



FLIRT H2

25.06.2024

STADLER

- 1. Setting**
- 2. Requirements**
- 3. Propulsion concept**
- 4. H2 fuel cells**
- 5. H2 storage**
- 6. H2 refuelling**

- greater LA area renown for extreme SMOG events
- very strict environmental protection laws in California
- availability of public funding for renewable technologies



1. SETTING

San Bernardino



1. SETTING

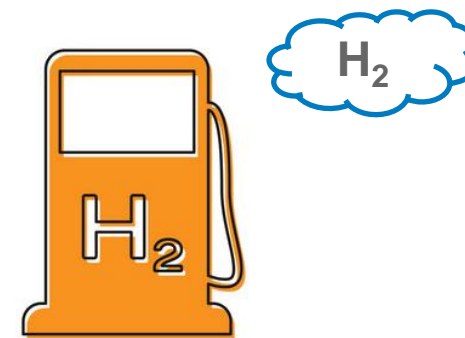
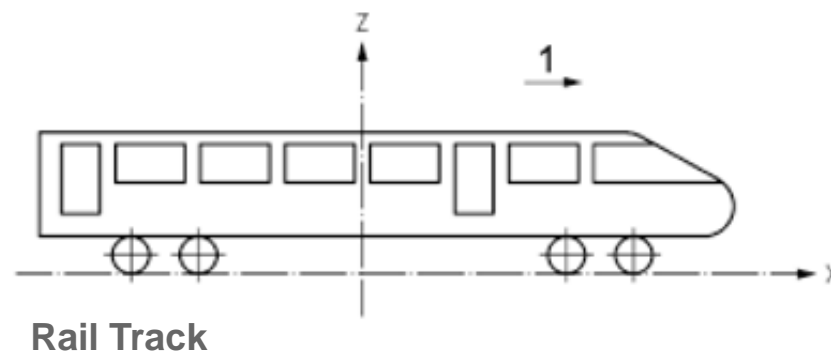
new rail service – opening 2022



1. SETTING

San Bernardino County Transportation Auth. (SBCTA)

- MSU study: H_2 -fuel cell hybrid train recommended
- 2019: state of California approves 30 M\$ grant for SBCTA allocated for R&D and implementation of a ZEMU vehicle
- condition: **zero emission of harmful substances from vehicle**



H_2 fuel station

2. REQUIMRENTS

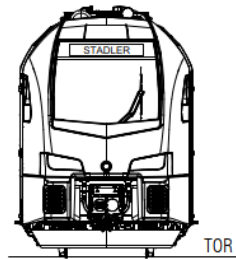
Vehicle specifications

- Identical to SBCTA DMU – as far as technically possible
- H₂ -Hybrid propulsion instead of diesel generator
- Maximum 1 x refueling per 24h
- Refueling duration: 15min target & 30min maximum
- Ambient temperature up to 49°C
- Vehicle suitable for San Bernardino – LA Union corridor
- total > 2'000 technical specifications



2. REQUIREMENTS

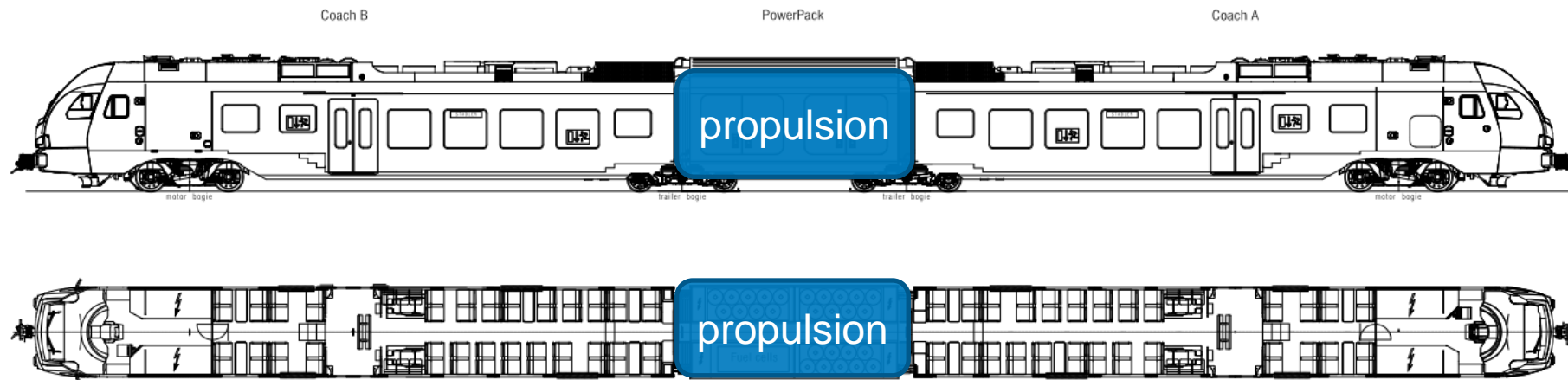
Vehicle concept



	B	A	TOTAL
FIXED SEATS	52	52	104
FLIP UP SEATS	6	6	12
TOTAL SEATS	58	58	116
STANDEES AREA (m ²)	15.1	15.1	30.2
STANDEES (4P/m ²)	60	60	120
TOTAL (fixed seats + standees)	112	112	224

length: 51.5 m
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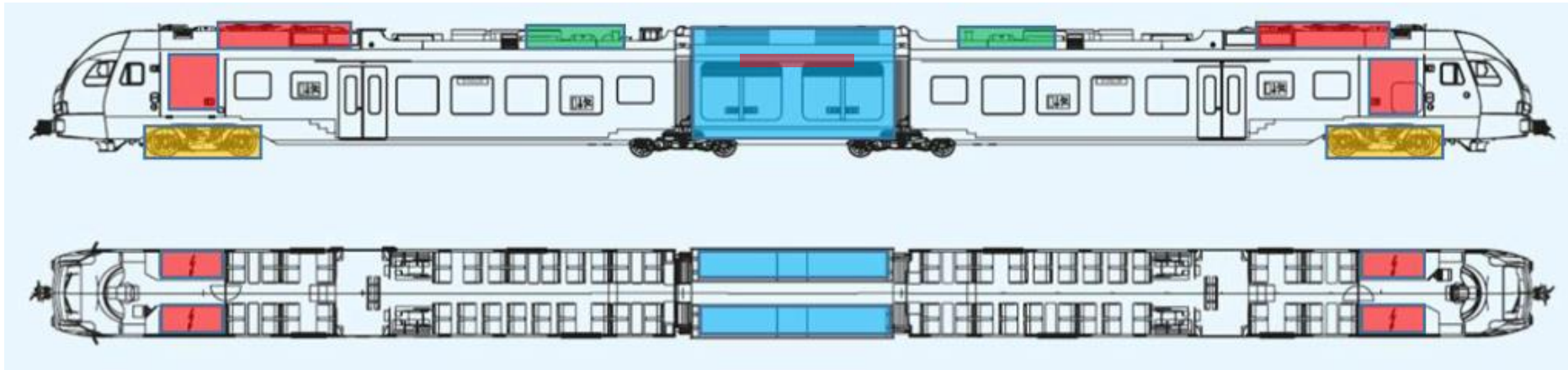
weight: 123



3. PROPULSION CONCEPT

Layout

- Extensive concept study
- Safety as key decision criterium



Traction converter, filters,
DC/DC converter, cooling

Traction batteries

Motor bogies

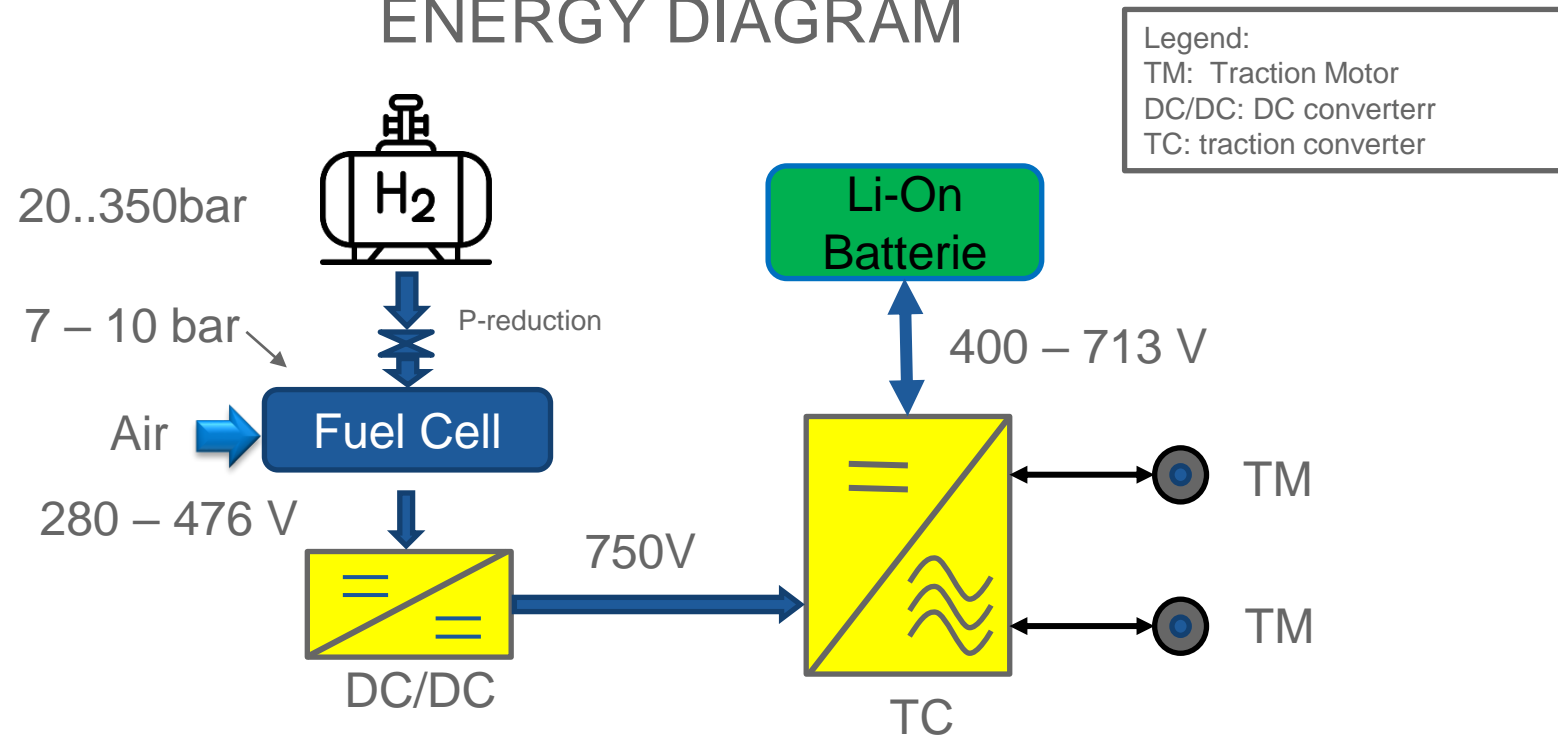
Power Pack with fuel cells,
H2 storage, cooling

3. PROPULSION CONCEPT

Performance

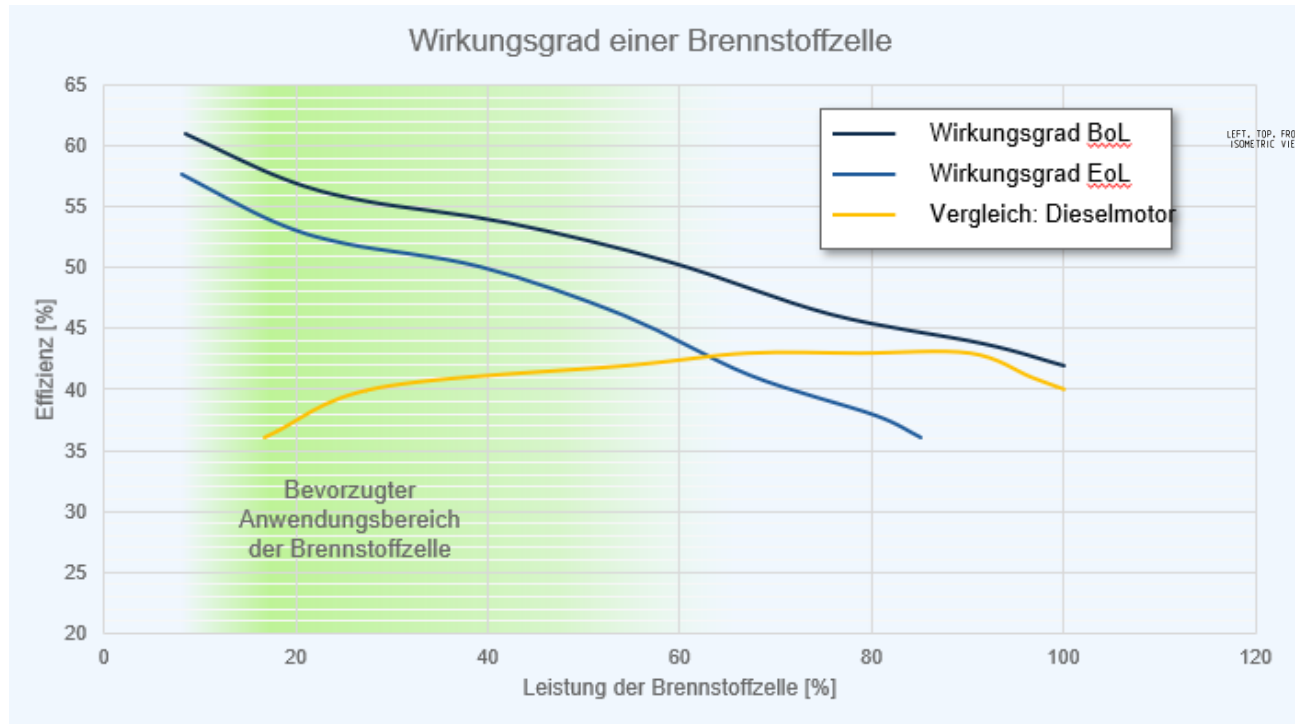
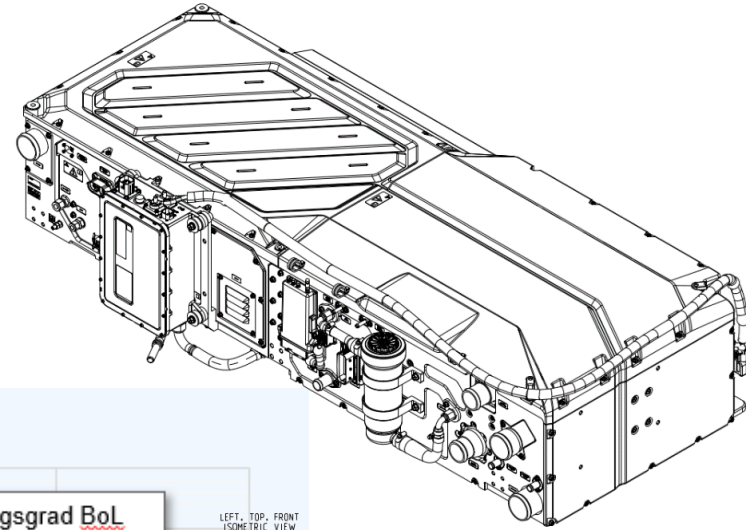
- Power at wheel up to 800kW
- Tractive effort up to 160 kN
- V max 128 km/h

ENERGY DIAGRAM



4. H2 FUEL CELLS

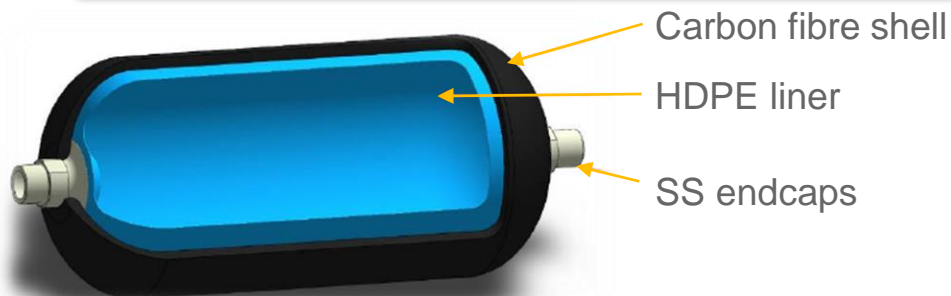
- Max power 100 kW
- Output voltage 280...560V
- Output current up to 360A



5. H2 STORAGE



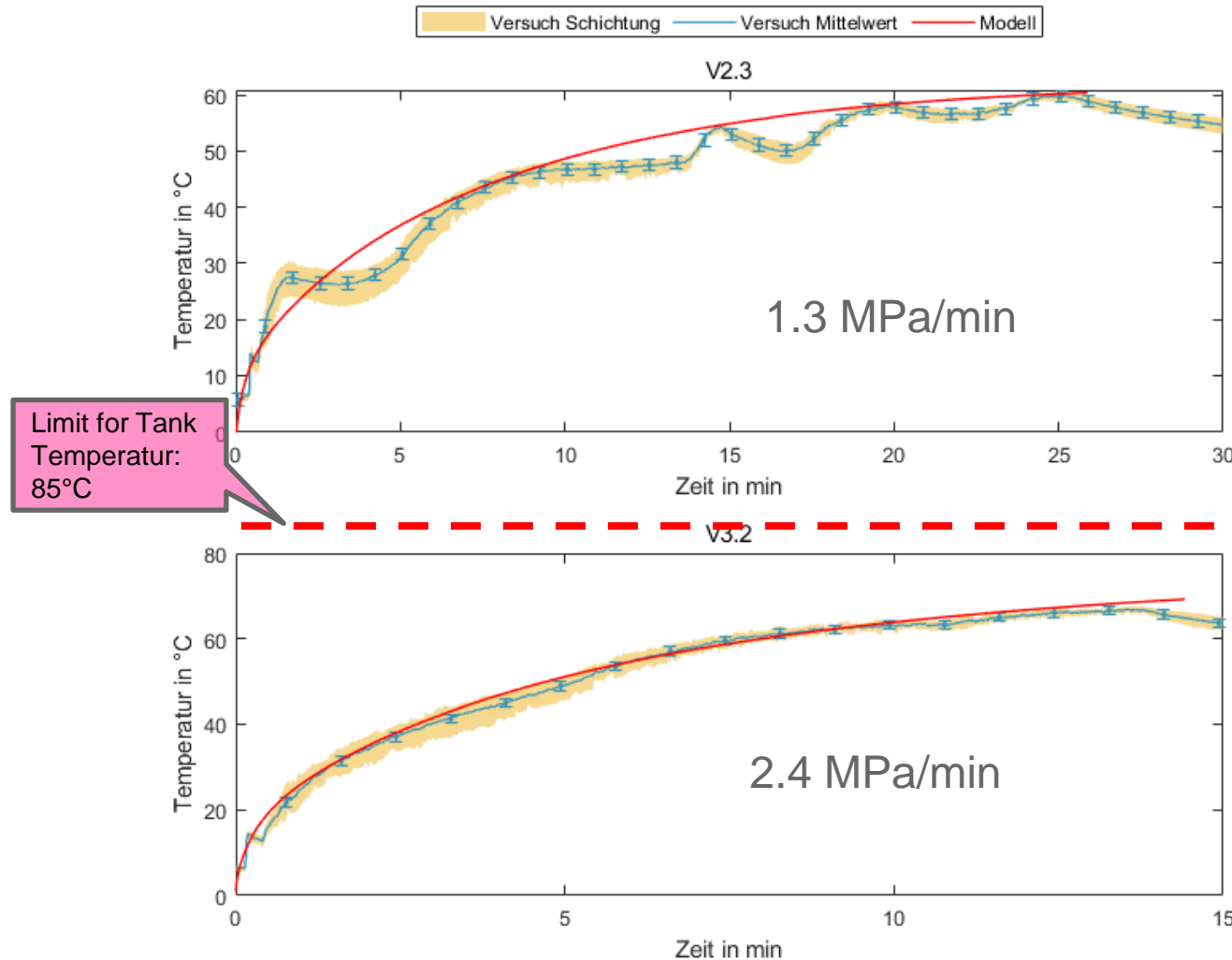
- Typ 4 – carbon fibre
- Diameter ca. 50 cm
- Length ca. 2 m
- Nominal pressure 350 bar
- Volume ca. 290 l



Winding of carbon fibres
onto HDPE liner

6. H2 REFUELING

Simulation & measurement of gas temperature during refueling



30 minutes refueling at ambient temperature around 20°C without pre-cooling

High ambient temperature (49°C) requires fuel station with pre-cooling of H2 to achieve 15 minutes refuelling target

6. H2 REFUELLING

300bar / 1'000kg truck trailer



open valves for overflow



grounding

connect fueling nozzle