Floating DC Nano Grid for Solar Charging of Recreational Boats

Presented by Peter van Duijsen

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Contents

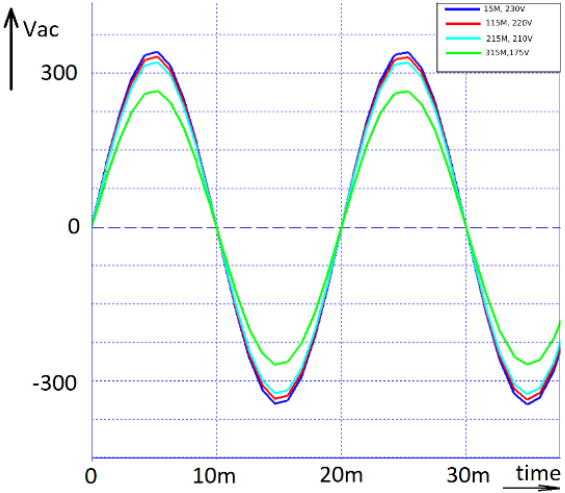
Floating DC Nano Grid

- Charging recreational electric boats in
- 150 docks and longest distance is 315 meters
- Replace everything with a DC grid

Existing Harbor power AC grid

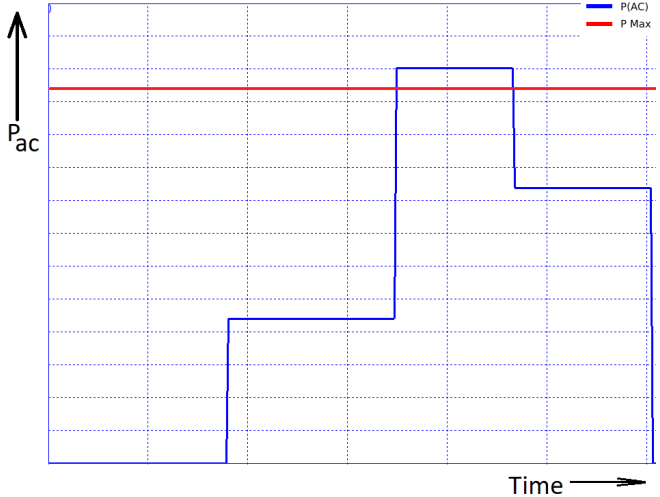
Docking of the Vlietstreek (Google maps), main grid (white), 15m(blue), 115m(red), 215m(light blue), 315m (green).

AC voltage drop



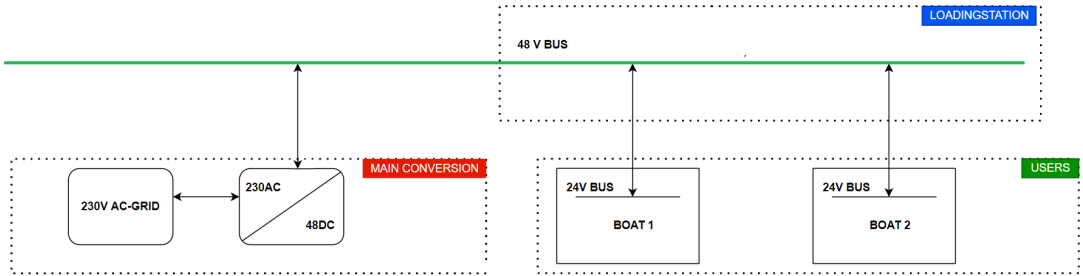
AC voltage drop after 315 meters(green).

Charge power



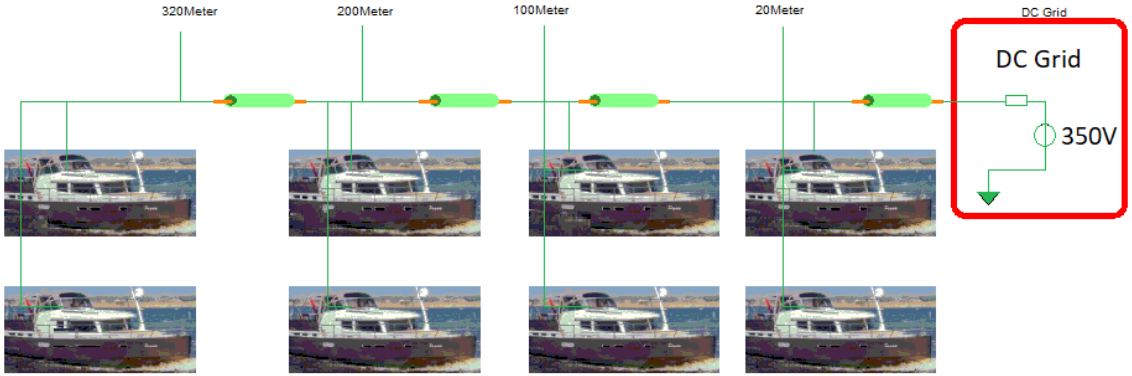
Charge power depends on the number of loads connected.

System overview



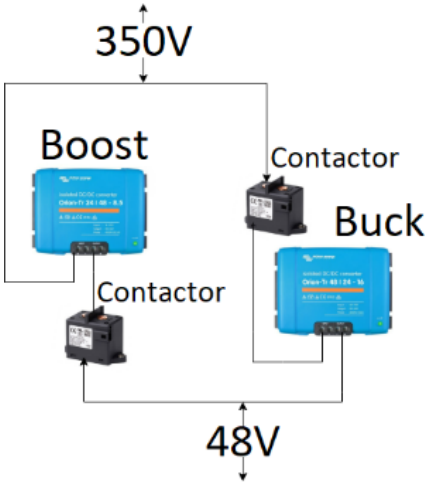
System overview, the green line includes the 350 volt DC grid with bidirectional conversion to the 48 volt DC grid.

DC 350 volt grid



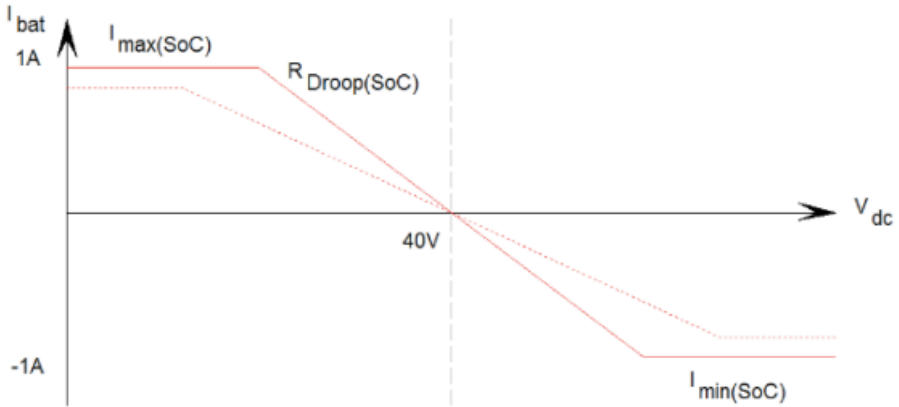
350 Volt DC grid.

Contactors



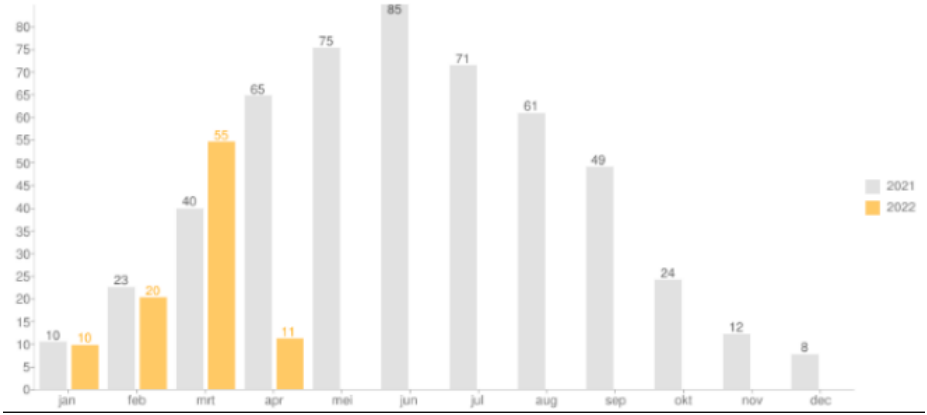
Coupling DC grids.

Droop control



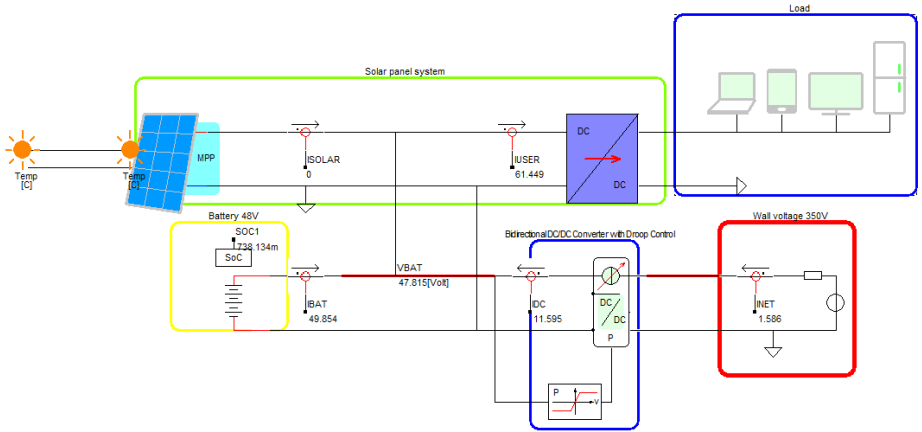
Droop control for battery charging.

Solar power



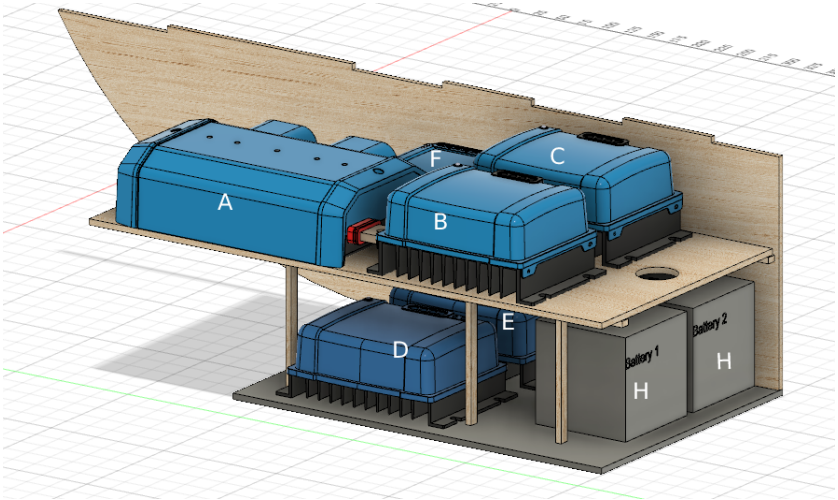
Solar panel power at the harbor during 2021 and 2022 until April.

Droop control simulation



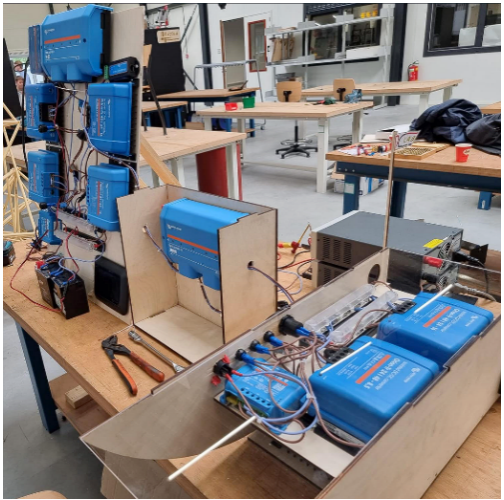
DC simulation of the Droop Control.

Prototype



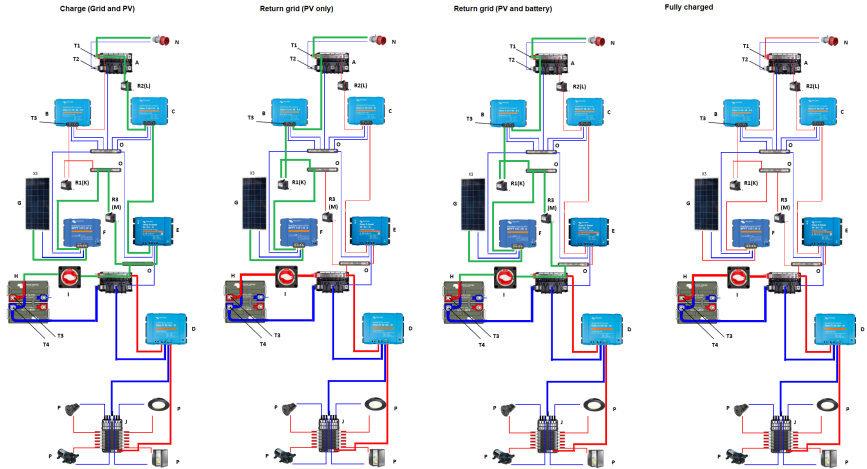
Solar inverters, chargers and batteries.

Test set-up



Test set up (left) and final application (right).

Connection Diagrams



The four connection diagrams with contactors to control the DC grid operation.

Conclusion

- Voltage drop in the AC grid is large
- Replace with DC grid
- Using commercial available solar converters and battery chargers
- Load sharing by droop control
- Since only commercial products are used, droop control not possible
- Using contacters instead of droop controllers
- Goal 1: Power congestion management
- Goal 2: Energy exchange between the boats

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