



FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

REVIVE
Refuse Vehicle Innovation
and Validation in Europe



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Programme Review Days 2019

Brussels, 19-20 November 2019

PROJECT OVERVIEW



- **Call year:** 2017
- **Call topic:** FCH-01.7.2017: Validation of Fuel Cell Trucks for the Collect of Urban Wastes
- **Project dates:** 1st of January 2018 – 31th of December 2021
- **% stage of implementation 01/11/2019:** 10%
- **Total project budget:** 8,7m €
- **FCH JU max. contribution:** 4,9m €
- **Partners:** Tractebel, Seab Servizi Energia Ambiente Bolzano SPA, Azienda Servizi Municipalizzati di Merano Spa, Suez Nederland Holding B.V., Gemeente Groningen, Gemeente Breda, Stad Antwerpen, Gemeente Amsterdam, Element Energy Limited, CEA, Waterstofnet VZW, E-Trucks Europe



PROJECT SUMMARY



Revive will accelerate the development of hydrogen fueled refuse trucks in Europe

Key objectives:

- Develop a high-performance fuel cell refuse truck
- Deployment of **15 trucks**
- At least **24 months** of demonstration in their operating environment
- Raise the profile of the FC technology as a **viable option for waste collection**
- **Analyze the future business models** for zero emission waste collection using hydrogen produced from waste sources through a dedicated **‘Waste-to-Wheel’ study**



PROJECT SUMMARY



Members of the REVIVE Consortium

Vehicle operator

SEAB SPA
Stadtwerke Meran
Suez Netherlands
City of Groningen
City of Breda
City of Antwerp
City of Amsterdam

Manufacturers

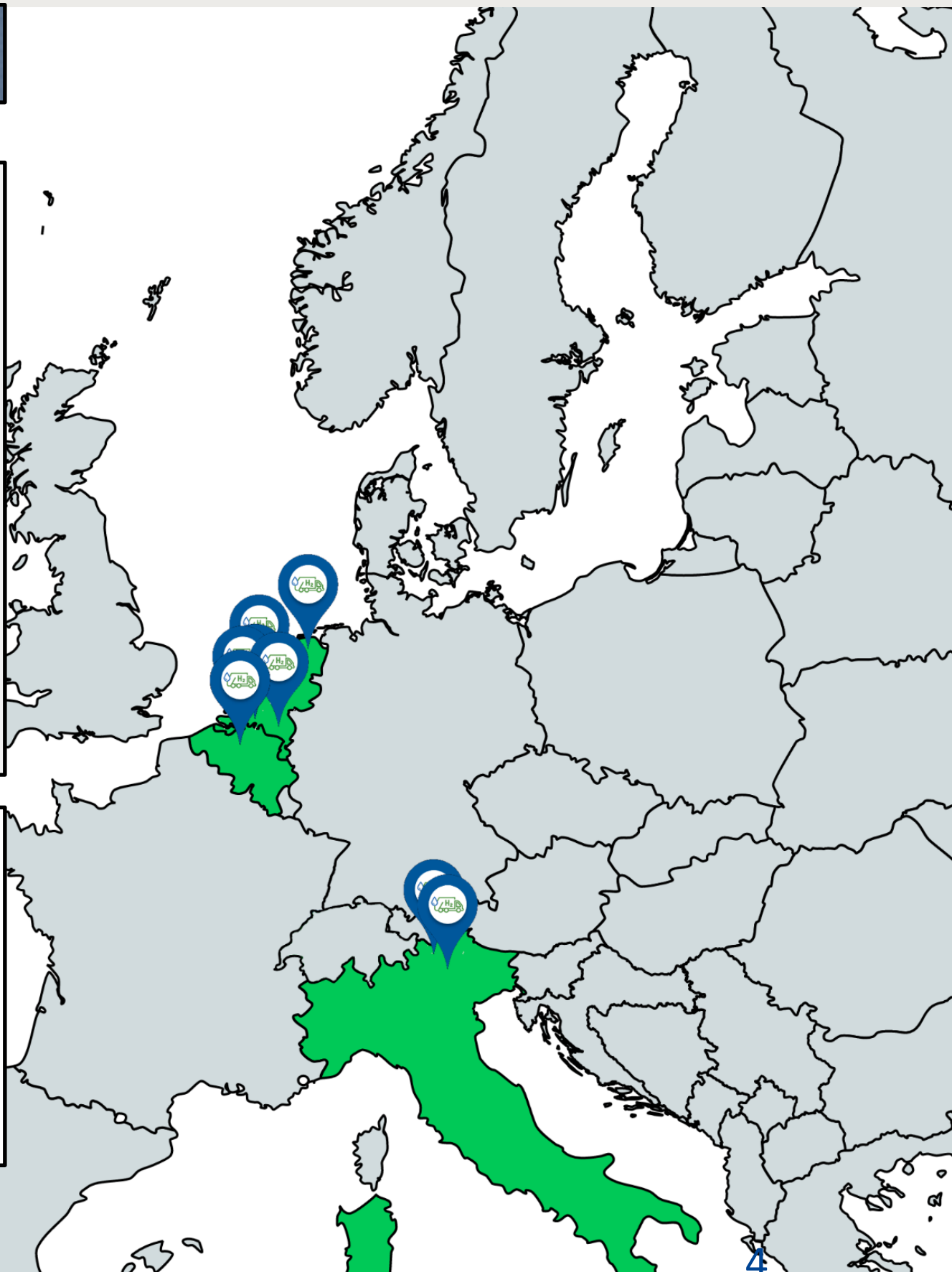
E-trucks Europe

Experts

Tractebel Engie
CEA
WaterstofNet
Element Energy



Deployment sites



PROJECT PROGRESS/ACTIONS – FC truck deployment

Vehicles ordered
(#trucks)

6 ordered
0 deployed



15
15



- A total of **6 trucks** are being built for delivery in 2020
 - First truck expected **in February 2020, in Breda**
- Contracting discussion for the remaining trucks are at advanced stages
 - New deployment sites under discussion



Source: E-trucks Europe, Breda truck under construction

PROJECT PROGRESS/ACTIONS – Current State of the Art

Currently, battery-FCH range-extended and diesel hydrogen hybrid prototypes are part of demonstration projects

- Demonstration of two 26t hydrogen-electric hybrid garbage trucks
- Demonstration of one hydrogen-electric hybrid garbage truck in Groningen



Life 'N Grab Hy!
HyTrec2

2019



Source: Life 'N Grab Hy!

2020-...

REVIVE: Advance FC technology

- Increase: TRL 6-7
- Integrate EU FC technology

15x



Hector (Interreg North West Europe):

7x



First FCE refuse truck for Renova (Sweden)

1x



Source: Waste management world

- 2 Dual Fuel 26t Refuse collection vehicles



2016

Source: sustainable Energy week, Gemeente Groningen

Levenmouth Community
Energy project



Source: Fife council

Interreg-project 'Waterstofregio Vlaanderen-Zuid-Nederland'



Source: WaterstofNet

2013

- Prototype hydrogen-electric refuse truck, built by E-trucks



2011-
2013

Nationale Innovationsprogramm Wasserstoff- und Brennstoffzellentechnologie (NIP)



Source: <https://www.now-gmbh.de>

- Prototype built by FAUN Group
FC powers the loader & compactor



Meanwhile outside EU:



Risks and Challenges

- **Availability of HRS infrastructure** -critical for project timing & has caused delays in the project
- **TRL of European FC suppliers**- TRL of selected suppliers lower non-EU suppliers
- **No standard truck configuration** – Every unique truck configuration needs to go through the homologation process and requires new testing
- **Lack of regulation** – No EU/National directives to stall, maintain and repair H2 vehicles
- **Lack of standardization for HD applications**– Safe fill protocol, communication cable



Source: E-trucks Europe



Communications Activities



- **Workshop at E-trucks – 6th of December 2019**

Workshop, with the opportunity to participate in a tour of the E-Trucks factory, showcasing hydrogen fuel cell trucks in different stages of development, including the first E-trucks prototype truck as part of the REVIVE project

- **Project twitter account ([@REVIVE_H2](https://twitter.com/REVIVE_H2))** – launched September

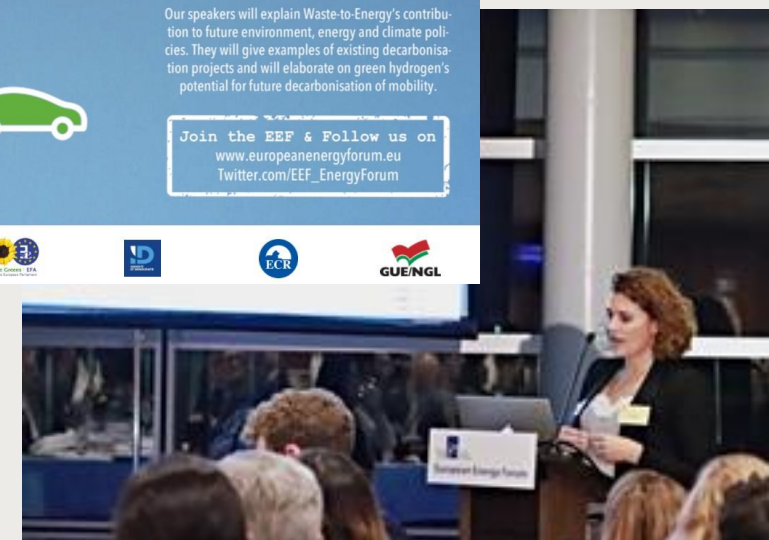


- **Project Website (www.h2revive.be)**

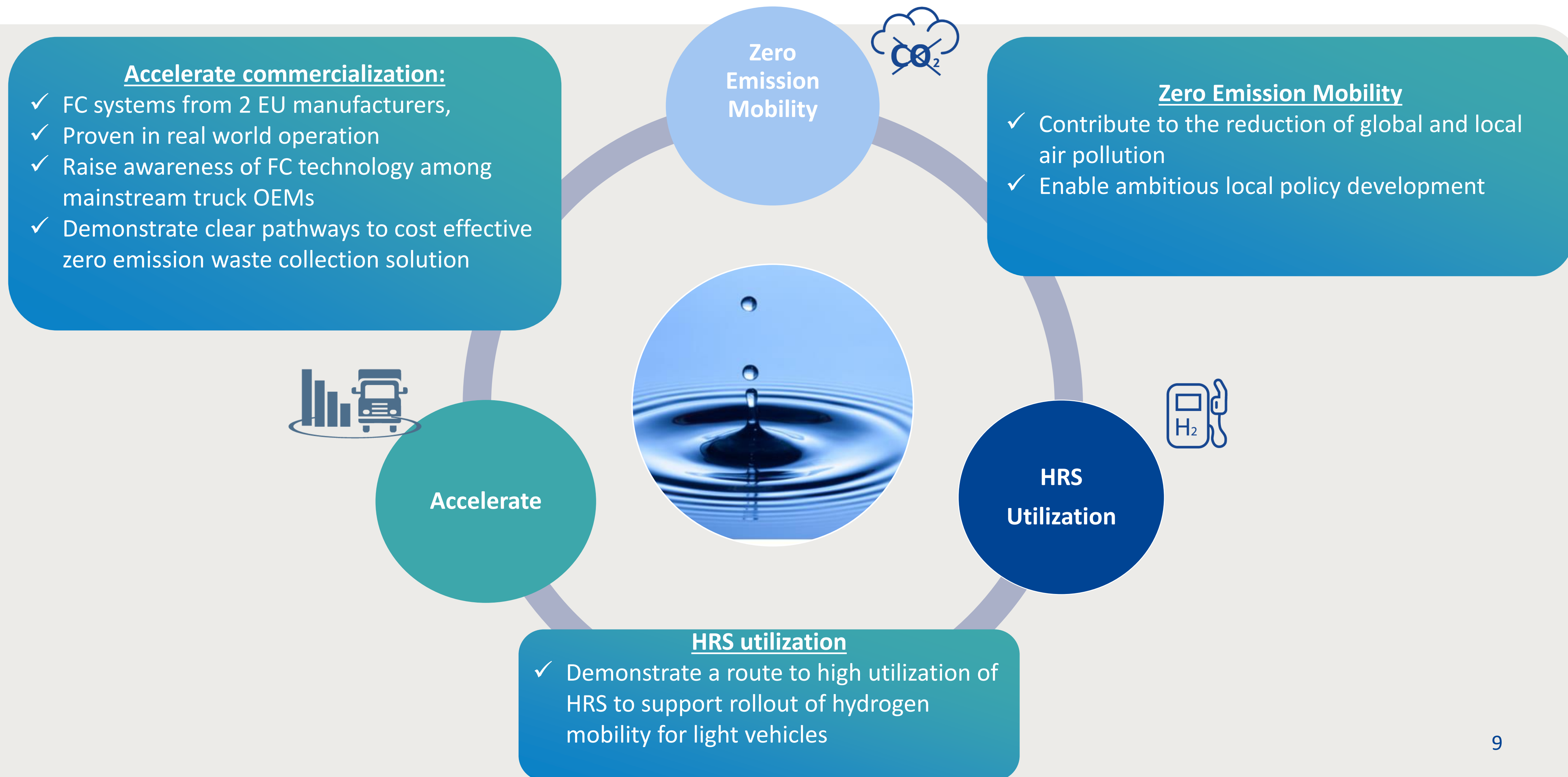
- **Events**

- European Research and Innovation Days (24-26/09/2019)
- Workshop CEWEP members (10/10/2019)
- EEF dinner debate (22/10/2019)

- **Several press releases launched**



EXPECTED IMPACT



SYNERGIES WITH OTHER PROJECTS AND PROGRAMMES



Interactions with projects funded under EU programmes



Life N'Grab Hy



- Phase 1 (yellow)
- Eindhoven
 - Veldhoven
- Phase 2 (green)
- Cologne
 - Antwerp
 - Rotterdam
- Phase 3 (red)
- Aberdeen
 - Bolzano *
 - Merano *
 - Bruneco *
 - Düsseldorf/Herten



Source: www.lifeandgrabhy.eu



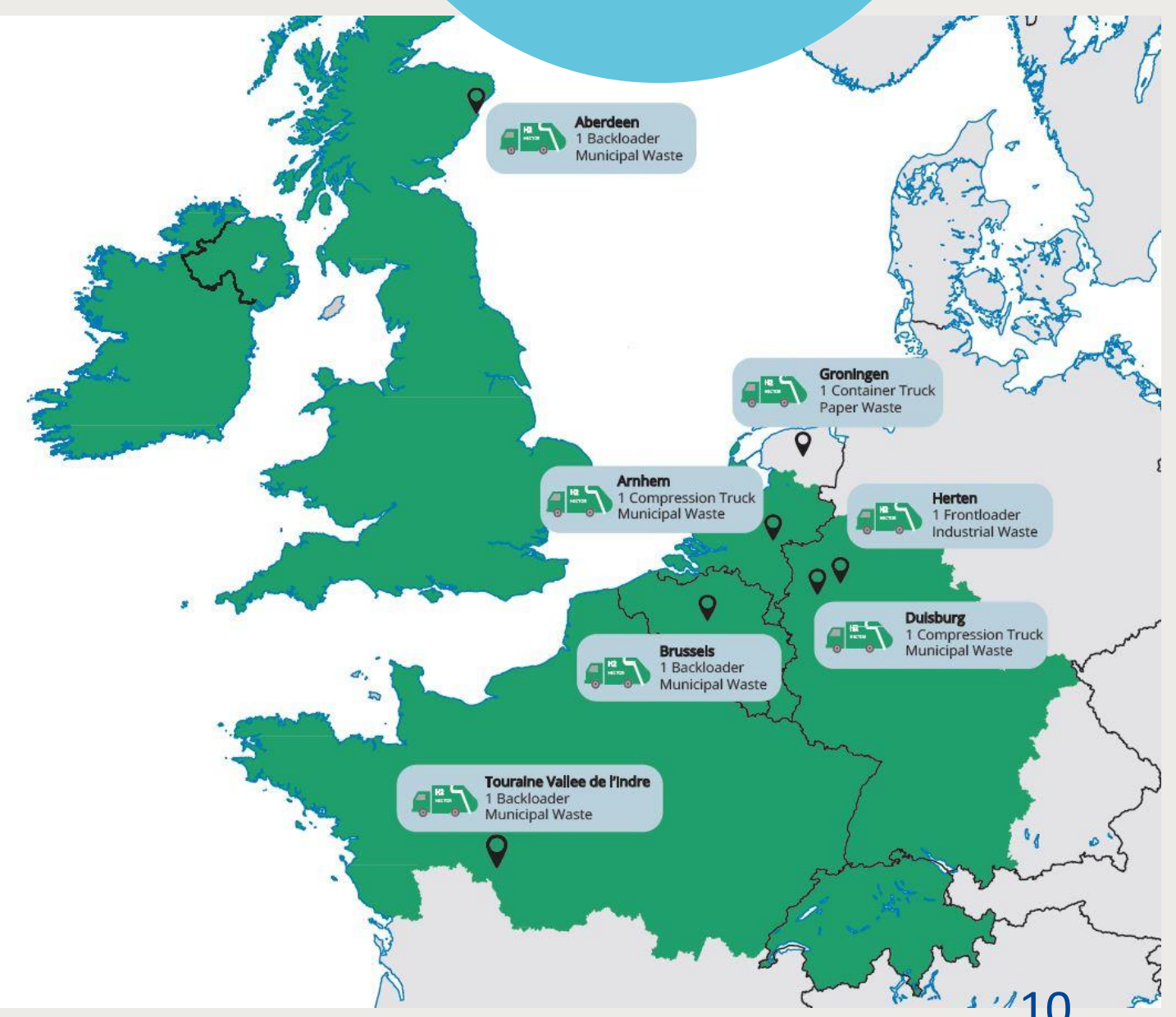
Letter of Cooperation
for the

Life 'N Grab HY!, REVIVE & Hector - projects

- Topics:
- ✓ Coordinate dissemination activities
 - ✓ Common definition of policy recommendations
 - ✓ Co-organisation of events



Hector



Source: www.nweurope.eu/hector

*Possible synergy by combining





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<i>Refuse trucks</i>	<i>MAWP 2017</i>	<i>Project Objectives</i>
Gross Vehicle weight	16t≤...≤26t	16 and 26 tons
FC power	≥40kW	>45kW
Operational lifetime	>20.000h	>25.000h
Availability	90%	90%
MTBF	≥2.500 km	>3.500
Tank to wheel efficiency	>42%	>50%

Other objectives

- ✓ Series production ability
- ✓ Minimum operational period is 24 months or 8,000 hours
- ✓ Meet requirements of end-user
- ✓ Deployment of at least 10 FC refuse trucks
- ✓ Minimum 3 cities with 2 trucks