



SUMMARY

PILOT PROJECT EVALUATIONS

(FEB 2024)



INTRODUCTION

Through the Dutch Program for Zero-Emission Construction Equipment (“Programma Schoon en Emissieloos Bouwen”), the Dutch government, in cooperation with regional governments, industry organizations, and knowledge institutions, is working to make construction equipment more sustainable. The program focuses on both on reducing the emissions of construction equipment as well as transitioning to zero-emission equipment.

In recent years, the sector has gained experience in using zero-emission machinery on construction sites. Four pilot projects were monitored and evaluated to assess the performance of zero-emission mobile machinery compared to conventional equipment, and new factors were identified.

The pilots took place between 2021 and 2023. The full report can be accessed via [this link](#): Evaluation of Zero-Emission Mobile Machinery Pilots (Dutch).

KEY FINDINGS FROM THE PILOTS

User Satisfaction

Operators (machinists) were generally satisfied with the zero-emission machinery after an initial adjustment period. The equipment performed well, with reduced vibration, noise, and odor. Initial problems and malfunctions were resolved, although in some cases, the machines were slower or less powerful than desired.

Project Manager Insights

Managers found that using zero-emission equipment can help projects move forward more easily by reducing nitrogen emissions and minimizing environmental impact.

Technical Knowledge

Contractors require additional expertise in electrical engineering and safety to select appropriate suitable electric equipment, organize charging stations, and manage transport.

Cost Considerations

Electric equipment is currently more financially viable for large, long-term projects. Bidders can realize significant "fictitious" discounts if they prioritize sustainability and circularity. Making zero-emission construction more financially attractive by reducing investment and operating costs is also seen as a possibility.

Supply Challenges

Limited availability and long lead times for zero-emission construction equipment delayed their use in the pilot projects. As demand increases globally, supply chains are expected to improve, but there's a need to stimulate manufacturers to produce zero-emission machinery on a larger scale.

Battery Capacity

Battery capacity has improved but is still insufficient, particularly for heavy machinery, which often can't operate for a full workday on a single charge.

Charging Logistics

Operators had to rely on swappable batteries or fast charging solutions. However, setting up fast-charging stations on-site is costly and time-consuming, and not always feasible. Mobile charging units, as tested in the "De Groene Boog" pilot, didn't provide enough power and were difficult to transport.

Coordination

Managing charging logistics was a major challenge. Larger sites with more more equipment faced increased complexity. Linear projects, such as railways, faced more logistical difficulties than point projects.

Infrastructure Preparation

Installing suitable charging facilities required significant planning. The complexity increased with the number and power requirements of the machines involved.

Charging Solutions

Various strategies to simplify charging infrastructure include: (i) addressing charging needs during the tendering phase, (ii) using two-phase contracts to allow time for setting up infrastructure, (iii) developing networks of permanent charging stations for heavy equipment, and (iv) making smarter use of existing grid capacity.

Rail Sector

The SBL project highlighted the challenges of making specialized railway equipment more sustainable. These challenges involve high investment costs, long depreciation periods, and the approval process for modified equipment on the main railway network. A simpler approval process for retrofitted rail machines would help accelerate sustainability in the rail sector.

Collaboration and Transparency

Transitioning to zero-emission construction equipment requires transparency, collaboration, and understanding between clients and contractors. Both parties need to be open about expectations and failures, work together to organize charging infrastructure, and accept that sustainable construction may lead to higher costs and longer project timelines.

The lessons from these pilots have contributed to ongoing initiatives within the program for Zero-Emission Construction Equipment and provide guidance for further steps toward zero-emission construction equipment.

OVERVIEW OF THE PILOT PROJECTS

Pilot	Type of project	Location	Project organization /Contractor	Project Duration	Pilot Duration (Observed From – To)
De Groene Boog	Construction of a highway connection between the A13 and A16	Rotterdam	De Groene Boog	2019 - 2025	2020 - 01/2024
HOV 't Gooi	Construction of a railway underpass for the HOV line 't Gooi	Hilversum	BAM	2019 - 2022	2020 - 2022
Wolferen-Sprok	Dyke reinforcement along the southern shore of the Waal	Dyke between Wolferen and Sprok	Combination De Betuwse Waard	2021 - 2024	2022 - 01/2024
Battery Locomotive	Development of an electric locomotive with a battery wagon	n.a.	Strukton Rail	2023 - 2024	2023 - 01/2024

OVERVIEW OF ZERO-EMISSION MOBILE EQUIPMENT PER PILOT

Zero-Emission Equipment	De Groene Boog	HOV 't Gooi	Wolferen-Sprok	Total
Crawler Crane	3	0	2	5
Tractor	0	0	2	2
Mobile Crane	1	0	0	1
Sand Transfer Machine	1	0	0	1
E-CO ₂ tainer	5	0	0	5
Shovel	1	0	0	1
Midi Excavator	1	0	0	1
Formid Acid Generator	1	0	0	1
Saw Machine	1	0	0	1
Telehandler	1	2	0	3
Crash Absorber	1	0	0	1
Asphalt Set	1	0	0	1
Sweep/Suction Truck	1	0	0	1
Crane	0	2	0	2
Aerial Work Platform	0	1	0	1
Forklift	0	1	0	1
Roller	0	1	0	1
“Krol” (road-rail machinery)	0	1	0	1
Total	18	8	4	30

This table summarizes the types of zero-emission mobile machinery used across the four pilot projects, detailing the equipment deployed in each project and their total usage across all pilots.