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FUTURE ENERGY OUTLOOKS SPECIAL REPORT

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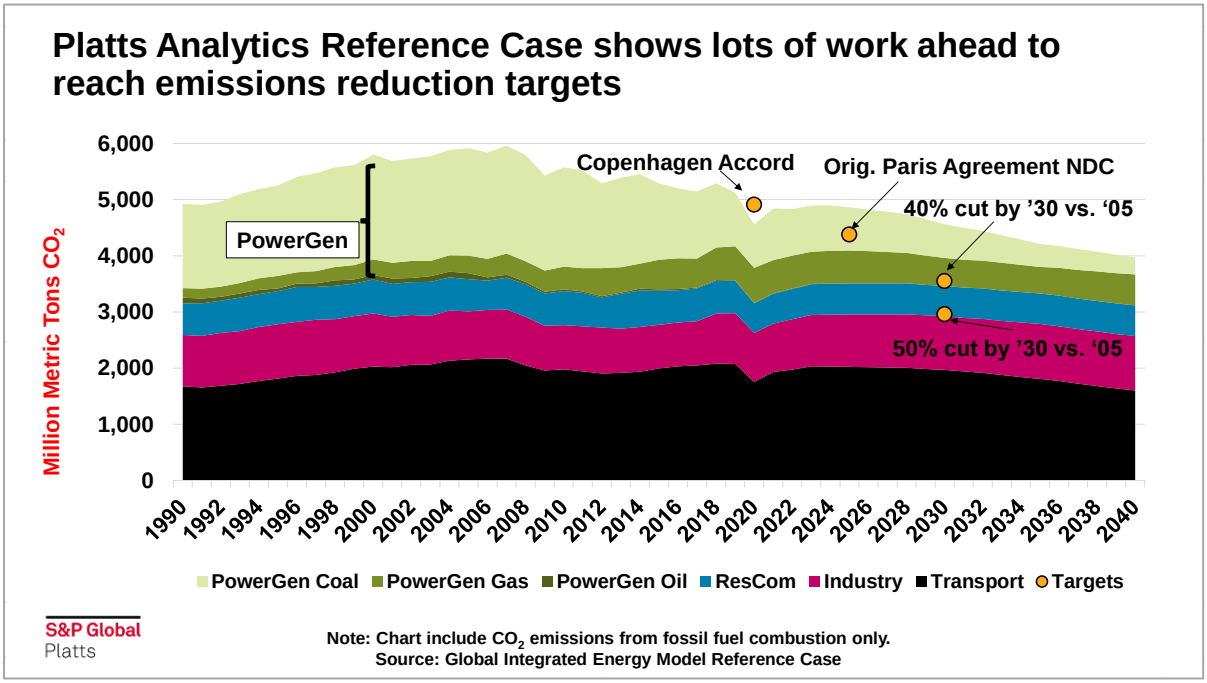
Biden signs Inflation Reduction Act, relying on carrots to drive clean tech adoption and decarbonization

- On August 16, US President Biden signed the Inflation Reduction Act (IRA). The budget reconciliation bill includes around $369 billion in climate energy provisions, vastly slimmed down from the original proposals in the Build Back Better bill, for extended tax credits for clean technologies and manufacturing, a methane free program applying to petroleum and natural gas systems, and rebates for new and used electric vehicles.

- S&P Global Commodity Insights' forecast of US 2030 combustion CO2 emissions is around 1,600 million mt above the 50% reduction vs. 2005 levels proposed by the Biden administration under the UNFCCC Paris Agreement covering post-2020 emissions and over 1,000 million mt above the 40% reduction vs. 2005 levels Democratic leadership claims the bill will deliver. Commodity Insights, through our *Global Integrated Energy Model*, forecasts reductions of 23% in 2030 compared to 2005 levels. Note that these estimates include CO2 emissions from fossil fuel combustion, and so exclude process CO2, as well as non-CO2 GHGs.

- The legislation comes several weeks after the Supreme Court scaled back the Environmental Protection Agency's authority to regulate power sector GHG emissions. The Court also strengthened the Major Questions doctrine, the concept that if Congress wants to give an administrative agency the power to make "decisions of vast economic and political significance," it must do so explicitly. This limits more ambitious federal action through the rulemaking process. Still, there are additional authorities through which EPA can invoke to bring down emissions from the power and other sectors.

Democrats came to an agreement on the spending package that includes around $369 billion in climate energy provisions, vastly slimmed down from the original proposals in the Build Back Better bill. The Inflation Reduction Act would give support in reaching the Biden administration's economy-wide GHG reduction target of 50-52% vs. 2005 levels by 2030 through various means, including extended tax credits for clean technologies and manufacturing, a methane fee program applying to petroleum and natural gas systems, and rebates for new and used electric vehicles.



The chart on the previous page illustrates US CO2 emission trends by source and fuel from Commodity Insights' *Global Integrated Energy Model*. Note that these estimates include CO2 emissions from fossil fuel combustion, and so exclude process CO2, as well as non-CO2 GHGs. Per the latest UNFCCC National Inventory Reprt form the US, combustion CO2 emissions made up nearly 80% of economy-wide emissions in 2021.

Commodity Insights has noted consistently the difficulty the US would have in meeting its international GHG reduction targts. In absolute terms, our forecast of US 2030 combustion CO2 emissions is around 1,600 million mt above the 50% reduction vs. 2005 levels proposed by the Biden administration under the UNFCCC Paris Agreement covering post-2020 emissions. Power sector coal emissions are forecasted to be around 600 million mt in 2030, meaning a full phase-out of coal (and assuming no increase in gas-fired generation) could meet just around 40% of the incremental requirements under a 50% target.

Establishment of methane fee program could address short term warning concerns, but uncertainty remains on applicability

The new methane fee program would apply to petroleum and natural gas systems emitting more than 25,000 mt of carbon dioxide equivalent of greenhouse gases annually. Using methane's Global Warming Potential of 25, that's roughly 1,000 metric tons of methane. The methane fee will be $900/mt of CH4 in 2024 ($36/mt of CO2e), $1,200/mt in 2025 ($48/mt of CO2e), and $1,500/mt in 2026 and thereafter ($60/mt of CO2e).

Methane Fee Program

$/mt, assuming GWP of 25

	Methane price per mt	CO2e price per mt
2024	$900	$36
2025	$1,200	$48
2026+	$1,500	$60

The chart to the right shows the number of petroleum and natural gas facilities by category that could be subject to the methane fee algonside their reported emissions from 2019. If come 2024, methane emissions remain the same, they would generate around $2.8 billion in revenue. However, language in the bill suggests that facilities covered by the EPA's methane emissions standards, which were proposed by the Biden administration in November, would be exempt from the methane fee program. At the same time, the Inflation Reduction Act also directs EPA to issue a rulemaking within two years to lower the reporting threshold to 10,000 mtCO2e. This program is not an allowance-based program. There are no tradeable credits.

Facilities and Emissions from Petroleum and Natural Gas System Categories Subject to Methane Charge

Facility Type	Number of Reporting Facilities	Reported Emissions (million mt of CO2e)	Reported Emissions (million mt of CH4)
Onshore petroleum and natural gas production	485	44.2	1.768
Onshore petroleum and natural gas gathering and boosting	361	21.9	0.876
Onshore natural gas transmission compression	624	4.2	0.168
Onshore natural gas transmission pipeline	39	2.9	0.116
Natural gas processing	457	2.9	0.116
Offshore petroleum and natural gas production	141	1.5	0.06
Underground natural gas storage	50	0.6	0.024
LNG import and export equipment	10	0.1	0.004
LNG storage	5	0.001	0.00004
Total	**2172**	**78.3**	**3.1**

Source: US Environmental Protection Agency prepeared by Congressional Research Service

Additionally, $1.55 billion are earmarked for grants and loans to assist companies to report and reduce their methane emissions, including $700 million specifically for such activities at marginal conventional wells. The bill does not seem to stipulate whether facilities would be permitted to use their received funds to meet their methane fee payment.

In addition, the bill increases royalites and lease bonuses, impacting well breakeven prices. More details on costs to oil operators can be found in a recent *Spotlight*.

Plug-in electric vehicle tax credit would be open to new and used vehicles and lift manufacturer's cap

The federal income tax credit for plug-in electric vehicles will be renewed starting in January 2023 and last until the end of 2032. The full value of the credit is $7,500 but only if certain requirements are met.

Half of the full value ($3,750) can be met if a certain percentage of critical minerals within the vehicle's battery are extracted and process in the US or in other countries the US has a free trade agreement with. The required percentage of value of critical minerals is 40% in 2023 and escalates by 10 percentage points until reaching 80% in 2027.

Plug-in Electric Vehicle Tax Credits

	Full Credit	Max Value of Vehicle
New Sedan	$7,500	$55,000
New Van, SUV, Pick-up Truck	$7,500	$80,000
Previously-owned	$4,000*	$25,000
Commercial below 14,000 lbs	$7,500	N/A
Commercial above 14,000 lbs	$40,000*	N/A

**or the lesser of 30% of the sale price*

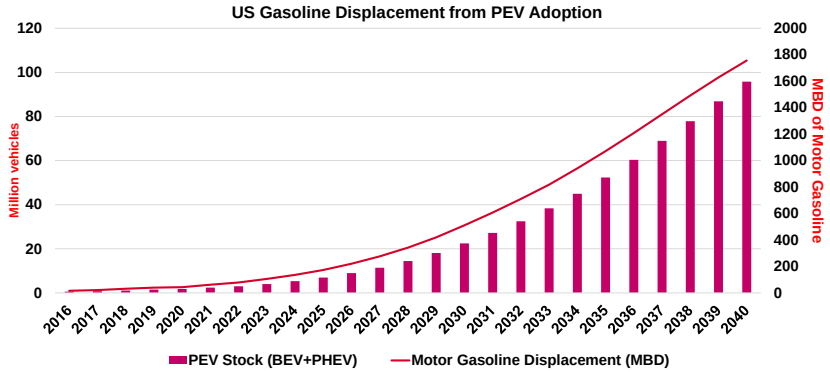
Vehicles are eligible for the remaining half of the full value by meeting certain percentage requirements of battery components manufactured and assembled in North America. The required percentage begins at 50% in 2023 and increases by 10 percentage points annually until reaching 100% in 2029.

Further stipulations apply to the tax credit for new EVs. Final assembly of the vehicle must occur in North America. The vehicle must have a battery capacity greater than or equal to 7 kWh. The maximum value of a qualifying vehicle is $55,000 for a sedan and $80,000 for a van, SUV, or pick-up truck. An income limit also exists. Individuals must have an adjusted gross income of less than $150,000 to qualify, while married couples must earn less than $300,000.

The previous tax credit for new plug-in electric vehicles was capped after 200,000 units per auto manufacturer. For instance, Tesla and GM have both sold over 200,000 units. Therefore, federal tax credits could no longer be claimed for purchasers of vehicles from those manufacturers. The new tax credit removes that cap entirely. What's more, a tax credit for used plug-in EVs will be available. The credit is capped at $4,000 or 30% of the sale price, whichever is lower.

The chart to the right shows how EV uptake in the US will reduce gasoline demand and therefore, GHG emissions. Taken from Commodity Insights' *Plug-in EV Sales Forecast: Global Light Duty PEV Sales and Energy Impacts*, EVs are set to displace 500 MBD of gasoline by the end of the decade.

US PEV adoption drives down gasoline demand over 500 MBD by 2030, but boosted tax credits could drive further reductions



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Source: S&P Commodity Insights Future Energy Outlooks Plug-in EV Sales Forecast: Global Light Duty PEV Sales and Energy Impacts

When creating EV projections, Commodity Insights considers several factors. This includes the total cost of ownership of an EV compared to an internal combustion engine vehicle (ICE). Our TCO calculations include the purchase price, which includes assumptions around fluctuations in battery costs, subsidies, ICE fuel costs (gasoline/diesel), EV fuel costs (electricity), vehicle efficiency, maintenance costs, resale value, etc. As we approach 2030, we forecast EVs' total cost of ownership to fall below that of ICE vehicles for the first time. This will occur as battery cell costs continue to decrease ($/Kwh), government incentives reduce purchase/operational costs, and OEMs scale up EV production. Other factors include available charging infrastructure, direct and complementary policies, OEM investments, and overall adoption momentum. Considering these factors, we forecast the US EV fleet of 2 million vehicles on the road today to expand to 6.9 million in 2025, 22.4 million by 2030, 52.3 million by 2035, and 95.8 million by 2040. These forecasts are integrated into our *Global Integrated Energy Model* to provide insight into power demand and displacement of traditional fuels.

Perennial favorites ITC and PTC get extension but will be dropped later this decade for Clean Electricity Investment/Production Credits

The Inflation Reduction Act will restore the federal investment tax credit for renewable energy projects (including solar, offshore wind, geothermal, fuel cells, microturbines, CHP, small wind, biogas, waste energy recovery, energy storage, linear generators, microgrid controllers, dynamic glass and biogas properties) completed between 2022 and 2024 to 30%. The credit can reach as high as 50% given the project meets a domestic content requirement (additional 10 percentage points) and is located in an "energy community." Projects that do not fulfill the wage and apprenticeship requirements could still receive a 6% ITC.

Solar developers would also have the option to claim the production tax credits (PTC) instead of the ITC on projects placed in service in 2022 or later. Wind and geothermal projects completed in 2022 should qualify for a PTC of $26 per MWh with the credit adjusted each year for inflation.

A new technology neutral PTC and ITC is in the IRA for zero-emissions facilities placed in service after the end of 2024. Eligible recipients can elect either a 10 year PTC worth $25/MWh (in 2021 dollars, inflation adjusted) or a 30% ITC under these sections, provided they meet prevailing wage and apprenticeship requirements (credit is one-fifth of these values if not). Tax credits available under this program begin to phase out when annual greenhouse gas emissions from electricity production in the US is less than or equal to 25% of 2022 emissions levels or in 2032, whichever comes later.

The IRA also expands the 45Q tax credit for carbon capture, utilization, and storage and direct air capture for projects that begin construction between the beginning of 2023 and the end of 2032, with credits being paid for the first 12 years of production.

Last renewed in 2018, the tax credit is increased to up to $85/mt for sequestration and $60/t for utilization, such as in enhanced oil recovery, only if wage and apprenticeship requirements are met. The credit is only $17/mt and $12/mt respectively if these requirements are not met. Electricity generating facilities must capture no less than 18,750 mt and have a capture design capacity of at least 75%. Other CCUS facilities must capture no less than 12,500 mt of CO2.

In addition to increasing the tax credit for CCUS projects, a new credit will now apply to direct air capture projects. DAC facilities can claim $180/mt for sequestration and $130/mt for utilization, but again, only if it meets wage and apprenticeship requirements. DAC facilities must capture at least 1,000 mt annually to be eligible.

Other tax credits include:

- Clean hydrogen production tax credit with base rate of $0.60/kg up to $3/kg if wage and apprenticeship requirements are met.
    - The rate is also adjusted according to life cycle GHG emissions rate:
        - Greater than or equal to 2.5 kg CO2e/kg H2 but below 4 kg CO2e/kg H2 = 20% of credit
        - Greater than or equal to 1.5 kg CO2e/kg H2 but below 2.5 kg CO2e/kg H2 = 25% of credit
        - Greater than or equal to 0.45 kg CO2e/kg H2 but below 1.5 kg CO2e/kg H2 = 33.4% of credit
        - Less than 0.45 kg CO2e/kg H2 = 100% of the full credit
- $15/MWh production tax credit for existing nuclear units that meets prevailing wage and apprenticeship requirements ($3/MWh if not) and earns average of $25/MWh or less in electricity revenues, excluding state subsidies.
- The bill extends the Residential Energy Tax Credit through the end of 2032. And increases the rate to 30% from 10%.
- A new standalone blending credit for Sustainable Aviation Fuel that ranges between $1.25/gal and $1.75/gal depending on the carbon-reduction profile of the fuel – more details can be found in a recent *Spotlight*.
- Manufacturing credits for solar cells (4¢/W) and modules (7¢/W).

Lastly, the 30% investment tax credit for new transmission lines originally in the Build Back Better proposal did not make the final version of the bill. However, there are still some incentives for transmission projects. $2 billion was earmarked to DOE through the end of the fiscal year 2030 for direct loans for construction and modification of certain transmission projects.

Supreme Court deals blow to regulatory state, but other pathways to emissions reduction target exist

While the legislation is a welcome development for climate hawks, the President does have the authority, particularly under the Clean Air Act (CAA) to drive further decarbonization. Specifically, this included a range of CAA regulations on vehicle-efficiency standards for both light- and heavy-duty vehicles, power plant emissions (though that was recently curtailed by the Supreme Court), and methane emissions from the oil and gas sector. Further, the 2005 Energy Policy Act and 2007 Energy Independence and Security Act allow for efficiency standards for buildings and appliances.

To provide a deeper understanding of the executive branch's regulatory priorities, Commodity Insights updates and publishes the *US Federal Regulatory Calendar*. With a new Unified Agenda released in late June, the Biden administration has revealed a timetable for its upcoming regulatory action.

As mentioned above, the US Supreme Court ruled to limit the Environmental Protection Agency's to regulate GHGs from power plants striking down generation shifting as a permissible "best system of emissions reductions" construct under Section 111(d) of the Clean Air Act. The

decision was routed in the "major questions" doctrine – the concept that if Congress wants to give an administrative agency the power to make "decisions of vast economic and political significance," it must do so explicitly. The extension of this approach can have further implications around the ability of the executive branch to unilaterally drive major policy directions, particularly through regulations.

EPA Administrator Michael Regan had testified back in April that emissions guidelines for existing power plants (RIN: 2060-AV10) would be proposed shortly after the Supreme Court's opinion. However, the Spring 2022 Unified Agenda does not expect the rule will be posted until March 2023. This will give the EPA more time to ensure any rule it promulgates can withstand an inevitable legal challenge. While specific details are unknown, there are some indications of what the EPA may ultimately propose. The agency published a white paper in April called *Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from Combustion Turbine Electric Generating Units* (link). It highlighted technologies such as carbon capture, utilization, and storage (CCUS), biomass co-firing, and hydrogen co-firing that can be adopted to reduce emissions from new stationary combustion turbines, both combined and simple cycles.

There are additional ways through which EPA can regulate power sector emissions. The agency recently proposed air quality standard actions (RIN: 2060-AV51) through the promulgation of a Federal Implementation Plan to address the transport of emitted ozone across state lines, impacting downwind non-attainment areas. Allowance-based ozone season trading programs for nitrogen oxides (NOx) emissions budgets (a precursor pollutant for ozone) for fossil fuel-fired power plants would be expanded to 25 states. The rule would also establish NOx emissions limitations for certain other industrial stationary sources in 23 states. Opponents of the rule have invoked the major questions doctrine in comments, specifically claiming that the rule would result in generation shifting. High NOx allowance prices stemming from the program could undermine the economics of higher NOx coal-fired generation (units without SCRs or SNCRs) and along with retrofit costs, drive incremental coal plant retirements.

Rules around coal combustion residue (CCR) were on the Unified Agenda. One (RIN: 2050-AH07) is proposing to establish a federal CCR permit program in Indian Country and in states without their own EPA-approved rule. EPA is also proposing to establish requirements and procedures to issue federal permits for disposal and other solid waste management of CCR. Another (RIN: 2050-AH18), is proposing revisions to the original CCR regulations, including procedures to allow facilities to request approval to use an alternate liner for CCR surface impoundments and requirements for annual closure progress reports. Increased regulatory costs for non-compliant coal-fired power plants can drive accelerated closures.

Additionally, the Securities and Exchange Commission's Climate Change Disclosure rule (RIN: 3235-AM87) would require companies to provide certain climate-related information, including GHG emissions, in their registration statements and annual reports. The final rule is expected to be released in October after the proposal's comment period ended in June.

These regulatory efforts are being complemented by other channels of federal government actions such as Executive Orders. For instance, the Department of Energy was recently given access to Defense Production Act funds that can be used for bolster domestic production of five different areas of energy technologies, including electrolyzers, fuel cells, and platinum group metals. President Biden has also directed the Department of the Interior to propose its first areas for wind energy development in the Gulf of Mexico.

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