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# The Industrial CCS Support Framework in the Netherlands

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# Disclaimer



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# Summary & Key Aspects of the CCS Programme:

- Through the carrot and stick approach of the SDE++ and Carbon tax, the Dutch government is rewarding early deployment of CCS.
- CCS application is fundamentally motivated by emission reduction requirements and objectives and is **solely targeting industrial emissions**.
- CCS is **capped at a total of 7.2MtCo2 from industrial processes** and about 3Mt$CO_2$ per year for waste gas power generation from industrial processes, i.e. at the Tata Steel Mill in Ijmuiden.
- The SDE++ provides a 15-year CfD-like subsidy support covering the 'uncommercial' cost of CCS operation, i.e. the cost above the EU ETS price. Free allowances under the ETS are retained and volumes of $CO_2$ from industrial applications that are captured and stored do not incur a charge under the new Dutch carbon tax system.
- No new industrial CCS subsidies will be granted after 2035 to reflect its role as a transitionary technology.
- Ownership of Transport and Storage (T&S) infrastructure is retained by operators, who are publicly owned (e.g. EBN and Gasunie 100% by Dutch government and the Port of Rotterdam Authority 50/50 between the Municipality and the Government).

# Introduction

The Dutch government implemented two complementary measures to create the framework that would both require and enable industry to reach its reduction targets:

- a feed-in contractual subsidy mechanism under the SDE[1] ++ scheme to reward the most cost-efficient $CO_2$ reductions in industry. This covers the uncommercial part of investing and operating CCS on industrial plants; and
- a carbon tax, increasing gradually over the next decade and reaching at least 125 EUR/t$CO_2$ by 2030.

The renewed government support for CCS in the Netherlands is rooted in the self-imposed but legally required emission reduction targets on its path to achieve net-neutrality by 2050.

At the end of 2020, the Dutch government ran the first round of its SDE++ subsidy programme. For the first time, the programme included support for CCS in industry. The original SDE scheme was first introduced in 2006 and merged two separate policy schemes supporting renewable energy and CHP. It became SDE+ in 2012 and the SDE++ in 2020, turning a renewable support system into a $CO_2$ reduction scheme.

The SDE framework has an embedded lowest-cost and market-based approach by holding auctions in which projects bid to offer. Free allowances under the EU ETS are retained by all emitters covered by the ETS. The SDE++ will run in its current form until 2025 with a total budget of €30 billion. CCS support is limited to a maximum of 7.2 Mt$CO_2$/year to help prevent it displacing of implementing other cost-effective tools nor hinder the development of long term sustainability solutions.

1 SDE stands for Stimulering duurzame energieproductie en klimaattransitie, or 'Stimulating sustainable energy production and climate transition'.

The in parallel introduced carbon tax acts effectively as a floor price under the EU ETS, by topping up the EUA price when it is below the level of the tax. Together the two policies of the SDE++ and the carbon tax provided a "carrot" and "stick" to frontload innovation.

## The Dutch Constitutional Climate Decision and its consequences

*The 2015 'Urgenda case' ruled that reducing emissions was necessary for the Dutch government to protect its citizens' human rights. The government was thereby forced to correct its climate policy for 2020. Targets for 2030 were subsequently set at 49% with pathways by the Dutch environmental agency (PBL) identifying the required emission reductions per sector. For the industry, it meant the elimination of an annual 14million tonnes of $CO_2$ by 2030.*

*The government launched a dialogue program, called 'Climate Tables' to ensure the necessary measures had the support of key stakeholders. These tables brough together representatives from government, the private sector and civil society to discuss measures for each sector of the economy, including industry. The resulting final 'Climate Agreement' of 2019 therefore sought to be carried by key actors, although the government also ensured its own prerogatives were followed. For industry, the Agreement entailed a policy framework to enable CCS through a combination of support instruments, most notably the SDE++, and increasing penalties for emitting $CO_2$ through a new carbon tax.*

# The SDE++: Creating a business case of industrial CCS

The SDE++ subsidy is a contractual payment of the difference between a base rate and a correction amount. The base rate is the price required to make an investment economic, i.e. the cost of the investment and operation of the climate technology. For CCS the base rate covers the cost to capture, transport and store (T&S) the $CO_2$. While the base rate remains unchanged over the contract period, the correction rate will be adjusted annually. The correction amount reflects the market price of the output, for renewables this is the market price of electricity. For CCS support the correction rate represents the average EU ETS of the respective year. The effective SDE subsidy is therefore the difference amount between the market value and the production cost. It thus acts as a Contract for Difference (CfD).

Both, installations already with a capture unit installed and those without can apply for funding, if the former adds at least one compressor to the installation. New industry installations with a $CO_2$ capture and storage as part of the project are eligible for support for the additional costs of CCS. The notion of CCS as a transitional technology for industrial decarbonisation is reflected in the decision to not offer any new SDE++ funding contracts for CCS after 2025.

SDE++ is only available for $CO_2$ that is stored and does not cover the cost for $CO_2$ capture that is instead used, for example in horticultures. To allow an emitter to both use and store captured $CO_2$, and receive respective financial support for the latter, the operator has to allocate the $CO_2$ that is stored through the associated share of full-load hours.

To ensure the timelines, pricing and scale of $CO_2$ capture and transport and storage are aligned, project applications need to provide a declaration with the T&S operating parties to this effect. To enable $CO_2$ transport hubs and prevent the higher risk and cost of single sink to source T&S, multiple emitters can, and should, apply with the same T&S partners that in turn have to guarantee sufficient available capacity for all their commitments. The contract amount is generally paid out to the emitter to cover own capture costs and remunerate the T&S services. However, subsidy payments can also be made directly to the T&S operators through a separate agreement between the partners and the government. Due to the complexity and scale of CCS projects, a contracting period of 2.5 years and implementation period of 5 years are in place.

The first SDE++ round ran between November and December 2020 with a total budget of €5 billion. Each capture project bid in a multi-phase tender process for a 15-year subsidy contract. The process ranks projects based on levels of subsidy intensity. Only projects below the respective cost threshold, i.e. base rate, were able to apply during each phase.

| Phasing and rates for low-carbon production | Maximum phase amout/base amount | | | | Base greenhouse gas amount | 2020 provisional correction amount | | Maximum full-load hours | Commissioning period | Subsidy term |
|---|---|---|---|---|---|---|---|---|---|---|
| Category | Phase 1 €/unit of product | Phase 2 €/unit of product | Phase 3 €/unit of product | Phase 4 €/unit of product | €/unit of product | ETS facility (inlcu, ETS correction) €/unit of product | Non-ETS facility €/ unit of product | hours/year | years | years |
| **$CO_2$ capture and storage (CCS)** | | | | | | | | | | |
| Existing $CO_2$ capture in existing production processes (4000 full-load hours) | 86,9640 | 86,9640 | 86,9640 | 86,9640 | 25,264 | 25,264 | 25,164 | 4000 | 5 | 15 |
| Existing $CO_2$ capture in existing production processes (8000 full-load hours) | 62,4760 | 62,4760 | 62,4760 | 62,4760 | 25,264 | 25,264 | 25,164 | 8000 | 5 | 15 |
| New $CO_2$ capture in existing production processes (8000 full-load hours) | 96,1773 | 100,3310 | 100,3310 | 100,3310 | 25,264 | 25,264 | 25,164 | 8000 | 5 | 15 |
| New $CO_2$ capture in new production processes (8000 full-load hours) | 92,3040 | 92,3040 | 92,3040 | 92,3040 | 25,264 | 25,264 | 25,164 | 8000 | 5 | 15 |
| **Electrification** | | | | | | | | | | |
| Electrolytic hydrogen production | 0.0512 | 0.0556 | 0.0764 | 0.1030 | 0.027 | 0.032 | 0.032 | 2000 | 4 | 15 |
| *Unit of product is in tonne $CO_2$ for $CO_2$ capture and storage and in kWh for the other categories.* | | | | | | | | | | |

Figure 1: Phasing and rates for CCS, Source: RVO,2020

The subsidy intensity is calculated by taking the application amount (the base rate) minus the long-term price (for CCS this is €/t $CO_2$) divided by the emission factor. The long-term price is the expected subsidy requirement per tonne of CO2. The emission factor represents the rate of $CO_2$ stored per t$CO_2$ currently emitted and thereby reflects the cost per tonne of $CO_2$ emissions avoided [2]. Subsidies are paid out per measured unit of output, in this case stored $CO_2$. The subsidy intensity equation for CCS looks like this:

**CCS subsidy intensity**

Subsidy intensity [euros/tonne $CO_2$] =
(application amount [euros/tonne $CO_2$] -long-term price [euros/tonne $CO_2$] /
(emission factor [kg $CO_2$/tonne $CO_2$/] / 1,000

To exemplify: For a new CCS project that has a base rate of 95€ (costs, for example, 70€ for capture and 25€ for transport and storage per tonne of $CO_2$), with a long-term price (i.e. correction amount, the average ETS price) of 37€ [3] and a 90% emission factor, read: capture rate, the 'Subsidy intensity' would be 64.44€/t$CO_2$. Assuming phasing and rate levels from Figure 1, this project would be eligible to compete during the first

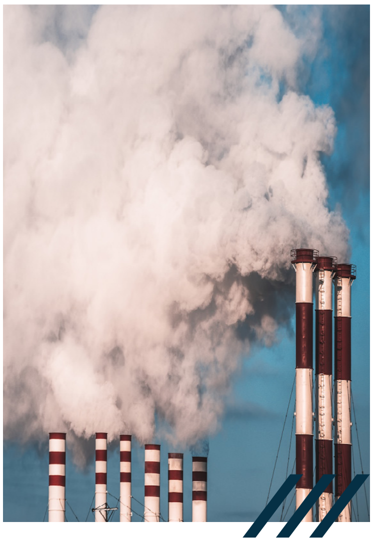
phase of the tender process. A competing project that has a lower cost (base rate) of 90€ yet an emission factor of only 80% would result in a Subsidy Intensity of 66.25€/t$CO_2$. In this case, the first project would be more likely to receive the SDE++ contract due to his lower intensity (€/t $CO_2$ abated).

The subsidy that is ultimately granted represents the maximum amount received over the duration period of the subsidy. This amount reflects the specified capacity and production, the latter being capped at a maximum full-load hours for each technology. If production is less, then the total subsidy amount will be adjusted accordingly.

2 Note the term 'avoided' here refers to the actual $CO_2$ prevented to reach the atmosphere regarding CCS and the expected emission effect of renewable electricity on the grid.
3 This is the long-term price used in the example by the Dutch government: https://english.rvo.nl/sites/default/files/2020/11/Brochure%20SDE%20plus%20plus%202020.pdf

The SDE++ categorises according to capture (pre or post-combustion) and conversion types (gaseous or liquid) and whether the installation is pre-existing or new-built. These categories are reflected in different base-amounts for the phasing. There is, however, no reflection of the distance to the storage site. Nor is there a sustainability criterion that reflects on the long-term value and necessity of a particular industry in a net-zero future. The fundamental approach of the system remains to ensure lowest cost projects and prevent excessive pricing for the T&S service.

# The Carbon Tax: raising the floor of the carbon price



The Dutch carbon tax came into force on January 1st, 2021. It aims to bridge the gap between EU and Dutch emission reduction targets. Although a state tax, the Dutch Emissions Authority (NEa) is the responsible body instead of tax authorities. The income from the $CO_2$ tax will be used to finance green initiatives in the form of subsidies.

The level of the tax, or carbon rate, has been set out from now until 2030; from €30/t$CO_2$ in 2021 to €125/t$CO_2$ by 2030. Power generation is technically exempt from the carbon tax but subject to a 'minimum CO2 electricity price' with a trajectory of €12.30/t$CO_2$ in 2021 to €31.90/t$CO_2$ by 2030. The tax mainly applies to emitters covered by the EU ETS, but also extends to waste incinerators. Others are exempt, such as district heating or greenhouse horticultures.

Crucially, $CO_2$ from industrial processes that is captured and stored is excluded from this carbon tax, since $CO_2$ is not emitted.

The tax acts effectively as a floor price under the EU ETS, by topping up the EUA price when it is below the level of the tax. The effective tax level is therefore the difference between the EUA price and the carbon tax rate that year. For example, if the tax is €30/t$CO_2$ and the EUA price is €25/t$CO_2$ a tax of €5/t$CO_2$ is payable. If the EUA price is above the level of the carbon rate, no tax is paid. In this way the tax determines a minimum level for the carbon price (a floor price) but does not prevent the carbon price from going higher if EUA prices exceed the statutory rate. There is no negative carbon tax rate, with government paying back the difference.

Installations that are not part of the ETS but covered under the new tax, such as waste incinerators, need to pay the tax in full.

Similar to the free allowances under the EU ETS, the Dutch carbon tax has a carbon-leakage protection mechanism, providing so called 'dispensation rights' to energy intensive industries (EII) exposed to international competition. Similar to EUA free allowances these dispensation rights effectively remove the carbon costs for a benchmark level of emissions.

To ensure there remains enough "stick" to drive emission reduction investments, dispensation rights will decrease annually in accordance with the set 'reduction factor'. The reduction factor is 1.2 for 2021, due to fall below 1 by 2025 and to 0.69 by 2030.

| Years | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | After 2030 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Price Path (€)** | 30 | 40.56 | 51.12 | 61.68 | 72.24 | 82.80 | 93.36 | 103.92 | 114.48 | 125.04 |
| **Reduction factor** | 1.2 | 1.14 | 1.09 | 1.03 | 0.97 | 0.92 | 0.86 | 0.8 | 0.74 | 0.69 |

**Table 1:** Current planned trajectory of the reduction factor and $CO_2$ tax level. Source: https://www.pwc.nl/en/insights-and-publications/tax-news/pwc-special-budget-day/taxplan-2021-co-2-levy.html

The dispensation rights are calculated as:

**Dispensation Rights**

Dispensation rights = amount of production x

amount of $CO_2$ related to this production based on EU ETS benchmarks[4] x reduction factor

Dispensation rights thus reflect actual production that year, in contrast to free allocation of EUAs which is based on previous production.

If less $CO_2$ is emitted than allowed based on the granted dispensation rights, the surplus can be carried back to the previous five years or sold to other carbon-taxpayers on a closed market. However, if sold on to other players, it is not possible to sell unused dispensation rights to use in a different year than the one in which they were granted. So, if an emitter requires less dispensation rights in year 2022, these can only be sold to and used by another emitter for 2022, and not for, e.g. in 2023 or for 2021.

This approach in effect creates a hybrid between an ETS and a carbon tax. In particular, it puts a floor on the carbon price and provides exemptions similar to those achieved with free allocation of allowances under a tax mechanism. Cost pressures for industrial installations are expected to increase significantly over the 2020s through a combination of the rising tax trajectory and decreasing reduction factor (compare Table 1).

4 For 2021 and 2022, the 2020 EU ETS benchmarks will be used instead of the recently adjusted benchmarks for the period of 2021-2025

# The SDE++, ETS Free Allowances and the $CO_2$ Tax in practice

As with other emission savings technologies, emitters do not have to purchase ETS allowances for $CO_2$ that has been captured and stored. In addition, any installation receiving SDE++ support retains its free allowances under the EU ETS. The incentive to invest in carbon capture, transport and storage under the SDE++ therefore functions in two ways.

i) The money previously paid to buy ETS allowances for emitted $CO_2$ is now invested into a technology that prevents $CO_2$.
ii) Free allowances previously used to cover emissions, can now be sold.
Current free allowance rates are typically at about 80% against the benchmark emissions. It is therefore safe to assume that an average industrial installation will be able to cover all residual emissions (for example in case of a 90% capture rate about 10% of current emissions) through free allowances and trade the remaining allowances.

As with the ETS, $CO_2$ that is captured and stored does not incur a $CO_2$ tax under Dutch law. Through the dispensation rights, a share of $CO_2$ emissions is also exempt. If an installation produces 500Mt of output and emits 1.5t$CO_2$/tonne of product, the calculation of $CO_2$ tax dispensation rights would look as follows:

**Calculation of $CO_2$ tax dispensation rights**

*Production amount X $CO_2$ related to this production (EU ETS benchmark) X reduction factor[5]*

500Mt x 1.5tCO2/tonne of output x 1.2 = 900MtCO2

By 2030, this amount will have reduced to 517Mt$CO_2$ under the reduction factor of 0.69 and the current benchmark. In practice the benchmark is also likely to reduce.

An installation deploying CCS under the current policy framework is unlikely to require purchasing ETS allowances or paying a $CO_2$ tax, due to the retention of free allowances and dispensation rights under the tax. This provides further incentive to reduce emissions, complementing the cost recovery framework under the SDE++ for the CCS technology itself. The possible reflection of CCS emission reductions in future ETS benchmarks (e.g. reducing from 1.5t$CO_2$/tonne of output to 0.15t$CO_2$/tonne of output) would, however, reduce the value of free allocation, and this would lead to a need for further support.

5 1.2 in 2020, reduced to 0.69 by 2030

# Delivering CCS for Industry in the Netherlands; and beyond

There are several CCS project clusters under consideration and development in the Netherlands, for example at the Chemelot and Terneuzen clusters, and at waste incinerators across the country. The Porthos Project at the Port of Rotterdam and the Athos project connecting industry around the Nordzeekanaal and the Tata Steel Works at Ijmuiden stand out in terms of strategic importance for Dutch climate plans to be achieved.

## Porthos: Oversizing the Backbone of Industrial Decarbonisation in the region

Industry located in the Port area have been cutting emissions over the past years, yet still emit over 13.5% of total Dutch emissions, or over 25MtCO2 a year (2019 data)[1]. The Porthos project is a coalition of the Port of Rotterdam, EBN and Gasunie all of which are entirely publicly owned, either through the Rotterdam municipality or the Dutch government. The project is developing a backbone $CO_2$ infrastructure in the port area, which is to be operational by 2024. It is currently the most advanced large-scale CCS project within the EU.

The Porthos infrastructure is to service both emitters in the immediate proximity to the port, and, in the future, emitters from further afield. This will most likely be via the rivers Meuse and Rhine towards the Dutch chemical cluster at Chemelot and the German industrial heartland in North Rhine Westphalia. As such, despite current expected levels of 2.5 $MtCO_2$ for T&S in the Port area, there are plans to build an infrastructure (i.e. pipeline) able to accommodate 10 $MtCO_2$ per annum. Given the SDE++ only remunerates actually stored $CO_2$, the commercial risk of oversizing infrastructure is absorbed by EBN and Gasunie.

6 https://www.portofrotterdam.com/en/news-and-press-releases/carbon-emissions-port-rotterdam-drop-swifter-national-average

Together with the ports of Antwerp and Zeebrugge, who announced a merger in early 2021, Rotterdam also forms the TransPorts project. For this trans-European $CO_2$ infrastructure dimension, Porthos was awarded Project of Common Interest status by the European Commission under the Connecting Europe Facility and received over €100 million in subsidies in February 2021.

During the first round of the SDE++, companies from the port area totalling some 2.5Mt $CO_2$ applied for funding. All are connected to the shared Porthos T&S infrastructure. In May 2021, the Dutch government awarded 2 bn € in SDE++ subsidy to six projects to capture their $CO_2$ and remunerate Porthos for the operation of the transport and storage component.

### Athos: Integrating $CO_2$ Usage and Storage for Industry

The Athos project has been initiated by the Port of Amsterdam, TATA Steel, Gasunie and EBN. It seeks to connect and integrate industry around Ijmuiden and Amsterdam. At its heart stance the single largest emitter and job provider in the Netherlands: the integrated steel mill of TATA steel with about 5 million tonnes $CO_2$ per year. Athos entails a CCS component for a share of the emissions in the region. Storage is to take place into empty aquifers, oil or gas fields off the coast of the northern Netherlands. The project is still in the planning phase with operations only to begin in the second half of this decade.

## More Bellona Publications on the topics of Industrial Decarbonisation and CCS

An Industry's Guide to Climate Action
https://bellona.org/publication/an-industrys-guide-to-climate-change

Building Back Greener
https://bellona.org/publication/policy-brief-building-back-greener-uk

Laying the Foundations for a Net Zero Society
https://bellona.org/publication/joint-paper-laying-the-foundations-for-a-net-zero-society

Norway's Longship CCS Project
https://bellona.org/publication/briefing-norways-longship-ccs-project

Models for Transport and Storage of Captured $CO_2$
https://bellona.org/publication/models-for-transport-and-storage-of-captured-co2

Contract Incentives for Industrial Carbon Capture
https://bellona.org/publication/contract-incentives-for-industrial-carbon-capture