost of CCS for the majority of these industries are much higher than the \$85/ton 45Q credit. In the US, many of the carbon capture opportunities being pursued are with industrial plants — ethanol, petrochemicals, steel — which could lead to an acceleration in investment. Additionally, the new higher threshold for direct air capture is likely to be supportive, but cost reductions/scale will be key.

One key factor in determining the cost of capturing is the concentration of carbon in the flue gas that are produced in the industrial combustion process. Other factors include the distances between capturing sites and storage sites (pipeline cost and carbon compression cost) and types of storage site used (onshore vs. offshore).

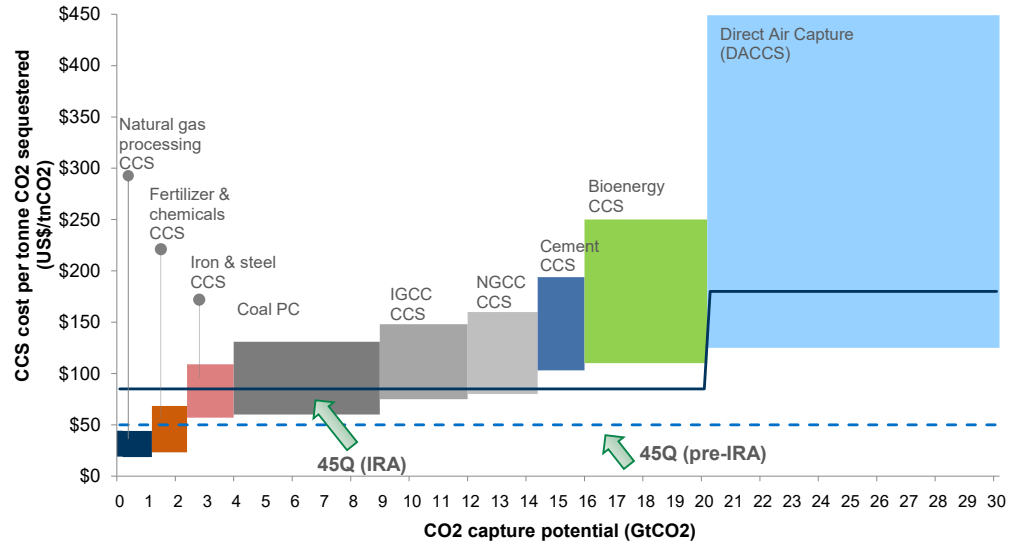
In the long run, several factors in addition to federal government support could make CCUS project economics more favorable.

- 1. Additional incentives at the state level (in absence of federal carbon price/tax).** This would incentivize companies in high-emitting sectors to use CCUS as a way to make their products more cost competitive against low-carbon intensive alternatives. For examples, several large-scale CCUS networks are currently being developed in the Midwest, with ethanol producers as their primary customers. The ability to sell ethanol in California and earn LCFS credits make these projects more economically attractive, despite the relatively high cost to capture carbon in the biofuels production process.
- 2. Economies of scale.** As more capturing plants join a CCUS network and the share the usage of pipelines and sequestration wells, the average cost for all network participants decreases. Companies that are building direct air capture plants expect

costs to fall as more plants come online over time. There are prior examples of transformative cost reductions, notably shale and solar.

3. Innovations in capturing technology and materials, particularly the absorbents and solvents used, could significantly reduce CCUS costs over time.

Exhibit 21: Global carbon capture cost curve and old/new US incentives for carbon capture with sequestration



Source: Global CCS Institute, Goldman Sachs Global Investment Research

IRA policy detail vs. prior policy, Build Back Better proposal

Exhibit 22: The Inflation Reduction Act would extend the 45Q tax credit and expand its scope

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	Credit for Carbon oxide sequestration (45Q)	Credit for carbon oxide sequestration (45Q)	Credit for carbon oxide sequestration (45Q)
Synopsis	Provides tax credit for the capturing, storing, and utilization of carbon oxide	Extends the tax credit for carbon capture, utilization and sequestration and increases its scope to include direct air capture	Extends the tax credit for carbon capture, utilization and sequestration and increases its scope to include direct air capture
Maximum Credit rate	<ul style="list-style-type: none"> Sequestered carbon oxide: \$31.77/metric ton in 2020, increases to \$50 by 2026 Sequestered carbon oxide with EOR and other qualified uses: \$20.22/metric ton in 2020, increases to \$35 by 2026 	<ul style="list-style-type: none"> Sequestered carbon oxide: \$85/metric ton in 2022 Sequestered carbon oxide with EOR and other qualified uses: \$60/metric ton in 2022 Direct air capture: \$180/metric ton in 2022 Direct air capture with EOR and other qualified uses: \$130/metric ton in 2022 	<ul style="list-style-type: none"> Sequestered carbon oxide: \$85/metric ton in 2022 Sequestered carbon oxide with EOR and other qualified uses: \$60/metric ton in 2022 Direct air capture: \$180/metric ton in 2022 Direct air capture with EOR and other qualified uses: \$130/metric ton in 2022
Eligible facilities	<ul style="list-style-type: none"> Begin construction before 1/1/2026 Annual capture requirements: Power plants: >= 500k metric tons; Small power plants: >= 25k metric tons; DAC and other facilities: >= 100k metric tons 	<ul style="list-style-type: none"> Begin construction before 1/1/2032 Annual capture requirements: Power plants: >= 18.8K metric tons, >75% of emissions; Other facilities: >=12.5 metric tons, >75% of emissions; DAC facilities: >= 1k metric tons 	<ul style="list-style-type: none"> Begin construction <u>before 1/1/2033</u> Annual capture requirements: Power plants: >= 18.8K metric tons, >75% of emissions; Other facilities: >=12.5 metric tons, >75% of emissions; DAC facilities: >= 1k metric tons
Claim period	First 12 years of operation	First 12 years of operation	First 12 years of operation
Payment	Tax credit only	Direct pay option available	<ul style="list-style-type: none"> <u>Tax-exempt entities: direct pay option available</u> <u>Non tax-exempt entities: direct pay option available for first 5 years of operation: one-time transfer of tax credits allowed</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Electric Vehicles: EV credit and cap removal supportive; questions remain on supply chain requirements

What's Transformational vs. Supportive

EV incentive a positive for OEMs and broader EV supply chain, though some questions persist as to the ability of complying with the components/materials sourcing requirements. As our US Autos team has written, the IRA could provide tailwinds for select OEMs levered to EVs for which the vehicle assembly takes place in North America. Looking upstream in the value chain, our colleagues believe the IRA could be a positive catalyst for the broader EV supply chain, which could potentially benefit from an acceleration in EV demand. However, we note requirements that battery components (from 2023) and battery materials (from 2024) not come from “foreign entities of concern” could pose supply chain challenges — particularly on lithium ferrophosphate (LFP) architectures, mainly originated from China, where sourcing from eligible countries/suppliers could represent a higher hurdle. As our colleagues note, the removal of requirements capping credits to only the first 200 thousands units sold is seen as a positive, as large OEMs with significant EV sale penetration in the US had reached or were close to reaching the cap.

On foreign battery production, we note Korean manufacturers could be well-positioned to benefit from the EV credits in the IRA. As our colleagues have written, the geographical requirements on battery manufacturing could result in Korean battery makers to benefit from market share gains in the US — among foreign companies. Our colleagues also note the expansion plans of China battery makers in the US have been more limited, with export competitiveness potentially weakening given the potential supply chain localization required in the US to qualify for incentives.

The expansion of EV credits to commercial vehicles can potentially provide tailwinds for commercial/heavy-duty EV manufacturers and logistics companies with fleet electrification targets. The IRA includes incentives for commercial clean vehicles, with battery capacity of not less than 15 kWh (7 kWh when weighing less than 14,000 pounds), charged by an external source of electricity. The credit is capped at \$40,000 (\$7,500 for vehicles weighing less than 14,000 pounds). **We believe these provisions could be supportive for OEMs levered to commercial and heavy-duty electric vehicles, as well as for electrification plans of fleet operators (e.g., logistic companies).** Though, we note that more clarity might be needed, as only vehicles made by qualified manufacturers, who have written agreements with and provide periodic reports to the Treasury, could qualify (see [here](#)).

IRA policy detail vs. prior policy, Build Back Better proposal

Exhibit 23: Inflation Reduction Act would extend and modify the tax credit for new EV purchases, though to lower levels than what was proposed in Build Back Better

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	New qualified plug-in electric drive motor vehicle credit for individuals	New qualified plug-in electric drive motor vehicle credit for individuals	<u>Clean Vehicle Credit</u>
Synopsis	New qualified plug-in electric drive motor vehicle credit for individuals	Credit term is modified, the per manufacturer limit is removed, and the credit amount increased	Credit term is modified, the per manufacturer limit is removed, and <u>the credit is renamed</u>
Maximum credit rate	Up to \$7,500 nonrefundable federal income tax credit may be available for buyers of qualifying plug-in electric vehicles.	Credit cannot exceed 50% of the vehicle purchase price, with a maximum per-vehicle amount of \$12,500	<u>The maximum credit per vehicle would be kept at \$7,500</u>
Credit components		Component of the new EV credit include: <ul style="list-style-type: none"> • \$4,000 for vehicles with battery capacity of 10 kilowatt hours that can be charged by an external source of electricity • \$3,500 for vehicles with a battery capacity of at least 40 kilowatt hour (50 kwh after 2026) that have a gas tank capacity of 2.5 gallons or less • \$4,500 for vehicles assembled at a domestic unionized facility • \$500 for vehicles powered by battery cells meeting domestic content requirements. 	<u>Component of the new EV credit include:</u> <ul style="list-style-type: none"> • <u>\$3,750 for any vehicle meeting the critical minerals requirement</u> • <u>\$3,750 for vehicles meeting the battery component requirement</u>
Eligible vehicle		<ul style="list-style-type: none"> • Retail price ≤ \$80k for vans, SUVs, or pickup trucks, and ≤ \$55k for other vehicles 	<ul style="list-style-type: none"> • <u>Clean vehicles include 1) plug-in electric vehicles with a battery capacity of at least 7 kilowatt hours; 2) fuel cell vehicles</u> • <u>Vehicle's final assembly occurred in North America</u> • <u>For vehicles placed in service after 2023, battery components must not be manufactured or assembled by a foreign entity of concern</u> • <u>For vehicles placed in service after 2024, critical minerals in the vehicle's battery must not be from a foreign entity of concern</u> • Retail price ≤ \$80k for vans, SUVs, or pickup trucks, and ≤ \$55k for other vehicles
Claim period	Expired on 12/31/2021	Expires on 12/31/2031	Expires on 12/31/2032
Phase out	The tax credit phases out once a vehicle manufacturer has sold 200k qualifying vehicles	<ul style="list-style-type: none"> • The 200k limit per manufacturer is removed • Starting in 2023, the credit would be reduced or phased out for high income claimants. 	<ul style="list-style-type: none"> • The 200k limit per manufacturer is removed • <u>High income claimants (annual income exceeds \$300k for couples, \$150k for other) are not eligible for the credit</u>
Payment	Nonrefundable	Credit would be refundable	<u>Nonrefundable</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Exhibit 24: The Inflation Reduction Act would create a new tax credit for the purchase of used EVs

	Build Back Better Act	Inflation Reduction Act
Name	Credit for previously owned qualified plug-in electric drive motor vehicles	Credit for previously owned clean vehicles
Synopsis	Creates a new refundable tax credit for previously owned plug-in electric and fuel cell vehicles	Creates a new tax credit for previously owned plug-in electric and fuel cell vehicles
Maximum credit rate	The credit would be up to \$4,000 but cannot exceed 50% of the vehicle's purchase price	The credit would be up to \$4,000 but <u>cannot exceed 30%</u> of the vehicle's purchase price
Eligible vehicle	<ul style="list-style-type: none"> • Credit would only be allowed for vehicles with a sales price of \$25,000 or less with a model year that is at least two years earlier than the calendar year in which the vehicle is sold 	<ul style="list-style-type: none"> • Credit would only be allowed for vehicles with a sales price of \$25,000 or less with a model year that is at least two years earlier than the calendar year in which the vehicle is sold
Claim period	Expires on 12/31/2031	Expires <u>on 12/31/2032</u>
Phase out	<ul style="list-style-type: none"> • The credit would phase out for married taxpayers with modified annual income above \$150k • For each \$1,000 that the annual income exceeds the threshold, The credit would be reduced by \$200 	<u>Married taxpayers with annual income above \$150k and individuals with annual income above \$75,000 are not eligible for this credit</u>
Payment	Credit would be refundable	Nonrefundable

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Inflation Reduction Act would create a new tax credit for Commercial EVs

	Build Back Better Act	Inflation Reduction Act
Name	Tax credit for commercial electric vehicles	Tax credit for commercial <u>clean vehicles</u>
Synopsis	Creates a new refundable tax credit for qualified commercial electric vehicles	Creates a new refundable tax credit for qualified commercial clean vehicles
Maximum credit rate	The credit would be lesser of: 1) 15% of the vehicle's cost (30% for vehicles not powered by a gasoline or diesel engine); or 2) the incremental cost of the vehicle relative to a comparable vehicle.	<ul style="list-style-type: none"> The credit would be lesser of: 1) 15% of the vehicle's cost (30% for vehicles not powered by a gasoline or diesel engine); or 2) the incremental cost of the vehicle relative to a comparable vehicle. <u>Credit amount cannot exceed: 1) \$7,500 for vehicles weighing less than 14,000 pounds, or 2) \$40,000 otherwise</u>
Eligible vehicle	<ul style="list-style-type: none"> Eligible vehicles would have a battery capacity of not less than 15 kilowatt hours and be charged by an external source of electricity. Mobile machinery and qualified commercial fuel cell vehicles would also be eligible for this credit 	<ul style="list-style-type: none"> Eligible vehicles would have a battery capacity of not less than 15 kilowatt hours (<u>7 kilowatt hours for vehicles weighing less than 14,000 pounds</u>) and be charged by an external source of electricity. Mobile machinery and qualified commercial fuel cell vehicles would also be eligible for this credit
Claim period	Expires on 12/31/2031	Expires <u>on 12/31/2032</u>
Payment	Tax-exempt entities have the option to receive direct payment	Tax-exempt entities have the option to receive direct payment

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Exhibit 26: Inflation Reduction Act would extend and increase the tax credit for installing EV charging stations

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	Alternative fuel refueling property credit	Alternative fuel refueling property credit	Alternative fuel refueling property credit
Synopsis	Credit for qualified alternative fuel vehicle refueling property installed by a business or at a taxpayer's principle residence	Credit term is modified and amount increased	Credit term is modified and amount increased
Maximum credit rate	Equal to 30% of refueling property installment costs, up to \$30,000 for each business location and \$1,000 for residences	<ul style="list-style-type: none"> Extends the credit at the 30% rate For business properties, the credit limit would increase to \$100,000 For residential properties, the credit limit would be raised to \$3,333.33 	<ul style="list-style-type: none"> Extends the credit at the 30% rate For business properties, the credit limit would increase to \$100,000 <u>No change to credit limit for residential properties</u>
Supplemental credit		A supplemental 20% credit would be available for costs above the \$100,000 limit for business property that refuels using only electricity or fuel consisting of >= 85% hydrogen by volume.	
Qualified property	Qualifying property includes: <ul style="list-style-type: none"> fuel storage and dispensing units electric vehicle recharging equipment 	Qualifying property would also include: <ul style="list-style-type: none"> bidirectional charging equipment 	Qualifying property would also include: <ul style="list-style-type: none"> Bidirectional charging equipment <u>Charging stations for two- and three-wheeled vehicles that are intended for use on public roads</u>
Claim period	Expired on 12/31/2021	Expires on 12/31/2031	Expires <u>on 12/31/2032</u>
Payment		Direct pay option available	Direct pay option <u>available to tax-exempt entities</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Group Inc.

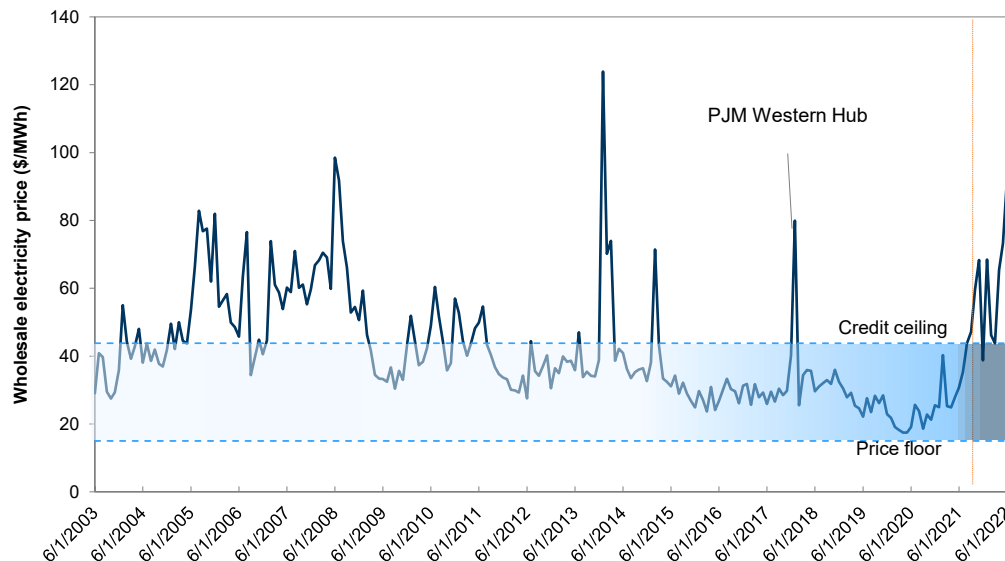
Nuclear: New 45U credit adds a price floor for existing nuclear fleet

What's Transformational vs. Supportive

The IRA supports the nuclear industry through the creation of a new production tax credit (45U) that essentially places a price floor on nuclear-generated electricity. For electricity produced after 2023, the credit amount is set at \$15 per MWh, and will phase down once the annual average price of electricity generated from the nuclear facility exceeds \$25 per MWh and reach zero at \$43.8 per MWh. Based on the wholesale electricity price for the PJM West region over the past 20 years, this credit would not be in the money given the recent sharp increase in prices ([Exhibit 27](#)). However, our US Utilities team has highlighted that the credit could provide the stability of cash flow for nuclear operators, which are viewed more favorably by rating agencies. The new credit is more important for plants that operate in unregulated markets, as regulated ones still benefit from economic protections of state utility rate-making that non regulated plants do not have.

According to the Nuclear Energy Institute, there are currently 92 nuclear reactors at 53 plant sites deployed across 28 states in the US. In 2021, nuclear accounted for 19% of the total electricity, and 50% of the emission-free electricity generated in the US. The average age of nuclear power plants in the US is about 40 years, and a number of them have incurred high repair and maintenance costs in recent years. The new 45U, along with provisions in the 2021 Infrastructure Investment and Jobs Act, will help operators of existing nuclear plants manage their costs and stay cost competitive in the long run. The Nuclear Energy Institute expects US regulators will consider applications to plants seeking to further extend their operating licenses to 80 years (40 year initial life, 20 year extension already granted).

Exhibit 27: The zero-emission nuclear tax credit is not in the money based on today's electricity prices
 Indicative chart showing the wholesale electricity price in the PJM West region and electricity prices for which the 45U would be in the money



The 45U credit would be applied based on regional electricity prices, which could differ significantly from national averages

Source: EIA, Congressional Research Service, Goldman Sachs Global Investment Research

IRA policy detail vs. prior policy, Build Back Better proposal

Exhibit 28: Inflation Reduction Act would create a new tax credit for zero-emission nuclear power that doesn't qualify for existing credits

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	Advanced nuclear production tax credit (45J)	Zero-emission nuclear power production credit (45U)	Zero-emission nuclear power production credit (45U)
Synopsis	Provides tax credit for the production of nuclear power from advanced facilities	Creates a new tax credit for qualifying zero-emission nuclear power produced and sold after 2021 that do not qualify for 45J.	Creates a new tax credit for qualifying zero-emission nuclear power produced and sold <u>after 2023</u> that do not qualify for 45J.
Maximum credit rate	<ul style="list-style-type: none"> 1.8¢ per kWh of electricity produced The amount of credit is limited to 6,000 MW of total electric generating capacity for all qualifying facilities nationwide per taxable year, allocated by the IRS. 	1.5¢ per kWh of electricity produced	1.5¢ per kWh of electricity produced
Eligible facilities	Qualifying facilities must use nuclear reactor designs approved by the Nuclear Regulatory Commission after 1993, and must be placed in service by the end of 2020	Taxpayer-owned facilities that use nuclear power to generate electricity that did not receive a tax credit allocation for 45J	Taxpayer-owned facilities that use nuclear power to generate electricity that did not receive a tax credit allocation for 45J
Claim period	8 years beginning on the date the facility was originally placed in service	Tax credit ends on 12/31/2027	Tax credit ends <u>on 12/31/2032</u>
Phase out	<ul style="list-style-type: none"> Taxpayers can claim no more than \$125 million in tax credits per 1,000 MW of the allocated capacity in any single year. Any unused portion of the 6,000 MW of capacity will first be reallocated to facilities placed in service before 2021. Any remaining unallocated capacity could then be allocated to facilities placed in service after 1/1/2021, in the order of start-of-service date. 	<ul style="list-style-type: none"> The credit would be reduced when electricity prices increases. The "reduction amount" is 16% of the excess of gross receipts from electricity produced by the facility and sold over the product of 2.5¢ times the amount of electricity sold during the taxable year. 	<ul style="list-style-type: none"> The credit would be reduced when electricity prices increases. The "reduction amount" is <u>80%</u> of the excess of gross receipts from electricity produced by the facility and sold over the product of 2.5¢ times the amount of electricity sold during the taxable year.
Payment	Tax credit only	Direct pay option available	Direct pay option <u>available to tax-exempt entities</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Advanced Manufacturing: Supportive for batteries and the on-shoring of wind and solar supply chains

What's Transformational vs. Supportive

The new advanced manufacturing credit created by the IRA are expected to be supportive for domestic wind, solar and battery component manufacturers.

However, to what extent it will succeed in bringing onshore the renewable energy supply chain remains to be seen.

Components that qualify for the new credit include solar panels, inverters, trackers, wind turbines, and batteries (please see the exhibits below for a complete list of components and their corresponding credit amounts).

According to our Clean Energy team, these credits represent roughly >40% of the current cost for solar panels, 20%-50% for inverters (depending on the inverter), 15%-20% for trackers, and 10%-15% for batteries. These credit would begin to phase down in 2031 and end by 2033.

There is still much uncertainty over how much these credits might incentivize companies to bring manufacturing to the US. Many companies covered by our Clean Energy team are still in the very early stages of evaluating new US capacity following the passage of the IRA. Some companies have announced that they are accelerating their evaluation process. At the same time, many companies have to weigh these credits against the likelihood of higher manufacturing costs in the US relative to where the components are manufactured today. Given the recent labor shortages and wage inflation there is uncertainty on how much more costly it would be to produce in the US. Another factor to consider is that the expansion of the clean electricity and residential clean energy credits may allow companies to justify bringing capacity closer to their US end markets. **On the other hand, the credit is expected to benefit companies that already have manufacturing capacity in the US, and should help stabilize the renewables supply chain in the long run.**

IRA policy detail vs. prior policy, Build Back Better proposal

Exhibit 29: The Inflation Reduction Act included credits for batteries and inverters that were not included in the Build Back Better Act

	Build Back Better Act	Inflation Reduction Act
Name	Advanced manufacturing production credit (45X)	Advanced manufacturing production credit (45X)
Synopsis	A new production tax credit (PTC) that could be claimed for the domestic production and sale of qualifying solar, wind and battery components.	A new production tax credit (PTC) that could be claimed for the domestic production and sale of qualifying solar, wind and battery components.
Maximum credit rate for solar		Credits for batteries and inverters include: <ul style="list-style-type: none"> • <u>The credit for inverters ranges from 1.5¢ to 11¢ per watt, depending on different types of inverters' capacity</u> • <u>For electrode active materials, the credit would be 10% of the production cost</u> • <u>Battery cells qualify for credit of \$35 per kWh of capacity, and battery modules qualify for a credit of \$10 per kWh of capacity</u> • <u>A 10% credit is available for the production of critical minerals</u>
Eligible facilities	The total credit amount would be increased by 10% for components manufactured in unionized facilities.	
Claim period	The credit would start to phase out after 12/31/2028, and would end by 12/31/2031	<ul style="list-style-type: none"> • The credit would start to phase out <u>after 12/31/2029</u>, and would end <u>by 12/31/2032</u> • <u>The phase out does not apply to the production of critical materials</u>
Payment	Direct pay option is available	<ul style="list-style-type: none"> • <u>Tax-exempt entities: direct pay option available</u> • <u>Non tax-exempt entities: direct pay option available for first 5 years of operation; allows for one-time transfer of tax credits</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Exhibit 30: Tax credits for the solar component manufacturing in the IRA

Inflation Reduction Act would create a new tax credit for the production of wind and solar components

	Build Back Better Act	Inflation Reduction Act
Name	Advanced manufacturing production credit (45X)	Advanced manufacturing production credit (45X)
Synopsis	A new production tax credit (PTC) that could be claimed for the domestic production and sale of qualifying solar , wind and battery components.	A new production tax credit (PTC) that could be claimed for the domestic production and sale of qualifying solar , wind and battery components.
Maximum credit rate for solar	Credits for solar components would include: <ul style="list-style-type: none"> • for a thin film photovoltaic cell or crystalline photovoltaic cell, 4¢ per direct current watt capacity • for photovoltaic wafers, \$12 per square meter • for solar grade polysilicon, \$3 per kilogram • for solar modules, 7¢ per direct current watt of capacity. 	Credits for solar components would include: <ul style="list-style-type: none"> • for a thin film photovoltaic cell or crystalline photovoltaic cell, 4¢ per direct current watt capacity • for photovoltaic wafers, \$12 per square meter • for solar grade polysilicon, \$3 per kilogram • for solar modules, 7¢ per direct current watt of capacity.
Eligible facilities	The total credit amount would be increased by 10% for components manufactured in unionized facilities.	
Claim period	The credit would start to phase out after 12/31/2028, and would end by 12/31/2031	The credit would start to phase out <u>after 12/31/2029</u> , and would end <u>by 12/31/2032</u>
Payment	Direct pay option is available	<ul style="list-style-type: none"> • <u>Tax-exempt entities: direct pay option available</u> • <u>Non tax-exempt entities: direct pay option available for first 5 years of operation; allows for one-time transfer of tax credits</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Exhibit 31: Tax credit for wind component manufacturing in the IRA

Inflation Reduction Act would create a new tax credit for the production of wind and solar components

	Build Back Better Act	Inflation Reduction Act
Name	Advanced manufacturing production credit (45X)	Advanced manufacturing production credit (45X)
Synopsis	A new production tax credit (PTC) that could be claimed for the domestic production and sale of qualifying solar, wind and battery components.	A new production tax credit (PTC) that could be claimed for the domestic production and sale of qualifying solar, wind and battery components.
Maximum credit rate for solar	Credits for wind components include: <ul style="list-style-type: none"> • for offshore wind vessel, the credit amount would be 10% of the sales price • for other wind components, credit computed as an applicable amount times the total rated capacity of the completed wind turbine for which the component was designed • The applicable amount would be 2¢ for blades, 5¢ for nacelles, 3¢ for towers, 2¢ for floating platform wind foundations, and 4¢ for floating platform offshore wind foundations • The credit for torque tubes and longitudinal purlin would be \$0.87 per kg, and the credit for structural fasteners would be \$2.28 per kg 	Credits for wind components include: <ul style="list-style-type: none"> • for offshore wind vessel, the credit amount would be 10% of the sales price • for other wind components, credit computed as an applicable amount times the total rated capacity of the completed wind turbine for which the component was designed • The applicable amount would be 2¢ for blades, 5¢ for nacelles, 3¢ for towers, 2¢ for floating platform wind foundations, and 4¢ for floating platform offshore wind foundations • The credit for torque tubes and longitudinal purlin would be \$0.87 per kg, and the credit for structural fasteners would be \$2.28 per kg
Eligible facilities	The total credit amount would be increased by 10% for components manufactured in unionized facilities.	
Claim period	The credit would start to phase out after 12/31/2028, and would end by 12/31/2031	<ul style="list-style-type: none"> • The credit would start to phase out <u>after 12/31/2029</u>, and would end <u>by 12/31/2032</u> • <u>The phase out does not apply to the production of critical materials</u>
Payment	Direct pay option is available	<ul style="list-style-type: none"> • <u>Tax-exempt entities:</u> <u>direct pay option available</u> • <u>Non tax-exempt entities:</u> <u>direct pay option available for first 5 years of operation; allows for one-time transfer of tax credits</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Low-Emission fuels: Extension of tax credit on biofuels likely to benefit producers, have limited impact on refiners

What's Transformational vs. Supportive

The extension of tax credit for biofuels and the creation of a new sustainable aviation fuel credit included in the IRA are expected to have positive impact on alternative fuel producers, but limited impact on refiners (blenders). The IRA extended existing tax credits for various biofuels and alternative fuels through the end of 2024. It also created a \$1.25 per gallon credit for sustainable aviation fuel (SAF) that drives a 50% GHG reduction versus the alternative fossil fuel, with an extra 1¢ per gallon for every additional percentage point of GHG emissions achieved higher than 50%, up to an \$1.75 per gallon cap. Small, pure-play producers that generate significant percentage of revenue from tax credits are expected to benefit the most from these programs.

A new carbon intensity (CI) based clean fuel PTC will be created to replace the biofuel and SAF credits for 2025-2027. The new PTC will pay a base rate of \$1.00 per gallon for non-aviation fuel and \$1.75 for aviation fuel multiplied by an emission factor, which would reach zero when the fuel's emission intensity exceeds 50 kg of CO₂e per MMBtu. **According to our Integrated Oil & Refiners team, on the margin, the new clean fuel PTC is expected to benefit fuels producers that use low CI feedstock such as tallow and cooking oil relative to those that use high CI feedstock such as soybean.** With regard to SAF, the technology development is in such early stages that the new tax incentives are not expected to meaningfully impact SAF's economics during the PTC's claim period. The IRA also included \$250 million in direct funding for the research and development of SAF technology.

In addition to the federal tax credit, biofuel blenders also generate revenue from selling excess Renewable Identification Numbers (RINs) in accordance to the federal Renewable Fuel Standard (RFS) and earning LCFS credits by selling biofuels in California. When the amount received from blender's credit increases, it will likely result in an increase in biofuel production, which will in turn increase the supply of RINs available for trading and reduce its price. On net, these two effects are expected to largely offset each other and the financial impact on biofuel blenders is limited. On the other hand, Canada and US states such as Washington are in the process of initiating their own low carbon fuel trading markets similar to the one in California. As these markets become operational over the next few years, they are expected to increase the demand for low-carbon fuels and potentially drive more projects in biofuels production, thereby benefiting producers and refiners.

IRA policy detail vs. prior policy, Build Back Better proposal

Exhibit 32: Inflation Reduction Act would extend credit for low-emission fuels

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	Incentives for biodiesel, renewable diesel, and alternative fuels	Incentives for biodiesel, renewable diesel, and alternative fuels	Incentives for biodiesel, renewable diesel, and alternative fuels
Synopsis	Tax credit for biodiesel, renewable diesel, alternative fuels, and second-generation biofuel production	Extends tax credit for biodiesel, renewable diesel, alternative fuels, and second-generation biofuel production	Extends tax credit for biodiesel, renewable diesel, alternative fuels, and second-generation biofuel production
Maximum credit rate	<ul style="list-style-type: none"> • \$0.50 per gallon for alternative fuels and alternative fuel mixtures • \$1.00 per gallon for biodiesel and renewable diesel • \$1.10 per gallon for agri-biodiesel • \$1.01 per gallon for second-generation biofuel production 	<ul style="list-style-type: none"> • \$0.50 per gallon for alternative fuels and alternative fuel mixtures • \$1.00 per gallon for biodiesel and renewable diesel • \$1.10 per gallon for agri-biodiesel • \$1.01 per gallon for second-generation biofuel production 	<ul style="list-style-type: none"> • \$0.50 per gallon for alternative fuels and alternative fuel mixtures • \$1.00 per gallon for biodiesel and renewable diesel • \$1.10 per gallon for agri-biodiesel • \$1.01 per gallon for second-generation biofuel production
Claim period	Credit for alternative fuels was available through 12/31/2021, all other credit available through 12/31/2022	Extends credit through 12/31/2026	Extends credit <u>through 12/31/2024</u>
Retroactive eligibility			<u>Tax credits for alternatives fuels that expired in 2021 would be reinstated for all of 2022</u>
Payment	Tax credit only	Credits in excess of excise tax liability may be refunded	Credits in excess of excise tax liability may be refunded

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Exhibit 33: Inflation Reduction Act would create a new tax credit for sustainable aviation fuel

	Build Back Better Act	Inflation Reduction Act
Name	Sustainable aviation fuel credit	Sustainable aviation fuel credit
Synopsis	Creates a new tax credit for the sale or mixture of sustainable aviation fuel	Creates a new tax credit for the sale or mixture of sustainable aviation fuel
Maximum credit rate	<ul style="list-style-type: none"> • Base rate of \$1.25 per gallon, plus \$0.01 per gallon for each percentage point the fuel's lifecycle greenhouse gas emission is reduced beyond 50% • With a maximum supplemental credit of \$0.50 per gallon, the largest possible credit per gallon is \$1.75 	<ul style="list-style-type: none"> • Base rate of \$1.25 per gallon, plus \$0.01 per gallon for each percentage point the fuel's lifecycle greenhouse gas emission is reduced beyond 50% • With a maximum supplemental credit of \$0.50 per gallon, the largest possible credit per gallon is \$1.75
Eligible fuel	<ol style="list-style-type: none"> (1) Meets ASTM standards; (2) Not derived from palm fatty acid distillates or petroleum; and (3) Certified to achieves at least a 50% lifecycle greenhouse gas reduction compared to petroleum-based jet fuel 	<ol style="list-style-type: none"> (1) Meets ASTM standards; (2) <u>Not derived from coprocessing an applicable material with a feedstock which is not biomass;</u> (3) Not derived from palm fatty acid distillates or petroleum; and (4) Certified to achieve at least a 50% lifecycle greenhouse gas reduction compared to petroleum-based jet fuel
Claim period	Starts in 2023, and expires after 12/31/2026	Starts in 2023, and expires <u>after 12/31/2024</u>
Payment	Credit can be used to offset fuel excise tax liability; direct payment is available when credit exceeds fuel excise tax liability	Credit can be used to offset fuel excise tax liability; direct payment is available when credit exceeds fuel excise tax liability

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Exhibit 34: Inflation Reduction Act would create a new tax credit for domestic clean fuel production

To take effect in 2025

	Build Back Better Act	Inflation Reduction Act
Name	Clean fuel production credit (PTC)	Clean fuel production credit (PTC)
Synopsis	<ul style="list-style-type: none"> Creates a tax credit for domestic clean fuel production Credit calculated as the applicable amount per gallon multiplied by the emissions factor of the fuel 	<ul style="list-style-type: none"> Creates a tax credit for domestic clean fuel production Credit calculated as the applicable amount per gallon multiplied by the emissions factor of the fuel
Maximum credit rate	<ul style="list-style-type: none"> The applicable amount: \$1.00 for non-aviation fuel and \$1.75 for aviation fuel The emissions factor is calculated based on the formula: $[(50 \text{ kg of CO}_2\text{e global warming potential per MMBtu} - \text{emissions rate of fuel produced}) / 50 \text{ kg of CO}_2\text{e per MMBtu}]$ 	<ul style="list-style-type: none"> The applicable amount: \$1.00 for non-aviation fuel and \$1.75 for aviation fuel The emissions factor is calculated based on the formula: $[(50 \text{ kg of CO}_2\text{e global warming potential per MMBtu} - \text{emissions rate of fuel produced}) / 50 \text{ kg of CO}_2\text{e per MMBtu}]$
Eligible facilities	Excludes facilities that receive the clean hydrogen or CCS tax credits	Excludes facilities that receive the clean hydrogen or CCS tax credits
Claim period	Starts in 2027	Starts <u>in 2025</u>
Qualifying fuel	<ul style="list-style-type: none"> For fuel sold in 2027 through 2030, emissions rate must not exceed 50 kg CO₂e per MMBtu For sustainable aviation fuel, emission rate must not exceed 35 kg CO₂e per MMBtu For fuel sold after 2030, emissions rate must not exceed 25 kg CO₂e per MMBtu 	<u>Only transportation fuels that have emissions rates ≤ 50 kg CO₂e per MMBtu would qualify for the credit</u>
Phase out	Phase out would occur at the later of 1) when greenhouse gas emissions from the electric power sector are ≤ 25% of its 2021 emissions, or 2) after 2031	<u>Credit ends after 12/31/2027</u>
Payment	Direct pay option available	Direct pay option <u>available for certain tax-exempt entities</u>

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Advanced Energy Projects

What's Transformational vs. Supportive

The Advanced energy project credit provides up to \$10 billion in funding for qualified projects across largely above-mentioned verticals via a 30% credit. This is an alternative but is not additional to above-mentioned credits. We see this as supportive for the Green Capex mosaic of verticals.

IRA policy detail vs. prior policy, Build Back Better proposal

Exhibit 35: Inflation Reduction Act would appropriate additional funding to the advanced energy project tax credit first created in 2009

	Prior Legislation	Build Back Better Act	Inflation Reduction Act
Name	Advanced energy manufacturing credit	Advanced energy project credit	Advanced energy project credit
Synopsis	Provided tax credit for qualified advanced energy projects through The American Recovery and Reinvestment Act of 2009	Provides additional funding for the qualified advanced energy manufacturing tax credit	Provides additional funding for the qualified advanced energy manufacturing tax credit
Maximum credit rate	<ul style="list-style-type: none"> • 30% credit rate, • \$2.3 billion in total has already been allocated 	<ul style="list-style-type: none"> • 30% credit rate • \$5 billion in allocations would be provided in 2022 and 2023 and an additional \$1.875 billion would be allocated in each year from 2024 through 2031. • In 2022 and 2023, \$800 million in annual allocations would be for projects in automotive and energy communities, respectively, with \$300 million set aside in each of the subsequent years. 	<ul style="list-style-type: none"> • 30% credit rate • <u>\$10 billion in allocations would be provided with at least \$4 billion allocated to energy communities</u>
Qualified projects		Qualifying advanced energy projects include: <ol style="list-style-type: none"> 1) reequip, expand, or establish a manufacturing or industrial facility for the production or recycling of renewable energy property; 2) energy storage systems and components; 3) grid modernization equipment and components; 4) property designed to remove, use, or sequester carbon oxide emissions; 5) equipment designed to refine, electrolyze, or blend any fuel, chemical, or product which is renewable or low-carbon and low-emission; 6) property designed to produce energy conservation technologies, electric or fuel-cell vehicles, including technologies, components, or materials for such vehicles and the associated charging infrastructure; 7) hybrid vehicles weighing less than 14,000 pounds, including technologies, components, or materials for such vehicles; 8) reequips an industrial manufacturing facility with equipment designed to reduce greenhouse gas emissions by at least 20%. 	Qualifying advanced energy projects include: <ol style="list-style-type: none"> 1) reequip, expand, or establish a manufacturing or industrial facility for the production or recycling of renewable energy property; 2) energy storage systems and components; 3) grid modernization equipment and components; 4) property designed to remove, use, or sequester carbon oxide emissions; 5) equipment designed to refine, electrolyze, or blend any fuel, chemical, or product which is renewable or low-carbon and low-emission; 6) property designed to produce energy conservation technologies, electric or fuel-cell vehicles, including technologies, components, or materials for such vehicles and the associated charging infrastructure; 7) hybrid vehicles weighing less than 14,000 pounds, including technologies, components, or materials for such vehicles; 8) reequips an industrial manufacturing facility with equipment designed to reduce greenhouse gas emissions by at least 20% 9) <u>reequips, expands, or establishes an industrial facility for the processing, refining or recycling of critical materials</u>
Claim period		Applicants have two years to: <ol style="list-style-type: none"> 1) prove that requirements for certification of the credits have been met; 2) place property in service 	Applicants have two years to: <ol style="list-style-type: none"> 1) prove that requirements for certification of the credits have been met; 2) place property in service

Differences between the BBB and the IRA are underlined and italicized

Source: Congressional Research Service, Goldman Sachs Global Investment Research

Beyond tax credits: Other IRA provisions that could help spur Green Capex

In addition to tax credits, there are a number of provisions in the Inflation Reduction Act that could accelerate and expand Green Capex in the US. We highlight three of them below.

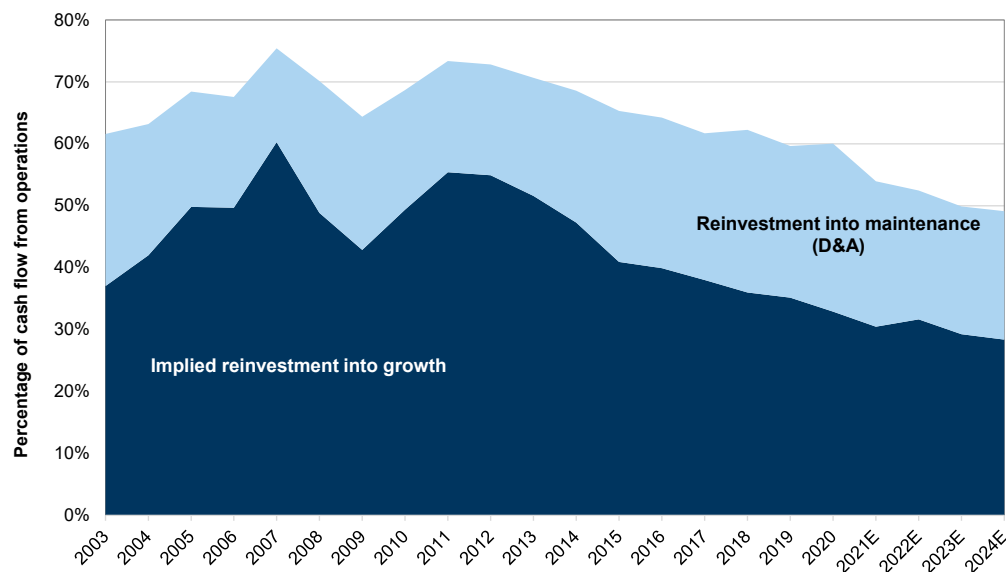
Excise tax on stock buybacks

The new excise tax on stock repurchases... The IRA imposed a 1% excise tax on the repurchase of stock by publicly traded corporates. The amount subject to tax would be reduced by new issuance of stock, either to the public or to employees. Repurchases that are less than \$1 million or are intended to fund employee pension and stock ownership plans would not be taxed. The CBO estimated that the tax could raise \$124 billion in additional revenue over 10 years.

... could provide greater incentives towards reinvestment. Over the past decade, reinvestment of cash flows into capex and R&D has steadily decreased as corporates favored returning cash to shareholders through buybacks and dividends ([Exhibit 36](#)). Our Portfolio Strategy team estimated that share repurchases for S&P 500 companies will exceed \$1.0 trillion in 2022, accounting for 30% of overall corporate cash use. In our Green Capex: Greenflation, Returns and Opportunity report, we estimated that for GS covered companies, reinvestment rates of cash flows into capex + R&D are still on the decline versus the historical highs in the 2000s, now forecast at 52% in 2022E, 50% in 2023E and 49% in 2024E. The new 1% tax could potentially incentivize corporates to slow buybacks in favor of greater reinvestment on the margin, especially given the improved investment credits offered in the IRA. While this is incrementally positive towards Green Capex initiatives, reinvestment rates into capex + R&D would still need to move considerably higher in order to bridge at least partially the gap needed to achieve the full incremental \$2.8 tn annual Green Capex needed in the 2020s on path to Sustainable Development Goals.

Exhibit 36: Reinvestment Rates of cash flows into Capex + R&D have declined over the last decade, opening up \$1 trillion of spare capacity that could be redirected to Green Capex; tax on share repurchase in the US is a modest incentive for additional reinvestment

Weighted average reinvestment rate, (capex + R&D) / (operating cash flow + R&D), split by D&A and implied reinvestment into growth; excludes Financials and Real Estate



Source: FactSet, Refinitiv Eikon, Goldman Sachs Global Investment Research

Electricity transmission provisions

Electricity transmission systems is a key Greenabler (Green Enabler) of renewable power and energy reliability in the US, especially after recent outages resulting from extreme weather events. According to industry analysts, US transmission

development to grow 2x-3x above the current run rate of roughly \$20bn/year for the nation to achieve Net Zero goals over the next 20-30 years. Though there were no tax incentives directed at electricity transmission in the IRA, it provided funding for several programs to develop electricity transmission infrastructure. This includes \$2 billion for a direct loans program to support certain transmission project development. To be eligible for a direct loan, a transmission project would need to be located in a National Interest Electric Transmission Corridor (NIETC) which are designated to promote energy security and intermittent energy sources such as wind and solar. Additional funding (about \$1 billion) are provided to (1) make grants to state and local governments for the siting of onshore and offshore transmission lines; and (2) study inter-regional transmission development. Collaboration between the three electricity grids to develop transmission is rare in the US. An increase in inter-regional electricity connection could potentially lead to more renewables utilization and lower costs for customers.

Methane emissions charge

The new methane emissions charge is expected to have limited impact on oil and gas producer cash flows, but on the margin could favor producers with low emissions intensity. The IRA initiated a charge on methane emissions from select

facilities in the oil and gas industry. It would start at \$900 per metric ton of methane (\$36 per mtCO₂e) in 2024 and increase to \$1,500 (\$60 per mtCO₂e) over two years. The methane emissions charge only applies to facilities that emit 25,000 mtCO₂e or more per year, and are required to report their greenhouse gas emissions to the Environmental Protection Agency (EPA). Facilities that will be subject to the charge include: (1) onshore and offshore oil and gas production; (2) onshore natural gas processing, transmission compression, underground storage; (3) LNG import and export equipment and storage; (4) onshore oil and gas gathering and boosting; and (5) onshore natural gas transmission pipelines. Notably, natural gas distribution facilities have been exempt from the methane emissions charge.

The methane emissions charge would be calculated based on a facility's emissions as reported to the EPA and an emissions threshold based on the type of facility. For example, the threshold for petroleum and natural gas production facilities is 0.2% of the natural gas sent to sale from such a facility. According to a [Congressional Research Service report](#), these thresholds would reduce the amount of methane subject to the charge by over 30%. The CBO estimated that the methane emissions charge would generate \$6.4 billion in additional revenue between 2026-2031. Our Exploration and Production team expects that the charge at \$900 per metric ton will have less than 1% impact to the EBITDA of oil and gas producers. In addition, the charge is likely to have a higher impact on companies with higher emissions intensity.

Fiscal impact of the IRA

The IRA is estimated to nearly triple the amount of tax incentives the Federal governments provides to green energy in ten years — from \$16 billion in 2021 to \$44 billion in 2031 (Exhibit 6). The US Department of Treasury estimated that tax expenditures based on existing law prior to IRA's passage will decline over time as more incentive programs expire. The incremental portion of the \$386 billion of spending provided by the IRA, when averaged out over ten years, represent about 4% of our estimated \$900 billion per year in additional Green Capex still needed to meet Net Zero, Clean Water and Infrastructure goals. However, because 70% of the spending in the IRA are tax credits, it will likely spur more Green Capex deployment from the private sector.

Public companies even before the IRA have the ability to invest \$1 trillion more annually in Green Capex without stretching balance sheets. As we have highlighted, a return to historical rates of reinvestment of operating cash flow into capex + R&D would open up an additional \$1 trillion of "spare capacity" for Green Capex, with relevant sector reinvesting 70% of operating cash flow at 1.5x net debt/EBITDA leverage. Notably, about 60% of the total spare capacity from global public companies comes from the oil and gas sector (please refer to our Green Capex: Greenflation, Returns and Opportunity report for more details). For any company in any sector considering investment expansion — particularly into new Green business lines, one key debate remains what it will take for investors to "**CARE**" about these potential Green Capex commitments. We believe it is important for companies to demonstrate:

- **C**ore competency
- **A**vailable capital
- **R**eturns
- **E**xecution

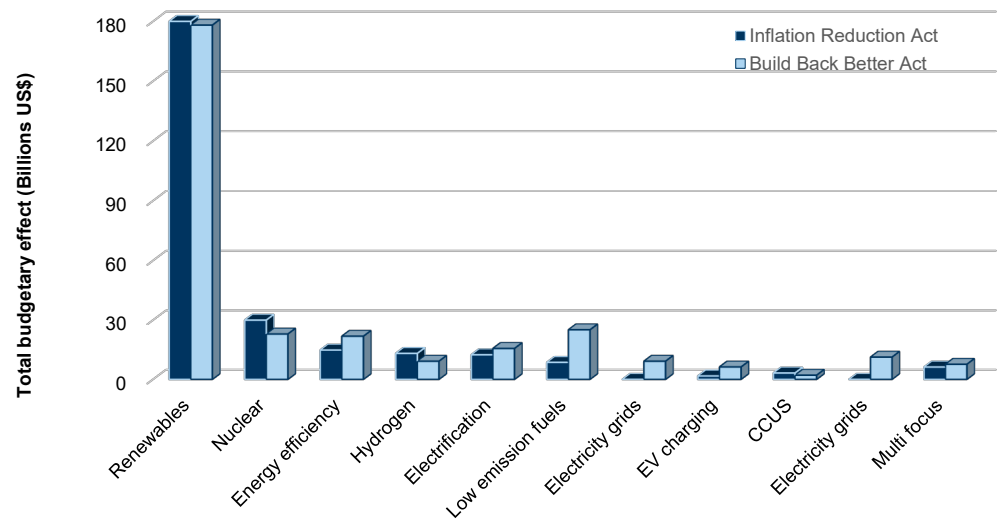
We believe the tax incentives provided by the IRA could allow these companies to generate higher **R**eturns and potentially increase materiality to overall earnings/cash flow over time with **E**xecution.

Based on our Green Capex Mosaic categories, we estimate that about \$180 billion of the energy tax incentives from the IRA would be directed towards renewables, approximately 67% of the total (Exhibit 37). The largest programs within this category are the extension of the existing renewable electricity PTC (\$51 billion), the clean electricity ITC (\$51 billion), and the advanced manufacturing PTC for wind and solar components (\$31 billion). According to the Congressional Budget Office, approximately 29% of the spending will come from newly created incentives, and another 26% will come from extensions of existing or recently-expired programs (Exhibit 38). The estimated spending for programs that target nascent technologies tend to be relatively small. For instance, only \$49 and \$54 million of spending is forecast to incentivize the production of sustainable aviation fuels and second-generation biofuels respectively. Similarly, the expanded 45Q credit for CCUS is estimated to cost \$3.2 billion. It should be noted, however, that the CBO assumptions on tax credit usage are largely based on

historical trends. To the extent that projects could proliferate rapidly as technologies become more mature and US carbon trading markets more proficient, federal spending on CCUS tax credits would be expected to rise substantially.

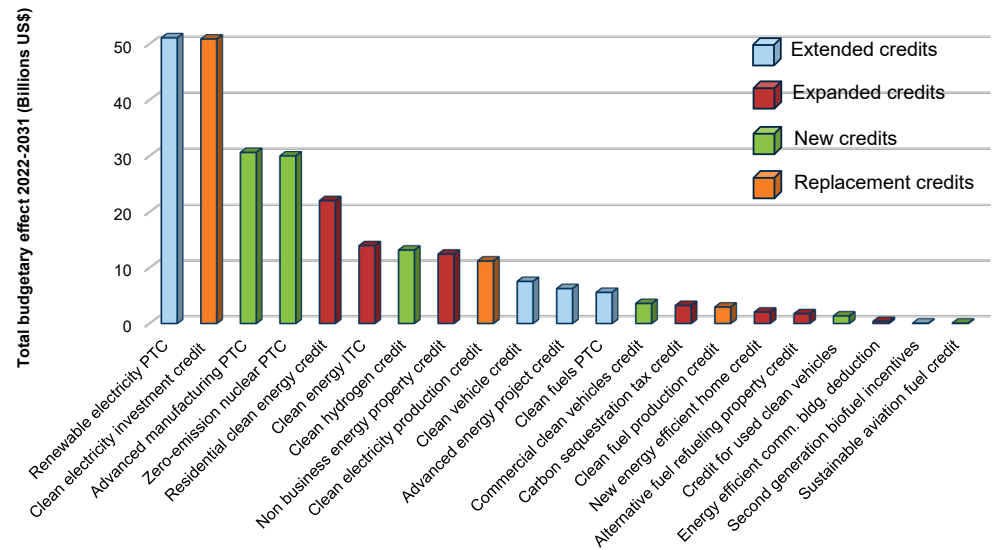
While the green energy tax provisions in the IRA are similar to those that were proposed in the Build Back Better Act (BBB) last year, one notable difference is that the slate of programs have been streamlined. A number of new incentives included in BBB have been removed, including tax credits for electric bicycles, electric transmission properties, semiconductors and semiconductor tooling equipment, and labor costs associated with the installation of mechanical insulation. In addition, the IRA will introduce wage and apprenticeship requirements that companies must meet in order to claim the maximum allowed credit rate.

Exhibit 37: Renewables make up ~67% of the total green energy tax incentives in the Inflation Reduction Act



Source: Congressional Budget Office, Goldman Sachs Global Investment Research

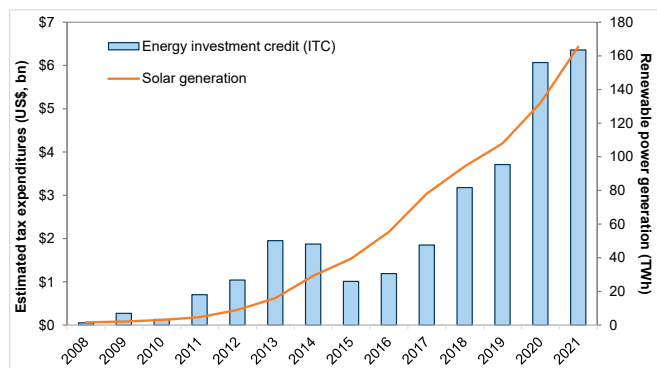
Exhibit 38: Inflation Reduction Act will look to stimulate significant investments in green energy through a slate of new, expanded and extended tax credits



Source: Congressional Budget Office, Goldman Sachs Global Investment Research

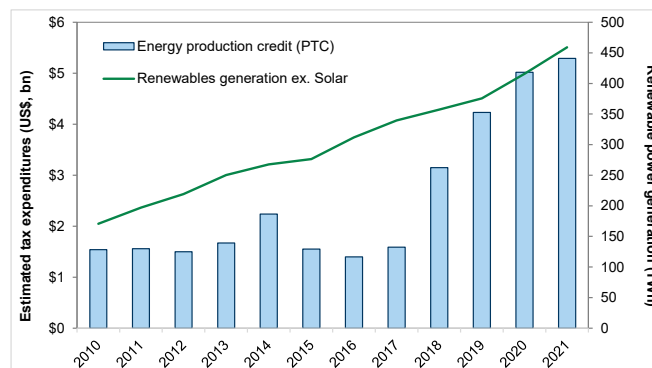
To assess the impact the IRA could have on emerging green technologies such as CCUS, hydrogen and battery storage, we take a look at the relationship between renewable power generation in the US and federal spending on the energy PTC and ITC over the past 15 years. When Congress first enacted the ITC for solar in 2005, only 0.7 TWh of electricity was generated using solar. It took a few years for solar generation to ramp up given the lead times needed for property acquisition and development. During the early 2010s, solar generation grew at 76% CAGR, propelled in part by the expansion of the ITC that was included in the 2009 American Recovery and Reinvestment Act ([Exhibit 39](#)). In 2021, solar properties generated 182.4 TWh of electricity, about 4% of the total electricity produced in the US. Similarly, other forms of renewable energy — in particular wind power that primarily benefit from the PTC — have also proliferated in generation capacity over the past decade ([Exhibit 40](#)). In 2021, federal expenditures on the PTC and ITC were estimated to be \$16 billion, about 73% of the total federal spending on green energy tax incentives.

Exhibit 39: The Investment Tax Credit contributed to an 103x growth in solar power generation in the US between 2008-2021
 More than 90% of the ITC spend is for solar properties



Source: US Department of Treasury, BP Statistical Review of World Energy, Goldman Sachs Global Investment Research

Exhibit 40: The Energy production credit (PTC) helped to significantly increase the generation capacity of renewable energy other than solar, including a 7x growth for wind between 2008-2021



Source: US Department of Treasury, BP Statistical Review of World Energy, Goldman Sachs Global Investment Research

We note that companies face additional challenges in deploying Green Capex, at least in the short to medium term, that could diminish the impact of the IRA. The first is supply chain bottlenecks. Despite recent improvements, many companies attending our recent Power, Utilities, MLPs and Pipelines Conference expressed continued difficulties in sourcing the necessary materials to develop their solar and wind properties (Please see our Utilities and Midstream teams’ conference takeaways note for more details). We would expect the provisions in the IRA aimed at on-shoring manufacturing on critical components of the Green Capex value chain could help ease supply chain concerns over time; though — as we note in our Green Capex report — these changes do not happen overnight, but rather with multi-year lead times. The second is the permitting process, which depending on the project and the location can reach several years to over a decade. For example, a number of CCUS projects currently in development are still waiting to receive the necessary EPA permits for drilling Class VI CO₂ sequestration wells. This could delay or even prevent these projects from being constructed. According to a [joint statement](#) by Senate Majority Leader Chuck Schumer and Senator Joe Manchin, Congress will aim to pass permitting reform legislation later this year.

Disclosure Appendix

Reg AC

We, Brian Singer, CFA, Michael Hao Wu, CFA, Enrico Chinello, Ph.D., Derek R. Bingham, Brian Lee, CFA, Zoe Clarke, Michael Lapedes, Mark Delaney, CFA, Nikhil Bhandari, Umang Choudhary, Carly Davenport, Neil Mehta, Joe Ritchie, Miguel De Jesus, CFA, Baoyi Zhou, Evan Tylenda, CFA, Brendan Corbett, Emma Jones, Madeline Meyer, Keebum Kim, Michele Della Vigna, CFA, Insoo Kim, CFA, Chao Ji, Daniela Costa, Philipp Konig, Jordan Alliger, Jerry Revich, CFA, Adam Samuelson, Kota Yuzawa, Ajay Patel, Fei Fang, Giuni Lee, Georgina Fraser, Ph.D., Yuichiro Isayama, Grace Chen, Varsha Venugopal and Rachit Aggarwal, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

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