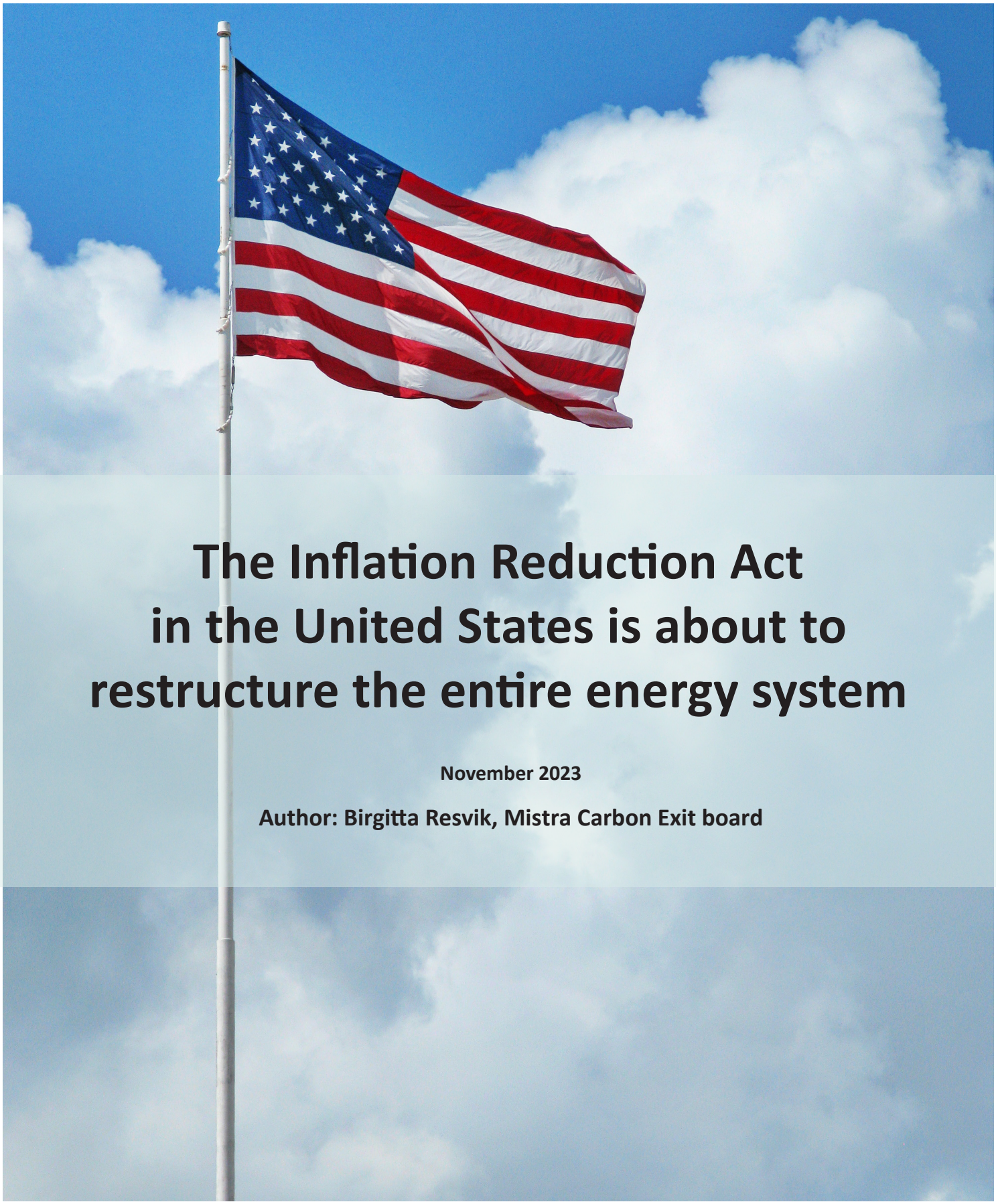


The Inflation Reduction Act in the United States is about to restructure the entire energy system

November 2023

Author: Birgitta Resvik, Mistra Carbon Exit board

MISTRA CARBON EXIT

The Inflation Reduction Act, a giant support scheme for green technology, was launched by President Biden in 2022. The act, often called the IRA, is also the main political policy for the climate issue in the United States, with the goal of reducing emissions to more than 50 per cent below the 2005 level by 2030.

The Inflation Reduction Act has created an intensive debate in the EU concerning the competitive situation: Will European industry be wiped out? Will European companies invest in the United States rather than in the EU?

There are several reasons to learn more about what is really happening in US as a result of the legislation introduced by President Biden in the form of tax credits and investment support, primarily through the IRA of 2022 and the Bipartisan Infrastructure Law (BIL) of 2021. Altogether more than USD430 billion can be directed to green technology, but tax credits are not capped, and the support is generally for ten years.

Questions this report aims to answer include: how much is invested in green technology, what are the effects on the electricity system, how is the reduction of CO_2 proceeding, and are the investors confident that the support will continue in the long term, in view of the upcoming elections?

This report is based on analysis and facts from researchers from different universities and institutes, but also on reports, analysis and media articles from the White House, Department of Energy and various think tanks. Observations and conclusions are from meetings, interviews and webinars with various stakeholders in Washington during October and November of 2023.

Birgitta Resvik

Contents

The Inflation Reduction Act in the United States is about to restructure the entire energy system

There are many reports, analyses and media statements from the White House about how the gigantic investments in green technology are proceeding, and all the new projects that are being supported. Optimism is high among US energy analysts, who believe that things are finally happening. And models need to be reworked when there are too many changes. The executive director of the International Energy Agency, IEA, Dr Fatih Birol, is also impressed, and stated this spring: "The Inflation Reduction Act is the single most important climate decision since the Paris Agreement in 2015".

The US is already reducing emissions, and analyses show nearly 50 per cent less emissions in 2035, compared to 2005. That is not far from the US's Paris target of 50-52 per cent by 2030 and net-zero by 2050.

At the same time, many politicians are critical of the fact that the support is too expensive, as are some of the politicians who voted for the Inflation Reduction Act in 2022 and the Bipartisan Infrastructure Law in 2021.

"The industry here in the US has been doped! Still, we hope that most of the projects will be successful", says Urban Ahlin, Sweden's ambassador to the United States.

More than USD430 billion in federal funding (although there is no actual ceiling) can be applied for in the field of green technology – this includes support for electric cars, charging infrastructure, all fossil-free electricity generation, battery storage and carbon capture. Various tax deductions are available, such as production and investment subsidies for e.g., produced kWh of electricity or kg of hydrogen, as well as for carbon capture[1].

The subsidies are generally for ten years, and are also given to projects that are planned within this time frame. But for the power sector, the subsidies remain until the emissions in the sector fall below 25 per cent of 2022 levels, so they could be in place until the end of the next decade. Households are given support for the purchase of electric cars and energy efficiency measures in the form of subsidies for heat pumps and solar installations.

The tax credits are various with different requirements - here some examples[1];

Production and Investment Tax Credits for solar and wind: USD 5-27,5/ MWh depending e.g. on certain labour requirements.

Production Tax Credit for Carbon Capture and Sequestration (45Q): USD 85/ton of CO_2 stored or USD 60 for CO_2 utilization.

Nuclear Power Production Tax Credit: USD 15/MWh.

Clean Fuels: The credit value is USD 1/gallon and USD 1.75/gallon for clean fuels for aviation.

Credit for clean hydrogen (45V): USD 0.60/kg H_2.

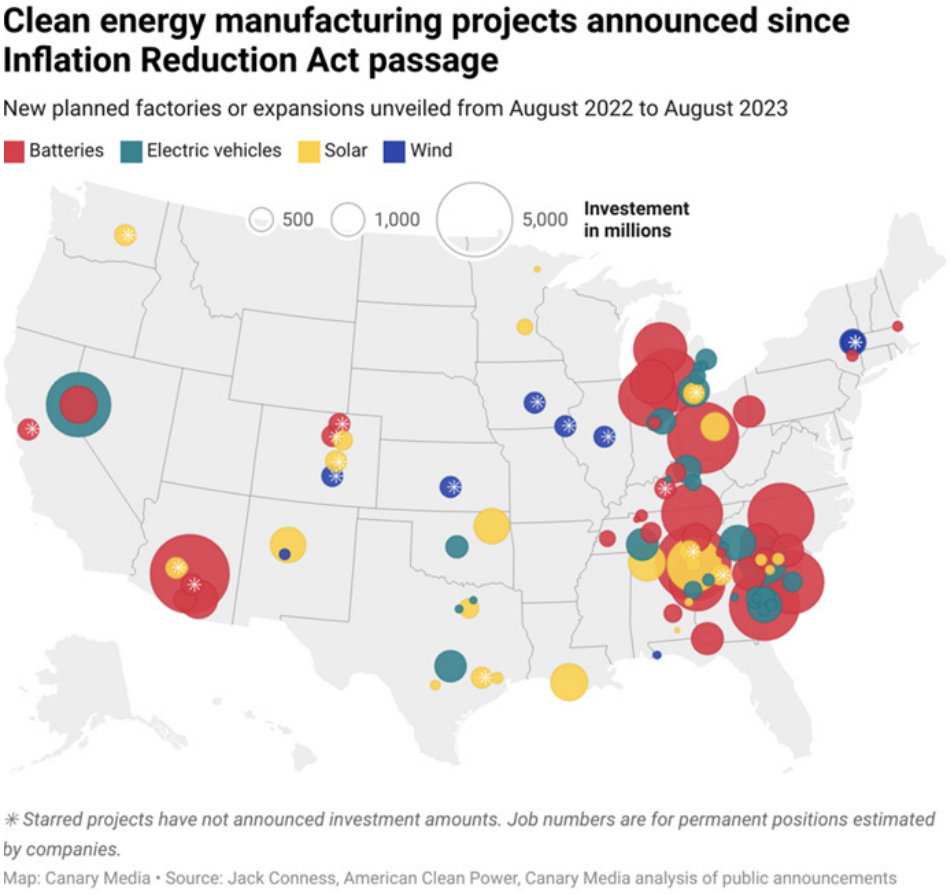
Clean Energy and Efficiency Incentives for Individuals: e.g. USD 2000 for a heat pump.

Clean Vehicles: up to USD 7500 for the purchase of a new electric or hydrogen fuel cell vehicle if it fulfils certain requirements.

New jobs are created – an important part of gaining support

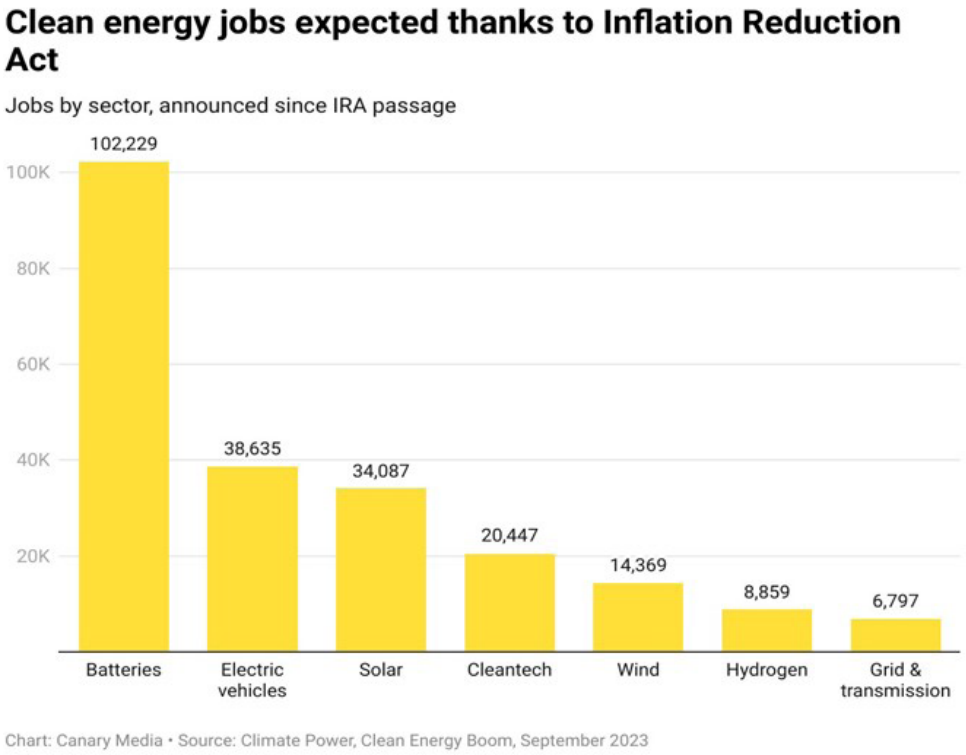
Many new jobs have already been generated with investments totalling USD310 billion in new projects. Analyses show that at least 211,000[2] jobs, and up to 400,000 if including indirect jobs, have been created thanks to the support from the IRA. The latest analysis shows that over 380 concrete projects have been started thanks to the IRA and BIL, mainly in the new "battery belt", which coincides closely with the historic industrial belt from Michigan, Indiana, and Ohio down to the southern states.

It thus fulfils one of the IRA's goals regarding the social aspect: 40 per cent of federal climate and energy investments will go to disadvantaged communities. An extra bonus (10 per cent of the investment) is given to the facility if they are located on what is called a "brownfield site" or a "fossil community". In November 2023, the Biden Administration announced USD2 billion in additional funding for investments that will be focused on community-driven initiatives responsive to community and stakeholder input. This is to ensure social equalization and to replace existing jobs, as well as to gain acceptance for the transition. Establishments that permit trade unions receive additional tax credits.



Reference: Canary Media, September 2023

The highest number of new jobs have been created in battery manufacturing, with 130 battery projects, and in electric car manufacturing there are 95 projects, either new or expanding ones. President Biden has set clear goals for the production of solar cells and wind power that will eventually be produced domestically, i.e. Made in America. Tax credits for this manufacturing industry are obtained through the IRA. Relative to the demand in 2030, the goal is for 50 per cent of solar cells, 100 per cent of solar modules and more than 50 per cent of wind turbines to be manufactured in the United States.



Reference: Canary Media, September 2023

One important conclusion is that in order to gain long-term support for these extensive tax subsidies, new jobs must be created, preferably across many states. In this case, it is felt that there is a higher possibility for political support to retain these powerful incentives, even if there is a change of power in the next presidential election. New statistics[2] show that most of the new clean energy projects are in congressional districts represented by Republican members of the House of Representatives. Since the passage of the IRA, companies have announced 121,000 new jobs and over USD242 billion in investments across 200 clean energy projects in 109 Republican-held districts. Of course, this will generate political pressure from the state level for the investments to continue, even though there are voices in Congress which want to withdraw the packages.

Emissions reductions closer to US's Paris target for 2030

Are these investments primarily a new industrial policy aimed at dealing with competition from China, or is there an ambition in the US to pursue a powerful climate policy? The administration highlights the powerful emission reductions that this policy provides, and that the US actually has a strict climate policy. Most of the different scenarios[3] show a range of emission reductions between 37 and 41 per cent, and the latest update from the project REPEAT[4], led by Professor Jesse D. Jenkins of Princeton University, shows a reduction of 43 per cent by 2030, compared to 2005.

Professor Jenkins believes that there are opportunities to further reduce the gap to the target of 50 to 52 per cent; "I'm optimistic, because I think we can make more happen when the IRA itself encourages more people to act."

Resources for the Future, RFF, is investigating how to close the gap to the target of 2030 by setting a price on carbon. With the incentives from the IRA, the price of carbon in the electricity sector can come down from an estimate of USD67 to USD28 per ton of CO_2, see diagrams[5] below.

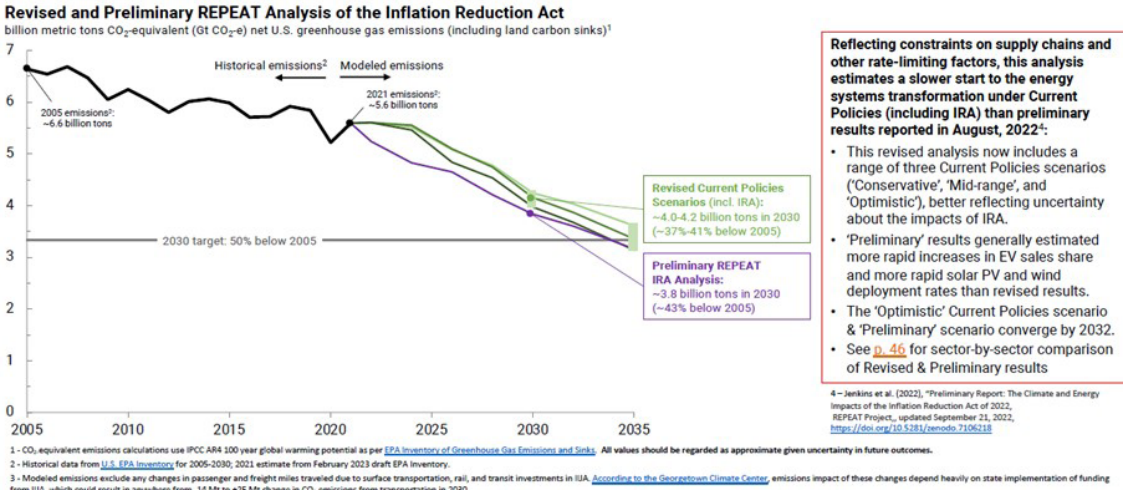
The administration has set a goal of an 80 per cent reduction in emissions (from 2005 levels) by 2030, with the label "80 by 30". The goal requires roughly 80 per cent of the electricity generation to come from non-emitting generation sources such as renewable energy and nuclear power.

A primary focus is on the electricity sector, as the major emissions reductions can be achieved during this decade. Decarbonization of other sectors, such as transportation and buildings, will enable emissions reductions to be achieved especially after 2030.

Reference: Burtraw et al, RFF, October 2023

In addition to what is happening at the federal level, it is of interest to monitor various initiatives at state level. In Washington State, a Cap-and-Invest programme, which is similar to an emissions trading system[6], has been in place for one year. The first auction was in February 2023 and the price level is now about USD50/ton CO_2. California has had a similar system for several years where the price is closer to USD30/ton CO_2. In about 14 of the US states there is some form of trading system.

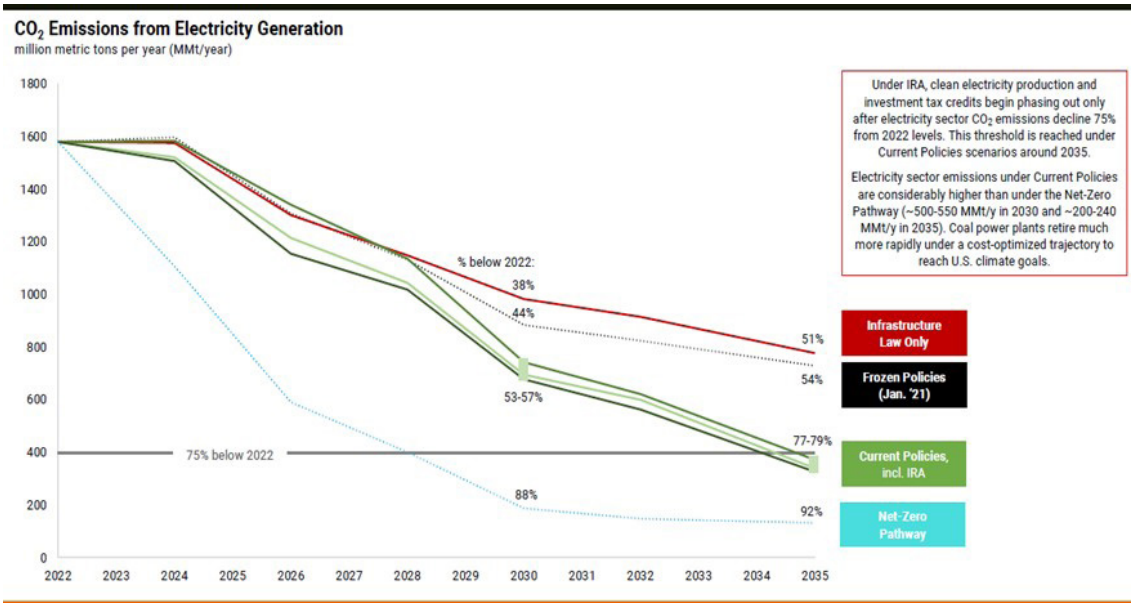
Other regulations at the federal level, such as the Clean Air Act, also have an important effect on the reduction of emissions. This legislation sets requirements for standards for vehicles and fossil power plants, thus also contributing to reducing emissions.



Reference: Princeton University, Zero-lab sept 2023

The electricity sector is being vigorously restructured

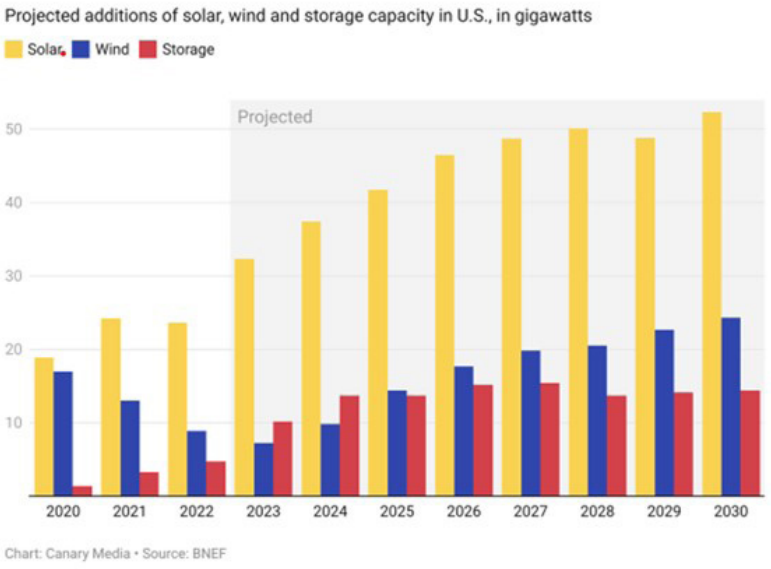
Most of the emissions reduction is expected to take place in the electricity sector, where a strong increase in new solar and wind power production, as well as energy storage, is predicted. President Biden's goal is 100% carbon-free electricity production by 2035. The maintenance of existing nuclear power is considered important, and carbon capture is seen as part of the solution. The share of fossil-free electricity was 42 per cent in 2022, and is expected to increase to 72 to 81 per cent by 2030[5]. Nuclear power currently accounts for about 20 per cent of electricity production, and is expected to remain at this level, as there is a strong focus on extending the lifetime of the existing reactors. The research and development of both SMRs and advanced reactors is supported by funding from the Department of Energy (DOE). Some fossil fuels, mainly gas, will remain in the energy system, but these facilities are supposed to be equipped with carbon capture in the future.



Reference: Princeton University, Zero-lab September 2023

As mentioned, electricity production of solar and wind power is predicted to increase dramatically. The Department of Energy forecasts that 250 GW of new wind power and up to 475 GW of solar power will be installed by 2030[7]. There is also a remarkable investment in energy storage, the vast majority of which is battery storage, although pumped hydro storage might be an alternative to some extent.

On the question of whether the future stability of the electricity system has been assessed, no concrete answers are provided. The assessment is that energy storage will be profitable, and will be able to meet the imbalances. At the same time, existing nuclear, hydro and gas power with CO_2 capture will remain as baseload power.



Reference: Canary Media, September 2023

Major federal investment in hydrogen development

The focus of the green transition is also on how the United States will form the hydrogen society of the future. In October 2023, US Secretary of Energy Granholm presented the seven major hydrogen projects, so-called hydrogen hubs, which have been selected to receive federal investment support after application and a one-year review.

The regulatory framework and funding for these investments comes from the Bipartisan Infrastructure Law, which means that the Inflation Reduction Act may also provide additional tax credits. These seven projects, which are made up of different consortiums and are spread across the country, will receive USD7 billion[10].

Three of the projects will use fossil gas and utilize carbon capture, while the others will use fossil-free power generation, either nuclear or renewable. A major issue is the coming rules for how to specify the production of hydrogen and if the production will be eligible for the tax credits, which can be at different levels. The rules will specify what constitutes "green hydrogen" and will identify some form of matching renewable electricity generation for electrolysis with hydrogen production. Excessively strict rules will suppress the industry. If they are too lenient, the result could be a net increase in greenhouse gas emissions.

Reference: DOE, Office of Clean Energy Demonstrations, October 2023

There is a clear goal in these development projects, which is to reach the production cost of USD1/kg hydrogen, which is expressed as requiring an 80 per cent cost reduction to USD1 per 1 kg in 1 decade ("1 1 1"). This is an interesting way of steering research,

which the US has done for a long time: setting quantitative price targets for the research in different areas of technology.

The purchaser of this hydrogen seems to be primarily the existing refinery and chemical industry as well as the heavy-duty transport sector. There is a debate among analysts and think tanks about how this hydrogen can best be used and contribute to industrial development. The Department of Energy, DOE, has a large demonstration programme for industrial development of more than USD8 billion, which is linked to the hydrogen strategy that has been presented – the US Clean Hydrogen Strategy and Roadmap[8] from September 2022. However, thus far, no real industrial projects seem to have been presented. On the other hand, some of the planned hydrogen hubs mentioned above are aimed at the transport sector, although there is discussion about how the infrastructure for this will be developed.

Some argue that these hydrogen investments are a step in securing a lead in electrolyzer technology and creating skills and a competitive industry in this field. There has been a question from the European side if the United States could be competitive enough to export cheap hydrogen, though probably in the form of ammonia or electro fuels. This statement is questioned by most energy analysts as being relatively unrealistic: "there would be demand for hydrogen in the US, and export will be costly". A parallel could though be drawn to the big increase in LNG exports from US in the coming years, which has been an unexpectedly quick change.

Infrastructure is becoming the major bottleneck

The transmission grid requires significant upgrading, considering the powerful transition that is taking place in the United States. It has already been mentioned that the US electricity grids are underperforming and require updating. As mentioned, solar and wind power production will increase enormously. Estimates from the DOE show a need for investments in transmission grids of between USD30 and 90 billion.

Incentives for investment in the grid are now being presented by the DOE. In October 2023, Secretary of Energy Granholm presented examples of support, in the form of loans, being issued to accelerate the construction of higher-capacity transmission lines. Three major projects will receive USD1.3 billion, which will be taken from the USD2.5 billion investment relating to power grids from the Bipartisan Infrastructure Law.

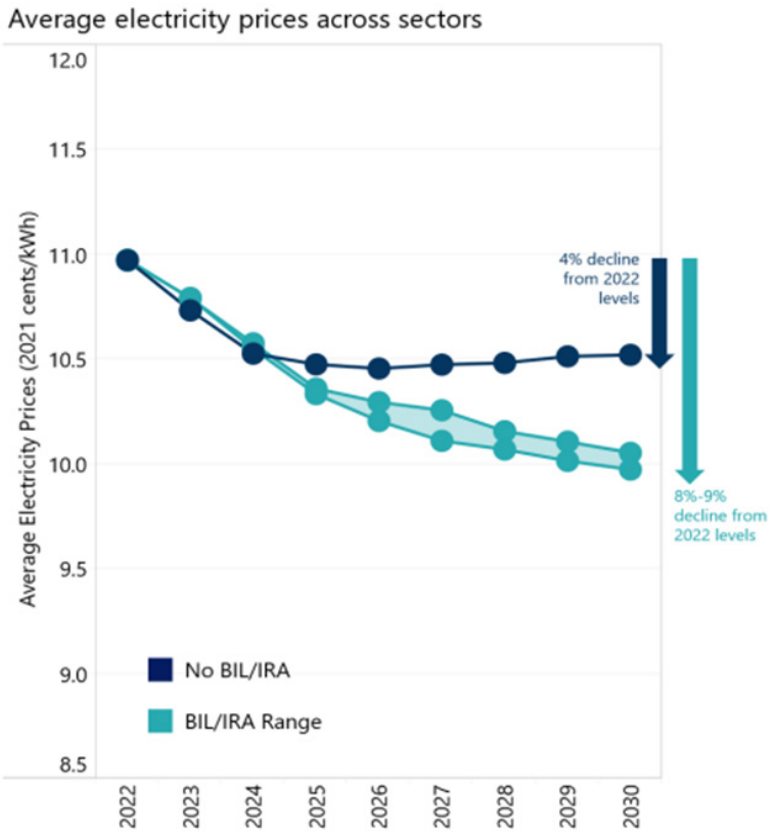
The fact that the electricity grid is the major bottleneck in this extensive restructuring is also the conclusion of the National Academies of Sciences, Engineering, and Medicine[9]. It argues that the permit process for electricity grids at state level needs to be reformed, and that federal agencies need to provide better technical and economic guidance in order to increase acceptance in society. It is mentioned that it takes about four years to obtain permits for minor electricity network projects, which is considered a long time. Furthermore, there is a general siting challenge for renewables, and a lack of acceptance among the general public.

Lower inflation due to lower electricity prices

One of the main arguments behind President Biden's introduction of the IRA was to reduce costs for consumers, and consequently also reduce inflation, hence the name of the act. Still, this financial argument is not prominent in the public debate. It seems instead to be primarily a political argument for gaining support for the subsidy programmes.

Analyses by DOE[7] show that the cost of electricity can be reduced by about 8 or 9 per cent by 2030, compared to 2022. For the business sector, it is predicted that the cost of electricity could fall by as much as 13 to 15 per cent. One could question how this analysis was conducted, considering the regional market design and the coming situation with a dominance of low-marginal-cost renewables and new incentives for storage.

For households, this change in electricity prices can facilitate a switch from gas heating to heat pumps, which is estimated to be an important factor. Further, with electrification of the transport sector, the need for oil imports is expected to decrease, and the cost reduction for the US may thus positively impact inflation.



Reference: DOE, September 2023

Strong focus on electric cars

There is much confidence that electric cars will increase their share of new car sales. Through the IRA, an electric car buyer receives a bonus of USD7500 if the car is assembled in the US and a proportion of the critical minerals and batteries are from the US or from countries with which the US has a free-trade agreement.

A DOE forecast states that sales of electric cars will increase from about 8 per cent today to 49 to 65 per cent by 2030[7]. The expansion of the charging infrastructure is intended to be supported by subsidies from the BIL. However, it can be noted that there is currently hardly any public charging infrastructure with fast chargers. Those who currently drive electric cars, mainly Tesla, charge at home.

Support enables a long-term approach

All in all, it can be concluded that President Biden's support programmes have been successful in terms of jobs as well in terms of climate policy. There is optimism among the business community, and investments are being made. The regulatory framework has now been largely determined and there is confidence in the continuity of the programmes. Many hundreds of thousands of new jobs have already been created and these are spread throughout the country, which means there will possibly be political support for the future.

The U.S. has now introduced a climate and energy policy that is largely based on "carrots", and it seems to be working. Through other regulations, however, there are still some "sticks", for example the Clean Air Act. Also, some states have a price on carbon, through their Cap- and Invest programmes. But the outlook for implementing a more general federal price on carbon dioxide seems bleak, considering today's political environment.

When the IRA was presented, many European voices were seriously concerned about the increased American competitiveness. A congressman in the US commented on the situation as follows: "It's ridiculous. Now there is a fear in Europe that you will lose competitiveness when we're only copying what you have been doing for years in Europe: support research, industry and provide specific credits to green energy. You should be proud – we have learnt from you."

References

1. J.Bistline et al: NBER.org May 2023 Economic Implications of the Climate Provisions of the Inflation Reduction Act | NBER

2. Canary Media, 3 November 2023 - Clean Energy Boom Report (climatepower.us)

3. J.Bistline, D.Burtraw et al: Science July 2023 Emissions and energy impacts of the Inflation Reduction Act | Science

4. Princeton University – REPEAT_Climate_Progress_and_the_117th_Congress.pdf (repeatproject.org)

5. D.Burtraw et al: October 2023: Leveraging the IRA to Achieve 80x30 in the US Electricity Sector (rff.org)

6. Cap-and-invest - Washington State Department of Ecology

7. Department of Energy September 2023 DOE OP Economy Wide Report_0.pdf (energy.gov)

8. Department of Energy; U.S. National Clean Hydrogen Strategy and Roadmap | Hydrogen Program (energy.gov)

9. National Academies of Sciences, Engineering and Medicine October 2023: Accelerating Decarbonization in the United States: Technology, Policy, and Societal Dimensions (2023)

10. DOE, Office of Clean Energy Demonstrations October 2023: Regional Clean Hydrogen Hubs Selections for Award Negotiations | Department of Energy

About Mistra Carbon Exit

Mistra Carbon Exit is a research programme that identifies and analyzes the technical, economic and political opportunities and challenges for Sweden to reach the target of net zero greenhouse gas emissions by 2045. We will identify pathways and policies for how Sweden and Swedish companies can become frontrunners in transforming society and industries, providing low carbon products and services while at the same time dressing market risks. This will make Sweden an important international example for other countries to follow.

Programme host:
IVL Swedish Environmental Research Institute

Programme director:
Lars Zetterberg, IVL Swedish Environmental Research Institute
lars.zetterberg@ivl.se

Vice programme director:
Filip Johnsson, Chalmers University of Technology
filip.johnsson@chalmers.se

Communications:
Maria Ljung, IVL Swedish Environmental Research Institute
maria.ljung@ivl.se

www.mistracarbonexit.com

MISTRA
CARBON
EXIT

MISTRA