

Environmental friendly trains - Jönköping, 04 April 2016



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Agenda

- Stadler company overview
- Stadler's solution for environmetal 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

DIVISION SWITZERLAND

DIVISION GERMANY DIVISION CENTRAL EUROPE DIVISION SPAIN DIVISION COMPONENTS

DIVISION SERVICE



Stadler Bussnang 1700 employees



Stadler Altenrhein 950 employees



Stadler Pankow (Berlin) 1000 employees

Stadler Pankow (Velten) Stadler Praha



Stadler Polska 800 employees



Stadler Valencia 850 employees



Stadler Winterthur 220 employees



Stadler Stahlguss 120 employees



40 employees

Stadler Reinickendorf 60 employees



Stadler Minsk 300 employees

50 employees



Stadler Szolnok 450 employees

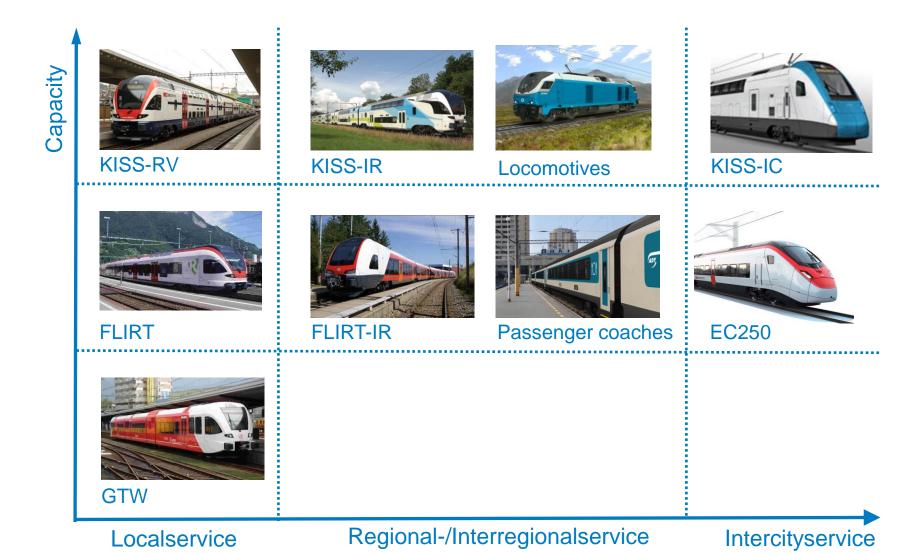


Stadler Algérie
100 employees
Stadler Niederlande
80 employees
Stadler Linz
20 employees
Stadler Meran
10 employees
Stadler Pusztaszabolcs
70 employees
Stadler Service
70 employees

Stadler Schweden 20 employees



Product Portfolio: Railway Vehicles





Product Portfolio: Urban Transport





















Tango

Variobahn

100%

Low floor portion

~70%

Light railways

Trams

Metro

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Product Portfolio: Tailor Made





Rack-railcars

Dual-voltage multiple unit









Interregio-ZB

Narrow gauge railway







Rack locomotive

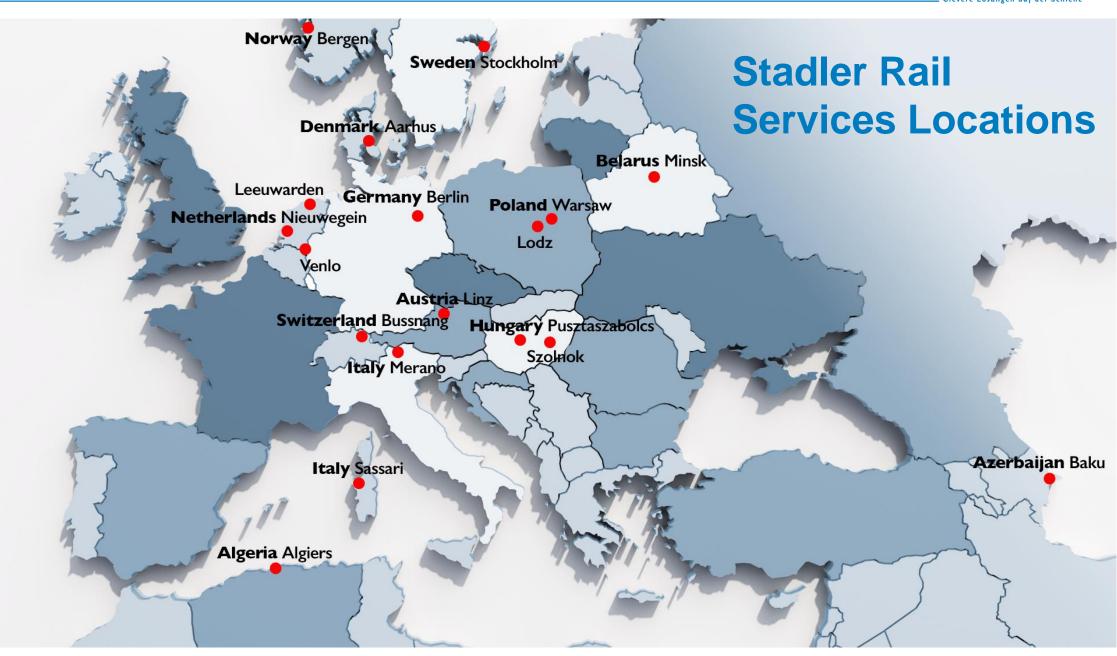
Passenger coaches

Infrastructure

Rack-Railways

Metre gauge Railways





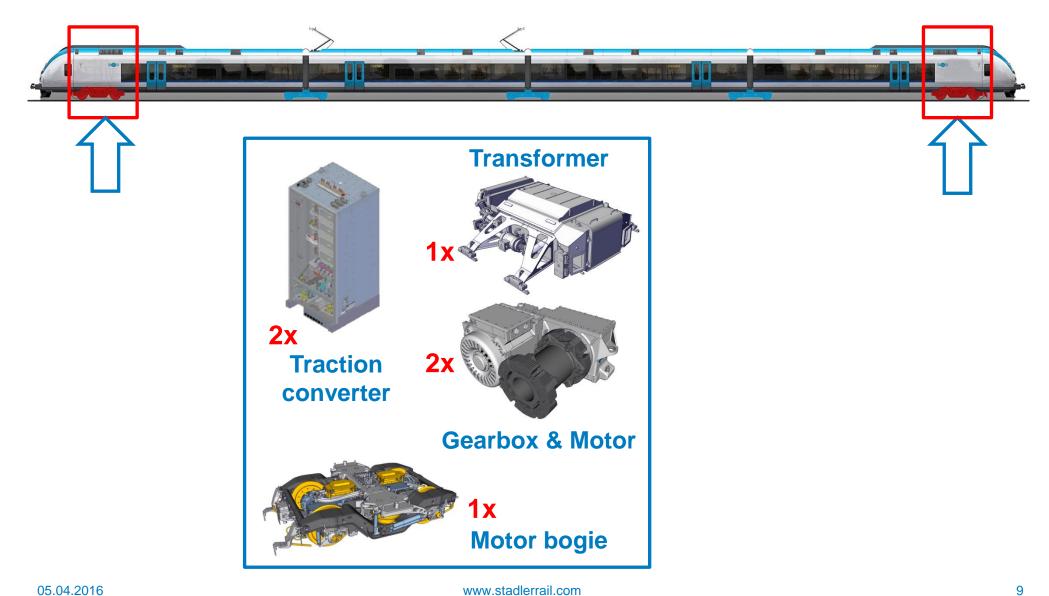


Stadler's solution for a environmetal friendly trains



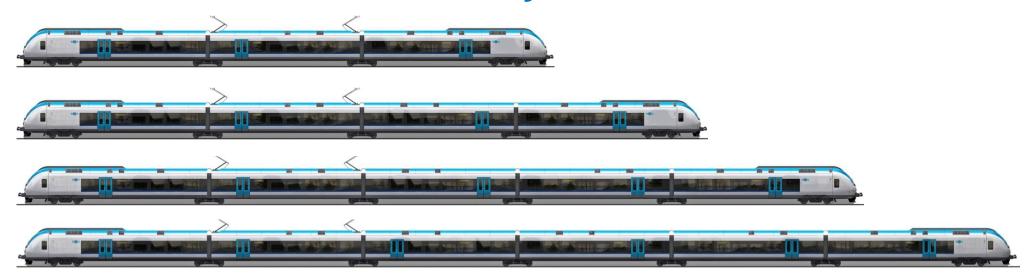


Traction concept FLIRT Nordic EMU





FLIRT Nordic EMU Modularity

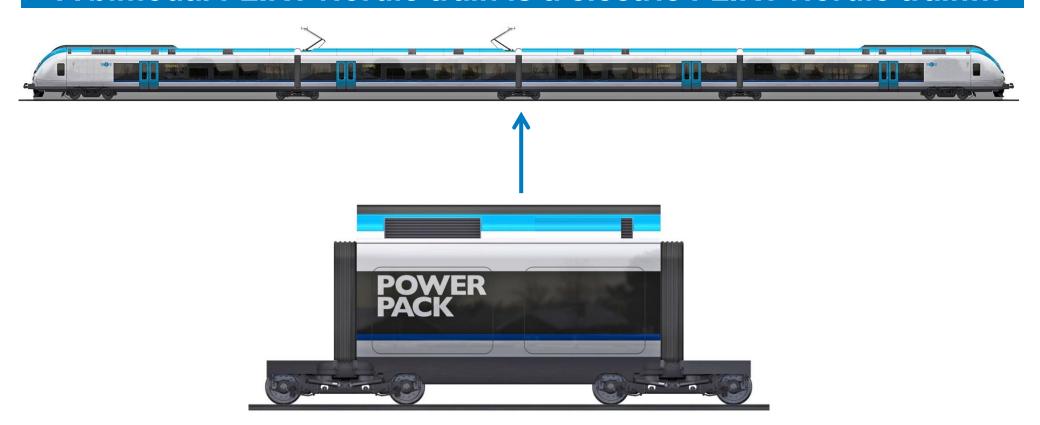


- Trains with 3 to 8 coaches are possible
- The difference is the amount of intermediate coaches
- The traction compartments are equal
- For additional traction power, an intermediate coach with a traction compartment can be added.



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

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Advantage of natural gas engine compared to diesel engine

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

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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 I diesel fuel tank
- 15'000 | CNG/CBG tank
- 5'400 I 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

