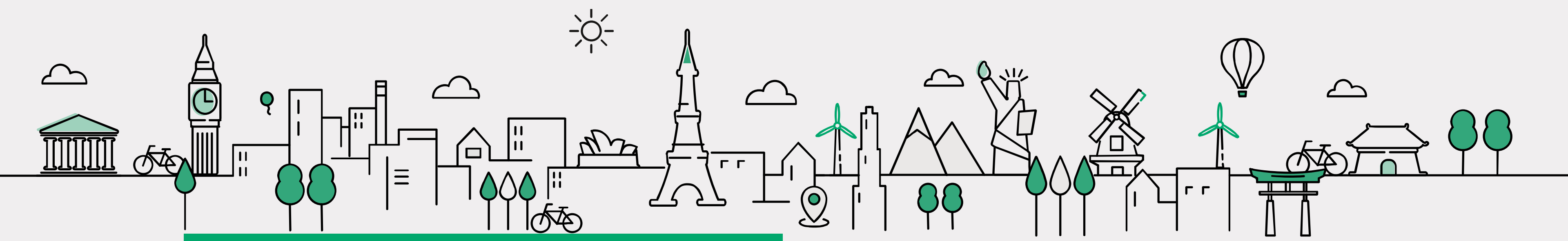
DEEP DECARBONIZATION

NET ZERO AND CARBON PRICING: CASE STUDY OF THE EU-ETS



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CPLC 20 APRIL 2021

BNP PARIBAS
ASSET MANAGEMENT

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The theory of carbon pricing in the EU-ETS

We postulate that the pricing paradigm of the European carbon market should in theory be a function of three variables:

1. market participants' understanding of the purpose for which the EU-ETS has been established (i.e. the policy objective it is intended to achieve);
2. market participant's perception of the effectiveness of design of the EU-ETS, and hence of its technical ability to achieve the policy objective;
3. market participants' assessment of the political priority attached to achieving this objective, and hence of policymakers' commitment to ensuring that the supply of European carbon allowances (EUAs) is engineered to deliver this outcome.

The EU-ETS: towards a new pricing paradigm

- From a low of €14.3/t in the early stages of the lockdowns across the EU the benchmark Dec-20 contract recovered to a near-record all-time high of €30.8/t in June, and has held at pre-COVID levels ever since.
- This seems a clear sign that market participants are starting to think beyond coal-to-gas fuel switching in the power sector – until now the main price driver for the EU-ETS since its inception in 2005 – as the marginal-abatement option that ultimately clears the market over the long term.
- Indeed, we think there are three reasons for thinking that a whole new pricing paradigm could be in the offing whereby the cost of using green hydrogen instead of grey hydrogen as an industry feedstock is set to become the key pricing parameter over the next decade.

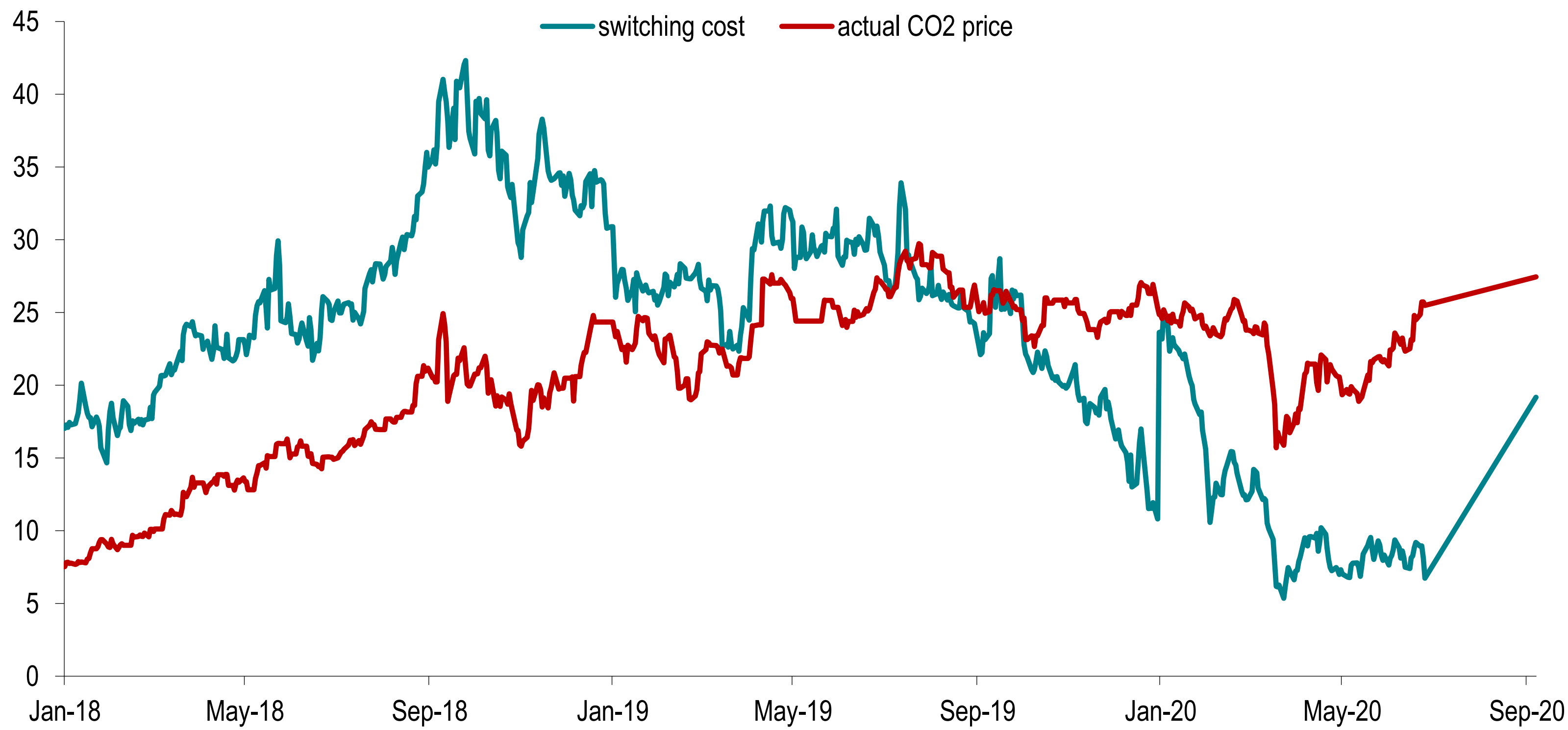
Note: Green hydrogen is produced via electrolysers powered by wind- and solar-generated electricity. Grey hydrogen is produced via a carbon-intensive process using natural gas as the raw material.

Three reasons for thinking green hydrogen holds the key

- First, given that the EU's target of net-zero emissions by 2050 is soon to be EU law, there is now a clear endgame for the EU-ETS. That endgame consists in ensuring that EUA prices reach the level required to achieve net-zero emissions by 2050, and in a significant step towards this goal the enhanced interim target to cut EU emissions by 55% by 2030 recently proposed by the European Commission will now require a tighter EU-ETS cap in 2030.
- Second, according to the European Commission's recently launched strategic vision for green hydrogen, net-zero emissions by 2050 cannot be achieved without green hydrogen contributing a significant part of the solution. At some point, therefore, EUAs will have to reach the price level that incentivizes the use of green hydrogen over alternative fossil-fuel energy sources in buildings, transportation, and power generation.
- Third, the pre-requisite for making green hydrogen commercially viable as an energy source is to make it commercially viable as an industrial feedstock by 2030.

The EU-ETS: the end of the fuel-switching paradigm

Dec-20 EUA price versus implied fuel-switching level, Jan-2018-Sep 2020 (€/t)



Source: BNP Paribas Exane

- **Given the economic shock to the EU-ETS from COVID, the price of EU carbon allowances (EUAs) has held up remarkably well in recent months**
- **Perhaps more significantly, though, and as can be seen, the Dec-20 EUA contract has also traded at or above the upper end of the coal-to-gas fuel-switching range for most this year.**

Our implied theoretical range for EUAs in 2030 = €34/t-€149/t

Implied 2030 EUA fair values for green hydrogen to displace grey hydrogen with gas at 10/MWh, 15/MWh, 20/MWh (€/t)

	Green hydrogen at €1.75/kg	Green hydrogen at €2/kg	Green hydrogen at €2.25/kg	Green hydrogen at €2.5/kg
Gas at €10/MWh	€79/t	€103/t	126/t	€149/t
Gas at €15/MWh	€56/t	**€79/t**	**€103/t**	€126/t
Gas at €20/MWh	€34/t	€57/t	€86/t	€104/t

Source: BNP Paribas Asset Management research estimates.

- Looking at a range of potential production costs for green hydrogen in 2030, and a range of potential gas prices, we derive a range of theoretical fair values for EUAs
- The range of our assumed costs for producing green hydrogen in 2030 goes from 1.75/kg at the low end, to €2.5/kg at the high end. The range of our assumed gas prices is 10/MWh, €15/MWh, and €20/MWh.
- On the basis of all the assumptions we have made, we think €79/t-€103/t is a fair indication of the range in which EUAs would need to trade in 2030 in order for green hydrogen to be competitive with grey hydrogen by that date.

Our implied theoretical range for EUAs in 2020 = €18/t-€80/t

Implied 2020 EUA fair values for green hydrogen to displace grey hydrogen discounted back from 2030 at 6% (€/t)

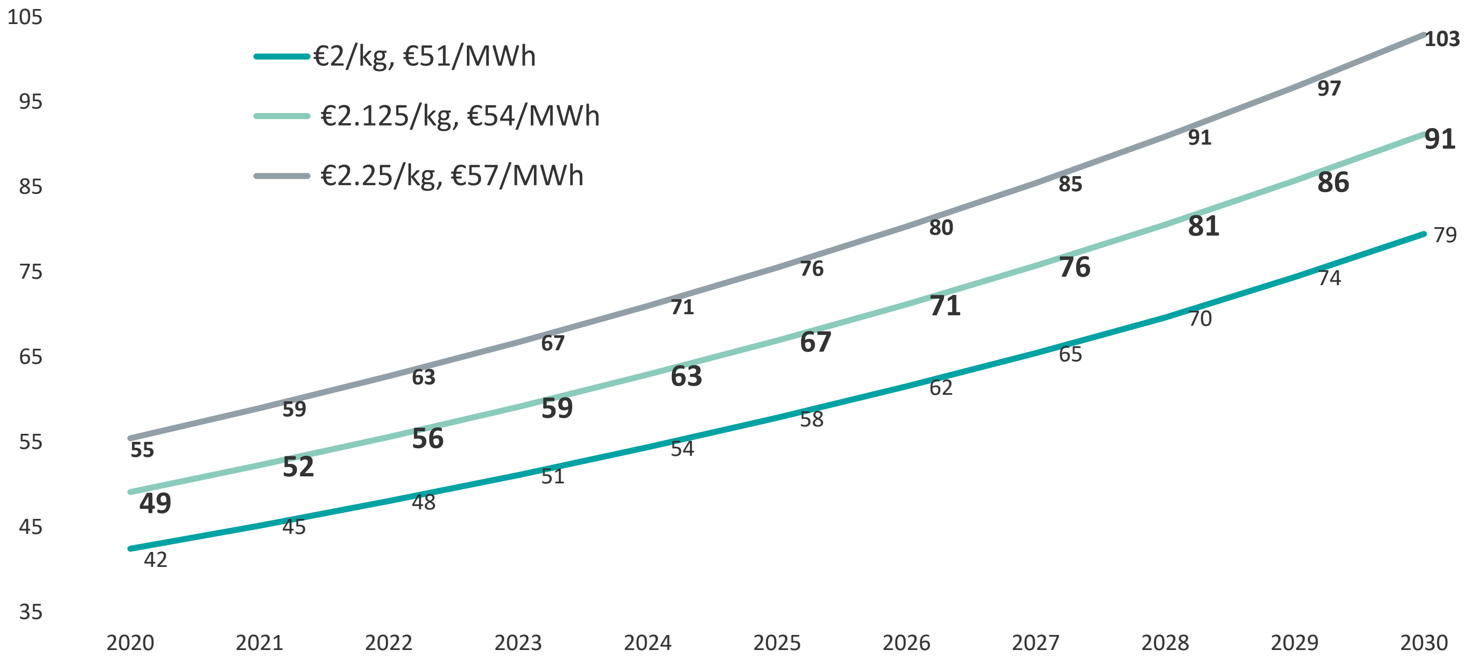
	Green hydrogen at €1.75/kg	Green hydrogen at €2/kg	Green hydrogen at €2.25/kg	Green hydrogen at €2.5/kg
Gas at €10/MWh	€43/t	€55/t	€68/t	€80/t
Gas at €15/MWh	€30/t	**€42/t**	**€55/t**	€68/t
Gas at €20/MWh	€18/t	€31/t	€43/t	€56t

Source: BNP Paribas Asset Management research estimates.

- **The range varies from a low of €18/t to a high of €80/t. If we then look at the potential 2030 costs for green hydrogen, we find that in the middle of our range – i.e. at €2/kg and €2.25/kg – the implied 2020 fair values for carbon discounted back from 2030 are €42/t and €55/t respectively.**
- **We think €42/t-€55/t is a fair indication of the theoretical fair-value range for EUAs today based on the need for green hydrogen to be competitive as an industrial feedstock in 2030.**

The shape of the EU-ETS forward curve in theory

Implied shape of EUA forward curve with varying 2030 costs of green hydrogen from €2/kg-€2.25/kg, ~~and with grey hydrogen gas-input costs of €15/MWh~~



Source: BNP Paribas AM Research estimates

- **Here we take the middle of our 2030 theoretical fair-value range for EUAs – €2/kg-€2.25/kg – to derive the resulting implied theoretical forward curves. This shows that at our mid-range scenario for 2030 EU gas of €15/MWh, and at a 2030 cost of production for green hydrogen of €2.213/kg, the implied fair value for EUAs would be €91/t.**
- **In turn discounting back at 6% would give us a theoretical implied 2020 fair value of €49/t.**

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