OSIRIS & URBAN RAIL - COMPREHENSIVE APPROACH TO MAKING THE SAVES

The findings of the OSIRIS collaborative R&D project are expected to assist urban rail operators in reducing their energy bills and the environmental impact of their operations.

Co-funded by the EU’s 7th Framework Programme, OSIRIS brought together 17 partners, including public transport operators, manufacturers, and research centres. The three-year initiative, which culminated in March 2015, sought to identify operational and technical innovations that lower the energy costs of running urban rail systems, costs that represent a considerable financial burden for transport companies – amounting to 15-20% of the operating expenditure of a light rail network, 10 to 15% of a metro. Note that after staff, energy is the second largest budget item in the operation costs structure.

Urban rail systems are complex, with the quantity of energy they consume depending on a range of inter-dependent factors. Though a new technology might yield improvements in one area, it might compromise other aspects of the system performance. This dichotomy often makes it extremely difficult to assess the net benefits of introducing new, energy saving technologies.

HOLISTIC TOOL FOR ELECTRICAL & THERMAL CALCULATION

What is needed, and what has been lacking so far, is a comprehensive approach to simulating,
evaluating, and optimising energy consumption; one that encompasses the whole picture, i.e. rolling stock, infrastructure, and operations. In response, OSIRIS has created a unique holistic tool – a highly complex, relational database, integrating various specialised modelling tools. “This software programme is designed to integrate all or most of all aspects of the urban rail system,” explains Caroline Hoogendoorn from OSIRIS partner UITP. “It serves to better understand interactions between the different energy consumers – both electric and thermal aspects – and to bridge the gap between small-scale measurements of improvements and global appreciation.”

**MODULAR DUTY CYCLE SYSTEM**

Another highlight of OSIRIS is its work on a standardised methodology for measuring the energy consumption of rolling stock. “During procurement of new trains, to help with decision making and optimise the overall process, comparing the energy consumption to be expected with a minimum level of reliability and predictability is vital,” says Laurent Dauby from UITP. Inspired by UITP’s SORT initiative (Standardised On-Road Tests Cycles, see box), the consortium opted for a ‘modular approach.’ In order to define any given line at various times of the day, a comprehensive set of ‘building blocks’ or modules were identified. Only a limited number of said modules (per service type) were found necessary to reasonably approximate real lines.

“To calculate these Duty Cycles a large amount of data was required,” reveals Ms Hoogendoorn. “It was provided by project partners such as the Milan and the Paris operators, but also from organisations outside the consortium.” These ‘external contributors’ belonged to the OSIRIS ‘Support and User Group’ (SUG), which met up every six months to access, contribute to, and validate the project results.

“While the work on Duty Cycles is not mature enough at this stage [March 2015] to be proposed as a standard, further work will be conducted within the UITP working bodies,” sums up Mr Dauby. “Should a wide consensus be reached, the tool could be used on voluntary basis. The benefits and added value of formal standardisation would then be investigated.”

**ADVANCED TECHNOLOGIES**

Various operational and technical innovations also formed part of the OSIRIS strategy. Alstom developed a cutting-edge auxiliary converter for metro trains, tested in cooperation with operator ATM in Milan. The objective was to improve the energy efficiency of the converter powering on-board systems, including heating, air conditioning, lighting, and the battery charger. “After becoming a standard company product, it will probably be adopted more widely,” comments Mr Dauby.

CAF deployed a new concept, on-board Energy Storage System (ESS) using Lithium-Ion batteries from Saft. Tested on a tram in Vitoria-Gasteiz (Spain), this technology captures and stores energy during braking, in order to reduce overall energy consumption and lessen power losses from the catenary and substations. Despite requiring further fine tuning, given the growing desire for electrical energy storage – both for rail and...
electric bus operations – it is certain there will be market volume to support deployment in the near future.

**Ansaldosts** produced a novel cooling system for technical rooms using underground water, tested with the support of ATAC in Rome Metro. The goal was to address the thermal behaviour of fixed installations and the cost of maintaining correct temperatures, to ensure the proper operation of signalling and communications equipment.

This heat pump system could be implemented widely since it consists of proven and recognised technologies used in cutting-edge applications. Furthermore, OSIRIS has identified many situations where underground water is available in the vicinity of stations.

**Boosting Performance - Reaping the Benefits**

The drive to improve the energy efficiency of urban rail looks set to continue indefinitely. “There have actually been some advancements in the past decade that have allowed rail vehicles to increase their traction energy efficiency,” Ms Hoogendoorn told Mobility. “But these savings have been cancelled out with the addition of comfort features such as energy-consuming air conditioning, WiFi, infotainment and other onboard equipment.” Such a ‘one step forward, one step back’ status quo explains why operators and manufacturers are constantly on the lookout for ways and means of consuming less energy.

As well as cost cutting, a further consequence of the OSIRIS action will be a smaller carbon footprint; a step in the right direction that will certainly help operators to maintain their competitive edge, in terms of their environmental impact, compared to private transport modes.

Last but not least, it is worth bearing in mind that public transport is often, if not always, subsidised to a certain degree in every country. Reducing energy-related bills is good news for governments, authorities and other entities allocating these budgets. “Indeed in the long run this energy drive also promises benefits for the city as a whole” agrees Ms Hoogendoorn. “Curbing operation expenses should then help reduce expenses for authorities.”

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