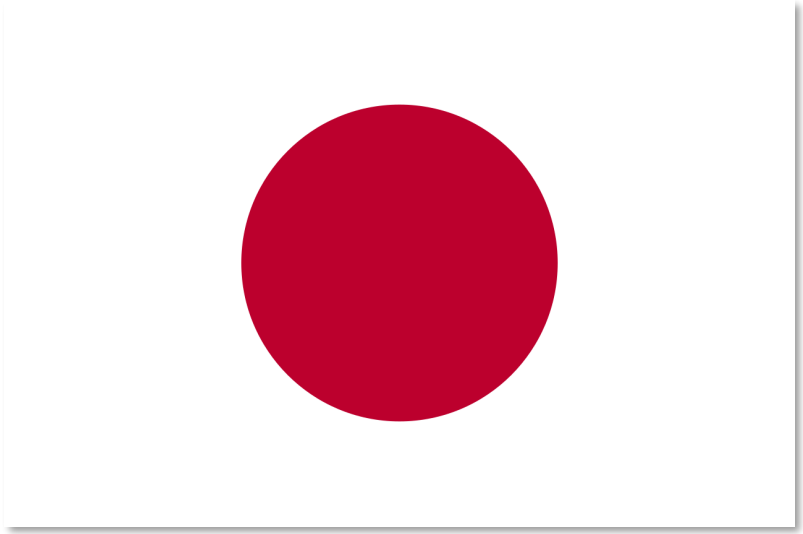


Rijksdienst voor Ondernemend Nederland

Info bijeenkomst Waterstof missie

Japan (RVO) en China (OostNL)

22-28 Sept 2019

Agenda

10:45	Introductie (Alexandra de Vogel, RVO)
10:50	Achtergrond waterstof in Japan en concept programma door Rob Stroeks, IA Japan
11:00	Achtergrond waterstof in China en concept programma door Taake Manning, IA China (via videoverbinding 🤞) en Judith van de Bovenkamp, OostNL
11:10	Praktische zaken voor deelname (Alexandra de Vogel, RVO)
11:15	Q&A beide missies
11:30	Presentatie Partners for International Business (Maurits van Dijk, RVO)
11:35	Pitch FME (Rogier Blokdijk)
11:40	Pitch door Hymove (Theo Hendriks en Tina Pan)
11:45	Pitch NWBA (William van Niekerk)
11:50	Q&A

12:00 – 12:45 Netwerklunch

Innovatiemissies RVO
team internationaal innoveren

International innovation and technology matchmaking

We promote and position the Netherlands as innovation country

We work together with embassies and consulates general

Timing

Waarom twee waterstofmissies tegelijk?

Japan: Hydrogen energy ministerial op 25 september in Tokio

China: Hydrogen Fuel Cell Vehicle Conference 26-28 september in Rugao

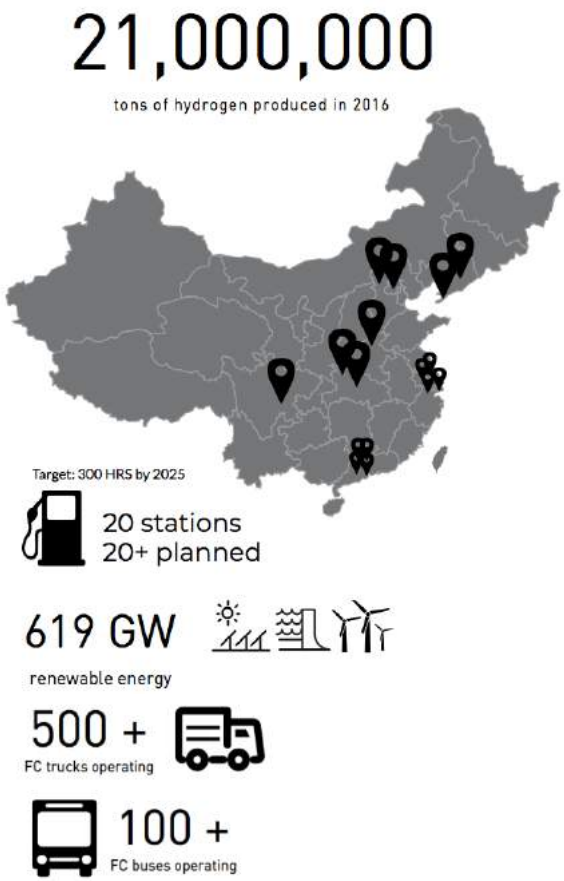
Achtergrond Japan

Rob Stroeks, Innovatie Attaché Japan

20 June 2019, The Hague

Hydrogen developments in China

Judith van de Bovenkamp
International Trade Development
Oost NL



Hydrogen in China

- China has been the **largest hydrogen producer** worldwide since 2010
  - Mostly produced via **coal-gasification**
  - **11.89 million tons** of **by-product** hydrogen produced
- China has invested heavily in **renewable energy capacity**
  - Installed capacity reached **619 GW** by the end of 2017
  - High **curtailment** rates, national average 12% in 2018

Need for improved energy storage!

National policy developments in China

Made in China 2025

Clearly proposed the development plan for NEVs. Following this plan the **Technology Roadmap for Hydrogen Fuel Cell Vehicles** was published with specific targets for key technology development.

By 2020 there should be **100 HRS** and 5000 FCEVs in demonstration. This will gradually increase to **1000 HRS** and > 1 mln FCEVs in service by 2030.

2015

2016

Energy Innovation Action Plan

NDRC and NEA released a plan focused on energy technology innovation until 2030. **15 key innovation tasks** are highlighted incl. hydrogen and fuel cells.

By 2020 **PEM fuel cells** need to achieve rated output power of **50-100 kW** and stacks achieve a **service life > 5000 hour**.

2017

13th FYP for Technological Innovation in Transportation

Released by MOST and MOT, the plan emphasizes i.e. the need for in-depth research and industrialization of key materials of FCEVs, improving H2 storage and transportation technology, **formulating standards for 70 MPa hydrogen tanks** for on-board storage, developing 70 MPa hydrogen refilling equipment etc.

2018

Adjustment Fiscal Subsidy Policy for NEVs

In June 2018 new subsidy standards from MOF, MIIT, MOST and NDRC took effect. The production of high-quality vehicles with longer driving ranges and lower energy consumption is encouraged. National subsidy for lithium-ion battery vehicles declined slightly, while that for **FCEVs remained unchanged**.

Industry development in China

亿华通 SinoHytec
中科富海 FULLCRYO
AT&M 安泰科技
NOWOGEN 氢能创能
CNTARC
WEICHAI
神华集团 SHENHUAGROUP
北京天海工业有限公司 BEIJING TIANHAI INDUSTRY CO.,LTD.
长城汽车
山东重工集团 SHANDONG HEAVY INDUSTRY GROUP
山东赛克赛斯氢能源有限公司 Shandong Saikesaisi Hydrogen Energy Co., Ltd.
东风汽车集团有限公司 DONGFENG MOTOR CORPORATION
TROOWIN
泰歌氢能汽车 TIGER FUEL CELL VEHICLE CO., LTD
CSIC 中国船舶重工集团公司第七一二研究所 CHINA SHIPBUILDING INDUSTRY CORPORATION No.712 INSTITUTE
喜玛拉雅 Himalaya & 清华大学 合力研发
氢雄 HydraV
氢阳能源 HYNERTECH CO., LTD.
武汉理工氢能源有限公司 Wuhan WUT New Energy Co.,Ltd
RE-FIRE
神力科技 SHEN-LI HIGH TECH
SAIC 上汽集团 SAIC MOTOR
富瑞氢能 FURUIHP
弗尔赛能源 FORESIGHT ENERGY
申沃客车 SUNWIN
Suzhou JingLi Hydrogen Production Equipment Co. Ltd
HYFUN 氢枫
国氢 SFCC
华特气体 HUATE GAS
suyun
中广核 CGN 核能
ISOLID 索弗克
瑞晖科技 RUIHUI
Kohodo 凯豪达氢能源 Kohodo Hydrogen Energy
飞驰客车 FEICHI BUS

Hydrogen leadership in China: Mr. Wan Gang

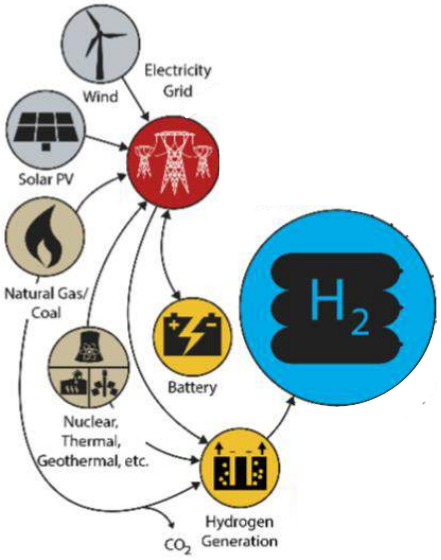
- Vice Chairman of CPCC and Chairman of China Association of Science and Technology
- Previous **Minister of Science and Technology**
- Expert of China's EV Industry

Strong advocacy for development of FCEVs

- FCEVs should be new focus, complementing EVs for **long-distance buses, urban logistics and heavy duty transport**
- Urging relevant departments in China to follow international example in **establishing technical standards**

Focus: break through the industrialization of membrane electrodes, air compressors and hydrogen storage tanks

Hydrogen production



Adapted from National Renewable Energy Laboratory

- Regional differences due to presence of other kinds of **primary energy source**
- China has nearly **1.000 coal gasifiers in operation**, coal – gasification is main H_2 production method
- NICE* argues that H_2 via SMR of **natural gas will not be competitive** in China (20% more expensive than coal)
- **Electrolysis of water** can solve the high curtailment rate problems of renewables in China, but PEM technology not advanced enough yet

China's strategy: non-green H_2 production until (at least) 2020*

*Beijing National Institute of Clean-and-low-carbon Energy (NICE)
*2016 China Bluebook on Hydrogen Energy Industrial Infrastructure

Hydrogen storage and transport

The handling of **hydrogen is complicated** and the realization of a hydrogen economy requires a system to efficiently **store and deliver** H_2

- Compressed H_2 gas in **high-pressure** cylinders
- Liquid H_2 under **low temperatures** in **cryogenic tanks** (10 – 12x volume possible compared to gaseous transport)
- Transport under ambient conditions using **Liquid Organic Hydrogen Carriers (LOHCs)**

China's situation & challenges

1. Hydrogen is classified as **hazardous chemical product**
2. Liquid transport of H_2 currently only for **military purposes** allowed
3. On-site H_2 generation only allowed **inside chemical parks**
4. No **pipeline infrastructure** for large-scale efficient H_2 transport

To improve H_2 supply chain new regulations, codes and standards are required!

Fuel cells

A device that converts chemical energy of a fuel and an oxidant into **electricity**

- **PEMFCs** most suitable for **automotive applications** due to i.e. low operating temperature and high power density

Table 1. Comparison of different types of Fuel Cells.

Fuel Cell	Operating Temperature (°C)	Power (kW)	Efficiency (%)	Application
PEM (Polymer Electrolyte Membrane)	60–110	0.01–250	40%–55%	Portable, Mobile, Low power generation.
AFC (Alkaline Fuel Cell)	70–130	0.1–50	50%–70%	Mobile, space, military.
PAFC (Phosphoric Acid Fuel Cell)	175–210	50–1000	40%–45%	Medium to large scale power generation and CHP (Combined Heat and Power).
MCFC (Molten Carbonate Fuel Cell)	550–650	200–100,000	50%–60%	Large scale power generation.
SOFC (Solid Oxide Fuel Cell)	500–1000	0.5–2000	40%–72%	Vehicle auxiliary power units, medium to large scale power generation and CHP, off-grid power and micro CHP.
DMFC (Direct Methanol Fuel Cell)	70–130	0.001–100	40%	Mobile, portable.

From Irshad et al. (2016)

SOFCs receive increasingly more attention worldwide, due to their

- Better **efficiency and durability**
- Ability to **co-generate heat**

Slightly different applications areas (e.g. stationary power generation)

No strong commercial activities in China yet, but lot of **R&D activities** at universities with support from MOST

In May 2018, global SOFC leader Ceres Power (UK) signed agreements with Weichai to jointly develop SOFC range extender for FC buses. Weichai Power now has a 20% stake in Ceres.

PEM fuel cell system

Key components

- Gasket
- **Proton Exchange Membrane (PEM)**
- **Catalysts**
- Gas Diffusion Layers (GDL)
- Bipolar plates
- Diaphragms

Stack = 66 % of costs*

Other components include fuel processors, power regulators and air compressors & humidifiers

Status quo in China

- Several suppliers of **key materials** but stack design remains challenge
- Ongoing R&D to seek **different catalysts** (non-noble metals)
- **Sunrise** (Dalian) independently developed fuel cell module with over **5,000 hours durability**
- Companies making progress **reducing platinum** dosage, getting closer to international level (**12 gram Pt** for FC stack)

**Source: Ernst & Young 2018*

Application areas

FUEL CELL

Gas to Power

Fuel cells can be used as for large scale power generation. In 2016 Nedstack (NL) delivered a 2MW PEMFC power plant in Yingkou, Liaoning.

Urban Heating

Dutch utilities companies have done a lot of R&D and do pilot projects using H_2 to heat buildings. China is not that far yet, just theoretical research.

Road vehicles

Fast developments in 2018, focus on heavy-duty segment. Several OEMs, system integrators active. H2 supply is still a challenge.

Other transport

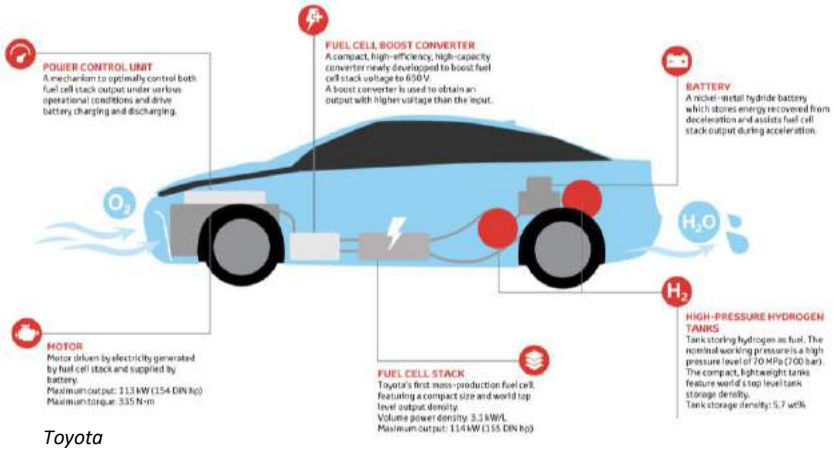
CRRC has been developing fuel cell trams. In 2019 operations will start in Foshan. Shipping industry is in early research stage.

Logistics

In USA, more than 20,000 FC forklifts are being used already. Progress has been made in Europe (France) as well recently. No such products deployed or developed in China yet.

China active?

Fuel Cell Electric Vehicles



Toyota

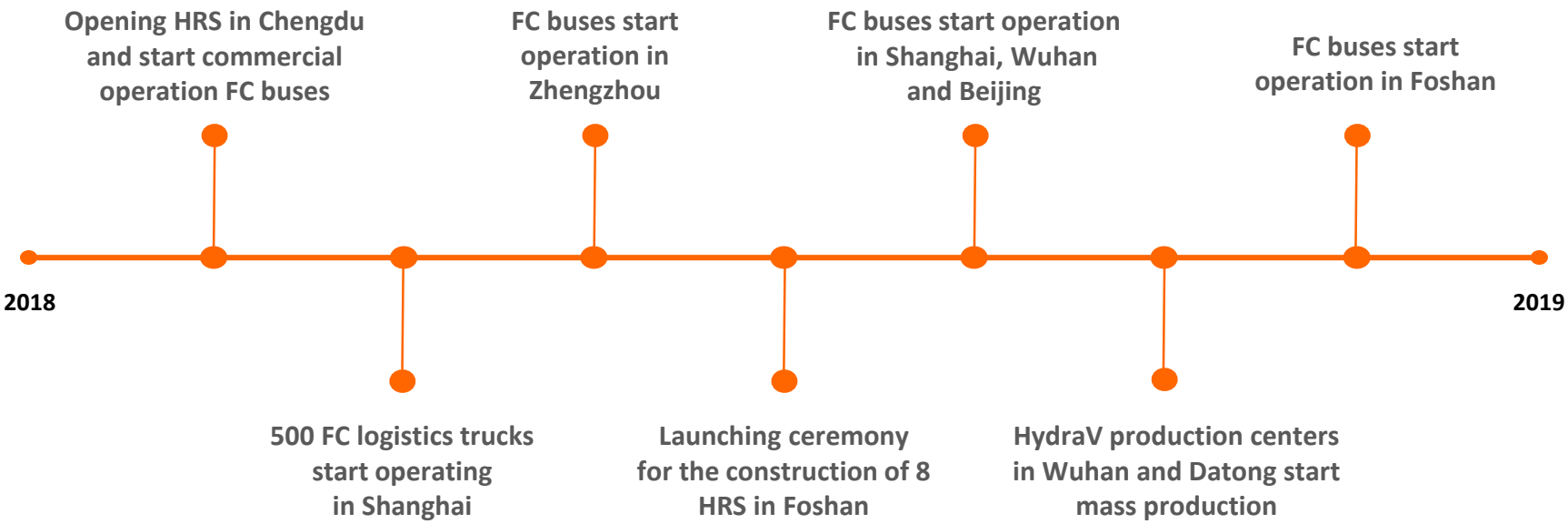
Status quo

- 20 **Hydrogen Refueling Stations**
- High-quality **FC power system integration** products (Re-Fire, SinoHytec), still using foreign PEMFCs
- Several companies have developed **70 MPa** on-board storage tanks (**Furui, Sinoma, Tianhai**)
- **Regulations** for 70 MPa storage expected in 2019

China's strategy: first fuel cell buses and commercial vehicles

1. China has **leading OEMs** for electric buses and large fleets operating
2. **On-board storage** of these vehicles is **35 MPa (**70 MPa technology and standards under development)
3. Few **HRS** can serve large fleet of vehicles due to set travel patterns
4. Improving **public awareness** by showcasing safety of hydrogen

Highlights of 2018



Several fuel cell buses have begun commercial operation!

Conclusion

2018 has been an exciting year!

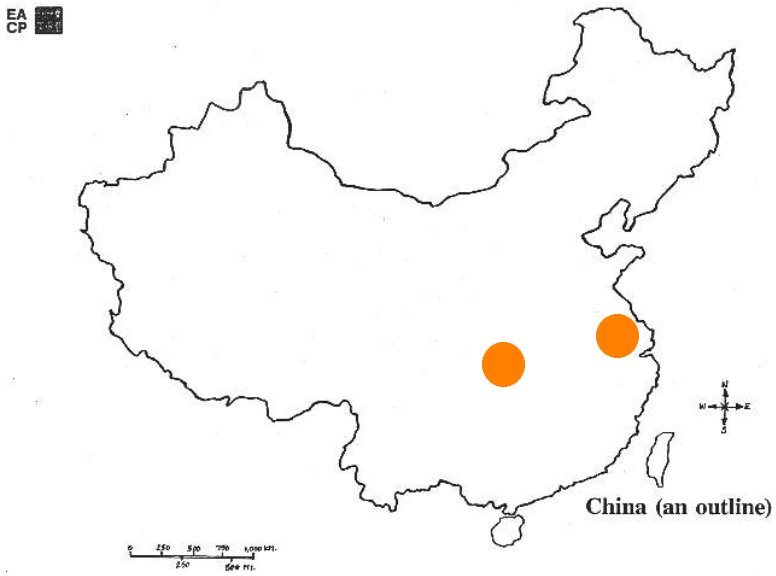
1. China's **national government** provides strong financial support; companies are clustered in **several alliances**

2. Hydrogen **value chain still weak** due unfavorable regulations, production will first follow fossil path; **new standards required** especially related to distribution and **on-site production**

3. **Fuel cell technology** is developing, but still behind international levels

4. Primary focus is currently **commercial vehicles and buses**; other application areas yet to be researched and supported by government

Two interesting locations to visit:



WUHAN (HUBEI PROVINCE)

Hubei sister province of Gelderland, Wuhan sister city of Arnhem. Purchase subsidies follow a 1:1 ratio with the central government subsidies. Until 2020, 20 HRS will be constructed to serve 2000 - 3000 commercial vehicles and buses.

RUGAO (YANGTZE RIVER DELTA)

International Hydrogen Fuel Cell Vehicle Congress, 3rd successive year. Aims to bring together global business leaders and technology developers at the vanguard of HFC innovation to foster worldwide collaboration across the FCV value chain.

Stay in touch!

Holland Innovation Network
Taake Manning

www.hollandinnovation.cn
manning@hollandinnovation.cn

Oost NL / GO4EXPORT
Judith van de Bovenkamp

www.go4export.nl
judith.vandebovenkamp@oostnl.nl

Praktische zaken

Inschrijven voor 12 augustus

- Inschrijven Japan: https://www.rvo.nl/actueel/evenementen/innovatiemissie-waterstof-japan
- Inschrijven China: https://go4export.nl/nl/aanmeldformulier-innovatiemissie-naar-china

Praktische zaken

- RVO Missieboekje
- Kosten
  - €250 (ex BTW) voor deelname aan de missie
    - Lokaal transport (excl vluchten)
    - Diners, lunches en borrels (mits vermeld in het programma)
    - Locaties tijdens de missie
  - Overige kosten
    - Vluchten en accommodaties
    - Eten en drinken op eigen gelegenheid

Praktische zaken

- Missieboekje (Engelstalig): Info wordt al bij inschrijving gevraagd
- Kosten
  - €250 (ex BTW) voor deelname aan de missie
    - > Lokaal transport (excl vluchten)
    - > Diners, lunches en borrels (mits vermeld in het programma)
    - > Locaties tijdens
  - Overige kosten
    - > Vluchten en ac
    - > Eten en drinke

Kosten voor deelnemers ong. 2500 euro:
- 250 euro inschrijfgeld voor de missie
- Vlucht naar Japan (Expedia gaf eind mei een prijs van $1051 voor rechtstreeks met KLM AMS-Tokyo en retour OSAKA-AMS)
- Hotel, incl. ontbijt (gemiddeld ongeveer 150 euro per nacht = 750 euro)
- Retourvlucht Tokyo – Kobe (schatting 150 euro)
- Lunches en diners die niet integraal onderdeel van matchmake events uitmaken (300 euro)
- Reisverzekering

Kosten voor organisatie:
- Organisatie programma
- Begeleiding vanuit RVO en post
- Transport over de weg (bus)
- Locaties voor matchmake-events, inclusief lunch en/of diner

Contact

Japan: Innovatiemissies@rvo.nl

China: Judith.vandeBovenkamp@oostnl.nl

Partners for International Business

Hydrogen China & Japan

25 June 2018

Maurits van Dijk

Maurits.vandijk@rvo.nl
+31 6 1196 2000

Rijksdienst voor Ondernemend Nederland

› What?

- Public private partnership between NL governments and NL Companies / knowledge institutes
- Three year program
- Government support → no subsidy

› Why?

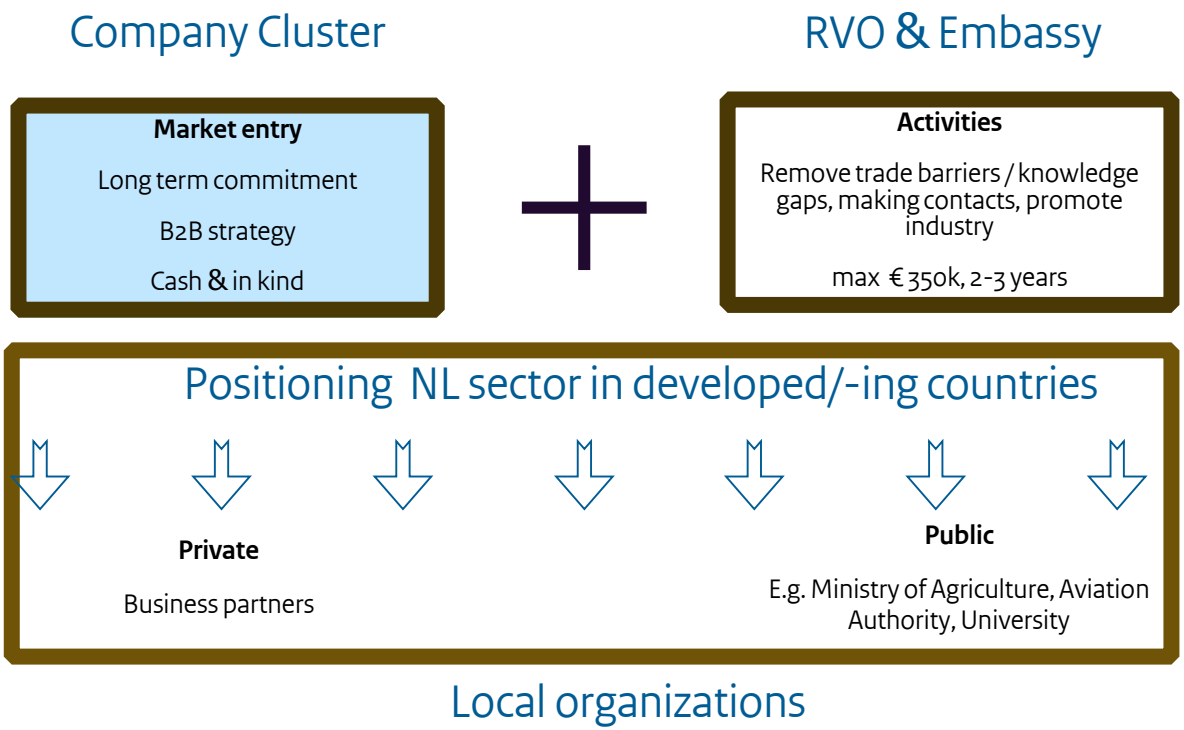
- Ministry of Foreign Affairs policy goal: To maintain and improve long-term position of NL top sectors in promising markets.

› When?

- Initiated by private sector
- If there is a role for NL government in accordance with existing national policy

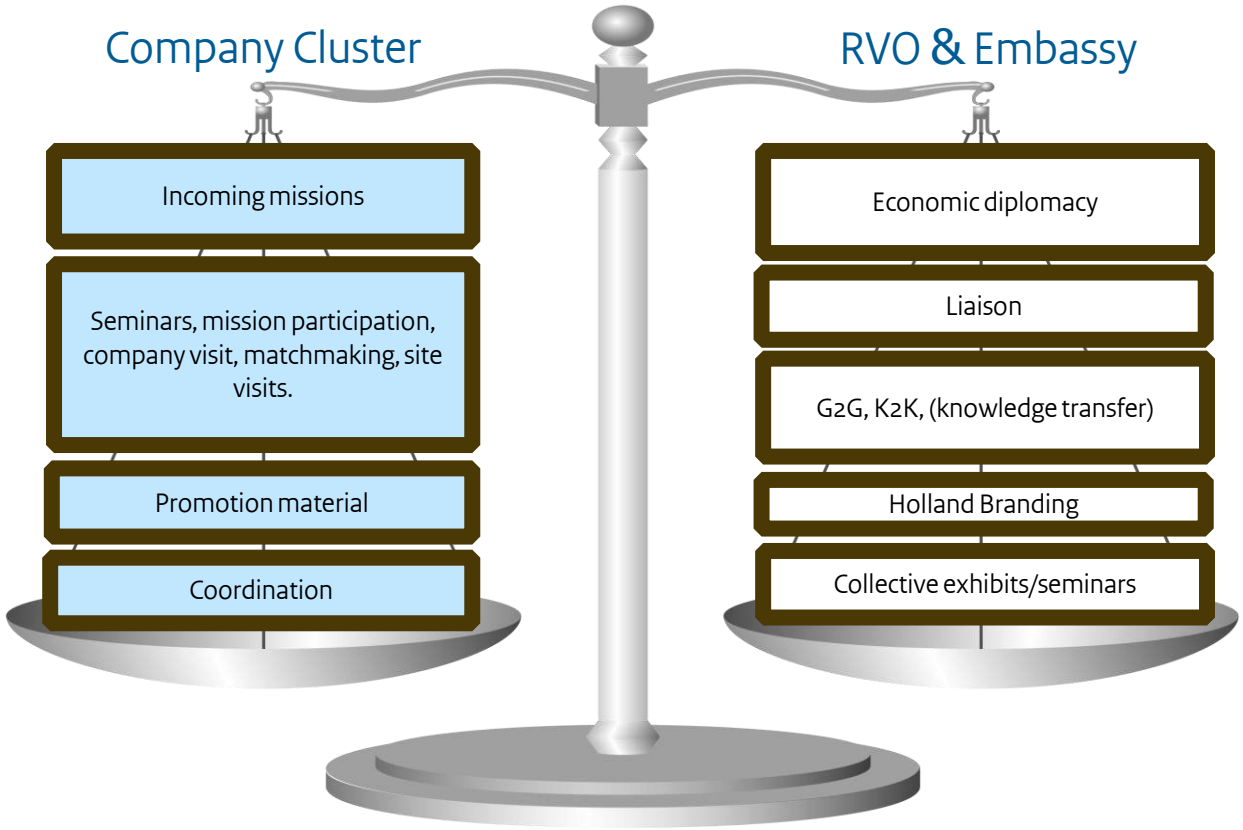
› How?

- Public-private approach
- Tailor made action plan (goals/results/activities)
- Allocation of approx. EUR 350.000 government budget to specific market/sector combination


Company Cluster
RVO & Embassy
Market entry
Long term commitment
B2B strategy
Cash & in kind
Activities
Remove trade barriers / knowledge gaps, making contacts, promote industry
max € 350k, 2-3 years
Positioning NL sector in developed/-ing countries
Private
Business partners
Public
E.g. Ministry of Agriculture, Aviation Authority, University
Local organizations

Criteria of PIB

- Long term commitment of cluster of businesses
- ≥ 5 NL companies and/or knowledge institutes;
- Convincing business case
- The NL proposition has a competitive advantage
- Distinct role for NL government
- Within PIB: the cluster represents the whole NL sector
- 50/50 contribution
  - No subsidy: financing of (commercial) activities of individual members can not be part of PIB due to EU rules concerning state aid
  - Minimum financial commitment
    - Financing a coordinator on behalf of participating cluster companies
  - Also in kind commitment (preparation, presence, meetings)


Company Cluster
RVO & Embassy
Incoming missions
Seminars, mission participation, company visit, matchmaking, site visits.
Promotion material
Coordination
Economic diplomacy
Liaison
G2G, K2K, (knowledge transfer)
Holland Branding
Collective exhibits/seminars

Economic Diplomacy

- The Economic diplomacy module covers activities aimed at market organization, market access and solving specific issues for the business cluster.
- These activities are carried out by the Dutch representation in the relevant country and the relevant ministries.

Examples

- Identify possible clients / partners, provide market information, sharing of networks
- Seminars, workshops, trade dinners
- Positioning of Dutch clusters
- Sectoral information

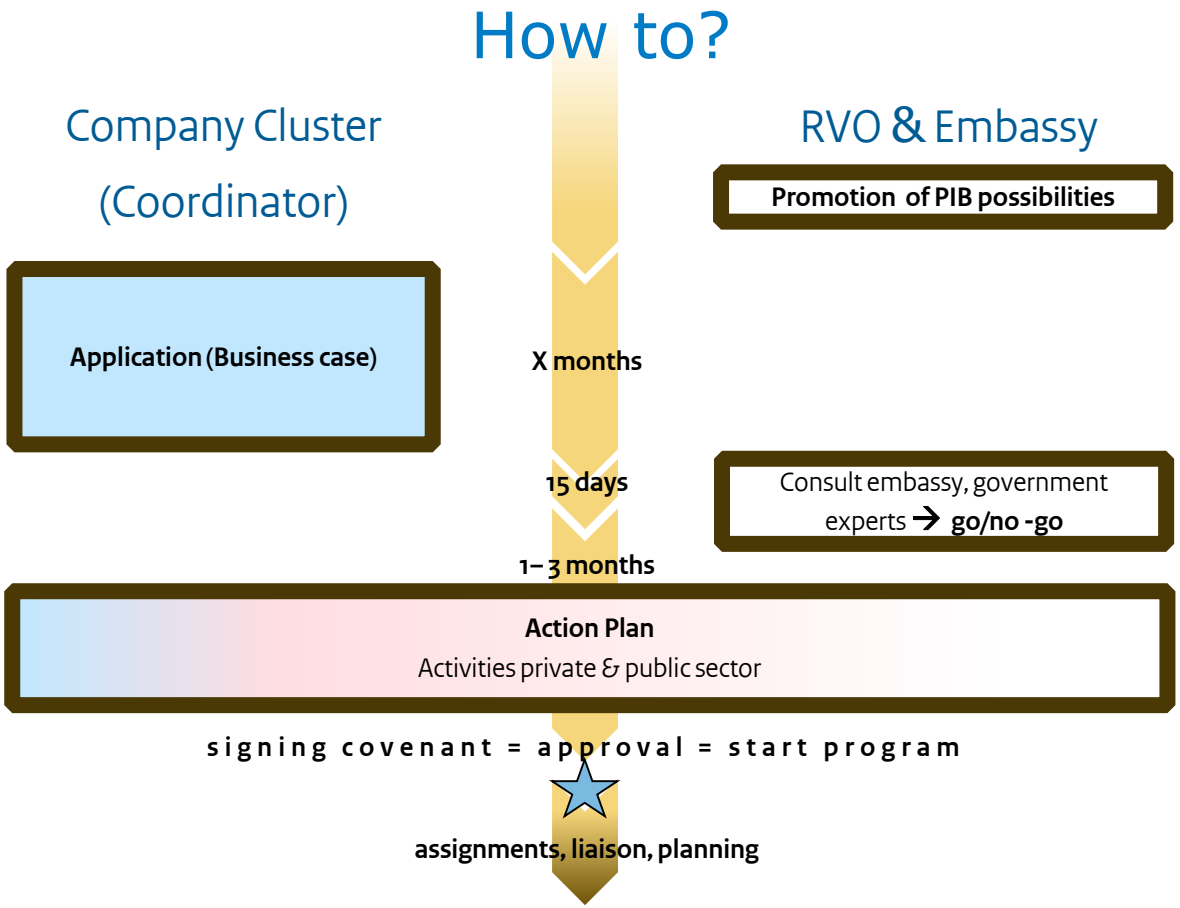
Examples of G2G & K2K

- K2K project
  - Stakeholders analysis
  - Positioning of cluster
  - Training program
  - Academic workshops
- G2G project
  - Organize participation of High level government officials
  - Market Analysis
  - Drafting formalised (R&D) cooperation

Liaison

- Liaison
- Local representation
- Sector knowledge, network in the targetcountry
- Initiating projects and opportunities
- Lobbying and maintaining networks
- Carrying out promotional activities
- Following up on trade fair participation and missions

How to?


Company Cluster
(Coordinator)
RVO & Embassy
Promotion of PIB possibilities
Application (Business case)
X months
15 days
Consult embassy, government experts → go/no -go
1– 3 months
Action Plan
Activities private & public sector
signing covenant = approval = start program
assignments, liaison, planning

Questions?

- **www.rvo.nl/pib**
  - ✓ Completed and current programs
- **https://mijn.rvo.nl/partners-for-international-business-pib**
  - ✓ Intake form (PDF)
- **pib@rvo.nl** and **088 042 42 42**

Waterstoftechnologie en de NL industrie

Bedrijven en activiteiten op gebied van waterstof

Projecten op 5 domeinen

Innovatiesamenwerking clusters buitenland

Japan

Netwerkevent H2Platform – 5 juli 2019

Meer informatie

- https://www.fme.nl/nl/fme-hydrogen-waterstof-energiedrager
- E: rogier.blokdijk@fme.nl

FME POWERED BY DUTCH TECHNOLOGY

HyMove
Hydrogen
moves
your world

SINO-DUTCH HYDROGEN NETWORK

HYMOVE

Dutch Hydrogen- Fuel cell Industry

- Area of expertise
- Large scale production of H2
- Transport of H2
- Small scale (local) production of H2
- Hydrogen supply infrastructure
- Hydrogen usage

Hydrogen use

- Automotive (buses, garbage collection trucks, logistic trucks)
- Marine (inland ships, cruise vessels)
- Stationary (cogeneration of Heat and Power n commercial applications)

Role of HyMove

- Supplier of heavy-duty FC systems for automotive and marine applications
- Supply chain integration supporting the introduction of H2FC vehicles and H2FC ships

I. Design of complete drive lines for automotive and marine applications

II. Integration of drivelines in automotive and marine applications

III. Leadership in project for introduction of trucks, buses and inland ships by integration of H2-production and transportation, operation of H2FC vehicles, financing

- Risk analysis and safety regulations of H2FC applications
- Business planning for large scale application of H2FC vehicles and ships

Challenge for Dutch H2 technology

HyMove
Hydrogen moves your world

- Huge market demand from China, but no screening of information
- Decentralized sectors within hydrogen industry
- Not present and invisible in Chinese market

Solution: joint forces

- Present Dutch Hydrogen industry
- Access of full H2 supply chain, from production to application

HYGEAR	CH4 Reformers
HyET Hydrogen — Efficient purification & compression	H2 purification & compression
Nedstack — PEM FUEL CELLS — To be sure	FC stacks
HyMove — Hydrogen moves your world	FC system, vehicle integration, supply chain integration
Hogeschool van Arnhem en Nijmegen	Components and system testing, energy scenario studies, supply chain integration

Together we mark the H2 footprint in China

Thanks!

HyMove
Hydrogen
moves
your world

NWBA

NEDERLANDSE WATERSTOF & BRANDSTOFCEL ASSOCIATIE

Een korte introductie

William van Niekerk, voorzitter NWBA

Over de NWBA

- De NWBA heeft als doel het toepassen van waterstof- en brandstofceltechnologie in Nederland in de breedste zin te bevorderen, ter verduurzaming van de samenleving.

- De NWBA is een vereniging met een bestuur dat wordt samengesteld en benoemd door de leden

- De NWBA heeft ca 40 betalende leden

- De NWBA is opgericht in 2002

NWBA
NEDERLANDSE WATERSTOF & BRANDSTOFCEL ASSOCIATIE

H2 IN THE NETHERLANDS

- The Netherlands has a **strong natural gas industry** with the 9th largest gas field in the world.
- The **second largest hydrogen producer** in Europe, producing around 10 billion m^3 every year.
- Dutch government decided in 2018 to phase out gas until 2030 to meet with climate goals.
- **Green hydrogen** plays important role in the energy transition and can contribute to emission reductions in multiple sectors (industry, heating, transportation).
- The northern part of Netherlands is uniquely located to develop a green hydrogen economy with **excess renewable energy** (wind and solar) availability.
- Currently, large companies such as **Shell** and **Nouryon** actively focus on hydrogen R&D, as well as universities (**TU Delft, TU Eindhoven**) and research institutes (**TNO**). Several new consortia and associations have been established.
- Currently **3 public HRS**, several planned/under construction.

NWBA
NEDERLANDSE WATERSTOF & BRANDSTOFCEL ASSOCIATIE

NWBA
NEDERLANDSE WATERSTOF & BRANDSTOFCEL ASSOCIATIE

KRACHTEN BUNDELEN

De NWBA bevordert

- het versterken van het Nederlandse concurrentievermogen op het gebied van waterstof- en brandstofceltechnologie en

- het ondersteunen bij het realiseren van waterstof- en brandstofceltoepassingen in Nederland

NWBA
NEDERLANDSE WATERSTOF & BRANDSTOFCEL ASSOCIATIE

KENNIS DELEN

12 maart 2019 – Mail vanuit de NWBA:

… om onze steun uit te spreken voor het idee om een missie van Nederlandse bedrijven en instellingen naar Japan te organiseren rondom waterstof- en brandstofcellen.

De NWBA bevordert

- het verzamelen en genereren van relevante kennis,
- het verschaffen van informatie, educatie en trainingen,
- het nationaal en internationaal uitdragen van de Nederlandse visie en expertise op het gebied van waterstof- en brandstofceltechnologie,
- het stimuleren van het ontwikkelen van waterstof- en brandstofceltechnologie en
- het adviseren op het gebied van waterstof- en brandstofceltechnologie.

NWBA
NEDERLANDSE WATERSTOF & BRANDSTOFCEL ASSOCIATIE

VERTEGENWOORDIGEN

De NWBA kan en wil

- Nederland vertegenwoordigen bij Europese initiatieven op het gebied van waterstof en brandstofcellen.

NWBA
NEDERLANDSE WATERSTOF & BRANDSTOFCEL ASSOCIATIE

RECENTE VOORBEELDEN

5 april 2019 - NWBA ondersteunt Europese call samenbrengen ‘Hydrogen Valley’ - De NWBA een letter of support ondertekend voor de noordelijke provincies. Deze letter of support maakt deel uit van de aanvraag voor 20 miljoen euro subsidie.

23 mei 2019 - H2 Workshop over vulpunten voor mobiliteit -*180 deelnemers*

11 juni 2019 – Ondertekening Green Deal Zeevaart, Binnenvaart en Havens - *De NWBA ontwikkelt een toolbox en technologiegids ten behoeve van zero-emissie binnenvaart en kustvaart en organiseert een serie workshops om van daaruit samenwerking en allianties te creëren.*

13 juni 2019 – Ondertekening samenwerking met HAN en HyMatters voor opleiding over waterstof - *Meerdaagse opleiding op HBO niveau*

NWBA
NEDERLANDSE WATERSTOF & BRANDSTOFCEL ASSOCIATIE

TEN SLOTTE

Waterstof is een actueel thema maar velen in Nederland zijn nog op zoek naar kennis.

Japan loopt voor als het gaat om de ontwikkeling van technologie en demonstratieprojecten

Daar kunnen we van leren en daarin kunnen we nieuwe partners vinden.

De NWBA ondersteunt dat van harte.

NWBA
NEDERLANDSE WATERSTOF & BRANDSTOFCEL ASSOCIATIE