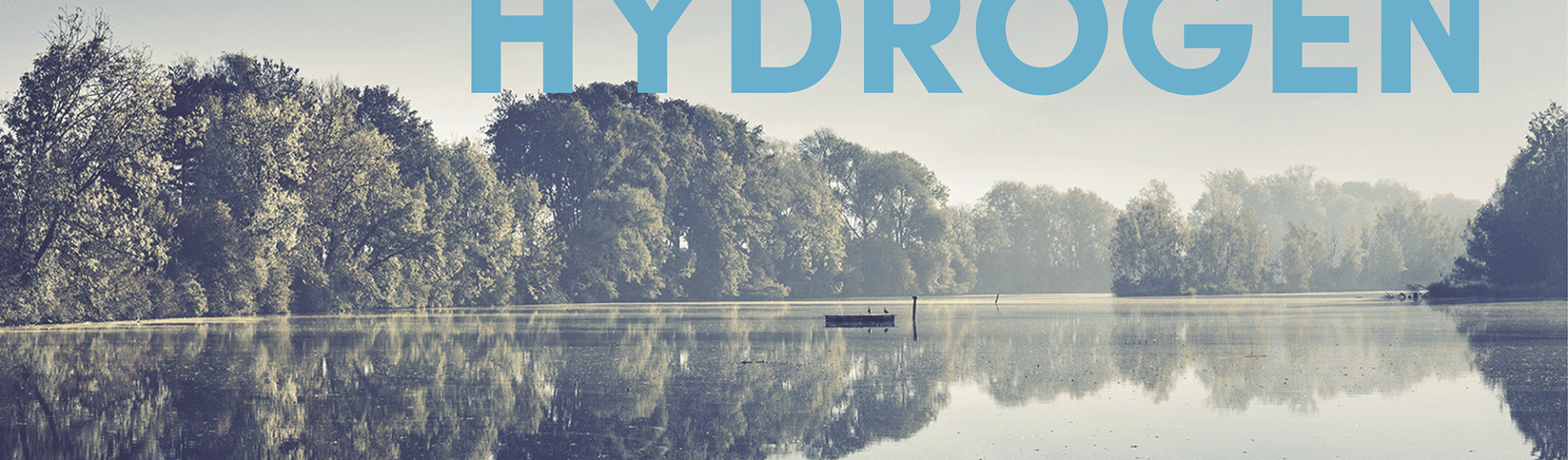


CEGH GreenHydrogen Index

GREEN HYDROGEN



Agenda

- **Introduction**
- CEGH GreenHydrogen Index
- AGGMs inGRID



Natural Gas

Gas trading places in Austria and in CEE:

- CEGH-VTP: benchmark hub for CEE region
- EEX CEGH Gas exchange markets in Austria and in the Czech Republic

Biomethane

Support the development of biomethane markets and its role in the future energy mix:

- CEGH GreenGas Platform
- EFET CEGH Standard Contract for Biomethane Certificates

Green Hydrogen

Support the development of hydrogen markets:

- CEGH Green Hydrogen Index
- Build-up of future hydrogen markets

CEGH GreenGas Platform

Easy access to trading in biomethane / GOs



- Platform was developed closely with market participants.
- CEGH GreenGas Platform allows buying and selling of (GOs) or bundled GOs together with biomethane or only biomethane without GOs.
- Connected Registers:
Austria: E-Control and Register AGCS
Germany: DENA register
- According to market feedback start as "bulletin board" and as "auction".
- Easy registration and newsletter function
- Expansion to other countries and extension of functionalities possible.
- EFET CEGH Biogas Certificate Standard Agreement was published in July 2023**

Filter Zurücksetzen

Status: ☒ offen, ☒ beendet, ☒ veröffentlicht, ☐ zurückgezogen

Unternehmen:

Angebots ID:

Seite:

Register:

Nachweis:

Land:

Veröffentlichungsdatum: to

Gebotszeitraum: to

GEROT SAUGABE BIS AUF WIDERRUF MÖGLICH

Veröffentlichungsdatum: 22.03.2023 11:08
Angebots ID: 846

Landwärme CE Trading Kft.

Produkt: Biomethan mit Herkunftsnachweis/Zertifikat
Register / Nachweis / Herkunftsländ: DENA / DENA Biogaszertifikat / Deutschland
Gebotszeitraum: bis auf Widerruf
Gefördert: Nein

Verkauf Minimum Preis: 172.80 €/ MWh

Menge	Lieferzeitraum
0,342 MWh/h	01.01.23 06.00 - 01.01.24 06.00

Menge: 3.004 MWh
Produkte (keine Gewähr) - Stand: 09.06.2021

EEG 2004 - Grundvergütung Biogas EEG 2009 - Grundvergütung Biogas EEG 2014 - Biomasse
EEG 2009 - Grundvergütung Biogas (auch Biomasse außerhalb BiomasseV) EEG 2017 - Biomasse (gesetzlich) EEG 2021 - Biomasse (Ausschreibung) EEG 2021 - Biomasse (gesetzlich)
EEG 2021 - Bioabfall (Ausschreibung) EEG 2021 - Einspeisevergütung ausgetriebene Anlagen Biogas (Biomasse)
E-Wärme 2008 - Wärmenutzung Bafög EnergieStG - Stromsteuerbefreiung (Biomasse)
TEHG - Befreiung von Abgabepflicht (Biomasse außerhalb MVO) KWKG 2017 - innovative Wärmespeichern
KWKG 2017 - innovative Wärmespeichern (Anteil Biomethan in KWKG) KWKG 2017 - Wärmenetze u. -speicher

GEROT SAUGABE BIS AUF WIDERRUF MÖGLICH

Veröffentlichungsdatum: 11.09.2022 13:50
Angebots ID: 808

Wien Energie Vertriebs GmbH & Co KG

Produkt: Herkunftsnachweis/Zertifikat
Register / Nachweis / Herkunftsländ: AGCS Biomethan Register Österreich / Biomethannachweis / Österreich
Gebotszeitraum: bis auf Widerruf

Verkauf Minimum Preis: 40.00 €/ MWh

Menge	Produktionszeitraum
876 MWh	01.12.21 - 01.01.22

Biomethan auf Basis von Biogas (B110000)

GEROT SAUGABE BIS AUF WIDERRUF MÖGLICH

Veröffentlichungsdatum: 11.09.2022 13:50
Angebots ID: 808

Wien Energie Vertriebs GmbH & Co KG

Produkt: Herkunftsnachweis/Zertifikat
Register / Nachweis / Herkunftsländ: AGCS Biomethan Register Österreich / Biomethannachweis / Österreich
Gebotszeitraum: bis auf Widerruf

Verkauf Minimum Preis: 40.00 €/ MWh

Menge	Produktionszeitraum
848 MWh	01.11.21 - 01.12.21

Biomethan auf Basis von Biogas (B110000)

CEGH GreenHydrogen Indices

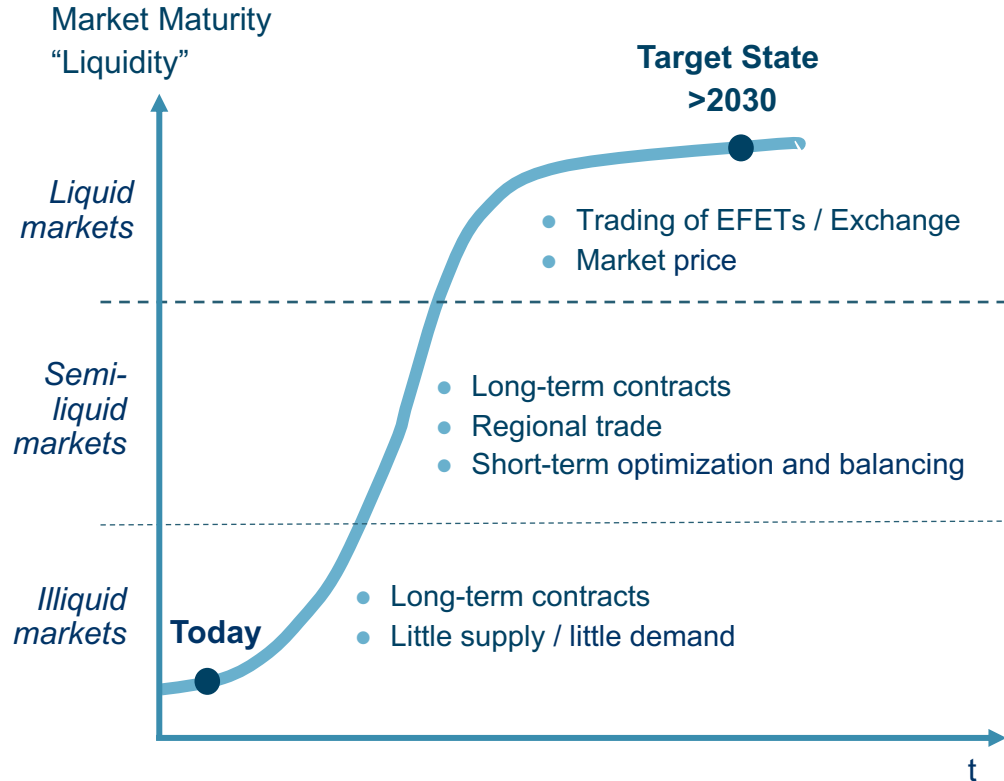
- **CEGH Hydrogen Indices facilitate** monitoring the „cost gap“ between hydrogen and alternative sources of energy supply and enables market participants to evaluate business cases for hydrogen projects.
- **Further enhancements of price assessments** planned once the hydrogen market becomes more liquid (e.g. benchmarking costs of supply, “net-back pricing”).

Stakeholder Dialogue

- **CEGH engages with key stakeholders** including politicians, regulators, producers and offtakers.
- Key areas for alignment include regulatory frameworks (e.g. third-party access to hydrogen infrastructure), market model (entry-/exit system vs. physical hub), balancing code, design of framework agreements etc.

Green Hydrogen – Development of Liquidity

Different Instruments in Different Market Maturity Stages



Green hydrogen / GOs of green hydrogen

Useful trading instruments to be offered:

Exchange (financial Clearing / Clearinghouse)

Platform based trading (Broker)

Balancing instruments

Standardized contracts (EFET)

Build-up of institutional & regulatory requirements

Price Information & Transparency

Auction- / Bulletin-Board / "Physical" Services
(Work in Progress)




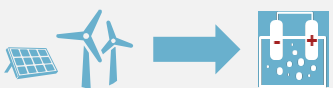
Agenda

- Introduction
- **CEGH GreenHydrogen Index**
- AGGMs inGRID

CEGH GreenHydrogen Indices (since Dec 2022)

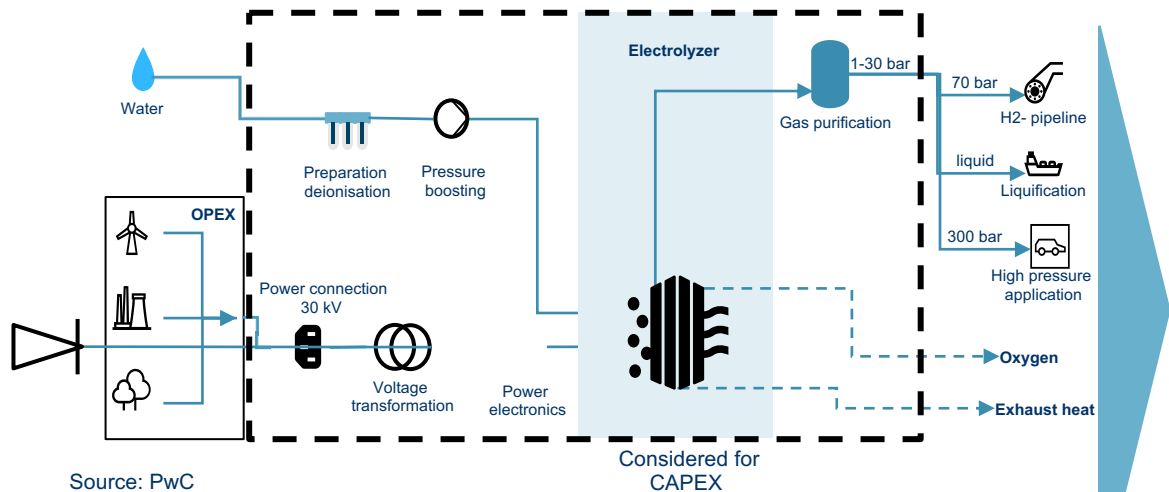
Measuring the Value of the Various “Shades” of Green Hydrogen



Index	Green Power Supply for Hydrogen Production	Product Definition
CEGH GreenHydrogen Spot Index	 <ul style="list-style-type: none"> Sourcing of “grey” power in the day-ahead market Sourcing of guarantees of origin via exchange / platforms 	<ul style="list-style-type: none"> Cheapest Day-ahead power prices optimized with a yearly hPfc
CEGH GreenHydrogen Forward Index	 <ul style="list-style-type: none"> Sourcing of “grey” power in forward markets Sourcing of guarantees of origin via exchange / platforms 	<ul style="list-style-type: none"> Cheapest Monthly, Quarterly, Seasonal and Yearly power prices optimized with yearly hPfc
CEGH GreenHydrogen PPA 40 Index	 <ul style="list-style-type: none"> 40% of green power (renewable PPA) and 60% “grey” power (forward) Sourcing of guarantees of origin via exchange / platforms 	<ul style="list-style-type: none"> Combination of 10 Years PPA and Optimized Grid Supply
CEGH GreenHydrogen PPA 100 Index	 <ul style="list-style-type: none"> 100% sourcing of green power via power purchase agreements (renewable PPA) 	<ul style="list-style-type: none"> 10 Years PPA Pay as Produced

Cost-Plus-Approach for Hydrogen Indices

Battery Limits applied for Capex Calculation



- Estimated Capex for electrolyzer is re-assessed on a regular basis
- Consideration of learning curve effects for „forward“ hydrogen price assessments

Cost of green power supply
+ Capex
= **“Cost-Plus”-Value of Green Hydrogen**

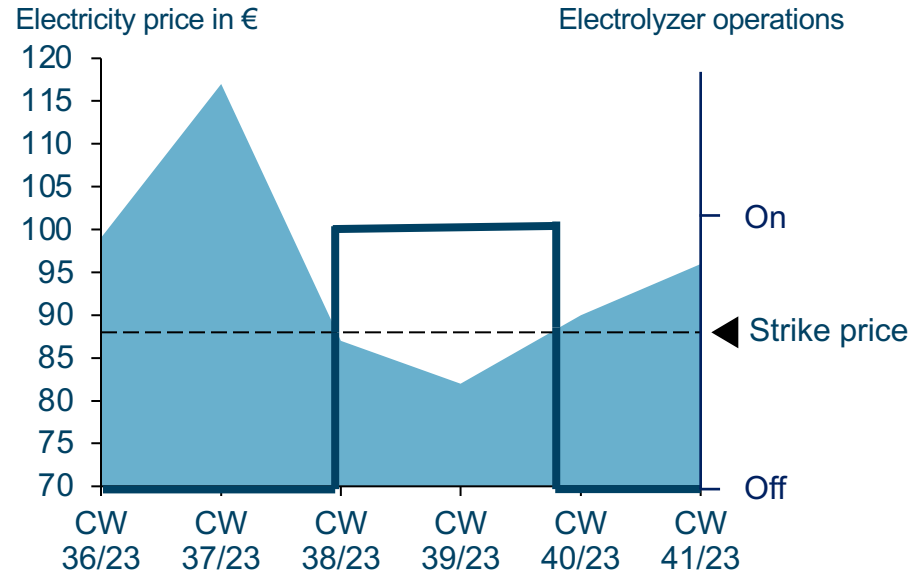
CEGH GreenHydrogen Spot & Forward

Operation of the Electrolyzer – Determined by Price Forward Curve

Modelling electricity procurement costs

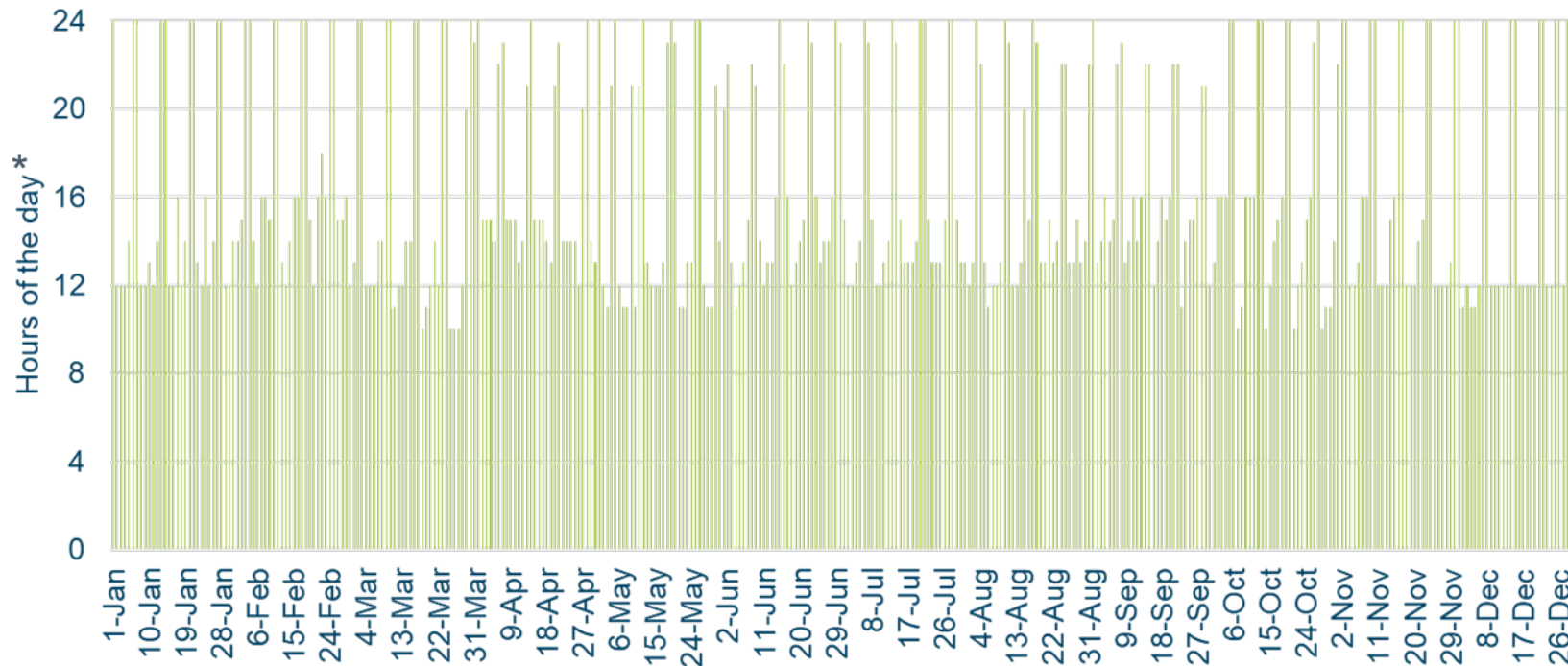
- The basis for optimizing the operation of the electrolyzer is the price forward curve
- It is assumed that the electrolyzer produces each month during the cheapest 500 hours / month (i.e. in total 6.000 FLH / year)
- Therefore, the electrolyzer runs in a cycling mode as cheapest hours occur / are forecasted

Electrolyzer production profile (illustrative)



CEGH GreenHydrogen Spot & Forward

Optimized Production Profile



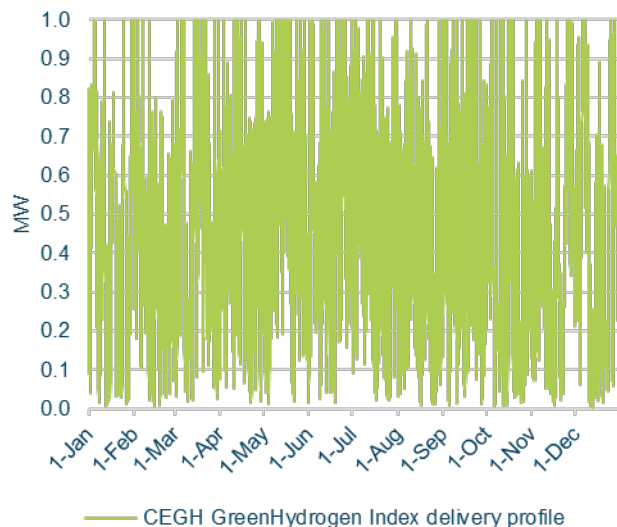
*total operating hours per day, necessarily not consecutive hours

CEGH GreenHydrogen and PPA 40 Index

Additional Procurement of Power Volumes

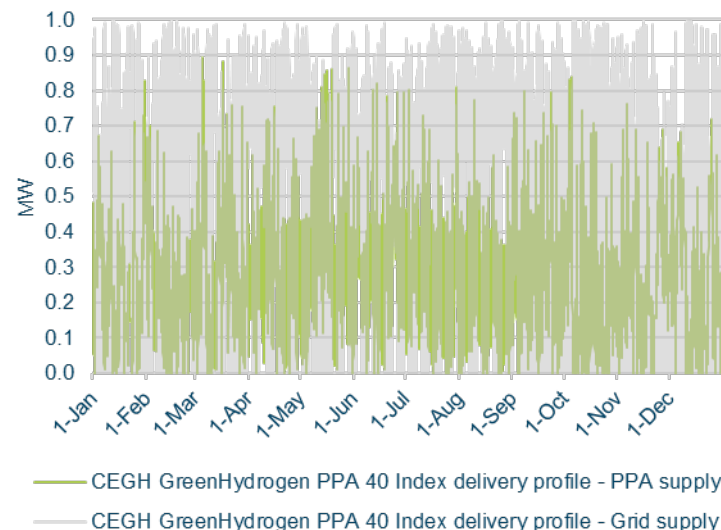


GreenHydrogen Electricity Procurement



- Only PPA power supply

PPA 40 Electricity Procurement



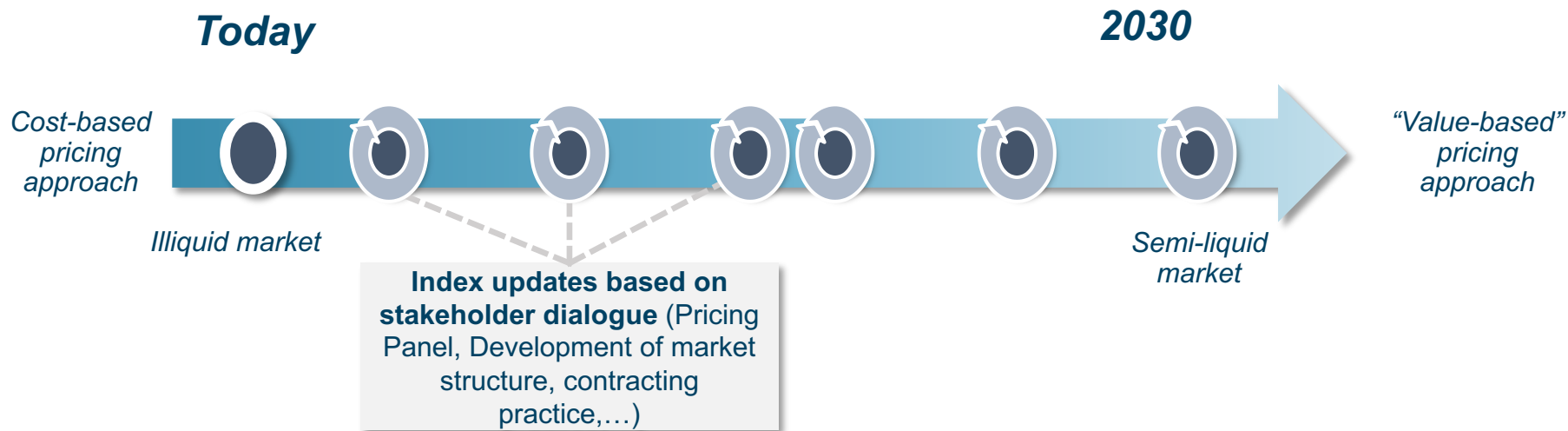
- PPA power supply amended with grid power + GoO

In the CEGH GreenHydrogen Index, the number of full-load hours is reduced to approx. 4,000 leading to an economic lifetime of the electrolyzer of approx. 15 years.

PPA40 – Purchase of green electricity to come to approx. 6,000 full-load hours

Continuous Alignment of Index Design

- Ongoing Stakeholder Dialogue ensures continuous Alignment of Index Design to evolving Hydrogen Market



Update Reflects Changed Market Conditions

Two major changes:

- **RED III and delegated acts in place**, ie. separation of RED III compliant index and other (grid power plus GoO) indices
- **Changed market conditions re. CAPEX**, interest rates, power prices

Basic index approach stays, i. e.

- Cost plus index
- Battery limits
- Electrolyzer capacity: 10 MW
- Indices

RED III and Delegated Acts now Decided

- Only **renewable power as basis for RED III compliant** renewable hydrogen
- Additional requirements acc. to delegated acts:
 - **Additionality** (power source max. 36 months older than ELY and not supported via EEG)
 - **Simultaneity** (- 2029: month, 2030ff: hour or price in bid zone < 20 EUR or 0,36 * to CO₂)
 - **Proximity** (same bid zone)
 - OR power production in **bid zone >90% renewable** (last year)¹⁾
- Only RED III compliant hydrogen eligible for national target fulfilment and support schemes
- Low-carbon fuels (e. g. hydrogen based on nuclear power, blue hydrogen, hydrogen based on grid power) are not counted towards national target achievement; nevertheless, electrolyzers can be operated based on grid power plus GoO's delivering "low carbon hydrogen"²⁾

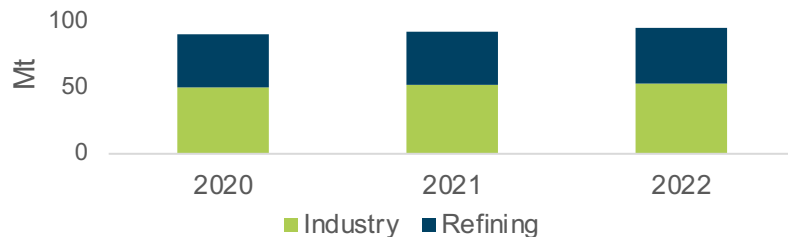
1) Additional requirements: Electrolyzer operating hours < Renewable power production hours in bid zone or emission intensity in bid zone < 18gCO₂/MJ

2) Proposal to regulate "low carbon hydrogen" expected to be decided by Dec. 31, 2024

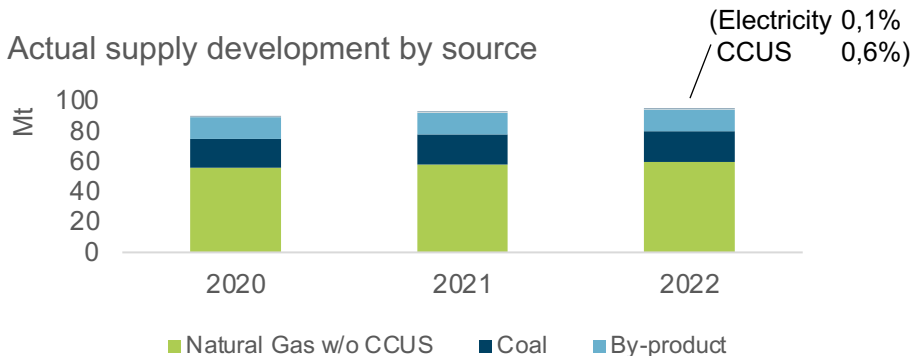
Green Hydrogen Market Development

Despite Huge Announcements Only Little Implementation yet

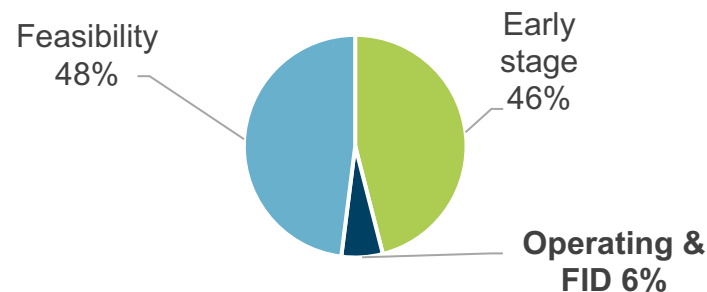
Actual demand development by offtake industry



Actual supply development by source



Forecast 2030



iea
Global hydrogen
review 2023

“The private sector has started [...], but **efforts remain at very small scale.**”

“Only **4%** of announced projects have taken **FID**”

Transforming H₂ into deployment **remains a struggle**

Updated Calculation Parameters

Implemented by 23 October 2023








- WACC from 8% to 9%
- CAPEX increase on currently observed levels (by 14% due to general cost increases and delivery shortages; only partially offset by larger electrolyzer units)
- PPA update on current environment
- Grid Costs, OPEX furthermore not considered¹⁾, but indication given how much that would add to the hydrogen price

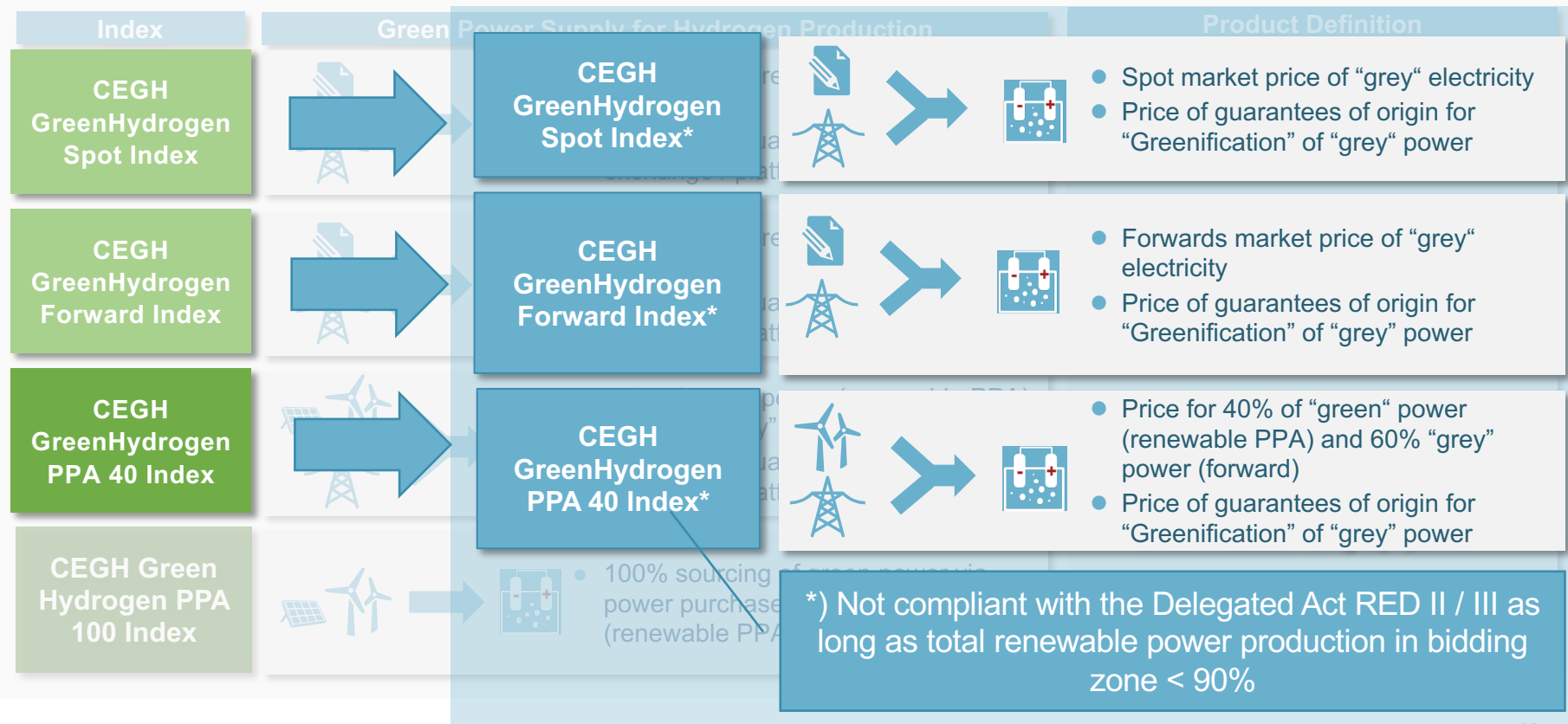
1) Grid cost exemption for electrolyzers still valid, prolongation in discussion

Renaming of Index to Show RED II & III Compliance

Only the CEGH GreenHydrogen Index is RED II & III Compliant

Index	Green Power Supply for Hydrogen Production	Product Definition
CEGH GreenHydrogen Spot Index	 <ul style="list-style-type: none"> • Sourcing of “green” power via ahead market • Sourcing of guarantees of origin via exchange / power purchase agreement 	CEGH GreenHydrogen Index* <p>According to market feedback, the compliance with the Delegated Act (DA), RED 2 should be stronger visible within the set of CEGH indices.</p> <p>The CEGH GreenHydrogen PPA 100 Index is the only CEGH Index – for the time being - that is compliant with the DA.</p> <p>We therefore rename the index to CEGH GreenHydrogen Index and will mark it accordingly in our publication (website, presentations, etc.).</p>
CEGH GreenHydrogen Forward Index	 <ul style="list-style-type: none"> • Sourcing of “green” power via ahead market • Sourcing of guarantees of origin via exchange / power purchase agreement 	
CEGH GreenHydrogen PPA 40 Index	 <ul style="list-style-type: none"> • 40% of green power via power purchase agreement and 60% “green” power via exchange / power purchase agreement • Sourcing of guarantees of origin via exchange / power purchase agreement 	10 Year Baseload H2
CEGH GreenHydrogen PPA 100 Index	 <ul style="list-style-type: none"> • 100% sourcing of green power via power purchase agreement (renewable PPA) 	 <ul style="list-style-type: none"> • 100% sourcing of green power via power purchase agreement • Price for 100% of “green” power • Separate purchasing of guarantees of origin not necessary

Renaming of Indices not RED II / III Compliant



Results of the CEGH GreenHydrogen Model Update

Published From 23 October 2023 Onwards



		Based on Trading Day 20th Oct 2023	
		Old Model Calculation	New Model Calculation
in EUR/MWh			
CEGH GreenHydrogen Index		156.691	201.952
CEGH GreenHydrogen PPA 40 Index*		158.841	193.270
CEGH GreenHydrogen Spot Index*		200.766	208.053
CEGH GreenHydrogen Forward Index*	Month+1	206.249	213.536
	Month+2	212.495	219.782
	Quarter+1	234.130	241.417
	Season+1	214.924	222.210
	Season+2	226.385	233.672
	Calendar+1	220.654	227.941
	Calendar+2	198.196	204.463
	Calendar+3	181.010	187.277

*) not compliant with the Delegated Act (DA), RED 2

CEGH GreenHydrogen Indices on CEGH's Website



Publication Date: 24.10.2023

 [download.CSV](#)

CEGH GreenHydrogen Index*

Delivery Period	EUR/MWh
10-Year PPA Pay-as-Produced	202.481

*Based on 100% power purchase agreement (PPA) supply, compliant with the Delegated Act, RED II.

CEGH GreenHydrogen PPA 40 Index**

Delivery Period	EUR/MWh
10-Year Pay-as-Produced	193.485

CEGH GreenHydrogen Spot Index**

Delivery Period	EUR/MWh
24-Oct-2023	209.668

CEGH GreenHydrogen Forward Index**

Delivery Period	Maturity	EUR/MWh
November	Month +1	210.817
December	Month +2	216.154
Q1 2024	Quater +1	243.187
Summer 2024	Season +1	223.599
Winter 2024	Season +2	235.517
Calendar 2024	Calendar +1	229.558
Calendar 2025	Calendar +2	204.334
Calendar 2024	Calendar +3	188.179

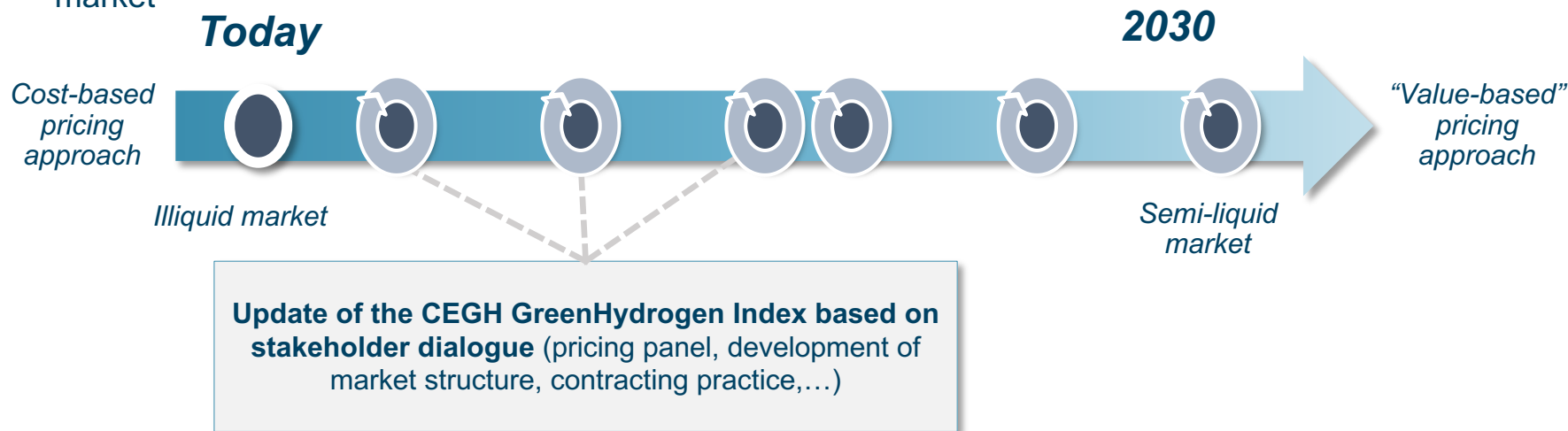
**Based on power supply, not compliant with the Delegated Act, RED II.

[Go to CEGH GreenHydrogen Index](#)

[Go to CEGH GreenHydrogen Index Specifications](#)

Continuous Alignment of Index Design

- New specification documents (clean and track changes) available on CEGHs website
- Ongoing stakeholder dialogue ensures continuous alignment of index design to evolving hydrogen market



- Regular update of PPA prices and / or other parameters like CAPEX to smoothen the impact of parameter changes on the index results



Thank you!