

Environmental friendly trains - Jönköping, 04 April 2016



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Agenda

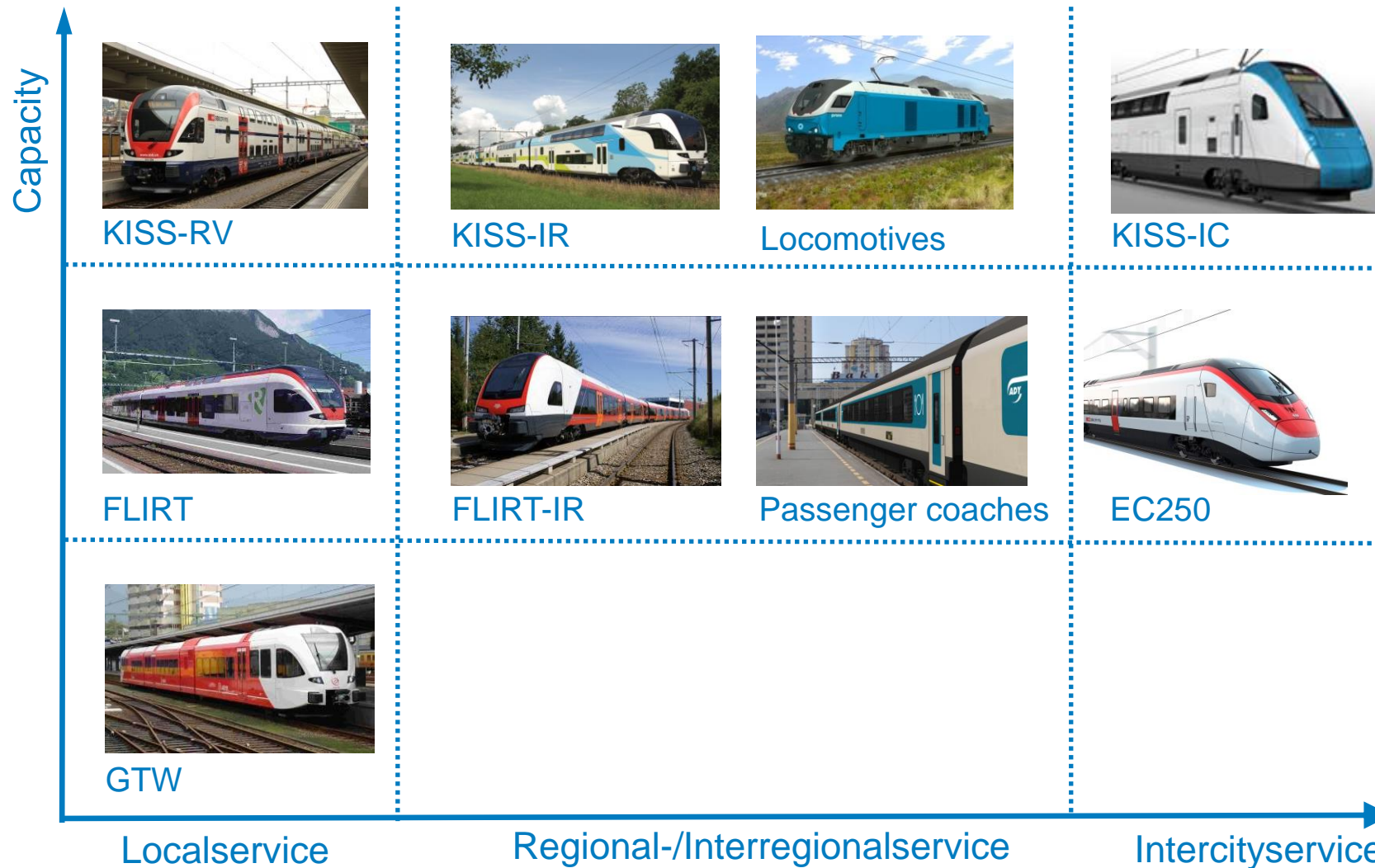
- **Stadler company overview**
- **Stadler's solution for environmental friendly trains**
- **Challenges for engines in railway vehicles**

The Stadler Rail Group

Consolidated turnover 2016 (Budget): ca. CHF 2,2 billion
Number of employees (Budget, FTE): ~ 7000



Product Portfolio: Railway Vehicles



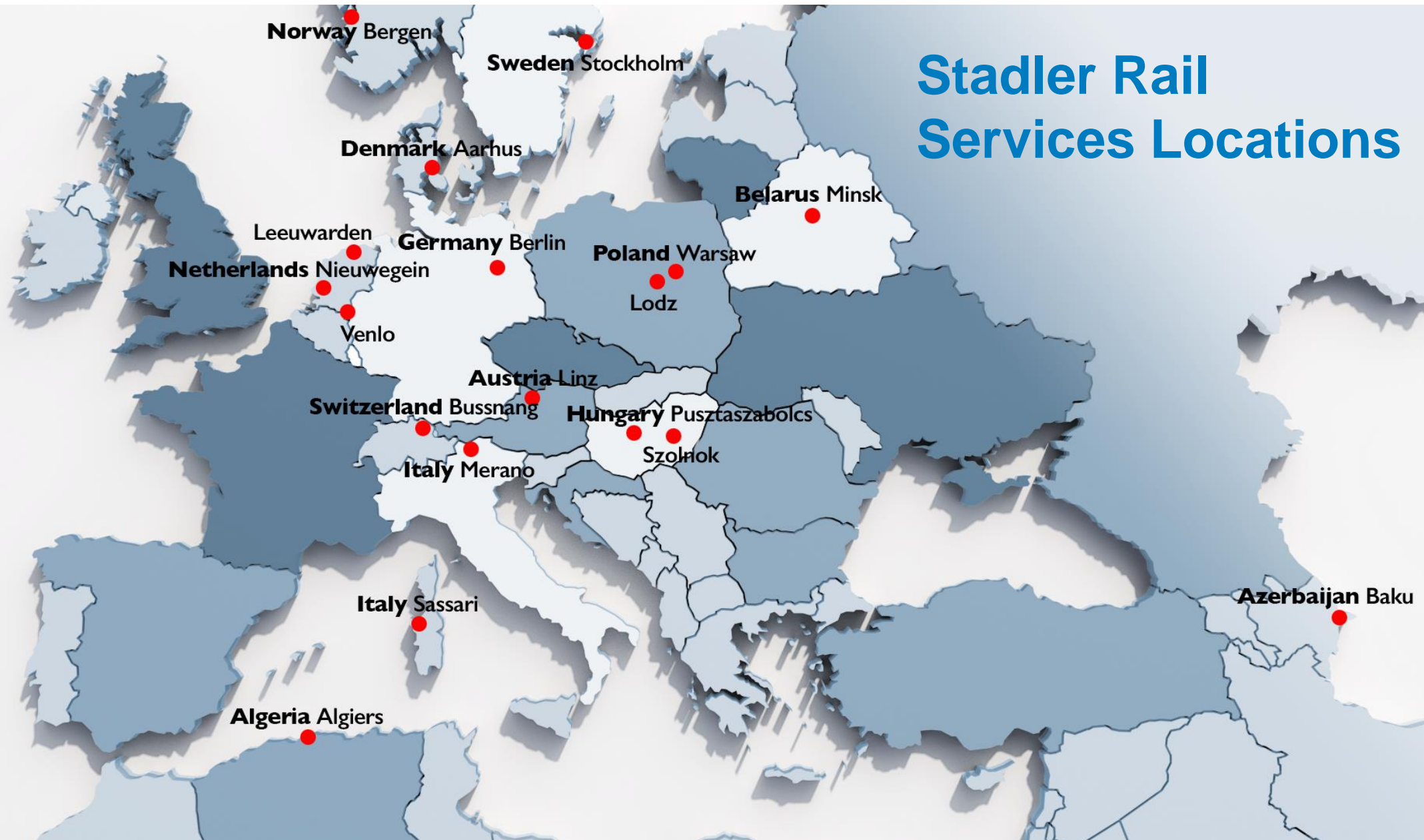
Product Portfolio: Urban Transport



Product Portfolio: Tailor Made



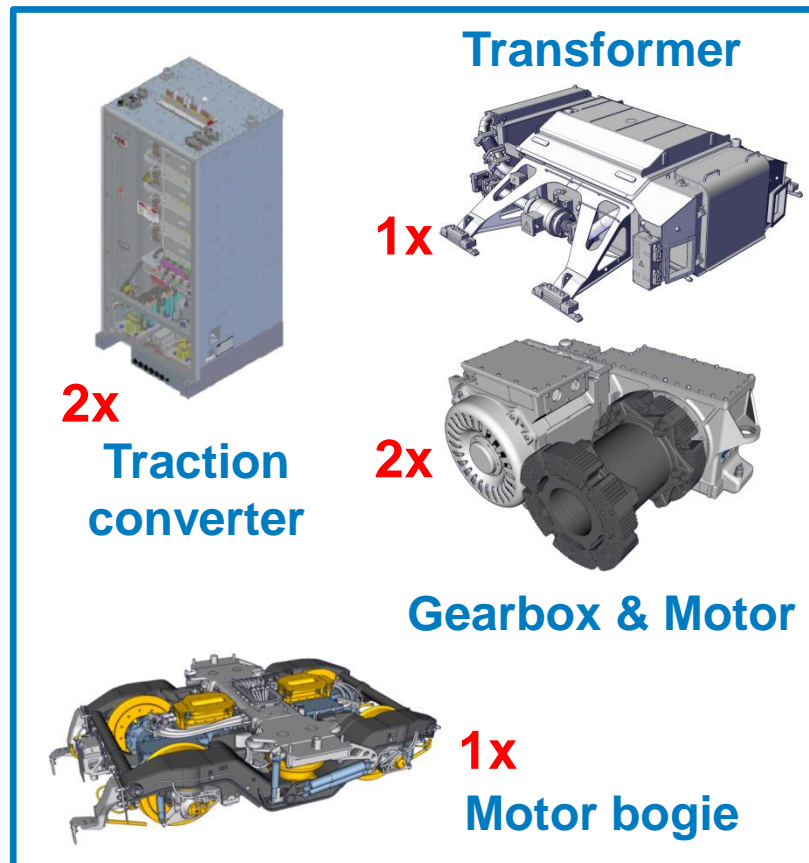
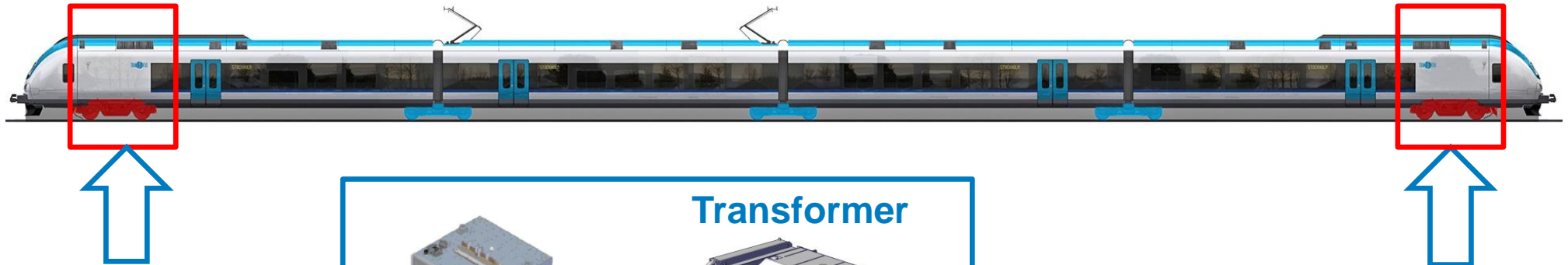
Stadler Rail Services Locations



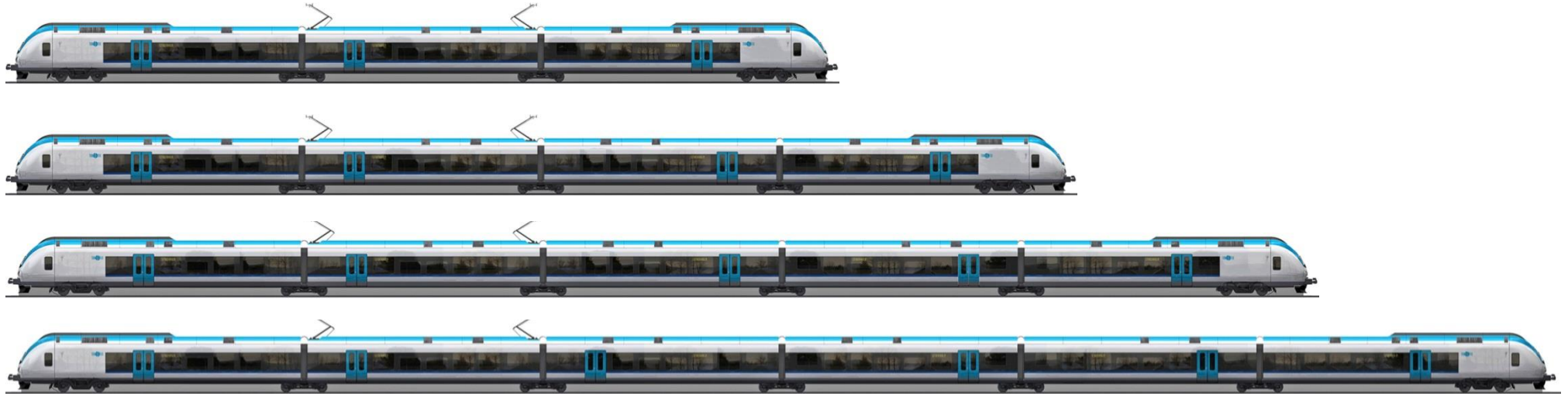
Stadler's solution for a environmental friendly trains



Traction concept FLIRT Nordic EMU



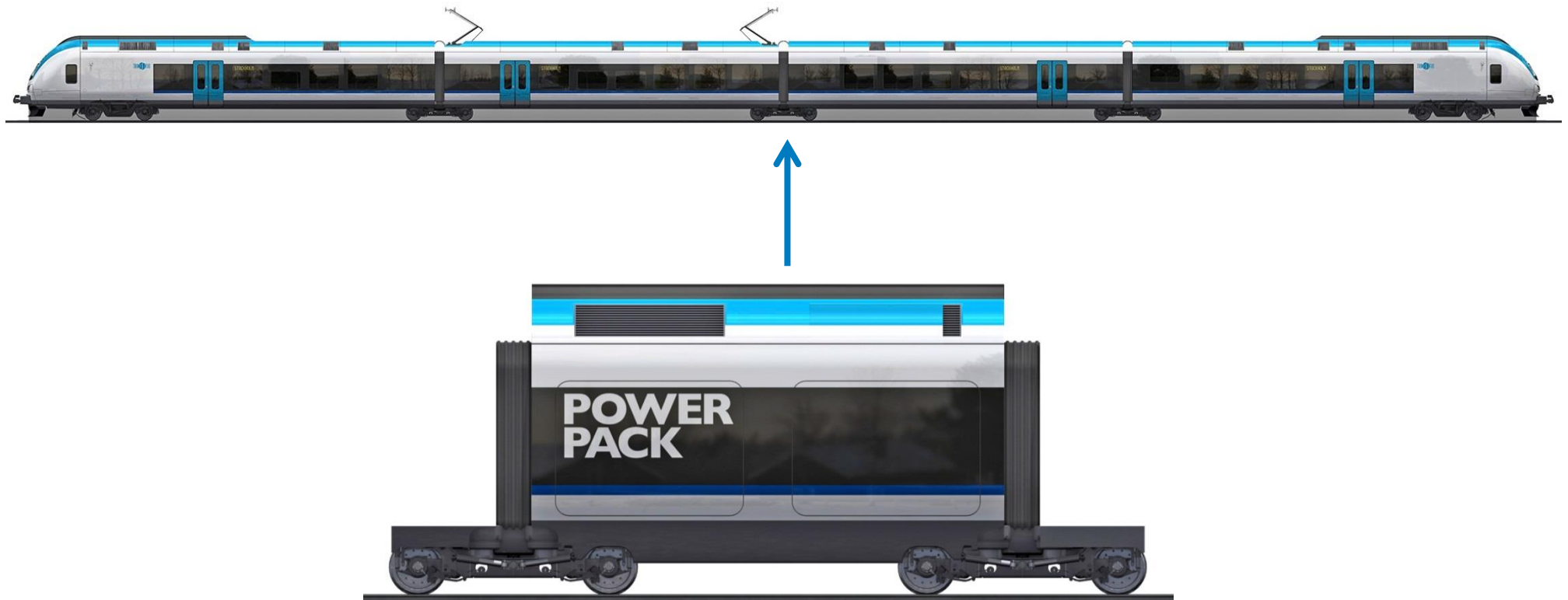
FLIRT Nordic EMU Modularity



- Trains with 3 to 8 coaches are possible
- The difference is the amount of intermediate coaches
- The traction compartments are equal
- For additional traction power, an intermediate coach with a traction compartment can be added.

Main characteristics FLIRT Nordic DMU and BMU

➤ A bimodal FLIRT Nordic train is a electric FLIRT Nordic train...



➤ ... with a power pack to generate the electrical energy

FLIRT Nordic DMU/ BMU Modularity



➤ Trains with a 2 to 5 coaches are possible

Why bimodal trains?

There are two (main) use cases for bimodal trains:

- To get direct connections from a regional line to a main station, often the trains have to drive on non-electrified and electrified lines.
- ✓ With a bimodal train less emission and noise during driving on the electrified line
- The plan to electrified a line and the need for new trains do not match.
- ✓ With a bimodal train from Stadler, after electrification of the line, the power pack can be removed easily and a fully-fledged EMU remains.

Challenges for engines in railway vehicles



Requirements for an engine of DMU/BMU

Engine:

- Engine weight
- Dimensions
- Power
- Exhaust emission level
- References

Criteria for supplier:

- Service network
- Support

Advantage of natural gas engine compared to diesel engine

- **Less CO and NOx emissions**
- **Generates nearly no sooty particles**
- **Less noise emissions**
- **Less CO2**

Disadvantage of natural gas engine compared to diesel engine

➤ The typical specific power is smaller

- Natural gas 22-25kW/litre
- Diesel 27-32kW/litre

➤ The fuel tank is bigger

- 1 litre diesel ~ 5 litre CNG at 200 bar
- 1 litre diesel ~ 1.8 litre LNG



Comparison of tank volumes for equal cruising ranges

Example of Power pack

- 3'000 l diesel fuel tank
- 15'000 l CNG/CBG tank
- 5'400 l LNG/LBG tank

➤ To use LNG instead of diesel fuel, the tank must be nearly doubled or the range is only the half.

Summary of alternative fuel in DMU/BMU

It's possible to use LNG, CNG or Biodiesel for engines in DMU/BMU

The development of the possible engines must be done

If using CNG or LNG, some additional risk must be covered

Influence of the operation of the trans must be considered (smaller range, less acceleration, more maintenance,...)

Thank you for your attention

