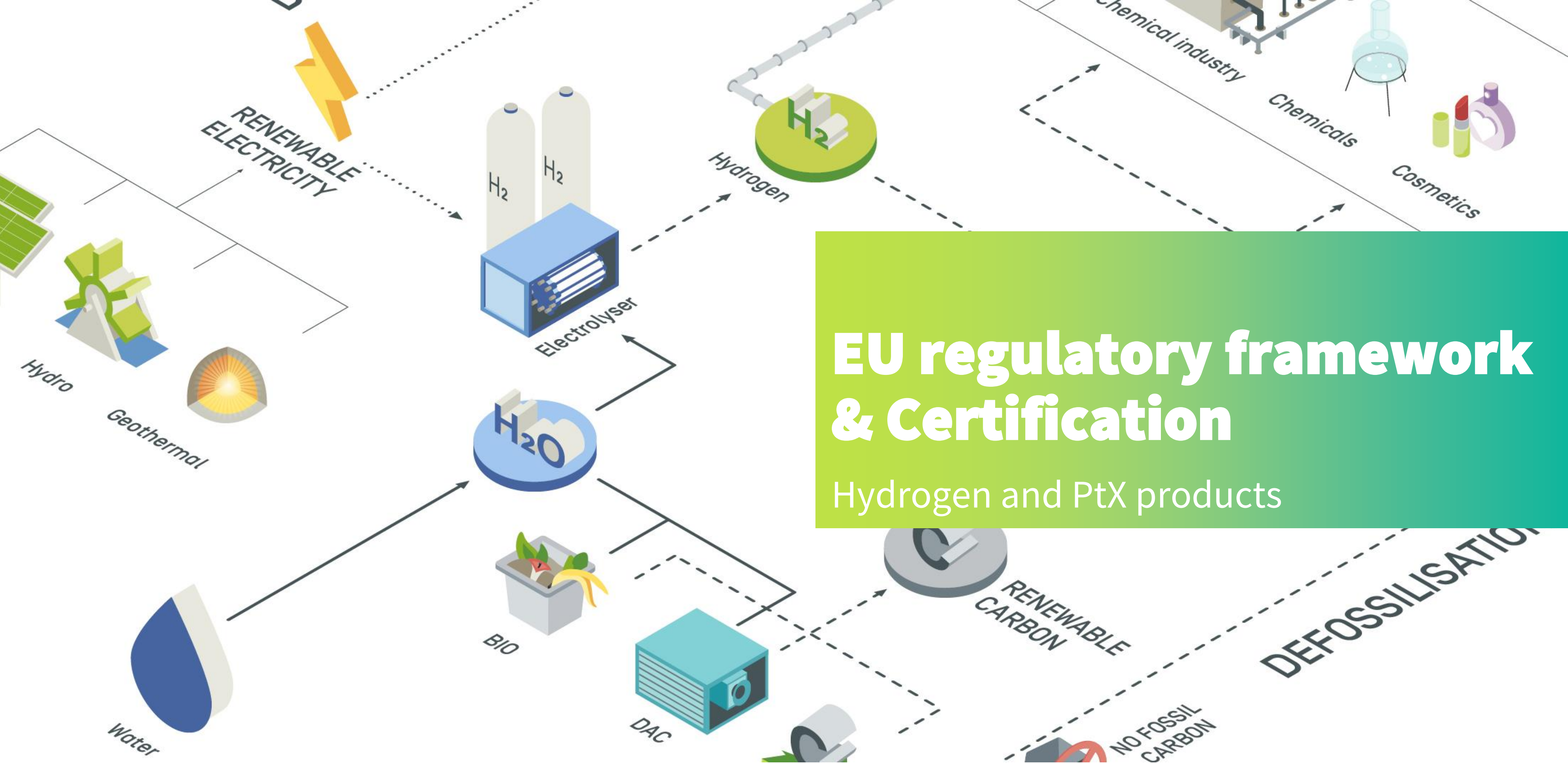

EU regulatory framework & Certification

Hydrogen and PtX products

International PtX Hub

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DISCLAIMER

Power-to-X Hub – Catalyzing Defossilisation Globally

Impact

Paris Climate Goals

&

Sustainable business and development opportunities

Sustainability

Market ramp-up

Knowledge

Partnerships

Goals and Opportunities

- Improving **regulatory frameworks** for sustainable PtX demand markets
- Actively shaping the **global PtX market** in the partner countries (“partnerships of equals")
- Setting-up a PtX **dialogue and networking platform**
- Developing **project proposals** for business cases with **international financing**
- Establishing an international **knowledge and training platform** for PtX.
- **Exchange of experience** with national and international partners
- Developing **trading platforms**

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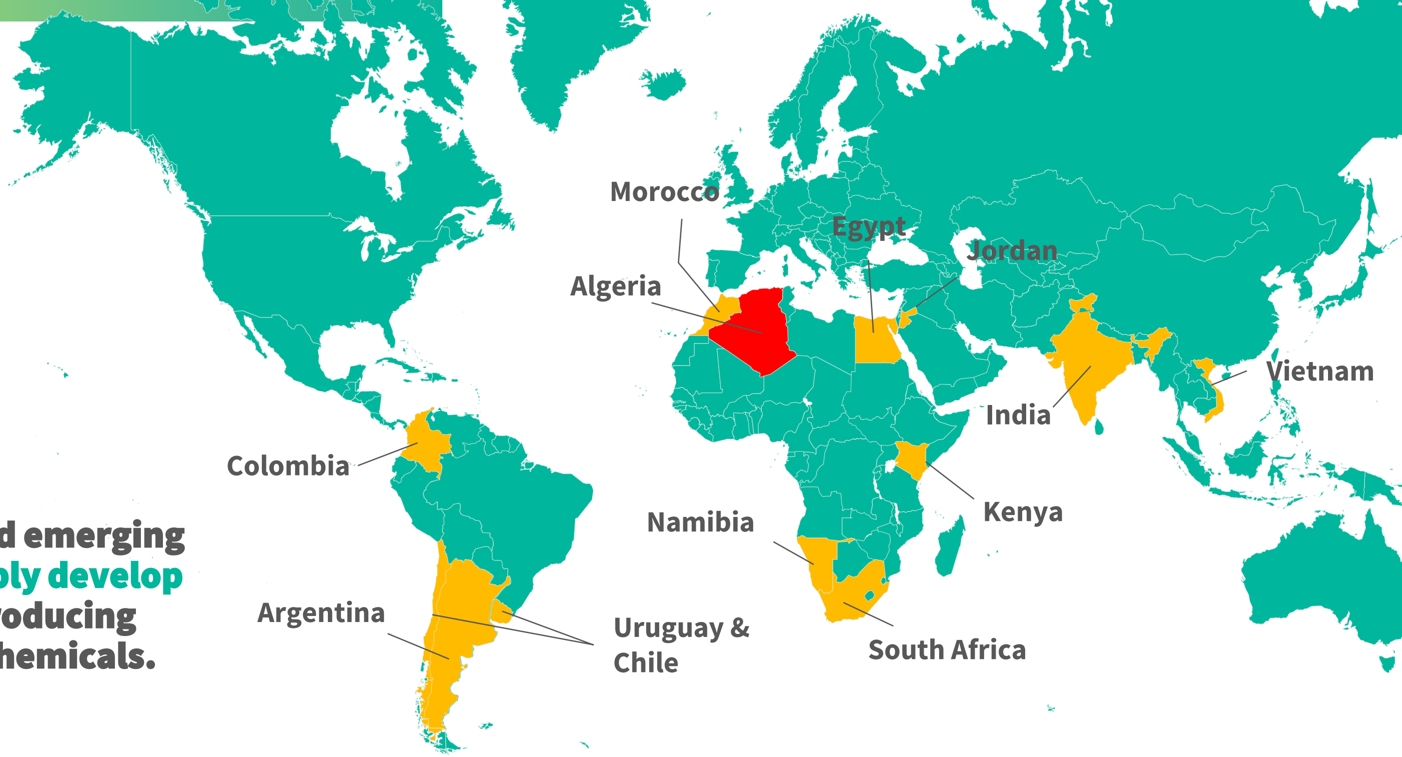
Our partner countries



Developing countries and emerging economies can sustainably develop their economies by producing Power-to-X fuels and chemicals.

Especially countries with significant potentials for solar and wind power can decrease their fossil fuel dependence and supply their own demand for fuels and chemicals, with the additional potential to export Power-to-X products and high-quality materials such as green steel.

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Content and objectives

1 EU policies and regulatory framework

- Know main EU policy frameworks
- Understand how these polices shape the market and how non-EU actors are involved

2 EU RED II Delegated Acts

- Awareness of the key requirements for renewable hydrogen in the Delegated Acts

3 Certification introduction

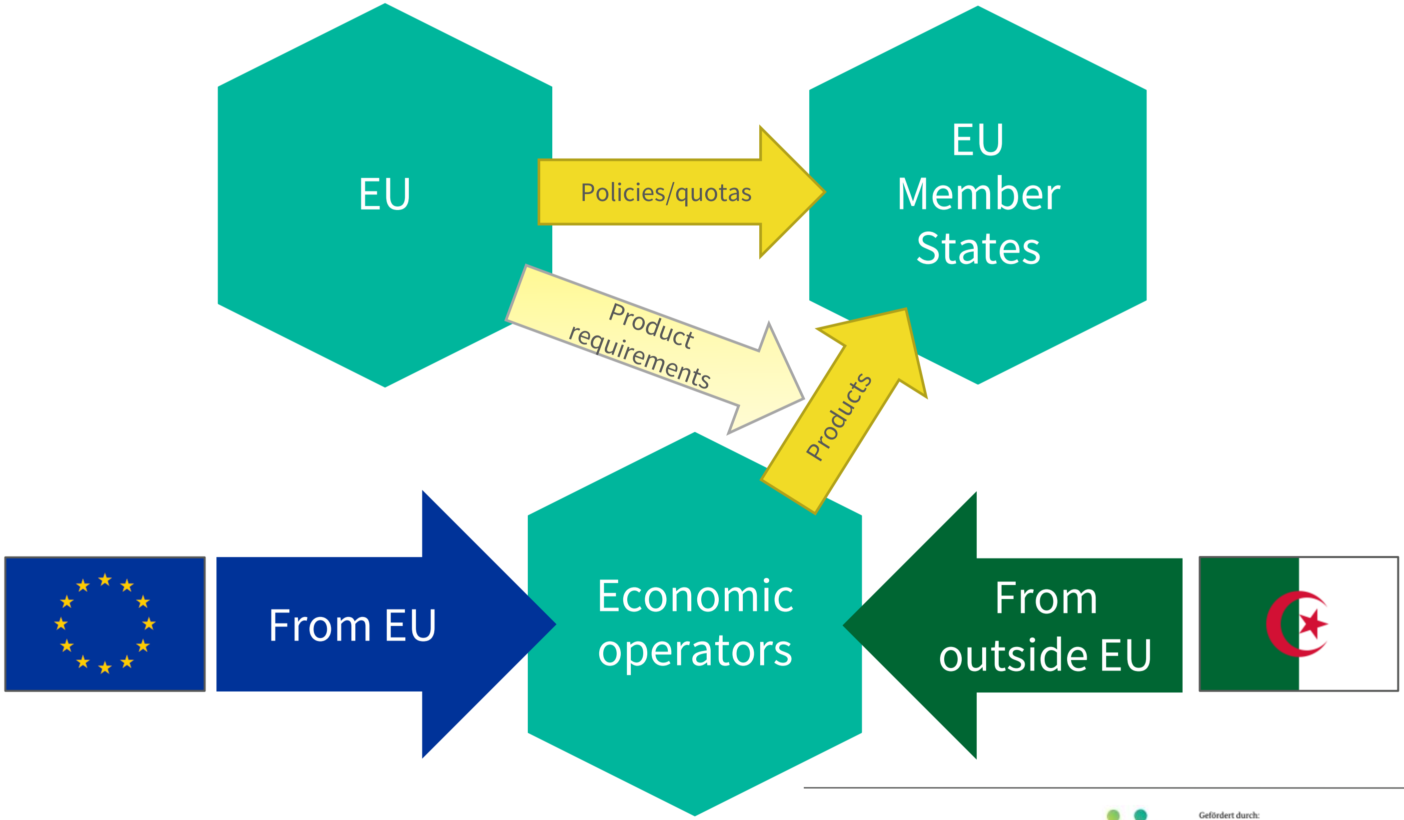
- Know what certification and standards are, and how they are related
- Understand why certification is needed
- Differentiate between sustainability and technical standards

4 Certification set-up in the EU

- Awareness of the main actors in the certification system based on the EU set-up, and their functions

1. EU policies and regulatory framework

EU market – shaped by regulatory framework



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Rapidly increasing ambition of EU climate and energy policies

	Adoption	Context	Climate Target	Renewables Target
EU Energy and Climate Package	2007-2009	1st comprehensive EU climate & energy policy package	- 20% by 2020	20% RE by 2020
Clean Energy Package	2014-2018	Input to & implementation of Paris Agreement	- 40% by 2030	32% RE by 2030
EU Green Deal / Fit-for-55	2019-2023	Reaction to climate disasters and massive youth climate movement	- 55% by 2030 - 100% by 2050	40% RE by 2030
REPowerEU	2022 ->	Reaction to Russia's invasion of Ukraine	Unchanged	45% RE by 2030 (?)

Climate Target: GHG emissions compared to 1990

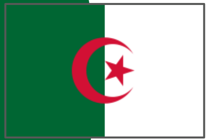
Renewables Target: Renewable Energy (RE) % of total energy consumption

45% RE by 2030 proposed by European Commission, backed by Parliament, not yet adopted by Council

REPower EU – Renewable hydrogen amibition

10 Mio. t_{H2} produced in Europe by 2030

10 Mio. t_{H2} produced outside Europe by 2030



EU Renewable Energy Directives (RED)

RED I (2009): 20% by 2020

10% special target for transport sector can be met with biofuels complying with sustainability criteria. It established rules on Guarantees of Origin (GOs).

RED II (2018): 32% by 2030

14% RES target for transport sector, including sustainable biofuels (stricter rules) and RFNBO => "renewable liquid and gaseous transport fuels of non-biological origin". Commission must adopt Delegated Acts with detailed rules on RFNBO.

RED III (nearly adopted, 2023): 40% by 2030

Based on "Fit for 55": Final text under negotiation. It includes specific RFNBO subgoals both for industrial sector and transportation (focus on aviation and shipping).

2. EU RED II Delegated Acts (I)

Delegated Act Article 27
Delegated Act Article 28

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RED II Delegated Acts on renewable H2 / RFNBOs

Delegated Act to Article 27 Renewable Energy Directive II (RED II) sets out **detailed requirements for sourcing renewable electricity** used in production of Renewable Fuels of Non-Biological Origin (RFNBOs), including renewable hydrogen

→**Determines when electricity used for production of RFNBO/ H2 is considered as "fully renewable" or not**

Delegated Act to Article 28 RED II specifies the **methodology for assessing GHG emissions savings** from RFNBOs.

→**Determines amount of GHG emissions savings from RFNBO / H2 (min. 70%)**

Applicable to EU-internal and outside. To be translated by voluntary schemes into their systems.

Electricity used for H2 / RFNBO counts as "fully renewable" if…

Option I (Article 3)
Direct electricity connection

Option II (Article 4)
RFNBO plant uses electricity from the grid

Option I – Direct connection

No connection of the RFNBO plant to the grid or grid connection only with smart metering system in place

Additionality
RES-e plants must be new

Option II.a – Electricity grid with high share of RES-e

Average RES-e share exceeds 90% in the bidding zone where the RFNBO plant is located;

yet use of electricity for RFNBO production limited by grid RES-e share

Option II.b – Electricity grid with low CO_2-emissions

Power purchase agreement (PPA) concluded with RES-e plants (except biomass) for (at least) the amount of electricity used and claimed fully renewable

Temporal correlation

Geographical correlation

Option II.c – Using imbalance settlement periods

Electricity consumed during a period of curtailment of RES-e plants and proven to reduce the risk of redispatch

Option II.d – All other grid situations

Power purchase agreement (PPA) concluded with RES-e plants (except biomass) for (at least) the amount of electricity used and claimed fully renewable

Additionality
RES-e plants must be new and unsupported

Temporal correlation

Geographical correlation

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Underlying principles of the Delegated Act

The production of renewable hydrogen should …

Principle of **Additionality**

… incentivise the deployment of **new renewable electricity generation capacity** (DA (8))

Principle of **Temporal Correlation**

… take place **at times** where the electrolysers support the integration of renewable power generation into the electricity system (DA (8))

Principle of **Geographical Correlation**

… take place **in bidding zones** where renewable electricity already represents the dominant share and adding additional renewable electricity generation capacity would not be necessary or possible (DA (5))

Additionality
(Article 5)

RES-E used for H_2 production is

- Generated in the same installation
- **OR** Sourced *via* renewables PPAs

5(a) RES-E plants must be new*
Started operating no more than 36 months prior to the installation

5(b) RES-E plants must be unsupported*
Has not received operating or investment support

*For installations which started operating before January 2028 this requirement only applies from January 2038 on.

+

Temporal correlation
(Article 6)

H_2 production takes place

- In the same calendar month than the sourced RES-E generation *(until Dec 2029)*
- In the same hour than sourced RES-E generation *(from Jan 2030 on)*

OR

Storage option

- Electricity is sourced from a storage facility with the same grid connection point than the electrolyser or RES-E plants
- Storage facility is charged at the time of generation of the contracted RES-E plants

OR

H_2 production takes place
during a one-hour period where the day-ahead price of the concerned bidding zone

- Is < 20 €/MWh
- **OR** Is < than 0.36 times the price for a certificate of 1 ton of CO2 equivalent

+

Geographical correlation*
(Article 7)

7(1a) Electrolyser and RES-E plants are located in the same bidding zone

OR

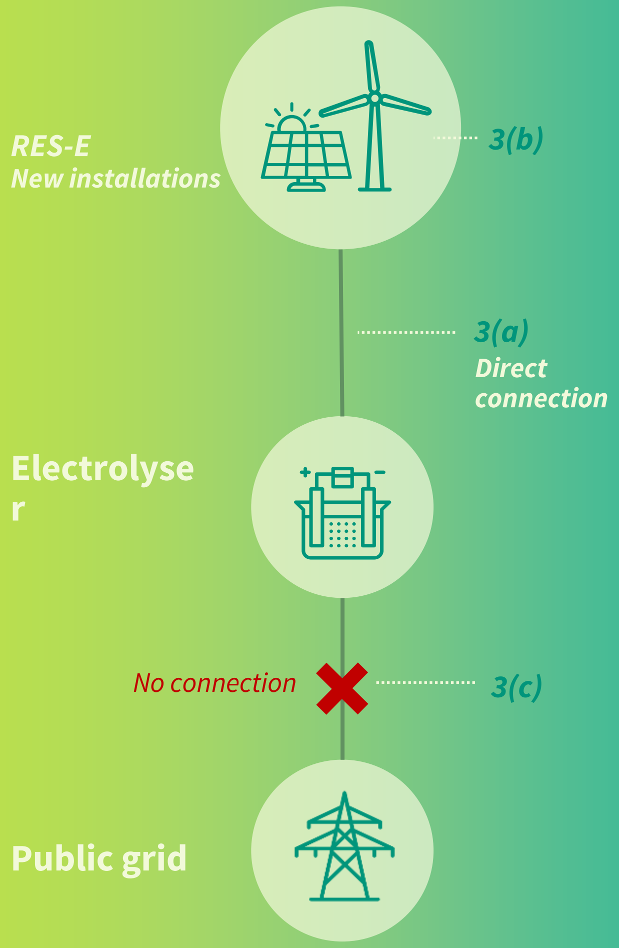
7(1b) Electrolyser and RES-E plants are located in interconnected bidding zones

Electricity prices of the day-ahead market in this zone are ≥ the prices in the electrolyser's bidding zone

OR

7(1c) RES-E generating plants are located
in an offshore bidding zone
interconnected to the electrolyser's bidding zone

*Further criteria can be imposed on a national law basis (6(2)).



Electricity produced off-grid
(Article 3)

3(a): RES-E plants must be connected to the electrolyser

- *via* direct line **OR** located in the same installation

3(b): RES-E plants must be new

- RES-E plant started operating no earlier than 36 months before the electrolyser

3(c): RES-e plants must not be connected to the grid

- **Option:** Electrolyser is connected to the grid, but a smart metering system is implemented which proves that no electricity is taken from grid

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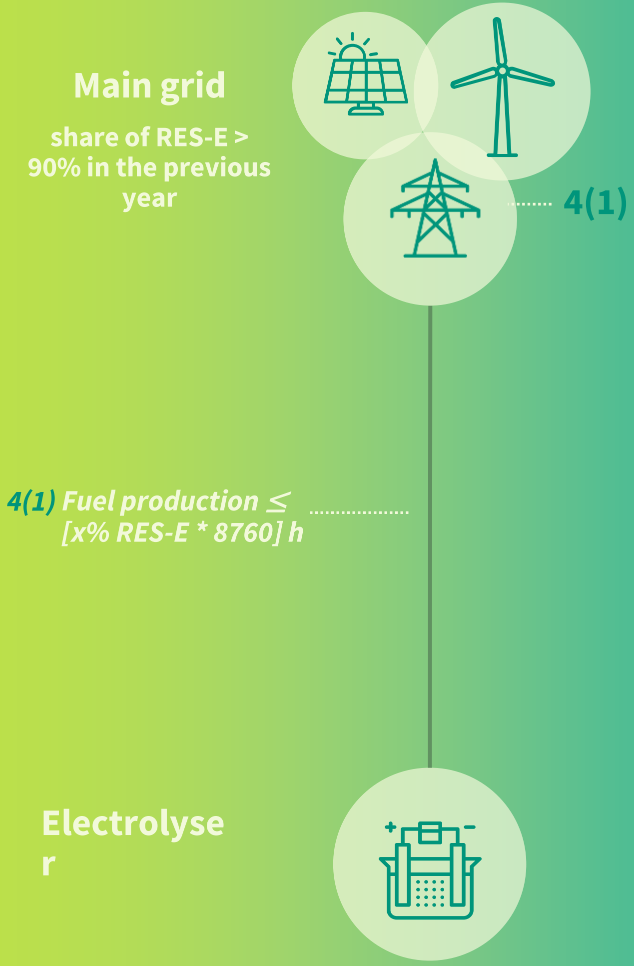

Electricity sourced from the grid (Article 4)

Renewable grid electricity

Electricity taken from the grid counts as **fully renewable**

4(1) … if the average RES-E share in the connected grid **exceeds 90%** in the previous year*

AND fuel production does not exceed [x% RES-E * 8760] h in the bidding zone where H_2 is produced

*Once this share has been provenly attained, it is assumed that this condition will also hold true in the subsequent five calendar years.

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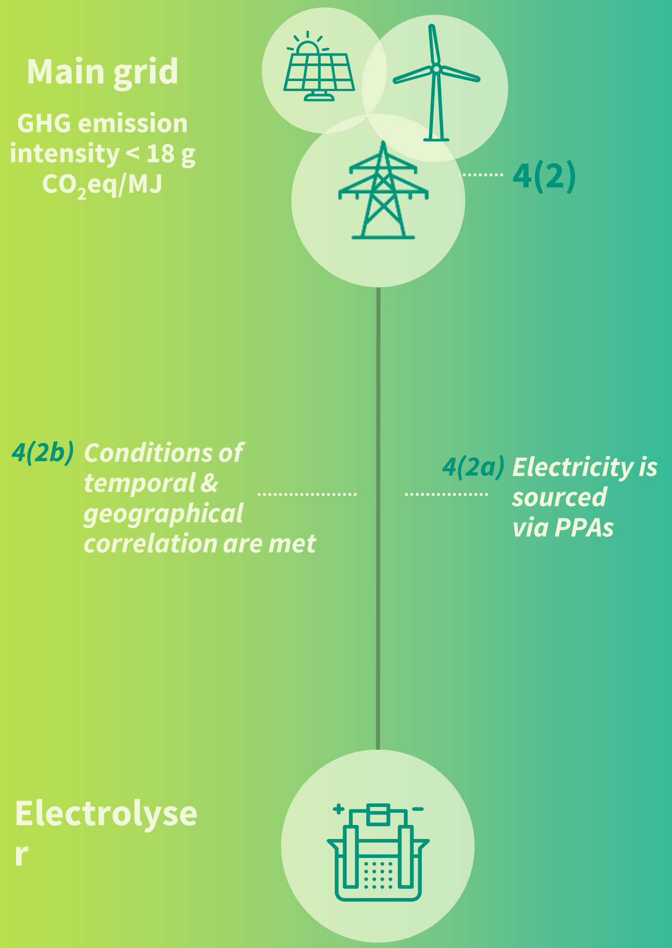

Electricity sourced from the grid (Article 4)

Low-carbon grid electricity

Electricity taken from the grid counts as **fully renewable**

4(2) … if the GHG intensity of the connected grid is **< 18 g CO2eq/MJ***

4(2a): The fuel producers have concluded one or more renewables power purchase agreements (PPAs)

→ These supply an amount of RES-E ≥ the amount of RES-E claimed & used for H_2 production

AND

4(2b): Conditions of temporal & geographical correlation are met (see later slide on more detail)

*Once this share has been provenly attained, it is assumed that this condition will also hold true in the subsequent five calendar years.

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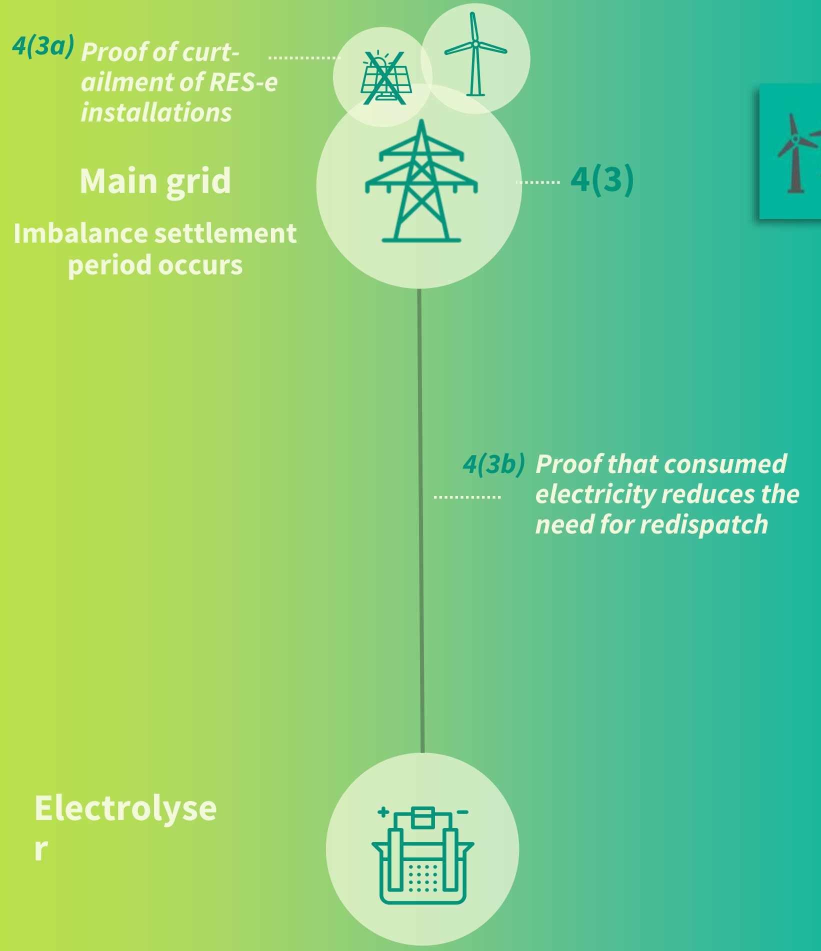


Electricity taken from the grid

Imbalance settlement period

Electricity taken from the grid counts as **fully renewable**

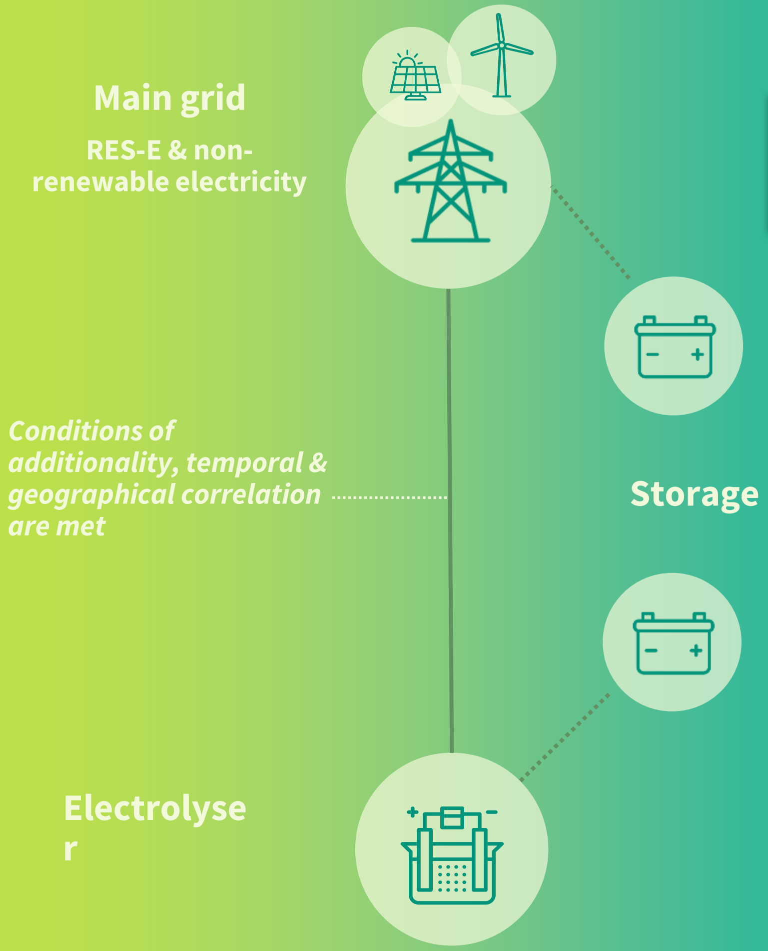
4(3) … if there is proof* that H_2 production helps to **reduce temporal grid imbalances**

4(3a): Electricity sourced for H_2 production is consumed during a time period in which RES-e installations were redispatched downwards (curtailment)

AND

4(3b): The electricity consumed reduced the need for redispatching by a corresponding amount

*The fuel producer must show evidence from the national transmission system operator on the stated conditions.



Electricity taken from the grid

Average grid electricity

Electricity taken from the grid counts as **fully renewable**

4(4): ... if requirements of additionality, temporal & geographical correlation are met

- **5 Additionality**
  PPAs | New | Unsupported
- **6 Temporal correlation**
  Matching of RES-e generation and H_2 prodcution on a monthly – (or later) hourly scale
- **7 Geographical correlation**
  Geographical proximity of H_2 production site and RES-e generation installations

2. EU RED II Delegated Acts (II)

Delegated Act Article 27

Delegated Act Article 28

Methodology for determining GHG emissions savings from H2 / RFNBO

Total emissions from use of fuel = $e_i + e_p + e_{td} + e_u - e_{ccs}$

e_i = e_i elastic + e_i rigid - e ex-use = emissions from **supply of inputs** (gCO2eq / MJ fuel)

e_p = emissions from **processing** (gCO2eq / MJ fuel)

e_{td} = emissions from **transport and distribution** (gCO2eq / MJ fuel)

e_u = emissions from **combusting** the fuel in its end-use (gCO2eq / MJ fuel)

e_{ccs} = emission savings from **carbon capture and geological storage** (gCO2eq / MJ fuel)

GHG emission savings = $(E_F - E) / E_F$

E_F = Total emissions of fossil fuel comparator (94 gCO2e/MJ for H2)

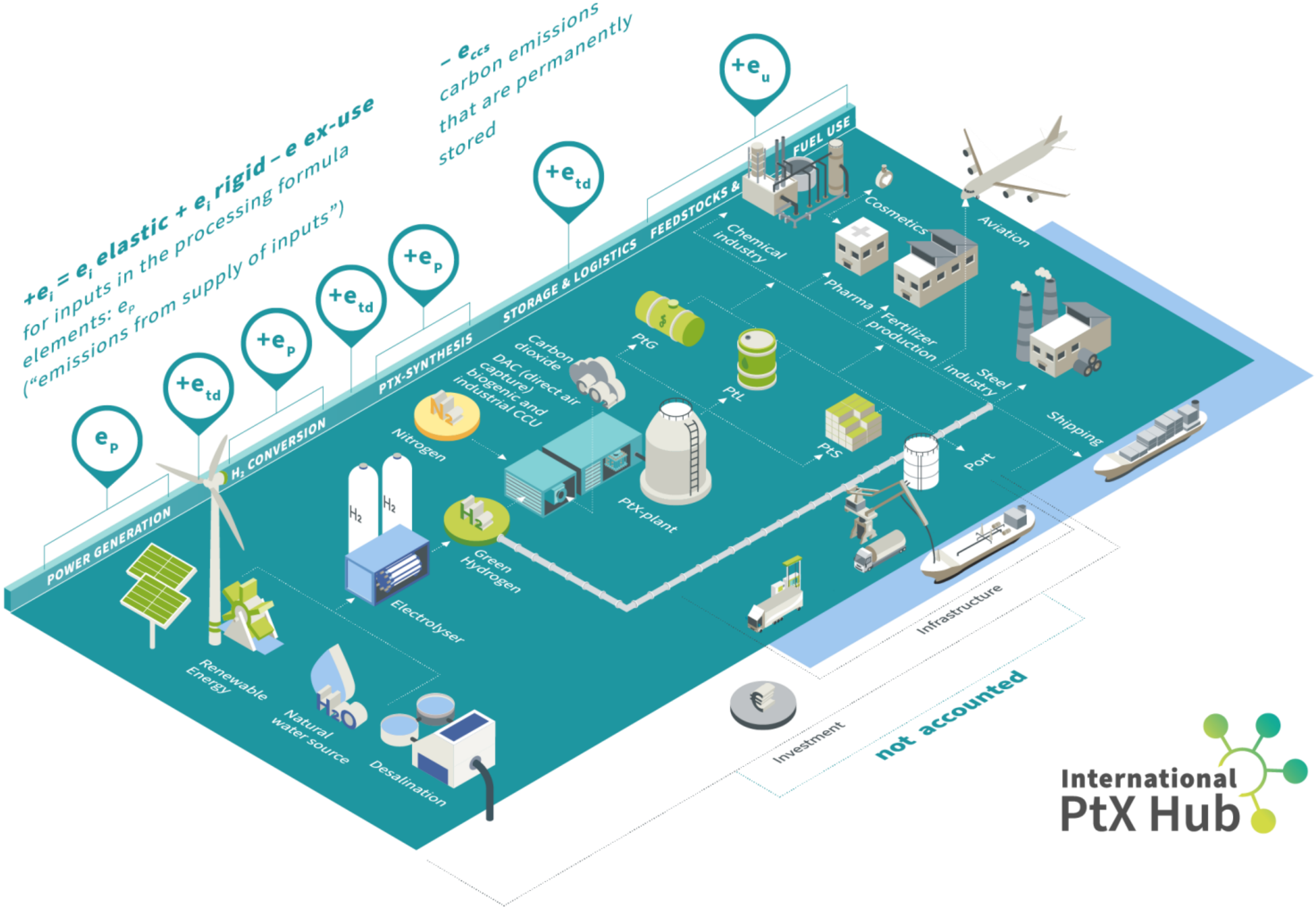
E = Total emissions of H2 (gCO2e/MJ)

→ **Min. emissions savings of 70% (GHG threshold for RFNBO is 28.2 gCO2e/MJ (3.4 tCO2e/t))**

Requirement for H2:

Min. 70% emissions savings compared to fossil fuel

Methodology for determining GHG emissions savings from H2 / RFNBO



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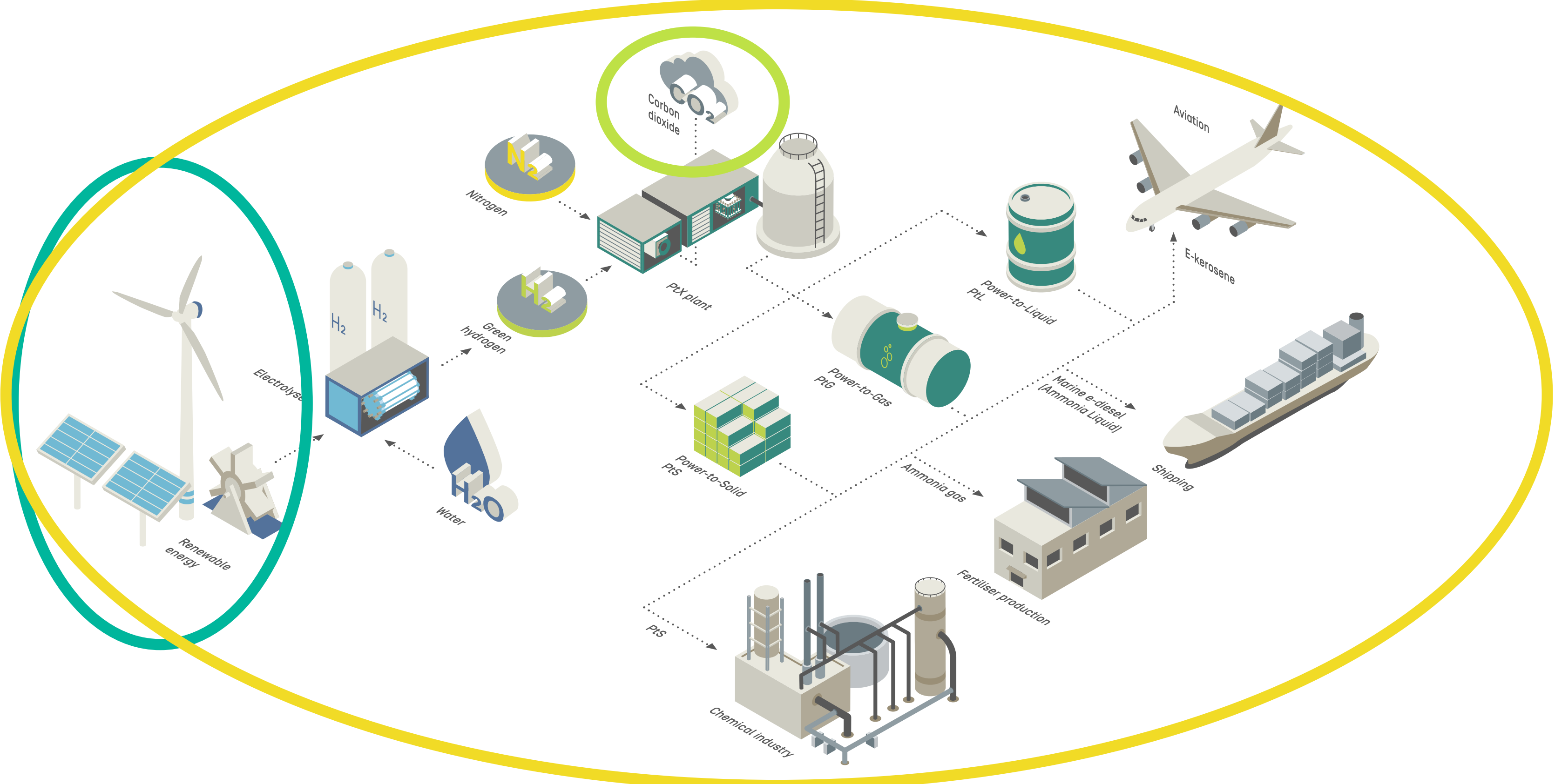
Methodology for determining GHG emissions savings from RFNBOs - CO_2 sources

Deductions for carbon capture from existing use or fate (e ex-use):

- The CO_2 has been captured from an **activity listed under Annex I of Directive 2003/87/EC** and **has been taken into account upstream in an effective carbon pricing** and is incorporated in the chemical composition of the fuel **before 2036**, This date shall be extended to 2041 in other cases than CO_2 stemming from the combustion of fuels for electricity generation, or;
- The CO_2 has been captured from the **air**, or;
- 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 CO_2 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;
- The captured CO_2 stems from the **combustion of renewable liquid and gaseous transport fuels of non-biological origin or recycled carbon** fuels complying with the greenhouse gas saving criteria, set out in Article 25(2) and Article 28(5) of Directive (EU) 2018/2001 and this Regulation or;
- The captured CO_2 stems from a **geological source of CO_2** and the CO_2 was previously released naturally;

with the exception of **captured CO_2 stemming from a fuel that is deliberately combusted for the specific purpose of producing the CO_2** and **CO_2, the capture of which has received an emissions credit under other provisions of the law.**

Sustainability criteria in the Delegated Act requirements



Renewable electricity sourcing

CO2 sources

GHG accounting

Case studies:

Implementation of EU rules on sourcing renewable electricity for RFNBO production:

Perspectives of non-EU countries

Available on our website:

Analysis of latest leaks of the REDII Delegated Acts specifying rules for green hydrogen in the EU

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Main take-aways from feedback on Delegated Acts

- No “show-stopper” criterion was identified that clearly hinders market ramp-up in a specific country
- Many unclear aspects in the exact application and interpretation of the criteria in the non-EU context still prevalent
  - “bidding zone”
  - “operating and investment aid”
- Especially for large-scale projects with direct connection: A grid connection could be imposed due to stability reasons, for synergies for economic development or economic reasons selling excess RE
- Renewable energy surplus during solar hours fed to the grid, during non-solar hours, this energy is taken back from the grid and is utilized for the green hydrogen project
- Temporal correlation (1h) and 36-months-synching might negatively affect project developments


1

Implementation of EU rules on sourcing renewable electricity for RFNBO production:

Perspectives of non-EU countries

Aggregated by
PtX Hub – Hinicio – Dii Desert Energy/MENA Hydrogen Alliance

The content of the report is based on inputs of project developers of the PtX Hub, Hinicio and Dii Desert Energy/MENA Hydrogen Alliance networks

Introduction and background

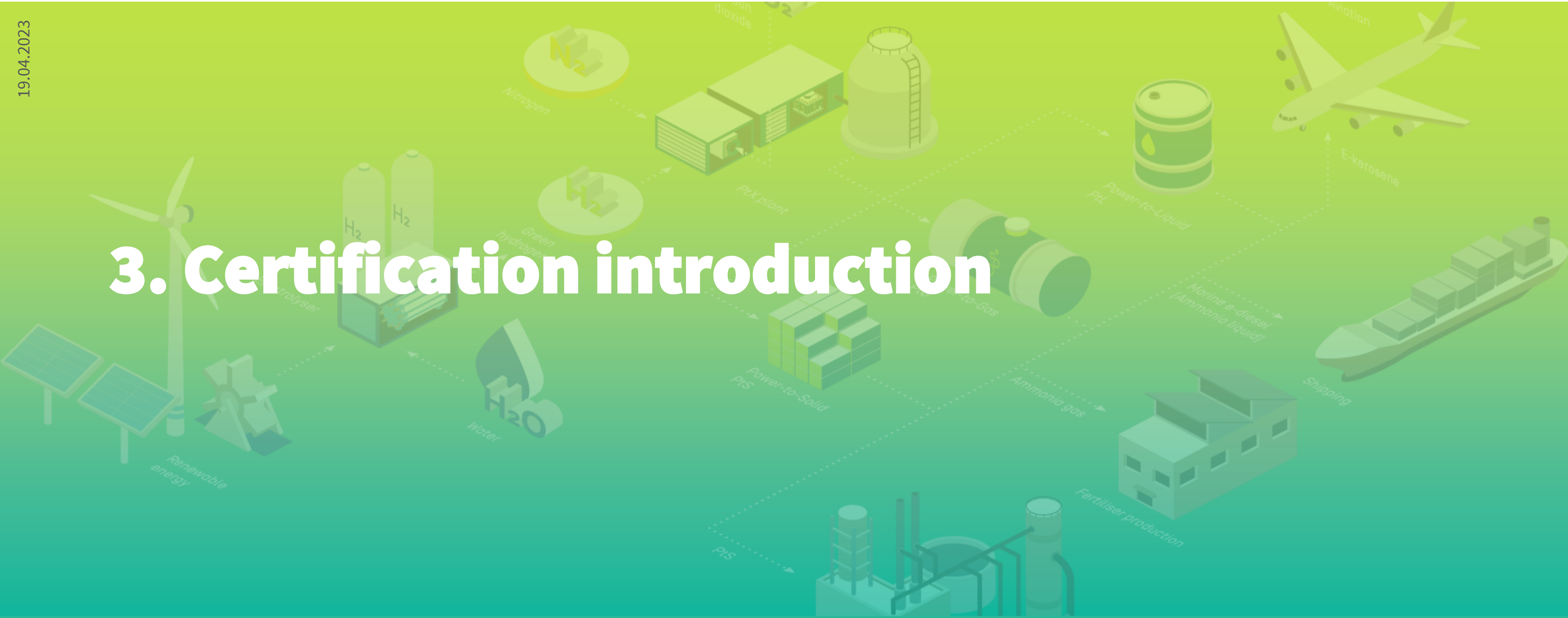
The Delegated Act (DA) on Article 27 of the Renewable Energy Directive (RED) II describes detailed requirements for sourcing renewable electricity for the production of renewable fuels of non-biological origin (RFNBOs). These requirements “apply regardless of whether the liquid and gaseous transport fuel of non-biological origin is produced inside or outside the territory of the [European] Union” (Article 6). But can these ambitious requirements be met by projects outside of the EU and what are potential obstacles?

The PtX Hub joined forces with Hinicio and Dii Desert Energy to analyse whether the requirements can actually be met in the regulatory system of respective countries outside of the EU. Therefore, interviews with project developers and other industry partners were conducted and feedback was aggregated based on a questionnaire that was specifically designed to capture obstacles and open questions concerning the DA on Article 27 illustrating where specifications may be required. Below feedback and open questions are summarized structured by the specific Articles in the DA.

Disclaimer:

Please be aware that the summary below does not necessarily reflect perspectives of the entire companies and organizations that took part in the survey nor the perspectives of Hinicio or Dii Desert Energy but rather aims at providing aggregated feedback from multiple perspectives with a focus of non-EU countries.

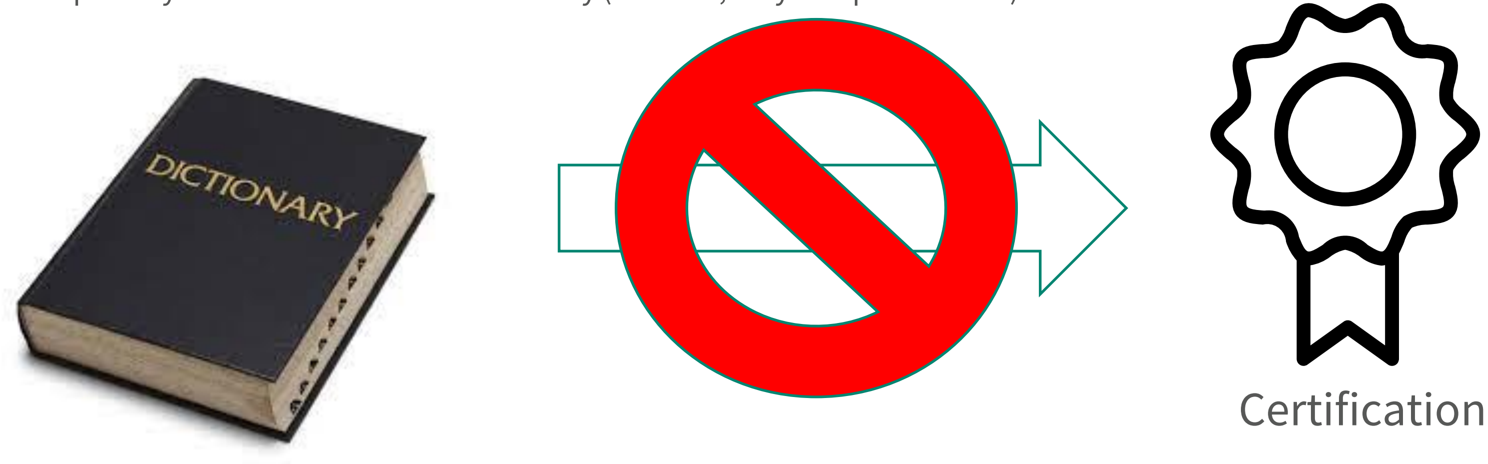
The summary below does not necessarily reflect the positions of the PtX Hub and of the commissioning institutions or the



3. Certification introduction

No common definition and differentiation of certification, standards, etc. exists

- One aim of this presentation is to find a common language so that we talk about the same thing!
- Globally, certification demand has increased in various sector and applications for many products and processes, especially when it comes to sustainability (biofuels, recycled plastics etc.)



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Standards = standardized ways of doing things

Certification = proof of compliance with standards

Standards ✓ → Certification

Standards ✗ → No Certification

Hydrogen/PtX certification

- Quality and safety standards (industry standards)
- Sustainability standards

influenced by:

- national and international regulations
- consumer's demand

Examples of industry (technical) standards: ISO standards

- Regardless of the color of hydrogen, industry standards always have to be met.

- ISO/AWI TR 15916 Basic considerations for the safety of hydrogen systems
- ISO/AWI 14687 Hydrogen fuel quality – Cylinders and tubes for stationary storage
- ISO/AWI 19887 Gaseous Hydrogen – Fuel system components for hydrogen fueled vehicles
- ISO/AWI 14687 Hydrogen fuel quality – Production specification

One product can be used globally in the same way and in the same applications →global tradability and trust

19.04.2023

Image: Alexander Kirch/Shutterstock

Certification: example from the aviation sector

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Technical/Industry standards

E.g., American Society for Testing Materials (ASTM) standard D1655 and DEF STAN 91-91 are used to ensure that jet fuels are suitable for their purpose

→ to function in a plane‘s engine

Sustainability standards

Airlines can get certified by an approved Sustainability Certification Scheme under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

→ to demonstrate GHG savings

Certification: Legal obligation vs. Voluntary disclosure

Legal obligation

e.g., requirements for Hydrogen and Renewable Fuels of Non-Biological Origin (RFNBOs) in the EU based on the Renewable Energy Directive (RED II)

→ for a product to qualify under a certain regulatory framework, certification is needed

Voluntary disclosure

e.g., FSC = Forest Stewardship Council – Sustainable resources for packaging

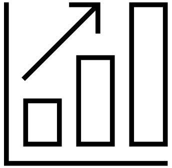
→ for demonstrating origin and/or sustainability charateristics of a product, certification is needed

Certification: Legal obligation vs. Voluntary disclosure

Legal obligation

is policy driven

A policy describes certain requirements for a product and certification is the tool to prove this



Voluntary disclosure

is demand driven

Consumers or the market demonstrate a willingness to buy a product with specific (premium) characteristics and certification is the tool to prove this

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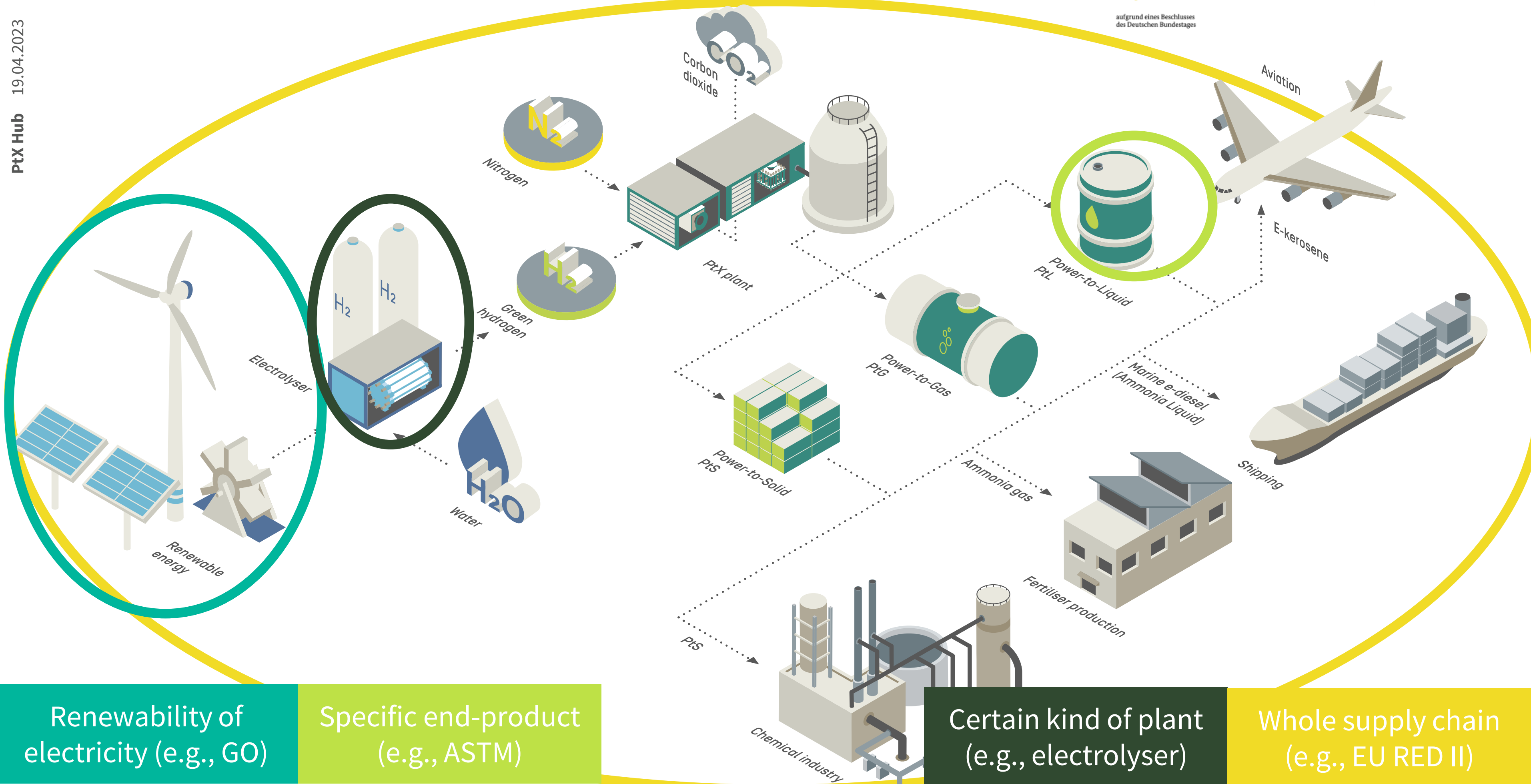
Different aspects of a supply chain can be “certified”



Renewability of electricity (e.g., GO)

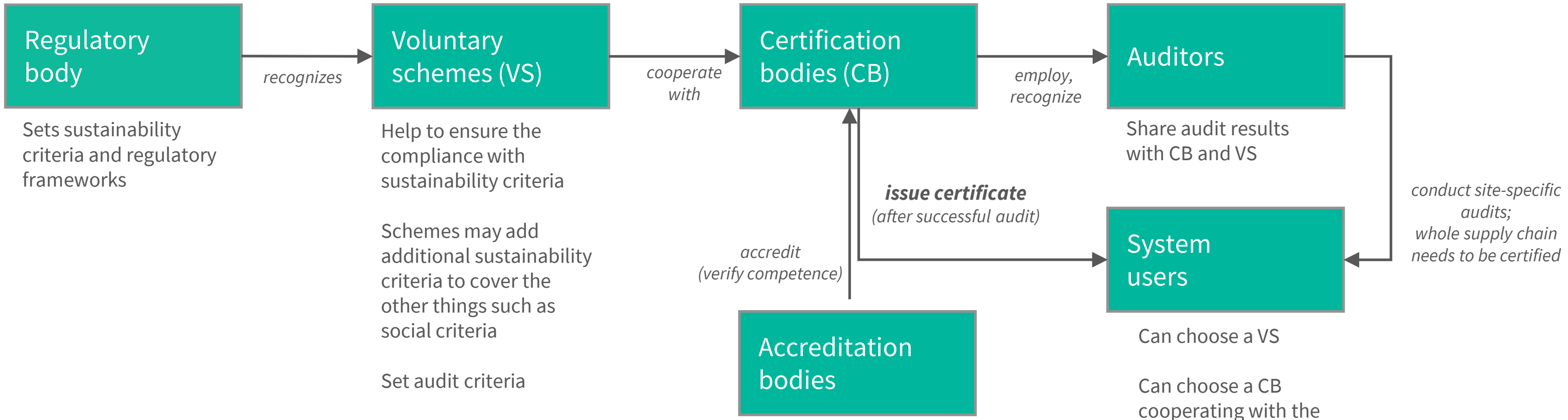
Specific end-product (e.g., ASTM)

Certain kind of plant (e.g., electrolyser)

Whole supply chain (e.g., EU RED II)

4. Certification set-up in the EU and snapshot of global developments

Certification set-up – Status quo



Regulatory body: Sets sustainability criteria and regulatory frameworks

Voluntary schemes (VS):

Help to ensure the compliance with sustainability criteria

Schemes may add additional sustainability criteria to cover the other things such as social criteria

Set audit criteria

Facilitate trainings for auditors

Publish all certificates online in a database

VS can be national or privately owned

Auditors: Share audit results with CB and VS

System users:

Can choose a VS

Can choose a CB cooperating with the chosen VS

German Energy Agency/World Energy Council – Germany (2022, p.17), PtX Hub

Existing and emerging schemes and regulatory mechanisms – an overview

19.04.2023

German Energy Agency/World Energy Council – Germany (2022, p.17); IPHE (2022); Government of Canada (2020); CMS (2021a); CMS (2021b); U.S. Department of Energy (2022)

Country	Status of H2/PtX standards and certification	Other
Australia	• No regulation • Hydrogen GO certification trials	• Zero Carbon Certification Scheme launched in 2020 by industry actors. For hydrogen, renewable ammonia and renewable metals
Canada	• Developing a Clean Fuel Standard for hydrogen and biofuels • CertifHy Canada Scheme is in development; to match the requirements of the Clean Fuel Standard	• Aims to develop a life cycle approach for its GHG emissions methodology
China	• Several industry standards already in effect, e.g., standards for hydrogen energy safety and quality testing	• China Hydrogen Alliance's Standard defines low-carbon, clean and renewable hydrogen based on the among on CO2 emitted in kgCO2e per kgH2
Japan	• 'Clean hydrogen' is not yet clearly defined • Discussions of establishing standards and a certification scheme but no progress has been made	• Regional certification scheme for CO2-free hydrogen in the Aichi Prefecture • J-Credit Scheme certifies GHG reductions and removals
UK	• Developing a low-carbon and renewable hydrogen standard	• Renewable Transport Fuel Obligation regulates renewable transprt fuels (incl. Hydrogen)
USA (federal)	• Draft Clean Hydrogen Production Standard (CHPS) released by DOE	• A proposed lifecycle GHG emissions limit of 4kg CO2e per kg of hydrogen • CHPS is not a regulatory standard; a guidance

H2/PtX certification: Gaps and challenges

Gefördert durch: Bundesministerium für Wirtschaft und Klimaschutz aufgrund eines Beschlusses des Deutschen Bundestages

Durchgeführt von: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Gap

- Certification scheme of specific end-products like steel, chemicals, etc.
- Global and aligned H2/PtX certification scheme

Why have a global and aligned scheme?

To allow exporting countries flexibility when trading hydrogen & PtX products

Challenges of a global scheme

Advanced certification schemes would be compelled to lower their ambitions

Globally, certification approaches differ widely

GIZ, ILF, LBST (2021, p.13); German Energy Agency/World Energy Council – Germany (2022, p.10-11)

Thank you

jan-hendrik.scheyl@giz.de

International PtX Hub

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IKI Internationale Klimaschutz Initiative

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