



PROVIDING MOBILE ELECTRICITY

WITH ZERO LOCAL
EMISSIONS



We are piloting battery power supplies for professional use to replace diesel and fossil fuel generators for work on construction sites.

Taken the whole life cycle emissions and other types than renewable energy during use into account, the battery solution is advantageous to reduce local air pollution and enhances health and quality of life.

ABOUT THE PROJECT



Our project aims to verify and quantify these assumptions. During the project, we tested 90 **instagrid ONE max** Battery-Power Supply System (BPSS) with twelve construction companies from seven EU countries. Each company received several pilot BPSS and tested them twelve months in different settings as part of their regular operations, from June 2021 to June 2022.

The project “Piloting clean power supply devices in construction and urban green care to reduce emissions from portable machines” is co-financed by the EU through the **LIFE Program**. The LIFE program is the EU’s funding instrument for the environment and climate action. Our project was accepted as a part of the climate action in the areas of energy efficiency and further development of related environmental policies within the cities within the European Union.

Duration of the project is from 01.09.2019 to 30.06.2022. The reporting and progress of this project was followed by EU LIFE Neemo monitoring team.





THE CHALLENGE

Air quality has become an urgent issue in European cities, which are struggling to reduce pollutants. Until today, most activities are dedicated to reducing impact from car. Also construction machinery emits the equivalent of hundreds of kilometers of a driving car every hour.

Construction machinery includes not only excavators and other heavy machines but also hand held tools and small petrol or diesel generators. Small portable engines < 19 kW are very common, especially in construction, gardening and landscaping.

Generators are still mostly without clean alternatives but contribute disproportionally to emissions due to low standards, idling and oversizing. Oversizing is needed for starting machines, and idling occurs from workflow interruptions, external conditions, and negligence.

The environmental authorities of the EU and the US (EEA and EPA) ascertain that the few construction machines (compared to number of cars) are responsible for as much as 15 – 20 % of the emissions in urban centers.





THE SOLUTION

Mobile electricity is needed on construction sites, at outdoor workplaces, for underground work and in remote areas, for emergency aid and industrial applications all over the world. Hence, there is a missing link between the need to reduce emissions from generators and ensuring the availability of off-grid electricity. In many settings, a professional-grade battery power supply provides a better solution without local emissions

Moreover, it brings battery-powered small equipment to full benefit, which often needs to be recharged more than once a day.

THE OBJECTIVE

- To pilot portable Battery-Power Supply Systems (BPSS) in european cities to substitute conventional diesel and fossil fuel generators and tools.
- To validate large-scale use of this technology to supply small electric machines (e.g. plate compactors, grinders, stone cutting machines, welders, demolition hammers, lighting).
- To promote the use of clean electricity instead of diesel and fossil fuel generators and to significantly reduce local emissions from construction and green care in urban areas.
- To enhance visibility, acceptance and willingness-to-buy in the industry.
- To influence green city procurement practices within the cities in EU.



We collected significant amounts of usage data on the battery usage through IoT connected monitoring of the devices as well as interviewing end-users at construction sites and the management of the construction companies involved in the project.

This data helped us to refine our technical understanding of battery behavior, facilitate maintenance to increase battery lifespan, gather insights about our users to adapt our solutions and reduce their environmental impact. We were able to validate the technical specifications of the battery in the field. In particular, we validated that the total energy delivered for a fully charged battery is 2.1 kWh and the average duration to fully charge the battery is 2h30.

We observed various usage patterns. The battery capacity showed to be more than sufficient to support the tasks of the users in the test group. We can observe from the data that the battery was rarely fully discharged during a workday. Rather it was used for punctual tasks according to the users needs. In most situations, the battery capacity is not a limiting factor to the use of the battery. A median duration of five hours of active use per day was identified. Another finding was that users consume on average 30 % of the battery capacity. Although used in cold conditions it maintained a good performance.



„Sometimes you have to simply overcome old habits ...“



What users are looking fore:

- Communication on production, recycling and disposal of the batteries
- Scalability of the batteries
- Solutions for recharging on-site

“Obviously, we use these battery-powered tools because of the sustainability aspect but also because they are better for the workers. They’re not as noisy and they don’t have exhausts and they’re not as heavy which means people are much happier and healthier when they use them. When my people are happy, they’re more efficient, they work harder and it’s a win-win situation.”



„I have got 3 batteries from instagrid and I want more! I’m addicted.“



„We have a sustainability strategy, and we have a holistic view of it. Batteries reduce emissions, they are not too heavy, workers should feel better (no noise), the ergonomics are so much better that the health of workers is much better and that leads to less costs for the health system. For me, the batteries improve the life of a person.“



“With batteries, you don’t need to lay cables anymore. I think the development is praiseworthy, there is no more noise and no more exhaust fumes. However, what I find critical is the need for this whole discussion to become more important and to be heard. I think this discussion is also being suppressed in the area of electric cars.”



„The first difference we’ve noticed for our employees is that we have less noise, we’re charging batteries in the main office and in the field office during employee breaks, we are still using diesel too.“

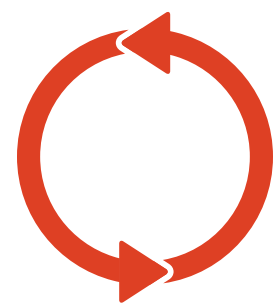


„Oh, we put everything on there, welders, circular saws and they all work fine. My workers fight over who gets the batteries ...“



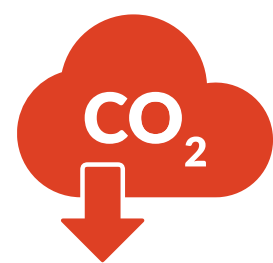


SAVING POTENTIAL OF A BPSS



LIFECYCLE CO₂ EMISSION PER UNIT (OVER LIFETIME / UNIT)

BPSS:	1260 kg CO₂-eq.
Gasoline generator:	9970 kg CO ₂ -eq.
Diesel generator:	15897 kg CO ₂ -eq.



CO₂ SAVINGS

Total project:	34 kt CO₂-eq.
Predicted savings until 2025:	1526 kt CO₂-eq.
Per unit (over lifetime/unit):	21 t CO₂-eq.



IMPROVING AIR QUALITY
by reducing 100 % of
local emissions and saving
during the project

**94 t VOC (HC),
419 PN (1E18),
6 kt CO, 16 t NOx**






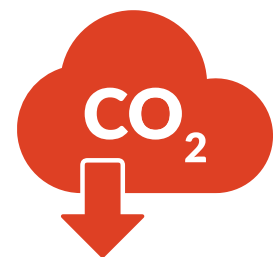
LIFECYCLE ANALYSIS

A relative distribution in to the stages of the lifecycle show that the use phase and the production phase dominate the environmental impact. The water scarcity footprint of the BPSS is mainly due to the production phase.

There is high innovative pressure and it is an active field of research. We are assessing this problem such as evaluating alternatives to the lithium-ion technology or sourcing the raw materials locally.

	Percentage of 1260 kg CO ₂ eq.	Percentage of water scarcity
Production	36 %	79 %
Transport	1 %	0 %
Use phase	62 %	21 %
End of life	1 %	0 %

OUR CONTRIBUTION TO THE SUSTAINABLE DEVELOPMENT GOAL



CO2 SAVINGS

Reduces CO₂ eq. per unit/per year

94 %
5 t CO₂ -eq.



Our portable BPPS bears the potential of creating access to modern, reliable and **clean energy in countries with a lack of energy infrastructure.**



CLEAN WORK ENVIRONMENT

Eliminates trip hazards
Less noise emissions
Improves the local air quality

100 %
- 74 dB
0 NOx, 0 PM,
0 CO, 0 HC



The modular design and employs only separable joining techniques to allow cost-effective repair, refurbishment and possible later upgrades.
Despite the heavy weight of the power supply, packaging is realized without plastics, using only cardboard material. This allows to **reduce waste by 78 tons per year (- 80 %).**
In addition, recycled aluminium is used for the housing.



PROVIDING JOBS

Jobs created in GER, FIN and UK
FTEs working for instagrid at suppliers and in sub-supply-chain

75 employees
50 FTEs



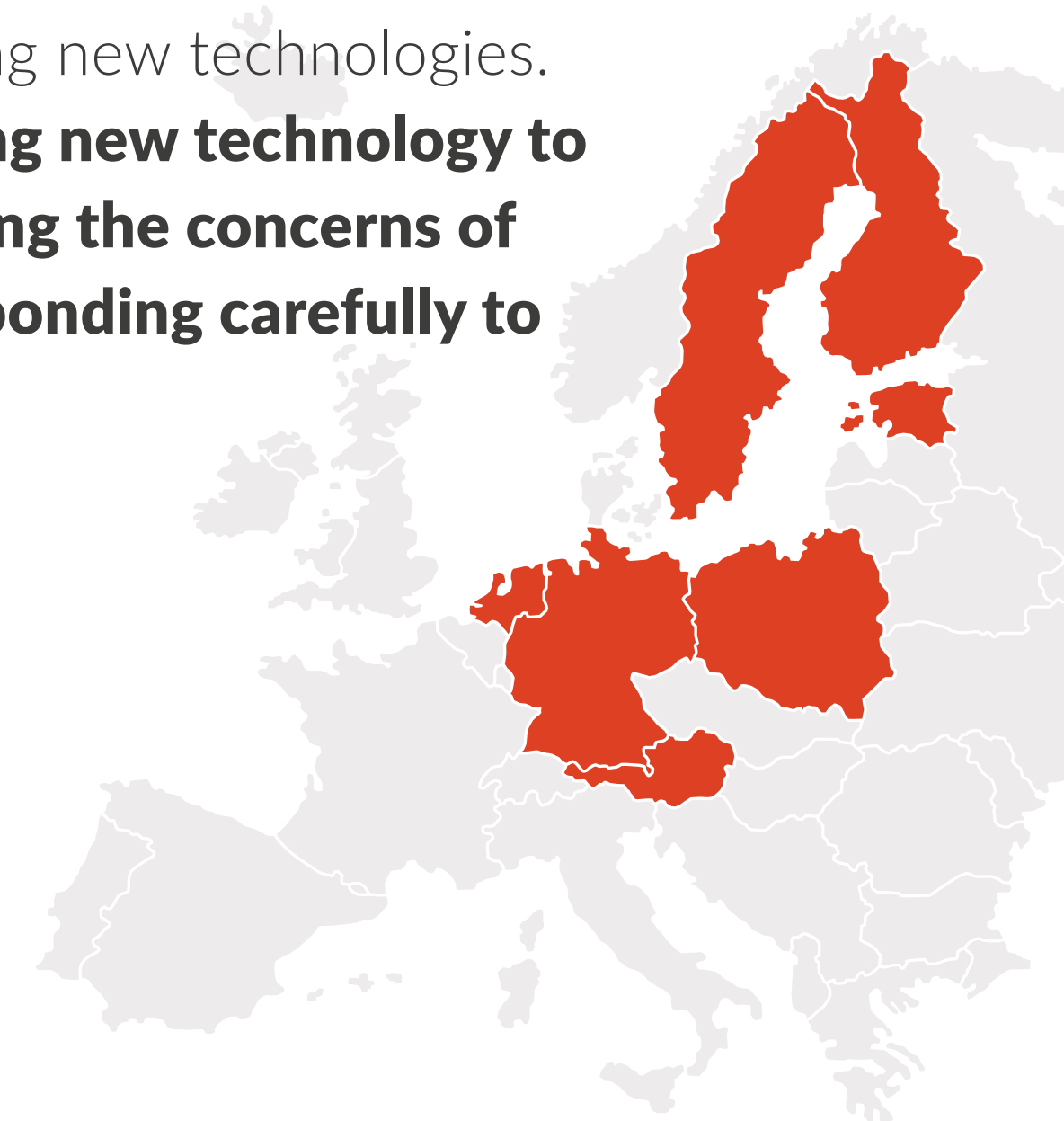


The construction industry is actively looking for solutions towards **zero-emission construction**. Many construction companies align their sustainability goals with the Paris Climate Agreement and collaborate closely with their local cities and municipalities to achieve the local sustainability targets. For example, the goal for the city of Amsterdam is not only to reduce the use of fossil fuels, and therefore emissions, but also to create cleaner and quieter working environments. One of the main challenges, is that there is no clear standardized calculation of CO₂ emissions in each country and across the EU.

All participating actors within our project are highly committed towards reaching more sustainable solutions within construction. However, differences in governmental support are clearly visible between the countries. To support the implementation of sustainable solutions, cities of Amsterdam, Stockholm and Helsinki apply a CO₂ emissions calculation method in the tender process, and the environmental KPIs are evaluated alongside the costs. These cities set highly ambitious sustainability targets, and accept higher costs, at least to some degree,

for more environmentally sustainable solutions. The results are achieved, by creating highly ambitious pilot-projects, with very strict objectives, such as 100 % fossil-free construction site. This sets the ambition level high for the local construction industry and these projects act as an example for the industry.

To increase acceptance of new technologies and counter-act reservations in construction companies, information gaps must be closed, prejudices reduced and the openness to innovations promoted. On the developer and construction companies' side, the greatest possible user-friendliness must be strived for implementing new technologies. **instagrid has set out for new to bring new technology to the construction market and is taking the concerns of potential users seriously and is responding carefully to their needs.**





WHAT'S NEXT?

- Develop a large-scale battery pilot system to replace large generators (Field trials scheduled 2023)
- Launch instagridONE optimized for US and UK professional markets (2023)
- Commercialize a power kit to provide clean on-board electricity for commercial vehicles (2023)
- Start a pilot project in Africa to make clean and affordable energy accessible for small business owners (2022)
- Improve communication on recycling and disposal of batteries (2022)
- Establish an annual Sustainability Report (2023)
- Go beyond hardware using the IoT module and its function



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EU LIFE PROJECT

Project number:

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LIFE CLEANAIRMM – LIFE18 ENV/DE/000054, is co-financed by the EU through the LIFE Program, within action for:

„Air quality and emissions, including urban environment“

Project Partner:

Hessisches Landesamt für Naturschutz, Umwelt und Geologie

