Charging Infrastructure

Charging Infrastructure at the Gates

- **Number of charging points:** 18
- **Power per charging point:** 250 kW
- **Supply:** 6 × 600 kW Kempower rectifiers
- **Dynamic function:**
    - Two rectifiers can be connected in parallel to deliver up to 1.2 MW distributed across 6 points.
    - Future-ready: Prepared for **MCS (Megawatt Charging System)**
    - Megawatt chargers can be installed when mature.

Charging Infrastructure at the embarkment

- **Number of charging points:** 16 standalones
- **Satellites:**
    - 8 × 360 kW liquid-cooled charging points
    - 8 × 200 kW standard charging points
- **Supply:** 4 × 600 kW rectifiers
- **Dynamic system:** Same as at the gates

Dynamic Charging Equipment and Fleet Management

- **Structure:** Each rectifier has 12 × 50 kW power modules
- **Power distribution:** Modules allocate power to charging points based on demand.
- **Connection:** 2 × 600 kW rectifiers can be connected together
- **Fault tolerance:**
    - Loss of 2 power modules → 1.1 MW still available
- **Fleet power management (Panion):**
    - Integrated with route planning, charging equipment, and battery
    - Optimizes charging based on the vehicle's next trip

    - Assigns just enough power to each electric truck for its planned route.
    - Improves utilization of the charging infrastructure and reduces costs.
- **Advantages:**
    - Power is distributed dynamically without interruption.
    - High operational reliability and flexibility

Energy Storage and Solar Power

- **Battery storage system:** 2 MW capacity
- **Solar PV system:** 252 MWh annual production
- **Functions and advantages:**
    - Reduces high power peaks from charging.
    - Charges batteries when electricity prices are low.
    - Supports the regional grid in frequency markets.
    - Contributes to green, local, and stable energy supply.

Power and Energy Units

Unit	Abbreviation	Size	Example
Watt	W	Base unit	An LED light uses approx. 10 W
Kilowatt	kW	1 kW = 1,000 W	Panel heater or water heater ≈ 2 kW
Megawatt	MW	1 MW = 1,000 kW	Wind turbine produces 3–5 MW
Gigawatt	GW	1 GW = 1,000 MW	A nuclear power plant ≈ 1 GW

Difference:

- Power (W, kW, MW, GW) = instantaneous output
- Energy (Wh, kWh, MWh, GWh) = consumption or production over time

---

Equipment Suppliers

- **Kempower AS** – Charging equipment.
- **PSW Power and Automation** – Battery storage.

Frequency in the Power System

- **What:** The frequency (usually 50 Hz in Norway) indicates whether electricity production and consumption are in balance.
- **Why important:**
    - If consumption exceeds production → frequency drops
    - If production exceeds consumption → frequency rises
    - Large deviations can destabilize the grid and damage equipment.

Balancing Market

- **What:** A market where electricity suppliers buy and sell adjustments in real-time to keep production and consumption balanced.
- **Who:** Statnett operates the balancing market in Norway.
- **How:**
    - Producers or consumers can offer to increase or decrease power quickly.
    - Statnett activates these resources to keep frequency near 50 Hz.
- **Purpose:**
    - Ensure stable electricity supply.
    - Minimize the risk of power outages.
    - Optimize the use of hydropower, wind power, and batteries in real-time.