SMART CAR PARK

Sustainable Parking in The Netherlands

dc.systems

Current‑OS

DC SYSTEMS
by Schneider Electric

Dutch Sustainability at its Finest

Project Summary

At A.S.R, a leading Dutch insurance firm, a 5000 m^2 two-level parking lot has been established that is environmentally conscious with a green outlook. This refurbished facility is equipped with 2000 solar panels, contributing to the company's CO_2 neutral office initiative. The state-of-the-art bi-directional electric vehicle chargers (V2X) are a defining aspect of this cutting-edge system, enabling a rapid transition to sustainable energy.

Highlights

- o Bottom-up congestion management approach.
- o DC stray currents measurement and monitoring.
- o Monitoring the transformation of electrical energy from AC to DC during charging and discharging.
- o Balancing local energy consumption with local generation.
- o Implementing a droop rate system to regulate current flow based on variable conditions.
- o Maximizing self-delivery of energy from PV sources by monitoring DC grid behaviour in response to changing droop rates.
- o Safe interface between AC & DC grid with the Active Front End (AFE).
- o Utilizing Current Routers to ensure safety of the DC grids.
- o Emulating a mini-grid system to utilize the capacity of electric vehicle chargers, enabling one fully charged EV to support the charging of other EVs as needed (V2V).
- o Implementing autonomous measurement and control, with locally set controls that operate the system automatically.
- o Compared to AC, all components are included in the sophisticated, smart DC systems, resulting in
  - Less materials used
  - Increased efficiency
 - Inherently more robust systems
- o Flexible grid topology.

Car Park covered with solar panels; busways connecting to string optimizers

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Project Specifications

The two-story parking lot was optimized to reduce AC usage and increase DC energy utilization.

- o 96 solar panels of 48kW connected to AMPT string optimizers on DC.
- o 250 AC EV chargers & 3 DC bi-directional EV chargers of 11kW each, scalable.
- o Active Front End of 50kW.
- o DC distribution cabinet equipped with Solid State Protection (i.e., Current Routers).
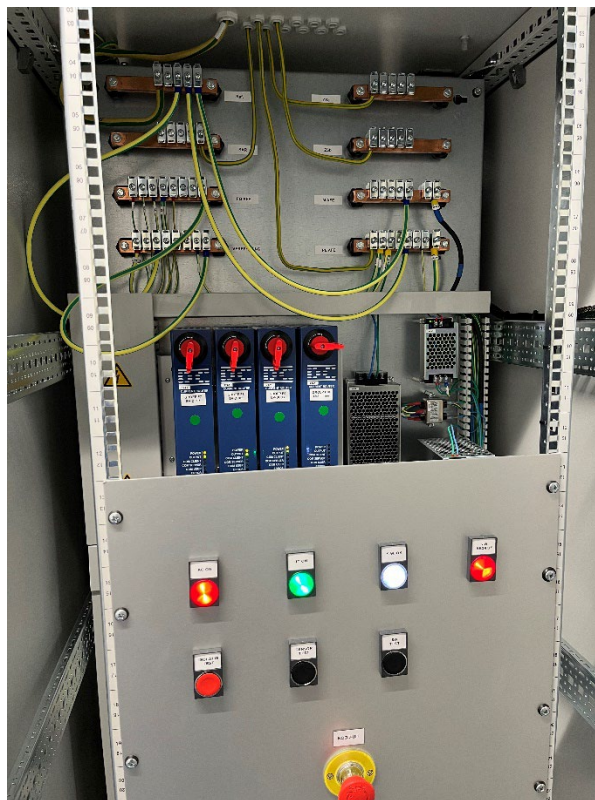
Current Routers providing ultra-fast Solid State Protection

- o Autonomous & fast control – based on the Current/OS protocol.
- o Sensor-activated LEDs on DC across both stories of the lot.
- o Stray currents – measuring voltages and currents in 17 places spread over parking decks.
- o Droop rate control: each device has its own settings for voltage and power characteristics.
- o 7 different earthing configurations to determine current leakage and minimizing possibility of corrosion.
    - • Standard TN-S system
    - • Standard TN-S system, supplied building-earth
    - • Standard TN-S system, supplied building-earth, separate Frame Ground
    - • Standard TN-S system, loose earth pin
    - • TN, DCCD, Frame ground floats, without extra pen
    - • TN, DCCD, Frame ground with extra pen
    - • Split ground
- o Testing influences on steel construction – the use of half-cell sensors embedded in the concrete structure provides an accurate assessment of iron potential at different points. This information is used to measure and analyze DC stray currents, which enables the evaluation of the impact of the DC stray

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current on the building and the identification of necessary measures to ensure safe and efficient system operation.

Measurement of stray currents in several points

o **Island mode**: In the event of a traditional AC power failure, the DC grid can be maintained through the support of EVs and solar energy. This enhances the overall grid reliability, positioning EVs and solar as key components in ensuring grid stability.
o The autonomous power system ensures consistent energy availability, regardless of weather conditions. During sunny periods, the system maximises charging of electric vehicles by utilising solar energy. If the conventional AC grid goes down, the EVs still remain charged by means of the solar-powered DC grid.
o EMS (energy management system).
o Priority settings – adjust V-P characteristic.

Venema's EV chargers running on DC

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Challenges Faced

- o The prolonged lead times for material delivery, due to the ongoing energy crisis and conflict in Europe, had a significant impact on the production and delivery of products. The extended procurement process and logistical delays caused a substantial slowdown in the production and delivery of components, causing hindrances in project execution.
- o Lack of standards and training around DC systems – The Current/OS Foundation is developing a set of rules for safe operations in DC microgrids. These rules, which encompass droop controls, voltage levels, stability of DC systems, and new safety zones differ from those for traditional AC systems. To properly implement these rules, engineers and technicians will need further training and education.
- o Extensive efforts required to make a relatively small system work on such a large scale.
- o Product development for higher energy ratings.
- o Unique DC systems – each system is one of a kind and requires adjustments based on the devices and priority requirements.

DC is Safe: with Standards

Due to the absence of standards for DC, this system was tested using redefined safety zones to enhance safety for individuals and reduce incidents. Safety is a major concern with DC, and these zones were established to ensure higher safety standards with Current/OS.

Protection

DC Systems innovation, Current Routers, offers a new type of protection called Solid State Protection. They serve as a replacement for conventional mechanical breakers, offering fast protection in the event of a fault and enabling selectivity among devices. Current Routers prevent high short circuit currents and provide RCD protection.

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DC Systems Active Front End built by Elektro Internationaal

AFE

The Active Front End is an innovative product of DC Systems that provides a secure connection between the AC and DC grid. It combines electrical power and grid-interactive capabilities for balancing the load and supply. By adding communication to the system, the behaviour of each device can be monitored and regulated individually through the Current/OS system.

Safety Wire

The all-encompassing DC grid combines various DC sources EV, PV, and batteries, resulting in increased system efficiency. However, with multiple sources, it can be unclear when the bus loses power when one source is switched off. To address this, the Safety Wire was implemented for all sources. If the signal of the Safety Wire is lost, all sources will cease supplying power to the bus, adding an extra layer of safety.

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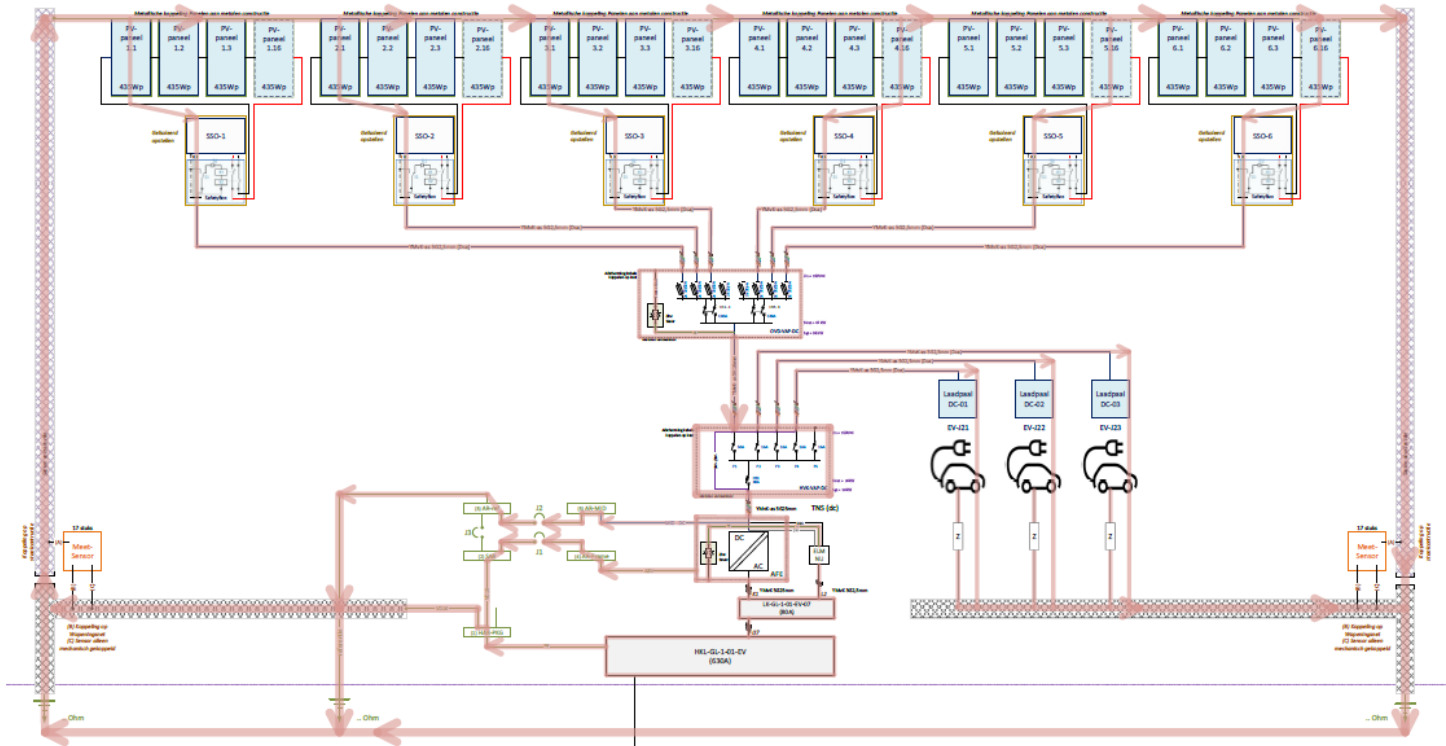
Electrical Design ASR Car Park

The Future of DC

As EVs become more prevalent on roads and photovoltaic panels become more widespread on rooftops, there is a pressing need for a transition to sustainable energy. A.S.R. is at the forefront of this transition, along with installer Kropman, EV chargers from Venema, and DC Systems' long-standing partnerships for creating custom DC solutions and components. This project exemplifies the essence of sustainability.

The future of DC energy is bright with new applications, training programs, and regulations being developed. This pilot project highlights the advantages that DC systems have over AC systems.

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Project Collaborators

The car charging park was made truly successful with several partners that have the same end goal: to achieve a sustainable energy transition with smart systems in DC.

- o Jos Ruijter, **A.S.R.**
  - o Coordinator, loading square, realization, integration in building.
  - o "There is no unequivocal solution for the energy transition, but the way in which controlled charging directly from the solar panels is used here certainly has a great future for charging plazas in the built environment."
- o Kevin de Bont, Werner Verhelst, Jan Meijer, **Kropman**
  - o Electrical and installation technology and energy management
  - o "Kropman wants to be at the forefront of smart technology among building service companies."
- o Jonathan van der Heiden, **DC Systems by Schneider Electric**
  - o System integration, DC products
  - o An overarching vision for DC being **the future of a sustainergy** - sustainable energy - **transition**, increasing training and exposure into DC systems along with partners.
- o Melvin Venema, **Venema E-mobility**
  - o EV charging station supplier
  - o "We believe in DC distribution in combination with charging equipment. Our slogan is **'Smart power starts here'**."

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