

How will the US Inflation Reduction Act affect hydrogen developments in 2023?

Hydrogen (H₂) will make an important contribution to the energy transition, although, as OIES has been arguing for some years, it is not the 'silver bullet' that some would advocate.¹ To be relevant to a decarbonised energy system, hydrogen will need to transition from its current high carbon production methods, mainly using natural gas, to lower carbon alternatives, either by capturing most of the CO₂ or by electrolysis using renewable power generation. Since 2020, many governments around the world have set increasingly ambitious targets for production of clean hydrogen² but it has been proving difficult to translate these bold ambitions into significant projects on the ground.

Indeed, in the OIES Key Themes for 2022, published a year ago, we highlighted, based on data in the IEA Hydrogen Database,³ those significant (>100MW) hydrogen production projects which were claiming an onstream date in 2023/4, making the assumption that if such an onstream date were to be realised, the vast majority would need to take a final investment decision (FID) in 2022. We noted (based on electrical input capacity) projects totalling 5000 MW in Europe, 2000 MW in Australia, and around 1500 MW each in the Americas and China. Reviewing the list of projects in the latest update to the IEA database, we find that only one 200 MW project (Holland Hydrogen 1 electrolyser in the Netherlands) actually took FID and started construction in 2022 and is now showing an onstream date of 2025. 200 MW is a significant step up from previous electrolyser projects in Europe (and there is just one comparable sized project under construction in China), but is clearly far short of the 10,000 MW globally envisaged just one year previously.

That said, there were some significant policy developments both in Europe and the USA in 2022, leading to our key theme for 2023 to track whether there will be a shift in focus for clean hydrogen developments towards the USA. The key policy developments to consider are:

- The USA's Inflation Reduction Act (IRA) signed into law in August 2022, which, despite its somewhat misleading name has been billed as the 'largest climate legislation in US history'⁴
- The European Union's REPowerEU documents, primarily intended to reduce European reliance on Russian natural gas following Russia's invasion of Ukraine in February 2022, which significantly increased the European ambition for low-carbon hydrogen by 2030.⁵

¹ <https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2020/03/Insight-66-Hydrogen-and-Decarbonisation-of-Gas.pdf>

² We use 'clean hydrogen' as a collective way to describe both hydrogen from fossil fuels with CCS (sometimes called 'blue' hydrogen) and hydrogen from electrolysis with renewable power (sometimes called 'electrolytic' or 'green' hydrogen).

³ <https://www.iea.org/data-and-statistics/data-product/hydrogen-projects-database>

⁴ <https://www.whitehouse.gov/cleanenergy/inflation-reduction-act-guidebook/#:~:text=On%20August%2016%2C%202022%2C%20President,change%20in%20the%20nation%27s%20history>.

⁵ For a more detailed analysis of the hydrogen provisions of REPowerEU see <https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2022/07/RePowerEU-Can-Renewable-Gas-help-reduce-Russian-gas-imports-by-2030.pdf>



The IRA contains some very specific and potentially very attractive incentives for production of low carbon hydrogen, both using electrolysis and with carbon capture and storage. The key 45V⁶ Production Tax Credits (PTC) and Investment Tax Credits (ITC) are shown in **Error! Reference source not found.** The precise mechanism for calculating carbon intensity is still to be determined, but is envisaged to use the well-established US GREET model and will also include upstream emissions (including methane emissions in the natural gas chain). It is therefore likely that the highest USD 3.00/kg PTC will only apply to electrolytic hydrogen produced using purely renewable electricity, since grid-based electricity would have too high a carbon intensity. At very low capacity factors, it may be more attractive to use the ITC, but it is generally assumed that most projects will choose to use the PTC. The IRA also contained a '45Q' tax credit for carbon capture and storage of USD 85/tonne CO₂ stored. Assuming 10kg CO₂/kg H₂ (as is typical for production from natural gas), this is approximately equivalent to USD 0.85/kg H₂, so may be more attractive than 45V for a blue hydrogen project developer.

Table 3: US Inflation Reduction Act hydrogen tax credits

Carbon Intensity (kg CO ₂ /kg H ₂)	Hydrogen Production Tax Credit (\$/kg H ₂)	Hydrogen Investment Tax Credit (%)
0 - 0.45	\$3.00	30
0.45 - 1.5	\$1.00	10
1.5 - 2.5	\$0.75	7.5
2.5 - 4	\$0.60	6

The USD 3/kg PTC appears very attractive, and by some analyses could reduce the effective cost of green hydrogen to around zero,⁷ providing a strong incentive for existing hydrogen producers (e.g. in refineries and petrochemical plants) to switch to green hydrogen.

By contrast, while REPowerEU included a significant step up in the target for hydrogen production by 2030 to 10 million tonnes per year within the EU and 10 million tonnes of imports, it was much less clear on how producers would be incentivised to deliver this. Some initiatives have been announced, including the German H2Global tender for imports of ammonia, EUR3bn to be made available via the European Hydrogen Bank and inclusion of hydrogen within 'Important Projects of Common European Interest' (IPCEI), but these do not yet form a robust basis for a project to take FID. In the UK, progress is being made on developing Contracts for Difference as part of the UK Hydrogen Business model, and this may prove a concept which the EU could build on.

At this stage, therefore, while there are always many steps for a specific project to reach FID, it appears that the framework in the USA provides much stronger incentives to promote investment than the more complex and less developed framework in Europe. Anecdotal evidence from various conversations, and some press releases⁸ indicates that demand for electrolyzers is being drawn to the USA. It will be instructive through 2023 to track whether this trend continues, the extent and location of actual FIDs and whether Europe, as well as other parts of the world, including China, respond to the strong hydrogen incentives in the Inflation Reduction Act.

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⁶ '45V' and '45Q' refer to the relevant sections of the US tax legislation, the internal revenue code

⁷ See for example: <https://www.rff.org/publications/reports/incentives-for-clean-hydrogen-production-in-the-inflation-reduction-act/>

⁸ See for example: <https://www.hydrogeninsight.com/electrolysers/nel-wins-56m-electrolyser-order-for-290mw-us-green-hydrogen-project-helped-along-by-new-h2-tax-credits/2-1-1335821>