

TNO innovation
for life



SHIP>NL
SUSTAINABLE HYDROGEN IMPORT PROGRAM

» AGENDA

SHIP>NL SESSIE I 18 JANUARI 2023

15:00-15:30 WELKOM EN TOUR DE TABLE

15:30-16:15 DEEP DIVE: MANAGING FUTURE SECURITY OF LOW CARBON HYDROGEN SUPPLY | CIEP

16:15-17:00 DISCUSSIE: WORLD HYDROGEN SUMMIT 2023: POSITIONERING NL ALS WATERSTOFHUB | RVO

17:00-18:00 AFSLUITING EN BORREL

MEERJARIG KENNISPROGRAMMA MET 5 LIJNEN

In deze sessie:

1 Technisch economisch	2 Beleid	3 Markt	4 Internationaal	5 Omgeving
<ul style="list-style-type: none"> ▪ Inzicht in importketens productie-conversie-transport-opslag-reconversie-gebruik ▪ Vraagontwikkeling, scenario's ▪ Infrastructuur & systeemintegratie: corridors, benutten bestaande infra. ▪ Technology assessments, R&D 	<ul style="list-style-type: none"> ▪ Impact van 'Fit for 55', REDII, Delegated acts, ETS/CBAM, etc. ▪ Impact van certificering en CO2 allocatie: emissiefactoren, LCA ketenanalyse, etc. ▪ Financiering en stimulering (EU & NL): IPCEI, PCI, TEN-E, JTF, EIB, Horizon Europe, MOOI, DEI, MIEK, SDE++, etc 	<ul style="list-style-type: none"> ▪ Marktmodellen: bilaterale contracten, vrije handel, waterstofbeurs ▪ Internationale handelsstromen: verwachte vraag- en aanbodvolumes en transportstromen ▪ Importtarieven, trade agreements en handelsbeperkingen, WTO, etc. 	<ul style="list-style-type: none"> ▪ Samenwerking met omringende EU/niet-EU importlanden om corridors te ontwikkelen ▪ Concurrentie met omringende EU/niet-EU importlanden ▪ Geopolitieke aspecten: strategische voorraden, afhankelijkheid, politieke stabiliteit van exportlanden 	<ul style="list-style-type: none"> ▪ Ruimtegebruik van ketenelementen ▪ Veiligheid: brandbaarheid, zorgwekkende stoffen, risicocontouren, etc ▪ Milieu: stikstof, lekkage ▪ Maatschappelijke acceptatie ▪ MVO / samenhang met SDG's in exportlanden
Synthese				

'HUISREGELS'

- Telefoon op 'stil'
- Vragen? Steek je hand op!
 - › De moderator zorgt ervoor dat je vraag beantwoord wordt (eventueel achteraf).
- Slides worden na de sessie gedeeld en zijn beschikbaar op onze website: [SHIPNL: Sustainable Hydrogen Import Program Netherlands - Nationaal Waterstof Programma](#)
- We bespreken uiteraard geen marktgevoelige zaken.
- Chatham house rules: De besproken informatie mag gedeeld worden, maar zonder de spreker te onthullen.

› JAARAGENDA

› Face-2-Face bijeenkomsten

- › Jan-Mrt-Mei-Jul-Sep-Nov
- › 2 uur + netwerkborrel
- › Onderwerpen o.a.

IRA en internationale concurrentie

Veiligheid en vergunningen

Deep dives verschillende dragers LOHC, NH₃, LH₂

Ketens en eindgebruikers

› On-line deep dives

- › Feb-Apr-Jun-Okt-Dec
- › 1 uur
- › Onderwerpen o.a.

H2Global

Electrolyser opschaling

Europese Wetgeving en ontwikkelingen

Infrastructuur

ACTUALITEITEN | TOUR DE TABLE



DEEP DIVE: MANAGING FUTURE SECURITY OF LOW CARBON HYDROGEN SUPPLY

Coby van der Linde | CIEP

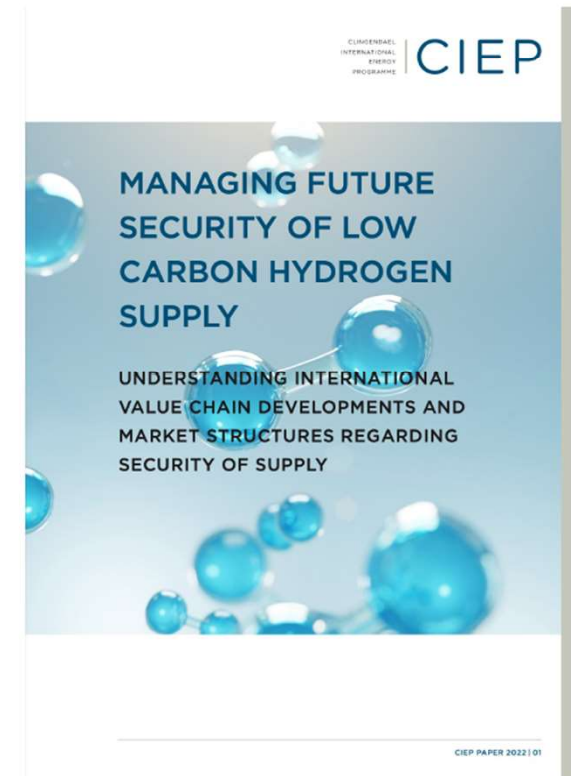
Managing Future Security of Low Carbon Hydrogen Supply

18 January 2023

Coby van der Linde

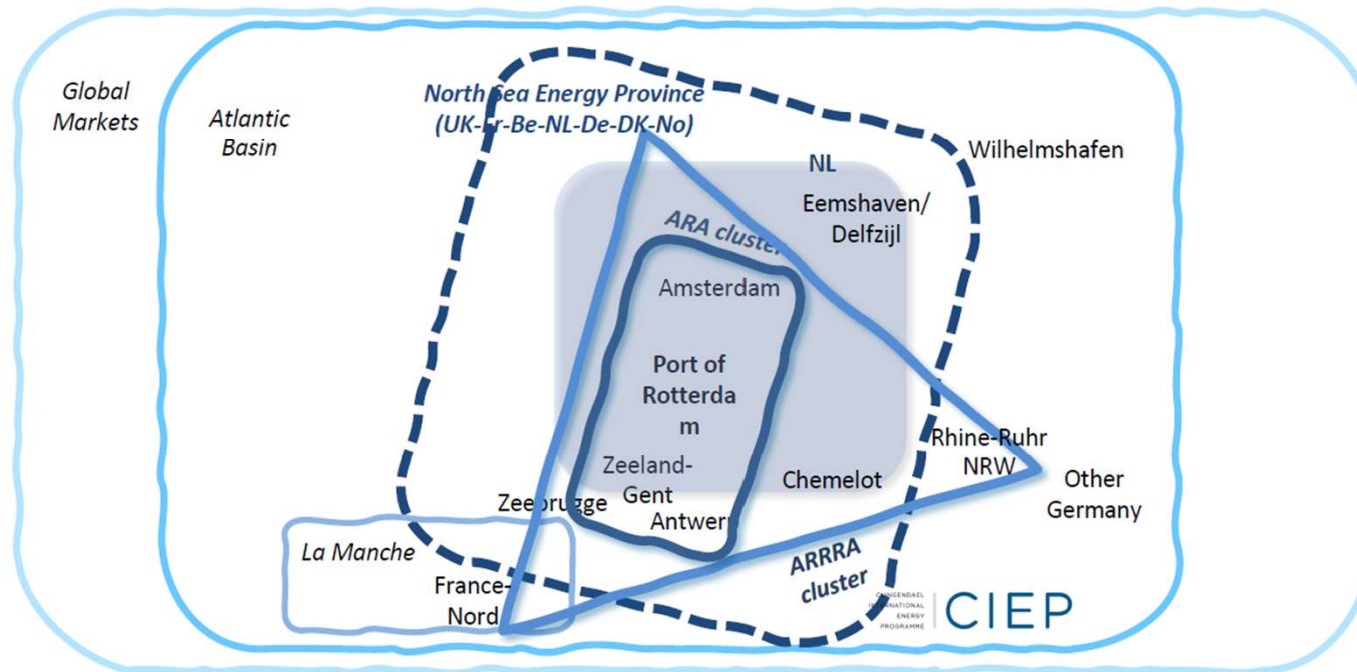
CLINGENDAEL
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www.clingendaelenergy.com

Dutch energy system is part of a larger system



The Dutch energy economy currently relies largely on oil and natural gas and needs to develop into an economy based on electricity (solar and offshore wind) and low carbon molecules.

The H2-ambitions also include a hub function, using existing (but refurbished) infrastructure, although the current investments of Germany on its North Sea coast, plans of Zeebrugge, North Sea Port and Eemshaven suggest that more E-entry and H2-conversion points will come into development than Rotterdam alone (now crude oil and oil products entry and exit point).

The current energy system relies largely on oil and gas

The expectation is that electrification will increase substantially, but the sheer size of the energy economy (also because NL is an energy hub for NW Europe reflected in the size of energy transportation) would greatly challenge E-transportation capacity to fulfil this role. Molecule transportation and storage provide important additional system functions.

The potential size of the hydrogen(carrier) market remains unclear. Uncertainty about technology break throughs (E-storage), the economics of the value chain and policymaking will dynamically determine the pace and size of the market.

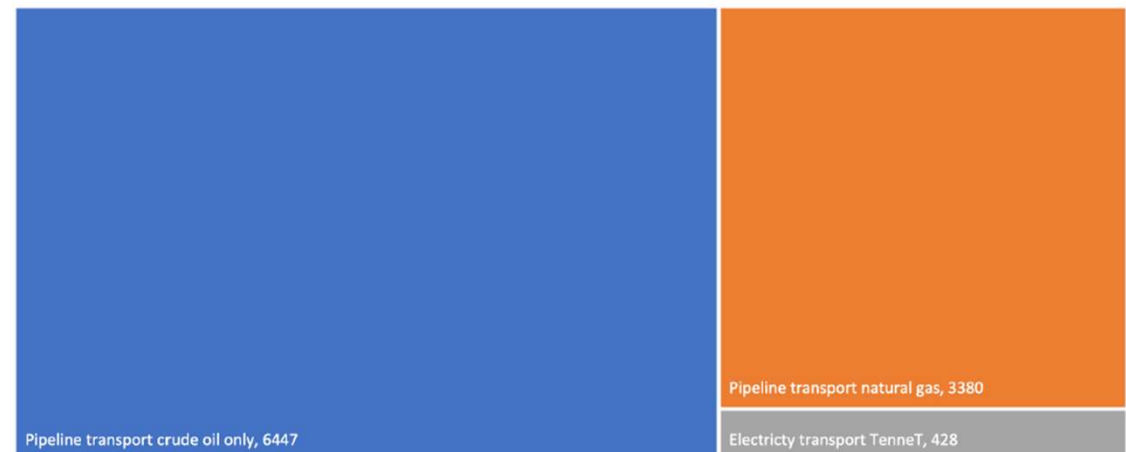
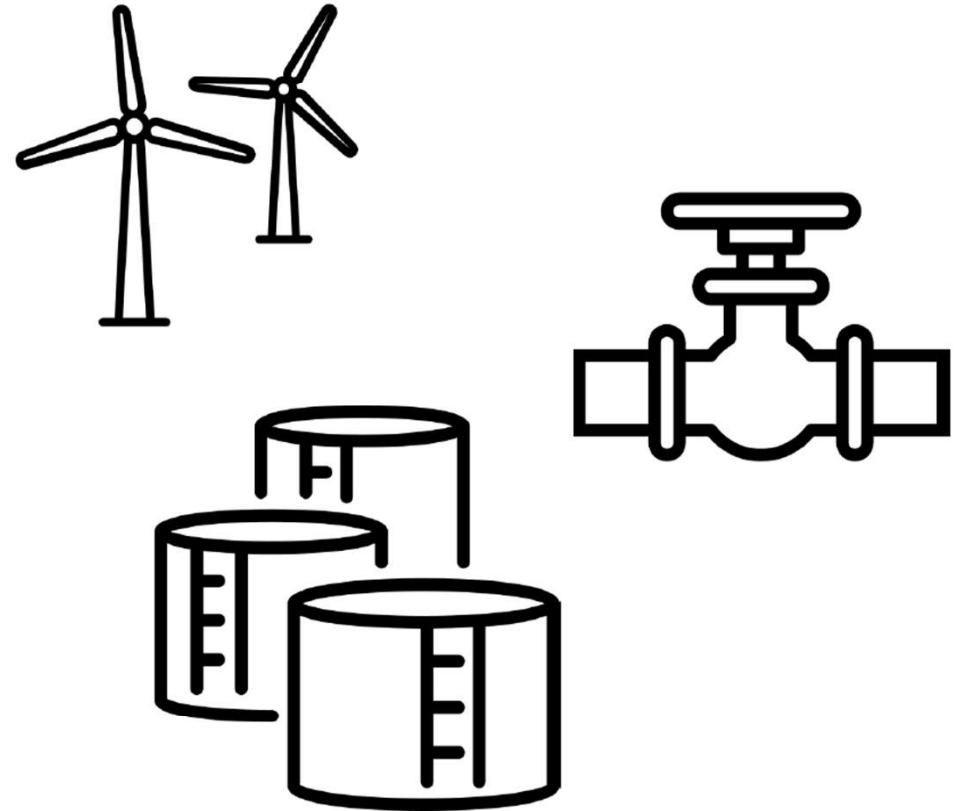


FIGURE 14 ANNEX: TRANSPORTED ENERGY CARRIERS SORTED BY ENERGY CONTENT, IN PETAJOULES, FOR THE YEAR 2018

Source: From just-in-time to just-in-case or just-too-late? CIEP 2022

Advantages of NL compared to neighbouring countries lies in the assets of the oil and gas industry - these may determine the type H2 carrier value chain or mix of H2 carriers that may come into development

- ⌘ North Sea service industry for gas is retooling to also service the growth of offshore wind (NL North Sea production for electrification and conversion in domestic market)
- ⌘ A dense pipeline network (gas and oil/oil products) which can be (partly) refurbished to carry H2 (carriers) to end users from entry/exit points
- ⌘ A large storage sector to facilitate buffering and other storage services for various H2 carriers and energy system functioning and stability



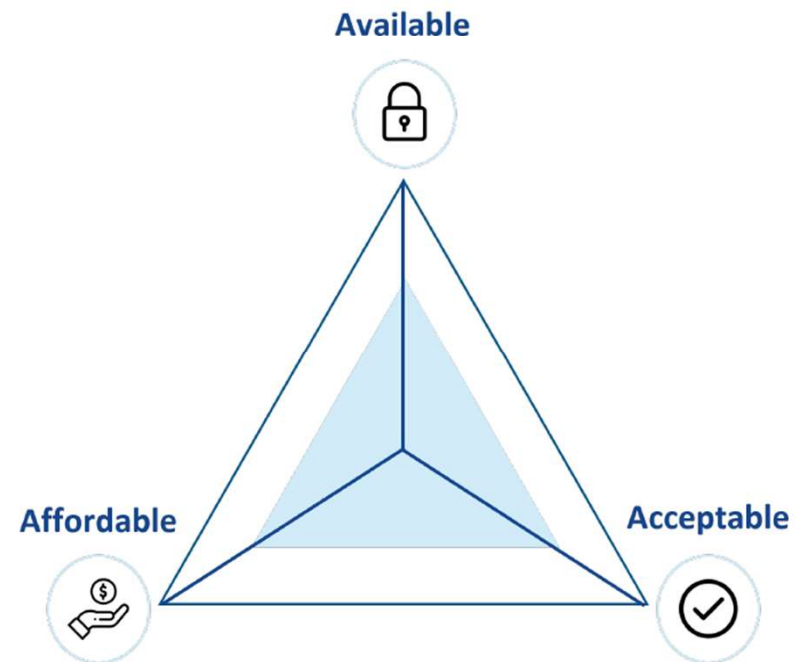
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Current Energy Crisis reminds us that the energy policy trilemma continues to be important: then, now and in the future.

The issue is how we can move from the current energy system to the new system while acceptability, security of supply and affordability are maintained. Onshore solar and wind are an issue with so many competing claims on land and infrastructure now and in the future. What sort of economy will we have in 10 to 20 years? Offshore wind on the North Sea has the most growth potential.

New value chains usually start from a concentrated supply (and to some extent demand) situation, while the current crisis also shows that affordability is a serious issue in the process of transition.

Also security of supply needs serious attention and always comes at a cost (diversity of supply, domestic supply, strategic reserves).




Energy policy trilemma

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We distinguish in security of supply issues between supply and capacity issues, and between operational (or short term), strategic (when structural import dependent) and long-term issues (for instance looking at investments).

Hydrogen is deemed to fulfil a systemic function in a future energy system and this function arose from the need for a storable alternative for electrons to satisfy peak (winter) demand during low wind/solar supply periods (like oil and natural gas perform this function now), managing variable supply when demand for energy is low, to increase the absorption of peak wind and solar E-supply while in the process of expanding E-transportation capacity, comparison of E and H2 transportation costs and developing E-storage.

And H2 together with circular carbon is important in industry.

	Operational 	Strategic 	Long-term 
Capacity	Capacity to process (or import) and transport hydrogen to meet defined peak daily demand	Processing (or import) and network supply capacity sufficient to meet peak firm demand in the event of defined loss of infrastructure	Processing and network expansion designed to meet the anticipated demand growth
Supply	Supply available to meet both the defined daily demand and to supply during a severe period/winter	Ability to meet firm demand in the event of a severe disruption to the principal supply source	Supply available to cover future projected demand

Security of supply low carbon hydrogen

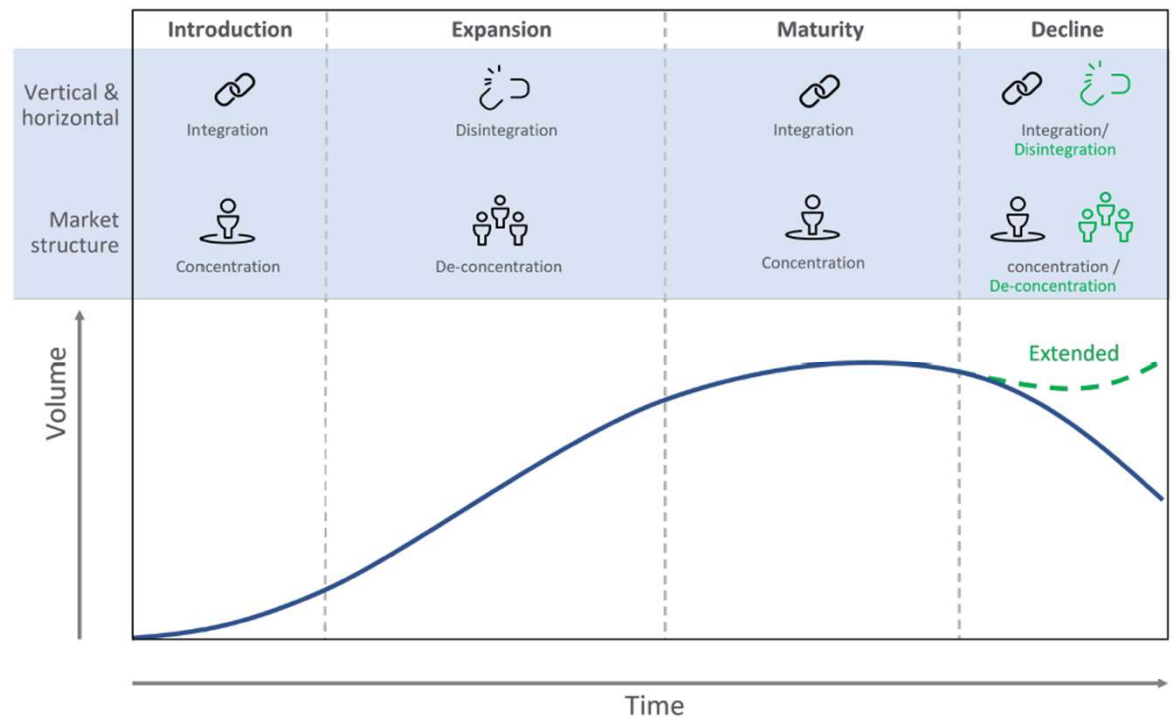
The reasoning of a future low carbon hydrogen value chain is based on the dynamic market theory and lessons from the oil and natural gas market (pipeline and LNG) developments

Development will go in phases: introduction, expansion, maturity, decline or extended growth phase.

Jury still out on which hydrogen carriers will be dominant form (based on value chain costs and infrastructure needs) or that we will have hybrid H2 carriers supply in future with their own conversion and storage needs

These phases also differ in terms of concentration of supply and demand or market organisation (more or less vertical and/or horizontal integration).

Oil and natural gas went through similar phases.



Phases of market development

Vertical and Horizontal integration



Vertical integration:

In H₂ production this could be offshore wind North Sea, conversion (electrolysers), storages, pipelines to transport H₂ to end-users

Or

Solar and offshore wind abroad, conversion to for instance LOHC, ammonia, LH₂ or methanol, seaborne transportation, conversion, storages, pipeline/coastal or river barge/truck, end-user

Horizontal integration:

H₂ pipeline transportation (private owned or public/ tpa or not); conversion on the coast and or inland, various production sites abroad, storages (concentration in companies, consortia or countries)

Policymaking in the various phases of market development

- ⌘ From the dynamic market theory insight it appears that policymaking should differ in the various phases of market development, not only in stimulating competition but also with regard to SoS.
- ⌘ The initial concentrated market (supply and demand) in the introduction phase will disappear or decrease when the market moves into the expansion phase. In this phase more producers and consumers are attracted into the market (without competition policy regulation). With regard to hydrogen value chains sectors can blend into new ones, reshaping the energy environment.
- ⌘ In the introduction and early expansion phase vertical integration and/or long-term contracts along the value chain (including transportation to industrial end-user) may be preferred as a way to mitigate risks in (long) supply chains, but also in domestic value chains.
- ⌘ Once the expansion phase is underway new competitors introduce competing contractual options and develop alternative and short term trading will increase to manage variable demand and supply. Also in the advanced expansion phase, a call for TPA may increase to accommodate more market players, also those only working a part of the value chain.
- ⌘ In the maturity phase consolidation in the sector increases and the market becomes more concentrated again. In this phase, competition policy is most effective.
- ⌘ In an extended market, developing a new market (in demand function or geography) can start a new expansion phase and deconcentration again.
- ⌘ The length of the various phases depends on government policy (stimulation of demand and supply, technology barriers, cost developments).

Introduction phase

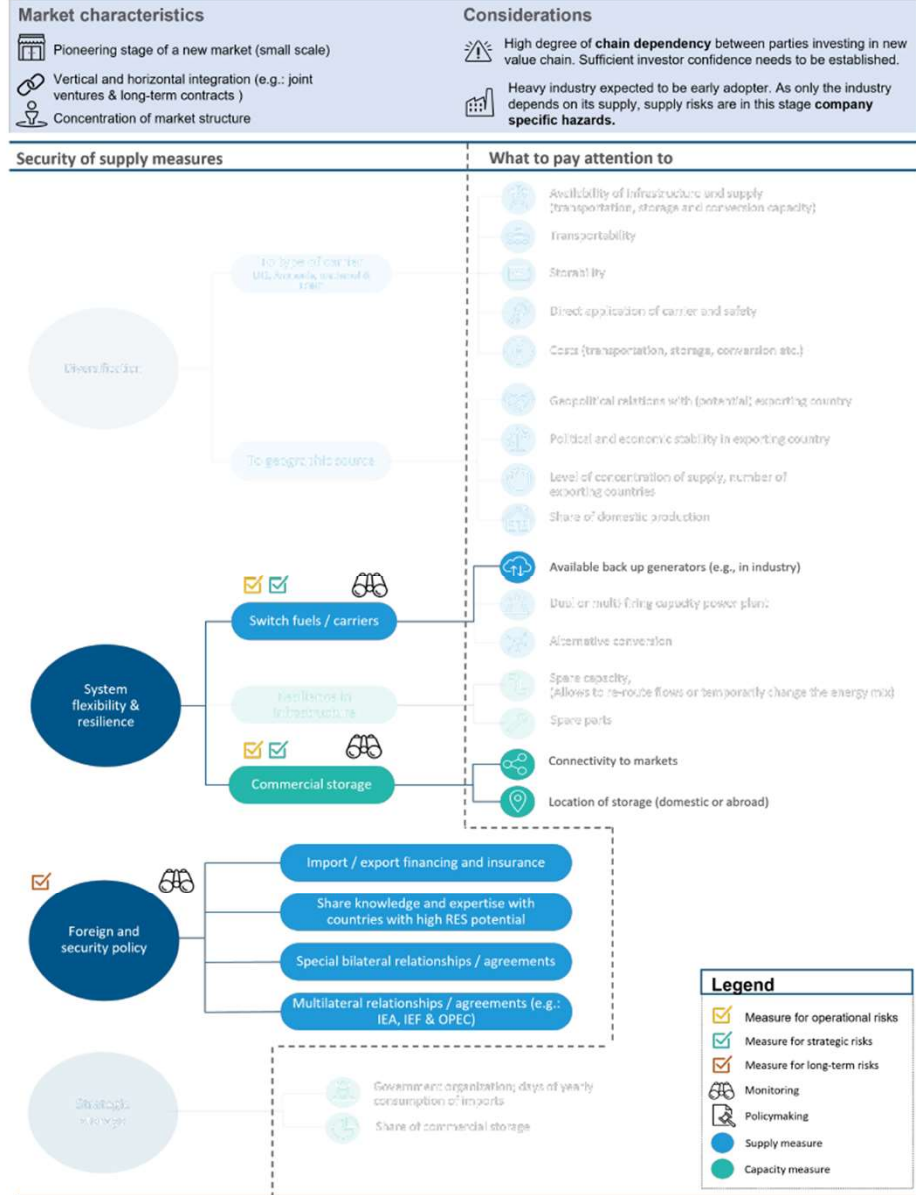
In this phase, building new energy relations is crucial to gain entry for companies to develop production and export conversion sites, while at the same time supporting the development of domestic infrastructure and stimulate demand.

Initial demand will be mainly in industry, able to generate larger flows. Likely developed initially as point to point trade arranged in LT contracts. Shorter term trade will be mainly between surplus and deficit contractual parties.

Much will depend on the availability of infrastructure to distribute to various end-users and storage.

SoS an issue for industrial users but if we apply the same principles as today, not yet an issue for government for additional policy measures.

Introduction phase



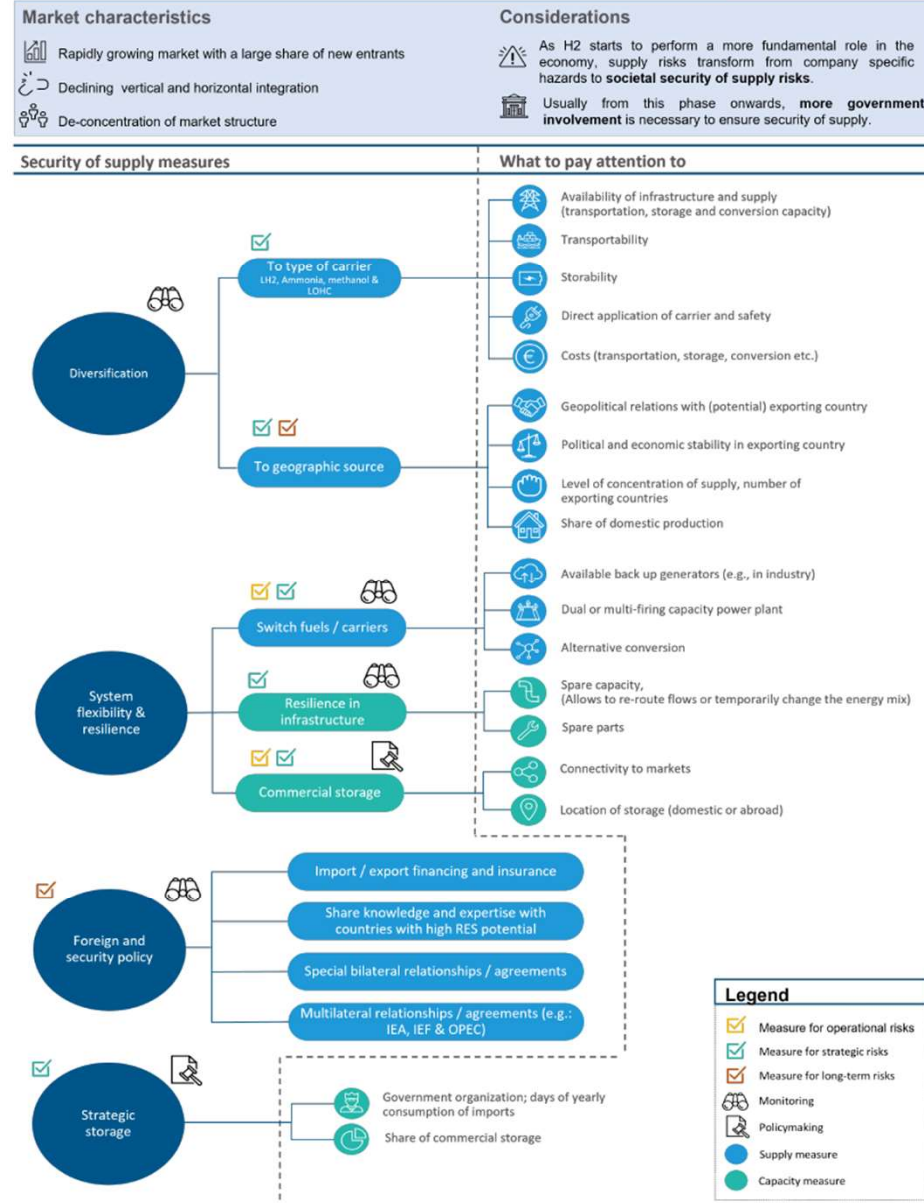
Expansion phase

In this phase diversification should be produced by the growth of market opportunities and growing competition. SoS can be strengthened by expanding good relations with more potential exporting countries.

Development of storage facilities and robust infrastructure and foreign relations need monitoring, while strategic storage is an option to increase LT system stability, particularly when more demand functions come into being.

In case of conversion and storage on the coast, like oil now, also for other EU markets (hub) a more active SoS may be needed to facilitate and secure the hub function, but also to secure sufficient supply in domestic market.

Expansion phase



Maturity phase

In late expansion and early maturity phase, market growth is becoming more modest and a diversity of demand functions and suppliers has developed over time.

The diverse demand functions require more market regulations to protect small (price taker) end-users against consolidation moves along the value chain. Competition policy and limits to horizontal and vertical integration may be considered. There are more models of competition than gas market model alone.

Domestic supply continues to add comfort to (structural) import dependency.

Diversification of supply and strategic storage needs to be an integral part of market policymaking.

Maturity phase

Market characteristics

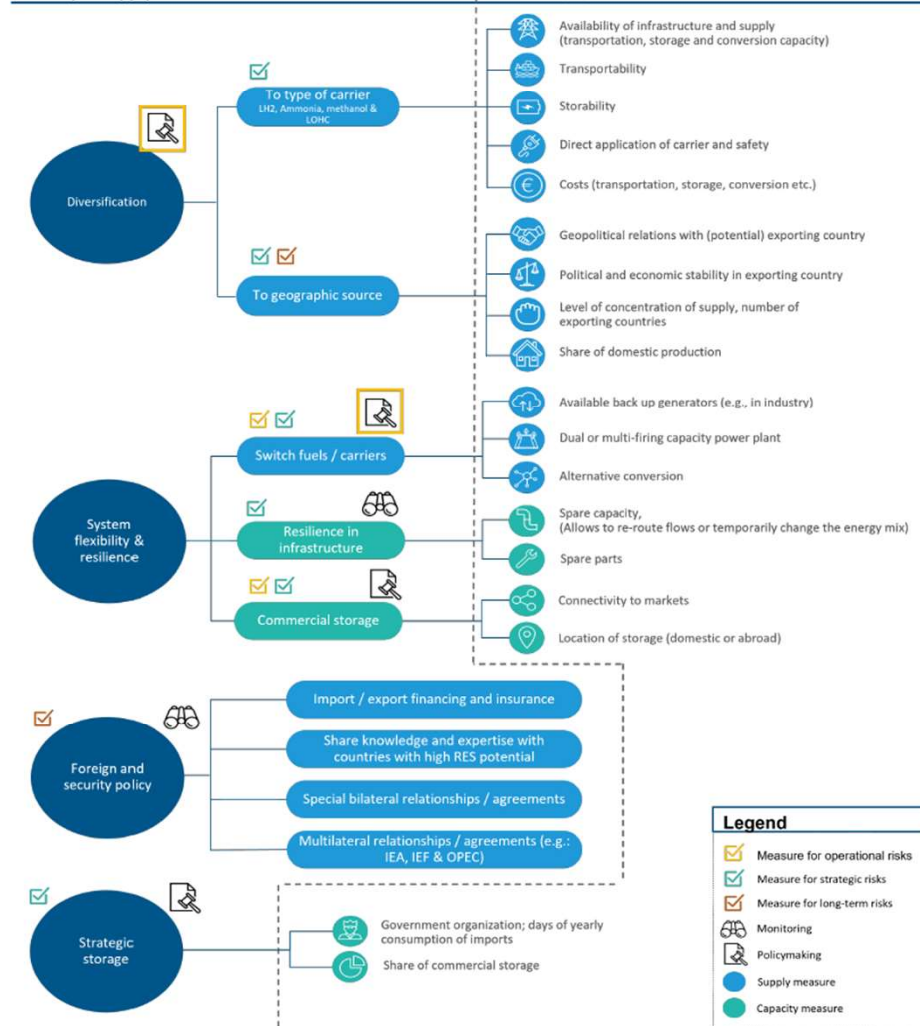
- Decrease in market growth
- Vertical and horizontal integration
- Concentration of market structure

Considerations

- The focus of suppliers shift to maintaining or growing market share through **mergers & acquisitions**. It is common that only a few large companies provide most of the supply.
- Policies to maintain competition** become more relevant. To ensure this doesn't steer the market to a single (low-cost) supplying country, additional diversification policymaking is necessary.

Security of supply measures

What to pay attention to



Discussion

- ⌘ Do we take sufficient account in our thinking and planning at the government level (national and EU) of the dynamic value chain development processes (here and elsewhere)? And do we take proper account of less discussed advantages to how buffer and service the energy system?
- ⌘ What is the role of organisations like the Global Hydrogen Fund, an *new midstream public-private partnership*? Will they develop into a new energy player? Will an EU buyers consortium allow NL to build the H2 hub or will EU distribution politics/monopsony prevent this to emerge?
- ⌘ Do we take the approach of other countries into account (US and Japan) on how to build (export/import) H2 carrier value chains? These competing models of support may influence the dynamics of value chain development and choice for H2 carriers. Same applies to preferences of potential exporting countries.
- ⌘ Are our and the EU's current policies (REPowerEU and gas and proposed hydrogen market directive) sufficiently in line with the dynamics of market development? Does the draft EU directive, assuming application of the gas market model already in 2030, jump the gun in the logic of phases of market development perhaps promoting domestic value chains first and longer supply lines (imports) much later?
- ⌘ Which lessons can we learn from the gas market model with regard to security of supply and the current energy crisis?
- ⌘ Which lessons can we learn from earlier market development in terms of institutional organisation (natural gas campaign in the 1960s and oil demand in the development of the new energy system)?

DISCUSSIE: WORLD HYDROGEN SUMMIT 2023: POSITIONERING NL ALS WATERSTOFHUB

Jeroen van Gils & David Koole | RVO



Positionering NL op WHS 2023

SHIP bijeenkomst 18-01-2023

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World Hydrogen Summit 2023

In een notendop

- > 9-11 mei 2023
- > 8000 bezoekers verwacht dit jaar
- > Programma RVO rondom WHS
 - Energy Executives Training (EET) Program
 - 50-100 publieke en private gasten uit buitenland
 - Groot NL paviljoen
 - Netwerkbijeenkomsten
 - Landen- en themasessies





NL overzichtelijk en als één importhub presenteren

Aanleiding

- > Importontwikkelingen gaan **hard**. Landen sorteren zich voor, inclusief NL
- > **Concurrentie** voor beschikbare H2 op wereldmarkt groeit
- > Nu soms **onduidelijkheid** over NLse speelveld H2

Toegevoegde waarde

- > Gezamenlijke boodschap **sterker** dan individuele insteek
- > NLse waardeketen **helder** voor buitenlandse gasten
- > Contact tussen de juiste partijen **sneller** bewerkstelligd
- > Kracht van **herhaling** op lange termijn



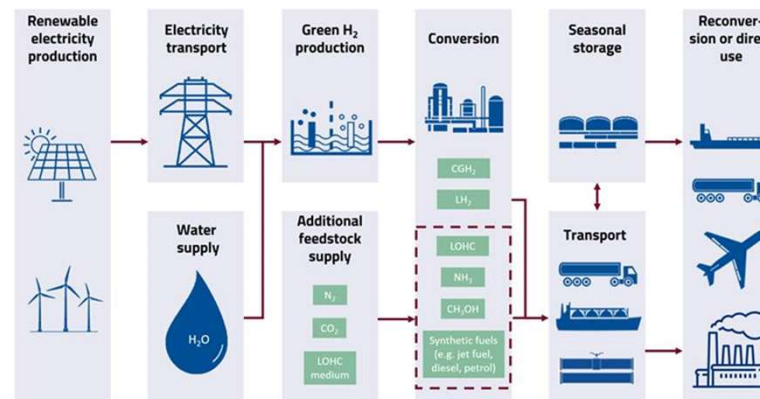
NL overzichtelijk en als één importhub presenteren

Eenduidig verhaal middels

- > Grafische weergave op paviljoen
- > Bijeenkomst NLse waardeketen
- > Film maken
- > Update NLse waterstofgids
- > (...)

Met oog voor

- > Behoud individuele netwerk- en contactmogelijkheden
- > Oftakers die nu nog minder betrokken zijn





Vragen voor SHIP

- > Wordt de behoefte gedeeld dat we ons meer **in gezamenlijkheid** willen presenteren als import hub op conferenties als de WHS of missies?

- > Liggen er bij jullie **specifieke behoeftes** mbt gezamenlijke boodschap?
 - Eigen rol in waardeketen
 - Prioriteiten in de boodschap

- > Liggen er bij jullie **specifieke behoeftes** mbt de WHS?
 - Matchmaking
 - Landensessies



VOLGENDE KENNISSESSIE WOENSDAG 15 FEBRUARI

On-line, 16.00 – 17.00 uur

- Voorlopige agenda:
 - › Deep dive: H2Global

H2Global

HARTELIJK DANK VOOR UW AANDACHT

Vragen? Of wil je iets delen met de groep tijdens een volgende sessie?

Neem gerust contact met mij op:

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