

Panel 4 – Energy Saving On Board

Basic Storage components

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Scope & Objectives

- Screen actual technologies for onboard energy storage systems
- Definition and specification of the requirements for suitable storage systems
- Evaluation of the saving potentials on possible applications on operation modes
- Selection and description of the most suitable storage technology for the desired application
- **Target: Reduction of the energy consumption 25-30% (Diesel Electric Multiple Unit as major application)**



Activities performed & Status

- Technology screening for onboard storage elements
 - Main technologies considered

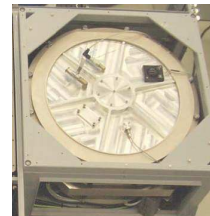
Supercaps,



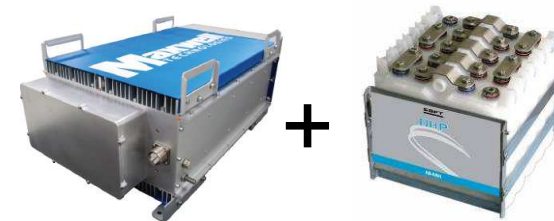
Batteries,



Flywheels



Hybrid storage



- Main saving aspects:
 - Time savings (additional power to the DC link in Booster operation)
 - Energy saving (operation in an energy optimized range or shorter operation)



Activities performed & Status

- Selection of the most valuable application

vehicle type	energy saving potential	demonstration scenario	space and weight available for	power needed	energy needed	possibility of regeneration	operating mode
DMU-regional	++	3	good *)	medium	medium	no	many stops
DMU-ICT	+	2	fair - poor	high	very high	no	few stops
EMU-DC-regional	+	3	fair	medium	high	limited	many stops
EMU-DC-ICT	o	2	fair	high	very high	limited	few stops
EMU-AC-regional	o	3	very poor	medium	high	good	many stops
EMU-AC-ICT	-	1 (2)	very poor	high	very high	good	few stops
Loco-Diesel-freight	o	2	very poor	very high	very high	no	very few stops
Loco-Diesel-shunting	++	n.a.	fair	low	medium	no	many stops
Loco-Diesel-passenger-regional	++	3	very poor	high	high	no	many stops
Loco-Diesel-passenger-long.dist.	+	2	very poor	very high	very high	no	few stops
Loco-AC-freight	-	2	very poor	very high	very high	good	very few stops
Loco-AC-passenger-regional	o	3	very poor	high	high	good	many stops
Loco-AC-passenger-long.dist.	-	1, 2	very poor	very high	very high	good	few stops
Loco-DC-freight	-	2	poor	very high	very high	limited	very few stops
Loco-DC-passenger-regional	+	3	poor	high	high	limited	many stops
Loco-DC-passenger-long.dist.	o	2	poor	very high	very high	limited	few stops
Metros	+	n.a.		medium	medium	limited	many stops
LRVs	+	n.a.		low	low	limited	many stops

demonstration scenario:

1) passenger (AC)

2) mixed traffic, int.

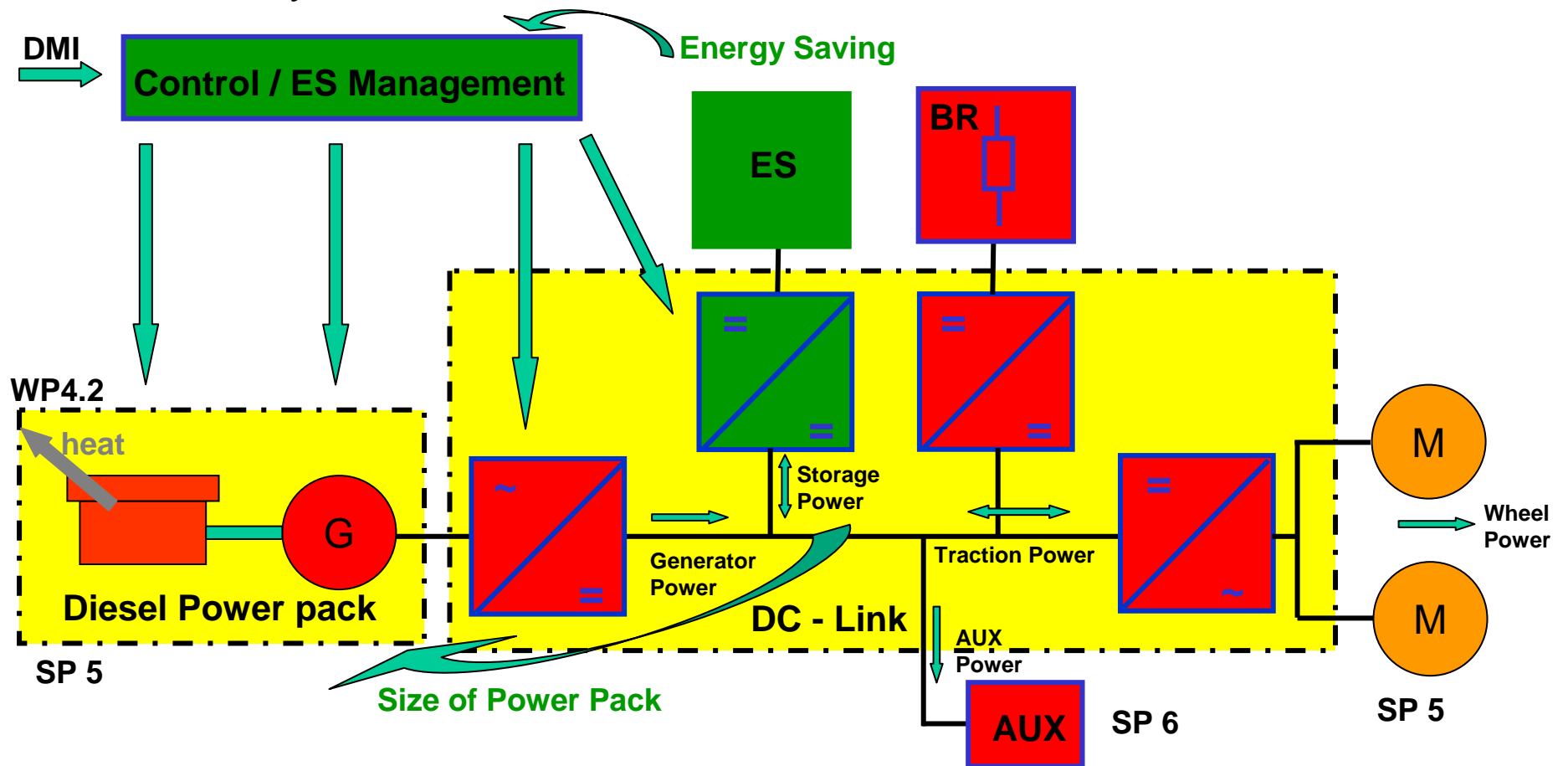
3) passenger transport regional

*) downsizing of existing equipment



Activities performed & Status

- Vehicle system overview DMU with ES



Activities performed & Status

- Requirements on onboard energy storage systems
 - Storage Power
 - Storage Energy
 - Weight
 - Lifetime
 - Yearly cycle capability
 - Environmental conditions

Vehicle - Target of lifetime of a storage system	Value
Vehicle lifetime	30 years
Operation hours	19 hours
Average traveling distance	5 – 20 km
Yearly cycle capability	20000 - 72000

Vehicle - Required energy	Value
2 car 375 kW Diesel	2,8 kWh
3 car 375 kW Diesel	4,2 kWh
3 car 500 kW Diesel	4,2 kWh

Vehicle -Additional weight of storage (target)	Value
2 car 375 kW Diesel	1,3 – 2,0 t
3 car 375 kW Diesel	1,7 - 2,6 t
3 car 500 kW Diesel	1,8 - 2,7 t



Results achieved and possible implementation

- Collection of the data and evaluation of the possible system concepts
 - For the selected regional application,
 - For agreed load profile
- For the time being double layer capacitors (DLC) are the most suitable technology
 - Most energy efficient operation in railway applications especially regional trains.
 - Most industrialized status compared to the other considered technologies.
- Hybrid solutions (NiMH batteries & DLC) for special customized profiles
- Energy storage system purely based on NiMH batteries is not an appropriate technology.
 - Transfer of the Li-Ion mass production technology from automotive hybrid field optimized solution.
- Flywheel solution could be an alternative
 - missing field experience
 - steps towards industrialization

Next Steps & Outlook

- Evaluation in simulations in WP2.5
- For other Diesel electric railway applications different load profiles could be applicable
- Will be investigated in following European Projects like “CleanER D” (Hybrid sub project).
- Various applications and experiments are developed, used or studied.
- Many solutions are in the market entry stage.



Thank you for your attention!

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