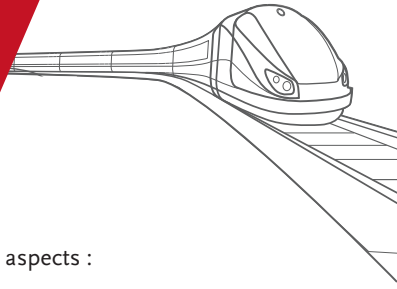


Vehicle Technology & E-Mobility



» ELECTRIC MOTORISATION AND ALTERNATIVES BUS DRIVES

• CHALLENGES

The requirements for vehicles in local public transport and regional passenger transport are changing. As a necessary step towards climate neutrality, the focus is on the electrification of vehicle fleets. Are you planning the conversion of your fleet and would like to develop a suitable strategy?

Zero emission vehicles are at the heart of sustainable mobility

Would you like a transparent comparison of the technical possibilities in order to be able to make a well-founded decision for your future path?

Or do you want to promote (individual) electromobility in your municipality?

• OUR ASSETS

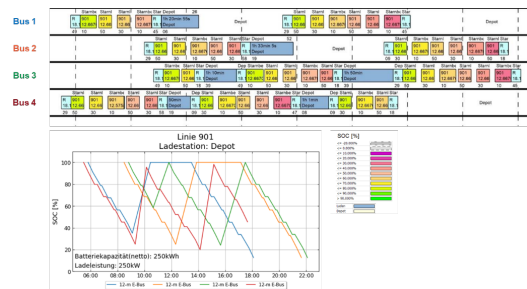
Together with you, we develop the necessary steps to achieve your goal, independently of manufacturers and open to all technologies. In doing so, we take into account technological requirements and regulatory framework conditions, operational and infrastructural needs and - last but not least - the economic aspects. With our specialised software tools, we can carry out energy, economic and ecological scenario analyses for optimised vehicle and resource use.

Our portfolio includes the following aspects :

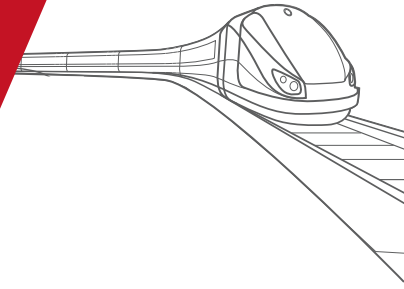
- For transport unions and operators:
 - Benchmark of the different drive technologies,
 - Determination of the the necessary facilities and infrastructure,
 - Calculation of the necessary energy consumption,
 - Presentation of the effects on operations and site development,
 - Operational optimisations,
 - Estimate of investment and operating costs (TCO approach),
 - Search for synergy potentials in the use of charging/tank infrastructures,
 - Determination of environmental impacts,
 - Preparation of short/medium/long-term implementation plans including explanation of the legal and organisational framework conditions,
 - Identifying the impact and the necessary facilities at the maintenance and storage sites.
- For cities and municipalities:
 - Develop action plans for the introduction and establishment of electromobility in cities and municipalities
 - Analyse the needs & strategies for short, medium and long term fleet renewal and the implementation of charging infrastructure

• OUR TOOLS

With our specialised software tools (VISUM, OpenTrack), we carry out energy, economic and ecological scenario analyses for the optimised use of vehicles and energy resources.



Vehicle Technology & E-Mobility



» ELECTRIC DRIVE AND RAIL TRACTION ALTERNATIVES

• CHALLENGES

Diesel multiple units have no future in regional passenger transport. On non-electrified lines, therefore, in the future, either battery or hydrogen trains will be used, or the entire railway line will be electrified with a new overhead catenary. As the ranges are limited when using batteries and hydrogen tanks compared to conventional diesel technology, recharging options must be planned during operation. Accordingly, on top of the vehicle technology, the infrastructure must also be optimally developed with overhead catenary on some sections or hydrogen filling stations.

The future of rail traction lies in alternatives to diesel

• OUR ASSETS

We carry out feasibility studies to prepare vehicle deployment, infrastructure and operations needed by the change of the source of traction energy. For this purpose, we model and simulate railway operations with our specific software and analyse the different technological and infrastructural framework conditions in various scenarios. The result of such energy flow calculations forms the basis for an economic and ecological evaluation of the studied drive technologies.

We currently carry out strategic planning for our clients: feasibility studies allow us to determine the best drive technology for an individual railway line. We then determine the adjustments to the infrastructure brought by the choice of the new traction energy. Furthermore, our strategic planning also includes the composition of future vehicle fleets for public transport authorities and the analysis of effects on operation. After the feasibility studies, we can support the planning of the practical implementation with advice from our civil engineers and our trusted partner companies who can also advise on the subject of vehicle procurement, for example.

We can model and simulate railway operation with alternative traction technologies. In addition, we can carry out energy flow calculations for various technological, operational and infrastructural scenarios. These analyses are supplemented by economic efficiency and emission calculations.

• OUR TOOLS

We work with OpenTrack, and with our own programmed Excel tool for energy flow calculation and economic efficiency evaluation (can also be purchased separately by customers), supplemented by evaluation and visualisation algorithms programmed in Python.

» ROLLING STOCK AUDIT

• CHALLENGES

The purpose of a rolling stock audit is to verify technical, accounting or contractual aspects in the event of doubts, questions, needs for clarification or explanations. It can follow periods of tension and misunderstanding in the relationship between a local authority and its operator, which have affected the relationship of trust. It can also more naturally be used during the renewal of a public service delegation to establish an inventory and audit at a given moment and thus have a concrete basis for future discussions with a new operator, to divide the costs of reconditioning between what will be the responsibility of the current operator, the future operator and the local authority. In the case where the outgoing candidate is reappointed, this audit avoids having to pay for certain costs in the new contract when they should have been carried out in the previous contract.

• OUR ASSETS

TTK supports public authorities in these matters by carrying out rolling stock audits. With the support of an expert partner in maintenance (former workshop manager), TTK goes to the maintenance and storage sites in order to assess the condition of the vehicles, on the basis of a sampling so as not to disrupt the operation requirements. The method is based on following a predefined checklist (interior, exterior, mechanical parts under the vehicle), analysing various documents such as technical inspection reports and maintenance logs, and interviewing the maintenance manager to understand his scope of intervention and methods. This work allows us to identify malfunctions and to estimate the costs of reconditioning or repairing vehicles according to their age.

• OUR TOOLS

Inspection sheet