



# VTT Review 2014



# CONTENTS

3	Review by the President & CEO
4	Technology for business
5	Examples of research results
6	Knowledge Intensive Products and Services
10	Smart Industry and Energy Systems
14	Solutions for Natural Resources and Environment
18	We are building Finland's future together with our partners
20	VTT's research programmes – turning challenges into opportunities
21	International and domestic cooperation
26	VTT's R&D facilities – an essential part of the national research infrastructure
27	Services for enterprises – big and small
28	Sustainability and responsibility
30	VTT has power
32	Awards and prizes
32	VTT Impulse and VTT Newsletter
33	VTT publications
34	Business development, commercialisation
35	VTT's know-how to create new growth for Finnish companies
36	VTT in figures
38	VTT became a limited liability company January 1, 2015
38	Organisation

The research examples presented in this review represent only a small fraction of VTT's activities, although they do provide some idea of the many and varied ways in which VTT's know-how influences technical development in Finland.

# Review by the President & CEO

**2014** was a watershed in the history of innovation policy. Rather than resulting in the activation of research and innovation, our industrial sector's long-standing struggle for a new competitive edge led to cost-cutting, which also affected investment in R&D. Fortunately, there were some exceptions to this!

Last year was also historical in the sense that public sector investment in competences, technology and innovation was redirected towards an evaluation of societal phenomena which are, to be sure, important in themselves. However, it is not easy to see the connection between these phenomena and the competitiveness of the business sector. The solutions implemented have led to the major restructuring of research organisations, with the permanent loss of significant competences. Only time will tell whether these solutions were the right ones.

Last year was an exceptional one for VTT as well. Our era as a government agency, which began in 1942, came to an end. We can now face the future as a more streamlined organisation. I am certain that VTT's transition from agency to limited liability company represents a major step forward for the entire Finnish innovation system. Even if it does not change VTT as an innovation player, this new arrangement will enable greater flexibility. In the beginning of 2015, the amalgamation of VTT and the Centre for Metrology and Accreditation MIKES – the national metrology institute of Finland – brought a nice addition to our expertise.

VTT will remain a research organisation which needs significant budget funding in order to break new technological ground. A well-functioning scientific research organisation must be prepared to take risks. The roles of research facilities and equipment are also emphasised in our selected focus areas. The share of budget funding must remain at a healthy level i.e. 40 - 50% of all of our funding. Of course, our collaboration with the private sector is a key metric of the impact of our operations. But what share of our activities can be accounted for by company-driven services? Although there is no right answer to this, around 30% of overall funding sounds about right.

**” I am certain that VTT's transition from agency to limited liability company represents a major step forward for the entire Finnish innovation system.**



The future looks bright for VTT. Positive signals are emerging from our customer base and major new opportunities have presented themselves. We are building a better tomorrow based on cooperation between various parties, which embraces both the university and private sectors.

Erkki KM Leppävuori,  
President & CEO

# Technology for business



**88%**

confirmed that a VTT project had speeded up or otherwise improved research and development work<sup>1</sup>.

The challenges of the future are today's opportunities. By providing research and innovation services that enhance the international competitiveness of companies, society and other customers, VTT creates the prerequisites for sustainable growth, employment and wellbeing in society.

We have identified six areas of research and technology through which we can help to meet the environmental, societal and economic challenges of the future: bioeconomy, low carbon and smart energy, wellbeing, resource-efficient production, clean world and digitalisation. As well as meeting global challenges, these important areas provide opportunities for new business activities and growth. Our service covers the entire innovation process, from idea through to commercialisation. We devote over 4,000,000 hours of brainpower a year to the development of technological advances.

By engaging in collaboration with us, you can promote the creation of new businesses, improve current processes, practices and products and boost the productivity of your R&D activities. We offer our customers and partners multidisciplinary and in-depth scientific, technological and business competences, unique research facilities and equipment, and extensive Finnish and international partnership networks. We create tailored solutions meeting each partner's needs in close cooperation with the customer.

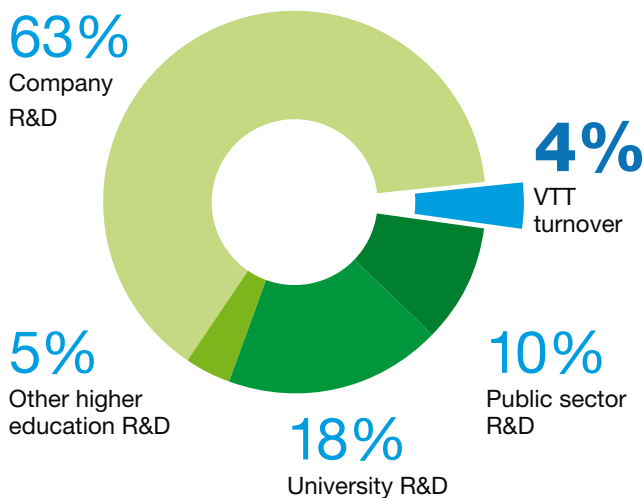
VTT is a key operator in both Finnish and international innovation networks and organisations. We play a major role in connecting Finnish companies and other players with European value chains and EU projects.

VTT gets technological results due to its strong, internationally respected scientific pedigree. Based on its expertise,

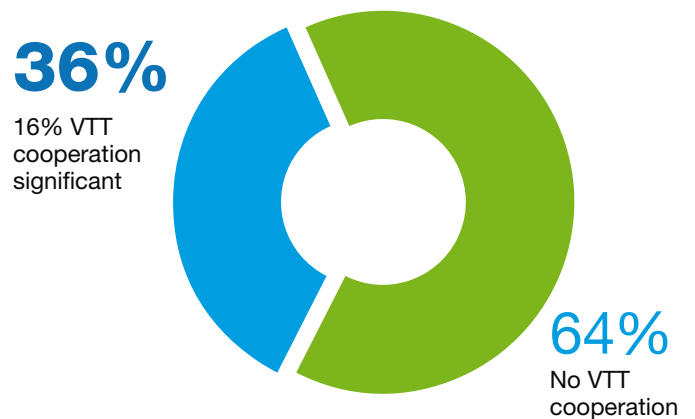
<sup>1</sup> Taloustutkimus Oy, VTT Customer Survey 2014. Share of survey respondents who had this benefit as their goal in their VTT project and felt that the benefit was generated in the project.

# THE MORE DEMANDING THE INNOVATION, THE GREATER OUR CUSTOMERS ESTIMATE VTT'S ROLE IN ITS DEVELOPMENT

**FINLAND: R&D EXPENDITURE,  
TOTAL VOLUME 6.8 BILLION €<sup>2</sup>**



**VTT HAS PLAYED A ROLE IN 36% OF FINNISH  
INNOVATIONS<sup>3</sup>**



VTT has generated solutions worth hundreds of millions of euros; our customers and society have used such solutions to improve productivity and create wellbeing. Our impacts on growth, employment and wellbeing are mainly achieved by improving the competitiveness of our customers. Through our activities, we have an impact on companies, the innovation environment and society.

36% of Finnish innovations contain VTT expertise.

According to the 2014 customer survey, our customers were highly successful in attaining their objectives through their VTT projects: 88% stated that a VTT project had accelerated or otherwise boosted their research and development work. 56% reported that their competitiveness had improved as a result of a VTT project.

## Mission

VTT produces research services that enhance the international competitiveness of companies, society and other customers at the most important stages of their innovation process, and thereby creates the prerequisites for growth, employment and well-being.

## Core values


- Together for the client
- One step ahead
- Passion for innovation
- Support and respect to the core

<sup>2</sup> Statistics Finland: R&D expenditure in 2012.

<sup>3</sup> Loikkanen, T. et al. Roles, effectiveness, and impact of VTT. Towards broad-based impact monitoring of a research and technology organisation. 2013. VTT, Espoo. VTT Technology 113. 106 p. + app. 5 p. <http://www.vtt.fi/inf/pdf/technology/2013/T113.pdf>

# Knowledge Intensive Products and Services

• U.S.-dollar-valued worldwide IT spending in 2015 is forecast to grow by 2.4% and be USD 3,200 billion • Public IT cloud services spending was to reach USD 47.4 billion and was expected to have a CAGR of 23% • Worldwide combined shipments of PCs, tablets, ultramobiles and mobile phones are projected to reach 2.5 billion units in 2014, a 7 percent increase from 2013 • The global spending on online games was estimated to exceed 21.4 billion U.S. dollars in 2013 • The Global Industrial Sensor market is forecasted to grow at a CAGR of 10 percent over the period 2013 - 2018 • South Korea-based companies Samsung and SK Hynix currently account for 35% of global 300mm wafer capacity. Samsung alone controls about 24% of all the world's 300mm capacity.



IoT will connect  
**50 bill.**  
devices and things  
by 2020

# INNOVATION FROM SILICON TO CLOUD

Focus areas: Industrial internet • Digital health • Hyperconnected society

## VTT VISIONS: PRODUCTIVITY LEAP WITH IOT

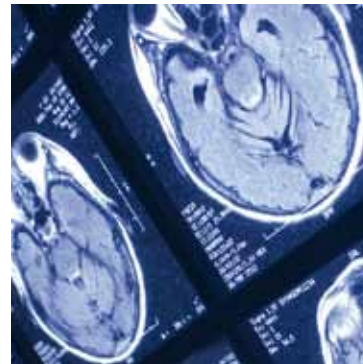
To maintain welfare and growth in Europe, a substantial productivity leap is needed. The Internet of Things (IoT) - the next step in ICT evolution - will boost productivity and create new business opportunities. We see the IoT as a set of enabling technologies that can be used by almost all areas of business and society to improve productivity. The core enabling technologies are sensing, communication, management and analysis of information, while the supporting enabling technologies are energy harvesting and low-power embedded systems.

There will be 50 billion connected devices by 2020, generating vast amounts of information. The real-time and openly available sensor information will offer immense benefits for business by enabling faster decision making, real-time control, enhanced operational efficiency and new business models.

However, Internet of things, hyperconnectivity and digitalisation are much more than connections between devices. Information and communication technologies and electronics are becoming entwined with our everyday lives in industry, the service sector, transport, logistics, health care, housing, education, and our leisure time, almost without our noticing it. It can't be ignored as a pervasive and growing market condition that is at the core of all business strategies. It is changing radically the way people act and interact and will have huge effect on our lives and productivity in all sectors.



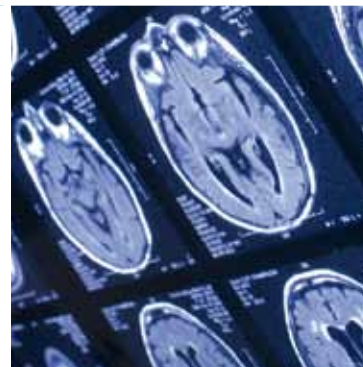
# Research results



Our simple but extremely SENSITIVE MAGNETO-METER can be used for neuroimaging, mineral exploration and molecular diagnostics.



We create productivity through INTERNET OF THINGS and INDUSTRIAL INTERNET: new applications, new models of operations, forum for industrial internet co-operation (FIIF).



We improve the capacity of enterprises and organisations to respond to the rising level of cyber threats. We set up the CYBER WAR ROOM, where cybersecurity testing can be performed in a controlled environment.



The PredictND project, coordinated by VTT, is developing and validating new procedures for the earlier DIAGNOSIS OF MEMORY DISORDERS. We are transferring, for example, image analysis technology to hospital environment.



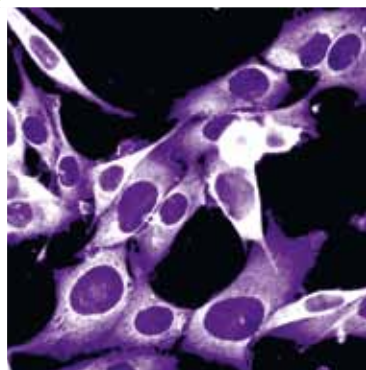
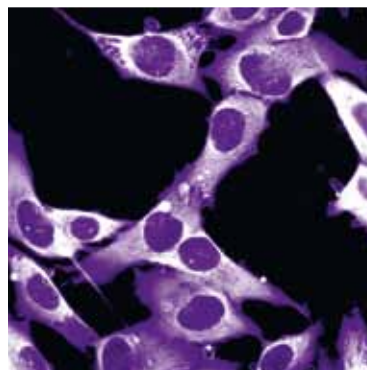
Read more: [www.vttresearch.com/kips\\_review2014](http://www.vttresearch.com/kips_review2014)



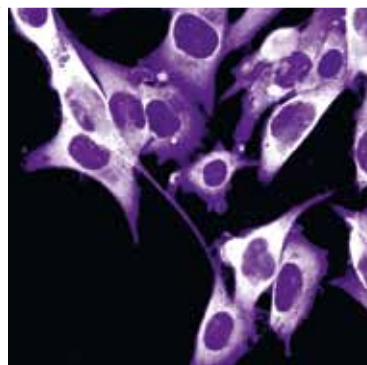
eCall in-vehicle emergency call service, eBus and smart systems allowing standardised charging of electric cars are examples of the SMART TRANSPORT SOLUTIONS developed with us that help to create more efficient transport and logistics chains and services.



We have developed a mass production method allowing the manufacturing of decorative, FLEXIBLE ORGANIC SOLAR PANELS. The panels can, for example, be placed on windows and walls and on machines, devices and advertisement billboards.



Our scientists demonstrated a new technique for harvesting ELECTRICITY FROM MECHANICAL VIBRATIONS of the environment. The technique can be used, for example, in wireless self-powered sensors and medical implants.



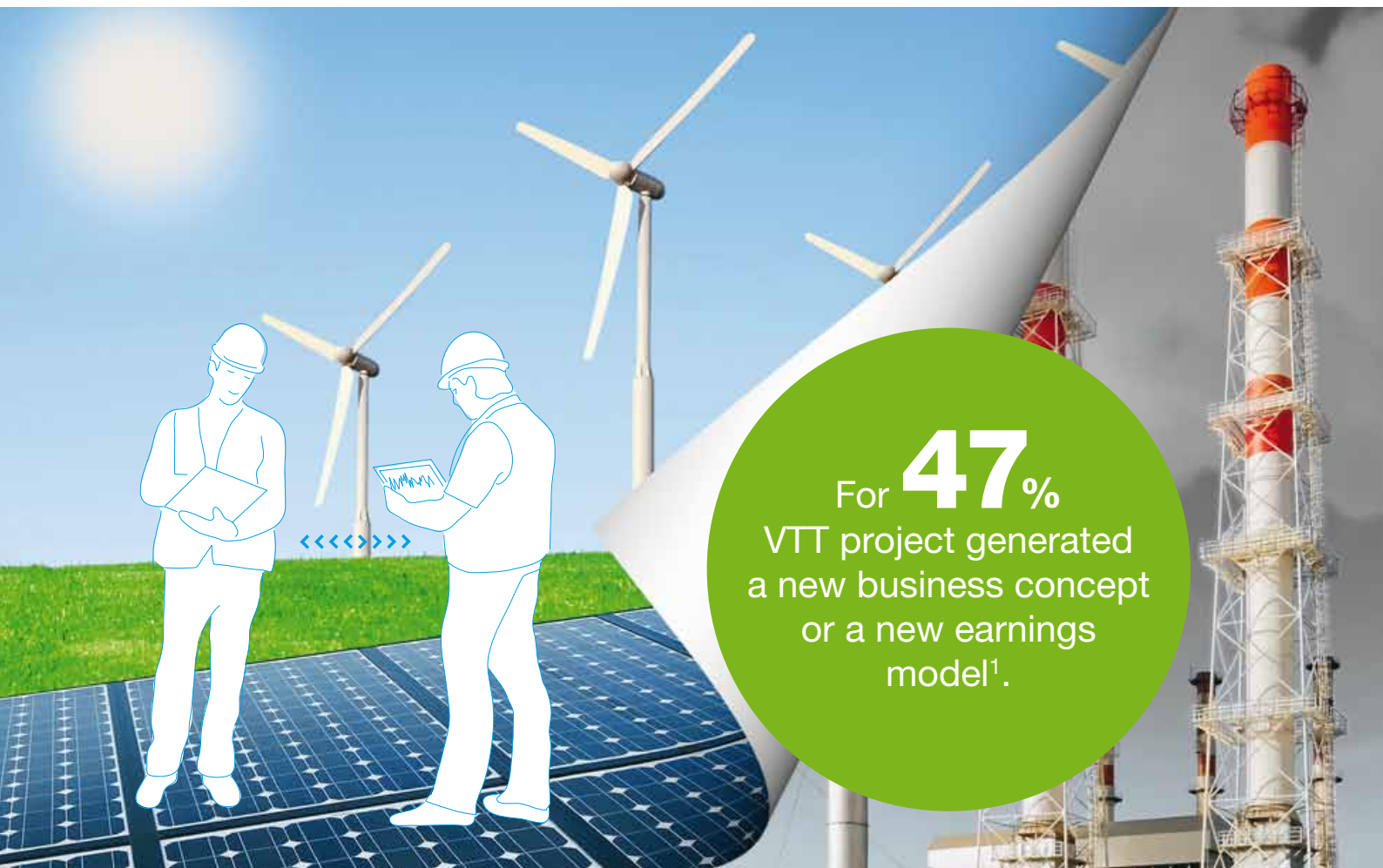
Revenio Group Oy is cooperating with VTT to commercialise a lightweight, handheld, ultra-precision hyperspectral CAMERA FOR THE DETECTION OF SKIN CANCERS and their precursors.



Rikola Ltd and InnoPharma Labs have commercialised smart MINIATURISED OPTICAL MEASUREMENT DEVICES based on the Fabry-Perot interferometer technology developed at VTT.

# Smart Industry and Energy Systems

• In 2013, the global engineering services industry's revenue was USD 725 billion, the principal activities being the provision of assessment, design and planning services on construction, the physical environment and industrial processes • The number of electrically powered vehicles in the world now totals more than 400,000 vehicles, and has been doubling for the past few years • It is predicted that one in three jobs will be converted to software, robots and smart machines by 2025 • About 70% of the total robot sales of nearly 180,000 units, in 2013 were in Japan, China, the United States, Korea and Germany. Between 2008 and 2013 the average robot sales increase was at 9.5% per year (CAGR) • The global 3D printing market is estimated to grow from USD 2.5 billion in 2013 to USD16.2 billion by 2018, attaining a CAGR of over 45 % in the forecast period.



For **47%**  
VTT project generated  
a new business concept  
or a new earnings  
model<sup>1</sup>.

<sup>1</sup> Taloustutkimus Oy, VTT Customer Survey 2014. Share of survey respondents who had this benefit as their goal in their VTT project and felt that the benefit was generated in the project.

# INDUSTRIAL INNOVATION

Focus areas: Machinery and automation • Efficient Energy • Smart cities

## VTT VISIONS: SMART MOBILITY AND CITIES, IMPROVED INDUSTRIAL PRODUCTIVITY

People and goods move in an energy-efficient and environmentally friendly manner. Mobility is based on smart, easily accessible and interactive services. Users' needs and preferences guide the development of services and the built environment.

The built environment, transport and industrial production use clean sources of energy. Production processes and operating methods are resource-wise.

Finland's success will be guaranteed by persistent renewal of our technology industry, harnessing the benefits of digitalisation. We ensure our competitiveness by developing new production technologies, automation and robotics, the industrial internet and augmented reality.

New value creation and value capture models combined with service business integrated with industrial products will bring profitable growth and new business.

Application of industrial internet in public service production will improve the quality of service as well as and the efficiency of producing them.



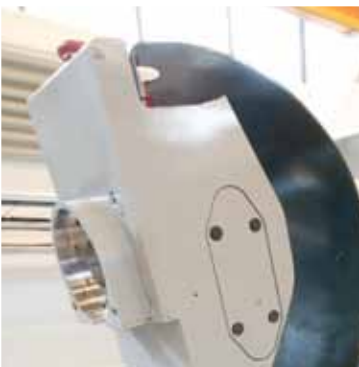
# Research results



Rolls-Royce and VTT unveiled a vision of Ship Intelligence with FUTURISTIC OX BRIDGE CONCEPT.



We create together with Finnish companies new business and competitive products based on ADDITIVE MANUFACTURING (AM) methods, like 3D printing.



We reached an important objective in the development of ITER FUSION REACTOR REMOTE CONTROL, when the divertor cassette was replaced for the first time using remote control.



Our ReUSE project showed that ECO-EFFICIENCY of buildings can be significantly improved by reuse and recycling of construction parts. DEMOLITION PLANNING should be part of the construction planning process.



Read more: [www.vttresearch.com/ind\\_review2014](http://www.vttresearch.com/ind_review2014)



Otaniemi ecocampus project showed that the average energy-saving potential in campus buildings is around 15 to 20 per cent. We are now taking Finnish KNOW-HOW ON THE ENERGY-EFFICIENCY of the built environment to China.



EU-funded innovation cluster, EIT RAW MATERIALS, is being set up in Espoo, Finland. It will focus initially on establishing the raw material needs of information technology, transport and the energy sector, as well as those related to the manufacture of machinery and equipment.



Kone Oy has utilised VTT ProperTune™ MULTISCALE MODELLING SOLUTION to control and improve wear performance of elevator components, predict lifetime in operational conditions, improve efficiency and enable systematic design of novel solutions.



We developed new methods and tools for sustainable manufacturing, for example, a TOOL TO ESTIMATE LIFE-CYCLE COSTS and compare investment alternatives, in the EU-funded SustainValue project.



# Solutions for Natural Resources and Environment

- Renewables account for 80% of new generation in OECD, solar PV capacity could top 500 GW globally in 2020
- The global market for biofuels is expected to reach USD 99 billion by 2014. The demand for biofuels is on the rise and will continue to grow rapidly through 2020
- It is estimated that over 90% of the annual global plastic production - 270 million tonnes - could be substituted by bioplastics. However, in 2012, bioplastics made up about 1% of the global plastics market
- Between 10 - 15% of the total European composite market was covered by Wood-Plastic Composites (WPC) and Natural Fibre Composites (NFC) in 2012.



National strategy  
on bioeconomy aims  
at increasing Finnish  
bioeconomy from  
60 bill. € to 100 bill. €  
by 2025

# PROSPERITY FROM NATURAL RESOURCES

Focus areas: Bioeconomy • Circular economy • Cleantech

## VTT VISION: BIOECONOMY – LIFE IN POST-OIL ERA

The bioeconomy is especially important for Finland. It already accounts for about EUR 60 billion of GDP, and a doubling of this amount by 2030 is considered possible. A successful bioeconomy requires a multidisciplinary approach, combining disciplines ranging from chemistry to design. As a cross-cutting approach it has an effect on the whole of society, linking food security and people's well-being to the sustainable use of raw materials and natural resources.

The key enabler of the bioeconomy is chemistry. It is chemical processes that make it possible to create more sustainable products and to use biobased raw materials in place of fossil ones. There are three platforms that form the chemistry toolbox, namely, cell factories (an example of industrial biotechnology), thermochemical processing, and biochemical conversion. These very same technologies can be used in different industries. They connect previously separate industrial sectors in the pursuit of new, sustainable business opportunities and value chains.

VTT offers a unique combination of competence, technology and cutting-edge piloting facilities for an innovation ecosystem attracting industrial and other stakeholders from Finland and elsewhere to make the bioeconomy happen.



# Research results



Bioeconomy aims at efficient and sustainable use of natural resources. Our vision of life in the era of a **BIOECONOMY IN FINLAND** in 2044 shows what life could be like in the after-oil era.



In the future, households may play a significant role as suppliers of electric power to the local but also national grid. In the **NEO-CARBON ENERGY** project, We are developing solutions to problems of the storage of solar and wind energy.



We can recover as much as 80% of the gold from cell-phone scrap by a **BIOLOGICAL FILTER** made of mushroom mycelium mats. The method makes industrial reprocessing of precious metals easier.



**TEXTILE WASTE** can be made **INTO FABRICS** that are even better than the original. Our methods are used for the recycling, decolouring, bleaching and dissolving of textiles.





Read more: [www.vtresearch.com/sone\\_review2014](http://www.vtresearch.com/sone_review2014)



Poly lactide, PLA is a bioplastic made from renewable materials with the help of lactic acid. With our methods FOAMING BIOPLASTICS are made into beads that are further refined into products such as insulation sheets.



WOOD AND STRAW material can be processed INTO CHEMICALS more efficiently by our new methods. The materials can be broken down into sugars even if the enzyme levels are very low, potentially 60% lower than in traditional pretreatment methods.



Our hybrid processing technologies, mechanical separation combined with bioprocessing, resulted in a tasty, nutritious and PROTEIN-RICH BREAD made FROM 70% FABA BEAN FLOUR.



We applied participatory design and developed new MEAL CONCEPTS and easy-to-use packages tailored FOR SENIOR CONSUMERS in cooperation with food industry partners.

# We are building Finland's future together with our partners



In meeting the challenges facing the business sector and society, our selected focus areas are bioeconomy, low-carbon energy, digitalisation, cleantech, resource-efficient production, and health and wellbeing solutions. We present our customers and stakeholders with five value promises based on these focus areas, and fulfil those promises together with our partners.

## Prosperity from natural resources

Holistic thinking and new sources or raw materials, such as waste or industrial side streams, provide a potential competitive edge based on new business models focusing on eco-efficiency.

## Self-sufficiency with clean energy systems

Clean and smart energy systems are key guarantors of Finland's energy security. Low emission and low carbon energy production methods also provide us with plenty of export opportunities.

## Competitive advantage from industry renewal

To secure our export base, we must renew our industrial sector. As a multi-technology organisation, VTT is working together with companies to improve competitiveness.

## Smart communities – good connections and smooth everyday life

Smart traffic, eco-efficient communities and resource-wise practices equal sustainable development towards smart communities. VTT is engaged in long-term co-operation on the development of smart traffic, construction and services.

## Finland on the top of the progressing digital disruption

The Internet continues to spread: we now run into it in the most surprising places and contexts. The industrial internet and universal digitalisation will have a multi-billion euro impact on the Finnish economy.



**We are moving towards cross-industry ecosystems.**

For these, we require new kinds of openings that can generate vital new business. This will take courage, open-mindedness and surprising combinations of new solutions. VTT is in pole position to meet these challenges.

Multi-technological know-how acquired over decades, long-term customer and research partnerships in Finland and abroad, and continuous foresight activities provide us with a head start which we want to use.



**Anne-Christine Ritschkoff**, Executive Vice President, Strategic Research

**4 million hours of brain power each year.**  
 VTT has a research staff of 2,375 professionals and 29% of our entire personnel have Ph.D. or Licentiate degrees.

**VTT'S SPEARHEAD AND INNOVATION PROGRAMMES**

**Spearhead programmes**

- Bioeconomy Transformation
- Productivity with Internet of Things (IoT)
- Smart Mobility Integrated with Low Carbon Energy
- For Industry (to begin in 2015)

**Innovation programmes**

- Intelligent Energy Grids
- Multidisciplinary and Multiscale Modelling in Engineering (ended in 2014)
- Arctic and Cold Climate Solutions (ended in 2014)
- Critical Technologies Towards 5G
- Personalised Solutions to Health and Wellbeing (ended in 2014)
- Human Driven Design – “Design for Life” (ended in 2014)
- Safe and Sustainable Nuclear Energy
- Mineral Economy

VTT's strategic programmes include **spearhead and innovation programmes** and the **iBET (innovative Business from Emerging Technologies) programme**.

All the programmes

- seek solutions to grand challenges
- involve high-level science and technology
- produce results with a genuine impact on Finnish industries and society

# VTT's research programmes - turning challenges into opportunities

## SMART MOBILITY INTEGRATED WITH LOW CARBON ENERGY - TRANSSMART

"The programme has led to the creation of an excellent platform for cooperation and a national programme involving ministries, public-sector agencies, the municipal sector, companies and research institutes. TransSmart is helping Finland to achieve the 2030 Climate Objectives in the transport sector. As part of the programme, we are also creating new cleantech business for Finnish companies in the sector. A new Finnish manufacturer of electric buses has been established as a programme spin off."



**Nils-Olof Nylund**, Programme Manager

## PRODUCTIVITY WITH INTERNET OF THINGS (IOT)

"With this programme, VTT has alerted companies to the importance and potential of the industrial internet and IoT and has helped them benefit from digitalisation. As well as our more traditional approaches, we are using strategic development programmes to bring the results to the private sector. In addition, we are engaged in ecosystem projects alongside SHOKs and company consortia."



**Heikki Ailisto**, Programme Manager

## BIOECONOMY TRANSFORMATION

"We are using this programme to implement Finland's bioeconomy strategy, based on the renewal of the local biomass conversion industry and profitability improvement. We have developed new processes and significantly boosted the efficiency of existing ones, which will foster the viability of using biomass-based raw materials. In addition, we have created new biomass-based materials with highly competitive characteristics compared to materials currently in use."



**Kristiina Kruus**, Programme Manager



<sup>1</sup> Taloustutkimus Oy, VTT Customer Survey 2014. Share of survey respondents who had this benefit as their goal in their VTT project and felt that the benefit was generated in the project.

# International and domestic cooperation

Research units in Brazil and South Korea • Actively involved in building the European innovation ecosystem • 21% of turnover generated abroad • 9% of companies on the Global Fortune 500 list are VTT customers • Experts working at VTT come from 39 different countries • VTT's EU/ERA funding for 2014 was approximately EUR 52 million.



The most frequent target countries for VTT employees working abroad in 2014 were **USA, South Korea, Great Britain and Canada.**

Foreigners accounted for approximately **5%** of VTT employees. There were 155 foreigners working at VTT in 2014.

**96%**  
of our customers said  
cooperation with  
VTT enhanced  
networking<sup>1</sup>.

VTT is fostering the transition towards a resource-efficient and sustainable economy by promoting responsible and competitive business activities. In a globalised world, developing Finland's knowledge base requires networked co-operation with world-class players and broad-minded collaboration across disciplines. Alongside its customers, VTT hooks up with international, knowledge-based and innovation-driven value networks, where VTT's EU-level networks and research and innovation partnerships have given VTT a strong position. While VTT's international public research activities mostly involve European cooperation, VTT is also focusing on collaboration with Finnish companies in selected global innovation environments as well. In 2014 VTT also made an active contribution to the start-up phase of SUUNTA process, a joint initiative of Team Finland's actors. SUUNTA work is aimed at promoting the renewal of Finland's business sector.

### Solutions to societal challenges and a revival in Europe's competitiveness are goals of European R&D cooperation

VTT is a key player in several networks and organisations participating in the multi-annual Horizon 2020 Programme in 2014 - 2020. The programme will help to realise the aims of the Europe 2020 Strategy in areas such as employment, research and innovation, climate change and energy, education and the elimination of poverty.

In recent years, VTT's key arenas in Europe have included European Technology Platforms, PPP initiatives (Public Private Partnerships), the Advisory Groups of the Horizon 2020 Programme, KET (Key Enabling Technologies) High Level Group and European Innovation Partnerships between Member States (especially EIPs in Raw Materials, Water and Smart Cities). VTT is also active in fostering information exchange with various stakeholders in Finland. The experience accumulated of new European cooperation models is important to the development of innovation systems in Finland and across the EU.

<sup>1</sup> Taloustutkimus Oy, VTT Customer Survey 2014. Share of survey respondents who had this benefit as their goal in their VTT project and felt that the benefit was generated in the project.

"During the current structural transformation, a joint national effort will be needed to make Finland more competitive and more attractive to foreign investment. VTT plays an important role in networking Finnish companies and other Finnish actors in EU projects and in European value chains, which provide SMEs in particular with internationalisation and business development opportunities."



**Leena Sarvaranta**, Vice President, EU Affairs

In addition to funding for scientific research conducted by university researchers, the Horizon 2020 Programme retains funding opportunities for close-to-market innovation activities in order to boost the European economy and employment, and to address the Grand Societal Challenges. Companies together with Research and Technology Organisations (RTO) play a key role in implementing such innovation activities. In 2014, VTT focused on preparation of such Horizon 2020 projects that would boost the competitiveness of industrial value chains in Europe as well as strengthen the regional innovation ecosystems and their cross-border networking.

VTT had 399 (2013: 699) publicly funded international research projects ongoing in 2014, of which 313 (2013: 471) were EU projects. Projects in the 7th Framework Programme numbered 242. In addition, two Horizon 2020 projects were launched in 2014. VTT participated in a

total of 461 projects during the 7th Framework Programme (2007–2014). VTT was particularly active in ICT, Nanotechnology, Materials and New Production Technology, Security, Energy, Biotechnology and Transport programmes. On average, the share of industry partners was 43% in those consortia where VTT was engaged in FP7.

During FP7, VTT received 22.5% (EUR 195 million) of the funding granted to Finland (EUR 867 million, statistical data for 2014). Finland also actively participated in programmes for the development of the European Research Area (ERA), and 20% of all national funding from Tekes to VTT in 2014 was directly linked with European initiatives (Eureka and ERANet, as well as Article 185 Eurostars and AAL).

### **International office network – visibility for VTT and benefits for companies**

VTT's chosen strategic focus areas in international research cooperation are industrial biotechnology, renewable forest industry and energy, and ICT and electronics. Significant emphasis on internationalisation continues the effort to boost business and improve the welfare of society. VTT has six overseas offices in total, two of which are research units (Brazil and Korea) run by VTT International Ltd, while the other four are so-called 'contact' offices intended to support and assist VTT's local networking and marketing operations.

In the research units located in Brazil and Korea VTT engages in active research and innovation with local research organisations. Research at the Brazil unit concentrates on deriving chemicals and renewable energy from biomass, and on the forest industry. VTT Brazil's key project was the PAISS project, which achieved excellent results in second-generation bioethanol production technology. The project involves broad-based co-operation between companies and universities. Support was provided for a new sector – the export of Finnish waste incineration technology – which involves companies both from Finland and Brazil. At the Korean unit, the main focus of research was on ICT and electronics, and the related applications, in cooperation with local universities and research institutes. Collaboration with Korean companies has grown in various sectors from year to year.

Of VTT's four contact offices, three belong to the joint Team Finland/Tekes network of Finnish innovation actors, and are located in Japan, China and Washington on the US East Coast. As part of Team Finland, VTT is able to

influence the choices made in overseas markets to ensure that they are to Finland's advantage. Membership of the network also supports VTT's business and internationalisation objectives.

VTT's Washington office markets environmental and electronics expertise to major corporations and brand owners operating in the area. The office has also helped reinforce cooperation with local universities and research institutes. In Japan, the emphasis was on cooperation in the ICT sector with local research institutes and universities. The main focus at Shanghai in China was on manufacturing industry and the energy sector, together with support for Finnish businesses. VTT's office in Brussels operates in collaboration with EARTO. EARTO is the interest organisation for European research and technology organisations (RTOs). In addition to the Horizon 2020 Programme, in 2014 the Brussels office broadened its engagement wider within innovation, industrial and regional policies. VTT also wants to foster its own direct contacts with EU institutions and other key stakeholders in Brussels.

### **VTT plays a key role in national innovation co-operation**

VTT continued its strategic collaboration with universities and research institutes, by building and implementing the Finnish Institute of Technology and Innovation (FIT) network. The objective of the network is to make use and impact of resources in Finnish research and development work more effective by enhancing cooperation and the division of tasks, especially between universities and research institutes. VTT has intensified its strategic co-operation with key universities and research institutes in the areas of bioeconomy, digitalisation, raw materials, and manufacturing and materials technology. New forms of co-operation have been developed in order to promote joint research infrastructures, entrepreneurship, and the commercialisation of research results.

VTT contributes extensively to national research and technology programmes, most significantly those run by Tekes and the Academy of Finland. VTT participated in four Strategic Research Openings of Tekes in 2014: Neo-Carbon Energy – to pole position in developing future energy system, the Digital Health Revolution, Living Factories and Design Driven Value Chains in The World of Cellulose and three Academy of Finland Centres of Excellence. VTT is coordinating and strongly engaged in both the SAFIR2014 national nuclear safety research programme

## A RETURN ON TAXPAYERS' MONEY. AMONG OTHER ACHIEVEMENTS, VTT IS FINLAND'S BIGGEST DRAW FOR EU RESEARCH FUNDING.

and the KYT2014 national nuclear waste disposal research programme. An international evaluation highlighted the high level and efficient resource use of the SAFIR2014 programme. It also identified some development targets which will be taken into account in the planning of the new SAFIR2018 programme to be started in 2015.

The Otaniemi Research Infrastructure for Micro- and Nanotechnologies has again been selected for Finland's research infrastructure strategy and road map for 2014 - 2020, and is now joined by the BIOFACTORY Alliance for Excellence in Sustainable Biomass Refining (both infrastructures shared by VTT and Aalto University). VTT is the coordinator of the Finnish Industrial Internet Forum (FIIF) founded at the year-end. The FIIF initiative, a forum for collaboration between Finnish industrial internet players, is run by the Federation of Finnish Technology Industries.

### **Internationally attractive innovation hubs strengthened**

VTT is building a new, world-class bioeconomy and cleantech piloting centre, Bioruukki, in Kivenlahti, Espoo. VTT will transfer its related activities and equipment there in stages. Companies are also being offered room in the centre, either alongside VTT or independently. A new kind of innovation ecosystem is being created at Bioruukki. This ecosystem will provide a framework for business growth and the achievement of the national bioeconomy strategy goals in key areas for Finland: bioenergy, biochemical sector, biomass fractionation and recycling. In partnership with industry, the new equipment and facilities will expedite and boost the commercialisation of R&D results. A research and technology infrastructure for gasification and pyrolysis technologies will be the first of these phased operations to start up, in spring 2015.

The PrintoCent platform set up in Oulu in 2009, has provided the city with an R&D community based in the

world's leading printed intelligence and optical measurement technology innovation centre. This community's total volume had topped EUR 20 million by 2014. Over 20 companies have been established so far, with a combined, fast-growing turnover of over EUR 5 million in 2014. PrintoCent continues to grow – 44 companies, many of them major internationals, have joined the platform. The PrintoCent community includes over 300 specialists and comprises member companies, start-ups and business initiatives, universities and research institutes. PrintoCent is also highly active at EU-level. Business coaching and incubator activities have been arranged as of 2010 and in 2014 the Innofest innovation contest and design competition for lights made of printed electronics were held for the first time. PrintoCent's founding members are VTT, University of Oulu, Oulu University of Applied Sciences and Business Oulu.

The Helsinki node of European Innovation and Technology Institute EIT ICT Labs continued to be productive. In addition to VTT, the node's key players include Aalto University and Nokia. There are 12 other partners, with KONE, F-Secure and Elektrobit joining in 2014. The node's overall volume grew by around 30% in 2014. As well as chairing the management board of the Helsinki node, VTT is leading the EIT ICT Labs-wide Future Cloud Innovation Action Line focusing on cloud and big data innovations.

In December 2014, EIT decided to fund a Knowledge and Innovation Community (KIC) in the field of raw materials. One of the six Co-location Centres (CLC) will be at Otaniemi in Espoo. VTT heads the Baltic Sea CLC in Otaniemi. This Finnish-Swedish-Estonian Centre consists of 15 industry and research organisations. The primary goal of the Centre is to generate new business activity, and provide education to entrepreneurial students and professionals in the field of sustainable production and the use of raw mineral materials.

Located on VTT's premises in Tampere, the Remote Operation and Virtual Reality Centre (ROViR) engages in



R&D for the international, world's largest fusion reactor project, ITER. Remote operation and virtual technology, with potential for industrial applications, play a key role in the maintenance of the ITER reactor. Functional tests were performed in 2014 and the corresponding industrial application of the system was jointly undertaken with an international company consortium. The expertise accumulated during these projects has been applied in development projects for Finnish companies.

VTT Centre for Nuclear Safety being built for VTT (2014 - 2016) is a key element in the development of the research infrastructure. Research currently scattered around Otaniemi will be concentrated in the new building: reactor safety modelling, calculation and simulation, material testing for nuclear energy technology, and long-term safety in the final disposal of spent nuclear fuel. Modern equipment, international activity of a new kind and, in particular, co-operation between VTT and Aalto University will ensure that this new project keeps Finland at the cutting edge of international development.

### **Regional specialisation and SMEs are growing in importance**

All over Finland VTT acts in close, regional cooperation with universities, research institutes, universities of applied science and companies. VTT's regional activities are focused on active participation in regional partnerships and project-based development alongside firms. VTT has representatives in 13 locations in Finland, who organise events on a regular basis for local companies, presenting VTT's activities and exploring opportunities for cooperation. The EU's Horizon 2020 programme offers cities and SMEs completely new kinds of development opportunities. Over the next few years, the European Innovation Partnership on Smart Cities and Communities (EIP) will create guidelines for coordinating overall policy action at EU and Member States levels. In 2014, alongside Tekes, VTT organised several public discussions involving city representatives to set goals for European cooperation. In particular, the key city regions of INKA programme were supported in their efforts to benefit from European R&D&I cooperation via the "Transforming cities into European innovation environments" projects partly funded by Tekes. The INKA programme also supports the implementation of smart regional specialisation strategies in Finland.

### **Further information**

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Leena Sarvaranta, Vice President, EU Affairs,  
tel. +358 50 570 7876

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tel. +358 40 526 7122

### **Principal European RTO alliances and expert groups for VTT**

- EARTO – European Association of Research and Technology Organisations
- EERA – The European Energy Research Association
- EIT ICT Labs
- EIT Raw Materials
- JIIP – Joint Institute for Innovation Policy
- KET – Key Enabling Technologies High Level Group (EU Commission)
- NULIFE/NUGENIA – Nuclear Generation II and III Association

### **VTT in Finnish research alliances and co-operation forums**

- Bioenergy Technology Alliance (BETA)
- Biotechnology cluster
- FSA - The Finnish Service Alliance
- PrintoCent Innovation Centre
- FIIF – Finnish Industrial Internet Forum
- SHOKs – Strategic Centres for Science, Technology and Innovation

### **VTT in the Academy of Finland's Centres of Excellence**

- Finnish CoE in Atomic Layer Deposition (ALD) (2012 - 2017)
- Finnish CoE in Low Temperature Quantum Phenomena and Devices (2012 - 2017)
- Finnish CoE in Molecular Engineering of Biosynthetic Hybrid Materials (2014 - 2019)

# VTT's R&D facilities - an essential part of the national research infrastructure

VTT's unique R&D facilities enable the development chain from basic research and process development up to prototyping and pilot manufacturing. Our research facilities are an essential part of the Finnish research infrastructure.



## **Bioruukki**

The largest bioeconomy pilot and research facility in Nordic countries. In the first phase, we will launch gasification and pyrolysis piloting operations there.



## **Biotechnology and food research piloting environment**

with its fermentation equipment offers unique facilities for the development and customisation of bio and food industry technologies.



## **Micronova**

World-class cleanroom facility, fully equipped for the fabrication of silicon, glass and thin film-based microsystems. All types of microsystems are developed and customised here by modular optics to meet customer needs.



## **MIKES**

VTT MIKES Metrology is the National Metrology Institute of Finland and performs high-level metrological research and develops measuring applications in partnership with industry.



## **Engine and vehicle laboratory**

Our engine and vehicle laboratory enables research on passenger cars as well as heavy-duty vehicles up to 60 metric tons to develop energy efficiency, emissions reduction and use of 2nd generation biofuels.



## **PrintoCent**

World's first pilot factory for printed intelligence industrialisation. The idea is to pilot manufacture printed electronics to be integrated to mass products.



## **ROViR**

Remote Operations and Virtual Reality Centre for the development of remote operations and virtual reality technology in industry.



## **A pilot-scale research environment for fibre processes**

enables the development of novel products and supports the renewal of the pulp and paper industry.

# Services for enterprises – big and small

**26%**  
The turnover of companies in key export sectors increased on average by 26% after innovations where VTT had a substantial role.

## OUR LONG-TERM SME CUSTOMERS ARE EXPERIENCED PARTICIPANTS OF R+D PROJECTS

R&D of products means three things: product development, technology development and innovation with partners. We co-operate with VTT on all of these fields.

### **Elias Boletis**

Director R&D Propulsion  
Wärtsilä

The key elements of Lumene's product development strategy are the ingredients from the Arctic nature and the enhancement and use of their anti-aging properties in Lumene's skin care products. Cooperation with VTT has been extremely productive, and we have been able to significantly expand our ingredient selection through the possibilities offered by biotechnology.

### **Tiina Isohanni**

Vice President, Innovation & Development  
Lumene Oy

The filter solution that we developed together with VTT is very important for our company: it was a once-in-a-life-time opportunity for us.

### **Seppo Vartiainen**

Chairman of the Board  
Jeven Oy

VTT's involvement in the development of our service business has speeded up the work by several months.

### **Mikko Veikkolainen**

Vice President, Research, Development and Innovation  
Kemppi Oy

Since early 90's we have used VTT resources extensively in developing fixed fire suppression systems. We have quickly evolved from a small company to a global market leader in water mist fire suppression systems.

### **Maarit Tuomisaari**

Senior Manager, Research, Testing & Approvals  
Marioff Corporation Oy

Thanks to the information and connections that opened to us via VTT we have obtained a better perception of where to invest in.

### **Olli Saarniaho**

CEO  
Veslatec Oy

<sup>1</sup> Taloustutkimus Oy, VTT Customer Survey 2014.  
Share of survey respondents who had this benefit as their goal in their VTT project and felt that the benefit was generated in the project.

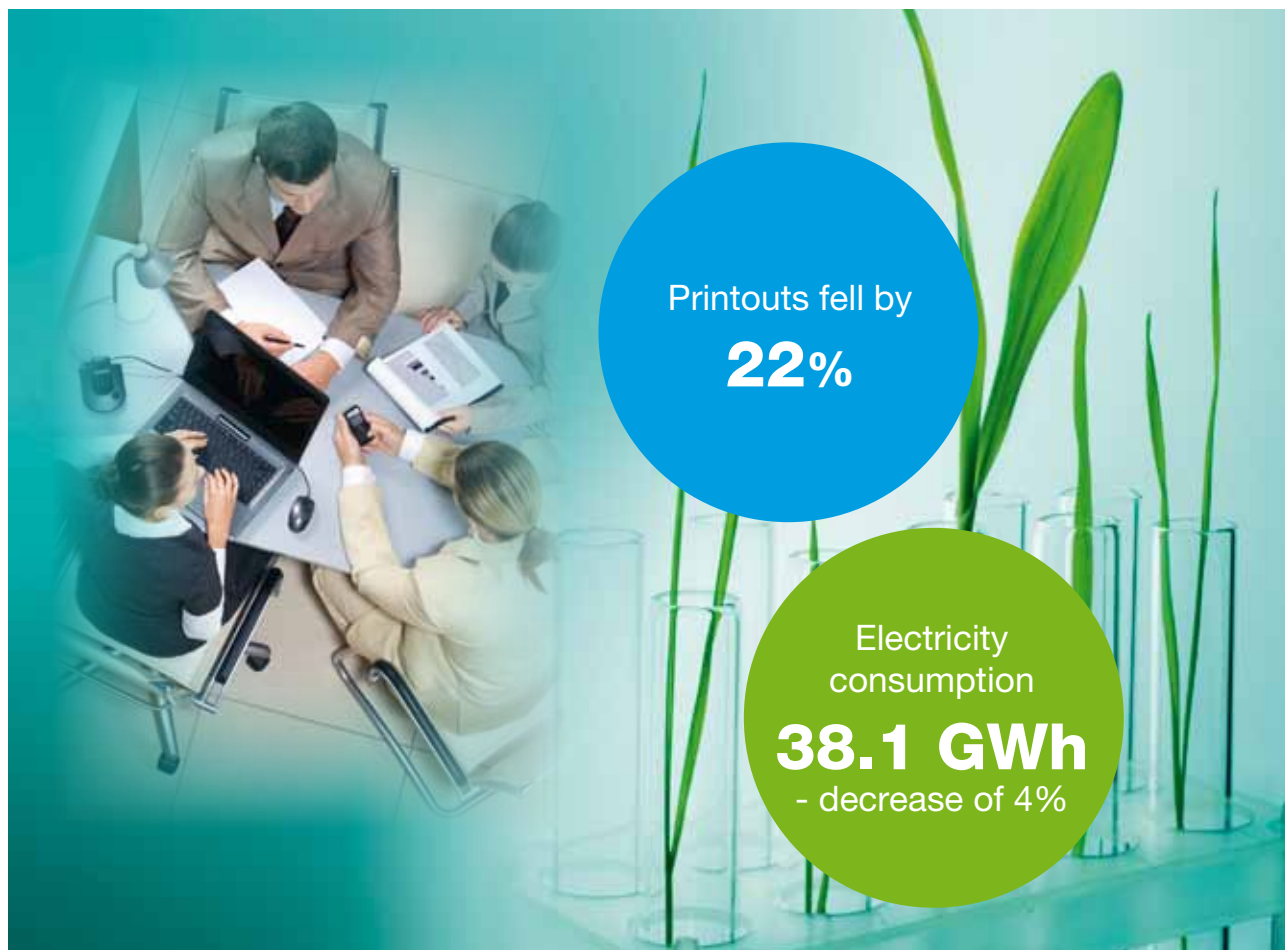
**44%**

adopted a whole new technology<sup>1</sup>.

**64%**

reported that their competitiveness improved as a result of a VTT project<sup>1</sup>.

# Sustainability and responsibility



Printouts fell by  
**22%**

Electricity  
consumption  
**38.1 GWh**  
- decrease of 4%

We take account of the principles of sustainable development, both in research and development and in our internal operations. VTT reports corporate responsibility according to the GRI G3 guidelines. We describe examples of corporate responsibility in the VTT Review and publish selected GRI metrics on the VTT website. Reporting includes the VTT Review, VTT Group Corporate Governance (CG) and the HR Report ([www.vtt.fi](http://www.vtt.fi)).

## **SOCIAL RESPONSIBILITY**

The focus areas of VTT's research – bioeconomy, low-carbon energy, digitalisation, cleantech, resource-efficient production, and health and well-being solutions – target a better living environment and a sustainable economy. Our spearhead and innovation programmes realise the goals of our research focus areas. Our research activity produces a stream of totally new sustainable solutions for the grand societal challenges. According to studies, the utilisation rate of our research results is extremely high, attaching great significance to VTT's impact

in promoting sustainable development. Our research results and experts are also widely called upon as a basis for public decision-making on the journey to a society founded on sustainable development.

## RESPONSIBILITY FOR OUR OWN PERSONNEL

VTT is ranked among top employers in employer surveys and our employer brand has remained on relatively high level. VTT was ranked fourth in the Universum employer survey of engineering students and second in the T-Media survey of Top employers. The focus in our well-being activities is in active caring, management work and effectiveness of selected well-being programmes. Managers received guidance in handling of challenging situations, support for starting professional guidance and training in active caring approach which was promoted also in rehabilitation events, work community and management training events.

In 2014, VTT carried out the most extensive co-operation procedures of its history. The lay-offs related to this naturally had impact on employee motivation and working atmosphere. The occupational health care report states that this shows on absences due to sickness in the final quarter of the year.

Calculated using the method of the Zero Accidents forum, the frequency of accidents was lower than ever, at 0.71 per million working hours. There were only three accidents leading to an absence from work. However, of these, one led to an extended sickness absence (170 days), with the consequence that the absences are viewed as serious (63 days of sick leave per single accident). The 8 serious accidents that occurred during work-related journeys in 2013 caused over 430 days of absence in 2014.

We continued with our chemical audits and also began planning and drafting an operational plan for the storage management and maintenance of information on chemicals, and the marking of chemical containers. This project progressed well and the related user training began in early 2015. We completed the eSafety online course material intended for induction activities in 2015. In its management review of 2014, the VTT executive management team decided that this course would be compulsory for all VTT employees.

We drew up three-year plans – for 2015 to 2017 – aimed at the development of environmental and occupational health and safety issues. We decided to continue with the theme of developing our occupational health and safety culture after the 2012 to 2014 three-year period. The new theme areas are 'a common workplace', 'tidiness and order' and 'reinforcing the management chain as a communicator of QEHS issues'.

The new perspectives 'a common workplace', 'tidiness and order' and 'reinforcing the management chain as a communicator of QEHS issues' will be our focus areas.

## ENVIRONMENTAL ISSUES

The compliance of VTT's operational system with the ISO14001 standard was confirmed and VTT was granted the related certificate on 16 January 2014.

We reduced the amount of travel in line with the related objective. This reduction could be seen across all travel, confirming that we are moving in the right direction. Our success in reducing domestic travel was highly significant from the perspective of CO2 emissions. Foreign travel also fell markedly compared to the previous year. A total of 32.1 million flight kilometres accumulated. There was also a major drop in personal car use. In addition, we analysed the use of rental cars for the first time. A total of 0.53 million kilometres were driven in rental cars and 0.57 million in VTT cars.

The amount of paper purchased fell by almost a quarter (24.4%), totalling just over 10,000 reams. Printouts fell by almost two million copies (22.0%), with colour printouts accounting for nearly half of this reduction.

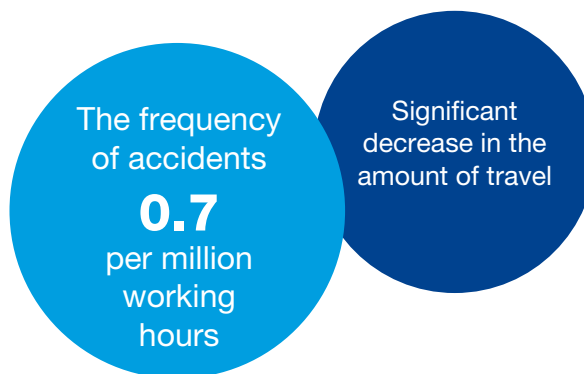
VTT consumed 38.1 GWh of electricity, which exceeded the figure for 2013 (36.7 GWh) but came under that of 2012 (39.0 GWh).

No Environmental Deed of the Year award was presented for 2014.

Mechanical components and an oil separator were installed for the purpose of soil decontamination following the Otaniemi oil spill. This soil decontamination can begin when electrical connections have been installed for the pumping well.

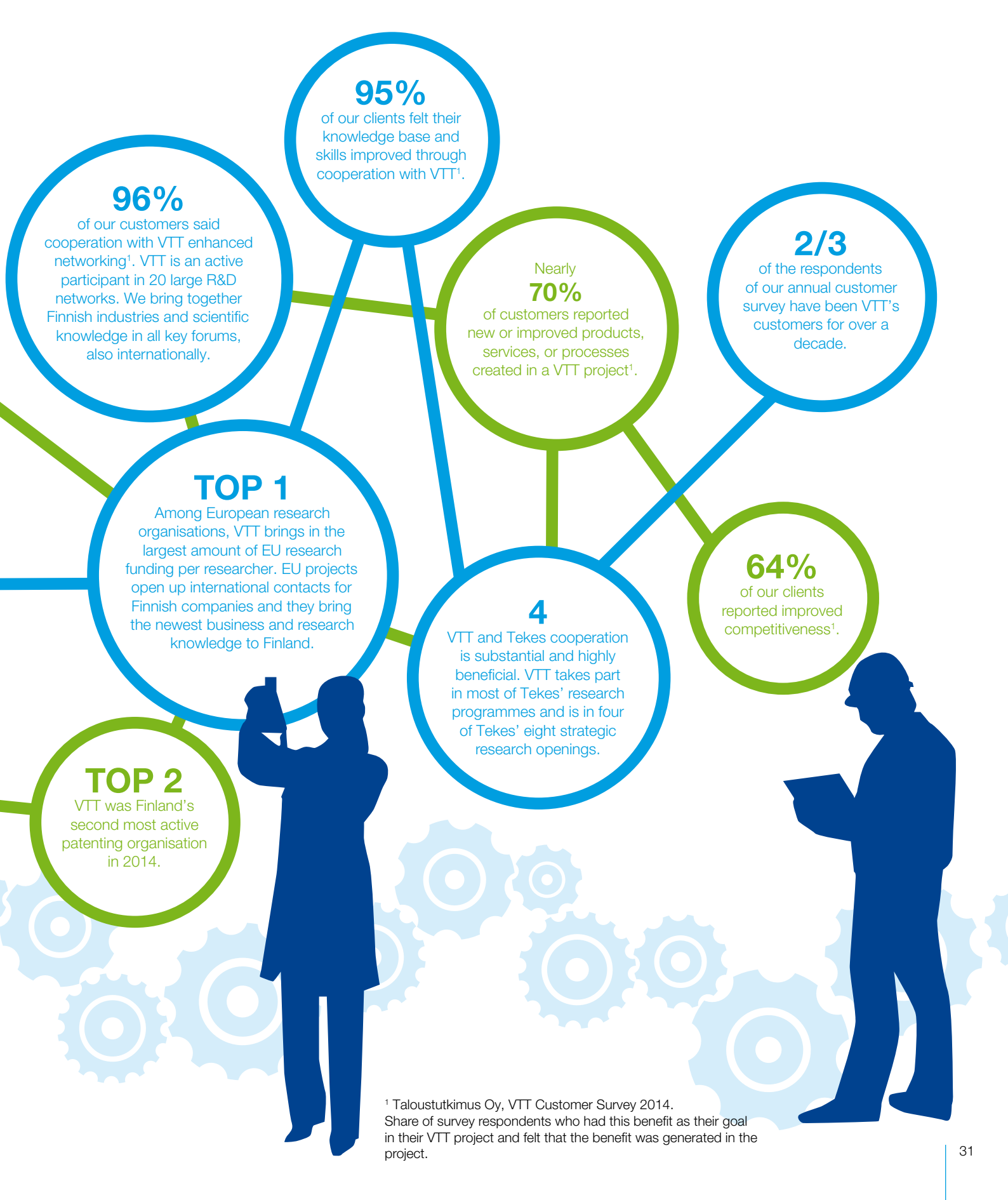
### Further information

Arja Merra, EHS, tel. +358 40 558 5653



# VTT has power





**95%**

of our clients felt their knowledge base and skills improved through cooperation with VTT<sup>1</sup>.

**96%**

of our customers said cooperation with VTT enhanced networking<sup>1</sup>. VTT is an active participant in 20 large R&D networks. We bring together Finnish industries and scientific knowledge in all key forums, also internationally.

**2/3**

of the respondents of our annual customer survey have been VTT's customers for over a decade.

Nearly **70%**

of customers reported new or improved products, services, or processes created in a VTT project<sup>1</sup>.

**TOP 1**

Among European research organisations, VTT brings in the largest amount of EU research funding per researcher. EU projects open up international contacts for Finnish companies and they bring the newest business and research knowledge to Finland.

**4**

VTT and Tekes cooperation is substantial and highly beneficial. VTT takes part in most of Tekes' research programmes and is in four of Tekes' eight strategic research openings.

**64%**

of our clients reported improved competitiveness<sup>1</sup>.

**TOP 2**

VTT was Finland's second most active patenting organisation in 2014.

<sup>1</sup> Taloustutkimus Oy, VTT Customer Survey 2014.

Share of survey respondents who had this benefit as their goal in their VTT project and felt that the benefit was generated in the project.

## Awards and prizes

- Bioenergia ry handed out the Pellet Award 2014 to Principal Scientist Eija Alakangas in Bioenergy Spring Day. Alakangas has worked long with national and international standardisation work for the development of pellet quality and market.
- Research Professor Marja Toivonen received the VTT Award for her outstanding individual performance and knowledge sharing at VTT.
- Research Professor Nils-Olof Nylund was awarded by the international Society of Automotive Engineers for his strong input in the development of automotive engineering.
- Principal Scientist Juhani Laurikko was granted a Medal of Motor Traffic. The medal is granted to a person who has significantly advanced road traffic development.
- Research Professor Ali Harlin received a PulPaper Award and a 5 000 euro grant. The award is granted to a person who has strengthened faith in future development of cellulose and paper industry and paved the way for diversifying application of the field.
- VTT Research Scientists Inka Lappalainen, Maaria Nuutinen, Tiina Valjakka and Toni Ahonen were awarded with the Mariano Corso Best Practical Award by the innovation network CINet for their conference paper on provider-customer interaction as a source for service innovation.
- Senior Scientist Sami Koskinen won the Best Technical Paper Award for the European region at the world's largest intelligent transport congress, the ITS World Congress held in Detroit.
- Director Leena Sarvaranta was appointed member of the Strategic Research Council working under the Finnish Academy. The SRC will make proposals to the government about themes of strategic research and make funding decisions.
- EVP Anne Ritschkoff from VTT was appointed to the Finnish Research Infrastructure Committee monitoring and developing Finnish and international research infrastructure activities.
- Research Professor Merja Penttilä was appointed to the International Selection Committee of the Millenium Technology Prize.
- VTT's logistics research scientists received the Best Scientific Paper Award in the European Conference of ICT for Transport Logistics (ECITL).
- The 10 Year Impact Award 2014 of the International Conference on Mobile and Ubiquitous Multimedia (MUM) was awarded to Dr. Jani Mäntyjärvi and his former colleagues for their paper presented in 2004. The method presented has been applied widely in the past ten years.

## VTT Impulse and VTT Newsletter



### VTT IMPULSE:

*A magazine on science, technology and business*

The VTT Impulse technology magazine is aimed at VTT's partners and customers and anyone with an interest in top-level technology and its applications.

You can order a free copy at:  
[www.vttresearch.com/impulse](http://www.vttresearch.com/impulse)

[WWW.VTTRESEARCH.COM/NEWS](http://WWW.VTTRESEARCH.COM/NEWS)

[WWW.VTTRESEARCH.COM/REFERENCES](http://WWW.VTTRESEARCH.COM/REFERENCES)

[WWW.VTTRESEARCH.COM/RESULTS](http://WWW.VTTRESEARCH.COM/RESULTS)



### VTT Newsletter

Would you like to know how research is changing the world? VTT Newsletter will give you information on the latest research results, the possibilities offered by technology, and details of future events. The newsletter appears once a month.

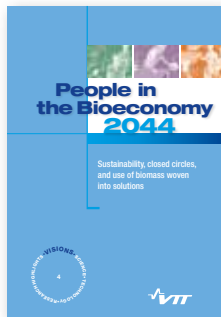
You can order your copy at:  
[www.vttresearch.com/newsletter](http://www.vttresearch.com/newsletter)



# VTT publications

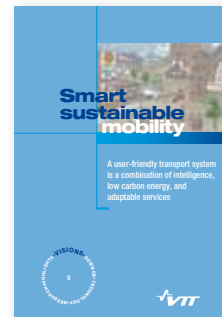
[WWW.VTTRESEARCH.COM/  
PUBLICATIONS](http://WWW.VTTRESEARCH.COM/PUBLICATIONS)

VTT employees publish research results in foreign and domestic science journals, in professional periodicals and publication series, as books, conference presentations or patents, and in the VTT publication series.



**People in the Bioeconomy 2044**  
Sustainability, closed circles, and use of biomass woven into solutions

VTT Visions 4



**Smart sustainable mobility**  
A user-friendly transport system is a combination of intelligence, low carbon energy, and adaptable services

VTT Visions 5



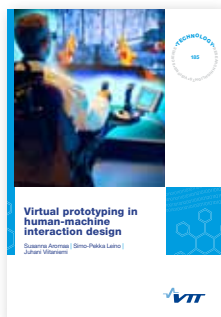
**Green solutions for water and waste**  
— science brought into action

VTT Research Highlights 11



**Processing of oat dietary fibre for improved functionality as a food ingredient**  
*Juhani Sibakov*

VTT Science 67  
Doctoral dissertation



**Virtual prototyping in human-machine interaction design**  
*Susanna Aromaa, Simo-Pekka Leino & Juhani Viitaniemi*

VTT Technology 185



**Perspectives on the international business strategies of small Finnish technology companies in developing countries**  
The case of small scale gasification

*Tatu Lyytinen*

VTT Technology 150

# Business development, commercialisation

## VTT SUPPORTS DEVELOPMENT OF NEW BUSINESS ALSO THROUGH SPIN OFF ACTIVITIES.

VTT has promoted the creation of several spin off companies. Their activities are usually based on technology created at VTT and patented by VTT. VTT's spin off activities are managed by VTT Ventures Oy. The spin off portfolio of VTT Ventures includes 20 companies in start-up phase. Among our spin off companies are:

**Medisapiens Oy** is offering online genome data and easy-to-use visualisation tools and advanced bioinformatics libraries designed to help biologists better understand genomics data. The gene expression database is used by pharmaceutical companies in developing next generation personalised medicines and by oncologists in choosing optimal cancer treatments for their patients.

**Desentum Oy** is developing next generation allergy vaccines. Its operations are based on gene technology which can be applied to alter the structure of an allergen, i.e. a protein causing allergy, so that it will cause less allergic symptoms than the original allergen, while remaining effective in desensitisation therapy.

**Asquilla Oy**'s revolutionary passive multi-band THz imaging systems provide end users with a completely new capability of stand-off screening for physical security and loss-prevention applications. The innovation behind Asquilla's solutions centres around the use of exceedingly sensitive bolometric detectors: these devices obtain superior performance compared to other sensing technologies and allow the system to operate at wavelengths previously unreachable with mm-wave cameras.

**Tactotek Inc.** manufactures 3D structural electronics by integrating printed circuitry and discrete electronic components into injection-molded plastics. Whether the design is rigid or flexible, TactoTek enables lighter, thinner designs that incorporate key electronics including LEDs for sophisticated lighting, sensors, ICs, and printed touch controls. Because TactoTek encapsulates printed circuits and electronic components inside injection-molded plastics, resulting parts are durable, and protected from harsh conditions.

**FocalSpec Oy** utilises unique Lateral Chromatic Imaging (LCI) technique to develop and provide quality control systems and devices for industrial online measurements. The technique is based on lateral chromatic aberration that enables measurement of high resolution topographic and tomographic profiles of the surface.

**Envault Corporation** offers a password-free way of protecting data against theft and loss. Envaulting technology removes small parts of the encrypted data and use the removed parts as the secret keys that allow opening the original documents only to authorised parties. It also offers remote control and auditing capabilities over encrypted materials.

# VTT's know-how to create new growth for Finnish companies

” *VTT has a unique capability to help companies to renew and grow in Finland and from Finland.*



## VTT Board

January 1, 2015

Chairman: **Aaro Cantell**, Chairman, Normet Oy

Deputy Chairman: **Matti Hietanen**, Counsellor of Government, Ministry of Employment and the Economy

Members:

**Kaija Pehu-Lehtonen**, SVP, Business Development  
Metsä Fibre Oy

**Anneli Pauli**, President, Professor (D. Sci., D.Sci. (Tech) h.c.)  
Lappeenranta University of Technology

**Kari Knuutila**, CTO  
Outotec Oy

**Petra Lundström**, VP, Nuclear Development  
Fortum Power and Heat Oy

**Harri Leiviskä**, CFO  
Suunto Oy

The new VTT Ltd started out at the beginning of the year, but what will change? Firstly, VTT now has a real Board of Directors with actual legal authority and accountability for the company's activities and development. It is now the responsibility of the Board to demand strong renewal of VTT from the management and to support and encourage them and the whole organisation in meeting these challenges. Secondly, as a limited liability company, VTT is now more agile and freer to focus its resources in new directions and to engage in new, bolder experiments. The aim is to get more out of the top-level, unique expertise of VTT's professionals. It is worth remembering that, with over 2,000 researchers, VTT is one of the largest and most important R&D organisations in northern Europe.

Incorporation did not change VTT's core tasks, which still are:

1. In selected areas maintain top research and technological expertise in Finland and cooperate with Finnish universities in these sectors. VTT must also cooperate more with world-class researchers from other institutes abroad. This more international role – in my view – is one of the key goals of the research activities now and in the future.
2. Using technological expertise to boost the competitiveness of companies in Finland. Over the years, VTT has gained enormous expertise and experience of how companies in various sectors have successfully renewed their own operations, and developed new business activities, products and services based on cooperation with VTT. I believe that Finland needs this type of new growth and therefore also, VTT's most urgent task is to strongly grow and expand this activity.

VTT has a unique capability to help companies to renew and grow in Finland and from Finland. But many companies are still unaware of the opportunities VTT can offer. There is still much more potential to unlock in companies operating in Finland, and in VTT itself. We need to actively increase our customer contacts at all levels. We also need to keep inventing and trying out new ways of cooperating with companies and telling them about the possibilities available. In practice, this means growing VTT's privately funded business activities. Right now, I think this is the best indicator of how well VTT's technological expertise can boost the competitiveness of companies in Finland.

Aaro Cantell, Chairman of VTT Board

# VTT in figures

## Internal income statement

	1.1. - 31.12.		Change
	2014	2013	
	(M€)	(M€)	(%)
<b>REVENUE</b>	<b>255.9</b>	<b>284.3</b>	<b>-10</b>
<b>Turnover</b>	<b>251.0</b>	<b>278.5</b>	<b>-10</b>
External revenue	163.1	189.6	-14
Revenue, domestic private sector	40.5	52.6	-23
Revenue, domestic public sector	70.5	84.5	-17
Revenue from Tekes	44.5	58.2	-24
Other revenues, domestic public sector	26.0	26.3	-1
Revenue, foreign private sector	18.8	15.5	21
Revenue, foreign public sector	33.3	37.0	-10
Revenue from EU	29.6	30.7	-4
Other revenues, foreign public sector	3.7	6.3	-41
Basic government funding	88.1	89.2	-1
Turnover adjustment items	-0.2	-0.3	-20
<b>Other operating income</b>	<b>4.9</b>	<b>5.8</b>	<b>-15</b>
<b>EXPENSES</b>	<b>269.5</b>	<b>290.3</b>	<b>-7</b>
Personnel expenses	152.5	164.5	-7
Materials and consumables	13.9	15.5	-10
Rents	29.4	29.4	0
Purchases of services	38.0	45.8	-17
Other expenses	13.2	15.3	-14
Depreciation	15.9	16.0	-1
Financial expenses and revenues	6.6	3.9	70
Extraordinary expenses and revenues	-0.1	-0.1	6
<b>RESULTS</b>	<b>-13.6</b>	<b>-5.9</b>	

## VTT Group

- Turnover 277 M€

## VTT

### Financial information

- Turnover 251 M€
- External revenue 163 M€ (65% of turnover)
- Basic government funding 88 M€ (35% of turnover)
- Revenue from abroad 52 M€ (21% of turnover)

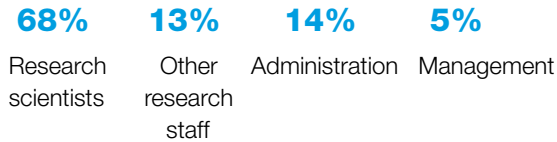
### Personnel

- Personnel 2,375
- University degree: 83%
- Doctors and licentiates: 29%
- 73 persons on assignment abroad
- 155 foreign visiting persons at VTT

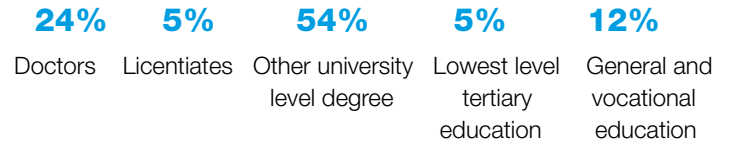
### Customers

- 1,380 customers
- 710 domestic companies
- 420 foreign companies
- 250 public organizations in Finland and abroad

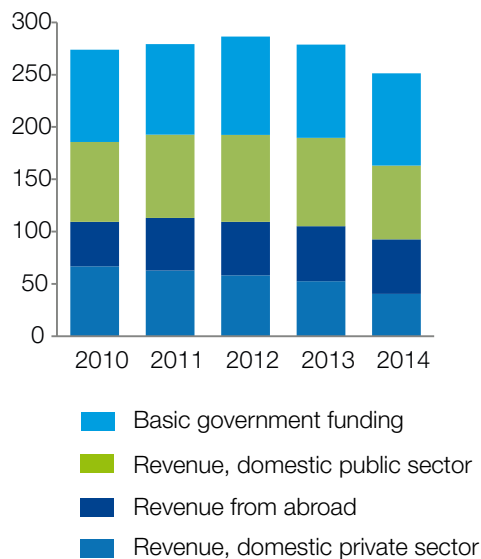
## Personnel strength and structure



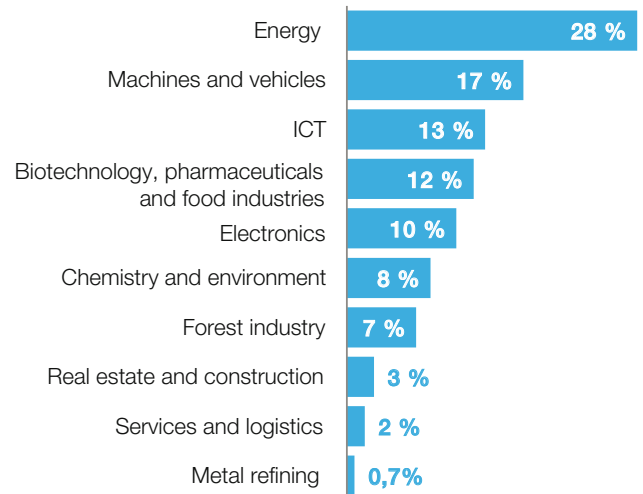
## Education of personnel



## Turnover, M€

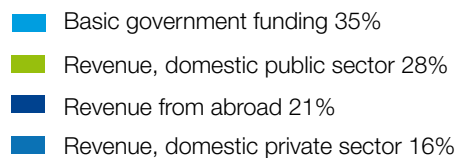


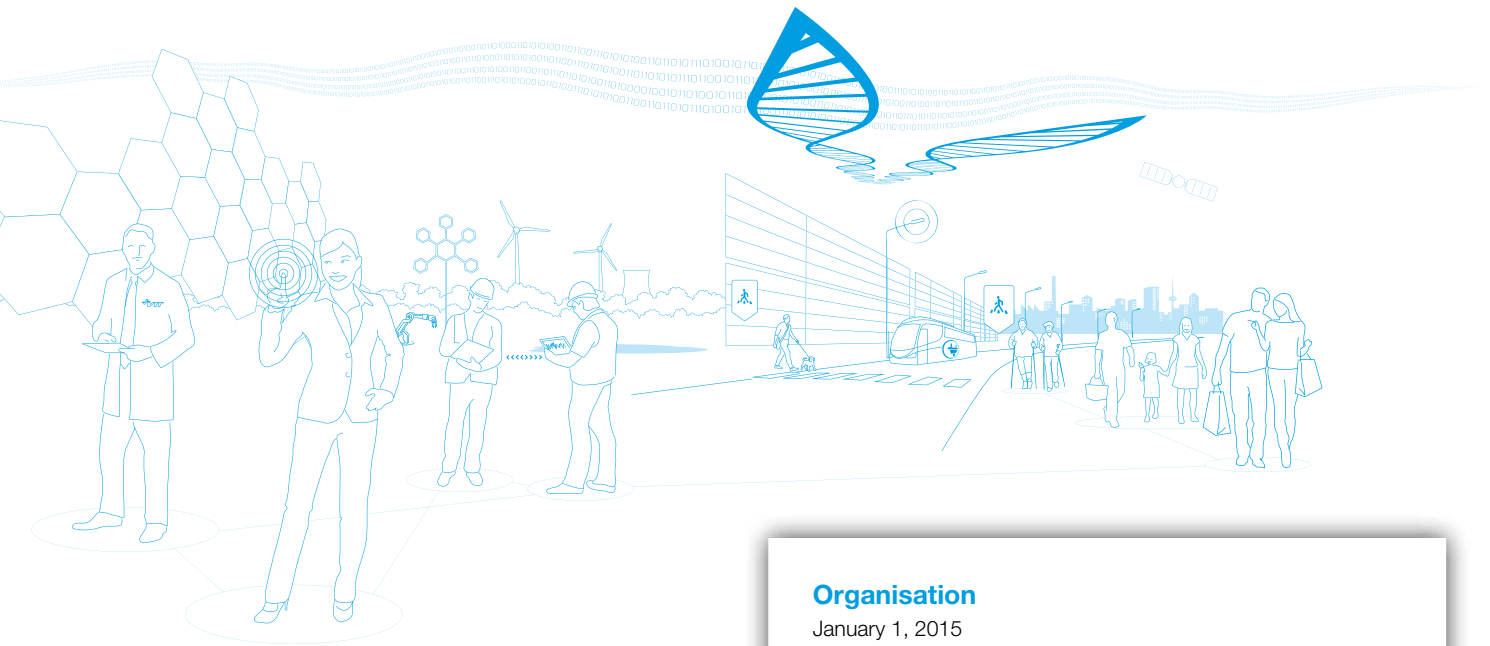
## Revenue from commercial activities in the domestic private sector (\*)



\*) Classification according to VTT's customer segments.

## Turnover by type of revenue





## VTT became a limited liability company January 1, 2015

VTT Technical Research Centre of Finland and the Centre for Metrology and Accreditation MIKES amalgamated January 1, 2015. At the same time, VTT became a limited liability company.

As a fully state-owned, not-for-profit-company with a specific service mandate, VTT Technical Research Centre of Finland Ltd is part of Finland's innovation system and operates under the mandate of the Ministry of Employment and the Economy. VTT still receives budget funding from the state for creating new technological opportunities, but the company's operational focus is on its company-driven service operations. As a limited liability company, VTT can now focus its resources on heading in new directions on a freer and more agile basis.

The company engages in applied technology research, transforming its research results into practical solutions. It is also Finland's national metrology institute.

VTT uses its research and knowledge as a basis for providing expert services for its domestic and international customers and partners in both the private and public sector. VTT is Finland's biggest applied research organisation and the Nordic countries' leading research and technology company.

VTT has focused its research on three business areas: Knowledge Intensive Products and Services, Smart Industry and Energy Systems, and Solutions for Natural Resources and Environment.

### Organisation

January 1, 2015

Erkki KM Leppävuori, President & CEO

### Business areas

#### Knowledge Intensive Products and Services

*Petri Kalliokoski, Executive Vice President*

#### Smart Industry and Energy Systems

*Jouko Suokas, Executive Vice President*

#### Solutions for Natural Resources and Environment

*Kari Larjava, Executive Vice President*

### CTO's Office

*Anne-Christine Ritschkoff, Executive Vice President*

### Business Support

*Seppo Viinikainen, Executive Vice President, Administration*

*Riitta Tolvanen, Senior Vice President, HR*

*Matti Karhunen, Senior Vice President, Legal, IPR and security*

*Timo Nurminiemi, Senior Vice President, Finance*

*Markus Ekman, Senior Vice President, Information management*

*Olli Ernvall, Senior Vice President, Communications*

### VTT companies

**VTT Expert Services Ltd**, *Laura Apilo, CEO*

**VTT Ventures Ltd**, *Antti Sinisalo, CEO*

**VTT International Ltd**, *Petri Kalliokoski, CEO*

**VTT Memsfab Ltd**, *Hannu Kattelus, CEO*

More information on VTT activities and research: [www.vttresearch.com](http://www.vttresearch.com)

Web version of VTT Review:  
[www.vttresearch.com/vttreview2014](http://www.vttresearch.com/vttreview2014)

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EXPERTISE.

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We use our research and knowledge to provide expert services for our domestic and international customers and partners, and for both private and public sectors.

We use 4,000,000 hours of brainpower a year to develop new technological solutions.



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