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Results of pilot audits against draft RED2 requirements for RFNBO in different certification schemes

Applicant:
Rijksdienst voor Ondernemend Nederland

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TRUSTED QUALITY SERVICES

Table of contents

1.Introduction

Both the European Commission and EU Member States have set ambitious objectives for the production and use of renewable hydrogen. Renewable hydrogen is hydrogen produced via electrolysis using renewable electricity. Market players are responding to these ambitions by developing electrolysis projects.

Under the recast of the Renewable Energy Directive (RED-II) renewable hydrogen can classify as RFNBO, i.e. 'Renewable Fuels of Non-Biological Origin', if it meets certain criteria. Other examples of RFNBOs are synthetically produced ammonia and methanol produced from renewable hydrogen.
At the moment of writing this report, RED-II criteria for RFNBOs have not yet been finalized and are only available in draft. Draft RED-II criteria have been laid down in two delegated acts, which the European Commission published on 20 May 2022. The first delegated act, the Delegated Act to RED-II article 27.3 ('DA 27.3') specifies when electricity used in an electrolyser for hydrogen production can be considered as 'additional', and thus eligible for the production of RFNBOs. The other Delegated Act ('DA 28.5') specifies a methodology for the calculation of greenhouse gas (GHG) emissions from RFNBOs. It is envisaged that compliance with Delegated Act requirements shall be demonstrated through voluntary schemes referred to in Article 30 of RED-II.

The latter means that there is an urgent need to develop and pilot RFNBO certification schemes, so that compliance of renewable hydrogen with RED-II RFBNO criteria can be demonstrated soon after the final Delegated Acts DA 27.3 and DA 28.5 have been published.

The Dutch Ministry of EZK and RVO wish to facilitate the process of RFNBO certification scheme development and implementation. For this purpose, they initiated and financed a project to pilot audit draft RFNBO certification schemes. Quality Services BV (QS) was contracted to execute the project, including the pilot auditing and reporting.

More specifically, the main objective of the project is to assess if compliance with draft RED-II RFNBO criteria can be demonstrated by using draft RFNBO certification schemes.

Related sub-objectives of this project are:

1. to asses if requirements in draft RFNBO certification scheme are workable for companies and auditable for certification bodies;
2. to facilitate scheme owners in developing (draft) RFNBO certification schemes;
3. to share knowledge on RFNBO certification, thereby facilitating European and non-European companies to prepare for future certification. Certification will allow these companies to sell RFNBOs to the European market.

This report summarises the project findings. Chapter 2 outlines the preparation of the pilot audit programme and some of the practical aspects of its execution. Chapter 3 summarises findings from the pilot audit programme. Chapter 4 lists project conclusions.

2. Preparation and execution of pilot audits

This chapter outlines how the pilot audit programme was prepared and executed. Section 2.1 specifies how involvement of certification schemes was ensured, and how a certification body and companies for pilot audits were selected. Section 2.2 summarises the scheme documentation that was used for the pilot audits. Section 2.3 describes the preparation, execution and reporting of the pilot audits.

2.1 Selection of certification schemes, certification body and companies

RVO was instrumental in preparatory activities that led to a comprehensive programme of six pilots audits. Preparatory activities started in May 2022, and included the following:

1. Stimulate the development of RFNBO certification scheme documentation;
2. Contract a certification body for the execution and reporting of the audit programme;
3. Select companies for participation in the audit programme.

These activities, executed by RVO in cooperation with the Dutch Ministry of Economic Affairs and Climate Policy (Ministry of EZK), are summarised below:

Ad 1. Stimulate the development of RFNBO certification scheme documentation
In May 2022, RVO contacted certification scheme owners with the aim to enthuse them to develop draft RFNBO certification scheme documentation that could be used in the pilot audit programme. Three certification schemes indicated that they were interested to respond to RVO's request: ISCC, REDcert and CertifHy.

ISCC was the first to submit a draft RFNFBO certification scheme to RVO, which comprised of three documents (submitted in the period from mid-July to mid-September). REDcert submitted a draft scheme document in mid-August. Upon submission of the draft scheme documentation, both certification schemes confirmed their interest to have the scheme documentation tested in the pilot programme.

CertifHy, having another auditor (TÜV SÜD) recognized to audit according to its scheme, decided not to participate directly in the RVO pilot programme but offered to share with RVO the learnings from its pilot that was run independently (refer to Table 2.2 and Chapter 3).

Ad 2. Contract a certification body for the execution and reporting of the audit programme
In June 2022, RVO invited three certification bodies to submit a proposal for the execution and reporting of the audit programme. Of the proposals received, Quality Services BV (QS) was selected and contracted.

QS was assigned to prepare the audits with interested companies, execute the audits and submit full audit reports to companies individually. Additionally, QS was assigned to prepare a report summarising the findings of the pilot audit programme (this report).

Ad 3. Select companies for participation in the audit programme.
The Ministry of EZK and RVO made an open invitation to companies to participate in the RFNBO pilot audit programme, in particular during online market consultation events for a Dutch subsidy scheme (*'Opschalingsregeling waterstof via elektrolyse'*) and during an online webinar organised in February 2022 by the National Hydrogen Programme NWP. Interested companies received a document with selection criteria and an application form. Nine companies returned the application form, out of which six companies were selected by the Ministry of EZK and RVO.

Companies' participation in the pilot programme was at own cost, meaning that all costs related to the preparation of the audit were borne by the companies themselves. Only the certification body was contracted and paid by RVO (refer to point (2) above).

Tabel 2.1 summarizes participating companies, key technical features of facilities and the draft certification schemes which were piloted. Annex I contains brief descriptions of the companies and their hydrogen facilities.

Tabel 2.1 Companies participating in the pilot audit programme, key technical features of facilities and draft certification schemes piloted.

Company	MW, Direct line or grid connected[1]	Location	Scheme piloted
Shell	0,05 MW, direct line and grid connection	Amsterdam (NL)	REDcert + ISCC
Air Liquide	200 MW, direct line and grid connection, simulation	Terneuzen (NL)	ISCC
Nobian	180 MW chlor-alkali electrolysis, grid connection	Rotterdam (NL)	ISCC + REDcert
Air Products	2000 MW, H_2 + NH_3 production, direct line, simulation	Neom, Saudi Arabia	REDcert + ISCC
GroenLeven	1,4 MW, direct line and grid connection	Oosterwolde (NL)	REDcert + ISCC
Gasunie	1 MW, direct line and grid connection	Zuidwending (NL)	ISCC + REDcert

Table 2.2 specifies details of the company that was pilot audited against the CertifHy scheme, and Annex I provides additional technical information. This pilot was not part of the RVO pilot programme as outlined above. The audit was performed by TÜV on behalf of CertifHy. The audit report was shared by CertifHy and findings have been included in Chapter 4 (anonymised). QS bears no responsibility for the contents of the TÜV audit findings and its report.

Table 2.2 *Company participating in the pilot audit organised by CertifHy, key technical features and draft certification schemes piloted.*

Company	MW, Direct coupled or net coupled	Location	Scheme
ENGIE-OCI-EEW	100 MW H2 + MeOH production, grid connection, simulation	Eemshaven (NL)	CertifHy

[1]: **A direct line electrolyser** is an electrolyser with a direct connection to an installation generating renewable electricity (e.g. wind turbines or solar panels), so that electricity is provided to the electrolyser via the direct line and not via the electricity grid. **A grid connected electrolyser** is an electrolyser that is connected to the electricity grid and is operated on electricity supplied from the grid. An electrolyser can also be a combination of direct line and grid connected.

2.2 Availability and use of scheme documentation

Both ISCC and REDcert have included requirements of draft DA 27.3 and draft DA 28.5 in their respective scheme documentation. For this, the schemes have followed a different approach:

- ISCC has prepared three draft documents on RFNBO certification: a document on the additionality requirements in the draft DA 27.3 (*ISCC EU 202-6 Renewable Fuels of Non-Biological Origin*), a document on RFNBO GHG calculations in the draft DA 28.5 (*ISCC EU 205-1 Renewable Fuels of Non-Biological Origin (RFNBO) and Recycled Carbon Fuels (RCF) – Greenhouse Gas Emissions*), and a document with audit requirements for RFNBOs (*ISCC EU Audit Procedure Chain of Custody for Renewable Fuels of Non-Biological Origin (RFNBOs) / Version 0.1 / Date: 15 September 2022)*.
- REDcert made additions to an existing document on GHG calculations (REDCert-EU document *'Scheme principles for GHG calculation'* Draft – *For internal use only).* Requirements for RFNBO GHG calculations (draft DA 28.5) plus criteria determining when additional renewable electricity can be counted as zero-emission (draft DA 27.3) were added to this document.

During the audit programme, it was found that the draft ISCC scheme documentation contains a more detailed elaboration of DA requirements than the draft REDcert scheme documentation. Also, the ISCC scheme documentation contained draft audit procedures, whereas the REDcert documentation did not (yet).

It needs to be noted that all scheme documents are only in draft, and will be finalised once the two DAs have been published. This is likely to lead to further changes and improvements of the scheme documentation, including the recommendations arising from the pilot audits (refer to Chapter 3).

ISCC and REDcert RFNBO scheme documentation was made available to RVO and certification body QS, whereas CertifHy RFNBO scheme documentation was made available to its certification body TÜV SÜD but not to RVO.

2.3 Audit preparation, execution and reporting

In August 2022, QS first contacted the pilot audit companies for an introduction and to discuss planning and practical details of the pilot audit. Also, confidentiality arrangements were discussed and agreed with a number of the participating companies.
In August and September draft ISCC and REDcert scheme documents were shared with the companies, which allowed them to prepare for the audit. Prior to the audit, QS also shared details of the audit programme with the companies.

All pilot audits were executed in October by means of a one-day visit to the company site. During the audit, also the RFNBO installations were inspected if in operation. The inspections paid specific attention to the location, operation and calibration of hydrogen and electricity meters. All audits were executed by the same audit team comprising of two auditors: a lead auditor complemented by an auditor with specific expertise on measurement of data and Guarantees of Origin (GoOs). One audit was witnessed by a RVO hydrogen expert, a second audit was witnessed by an ISCC scheme manager and a third audit was witnessed by a REDcert scheme manager.

Each audit was concluded with a meeting with company representatives during which findings including non-conformities were discussed. A summary of findings was also made available to the companies soon after the audit. A full audit report was sent to the companies in November 2022.

Cooperation of companies
All pilot companies showed strong commitment to the pilot audit: they prepared the audit, were transparent and cooperative during the audit and interested to receive feedback from the auditors.

Discussion of draft pilot audit findings with relevant stakeholders
Draft pilot audit findings were discussed informally with policy makers from the European Commission and with ISCC, REDcert and CertifHy scheme managers. This was done on their request.

3. Findings from the pilot audits

This chapter summarizes findings from the pilot audits. Audit findings are presented in aggregated and anonymized form, meaning that no reference is made to (findings in) specific audits or companies.

Section 3.1 summarises a number of **general findings**.

Section 3.2 lists **key findings** that are critical for the credible and successful implementation of the draft certification scheme requirements (based on Delegated Acts) by economic operators.

Section 3.3 to 3.7 list more **detailed findings**, categorized by the type of requirements outlined in the draft Delegated Acts 27.3 and 28.5. Each section also specifies recommendations for the European Commission or certification scheme owners.

3.1 General findings

None of the companies currently fully complies with applicable requirements. In each RFNBO pilot audit a number of non-conformities were found that were not solved by the companies in the weeks after the audit.

There are at least four factors that explain the existence of these non-compliances:

- The first factor is that some of the RFNBO installations are still under development or only in simulation mode;
- Secondly, companies are not yet (fully) familiar with relevant requirements and/or have not yet fully implemented in the organization all necessary measures to comply with the requirements. Implementing the additional measures required to solve all non-conformities takes more time than the couple of weeks available in this project;
- Thirdly, on a more technical note, some of the companies did have insufficient proof to count electricity as fully renewable, or the calculated greenhouse gas saving did not exceed the required 70% (also refer to Section 3.2);
- Finally, companies decided not to address non-conformities prior to the publication of the final version of the two Delegated Acts and related certification scheme documentation. This is understandable as the draft documentation may be subject to change.

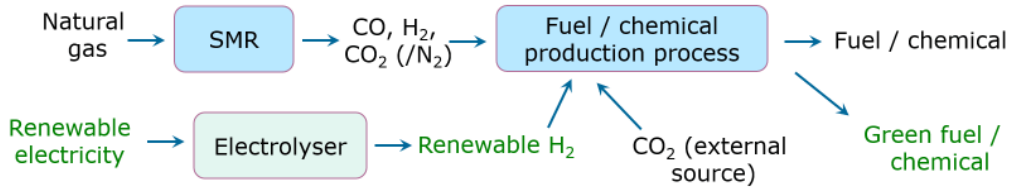
3.2 Key findings in relation to Delegated Acts' requirements

The pilot audits have shown that **in principle it is possible for economic operators to meet all DA requirements**, both in cases with directly connected renewable electricity installations and in cases where electricity is (partly of fully) taken from the grid. There is at least one important exception to this conclusion, which is that the greenhouse gas emissions savings requirement cannot be met if a significant part of the electricity from the grid cannot be counted as fully renewable. This might also be the case for co-processing of renewable and non-renewable inputs. These exceptions have been elaborated below under 'greenhouse gas requirements' and in section 3.6.

Greenhouse gas requirements
The greenhouse gas requirement cannot be met if a significant part of the electricity from the grid cannot be counted as fully renewable.
It will be impossible to meet the greenhouse gas requirement in a situation where the electrolyser uses electricity from the grid or uses both renewable electricity via a direct line and electricity from the grid, and a significant part of the electricity taken from the grid does not meet the requirements to be counted as fully renewable (i.e. via a Power Purchase Agreement (PPA) meeting all relevant requirements, see below). This is because the greenhouse calculation shall include the full electricity input and the output of **both RFNBO and non RFNBO** : if the grid electricity cannot be counted as fully renewable (and is a significant part of the total electricity used), then the calculated greenhouse gas savings will not meet the required threshold of

70%. The share of electricity not counted as fully renewable that can be used while still meeting the 70% GHG threshold depends on the GHG intensity of electricity taken from the grid, for which national numbers need to be used (values can for instance be found in Table A in Annex C of the draft DA 28.5). A calculation example for the Netherlands can be found under the following link: https://nationaalwaterstofprogramma.nl/actueel/nieuws/downloads_getfilem.aspx?id=1475366&forcedownload=true

The greenhouse gas requirement might also not be met in case of co-processing of renewable and non-renewable inputs. The last paragraph of point 1 in Annex A of draft DA 28.5 suggests that also in case of co-processing, the greenhouse calculation shall include the full input of both renewable input and non-renewable input, and that one GHG emission value is to be calculated for both RFNBOs and non-RFNBOs. This is for example the case if methanol is produced from renewable hydrogen and other components produced by using natural gas. This has been depicted below:



The European Commission informally indicated that the last paragraph of point 1 in Annex A of draft 28.5 applies to full input of renewable and non-renewable electricity, but is not applicable to other inputs as in the above example of co-processing. It is crucial to clarify this point in the final version of DA 28.5, as it determines whether in the case of co-processing of renewable and no-renewable inputs the greenhouse gas criterium can or cannot be met.

Additionality

Another key finding is that **hourly registration of electricity supply must be included as a condition in the contractual arrangements** between the company operating the electrolyser and the renewable electricity producer supplying the electricity via the grid and covered by a PPA.
As it is a requirement for the company operating the electrolyser to register the renewable electricity used for RFNBO production on an hourly basis, this information needs to be made available by the renewable electricity producer. This level of detail of information sharing is currently not common in PPAs, and will require additional contractual arrangements to be agreed between both companies. This may be covered by the PPA or by a separate arrangements between both companies.

Risk of double claiming

Another key finding is related to the **linkage between Guarantees of Origin and Proof of Sustainability.** Currently, both draft DA 27.3 and the piloted certification schemes do not yet explicitly require that **if** both Guarantees of Origin (GoOs) and a Proof of Sustainability (PoS) have been issued for RFBNOs, both must be coupled/linked in registration or transaction of RFNBOs. This requirement is necessary to avoid that GoO's and PoS's can be used independently, leading to risks of double claiming of RFNBOs.

Specification of DA requirements in voluntary schemes

It is possible to specify draft DA 27.3 and draft DA 28.5 requirements in a voluntary scheme in such a way that (a) scheme requirements are clear to economic operators and (b) are auditable for certification bodies. Current draft versions of certification schemes used in the pilot audits will need a number of additions and clarifications. Recommendations have been listed in the sections 3.3 – 3.7.

3.3 Findings in relation to 'Rules for counting electricity sourced from directly connected installations as fully renewable'

3.3.1 What are the requirements in draft Delegated Act 27.3 and in the draft scheme documents?

Article 3 of draft DA 27.3 specifies the evidence that a fuel producer must provide in order to count electricity obtained from a direct connection to an installation generating renewable electricity as fully renewable. The required evidence relates to the definition of the direct line (3a), the start of operation of the installation generating renewable electricity (3b), and evidence in case the installation producing electricity is also connected to the grid (3c).

ISCC EU has included Article 3 requirements in its draft document '*ISCC EU 202-6 Renewable Fuels of Non-Biological Origin (RFNBOs)*', i.e. in Section 4.1.1 *'Electricity from directly connected installations'*.

REDcert-EU has included Article 3 requirements in its draft document *'Scheme principles for GHG calculation'*, i.e. in section 5 *'Liquid or gaseous renewable fuels for transport of non-biogenic origin and recycled carbon fuels*'.

3.3.2 Findings from the audits and recommendations

The pilot audits have shown that economic operators can comply with the requirements listed in Article (3) of draft DA 27.3.

The pilot audits have also highlighted a couple of points that require further clarification:

1. Article 7 ('Transitional phase') specifies that the following requirement in Article 4(2)a shall apply from 1 January 2027: 'the installation generating renewable electricity came into operation not earlier than 36 months before the installation producing the renewable liquid and gaseous transport fuel of non-biological origin'. This Article 4(2)a is relevant for electricity taken from the grid and to be counted as fully renewable. We understand that this exemption rule of 1 January 2027 does not apply to directly connected renewable electricity installations. If this is indeed the case, this would effectively mean a stricter requirement for directly connected renewable electricity installations than for grid connected renewable electricity installations. This does not seem logic.

   We recommend the European Commission to clarify this point in DA 27.3.

2. The draft certification schemes do not require that the certification body checks whether Guarantees of Origin (GoOs) for produced renewable electricity have been sold to third parties. This check is necessary to prevent sale of GoOs (for renewable electricity) to third parties without cancellation of these GoOs for (own) use in the electrolyser, as this leads to double claims of GoOs.

   Recommendation for certification schemes: Include a requirement in scheme documentation that the certification body checks whether GoOs (for produced renewable electricity) have not been sold to third parties, and that these GoOs have correctly been cancelled for own use.

3. The pilot audits have also highlighted a number of points in relation to the 'starting date of RFNBO' production and 'starting date of electricity production'. As these points apply to both directly connected installations and directly connected installations, they are discussed separately in Section 3.5.

3.4 Findings in relation to 'Rules for counting electricity taken from the grid as fully renewable'

3.4.1 What are the requirements in draft Delegated Act 27.3 and in the draft scheme documents?

Article 4 of draft DA 27.3 specifies the evidence that a fuel producer must provide in order to count electricity taken from the grid as fully renewable. Required evidence includes information on the minimum share of 90% renewable electricity in the bidding zone where the renewable energy is produced (4.1) or, alternatively, in relation to PPAs concluded to purchase renewable electricity for fuel production (4.2). In relation to the PPA, additional requirements apply on the dates that installations come into operation, on subsidy received for hydrogen production, on the temporal correlation between the generation of electricity and the RFNBO production, and on the geographical correlation.
The article also contains extra provisions for research, testing and demonstration facilities (4.3), on use of electricity during imbalance settlements (4.4) and on additional criteria that Member States may define in relation to the location of installations (4.5). Finally, Article 27.3 of RED-II gives another possibility to specify evidence, which is the average share of electricity from renewable sources in the country of production, as measured two years before the year considered.

Figure 3.1 provides an overview of four routes for directly connected installations (a) and for electricity from the grid in (b), (c) and (d).

ISCC EU has included Article 4 requirements in its draft document '*ISCC EU 202-6 Renewable Fuels of Non-Biological Origin (RFNBOs)*', i.e. in Section 4.1.2 *'Electricity from the* grid' and Section 4.2 *'Criteria for counting electricity from the grid as fully renewable'*.

REDcert-EU has included Article 4 requirements in its draft document *'Scheme principles for GHG calculation'*, i.e. in section 5 *'Liquid or gaseous renewable fuels for transport of non-biogenic origin and recycled carbon fuels*'.

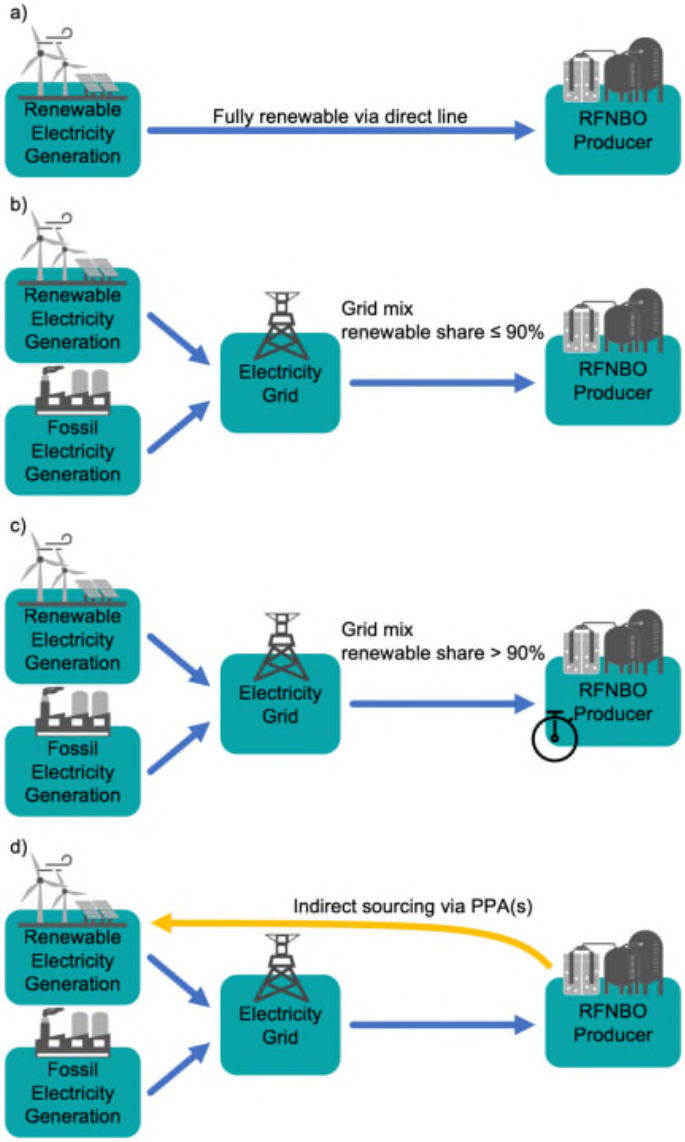


Figure 3.1 Graphical summary of the four sourcing options for electricity [figure taken from ISCC document EU 202-6, draft version 1.0]

3.4.2 Findings from the audits and recommendations

The pilot audits have shown that economic operators can comply with the requirements listed in Article (4) of DA.

As was already mentioned under 'Key findings' in Section 3.1 a critical precondition is that hourly registration of electricity supply must be included in the contractual arrangements between the company operating the electrolyser and the renewable electricity producer: as it is a requirement for the company operating the electrolyser to register the renewable electricity used for RFNBO production on an hourly basis. This information also needs to be made available by the renewable electricity producer. This level of detail of information sharing is currently not common in PPAs. This may be covered by the PPA or by a separate contractual arrangements between both companies.

The pilot audits have also highlighted a number of points in relation to the 'starting date of RFNBO' production and 'starting date of electricity production'. As these points apply to both grid connected installations and directly connected installations, they are discussed separately in Section 3.5.

3.5 Findings in relation to 'starting date of RFNBO production' and 'starting date of electricity production'

3.5.1 What are the requirements in draft Delegated Act 27.3 and in the draft scheme documents?

Both Article 3 (b) and Article 4 (2a) include the following requirement: 'the installations generating renewable electricity came into operation not earlier than 36 months before the installation producing renewable liquid and gaseous transport fuel of non-biological origin'

ISCC EU has included this requirement in its draft document '*ISCC EU 202-6 Renewable Fuels of Non-Biological Origin (RFNBOs)*', i.e. in Section 4.1.1 *'Electricity from directly connected installations'*, in Section 4.1.2 *'Electricity from the* grid' and in Section 4.2 *'Criteria for counting electricity from the grid as fully renewable'*.

REDcert-EU has included Article 4 requirements in its draft document *'Scheme principles for GHG calculation'*, i.e. in section 5 *'Liquid or gaseous renewable fuels for transport of non-biogenic origin and recycled carbon fuels*'.

3.5.2 Findings from the audits and recommendations

The pilot audits have shown that economic operators can comply with the requirements on 'starting date of RFNBO production' and 'starting date of electricity production' . The pilot audits have also highlighted a number of points that are not yet clear from draft DA 27.3 or scheme documentation.

1. In relation to the definition of 'starting date of RFNBO production', the following points are not clear from the draft DA 27.3 or scheme documentation:
    a. Whether 'starting date of RFBNO production' means the date of the first commercial delivery or any other date (e.g. start of commissioning). Our understanding from informal input from the European Commission is that this starting date is defined as the date of first commercial delivery. However, this is not explicitly mentioned in draft DA 27.3 or the draft scheme documentation;
    b. Article 3b of draft DA specifies that 'Where additional production capacity is added to an existing installation producing renewable liquid and gaseous transport fuel of non-biological origin, the added capacity shall be considered to be part of the existing installation, provided that the capacity is added at the same site and the addition takes place no later than 24 months after the initial installation came into operation'. Our understanding from informal input from the European Commission is that this means that if capacity is added more than 24 months after the initial installation came into operation, the full installation shall be considered to be a new installation. This is not explicitly mentioned in draft DA 27.3 or the draft scheme documentation;
    c. Whether a full revision of the RFBNO facility leads to a new 'starting date' of the facility. Our understanding from informal input from the European Commission is that this is not the case if there is no increase of capacity. This may be different if capacity increases due to revision (e.g. as a result of efficiency increases). This is not explicitly mentioned in draft DA 27.3 or the scheme documentation.

2. In relation to the 'starting date of renewable electricity production' it is unclear what shall be considered as starting date(s) when a renewable electricity facility is taken into operation in several steps during a period of several months or years. This is for example common practice for large offshore wind parks, where the first installed turbines may come into commercial operation many months before the last installed turbines come into commercial operation.

We recommend the European Commission to clarify the above points in DA 27.3.

3.6 Findings in relation to 'Common rules'

3.6.1 What are the requirements in draft Delegated Act 27.3 and in draft scheme documents?

Article 5 of the draft DA 27.3 specifies requirements in relation to the hourly documentation of the amount of electricity used to produce RFNBOs (a), the amount of renewable electricity generated (b) and the amount of RFNBOs produced (c).

ISCC EU has included Article 5 requirements in its draft document '*ISCC EU 202-6 Renewable Fuels of Non-Biological Origin (RFNBOs)*', i.e. in Section 4.3 'Documentation of renewable electricity'.

REDcert-EU has included Article 5 requirements in its draft document *'Scheme principles for GHG calculation'*, i.e. in section 5 *'Liquid or gaseous renewable fuels for transport of non-biogenic origin and recycled carbon fuels*'.

3.6.2 Findings from the audits and recommendations

The pilot audits have shown that economic operators can comply with the requirements listed in Article (5) of DA.

The pilot audits have highlighted three points that require further clarification:

1. Currently, both the Delegated Act and the piloted certification schemes do not yet explicitly require that **if** both Guarantees of Origin (GoOs) and a Proof of Sustainability (PoS) have been issued for RFBNOS, both must be coupled/linked in registration or transaction of RFNBOs. This requirement is necessary to avoid that GoOs and PoS's can be used independently, leading to risks of double claiming of RFNBOs (also refer to 'Key findings' listed in Section 3.1).

   Recommendation to certification schemes: Add a requirement in scheme documentation which specifies that **if** both Guarantees of Origin (GoOs) and a Proof of Sustainability (PoS) have been issued for RFBNOS, both must be coupled/linked in registration or transaction of RFNBOs.
   (Note: this issue might also be solved when Union Database requirements (under development) will prevent independent use of GoOs and POS's.

2. The draft DA 27.3 nor the draft certification schemes specify the required measurement accuracy for the measurement of the volume of hydrogen produced. A specification is required to avoid excessive inaccuracies, and to ensure that this requirements is implemented equally by certification schemes.

   Recommendation for the European Commission: specify the required measurement accuracy for measuring the volume of hydrogen produced (in DA 27.3 and/or scheme documentation). Dutch legislation on GoO from hydrogen requires a measurement accuracy of 2.5%. This may be taken as a reference. In addition, we recommend the European Commission to develop a EU standard for hydrogen metering and calibration.

3. The draft DA nor the draft certification schemes specify the required measurement accuracy for electricity. A specification is required to ensure that this requirement is implemented equally by certification schemes. In current practice, recognized measuring companies or MID[2] meters are being used following Dutch regulations.

   Recommendation for the European Commission: specify the allowable measurement accuracy and/or methods for electricity (in DA 27.3 and/or scheme documentation).

[2] MID stands for Measuremement Instrument Directive. This Directive (2014/32/EC) contains requirements for measurement devices including kWh meters. MID meters comply with the Directive's requirements.

3.7 Findings in relation to greenhouse gas calculations

3.7.1 What are the requirements in draft Delegated Act 28.5 and draft scheme requirements?

Draft Delegated Act 28.5 specifies a methodology for assessing greenhouse gas emissions savings from RFNBO and from recycled carbon fuels.

ISCC EU has included draft DA 28.5 requirements in its draft document '*ISCC EU 205-1 Renewable Fuels of Non-Biological Origin (RFNBOs) and Recycled Carbon Fuels (RCF) – Greenhouse Gas Emissions*', and also in Section 5 *'Traceability and Chain of Custody'* of its draft document '*ISCC EU 202-6 Renewable Fuels of Non-Biological Origin (RFNBOs)*'

REDcert-EU has included draft DA 28.5 requirements in its draft document *'Scheme principles for GHG calculation'*, i.e. in section 5 *'Liquid or gaseous renewable fuels for transport of non-biogenic origin and recycled carbon fuels*'.

3.7.2 Findings from the audits and recommendations

The pilot audits have shown that economic operators can in principle comply with the requirements in relation to greenhouse gas requirements, with the exception of the cases highlighted in Section 3.1.

The pilot audits have also highlighted a number of points that require further clarification:

1. The greenhouse gas calculation shall be made over the total input of electricity (both renewable and non-renewable) and the total output of both RFNBO and non-RFNBO. In case of co-processing, the greenhouse gas calculation shall be made over the total input of renewable and non-renewable inputs and the total output of renewable and non-renewable product. These are crucial requirements as they may have a large impact on the outcome of the greenhouse gas calculation and compliance with the 70% greenhouse gas savings requirement (refer to 'key findings' in Section 3.1). Although ISCC had already included these requirements in its scheme documentation, it appeared that these were not yet clear or not yet fully understood by a number of piloted companies. REDcert had not yet included these requirements in its draft scheme document.

   Recommendation for certification schemes: include these requirements in scheme documentation (if not yet included), and add a clear explanation (guidance) of how this shall be fulfilled.

2. Draft DA 28.5 and draft certification schemes have not specified the time period over which the greenhouse calculation shall be done. The time period of calculation can have a significant impact on the result of greenhouse gas calculations, as renewable electricity production and supply may fluctuate over time, meaning that there might be fluctuating ratio's between renewable and non-renewable electricity and/or RFNBO and non-RFNBO produced.

   Recommendation for the European Commission: Specify in DA 28.5 and/or in system documents the time period over which the greenhouse calculation shall be done.

3. The use of the term 'fuel' in the last paragraph of article 1 in DA 28.5 may cause confusion, as (products) from hydrogen can also be used for non-energy applications (e.g. production of chemicals). We recommend the European Commission to replace the term 'fuel' by 'product'. This will make clear that this paragraph also applies to (products from) hydrogen used for non-energy applications.

4. A number of aspects related to the calculation of processing emissions (Ep) require further clarification in scheme documentation:
    a. Electricity used in the process shall be taken into consideration when calculating Ep. It is not clear from draft DA 28.5 or draft scheme documentation if after the first year of operation actual measured data shall be used, or if a calculation based on design specifications suffices.
    b. We understand that CO_2 emissions of electricity used in the process can be considered to be zero, provided it is supplied from a directly connected renewable installation or from the grid via a PPA meeting all the requirements that apply to renewable electricity. However, It is unclear whether CO_2 emissions of electricity used by other operators in the supply chain (e.g. warehouses, transport) can also be considered to be zero, in case it is supplied from a directly connected renewable installation or from the grid via a PPA meeting all the requirements that apply to renewable electricity.
    c. Draft scheme documentation state that 'emissions from auxiliaries processing input' shall be taken into account in the greenhouse gas calculation. This requirement can be interpreted as including all energy required to produce RFNBO. It can also be interpreted as only auxiliaries directly processing input and for example not a cooling system which is not in direct contact with the process. To avoid different interpretations we suggest to specify whether 'emissions from auxiliaries processing input' includes all energy which is required to produce RFNBO.

    We recommend the European Commission to clarify the above points in DA 28.5 or scheme documentation, such as to ensure that certification schemes implement these points equally.

5. We understand that if natural gas is taken from the grid and used in the processing (e.g. for heating purposes), this can only qualify as green gas if it supplied via physical mass balance approach and if it is supplied with a correct GoO and a PoS of EC recognized voluntary scheme. Only if these requirements are fulfilled the gas qualifies as green gas and the corresponding GHG emission figures can be used in the GHG calculation. Only cancelling of general GoO for green gas is not sufficient.

    We recommend certification schemes to clarify this requirements in scheme documentation.

6. According to draft DA 28.5 greenhouse gas calculation rules (point 12 in Annex A), 'leakage' shall be taken into consideration. From draft DA 28.5 and draft scheme documentation it is not clear if leaked hydrogen shall be considered a greenhouse gas emission and if so, which GWP-factor applies.

    We recommend the European Commission to clarify this requirement in DA 28.5, such as to ensure that certification schemes implement this requirement equally.

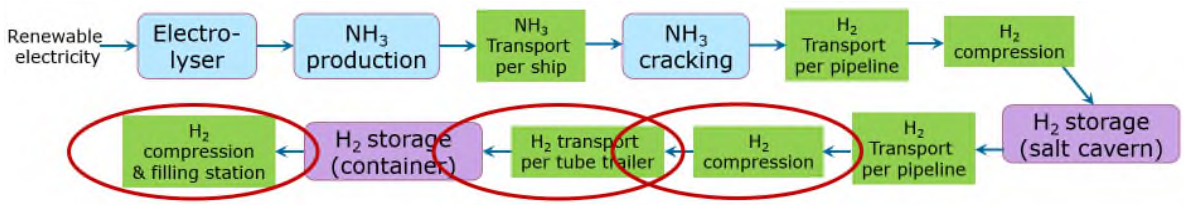
7. According to draft DA 28.5 calculation rules 'water use' for the electrolysis shall be included in greenhouse gas calculations. From draft DA and draft scheme documentation it is not clear how this shall be done:
    a. is water use to be calculated under processing emissions (Ep) or under emissions from inputs (Ei)?
    b. can standard ratios be used for the calculation (e.g. 15 kg water per kg hydrogen produced), or are actual measurements required?

    We recommend certification schemes to clarify this in scheme documentation.

8. Draft scheme documentation do not include general density and LHV values for hydrogen.

   In order to harmonize GHG calculations we recommend to include these values in scheme documentation.

9. Draft DA 28.5 includes a requirement: *'emissions from compressing and distribution of hydrogen for its direct use in vehicles shall not be included*'. We understand that this requirement only applies to steps in the supply chain that aim to supply hydrogen to transport, and that it does not apply to steps in the supply chain where it is not certain that hydrogen will be supplied to transport (but may be supplied to any other end-use sector). This has schematically been depicted below. The requirement applies to the red-circled transport and compressing steps.



   We recommend the European Commission to clarify this requirement in DA 28.5.

10. CO_2 emissions from municipal solid waste (MSW) combustion
    Annex A, 11c of DA 28(5) states that: *'Emissions from existing use or fate include all emissions in the existing use or fate of the input that are avoided when the input is used for fuel production. These emissions shall include the CO_2 equivalent of the carbon incorporated in the chemical composition of the fuel that was or would have otherwise been emitted as CO_2 into the atmosphere. This includes CO_2 that was captured and incorporated into the fuel provided that at least one of the following conditions is fulfilled:*
    c. The captured CO_2 stems from the production or the combustion of biofuels, bioliquids or biomass fuels complying with the sustainability and greenhouse gas saving criteria and the CO2 capture did not receive credits for emission savings from CO_2 capture and replacement, set out in Annex V and VI of Directive (EU) 2018/2001, or;'

    From DA 28.5 or scheme documentation it is not clear whether the above mentioned article includes CO_2 from the biogenic part of combusted municipal solid waste. We understand that CO_2 from the biogenic part of municipal solid waste (MSW) meets the first part of the requirement under 11c. This is because MSW does not have to comply with any of the RED-II Article 29 requirements, and therefore automatically meets these requirements.

    Recommendations for certification schemes: to clarify in scheme documentation that the biogenic part of MSW fulfils first part of the requirements under 11c, Annex I in DA 28.5.

4. Conclusions

The following conclusions have been drawn from this pilot RFNBO certification study. It is concluded that – although none of the companies that were audited complied to all requirements - compliance with the RED-II RFNBO criteria can be demonstrated by using RFNBO certification schemes.

In more detail the conclusions for each of the three sub-objectives are:

1. To a large extent, the requirements in the draft RFNBO certification schemes are workable for companies and auditable for certification bodies. In summary, key findings from the pilot audit programme are:
    a. in principle it is possible for economic operators to meet all DA requirements, both in cases with directly connected renewable electricity installations and in cases where electricity is (partly of fully) taken from the grid. There is at least one important exception to this conclusion, which is that the greenhouse gas emissions savings requirement cannot be met if a significant part of the electricity from the grid cannot be counted as fully renewable. This might also be the case for co-processing of renewable and non-renewable inputs.
    b. hourly registration of electricity supply must be included as a condition in the contractual arrangements between the company operating the electrolyser and the renewable electricity producer supplying the electricity via the grid and covered by a PPA.
    c. risk of double claiming: draft DA 27.3 and the piloted certification schemes do not yet explicitly require that if both Guarantees of Origin (GoOs) and a Proof of Sustainability (PoS) have been issued for RFBNOs, both must be coupled/linked in registration or transaction of RFNBOs. This requirement is necessary to avoid that GoO's and PoS's can be used independently, leading to risks of double claiming of RFNBOs.
    d. Some of the requirements laid down in the draft certification schemes require further clarification, as these are not specific enough or leave room for interpretation. Recommendations to both the European Commission and certification scheme owners have been made (Refer to Section 3.3-3.7 for details);
2. The RFNBO certification pilot audit programme facilitated scheme owners in developing draft RFNBO certification schemes. Following the prospect of the independently organised pilot programme, both ISCC and REDcert were incentivised to develop draft RFNBO certification scheme documentation. The pilot audit programme also helped in the development of the CertifHy draft RFNBO certification scheme documentation. The advantage of this early development of draft certification schemes is that it will be much easier to finalise final versions of certification schemes once the final Delegated Acts will have been published. These schemes can then be submitted to the European Commission for recognition as RFNBO voluntary scheme, following which companies can become certified against the schemes.
3. The pilot audit programme has facilitated six companies in preparing themselves for future certification, as they have developed practical experience and insights from the pilot audits. Moreover, this report gives insight in the RFNBO certification process and in the main issues that arise during the certification audits, which will help European as well as non-European companies to prepare for future RFNBO certification allowing them to sell RFNBOs to the European market in the future.

5. References

[1] European Commission (2022). DRAFT Commission delegated regulation supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin. The draft is available via this link.

[2] European Commission (2022). DRAFT Commission delegated regulation supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a minimum threshold for greenhouse gas emissions savings of recycled carbon fuels and by specifying a methodology for assessing greenhouse gas emissions savings from renewable liquid and gaseous transport fuels of non-biological origin and from recycled carbon fuels. DRAFT version. The draft (two documents) is available via this link.

[3] ISCC (2022). ISCC EU 202-6: Renewable Fuels of Non-Biological Origin. Version 1.0 (draft)

[4] ISCC (2022). ISCC EU 205-1: Renewable Fuels of Non-Biological Origin (RFNBO) and Recycled Carbon Fuels (RCF) – Greenhouse Gas Emissions. Version 1.0 (draft).

[5] ISCC (2022). ISCC EU Audit Procedure Chain of Custody for Renewable Fuels of Non-Biological Origin (RFNBOs) / Version 0.1 / Date: 15 September 2022.

[6] REDcert (2022). REDcert-EU: Scheme principles for GHG calculation. Draft – For internal use only. Version EU 06.

Annex 1 Brief description of participating companies

Shell – 50 kW test electrolyser at Energy Transition Campus Amsterdam (the Netherlands)

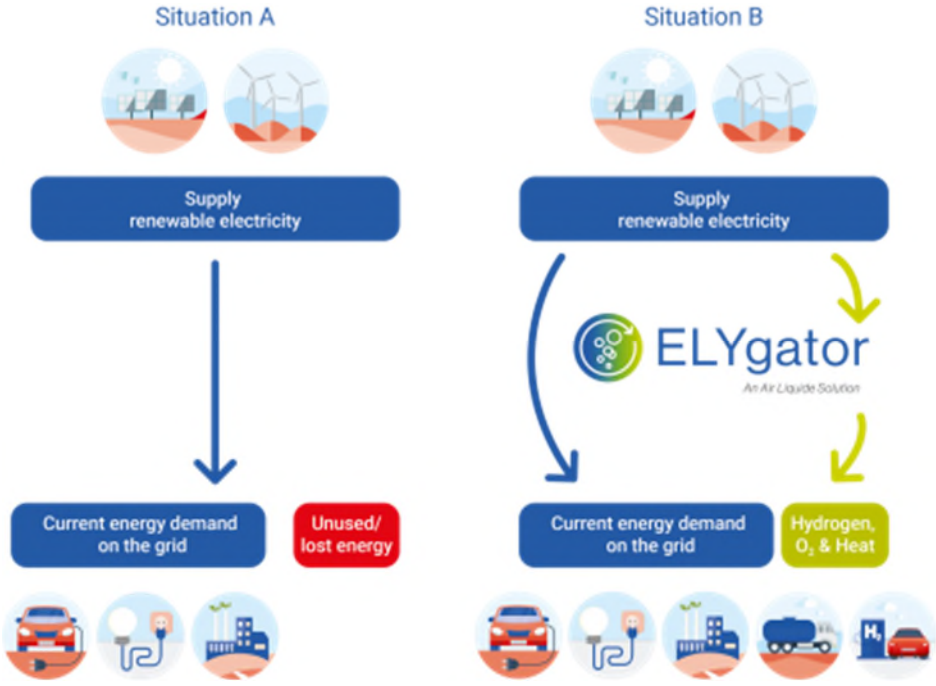
The electrolyser is a test pilot of an alkaline electrolyser of 50 kW, located at Outside plot in Energy Transition Campus Amsterdam (ETCA). This is Shell's first demonstration of a fully integrated renewable green hydrogen supply chain: solar PV panels located on the roof of ETCA can provide power at daytime and power by grid (Wind park Borssele) at night to generate green hydrogen. After compression to a maximum of 300 bar the hydrogen can be delivered to different end-users: research pilot plants (GTL) and Hydrogen dispenser for H_2 FCEV (Hydrogen cars for Shell's employee at business trip).

Other goals of the operation are:

- Collect learnings in commissioning, start-up, maintenance and operation to support other projects
- Testing other technologies: electrical integration, control architectures
- Miscellaneous support: deliver green H_2 to green kero project (synthetic fuel for airplane based on green H_2 and CO_2), water taxi program (first water boot using H_2)

Air Liquide – planned 200 MW electrolyser 'ELYgator' at Terneuzen (the Netherlands)

ELYgator entails a planned hydrogen production facility to demonstrate the scaling up of the currently available capacities. ELYgator will include an electrolyser with a capacity of 200 MW, integrating two different electrolysis technologies (PEM and Alkaline) and using renewable electricity (wind/solar). The ELYgator project, to be located in Terneuzen in the Netherlands, is planned to be in operation in 2026-2027. It is expected that the project will benefit from Air Liquide's existing hydrogen network, that provides a solution to accommodate the required flexibility inherent to the real time coupling with renewable sources of energy.



Gasunie – 1 MW electrolyser 'Hystock' at Zuidwending (the Netherlands)

The Gasunie 1 MW electrolyser – named Hystock – is located in Zuidwending (The Netherlands) at the site of the Gasunie EnergyStock storage facility. At this site salt caverns will be developed for the storage of hydrogen. The Hystock electrolyser was officially opened by King Willem-Alexander in June 2019.
The main parts of the installation are housed in three sea containers: one for the electrolyser, one for the electronics and one for a compressor allowing to deliver hydrogen via tube trailers.
The installation is offering conversion capacity for market parties to convert renewable electricity in renewable hydrogen. In the pilot electricity from an onsite 2.4 MW solar park plus electricity from the grid are converted to green hydrogen. Market parties that use conversion capacity at Zuidwending have used the green hydrogen for the local industry and for the mobility sector, including for testing the hydrogen-fuelled train between the cities of Leeuwarden and Groningen.

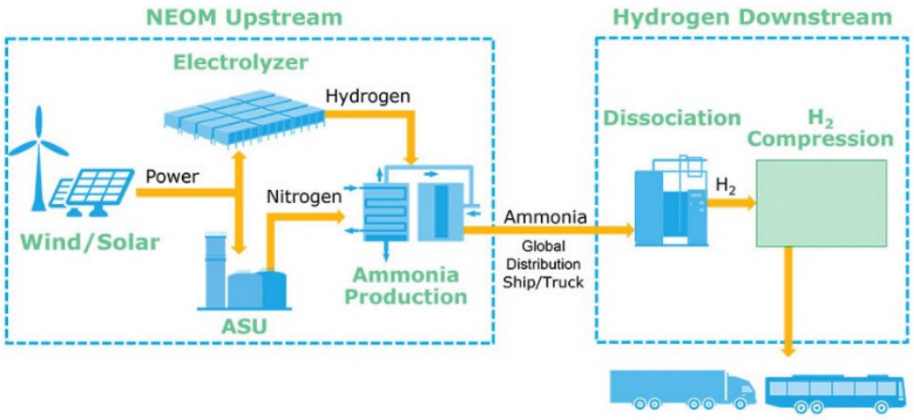
Nobian – 180 MW chlor-alkali membrane electrolysis at Rotterdam (the Netherlands)

In Rotterdam Nobian operates a 180 MW chlor-alkali membrane electrolyser, Europe's largest single-line facility. The main inputs are salt dissolved in pure water and electricity. The salt is delivered by inland waterway vessels from Delfzijl. Electricity is supplied via the electricity grid, and part of the required power is purchased directly from wind parks such as 'Bouwdokken' and 'Krammer', as well as other renewable sources in the Netherlands and north-western Europe. Nobian's Membrane electrolysis plant helps to stabilize the electricity grid by automatically responding to imbalances in supply and demand of power due to fluctuations in wind and solar generation. In Rotterdam Nobian currently offers 40 MW of controlled reserve power to the grid. The main products of the plant are chlorine and sodium hydroxide: per tonne of chlorine, 1.1 tonne of caustic soda and 28.5 kg of hydrogen are produced. The hydrogen is sold to external users and used on-site to produce steam.

Air Products - NEOM Green Hydrogen Company – Ammonia production (Saudi Arabia)

An equal production joint venture of ACWA Power, Air Products and NEOM incorporated in August 2021, NEOM Green Hydrogen Company (NGHC) is establishing the world's largest green-hydrogen-based ammonia production facility run on renewable energy. This plant, located in Saudi Arabia, will produce up to 600 tons per day of carbon-free hydrogen in the form of green-ammonia as a cost-effective solution for transportation globally.
The project is based on proven technologies. Novel aspects include the integration of these technologies, particularly at this scale and utilizing ammonia to transport it around the world to be dissociated to produce green hydrogen for the transportation market. This project will save the world almost five million metric tonnes of carbon dioxide (CO_2) per year compared to diesel trucks or buses.

Green hydrogen is produced from over 2 GW of alkaline water electrolysis using 4 GW of newly installed renewable energy from solar and wind. The renewable hydrogen is converted into up to 1.2 million tonnes of ammonia using conventional technology. Air Products will be the exclusive off-taker of the green products produced at the facility, and NGHC's jetty will be used for the direct transfer of green ammonia to tanker ships, close to global shipping lanes at the crossroads of world distribution.



Alliander & GroenLeven – 1.35 MW electrolyser (SinneWetterstof)

The SinneWetterstof project is a collaboration between Alliander and GroenLeven. The SinneWetterstof installation consists of a 1.35 MW electrolyser, which feeds hydrogen into a buffer tank. The renewable hydrogen is then compressed and stored in tube trailers, which deliver the hydrogen to the end user. This project is operated at the “Ecomunitypark” in Oosterwolde, which is located adjacent to a 50 MW solar park developed by GroenLeven. The goal of the project is to conduct experiments and tests in relation to grid flexibility and different production scenarios.

ENGIE-OCI-EEW - HyNetherlands – 1OO MW electrolyser to e-methanol (HyNetherlands)

The first phase of the HyNetherlands project targets the deployment of a 100 MW hydrogen plant capacity by 2025 together with the production of e-methanol.

The HyNetherlands project (HyNL) aims at developing, building and operating one of the first large scale renewable power to e-methanol production plants in Europe (OCI/BioMCN) by combining renewable RED II compliant hydrogen from electrolysis (ENGIE) and biogenic CO_2 (EEW) captured from a waste-to-energy plant, processing non-recyclable waste, to produce high quality e-methanol.

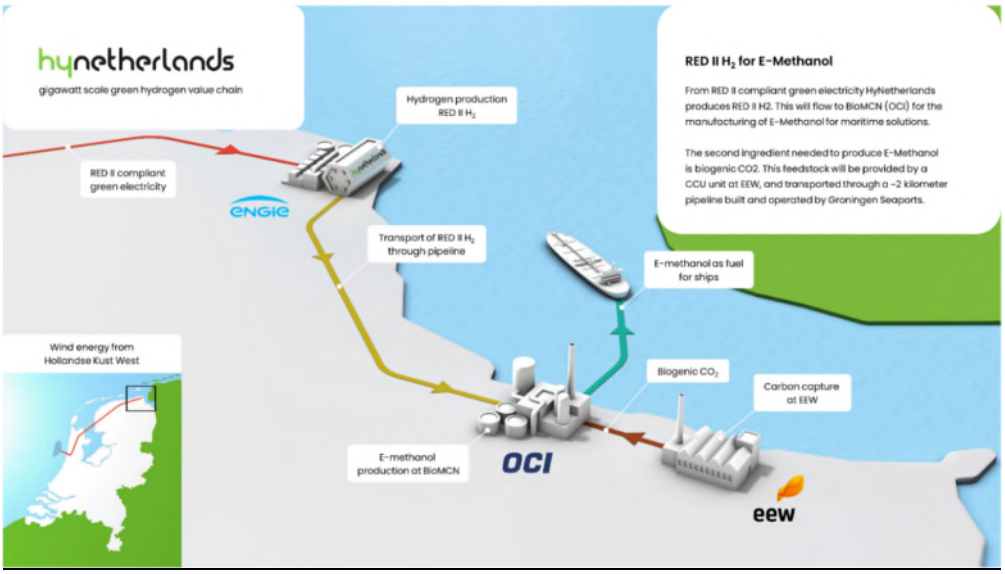


Figure 1: HyNetherlands project

To deliver these products to the market, the HyNL project includes the following key components:

- A 100 MW_e hydrogen plant using John Cockerill pressurized alkaline electrolysis technology, capable of producing approx. 14,100 tons of renewable hydrogen and 113,000 tons of oxygen per year via the consumption of more than 795 GWh of renewable electrical energy either coming from RED2 compliant contracted offshore wind farm (above 70% of the power supply) and the remaining supply coming from the grid mix with Guarantees of Origin. Remaining volume will be delivered to mobility and industry application.
- A carbon capture unit capable of capturing 270,000 tons of CO_2 per year, built on EEW site, of which 77,500 tpa of biogenic CO_2 is delivered to HyNL. The carbon capture installation will be integrated in two existing waste to energy lines treating non-recyclable waste at the existing EEW Delfzijl site.
- An existing methanol synthesis and distillation plant on OCI/BIOMCN site capable of producing 56,000 tons of e-methanol per year from biogenic CO_2 (77,500 tpa) captured from EEW waste-to-energy plant and renewable hydrogen (10,500 tpa) supplied by ENGIE´s renewable hydrogen plant.

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