Panel 2
" Best of " Reversible DC Substation

Railenergy Final Conference

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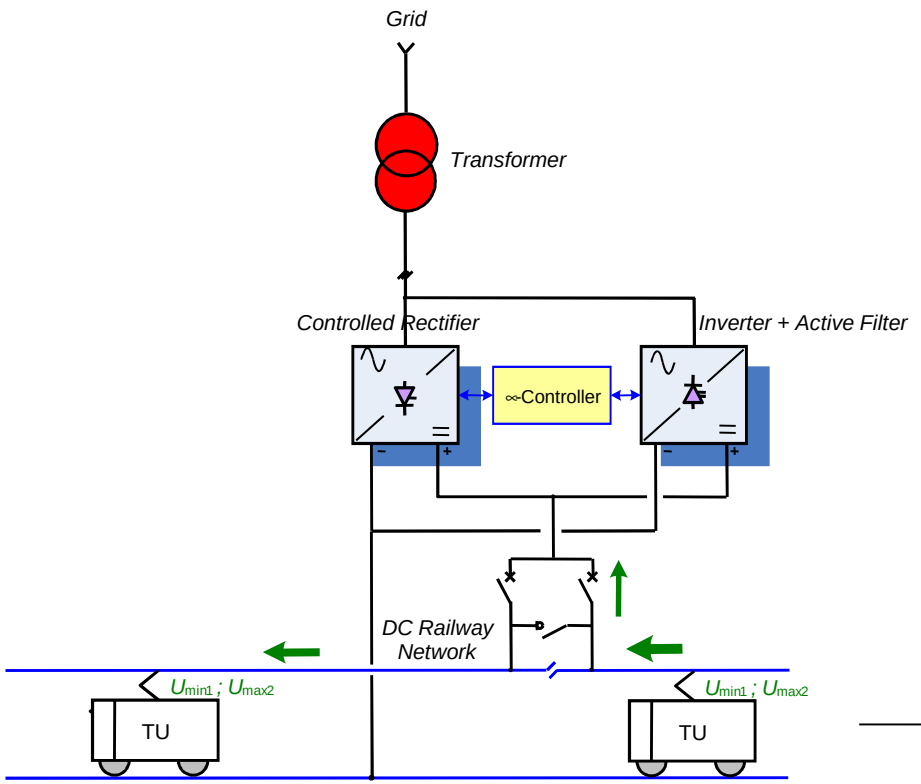
"Best of" reversible DC substation Context

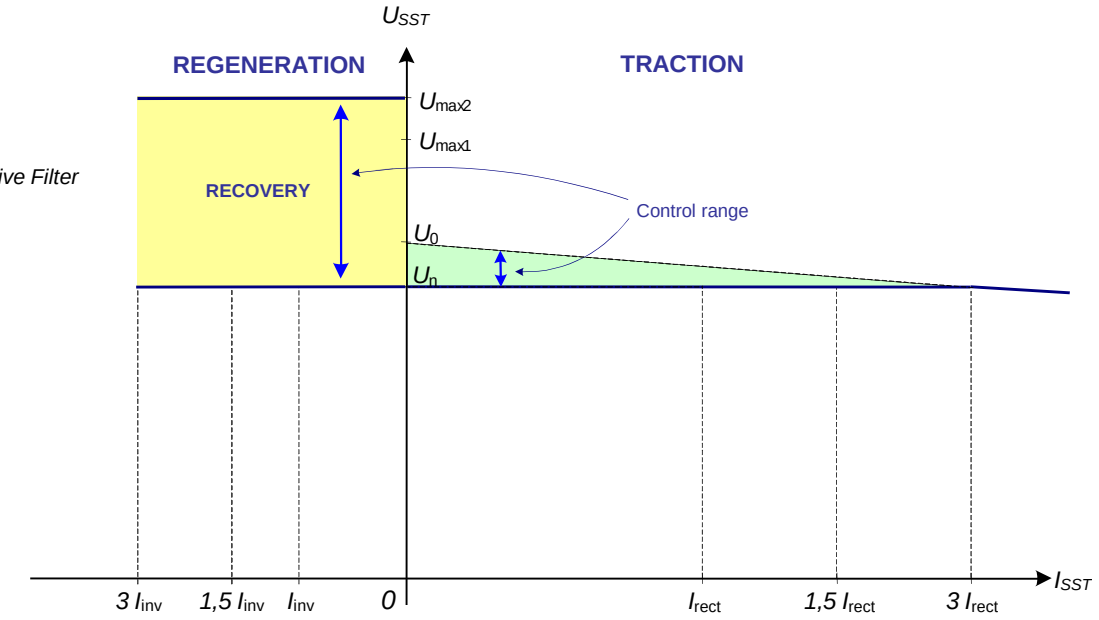
- Transport Authorities and their suppliers today seek Energy Efficiencies as a contribution to both:
  - Their overall business performance
  - Their identity as modern & responsible public service organisations
- This presentation is about the original design and validation of a reversible DC substation conceived by ALSTOM and shared with Railenergy Trackside works:

  - It is one of several ALSTOM solutions developed to address customer demand for superior energy management capability in public transport.

  - It is also the fruit of initiatives and research work that go back to a time before "Sustainable Development" became fashionable.

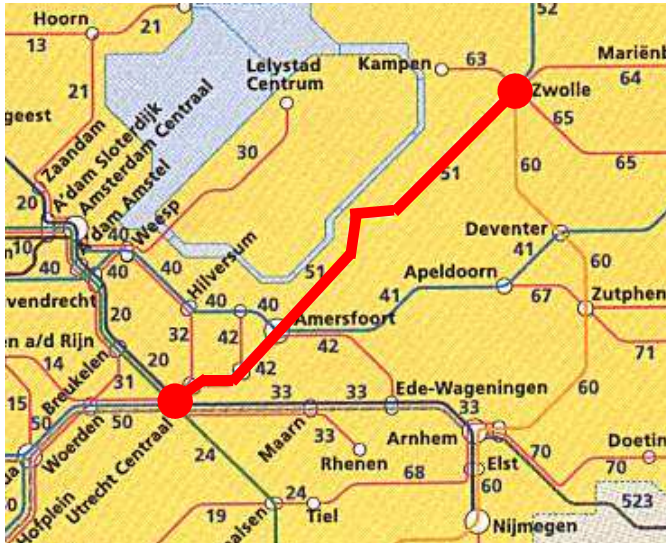
“Best of” reversible DC substation
New technology





“Best of” reversible DC substation Simulation and evaluation

- +7% energy saving on Utrech-Zwolle regional line, Netherlands
- Improved line receptivity (from 77% to 99%)
- Simplified model has been used for simulation purposes
- In reality, line receptivity likely to be 100%
- Rheostatic braking not used anymore (lower tare mass/equip. volume)



1.5 kV DC
87 km long
15 stations
15 min headway
6-to-12 car EMU

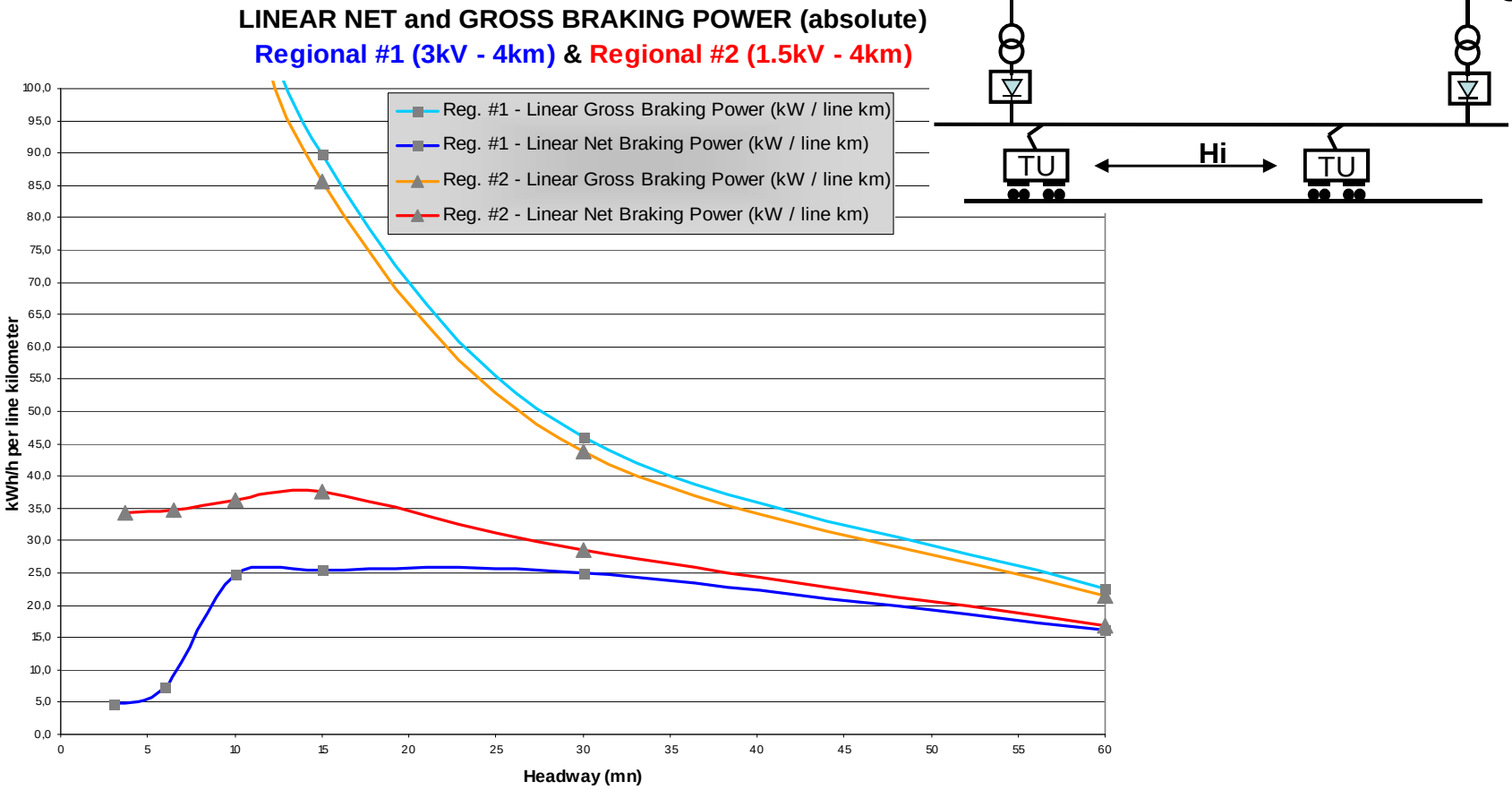
"Best of" reversible DC substation Sensitivity analysis

Amount of Energy saving is dependent upon:

- Operational headways
- Frequency of the stop points
- System voltage
- Line gradients
- Rolling stock auxiliaries power consumption

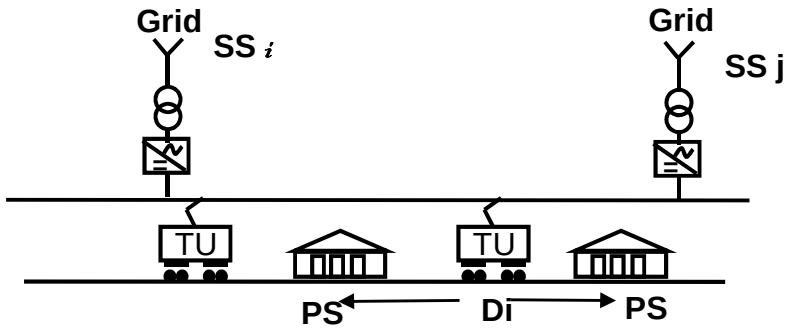
“Best of” reversible DC substation Sensitivity analysis

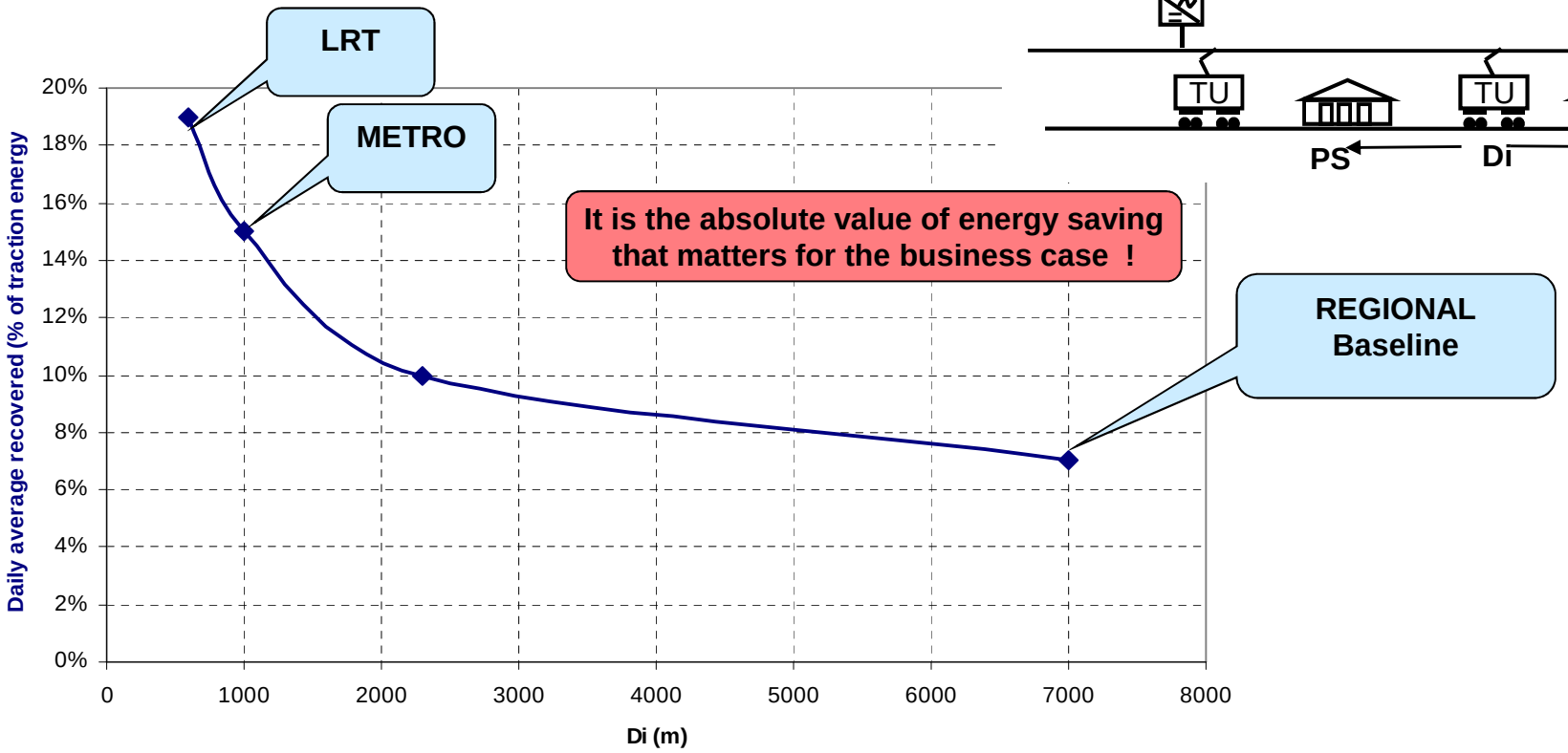
Operational headways:



"Best of" reversible DC substation Sensitivity analysis

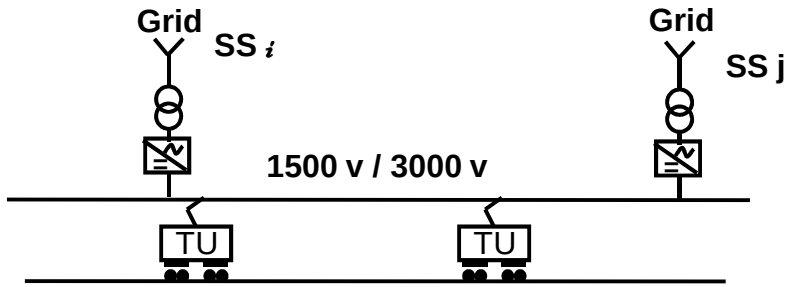
Frequency of the stop points:

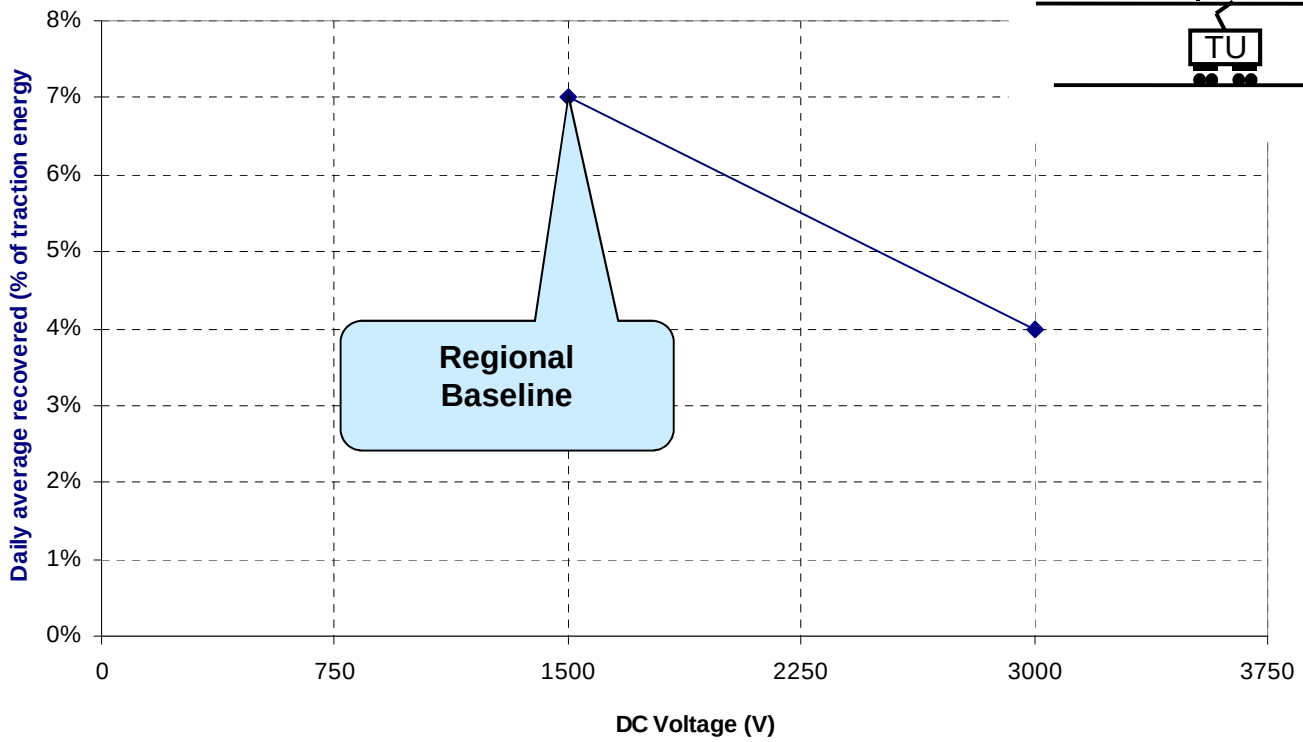




“Best of” reversible DC substation Sensitivity analysis

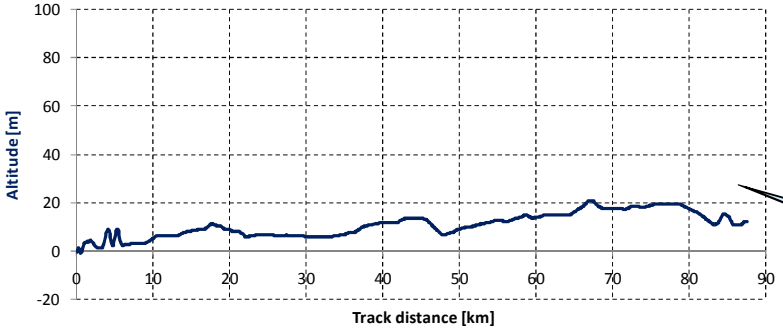
System voltage:

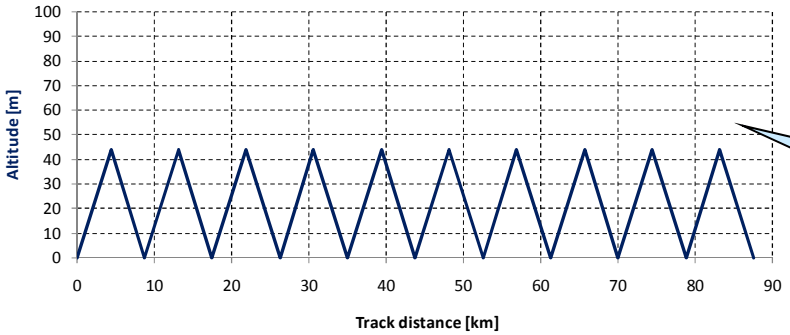


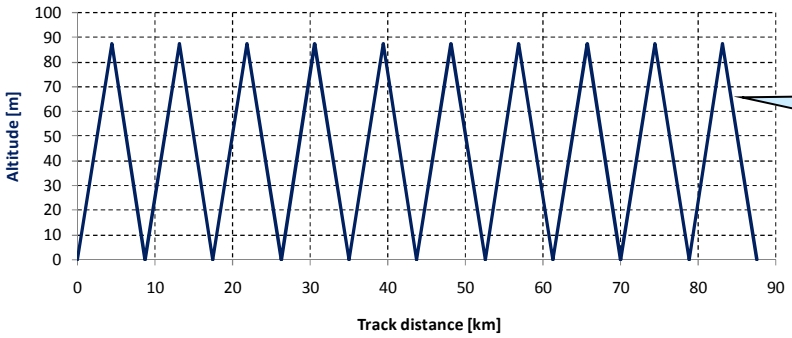


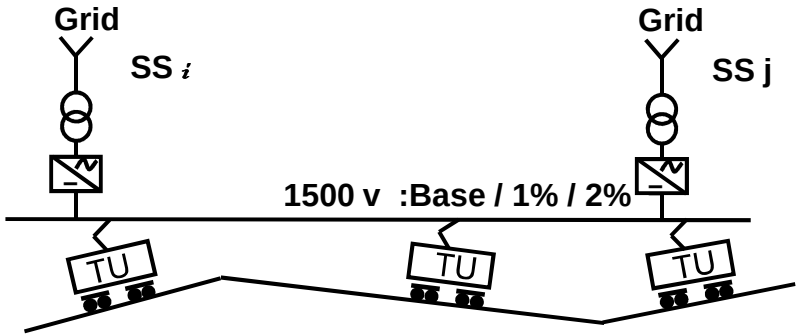
“Best of” reversible DC substation
Sensitivity analysis

Line gradients:









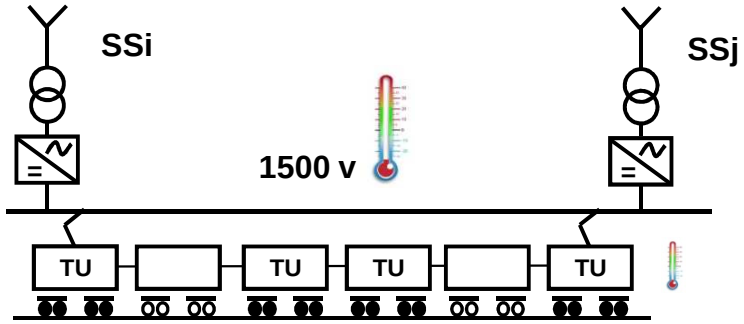
Regional Baseline gradient
+7% savings

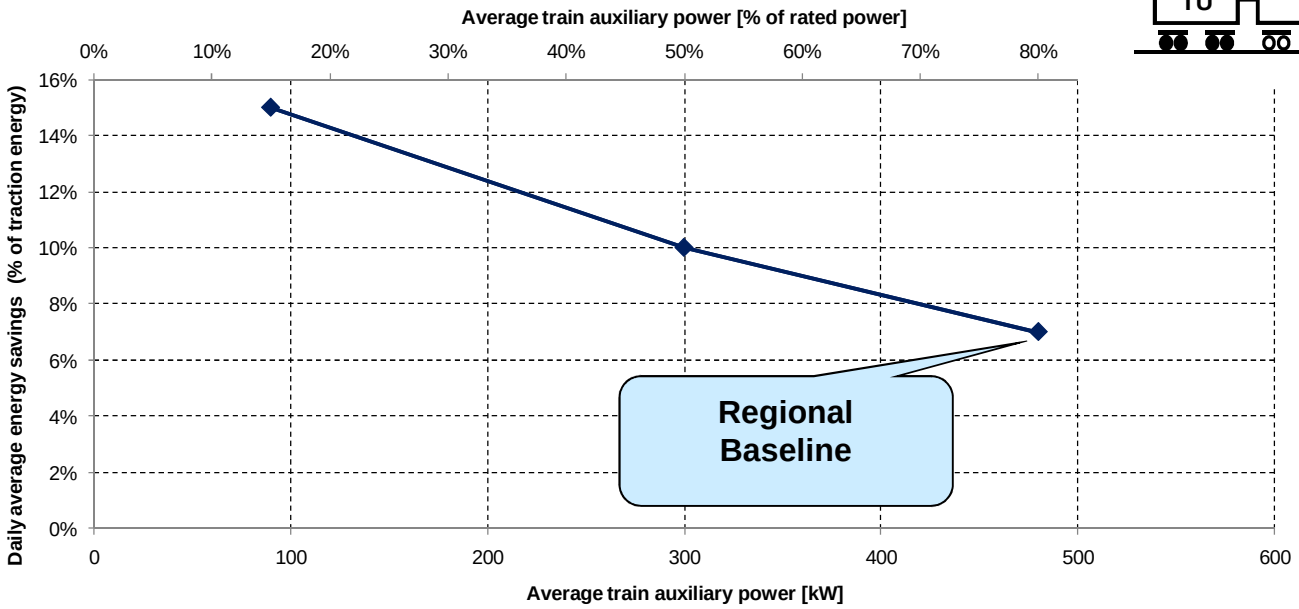
1% hills
+8.5% savings

2% hills
+9% savings

"Best of" reversible DC substation Sensitivity analysis

Train auxiliary power:





“Best of” reversible DC substation
Conclusion & outlook

- Energy saving targets were reached, and sensitivity analysis was carried out confirming the great potential of reversible substations for energy savings,
- Validation by LCC analysis and Technical Assessment Report were done,
- A TecRec (UIC-UNIFE Technical Recommendation) on reversible substation is under progress for future integration into CENELEC standards,
- An industrial plan is being built on ALSTOM side for 1500V and 3000V DC substation, to be “Free for tender” after validation of a full scale substation on a railway network.

Clip of HESOP project presentation