VTT impulse

Information about science based innovations, solid facts to support decision-making, performance and business development for VTT’s partners, customers and anyone interested in high technology and its applications.

A MAGAZINE ON SCIENCE, TECHNOLOGY AND BUSINESS

Finland is aiming towards smart transport

Esko Lukkari | 10.5.2017

The TransSmart research programme has involved a major effort to develop low-carbon, smart traffic.

According to Research Professor **Nils-Olof Nylund**, the results of the programme, which ended last year, boil down to five issues: the networking of actors, the development of electric buses and start-up of bus production,

smart transport services, promoting the use of biofuels, and background data for the climate and energy strategy aimed at reducing emissions.

The programme has brought together four ministries, two government agencies, industry, universities and future urban traffic projects. Research is continuing under the TransDigi co-operation platform project, which involves the state administration, universities, universities of applied sciences and businesses, in addition to VTT. Helsinki Region Transport, HSL, has made an agreement with VTT worth three million euros for the development of smart, low-carbon public transport.

TransSmart has been in cooperation with almost all European car manufacturers in the development of automated driving.

Electric transport projects

Technologies and solutions for electric commercial vehicles have been developed as part of the ECV (Electric Commercial Vehicles) project and its sub-project, eBus. The work was supported by VTT's vehicle and battery testing laboratories, where analysis and measurements of batteries, electric motors, power electronics and electrical power trains we carried out. Following the work in the ECV project, HSL, the Helsinki region PTA, is now running a pre-commercial ePELI pilot project for electric buses . This pilot is the last step before entering roll-out according to strategy and competitive bidding involving electric buses.

Under the eBus project, an electric bus prototype was built on a Kabus chassis, which now provides companies with an open R&D platform for the development of batteries, electric motors, powertrain and auxiliary componenst, big data solutions and vehicle automation. A VTT spin-off, electric bus manufacturer Linkker, also grew out of this work.

– This mobile laboratory is both a physical and digital platform for the development of electric buses, commercial vehicles, mobile machinery and automation, says **Mikko Pihlatie**, a Research Team Leader at VTT.

The connection of electric buses in series and self-charging are being developed under EU projects and alongside HSL. Metropolia, which is leading the EU-funded SOHJOA project, due to end in 2020, was in charge of developing the automated, last-mile bus concept. Robot buses have already been tested in Tampere, Helsinki and Espoo.

VTT is also developing automated vehicle technology in Tampere: a robot car, Marilyn, has been built on a Citroën chassis.

– The vehicle's intelligence can handle 85 percent of situations, but the target is much higher. It has not yet been driven on public roads without manual control so far. The capabilities of the car will be tested and developed iteratively in traffic this spring, says **Matti Kutila**, a Senior Project Manager at VTT.

The car is equipped with EUR 70,000 of smart technology: stereo vision, thermal cameras, sensors, ECUs and GPS/Glonass. Closed lanes or extreme weather conditions remain a challenge to the automated cars for years but this is the area where we are leading actor in Europe.

A leading country in biofuels

Finland is a leading country in the development of biofuels and TransSmart has played a key role in promoting their use. The new energy and climate strategy envisages raising the share of biofuels in Finland from 15 to 30 percent by 2030.

The BioSata project began as a continuation of TransSmart last year. As part of this, all bus services procured by HSL, and city of Helsinki's construction service Stara's trucks and machinery, will convert to biofuel by 2020, says Nylund.

HSL uses 35,000 and Stara 2,000 tonnes of fuel a year.

– The biofuel suppliers UPM, Neste and St1 are committed to supplying all biofuel for HSL's fleet by 2019, he adds.

The Helsinki region is serving as a pilot for biofuels. The Ministry of Economic Affairs and Employment is funding the BioSata project, which forms part of the Helsinki region's Smart & Clean project.

Smart services are on their way

In the future, people and goods will have to be moved around efficiently, using minimum-emission technology. It is helping in areas such as journey chains that seamlessly combine different modes of transport and is generating new service models such as car sharing.

The intelligent transport business has been B2C and B2B-based, but the consumer markets are now taking off. The key words for new business models and innovations are ecosystems, PPP (public-private-people partnership), crowdsourcing, the social media and the MaaS – Mobility as a Service concept.

Principal Scientist **Raine Hautala** points out that TransSmart's intelligent transport focus area lay in developing user-centred MaaS services and a resource-efficient transport system.
VTT has coordinated the national MaaS projects and one international project in which the other research partners are Chalmers University of Technology and AustriaTech.

– One of the key projects is Living Lab Bus, which will end in 2018. This involves an open experimental environment built around Linkker's electric bus, for the faster achievement of smart services and other product development. The data gathered by the bus's sensors can be used to produce real-time information for drivers and passengers, and information on the movements of buses, says Hautala.

– A bus travelling Route 23 in Helsinki has been gathering data since January. Smart service trials visible to passengers will begin in the spring, expanding to ten electric buses in the autumn. Similar experiments and R&D will be done in Tampere and Turku.

Six Finnish companies, four research institutes, HSL and the cities of Helsinki and Turku are currently involved in the Living Lab Bus project. The first foreign company will join in the spring, when bus passengers will also begin participating in smart service trials.

Demand is growing for electric buses

Linkker, a key firm in Finland’s electric vehicle industry, is taking the next big R&D step.

Linkker is raising its annual sales of buses from dozens to hundreds. The idea is to enlarge its sales area to Western Europe and perhaps Asia.

– We need more resources, in order to start growing along an acceleration curve, says **Kimmo Erkkilä**, Director of Business Development.

Linkker is actively seeking partnerships to enable its geographical expansion.

Electric buses becoming cheaper

Demand for electric buses is expected to grow sharply, when volumes rise and prices fall to the level of diesel buses. An estimated 50,000 electric buses will be sold around the world in 2020.

Paris and Amsterdam intend to electrify their bus traffic by the year 2025. Helsinki has a goal of 30 percent.

Linkker’s toughest competitors are the Polish company Solaris, which won Tampere's electric bus tendering competition, the Dutch VDL and Ebusco, which is under joint Dutch and Chinese ownership. Volvo is also entering the market, with at least Scan and Mercedes-Benz soon to follow.

– The competitive situation is changing and we are in a hurry, says Erkkilä.

Linker was almost the first company to develop and commercialise a production-ready electric bus concept. It has no intention of losing its lead.

Manufacturing outside Finland

Linkker has been giving thought to having a second contract manufacturer alongside Fortaco.

– As volumes grow, we cannot get by based on Finnish production alone if we mean to enter the Asian markets, he explains.

Electric buses are still twice as expensive as diesel ones, which can be bought for EUR 200,000 to 240,000.

– Production runs of hundreds of electric buses would enable a price reduction of EUR 50,000. Production runs of thousands might mean that only the battery price is different, he comments.

The operating and maintenance costs of electric buses are smaller than those of diesel buses. They have no gears and the motor is easy to maintain. They are also emission-free and silent, being heated and cooled with air source heat pumps.

Finnish firm Visedo Oy is Linkker’s motor supplier. Its magnetic motor has a power of 180 kWh.

– The purchase prices of electric buses will equal those of diesel buses in ten years, he says.

Fortaco has a new production line

Fortaco, which is located in Sastamala, has completed a new production line.

– It can produce 200 buses a year, but we need to double that number. Our maximum production capacity is around a thousand buses, Erkkilä says.

With an aluminium body, Linkker’s bus consumes 30 percent less electricity than its competitors. Its 55 and 63.5 kWh batteries are lighter due to the bus's light body. The bus can cover a kilometre per kilowatt-hour.

Its rapidly chargeable 55 kWh battery can be charged for an average city journey of 10 kilometres in three minutes. A fully charged bus has a range of 30 kilometres. Charging intervals do not pose a problem in cities. Buses are charged in transit or at the end point of routes. This ensures that the batteries are not exhausted.

Linkker is currently assembling twenty buses and around a dozen have been delivered to customers. Two have been delivered to Copenhagen and Turku’s fifth Linkker bus is under production. Helsinki has already received a few buses as part of a 12-vehicle order.

Images: Juho Kuva, Antonin Halas