Recommendation for working agreements and Standards regarding the Connectivity of installations at an Emission-free Building site (known as SCEB)

Formulated by ENI

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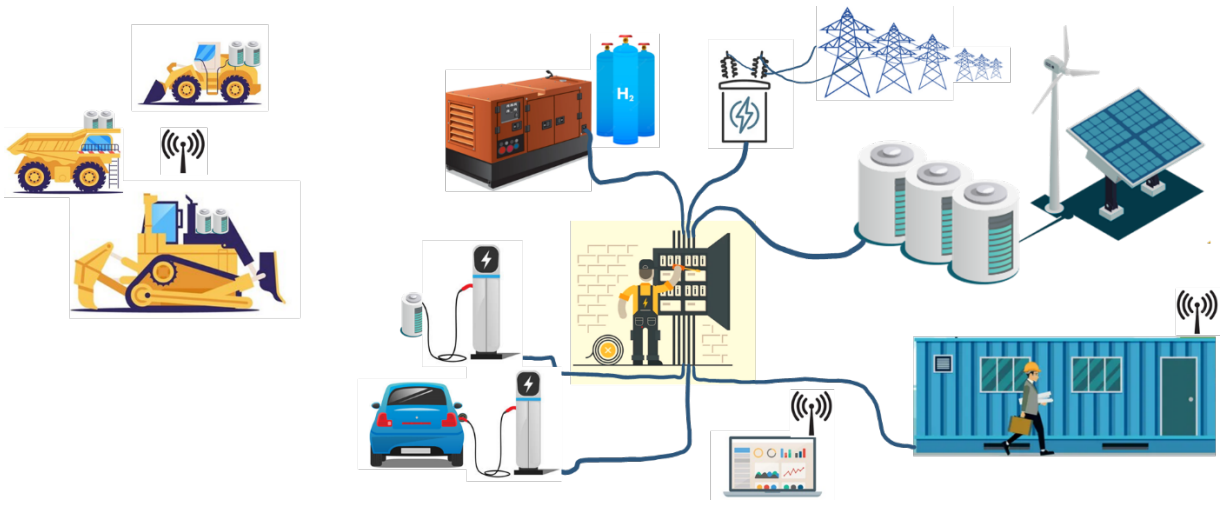

Introduction

In a unique ecosystem of front-runners, ENI (Emission-free Network Infra) is working on the development of emission-free building sites. Members include contractors, suppliers, energy companies, lessors and machine manufacturers.

A building site is a location where many parties converge. Construction combinations, suppliers and subcontractors need to jointly execute work in varying line-ups. The use of someone else's building site infrastructure is a day-to-day occurrence. Components of the **energy system** at a building site therefore need to be rendered uniform in order to be able to guarantee **safety and flexibility** in the longer term. ENI is therefore working at **standardisation and exchangeability** in the field of energy installations.

There are currently many new technical innovations available in terms of energy supply and management at building sites. Think in terms of battery containers, solar and wind powered energy, generators running on alternative sources of energy such as hydrogen, registration apps and of course electrical building site machinery. However, there are as yet no statutory standards to guarantee that installations from various suppliers can be seamlessly combined in a wide range of combinations. This applies to the **physical connections** (cables and connectors) as well as to **data flows** and **working agreements**.

ENI has therefore formulated a list of recommendations for standards regarding connectivity at the emission-free building site. As there is still limited practical experience with complex building site installations, the following advice may be subject to change. Future updates of this document will include any new insights.

This initial list of recommended standards was formed by a round table of ENI participants who represent both systems suppliers and users: Greener, Dens, Smart Grid, Bredenoord, Genpower, Elaad, Equip, Heijmans, Dura Vermeer and GMB.

Recommended standards for an emission-free energy supply

Subject	Question	Recommendation
General		
Authority regarding a building site installation	Who has final responsibility when it comes to the design and use of the energy supply and related systems?	We advise appointing a functionary responsible for the installation who – in the same way as a safety specialist – has a veto mandate in order to guarantee a safe and effective building site installation. The functionary responsible for an installation must be proficient, and must be able to exercise authority over the installation within the agreed demarcation, versus those responsible for the project.
Demarcation and malfunctioning process	Who is responsible for which elements within the total energy system? Which malfunctioning process is appropriate?	Each (complex) building site requires an installation drawing, which establishes the responsibilities and gearing processes between suppliers and users. This must at least include the following activities: the placement and movement of hardware, connecting of installations, commissioning and decommissioning, and process agreements in case of malfunctions.
Safety due to knowledge and access policy	What are employees allowed to undertake at the building site with a view to electrical installations?	A designation policy must be formulated at the building site in accordance with the NEN 3140 for users at the building site. This must be supported by an appropriate spatial layout and fencing, key policy and system authorities. If employees need to 'plug' equipment (e.g. when charging machinery), safety protocols and measures must be in place in order to prevent and minimise inexpert use and hazards (of for example electrocution). A new and complex subject such as electricity at the building site requires explicit attention in toolboxes, working instructions and inspections.
SHE Plan information	What must the supplier / owner provide for the SHE dossier at the building site?	The SHE dossier requirements for energy systems are no different to those for other supplies, in principle. As this is a new subject at the building site, we do recommend paying extra attention to the supplementary requirements, based on PGS-37 for the storage of batteries and energy storage systems. Transport slips may also be useful (incl. ADR notes) if there is internal transport which is not the responsibility of the supplier.

Architecture		
Phase distribution	How do you ensure an even load of the phase distribution of all energy users and generators?	This subject requires individual assessment by the functionary responsible for the installation. It will be particularly important for the peak shaving functionality and decentralised generation. If the phase distribution is inadequate, there is a risk of losing power at the building site, and inherent damage.
Safe connections	How can CEE connectors and installation components not safeguarded by a CCS2 protocol, be used safely?	Connections using CEE connectors are currently not protected by electrical and/or mechanical safety mechanisms. When charging machinery therefore, these should preferably be replaced by CCS2 or type 2 connector systems. Where this is not possible, labels and working instructions or limited access may be the solution.

Subject	Question	Recommendation
Network		
Voltages	What are the suitable voltages for work at the building site?	The recommended voltages at the building site are one of the following: For single phase + N connections: 230V AC For three-phase + N connections: 400V AC For mobile machinery: CCS2 (200V - 920V DC) or MCS In future DC microgrids: Current OS
AC/DC	Will we use AC/DC and DC/AC converters throughout the building site or is there already the possibility of switching to a DC network?	The first trial projects using DC networks are underway, but not yet common. We cannot yet formulate concrete advice on this, due to a lack of practical experience.
Data flows		
Consumption reporting and source of power	How do we measure the consumption, also for multiple parties at one and the same building site, and how do we determine whether electricity is green or grey?	Many clients require detailed energy accounts in order to be able to report on CO_2 emissions. Registration of this data is almost impossible at an emission-free building site, without an integrated energy management system. We therefore advise that all energy sources and users are registered by means of data flows (see following point), and that there is insight into consumption and generation of energy via dashboards or reporting. This will be useful, for example, when calculating electricity used by subcontractors, or the use of the charging infrastructure by other projects or external parties. In order to be able to register related emissions, it is necessary to know the type of energy (green/grey) of local generation and supply of kWh via the network connection, exchange batteries or other energy carriers.
Energy data	Is it possible to establish a standard "energy management" protocol, of the J1939 type used for the steering of motors?	We recognise the need to accurately map out all energy flows for technical steering and optimisation, but also as proof of emission reductions and for financial administration purposes. All machines, components and energy suppliers must provide sufficient information via a uniform method. See appendix 1 for the minimum recommended data points. We recommend that the exchange of data takes place via APIs for the most generic and uniform working method.
Energy sources		
Energy carriers (Hydrogen, Methanol, Ammonia, Formic acid, Biogas, others)	What approach must we take to alternative energy carriers used at the building site?	The energy supplier must be involved in the safety agreements within the system as a whole, and must be allocated responsibilities within the agreed demarcation. A new PGS 36 guideline is being formulated for the parking, storage, repair and maintenance of hydrogen machines. Once published, compliance will be required. Furthermore, ENI is not the appropriate party to make statements regarding connectivity issues with hydrogen, for example.
Decentralised generation	What are the important areas of attention for decentralised generation of power via PV or wind energy?	The connections of decentralised generation and energy storage must comply with all the recommendations provided regarding connectivity of the electrical installations. The phase distribution may become even more important in the event of decentralised generation. Always ensure that the functionary responsible for an installation has the necessary expertise.

Subject	Question	Recommendation
Hardware		
Assembly for Construction Site (ACS)	How will the large charging requirements of electrical equipment affect my ACS?	Current ACS can soon overheat when continuously charging machines. For example, the oxidation on older connectors can cause extra resistance, and therefore heat. The maximum charge has yet to be determined, but we would recommend sticking to a maximum continuous charge of 75% (i.e. 47 Ampère in a 63 Ampère installation) Take this into account in the choice and design of ACS systems. It is therefore sensible to separate the charging infrastructure from the current site power installations.
Cables and connectors	Which connectors should be used for maximum connectivity between the various systems?	We would recommend only using CCS2 or MCS connectors when charging heavy duty machinery, for the purpose of both uniformity and safety features. When connecting building site machinery up to 125 Ampère, we recommend CEE connectors, and Powerlock connections for 125 Ampère and more. Connections should be kept locked away out of reach of non-authorised persons. Extension leads may not be used for charging cables with connectors. Cables must be calculated to cope with the maximum continuous load. The NEN 1010 (Installation directive) or the NEN-EN-CIE 60204 (Machine directive) describe the necessary thicknesses. The NEN 3140 describes the 5 steps to be taken for safe working (LoToTo) on machines and installations, including the markings, PPE and safety regulations (e.g. the use of an operating switch when undertaking maintenance).
Safety and warning features	How should installations at the building site be identified with a view to safety?	Attach relevant and easily visible stickers to installations and containers. In ATEX zones, always use gas meters, information signs and approved safety cordons. All handbooks must be present in the SHE dossier before it becomes available for use. Working agreements must comply with the impending PGS-37 legislation and the designation policy as described in NEN 3140.
Physical space at the building site	How to take account of emission-free installations when designing the building site?	When designing your building site, take account of extra requirements for electrical installations, energy storage such as hydrogen tanks, and cabling. Think in terms of collision prevention measures for battery containers, minimum safety distances and ATEX zones, as well as the extra space required for logistic movements such as the periodic replacement of energy carriers and storage systems.

Appendix 1 – uniform data points

Data label	Value
SOC (State of Charge)	0– 100%
SOH (State of Health)	0– 100%
Actual current	-1000A – 1000A
Actual voltage	0– 1000V
Max discharge current	-1000 – 0 A
Max charge current	0 – 1000A
Total energy available	0 – 5000kWh
Remaining energy available	0 – 5000kWh
Min voltage system	0– 1000V
Max voltage system	0– 1000V
Actual voltage system	0– 1000V
System status	Charge, discharge, balancing
Fuel level	0– 100%
System temperature	-100°C – 100°C
Power output	-1000kW – 1000kW
Time to charge	0 – X min
Time to discharge	0 – X min
Start-Stop	1/0
Energy source **	Own values, e.g. NL green, EU green, grey with related emission factor

** The source of electricity is not an automated data point. However, this information is necessary for reporting requirements regarding CO_2 emission reduction or nitrogen emissions. We therefore recommend that you include a field for noting which emission data must be calculated for the various sources of energy. Think in terms of recording the emission factors for a mains network connection, or when charging exchange batteries elsewhere, when purchasing battery containers or when deploying green or grey hydrogen.