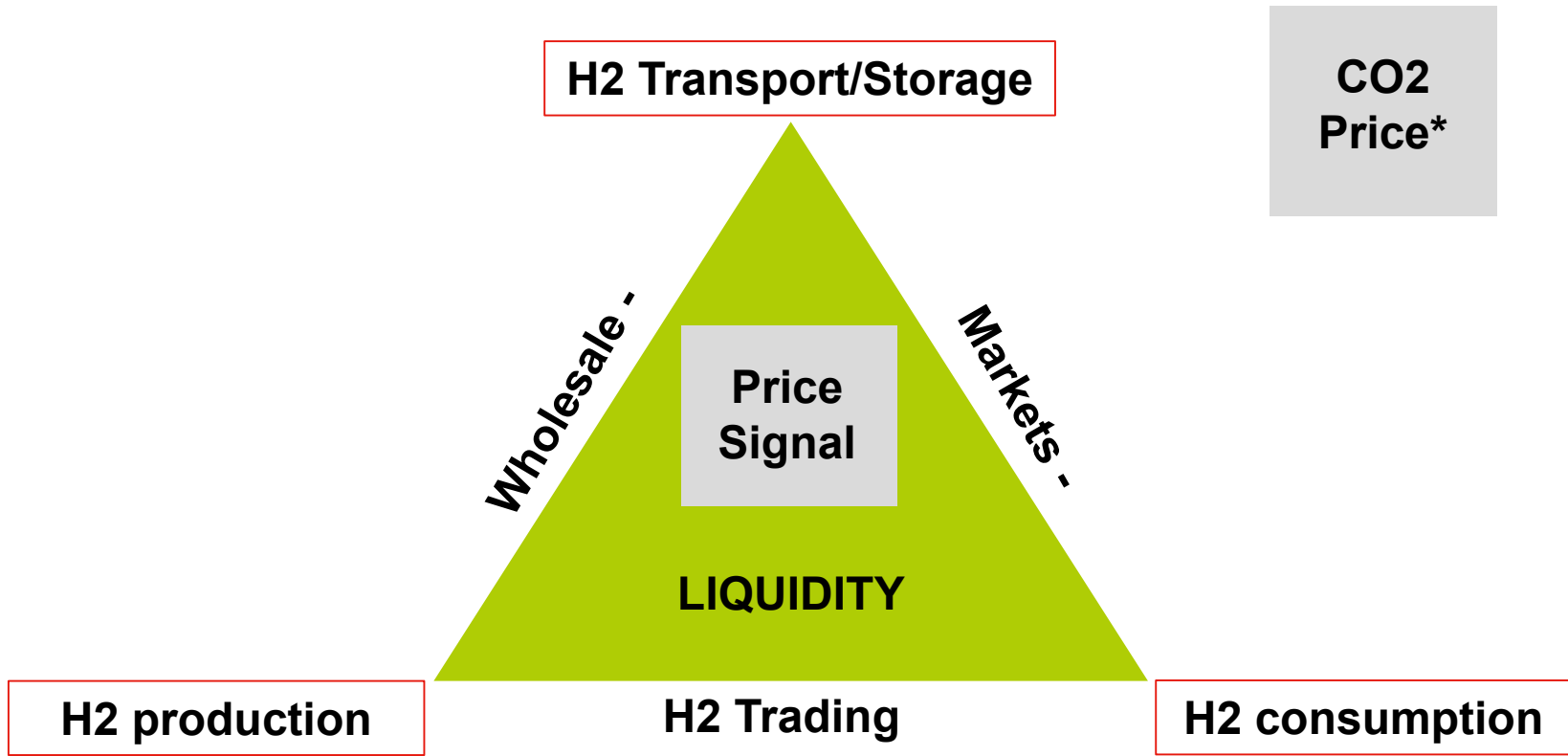
A composite image featuring a blue sky with white clouds at the top, a white hydrogen storage container with a blue 'H2' logo in the middle, and a green field with solar panels and wind turbines at the bottom.

“What is required to ramp up markets for (green) hydrogen? What role can energy exchanges play?”

Daniel Wragge, Director Political & Regulatory Affairs, EEX  
Istanbul

21./22. September 2023

# Hydrogen markets + price signals are pivotal for the ramp-up of a hydrogen economy



Source: European Energy Exchange

\* including application through CBAM

- H2-wholesale market = link between the different stages of the value chain
  - Price signal = Investment signal + allocation function + CO2-abatement
- => State subsidies also need to foster the ramp-up of H2-markets (“HUB”)

A composite image showing a green field in the foreground, a white hydrogen storage container with 'H2' branding in the middle ground, and wind turbines and solar panels in the background under a blue sky with clouds.

Thank you for your attention!

[daniel.wragge@eex.com](mailto:daniel.wragge@eex.com)

REPOWERING THE FUTURE



THE TURKISH HYDROGEN MARKET

*- MARKET DEVELOPMENT FOCUSED -*





## ERIH AT A GLANCE

- ERIH is a global renewable energy company, founded in 2008 in Ankara. ERIH has been involved in more than 3 GW of renewables in 13 countries. We have invested in 7 solar parks and 1 wind power plant in 4 countries.
  - ERIH has been working on the development of Hydrogen projects since 2020 and is now the 50 per cent shareholder of the Joint Venture company called ADA Hydrogen Investment Holdings B.V. (ADAH<sub>2</sub>) with Pan-African Soleil Holdings Inc. (PASH).
  - Goal of ADAH<sub>2</sub> is to develop and invest into green hydrogen, green ammonia and other derivatives of H<sub>2</sub>.
  - PASH is a London headquartered impact investor company established in 2012 to develop, finance, build, operate and maintain clean power assets globally. PASH is funded by Galena Asset Management, part of the Trafigura Group, and is looking to invest £3 billion over the next 5 years.
  - ADAH<sub>2</sub> has an agreement with PASH to develop green hydrogen projects in 7 countries, with the aim of reaching 3 GW of electrolyser capacity along with sufficiently sized renewables' projects. In Turkey and Paraguay, development sites have been identified and applications are being made.
-



## TURKIYE – A Dynamic Development Market & Rapid Deployment Capability

- In the early 2000's, Turkiye's regulatory authorities were engaged in a progressive 'renewables agenda', focusing on the rapid development of the country's significant wind potential.
- Under YEKDEM (Renewable Energy Support Mechanisms) a FIT was introduced along with additional benefits and guaranteed prices for local manufacture of key components.
- Solar PV, particularly following a 2014 change in 'unlicensed market' (<1MW) regulations, resulted in a rapid increase of installations and saw Turkey become one of the major solar installing countries.
- The rapid growth of installations phase was short-lived. After a period of 3,5 years, Türkiye changed course towards bidding mechanisms and increasingly larger, centralized solar projects. New installation figures for solar drops sharply.
- The industrial demand for cleaner and more affordable energy lead to a change in legislation by the Ministry of Energy, resulting in the rebounding of solar installations for self-consumption projects.





## Strengths

- Turkiye has a very strong base of project developers & implementers.
- It has excellent solar irradiation, good on-shore and excellent off-shore wind potential.
- There is no shortage of willing & able investors, with substantial experience in Renewable Energy.
- There are already many Hydrogen initiatives in place that are actively trying to form Hydrogen Development Hubs and/or projects .
- Turkiye has a declared Hydrogen Energy Strategy and Renewable Energy Installation targets for 2035. The right signals from regulatory authorities would allow developers and investors to engage.
- Strong trade relations with Europe which is poised to become the primary market for green H2 products.

## In Need Of

- Well established Project development regulation that allows for all forms of Hydrogen derivatives and a wide spread of Project Sizes (in terms of kg per day).
- Either a Feed in Tariff or a CfD like mechanism to bolster financial feasibility and bring H2 closer to its consumers and markets.
- Availability of international Project finance and a means of integration to an international derivatives market.
- Close collaboration with off-takers to define the demand and choose the right Project sizes.



Thank you for listening

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*T: +90 532 569 6057*



# ENERJİSA ÜRETİM APEX CONFERENCE

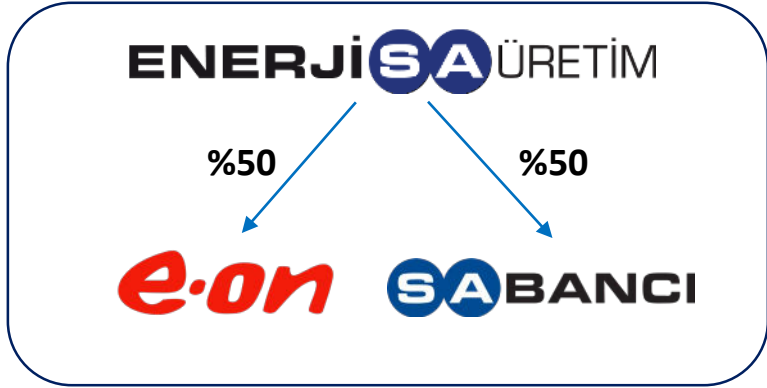
Istanbul – 2023

*Üretiyoruz.*  
ENERJİSA ÜRETİM



# Enerjisa Üretim

Power generation and energy trading company with diversified asset base.



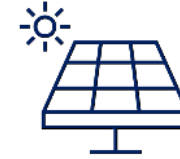
12 Hydroelectric

1354 MW



5 Wind

332 MW



5 Solar

40 MW



3 Natural Gas

1,583 MW



1 Lignite

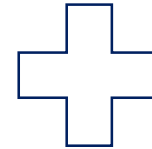
450 MW

23

Power Plants

3727 MW

Total Installed Capacity



2 bn\$ Trading Volume

with Power and Gas Deals  
in Türkiye and Europe



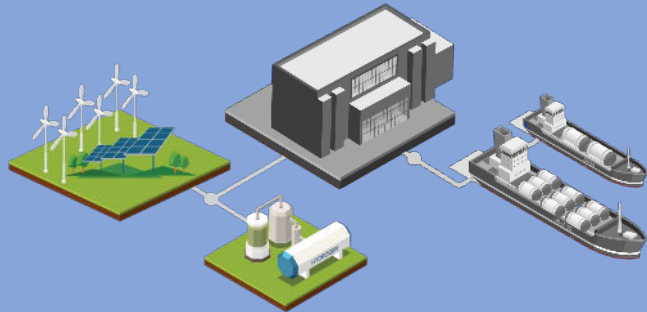
Voluntary Carbon and Green Certificates Deals  
in 20 countries

# Enerjisa Üretim Hydrogen Strategy

Utilizing Turkey's renewable potential and geopolitical position, Enerjisa Üretim intends to be a major player in the domestic and European green hydrogen markets.

## Distributed production with local consumers

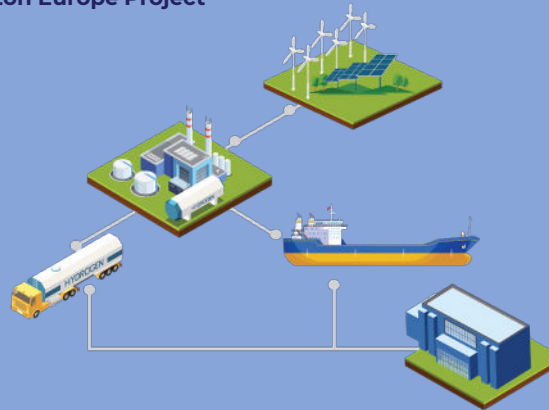
### Local collaboration/ On-site generation



**On-site** green hydrogen generation by **collaborating** with local consumers. The significant driving factors are the knowledge sharing in **port management, export**, and the production of hydrogen derivatives, as well as the **reduction of Opex and Capex**.

## Regional hydrogen production

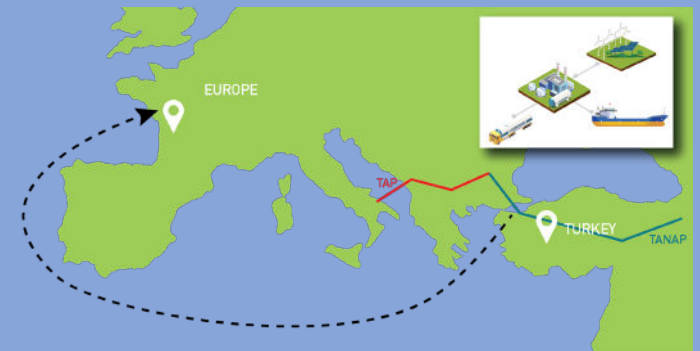
### Horizon Europe Project



Develop and demonstrate a **hydrogen valley** covering a defined geographical area in which hydrogen serves in general more than one end user or application in mobility, industry and energy.

## Large - Scale green hydrogen project

### Development of large-scale green hydrogen project.



The production of **large-scale green hydrogen** in Turkey and its sale to the **local and European market** as green hydrogen or its derivatives. Evaluation of all possible transportations methods to **export to Europe**.

**ENERJISA ÜRETİM**

Open to all possible cooperation with local consumers.

HYSouthMarmara project was selected to be funded within the Clean Hydrogen Partnership 2022 Second Call.

Feasibility study has is progressing out with Technip Energies.



# ENERJİSA ÜRETİM

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2023

*Üretiyoruz.*  
ENERJİSA ÜRETİM



# **CEGH GreenHydrogen Index**

## **APEX CONFERENCE**

22 September 2023

Istanbul

CEGH GreenHydrogen Index

**GREEN  
HYDROGEN**



## CEGH GreenHydrogen Indices

- **CEGH Hydrogen Indices facilitates** 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.

# CEGH GreenHydrogen Indices

Regulations are the main Driving Force for Different “Hydrogen Colors”



	“Grey” H <sub>2</sub>	Green H <sub>2</sub>	H <sub>2</sub> Blend	Renewable H <sub>2</sub> <sup>1</sup>
Illustration				
Electricity procurement	Electricity is procured from the grid, therefore the hydrogen produced does not meet any requirements for labelling	Electricity is procured from the grid and, additionally, GoOs are purchased from marketplaces	Green electricity is either procured via direct line or PPA as well as regular (“grey”) electricity from the grid	Green electricity is either procured via direct line or PPA
(Regulatory) requirements	No additional requirements concerning the operation of the electrolyzer	No additional requirements concerning the operation of the electrolyzer	Balancing of renewable electricity and hydrogen production for min. 40% of the production volume	Hourly balancing of renewable electricity and hydrogen production for 100% of the production volume
CEGH Index	-	CEGH Green Hydrogen Spot & Forward Index	CEGH Green Hydrogen PPA 40 Index	CEGH Green Hydrogen PPA 100 Index

<sup>1</sup>In line with requirements REDII Delegated Act



# CEGH GreenHydrogen Indices on CEGH's Website



Publication date: 19.09.2023

 download.CSV

## CEGH GreenHydrogen PPA 100 Index

Delivery Period	EUR/MWh
10-Year Baseload	156.405

## CEGH GreenHydrogen PPA 40 Index

Delivery Period	EUR/MWh
10-Year Baseload	161.602

## CEGH GreenHydrogen Spot Index

Delivery Period	EUR/MWh
19-Sep-2023	110.117

## CEGH GreenHydrogen Forward Index

Delivery Period	Maturity	EUR/MWh
October 2023	Month +1	165.664
November 2023	Month +2	195.834
Q4 2023	Quarter +1	189.103
Winter 2023	Season +1	202.492
Summer 2024	Season +2	200.656
Calendar 2024	Calendar +1	212.957
Calendar 2025	Calendar +2	199.531
Calendar 2026	Calendar +3	182.945

➤ [Go to CEGH GreenHydrogen Index](#)

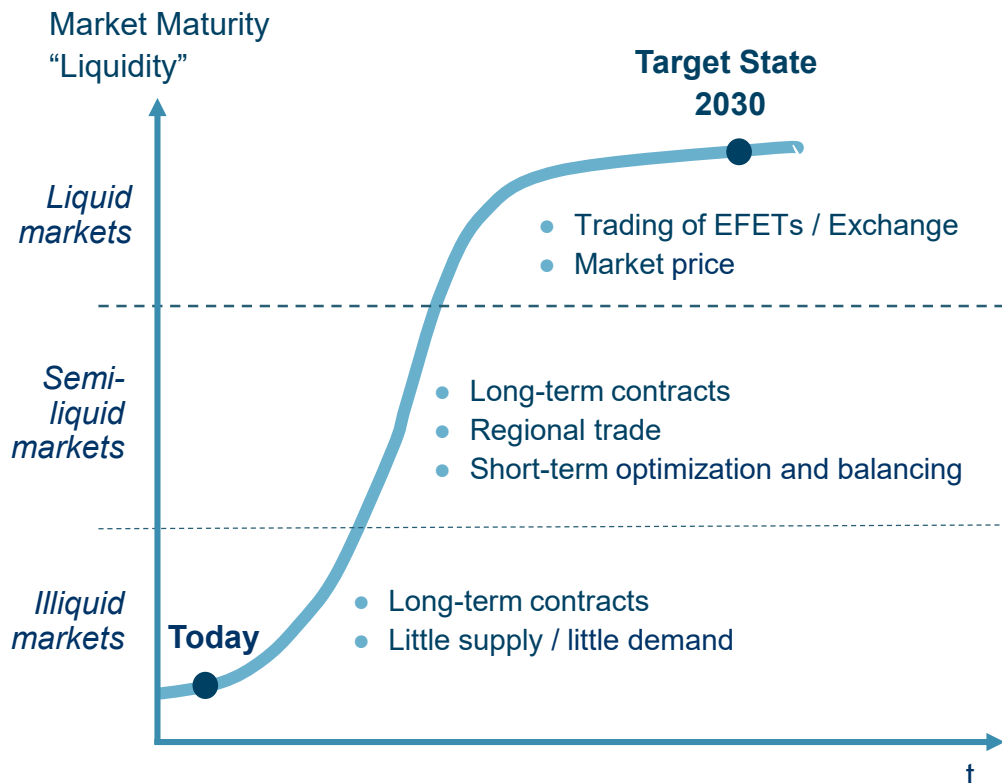
➤ [Go to CEGH GreenHydrogen Index Specifications](#)



**THANK YOU  
FOR YOUR  
ATTENTION!**

# 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)**

# CEGH Green Hydrogen Indices measure the Value of various “Shades” of Green Hydrogen

Index	Green Power Supply for Hydrogen Production	Product Definition	Update
CEGH Green Hydrogen Spot Index	 <ul style="list-style-type: none"> <li>• Sourcing of “grey” power in the day-ahead market</li> <li>• Sourcing of guarantees of origin via exchange / platforms</li> </ul>	<ul style="list-style-type: none"> <li>• Over 24 hours optimized average baseload H2 Delivery</li> </ul>	<ul style="list-style-type: none"> <li>• Daily</li> </ul>
CEGH Green Hydrogen Forward Index	 <ul style="list-style-type: none"> <li>• Sourcing of “grey” power in forward markets</li> <li>• Sourcing of guarantees of origin via exchange / platforms</li> </ul>	<ul style="list-style-type: none"> <li>• Monthly, Quarterly, Seasonal and Yearly Products</li> <li>• Baseload delivery</li> </ul>	<ul style="list-style-type: none"> <li>• Daily</li> </ul>
CEGH Green Hydrogen PPA 40 Index	 <ul style="list-style-type: none"> <li>• 40% of green power (renewable PPA) and 60% “grey” power (forward)</li> <li>• Sourcing of guarantees of origin via exchange / platforms</li> </ul>	<ul style="list-style-type: none"> <li>• 10 Year Baseload H2</li> </ul>	<ul style="list-style-type: none"> <li>• Daily</li> </ul>
CEGH Green Hydrogen PPA 100 Index	 <ul style="list-style-type: none"> <li>• 100% sourcing of green power via power purchase agreements (renewable PPA)</li> </ul>	<ul style="list-style-type: none"> <li>• 10 Year Baseload H2</li> </ul>	<ul style="list-style-type: none"> <li>• Daily</li> </ul>



**ZETA**

An initiative of Dii Desert Energy

# ZETA

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ZERO EMISSIONS TRADERS ALLIANCE



**ZETA**

An initiative of Dii Desert Energy

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**ZETA (Zero Emissions Traders Alliance)** is a non-profit foundation designated to create a transparent market design for liquid no-emissions traded markets in the MENA-region, registered in The Netherlands in May 2023

[www.zeta-global.org](http://www.zeta-global.org)

[secretariat@zeta-global.org](mailto:secretariat@zeta-global.org)



**ZETA**

An initiative of Dii Desert Energy

## Only Energy Markets can deliver net zero

- ✓ Companies investing in CO<sub>2</sub>-reduction make investments towards the future
- ✓ RES-projects create long term exposures in green molecules, these need to be hedged in a market, LT Agreements do not offer price risk management
- ✓ More liquidity → Lower price over time → Need to Hedge
- ✓ Price Transparency → market confidence in H<sub>2</sub> (derivatives)
- ✓ Fair price discovery for green molecules, CO<sub>2</sub>, H<sub>2</sub>, RES etc.
- ✓ Using incentives for companies to reduce emissions
- ✓ additional benefits though optimization with
- ✓ green certificates that are standardized, fungible and
- ✓ Globally accepted to deliver value for compliance buyers

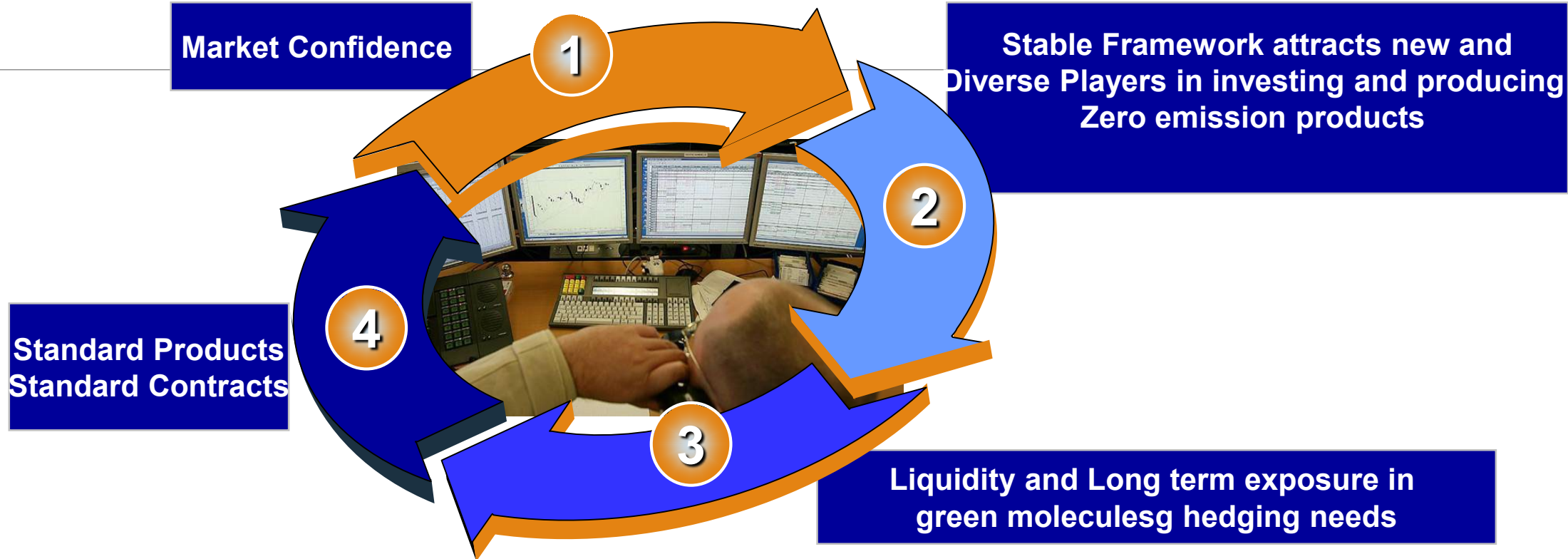




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# Net Zero Market Development







**ZETA**

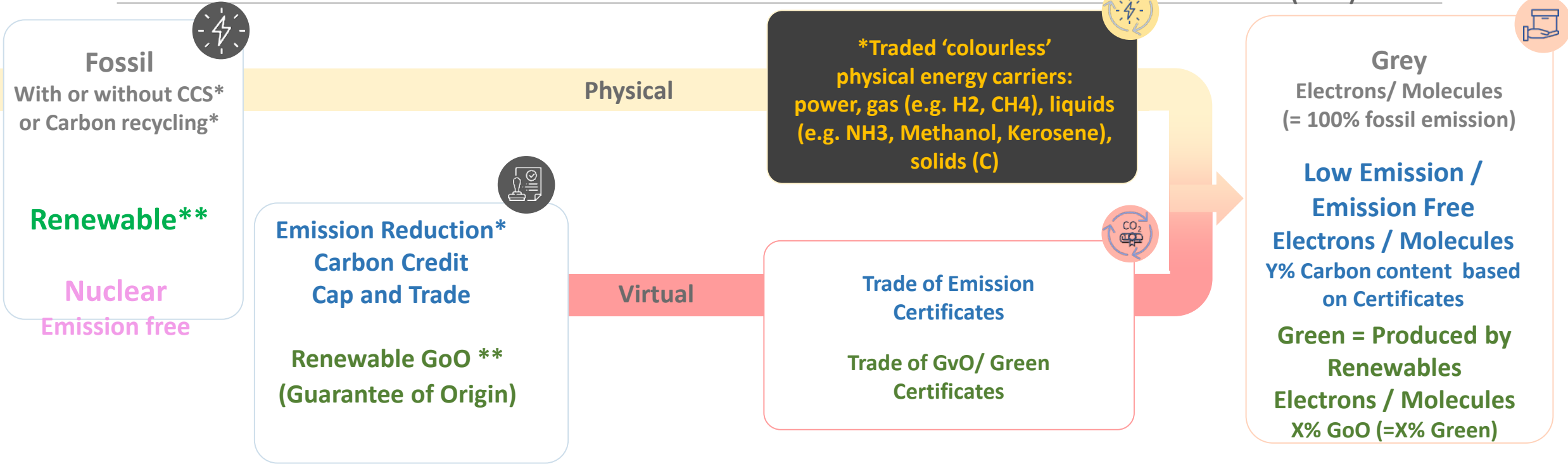
An initiative of Dii Desert Energy

**Energy Sources**

**Certificates**

**Traded Markets**  
Price discovery  
Power, Gas, Hy Exchanges

**(Emission Free) Products**  
for Industry Off-takers and  
(End-)Consumers



\* Principle: GoO (Green certificates) can be transferred among electrons or molecules (e.g. H<sub>2</sub>, Efuels)