CertifHy

Creating the 1st EU-wide Guarantee of Origin for Green Hydrogen

Project supported by the FCH JU

Overview of CertifHy phase 1 and GO schemes

2017-12-18

www.certifhy.eu

#CertifHy

Agenda

- Introduction to GO schemes

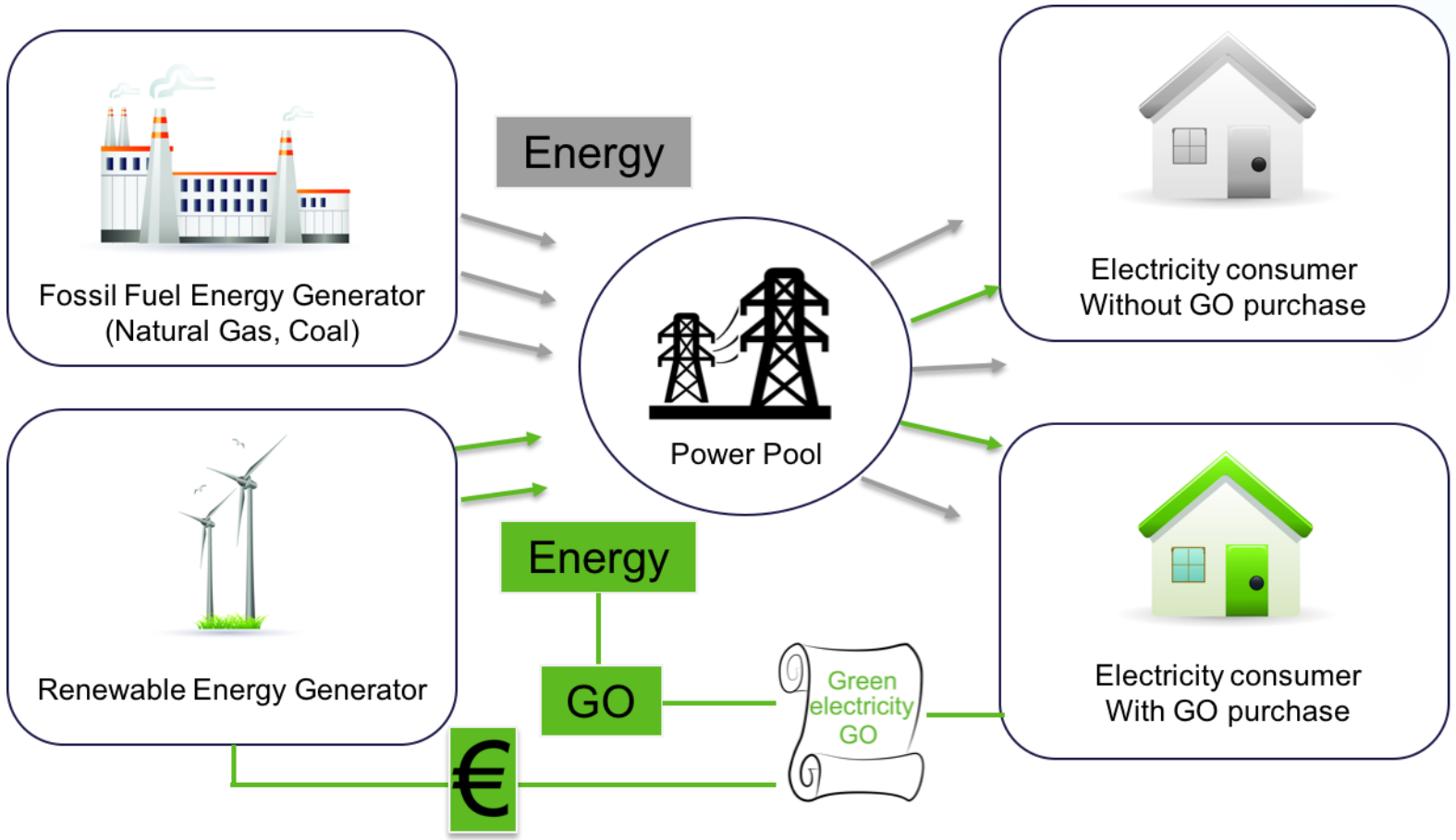
- CertifHy Phase 1:
- Definition of green hydrogen
- GO scheme

- Business Models for Green H2 GO's

- CertifHy Phase 2

- Appendix: Analysis of pathways leading to green H2 production

Guarantee of Origin (GO) scheme for Electricity has allowed Electricity Suppliers to sell renewable electricity (RE) contracts to households and provide evidence of RE consumption to their customers.

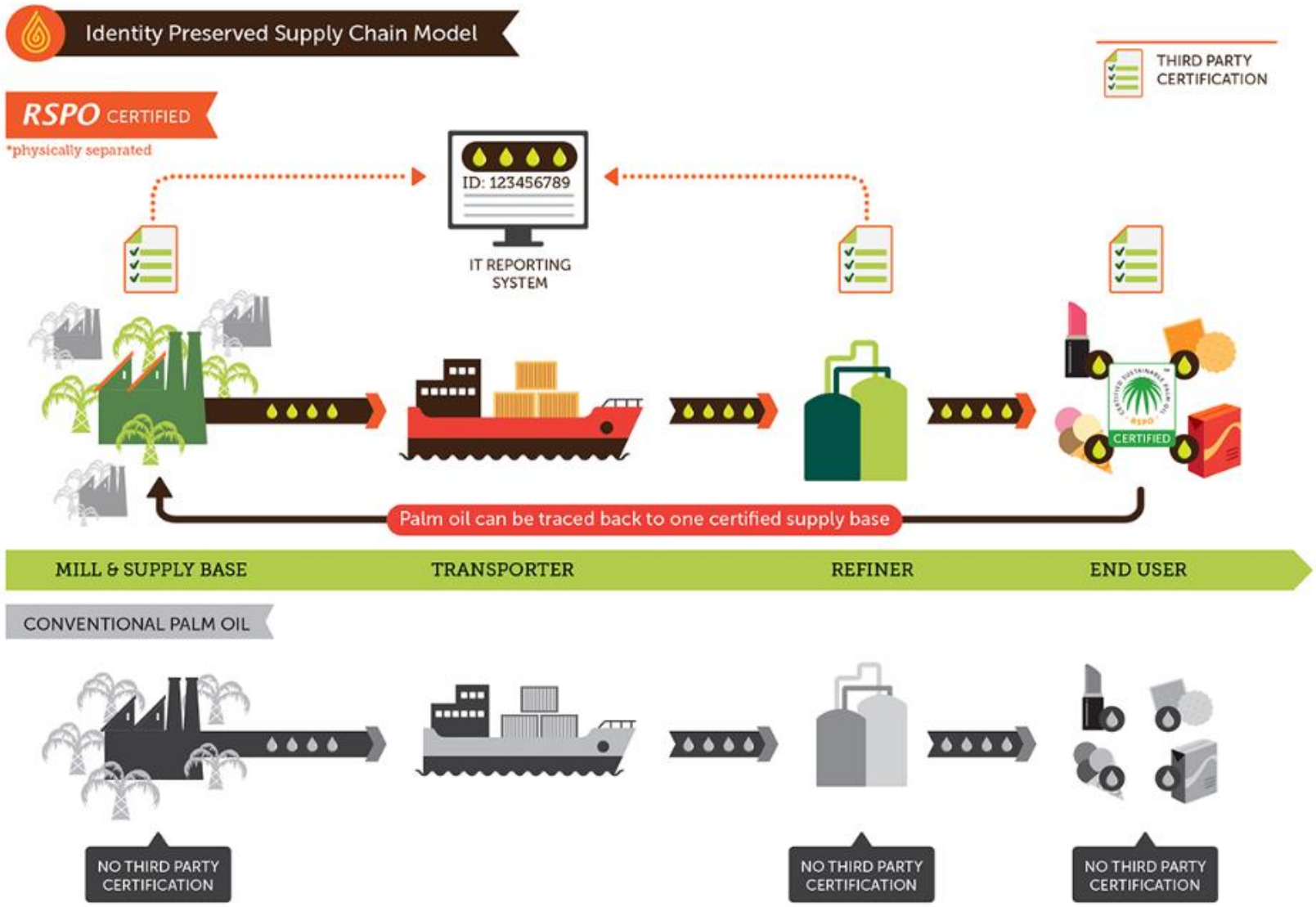


In Flanders, consumers can check via the regulator their electricity consumption to be renewable (as the electricity supplier cancelled GOs):
http://www.vreg.be/nl/controleren-hoe-groen-uw-stroom-groencheck

IDENTITY PRESERVED

Sustainable palm oil from a single identifiable certified source is kept separately from ordinary palm oil throughout supply chain.

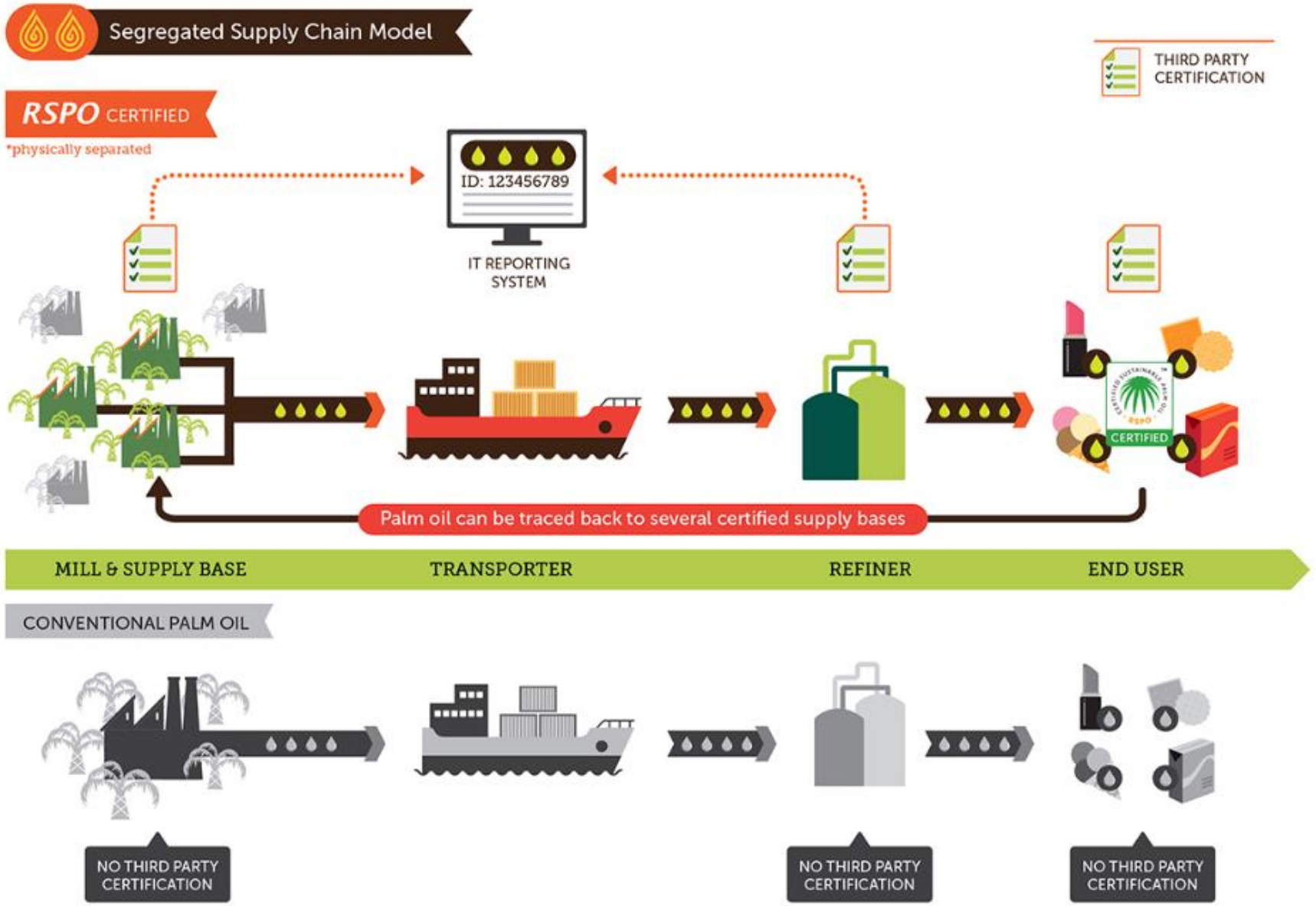
Different schemes exist for sustainable palm oil



SEGREGATED

Sustainable palm oil from different certified sources is kept separate from ordinary palm oil throughout supply chain

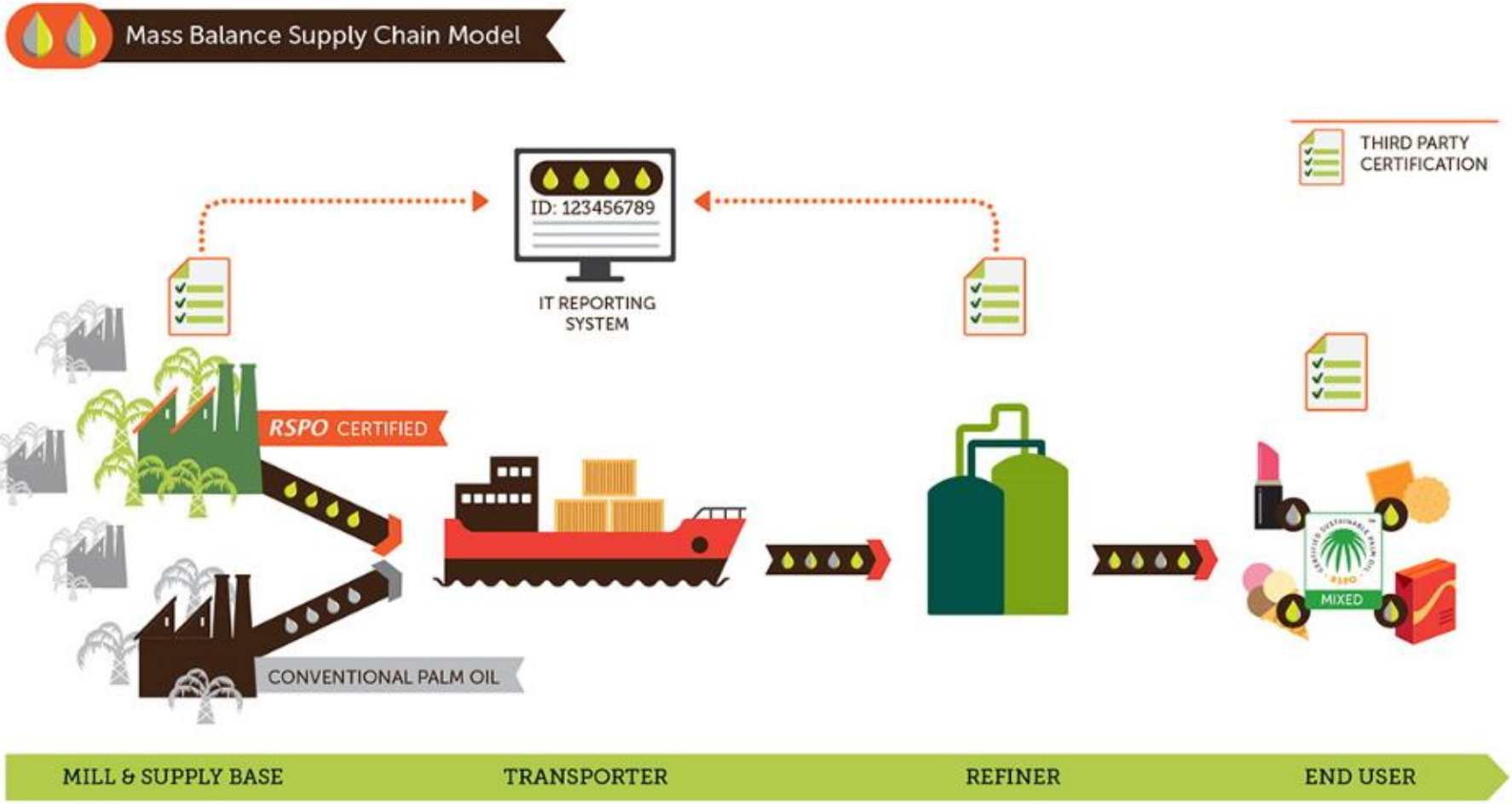
Different schemes exist for sustainable palm oil



MASS BALANCE

Sustainable palm oil from certified sources is mixed with ordinary palm oil throughout supply chain.

Different schemes exist for sustainable palm oil

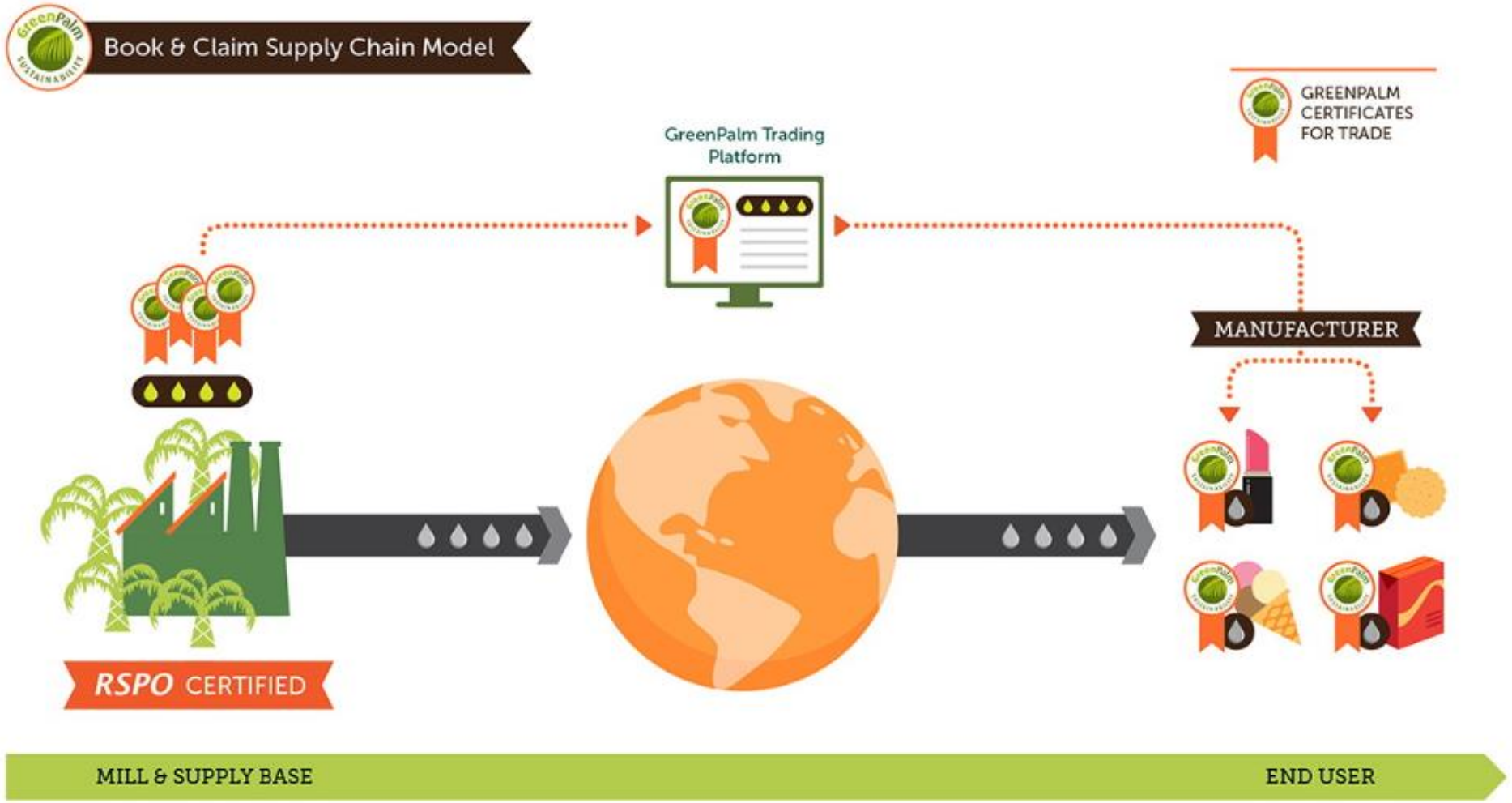


Source: http://www.rspo.org/

GREEN PALM / BOOK & CLAIM

The chain is not monitored for the presence of sustainable palm oil.
Retailers can buy a GreenPalm certificate from certified grower

Different schemes exist for sustainable palm oil



Source: http://www.rspo.org/

A book and claim system has been chosen for sustainable palm oil to avoid duplication of an expensive supply chain

Sustainable palm and palm kernel oil:
The cost & complexity of segregation

Source: http://greenpalm.org

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Business Models for Green H2 GO's

CertifHy Phase 2

Appendix: Analysis of pathways leading to green H2 production

CertifHy aims to develop the 1st European-wide Green and Low Carbon hydrogen GO scheme

2014 — 2016 — 2017 — 2018/9 — 2020s..

Phase 1

1. Define a **widely acceptable definition of green hydrogen**
2. Determine how an **EU wide robust GO scheme** should be **designed and implemented**

Phase 2

1. Set-up a **hydrogen GO Stakeholders' platform & its Steering Group**
2. **Finalise the scheme design** ensuring it can be the **main route to guarantee the origin of green & low carbon hydrogen across EU Member States**
3. **Run a pilot scheme** to test the proposed design.
4. **Identify actions** which need to be undertaken after the completion of the study **to achieve an EU wide deployment of the scheme**

Phase 3

1. **Prepare EU wide deployment:**
   Implement key elements
   - Competent authority,
   - Issuing Body,
   - Registry operator,
   - Accreditation body
2. **Finalise Regulation, Codes and Standards:**
   - CEN Standard
   - EU and national regulation
   - CertifHy scheme docs

The current definition of Green and Low Carbon Hydrogen and GO scheme has been the result of a 2 year consensus building process from 2014 to 2016

Consortium

Hinicio

TÜV SÜD

ECN

ludwig bölkow systemtechnik

Affiliated Partners

AIR LIQUIDE ADVANCED BUSINESS & TECHNOLOGIES

THE LINDE GROUP Linde

HYDROGENICS SHIFT POWER | ENERGI

colruyt

AREVA H_2Gen

eDF

OMV

uniper

TOTAL

GROUP MACHIELS

AkzoNobel

AIR PRODUCTS

WP7: Project Management and Administration
Project leader: Hinicio

Robust + Transparent system

Rationale of green H2

WP1: Generic market outlook for green hydrogen
Project leader: Hinicio

WP2: Definition of "Green Hydrogen"
Project leader: TÜV SÜD

Common definition with all stakeholders

WP4: Definition of a new framework of guarantees of origin for "green" hydrogen
Project leader: TÜV SÜD

WP3: Review of existing platforms for GO
Project leader: ECN

Lessons learnt from other initiatives

WP5: Roadmap for the implementation of an EU-wide GO scheme for green hydrogen
Project leader: ECN

Enabling implementation

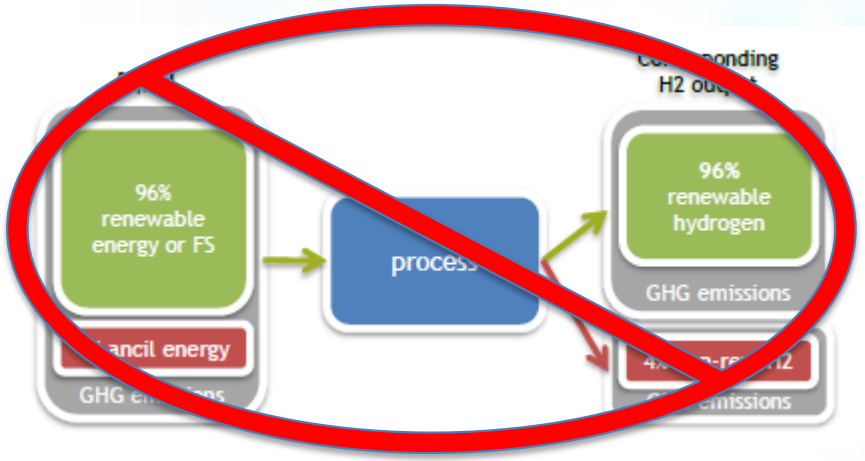
Buy – in

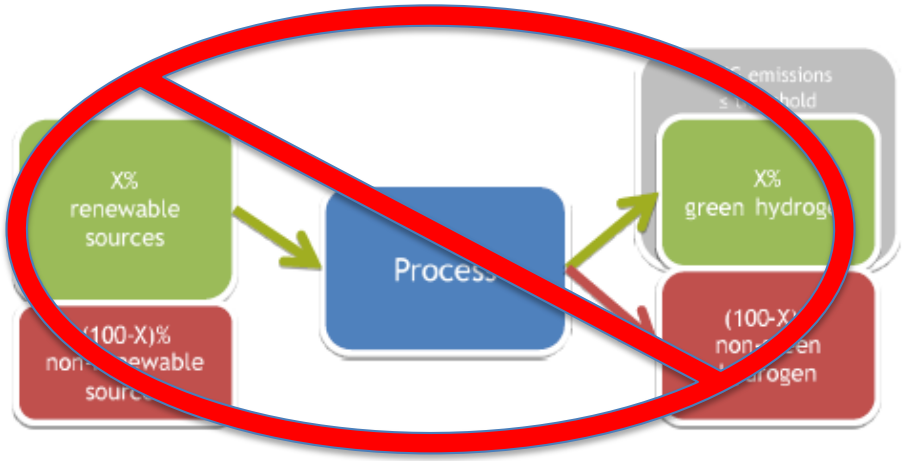
WP6: Stakeholder Engagement & Communication
Project leader: Hinicio

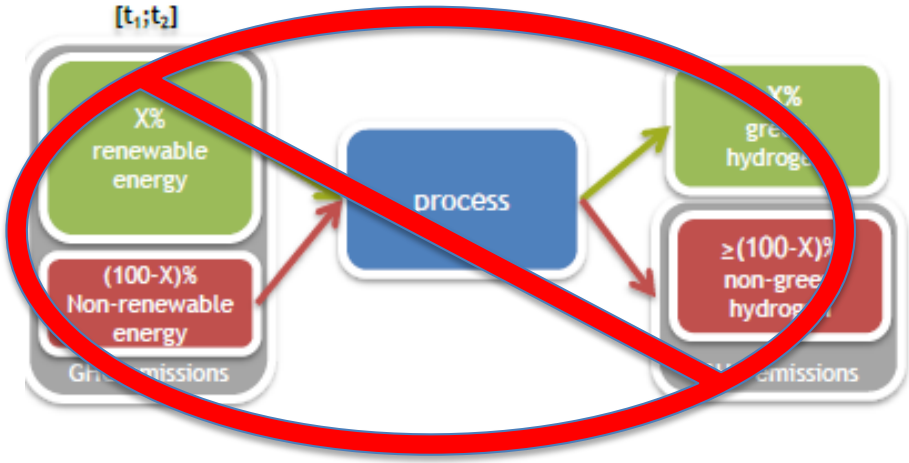
Over those two years: a step-by-step consensus building approach was followed with many models developed along the way

Example of intermediary approaches:

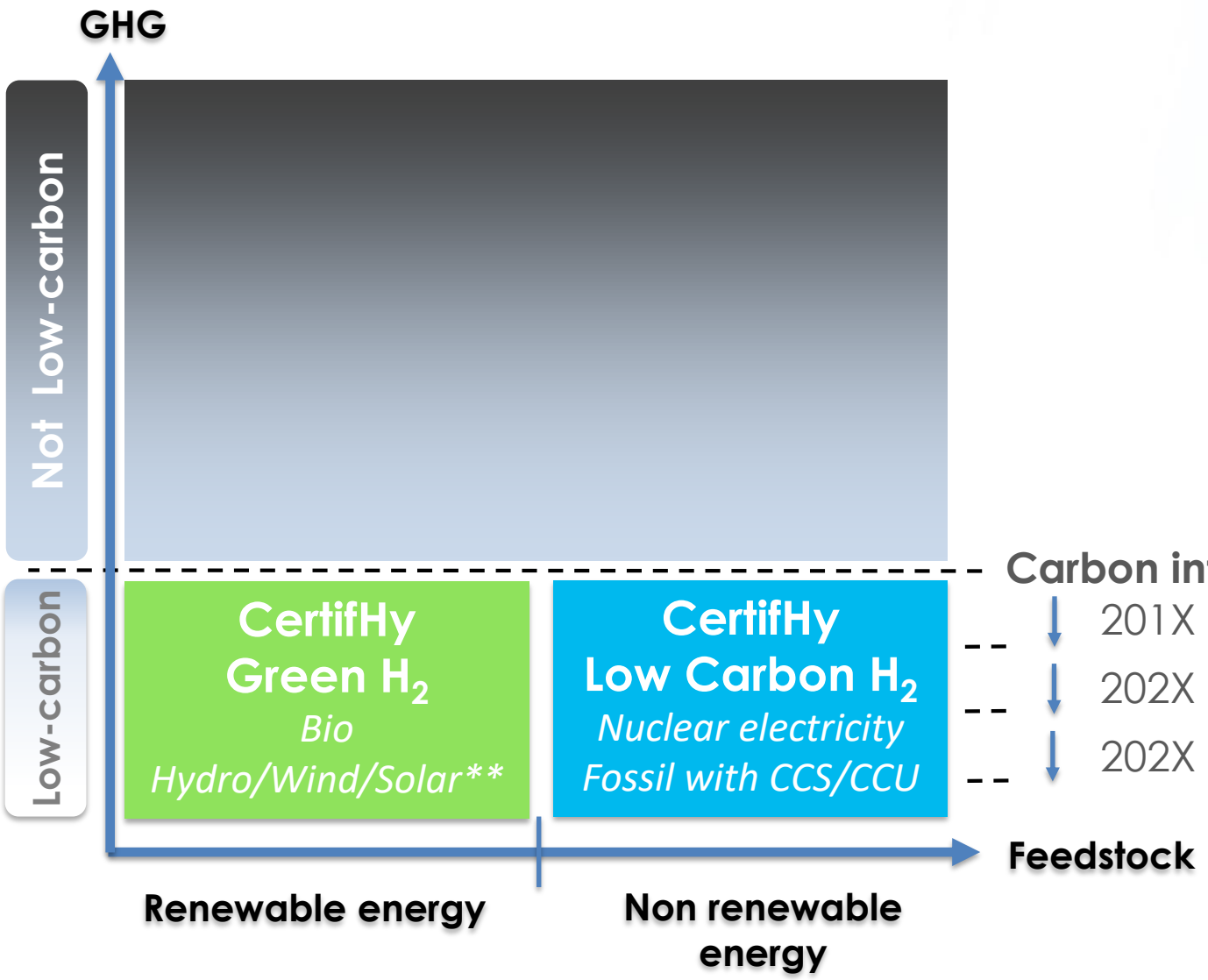
- GHG emissions to be allocated to RE part
- GHG emissions to allocated to both RE and non-RE part
- Green H2 to have zero GHG emissions
- See D2.4 on http://www.certifhy.eu in "publications-and-deliverables" for a full report







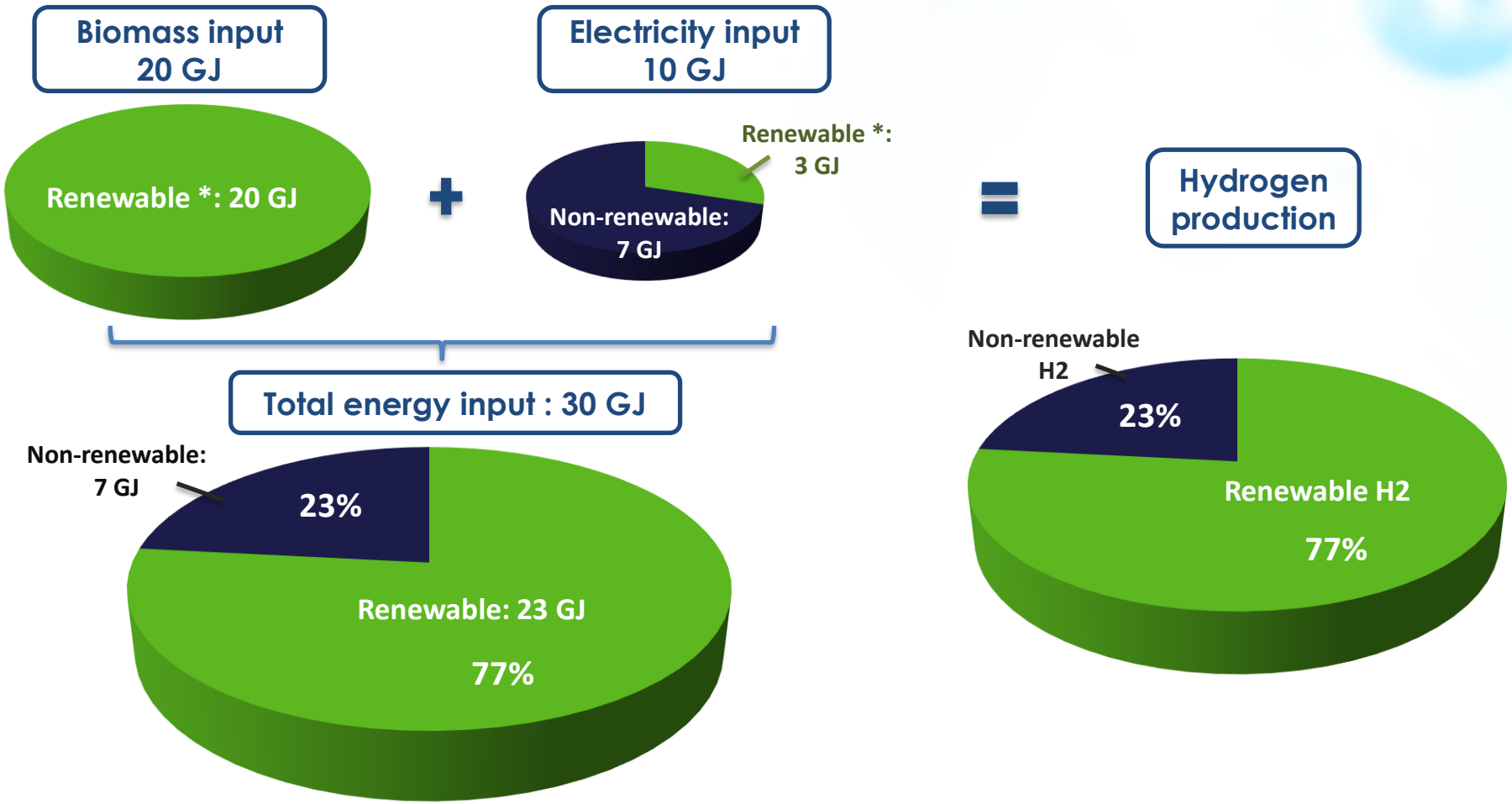
The definition of green and Low Carbon hydrogen was one of the main outcomes of the program



* Greenhouse gas emissions (CO_2 equ.) per unit of hydrogen over whole generation pathway up to marketable product

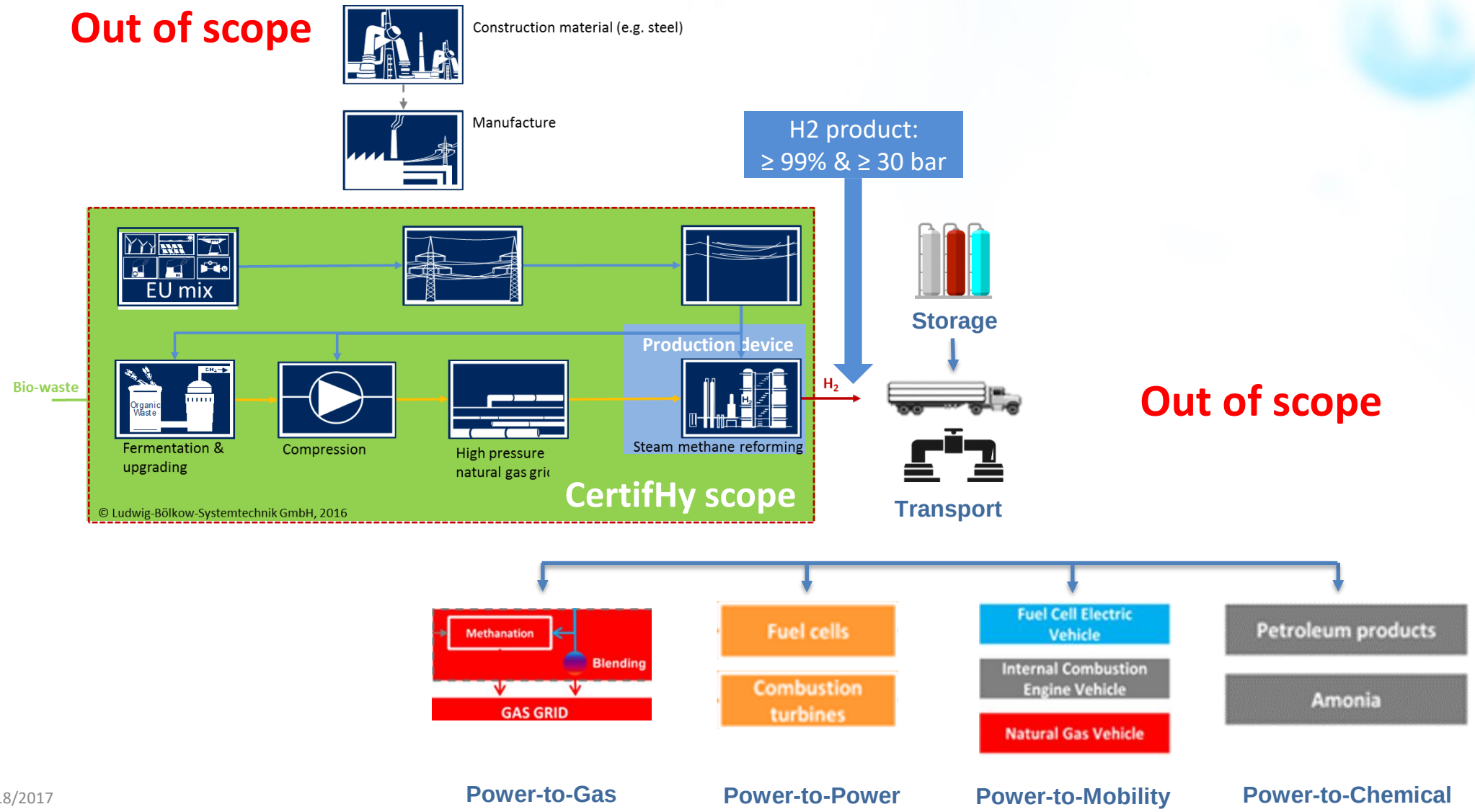
** Zero carbon intensity since electricity from these sources is considered to have zero carbon intensity by convention

Renewable hydrogen will be as green as the energy input into the production device

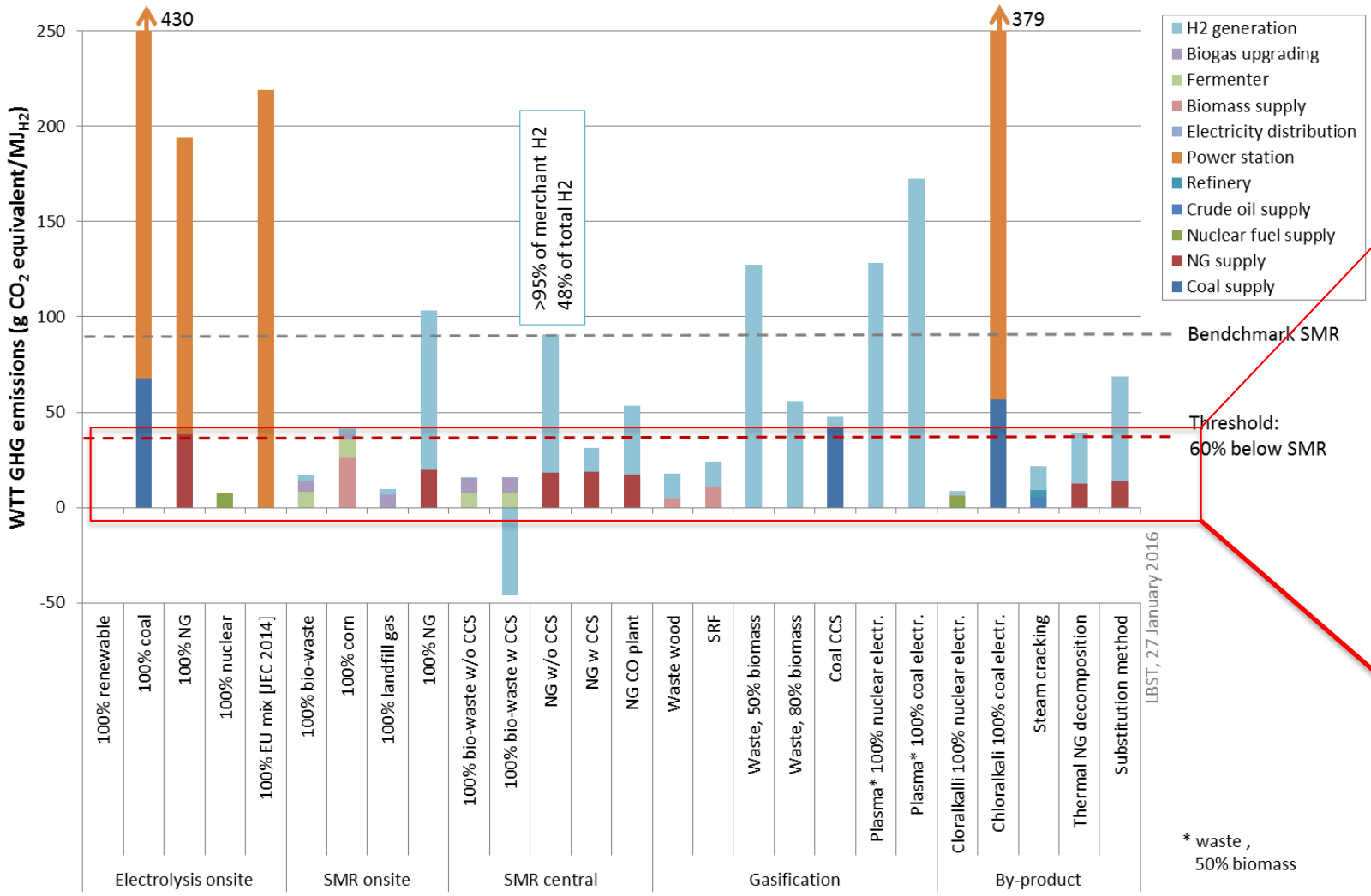


* Via GO or direct feedstock

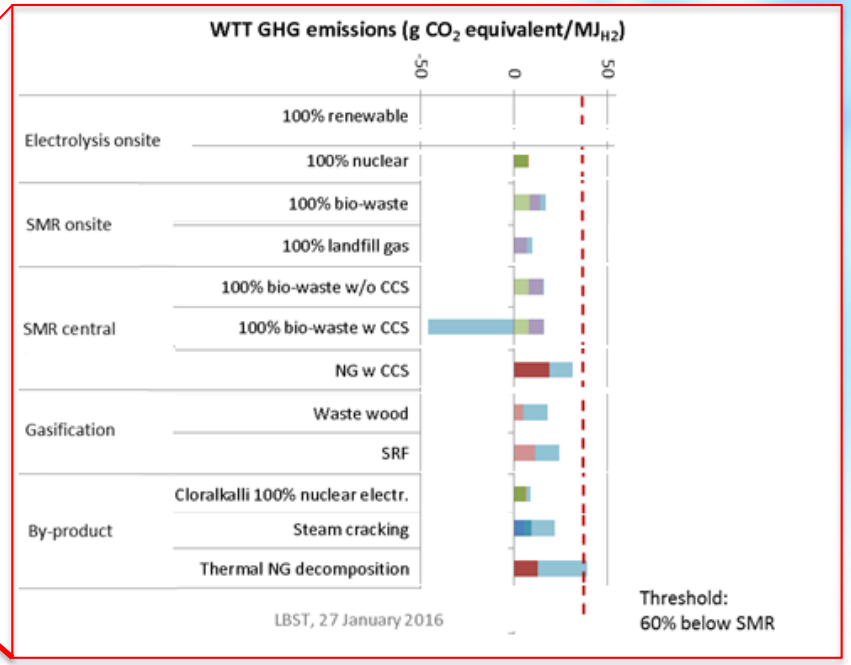
Hydrogen GOs and the associated GHG emissions cover the whole generation pathway up to marketable product



With the low carbon benchmark set at an ambitious level, yet allowing for bio-based sources to be eligible

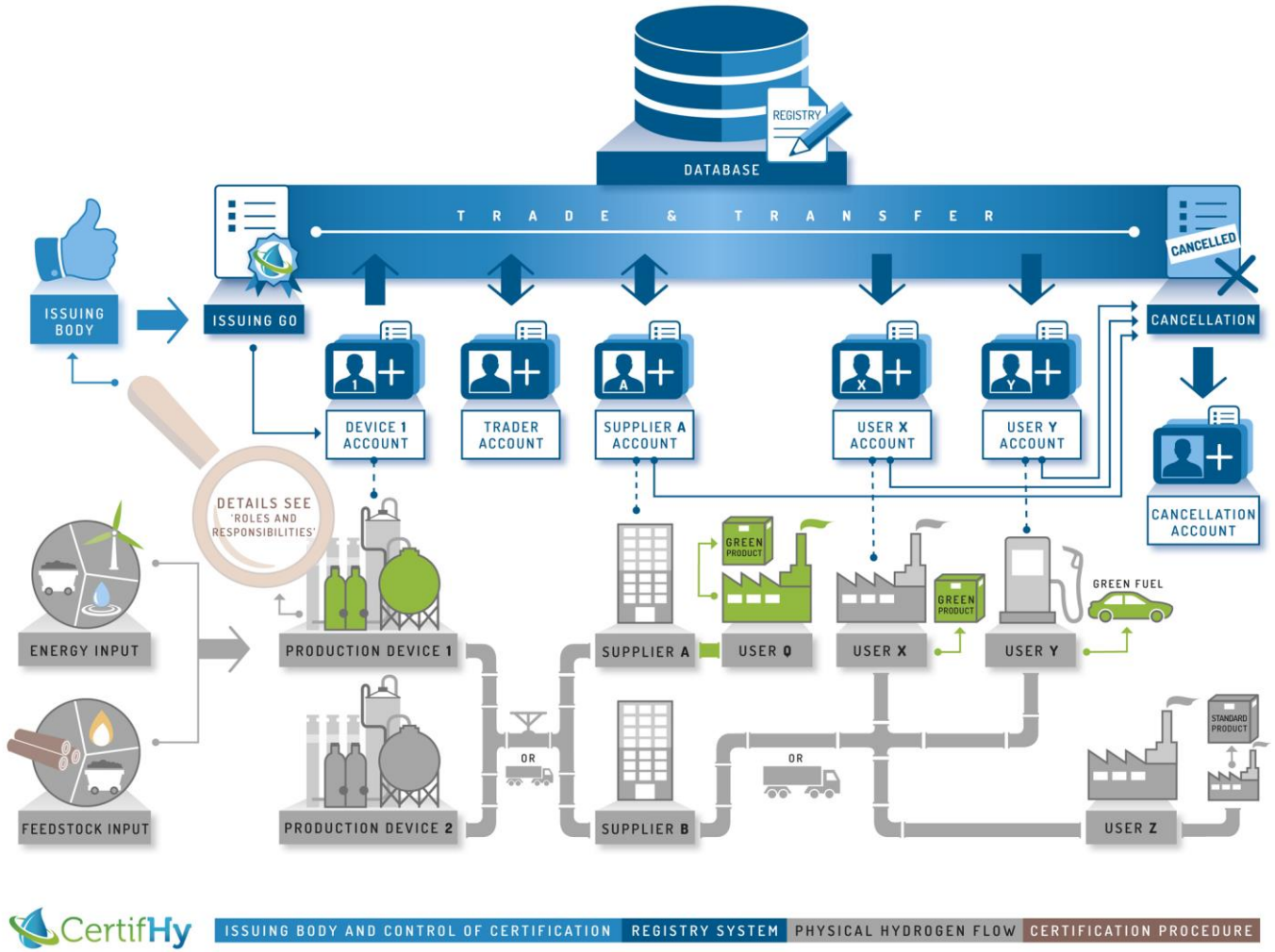


Eligible pathways

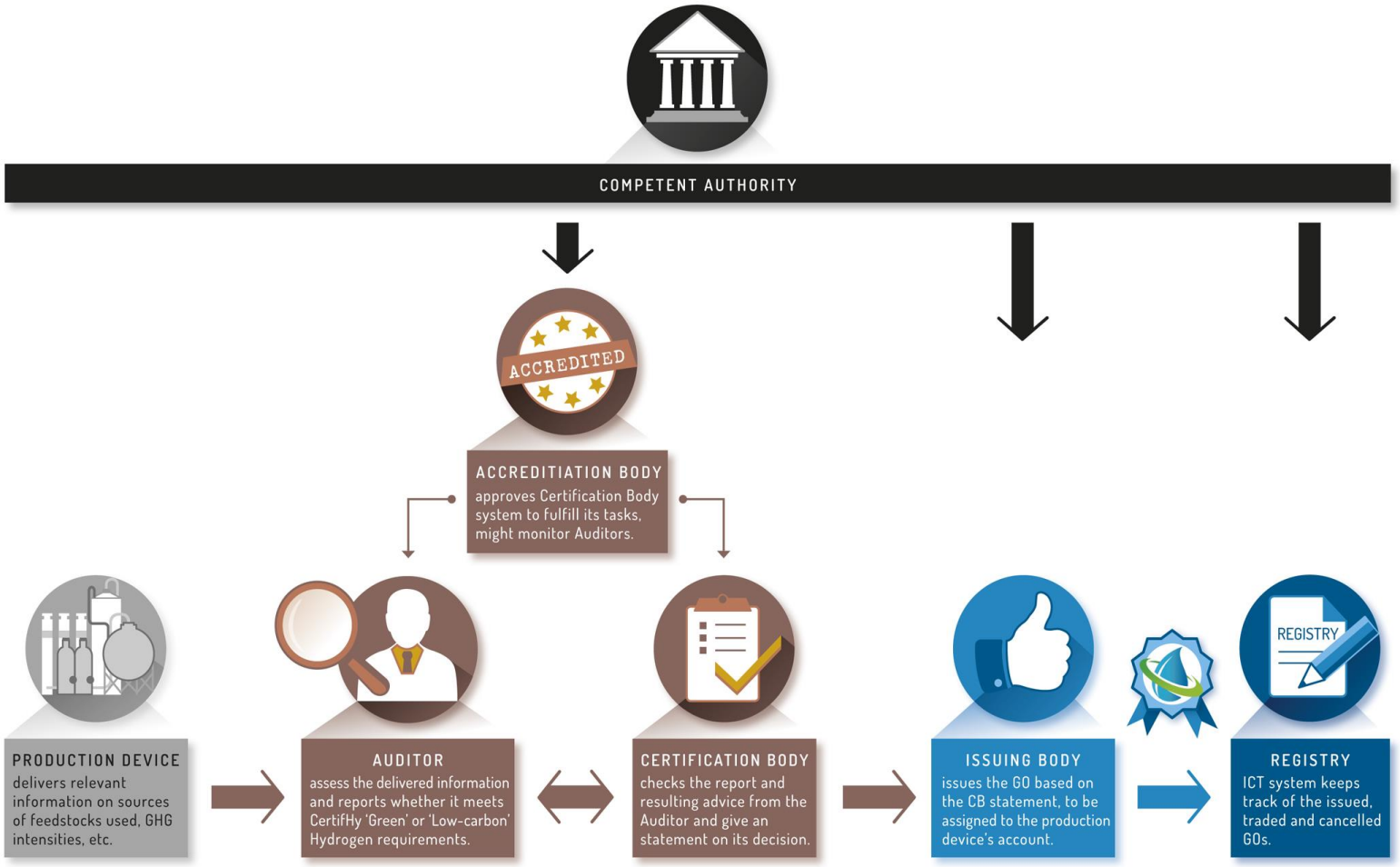


The definition of green and Low Carbon hydrogen was widely endorsed by stakeholders

Getting consensus on a GO Scheme was the second major outcome (1/2)



Getting consensus on a GO Scheme was the second major outcome (2/2)



OVERALL CONTROL SYSTEM | PHYSICAL HYDROGEN FLOW | REGISTRY SYSTEM
ISSUING BODY AND CONTROL OF CERTIFICATION | CERTIFICATION PROCEDURE

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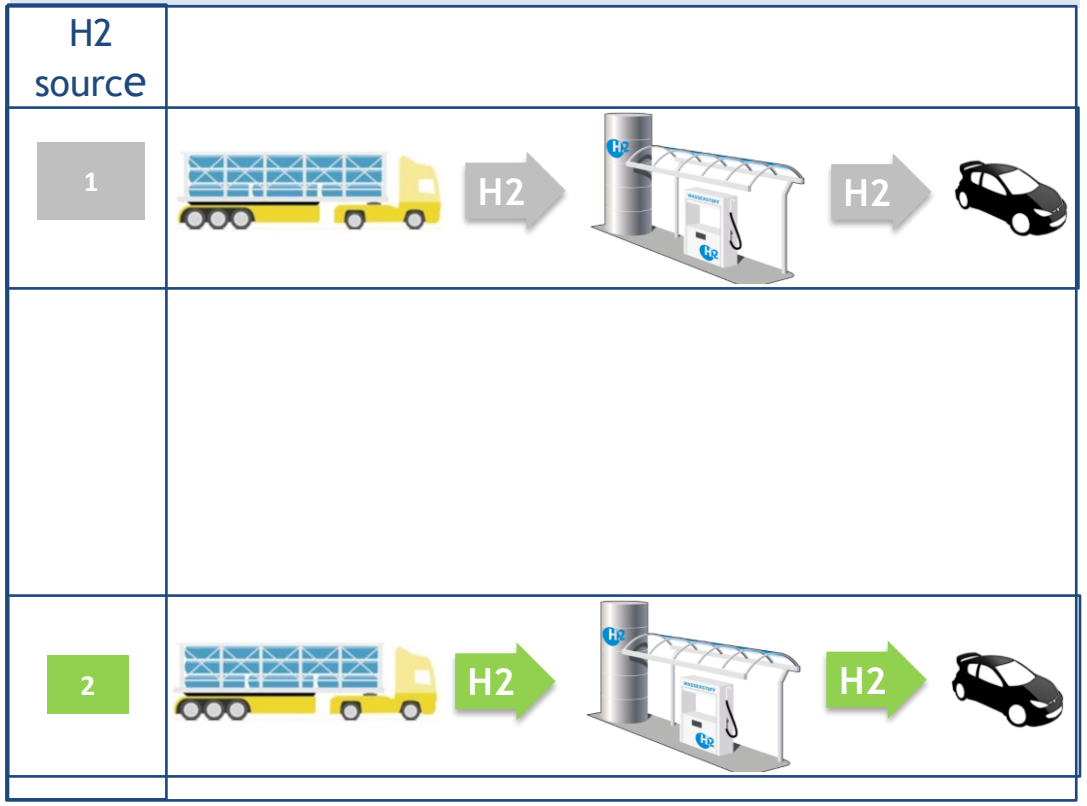
CertifHy Phase 2

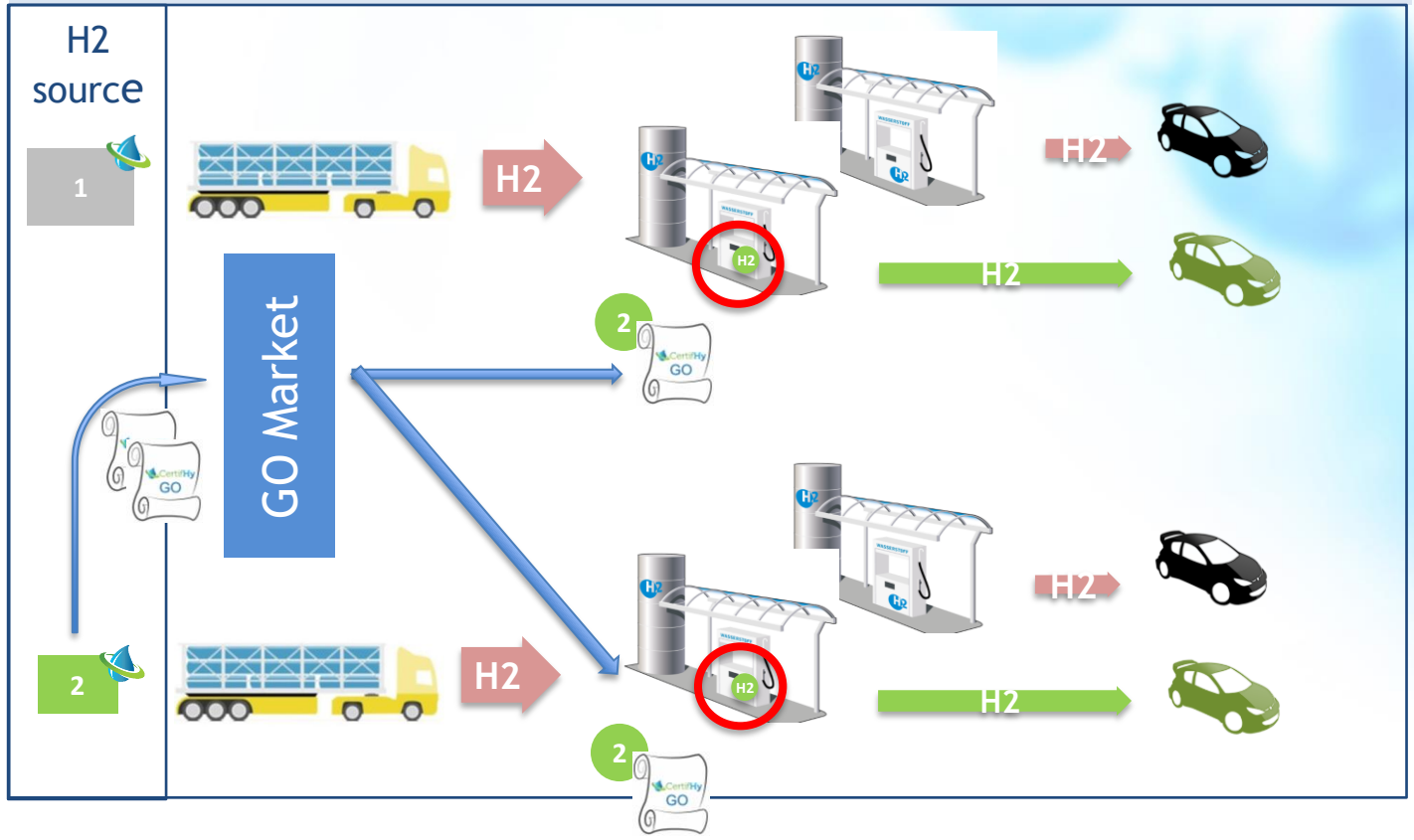
Appendix: Analysis of pathways leading to green H2 production

A GO scheme allows access to green hydrogen for users that are not in the vicinity of green hydrogen sources & optimises the economics and environmental footprint of a green H2 supply chain

No GO Scheme: Dedicated Supply Chain



CertifHy GO Scheme: Case HRS operator ensures green hydrogen being consumed by FCEV



n H2 source

Benchmark

Renewable and low carbon

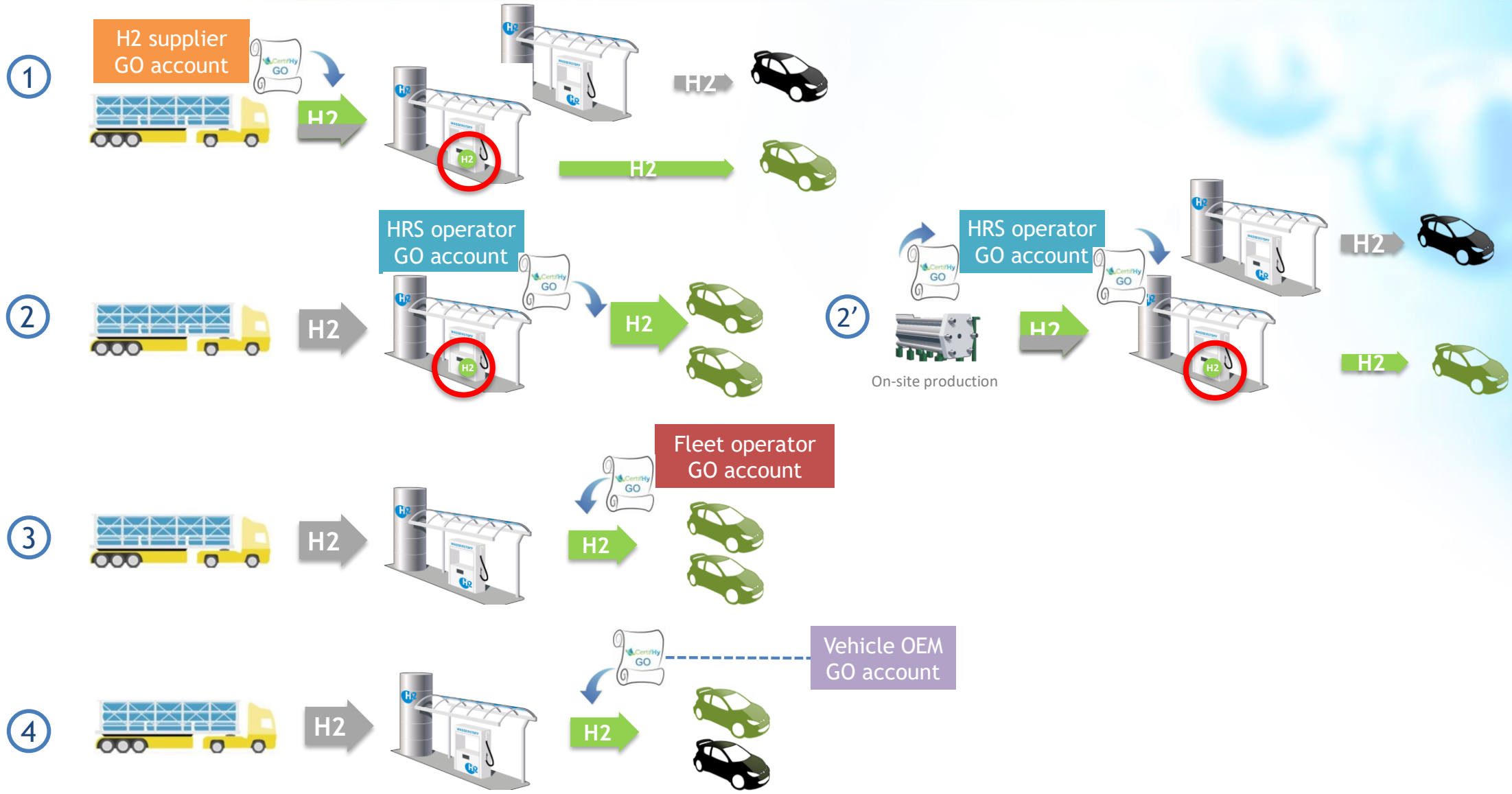
Residual mix

Participating to CertifHy scheme

CertifHy Green H2

As with RE GO's, H2 GOs will create new business models for Green Hydrogen for H2 suppliers, HRS operators, Fleet Operators & OEMs

GO Market



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2014 — 2016 — 2017 — 2018/9 — 2020s..

Phase 1

1. Define a **widely acceptable definition of green hydrogen**
2. Determine **how to design and implement** a robust **EU wide GO scheme**

Affiliated partners:

TOTAL, MACHIELS, AkzoNobel, colruyt, Shell, AIR PRODUCTS, AREVA H_2Gen, BMW, EDF, AIR LIQUIDE, THE LINDE GROUP, HYDROGENICS, uniper, OMV

Phase 2

1. Set-up a **hydrogen GO Stakeholder platform**
2. **Finalise the scheme design** ensuring it can be the **main route to guarantee the origin of green & low carbon hydrogen across EU Member States**
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Who are we?
The CertifHy project team

CertifHy phase 1 & 2

Hinicio
Project leader

Independent strategy consulting firm specialized in sustainable energy and transport with a European competence centre on hydrogen and fuel cells.

ECN

The Energy research Centre of the Netherlands (ECN) is a leading independent European institute for applied energy technology development, energy research, and policy advice.

ludwig bölkow systemtechnik

LBST is an expert consultancy for sustainable energy and mobility founded with a European competence centre on hydrogen and fuel cells with one of the longest track-records.

TÜV SÜD

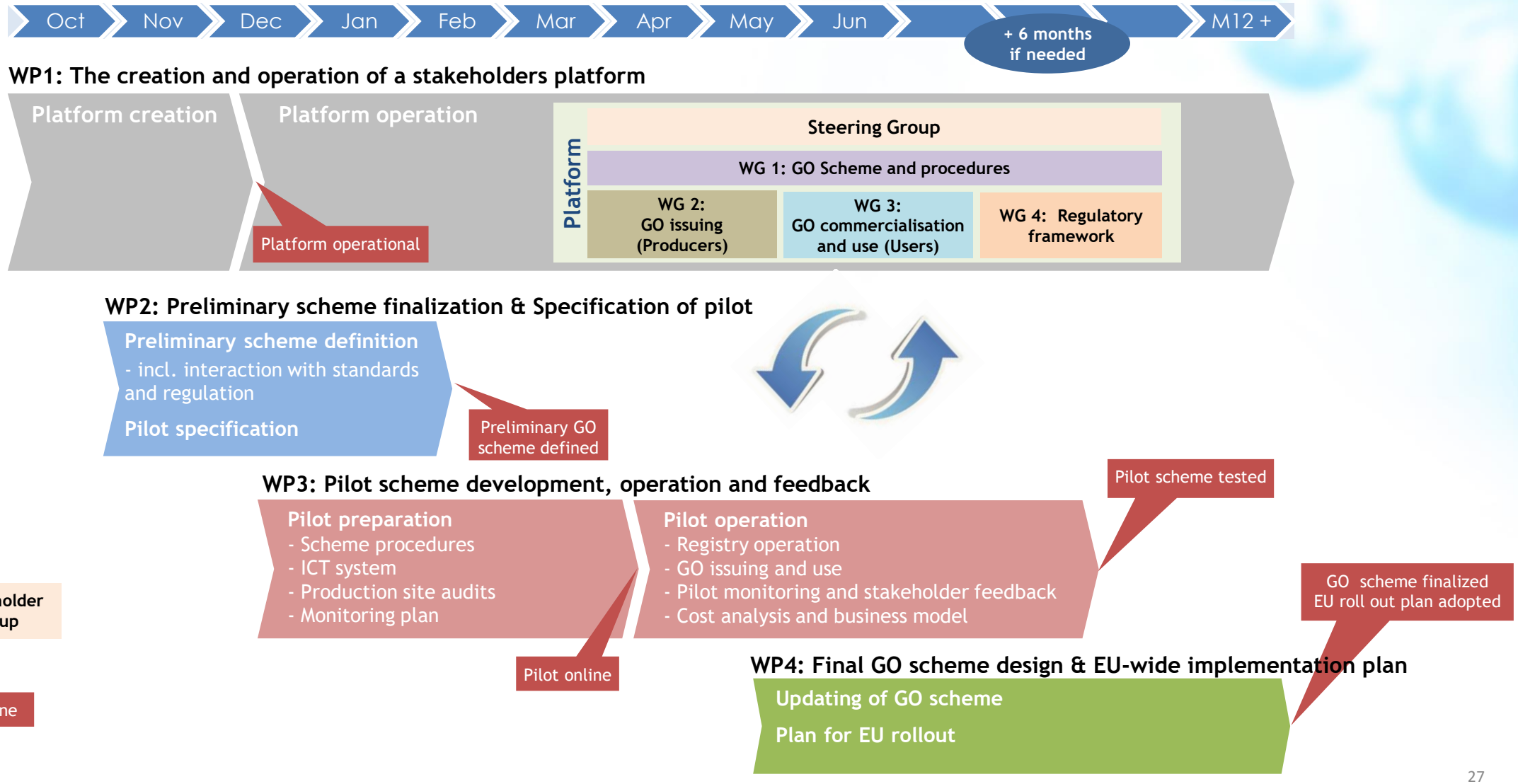
TÜV SÜD is one of the world's leading technical service providers of testing, inspection, certification and training solutions with the strategic business segments INDUSTRY, MOBILITY and CERTIFICATION.

CertifHy phase 2

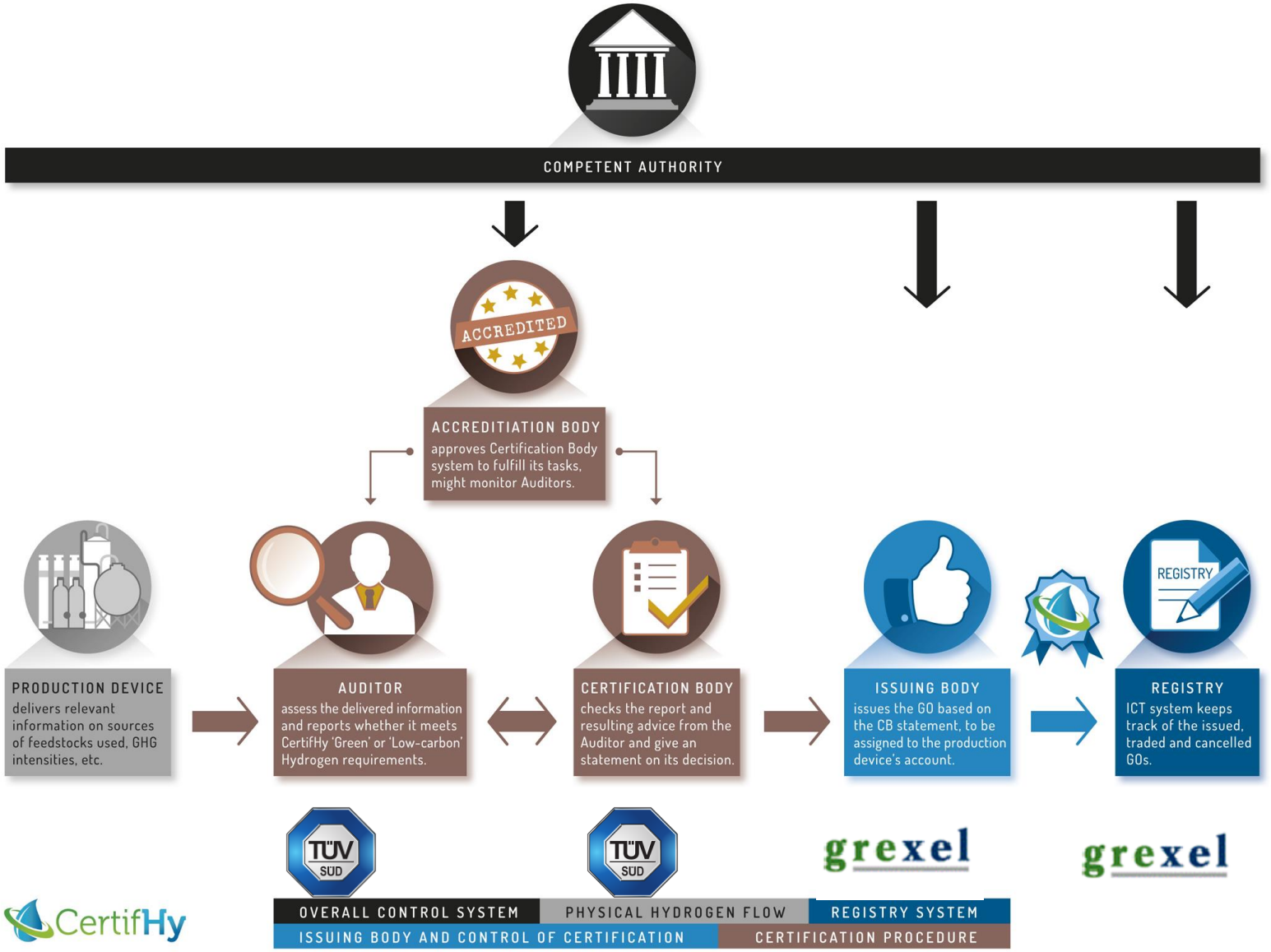
grexel

Grexel is the leading European energy certification service provider

The scheme will be developed in interaction with Stakeholder Working Groups for consultation and approval



The pilot scheme
Key elements of the GO scheme & procedures will be tested



- The Stakeholder Platform is expected to become the competent authority, in due time.
- TÜV SÜD will audit **4 pilot hydrogen production sites** & verify production batches.
- GREXEL will adapt an existing GO registry.
- GREXEL will issue and allow for trading of the associated GOs.
- Final customers will purchase the GOs.

Who are the CertifHy phase 2 pilots?
4 pilot producers with different production pathway which will lead to the issuance of GOs to the market

SMR with CCU - Port Jérôme (France)

1

Available GO volume	TBD
	Up to 900 000 kg

Electrolyser + Wind - Halle (Belgium)

2

Available GO volume	0
	0

Up to 900 tons of Low Carbon H2

Chlor Alkali - Botlek (Netherlands)

3

Available GO volume	Up to 50 tons

Electrolyser + grid - Falkenhagen (Germany)

4

Available GO volume	Up to 38 tons

Up to 88 tons of Green H2

Stakeholder platform entities role and composition

	Stakeholder Platform	WG1: GO scheme and procedures	WG2: GO issuing (Producers)	WG 3: GO commercialisation and use (Users)	WG 4: Regulatory framework	Steering Group
Role	• Act as a discussion fora for stakeholder • Endorse the overall scheme	• Define the scheme • Provide input to and interface with standardisation with regards to structure and content	Define the requirements that will apply to the H2 production sites	Specify the features that are needed to address market needs in terms of GO product and commercialisation	Ensure alignment between GO scheme and the pertinent regulation, especially at EU level	• Take decisions regarding platform governance & organisation • Endorse the important scheme decisions • Convene Plenary Sessions
Composition	• All pertinent stakeholders	• GO scheme experts (including industry) • Standardisation experts	Operators of H2 production sites	All actors involved with the distribution and use of GOs (fleet operators, industrials from the automotive, steel, glass, etc sectors, industrial gas companies…)	• Public affairs experts of the stakeholder group • Representatives of the Commission	• Working Group Chairs and Co-chair • European institutions (DG Energy, DG Clima, DG Move, DG Environment, FCH 2 JU)

Working group composition - WG1

WG1 GO scheme and procedures

Members		
Category	**Sub-category**	**Stakeholders**
Industry	Industrial gas suppliers	***Air Liquide***
	Utilities	**EDF, Engie, HYGRO, Statkraft Markets, Uniper, Verbund**
	Oil&Gas	**Shell**
	Other operators	**Colruyt**
	Equipment manufacturers	**Hydrogenics, Mitsubishi Hitachi Power Systems Europe**
	Automotive	**Daimler**
GO Scheme experts		**AGCS, AIB, I-REC Standard, Energinet, Vertogas**
Standardisation experts		**NEN**
Associations		**H2NL**
Regulators		**VREG**
Research organisations		**European Marine Energy Centre (EMEC), Groupe Européen de Recherche sur le Gaz (GERG), *NREL***
Consultancies		***Deloitte Tohmatsu Consulting, Patch LLTD***

Legend
Member
Chair
Co-chair
Observer

Working group composition - WG2

WG2 GO issuing	Members		
	Category	**Sub-category**	**Stakeholders**
	Industry	Industrial gas suppliers	**Air Liquide, Air Products, Linde**
		Utilities	**Bischoff & Ditze Energy GmbH, CNR, Enertrag, Engie, Electrabel, Enovos, HYGRO, Uniper**
		Oil&Gas	**OMV, Q8**
		Other operators	**Colruyt, Group Machiels, HYOP, *Wind to Gas SüderMarsch***
		Equipment manufacturers	**FLD Technologies, Hygear, ITM Power, NEL,** *Hydrogen Technologies d.o.o*
		Chemicals	**Akzo Nobel**
	Standardisation experts		**H&R GmbH**
	Cities / Regions		**Aberdeen city council,**
	Associations		**Wind Europe**
	Research Organisations		**EMEC, European Gas Research Group (GERG), ICSI Rm. Valcea, University of Valladolid,** *Japan Petroleum Energy Center, NREL*
	Consultancies		*Deloitte Tohmatsu Consulting*
	Other		*METI*

Legend

Member

Chair

Co-chair

Observer

Working group composition - WG3

WG3 GO Commercialisation and use	Members		
	Category	**Sub-category**	**Stakeholders**
	Industry	Industrial gas	**Air Products, Air Liquide, Linde**
		Utilities	**Bischoff & Ditze Energy, EnerTrag, Engie, Engie Electrabel, Enovos, HYGRO, Statkraft Markets, Verbund**
		O&G	***Q8*, Shell**
		Other operators	**Colruyt, Group Machiels, Wind to Gas SüderMarsch**
		Equipment manufacturer	**Solenco Power,** *Hydrogen Technologies d.o.o*
		Automotive	**Daimler, Toyota Motor Europe**
	Fleet operators		**PitPoint**
	Cities/Regions		**Aberdeen City Council**
	Associations		**European Hydrogen Association (EHA), HyER, NOW, WaterstofNet**
	GO scheme experts		**AIB, RECS International**
	Research organisations		**EMEC,** *Japan Petroleum Energy Centre, Mizuho information and research institute*
	Consultancies		**Ecofys, EEI,** *Deloitte Tohmatsu Consulting*
	Other		*METI*

Legend

- **Member**
- **Chair**
- ***Co-chair***
- *Observer*

Working group composition - WG4

WG4 Regulatory framework

Members		
Category	**Sub-category**	**Stakeholders**
Industry	Industrial gasses	**Air Liquide, Linde**
	Utility	**EDF, Engie**
	O&G	**Shell, OMV**
	Equipment manufacturers	**FLD Technologies, Hydrogenics, Mitsubishi Hitachi Power System Europe**
	Industry associations	***Wind Europe***
	Other operators	**Colruyt**
Associations		**H2NL, Hydrogen Europe, NOW, WaterstofNet**
GO scheme experts		**CEN, ICSI Rm. Valcea, NEN**
Standardisation experts		**AIB, H&R, RECS International**
Research organisations		**Bilbao Faculty of engineering, GERG, EMEC**
Consultancies		*Deloitte Tohmatsu Consulting*

Legend

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- *Observer*

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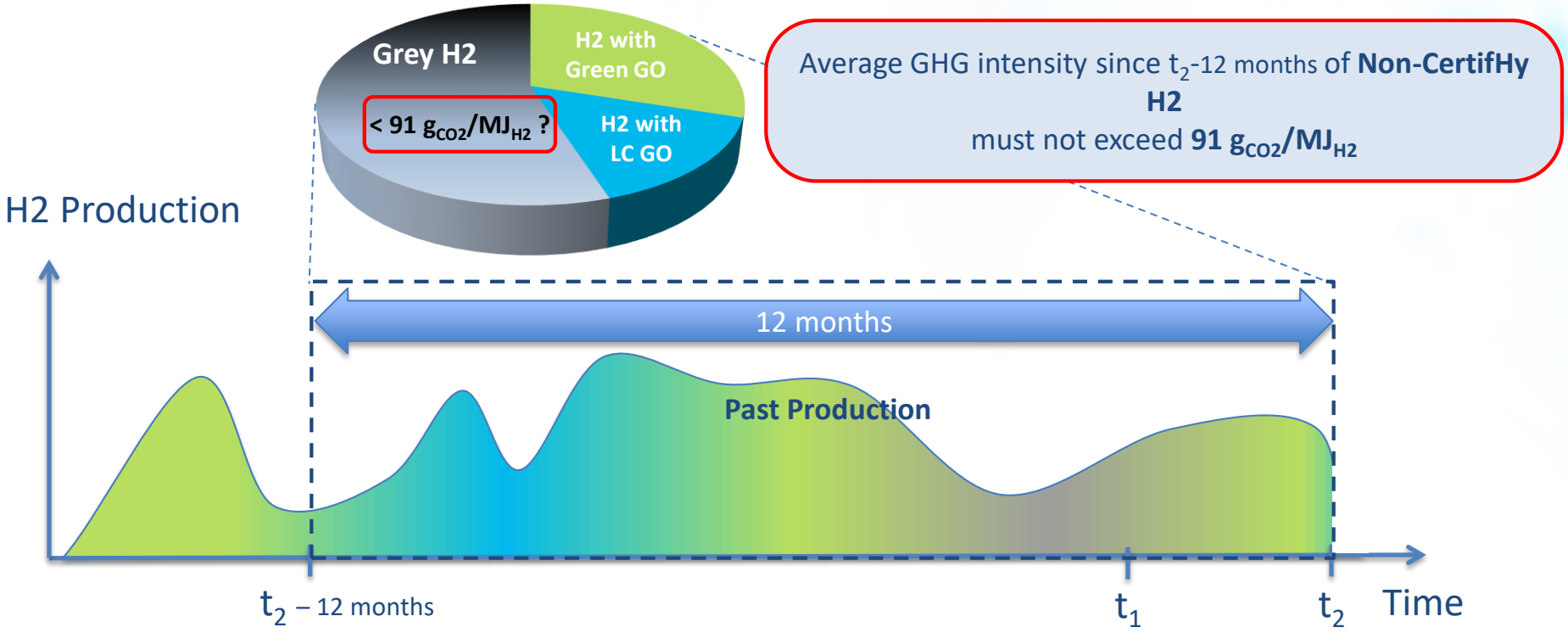
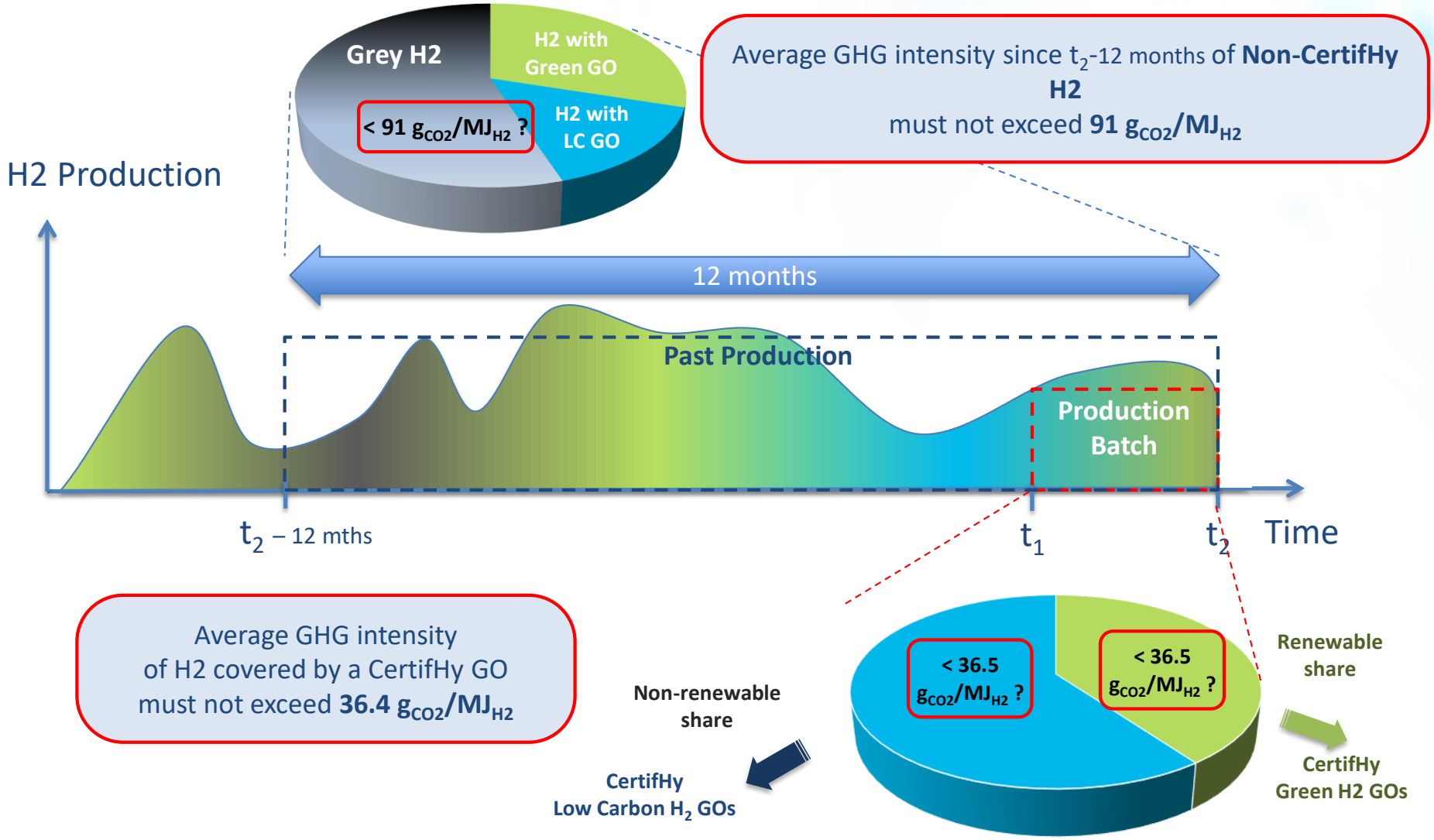
Application of Benchmark threshold on Past Production of the Hydrogen Plant



At the batch level, hydrogen needs to be Low Carbon for producing CertifHy Green or Low-Carbon GOs



Decision tree presenting the criteria for producing Low-Carbon and CertifHy Green H_2

Average **emissions** of **Non-CertifHy H_2 <91g$CO_{2\ eq}$/MJ** (benchmark)?

No

Production unit NOT ELIGIBLE

Yes

Renewable energy input into batch?

No

100% Non- renew. batch

Batch emissions < 36,4g$CO_{2\ eq}$/MJ (40% of benchm.)?

No

100% Grey H_2

Yes

100% Low-carbon H_2

Yes

X% renewable and and **(1-X%) non-renewable. share**

Renewable share emissions **< 36,4g$CO_{2\ eq}$/MJ ?**

No

X% Grey H_2

Yes

X% Green H_2

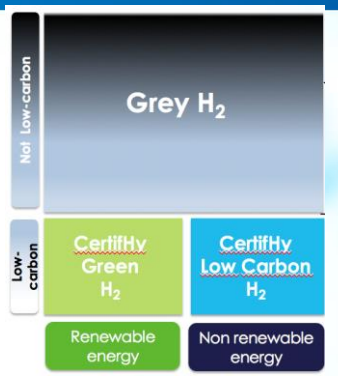
Non-renewable share emissions **< 36,4g$CO_{2\ eq}$/MJ ?**

No

1-X% Grey H_2

Yes

1-X% Low-carbon H2



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Q&A