SMART LOW-CARBON TRANSPORT

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TRANSSMART

The TransSmart spearhead programme is a platform for the development of smooth-running, cost-efficient and environmentally friendly transport systems.

Our transportation systems need to be reshaped to make them more sustainable. This should involve using low-carbon energy, employing clean and energy-efficient vehicles, devising intelligent ITC and transport solutions, and supporting the necessary socio-technical changes.

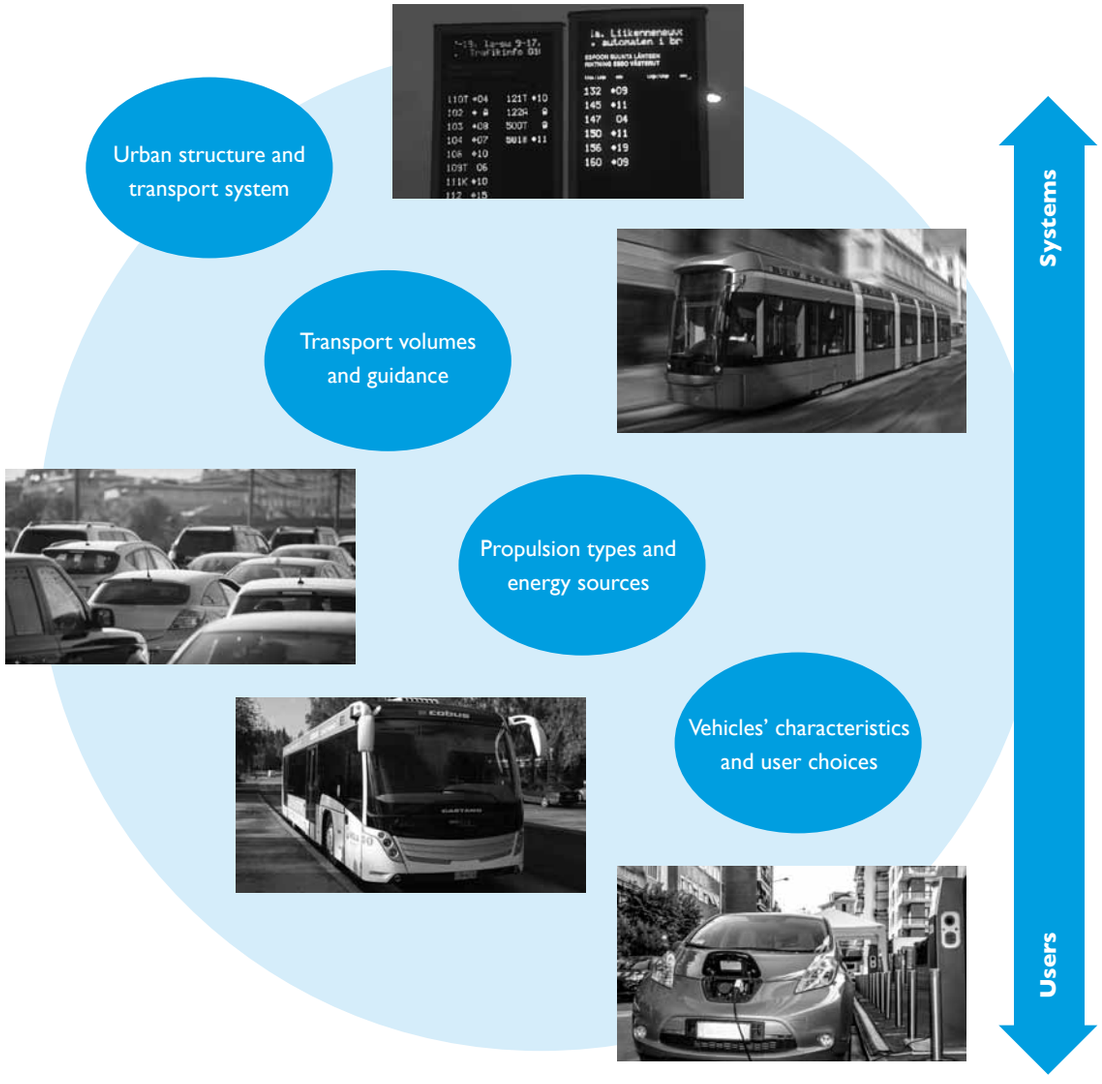
The programme has been initiated and is coordinated by VTT, in line with two of VTT's strategic priorities: sustainable development and the digital world. It takes advantage of VTT's multidisciplinary expertise in traffic and transportation.

The programme has both social and business dimensions. Society will benefit from the development of more efficient transport services run with minimized costs and environmental impacts. Business angles include the development of markets for Finnish providers of new, low-carbon and intelligent traffic-related solutions such as biofuels, electric vehicles and ICT services.

The programme also aims to produce information and tools for decision-makers in the transport sector to help them improve entire transport systems.

The targeted budget of the four-year programme is around €50 million. Through the TransSmart programme VTT collaborates closely with other research institutions to help develop the products of business partners, and to cooperatively realise exemplary projects piloting new technologies.

Edited by Fran Weaver



FOCUS AREAS

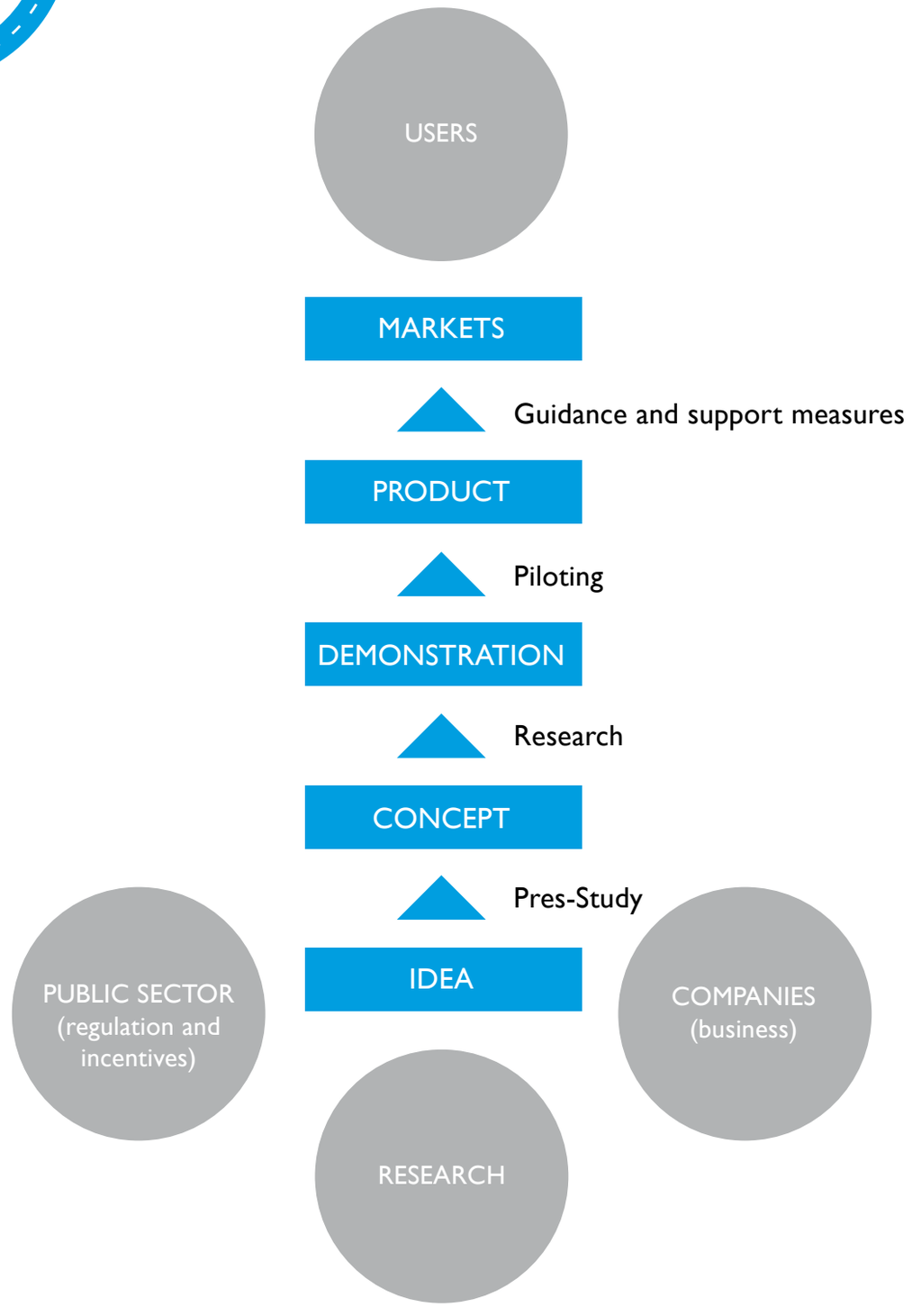
Global phenomena such as climate change, urbanization and urban sprawl, security issues, aging populations, the expansion of markets, and the digitalisation of the operating environment all impose significant pressures with regard to the need to improve our transport systems. The current decision-making system in the transport sector must be purposefully and holistically developed towards a smart and low-carbon future. Different solutions such as biofuels, efficient vehicles and intelligent services should all be considered and developed as part of the overall package of transport solutions.

The European Commission's Communication on Smart Cities and Communities – The European Innovation Partnership (SCC), published in July 2012 – seeks ways to make urban development more energy-efficient and less carbon-intensive. It emphasises the need to create a cooperative environment to facilitate the comprehensive development of transport solutions, energy use and ICT services in ways that promote the creation of sustainable urban structures.

Urban transport systems are particularly important, as 68% of EU residents live in urban areas. Areas where development work is needed include the integration of different technical systems, models for cooperation between different actors, acquisition models, and friction caused by regulation. We also need to enhance the processes that lead from innovation to products, and to speed transitions from solutions that serve one operator or function towards multi-stakeholder solutions. The user's role in traffic is also changing due to the ubiquity of social media, the internet and smartphones equipped with new service applications.

Many large global companies and a number of universities and research institutions have already been active in the development of smart cities. In Finland such collaboration is organised within the frameworks of the Innovative Cities (INKA) programme, led by the Ministry of Employment and Economy, the Smart City programme run by TEKES (the Finnish Funding Agency for Innovation), and the knowledge and innovation network Fintrip, set up by the Ministry of Transport and Communications. TransSmart is closely linked to the Fintrip network.

The key challenge is considered to be the need for new cooperation models and structural solutions that will link separate functions and operators to enhance the performance of entire transport systems.



APPROACH

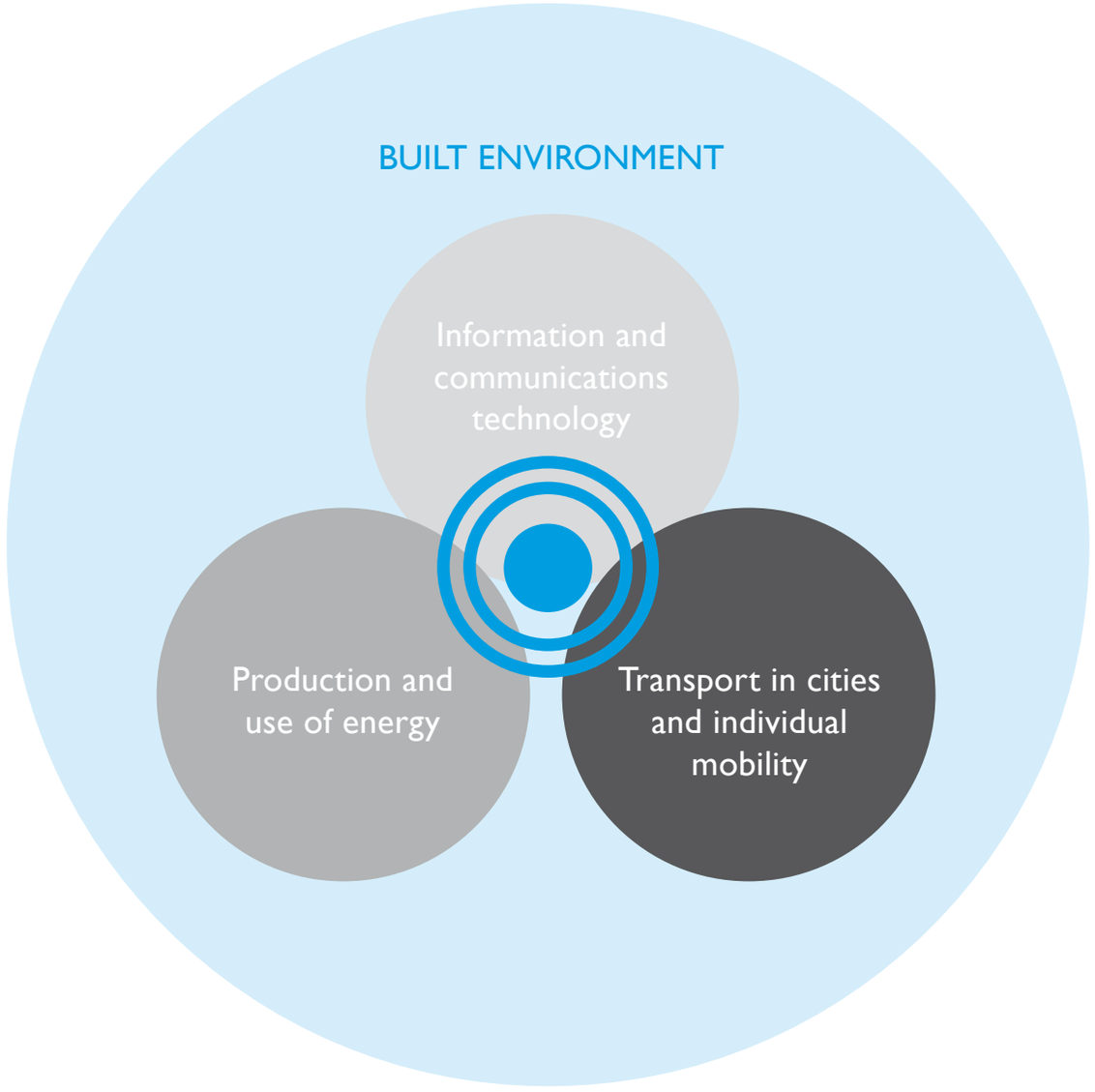
TransSmart relies heavily on the time-tested cooperation between various actors in both the public and private sectors that was developed by its predecessor the TransEco programme. Applying this multi-level framework for studies in transport sector will enable both businesses and the public sector to achieve their goals through collaboration.

TransSmart's external Executive Committee brings together all major parties in the road transport sector, including the ministries (Ministry of Transport and Communications, Ministry of Employment and Economy, Ministry of Finance, Ministry of the Environment), public agencies (TraFi, LiVi), local authorities (HSL), key companies (Neste Oil, St1, Valmet Automotive) as well as interest groups (the Federation of the Oil Importers, the Association of Automobile Importers, SKAL - Finnish Transport and Logistics, and the Federation of Finnish Technology Industries). This tripartite collaboration, involving the public and private sectors as well as the research community, creates a robust foundation for TransSmart's research projects.

Far-sighted decisions on transport energy solutions or the construction of infrastructure for new services should not be made without an adequate knowledge-base. In TransSmart this knowledge-base consists of the collective knowhow built up by research institutes, universities and corporate research activities, including company-led demonstration projects. Some research projects will be set up specifically to provide a company with technical support for demonstration projects.

Projects will be supported during every phase of TransSmart. The best ideas will initially be screened through feasibility studies, after which functional concepts will be designed on the basis of the selected innovations. Demonstrations and pilot projects will also be run to help further develop products for eventual introduction into the market.

Steering mechanisms in the form of incentives, or in some cases obligations, may be needed to help new solutions penetrate the market. Particularly in passenger transport, where the number of decision-makers is high, we must also invest in interactions with end-users in the form of information and training activities. In this respect the programme will largely rely on Motiva's publicity work.



THEMES

LOW-CARBON ENERGY

- Biofuels and other low-carbon fuels
- Energy infrastructure for electric and fuel cell vehicles
- EV fast charging and grid effects
- Energy storages for vehicles

ADVANCED VEHICLES

- Efficient use of vehicles
- New vehicle technology and hybrid power units
- Electric and fuel cell vehicles
- Low-emission commercial vehicles and working machinery
- Clean marine engineering

INTELLIGENT TRANSPORT SERVICES

- Smart collaborative systems and services
- Development of services and business ecosystems
- Multimodal traffic management systems
- Smart systems for cities and transport corridors

THE TRANSPORT SYSTEM

- Transport system foresight
- System-level policies and impact assessments
- Users' values, needs, intentions and approval
- Stakeholder networks and their management

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PROJECT EXAMPLE

COOPERATION AND NETWORKING ON NEW FUEL OPTIONS

Finland has decided to accelerate the introduction of biofuels for transport. The national biofuel distribution obligation will gradually increase to 20% by the year 2020. The underlying idea is that the production of sustainable biofuels will generate profitable new business for Finnish industry, while also leading to significant emission reductions.

A pilot project within the TransSmart programme is bringing together all the main stakeholders including energy companies and vehicle operators, as well as decision-makers at municipal level and in the ministries.

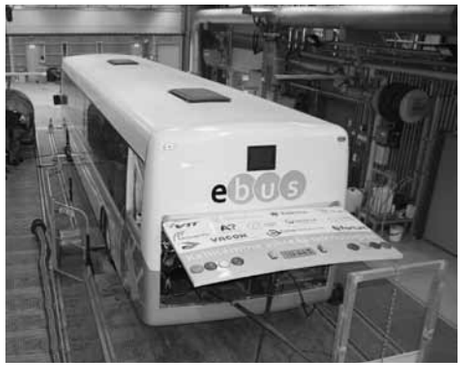
The project is focusing on new biofuels that can replace conventional diesel fuel, as well as new ways to take advantage of biofuels. The project will also create an entire value-chain extending from producers through to distributors and end-users. The project will identify the most cost-effective production methods and uses for various biofuel options. Participating companies will automatically receive information on several parallel options. The project is linked to the International Energy Agency's Advanced Motor Fuels (AMF) research agreement.

The project will also produce new and constantly updated status information that will be used to evaluate and review the viability of Finnish biofuel strategies, and to assess the level to which biofuel distribution obligations should be imposed.

The project consists of three enterprise projects and a supporting research project run by VTT. The project is mainly funded by Tekes. The themes of the company projects are: the use of ethanol in heavy vehicles (NEOT and St1); tall oil-based renewable diesel fuel (UPM Biofuels); and increasing the share of biomethane in heavy-duty vehicles (Itella and Stara/City of Helsinki). VTT's project will focus on new types of biofuels and the development of methods for measuring the exhaust emissions from these alternative fuels, as well as related international cooperation with the International Energy Agency.

In addition to the above-mentioned parties, funding is also being provided by Helsinki Region Transport (HSL), Gasum and Neste Oil. Other partners involved in the project include Helsinki Bus Transport (HelB), Veolia Transport Finland, Scania Suomi, Volvo Trucks Finland and VV-Auto.

PROJECT EXAMPLE



eBUS

eBUS – the field-test and test environment for electric buses – is funded by Tekes, as part of Tekes's own EVE programme and VTT's Electric Commercial Vehicles (ECV) project. The eBUS project consists of two parallel elements: revenue service operations; and an R&D section. It will test electric buses in real Finnish driving conditions, while boosting product development by creating additional research and testing capabilities.

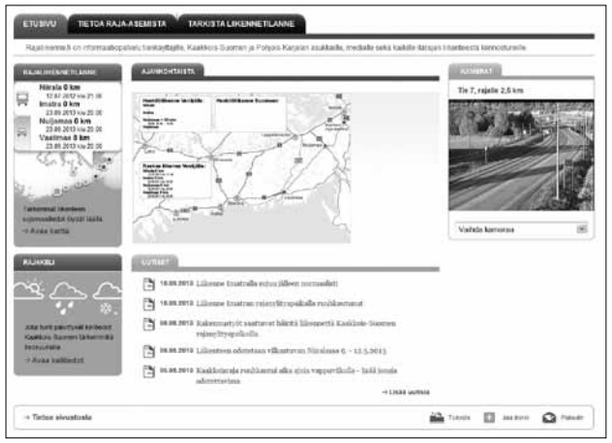
eBUS forms a world-class test environment for the performance of electric buses in the Helsinki Metropolitan Area, with the city of Espoo as the centre of activities. Challenging climatic conditions will add to the uniqueness of the testing environment. The project also benefits from the involvement of key Finnish companies and a major international bus operator (Veolia), as well as research institutions and the public sector. All the project participants are committed to seamless cooperation. The project will also form a valuable contact point for the Finnish electric vehicle cluster and the international automotive industry.

The field-test operations section, led by Veolia Transport Finland, will mainly involve running pre-series electric buses on routes in Espoo. The research and measurement section is managed by VTT, with Helsinki Metropolia University and Aalto University also involved in development work.

As part of the eBUS project a testing and development platform has been created in the form of a "test mule": an electric bus that enables participants to test and develop their components and sub-systems, and benchmark them against competitors' offerings.

The design, dependability and service life of power-line components in buses and heavy-duty electric working machinery is a key area for development, where it is important to build up an understanding of operational profiles and duty-cycles for different practical applications.

eBUS will take advantage of applicable outcomes from the wider ECV project including battery testing and modelling. Subjects for research include charging technologies, losses and their management, working cycles, extreme conditions and thermal management. The ECV project as a whole will enable component and system suppliers to gain experience and test their products both for buses and for electric working machinery, thus providing a valuable reference for demanding applications.



HELSINKI – ST. PETERSBURG: A SMART TRANSPORT CORRIDOR

To enhance the sustainability of traffic and transport, significant changes will be required both in transport systems and in the concept of mobility itself. In addition to developing vehicles, we will need to address people's behaviour related to travel and mobility.

In recent years national transport policy has been reshaped with sustainability to the fore-front. This has brought environmental management and the exploitation of smart systems onto the centre stage. The development of the transport system is now based more clearly on users' needs.

The Helsinki – St. Petersburg Smart Transport Corridor project (FITSRUS) is being realised through Finnish-Russian collaboration. The aim is to improve connections between the two cities initially for road links, and then more widely as the whole corridor, taking into account all modes of transport and issues at border crossings. The project will deploy a wide variety of intelligent services for travel and transport.

The objectives of the FITSRUS project have been agreed at the ministerial level by the two countries' Ministers of Transport through a cooperation agreement signed in 2012. The project is being jointly led by the Finnish Ministry of Transport and Communications and Russia's Ministry of Transport, with a joint executive committee holding overall responsibility.

The Finnish Transport Agency (LiVi) is responsible for implementing and supervising pilot schemes. The Finnish Transport Safety Agency (TraFi) also participates in this work, particularly with regard to the emergency communication system eCall. The consortium carrying out the pilots is led by Vediafi Ltd, with other participants including Corenet, St1, Risk Pointer, Shenguru, Citat, VR, Vaisala and VTT.

The basic concept for the corridor was devised during 2013, when the first piloted collaboratively developed services were also launched, including automatic weather and road condition information services, automated fault management services, real-time traffic information services and various public transport services.

According to the preliminary Finnish-Russian cooperation plan, after the initial pilots for road traffic are realised, developments will be directed for almost for a decade to the entire corridor and its various modes of transport. The cooperation aims particularly to improve mobility, but the idea is also to open up export opportunities around the world for companies from both countries.

PROJECT EXAMPLE

SYSTEMIC CHANGE IN THE TRANSPORT SYSTEM

Smart, low-carbon transport will require large-scale system-level changes. In addition to new technological solutions, systemic change will also necessitate the reshaping of social, cultural, economic and legal factors as well as citizens' behaviour. The TransSmart spear-head programme takes a model of socio-technical change as a starting point for the system-level analysis of the necessary changes.

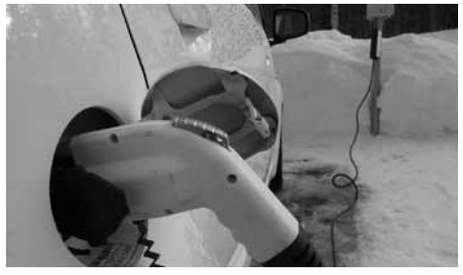
The TransSmart programme will create new tools while also utilising existing research methods for forecasting, impact assessment, modelling and analysing user behaviour. These tools may be applied to steer developments and facilitate well-informed decisions in the public and private sector that will take us towards a smart, low-carbon transport system.

One example of an ongoing smart transport system development project is the Co-Nordic TOP-NEST project, funded by Nordic Energy Research (NER). This project examines systemic change towards a road transport system in 2050 based entirely on renewable energy. Technology platforms and energy sources under consideration include electricity, biofuels and hydrogen. The necessary future value chains and political decisions are being analysed for four different future scenarios.

The ERA-NET project eMap, jointly funded by national transport agencies and the European Commission, meanwhile examines possible implementation paths for the spread of electric vehicles in Europe during the years 2025-2030. This analysis is based on user demand and modelling of the market for electric cars.

Two major EU projects, DriveC2X and TEAM, are developing cooperative systems to improve and increase sustainability in transport together with the automotive industry. These collaborative systems are based on the idea that road users will no longer be just passive recipients of transport information and objects of control, but instead will actively participate in the generation and transmission of information to other users. In addition to technical challenges, such systems face many open questions regarding acceptability, effectiveness, and users' willingness to pay. VTT is responsible for examining these issues.

Through a future-oriented action within the TransSmart programme a roadmap will be drawn up to identify synergies between the programme's four sub-themes and key areas of cooperation, while also determining favourable directions for research addressing related societal challenges.



OUTCOMES

The complex outcomes of the TransSmart programme are intended to benefit various stakeholders. Some findings will deepen the knowledge-base on related issues, and thus serve decision-makers, especially at different levels of the public administration. At the same time they will help us to achieve emission reduction targets and improve the energy efficiency of the transport sector cost-effectively. Some projects also aim to create tangible products, concepts or new service concepts, thus establishing a basis for future business activities. Some of these developments may even progress all the way to the end-user phase with the support of the programme.

The TransSmart programme combines a number of interdisciplinary research themes related to the transport sector, and will help build a network facilitating cooperation between researchers. New and innovative solutions invariably arise when researchers from different backgrounds and fields of expertise work together. Furthermore, the involvement of companies from an early stage in the innovation process gives a good starting point for rapid product development and commercialisation.

Although objectives and policies are decided in the political sphere, in modern society it is generally necessary to act in accordance with market forces and seek the acceptance of consumers. When striving to encourage profound changes in citizens' behaviour we therefore need to pay close attention to the contents of communications, to ensure that the key messages are received and interpreted correctly.

It is a great challenge to describe the complex inter-relationships between the transport system and its impacts well enough to convince ordinary citizens that the need for change is so great that everyone's contribution will be necessary. There will clearly be a need for new actions involving public-private-people partnerships (PPPPs).

www.transsmart.fi

Libris, 300 kpl, 11/2014
ympäristömerkitty
painotuote xxx/xxx

Coordination VTT

Communications Motiva