Executive Summary
The steel industry is a global colossus. Each year 6 billion tonnes of steel and steelmaking materials are moved around the world by truck, rail and ship. Despite a relatively light per tonne carbon footprint, the sheer size of the boot means the sector accounts for 7-9% of global CO2 emissions.

Initially a cautious responder to the hydrogen (H₂) economy, momentum for projects and funding is building. Argus examine a German use-case and funding mechanism recently announced, before discussing newly released metrics offering transparency to hydrogen and steel industry participants.

The Iron Giant: Hydrogen (H₂) demand centre flickers to life
German steel producer Thyssenkrupp in July announced its tkH2Steel project had won €2bn of European Commission (EC) funding for decarbonising steel production. Of this, €550mn will be a direct grant toward capital expenditure-related investments, including a direct reduced iron (DRI) plant and two melting furnaces.

Almost three times, or €1.45mn, as much has been set aside for continuing funding to defray the cost of maximum decarbonisation over the first decade of plant operation. This operational expenditure-focused support is contained within a conditional payment mechanism (CPM) clause.

The CPM scheme encourages the use of renewable (green) over low-carbon (blue) H₂ during the first 10 years of production. This aligns with German national policy, with revisions to its national strategy shutting the door on encouraging domestic blue H₂ production.

Long arm of the state...offers a helping hand
While the German government has decided to nudge decisions on H₂ carbon intensity it does not appear to be forcing the make or buy decision. The CPM talks about “procured” not “produced” H₂. Given the high cost of German H₂ production, relative to other locations, this implies it could come from overseas.

This may reduce the value of support the EC could be on the hook for.
It is likely that the H₂ will not come too far though. Apparent cost advantages are sharply reduced if imports travel via vector. Taking the example of ammonia, the 20pc cost of cracking ammonia back to nitrogen and H₂ goes a long way to nixing...
apparent competitive advantage. Supplies may be an intra-
European affair, so Iberian gas-state H₂ via pipeline looks
attractive.

Thyssenkrupp’s “green DRI” plant, produced using green H₂,
is scheduled to come on line in 2029, requiring 143,000 t/yr
toques of renewable H₂ or 1.43mn t over the 10-year funding
period.

The €1.45bn is earmarked to bridge the differential between
lower blue and higher green H₂ costs.

EC funding...needs more funds?
The spread between German-produced blue and green H₂ costs
over the past 12 months has averaged €1.60/kg. Domestic
production would leave funding almost €840m underpowered.

But this may seriously underestimate the level of underfunding,
given that the past year has seen extraordinarily elevated natu-
ral gas prices. They were so high that at times green H₂ produc-
tion costs were substantially less than cheaper blue. The green
premium to blue delta typically averages over €4/kg.

Comparing less costly potential import sources, such as
Spanish green H₂ vs Russian blue (SMR+CCS) H₂, the delta has
been stubbornly high and averaging €3.52/kg over the past
year.

Will the gap be fully met, or is this a case of greasing the slip-
way to get decarbonisation under way? Instead of hoping for
more funding, Thyssenkrupp may be confident of being able to
pass through higher costs to customers for high value-added
manufacturing in sectors such as appliances or automobiles.
And/or that the new reality of low-carbon intensity steel and
the EU’s Carbon Border Adjustment Mechanism offer a sus-
tainable moat to local producers.

The cost of decarbonisation
This example of funding is specific to one steel producer but
the wider sector must also weat abatement. Argus launched
costs for H₂-based DRI, with oxygen in iron ore (Fe2O3) being
driven off by H₂, rather than natural gas. DRI can be consumed
by steel producers in electric arc furnaces, or briquetted and
used in blast furnaces to a ∼30pc rate.

Steel producer feedstock blending can reduce the carbon
intensity of overall production, in the same way ammonia
co-firing in coal-fired power stations can. DRI use goes beyond
reducing emissions at the iron ore sintering stage, although it
can also reduce coke use in the hot metal stage.

These display the cost differential between DRI production
using natural gas, blue H₂ and green H₂, underscoring why a
mechanism is required to encourage “going green”. But the EC
is funding the cost of H₂, not DRI, as it excludes the iron ore
costs.

Argus also launched indexes displaying the outright cost of
H₂ alone in DRI production. The right-hand chart displays that
differential on a northwest European basis.

Steel production is an area of massive potential for H₂ de-
mand. The 143,000 t/yr highlighted as required by Thyssenk-
rupp represents 4-5pc of total German 2030 H₂ demand. Given
that refining and fertiliser markets come first to most minds,
with marine fuel and co-firing power generation leading the
novel uses category, this volume of new demand is non-trivial.

A drop in the steel ocean but big ripples locally...
Thyssenkropp is the world’s 43rd largest steel producer.

Its annual output is less than half the mean of the top 50 steel
mills and its yearly output would be 10pc under the monthly
output of the world’s number one producer.

Yet its demand for partial operational decarbonisation is sub-
stantial in a national setting.

The grant supported DRI plant is planned for operation by
2026, with the 143,000 t/yr of H₂ demand coming as early as
2029. Given the uncertainty surrounding H₂ availability, the
DRI plant will run conventionally at first, using natural gas.
Then H₂ will be phased in from 2027 and natural gas phased
out by 2037, giving 10 years of operational wriggle room.
Steel decarbonisation is a long-term story: one gathering pace

Yet this will only be the beginning. Thyssenkrupp puts its H₂ demand volume to achieve full carbon-neutrality at 720,000 t/yr — five times larger than the proposed stage one decarbonisation.

Today steel is a small component of overall H₂ demand, largely from off-gas recycling. But if the global steel industry taps H₂ for decarbonisation the sector will be a monstrous consumer.

Nor is this funding isolated. Fellow German steel producer Salzgitter received €1bn of EU funding last year to transition its Lower Saxony site to H₂-produced DRI.

ArcelorMittal received €850m to decarbonise its French Dunkirk site, which comes on top of €335m won in 2022 for its Belgian Ghent site and a pilot study for H₂-fed DRI production.

New firms are emerging. H₂ Green Steel in Sweden has been striking binding agreements to supply “green steel” to auto producers for its 2.5mn t/yr of capacity, which include BMW and Mercedes-Benz. Hydnum Steel in Spain is targeting auto and appliance sectors with its similar output of 2.6mn t/yr of H₂-derived steel.

Demand is clearly expected to be large. German steel distributor Kloeckner and consultancy BCG last month released a report that forecasts green steel demand could exceed supplies by 15mn-20mn t by 2030.

How to watch 'maximum decarbonisation' costs for the steel sector

It is unclear when subsidy support will flow for the operating expenditure component between 2027-37.

Nor is it evident which costs will be compared, such as which import source countries will provide green H₂ prices and the counterfactual blue H₂ prices.

The tenor of changes is unknown at this point. Tenders could be annual affairs or a single 10-year supply contract, which would run the whole term of the support offer.

It remains useful to know how large the gap is that this funding needs to plug. Argus has launched a German decarbonisation index to track the differential between green and blue H₂ domestic production costs in Germany (PA code 0040300).

For those that wish to view alternative country sources, Argus Hydrogen and Future Fuel users can construct bespoke comparisons between 25 countries in Africa, the Americas, Asia-Pacific, Europe, the Middle East and Russia. These can be stored in multiple self-described environments for continuing reference.

A number of sector-specific subsidy schemes are being rolled out globally. Because of its potential size those for the steel industry will be likely be increasingly important ones to watch.

Steel decarbonisation spread

For any specific questions on hydrogen and energy transition feel free to contact Tim.Hard@argusmedia.com or the team at HFF@argusmedia.com

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