ASEAN Ports and Shipping 2020

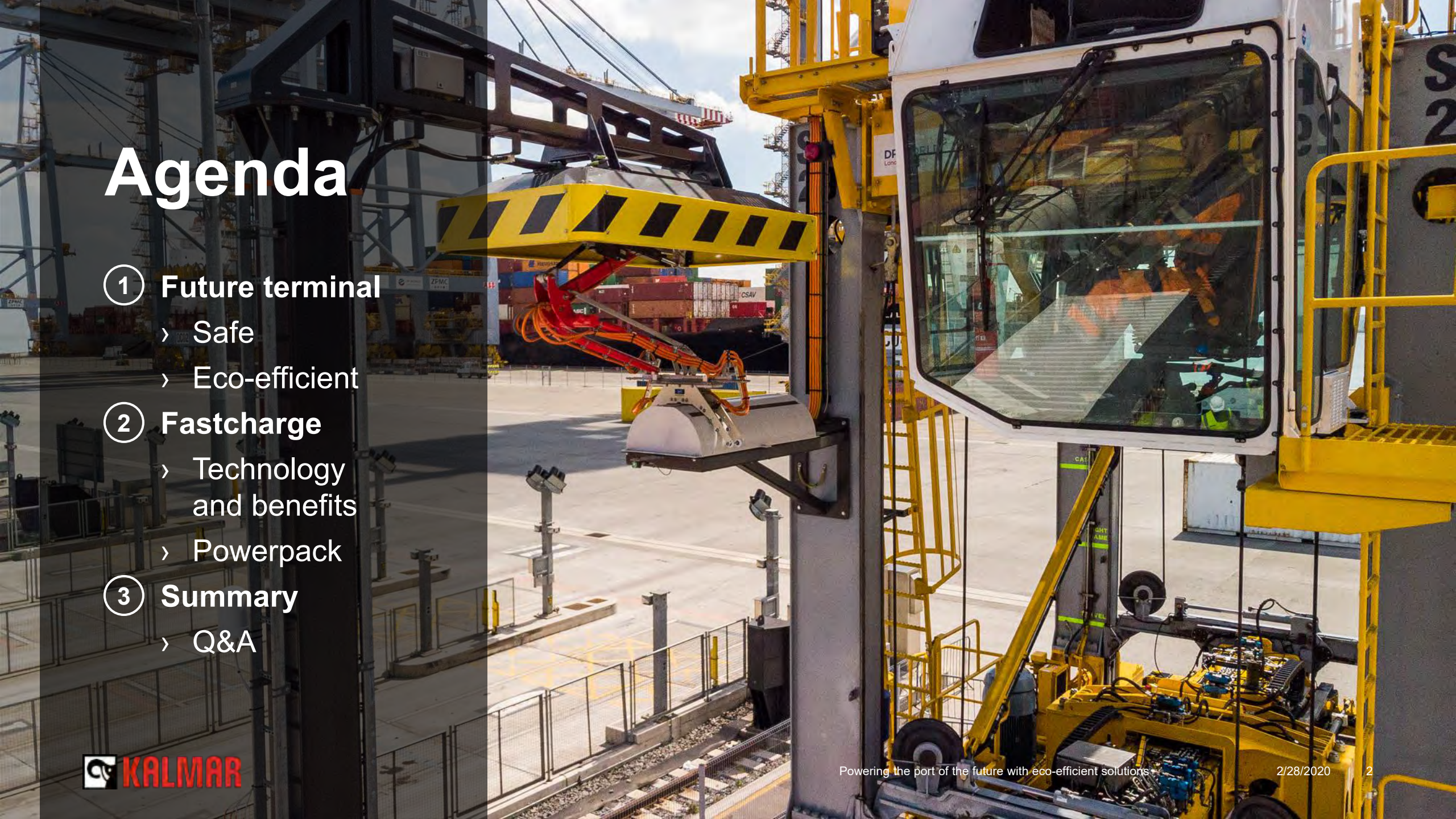
Jakarta 25-27 February 2020

Powering the port of the future with eco-efficient solutions

Ismo Matinlauri

Agenda

1. **Future terminal**
   - › Safe
   - › Eco-efficient
2. **Fastcharge**
   - › Technology and benefits
   - › Powerpack
3. **Summary**
   - › Q&A



Future terminal

Safe
Loss of life and LTI rate

Efficient
Productive, low handling unit cost

Eco-efficient
CO2 emission taxation

Flexible, scalable
Possibly to adapt to changes in business environment

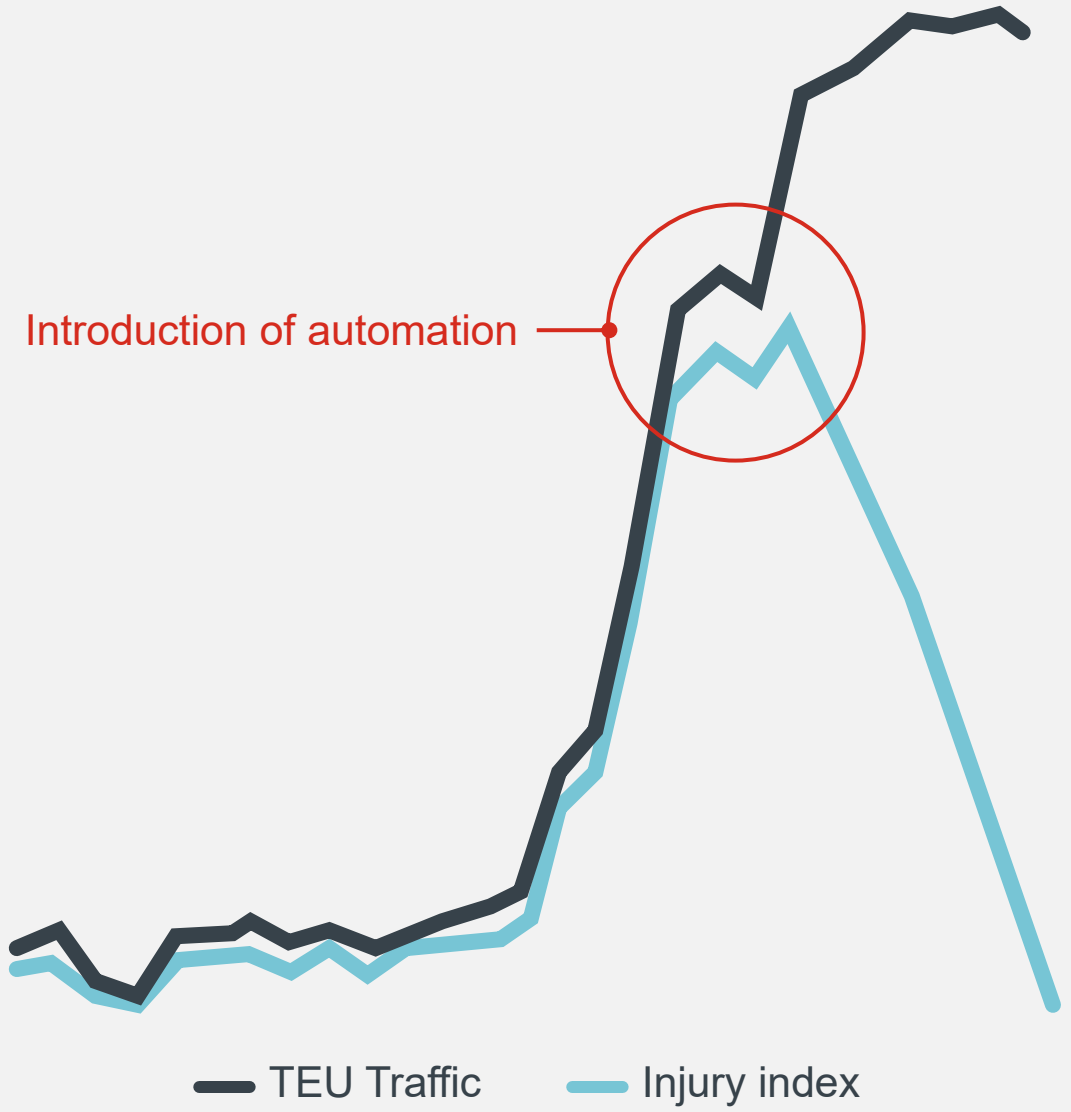
The right solution for you depends on your specific situation.

Example of Safety

Kalmar AutoStrad(TM) vs manual straddle carrier

- **Ever increasing focus on safety**
- Over **90%** lower Loss Time Injury (LTI)
- Throughput up by **39%**
- Over **90%** lower employee costs
- **98%** vessel departure performance
- Average crane rates over **35 moves/h**
- Maintenance savings around **$500k** over the lifetime of a single machine

> **We went 12 months without a single lost time injury among our 160 employees.**
>
> **Matt Hollamby**, Brisbane manager, terminals division Patrick



KALMAR

Key Drivers for Automation

- Competitive advantage
- Cost of utilities
- Cost of labour
- Safety
- Environmental benefits
- Security
- Performance
- Maintenance and damage

Cut emissions

Zero emissions at source

Less noise and light pollution

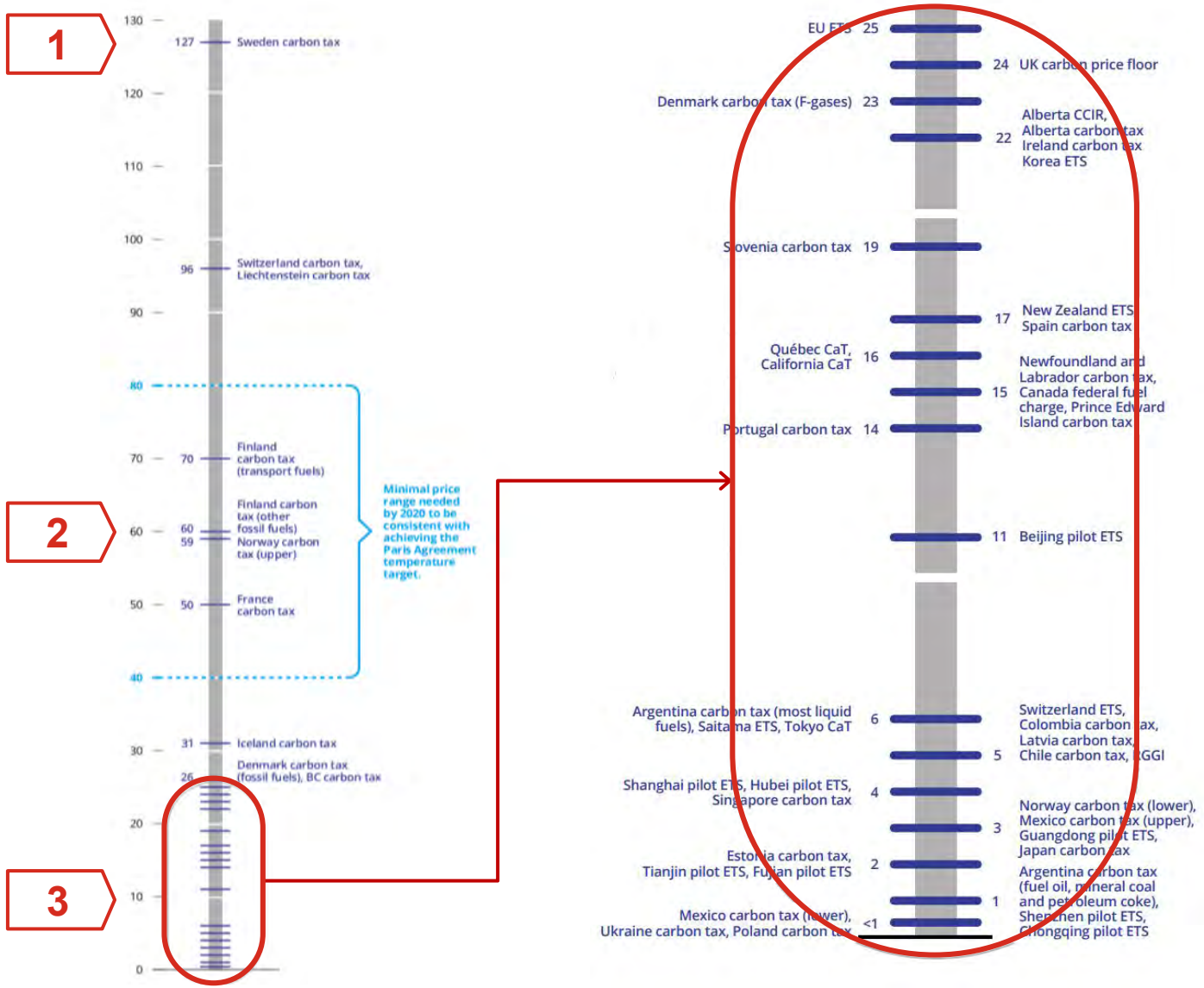
Meets future emissions standards

CO_2 Taxation Development

KALMAR

Current state of ‘carbon’ taxation

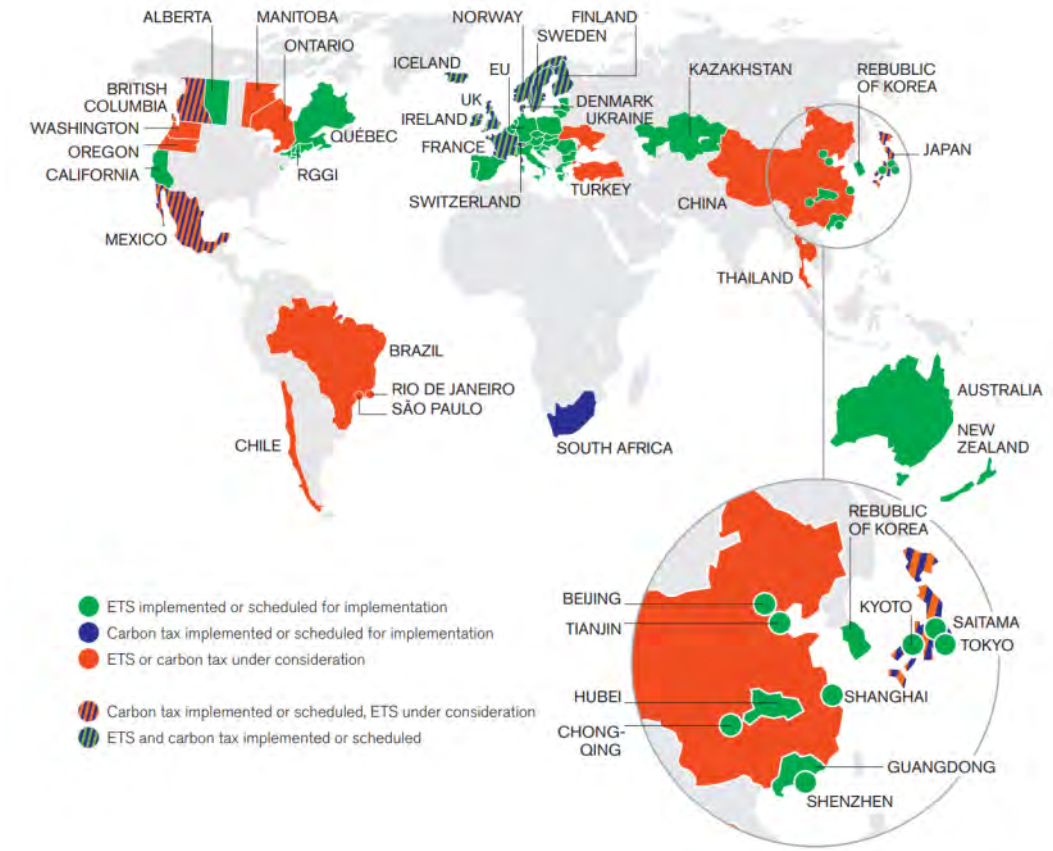
- Implemented or scheduled for implementation in 57 countries
- Pricing initiatives range US$ 1-127 / ton CO_2
- 51% of the emissions covered are priced < US$10 / ton CO_2



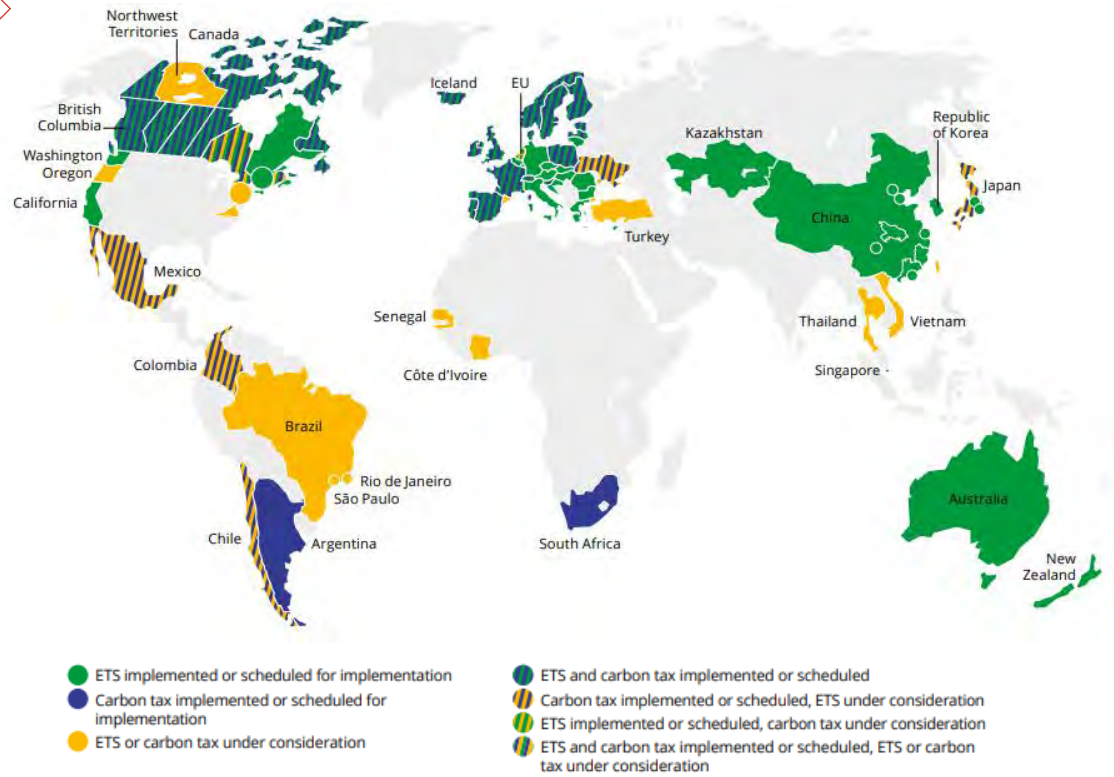
3 main zones driving business case development

‘Carbon’ taxation development

Year 2014



Year 2019



(World Bank 2014; World Bank 2019)
ETS=Emission trading system

Development of ‘carbon’ taxation in the future

Carbon taxation KPI’s	2014	2019	2024
Coverage of Greenhouse Gas emissions	12%	20%	?
Jurisdictions involved	40 national, over 20 subnational	46 national, 28 subnational	

- Participated countries need to hit the minimal range (US$ 40-80 / ton CO2) by 2020 in order to be consistent with the Paris agreement temperature target
- Awareness of carbon taxation is increasing
- China, Vietnam, rest of Canada have implemented or scheduled implementation between years 2014 and 2019

The trend shows increased coverage and pricing of carbon initiatives

(World Bank 2014; World Bank 2019)

Carbon dioxide taxation in Straddle/Shuttle Carrier context

- The first full scale deployments are being delivered. The market is awaiting for references.
- The increasing CO_2 taxation initiatives will increase the financial feasibility of the FastCharge solution despite the higher CAPEX cost.
- Drivers in the electrification of port operations:
  - Operational cost savings
  - Increasing carbon taxing contributing to business cases
  - Sustainability as a core value - customer demand for a low carbon footprint in the logistics chain
  - Government incentives for green investments

KALMAR

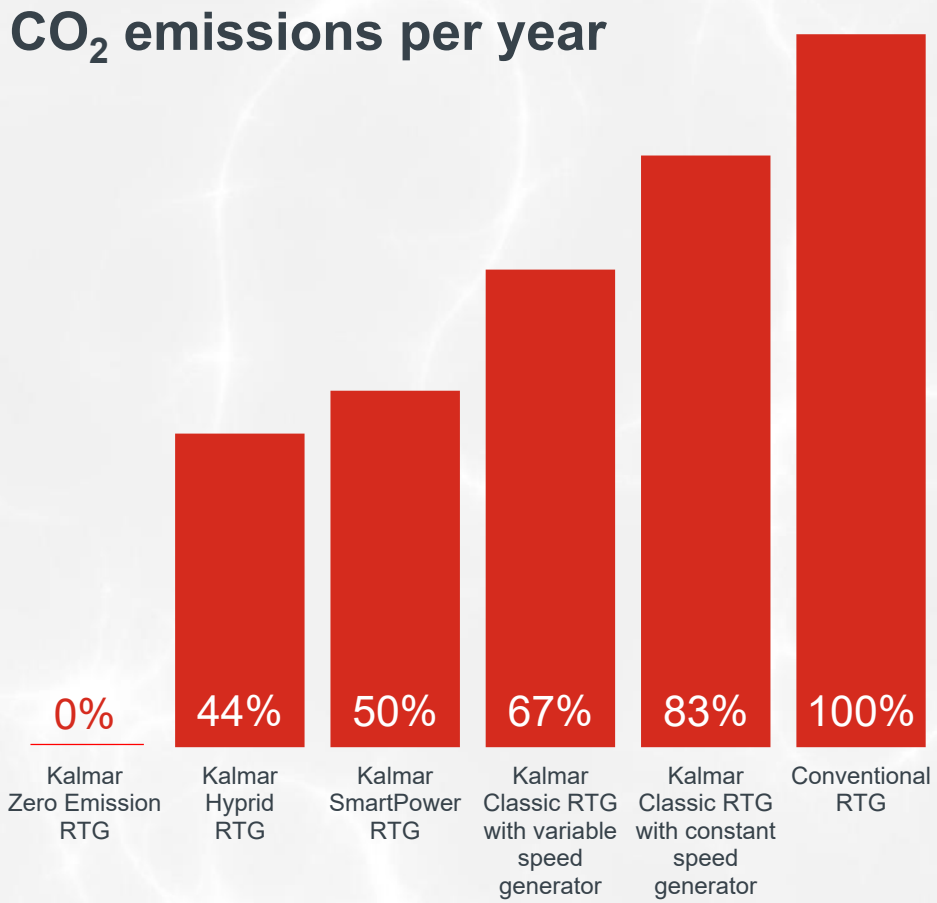
The impact of electrification

Economical Advantages

- Reduced maintenance and operating costs
- Major savings in Diesel
- Cost and time saving through reduction in refueling stops.
- Investment with high returns
- Fast payback

Environmental Advantages

- Reduced CO2 Emissions.
- Less exhaust gas pollution
- Low-Noise operation



The future is all **electric** …and **automated**

Kalmar
FastCharge™

https://www.youtube.com/watch?v=teyp3NLi1ig

FastCharge technology and benefits

Kalmar FastCharge™ solution

- Enables 24/7 operation for battery-powered machinery
- Consists of charging station(s) and charging interface(s)
- Zero local emissions
- High-power charge optimises the fleet's utility and availability rates
- Maintains the highest possible battery system health and lifetime for the machinery
- Includes vehicle-to-grid (V2G) and smart grid capabilities

Kalmar FastCharge™ Solution for AGV

FastCharge Solution.

1. FastCharge station is suitable for both low and high voltage power grids.
2. Automated and safe charging connection between the FastCharge station and AGV.
3. Standardised communication between AGV and the FastCharge station for reliable charging.

AGV Navigation System.

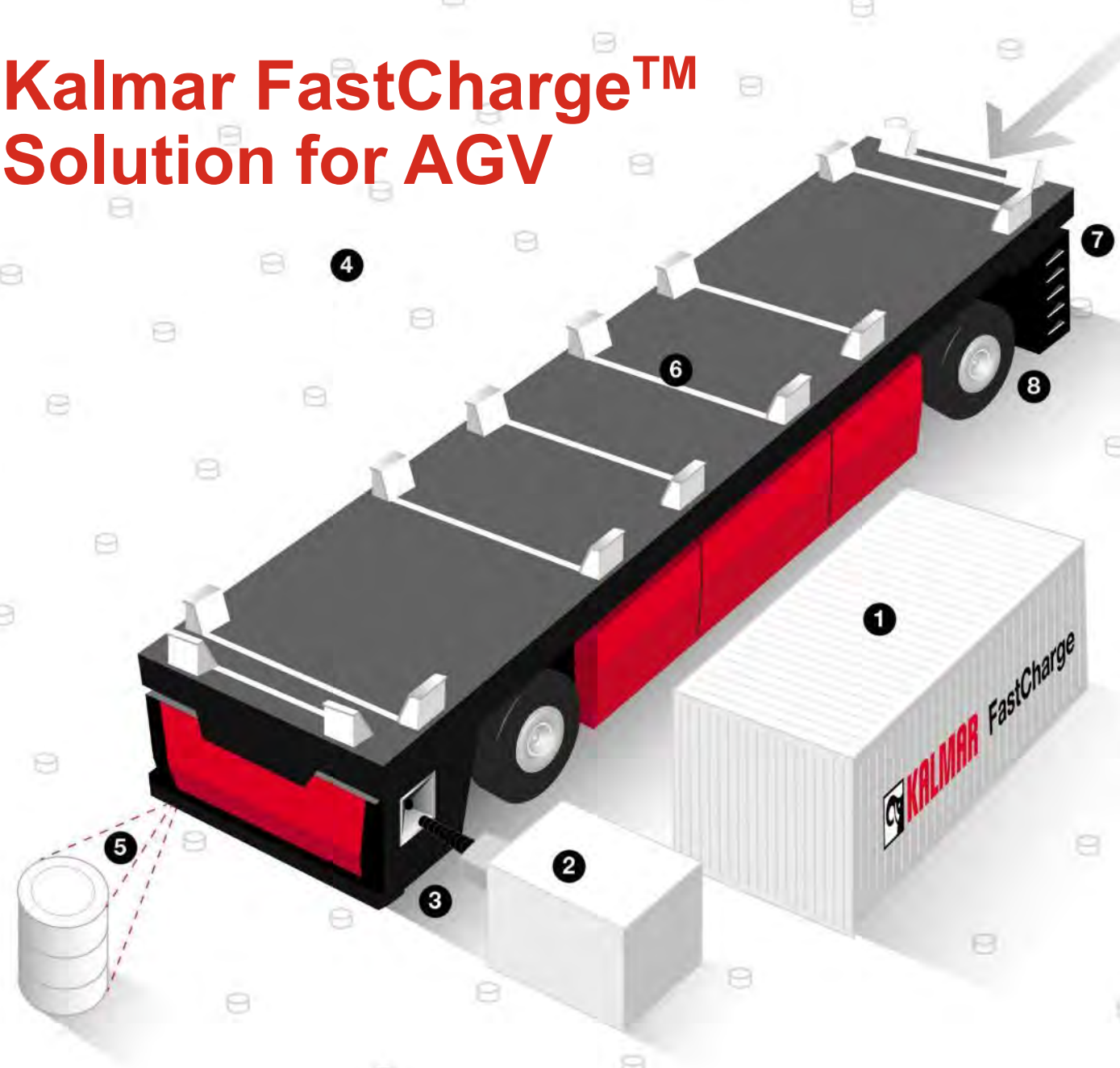
4. Ground based transponder grid enables safety rated absolute positioning and reliable navigation of the AGV.
5. Laser based obstacle detection system detects any obstacles on the driving path.
6. The Inertial Measurement Unit (IMU) provides three dimension acceleration as well as vehicle roll, pitch and yaw to improve the positioning accuracy and reliability.
7. AGV communication is backed by an all weather, high availability, secure Wi-Fi network. Tele-operation device for service and maintenance.
8. Redundant odometry sensors to measure wheel speed and steering angle for accurate dead-reckoning.

FastCharge™ charging station

- Charging type: DC fast charging
- Charging power: 0-600 kW
- Time to full charge: 5 min @ 600 kW
- Typical charging time in one operation: 30 to 180 sec @ 600 kW

FastCharge™ charging connection

- Charging current: Up to 800A
- Combined Charging System (CCS) for standardized communication interface.



Kalmar FastCharge™ Solution for FSH and FSC

Charging type:
DC fast charging

Charging power:
0-600 kW

Time to full charge:
5min @ 600 kW

Typical charging time in operation:
30 to 180 sec @ 600 kW

Machine compatibility

Straddles, Shuttles and AGVs are opportunity charged at natural points along their operational routes

FSH

FSC

AGV

Kalmar KT2-E
Electric Terminal Tractor

Basic machine

- Electric drive motor
- 4 battery packs (series / parallel)
- Interface for DC Fast Charger ~150 kW
- Thermal battery management system (-30 to +50 degrees)
  - Cooling for high ambient conditions and high charge rates
  - Heating for extremely low ambient conditions
- Accessory drive systems:
  - Brake air compressor with motor
  - Lift system pump with motor
  - Steering system pump with motor
  - A/C compressor
  - Cabin heating element

Charging system possibilities

Kalmar Power Pack

KALMAR

Kalmar FastCharge™ Kalmar Power Pack

An additional stationary battery storage, which acts as an energy buffer in parallel to the charging station.

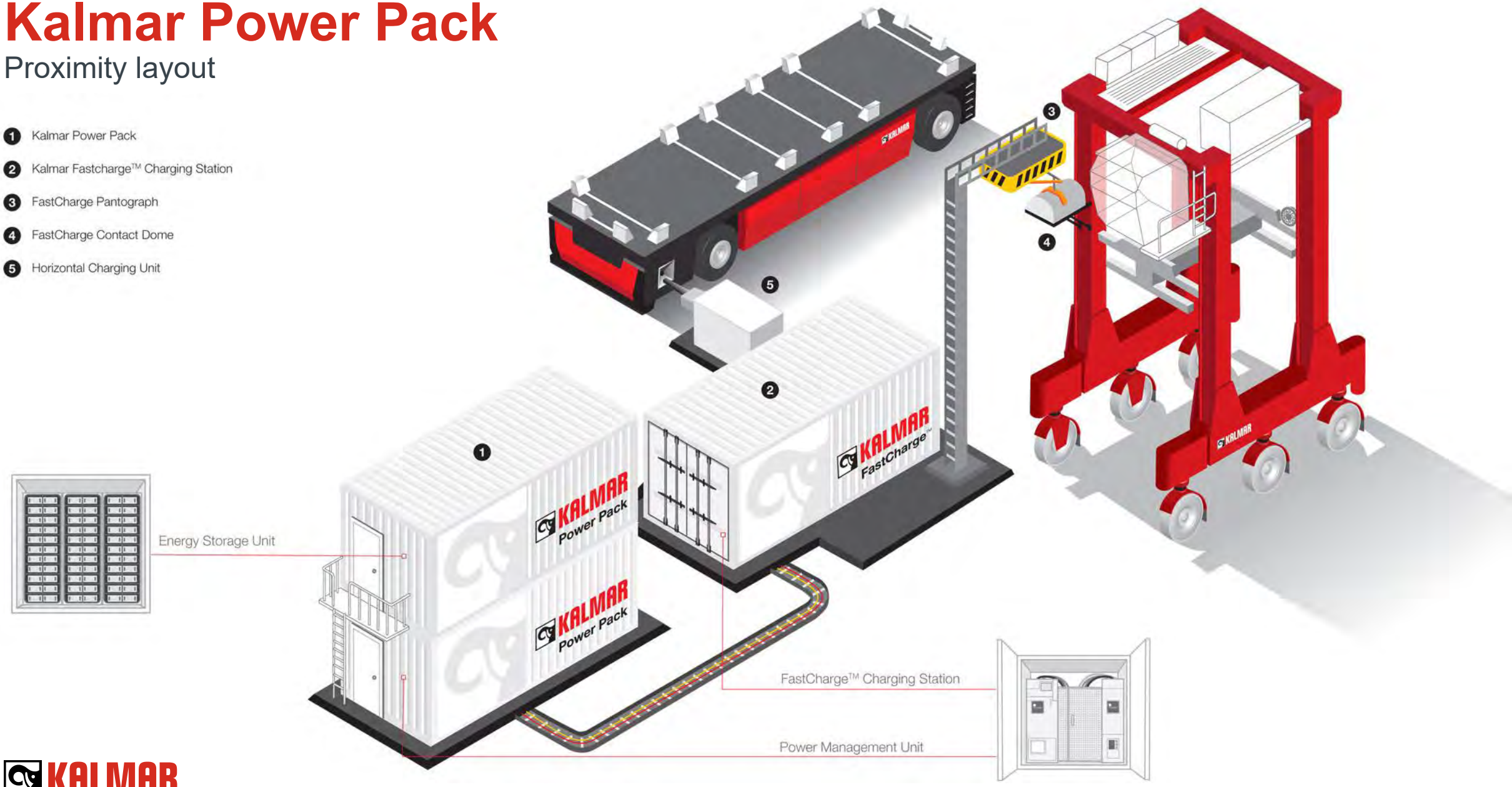
Can be charged with small power from the grid over a flexible time period

- power peaks for charging don’t affect the grid, but only the battery storage
- helps to decrease the grid side load and stabilise the terminal distribution grid
- increases the overall quality of electric power in the terminal

Kalmar Power Pack

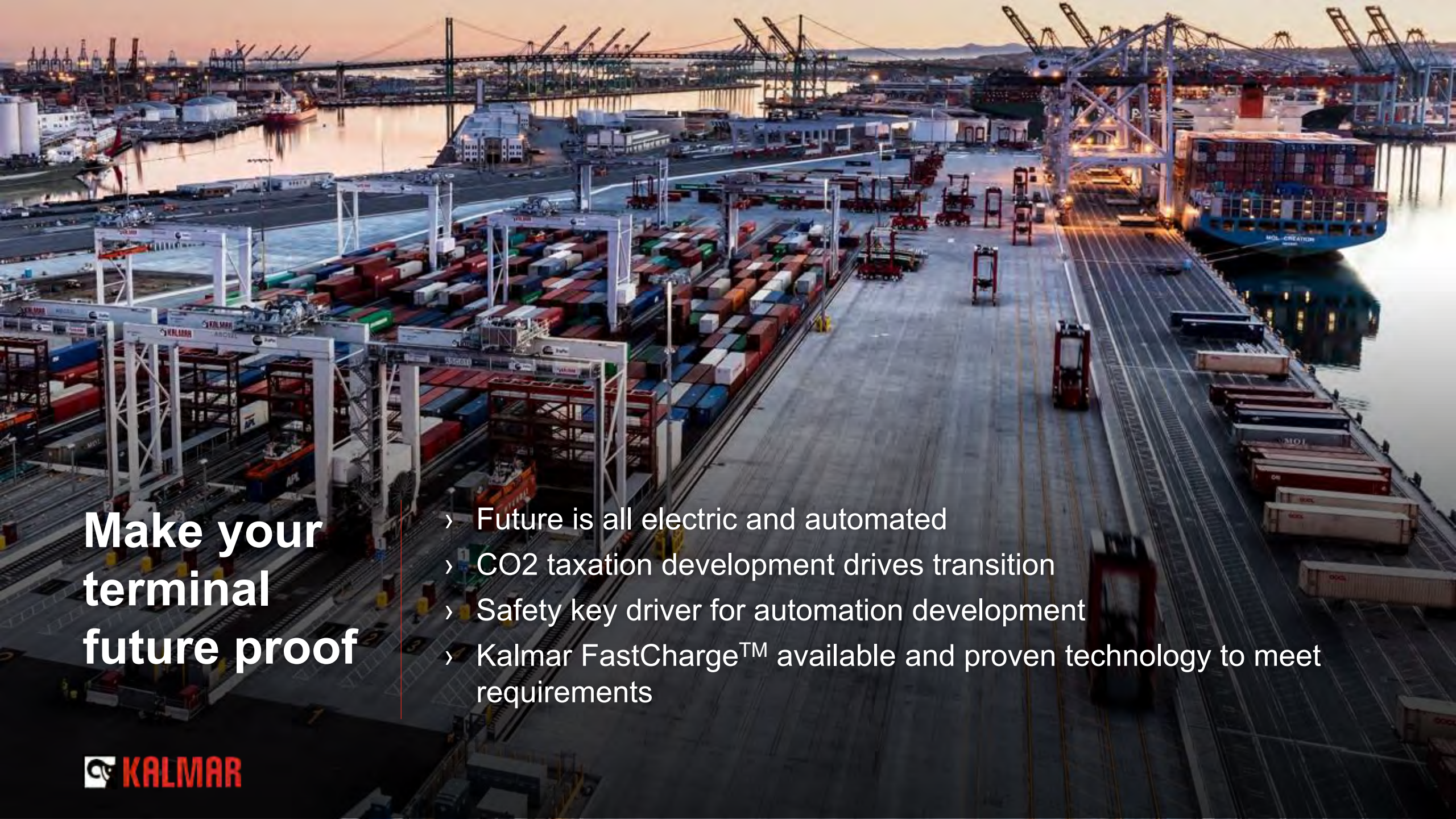
Proximity layout

1. Kalmar Power Pack
2. Kalmar Fastcharge™ Charging Station
3. FastCharge Pantograph
4. FastCharge Contact Dome
5. Horizontal Charging Unit



KALMAR

Summary



Make your terminal future proof

- Future is all electric and automated
- CO2 taxation development drives transition
- Safety key driver for automation development
- Kalmar FastCharge™ available and proven technology to meet requirements

KALMAR


KALMAR
E-ONE
Q&A

Making your every move count.


KALMAR