

GETEC BENELUX

Project: H2AAS

H2 As A Service / Cluster Northern Netherlands

Adding H2 as an intermediate step
in the local energy transition of the
industry.

René Hartman
November 9th, 2023

ENERGY FOR MORE.



GETEC



OUR COMPANY AT A GLANCE



~€ 1.8 billion

SALES 2022*

~11,800

UNITS
PRODUCING
>5.4 GW_{th}

~46 %

OF SALES GENERATED
OUTSIDE GERMANY

~15 years

TERM OF SALES
FROM LONG -TERM
CONTRACTS

~30 %

RENEWABLE
ENERGIES

712,000t

CO₂ SAVINGS/ YEAR

94 %

NON-COAL-
GENERATION

#1

IN ASSET-BASED
ENERGY SERVICES IN
GERMANY

~800

SERVICE EMPLOYEES
DEPLOYED

~2,600

EMPLOYEES
THEREOF 545 ENGINEERS

4 x 24/7

EUROPE-WIDE SMART
CONTROL CENTERS
FOR OUR CUSTOMERS

> 1m

PEOPLE SUPPLIED WITH
HEATING, COOLING
AND ELECTRICITY

~75 %

DIGITIZATION
OF OUR
FACILITIES

INFRASTRUCTURE
INVESTMENTS FUNDS /
JP MORGAN

J.P.Morgan



OUR BUSINESS & OUR SOLUTIONS AT A GLANCE



...FOR INDUSTRIAL CUSTOMERS

Aquisition of Multi Client Sites



- Design
- Build
- Finance
- Maintain
- Operate

New construction



Aquisition of assets (Client Sites)



... FOR THE REAL ESTATE



Houthavenkade - Zaandam

WE ACCOMPANY THESE CUSTOMERS ON THEIR WAY TO NET ZERO



5.4 GWth
Total output



11,800
Assets



INTRODUCTION

Project H2AAS

There are several companies in the Netherlands that have received a letter from the Minister to strongly reduce gas consumption (Groninger gas). The reason is the earthquake problems in the north of the Netherlands, as a result of which the cabinet has decided to close various gas fields in Groningen. These companies are (for the time being) not connected to Gasunie's hydrogen backbone. These companies have united in Industry Cluster East Groningen. A total of 10 companies are located in the north of the Netherlands and this project has been given the title H2AAS (H2 As A Service).

A 'supercharger' has been appointed to support these 10 companies. This person has good contacts with the management of GETEC Netherlands and in this way we came into contact and we explored whether we could take up these activities as GETEC / Single Client Site Industry.



INTRODUCTION



Project H2AAS (H2 As A Service)

For the H2AAS project, the following companies are involved, divided into “frontrunners” and “followers”. These are:

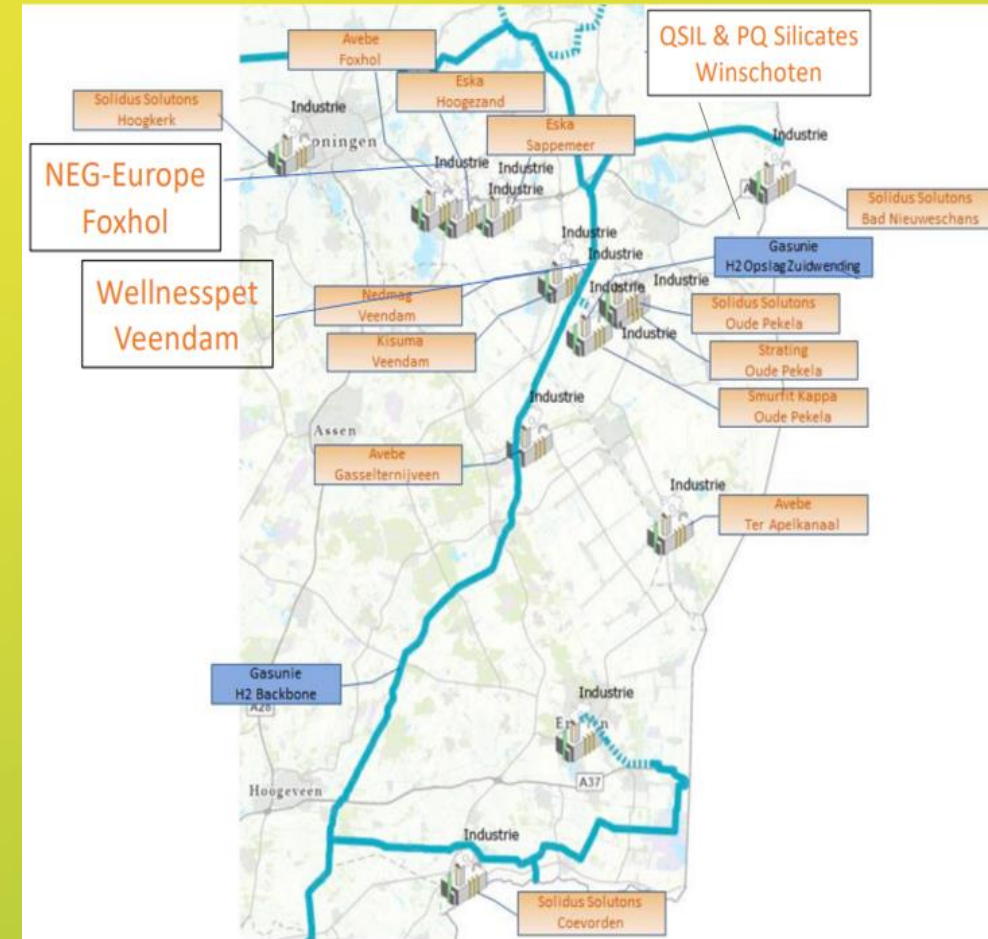
Frontrunners

- Nedmag – Veendam
- Strating – Nieuwe Pekela
- Wellness petfood – Wildervank
- Smurfit Kappa – Oude Pekela
- ESKA – Hoogezand

Followers

- AVEBE – Veendam
- Kisuma - Veendam
- QSIL – Winschoten
- PQ – Winschoten
- Solidus Solutions

A short explanation of the participating “frontrunner” Nedmag.



INTRODUCTION OF PARTICIPATING COMPANIES



Project H2AAS

Nedmag Veendam

Nedmag (Nederlands magnesia) is a Veendam-based company that extracts magnesium salts in the province of Groningen. Nedmag manufactures magnesium products based on the extracted salt. Nedmag is the market leader in Europe in the production of Dead Burned Magnesia (DBM), calcined magnesium oxide or heat-treated magnesium hydroxide and dolomite.

Nedmag's production activities take place in the Groninger Veenkoloniën. The head office and factory are in Veendam and the salt mine is in Tripscompagnie. For the extraction of the magnesium salt, Nedmag has a salt mine 1.5 km underground south of Tripscompagnie. The salt is extracted through so-called solution mining. As one of the few companies, Nedmag can guarantee a purity of 99% during production.



CASE H2AAS > REQUEST GETEC



In order to join forces, share knowledge and work together, various explorations were carried out in the year 2022 by the 'supercharger' of the project. One of the outcomes of the exploration conducted during August/October 2022 is to "add green H2 on location", which is in line with the scope for follow-up action formulated in the East Groningen Industry Cluster (from the report to the Province of Groningen - mid-November 2022) .

Based on the Industry Cluster (IC) discussions on 3 and 4 November 2022 about the findings presented, consultations with the Province of Groningen and a number of stakeholders, a plan for concrete follow-up actions has been made. The important starting points for the follow-up program will also remain: contributions to the profiling and to the social/economic vitality of East Groningen and the achievement of concrete transition results for one or more IC companies/locations.

As is the case for many CES Cluster 6 companies, the 10 companies within the Industry Cluster (IC) East Groningen (14 production locations spread in that region) face significant challenges in the energy transition for their heat processes.



CASE H2AAS > REQUEST GETEC



Of course, the focus is also strong on them process optimization and electrification. However, due to the uncertainties about the E-system and the relatively unfavorable position of the IC companies on the future green gas market for heat applications, the IC is also exploring the option of starting regionally with the addition of green gas in this period. H2 at production locations (so not on the public grid). Regionally, because it may take a long time before green H2 will become available to Cluster 6 companies via the Gasunie H2 backbone and infrastructure to be constructed.

H2 partial information is available in various places (burners, % admixture, small electrolyzers, etc.). In order to be able to weigh up the role that H2 admixture can play, the IC, with the support of the Province of Groningen, has therefore launched a broad joint reconnaissance started. The aim is to bring together available knowledge and experiences, to share this with the IC participants and then to be able to conclude whether/how this option can play a role in the energy transition for this category of companies. That can then lead to targeted follow-up projects for the companies of the East Groningen Industry Cluster.



CASE H2AAS > REQUEST GETEC



Request:

The supercharger and the 10 participating companies, has asked GETEC for help! The participating companies do NOT intend to build or operate an H2 installation themselves, but asks GETEC to develop a proposal to be able to add H2 to the existing production installation in the future. The starting point is to add (max) 15% H2 to the existing installations. This can be done via dedicated H2 installations or via H2 tube trailers.

The participating companies are aware that H2 is more expensive than Groningen gas. Getec is only working out a proposal, in which the Nedmag case is regarded as leading (reference).



CASE / NEDMAG - VEENDAM



Nedmag needs both electricity and natural gas for its processes. Natural gas is used as a combustion medium for its processes. In addition to relatively simple central heating boilers (which we have not considered for this study due to their low consumption and simple technology), we have 4 different types of combustion stations:

<u>Technique</u>	<u>% of total gas consumption</u>
• Boilers (both steam and thermal oil)	20%
• Fan heaters	15%
• Calcination furnaces	50%
• Sinter furnaces	15%

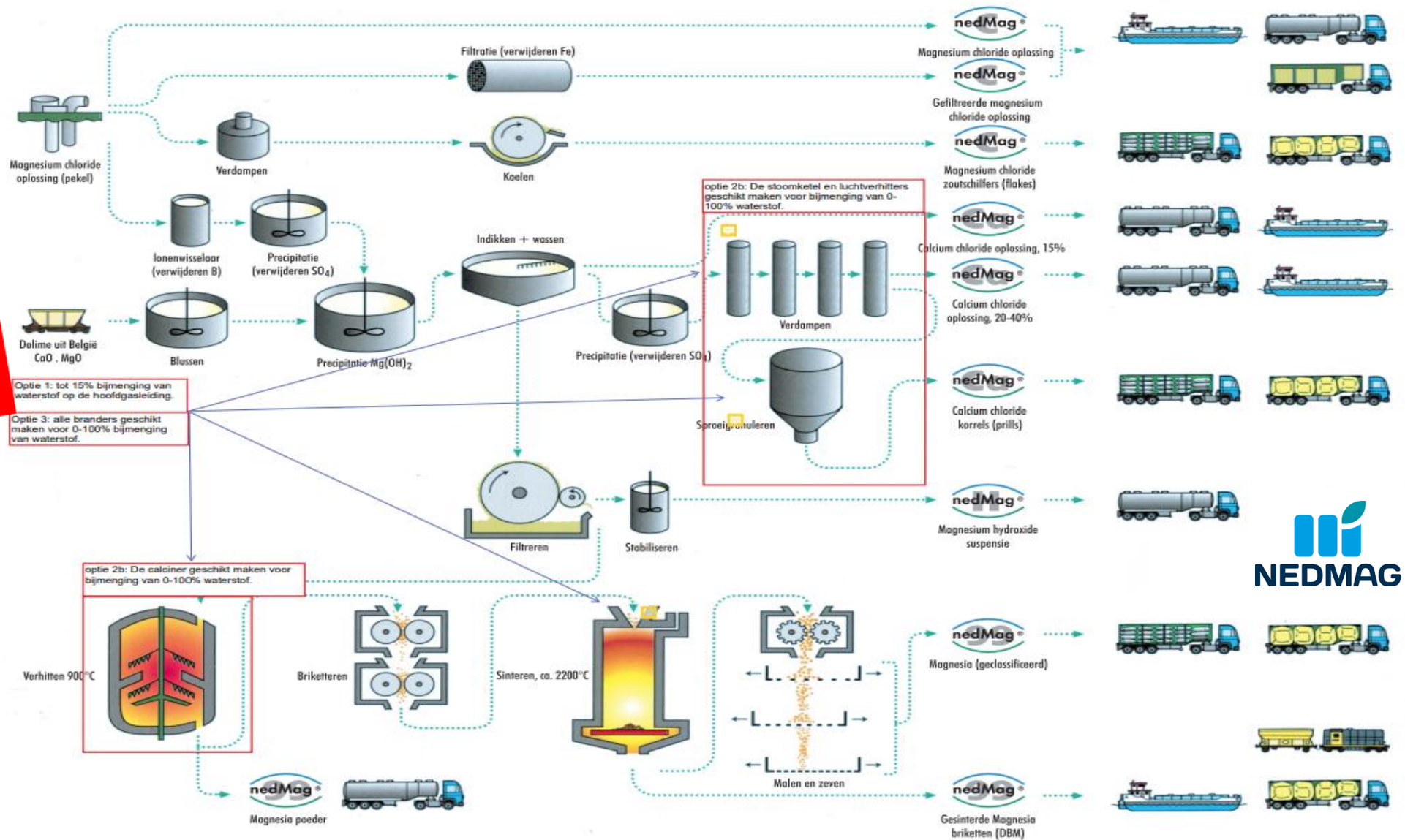
Nedmag expects (green) hydrogen to become the CO₂-free alternative to natural gas. Only 20% of our current natural gas consumption can be electrified (boilers). The remaining 80% is used as an energy source for direct heating to very high temperatures. With this heating (combustion of the molecules), the flue gas flow (speed and volume) is important for the process management that we have in a large part of those processes. In the calcining ovens, the flue gas flow also serves as a preheating medium for part of the feed to be dried (which provides an energy advantage).

Nedmag has two productions locations: Billitonweg and Tripscompagnie (both Veendam).



CASE / NEDMAG - VEENDAM

Nedmag process with options



H2 added
Max. 15%

NEDMAG

CASE / NEDMAG VEENDAM



Technical issues that arise when using H₂ as a combustion medium:

When starting the blending of green hydrogen, we must be sure that burner lines/burner systems are suitable for handling hydrogen-natural gas mixing variations. Both our own studies and the research of DNV-GL 'Hydrogen as a fuel for heating processes' show that we have to take the following into account:

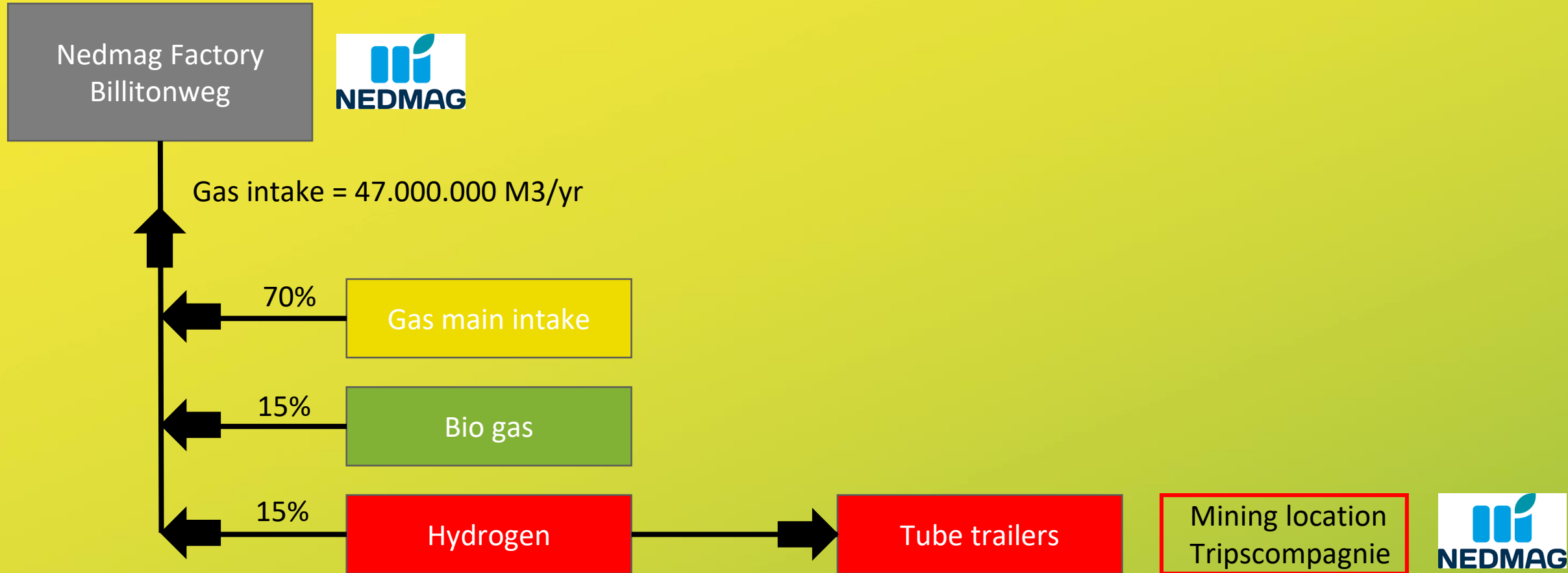
- Hydrogen has a different calorific value than natural gas;
- At a constant calorific value, the mixing ratio of air and fuel must be adjusted when hydrogen is added;
- Hydrogen gas requires more volume than natural gas; this may allow adjusting fuel lines;
- Due to the higher temperatures of the flame, there is a good chance that NO_x emissions will be higher;
- The temperature distribution in the hydrogen flame is different from that of natural gas;
- Because of the different temperature distribution (and certainly directly at the burner) we have to take into account a greater heat load on the burner head and the immediate environment at the outlet of the burner (especially refractory);
- The color of the flame of burned hydrogen is different from natural gas;
- Hydrogen gas is more volatile than natural gas, the question is whether our current natural gas systems are hydrogen proof (pipes, appendages, etc);
- The composition of hydrogen flue gases is different from that of natural gas;
- Because we have different types of burners, the results of the above items are different per burner type.

In order to determine/decide which measures we need to take to properly manage the above matters, we must determine in advance how much hydrogen will be generated over time.

CASE / NEDMAG VEENDAM



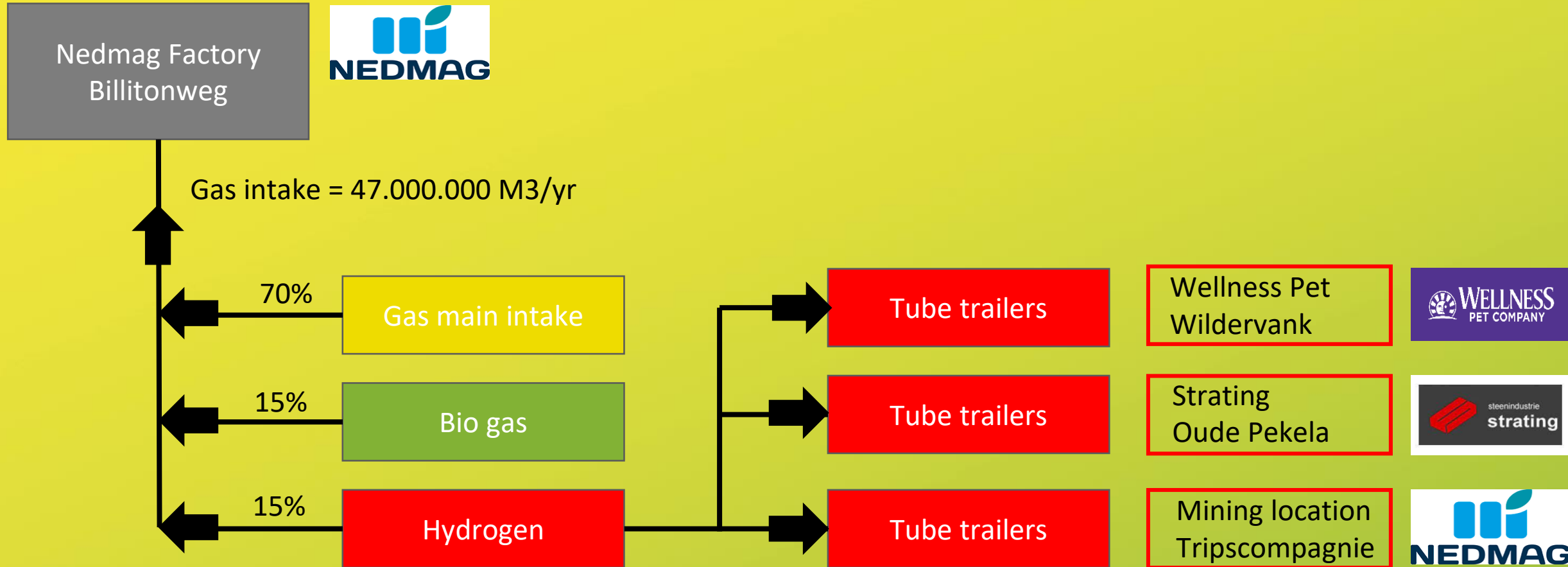
Option 1:



CASE / NEDMAG VEENDAM



Option 2:



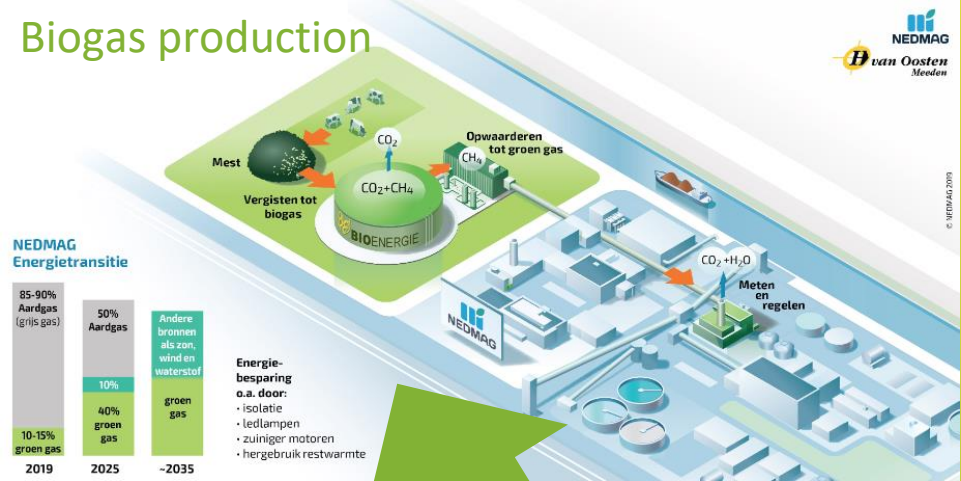
CASE / NEDMAG VEENDAM



Nedmag location Billitonweg Veendam



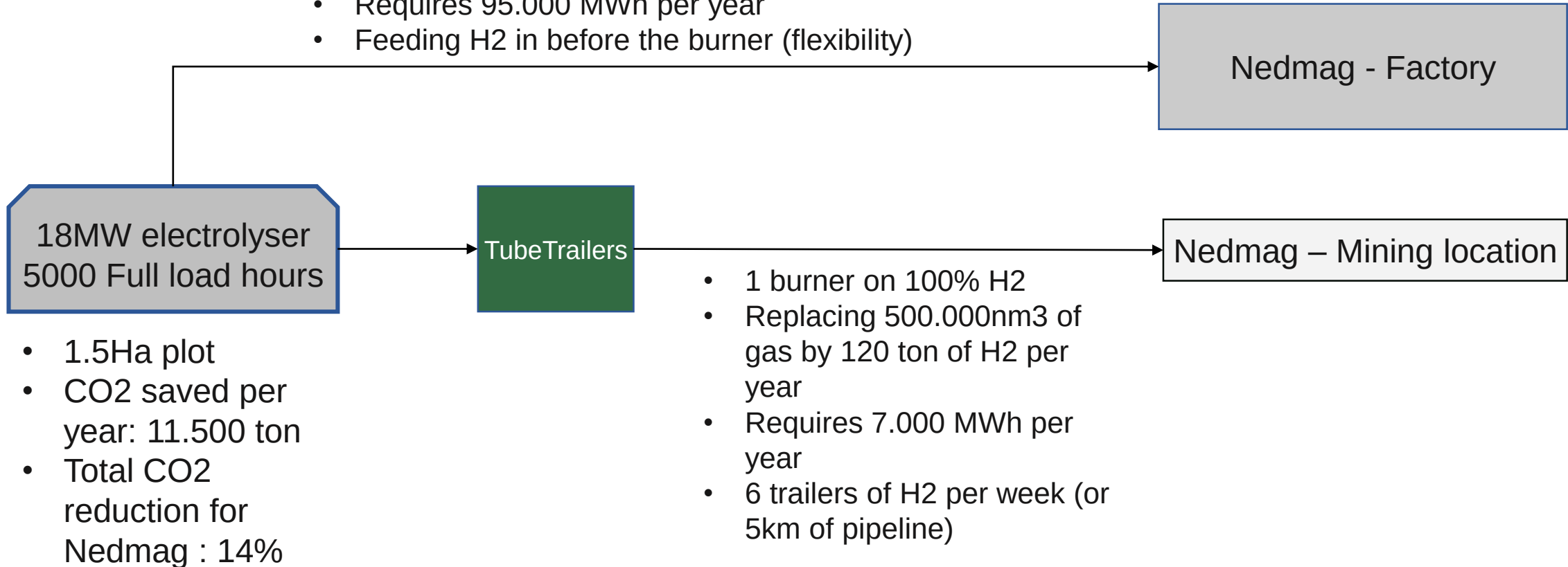
H2 location



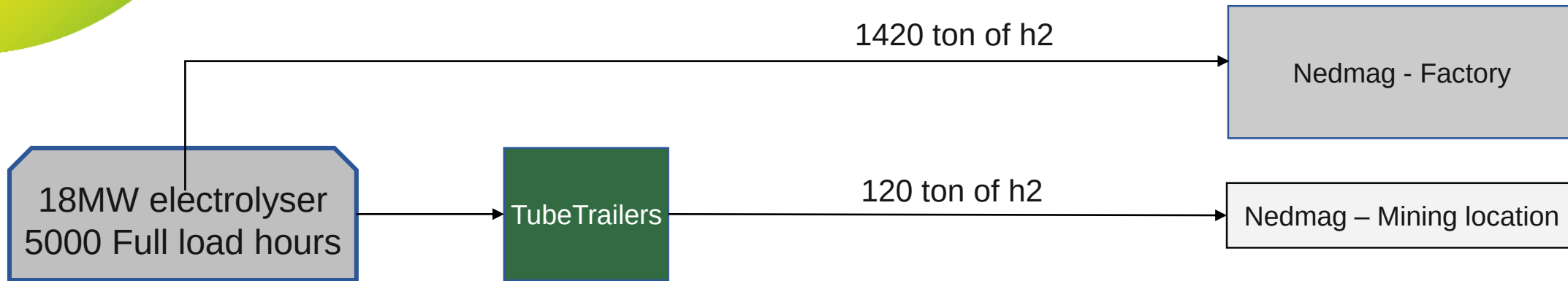
NEDMAG VEENDAM / elaboration of proposal



- Replacing 5,900.000 nm³ of gas by 1420 ton of H₂ per year (15%)
- Requires 95.000 MWh per year
- Feeding H₂ in before the burner (flexibility)



NEDMAG VEENDAM / elaboration of proposal

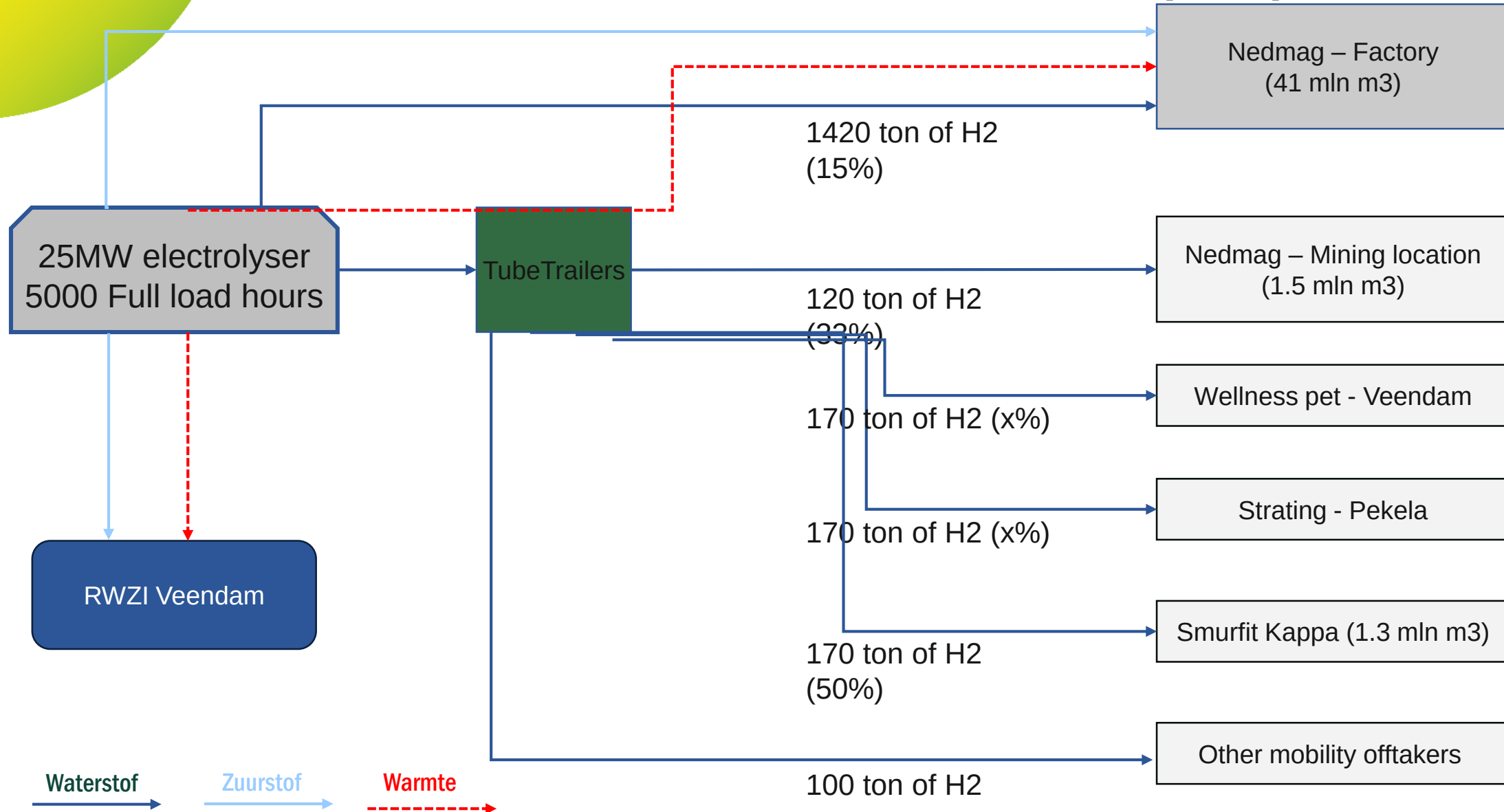


Financials (for a 15 year project)

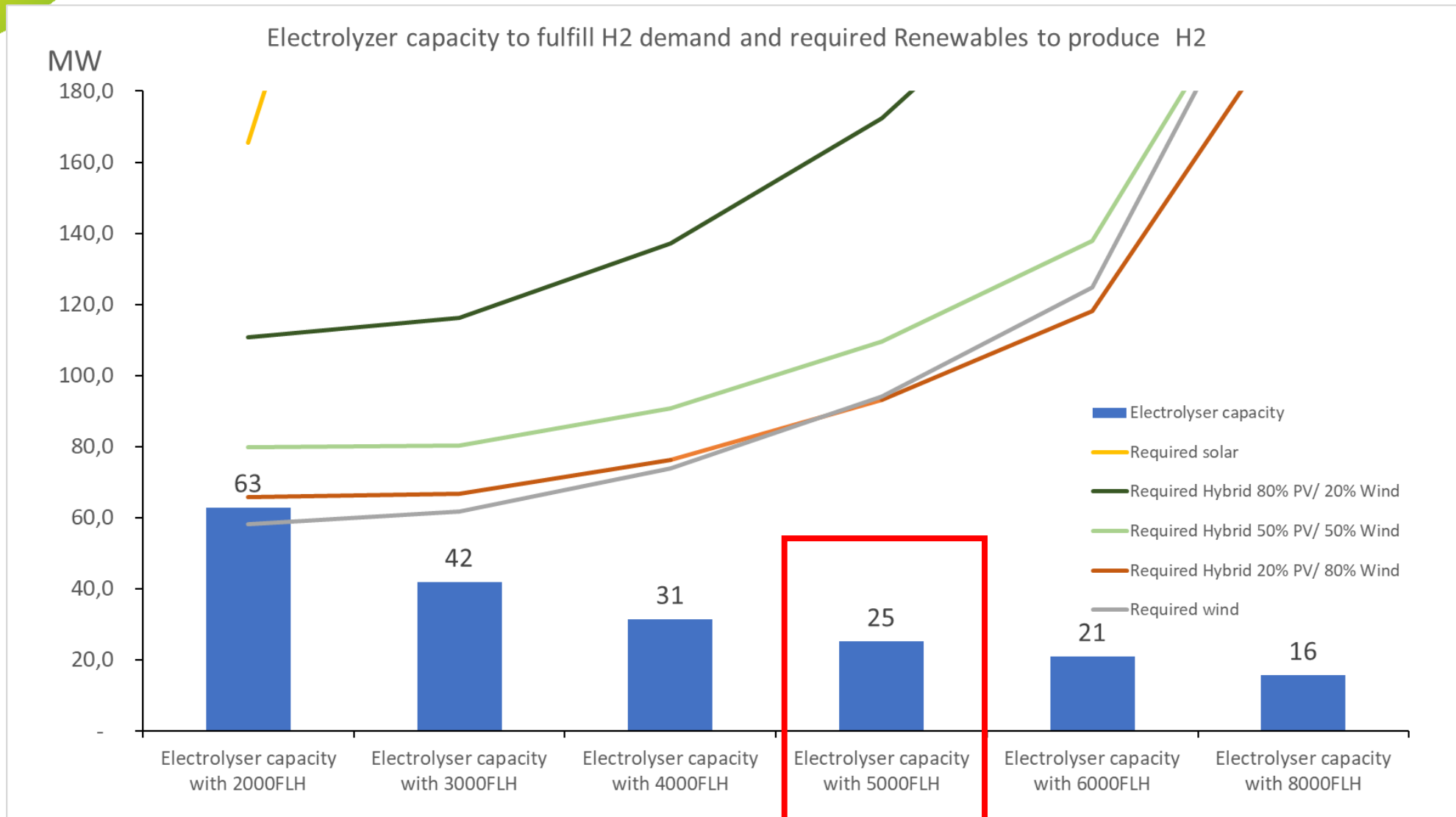
- Forecasted average natural gas cost = € 1,800,000 per year
- Forecasted average ETS cost = € 1,300,000 per year
- Average hydrogen costs (CAPEX + OPEX + electricity) = € 5,700,000 per year
- Saved costs on CO2 emissions = €1.300.000 per year
- Yearly netto cost difference = € -2,600,000*
- Hydrogen to natural gas cost ratio = 2.2*
- Average yearly H2 sales price = +- € 6 / 9 per kg

*Excluding revenue from Oxygen, Heat and NOx reduction

NEDMAG VEENDAM / elaboration of proposal



NEDMAG VEENDAM / elaboration of proposal





- Totaal: 55,768m²
- Industrie bestemming (cat 4.2)
- Archeologische waarde 3 (De voor 'Waarde - Archeologie 3' aangewezen gronden zijn, behalve voor de andere daar voorkomende bestemmingen, mede bestemd voor behoud van archeologische (verwachtings)waarden.) → archeologisch onderzoek
- Standaard Geluidsruimte (dB(A)/m²:60)
- Binnen het bouwvlak (specifieke bouwaanduiding - bouwklasse e)

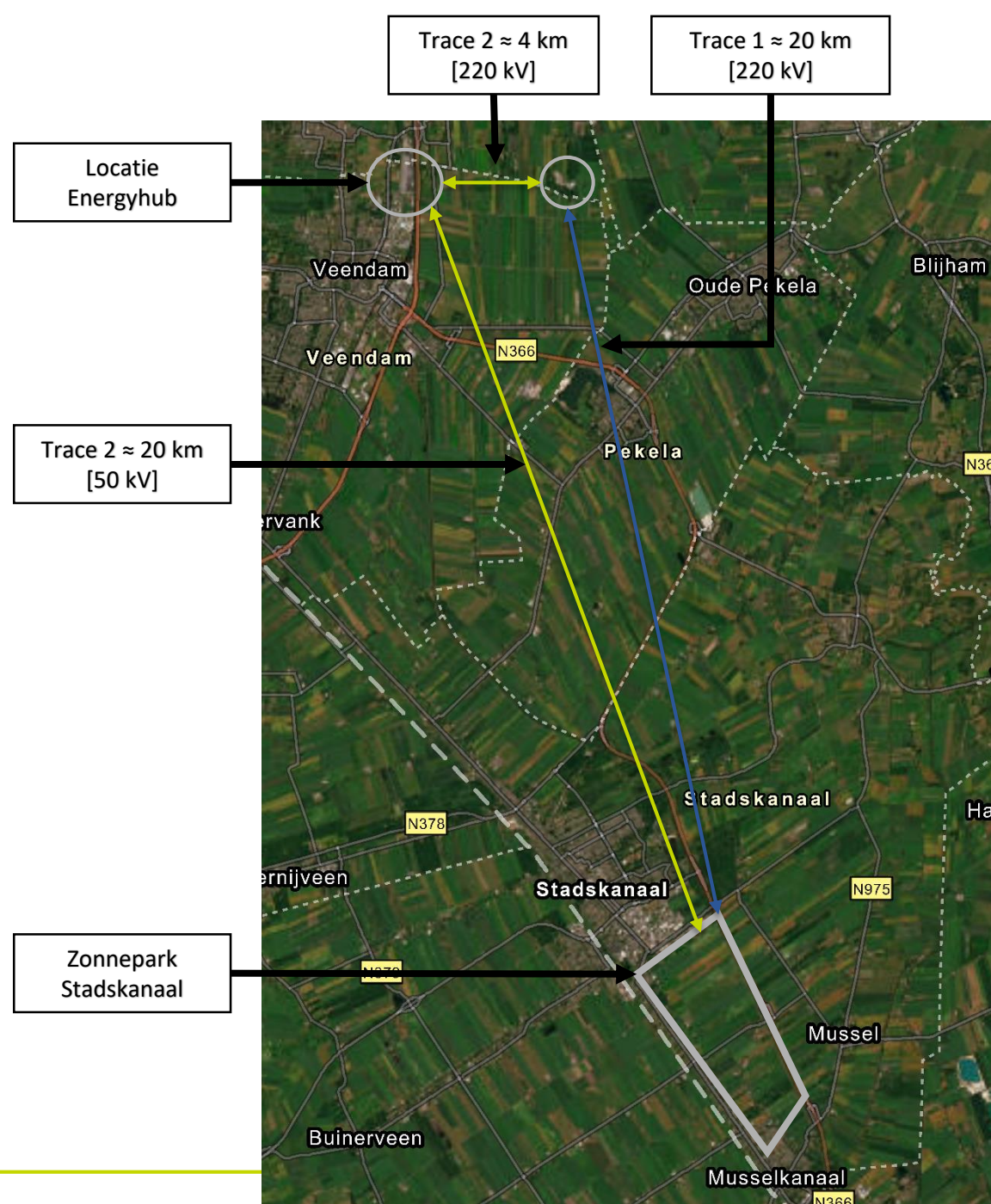
Trace opties

Trace optie 1: PV Musselkanaal(↔)

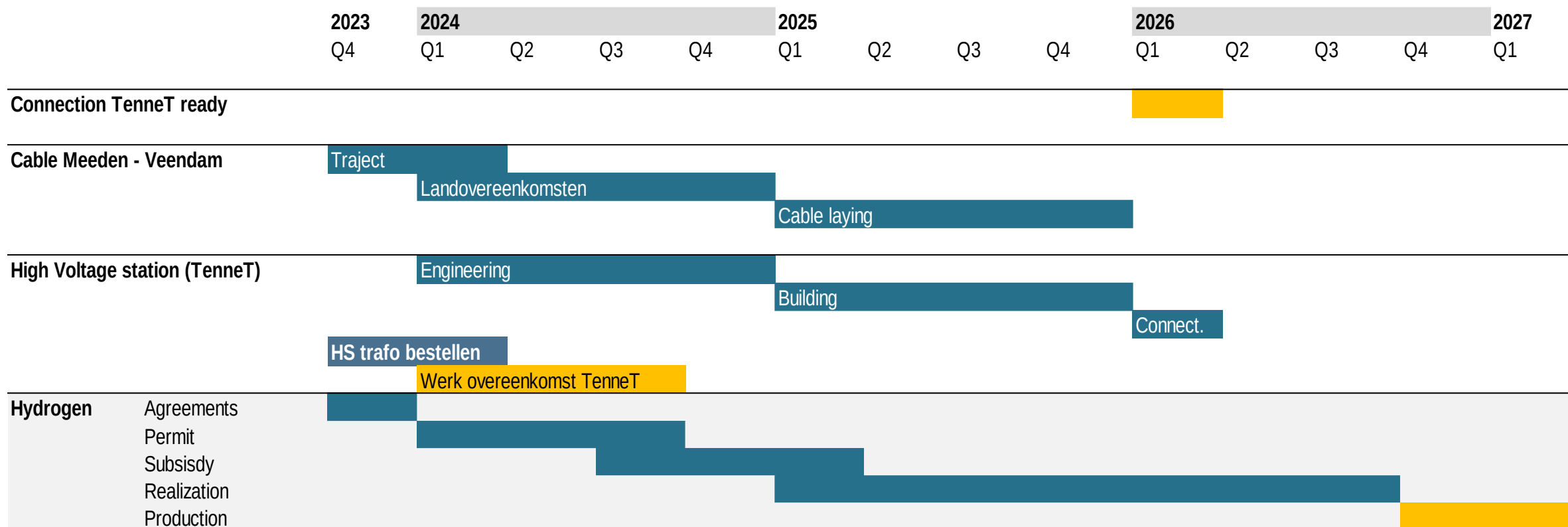
- 220 kV richting Musselkanaal
 - Zon + (mogelijk) BESS bij Musselkanaal
 - Kosten inschatting
- + Ontwikkeling in vergevorderd stadium
- Hoogspanningstrafo nog niet vergund
 - Dure aansluiting zonnepark, BESS vergunning nog niet gestart

Trace optie 2: Energyhub (↔)

- 220 kV richting Nedmag
 - 4 x 33kV richting Musselkanaal
 - Middenspanning
- + 4 HA industrie grond beschikbaar [40k per HA per jr]
- + Hoogspanning tot 1000 MVA in bestemmingsplan
- + Lokale waterstof afname



Planning





THANK YOU FOR YOUR ATTENTION

GETEC
Head of Industry

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