SINTEF

Paving the way to a greener future: Insights and innovations from zero emission construction

NET ZERO CITIES

EU MISSION PLATFORM

CLIMATE NEUTRAL AND SMART CITIES

Funded by the European Union

Teknologi for et bedre samfunn

Background

Identify strategies for next steps in the net zero transition for the electrification of construction sites in terms of:

- Stakeholders
- Themes
- Readiness level

Clarifications

This document does not consider fossil free measures. This document does not necessarily recommend stand-alone pilot projects due to YAP (yet another pilot) syndrome and because this does not encourage contractors to invest in electric construction machinery for a one-off project. Instead, a comprehensive plan for the implementation of electric machine parks is preferrable.

Stakeholders


Policy makers


Developers


Contractors


Suppliers

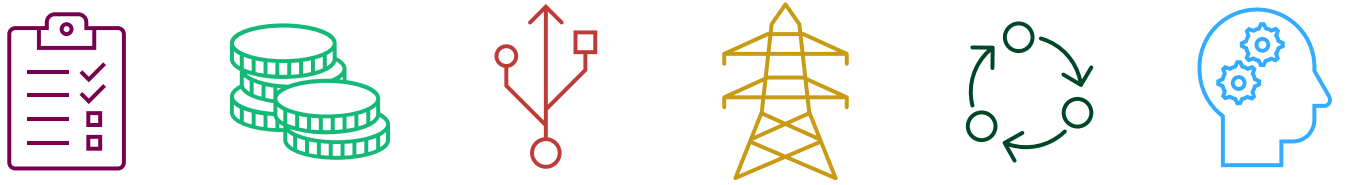
Policy makers: public policy makers at the EU, national, regional, or local scale (e.g. politicians, councillors, NGOs, civil servants)

Developers: municipalities and public and private project owners

Contractors: public and private builders

Suppliers: energy infrastructure suppliers (e.g. grid companies, renewable energy providers etc.), consultants and construction machinery manufacturers and importers

Themes



Policy Economy Technology Infrastructure Operation Knowledge

Policy: Requirements, regulations, and legislation guiding decision-making processes.

Economy: Financial models to minimize risks and ensure affordability.

Technology: Innovations in products, processes, or services, such as electric construction machinery, battery and energy management systems.

Infrastructure: Essential physical and technical systems like power grids, charging infrastructure and alternative energy sources.

Operation: Decision-making procedures and daily management activities on construction sites.

Knowledge: Competency, training, and development among stakeholders.

Readiness level

First movers: Pioneer stakeholders who are taking the first steps towards electric construction sites.

Gaining momentum: Stakeholders with some experience in electric construction sites and want to increase volume.

Experienced actors: Stakeholders who have experience with electric construction sites and are ready for full implementation.

POLICY MAKERS

Policy makers

First mover

Gaining momentum

Experienced actor

- Political vision and clear road map on ambitions and goals for emission free construction (e.g. Storbyerklæringen).
- Provide incentives and financial support for investing in electric construction machinery (e.g. Enova, Klimasats).
- Start to develop standardised requirements for emission free construction sites (e.g. Oslo's standard climate requirements for construction sites).
- Develop research and development programmes (e.g. Pilot-e, NZC).

Policy makers

First mover

Gaining momentum

Experienced actor

- Establish standard definitions and methods for emission free construction sites (e.g. SN/TS 3770:2023).
- Provide incentives and financial support for investment in electric construction machinery.
- Explore the potential for national requirements for emission free construction sites (e.g. hackathons, seminars, webinars, or workshops).

Policy makers

First mover

Gaining momentum

Experienced actor

- Provide incentives and financial support for alternative renewable energy and infrastructure (e.g. district heating, PV, green hydrogen, charging infrastructure, and battery energy storage)
- Introduce emission free requirements for construction sites.
- Introduce low or zero emission zones (e.g. London).
- Expand emission free requirements to other sectors (e.g. agriculture, mining, forestry, emergency vehicles, snow ploughs etc.)
- Share case study examples with other stakeholders embarking on zero emission construction sites.

DEVELOPERS

Developers

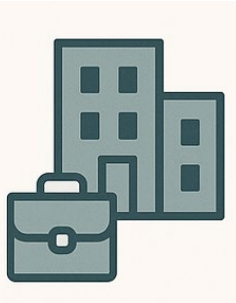
First mover

Gaining momentum

Experienced actor

- Clear road map on ambitions and goals for emission free construction sites to ensure predictable market conditions.
- Engage with stakeholders.
- Investigate market availability of electric construction machinery.
- Encourage and participate in research and development.
- Make good use of available financial support (e.g. Enova, Klimasats).
- Participate in knowledge sharing networks.

Developers



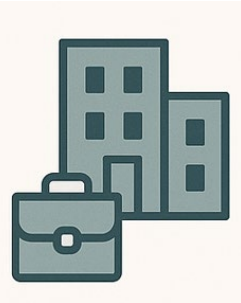
First mover

Gaining momentum

Experienced actor

- Set emission free requirements for construction sites (e.g. award environmental criteria in public procurement).
- Ensure an early dialogue with energy companies, contractors, and suppliers.
- Provide incentives for electric construction machinery.
- Develop routines for data collection and project follow up.
- Establish a network for information and knowledge sharing.
- Develop new business models for electric construction sites.

Developers



First mover

Gaining momentum

Experienced actor

- Incentives for investing in electric construction machinery and infrastructure.
- Invest in charging points for heavy duty vehicles.
- Use networks to target private actors for information and knowledge sharing.
- Use **standard** requirements for electric construction machinery in public tenders.
- Lobby for incentives and financial support.
- Ensure an early dialogue with energy companies, contractors, and suppliers.

CONTRACTORS

Contractors

First mover

Gaining momentum

Experienced actor

- Make a plan for upgrading the machine park and vehicle fleet to be electric. Find out which technology, incentives and subsidies are available.
- Start investing in and renting small electric construction machinery and charging infrastructure.
- Participate in electric construction site projects.
- Ensure energy and power availability on-site.
- Estimate energy and power demands.

Contractors

First mover

Gaining momentum

Experienced actor

- Expand the machine park and invest in medium electric construction machinery.
- Include electric construction machinery in public tender competitions.
- Establish standard guidelines and procedures for the planning and operation of electric construction sites.
- Train staff in the planning and operation of electric construction sites.
- Include energy management and energy flexibility measures (e.g. reduce peak loads, nighttime charging, strategic scheduling, 5 working days instead of 4, disconnection agreements, establish charging hot spots, V2G bidirectional charging)
- Develop new business models.
- Develop routines for data collection and project follow up.

Contractors

First mover

Gaining momentum

Experienced actor

- Expand the machine park and invest in large electric construction machinery and charging infrastructure.
- Full-scale implementation of electric construction machinery in all construction projects.
- Lobby for national requirements.

SUPPLIERS

Suppliers

First mover

Gaining momentum

Experienced actor

- Have a clear and early dialogue with other stakeholders.
- Establish energy and power planning and management tools, guidelines and procedures.
- Ensure availability of construction machinery and energy infrastructure.
- Consider converting common existing diesel construction machinery to electric operation (e.g. excavators, wheel loaders, dumpers). Start with smaller machines.
- Invest in research and development.
- Hold demonstration events in partnership with other stakeholders.

Suppliers

First mover

Gaining momentum

Experienced actor

- Ensure grid capacity or alternative energy storage and peak-shaving options for full-scale implementation.
- Develop standardised technological solutions for hardware and software that improve machine efficiency and battery charger technology.
- Create data sharing platforms for monitoring and evaluating electric construction sites (e.g. energy, emissions, air quality, noise).
- Plan for and introduce series production lines for electric construction machinery and reduce lead times.

Suppliers

First mover

Gaining momentum

Experienced actor

- Improve grid capacity and facilitate for alternative renewable energy sources.
- Phase out diesel factory production lines in favour of electric.
- Develop a second-hand market for electric construction machinery.
- Lobby for national requirements.

Co-benefits

- Reduced GHG emissions
- Reduced local pollutions (NOx, SOx, particulate matter)
- Reduced noise pollution and vibrations
- Better working conditions for construction workers e.g. less vibrations, cleaner air
- Better conditions for inhabitants
- Socio-economic benefits of averting climate change and damage to human health
- Better fuel efficiency
- Cheaper maintenance and operational costs
- Less chance of on-site fuel spills
- Enhanced safety on-site
- Improved on-site communications
- Competitive advantage in the market

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