SMART SOLUTIONS
FROM FINLAND

Tekes

Kuva: Sakari Piippo

Foreword

Finland is a northern, sparsely populated country, where conditions vary greatly between different seasons. Life and traffic must flow smoothly whether the temperature outside is -20 C or +20 C degrees.

These stringent conditions are forcing innovation.The aim of this brochure is to introduce a variety of Finnish smart solutions and projects that Tekes has recently funded. Thematic areas covered are Smart Energy, Smart Building, Smart Transport and services related to these themes. Some Smart City examples are also presented.

Tekes works with the top innovative companies and research units in Finland. Every year, Tekes finances some 1 500 business research and development projects, and almost 600 public research projects at universities, research institutes and universities of applied sciences.

Research, development and innovation funding is targeted to projects that create in the long-term the greatest benefits for the economy and society. Tekes does not derive any financial profit from its activities, nor claim any intellectual proprietary rights.

If you want to know what innovative is going on in Finland and find Finnish partners, please contact Tekes.

Karin Wikman
Program manager
Tekes Witty City –program (2014-2017)
www.tekes.fi

Did you know this about Finland?

- 5,5 million inhabitants. Biggest cities Helsinki (613 000), Espoo (261 000), Tampere (220 000), Vantaa (208 000), Oulu (194 000), Turku (182 000)
- 1st in World Economic Forum's Human Capital index (2015)
- 4th most competitive country in the world (WEF 2015)
- 3rd least corrupted country in the world (Transparency International 2014)
- 1st in learning skill among 15-year olds in Europe (Pisa 2012)
- Most stable society in the world (FPP 2014)
- Best framework conditions for entrepreneurship in Nordic countries (Nordic Growth Entrepreneurship Review 2012)
- Finland is one of the Innovation leaders in the EU (Innovation scorebord 2015).
- Strong commitment to innovation by both the public and private sector. R&D expenditure above 3 % of GDP, about 3% of work force involved in R&D, being one of the highest shares in the world

Companies and projects

Smart Transport

Living Lab Bus
Pay IQ Oy
Linkker Oy
Leanpark Oy
ShareIT Bloxcar Oy
FinBin - Lehtovuori Oy

Smart Energy

Neo-Carbon Energy
Future Flexible Energy Systems
Convion Oy

Smart Buildings

Drumbeat – web enabled construction lifecycle
Power Balance Management
Nuuka Solutions Oy

Smart City Solutions

Smart City Turku
Smart City Jyväskylä
Growth Corridor Finland
Sito Oy
Endev Oy
Dimenteq Oy
Tehomet Oy

SMART TRANSPORT

ACTIVITIES IN FINLAND

The traffic and transport sector is facing major changes. More and more people are seeing their mobility and transportation needs as services they prefer to buy easily. Owning vehicles is not any more a must for the younger generation.

Tekes' Smart City programme focuses on:

Mobility as a Service (MaaS), which means providing a travel service with one ticket from door-to-door, enabling routing, booking, paying etc. with one user-friendly application on your mobile device. Different players are currently running numerous pilots and demonstrations around Finland. There are also many new companies being founded that provide MaaS services.

Autonomous driving (robot cars) is one of the most promising mobility technologies. Owning a car is no longer compulsory when you can simply order a self-driving vehicle to your door when required. Technologies in this area still need development and Tekes is involved in certain infrastructure platform projects where the likes of sensor and communication technologies are being tested in real conditions. These platforms are also open to international enterprises for testing their technologies and service concepts.

Electric vehicles and traffic. All kinds of vehicles will gradually be electrified in the future. Electric passenger vehicles are becoming mainstream in some markets. Public transportation is also most likely going to be electric in the near future. Heavy machinery companies have started to introduce hybrid or pure electric work machines to the market. New businesses have been created that provide services for electric vehicle owners, such as charging. An electric bus manufacturing business has also been launched.

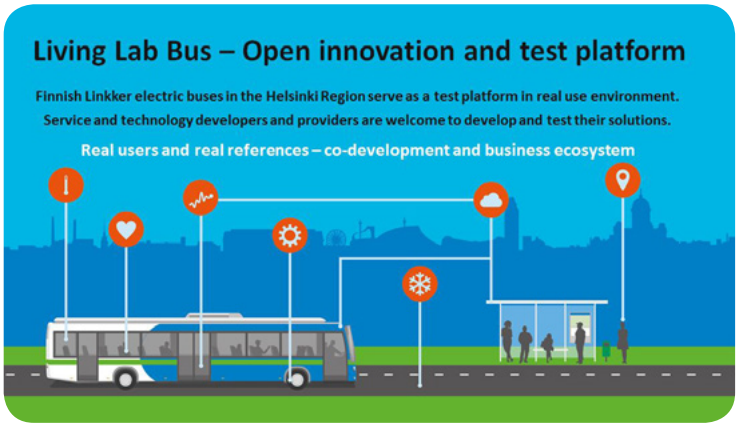
Light (electric) vehicles. More and more people are using light vehicles in their daily life. Cycling has become a very popular form of commuting to work in many countries, also in Finland. A considerable amount of tourism-related income is generated by cycling services. In Finland a new law came into force in 2016 that allows the use of light electric vehicles in public places and lanes. Tekes is involved in many activities where light vehicle businesses are being developed.

Contact person:
Martti Korkiakoski, Tekes
martti.korkiakoski@tekes.fi
phone +358 50 5577 875

Living Lab Bus (LLB) - environment

Living Lab Bus – Innovation and test environment

The Living Lab Bus enables development, testing and demonstration of various services and technologies in a real use environment. A fleet of innovative electric buses in normal operation in the Helsinki Region are used as a concrete test environment. The environment is implemented in co-operation with private companies and research organisations together with the support of the public sector. In addition to those involved from the beginning, third parties are welcome to get in contact to participate and use the platform to test their own solutions.



Consortium: Ajeco Ltd., EEE Innovations Ltd., Foreca Ltd., iQ Payments Inc., Linkker Ltd., HSL, City of Helsinki, City of Tampere, VTT Technical Research Centre of Finland Ltd., Aalto University, University of Tampere, Tampere University of Technology

More information:
www.vtt.fi/sites/livinglabbus/

PayiQ Oy

PayiQ develops cloud-based intelligent mobile solutions for public and private transport utilizing Microsoft Azure technology. We are the leading mobile payment solutions enabler for Mobility as a Service (MaaS) operators. Our focus is on mobile tickets, security and safety serving all travel means including various flavors of shared economy. PayiQ is a Microsoft CityNext Partner and active member in Global MaaS Alliance.

More information:
Tuomo Parjanen
tuomo.parjanen@payiq.net
www.payiq.net

Linkker Oy

Linkker offers an industry driven approach for full transition to zero emission city bus public transport. Linkker's philosophy is to build sustainable battery electric bus systems with low lifetime cost and optimized for production of transport services. Our solutions are energy efficient lightweight electric bus, energy efficient drive line and together with our partners also charging infrastructure.

The combination of lightweight bus construction and energy efficient drive line reduces energy consumption with the benefit of reduced charging times, higher autonomy and longer battery life time.

The City of Copenhagen has chosen Linkker to deliver an emission free electric bus system for a bus line in central Copenhagen. Linkker supplies also the Finnish cities of Turku, Espoo and Helsinki with electric buses, and the knowledge gained from the operations will be shared to accelerate transition in Your City!

More information:
Tom Granvik
tom.granvik@linkkerbus.com
www.linkkerbus.com

Leanpark Oy

Leanpark helps to build better cities with the Leanpark All Vehicle Robotic Parking system. Leanpark increases the efficiency in parking by a factor of 3x to 5x compared to traditional parking. New to 2016, the Leanpark All Vehicle Robotic Parking system supports the widest range of vehicles in the industry, including electric cars and motorcycles. Be ready for the era of electric vehicles with Leanpark All Vehicle Robotic Parking.

More information:
Jukka Riivari
Jukka.Riivari@leanpark.com
www.leanpark.com

Shareit Bloxcar Oy

Shareit car-share aggregator, integral part of MaaS. Shareit is a fast-growing company whose big idea is asset utilization, namely cars. Cars are expensive. Millions of cars sit unused every single day all over the world on rental forecourts and in people's driveways. We want to change all this and make better use of our existing cars, all while earning private car owners and businesses more money. By bringing together cities, online route planners, Maas operators, ride-sharing platforms and car rental companies - and others - under one platform dedicated to the idea of car-sharing and intelligent transport we will change the way people and business think about using and owning cars.

More information:
Paul Nyberg
info@shareit.fi
www.shareit.fi

FINBIN Products/ Lehtovuori Oy

Finbin Products by Lehtovuori Oy provides living environment products and solutions for furnishing public interior and exterior environment. The products represent Finnish design combined with usability and latest technology.

Our product offering of urban furniture, added to our competence and knowledge in designing and solving practical and innovative questions of the living environment, guarantees you the best possible solution.

FINBIN® Care – Smart Urban Furnishing

Finbin® Care -mobile applications connects users of public environment and service providers. Benches, litter bins, light bollards and other urban furniture are equipped with NFC/QR tags which connects a mobile phone directly to the cloud based system. User can give instant feedback and make announcements about maintenance needs for service providers. System provides inventory and location info for the maintenance management.

More information:
Martti Mäyry
martti.mayry@lehtovuori.fi
www.lehtovuori.fi
www.finbin.fi

Smart Bicycle parking

Lehtovuori Oy is running a development project to create a revolutionary solution for bicycle parking. This solution combines different bike-racks, other bicycle storages and digitalization. Bicycle storages open digital platform allows numerous third party applications to create new business opportunities.

These new services could be eg. bike-sharing/renting, combining light traffic and public transport systems. Bicycle parking system will be piloted in the city of Tampere Finland during 2016.

More information:
Arttu Kotilainen
arttu@hbd.fi
www.lehtovuori.fi/bicycle-parking

SMART ENERGY
IN FINLAND

The majority of Finland's population lives in cities and towns. Cities and communities use as much energy as industry. Urban development is therefore of great importance when trying to reduce energy consumption and greenhouse gas emissions.

Finland has a strong energy technology cluster.There are several world-class reserarch teams and many SMEs and large companies working on new and interesting solutions. Clean energy solutions related to decentralized production are considered to be a a significant international business opportunity for Finnish companies.

Smart grid technologies is one key area of interest. Finland is one of the the few European countries where hourly data can be read remotely from the meter.

The majority of the Finnish cleantech business value comes from **energy efficiency** related technologies.

Finland is one of the world's leading users of renewable sources of energy, especially **bioenergy**. The focus is on wood- and bio based bio-fuels, but the interest in **solar energy** and **energy storage** techologies is on the upswing. Solar energy, **geothermal energy, heat pumps** and various bioenergy-related solutions will also complement **district heating and cooling** production.

Focus areas are **solar energy, energy storage, energy efficiency and smart grids**.

Contact:

Karin Wikman
karin.wikman@tekes.fi
+358 50 5577723

Neo-Carbon Energy

An emission-free energy system for the future

Neo-Carbon Energy is creating an entirely new system for generating energy that is emission-free, cost-effective and independent. The aim is to design a system that is based mainly on solar and wind power and make 100% renewable and emission-free energy system possible. A vision of the needs of such a system and its societal impacts is created as well as commercial potential identified.

Among the project focus areas are the development of electricity grid-balancing energy storage technology, integrating and electrifying different energy using sectors (called sector bridging), and thereby solve the intermittency problem of solar and wind energy. The project has for the first time created a global energy internet model capable of simulating the hourly operation of the future energy system. During the project a proof-of concept plant is built that produces fuels from CO2 and water captured from the air.

Our vision:
https://www.youtube.com/watch?v=wcRuTnNYMqI

Consortium:
VTT Technical Research Centre of Finland,
Lappeenranta University of Technology,
University of Turku

More information:
www.neocarbonenergy.fi
facebook.com/neocarbonenergy
Twitter: @neocarbonenergy

Future Flexible Energy Systems

consortium

FLEX^{e} is a consortium in Finland gathering 17 companies and 10 research institutions or universities covering the entire value network of energy systems. The consortium covers a broad spectrum of competences ranging from electrical energy engineering, technological knowhow for energy generation, ICT, and system automation, as well as expertise in energy production, transmission, distribution and usage.

The aim is to create novel technological and business concepts enhancing the radical transition from the current energy systems towards sustainable systems. FLEX^{e} combines smartness, flexibility, environmental performance and economic success with customer acceptance and engagement. The following topics have been selected to be in focus of research:

- Systemic views on the transition to business ecosystems of a future flexible energy system – understanding future demand profiles and the role and value of different flexibility options;
- Optimised and secured integration and operation of future energy networks;
- Flexibility management of distributed resources – increasing efficiency across the whole energy system and supporting active participation of all partners of the system;
- Flexible generation for future energy system – new operational modes for secure, cost-effective, clean and competitive supply.

More information:
http://clicinnovation.fi/activity/flexe/

Convion

Convion is a developer of fuel cell systems for distributed power generation. High temperature fuel cell technology of Convion systems has an industry leading conversion efficiency of >53% net-AC in power range of tens to hundreds of kilowatts and zero local emissions of NOx, SOx, particulate matter or hydrocarbons. These features make possible continuous, base load type power generation in small scale, anywhere, at lowest fuel expenses of all technologies.

Continuously operating Convion fuel cell co-generation systems can be co-located with the loads they serve. Such an approach enables optimal load-matching of generation, minimization of primary energy use and emissions. In addition, on-site co-generation adds redundancy in the source of power without a dedicated back-up system. As key building blocks of micro grids, fuel cell systems provide dependable power and heat for an end user application alongside with intermittent renewables.

Convion technology enables flexible use of different types of fuel gases including biogases. In their power range, Convion systems are superior to conventional technologies in efficiency, maintenance need and interval as well as emissions – providing competitive life cycle costs of ownership. Together with partners, Convion will showcase a replicable concept of waste water treatment and biogas production integrated with on-site co-generation by fuel cells in 2016 in the city of Turing, Italy.

More information:
Tuomas Hakala
tuomas.hakala@convion.fi
www.convion.fi

SMART BUILDING
IN FINLAND

Finland is situated in the northern hemisphere, between the latitudes 60° and 70°. The average temperature in Helsinki on the southern coast of Finland is approximately 6°C and the seasons vary from hot summers to cold and snowy winters. The harsh weather conditions have forced us to be innovative in developing smart and resource-efficient solutions. These solutions highlight advanced concepts for city planning, as well as sustainable and smart living, energy, and mobility services integrated to modern ICT technologies. Sustainable built environment is completed with advanced waste management, lightning and recycling. These themes are not Finnish-specific: they can be shared globally. Buildings and real estates account for approximately half of the total capital and 40 percent of energy and material resources globally. Buildings are becoming smarter and increasingly data intensive.

The Finnish state-of-the-art competence can serve as a base for the solutions that are developed for global needs. Finnish companies and research teams have specific competences in areas like ***Building Information Modeling (BIM), Energy efficient construction, Energy efficient homes*** and ***Home automation, Smart Workplaces and Indoor air quality***. Finnish cities, research teams and companies have progressive activities on developing participatory, sustainable and **digital urban planning** including public-private-people partnership.

We want to remain a forerunner in supplying sustainable innovations also in the future. In the following pages you can find few examples of innovative products, solutions and services related to smart buildings. Tekes provides an easy access to the Finnish innovation ecosystem, and a significant link to Finnish companies that participate actively in different research and development projects. Please feel free to contact the Tekes experts for additional information.

We are at your service!

Contact person:
Jukka Huikari, Tekes
jukka.huikari@tekes.fi
phone +358 50 5577 939

DRUMBEAT

Web-enabled Construction Lifecycle

In the future networked society a Web-based approach to connect building information to other data will make it easily accessible and greatly increases its value. The Drumbeat project takes practical steps to implement the Web of Building Data concept in real industry-driven use cases focusing on different phases of the construction lifecycle: design coordination, supply-chain management and facility management. The ultimate aim is the emergence of an open ecosystem around the Web of Building Data platform; the platform will be provided as open source software, and other companies and student groups will be activated in its use.

Consortium: Aalto University, VTT Technical Research Centre of Finland, Trimble Solutions Oy, Solibri Oy, Parma Oy, Skanska Oy, Granlund Oy, Progman Oy, A-Insinöörit Oy

Contact person:
Markku Kiviniemi
markku.kiviniemi@vtt.fi

Power Balance Management in Consumer Stores and Warehouses

The project is focusing on new balancing power concepts, which are able to use the reactive demand flexibility of buildings and more specificly in consumer stores and warehouses. The need for balancing power is increasing with the increase of wind and solar energy and decrease of fossile-based balancing power.

The project is formed of a group of companies, research organizations, consumer store chain and a grid company, which are together developing a new power balance management business eciosystem and flexible demand based business models. The main driver of the project is the increasing demand response as part of power balance management.

Consortium:
VTT Technical Research Centre of Finland, Oulu University,
Rejlers Oy, Emtele Oy, GEF Oy, Jetitek Oy

Contact person:
Klaus Känsälä, VTT

Internet of Buildings

The Internet of Buildings -project provides a definition for a new industry and its economic and resource benefits. The research provides new information on resource efficiency and renewable energy utilisation possibilities as well as on new products, services and technologies. Internet of Buildings ecosystem will create significant potential for global resource efficiency from the perspective of energy-use management. Know-how in global resource and energy flow management provides the Finnish real estate sector with a world's first product, which they can export onto the global market.

Contact:
Matti Säynäjoki
matti.saynajoki@aalto.fi
Aalto University

Nuuka Solutions Oy

Nuuka Solutions offers a Big Data type of software platform for commercial and public buildings to improve energy efficiency, indoor climate condition and sustainability.

Nuuka SaaS service is a fully device manufacturer-independent system which helps to automatize data collection directly from energy meters, building automation systems, IoT systems, utility and waste companies etc. Building owners can connect different service providers to use Nuuka to improve and streamline their energy and sustainability management processes.

More information:
Mikko Maja
mikko.maja@nuukasolutions.fi
www.nuukasolutions.com

SMART CITY SOLUTIONS
IN FINLAND

Turku – Smart city

The City of Turku aims to be carbon-neutral by 2040 and strongly promotes sustainable energy transition, circular economy and smart mobility.

Mobility as a Service

Turku is a pioneer city in integrating public transport in Mobility as a Service (MaaS) solutions. MaaS combines different transport modes into user-friendly mobility service packages. Regional bus tickets will be included in the local MaaS package (cooperating company: Tuup Oy (FI)). Last-mile-by-taxi pilot cooperation project between regional bus traffic and local taxi operators will start in September 2016 (IQ Payments Oy (FI), INIT Gmbh (DE) and Western Systems Oy (FI)). A new international MaaS project will be launched next autumn together with Madrid, München, Stockholm and Ruse.

The fully integrated mobile ticketing system of regional bus traffic has over 20 000 registered users, and has tickets, monthly passes and reload functionalities to account based products (IQ Payments Oy). The regional bus traffic has an ID based multimodal and integrated ticketing system (INIT Gmbh and Western Systems Oy).

Diverse electric mobility

Turku will introduce electric buses in public transport in August 2016. The bus line from the city center to the port and to the airport will be operated with electric buses. Six buses and two opportunity charging stations will serve the 12 km route with over one million passengers annually (Linkker Oy (FI), Heliox B.V. (NL), Schunk Bahn- und Industrietechnik GmbH (DE), Turun kaupunkiliikenne Oy (FI), Oy Turku Energia – Åbo Energi Ab (FI))).

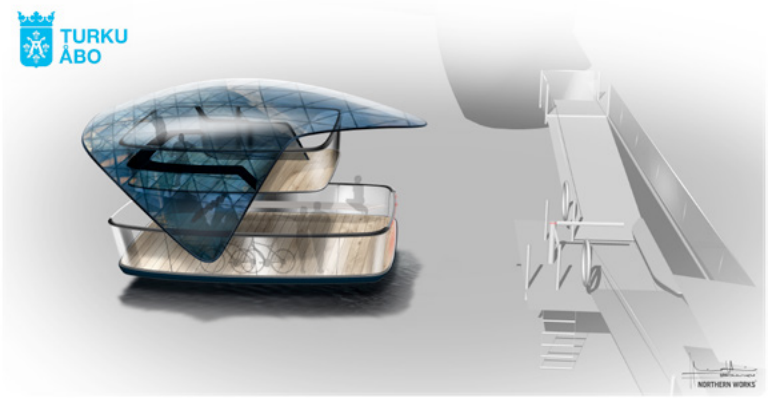
An autonomous passenger ferry is planned for the river Aura with possible connection to Ruissalo Island. The electric ferry functions without crew and is operated from a remote control center. The project is developed in cooperation with Finnish maritime industry, universities and research institutions. An electric funicular railway will connect Aura riverside to Kakola, the 19th century prison area that will be converted into a residential use.

Smart and sustainable Skanssi

Skanssi is a pilot area for smart and sustainable urban development. The building starts this year, and by 2030 Skanssi area will have 8000 residents. Skanssi will have a two-way district heating network, allowing small-scale production and flexible trade of energy (Oy Turku Energia – Åbo Energi Ab). Skanssi will host multifunctional service points, which combine bike sharing, e-vehicle charging and digital screens.

Skanssi is a platform for testing novel solutions like climate friendly asphalt, green roofs, ecological storm water treatment and multi-functional shared spaces. An autonomous bus connection to Kupittaa campus and hospital area is also planned. The experiences from Skanssi can be shared and used elsewhere, both in Turku and abroad.

More information:
Jari Paasikivi, Janne Rinne
jari.paasikivi@turku.fi
janne.rinne@turku.fi



Jyväskylä, City on the Move

Jyväskylä, lively and big on variety, is a leading centre of education, expertise, culture and sport – a city characterised by unspoilt nature and world-class architecture. In central Finland, nearby everything.

Hippos2020 – passion for sports and wellness

Hippos2020 is an unique hub of professional- and amateur sports, wellness and experience in Central Finland. Highest level education and research of sports is situated in Hippos as well as conditions to exercises various sports. It´s gonna be a leading hub of sports research in Northern Europe. In the middle of the city one can exploit all services in downtown Jyväskylä.

Kangas- a living fabric of business and people

Smart and safe Kangas will be the most cyber secure area of the most stable country in the world. The fibre networks are realiable and the sensor data is stored in a common data center. The smart infrastructure benefits homes, businesses, assisted living, energy companies and public services.

Campus FI (Campus Future Innovation)

Campus FI Creates the health and social work products of tomorrow in a customer-oriented and multidisciplinary way. The labratory produces practical solutions for challenges in the field and supports the ongoing process of renewal.

Research, develpoment work, innovation processes and education comprehensively promote the wellbeing of Central Finland`s residents. Innovation acitivity will create a highprofile competence and business cluster for health and social work that is based in the strengths of the region.

More information:
Kari Halinen
kari.halinen@jkl.fi

JYVÄSKYLÄ

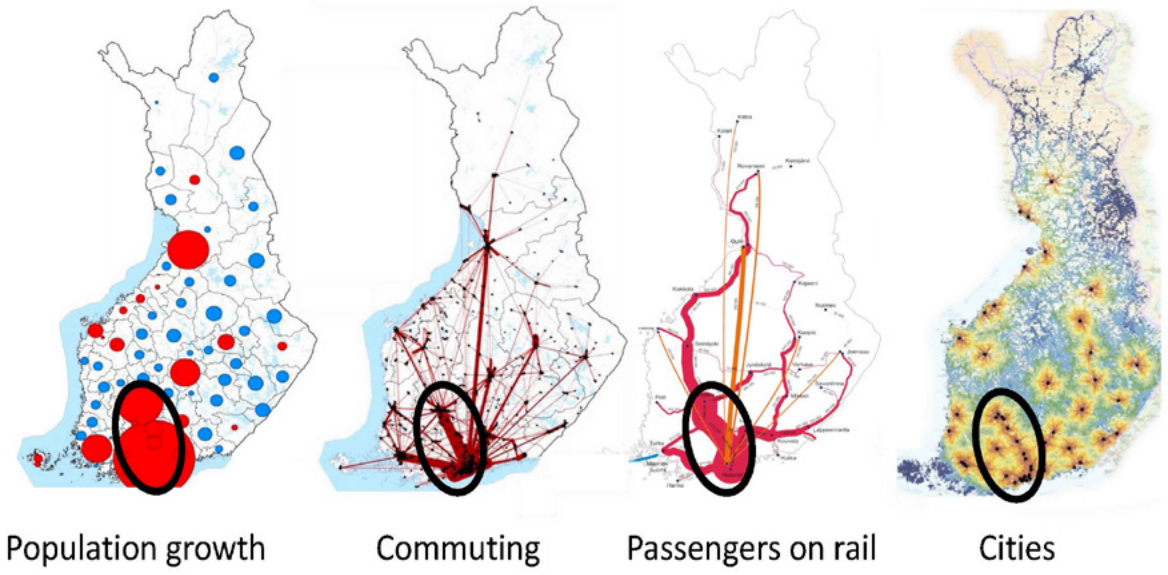
Growth Corridor Finland

Growth Corridor Finland is a network of 20 cities (from Helsinki to Tampere), three Regional Councils, four Chambers of Commerce, the Federation of Finnish Enterprises and four Ministries.

Every third Finn already lives within the area, here are situated 40 % of workplaces and 60 % of all the Finnish R&D -investments are targeted into the area of this corridor. GCF forms the forefront basis of national growth and competitiveness and the biggest pool of workforce in Finland. The network is going to develop Growth Corridor Finland to be the best testbed for intelligent mobility in Europe.

More information:
Anna-Mari Ahonen
anna-mari.ahonen@hameenlinna.fi
www.suomenkasvukaytava.fi

SUOMEN KASVU KÄYTÄVÄ



SITO Oy

Sito is a multitalented company in the field of infrastructure, traffic solutions, logistics, land use, environment and digital services. More than 500 experts offer high-quality services covering the whole of Finland. In addition we have office in Norway and Poland. Our versatile services cover all stages of the design process, from consultation to project management.

We provide comprehensive digital services for all phases of the infrastructure project life cycle. Through our productized, regional or municipality-specific digital cloud services, we improve the maintenance of the basic registers, zoning, building control, and related services provided by municipalities' technical offices, the management of infrastructure property, as well as mobility and transport services. Our mission is to help cities and infra owners to gain cost efficiency by digitalization.

Smart City Solutions:

- Open 4D City Model in City Planning and Building Inspection
- Construction site management with GIS and BI
- e-Commerce solutions for the cities

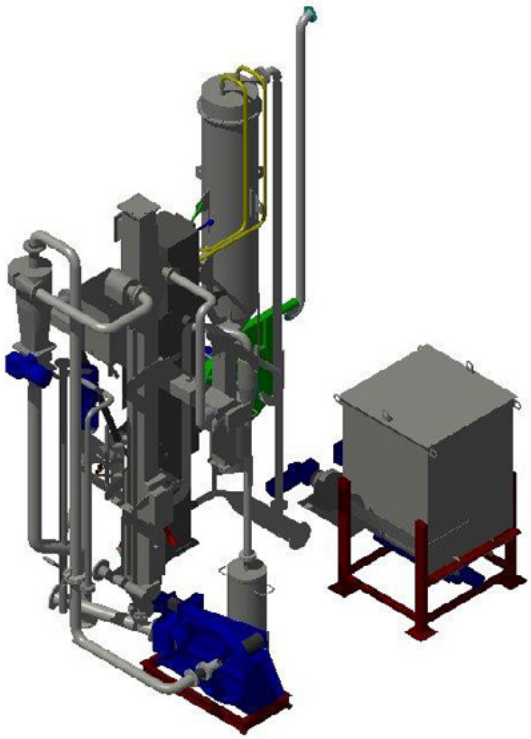
Contact, more information:
Mikko Ristikangas
mikko.ristikangas@sito.fi
www.sito.fi

Endev Oy

Endev's innovative PAKU solution is developed for efficient and cost-effective municipal sludge treatment and disposal on-site. PAKU technology is a sustainable option for high water content materials handling. Solution is based on the patented drying and combustion technology. The need to meet more stringent environmental regulations, to eliminate new kinds of pollutants and recover nutrients are creating pressure on existing waste water treatment solutions.

The PAKU process is energy self-contained and only needs sludge to maintain the combustion. This enables to stop the expensive and un-ecological transport of the sludge to external sludge treatment facilities. The end product of PAKU can be used as a phosphorous fertilizer as micro plastics, hormones, drug residues and other pathogens are incinerated in the process. The combustion process produces also external heat which can be used for e.g. district heating.

Thermal oxidation of the municipal sludge is cost-efficient as PAKU's investment and operating costs are considerably lower compared to other methods of sludge treatment.



More information:
Arttu Laasonen
arttu.laasonen@endev.fi
www.endev.fi

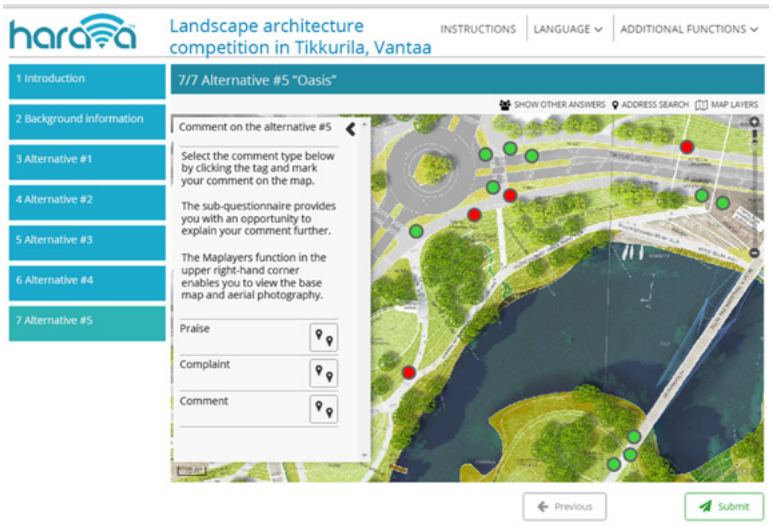
Dimenteq Oy

Dimenteq is an IT services company specializing in GIS solutions. We create tailor-made applications for your business and are dedicated to developing outstanding services with GIS technologies.

Interested in participatory planning? Need help with your planning process? Get to know Harava – a map-based survey tool developed by Dimenteq. Harava provides a smart way to collect data and information from your environment. It is a map-based survey tool that integrates responses with spatial data to make your survey more accurate. Harava supports standard APIs and integrates well with existing GIS architecture.

Harava has been listed among the Good Practices by the UN Human Rights Council in March 2015.

More information:
Juuso Salmu
juuso.salmu@dimenteq.fi
www.dimenteq.fi



Tehomet Oy

Tehomet is the Nordic countries' largest manufacturer of custom steel and wooden light poles and lighting masts. We offer a wide selection of lighting poles manufactured from steel, wood or aluminum.

Our strength is on creating a solutions specially tailored for your unique needs. We have designed and manufactured customized, distinctive architectural outdoor lighting wonders which illuminate and inspire in Nordic regions and across the Europe market areas.

Contact, more information:
Sami Huuskonen
samu.huuskonen@tehomet.com
www.tehomet.com