Towards eco-efficient cargo handling operations

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Your Host Today

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Vice President India, Middle East & Africa

- ECT (Rotterdam), 10 years as Project Manager Automation
- Euromax (Rotterdam), 8 years as Project Director Equipment
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Agenda

1. **Why now**
2. **Towards eco-efficient operations step by step**
   - Eco-efficient vision and target
   - Infrastructure strategy
   - Eco-efficient cargo handling solutions
   - Future operational scenarios and business case
   - Implementation and operational optimisation
3. **Summary**

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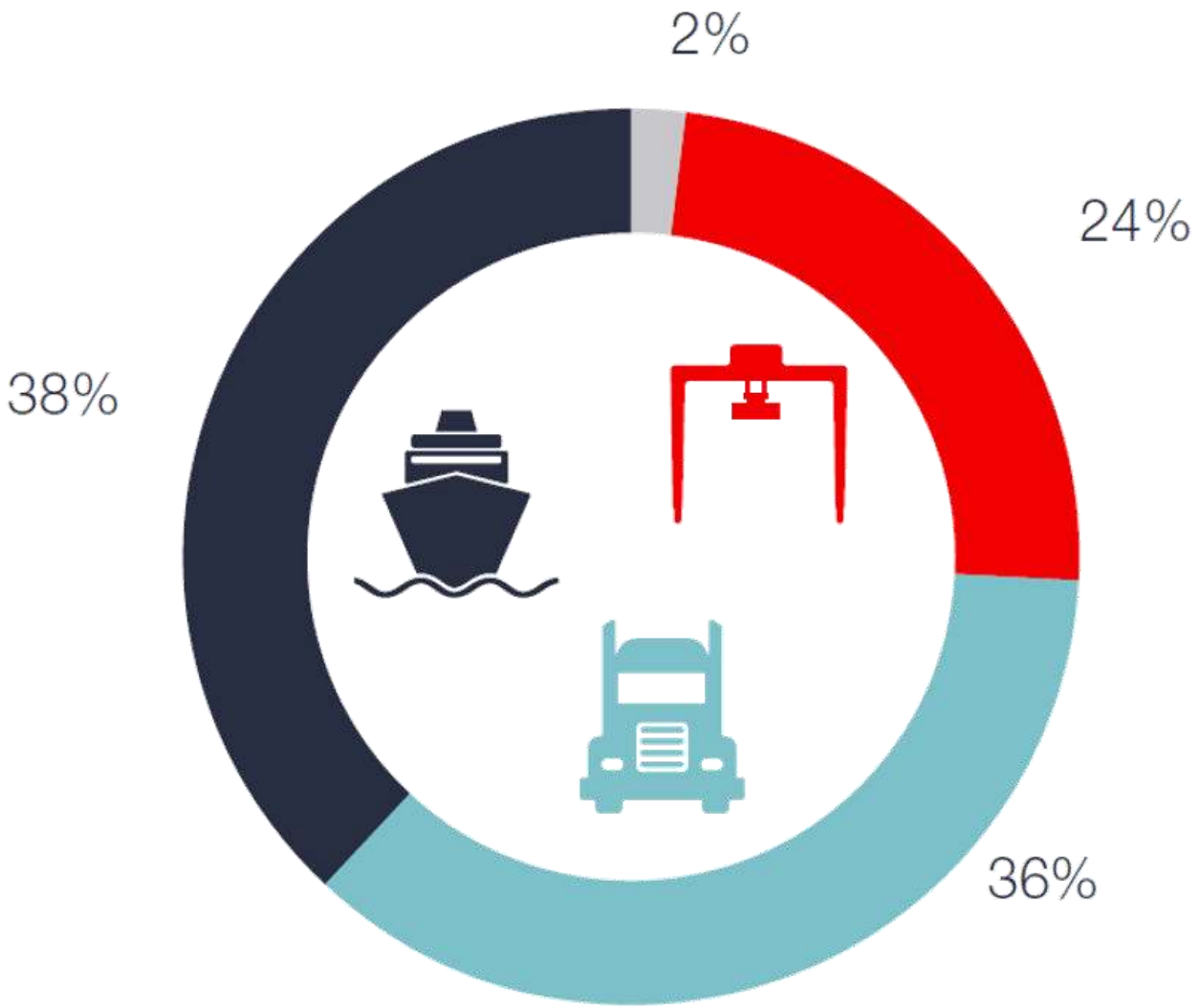
Emission distribution in container terminals



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Ports are actively involved in efforts to cooperate on environmental protection and sustainable development

96%

of ports have an environmental policy in place

81%

of ports have an environmental monitoring program

91%

of ports communicate their environmental policy to stakeholders.

Source: The European Sea Ports Organisation (ESPO) Environmental Report 2020

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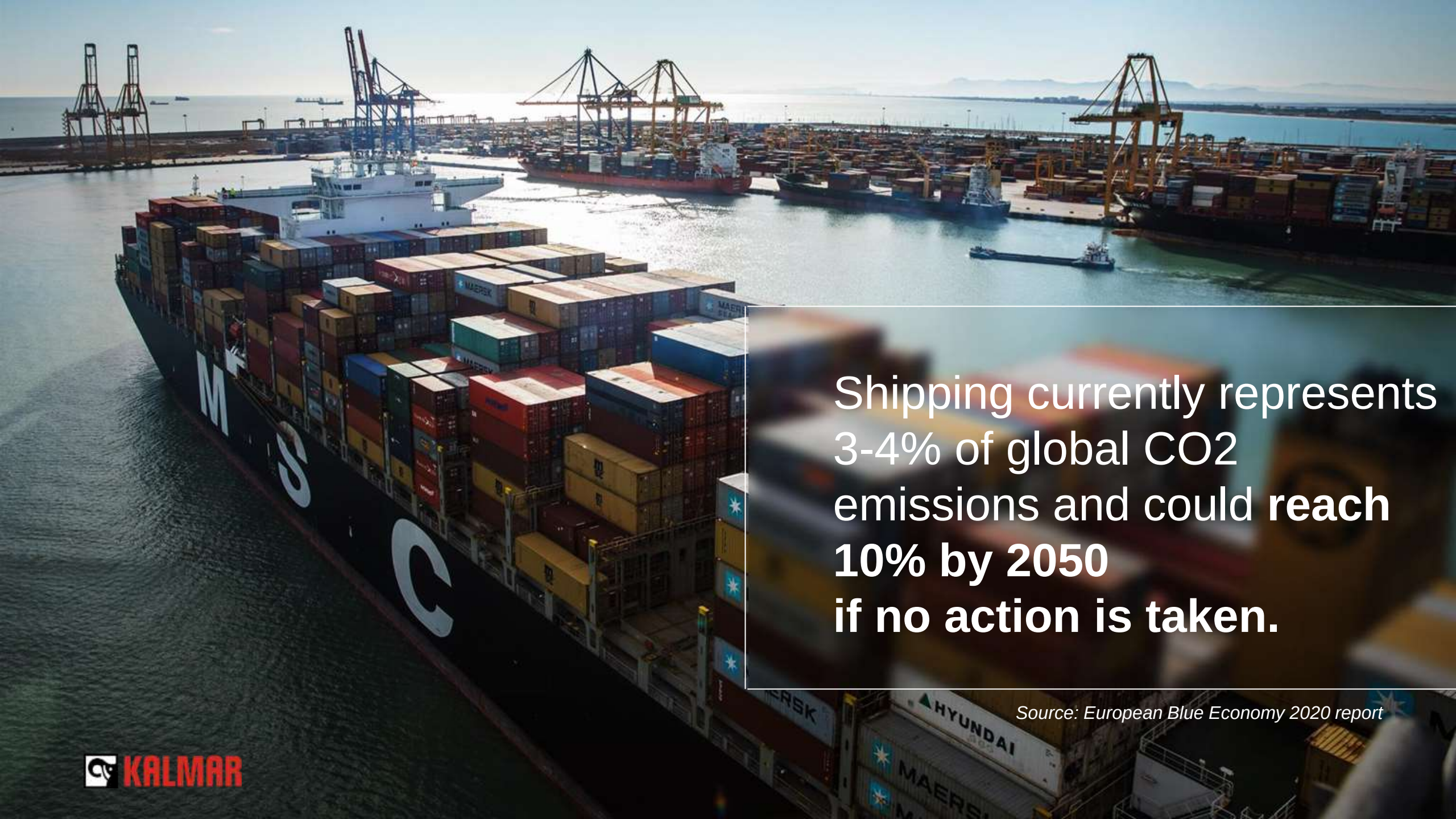
Shipping currently represents 3-4% of global CO2 emissions and could **reach 10% by 2050 if no action is taken.**
Source: European Blue Economy 2020 report
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Operators’ biggest concerns regarding zero emission equipment

- Will new zero emission equipment have technical failures in the beginning that will impact my productivity?
- Will there be enough grid capacity and green electricity to charge batteries?
- How much will battery powered equipment impact my operations if I need to charge several times per day?
- Very high investment to shift to both new equipment and new infrastructure
- What will battery cost and residual value be? And with that - how can I ensure a good total cost of ownership?

Source: Kalmar Market Study, September 2020

Eco-efficiency vision and targets

Infrastructure and charging strategy

Eco-efficient equipment options

Operational scenarios and business case

Implementation and optimisation

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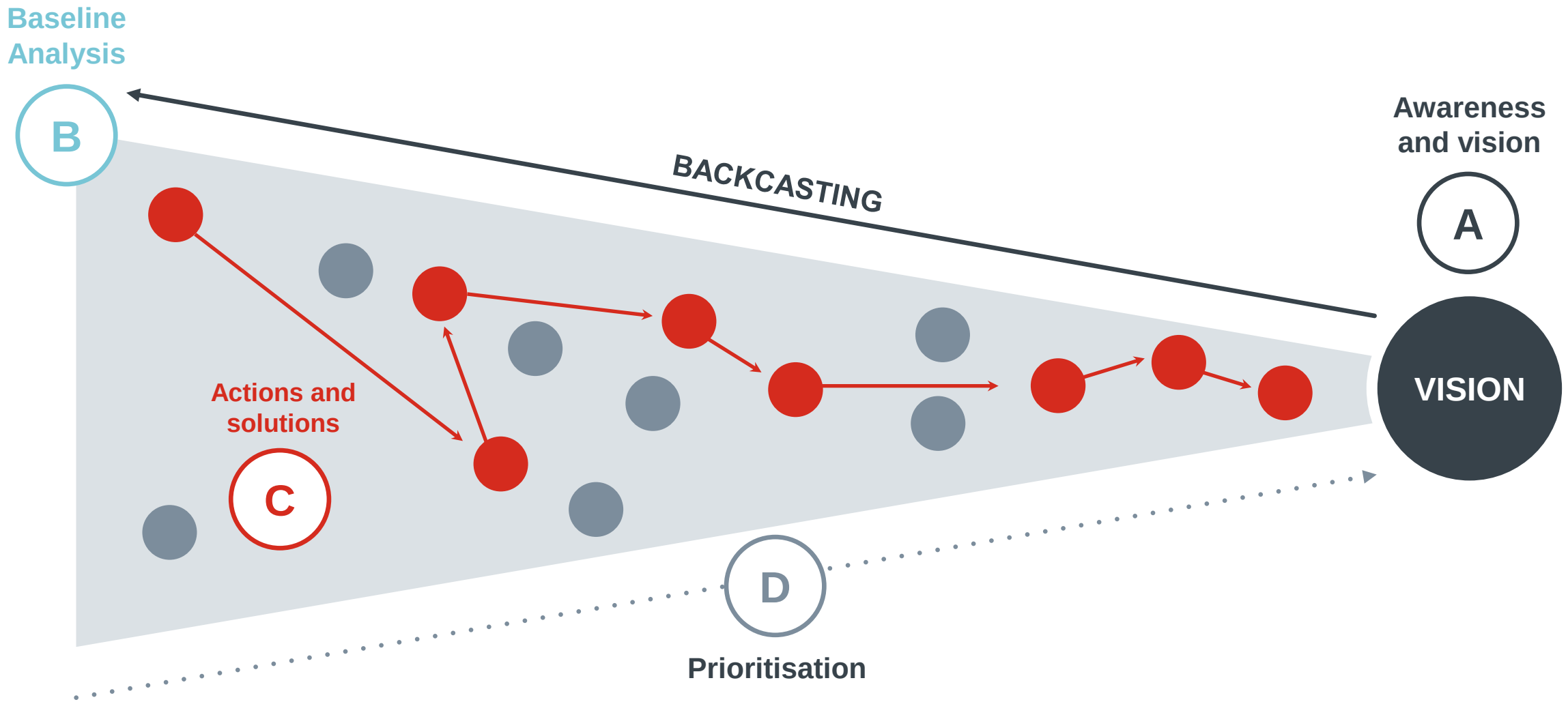
Step 1:
Defining eco-efficiency vision and target

Creating a strategic roadmap for the future



What do I need to understand to create vision and target state?

Public and internal pressure

Legislation

Customer interest

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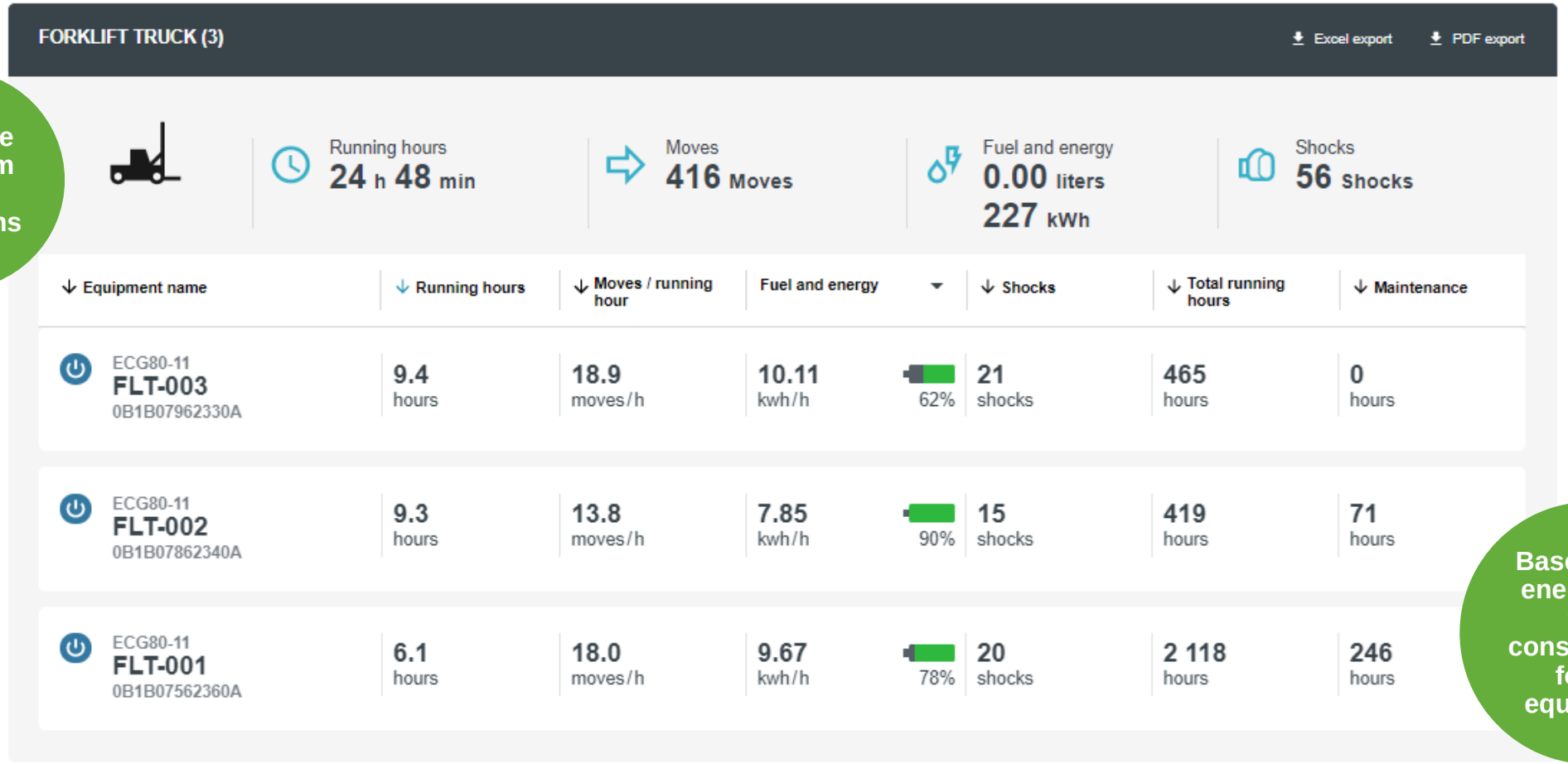
The current operations can be easily assessed based on real-time data

Real-time data from your operations



Baseline for energy and fuel consumption for all equipment

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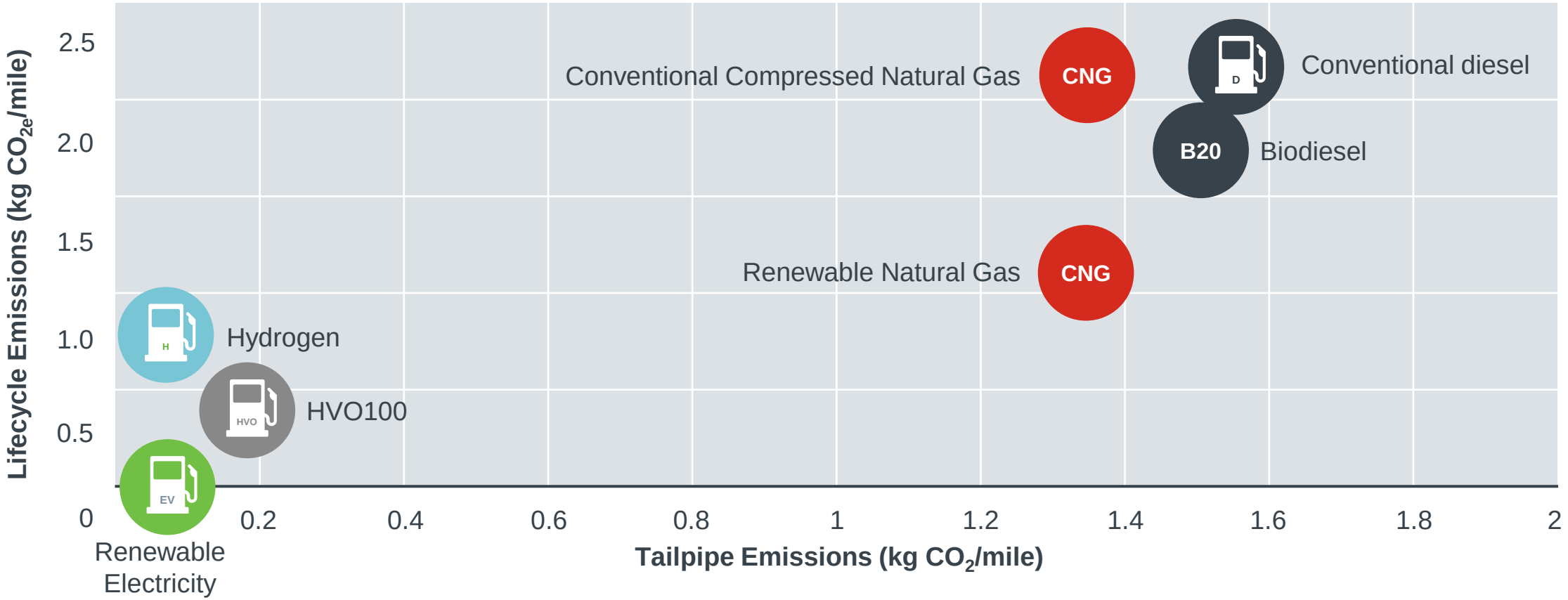
Step 2:
Creating infrastructure strategy

Fuels and power by lifecycle and consumption emissions

Alternative Fuels by Lifecycle and Tailpipe Emissions



https://www.breakthroughfuel.com/blog/overview-alternative-transportation-fuels/

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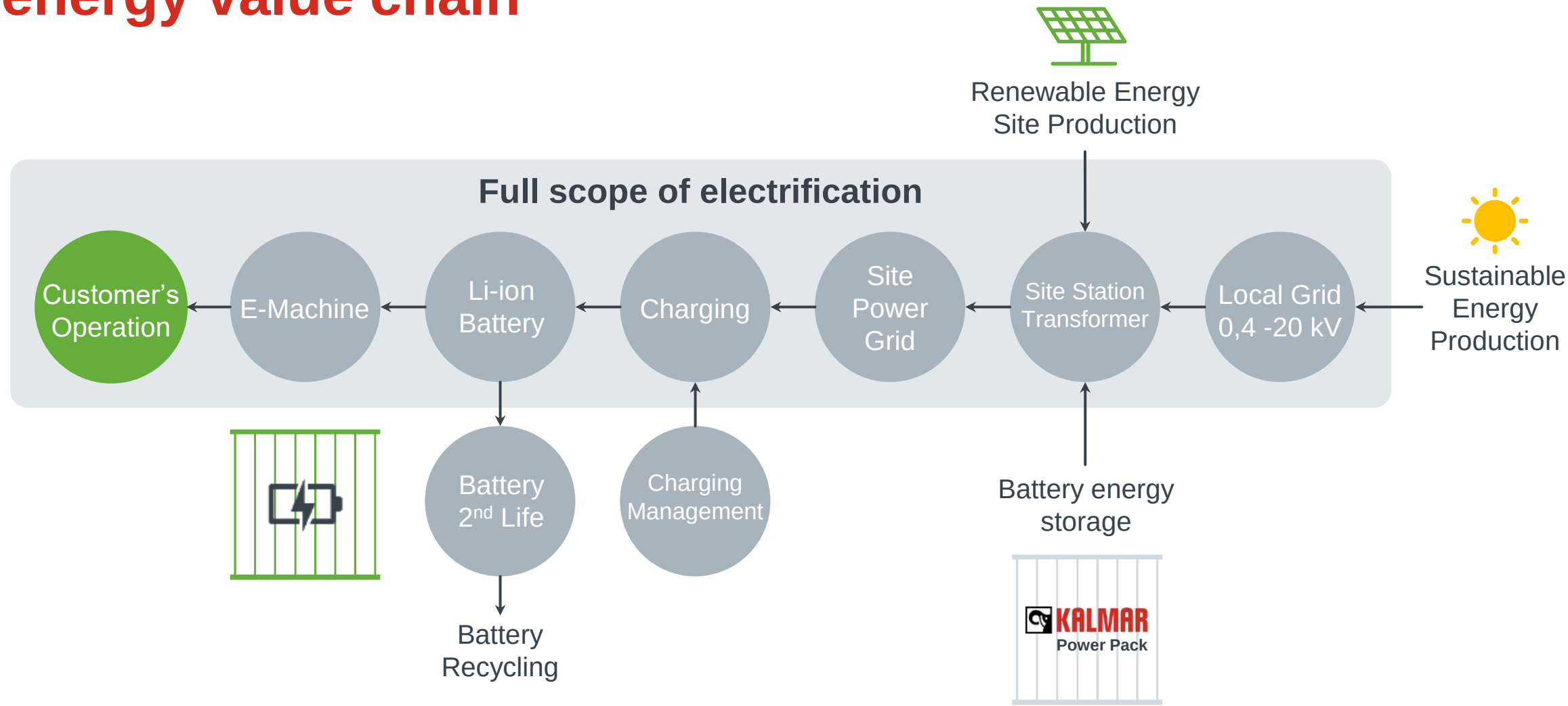
Infrastructure example: A sustainable electric energy value chain



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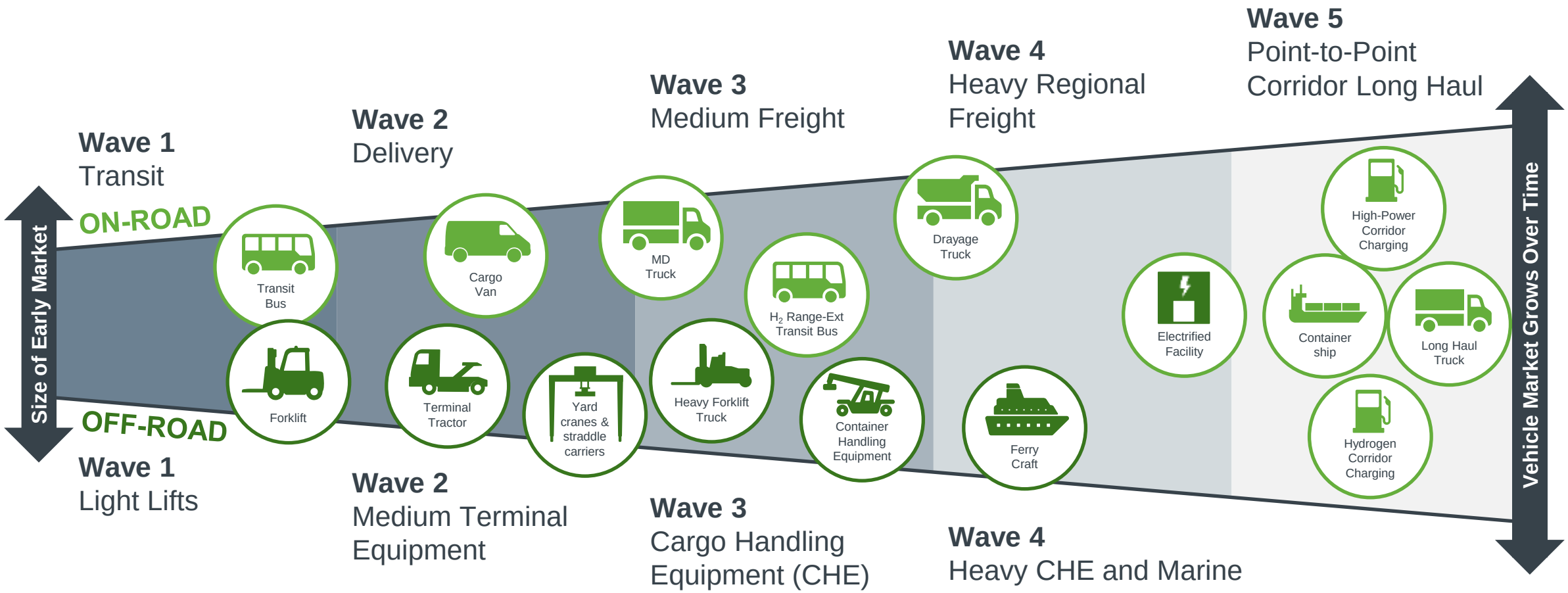
Step 3:
Evaluating eco-efficient cargo handling solutions

Zero emission equipment progress



Market Progress Over Time

Similar drivetrain and component sizing can scale to early near applications

Expanded supply chain capabilities and price reductions enable additional applications

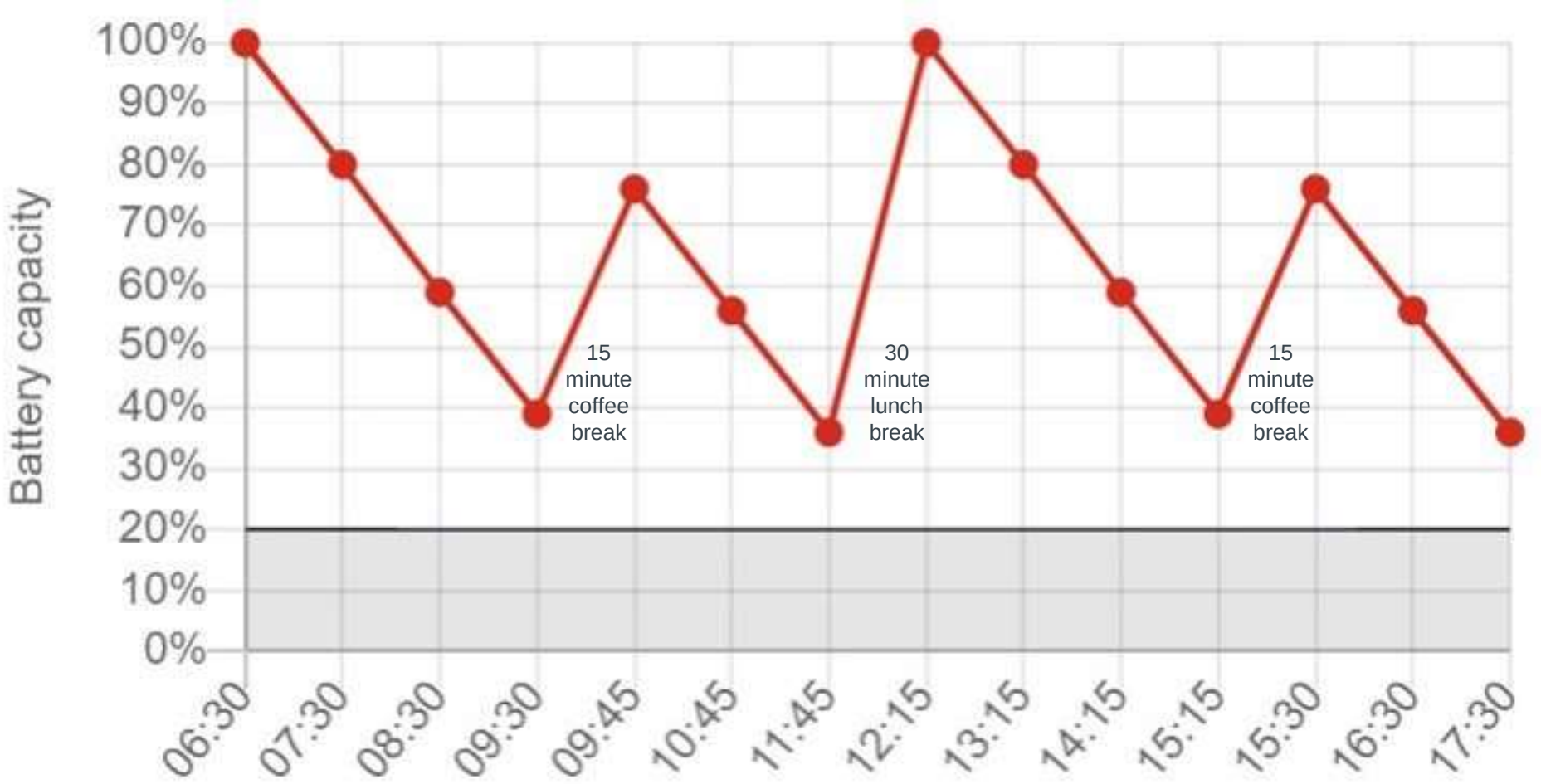
Steadily increasing volumes and infrastructure strengthen business case and performance confidence

Three eco-efficient powertrain options

Powertrain	Energy source	Things to consider
Battery	**Electricity**	Battery size versus operational requirements Opportunity charging possibilities Charging management of fleet Availability of green electricity Battery lifetime and life cycle
Fuel cell	**Hydrogen**	Availability of green hydrogen Handling requirements Rebuilding of exiting combustion engines
Internal combustion engine		
	Hydrotreated Vegetable Oil	Installation of new tank for HVO100

Operational impact for electric Reachstacker

Average drive cycle with Li-Ion battery and 300 kW charger



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Electric Empty Container Handler

Electric Reachstacker

Electric Heavy Forklift

Next Generation Electric Terminal Tractor

2021: Kalmar will introduce a fully electric portfolio.

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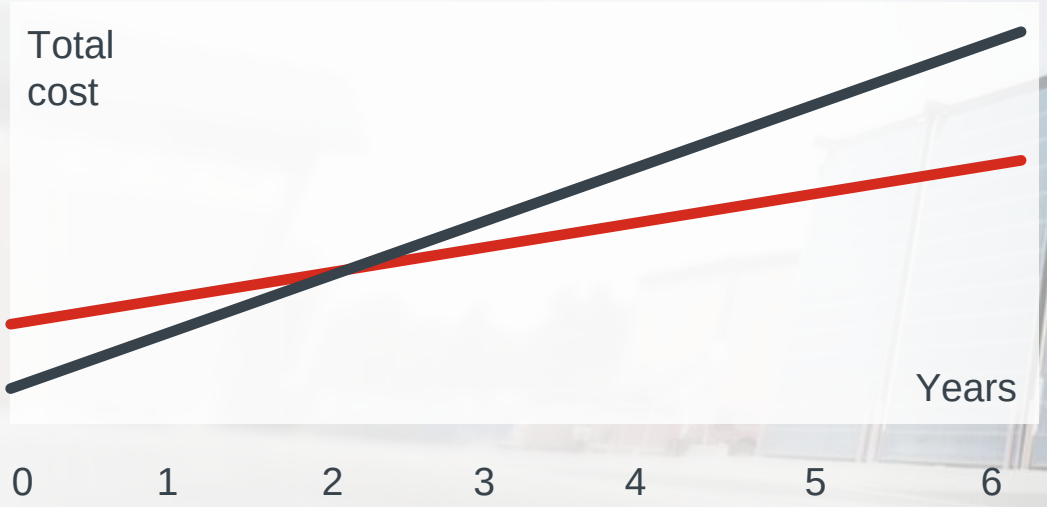
Step 4:
Building future operational scenarios and business case

ROI should be based on TCO calculations

- Electric equipment will have less moving parts, longer maintenance cycles and thus cost 50% less to service and maintain
- Predictive fuel costs as electricity prices more stable than diesel fuel



Assumptions: 2500 h/year. 1.2 €/l, 8 ltrs consumption per hour.
Electricity price 0,12 €/h with consumption of 17 kWh/h

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Diesel versus electricity cost variances

Country	Diesel cost	Electricity cost	Cost factor	
Norway	1,48	0,04	35,56	*
Denmark	1,36	0,05	25,11	*
Sweden	1,55	0,06	24,17	*
Finland	1,50	0,06	23,95	*
Iceland	1,50	0,07	21,05	*
Netherlands	1,38	0,07	20,34	*
Portugal	1,35	0,08	17,04	*
France	1,41	0,08	16,65	*
Italy	1,42	0,09	16,61	*
Germany	1,29	0,08	15,21	*
Spain	1,18	0,08	14,99	*
Hong Kong	1,75	0,12	14,50	**
Poland	1,13	0,08	14,13	*
Austria	1,17	0,09	13,31	*
Canada	0,83	0,08	10,91	**
Ireland	1,36	0,13	10,73	*
Switzerland	1,44	0,14	10,12	**
China	0,81	0,09	9,36	**
Belgium	*0,70*	*0,08*	*8,83*	*
UK	*0,76*	*0,11*	*7,14*	*
USA	0,69	0,10	6,77	**

Red diesel cost estimation

Red diesel cost estimation

* Source: Eurostat https://ec.europa.eu/eurostat/databrowser/view/ten00117/default/table?lang=en)
** Source: https://www.globalpetrolprices.com/electricity_prices/

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Step 5:
Implementing and optimising your green investment

Driver training

- A mix of theory and hands-on experience courses
- Courses for Operators and Technicians
  - How to get best performance from the equipment.
  - How to improve driving efficiency
  - How to drive safer
- Can be held at Kalmar or customer site
- Flexible training formats

Hands-on courses

Webinar

eLearning

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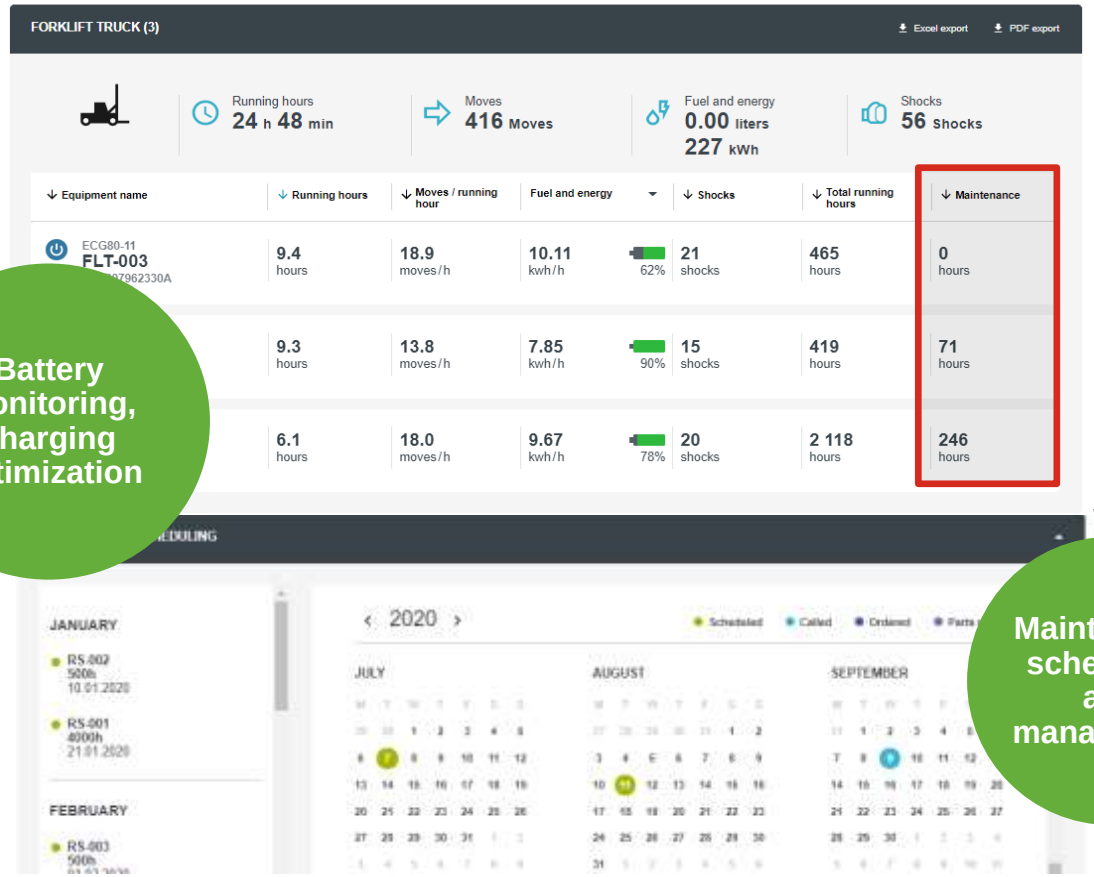
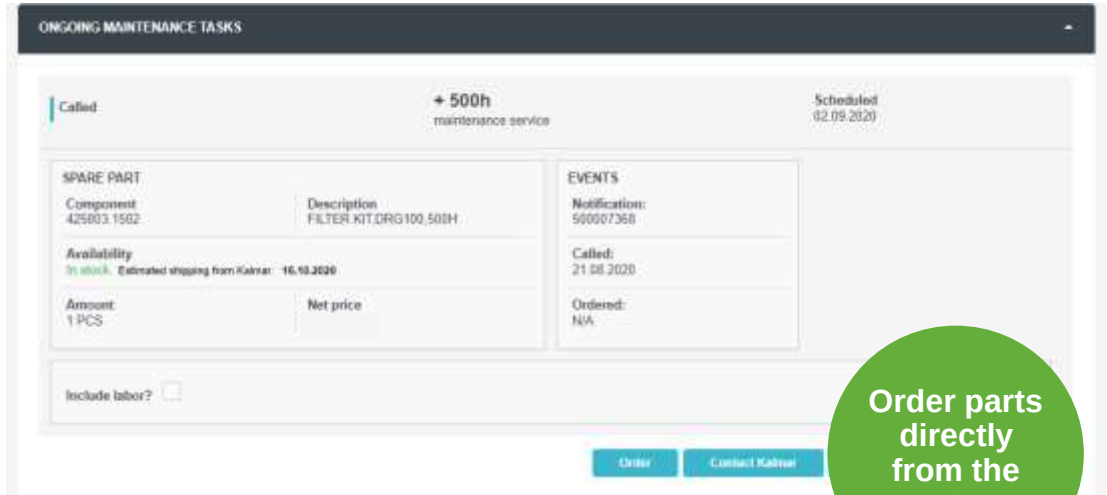
Optimising your fleet performance and value through proactive data-driven maintenance



Battery monitoring, charging optimization

Maintenance scheduling and management



Order parts directly from the system

Record equipment findings with checklist

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Summary and conclusions

Summary and conclusions

- ✓ Understand current state and issues.
- ✓ Set the target state.
- ✓ Make sure data is collected and shared.
- ✓ Analyse your options and the financial impact.
- ✓ Find opportunities for a step by step approach but having your long term goal in mind
- ✓ Take people onboard and start the implementation in a collaborative way.

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Sustainability is today's **opportunity**
but tomorrow's **liability**.
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Q&A
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Thank you!

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Electric Reachstacker ERG420-450

Available from 2021

Battery.

Li-Ion (NMC)
4 different battery sizes
245 - 327 -407 - 587 kWh

Wheelbase.

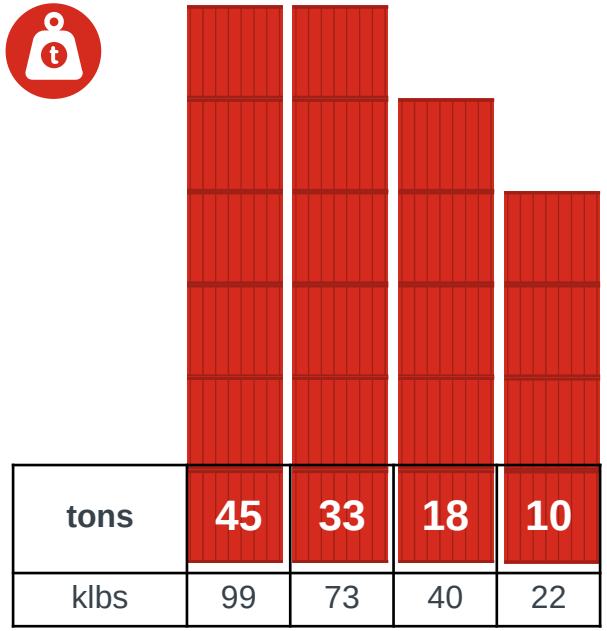
6,00 + 6,50 m
(236” + 256”)

Models.

6 Toplift

2 Combi

Capacities (max).



tons	45	33	18	10
klbs	99	73	40	22

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Electric Forklift ECG180-330

Available from 2022 Q2

Batteries.

670V Li-Ion (NMC)
3 different battery sizes
163-245-392 kWh

Wheelbases.

4.00 + 4.25 + 4.75 m
(157” + 167”+ 187”)

Models.

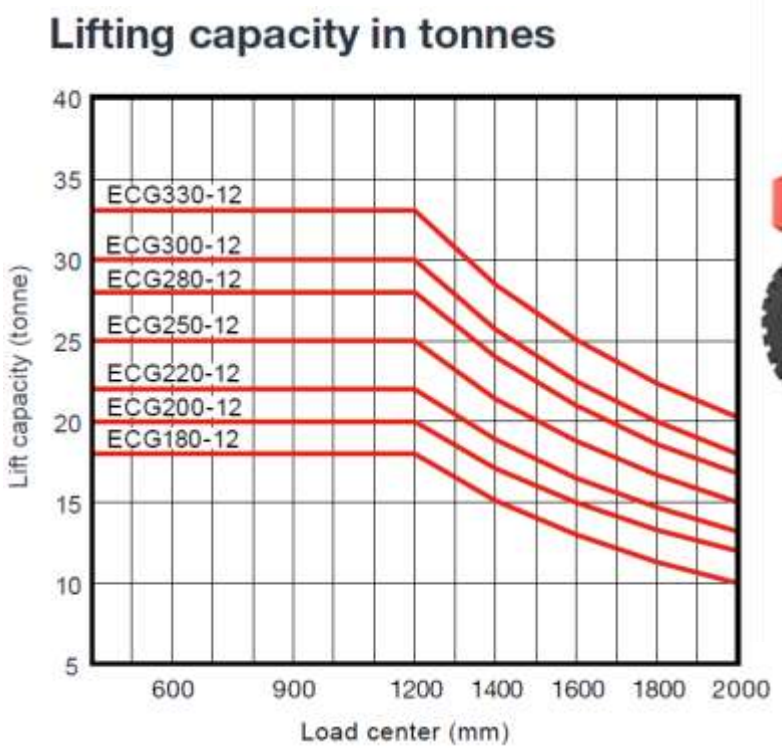
7 Forklifts/Lift capacities

Lifting Equipment.

3 Mast types

Capacities (max).

Cap: 18-33 tons (40-73 klbs)
Load Center: 1.20 m (48”)



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Ottawa Electric Terminal Tractor T2E+

Available from 2021

Battery.

Li-Ion (NMC)
2 different battery sizes
(152 - 182 kWh)

Wheelbase.

126’’ 3200mm
136’’ 3450mm

Models.

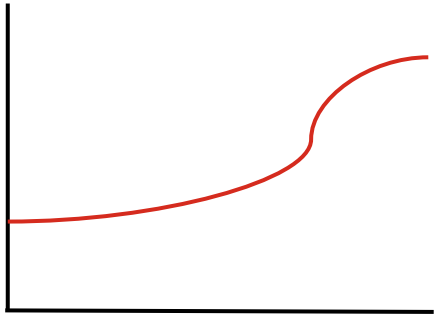
3 Distribution*

2 Container Terminal

* (including 1 DOT model for the USA)

Capacities (GCW max).

tons	37	50	70	90
klbs	81	110	150	195



Lifting height

431mm
813mm
990 mm

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