

# 荷兰施托克：150年的成长和创新

荷兰施托克集团（STORK）成立于1868年，在全球拥有1.8万名员工，主要聚焦于石油/天然气/化工/电力/其他工业领域的技术及服务，包括：

## 1、油气/化工/海洋领域的技术及服务：

- 腐蚀监测/检测技术（在全球已安装超过1,500套系统，包括FSM电场指纹，无线超声在线测厚，保温层下腐蚀监测等多种非侵入式技术）。
- 海管阴极保护检测及监测技术（拥有近7万公里海管及1千多个平台的检测业绩）。
- 新型复合材料防腐及补强（适用于海管、平台、飞溅区等水下/水上易腐蚀区域）。
- 热态螺栓更换专利技术及法兰全面管理方案。
- 沉箱全面管理及检查维修。
- 其他技术服务：无损检测/热处理技术/表面处理/除沙/接近技术/平台及FPSO暖通空调等等。

## 2、进口转动设备的维修及升级改造（透平/叶片/齿轮箱/压缩机/泵/发电机等）：Stork是欧洲最大的转

动设备一揽子维修改造独立服务商。

3、**热能领域专有技术**，包括：内置式除氧专利技术（已应用于中国上千个项目之中），超低氮油/气多燃料燃烧技术，混合动力锅炉技术等。

4、**氢能领域**：Stork领导或参与了氢能上中下游的多个项目，服务内容包括咨询、工程、设计、项目管理、资产管理、运维、安全防爆、技术及设备等。

5、**工业资产管理技术**：Stork是世界上少有的能够提供“一站式”资产管理技术及工业技术服务的公司，已为多家油气化工跨国公司提供了高价值服务。



Oil and gas  
石油和天然气



Refining and chemicals  
炼厂和化工



Power  
电力



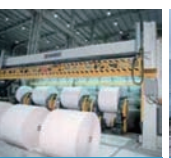
Manufacturing  
制造



Renewable  
氢能 and 可再生能源



Food and pharmaceuticals  
食品和医药领域



Paper and pulp  
造纸行业



Metals and mining  
金属和矿山



Infra and rail  
基础设施和铁路

# STORK - 氢能

Stork（施托克）领导或参与了氢能上、中、下游的多个项目，服务内容包括咨询、工程、设计、项目管理、运维、安全防爆、技术及设备、资产管理技术等。

- Stork是北荷兰绿色氢能经济网Hydrogreenn的主席和创立者(包括180家会员组织)。

## ● 参与欧盟研究项目 - “绿氢路线图”：

- ◆ EU Research report “Roadmap for Green Hydrogen” (GE2GH2)
- ◆ Stork资产管理技术 - 从绿电到绿氢



- Stork是荷兰国家标准协会NEN氢能领域的常务理事, 包括:

- 荷兰国家建筑环境和工业氢能平台成员。
- 荷兰国家氢与环境安全工作组成员。
- 荷兰国家天然气管网混或改氢工作组成员。

- 2019年在荷兰创办氢能技术培训学校。

Stork and HYDROGEN MBO-HBO Education



Stork – 北荷兰绿色氢能经济网  
Hydrogreenn的主席和创立者  
(包括180家会员组织)



参与欧盟研究项目 - “绿氢路线图”  
EU Research report “Roadmap for  
Green Hydrogen” (GE2GH2)  
Stork资产管理技术 - 从绿电到绿氢

▪ Stork是荷兰国家标准协会NEN  
氢能领域的常务理事，包括：



- NEN – National platform Hydrogen in build environment and Industry.
- 荷兰国家建筑环境和工业氢能平台成员。
- NEN – workgroup member en liaison “Hydrogen and environmental security “Waterstof en omgevingsveiligheid”
- 荷兰国家氢与环境安全工作组成员
- NEN – workgroup member “Migrate Natural gas network to Hydrogen network”
- 荷兰国家“天然气管网掺或改氢”工作组成员

▪ 2019年在荷兰创办氢能技术培训学校：  
Stork and HYDROGEN MBO-HBO Education



Role: STORK

- Main Sponsor
- Member Supervision board
- Know how for Training
- Support with Project cases

# STORK - Seen an expert in Hydrogen community

## (一) Stork- 氢能社区应用专家 (氢能供热项目)

**KLIMAATOP NOORD NL 2017**  
9 november 2017  
Energy Academy gebouw, Groningen

### Energietransitie in stroomversnelling

## Stork in transitie

Renewable Energy Competence Center

Groningen - 9 november 2017

### HYDROGREENN

“the Green Hydrogen Economy in the Northern Netherlands  
The Netherlands as a guiding country

TRUST: THE CORE OF INTERNATIONAL BUSINESS  
APR 22-27 2018  
LEEUWARDEN - AMSTERDAM  
49<sup>TH</sup> WTCA GENERAL ASSEMBLY

Willem Hazenberg STORK HYDROGREENN

Leeuwarden 23-April-2018

HYDROGen Green Regional Energy Economy Network Northern Netherlands

Actueeltema  
**H<sub>2</sub>: waterstof transitie**  
naar DUURZAAMHEID

Willem Hazenberg

|                     |                 |                   |               |              |
|---------------------|-----------------|-------------------|---------------|--------------|
| SOLAR               | WIND            | GEOTHERMAL        | WOODY BIOMASS | LANDFILL GAS |
| ANAEROBIC DIGESTION | RECYCLED ENERGY | COAL MINE METHANE | PYROLYSIS     | HYDROPOWER   |



### HYDROGREENN

“Hoogeveen HYDROGEN City Heating project”  
The Netherlands as a guiding country

FCH

Willem Hazenberg STORK HYDROGREENN

Groningen 16-April-2018

HYDROGen Green Regional Energy Economy Network Northern Netherlands

Hydrogeen Case Hoogeveen Nijstad-East

HAMBURG 8-March 2018

Willem.Hazenberg@stork.com

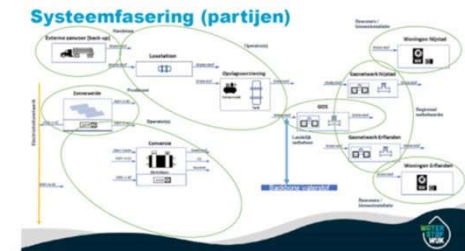
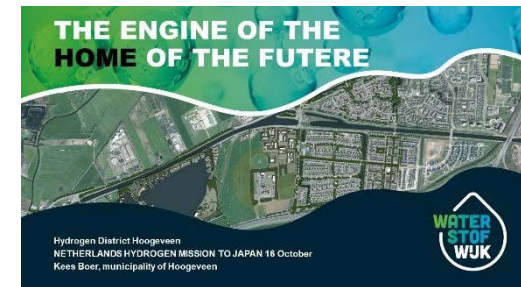
HYDROGen Green Regional Energy Economy Network Northern Netherlands



# HYDROGREENN- Stork Hydrogen projects ongoing 2022 operational

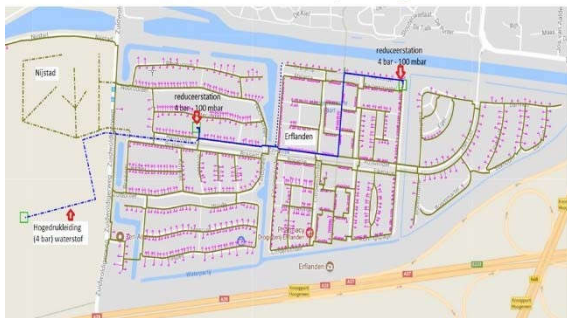
Project management and “Consortium lead” City Hydrogen heating Municipality of Hoogeveen research project for 22 organizations.

城市氢能供热项目：Stork作为项目管理方和联合体牵头人，共22家公司参与。  
(包括荷兰 Hoogeveen市/Alkmaar市/Nieuwborgens市/BorgerOdoorn项目)



[Link Video H2 test](#)

## Erflanden on Hydrogen



## HYDROGEN DISTRICT HOOGVEEN CONSORTIUM



## Rijk stelt 4,4 miljoen euro beschikbaar voor Waterstof Erflanden

De gemeente Hoogeveen krijgt via het Programma Aardgasvrije Wijken een bijdrage van 4,4 miljoen euro om in een deel van de wijk Erflanden aardgas te vervangen door groene waterstof. Dat kan door het bestaande aardgasnetwerk te gebruiken voor het vervoer van waterstof en door de huidige cv-ketels te vervangen door waterstof cv-ketels. Het doel van het landelijke Programma Aardgasvrije Wijken is om te leren op welke wijze de wijgerichte aanpak kan worden ingericht en opgeschaald. Wethouder Werner Kate is bij met deze toekenning: 'Met deze bijdrage kunnen we aan de slag in Erflanden, samen met de bewoners en onze samenwerkingspartners, om te komen tot draagvlak en uitvoeringsplannen.'

## NAM loca



# “From Cry to concrete” in 3 years 从不知所措到具体实施



由Stork公司担任的项目经理向荷兰国王介绍项目情况  
Stork Project Manager Willem Hazenberg of the Hydrogen City project explain the Dutch King Willem Alexander the project “waterstofwijk Hoozeveen” at the Gasunie premises.

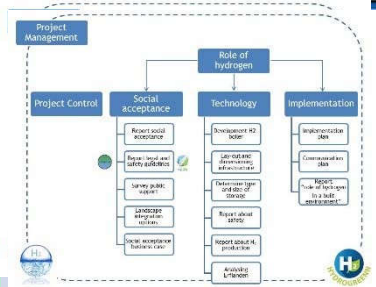
Gemeente Hoozeveen Wat is er in 1 jaar gebeurd in Waterstof land

Hoozeveen Nijstad Oost Waterstof wijk Project Status

1 miljoen toegezegd aan middelen/uren door 21 organisaties

Design sessies Entrance Project coalitie - RVO plan Hoozeveen

Eerste bijeenkomst 12-9-17 Delfzijl



Design sessies Entrance Project coalitie - RVO plan Hoozeveen

Eerste bijeenkomst 12-9-17 Delfzijl

### INVESTERINGSAGENDA WATERSTOF NOORD-NEDERLAND

Op weg naar emissievrije waterstof op commerciële schaal

### Erflanden op Hydrogen

Stakeholders: TNO, SBE, CRONINGEN SEAPORTS, TIELUM, B. BEKAERT, GasTerra, N-TRA, DNV-GL, kiwa, SIEMENS, alllander, JP, SBE, CRONINGEN SEAPORTS, TIELUM, B. BEKAERT, GasTerra, N-TRA, DNV-GL, kiwa, SIEMENS, alllander, JP.

### Stork and HYDROGEN MBO Education

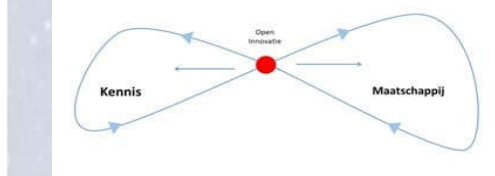
Feb 2019 Start first MBO class students

Role of STORK:
 

- Main Sponsor
- Member Supervision board
- Know how for Training
- Support with Project cases

### THE NORTHERN NETHERLANDS HYDROGEN INVESTMENT PLAN 2020

EXPANDING THE NORTHERN NETHERLANDS HYDROGEN VALLEY



# Part of the EU HEAVENN project

此项目为欧盟 HEAVENN 示范项目（投资28亿欧元）的一部分



Home - Actueel - Nieuws

## Europese miljoenen voor ontwikkeling waterstoftechnologie in Noord-Nederland

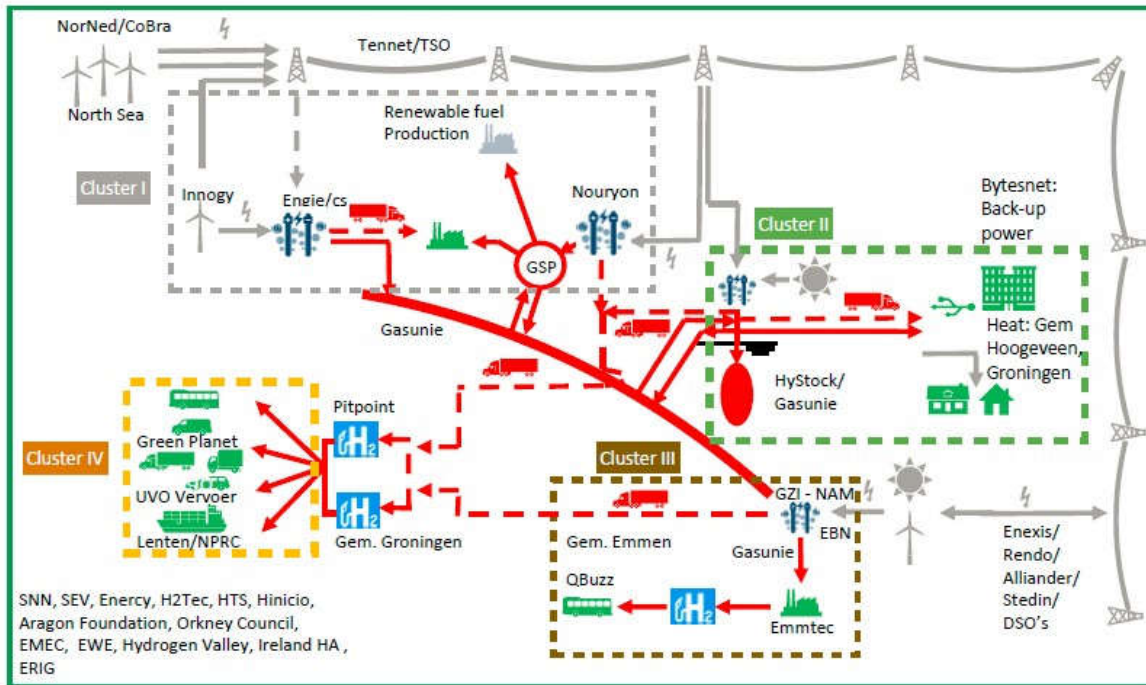
20 augustus 2019

Noord-Nederland is door Europa aangezien als de regio waar de komende jaren de groene waterstoftechnologie zich verder moet ontwikkelen. Vanaf februari gaat er € 20 miljoen subsidie naar het project Hydrogen Valley, gericht op de ontwikkeling van een volledig functionerende groene waterstofketen. Het project kost in totaal € 90 miljoen, duurt zes jaar en gaat begin 2020 van start.



### Internationale steun

De subsidieaanvraag is ingediend door HEAVENN, een samenwerkingsverband van 31 publieke en private partijen uit zes Europese landen. De leidende partijen bij de aanraag waren het [2] Samenwerkingsverband Noord-Nederland (SNN) en de [2] H2valley Energy Coalition. Bij het project worden de partijen internationaal ondersteund, onder meer vanuit de Verenigde Staten en Japan. Het HEAVENN-project is bijzonder omdat het de hele waterstofketen omvat en verduurt binnen één geografische regio.



## Hydrogen Energy Applications for Valley Environments in Northern Netherlands

荷兰北部氢谷的氢能应用

The Movie:

<https://vimeo.com/368013901>



# DEMONSTRATION PROJECT DELIVERABLES (1)

## 欧盟/荷兰示范项目 – 氢能集中供热系统

1. An innovative hydrogen central heating system without CO2 emissions thanks to a retrofit solution.

基于改造方案的无二氧化碳排放创新型氢能集中供热系统

2. The technical development of a hydrogen central heating system with a plan for a hydrogen gas meter.

氢气集中供热系统的技术开发

3. Legal and organizational support through the development of guidelines in the field of legislation,

通过制定立法领域的准则提供法律和组织支持

4. safety, standards and certification.

安全、标准和认证

5. Well-founded advice for development and increased social support.

为发展和增加社会支持提供建设性意见

6. An economic spin-off for business through scalability to more than a million homes in the Netherlands alone.

通过扩展到100多万户荷兰家庭，为商业带来了经济上的副产品。

7. A substantiated social cost / benefit analysis.

经证实的社会成本/收益分析





# DEMONSTRATION PROJECT DELIVERABLES (2)

## ■ 项目情况:

使用既有的天然气管道来输送氢气，用氢气锅炉替代天然气锅炉进行集中供热。

By reusing the existing natural gas network and replacing the current natural gas-fired central heating boilers with hydrogen boilers, the consortium believes that part of the existing Dutch housing stock can be converted from natural gas into hydrogen.

## ■ Stork负责内容:

- Project scope management 总体规划和项目管理（领导22家联合体成员）
- Project consultancy 项目咨询
- Technical and economic studies 技术和经济性研究
- HAZOP studies 危险与可操作性分析研究
- Design engineering 工程设计
- Aboveground construction—Loading station, high pressure receiving station, storage, instrumentation, control, and safety installation. 地面部分的施工建设：装载站，高压接收站，存储，仪器仪表，控制系统和安全设施。
- Electrolyzer selection 电解装置选型，以及锅炉/燃烧器等。
- Power distribution design and build 输配电设计和建设

## (二) Stork资产管理技术 - 在 欧盟气候研究项目中的应用

Stork Asset Management  
Technology ([AMT](#)) EU research  
project



*A Fluor Company*



## 欧盟研究项目EIT Climate KIC (GE2GH2)

从绿电到绿氢

# Green Electrons to Green Hydrogen

FIELD PROVEN. FUTURE PROOF.

[Link to the Stork AMT report \(GE2GH2\)](#)

# Questions to be answered in this Climate-Kic study.

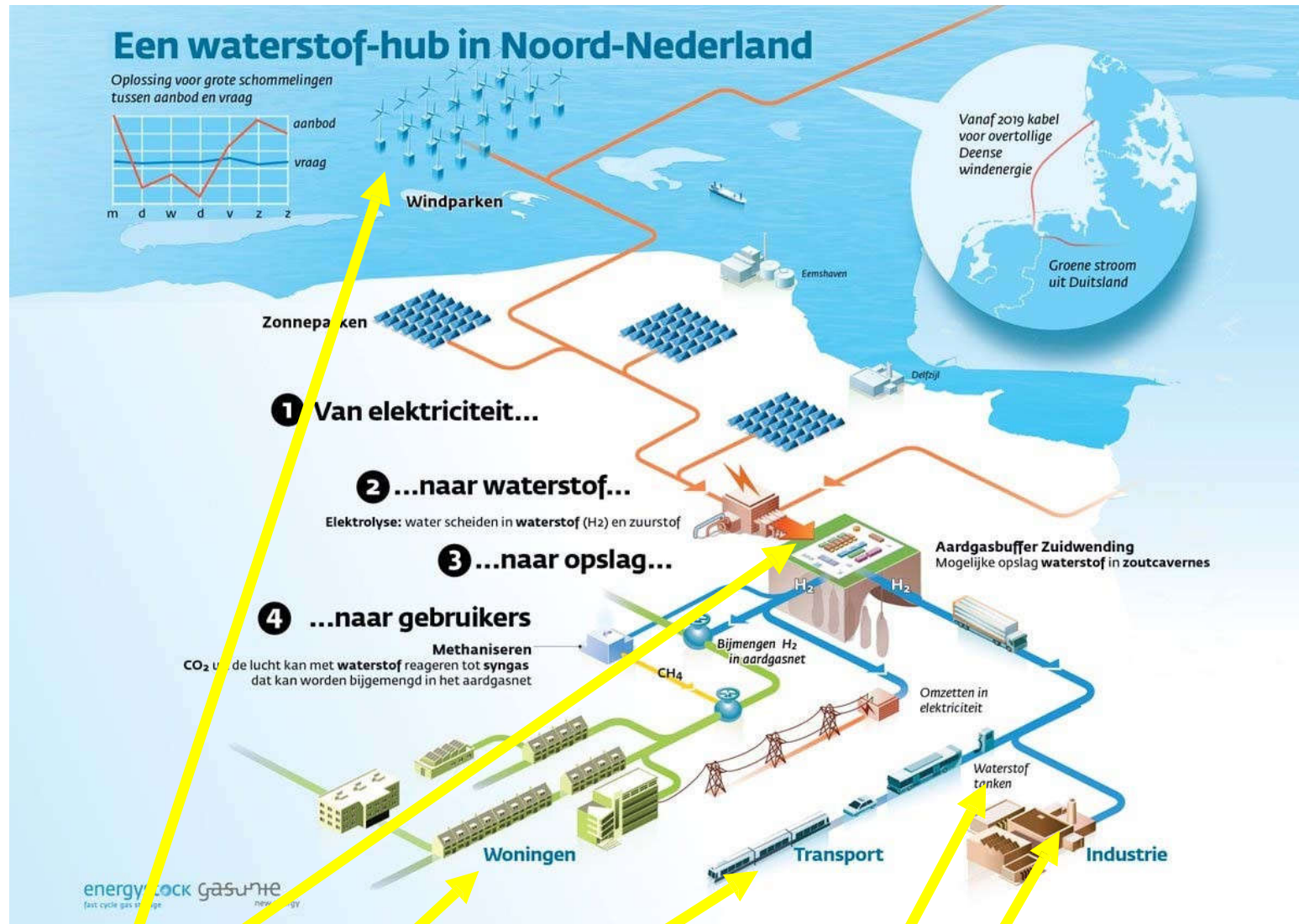
## 此欧盟研究项目中的问题讨论

- (WP 2) What is the potential **market demand** for green hydrogen in transport, industry and buildings?  
(WP 2) 交通、工业和建筑领域对绿氢的潜在市场需求是什么？
- (WP3) What are the best practices and **best available technologies** for green hydrogen production, transport, distribution, storage and conversion?  
(WP3) 绿氢制氢、运输、分配、储存和转化的最佳实践和最佳可用技术是什么？
- (WP4) What does the **supply chain** look like, which stakeholders are involved and what is their position?  
(WP4) 供应链是什么样子的，涉及哪些利益相关者，他们的立场是什么？
- (WP5) What are the associated **costs** for producing, transporting and converting green hydrogen?  
(WP5) 生产、运输和转化绿氢的相关成本是多少？
- (WP6) Is there a viable **business model** for the parties involved in the supply chain?  
(WP6) 供应链各方是否有可行的商业模式？
- (WP7) What are the **risks, opportunities and success criteria** for large scale hydrogen supply and what are the challenges and barriers and how to tackle them?  
(WP7) 大规模供氢的风险、机遇和成功标准是什么？挑战和障碍是什么？如何应对？
- (WP8) What is the **roadmap and what are viable pathways for rapidly scaling green hydrogen**?  
(WP8) 快速扩展绿氢的路线图和可行途径是什么？

<https://www.researchgate.net/publication/338108680> Welcome to the webinar  
%27The future of green hydrogen%27 Sheets in the Netherlands for industry mobility and build enviroment

# Hydrogen Hub North Netherlands

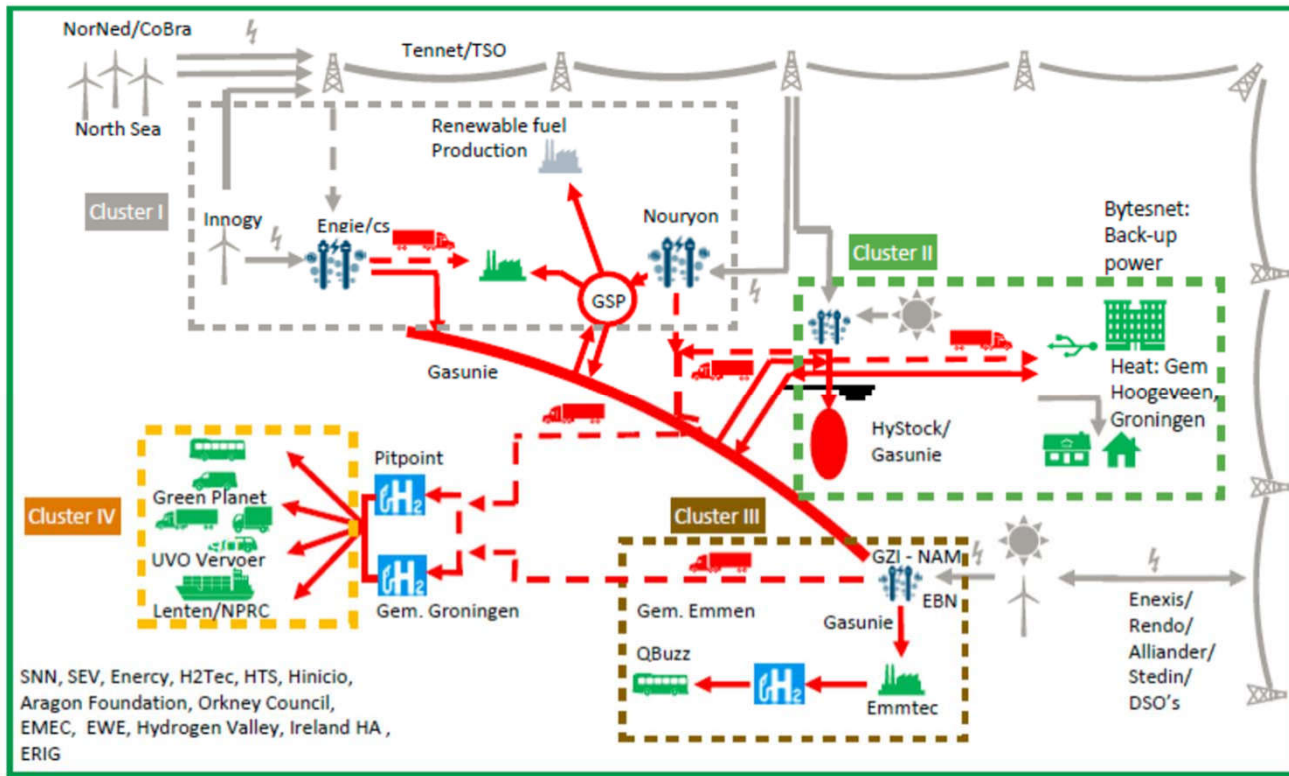
## (三) 荷兰北部氢谷绿氢项目 (黄色箭头为Stork所参与项目)



STORK Competence Center renewable Energie (Arrow is involved)



A Fluor Company



Home - Actueel - Nieuws

### Europese miljoenen voor ontwikkeling waterstoftechnologie in Noord-Nederland

12 augustus 2019

Noord-Nederland is door Europa aangezien als de regio waar de komende jaren de groene waterstoftechnologie zich verder moet ontwikkelen. Vanaf Brussel gaat er € 20 miljoen subsidie naar het project Hydrogen Valley, gericht op de ontwikkeling van een volledig functionerende proef waterstofnet. Het project kost in totaal € 90 miljoen, duurt zes jaar en gaat begin 2020 van start.



### Internationale steun

De minister van Energie is ingedivideerd door HEAVENN, een samenwerkingsverband van 31 publieke en private partijen uit zes Europese landen. De lokale partijen zijn de aanvrager waren het 25 Samenwerkingsverband Noord-Nederland (SNV) en de 22 New Energy Coalition. Bij het toepassen worden de partijen internationaal ondersteund, onder meer vanuit de Verenigde Staten en Japan. Het HEAVENN project is bijzonder, omdat het de hele waterstofketen omvat en verstrekt binnen één geografische regio.

## HEAVENN - Hydrogen Energy Applications for Valley Environments in Northern Netherlands

荷兰北部氢谷中的能源应用

The Movie:

<https://vimeo.com/368013901>

[Investment Agenda Hydrogen Northern Netherland.](#)

**INVESTMENT AGENDA  
HYDROGEN NORTHERN  
NETHERLANDS**

Heading for emission-free hydrogen at commercial scale

# Stork Project HY-STOCK (Gasunie)

## (四) Stork Gasunie 电解制氢项目

Technical Mechanical H2 construction work- 1 MW Gasunie ITM-Power electrolyzer Zuidwending. And involved in the kick-off project for the subsidy.

Stork负责机械方面的建设工作-1 MW Gasunie ITM电力电解槽 Zuidwending，并参与项目启动。



# Stork and HYDROGEN Projects

## (五) Stork 氢能项目- 加氢站 (自2014年)

- Maintain and Calibrate Hydrogen fuel station Air Liquide Netherlands/Belgium
- 维护和校准法液空公司加氢站（荷兰/比利时）
- 自2014年开始对加氢站进行预防性维护和故障检修，包括荷兰的第一个70MPa加氢站。
- Build Pitpoint Hydrogen fuel station Delfzijl (all construction WTB and EI&A) above the ground with Akzo Nobel MEB plant.
- 在阿克苏诺贝尔MEB工厂的地面上建造Pitpoint加氢站Delfzijl（包括所有施工WTB和设计施工）。



# Stork and (PSA) HYDROGEN Project EVONIK

## (六) EVONIK氢能项目

Stork所负责的工作:

All services: Mechanical construction at plant:  
负责工厂所有机械方面、仪表电气的施工建设:

- EI&A services 仪表电气、机械等设计施工服务
- Resident Stork people onsite in Internal organization
- 常驻Stork员工现场组织工作
- ATEX inspection All side (incl. PSA) and after Inspection needed modification work (EI&A)
- 防爆全面检查(包括变压吸附)及检查后所需的修改工作(设计施工)
- Plant Control & ESD system Migration / replacement, Project Management, engineering, Work preparation, construction and commissioning).
- 工厂执行和ESD系统迁移/更换, 项目管理, 设计, 任务准备, 施工和调试





# Stork and (PSA) HYDROGEN Projects BIOMCN

## (七) BIOMCN氢能项目

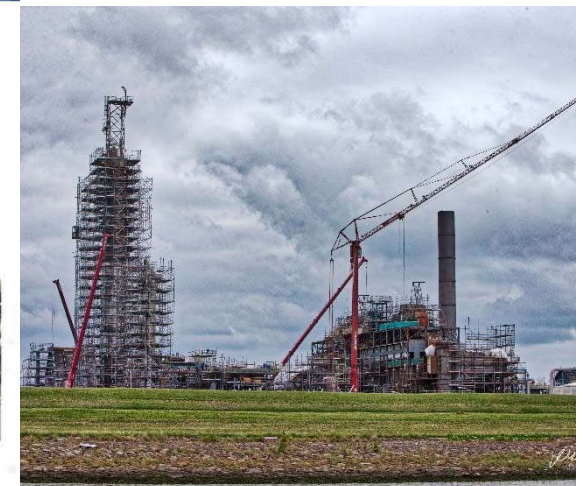
All services: Mechanical construction at plant:

负责工厂机械、电气仪表的施工建设:

- El&A services 电气仪表、机械施工等服务
- Resident Stork people onsite in Internal organization
- 常驻Stork员工现场组织工作
- ATEX inspection All side (incl. PSA) and after Inspection needed modification work (El&A)
- ATEX全面检查(包括PSA)及检查后所需的修改工作
- Plant ESD system replacement commissioning 工厂ESD系统更换调试
- Turn-around management 检修管理
- Inspect and start up old plant after 10 years out of service.
- 检查并启动已停机10年的老工厂

Video Stork BioMCN

<https://vimeo.com/193540>



# Stork and Project BIOMCN in more detail

## BIOMCN项目Stork所提供的具体服务

All services: Mechanical construction at plant:  
所有服务包括:

The following in house Stork Services are provided to BioMCN:

- Mechanical Services (Stork ISCE) 机械服务 (Stork ISCE)
- Boiler services (Stork Thermeq) 锅炉服务 (Stork Thermeq)
- E&I and A Services (Stork ISCE) 设计施工服务 (Stork ISCE)
- Valve Revision/overhaul (Stork specialists) 阀门修改/彻底检修(Stork专家)
- Rotating overhaul (Stork Specialists) 转动设备彻底检修(Stork专家)
- Turbine revision (Stork Turbo Services) 透平改造(Stork涡轮服务公司)
- Heat treatment (Cooperheat) 热处理(Stork Cooperheat)
- Facilities and Tools (Eqin) 设施和工具(Eqin)



# Hydrogen Reference Projects

## (八) 氢能应用 – 燃烧器改造项目

- Burner Projects (retrofit) for high contents of H2 in fuel gas:
- 燃烧器项目(改造): 高含量氢气的燃料, 实施业绩包括:

|                         | H2 % in fuel gas |
|-------------------------|------------------|
| Thai Oil                | 25%              |
| Shell Moerdijk 壳牌       | 25%              |
| Fina Antwerpen          | 30%              |
| Shell Berre 壳牌          | 50%              |
| Shell Petit Couronne 壳牌 | 25%              |
| BASF Ludwigshafen 巴斯夫   | 25%              |
| Hexion Botlek           | 40%              |
| Tupras (Turkey)         | 60%              |

- Burner Projects (retrofit) for solely H2 gas:
- 燃烧器项目(改造): 100%氢气燃料, 实施业绩包括:

|                    | H2 % in fuel gas |
|--------------------|------------------|
| SABIC BoZ          | 100%             |
| Solvay Tavaux (Fr) | 100%             |
| AKZO Hengelo       | 100%             |
| Vynova Tessengerlo | 100%             |

# Hydrogen Development Stackless Boiler

## 氢能应用 - 无烟囱锅炉

### Characteristics 特点

- Hydrogen + Oxygen produced by electrolyzers 电解槽产生的氢+氧
- No CO<sub>2</sub> during combustion of Hydrogen 燃烧无CO<sub>2</sub>

- Combustion of hydrogen with air -> high Nox

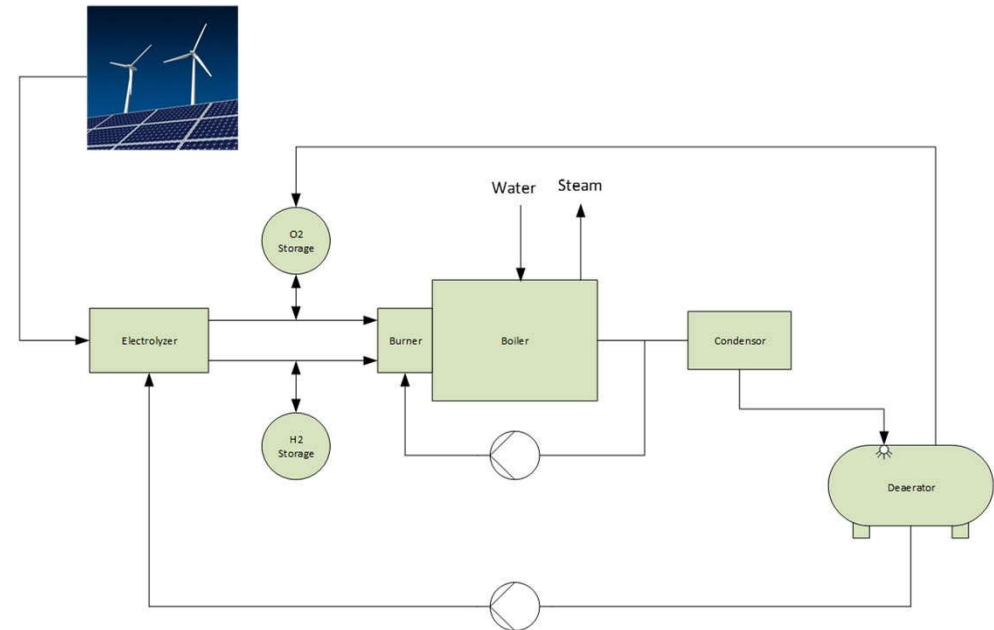
氢气与空气的燃烧产生高NOx

- Combustion of hydrogen with Oxygen -> no emission, just water  
氢与氧的燃烧：没有排放，只有水

### Goal 目标

Develop possible solution to retrofit existing boilers to eliminate emissions

开发改造现有锅炉以消除排放的可能解决方案



# Hydrogen Development Asphalt heating

## (九) 氢能应用 - 沥青加热系统

- Cooperation: A Dutch Asphalt company 某一荷兰沥青公司
- Reason: More stringent demand from government for sustainable production of asphalt 政府对沥青可持续生产的更迫切需求
- Assignment: Development of a heating system to recycle asphalt in a sustainable way. 开发加热系统，以可持续的方式回收沥青
- First phase: Design and delivery of bitumen heater on Hydrogen. 氢燃料沥青加热器的设计和供货
- Second phase: Design and delivery of a heating system on Hydrogen for asphalt kilns. 沥青窑氢加热系统的设计与供货
- Number of sites: First of 7.
- Current status: Phase 1

## (十) 在荷兰格罗宁根建设氢气管网 (200/50/8 bar)

Build a 200 bar, 50 bar and 8 bar Hydrogen net at Energy Transition Center Groningen. Start construction sept 2020.

在格罗宁根能量转换中心建造一个200巴、50巴和8巴的氢气管网。  
2020年9月开工建设。

### Stork所提供的服务：

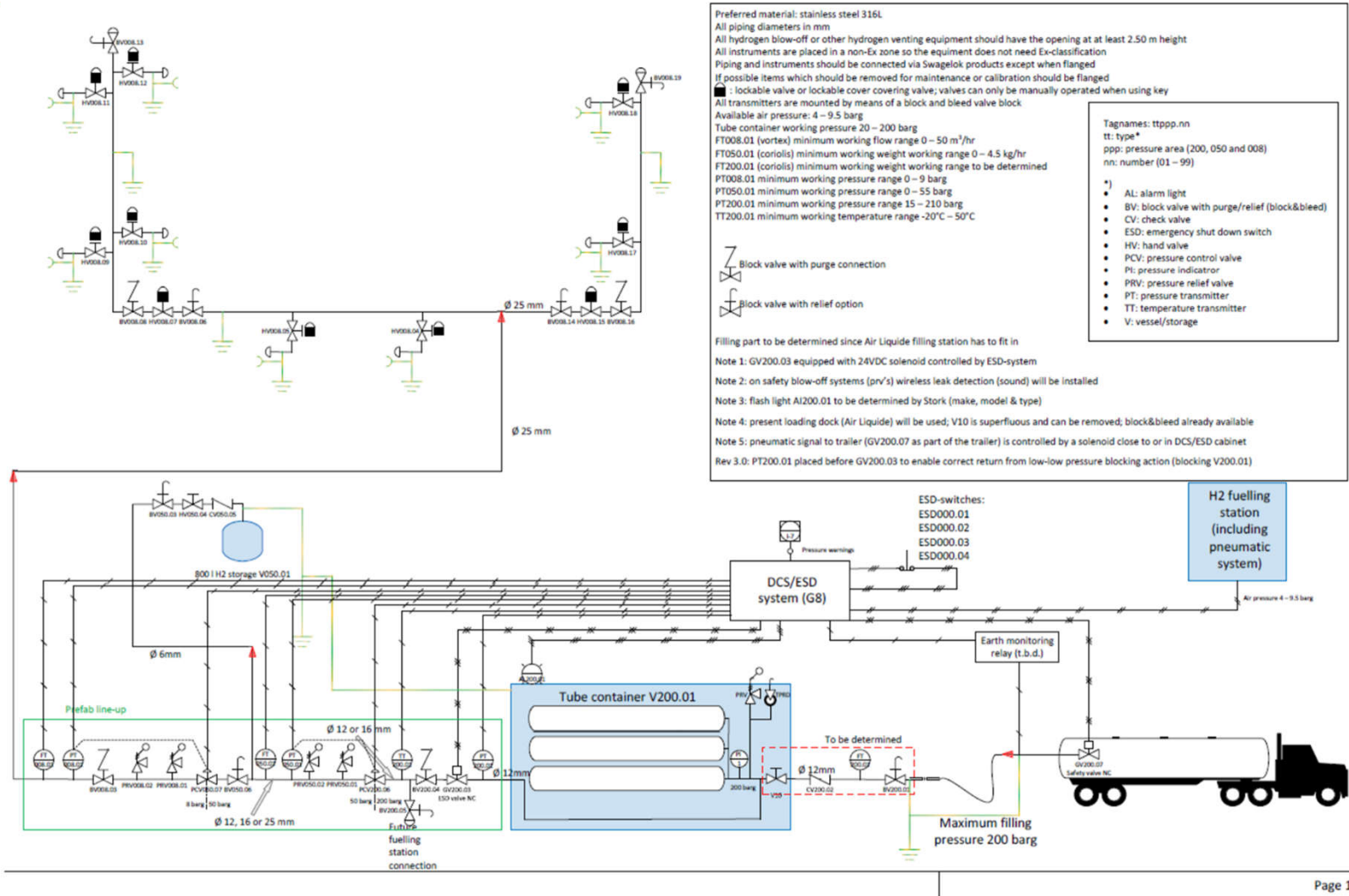
- Piping 管道系统
- Instrumentation 仪控
- Safety instruments and loops  
安全仪表和回路



# EnTranCe Hydrogen transition bridge 200/50/8 bar

September 25, 2020

P&ID Energy Transition Bridge hydrogen expansion (rev 3.0)

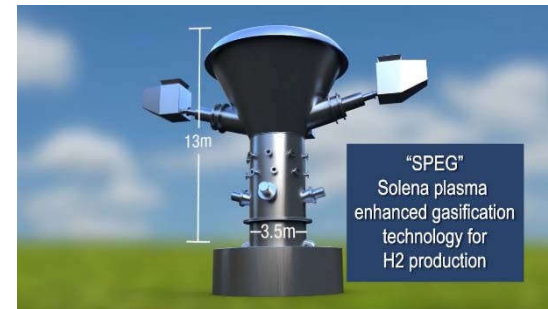


# SGH2 Energy (Fluor Stork project) waste to H2

## (十一) 世界首个垃圾等离子气化 - 商业制氢项目

### • **Fluor-Stork**是项目联合体主要成员。

|                                  |      |   |   |                     |
|----------------------------------|------|---|---|---------------------|
| • Project                        | 项目   | : | SG H2 Energy                              | SG氢能                |
| • Type                           | 形式   | : | Waste to H2 Gasification - Plasma         | 垃圾制氢                |
| • Location                       | 地点   | : | California – Lancaster plant              | 加州-兰卡斯特             |
| • Capacity feed input            | 进料容量 | : | 42.000 Ton waste as input.,               | 42,000吨垃圾进料         |
| • Capacity H <sub>2</sub> output | 氢气产出 | : | 11 Ton/Day 38.000 Ton/year H <sub>2</sub> | 产氢11吨每天, 38,000 吨每年 |
| • Start construction             | 建设开始 | : | Q1 2021                                   |                     |
| • Start-up commissioning         | 调试时间 | : | Q4 2022                                   |                     |
| • Full operational               | 全面操作 | : | Q1 2023                                   |                     |
| • Maintenance contract           | 维护合同 | : | 20 Year                                   |                     |

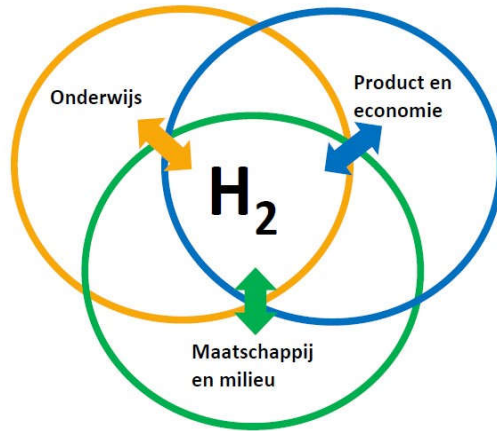


- <https://www.sgh2energy.com/technology/>
- <https://fuelcellsworks.com/news/worlds-largest-green-hydrogen-project-to-launch-in-california/>
- <https://www.designboom.com/technology/worlds-largest-green-hydrogen-plant-lancaster-05-27-2020/#:~:text=the%20SGH2%20lancaster%20plant%20will,tons%20of%20recycled%20waste%20annually.>



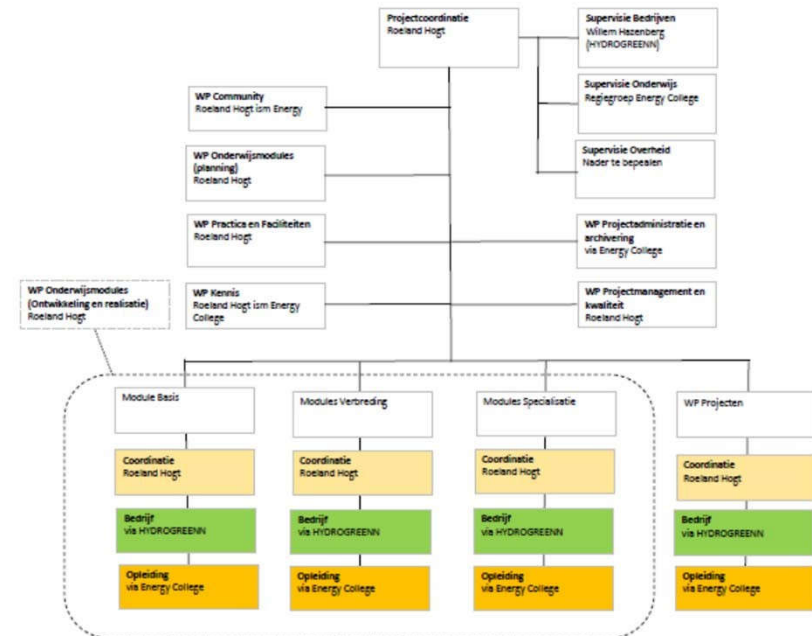
# Stork and HYDROGEN MBO-HBO Education

## (十二) Stork 和 氢能MBO-HBO 教育



Role: STORK

- Main Sponsor 主要赞助商
- Member Supervision board 监事会成员
- Know how for Training 培训
- Support with Project cases



Multiple students use the Stork/ HYDROGREEN cases for Bsc. Master or PHD programs.

很多学生将Stork/HYDROGREEN案例用于本科，硕士或博士课程



# Fluor CCS knowhow for Blue H2 ambition

## (十三) 其他氢能技术:

### 福陆Fluor (Stork母公司) - 蓝氢碳捕获技术

## Fluor CCS knowledge

Fluor provided preliminary services, front-end engineering and design, engineering, procurement, and construction (EPC) for Shell's Carbon Capture and Storage (CSS) Quest project. The Quest project was built on behalf of the Athabasca Oil Sands Project joint venture owners (including Shell, Chevron, and Marathon Oil) with support from the Canadian and Alberta Governments.

Fluor为壳牌公司的碳捕获和储存 (CSS) 项目提供前期服务、前端工程设计、建造、采购和施工 (EPC)。Quest项目是代表阿萨巴斯卡油砂项目合资企业所有者 (包括壳牌、雪佛龙和马拉松石油) 在加拿大和阿尔伯塔省政府的支持下建造的。

**Fluor used its patented and innovative 3<sup>rd</sup> Gen Modular Execution<sup>SM</sup> approach for the 1.1 million tonne-per-year carbon capture facility at the Scotford Upgrader. Captured carbon dioxide is sent about 80 kilometers from the facility via underground pipeline to an underground storage site.**

Fluor公司利用其专利和创新的第三代模块化执行方法，在斯科特福德升级厂建立了110万吨/年的碳捕获设施。捕获的二氧化碳通过地下管道从该设施输送到大约80公里的地下储存地点。

[https://www.fluor.com/client-markets/energy-chemicals/carbon-capture\\_Film](https://www.fluor.com/client-markets/energy-chemicals/carbon-capture_Film):

<http://www.fluor.com/about-fluor/videos>

*Stork是Fluor旗下全资子公司*

## Abstract 摘要

Fluor uses multiple routes to address the needs of the hydrogen market. Fluor's patented process for hydrogen recovery provides a cost effective method for recovery, reduces the cost of recovery with simultaneous by-product. Fluor also has experience in "trigen" projects, an environmentally friendly process with tight control on NO<sub>x</sub> and SO<sub>x</sub> emissions, that concurrently produce hydrogen, power, and steam by gasification of either residue or petroleum coke. Lastly, Fluor uses the steam reforming of light hydrocarbons to meet the requirements of a specific site.

Fluor利用多种途径来满足氢气市场的需求。Fluor的氢回收专利工艺提供了一种成本效益高的回收方法，降低了回收成本，同时产生副产品。Fluor还拥有“trigen”项目的经验，这是一种严格控制NO<sub>x</sub>和SO<sub>x</sub>排放的对环境友好工艺，可同时生产氢、电能，通过残渣或石油焦的气化产生蒸汽。最后，利用轻烃的蒸汽重整来满足特定场所的要求。

## Client Benefits

Fluor can offer Clients a "complete hydrogen solution" that includes:

- Hydrogen management studies, 氢气管管理研究,
- Hydrogen plant revamp studies, 氢气装置改造研究
- Steam reforming technology, 蒸汽重整技术
- Gasification technology, 气化技术
- Hydrogen recovery from fuel/waste streams 从燃料/废物流中回收氢气

<https://www.fluor.com/about-fluor/corporate-information/technologies/hydrogen-supply-systems-optimization>

# Hydrogen Experience: Stork

## 总结 (1) : Stork (施托克) 氢能经验

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Stork及其母公司Fluor至今已涉足**近百个氢能项目**，包括灰氢/蓝氢/绿氢项目。

Ambition to be the firm recognized as industry reference & leader in Renewable Energy, especially in the field of Hydrogen. For Consulting, Engineering, Project management, Construction, Maintenance and Asset management.

Stork 致力于成为业界公认的可再生能源，特别是氢能源领域的领先者，从事咨询、工程、技术及设备、项目管理、施工、维护和资产管理。

Selective experience includes: 可选性的经验包括:

- Pipelines to/from industrial sites
- 进出工业场地的**管道**
- Maintenance and calibration of H2 fueling stations in NL/B
- 荷兰/比利时**加氢站**的维护与标定
- Development of stackless boiler concept (burning H2 with O2 only)
- 氢气燃烧器和无烟囱**氢能锅炉**的发展
- Construction of H2 grids (200, 50 and 8 bar) at Energy Transition Center in NL
- 在荷兰能量转换中心建造/改造**氢气管网** (200巴、50巴和8巴)
- Mechanical construction scope for 1 MW electrolyser Gasunie Zuidwending, NL
- 荷兰 Zuidwending **电解槽**机械施工范围
- EU Research report “Roadmap for Green Hydrogen” (GE2GH2)
- 欧盟研究报告“**绿氢路线图**” (GE2GH2)

# Hydrogen Plant Experience: Fluor

## 总结 (2) : Fluor (福陆, Stork母公司) - 氢能经验

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Production (from a variety of feedstocks: NG, LPG, oil residues):

生产 (各种原料: 天然气、液化石油气、油渣) :

- Conventional: Gasification, SMR, POX
- 灰氢: 气化、SMR、POX
- Blue: includes a carbon capture solution
- 蓝氢: 包括碳捕获解决方案
- Green: Balance of Plant, system integration
- 绿氢: 配套设施, 系统集成净化

Purification: 净化 PSA - Others

Compression 压缩

- Consumption:
  - Hydrocracking, hydrotreatment 加氢裂化、加氢处理
  - Hydrogenation 氢化
  - Polysilicon 多晶硅
- Others Corrosion/metallurgical aspects 其他腐蚀/冶金方面

Materials 管道材料方面: 输氢和混氢管道材料选择、失效分析等研究

HSE aspects: 健康安全环境方面