

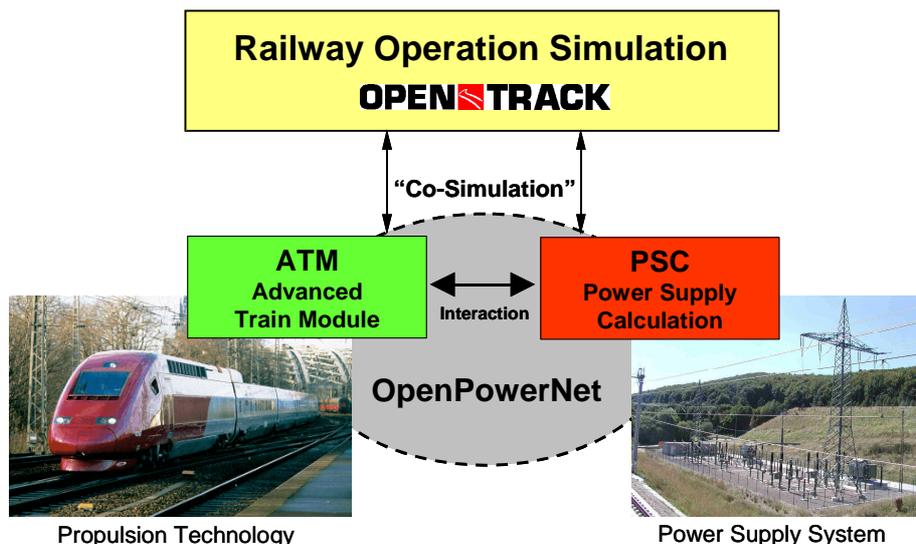
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## OpenPowerNet – Simulation of Railway Power Supply Systems

For prognosis and analysis of railway energy consumption the use of simulation tools is state of the art today. For that purpose a lot of software tools with different precision are available.

Energy consumption of electrical railways is mainly influenced by the driving and propulsion efficiency characteristics of the trains as well as by the behaviour of the traction power supply system. For a realistic prognosis by simulation detailed information about the current power consumption, the actual position of the trains and the capability of the power supply network must be available at the same time. Therefore a series of compromises either concerning the railway operation simulation or the electrical network modelling depth were made in the past.

For this reason the idea was to create a plug-in simulation module for railway power supply networks using the advantages of an existing commercial railway operation simulator. Due to its excellent capability and convenience the Swiss **OpenTrack** simulator was chosen for that purpose. The new developed energy simulation module called **OpenPowerNet** works together with OpenTrack as a so called “co-simulation”. Each program has its clearly delimited task. OpenTrack deals with the timetable-based train operation simulation using the infrastructure and train data. OpenPowerNet simulates in sync the entire electrical network taking into account the networks voltage situation depending on the trains power consumption and position. All retroactive effects are considered exactly. OpenPowerNet itself consists of two parts: the Power Supply Calculation (PSC) for the electrical network and additionally the Advanced Train Module (ATM) modelling the propulsion technology of the trains in detail.



OpenPowerNet can simulate all common AC- and DC-railway power supply systems taking into account the entire electrical network structure. Furthermore different levels for the propulsion modelling are available. Various post-processing tools allow multiplex data analyses.

OpenPowerNet can be used as an energy prognosis and analysis tool as well as for the dimensioning and optimization of power supply installations. The accuracy of the simulation was verified by field measurements. On the new High Speed Line Zuid (NL) it is applied for the commercial train energy billing of different train operators. For Chinese high speed lines the rating of the current return system was examined. At present the analysis and optimization of the Zurich Tram and Trolley bus power supply network is done with OpenPowerNet.

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