World-class **sustainable solutions** from Finland

Sustainable Urban Development
Sustainable Buildings
Sustainable Solutions

Content

Finland – The place to innovate

Characteristics for the built environment 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. Due to the harsh weather conditions in Finland, buildings are always built with care, and special attention is paid to energy efficiency.

On an international scale, populated areas in Finland are small and situated far from each other. The relatively long distances result in longer trips to work and to run errands. Building and maintenance costs for the infrastructure are also high, which is a challenge to productivity and efficiency in the markets.

The Finnish innovation environment

Finland offers a first-class innovation and business environment. Starting a business is easy and straightforward, and highly educated people in the labour market enhance opportunities, as well as public research and development funding that is available for businesses.

Finland invests more than 3.4 percent of its GDP in research and development, which makes it one of the most research intensive countries in the world. Public R&D programmes that have an essential role in the Finnish innovation system create significant links between small and large companies, universities and research institutes.

Sustainable building in Finland

Sustainability is the key to well-being in the future. Regardless of the target, sustainability always calls for a balance between societal, economical and ecological issues. This is not an easy equation, but it is doable.

Buildings and construction account for some 40 percent of all energy use and emissions, and the proportion is even higher, if we include transport emissions. Sustainability and energy efficiency of our built environment are of crucial importance when trying to mitigate climate change.

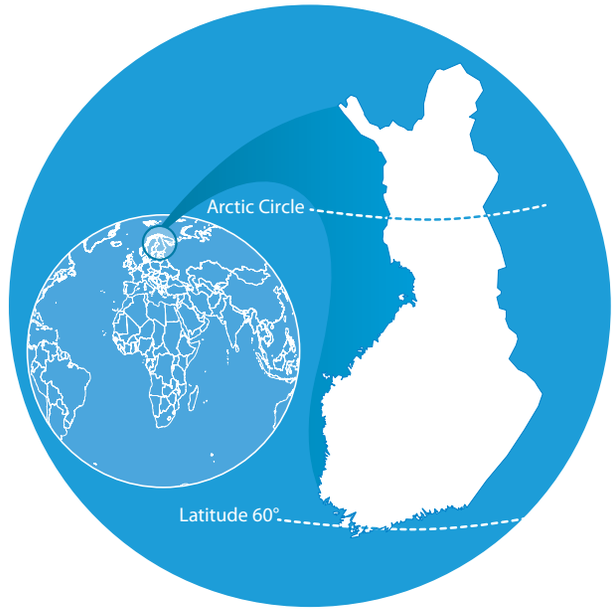
Compared to some other countries, the Finnish building stock is relatively young, well-maintained and energy-efficient. Due to the long and cold winters, Finns have been constructing energy-efficient buildings already for decades. Today, Finnish know-how is on a world-class level.

Sustainability is also good for business. Several construction companies, manufacturers and engineering companies have developed solutions and models that are not only ecologically excellent, but they make sense also economically.

The demand for sustainability is also changing the market. Customers, as well as decision-makers support the transition towards low-carbon society. Building codes guide towards low-energy buildings and local renewable energy production assists in cutting the CO_2 emissions.

After the energy crisis 30 years ago, Finland was a pioneering country in energy efficiency. The action plan **ERA17** for an Energy-Smart Built Environment 2017 encourages Finland to regain its position as the leader in energy-efficient built environments. The ambitious goal is to reach the efficiency requirements set for 2020, already in 2017 that is Finland's centennial year.

Sitra, Tekes and **VTT** have been challenging business and academia to innovate solutions for a sustainable, energy-efficient built environment. Sitra, the Finnish Innovation Fund promotes the stable and balanced development in Finland, the growth of its economy, and its international competitiveness and co-operation. Tekes, the Finnish Funding Agency for Technology and Innovation is the main public funding organisation for research, development and innovation in Finland, boosting wide-ranging innovation activities in



research communities, industry and service sectors. VTT Technical Research Centre of Finland is a globally networked multitechnological applied research organization actively developing and implementing sustainable solutions in Finland and internationally.

In this publication we present Finnish state-of-the-art cases: areas, buildings and solutions that all contribute to sustainability. With world-class expertise Finland has set a target to become the world's best built environment by 2050. Where do you want to be then?

- sitra.fi/en
- tekes.fi/en
- vtt.fi/en
- era17.fi/en

Sustainable Urban Development

improves living and business environments, increases community participation and reduces energy use.

See some examples how we have started to tackle the challenges of the carbon-free future.

Eco-Viikki – Finland's first ecologically designed neighbourhood

Located 8 kilometres north of central Helsinki, Eko-Viikki has been a pioneer in ecological building and sustainable urban planning in Finland. The planning of the area started already in the 1970s, the construction in 1999, and today it is home to 12,000 people. The number of inhabitants will grow by several thousand more once the new residential areas are completed.

Guided by ecological criteria

In planning **Eco-Viikki**, the main goal was to create a sustainable, healthy and comfortable living environment with solutions that save energy and reduce the amount of waste generated. Construction of the area was guided by a special set of ecological criteria and has implemented many pioneering solutions and practices.

Paving the way

The first Finnish apartment buildings to use solar energy, both thermal and photovoltaic, are located in Eco-Viikki. The utilization of solar energy has been

one of the main themes in experimental ecological building in the area. Nine properties containing 412 homes equipped with solar collectors are connected to the district heating system. The collectors produce 15 to 20 percent of the heat needed for hot water, and 5 to 10 percent of the total energy for heating. The first apartment building with photovoltaic system produces approximately 25 percent of electricity consumed by the building (excl. households).

One of Finland's first wooden apartment development projects was carried out in Viikki. It has paved the way for the development of multi-storey buildings based on a timber frame.

Special characters

Eco-Viikki is not only a residential area, but also an environment of many facets. **Viikki Science Park** houses a university building, research institutes, laboratories and business premises. The **University of Helsinki** has one of the campuses there, with the main focus on biosciences. The area has a rural atmosphere with field landscapes and grazing cows – Viikki is also the university´s experimental farming area.

The Viikki Teacher Training School of the University of Helsinki is located in Eco-Viikki. The educational philosophy of the school to teach its students skills and knowledge combined with the location in an ecological environment has helped the school to emphasize sustainable solutions in the everyday life.

The pioneering solutions and practices in Eco-Viikki have guided the sustainable construction and planning ever since they have been implemented. Synenergy Building (Synergia in Finnish), the base for the **Finnish Environment Institute** that is being built in Eco-Viikki is a good example of sustainable modern solutions.

Today, the public and private organizations at Viikki employ more than 4,000 people, and the number will rise to 7,000. The university campus serves some 7,000 students.

▶ en.uuttahelsinkia.fi

Reclaimed harbours become an eco-efficient living environment

The harbours of downtown Helsinki have been relocated beyond the city centre. Reclaimed shorefronts of the inner city are being developed into a new urban residential environment.

In recent years, energy efficiency and sustainable construction have become an integral part of town planning and new area development. These are also the main criteria in the rebuilding of **Jätkäsaari** and **Kalasatama**, two former harbour sites in **Helsinki**.

These sites represent major urban development projects, now at their planning and implementation phase. These projects will lay the foundations for sustainable urban development and construction in the coming decades. Both Jätkäsaari and Kalasatama are ideally located and easily integrated into existing urban structures, public transport, as well as district heating and cooling networks. The goal is to keep the energy use and greenhouse gas emissions as low as possible.

Sustainable solutions in Jätkäsaari

In Jätkäsaari, people will live and work in an urban environment in which they enjoy easy access to a wide selection of services, as well as effective public transport and convenient bicycle routes. The goal is to develop and demonstrate energy-efficient, innovative solutions for low-carbon urban design and

construction. Jätkäsaari will become the home for 16,000 people and workplace for 6,000.

Waste management in the entire Jätkäsaari area will be carried out using an automated pipe collecting system that transports sorted waste underground at high speed.

Low2No directs city planning to sustainability

In a block in the heart of Jätkäsaari, Sitra has launched the **Low2No** project, designed to have as small a carbon footprint as possible. The project will guide construction, operation and maintenance of the mixed-use block, to meet strict specifications for sustainability. The block will have residential buildings, office space and shopping malls. Sitra has far-reaching goals to use the results of the Low2No project for promoting low-carbon residential development and city planning nationally and internationally. Sitra is developing the block in partnership with the construction company **SRV** and the housing company **VVO**.

In this block named Airut, greenhouse gases will be reduced with energy efficiency and on-site production measures, wooden materials, smart controls and reporting expected to enable behavioural change, and with special services and mobility design. In 2009, an international Sustainable Development Design Competition was organised to formulate a concept for combining sustainable development with social and economic viewpoints as well as with high quality architecture.

Development work is ongoing and construction will start in 2012.

Kalasatama showcases ecological solutions

Kalasatama is being developed into a sustainable modern residential and business district on the waterfront. The maritime milieu is ideal for living with effective public transport, while its central location makes it an easily accessible workplace. When completed in the 2030s Kalasatama will house 18,000 residents and offer 10,000 workplaces.

Kalasatama will be built in the middle of an existing compact urban structure, and will make the urban structure of Helsinki even more compact. Effective public transport is one of the benefits of the area. The light traffic network will be extensive, with numerous bicycle paths and pedestrian zones leading to the centre of Helsinki. There will also be an automobile-free block, for ecological living for residents without a car.

On-site and district energy services are being piloted in order to test electric car integration with the grid. Kalasatama's smart grid will allow the energy consumer to be a producer, too. The area will be a testing ground for future smart energy solutions of global significance: **Helsingin Energia**, **Helen Sähköverkko**, **ABB** and **Nokia Siemens Networks** are collaborating on technological innovations in energy, information and telecommunication.

A possible rise in the sea level and unusual weather conditions have been taken into account in planning Kalasatama. The streets will be built at least 2.6 metres above the sea level and the lowest floor level will be approximately 3.5 metres above sea level.

- en.uuttahelsinkia.fi
- low2no.org

Community development facilitating sustainability

City planning solutions depend on many factors: energy supply, food production, traffic and transport, the effects of an ageing population, services, commerce and competitiveness. They also play an important role in facilitating sustainability.

Skaftkärr – an energy-efficient residential area

Skaftkärr is a new residential area under construction in the town of **Porvoo**. It will provide housing for at least 6,000 people. Energy efficiency is the leading principle in planning and building the area. This means that all buildings, services, living conditions, traffic arrangements and waste management will be set up and run in an energy-efficient and sustainable way.

A special Living Lab study will be used to develop heating, ventilation, and air conditioning systems, community service strategies, and energy service concepts. It will also provide the R&D with energy consumption data. All the processes will be developed in collaboration with future residents.

Energy-efficient solutions developed for Skaftkärr will rely on distributed energy generation and renewable district heat. **Porvoon Energia Oy**, the local energy company already produces 70 percent of district heating from renewable energy sources. Investments in biopower and solar energy will raise the share to 90 percent. Experimental passive and low energy buildings will be constructed in the area and they will be used in developing business models for sustainable construction.

Inspired by the Skaftkärr project, the town of Porvoo has launched a multifaceted action plan that will systematically take Porvoo towards carbon-free housing.

Sibbesborg, a competition for sustainable development

Sibbesborg is situated 30 kilometres east of the centre of Helsinki in the municipality of **Sipoo**. Today only some 3,000 people live in the area of 26 km^2, but Sibbesborg is due to be transformed into a small town with 70,000 to 100,000 inhabitants. Located next to the growing capital of Finland, Sibbesborg is ideally placed to become a model for sustainable urban planning.

Sipoo has launched an open international competition for sustainable development of the Sibbesborg area. The competition format is interactive, allowing residents and experts opportunities to influence the objectives, the agenda and the principles of evaluation from the very beginning. Land use targets, sustainable societal development and local values will form the basis of the planning. Ideas and approaches have been collected in several workshops. With this competition a new concept for architectural competitions is being developed, in which the entries convert aspects of sustainable community development into practical solutions.

▶ skaftkarr.fi/en
▶ sibbesborg.net

Off the grid, carbon neutral community

In the model community of locality, a group of inhabitants of the same area form an entity to invest in a shared ownership for off the grid, carbonneutral energy generation. The area may possess attractive energy resources, for example wind or biomass that can be locally exploited. Studies show that locally owned projects bring more local benefits in the construction stage because more sub contracting and services are purchased locally.

Kempele Eco-block, far in the North

A good example of a community of locality is the **Eco-block in Kempele**, a municipality in northern Finland near the Arctic Circle. All of the energy needs of buildings in the block are met by a small-scale CHP (Combined Heat and Power) plant and wind generator. The plant delivered by **Fortel Components Oy**, produces 30 kilowatts of electricity and 90 kilowatts of heat by burning locally available biomass, such as wood chips to cover all energy need of the houses in the block.

The households in the Kempele Eco-block live off the grid, meaning that they are totally independent of electricity produced elsewhere. All the electricity generated by the biomass plant is consumed in the block, and all the heat produced is used for heating the houses in the block.

The heating network is implemented as a low-temperature system to minimize heat losses. The Eco-block consists of ten detached houses – all them are built to meet the low-energy level. All the households are equipped with energy-efficient domestic appliance to keep the energy consumption low.

The block has shown that it is possible to live off the grid without compromising comfort, even in a harsh climate. The last houses in the block were completed in summer 2010. Its district heating network has been in operation since 2009.

Easy living and well-designed public transport, core goals in urban planning

Dialogue and open competitions for development are the driving forces in planning and designing modern urban areas. Transforming an old urban neighbourhood into a modern attractive environment takes more effort.

Renewal of Peltosaari

The town of **Riihimäki** in southern Finland has actively sought new solutions for renewing one of its neighbourhoods. **Peltosaari** was built rapidly in the 1970s and 1980s, when Riihimäki's population was growing. It now faces socio-economic problems, and the value of the property has decreased. There are many energy-wasteful apartment buildings requiring renovation. It has ceased to be an appealing and attractive place to live, although its location is excellent, with good public transport.

Riihimäki has tackled the problems in Peltosaari in numerous ways, such as by multi-disciplinary research and encouraging dialogue between architects, planning experts, developers, builders and residents in the area.

Applicable ideas by competition

A competition for ideas on renewing Peltosaari was organized by Riihimäki in the beginning of 2011. The competition produced around 60 entries that now serve as a basis for decision-making and planning. Pilot buildings have been used to show technical alternatives to

improve eco-efficiency, overall performance and architectural solutions.

VTT calculated the costs and benefits of the building stock, demolition and reconstruction of buildings in poor condition and development of services. The refurbishment and development is calculated to cost 80 to 90 million euros. Improvements are estimated to bring annual savings of approximately 2 million euros in energy costs, and a value increase of 100 million euros. Technology will cut the heating need by at least 70 percent and will utilize renewable energy sources. The rise in value will result from extensions to buildings and infill construction, as well as new jobs and services created in the renewed, attractive urban area.

Good practices from the Peltosaari urban area will be utilized as a model in urban planning also elsewhere in Finland.

Vuores, a forerunner in urban planning

Vuores is a new urban area in **Tampere**, Central Finland that is planned to showcase a high quality of life and good accessibility by public transport to downtown Tampere and the nearby university campus. There will also be good access to surrounding forests and high-tech business parks. The area will contain innovative energy production systems and new housing solutions. In Vuores, cutting-edge technology is being integrated into the environment.

The residential buildings are being designed to be energy-efficient and their lifecycle to be long. Several research and development projects are underway in Vuores, ensuring energy efficiency and promoting the use of renewable sources such as wind, solar and geothermal energy. The buildings will meet the new code requirements in advance and be nearly zero-energy buildings. New possibilities in timber construction are also being explored: there will be a whole block of wooden residential buildings, the largest one in Finland with 500 to 700 apartments.

Dialogue and various competitions have helped promote cooperation in high-quality planning, design and construction.

The first residential buildings are being built for 1,000 people, and the attractive boulevard was inaugurated in the summer of 2011.

When completed in 2020, the area will house 13,500 inhabitants and offer 6,000 jobs. The **Finnish Housing Fair** in 2012 will be arranged in Vuores with the themes of garden city and eco-efficient living.

▶ vuores.fi

ECO_2 leads Tampere towards a carbon neutral city

The city of Tampere has launched ECO_2 – a programme for an Eco-efficient Tampere in 2020. It aims at avoiding the increase of greenhouse gas emissions that would otherwise result from the growth of the city's population. The programme will promote a low-carbon and carbon-neutral urban structure.

ECO_2 not only coordinates and supports the implementation of climate and energy objectives in **Tampere**, but also encourages growth in the environment business, with the emphasis on cleantech, energy saving, renewable energy and eco-efficient construction.

One of the key goals is to get decision-makers, management and employees in Tampere urban planning to generate solutions that support low-carbon and carbon-neutral structures.

Tampere to spread good practices

Tampere has taken a long term commitment to be a forerunner in climate policy and participate in national and international networks that spread good practices.

The city has taken concrete decisions that aim at an eco-efficient urban life:

- It will decrease emissions by more than 20 percent by 2020 and by more than 40 percent per capita by 2030.
- The Tampere Power Utility, owned by the city, has resolved to cut the use of fossil fuels and increase the share of renewable energy resources to 80 percent by 2040.

Tampere is tackling climate goals in many ways.The city requires that all new buildings meet, or beat, the requirements of category A of the energy performance certificate.

Several passive and nearly zero-energy houses will be constructed for the Housing Fair 2012 that will showcase modern eco-efficient housing solutions.

The new district of Vuores will contain Finland's largest block of wooden residential houses. Eco-efficiency has been the leading force in developing the district.

Suburbs of Nurmi-Sorila, Niemenranta and Härmälänranta target at carbon neutrality.

Tampere will start a renovation programme in old residential areas to improve their energy performance.

The city centre will have a sports and concert arena with the world´s highest rating of BREEAM, a leading green building design and assessment method.

The city will also launch a new Sustainable Building Centre that will provide information and guidance on energy-efficient construction and housing.

Accurate facts behind the decisions

To assist in taking far-reaching decisions, Tampere has launched several research studies in the ECO_2 programme to support future urban development, planning and decision-making. ECO_2 cooperates with a wide network of partners, such as **VTT**, **Tampere University of Technology**, **Aalto University, Tekes**, **Sitra**, **Skanska**, **YIT**, **NCC**, **Tredea** and **Hermia**.

▶ eco2.fi/en

Making the impossible possible

Five Finnish municipalities have resolved to act as pioneers in curbing their greenhouse gas emissions ahead of the schedule set by the European Union. This ground-breaking initiative involves Mynämäki, Uusikaupunki, Kuhmoinen, Padasjoki and Parikkala.

In 2008, five municipalities decided to cut their greenhouse gas emissions by more than the EU target. By 2010, they have taken over 70 initiatives to enhance energy efficiency, save energy, use renewable energy sources, and make sustainable investments. A further 60+ measures are being planned.

They aim to achieve carbon neutrality by 2030. At that time their greenhouse gas emissions will be at least 80 percent less than in 2007.

In the **CANEMU** project (Carbon Neutral Municipalities, HINKU in Finnish), researchers, businesses, politicians and residents are working together to devise and adapt solutions that will reduce emissions, especially in housing, transportation, as well as in food products and processing. All the municipalities are seeking to increase the use of renewable energy and to improve material and energy efficiency.

Devoi Ltd. was one of the driving forces to launch CANEMU project in 2008.

Good results by wide collaboration

Alongside a broad network of experts from other research institutes and enterprises, the Finnish Environment Institute **SYKE** is supporting the CANEMU project. Work previously carried out separately is now viewed as being part of a larger entity, while contributing to a common goal.

Tens of companies are actively participating in the initiative.

The project has identified a number of factors that contribute to successful emission reduction. One is the commitment of municipal leaders, who understand that emission reduction is an opportunity for the municipal economy and business life. The town of Uusikaupunki informs that the project has created 150 new jobs.

Measures for curbing emissions must extend to all municipal sectors and decision-making. Enterprises need tools for improving their energy efficiency and reducing the carbon footprints of their products. Enterprises and citizens alike need reliable information on suitable energy solutions. One good example is **Yara Suomi Oy** in Uusikaupunki that has been able to reduce greenhouse gas emissions by 90 percent in the plant that produces fertilizers.

All five municipalities are deeply committed in the project. They have improved energy efficiency in their premises and area lighting. Uusikapunki has shown the best results by reducing emissions by 14 percent by 2010 compared to the level in 2007.

The municipalities have converted their own fossil-fuel-fired heating and power plants to renewable energy, and at the same time they have encouraged households to utilize renewable energy solutions, such as geothermal heating.

- environment.fi/canemu
- devoi.fi

Sustainable Buildings

include measures to reduce energy use.

Energy-efficient building concepts are viable in harsh weather conditions in Finland. The following examples show, how we have tackled some of the challenges.

Energy-efficient houses in a cold climate

Energy Performance of Buildings Directive recast by the European Union requires that all new buildings need to fulfill the principle of a nearly zero-energy building as of the beginning of 2021. Such buildings, and even net zero-energy buildings, are achievable in the cold Finnish climate.

Latitude 62° – Perfect place for a solar house

The **IEA5 Solar House**, located in **Pietarsaari** in the northwestern coast of Finland was built already in 1994, in connection with the International Energy Agency's Solar Heating and Cooling programme. The aim was to build a house with as low energy use as possible, by utilizing the best technology available at the time. Good indoor climate and comfortable living conditions headed the list of requirements for the design.

Solar heat, geothermal heat and solar electricity together with a high insulation level and low-energy windows are the main features of VTT's concept design of the house. Although the technical systems were performing well, the ventilation system with heat recovery and the geothermal heat pump were upgraded a few years ago. This helped to reduce the energy use even more. VTT's regular follow-ups show that IEA5's total delivered energy use is now approximately 50 percent less and the net energy need for heating approximately 30 percent less than that of a normal single-family house built in 2010.

The net heated floor area of the solar

house is 166 m^2. The building has an extremely well insulated timber frame envelope. All necessary technical systems are in the centre of the two storied house, thus making it possible to utilize the heat loss of the equipment in the heating of the house. The heat distribution system is water based underfloor heating.

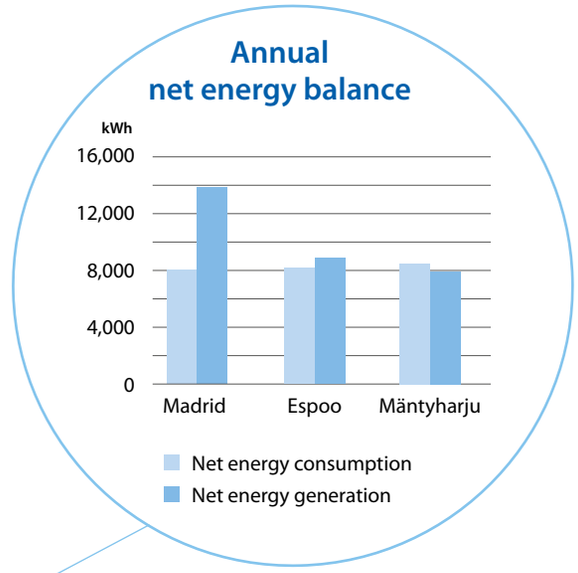
The inhabitants of the house are able to monitor and control the performance of the house via internet even when travelling abroad.

The building's photovoltaic system consists of 45 amorphous silicon solar panels with a capacity of 2 kW. The produced electricity is fed to a local grid. When the plans to replace the existing system with a similar 8 kW capacity system are realized, the electricity generation of the building will exceed its electricity use – turning this northern nearly-zero energy house into a net-zero energy building.

Certified house concept for the cold climate

Paroc Passive House concept is a Northern European concept for a cold climate. The development project has been run by Paroc and VTT. The goal was to set passive house requirements for northern buildings based on the requirements set by the Promotion of the European Passive Houses project. The Finnish project includes a number of pilot buildings in Finland, Sweden and Lithuania. The pilot buildings will be monitored for several years in order to verify the simulated values.

The project has also contained the development of a certification scheme for passive houses for cold climate. This includes requirements for the energy efficiency of the building envelope: air-tightness, heating energy need and total delivered energy use, and excellent indoor air quality. Paroc Passive house concept is the first passive house concept certified by VTT according to these requirements.



Zero-energy in Helsinki, plus energy in Madrid

The **Aalto University** team designed and constructed a solar-powered zero-energy house for the Solar Decathlon Europe 2010 competition. The target was to create a grid-connected house, which would function as a net zero-energy building in Finland and as a net plus-energy building in Madrid, where the final of the competition was organised in June 2010. The **Luukku** house was awarded the first prize in the Solar Decathlon Europe Competition 2010 for Architecture. The final location of the house is in Mäntyharju, Finland.

The energy is generated in 60 m^2 of photovoltaic panels and 5 m^2 of solar thermal collectors, installed on the roof. According to the simulation results, both net energy balance targets can be met with average solar gains.

The Luukku house presents a concept for a net zero-energy building in the northern climate, using the sun as the only source of energy. The results are useful when evaluating the challenges set by the European Energy Performance of Buildings Directive (EPBD), which sets a target that all new construction should be nearly zero energy in the member countries of the European Union from 2020 onwards.

- energiaviisastalo.fi/energywise/en
- sdfinland.com

Green concepts in snow-white surroundings

Recent experiences in Finland prove that it is possible to build zero-energy buildings at high latitudes. And this does not apply to single-family houses only: at the moment public buildings, commercial buildings as well as apartment houses are being built. They are both energy-efficient and cost-efficient. The most northern example of green buildings can be found in Lapland, 150 kilometres above the Arctic Circle.

Low-energy building concept hooks up with wood

Construction company **Reponen Oy** built its first low-energy apartments in 2005. Today, the company is one of the leading experts in constructing energy-efficient apartment buildings in Finland. The company has developed its own concept for passive house construction in close co-operation with, VTT. The concept brings up to 70 percent savings in total energy consumption, compared to a normal high-rise building.

The concept is simple: a well-insulated and extremely airtight envelope (doors, walls, windows,) together with an efficient heat recovery of the ventilation system. The heating energy demand varies from 20 to 30 kWh/m^2 depending on location and targets (passive or low energy).

The company has built the first low-energy high-rise in Finland in 2009. VTT monitors the building's energy and water consumption, as well as the inside and outside temperatures and humidity of the 31 apartments. The measurements have shown that the indoor air quality is good, and the energy consumption is far below the current EU regulations.

The concept is now being enhanced with ecological wood construction: Reponen is raising Finland's first five-storey wooden apartment building in Vierumäki, near Lahti, in southern Finland. With a small carbon footprint, the hybrid wooden apartment building with 27 homes is being constructed as a passive house.

Net zero-energy buildings in high latitudes

Two net-zero apartment buildings with basically similar architecture were constructed in Finland, in Kuopio (latitude 62,9° and in Järvenpää (latitude 60,5°). These buildings have proven that a zero-energy building is possible at high latitudes.

The Kuopio apartment building is owned by **Kuopas**, **Kuopio Student Housing Company** and the Järvenpää building by **Järvenpään Mestariasaunnot Oy**.

The preliminary cost analysis at Järvenpää shows that the extra costs of the net zero energy approach are in the range of 10 to 15 percent. As the extra costs of the basic solution for a zero-energy building vary between 2 and 5 percent compared to typical apartment houses, further development will lower the extra costs for the net zero-energy approach to 10 percent or even less.

Office buildings take a green stand

Ecologically sustainable, cost-effective and well-designed – all these and much more are the new head-offices of three prominent Finnish organizations. All three offices provide a good working environment for the employees, while expressing the green values of the organization and setting an example on environmentally sound construction and design.

Vaisala is a global leader in environmental and industrial measurement. Headquartered in Finland, the company employs around 1,350 professionals all over the world. From the very beginning, the new head office in the city of Vantaa was designed to be both energy-efficient and self-sufficient.

Over 700 m^2 of photovoltaic panels generate almost 20 percent of the building's electricity consumption. The solar power generation amounts to 100 MWh annually, making the building one of the largest energy producers in Finland. An extensive geothermal power system produces the bulk of the energy needed to heat and cool the building.

Vaisala's own technology is put to good use in the building, as well. Innovative instruments form a part of the heavy-duty automated ventilating and air conditioning system.

Vaisala equipment is also used to monitor the weather conditions outside the office building. A snow-melting device uses geothermal energy to keep the courtyard free of snow during the winter.

The new office building achieved a LEED for New Construction at Gold level in 2011.

A glimmer of light

The new **Pilke House** in Rovaniemi is an example of top expertise in ecological wood construction and a masterpiece of Finnish architecture. The building houses **Metsähallitus**, a state enterprise responsible for managing and using the state-owned land and water areas in a way that benefits Finnish society to the greatest extent possible. The word "pilke" refers to small firewood or the glimmer of sun – or to a twinkle of humour in one's eye.

Pilke includes office premises for 135 employees and a Science Centre that showcases the sustainable use of northern forests. In the construction phase, the carbon emissions of the wooden house are only one third compared to a concrete or steel building of the same size. The house is connected to the district heating network of the city. Its air-conditioning system is based on heat recovery.

Feel the pulse

Synergy Building (Synergia in Finnish) in Viikki, Helsinki, will be the future office and laboratory building for the **Finnish Environment Institute**, also

known as **SYKE** (Pulse in English). The building project is led by **Senate Properties**, which provides workspace services for state organizations.

The environmental experts and the whole personnel of SYKE have participated in determining the aims and design solutions for the building. The overall aim was to design an ecologically sustainable building that forms an excellent working environment, as well as to create good practices for the public building sector in Finland. The massive wooden construction for over 600 employees will have a low carbon footprint and the objective is to achieve an nearly zero energy building applied to the location. The scheduled completion is 2014–2015.

Synergy Building is based on the winning entry in the international design competition in which six teams prepared the comprehensive design of approximately 20,000 m^2 office and laboratory building.

The assessment criteria had four main categories with equal importance

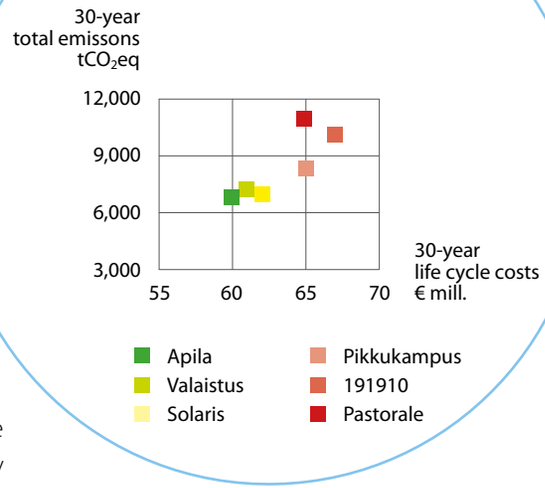
- Ecological sustainability including energy performance and material efficiency
- Urban and architectural quality
- Usability
- Feasibility

One of the innovations of the competition was to sum up the energy performance and material efficiency data in $kgCO_2/m^2$ in the assessment process.

The competition results showed that the inclusion of quantitative energy performance, material efficiency and economic efficiency targets will direct the design and selected concepts from the very first steps of the design teams. Best entries were able to sum up high architectural quality, good functionality, energy and material efficiency as well as cost efficiency.

As concluded by the jury, there was no need to select between ecologically efficient and cost-efficient entries – moreover the selection was made within the group of entries being both ecologically and cost-efficient.

Comparison of entries



Emission-free shopping

Äkäslompolo and Ylläs may not be the easiest place names to pronounce for a visitor to Finland, but the places themselves are worth visiting. Not only for skiers, but also for those interested in environmental issues and low-energy commercial buildings. The village of Äkäslompolo, next to Ylläs fell, is namely the home for **Jouni's Store**, a northern mall with a supermarket, restaurants, gift shops, cafes – and fresh green ideas.

During the recent extension project, the village shop was fitted with a state-of-the-art heating and cooling system. The system operates solely with renewable energy and with heat recovered from the store's own refrigeration equipment. Geothermal energy for both heating and cooling comes from boreholes drilled into the bedrock. Internal and external energy sources are channelled into the premises through a low-energy centre. The integrated building services system was supplied by **Are**.

The refrigeration equipment and freezers inside the store use only clean CO_2 as a coolant. The CO_2 is recovered from other processes, before it has a chance to burden the environment.

The inventive system reduces emissions that cause climate change, saves up energy and helps to cut back energy costs. In addition, it allows comfortable indoor temperature and good indoor air quality inside the store.

Two other low-energy commercial buildings on a much larger scale are in process in other parts of Finland. In Pori, an old cotton factory is being turned into an emission-free shopping mall and culture centre by the real estate invesment company **Renor Ltd**. The new mall called **Puuvilla** (Finnish for "cotton") will use available natural resources, thermal and solar energy, for both heating and cooling. Energy is distributed evenly through a central energy station to places where it is needed – and just the right amount. If there is no need for heating, extra heat will be directed underground for storage. This will boost the building's overall energy efficiency.

A new home equipment store for **Kodin Ykkönen** department store chain is now in the planning phase in southern Finland. This pilot project will develop guidelines for the design and construction of a very-low-energy commercial building. The selected energy saving measures include an energy-efficient lighting system, efficient heat recovery from the outlet air and increased air-tightness of the building envelope. The project will also examine the utilization of renewable energy sources. The research partners are VTT and Kimmo Lylykangas Architects.

Homes for the elderly, moulded to energy efficiency

Typically homes for senior citizens are buildings of high energy use. When reducing their use of heat and electricity, it is very important that air quality and living comfort remain high.

In the centre of Lahti, a nearly zero-energy home for the elderly, **Onnelanpolku** (Path of Happiness) based on VTT's concept solutions will be built in stages in 2012–2014. The energy solutions will be based on district heating, demand reduction measures, effective heat recovery and on-site renewable energy production.

This project will produce a model and design principles for very-low-energy buildings for elderly people. Moreover, it will provide information about the dynamics of energy use in large building entities.

- vaisala.com
- sciencecentre-pilke.fi
- environment.fi/eco-officebuilding
- kauppakeskuspuuvilla.fi/en/
- kuopas.fi
- are.fi
- renor.fi
- senaatti.fi

A nature-friendly logistics centre runs on geoenergy

Big is beautiful at SOK company's new and huge logistics centre, the size of ten Finnish parliament buildings put together. The big centre will host the country's biggest hybrid heat pump plant built so far.

SOK's new logistics centre is under way in Helsinki's neighbouring town in Sipoo. The 75,000 m^2 building will be finished in 2012. The energy needed for heating and cooling the vast facilities comes from a hybrid heat pump plant built in conjunction with the centre. The plant uses almost solely renewable energy sources: geothermal energy, solar energy and bioenergy from wood pellets provide over 90 percent of the annual energy consumption (approximately 20 GWh) of the centre.

Geothermal heat comes from over 150 boreholes drilled into the granite rock under the building. Each well is 300 meters deep – a record depth in Finland. The rock works like a battery: geothermal heat and solar accumulate heat inside the rock during the summer, and in winter time the rock releases the saved-up energy. In summer, the centre utilizes free cooling energy from inside the rock.

The extra energy needed to heat the logistics centre in winter comes from wood pellets. In addition, there are two hectares of solar energy collectors integrated in the concrete envelope. Two oil-fired boilers, were built just in case – for peak load situations in winter.

The geothermical energy field in Sipoo covers 8.3 hectares and is the largest one yet in Finland. The investment costs are approximately two million euros, on top of it comes the investment of the heating plant with oil-fired boilers. However, once the field is operating, the energy it produces is both renewable and nearly carbon neutral. The whole plant's CO_2 emissions are approximately 400 tons per year, compared to the 6,000 tons emitted by a district heat plant producing the same amount of energy from fossil fuels.

The unique energy system was developed in close co-operation with client SOK, **Fortum Power Division** and the **Geological Survey of Finland** (GTK).

Sustainable Solutions

LED applications, solar energy systems, advanced heating and cooling…

Learn more about how our solutions for sustainability could help you.

Strong expertise in interdisciplinary LED applications

There are approximately 30 companies specializing in LED applications in Finland. Most of them provide solutions that require interdisciplinary expertise, and special competence and know-how in application management. Finnish companies represent globally the cutting edge in LED applications for greenhouses, aviation obstacle lights, architectural lights, parking garage and street lights.

First in the world

Obelux Oy was the first company to release a LED Aviation Obstacle Light System in 1996 and to set a new standard for the whole industry. Today, the company is installing the first high intensity obstacle lights using LED technology in the television mast of Tiirismaa. With 327 metres, the mast is the highest structure in Finland.

In the obstacle light solutions, the LED technology supplied by Obelux has proven to be extremely reliable and long lasting, even in harsh Nordic weather conditions. The expected lifetime is more than 10 years – an advantage that is especially remarkable in applications on sites that are very difficult to access. The company supplies LED solutions for entertainment and architectural lights, too. These solutions are able to produce more than 16 million different colourful shades of lights.

More than light

Valoya Oy supplies LED lighting to greenhouses. The LED lights produce exactly the light that plants need, and thus bring savings in electricity

consumption. Compared to traditional High Pressure Sodium lamps and fluorescent tubes, the better light spectrum of Valoya LED lights also improves the quality of crop and enables faster growth times.

The LED lights have been developed in interdisciplinary research projects that have combined the company´s advanced LED expertise with leading horticultural and photobiological know-how of Valoya's own scientists and research partners. The results of energy savings and improved quality have also been proven in large scale customer installations.

The Valoya LED solutions are currently in production use with leading plant growers in 13 countries.

Energy savings and road safety

Lumi Group has developed innovative LED solutions for street and area lighting. The company offers the latest technology that combines high quality lighting and energy efficiency.

Trends towards energy savings and sustainable development bring radical changes in lighting applications in the near future. It is not only energy savings, but road safety that efficient LED lighting solutions can improve significantly.

In the comparison tests carried out in the Nordics, the LED lighting systems delivered by LUMI Group have been rated especially well.

Short payback periods

Greenlux Finland Oy has specialized in LED solutions for large office and public buildings, such as parking garages, warehouses and storages.

The company has several public building references in Sweden. In 2009 Greenlux supplied first LED lighting systems to the Stockhom-Arlanda Airport that has high goals in environmental performance. After the first delivery there have been many more. The customer reports 50 to 80 percent energy savings compared to old lighting systems. A large part of the savings is achieved because the LED product life cycle requires less maintenance. The investments have had a payback period of less than three years.

- obelux.com
- valoya.com
- lumi-group.fi
- greenlux.fi

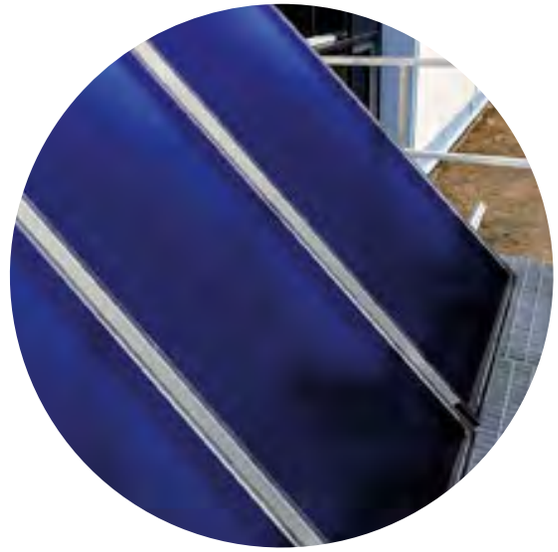
New swimming pool has more under the surface

Sun and water mix well in the new public swimming complex in the city of Pori on the west coast of Finland. This is the first indoors swimming pool in the country to use solar energy on a larger scale. The project has given guidelines for future solar energy building schemes in the city.

The west coast is one of the sunniest regions in Finland. No wonder, then, that Pori, a city of some 83,000 inhabitants, comes up with bright ideas on how to utilize solar energy in buildings. The new public swimming pool, opened in September 2011, is an example of the city's new approaches to fighting climate change.

The thermal collectors and photovoltaic panels producing energy for heating and electricity cover over 600 m^2 of the complex. There are 200 m^2 of solar collectors and 360 m^2 of photovoltaic panels on the roof, and a completely new solar system (80 m^2) is integrated into the building´s southern facade.

The architectonically integrated solar thermal system by **Aurubis Finland Oy** (former Luvata Rolled Products) is tailor-made to fit into the architecture of the complex. It integrates the copper envelope of the building with a hidden solar thermal energy system on the underside. The system has been optimized to balance the energy yield and use of available surface area.



The solar thermal collectors on the roof of the complex heat the pool water in the seven pools. The collectors yield approximately 120,000 kWh of thermal energy per year, about 5 percent of the total energy needed to heat the water. The photovoltaic panels on the roof generate some 45,000 kWh of electricity annually; this covers 3 percent of the actual need.

Although solar energy can replace only a fraction of the total energy need of the complex, the project is an indication of the environmentally friendly building in full swing in Finnish cities and municipalities.

More bright ideas on solar energy

The future of the growing solar thermal industry lies in new applications. **Savo-Solar Oy** is introducing to the market a top technology solar collector that produces more energy during its lifetime compared to any traditional collectors.

The patented vacuum nanocoating and coating process together make it possible to coat the complete absorber that is found inside a solar collector. Because of this the company was able to design the absorber in a completely new way – thus making it more energy-efficient and stronger. The new invention received the Intersolar Award in the field of solar thermal energy in Germany in June 2011.

Savo-Solar's direct-flow collectors assure a superior heat transfer from the absorber to the fluid as well as uniform heat distribution on the absorber surface, which minimizes radiation losses. The collectors can be integrated in single-family houses, industrial buildings and in district heating plants. The company, based in the town of Mikkeli in eastern Finland, has an annual coating capacity of one million square metres.

- aurubis.com
- savosolar.fi

Helsinki – a cool city with a smart heating system

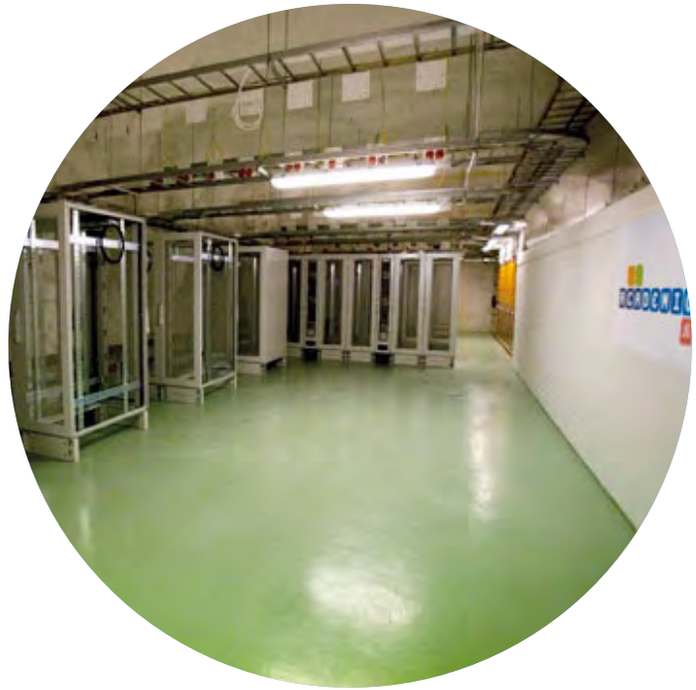
Helsinki has an impressive district heating network of over 1,300 kilometres. Add to that combined heat and power production, and you have the recipe for the world's best energy efficiency in cogeneration.

To top this, Helsinki has the world's largest heat pump that produces district heating and cooling in a single process. The unique system, situated in a rock tunnel some 25 m underground, uses both sea water and purified waste water for cooling and heating purposes. As a result, the CO_2 emissions of the plant are 80 percent smaller than those of an alternative production solution.

Helsingin Energia, the energy company of the city of Helsinki, produces electricity and district heat by combined heat and power (CHP) generation. In CHP plants, the energy contained in the fuel can be utilized almost totally, which means a high energy-efficiency of over 90 percent. With CHP, Helsinki saves each year an amount of energy corresponding to the annual heat requirement of 270,000 detached houses.

At the same time, overall emissions are substantially reduced. Carbon dioxide emissions from energy production are 35 percent lower in cogeneration than in separate production.

With the help of the comprehensive network, district heating covers approximately 93 percent of the capital



city's heating energy requirement. District heating is also used to produce hot service water for the cold capital.

In addition to CHP, a process called tri-generation is used at one of the company's plants, with district cooling produced in the same process as heat and electricity.

The need for cooling has increased rapidly in Helsinki in recent years. It is supplied to office buildings, shopping centres, computer rooms and apartment buildings.

Helsingin Energia's new solution takes computer halls into an eco-efficient age: the computers are cooled by district cooling, and the heat produced by the machines can be piped into the district heating network to heat buildings in Helsinki.

As a result, district cooling is considerably expanding in Helsinki. In fact, the network in Helsinki is the third largest and most rapidly growing system in Europe. 80 percent of the city's district cooling is produced from energy sources that would otherwise be unused, such as sea water and unused thermal energy. With the system, the city achieves significant energy savings and is able to reduce CO_2 emissions in the area.

Green IT-solutions

The central idea in district cooling and heating is to transfer surplus heat where it is needed. One example of this is the data centre solution, which has received a lot of international attention: the heat produced by computers is transmitted to the district heating network.

Academica Oy's services include a data centre where customer companies can place their servers in safe keeping. A lot of energy is needed both to run the computers and to keep them cool. In the company's data centre in Helsinki, heat pumps are used to feed the surplus heat caused by the machines into the district heating network, and from there on to heat the residences and service water around Helsinki.

At **Tieto** company, the computer room is cooled by heat pumps, and the heat from the servers is used by the local district heating company to heat homes in the city of Espoo. The data centre produces approximately 30 GWh of heat energy per year, about the same amount that is needed to keep warm 1,500 one-family houses. In this way, there is less need for energy production based on fossil fuels and, consequently, 10,000 tons less CO_2 emissions.

- www.helen.fi/energy
- tieto.com
- academica.fi/academica-brief

Better data on buildings and their environmental impact

Smart 3D for better quality

Construction group **Skanska** and its design partners are applying Building Information Modelling BIM to their office construction projects. BIM is a three-dimensional virtual model that contains detailed information about the layout of the building, its components and materials and their main characteristics.

Virtual modelling results in a better managed and fine-tuned construction process. It is a way of eliminating possible errors during the design stages. Using BIM, construction can be simulated on a computer before the building work begins.

Modelling yields a wealth of data on building spaces and materials. This data can be utilised by all parties in the project. Skanska uses BIM for visualising the building, calculating quantities and costs, procurement, scheduling and production planning. Modelling brings better quality and efficiency. The customer can use the virtual model in applying for permits, allocating floor space, marketing and post-construction maintenance. When the building is complete, the model is passed on to the customer.

BIM can also be used for assessing the environmental impact of alternative designs. For example, the carbon footprint of construction materials can be defined at the design stage based on the carbon sequestered in them.

Skanska is building an office centre in Helsinki that will also house the company's head office in Finland. The project is applying BIM to integrate construction design, building services and space planning.

BIM is applied for the first time in energy-efficient urban planning in the city of Tampere. In this **Härmälänranta** case modelling performs alternative calculations to estimate how size, height and location contribute to energy efficiency.

Environmental classification and sustainability assessment in use

Environmental classification system for buildings has been developed and implemented in Finland since 1998. When the development started, none of the existing rating schemes was found applicable, and a national system, called **PromisE** was developed. The first version

applied for existing building stock, such as offices, residential buildings and retail stores, was taken into practice in 2002. Three years later, a version for new buildings was introduced. Today, also LEED and BREEAM are used, mainly for retail and office buildings.

Finland has been active in international standardization and development in sustainability of buildings. In the European Union, VTT coordinates the **SuPerBuildings** project that develops and selects sustainability indicators and assessment methods as well as benchmarks sustainable buildings. While present sustainable building rating systems are applied in branding and for designers, there is a growing demand for more quantitative sustainability indicators.

VTT is also having an important role in number of other European sustainable building related research activities, e.g. in the areas of very low- and zero-energy buildings, sustainable renovation and performance and value measurement.

At present, there is an increasing demand for quantifiable systems, such as carbon metrics. The goal is to pass from check lists towards values that can be benchmarked. **Environmental estimator** for building design (ILMARI) calculates the environmental impact with the help of quantity take-off and manually defined quantities. The estimation covers the "cradle to gate" phases, assessed transportations, installation losses and the renewal periods during the defined service life. The environmental impacts of materials are mainly based on the Finnish environmental declarations of building materials. The information is completed with generic data developed by VTT.

EcoPass calculates the sustainability of holiday homes

EcoPass developed by VTT assesses the eco-efficiency of holiday homes using six different indicators, such as location and accessibility, energy consumption, use of renewable energy, carbon footprint of construction, sorting and recycling of solid waste, and water supply and sewerage.

A similar approach was developed for holiday resorts. The aim is to tackle a resort area as a whole. The environmental classification of the area includes location and transport, infrastructure, natural environment, services in the area, and energy as assessment categories.

Eco-efficiency points (total eco-efficiency)

points	value category	CLASSIFICATION
110 or more	top value	A+
105–109.9	exellent	A
95–104.9	good	B
86–94.9	normal	C
75–85.9	sufficient	D
below 75	weak	E

HEKO to assess eco-efficient urban development

The **HEKO** tool is an urban development assessment tool developed for the City of Helsinki. The tool is based on the interpretation of the hard core of sustainable development, such as ecological sustainability, environmental imperative and eco-efficiency. The issues that are assessed by the HEKO tool are land, water, energy, transport and services, as well as carbon and material cycles.

Improved working conditions

A sustainable work environment is economical. It means that the space available for the organisation is optimal for its purposes and needs. Moreover, sustainability requires flexibility and utilization of resources in a smart way.

New ways of working and solutions that support them should result in improved employee satisfaction and working conditions. More effective use of the space and reduction of the need to travel are expected to bring economic and environmental benefits.

VTT has launched a project with the target of transforming VTT's work environment: building a "next generation" workplace with a diverse portfolio of renewed spaces and places to serve VTT professionals, tools and software to facilitate communication between different sites, partners and team members, and management and human capital practices to glue it all together.

Finnish sustainability concepts in international markets

Sustainable, modern urban living in China

DigiEcoCity™, a unique Finnish city concept, is being implemented in China. The aim is to create cities that combine the innovations of digital technology with sustainable development.

The first two urban DigiEcoCity areas are being built in southeast China – one in Gongqing, Jiangxi province, and the other in Danyang, Jiangsu province. Both will be home for 100,000 inhabitants once completed in the late 2010s. Additional projects are under discussion in the Beijing and Shanghai areas.

The DigiEcoCity concept combines the principles of sustainable development, the innovations of the digital revolution, and the urban functions that provide the framework for a good life in a garden city environment.

The use of solar, geothermal and bioenergy sources, automatic waste management, recycling and energy conservation, low energy lighting as well as water and sewage systems will be implemented in a sustainable and feasible way.

Digital solutions make cities more ecological, because virtual services can re-

duce and partially replace traditional physical operations, such as bank buildings. Digital innovations can transform ways of working, healthcare and schooling.

The concept has been developed in collaboration between Finnish and Chinese experts. The DigiEcoCity projects create significant business opportunities for enterprises in design, planning, construction and operation. Involvement of Chinese companies, with their local competencies in technology, business understanding and consumer requirements, is vital for these projects.

In Gongqing, the Regulatory Plan that set guidelines for land use and main infrastructure systems has been finalized and the project is moving forward into detail planning and first phase infrastructure development.

EcoCity – A hub for technological creativity and innovation amid unspoiled nature

The Miaofeng Mountain Town EcoCity will be built in Beijing's Mentougou district, in China. The EcoCity area, in the scenic Miaofeng mountain area, covers 17 villages of varying sizes. The Finnish experts that have been active in promoting the project in China claim that the city will not pollute its surroundings and will use a minimum amount of natural resources.

The Mentougou **EcoCity** concept includes innovative and ecological town planning, energy-efficient housing and low-waste living, a closed water system, integrated telecommunications, low-emission passenger traffic, efficient waste management and recycling, and emission-free local power production based on solar, wind and bio-energy. The architecture and positions of the buildings will conform to the site's natural topography and characteristics, and will be situated around small bodies of water. Modular homes will climb the mountain sides, blending into the landscape.

Ecological city planning in St. Petersburg

Finnish competence in modern city planning has been applied in the **EcoGrad** project in St. Petersburg. The objective of the project was to develop a design concept for eco-efficient districts in this Russian metropolis. The concept is founded on the GOLD (Globally Optimized, Locally Designed) principle, meaning that local conditions have been taken into account while applying globally optimized solutions.

The EcoGrad concept focuses on dense city development, minimum power consumption, maximum use of renewable energy sources, minimum need for travel, maximum use of public transportation and sustainable solutions for waste and sewage management. The development project has involved local residents in the planning process, which is unusual in Russia.

Wuxi Grand Theatre

An opera house designed by the Finnish architectural company, **PES-Architects**, is rising in the city of Wuxi, 150 kilometres north-west of Shanghai. Construction began in 2009 and will be completed by the end of 2011.

Wuxi Grand Theatre is a comprehensive landmark of Finnish architecture, design and engineering.

Waste management by smart pneumatic collection technology

A good example is the automated waste collection system developed by **Mari-Matic Oy**. This novel system consumes only one third of the energy of conventional pneumatic waste collection solutions, and even 40 percent less than traditional truck and container based collection method. This new technology efficiently minimizes the problems of odour, noise, and fine particles.

The most significant innovation of the system is the reduction the of pipe diameter from conventional 500 mm to 200 mm. The pipe size reduction has been achieved through the development of a formator unit; a device that reshapes waste bags to fit into a smaller pipe. Smaller pipe size enables fast and economical installation, requiring up to 25 percent less investment compared to competing pneumatic collection solutions. Smaller pipe diameter also allows the system to be easily retrofitted into the existing city or community structure. Other major innovations introduced by MariMatic Oy include composite piping

material that significantly reduces installation time and prolongs pipeline lifetime, and a ring-line pipe structure that further reduces energy consumption.

Ecosir Group is another Finnish company designing and supplying automated vacuum pipeline collecting systems for waste management. Since 2005, the company has delivered systems that can be used to transport one or several fractions of waste, such as energy, cardboard, organic and mixed. The first solution was built in Helsinki, at the Kamppi shopping centre and its apartment houses.

Ecosir Group has delivered advanced waste collecting systems and its technology know-how to all major hospitals, public buildings and shopping centres in Finland and to the international applications for the Beijing Summer Olympics in 2008, the Expo 2009 Shanghai and Beijing City 2010 in China among other deliveries in Denmark, Russia and the Middle East.

Modular solutions combine sustainable and cozy living

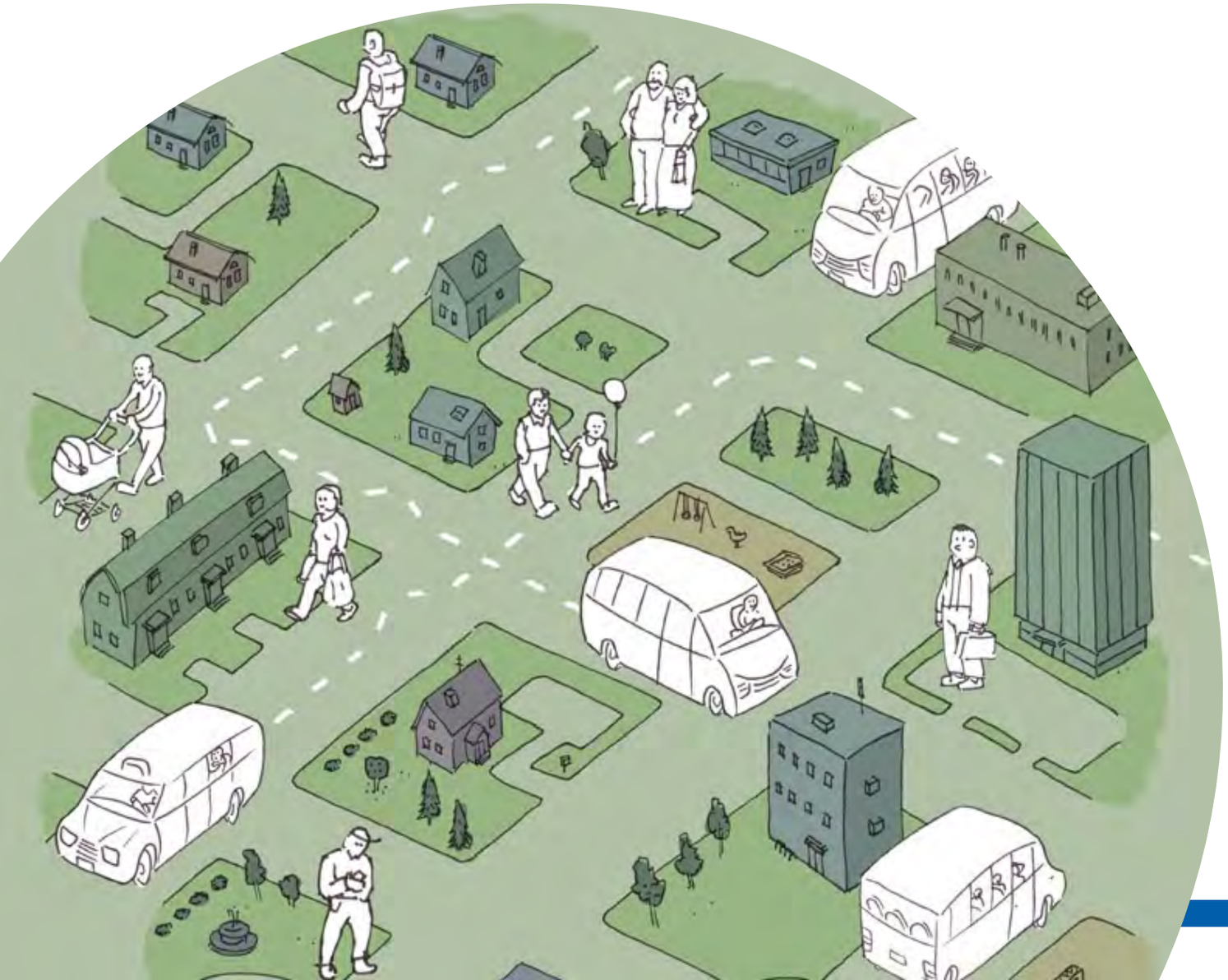
Modular construction solutions represent an industrial breakthrough for construction. They combine next-generation steel core panel technology and the tested modular construction methods used in the shipbuilding industry. The modules, delivered by a Finnish company **NEAPO Corporation**, have been utilized in multi-storey residential buildings.

Prefabricated modules are delivered to the construction site and installed in one piece. Each module contains a pipe-cased shaft for utilities including ventilation, water, electricity and drainage. The modules have a steel sandwich structure that is especially beneficial to the environment, because it is 100 percent recyclable. During the construction process, energy use is nearly 40 percent lower and the carbon dioxide emissions nearly 60 percent lower than the industry average.

- digiecocity.com
- pesark.com
- marimatic.fi
- ecosir.com
- neapo.fi/en

Revolutionizing the urban transport

The modern Demand Responsive Transport (DRT) system based on state-of-the-art IT infrastructure will open a new avenue for urban transport. Positioned as a complementary service, the system does not compete with traditional public transport.



Public transport is a necessity in urban areas, as it provides mobility to those not using private cars. However, the problem is that a large number of urban travellers do not see public transport as a real alternative for private cars.

The modern DRT system called Metropol combines the social, economic and environmental benefits of the bus service with the high quality service of a private car. It does not require advance reservations while the users can rely that the service is available even if the request is immediate. How is this possible?

Current information and communication technology (ICT) has enhanced possibilities to offer economically viable DRT services with special characters in

urban areas. Thanks to modern ICT that enables real-time communication between a fleet of minibuses, customers and a central dispatching system, the DRT service developed at Aalto University operates in real time, in a fully automatic fashion. The customers make the requests using a handheld mobile device, such as a smart phone.

Smart system provides alternative routes

For each customer´s request the DRT service computes a set of alternative trips to the destination and communicates a few best ones to the customer who selects the most suitable one. The prices of the proposals can vary and are determined on the basis of the promised quality of service for each proposal.

The real-time service is offered from stop-to-stop. Since the stop density can be high, the walking distance from home to stop is at most some hundred metres, even in sparsely populated areas. The service is competitive, because many customers are sharing the ride simultaneously. It is scalable to serve high demand densities of urban metropolitan areas with fleet of thousands of vehicles. The higher the demand and vehicle density, the better the quality and the economic efficiency of the service will be. Still, the scalability enables the well-functioning service also in low-density rural areas.

Ajelo Oy, a private Finnish company has been established to pilot and commercialize this state-of-the-art DRT service. The service is being piloted in the Helsinki Metropolitan area by Ajelo, **Aalto University**, **Helsinki Region Transport** and the **Finnish Transport Agency**.

▶ ajelo.com

Photos: Academica, Ajelo, City of Helsinki, City of Tampere, DigiEcoCity, Ecosir, Fortel Components, Greenlux, Pekka Huovila, Esa Kyyrö, Teemu Lehtinen, Low2No, LUMI Group, Marimatic, Jyri Nieminen, Jakke Nikkarinen, Obelux, Paroc, Peltosaari, PES-Architects, Olli-Pekka Pietiläinen, Reponen, Jarmo Roiko-Jokela, Jouni Saaristo, Sarianna Salminen, Savo-Solar, SOK, Kaarina Toivonen, Vaisala, Valoya and Taneli Varis.
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World-class **sustainable solutions** from Finland

Sustainability is the key to well-being in the future. Sitra, Tekes and VTT have been challenging Finnish business and academia to innovate solutions for a sustainable, energy-efficient built environment.

In this publication we present Finnish state-of-the-art cases that empower sustainability.

SITRA Tekes VTT