

Empowering the Future.



Energy Hubs for Ports –
Integrated Energy
Management in Green Ports
7th July 2021

WEBINAR Decarbonising Small and Medium Ports

July 7th 2021

What's going on with the **energy** in the world?



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Power supply requirements

“Sustainable Development Goals” by UN
“Clean Energy for all Europeans Package” by EU

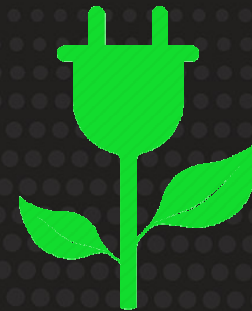
Digital Industrial Transformation



Availability



Reliability



Green

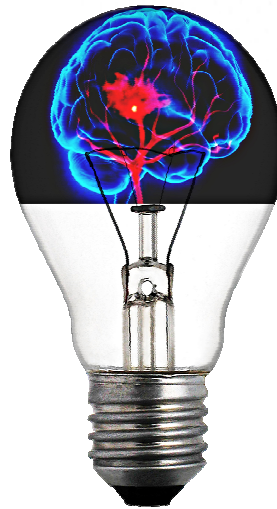
Clean and secure power supply are critical



To sum up, organizations' needs



**Reduce
Costs/Diversify
Revenue Streams**



**Availability
Reliability
Supply**



**CO₂
Reduction**

Management System
+ User Interface

eHUB
Digital Energy-Hub

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Smart Building with
Demand Side Management

Micro-Wind
Generation

Self-Sustainable
Public Lighting

Photovoltaic
Generation

Digital Substation
+ Storage System

EV Conductive Charging
(DC&AC)

EV Inductive Charging
(Wireless)

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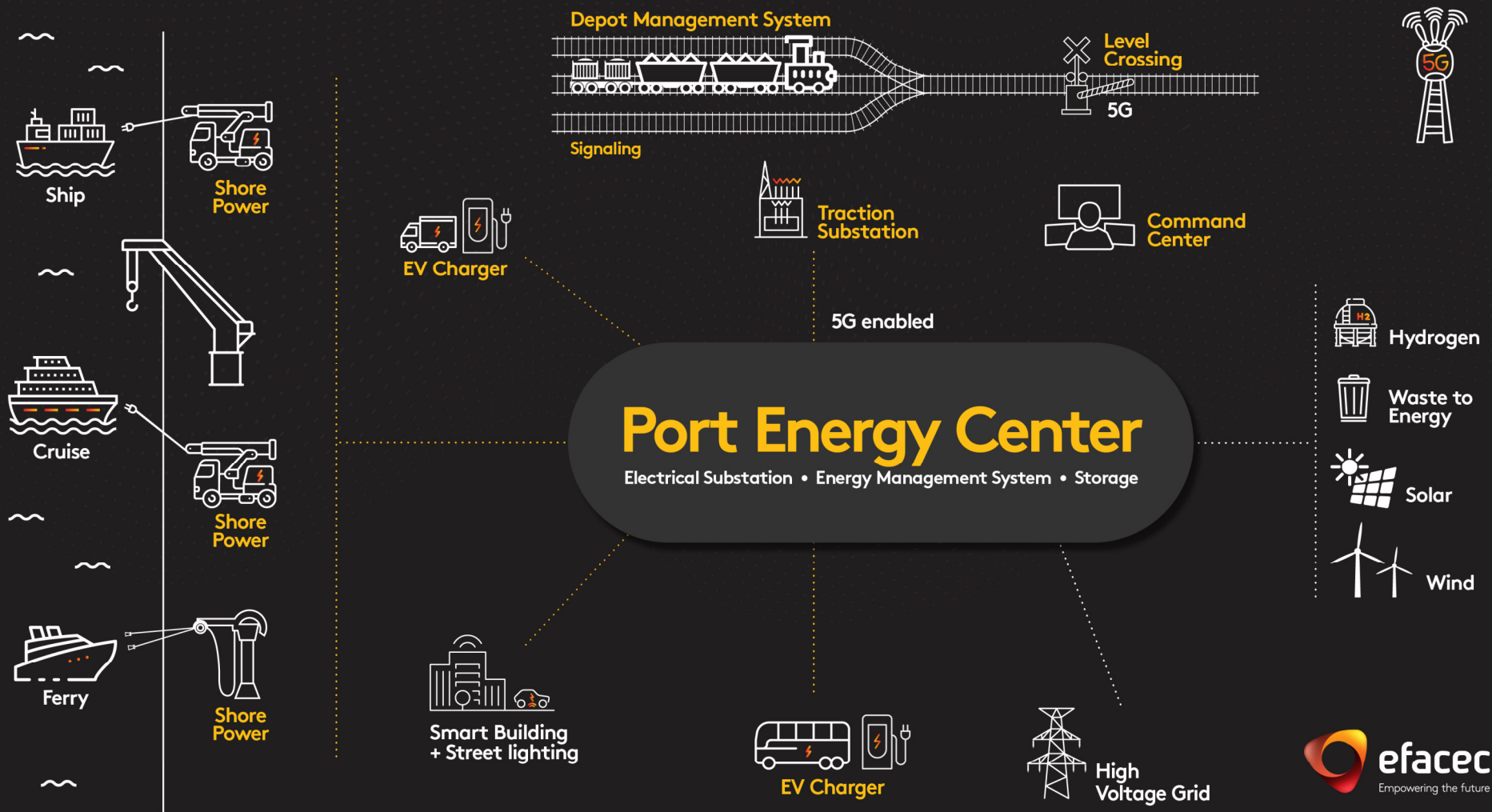
Shipping industry produces nearly 4% of the global CO₂, 10-15% of global nitrous oxides (NO_x) and 4-6% of global sulfur oxides (SO_x).

Several ports are near heavily populated cities and can cause negative impact on the surrounding communities.

25% of the European Ports surveyed reported more than 50% of traffic volume related with energy commodities

1996	2004	2009	2013	2016	2017	2018
Port development (water)	Garbage / Port waste	Noise	Air quality	Air quality	Air quality	Air quality
Water quality	Dredging operations	Air quality	Garbage / Port waste	Energy consumption	Energy consumption	Energy consumption
Dredging disposal	Dredging disposal	Garbage / Port waste	Energy consumption	Noise	Noise	Noise
Dredging operations	Dust	Dredging operations	Noise	Relationship with the port community	Water quality	Relationship with the port community
Dust	Noise	Dredging disposal	Ship waste	Garbage / Port waste	Dredging operations	Ship waste
Port development (land)	Air quality	Relationship with the port community	Relationship with the port community	Ship waste	Garbage / Port waste	Port development (land)
Contaminated land	Hazardous cargo	Energy consumption	Dredging operations	Port development (land)	Port development (land)	Climate change
Habitat loss / degradation	Bunkering	Dust	Dust	Water quality	Relationship with the port community	Water quality
Traffic volume	Port development (land)	Port development (water)	Port development (land)	Dust	Ship waste	Dredging operations
Industrial effluent	Ship discharge (bilge)	Port development (land)	Water quality	Dredging operations	Climate change	Garbage / Port waste

Top ten environmental priorities – Energy Efficiency in European Ports, 2019 [1]



Solutions for Ports

Port Energy Center

- ✓ Energy Management Systems
(from several sources of energy)
- ✓ Electrical substation
- ✓ Storage;
- ✓ MV network
- ✓ Rectifiers
- ✓ Onshore power (charging equipment)

Renewable Energy

Power generation complementary installations:

- ✓ hydroelectric
- ✓ wind
- ✓ biomass
- ✓ waves
- ✓ solar

Solutions for Ports and Harbors

Signalling and Rail Safety Systems

- The signalling solution for:
 - ✓ Terminus & Junctions Interlocking SIL4 Signalling Boxes
 - ✓ Traffic Light Priority & Point Control systems
 - ✓ SIL3/4 Signalling systems for Depot
- Level crossing (5GO and 5Growth projects)

• Management Systems

- ✓ Railway Depot Management System
- ✓ Technical Supervision Systems
- ✓ Scada for Auxiliary Systems
- ✓ Telecommunications Systems

• EV Chargers

- ✓ Trucks
- ✓ Bus
- ✓ Cars

Multi-Instance Energy Management System

Forecasting tools:

- Combining eHUB platform with smart logistics in order to anticipate energy needs from EV distribution fleet and new ships, considering the energy resource required and grid location;
- Advanced forecasting tools for PV generation, different types of loads and energy storage availability;

Multi-vector and multicarrier energy management:

- Digital twins of the multiple resources and grid;
- Cross-sector representation (electricity, biofuels, heat/cold);
- Operation considering multi-vector constraints and requirements;

Multiple interfaces with different stakeholders:

- Local flexibility services for the DSO (congestion management, voltage control, reactive support, reverse power flow management, etc.);
- Ancillary services provision (frequency control, regulation reserve, etc.) for additional revenue streams through energy retailer/aggregator;

Operation tools for decarbonization:

- Optimization of global energy costs, weighted by the carbon footprint, and considering available distributed resources in the port;
- Maximizing ROI of distributed assets through multiple service performance to different actors (grid operators, markets);
- B2B green energy credits exchange within the Port Community;

Energy Storage and AC/DC Grid

Distributed Architecture:

- Different energy storage systems designed for the different applications in the port, but contributing to the overall optimization of the Port energy use;
 - Electrical energy costs reduction; Peak-shaving; Grid Services: Local services to the DSO; Power System Ancillary Service;
 - Backup Power;

Energy Storage technologies and circular economy:

- Second-life EV batteries for grid purposes:
 - Circularity achieved by defining plans for usage of light and heavy EVs batteries for re-purposing in the future, further increasing decarbonization and resources usage;
- Combination of battery technologies to diversity application scope: power driven applications and energy driven applications.

Combined operation of the AC/DC microgrid:

- Power conversion architecture focused in improving energy efficiency by reducing conversion steps;
- Potential for autonomous operation of the DC part, ensuring continuous operation for its resources;
- Utilization of the power electronics interface to locally contribute to voltage regulation;

Demand Side Management

Controllable loads with Demand Response:

- Integrated Smart Building energy management
- Ice (cold) storage that address cold needs for industrial processes and buildings (HVAC);
- Thermal storage for industrial processes

New loads for energy efficiency purposes:

- Efficient Port Cranes with integrated energy storage system (Supercapacitors / batteries) for peak power reduction while participating in the overall energy management;
- New DC loads that can be integrated in the DC part of the microgrid

EV Charging Stations:

- Smart Charging
- Vehicle-to-Grid (V2G) and Vehicle-to-X (V2X)

THANKS!
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