



*Life 'N Grab Hy*

clean cities, clean air with hydrogen



# The LIFE 'N Grab HY! project & a wider perspective on heavy duty transport on hydrogen

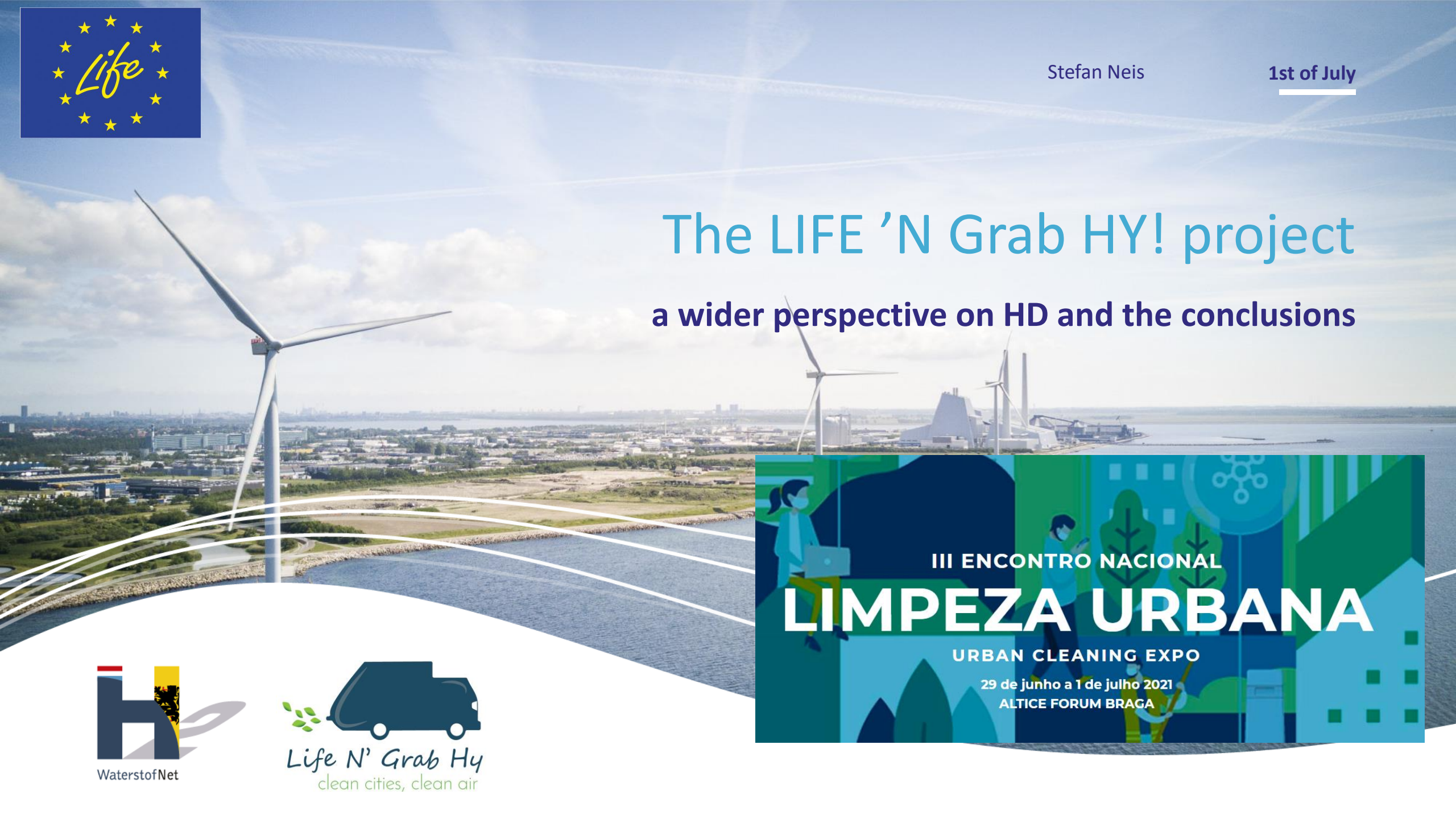
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1st of July

# The LIFE 'N Grab HY! project a wider perspective on HD and the conclusions



III ENCONTRO NACIONAL  
**LIMPEZA URBANA**  
URBAN CLEANING EXPO  
29 de junho a 1 de julho 2021  
ALTICE FORUM BRAGA



# The situation within cities

- More awareness of the environment
- Europe and cities want: **Clean cities & clean air**, Reducing GHG-Emissions to prevent PM and smog
- Introducing Low & Zero-Emission zones, low noise windows and even lowering speedlimits on the highways
- This affects: (Inner)City municipal services



# The project



- Garbage trucks are mainly operational in densely populated urban areas, in which there are strict criteria concerning emissions and environmental standards. There is an **increasing need for zero emission solutions** to comply with this upcoming access restrictions imposed by cities as part of air pollution reduction strategies.
- **Garbage trucks on hydrogen are a promising solution to meet this challenge.**
- They are zero emission, largely silent and and at the same time they provide the equivalent flexibility of diesel fuelled vehicles, as battery vehicles struggle to meet the range requirements. So garbage trucks on hydrogen are meeting the requirements of as well municipalities, waste collection institutions as the local residents.
- That's why WaterstofNet, E-Trucks Europe, Baetsen Groep, Cure Afvalbeheer and Hydrogenics initiated the Life 'N Grab Hy! project.
- **Life 'N Grab Hy!**, short for 'Liquidation of Full Emission and Noise by GARBage trucks with HYdrogen' is a by Life funded European demonstration project.



Green idea + SME = H2 Garbage Truck  
+ FUNDS = more growth and jobs



# LIFE 'N Grab HY!



## Project objectives technology

- Design and manufacture two 26T hydrogen hybrid electric waste collection vehicles
- Homologate these vehicles and receive a license plate
- Demonstrate these vehicles in real life conditions
- Demonstrating in 3 phases:
  - Phase 1: home sites of the operators Baetsen and Cure
  - Phase 2: Cologne, Antwerp and Rotterdam
  - Phase 3: 5 other EU cities
- Creating additional public awareness for hydrogen as an energy carrier
- Experiences are gathered, lessons learned are listed , creating a booklet with the projects' realizations
- This booklet is also a guidebook on deploying hydrogen electric hybrid technology in waste collection

# LIFE 'N Grab HY!



## Environmental impact and additional objectives

- Saving GHG-emissions and reducing the use of fossil fuel for the collection of waste at these operators
- Gathering data and monitor the environmental impact of the individual and combined demonstration
- Investigate the socio- and techno- economic impact of these demonstrator vehicles
- Adapt 2 maintenance facilities to be able to maintain and work on the hydrogen garbage trucks
- Organise training for drivers, mechanics and first responders.
- Cooperate with other LIFE and EU-programme projects

# LIFE 'N Grab HY!



## Budget info

- Total amount € 2.7 M  
EC Co-funding: € 1,6M
- Project duration 4 years, after amendment 5,5 years (1 year Covid-19)
- Started on 1/9/2015
- Ends on 30/3/2021

## Main Target

Demonstration of 2 FC-Hybrid Refuse collection vehicles in several European cities.

For each site	In general
<ul style="list-style-type: none"><li>• <i>Press releases and a workshop (before and after) to announce the technology and show results</i></li><li>• <i>Video of operation in each site</i></li></ul>	<p><i>All experience are bundled in a Guidebook to deploy hydrogen electric hybrid technology, applied on refuse-trucks.</i></p>
<ul style="list-style-type: none"><li>• <i>Calculation about the impact of the demonstration.</i></li></ul>	<p><i>The Guidebook gives an overview of the impact in each site</i></p>
<ul style="list-style-type: none"><li>• <i>Define a deployment plan for hydrogen refuse trucks.</i></li></ul>	<p><i>A Final conference will present the realisations at the sites.</i></p>

# LIFE 'N Grab HY!



## Milestones

- Implementation of Zero-Emission Refuse collection in 10 different European cities.
- Techno-economic impact analyses of these vehicles in the different user-cases
- Socio-economic impact of the Zero-Emission solution for these European cities

Quantifiable project results	
<i>Number of demonstrators</i>	<b>2</b>
<i>Savings in pollution / GHG-Emissions</i>	<b>125T CO2 1075kg CO 2.5T Nox 51kg PM</b>
<i>Savings in energy</i>	<b>250MWh</b>
<i>Deployment plans for local sites</i>	<b>10</b>
<i>Generic plan for the realisation of 20-20-20 norms for waste collection</i>	<b>1</b>



# LIFE 'N Grab HY!



## Expected impact

### Qualitative project results

- *The general public will be informed about hydrogen technology through a real-life demonstration in their own cities.*
- *Examples for the implementation of hydrogen vehicles in normal diesel maintenance workshops will be available*
- *Stakeholders will be triggered about the possible realizations in a direct way*
- *Best practices will be made available for drivers, loaders and technicians*
- *The technology roadmap will be defined in a more concrete way*

These results will lower the threshold for the breakthrough of clean technology applications, such as hydrogen based heavy duty vehicles, in the near future.



## Contributions to regulations and policy

- WHITE PAPER Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system
- DIRECTIVE 2014/94/EU ON THE DEPLOYMENT OF ALTERNATIVE FUELS INFRASTRUCTURE
- Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe
- Directive 2002/49/EC - the assessment and management of environmental noise  
Environmental Noise Directive (END)
- Regulation (EU) No 540/2014 on the sound level of motor vehicles and of replacement silencing systems amending Directive 2007/46/EC
- Paris, London, Amsterdam zero-Emission cities
- Dutch National “Covenant for zero emission waste collection”

# LIFE 'N Grab HY!



## Why electric, why hydrogen?

- Zero emissions no CO<sub>2</sub>, Nox, Particulate matter
- Low noise
- Better working conditions for loaders
- No energy losses when stationary
- Disadvantage 100% battery-electric:
  - Limited range and costs
- Solution: Hydrogen range extender, but also more expensive than traditional diesel.



# LIFE 'N Grab HY!



## Developments for waste collection vehicles



- First prototype operational in 2014
- 2019: 2 operational trucks
- 2021: 4 operational trucks on the road (Groningen, Eindhoven, Veldhoven, Breda)
- Good experiences with end-users and the local populations
- OEMs follow up with a hydrogen model
- > 100 trucks in combined order at EU OEMs
- Zero-emissie vanaf 2025 (Convenant)

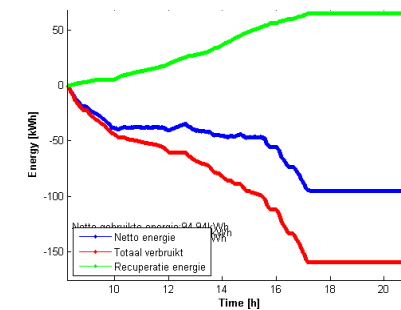


Dagelijkse uitstoot vermindering [g]					
	EURO I	EURO II	EURO III	EURO IV	EURO V
CO	1864.3	1657.1	870.0	621.4	621.4
HC	455.7	455.7	273.4	190.6	190.6
NOx	3314.3	2900.0	2071.4	1450.0	828.6
PM	149.1	62.1	41.4	8.3	8.3

109.37  
kg CO<sub>2</sub>/dag

Jaarlijkse uitstoot vermindering [kg]					
	EURO I	EURO II	EURO III	EURO IV	EURO V
CO	82.4	73.2	38.5	27.5	27.5
HC	20.1	20.1	12.1	8.4	8.4
NOx	146.5	128.2	91.6	64.1	36.6
PM	6.6	2.7	1.8	0.4	0.4

4.83  
T CO<sub>2</sub>/jaar



# LIFE 'N Grab HY!

## a steppingstone and turning point

### REVIVE:

- 15 trucks in 8 European cities
- Multiple OEMs (DAF+E-Trucks, Scania+Renova)
- Different FCs
- Large scale demonstration and market preparation

### Hector:

- 7 fuel cell garbage trucks, in 7 pilot-sites
- Multiple (Faun, Daf+E-Trucks)

### H2Rent

- 6 Refuse trucks for the Netherlands (E-Trucks)





# LIFE 'N Grab HY!



## Potential fleet sizes

### Potential in NL:

- Total fleet 5000 vehicles (10% annual change-over rate)

### Potential in EU:

- Total annual change-over rate of 6000 vehicles/year\*
- This will also mean significant GHG-emission savings when these vehicles are implemented on a large scale.

\* Not all waste collection vehicles will be hydrogen electric hybrids

## Other developments is heavy duty



<https://fuelcelltrucks.eu/project/>



# Results lined up

## Project figures

- 2 Hydrogen electric hybrid trucks designed and build
- First hydrogen hybrid in the EU with full homologation
- First 2 maintenance facilities adapted for hydrogen
- 3 demonstration-sites, 2 European countries



# Results lined up

## Project figures

- Total of 24.000 kms driven [Cape town to Vladivostok]
- GHG emissions saved and air quality improved
  - 45 Tons of CO<sub>2</sub>
  - 20 kgs of Particulate Matter
  - 60 kgs of Nox
  - 93 kgs of CO
- Low noise operation => - 4Db (A)



# Lessons learned



## What to and not to do....

- New truck chassis and compactor works best
- Second LIFE investment in a truck + compactor gives additional issues due to age
- Larger FC needed, to recharge batteries
- Higher power output driveline / Electric motor

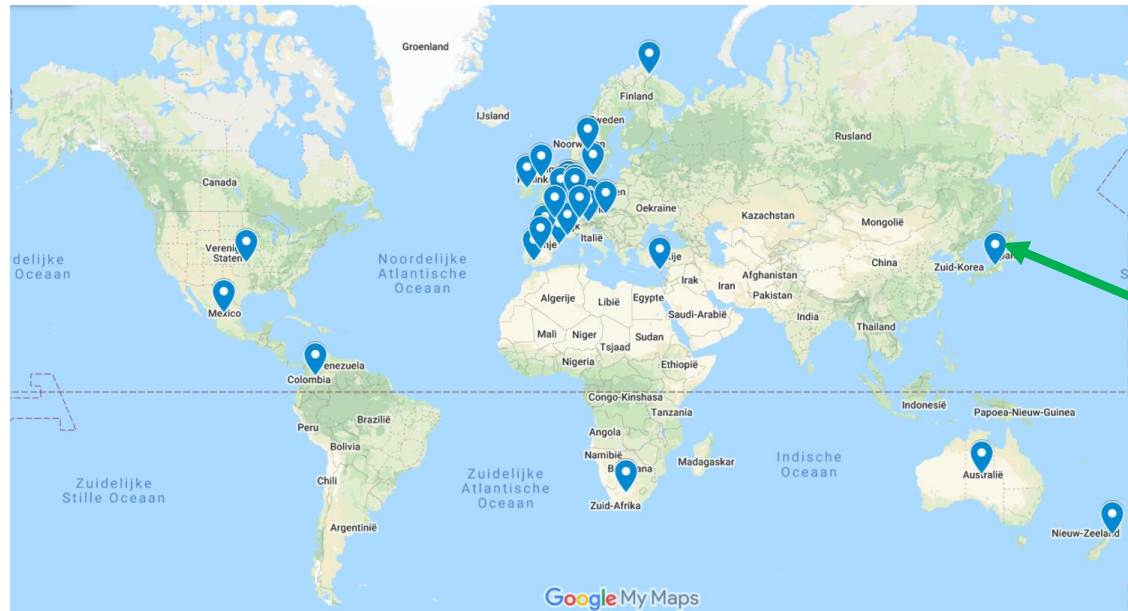




# Conclusions of the project

## Commercialisation

- LIFE 'N Grab HY! – “the vital step for upscaling” :
  - Prototype => Commercialisation
- World wide interest
  - > 50 cities and regions directly interested in the project and the LIFE 'N Grab HY! waste collection vehicles looking for next step



Source: <https://www.marketing91.com/wp-content/uploads/2019/12/Commercialisation-The-Definition.jpg>



# Conclusions of the project

## From prototype to...production

- E-trucks built 2 new production facilities in the Netherlands and Belgium
- Orders of > 25 trucks are placed
- Growth in employment at E-Trucks

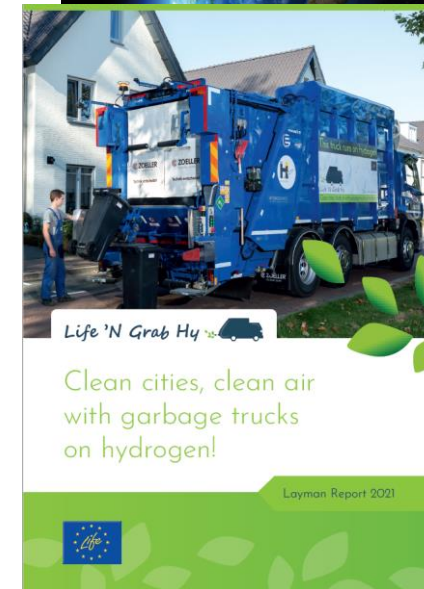


# Conclusions of the project



## Environment

- GHG – emission savings realised
- Air quality improved locally
- Improved working conditions also regarding health and safety
- The real results will become evident in the near future, when multiple vehicles are operated, multiplying the impact.
- The end users are in favour of the technology, but the costs of the vehicles and hydrogen have to be reduced
- Laymans report available now!
- Demonstration site flyers available now!
- After-Life report available soon.





Thanks to.....



We want to thank LIFE-EASME for their trust, faith and flexibility in the project



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Bedankt voor uw aandacht!  
Thank you for your attention!



WaterstofNet