

2015



INDUSTRY



HEALTHY LIVING



DEFENCE, SAFETY
AND SECURITY



URBANIZATION



ENERGY

TNO innovation
for life

TNO ANNUAL REPORT 2015

CONTENTS

Management summary 3

Foreword by Paul de Krom 4

Profile, mission and impact 5

FIVE THEMES

Strategy 2015-2018 7



INDUSTRY

Our impact

Showcase

8

9

12



HEALTHY LIVING

Our impact

Showcase

13

14

17



DEFENCE, SAFETY AND SECURITY

Our impact

Showcase

18

19

22



URBANIZATION

Our impact

Showcase

23

24

27



ENERGY

Our impact

Showcase

28

29

32

ABOUT TNO AND THE TNO REPORTS

Organization 33

The TNO Board of Management 35

Report of the TNO Board of Management 36

Corporate governance 38

Financial key figures 2015 40

Financial summary 41

In control statement 43

Report of the TNO Supervisory Board 44

Report of the TNO Council for Defence Research 45

Report of TNO Bedrijven B.V. 46

RESPONSIBLE BUSINESS

Key figures: personnel and environment 2015 47

Value creation, stakeholders and approach 48



GOOD RESEARCH

Integrity

Client satisfaction

Knowledge position

Animal testing

51

51

52

52

53



HEALTHY EMPLOYEES

Engagement and loyalty

Vitality

Diversity

Training and development

53

53

53

54

54



ENERGY EFFICIENCY

Carbon footprint

54

54



SAFETY

Safety in the workplace

Incidents

55

55

55



SOCIAL ENGAGEMENT

Innovation for Development

Social return

56

56

56

Appendix Staff establishment, sick leave, etc. 57

GRI index 58

FINANCIAL STATEMENTS 2015

62

MANAGEMENT SUMMARY

Throughout 2015, TNO worked to achieve impact through innovation, to foster cooperation both within and beyond the organization, and to improve operational efficiency. Positive results can be reported in all three areas.

FIVE THEMES

In this Annual Report, we present the five focal points, or 'themes', of our research. We describe our overall impact and present a number of projects which illustrate how we work alongside various partners to achieve synergy and innovation. The 'showcase' articles offer many examples of our successful collaboration with private sector companies, resulting in innovative products such the 'Extractor', a radical redesign of the traditional welding torch which will greatly reduce the risk of occupational disease among welders.

REDUCTION IN GOVERNMENT FUNDING

TNO closed 2015 with a positive result of 2.5 million euros. Given the recent reduction in direct government funding, which has negatively affected market revenue and forced us to undertake an internal reorganization, we are satisfied with this level of performance.

The objective of the reorganization process, known as Project Focus, was to compensate for the announced cut in the government's contribution for 2016 and 2017, the amount concerned being 17.6 million euros. We were forced to make certain choices with regard to the research portfolio and did so in close consultation with our stakeholders. The factors which influenced financial performance in 2015 are described in the ['Financial Summary'](#).

IMPROVED OPERATIONAL PERFORMANCE

The positive financial results are due in part to improved operational performance. Specific attention was devoted to project management throughout the reporting year. Our efforts were not in vain: the external audit for ISO 9001 accreditation found no 'nonconformities' or 'observations' of significance.

GOOD EMPLOYERSHIP

TNO attaches much importance to good employership. As a knowledge organization, everything we do relies on our human

capital: the people who contribute their talent and expertise. We are therefore extremely gratified that TNO was named 'Favourite employer in the technology sector 2015' by the graduate careers journal Intermediair for the third consecutive year. An internal survey revealed that the number of employees experiencing work-related stress fell from 21.6% in 2014 to 16.6% in 2015. Despite the clear improvement in this and several other areas, we shall continue to devote close attention to staff satisfaction, as described in the [Responsible Business section](#) of this report.

WORD OF THANKS

We wish to thank all stakeholders for their contribution towards our results. Only through effective cooperation are we able to create the innovations that strengthen the competitive strength of Dutch industry and underpin the economic and social wellbeing of our country. We greatly appreciate the constructive input of all partners in 2015 and are confident that this successful collaboration will continue in 2016 and beyond.

TNO Board of Management

FOREWORD

BY PAUL DE KROM

I greatly enjoyed getting to know TNO over the past year. I have been extremely impressed by the sheer depth and breadth of knowledge to be found throughout the organization. However, it was also clear that TNO faces a number of significant challenges and that not all opportunities have yet been taken. The Board of Management therefore designated three spearheads of policy in 2015: developing innovations with demonstrable impact, intensifying internal and external cooperation, and increasing the effectiveness of our operations.



[QuTech](#), in which we are working alongside TU Delft to develop the quantum computer, is a good example of the type of partnership we shall seek in future. During the past year, this project has expanded to include various public, semi-public and private sector organizations, such as the HTSM (Hightech Systems and Materials) Top Sector federation, Microsoft and Intel. Another good example of cooperation in pursuit of a common objective is the [Brightlands Materials Center](#), in which TNO's partners are the Province of Limburg and Royal DSM. It is becoming increasingly apparent that 'joint innovation' is essential if we are to provide an effective response to complex issues. This entails sharing knowledge, facilities and financial resources. In 2016, we intend to explore further opportunities in this context and will review our current strategy to ensure that it is fully aligned with that of other knowledge institutes. Our main focus will nevertheless remain unaltered: we shall continue to pursue innovations that have significant impact and that support the major societal transitions. Several examples are included in this report.

QuTech's activities attracted considerable [media attention](#) during 2015, as did several other issues in which TNO plays a prominent role. They include the investigation into the MH17 crash, public concern about diesel emissions, and the situation in Groningen, where subsidence and earth tremors are blamed on gas exploration. All have great social relevance and hence attract great public interest. I hope it is unnecessary to state that TNO continues to observe the key values of impartiality, objectivity and thoroughness.

Looking back on 2015, I conclude that our success was largely attributable to focus, by which I mean a focus on quality, on content and on sound operational performance. When I joined the organization, I realized that it was essential to increase the predictability of operational performance. We have made some major improvements in this regard. This is a significant

achievement and one that is extremely important to our future, not least in view of the ongoing reduction in government funding. Budget cuts have already prompted a reorganization process and have forced us to make certain choices with regard to the research portfolio. Despite such difficulties, TNO closed the reporting year with a positive result of 2.5 million euros.

The reorganization called for the workforce to be downsized by 216 FTE. Fortunately, much of the reduction could be achieved through natural employee turnover and alternative employment was found for 23 of the 97 surplus personnel.

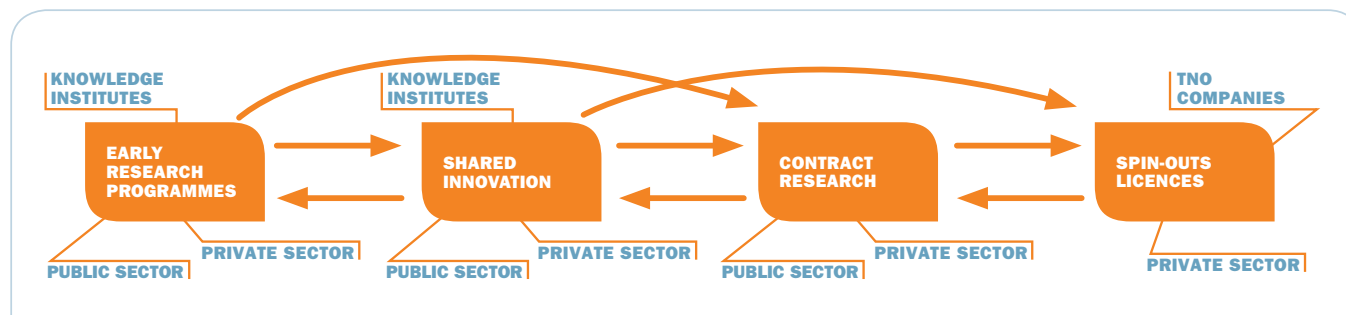
I wish to take this opportunity to thank all stakeholders – in which I include the Top Sector federations, other members of the knowledge coalition, the strategic advisory councils, the Supervisory Board, the Council for Defence Research, the European Commission, the TO2 partners, industry, the Ministry of Economic Affairs and other government departments – for their commitment, support and confidence. I particularly wish to thank all TNO employees and the staff co-determination bodies. Despite the uncertainties caused by the reorganization process, all 'kept their eyes on the ball' and continued to show their customary determination in working to create smart solutions for the benefit of society.

As a relative newcomer, I can now join the other members of the Board of Management in looking back on a very inspiring and stimulating year. It was a year in which we once again sought closer contact with the outside world. Our success in doing so resulted in many innovations which will strengthen the competitive ability of Dutch industry, help to maintain the safety and security of the Netherlands, and promote the health and well-being of society at large. In short, we have embodied our

For the Board of Management,
Paul de Krom, Chair

TNO brings together people and knowledge to create innovations that will strengthen the competitive ability of Dutch industry,

TNO plays a specific role in pursuing innovation on behalf of three public sector clients: the Ministry of Defence, the Ministry



of Social Affairs and Employment, and the [Geological Survey of the Netherlands](#) (GDN). These organizations have certain statutory research tasks, some of which they have delegated to TNO. We also manage the 'Innovation for Development' programme in which relevant knowledge is disseminated to the small and medium-sized enterprise sector to support [innovation in the developing countries](#).

FINANCIAL MODEL TNO

TNO is a 'not-for-profit' knowledge organization. In practice, we must ensure that all costs are covered and a modest profit is made in order to maintain a sound capital position and safeguard the continuity of knowledge development.

The 'early research' and 'shared innovation' programmes often rely on some public funding. Where this is the case, the public contribution can never exceed that of the costs actually incurred by TNO. The costs of involvement in other public research programmes, such as the European Union's Horizon 2020, are only partially reimbursed, participation requiring TNO to 'match' the public contribution from its own resources. This means that the required modest profit can only be achieved through direct contract research, spin-outs or income from licensing agreements.

Developing the knowledge which will eventually be used by the market can be a very expensive undertaking. A return on investment cannot be guaranteed due to the risks involved. Active and effective management of the entire process of knowledge development and valorization is therefore essential in the interests of continuity.

THE INNOVATION LANDSCAPE

In October 2015, the government, Top Sector federations and relevant knowledge institutions signed the innovation contracts

for the 2016-2017 period. All parties, including TNO, thus confirmed their commitment to the Top Sectors. TNO will strive to increase the competitive strength of Dutch industry and will seek solutions to the major societal challenges of today. Areas for attention include the energy transition, safety and security, and the affordability of healthcare. TNO will also attempt to establish crossovers between the various sectors, because innovation takes place at the convergence of the technological disciplines and their practical application.

On 27 November 2015, the [National Research Agenda](#) was presented to the Minister of and State Secretary for Education, Culture and Science (OCW), and their colleague the Minister of Economic Affairs. The agenda lists 140 'clusters' of research questions which have been distilled to form 16 prospective 'routes', illustrating opportunities to create new connections throughout the research chain. The agenda has been produced by the knowledge coalition* with a view to coordinating research activities and increasing the strength of the knowledge infrastructure. TNO experts are involved in several aspects of the agenda's development, including the design of the proposed routes.

EUROPE

Throughout 2015, TNO was involved in research activities which form part of the new European framework programme, Horizon 2020. During its first two years, 2014 and 2015, the programme has awarded TNO some 33 million euros in research funding. The Netherlands Organization for Scientific Research (NWO) has added a further 9% under the new national matching arrangements ('Encouraging European Research'). This enables us to take a more active part in several other components of the Horizon 2020 programme and to make a greater contribution to the Dutch innovation system. Alongside excellence in research, the assessment criteria for project proposals at the European

level now devote even greater attention to the impact of the research outcomes. TNO is of course familiar with this approach and will continue to compete for funding on this basis.

* The knowledge coalition comprises the Royal Netherlands Academy of Arts and Sciences (KNAW), SME Netherlands, the Federation of University Medical Centres (NFU), the Netherlands Organization for Scientific Research (NWO), the T02 partners, the Netherlands Association of Universities of Applied Sciences, the Confederation of Netherlands Industry and Employers (VNO-NCW), the Association of Universities in the Netherlands (VSNU) and TNO.

PREPARING FOR THE 2018-2021 STRATEGY PERIOD

To keep pace with the two-year duration of the innovation contracts, the process of revising and updating the T02 strategic framework for the 2018-2021 period is to begin in 2016. The framework coordinates the activities of the six main institutes of applied research in the Netherlands**. In matters affecting the positioning of applied research, TNO will follow the strategic framework as closely as possible. At the same time, we shall update our own strategy with particular reference to the research portfolio. We shall also devote much attention to further internationalization and how TNO can facilitate large-scale partnerships within the 'Joint Innovation Centres'. Ensuring adequate staffing levels and positioning for the major, long-term collaborative projects will demand thorough preparation. The refinement of our own portfolio is an ongoing process. The current roadmaps provide direction and form the basis of strategy, which is then further developed in consultation with our stakeholders.

** DLO, NLR, ECN, Deltares, Marin, TNO.

STRATEGY 2015-2018: FIVE THEMES

TNO focuses on five societal transitions:

**INDUSTRY**

From stagnation to growth in high-tech industry.

**HEALTHY LIVING**

From illness and care to health and lifestyle.

**DEFENCE, SAFETY & SECURITY**

From disparate threats to manageable risks.

**URBANIZATION**

From problems created by urbanization to vital urban regions.

**ENERGY**

From conventional sources to sustainable energy systems.

INDUSTRY

FROM STAGNATION TO GROWTH IN HIGH-TECH INDUSTRY



› ‘CREATING PROSPERITY THROUGH INNOVATIVE INDUSTRY’

Industry helps determine the Netherlands' social and economic well-being. It creates employment, and every new job in industry represents a job elsewhere. Industry accounts for eighty per cent of our physical exports. TNO supports private sector innovation, contributing knowledge in areas such as big data, space technology, sensors, optical systems, 3D printing, biobased materials and the Internet of Things. Our specialist knowledge and facilities help companies to arrive at new, innovative solutions. One specific focus is 'Smart Industry', in which we are accelerating the computer automation of production processes. New technologies optimize those processes to make manufacturing more efficient, with higher quality at lower costs.

‘During the past year, TNO and its partners have raised Smart Industry onto a new level. It is now a familiar concept among all stakeholders, from government to companies of all sizes. We organized a number of workshops to consider the “soft” aspects of Smart Industry. What will it mean in terms of human resources and the skills that staff are expected to possess?’

We also helped to set up around ten “field labs”: experimental settings in which private sector companies, government agencies and research institutes work together to develop, test and implement joint solutions.

Solliance stands out as another example of our success in 2015. Combining strengths and a multidisciplinary approach remain the keywords. Technologies are merging, and ICT is playing a more prominent role in all sorts of fields. The baby boom is over, the financial bubbles have been burst, resources are becoming ever scarcer. Nevertheless, the Netherlands has established an excellent position from which to create new wealth and social well-being based on innovative industry.’

ARNOLD STOKKING, MANAGING DIRECTOR, INDUSTRY

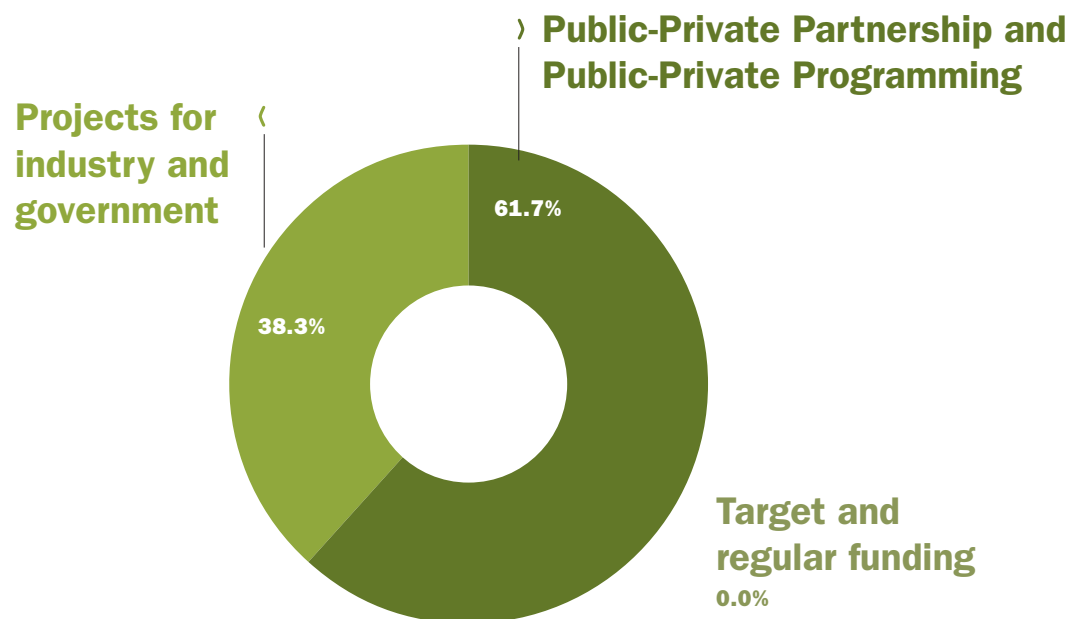
‘COMBINING STRENGTHS AND A MULTIDISCIPLINARY APPROACH REMAIN THE KEYWORDS’



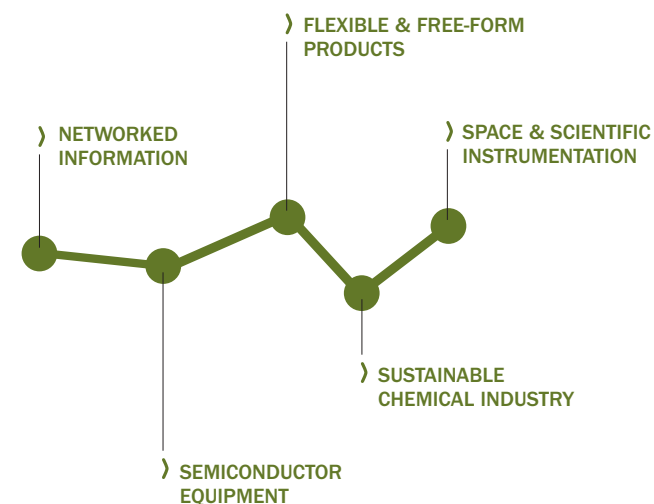
OUR IMPACT

TNO stands for targeted innovation. We do not develop knowledge for its own sake but in anticipation of its practical implementation in the real world. The Industry portfolio is based on five roadmaps. In this section, we present a number of projects which illustrate our social and economic impact.

› BREAKDOWN OF PORTFOLIO FUNDING



› ROADMAPS



FIVE THEMES



THE FOURTH INDUSTRIAL REVOLUTION

Alongside partners such as VNO-NCW, Nederland-ICT, the FME technology federation and the Netherlands Chambers of Commerce, TNO has launched the 'Action Agenda for Smart Industry in the Netherlands'. The fourth industrial revolution is now upon us and will have inescapable consequences for companies of all sizes. Robotics, sensor technology, the Internet of Things, 3D printing: all are new technologies that will shape our future. In the past year, TNO and its partners have given over one hundred presentations attended by a total of several thousand people. We have helped to set up departments of Smart Industry in no fewer than fifteen universities of applied sciences, and we are responsible for nine of the ten field labs now in operation. We produced a design for the digital factory of the future, in which OEMs and their suppliers are interconnected online. We have conducted a 'Smart Industry Scan' for the SME sector. At the European level, our approach has been cited as an 'inspiring example', on a par with Germany's Industrie 4.0 programme. As the architect of new technological applications, we continue to play an essential role in innovation by and for national industry.



[Industry](#)

[Incentive programmes](#)

[Dutch industry, smart\(est\) industry](#)

[The Smart Industry Scan](#)

FOTO: BART VAN OVERBEEKE FOTOGRAFIE



THE ONLINE COW

Mention the 'Internet of Things' or 'Big Data' and most people think of communication between computers and systems. TNO and the dairy sector have gone a step further with the 'connected cow'. Cattle sheds are equipped with sensors which monitor the physical status of animals, providing the farmer with a wealth of information that allows him to make informed decisions about feeding requirements, health and fertility. The result is cows that give more milk over a longer period. The farmer's business operations become that much more efficient and sustainable. The Smart Dairy Farming field lab has installed the new technology at seven locations, with hundreds more planned in the next phase. This unique solution will strengthen the position of the Dutch dairy sector, placing it firmly on the world map.



[Sharing knowledge in the dairy sector](#)

[Smart dairy farming](#)



THE HOLST CENTRE: INNOVATION ATTRACTS MULTINATIONALS

Atomic Layer Deposition (ALD) is a technology that allows a surface to be coated with an extremely thin layer of a functional material. Its development has been given a significant boost by a TNO discovery. At present, the main application of ALD is in the manufacture of computer chips. This is, however, a complex and expensive process. 'Spatial ALD', developed at the Holst Centre by TNO and our industrial partners, makes the production process very much quicker and hence much less costly. The technology can be applied in numerous products other than computers, such as (flexible) solar cells and OLED displays. Spatial ALD has placed TNO and its partners among the global elite. One such partner is Mayer Burger (Netherlands) B.V., formerly Roth & Rau, a leading technology company based in Eindhoven which is now manufacturing production machinery based on the Spatial ALD concept. A large European multinational has already placed a firm order. Cooperation within the Holst Centre has therefore created new technology which in turn has created new industry. Moreover, the ability to produce solar cells and energy-efficient OLEDs at lower cost will also bring environmental benefits.



[Flexible & free-form products](#)

[Holst Centre: open innovation by imec and TNO](#)

[Solliance: where research and industry join forces](#)



FIVE THEMES



› CONVERTING WASTE INTO SUSTAINABLE RESOURCES

Every year, Dutch households produce a total of almost five million tons of domestic waste. As a member of the Biorizon partnership, TNO has been working alongside Attero, AEB, Orgaworld and the Dutch Waste Management Association on the Waste2Aromatics project. The objective is to find a way of recovering complex carbohydrates (sugars) from organic waste flows and using them to produce biobased aromatics: important resources in the chemicals industry that are currently extracted from oil resulting in significant carbon emissions. The project has already resulted in some extremely promising technologies which will benefit both industry and the environment. The business cases produced by TNO yielded a very positive picture, as a result of which there is a sound basis and enough interest for a follow-up project in the form of a pilot conversion plant. We are now working on the design of the pilot under the Biorizon banner. In the past, TNO helped to develop innovative production methods for biomass and sustainable energy. We are now jointly responsible for the production of high-quality, sustainable chemical compounds as well. This is an important step towards the circular 'closed loop' economy.



[Biorizon's method of converting domestic waste into biobased aromatic compounds has attracted considerable interest](#)



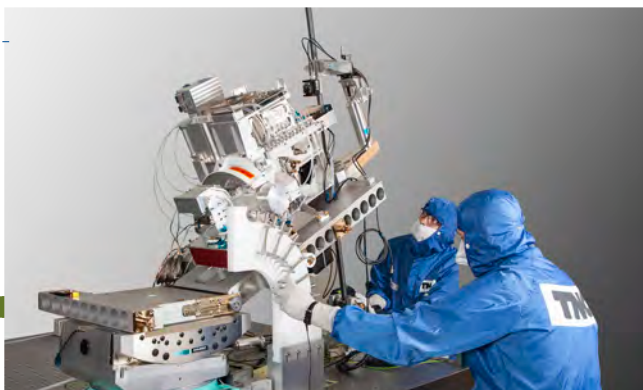
› STATE-OF-THE-ART INSTRUMENT FOR CLIMATE RESEARCH

Following a successful build-and-test phase, the Dutch earth observation instrument Tropomi was installed in the Sentinel Precursor satellite in mid-2015. Tropomi is the most accurate instrument of its kind ever built. Following its launch by the European Space Agency (ESA) in 2016, it will orbit our planet taking measurements to support research into atmospheric pollution and climate change.

TNO experts produced the initial optomechanical design for Tropomi. The build and calibration phase was undertaken by a consortium of mostly Dutch partners, led by Airbus Defence and Space Netherlands. TNO was responsible for producing the telescope and the spectrometer which analyses ultraviolet, visible and near-infrared light. Tropomi is smaller, lighter and more accurate than its predecessors by virtue of several innovations developed by TNO in partnership with SRON, such as free-form optics and the 'immersed grating' system. The instrument will monitor several variables, including atmospheric concentrations of carbon monoxide, nitrogen dioxide, methane and ozone. It will provide daily information about air quality with a grid resolution of seven by seven kilometres, allowing pollution to be tracked at the level of an individual town or city.



[The Tropomi earth observation instrument](#)
[State-of-the-art instrument for climate research](#)

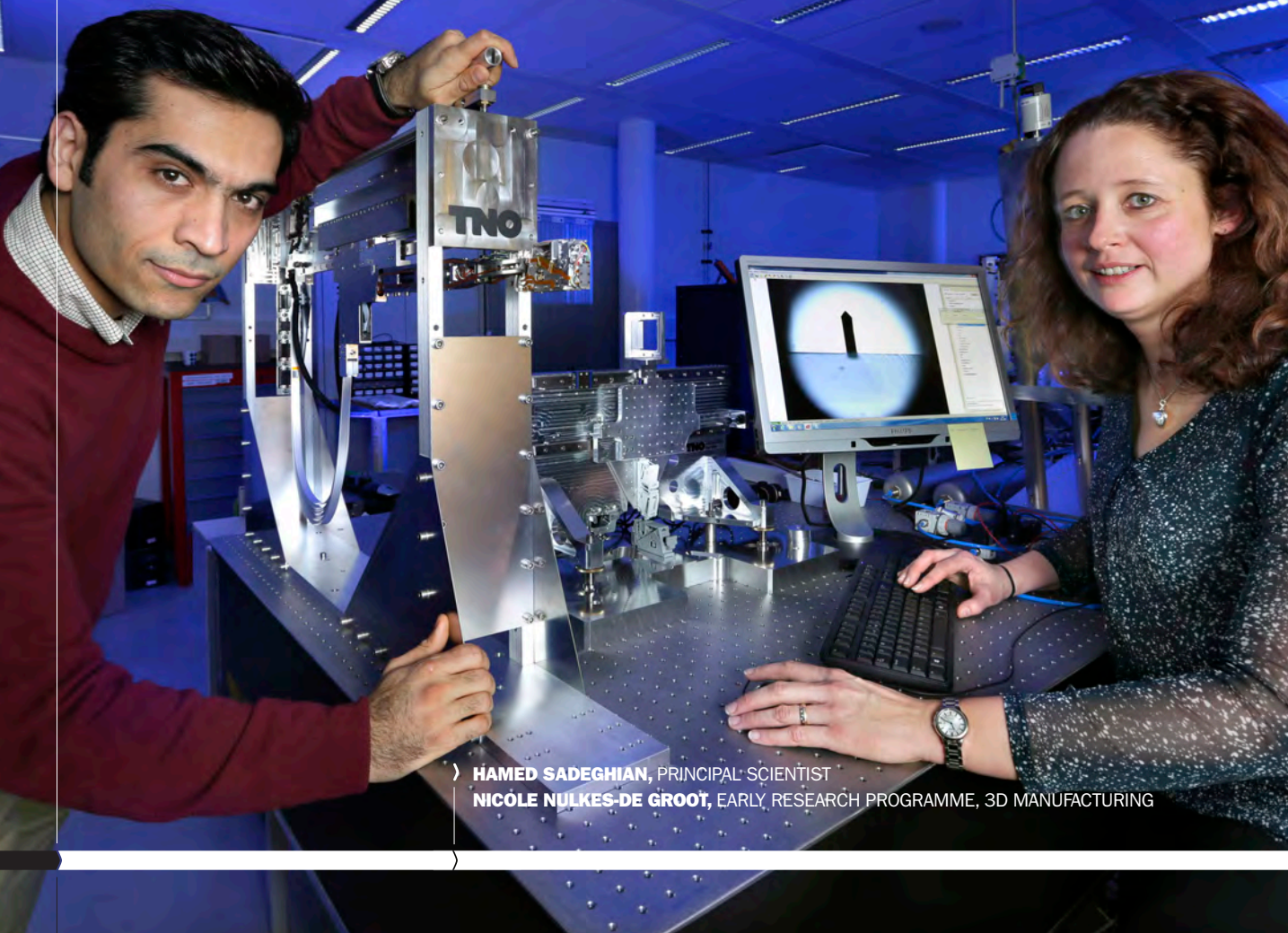


› STRATEGIC ADVISORY COUNCIL

- › A.H. LUNDQVIST, CHAIR
- › DR L. DEFERM, IMEC
- › DR H. VAN HOUTEN, PHILIPS RESEARCH
- › J.P. BENSCHOP, ASML
- › PROF. H. BRINKSMA, UNIVERSITY OF TWENTE
- › J.F.E. FARWERCK, KPN NETHERLANDS
- › PROF. R.L. LAGENDIJK, TU DELFT
- › J. ROTTEVEEL, ISIS
- › DR D.A. SCHIPPER, DEMCON
- › J.K. WESSELING, MINISTRY OF ECONOMIC AFFAIRS
- › DR M. WUBBOLTS, DSM INNOVATION CENTRE



'NANOMANUFACTURING AND QUANTUM COMPUTING'



HAMED SADEGHIAN, PRINCIPAL SCIENTIST
NICOLE NULKES-DE GROOT, EARLY RESEARCH PROGRAMME, 3D MANUFACTURING

'TNO has brought together leading researchers from the private sector and scientific field to raise 3D nanomanufacturing to the next level. One aspect that makes our work particularly interesting is the involvement of young researchers. PhD students inspire us with their new perspectives and approach. The essence of our applied research is teamwork, both internal and external. Rapid innovation demands collaboration with and between universities, knowledge institutes and industry. Research in the field of 3D nanomanufacturing has already given rise to several promising new applications. We have opted to focus on two specific areas: healthcare and quantum computing. In healthcare, for example, we are now developing early diagnosis techniques based on the use of nanoparticles that are actually introduced into the patient's body. Early diagnosis is often the key to effective treatment.'

Nanotechnology will also have a significant impact in terms of portable IT devices: smartphones, laptops and tablets.

'GIANT STEP AHEAD FOR PUBLIC HEALTH'

The desire is to make processors ever smaller, but existing technology places limits on the degree of miniaturization that can be achieved.

We are exploring and pushing back those limits. We are now working to develop the quantum computer within QuTech, a partnership of TNO and TU Delft with input from various companies including Intel and Microsoft. Our efforts will lead to a revolution in computer technology, with processors many times faster than the current generation. We are also working on another application of quantum technology: secure and "uncrackable" communication technology. In all cases, the production processes must be closely monitored. Tolerances are exact; there is no margin for error. We have joined a large industrial partner to develop a new, innovative production control method. Nanomanufacturing and quantum technology thus complement each other perfectly.'

FIVE THEMES



HEALTHY LIVING

FROM ILLNESS AND CARE TO HEALTH AND LIFESTYLE



› 'FOCUS ON PARTICIPATION RATHER THAN ILLNESS OR DISABILITY'

In the years ahead, the most important considerations in health and healthcare will be the prevention of disease, the quality of services, and affordability: keeping the costs of our healthcare system within bounds. The increasing incidence of lifestyle diseases and chronic conditions call for a new approach in which the focus is on participation rather than illness or disability.

Prevention of ill health demands innovations in areas such as nutrition – good, healthy and safe food must be readily available – and working conditions. And if someone does fall ill, treatment will be more effective – and cost-effective – if it is tailored more to the individual. We must move towards 'personalized medicine'.

'OUR OBJECTIVE IS A HEALTHY, VITAL AND PRODUCTIVE SOCIETY'

'Local authorities have been given far greater responsibility in the social domain and we are providing the necessary support. We are involved in numerous projects and programmes to promote employment participation and improve healthcare services. We are pursuing innovations in health and welfare for young people, as well as innovations that will help seniors remain healthy, safe and active for longer. Diet and nutrition play an important role. We are helping manufacturers at home and abroad to produce healthier food products without compromising flavour or consumer appeal. One example is Peijnenburg Zero, the world's first sugar-free spiced rye cake. Our objective is a healthy, vital and productive society.'

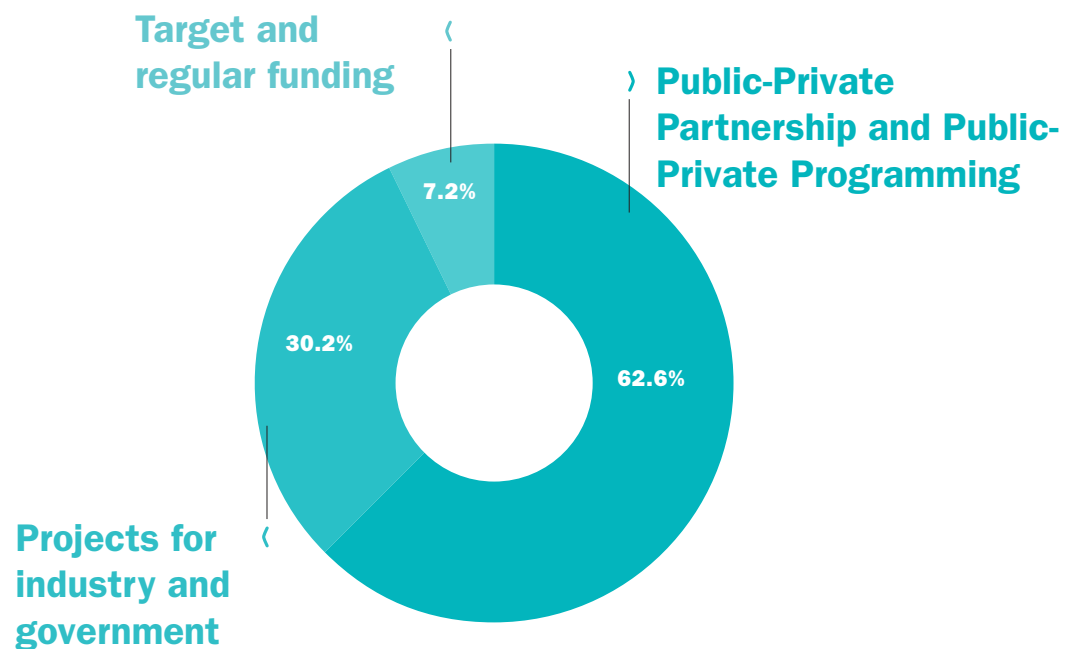
NIEK SNOEIJ, MANAGING DIRECTOR, HEALTHY LIVING



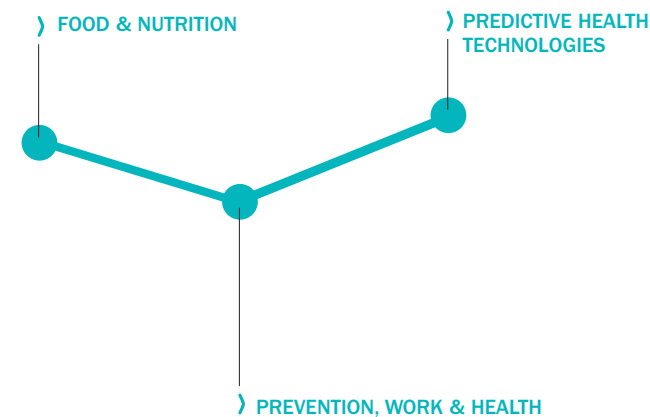
OUR IMPACT

Within the Healthy Living theme, the research portfolio is based on three roadmaps which link our knowledge to that of our partners in pursuit of the desired societal and economic impact.

› BREAKDOWN OF PORTFOLIO FUNDING



› ROADMAPS



FIVE THEMES

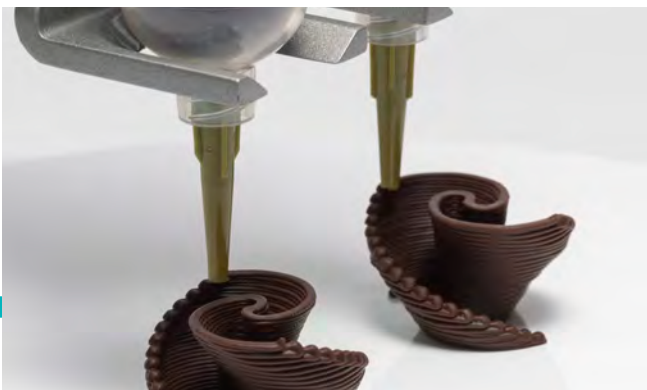


› LEADING THE WAY IN 3D-PRINTING FOR FOOD

Ongoing collaboration between experts in two fields – food and industrial innovation – has allowed TNO to achieve a global position in 3-D food printing. At Expo 2015, held in Milan, we joined the Italian food processing company Barilla to demonstrate a prototype of a machine that can print out shapes with all the flavour and texture of fresh pasta. Our pasta printer opens up new markets for manufacturers, but also for restaurants or hospital kitchens, for example. Its successful demonstration has led to further cooperation with several large food processing companies in Europe and the United States. Now that we have shown that it is possible to produce edible products in virtually any shape, we are turning to the next challenge: adding functionality to the printed foodstuffs. The objective is to produce complete individualized ‘à la carte’ meals quickly and on a large scale. This would be particularly useful in hospitals, where patients may require a special diet due to allergies or difficulty in chewing and swallowing regular meals. 3D food printing will therefore help to promote health and reduce food wastage.



[A world first: the 3D pasta printer](#)
[Unique products through 3D food printing](#)



› AN INTEGRATED APPROACH TO HEALTH AND WELFARE

In the Amsterdam-Noord district, some twenty per cent of households are classified as ‘low income’. Unemployment and debt are familiar problems, while many families face various health issues. TNO researchers are working alongside health and welfare agencies to resolve these issues and create a healthier community. We apply a grass-roots approach in which the first stage was establishing tasks and responsibilities. Next, we set up an ICT infrastructure, oversaw training for the professionals in the field and remain on hand to guide their work. In short, we have created a fully professional organization in which everyone knows what is expected of them and has access to all necessary resources. The result is optimal service for those who require it. A baseline measurement was taken, followed by assessments at six-monthly intervals. The findings are compared against a control group. Results to date are extremely promising. Social participation among the target group has shown a significant increase. There have been measurable improvements in both physical and mental health. Self-reliance has also increased: people are now doing things they never imagined possible. The Ministry of Health and Welfare has shown much interest in the approach, elements of which are to be adopted by local authorities throughout the Netherlands.



[Integrated care at the neighbourhood level](#)



› CAKE WITH NO ADDED SUGAR

‘Ontbijtkoek’ is a type of spiced rye cake popular in the Netherlands. The leading manufacturer is Peijnenburg, founded in 1883, which has recently introduced the first ever variety without added sugar. The recipe for ‘Peijnenburg Zero’ is based on TNO research into the functionality of sugars and sugar substitutes. Our food technologists focused on how sugars and artificial sweeteners affect the texture of the product. They then developed a formula which does away with added sugars altogether, without influencing either flavour or texture. The result is a delicious, moist cake which has a negligible 2% sugar content, being the natural sugars found in the main ingredient, rye. Peijnenburg Zero has 23% fewer calories than the traditional equivalent while its fibre content is higher. The product has proven popular among consumers since its launch. Peijnenburg and TNO are to continue their working partnership to develop further high-quality, healthy products.



[Peijnenburg zero](#)



FIVE THEMES



AEROSPACE TECHNOLOGY HELPS PEOPLE WITH DIABETES


People with diabetes have to monitor their blood glucose levels. In the past this has involved pricking a finger to draw blood, sometimes several times a day. It is not a pleasant experience for anyone, especially very young children and their parents. TNO researchers have devised an alternative method that relies on a small laser. Blood glucose can now be monitored without piercing the skin at all. This solution is entirely painless and safer, and spares the patient's delicate fingertips. We developed the technology and the equipment in partnership with the Dutch Diabetes Foundation and the Isala hospital in Zwolle, where it has been tested by several hundred patients. The technology is complex because it is necessary to 'decode' the reflected laser light to isolate the relevant information. Another challenge was making the device small enough to be portable. Innovations like this call for a multidisciplinary approach, involving experts in sensor technology, optics, computer modelling, statistics and even aerospace instrument designers. TNO is one of the very few organizations with all these disciplines under the same roof.

 [Diabetes in figures](#)
[Specialisms of the centres](#)



DIGITAL STRESS COACH PROMOTES VITALITY

Many companies offering vitality services have now adopted the TNO Stress Coach method, which provides a quick and reliable way of assessing a person's physical and mental resilience. The first version was in the form of a computer program. In partnership with several SME companies, we went on to develop a mobile app, to be launched in early 2016. It differs from many health apps in that the technology is based on validated computer models and extensive scientific research by reputable institutions such as the University of Leiden. It can, for example, predict whether a sportsman is in peak condition and ready to give of his best, or whether an employee is at risk of imminent burnout. The models combine subtle physical and psychological indicators of (excessive) stress which provide timely warning to the individual user. Companies can use the app as part of their employee vitality scheme. For organizations such as the Ministry of Defence and the national police, it is essential that personnel maintain a state of readiness. Both have shown interest in the technology. The Stress Coach is one of many instruments developed by TNO to keep our society fit and vital.

 [The world continues to learn.](#)



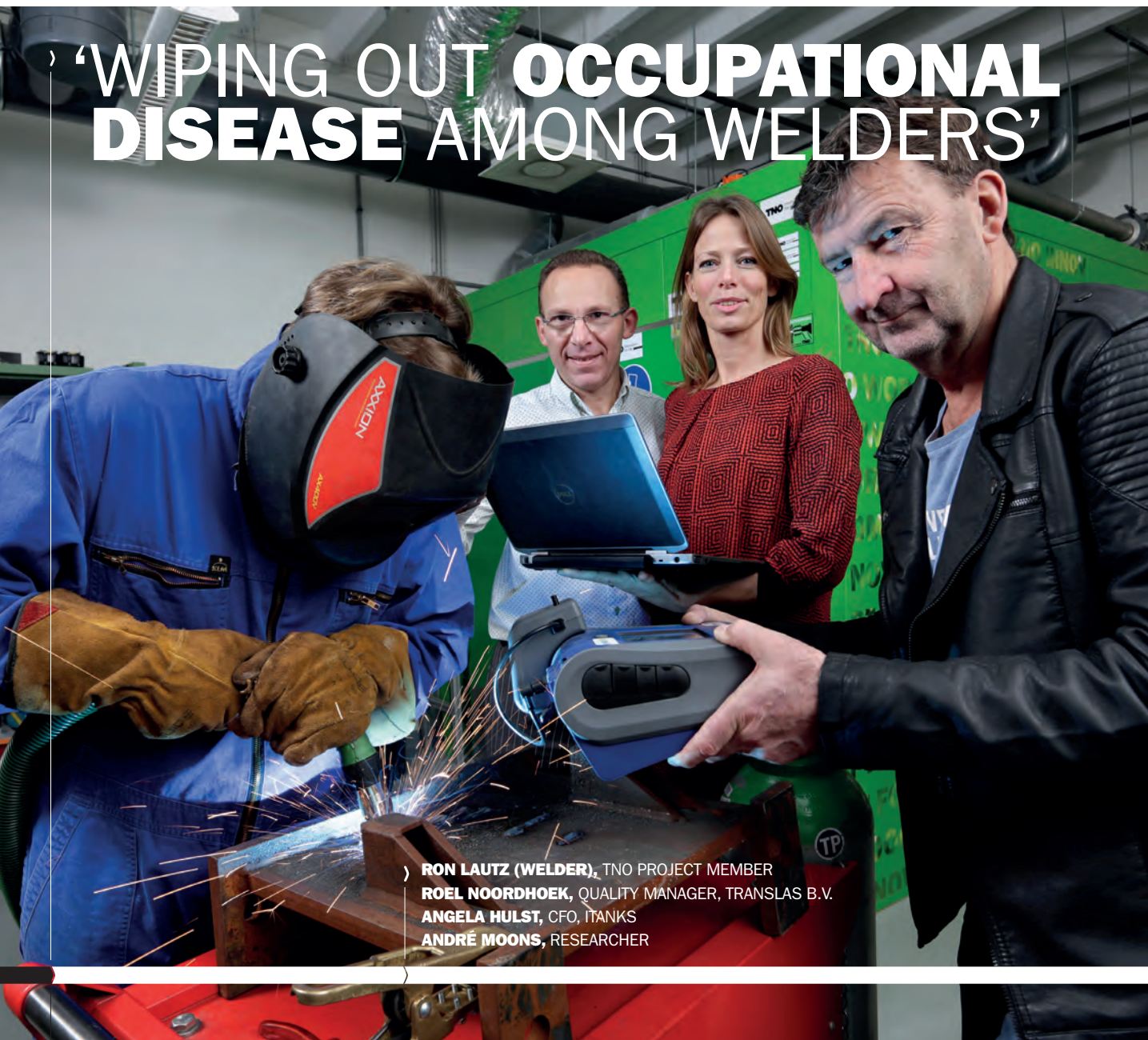
STRATEGIC ADVISORY COUNCIL

-) PROF. E.C. KLASSEN, CHAIR
-) PROF. E.M.M. MEIJER, FRIESLAND CAMPINA CORPORATE CENTRE
-) C. OUDSHOORN, VNO-NCW
-) D.M.J.J. MONISSEN, MAXIMA HOSPITAL UTRECHT
-) H. SMID, ZONMW
-) J.W. HOFSTRAAT, PHILIPS RESEARCH

FIVE THEMES



‘WIPING OUT OCCUPATIONAL DISEASE AMONG WELDERS’



) **RON LAUTZ (WELDER)**, TNO PROJECT MEMBER
ROEL NOORDHOEK, QUALITY MANAGER, TRANSLAS B.V.
ANGELA HULST, CFO, iTANKS
ANDRÉ MOONS, RESEARCHER

‘Have you any idea how many welders there are in Europe? Almost 750,000. And they are exposed to hazardous substances every day,’ states TNO researcher André Moons. ‘My colleague Bas Knoll and I found this an unacceptable situation. Inhaling welding fumes can lead to pulmonary and cardiovascular disease. There are safety regulations and statutory exposure limits but they are not particularly effective in practice. We have found situations in which the upper limits were exceeded by a factor of ten. We decided that the technology must be improved, so we assembled a multidisciplinary team of TNO experts including industrial designers and specialists in emissions, respiratory disease, hazardous substances, human-technology interaction and ergonomics. We designed a welding torch that reduces the operator’s exposure to hazardous fumes by over 95 per cent. We then found a company willing to develop and market the product: Translas, a Dutch manufacturer of welding equipment which exports to over forty companies worldwide. The iTanks innovation centre in Rotterdam provided investment.

‘MUCH CONTRIBUTION BY WELDERS’

This is very much a joint project to which all partners have made a contribution based on their own area of expertise. We see this as the only way in which to arrive at a worthwhile practical innovation. Welders themselves have also made a significant contribution, telling us what will and will not work in practice. The new torch has now been tested by hundreds of welders in the Netherlands and elsewhere. All report that it is more comfortable and pleasant to use than the conventional equivalent, yet produces results of equal quality. They welcome the extra protection it provides.’ TNO has earned international recognition for the device in the form of the Innovation Award for Applied Science 2015, presented by the European Association of Research and Technology Organizations (EARTO), which has some one hundred members. ‘Of course we are proud of the award, but we are even more proud to have improved the health of the welding profession. There has been considerable interest from Europe and the United States. I would like to see our torch being used by all welders in the world, whereupon occupational disease will become a thing of the past,’ says André Moons.

FIVE THEMES



[The Extractor](#)

[Hazardous fumes reduced by 90% to 95%](#)

DEFENCE, SAFETY AND SECURITY

FROM DISPARATE THREATS TO CONTROLLABLE RISKS



› 'INTERNAL AND EXTERNAL SAFETY ARE INCREASINGLY INTERTWINED'

A country's wellbeing relies on the safety of its population. People must not only be safe but they must feel safe. TNO places its expertise at the disposal of the emergency services, defence organizations and private industry in order to create innovations that will help them to protect our safety and security. We are concerned with all aspects – physical, social and digital – as well as the perception of safety.

Terrorism, crime and disasters are not confined by national borders. Moreover, it is sometimes difficult to identify the threats to our safety: who are the 'bad guys'?

'Europe is surrounded by conflict zones. Wars being waged far away have tangible effects here: the MH17 incident, the barbaric acts of the self-styled Islamic State, the Paris attacks, the ongoing influx of migrants from the Middle East. Internal and external safety are becoming increasingly intertwined.

Technological developments also affect our safety and security.

'EUROPE IS SURROUNDED BY CONFLICTS'

Information technology makes a massive contribution to our welfare and prosperity but the digital domain is particularly susceptible to illegal activity, including terrorism. Cybersecurity is a relatively new and fast-changing discipline but one in which TNO researchers are increasingly active. For example, we help to trace those responsible for criminal activity on the "Dark Web", an area in which we possess unique knowledge. We have identified the risks and opportunities presented by unmanned aircraft – drones – and have developed innovative solutions to defend against drone attacks. We advise on the unwelcome aspects of technology and what would happen if innovations fall into the wrong hands.

We help the defence forces to prepare for the future, as in our various studies to support naval equipment replacement programmes. We advise about the ways in which technology will shape future conflicts and weapons systems. The demand for knowledge and innovation is greater than ever, and we are required to provide that knowledge even more quickly.'

HENK GEVEKE, MANAGING DIRECTOR, DEFENCE, SAFETY AND SECURITY



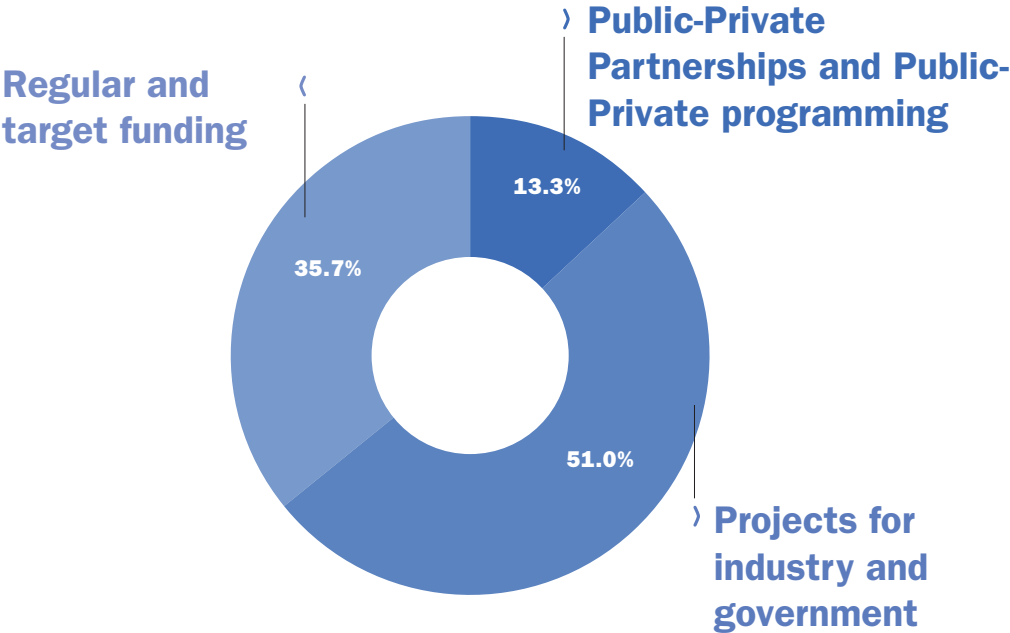
FIVE THEMES



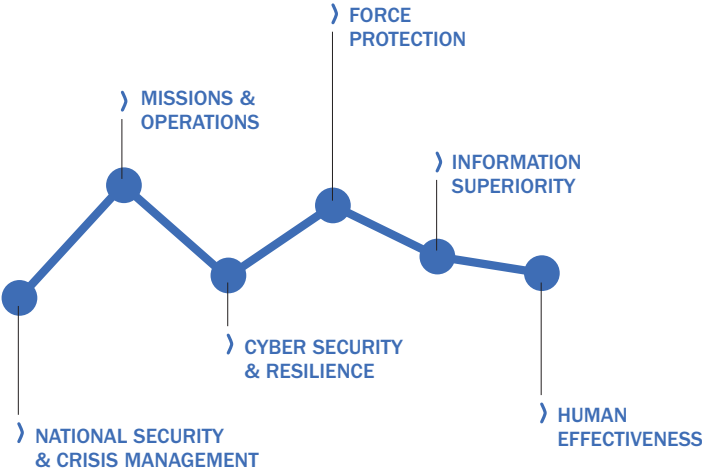
OUR IMPACT

Safety and security are basic societal requirements. TNO brings together people and knowledge to create innovations that will support our national and individual safety. The Defence, Safety and Security theme is concerned with innovations both large and small, many of which relate to weapon systems. Our activities are based on six roadmaps.

› BREAKDOWN OF **PORTFOLIO FUNDING**



› **ROADMAPS**



FIVE THEMES



THE COMPLEX CHALLENGES FACING DEFENCE FORCES

National security can never be taken for granted and the 'powder keg' regions, some bordering Europe itself, now demand a new approach. Military solutions alone are no longer enough: there must be intensive ongoing cooperation between the government, the knowledge partners and industry. This was a key message of the Future Force conference, organized by TNO in association with the Ministry of Defence (MOD) and The Hague Centre for Strategic Studies (HCSS). The Netherlands' Chief of Defence, General Tom Middendorp, joined some 450 colleagues and partners from all NATO countries in examining the challenges which are likely to present themselves in the very near future. TNO is the MOD's primary strategic partner. We help the ministry to ensure that its significant and complex investments are well planned and executed. We apply a short innovation cycle to ensure that innovations can be applied in practice as quickly as possible. We are also engaged in longer-term innovation processes. For example, we recently commenced preliminary studies to support decision-making with regard to replacement programmes for the Royal Netherlands Navy. Our work also has environmental benefits and ensures that the Dutch defence industry can maintain an important competitive advantage.



[Conclusions of the Future Force conference](#)
[Issues in defence, safety and security.](#)



DETECTING AND DISARMING DRONES

The rapid emergence of mini-UAVs (unmanned aerial vehicles, popularly known as 'drones'), has raised many questions about both risks and opportunities. Both the Ministry of Defence and the National Police are interested in the use of mini-UAVs to guard sensitive sites, monitor large events, collect intelligence information and counter terrorist activity.

In a study conducted for the Ministry of Defence, TNO examined ways in which hostile mini-UAVs can be detected, diverted, disarmed or destroyed. We are a world leader in all required technologies: observation and surveillance systems, information processing, cybersecurity, communication and localization, and electronic warfare.

We do not consider it feasible to develop a single system that will neutralize all UAV threats. We have therefore opted for a 'toolbox' approach and this sets us apart from organizations that are focusing on simple countermeasures.



NEW CONCEPT FOR INTERNATIONAL KNOWLEDGE SHARING

TNO and the Norwegian defence research institute FFI (Forsvarets forskningsinstitutt) are to undertake joint research in protection against CBRN (chemical, biological, radiological and nuclear) weapons. The two countries' defence ministers signed an agreement in late October, thus heralding the start of the 'Strategic Mutual Assistance in Research & Technology' initiative, or SMART. The innovative approach is intended to produce better results without incurring any additional costs. Although FFI and TNO will provide mutual assistance, each institute will remain entirely independent. Norwegian defence staff may choose to approach TNO with their research requirements, while the Dutch Ministry of Defence can go directly to FFI. This arrangement is unique. No doubt the other members of NATO and the European Defence Agency (EDA) will follow the initiative with great interest. It represents a new concept in international knowledge sharing in the defence field. Two projects are already underway: one is concerned with biological protection and the other is examining biomedical aspects. Further projects in space technology for defence are planned.



[Norway and the Netherlands share knowledge](#)



FIVE THEMES



UNIQUE KNOWLEDGE OF THE DARK WEB INTERNATIONALLY SHARED

In 2015, police officers from many countries attended a five-day training course in investigating and combating criminal activity on the 'Dark Web'. The course was developed by TNO and run in association with the Interpol Global Complex for Innovation in Singapore. TNO is an acknowledged world authority on the criminal use of the Tor network, an extremely complex system of over seven thousand relays which has been created to conceal a user's location and identity. In this secret 'back room' of the internet, people can exchange messages and conduct transactions while remaining anonymous. TNO has developed unique knowledge and technology to combat illegal activity such as the traffic in child pornography, weapons and drugs. Investigators attending the October course used a simulated version of the Tor network to see things from the criminals' perspective. TNO's expertise in this field has resulted in several illegal marketplaces being wound up and the people responsible being brought to justice.



[Interpol news and media](#)

[Interpol leading the fight against the Darknet](#)

[Casting light on underground criminal activities](#)

[Tackling shady dealings on the Darknet](#)



A SEA-BORNE WORLD FIRST DURING THE ASD

In October 2015, the Royal Netherlands Navy took part in a major international marine exercise: the At Sea Demonstration (ASD). The Dutch frigate De Zeven Provinciën achieved a world first by successfully neutralizing a surface-level missile while simultaneously detecting a ballistic missile in space. Ships exchanged real-time data about the detected threats via a network of tactical datalinks (TDLs). The fleet's TDL capacity has been greatly increased in recent years to make this possible. TNO assisted the process by producing the Programme of Requirements and testing TDL capacity after installation. TNO researchers were also on board during the ASD to collate and analyse the TDL data. The Ministry of Defence has stated that TNO's input was vital to the success of the ASD.



STRATEGIC ADVISORY COUNCIL

-) GEN. (RETD) A.C.J. BESSELINK, CHAIR
-) H.J.J. LENFERINK, MAYOR OF LEIDEN
-) G. VAN KLAVEREN, LIMBURG-ZUID REGIONAL FIRE SERVICE
-) L. ROFFEL, THALES NEDERLAND
-) PROF. H. RUDOLPH, NETHERLANDS DEFENCE ACADEMY
-) R. NULKENS, NIDV
-) P. TAAL, MINISTRY OF ECONOMIC AFFAIRS
-) R. BERKVENS, DAMEN SHIPYARDS
-) MS P. ZORKO, NCTV
-) C. HAARMEIJER, RE-LION
-) PROF. H. BIJL, TU DELFT
-) PROF. I. HELSLOOT, RADBOUD UNIVERSITY
-) GEN. E. SCHEVENHOVEN, MINISTRY OF DEFENCE
-) DR S.J.G. REYN, MINISTRY OF DEFENCE
-) REAR ADM. A.J. DE WAARD, MINISTRY OF DEFENCE



‘DEFENCE RESEARCH CREATES NEW BUSINESS ACTIVITY’

› MYRA VAN ESCH-BUSSEMAKERS,
DIRECTOR, HUMAN FACTORS

‘Bring the Ministry of Defence (MOD) and TNO together, invite other research institutes to contribute, involve private sector companies large and small, and you have a very fertile seedbed for innovation. October saw the very successful launch of the AEOLUS Human Performance Innovation platform. In Greek mythology, Aeolus was the ruler of the winds. The aim is to step up research examining human physiology and performance in extreme circumstances, such as (military) aviation and space exploration. We intend to stay one step ahead of the rest of the world.

The partnership between the Royal Netherlands Air Force’s Centre for Man and Aviation (CML) and TNO represents a very strong knowledge position. Topics of interest include commercial space travel. There may soon be flights taking passengers to an altitude of 100 kilometres to experience a few minutes of weightlessness. What effect will this have on health or long-term performance? No one yet knows, but the answer is also interesting to the MOD in terms of the ability to deploy troops

‘COMPANIES ARE EAGER TO TAKE PART IN THIS TYPE OF RESEARCH’

quickly: will it be possible to send an operational contingent to the other side of the world within hours? Another area of interest is how pilots will function in the

new F35 Joint Strike Fighter aircraft. They are to wear a helmet which acts as an interface with all systems, and special clothing to counteract the effects of the massive G-forces. Everything has been designed to perfection in terms of the technology and systems, but we are interested in how we can optimize the performance of the pilots themselves.

It is gratifying that so many companies are eager to take part in this type of research, from rollercoaster builders to new computer games developers. They inspire us to think “outside the box”, while we help them to spot new business opportunities. I am confident that our collaboration will result in some spectacular innovations.’

FIVE THEMES



URBANIZATION

FROM CHALLENGES TO VITAL URBAN REGIONS



› 'INCREASING COMPETITIVE STRENGTH AND LIVEABILITY'

Cities and towns attract residents and business users, but they are also vulnerable. The urban regions are becoming more densely populated, busier and more complex. This poses a risk to both competitive ability and the quality of life. TNO develops innovative concepts to guide the process of urbanization, creating concrete solutions for both the short and long term. Working alongside public sector authorities and the business community, the organization's experts apply their knowledge to enhance the quality and sustainability of the urbanization. 'We seek solutions to challenges in the areas of mobility, infrastructure and buildings, spatial development and environmental management. We combine knowledge in the various disciplines to create new opportunities for the city. We base our advice on extensive, in-depth knowledge of the various elements, such as infrastructure, construction, energy, mobility, sustainability, ICT and human behaviour, which can be addressed individually or within a multidisciplinary approach.'

'OUR KNOWLEDGE IS AN IMPORTANT EXPORT PRODUCT'

We offer integrated solutions in line with current demand from both the public and private sectors. Our software program Urban Strategy reveals the interrelationship between the various issues and enables us to "zoom in" on specific challenges and potential solutions without losing sight of the overall context. We act as knowledge partner to several Dutch municipalities and our knowledge is also an important export product. In the field of transport and mobility, we have launched a research programme examining "truck platooning", a form of guided vehicle technology that can increase fuel economy and reduce both emissions and congestion. We hope that the concept will be introduced onto the roads by 2020. Our interest goes further than the technology itself or the safety aspects. What effect will "driverless" vehicles and electric transport have in terms of the development of an urban region? The overall context is extremely important. Another area of interest is the energy transition, which will undoubtedly have a major effect on the urbanization. We are bringing together specialist knowledge in all the various sub-disciplines.'

LEO KUSTERS, *MANAGING DIRECTOR, URBANIZATION*



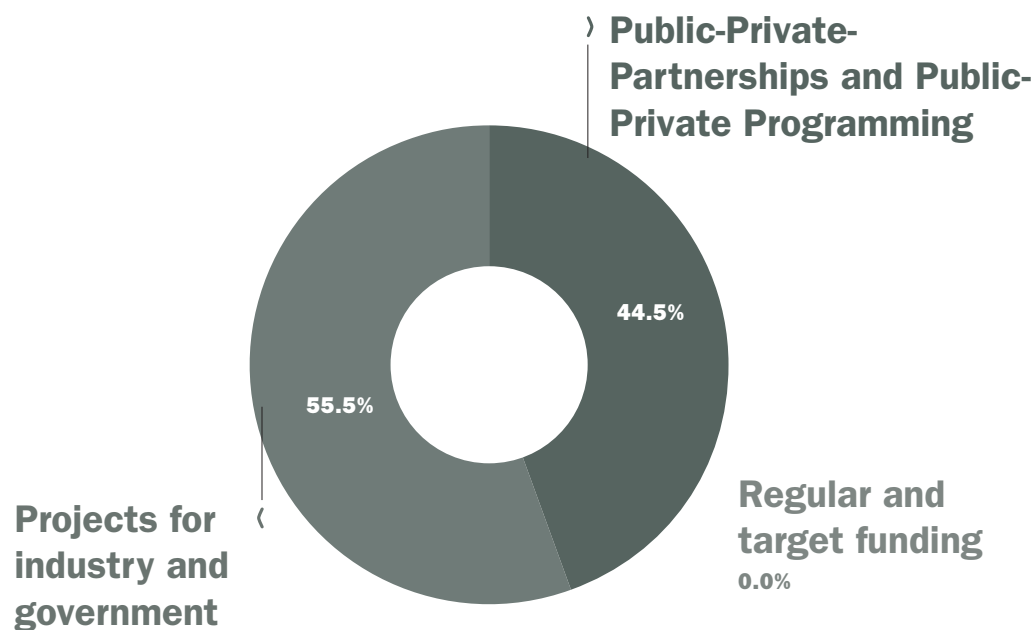
FIVE THEMES



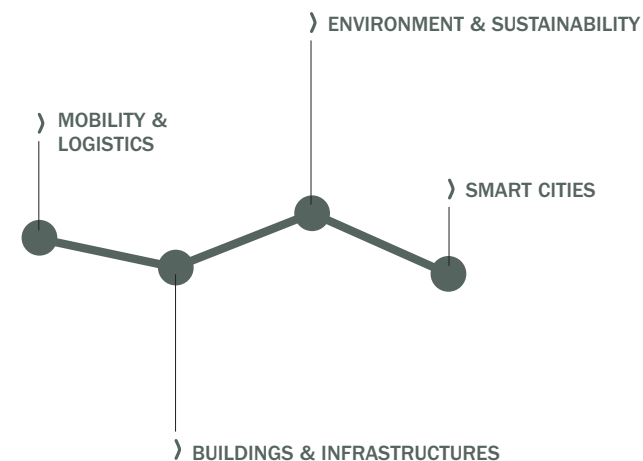
OUR IMPACT

The urbanization theme seeks to enhance the liveability of our towns and cities while also increasing their competitive strength. We bring knowledge and people together to arrive at the necessary innovations. The research activities are based on four roadmaps. The following pages present projects that illustrate our impact.

› BREAKDOWN OF PORTFOLIO FUNDING



› ROADMAPS



FIVE THEMES



NEW GENERATION OF TRUCK ENGINE: 20% LESS CO₂

Reactivity Controlled Compression Ignition (RCCI) is not a new technology. It was demonstrated by researchers at the University of Wisconsin in 2011 but nevertheless remains the focus of ongoing research. RCCI exploits the fact that different fuels have different combustion properties. By combining fuels, such as diesel and natural gas, it becomes possible to increase engine efficiency while greatly reducing emissions. In association with a major truck manufacturer, TNO has made significant progress in applying the technology in a multi-cylinder internal combustion engine. The process involved sharing both knowledge and test facilities. In 2015, we were able to demonstrate that the technology works well in the real world, and that it can achieve a twenty per cent reduction in carbon dioxide emissions. Initial tests involved a truck with a standard load proceeding at a constant speed on a level road surface. The results were so promising that we have extended our partnership with the manufacturer with the aim of developing RCCI as a commercial product. In the years ahead, we shall demonstrate that the technology can be equally effective even in extreme conditions. We believe that we will soon be able to unveil a new generation of truck engines that are extremely efficient and can run on various types of fuel.



QUICK AND SAFE ROAD INSPECTIONS

Over eighty per cent of major highways in the Netherlands have a porous asphalt surface designed to decrease traffic noise. Although this material is very resilient, it is susceptible to damage in the winter months as water penetrates, freezes and expands. Regular inspection is necessary to determine whether and when maintenance is required in the interests of safety and comfort. Visual inspections by human operatives are labour-intensive, expensive and possibly subjective. There are also safety risks. TNO is working with Rijkswaterstaat (the Dutch national department of transport, public works and water management) to develop a smart, safe and cost-effective alternative which allows the entire road surface to be inspected without any disruption to regular traffic. A vehicle fitted with the system will be able to identify any damage requiring attention while travelling at a speed of up to 120 kilometres per hour along the hard shoulder. Sensors provide detailed information which allows maintenance to be planned with greater efficiency.



MAPPING ULTRAFINE PARTICULATES

Vehicles on highways and in busy city centres produce ultrafine particulates which, when inhaled, can cause serious health problems. In the summer of 2015, TNO continued its ongoing study of traffic pollution in Eindhoven. Twelve people were equipped with portable monitoring equipment and GPS. Our work tied in with Eindhoven's clean air programme 'AiREAS'. TNO was able to contribute expertise in air quality, sensor technology and computer modelling. We have also undertaken a full analysis of the monitoring data. The results of this study will enable people with respiratory problems to avoid situations with particularly high concentrations of particulates. It will also support various civil initiatives and provide additional data for epidemiological studies. TNO is also an active partner in the European HEALS project, in which we apply inexpensive sensors and smart approaches to augment information about exposure to hazardous airborne substances.



[Measuring actual exposure to ultrafine particulates](#)
[AiREAS: for clean air and health in the city](#)
[HEALS welcome letter](#)



COMBINING STRENGTHS IN A UNIQUE ENVIRONMENTAL LAB

In 2015, TNO joined forces with two other leading environmental and climate research institutes – Deltares and the faculty of Geosciences at Utrecht University – to form the 'Utrecht Castel Laboratory'. The partners acknowledge that bringing together our extensive knowledge in water, air and soil quality research can lead to real scientific breakthroughs. Collaboration will help us gain a better understanding of the effects of climate change and urbanization. The lab's researchers are highly motivated. They have risen to the challenge of maintaining the 'liveability' of our planet, which entails striking an appropriate balance between environmental and economic interests. Utrecht Castel offers a sound basis for sustainable progress in all respects.



[Utrecht Castel: sound basis for progress](#)

[Combining strengths in a unique environmental research laboratory](#)

[A cleaner human environment through combined expertise](#)
[Digital pages](#)



MAINTAINING THE LIVEABILITY OF LARGE CITIES

Responding to the complex challenges of the modern city demands a broad range of expertise in disciplines such as transport and mobility, environmental management, air quality, energy, safety and behavioural science. All must be brought together to form fully integrated solutions. Because TNO can offer all these disciplines under one roof, we were approached by MetroGroup, the regional transport operator in Shenzhen, China. With a population of fifty million, Shenzhen is the largest urban agglomeration in the world. We are now advising MetroGroup on urban development close to major public transport hubs. We are, for example, helping to plan a new terminus in the financial district of Qianhai, which will be used by some 750,000 passengers every day. The project draws on our expertise in mobility, human behaviour, safety, air quality and sustainability. We are helping to ensure that the city remains accessible and liveable. Equally important, the knowledge we are developing in China is also made available to Dutch industry. We are placing the Netherlands firmly on the world map as a leading provider of smart city concepts, which could well prove an important export product.



STRATEGIC ADVISORY COUNCIL

- › S.M. DEKKER, CHAIR
- › R. PAUL, PORT OF ROTTERDAM AUTHORITY
- › H. SCHIPPERS, DAF TRUCKS N.V.
- › J.H. DRONKERS, MINISTRY OF INFRASTRUCTURE AND THE ENVIRONMENT
- › L.H. KEIJTS, STICHTING PORTAAL
- › N.J. DE VRIES, ROYAL BAM GROUP N.V.
- › F.J. VAN BRUGGEN, ANWB
- › M. UNCK, NS
- › MS M. MINNESMA MBA, STICHTING URGENDA
- › MS A. RAKHORST, DUURZAAM.NL

FIVE THEMES



‘DRIVERLESS TRUCK TECHNOLOGY: THE DREAM BECOMES A REALITY’

› **BASTIAAN KROSSE**, PROGRAMME MANAGER,
DRIVERLESS TECHNOLOGY

‘Just imagine – congestion has been resolved and you no longer find yourself sitting in a traffic jam every morning. Fuel consumption and carbon emissions have been cut by ten per cent. All this has been achieved by interconnecting vehicles so that they can travel in convoy. In the truck platooning concept, only the lead vehicle has a human driver. All other vehicles in the convoy ‘follow the leader’. They brake, accelerate and are steered automatically.

This is no pipe dream. I am convinced that truck platooning will be seen on our roads within a few years. In March 2015, we demonstrated the DAF EcoTwin system using two interconnected trucks. In 2016, we shall move on to the next step. To coincide with the Netherlands’ presidency of the European Union, the Ministry of Infrastructure and the Environment, the Department of Transport and Public Works (Rijkswaterstaat) and the Netherlands Vehicle Authority (RDW) are to organize the European Truck Platooning Challenge. This gives the field the opportunity to consider all aspects: robust vehicle automation,

communication
technology,
legislation,
acceptance,
liability and
insurance.

‘I’M CONVINCED WE’RE GOING TO MAKE THIS HAPPEN’

It has to be an

international process because the new automated trucks will not be confined to Dutch roads. They will serve all European routes. TNO has acquired a strong reputation in driverless vehicle technology. We have extensive knowledge of the technology itself, development and validation methodologies, legislation and human behaviour. It is this combination that makes us unique. We have also built a strong international network of vehicle manufacturers, secondary suppliers, government authorities, insurance companies and logistics operators. Their collaboration will bring cooperative vehicles to fruition that much sooner. It is not so much a ground-breaking feat of technology but a logistic innovation which will make road transport cleaner, safer and more efficient, thus increasing the Netherlands’ competitive strength.’



[Two interconnected trucks](#)
[DAF and TNO demonstrate EcoTwin](#)
[2016 European Truck Platooning Challenge](#)

FIVE THEMES



ENERGY

FROM CONVENTIONAL SOURCES TO SUSTAINABLE ENERGY SYSTEMS



› 'THE ENERGY TRANSITION CALLS FOR HYBRID SYSTEMS'

Society stands on the threshold of a major transition. We are about to replace an energy system based on fossil fuels with one based on sustainable alternatives: 'renewable resources'. The exact form of this transition remains unclear. It will probably be somewhat faster than previously thought, although inevitably we shall continue to use some fossil fuels for several decades to come. The next ten years will see the emergence of 'hybrid energy systems', in which various fossil fuels and renewable resources are used side by side. TNO possesses the knowledge and ambition to fast-track this part of the overall transition through various innovations, both technical and non-technical.

'WE SHALL CONTINUE TO USE SOME FOSSIL FUELS FOR SEVERAL DECADES TO COME'

'We have been researching the desired form of a hybrid energy system for several years. The key requirement is flexibility. The challenge for the years ahead will be to launch field labs with practical experiments that can be scaled up at a later date. On the one hand, we are developing new technologies and methods which minimize the social and environmental risks associated with the use of fossil fuels. On the other hand, in 2015 we also began to devote much attention to new, sustainable alternatives such as geothermal energy and residual heat from industrial processes, which can be used to heat buildings as a replacement for gas boilers. With this type of innovation, we are moving ever closer to the energy transition.'

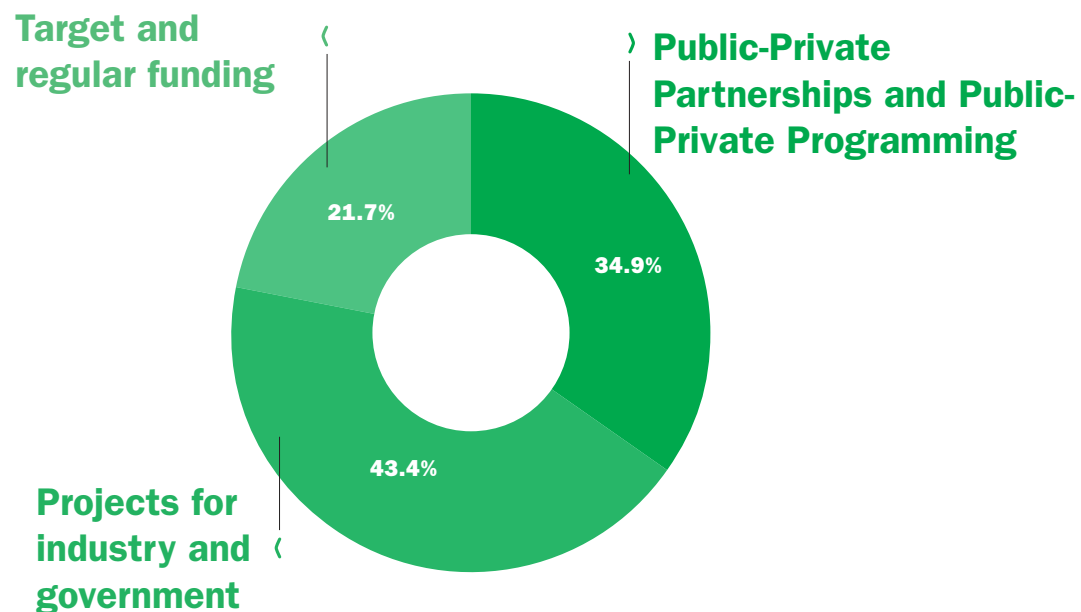
MART VAN BRACHT, MANAGING DIRECTOR, ENERGY



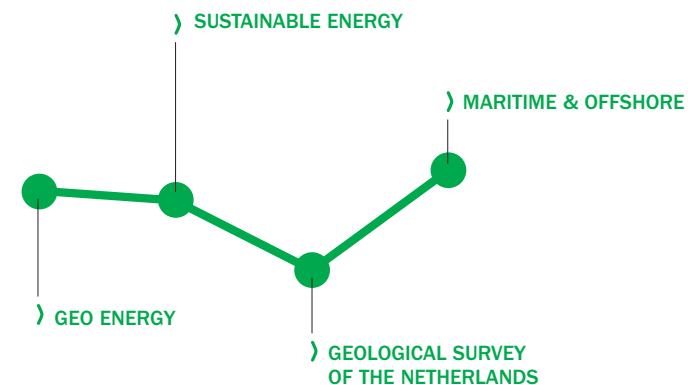
OUR IMPACT

The energy transition calls for innovations with major societal and economic impact. TNO brings together the people and knowledge needed to bring these innovations to fruition. The research portfolio of the Energy division is based on four roadmaps. The following project descriptions illustrate our impact.

› BREAKDOWN OF PORTFOLIO FUNDING



› ROADMAPS



FIVE THEMES



HEATING SYSTEMS AS AN ALTERNATIVE TO GAS

Government policy, as set out in the Energy Agreement, acknowledges the use of residual heat from industrial processes as one of the pillars of the transition from fossil fuels to sustainable sources of energy. Exactly how this is to be achieved is still unclear. Practically all households and many industrial users continue to rely on natural gas for heating. The replacement of gas-fired boilers with distributed heating systems will demand huge investment in new infrastructure and significant modifications to the urbanization. TNO has produced a vision document which sets out how residual heat from industrial processes and geothermal energy could eventually replace natural gas heating. Our proposals involve complex new distribution networks. No longer will heat be channelled from a single source to a single user. Rather, there will be many different sources and many different users with different temperature requirements. TNO is working to resolve the technological challenges involved in matching supply to demand, heat storage, converting electricity into heat and developing the necessary smart grids. We are closely involved in all major ongoing initiatives in the Netherlands. By combining the many areas of expertise available within the organization, we can offer fully integrated solutions.



BRO: OPEN DATA FOR ALL

Beginning in 2017, the Netherlands is to phase in a central database that contains all information about the country's underground infrastructure. The Geological Survey of the Netherlands (GSN), a division of TNO, will be responsible for the operational management of this database, known as BRO. Public sector authorities will be required to submit all information relating to the subsoil to a depth of five metres, which will then be made available as 'open data'. The Netherlands is a world leader regarding the quantity and quality of information about what lies beneath our feet. In a densely populated country such as ours, reliable and accessible information is absolutely essential. The BRO database will help government authorities, private sector organizations and property owners to make fact-based decisions with regard to aspects such as accessibility, water safety, geothermal energy, gas extraction, and so forth. Over the coming ten years, TNO is to develop a fully automated system that will be accessible to all.



[Dinoloket](#)

[BRO info: plant production in Bosnia](#)

[Geological survey of the Netherlands](#)

[The BRO Bill passes its final reading](#)



POLAR EXPEDITION: UNDERSTANDING THE EFFECTS OF OIL EXPLORATION

What is the environmental impact of drilling for oil and gas in the Arctic region? To help answer this question, TNO researchers joined last August's SEES polar expedition to Edgeøya (Edge Island), in the Svalbard archipelago. Located to the south-east of Spitsbergen, midway between mainland Norway and the north pole, this barren island was the scene for oil exploration in the 1970s. At that time, little or no attention was paid to the potential environmental impact. Our researchers took a series of deep-bore samples which reveal how the oil exploration has affected the local ecosystem. TNO has combined its expertise with that of the specialist IMARES research institute at Wageningen University. Together, we are in an unparalleled position to study the samples and produce reconstructive models. We have developed a new method that allows the collection and analysis of a significant volume of data at relatively low cost. Our findings will allow governments to make grounded decisions with regard to exploration permits, while companies will be better able to monitor the effects of their activities on the local environment.



[Environmental impact of historic oil exploration](#)

[Services and areas of expertise](#)

[TNO hopes for breakthrough in polar oil exploration](#)



A EUROPEAN FIRST CARBON CAPTURE AND STORAGE

Europe's first large-scale Carbon Capture and Storage (CCS) demonstration project is to be conducted in the Netherlands. It was for some time uncertain whether the project would go ahead at all, given the low price of CO₂ under the European Union Emissions Trading System (ETS). The designation of a suitable storage location and additional funding from the EU, the Netherlands, Norway and Germany have saved the project. In December 2015, the Minister of Economic Affairs announced that he was inclined to approve the storage location proposed by TNO, which is some three kilometres off the coast of Rotterdam. We conducted the feasibility study alongside the partners in ROAD (Rotterdam CCS Demonstration Project), who are Uniper Benelux (formerly E.ON), ENGIE Energie Nederland (formerly GDF SUEZ), Oranje-Nassau Energie, LTO and OCAP. The installation will be able to capture and store 1.1 million tonnes per annum of the CO₂ produced by the planned Maasvlakte coal-fired power station. This will reduce potential carbon emissions to a very significant degree. In addition, it will be possible to supply CO₂ to the glasshouse-based horticultural industry throughout the Westland region.



[CCS for more efficient gas extraction](#)

[Greater sustainability in glasshouse horticulture](#)



SUSTAINABLE DEVELOPMENT IN THE CARIBBEAN

TNO's work is not confined to the Netherlands or even Europe. We travel far and wide to improve sustainability. In 2015, we ran several knowledge transfer projects for the benefit of local authorities and companies in the Caribbean. We also joined the University of Aruba and Arizona State University in hosting a summer school at which around twenty students from the USA and the University of the West Indies were introduced to the concept of 'Smart Island Solutions'. For the administration of Bonaire, we developed a broad-based energy vision for the island.

We have expanded our activities throughout the Caribbean region and into South America. In the Dominican Republic, for example, we are involved in several projects to improve energy provision in the rural areas. In Colombia, we are working to reduce the carbon footprint and promote the 'circular economy' in association with our local knowledge partner, Making Sense. Last but not least, we are proud to be a partner in the United Nations Small Island Sustainable Development Center of Expertise (UNDP).



STRATEGIC ADVISORY COUNCIL

- › P. JANSEN, CHAIR
- › Y. SEBREGTS, SHELL
- › J. Roodenburg, HUISMAN EQUIPMENT B.V.
- › DR D.P. MOLENAAR, SIEMENS
- › G.J. LANKHORST, GASTERRA
- › P. VAN RIEL, FUGRO N.V.
- › PC. MOLENGRAAF, ALLIANDER
- › PROF. T.H.J.J. VAN DER HAGEN, TU DELFT
- › E.J. DE VRIES, MINISTRY OF ECONOMIC AFFAIRS
- › J.F. DE HAAS, ENECO
- › J.D. BOKHOVEN, ENERGIE BEHEER NEDERLAND B.V.
- › G.J.M. SCHOTMAN, SHELL NETHERLANDS
- › MS T. KLIP-MARTIN, WATERSCHAP VALLEI EN VELUWE
- › B.J. KROUWEL
- › C.B.F. KUIJPERS, MINISTRY OF INFRASTRUCTURE AND THE ENVIRONMENT
- › PROF. P. HOEKSTRA, UTRECHT UNIVERSITY

FIVE THEMES



'EXTENDING THE WORKING LIFE OF OFFSHORE WIND TURBINES'

RICHARD PIJERS, SCIENTIST (LEFT)
GERARD VAN DER WEIJDE, PROJECT MANAGER (RIGHT)

Government policy, as set out in the Energy Agreement, provides for the construction of offshore windfarms which will generate enough electricity to supply some three million households. At present, offshore wind energy remains more expensive than that produced by burning fossil fuels. Costs, including those of installation and maintenance, must be reduced. But how? Experts in several disciplines, including steel fatigue, statistics and dynamics, have turned their attention to this question. As TNO project manager Gerard van der Weijde explains, 'Experienced researchers are working alongside their keen young counterparts. All are eager to develop new knowledge.' Several project proposals have been awarded funding by the Top Consortium for Knowledge and Innovation in Offshore Wind (TKI WoZ) and its affiliated companies and organizations. 'At our Structural Dynamics Lab we have set up several trial installations of various sizes in which we can simulate the extreme loads on the wind turbines, both above and below water. We then use the resultant data to produce new predictive calculation models

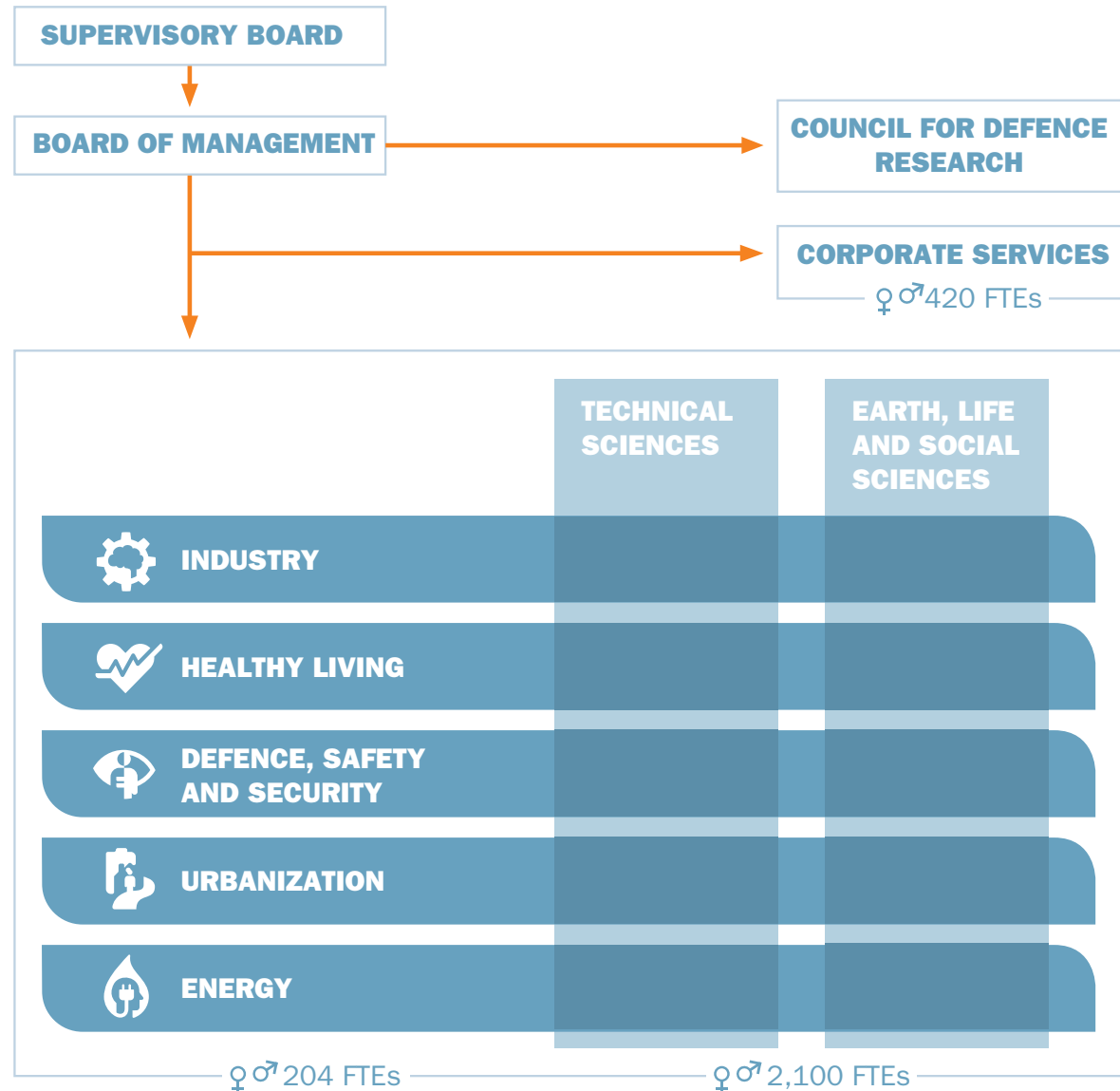
'EXTENDING OPERATIONAL LIFETIME BY 20% WHILE REDUCING INSPECTION REQUIREMENT'

for metal fatigue. The statisticians are developing a probability model to determine the ideal inspection frequency based on past inspection findings and costs. The aim is to be able to predict the useful working life of an offshore wind turbine

with a much higher degree of accuracy. This will allow operators to conduct fewer maintenance inspections, thus reducing lifetime costs. The current estimates are extremely conservative. We believe it is possible to extend the operating lifetime by twenty per cent while cutting the number of inspections by half. This will reduce the total cost of ownership and enable operators to charge less for the electricity they generate, making offshore wind energy that much more attractive. We are now at the halfway point of our research and lab tests. Companies from several countries have expressed interest in the results, which gives us an extra incentive to make a good job of it.

ORGANIZATION TNO

TNO is a matrix organization which is structured along two axes. Along one axis, the researchers, consultants and project managers (approximately 2,100 FTEs) are divided between two expertise categories: Technical Sciences, and Earth Life & Social Sciences. On the other axis are the five societal transitions, or themes, on which TNO bases its activities (approximately 204 FTEs). The roles of the Board of Management, Supervisory Board and Council for Defence research are described in the chapter on [Corporate Governance](#).



› INTRODUCING THE BOARD OF MANAGEMENT



› MEMBERS OF THE BOARD OF MANAGEMENT

FROM LEFT TO RIGHT:

- › WIM NAGTEGAAL, Chief Operational Officer (COO)
- › CIS MARRING, Chief Financial Officer (CFO)
- › PAUL DE KROM, Chief Executive Officer (CEO)
- › JOS KEURENTJES, Chief Scientific Officer (CSO)

BOARD OF MANAGEMENT: EXTERNAL APPOINTMENTS

PAUL DE KROM, CHAIRMAN AND CEO

Since 1 March 2015

Various executive and non-executive appointments, including:

- Supervisory director, Utrecht University of Applied Sciences
- Supervisory director, HTM Personen Vervoer N.V./HTM Beheer B.V. (public transport)
- Member, Southern Randstad Economic Development Council (EPZ)
- Board member, Thorbecke Society (Monstequieu Institute)
- Director, Royal Holland Society of Sciences and Humanities (KHMW)
- President, T02 Federation

VICE ADMIRAL (RETD) W. NAGTEGAAL, COO

Since 1 February 2014

Various executive and non-executive appointments, including:

- Supervisory director, National Maritime Museum
- Board member, Netherlands Industry for Defence and Security (NIDV)
- Board member, Nederland Maritiemland (NML)
- Supervisory director, The Hague Centre for Strategic Studies (HCSS)
- Chairman of the Board of Trustees, Maritime Knowledge Centre Foundation (MKC)

MS F. MARRING, CFO

Since 1 February 2014

Various executive and non-executive appointments, including:

- Trustee and board member, TNO Pension Fund
- Supervisory director and chair of the Audit Committee, Oasen N.V.
- Supervisory director and chair of the Audit Committee, Novec B.V.
- Board member, Stichting Beheer LTP

PROF. J.T.F. KEURENTJES, CSO

Since 1 February 2014

Various executive and non-executive appointments, including:

- Professor, Eindhoven University of Technology
- Board member, TKI HTSM
- Board member, Stichting Holland High Tech
- Board member, Energy Top Sector
- Supervisory director, TKI Bio-Based Economy
- Member of NWO Programme Council and Assessment Committee for Chemical Sciences
- Member of steering committee of the National Research Agenda
- Supervisory director, QuTech
- Member, VNO-NCW programme council for science and technology
- Member of National Steering Committee for Applied Research (NRPO-SIA)
- Trustee, Future of Technology Foundation (STT)
- Supervisory director, Ventinova Medical B.V.
- Member of editorial board, Chemical Engineering Processing (Elsevier)

J. HOEGEE, SECRETARY

Since 15 October 2014

REPORT OF THE BOARD OF MANAGEMENT

The Board of Management established three key strategic objectives for 2015:

- innovations with impact;
- greater cooperation, both internal and external;
- sound business operations.

Attention was also devoted to strengthening the TNO knowledge basis and streamlining the organization's management structure.

INNOVATIONS WITH IMPACT

This Annual Report includes numerous examples of innovations that address the five transitions underpinning TNO's strategy. Our aim is to achieve a positive impact, be it social, economic or ecological. In other words, we are concerned with 'People, Planet and Profit'. All our activities are undertaken with this mission in mind. The projects and programmes in which the desired impact is achieved are defined according to 22 'roadmaps' which were approved and finalized by the Board of Management in 2015. The Board also defined procedures for monitoring progress.

GREATER COOPERATION

The solutions we wish to develop are generally impossible to achieve without close cooperation. This may entail multidisciplinary teamwork within the organization, while collaboration with external partners, clients and stakeholders is also of increasing significance. In 2015, we emphasized the importance of partnerships and alliances through a further refinement of the Joint Innovation Centre (JIC) concept. Working in this context has already given rise to several successful initiatives, such as QuTech and the Brightlands Materials Center. We enjoy close cooperation with Wageningen University in the field of food science and are closely involved in the '[Grand Design](#)' programme. Our partnership with the Ministry of Defence in the [AEOLUS](#) Human Factors project is another example of successful collaboration.

SOUND BUSINESS OPERATIONS AND FINANCES

This strategic spearhead has prompted a number of initiatives. We have successfully decreased the volatility of financial flows and can now work on the basis of more reliable projections. In the past, we have been susceptible to unexpected losses or equally unexpected windfall gains. A keener focus on operational and project management has served to iron out these fluctuations. The improvement in project management

procedures was acknowledged by the audit for ISO 9001 accreditation, conducted by DNV-GL in 2015.

The Focus project has also served to place our business operations on a more solid footing. It has enabled us to restructure the line management organization and to offset the €17.6 million reduction in direct government funding for the 2016-2017 period. We have had to make certain choices with regard to the research portfolios and have done so in close consultation with our stakeholders. Activities in some knowledge areas have been wound down sooner than originally planned, which has resulted in some unavoidable job losses. Even so, TNO has been able to maintain its multidisciplinary knowledge base, which continues to make a significant contribution towards strengthening the Netherlands' innovative ability.

A number of projects have been introduced to improve specific aspects of performance. Examples include the performance coaching process and training focusing on improving sales and acquisition.

Partly as a result of these various interventions, TNO is able to report a positive result of 2.5 million euros for the 2015 fiscal year. Given the reduction in government funding and the associated restructuring costs, we may regard this as a highly satisfactory achievement. The full financial statements included elsewhere in this report are accompanied by a [summary](#) and explanatory notes.

SIMPLIFICATION OF MANAGEMENT PROCEDURES

During the reporting year, the Board of Management produced a 'Balanced Scorecard' which includes a number of selected Key Performance Indicators (KPIs). We believe that its introduction will greatly simplify and improve management procedures in 2016 and beyond. Alongside financial targets, the KPIs address

aspects such as the attainment of the roadmap 'milestones', further spin-offs and new alliances, all of which are seen as crucial to the achievement of the overall strategy. Other KPIs relate to fundamental aspects such as integrity, the knowledge basis, health & safety and the general wellbeing and engagement of our personnel.

The KPIs will form an integral component of the TNO management cycle. They play an important part in establishing our direction, and they present measurable targets against which our success can be accurately gauged. A more detailed account of how the KPIs support the fundamental aims of the organization is given in the section on [Responsible Business](#).

THE KNOWLEDGE BASE

The Early Research Programmes (ERPs) form the basis for the ongoing development of our knowledge. In 2015, we worked on the following ten ERPs, full details of which can be found at www.tno.nl.

- Quantum Computer / Quantum Internet
- Complexity
- Personalized Food
- Energy Storage & Conversion
- 3D Nanomanufacturing
- Structural Integrity
- Human Enhancement
- Making Sense of Big Data
- Organ-Function on Chip
- Submicron Composites

Our knowledge is subject to an ongoing process of third-party assessment and validation. The 'Knowledge Position Audits' are described in the section headed '[Knowledge Position](#)' in the chapter on Responsible Business.

FAVOURITE EMPLOYER

The graduate careers journal *Intermediair* holds an annual survey of employer organizations, based on information provided by its readers. In 2015, TNO was voted 'Favourite Employer in the Technology Sector' for the third consecutive year, an achievement in which we take much pride.

CORPORATE GOVERNANCE

STANDARDS FOR MANAGEMENT AND SUPERVISION

TNO is a semi-public organization established by Act of Parliament. As such, it is expected to maintain an independent position while bringing knowledge and people together. Applying an objective approach, TNO seeks and develops practical innovations which will benefit society, industry and the national economy.

The term Corporate Governance refers to the rules, standards and management of an organization, which must provide effective direction and supervision to ensure that all activities are conducted in a responsible, accountable and transparent manner.

TNO's corporate governance structure is established by the TNO Act 1930, as amended. In addition, the organization is bound by the Code of Conduct for TO2 organizations, as stated in the government policy document *Visie op het Toegepaste onderzoek* ('Vision of Applied Research'), as well as by the Joint Standards Framework for Financial Management and Supervision of Semi-public Institutions.

With a view to ensuring integrity and transparency, TNO has its own internal Code of Conduct, a formal complaints procedure and a 'whistleblower' scheme. All are based on the codes of governance applicable to public sector, private sector and the research field, such as the Netherlands Code for Good Public Governance, the Corporate Governance Code and the Scientific Integrity Code.

The Standing Orders of the Board of Management, Supervisory Board and Strategic Advisory Councils, together with the Mandate document, form the statutes of the TNO organization, referred to elsewhere as the 'TNO Regulation'. The Mandate document defines the authority of the various officers in order

to ensure that an effective system of checks and balances is in place. It further requires the external auditor to assess compliance with the mandate on an annual basis. TNO applies a risk inventory system based on a risk matrix. TNO holds full ISO 9001 certification. TNO and its designated officers (up to and including the second tier) are registered with the Chamber of Commerce as required by law.

THE BOARD OF MANAGEMENT

The chairman and members of the Board of Management are appointed by the Crown, in principle for an unlimited period. Their salaries and secondary benefits are in keeping with the requirements of the Standards for Remuneration Act (WNT).

The Board of Management is responsible for the day-to-day management of the TNO organization, and for defining and pursuing the corporate objectives, policy, strategy and results. As stipulated by the TNO Act, the Board applies a set management model whereby the members have joint and collective responsibility for the Board's decisions and actions. In addition, each member has a specific area of individual responsibility: strategic, scientific, operational or financial.

THE SUPERVISORY BOARD

The chairman and members of the Supervisory Board are appointed by the Crown for a period of five years with a potential extension for one further five-year term. Remuneration is in keeping with the provisions of the Standards for Remuneration Act (WNT).

The Supervisory Board oversees the policy and performance of the Board of Management, to which it provides advice as appropriate or necessary. Its supervision relates to the achievement of the objectives and Key Performance Indicators, strategy, production and adherence to the Annual Plan (including

investments), financial reporting and compliance with all extant legislation. The TNO Act establishes which Board of Management decisions require the approval or consent of the Supervisory Board.

The Supervisory Board evaluates its own performance on an annual basis and conducts evaluation interviews with the chairman and each individual member of the Board of Management, also on an annual basis. The Supervisory Board has established two committees: the Selection and Remuneration Committee and the Audit Committee, both of which are formed from among its own number and are charged with responsibilities defined by the Supervisory Board itself. The Selection and Remuneration Committee is concerned with matters of Human Resources, while the Audit Commission allows the Supervisory Board to discharge its statutory responsibility for financial management and to strengthen risk management procedures. Standing Orders are in place for both committees.

The financial statements are accompanied by an auditor's statement verifying their accuracy and reliability, issued by an external accountant appointed by the Supervisory Board. The accountant, KPMG, was retained in 2011 for a period of five years, with the option of two one-year-extensions. The accountant also performs a separate audit to ascertain the legitimacy of claims to government funding and the use of such funding, in accordance with the audit protocol agreed between TNO and the Ministry of Economic Affairs.

THE COUNCIL FOR DEFENCE RESEARCH

The policy of the defence research arm of TNO is established by the Council for Defence Research (RDO), as stipulated by the TNO Act. To maintain an effective defence and security apparatus, the Netherlands must continually review and revise its military capacity to take advantage of new options and

innovations. This demands scientific support in a wide range of knowledge and technology disciplines. Some disciplines are so specific to defence that it falls to the Ministry of Defence to ensure that the necessary knowledge is available. In the interests of synergy and efficiency, however, most defence-related research is conducted by TNO in close collaboration with government, the private sector and other research institutes. TNO's involvement dates back to 1947.

Defence, national security and public safety are closely interrelated areas. TNO's work for other clients serves to deepen and broaden the knowledge basis, straddling them all. Our work for other clients in the domain of defence and security broadens and deepens our knowledge base, whereupon our expertise remains affordable for the government. One member of the Board of Management is appointed by the Crown further to nomination by the Minister of Defence. He or she also acts as chair of the Council for Defence Research, on which the majority of seats are held by representatives of the MOD.

STRATEGIC ADVISORY COUNCILS

TNO is structured as a 'thematic project organization', whereby all activities are based on one of the societal transitions or 'themes'. For each theme, there is a Strategic Advisory Council that supports decision-making with regard to the priorities and spearheads of research, as well as the form and content of the relevant programmes. It monitors external developments and draws those of significance to the attention of the research theme's management. The members of a Strategic Advisory Council are prominent experts drawn from the public sector, industry and the knowledge infrastructure. Appointments are made by the Board of Management at the recommendation of the theme directors. A Council will convene at least twice a year and meetings are attended by at least one member of the Board of Management. In addition, the Board will hold a private interview with the chair of the Strategic Advisory Council at least

once a year to discuss matters such as the strategic choices to be made within the research roadmaps and developments in applied research.

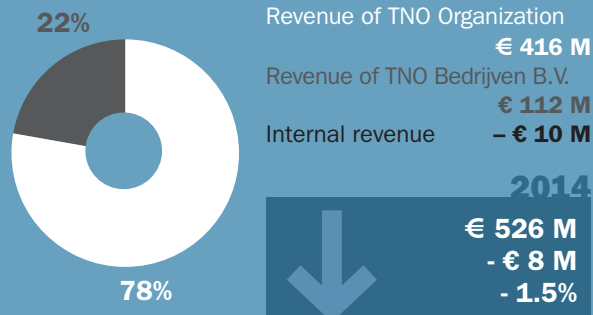
TNO BEDRIJVEN B.V.

TNO is the sole (100%) shareholder in TNO Bedrijven B.V., the holding company under which various operating companies fall. To ensure an effective separation of interests between TNO and TNO Bedrijven B.V., their governance arrangements and operations have been brought under different legal entities. The status of TNO Bedrijven B.V. as a 'two-tier' limited liability company with its own Supervisory Board means that TNO's influence as shareholder is limited and TNO Bedrijven B.V. operates 'at arm's length'. As majority shareholder in TNO Bedrijven B.V., TNO does however produce a consolidated balance sheet.

FINANCIAL KEY FIGURES 2015

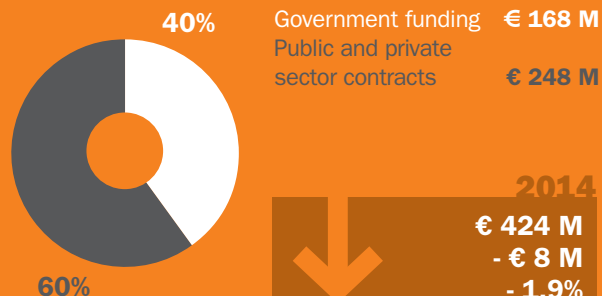
CONSOLIDATED REVENUE

€ **518** MILLION



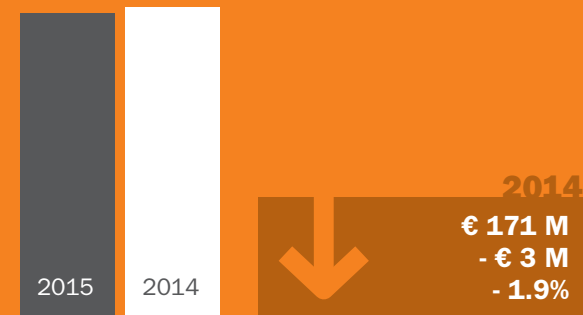
REVENUE TNO (INCL. GOVERNMENT FUNDING)

€ **416** MILLION



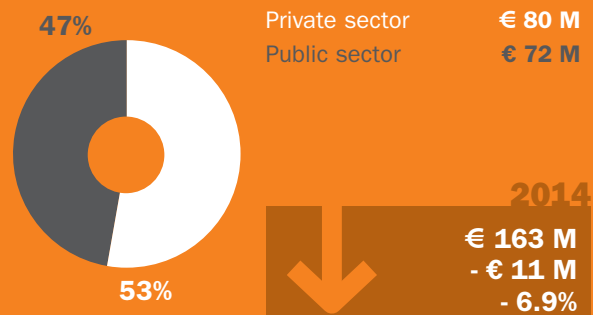
GOVERNMENT FUNDING

€ **168** MILLION



DOMESTIC REVENUE

€ **152** MILLION

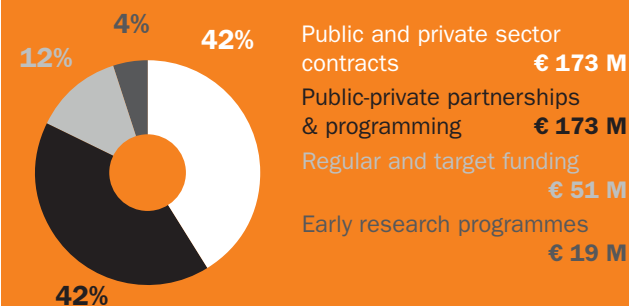


INTERNATIONAL REVENUE

€ **96** MILLION



REVENUE TNO BY TYPE OF RESEARCH



FINANCIAL SUMMARY

RESULT

TNO returned a positive result of 2.5 million euros for the 2015 accounting year. This figure represents good operational results offset by the non-recurring reorganization costs and depreciations. The result for 2014 was 8.7 million euros. (These figures relate to the consolidated results of TNO, including its subsidiary TNO Bedrijven B.V.)

REVENUE

The shrinkage noted in earlier years continued in 2015, largely due to the reduction in direct government funding, which fell by 3.2 million euros in 2015. The total reduction for the 2012-2015 period is 24.4 million euros, as government funding decreased from 192.3 million to 167.9 million euros. The announced budget cuts are to continue until the end of 2018.

Because there is a reasonably stable relationship between government funding and market revenue, the latter also saw a reduction, of 4.8 million euros, in 2015. For several years, the average ratio of government funding to market revenue was 1: 1.5. This is due to TNO's position as a pre-competitive research institution, whereby market parties' involvement has generally been within Public-Private Partnership structures.

The use of any government funding to support pre-competitive research is subject to separate administration and accounting to provide a clear distinction between economic and non-economic activities.

Consolidated revenue fell from 526.4 million euros in 2014 to 518.4 million in 2015, while non-consolidated revenue decreased from 424.1 million to 416.1 million. TNO has experienced a shrinkage of 30% since 2008.

The following paragraphs relate to the results shown on the non-consolidated balance sheet.

OPERATING EXPENSES

In anticipation of the expected decrease in revenue, various measures were implemented in 2013 and 2014 to prevent or reverse the ongoing increase in operating expenses. As a result, the average staffing level fell by 130 FTEs in 2015, representing a reduction in direct wage costs (including pension contributions and social insurance) of 6.6 million euros. Other, indirect personnel costs fell by 4.0 million. Insourcing costs (temporary and agency staff) rose by 0.8 million, in line with the strategy of maintaining more flexible staffing levels in response to fluctuations in work volume.

In the knowledge that government funding was to be further reduced in 2016, and following a thorough portfolio analysis, the Board of Management decided to implement further restructuring measures. In the 2015 accounting period, the costs of reorganization and downsizing measures totalled 13.6 million euro.

The balance sheet shows a reduction in miscellaneous operating expenses of 0.8 million euros compared to 2014. Accommodation costs fell by 2.9 million further to a number of relocations. Other costs fell by 1.3 million. However, long-term accommodation obligations in combination with the organizational shrinkage required the addition of 3.9 million euros to the provisions.

In percentage terms, the reduction in direct project costs (5.3 million euros) was greater than the decrease in revenue. This was partly because a greater number of activities were conducted in house rather than being outsourced.

Amortization costs further to depreciation have been showing a downwards trend for several years, due to the fact that the investment level has consistently been kept below the internal norm of 5% of revenue. In 2015, amortization costs fell by 1.0 million euros compared to the 2014 level, largely due to the long lead period of planned investment projects. Because investments in 2015 were significantly below the permitted level, a more generous investment budget is available in 2016.

RESULT FROM PARTICIPATIONS

The 'result from participations' relates to TNO's financial interest in TNO Bedrijven B.V. and its subsidiaries. The operating result showed some improvement compared to the 2014 level. Despite disappointing developments further to the difficult market conditions faced by one subsidiary and the negative valuation of one interest rate swap, no incidental write-downs were required. The overall result from participations was therefore a loss of 1.5 million euros.

NET RESULT

The positive result from ordinary activities was 4.0 million euros. This figure includes incidental balance sheet entries such as the restructuring costs and an addition to the general provisions, as noted above. The incidental costs during 2015 were entirely offset by incidental income plus the budgetary provision formed for this purpose. Incidental costs therefore had no effect on the corrected operating result, which remains 4.0 million euros.

Allowing for the negative result from participations of 1.5 million euros, the overall net result was therefore 2.5 million euros. Equity therefore showed a slight increase from 174.5 million to 177.2 million euros, including an appropriated reserve of 60.5 million euros in respect of defence-related real estate. The amount maintained in this reserve was supplied by the Ministry of Defence.

CASH AND CASH EQUIVALENTS

At the close of 2015, the balance of cash and cash equivalents stood at 115.4 million euros, an increase of 21.3 million euros compared to year-end 2014. Close attention to effective management of working capital resulted in a 21.6 million improvement in the position of work in progress and accounts receivable. Of the total increase in cash and cash equivalents, 10.8 million euros is attributable to the positive result, investment contributions and miscellaneous balance sheet entries during the reporting year. Advance payments received in previous years and totalling 11.1 million euros appear on the balance sheet for 2015. As noted above, the amount of 60.5 million is held in an appropriated reserve in respect of investments in defence-related buildings and land.

FINANCIAL INSTRUMENTS

General

In the course of its regular operations, TNO uses various financial instruments that expose the organization to market and/or credit risks. This relates to the financial instruments recognized on the balance sheet, as well as currency forward contracts and interest rate swaps applied to protect transactions cash flows and interest rate swaps. TNO does not trade in financial derivatives. It applies procedures and guidelines intended to restrict the credit risk presented by each market or individual party (client). Should any party default on its payment obligations, the losses thus sustained are limited to the market value of the relevant instruments. The contract value or notional principal sum of the financial instruments is no more than an indication of the extent to which they are used rather than the actual amount of the credit or market risk.

Interest rate risk

The interest rate risk is limited to any fluctuation in the market value of loans receivable or borrowings. It is preferable for all loans to have a fixed interest rate throughout their term. Where this is not the case, the policy of TNO is to use derivative financial instruments to manage (interim) interest rate fluctuations. Loans are held until maturity.

Credit risk

TNO is exposed to credit risks further to certain transactions where losses could occur if a counterparty were to default on payment. The level of risk is limited due to the sheer number and diversity of debtors. There is only a concentration of credit risk in terms of geographic distribution, in that most clients and contracting parties are registered and active in the Netherlands.

IN CONTROL STATEMENT

The Board of Management regards the internal audit and risk management systems to be an important component of the organization's operational effectiveness. The purpose of these systems is to preclude or mitigate risk to the greatest extent possible.

RISK MANAGEMENT FRAMEWORK

TNO produces a strategic plan every four years. The current strategy plan, entitled 'Trends and Transitions for TNO', covers the period from January 2015 to December 2018. The strategy is reviewed annually to ensure that it remains current and appropriate, with interim modifications made as necessary. An Annual Plan and budget are produced each year. Progress in the achievement of the aims is subject to monthly assessment against norms, targets and the budget. Beginning in 2016, a set of Key Performance Indicators is also to be applied.

A review of the administrative organization and financial processes is included in the external accountant's annual audit. Senior managers are informed of the findings by means of a Management Letter. Action is then taken to address any points for improvement that have been identified. An annual risk analysis is also conducted. Changes in the nature or severity of risks are monitored on an ongoing basis, whereupon the analysis is updated accordingly. All risk management activities, including the updating of the analysis, are subject to regular discussion with the Supervisory Board's Audit Committee.

All TNO staff are required to work in accordance with the TNO Management System, which describes the primary, support, management and improvement processes by which TNO pursues its mission and objectives. In particular, the Management System establishes protocols and procedures with regard to mandating and delegation, information security, risk analysis and the risk management of projects, the compilation administration of project dossiers, IP policy and knowledge development. The Operational Excellence & Auditing department performs regular compliance audits for all agreed procedures. There are also regular external audits for the purposes of ISO accreditation, as well as external reviews to ascertain the knowledge level of the various research groups.

RESPONSIBILITIES AND ASSESSMENTS

The Board of Management is responsible for the form, continuity and operational effectiveness of the internal risk management systems, the purpose of which is to ensure that the attainment of all operational and financial objectives is safeguarded to the greatest extent possible. However, the risk management system cannot guarantee the attainment of all objectives, and neither can it preclude all risks of material significance, such as loss, fraud or malfeasance.

CONCLUSION

The Board of Management is of the opinion that the risk management systems and procedures were adequately designed and implemented throughout 2015, and that they proved effective in practice. No incidents or indications that would undermine this opinion were noted during the reporting year.

REPORT OF THE TNO SUPERVISORY BOARD

The Supervisory Board aims to hold each of its meetings at a different TNO location. During their visits to the various divisions and units in 2015, members were once again able to view some extremely diverse and inspiring innovations. The Supervisory Board continues to be extremely impressed by the expertise and commitment of TNO staff, whose passion for their work continues to strengthen the role and position of the organization.

AREAS FOR ATTENTION

In 2015, TNO faced a further reduction in government funding, and will do so again in 2016. As a result, the Supervisory Board must devote particular attention to:

- The process and criteria by which decisions are made about the use of government funding, bearing in mind the requirements of the TNO Act. We consider it essential that TNO retains the ability to generate maximum economic and societal impact.
- Effective adaptation to the new organizational structure and the results of the downsizing.

To establish a sustainable knowledge base and safeguard continuity, the Supervisory Board must also address:

- Operational effectiveness, to include the real estate portfolio, strategic investments and risk management for large projects.
- Finances and management of corporate risks, for which purpose an internal audit function was introduced during the reporting year.

The Supervisory Board takes a keen and active interest in developments affecting all applied research institutes in the Netherlands (T02).

The Supervisory Board approved the 2015 financial statements on 16 March 2016, formally discharging the Board of Management for its management and policy during 2015.

The Supervisory Board conducted the annual evaluation interviews with the chairman and members of the Board of Management.

The Supervisory Board's evaluation of its own performance in 2015 was supported by an external management consultant.

MEETINGS

The Supervisory Board held five regular meetings during 2015, each of which was preceded by a closed meeting. The Supervisory Board convened on one other occasion to discuss strategic portfolio choices as prompted by the reduction in government funding.

The Selection and Remuneration Committee held two scheduled meetings. The Audit Committee also held three scheduled meetings. The members of both committees maintained contact at other times, as necessary.

The chair of the Supervisory Board attended two meetings of the Works Council and was accompanied by one of the other Supervisory Directors on each occasion. The Supervisory Board also maintained regular contact with the Ministry of Economic Affairs.

MEMBERSHIP OF THE SUPERVISORY BOARD DURING THE REPORTING YEAR

Due to indisposition, Ms J.D. Lamse-Minderhoud was unable to attend meetings of the Supervisory Board in the latter four months of the year. During her absence, the Supervisory Board could rely on the support of the external financial advisor, Mr PH.J.M. Visée.

Dr C.A. Linse, Chairman of the Supervisory Board

REPORT OF THE TNO COUNCIL FOR DEFENCE RESEARCH

Global developments are both rapid and unpredictable. New threats are emerging with disturbing regularity, some unexpectedly close to home. The importance of maintaining a defence capability is widely acknowledged. Our country needs professional defence personnel who can respond effectively to unpredictable conflict situations. In early 2015, TNO and the Ministry of Defence co-organized the Future Force conference. One of its more general conclusions was that no government could have foreseen all recent developments. The only appropriate response at this time is to increase defence budgets, promote innovation and encourage cooperation within friendly alliances. These are all essential measures if the risks to the Netherlands, and the entire western world, are to be properly managed.

The Ministry of Defence's forthcoming Strategic Knowledge and Innovation Agenda (expected in 2016) rises to these challenges and requires TNO to make a significant contribution. The objective is to establish an adaptive defence force which recognizes and exploits the importance of innovation. In the realm of national security, maintaining a safe and stable society is one of the 'grand societal challenges' formulated at the European level. TNO is currently involved in the government's preparatory action to support the European defence research programme which will commence in 2020.

The management structure of TNO's defence arm was modified in 2015. If necessary, the Council for Defence Research can now draw upon the advice of a new, larger Strategic Advisory Council. In this first year of TNO's new strategy period, the strategy for Defence, Safety and Security activities was operationalized on the basis of roadmaps. The benefits of the new organizational structure within the defence arm, such as shorter lines of communication, became apparent. The effectiveness of TNO's relationship with the Ministry of Defence was undiminished, while interaction with the most senior defence personnel, including the Chiefs of Staff, was more intensive than ever before. Meetings were also held with the Ministry of Security and Justice to discuss collaboration and the access that both parties should have to strategic knowledge of the more specific, possibly unique, kinds. Following a period of crisis and cuts, the defence and security market is now showing recovery. The order volume for 2015 was highly satisfactory and TNO's defence arm has been recruiting new staff. Good progress is being made on the construction and renovation work in The Hague and Ypenburg. The next phase of the Waalsdorpervlakte and Ypenburg projects will start in 2016. A decision regarding the future of the Rijswijk facilities, at which research into chemical, biological and radiological/nuclear materials(CBRN) is conducted, will be made in 2016. Preparations have already begun.

Research in the sphere of defence and security should of course give rise to innovative projects with real impact. The long-term projects lay the basis for future impact, while strategic investments made in the past underpin the practical valorization projects and short-cycle innovation of today. Projects are generally undertaken in close collaboration with the Ministry of Defence, the Ministry of Security and Justice, and/or private sector partners. Some projects are further to international defence cooperation, which may be said to be flourishing. Others are contract research projects conducted on behalf of a specific client, whether a national or international government agency or

a private sector company. Notable projects that commenced or continued in 2015 include a major study funded by the European Internal Security Fund, several Concept Development & Experimentation (CD&E) projects for the Ministry of Defence, successful demonstrations of counter-drone measures, and the development of a computer game which will help to identify the skills and qualities required by the service personnel of the future. TNO was also able to contribute to the official investigation of the MH17 incident, based on our extensive knowledge of missile technology.

As in the past, TNO plays a significant role in the MOD's operations and procurement processes. TNO experts have been posted to Edwards Air Force Base in California where they are involved in the F35 replacement programme. Others took part in a recent missile defence exercise at sea. Some staff work on location at a Warfare Centre, or oversee CD&E testing alongside their counterparts from the Ministry of Defence. One notable activity in recent months has been preparing helicopter pilots to deal with brownout in preparation for their deployment to Mali. Much of this training takes place in TNO's 3D flight simulator 'Desdemona'.

Our partnerships, alliances and joint programmes continue to develop well. They include the Cyber Research & Capability Center in Singapore, and the AEOLUS programme in which we work alongside the Royal Netherlands Air Force's Centre for Man and Aviation (CML). The Netherlands and Norway have recently launched the 'SMART' programme for CBRN research. It may prove a precursor of more extensive European cooperation in defence research.

**The Council for Defence Research,
Wim Nagtegaal, chair**

REPORT OF TNO BEDRIJVEN B.V.

The mission of TNO Bedrijven B.V. is 'impact and value creation through the valorization of TNO knowledge'. This aim is pursued only where others are unable or unwilling to do so unaided.

TNO Bedrijven B.V. applies three main working structures:

- Joint ventures in pursuit of new technology, in which TNO Bedrijven B.V. works alongside at least one market party;
- TNO spin-outs, undertaking recurrent repetitive work which is no longer appropriate to the R&D setting;
- Starters: TNO staff who set up their own business based on a licensing agreement.



TNO Bedrijven B.V. is a shareholder in Yes!Delft

JOINT VENTURES

The distance between an innovative concept and the actual market introduction of a product or service is often too great for any one company to bridge. The participation model applied by TNO Bedrijven B.V., which entails a shareholder agreement between two or more parties, can be the answer. It allows a joint venture to be financed and managed as an autonomous, standalone company – a 'business in its own right' – with the various rights and responsibilities formally established. Three new ventures were launched under this arrangement in 2015: [Biodentify](#), [InnoSer Laboratories](#) and [Dutch DNA Biotech](#).

TNO SPIN-OUTS EN STARTERS

TNO Bedrijven B.V. did not assume responsibility for any operations of a repetitive nature in 2015. The reporting year did however see the launch of two new start-up companies, both of which have taken advantage of the YES!Delft business incubator programme (in which TNO Bedrijven B.V. is a shareholder). Over time, starters may cease to fit into the strategic portfolio of TNO Bedrijven B.V., or perhaps their development would be better served when in the ownership of another party. TNO Bedrijven B.V. will then dispose of its holding at an appropriate market price. Where (commercial) development is unsatisfactory, which is sometimes inevitable given that start-up companies are by definition concerned with early-phase development, discontinuation or divestment may be the only option. In 2015, seven companies were sold and two were wound up. Given its size and the value of its holdings, TNO Bedrijven B.V. is required to apply a two-tier governance system. It must have a Supervisory Board which is entirely independent of the main TNO organization. In addition to the usual statutory tasks, this Board must ensure that there remains a clear and uncrossable dividing line between the public domain in which TNO operates and the private domain in which TNO Bedrijven B.V. is active.

Victor Elsendoorn, Managing Director, TNO Bedrijven B.V.

TNO Bedrijven B.V. maintains links with the five themes of TNO's research:



INDUSTRY

CelSian Glass & Solar
SoLayTec
LDI Systems



HEALTHY LIVING

CBO
BATAVIA Bioservices
Dariuz
DUCARES
SU Biomedicine
TNO Management Consultants
TNO Triskelion
Value2Share
Innoser Laboratories



DEFENCE, SAFETY AND SECURITY

APP
HCSS
ProQares



URBANIZATION

Delft Patents
Efectis
Prime Data
TASS International (and subsidiaries)
TNO Diana
Transport & Mobiliteit Leuven



ENERGY

EuroLoop
Triple E Consulting
Biodentify

KEY FIGURES: PERSONNEL AND ENVIRONMENT 2015

PERSONNEL

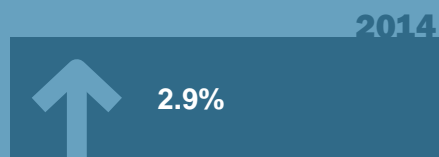
NO. EMPLOYEES

2,926 TOTAL STAFF
ESTABLISHMENT



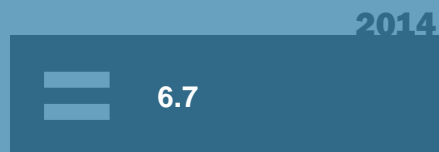
ABSENTEEISM/SICK LEAVE

3.41%



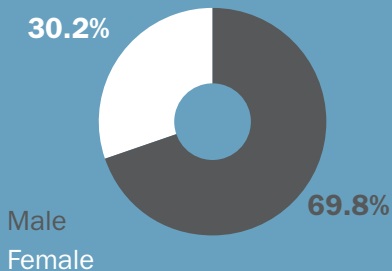
STAFF ENGAGEMENT

6.7 SELF-REPORTED
(SCORE OUT OF TEN)

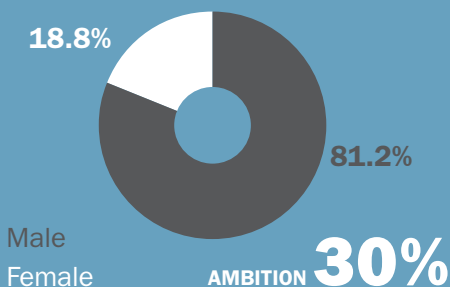


DIVERSITY

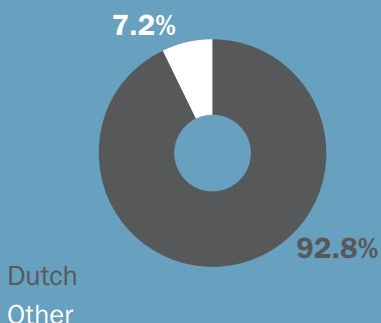
GENDER SPLIT MALE/FEMALE TOTAL TNO



GENDER SPLIT IN SENIOR MANAGEMENT (SB, EB, top & middle)



NATIONALITY



ENVIRONMENT

TOTAL CO₂ EMISSIONS (KILOTONNES)

Scope	2013	2014	2015
1	9	8	8
2	24	24	21
3	120	116	108
Total	153	147	137

KILOMETRES TRAVELLED

Million km	2013	2014	2015
On business	14.1	13.5	14.4
Commuting	32.4	31.3	31.0
Air travel	26.2	27.2	25.2

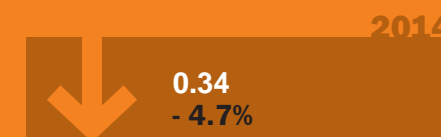
ENERGY CONSUMPTION OF TNO BUILDINGS

CO ₂ emissions	2013	2014	2015
Gas (10E6 m ³)	4.1	3.4	3.6
Electricity (GWh)	39.1	38.8	34.8
Heating (TJ)	21.5	25.3	18.2
Total	293	273	256

ENVIRONMENT

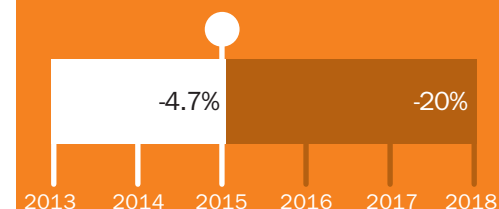
TOTAL CARBON FOOTPRINT

0.33 KILOGRAM CO₂
PER € TURNOVER



LEAN & GREEN TARGETS

(Reduction in CO₂ emissions through mobility measures)



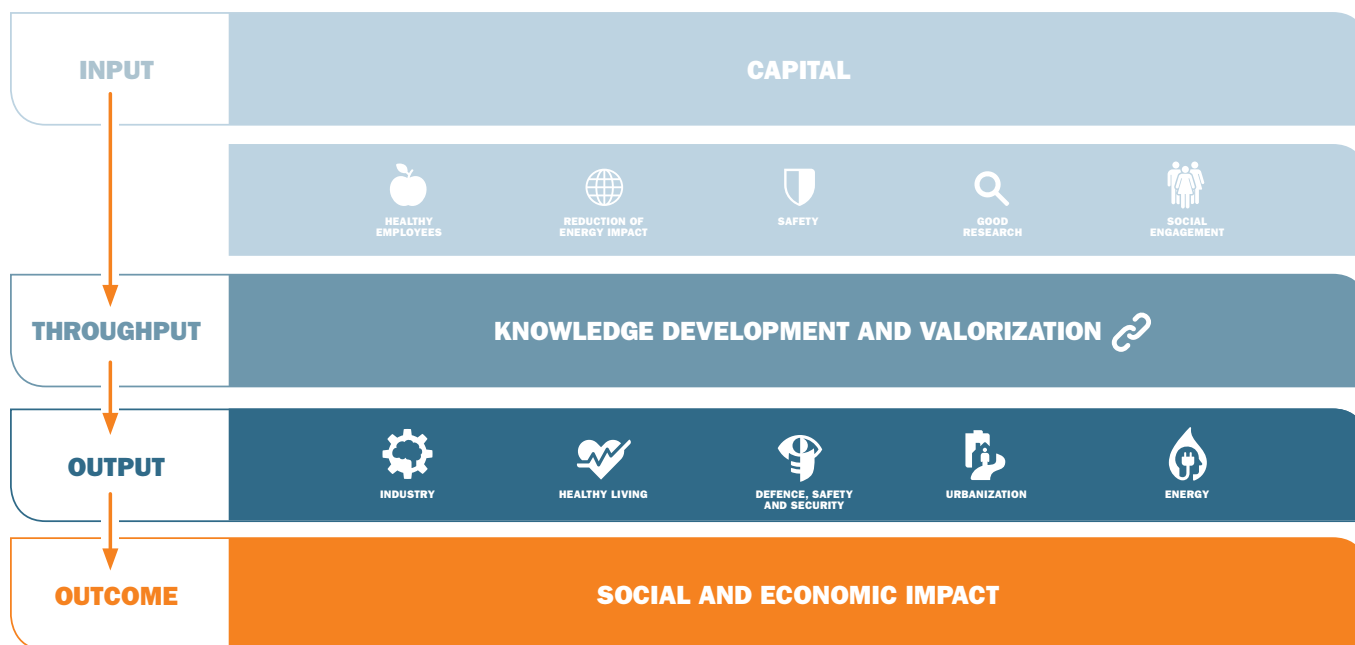
DIRECTE CO₂-EMISSIONS

Fuel (TJ)	2013	2014	2015
Gas	131	108	113
Diesel	9	10	10
Petrol	9	9	7
Total	149	126	130

RESPONSIBLE BUSINESS

The first part of this Annual Report describes the transitions which TNO has selected, in consultation with our stakeholders, to form the basis of our research activities. It also gives examples of the economic and social impact we achieved in 2015. In this section, we consider the choices that TNO has made in order to create added value. This can be visualized by means of the value creation model.

VALUE CREATION MODEL

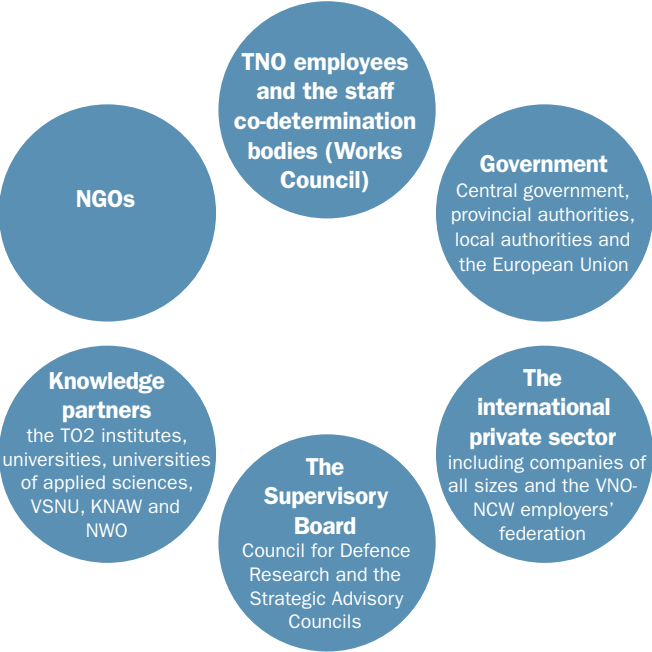


The value creation model is a diagrammatic representation of how TNO uses capital resources (people, facilities and funds) in the process of knowledge development and valorization, which gives rise to innovations (output) and impact (outcome).

STAKEHOLDERS

If we are to achieve the desired social and economic impact, ongoing dialogue with our stakeholders is vital. Each [theme](#) has its own [Strategic Advisory Council](#). TNO also maintains close contact with the top sectors and their representative organizations. This stakeholder consultation enables us to coordinate the research and innovation agendas with those of the government, private sector and our fellow knowledge institutes. During the reporting year, we also met with numerous politicians at both national and local level, as well as representatives of the Ministry of Economic Affairs and the Ministry of Education, Culture and Science.

Our main stakeholders include:



OUR APPROACH

TNO strives to achieve economic and social impact within the five main themes, for which the research portfolios are based on a number of predefined '[roadmaps](#)'. At the same time, we must devote attention to the manner in which we achieve this impact.

The CSR steering group

We are gradually increasing the sustainability of all aspects of TNO's operations. Topics to which the CSR steering group devoted particular attention during the reporting year include:

- 'Lean & Green': reducing the organization's carbon footprint through mobility measures.
- Social Return: providing jobs for people whose access to the employment market is restricted.
- Creating Shared Value: increasing awareness of economic and social value within the organization, e.g. among project managers.

We have engaged external consultants to assist in these processes and we take advice from organizations such as CSR Netherlands.

Five pillars of sustainability

The CSR steering group has conducted an [internal stakeholder consultation](#) which identified five ‘material’ aspects. They form the five pillars of our sustainability policy. In 2016 we intend to discuss them with both internal and external stakeholders.

The five pillars of sustainability are:

 **GOOD RESEARCH**

 **HEALTHY EMPLOYEES**

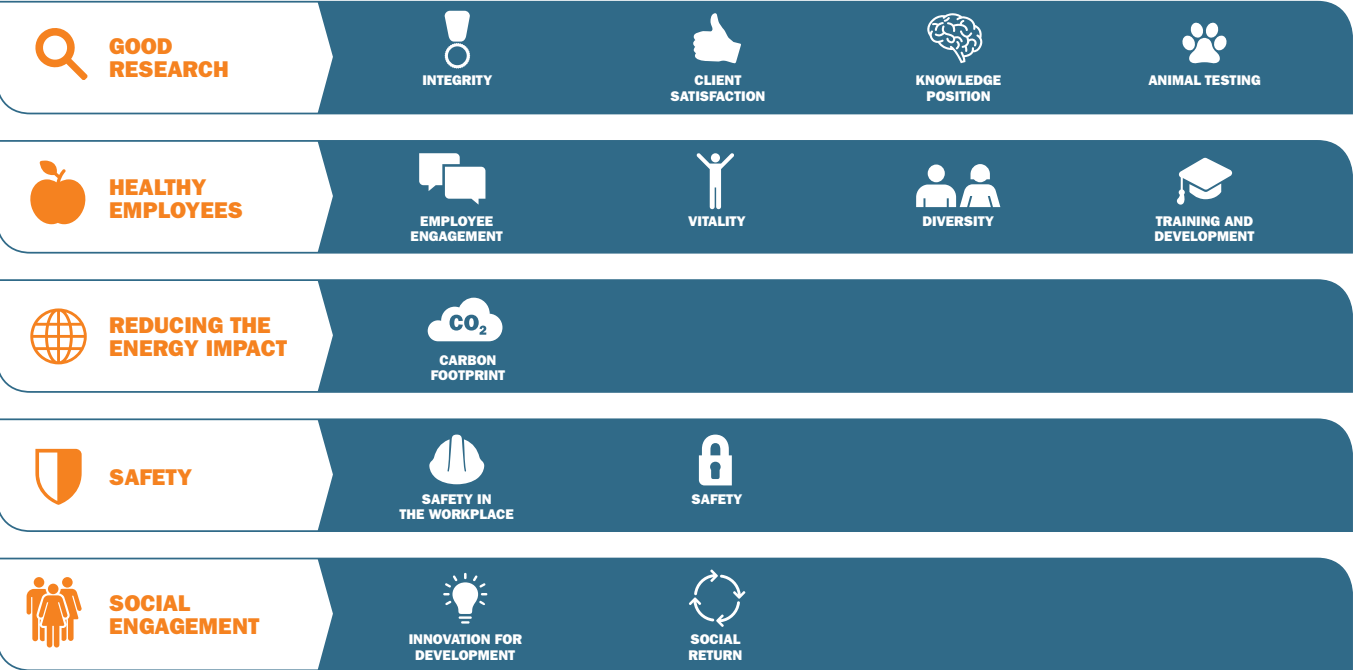
 **REDUCING THE ENERGY IMPACT**

 **SAFETY**

 **SOCIAL ENGAGEMENT**

For each pillar we have identified a number of specific topics, describing their ambitions, approach and results. The pillars and topics are shown on the right. Click on a topic for further information.

PILLARS OF SUSTAINABILITY AND TOPICS



RESPONSIBLE BUSINESS IN PRACTICE

This section describes the five pillars and twelve underlying topics in more detail.

HEALTHY EMPLOYEES AND SOCIAL ENGAGEMENT

TNO devotes considerable attention to personal and professional development. Our staff can take advantage of various training opportunities. We provide internships and work experience placements for (undergraduate) students, and our research projects regularly involve PhD students preparing their final thesis. The education process is very much a two-way street. Some sixty TNO staff hold part-time teaching posts at universities throughout the Netherlands and therefore help to disseminate knowledge into society at large.

GOOD RESEARCH

INTEGRITY

- Ambition**
- TNO attaches immense importance to integrity, as our stakeholders can attest. We wish to meet and exceed society's expectations, and we continue to learn from the ongoing developments in this sphere.
- Approach**
- There are various ways in which TNO ensures the integrity of all activities undertaken by its staff:
- We have produced a vision document setting out our key values.
 - We apply the [TNO Code](#) which presents clear standards of conduct.
 - We have an organizational structure that supports good governance by establishing clear dividing lines between activities which could be seen as representing conflicting interests. The arrangements are described in greater detail in the section on [Corporate Governance](#).
 - We work to increase awareness of our position and any potential dilemmas among our staff and other stakeholders (as necessary).
 - We have an effective 'whistleblower' scheme and a formal complaints procedure. Staff are fully informed about what to do and whom to contact should they become aware of any irregularities, or if they have a complaint about any aspect of the organization. All information is treated in the strictest confidence.

The ambition and approach are set out in the Integrity Plan 2016. Compliance is overseen by the Integrity Committee and the Integrity Officer.

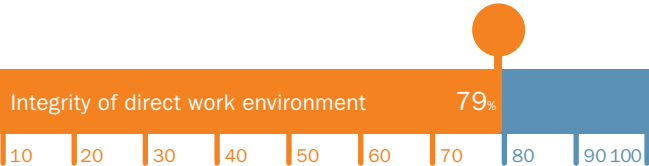
Results

TNO has always been an independent organization which acts impartially and with complete integrity. It will continue to do so in future. TNO meets or exceeds all statutory requirements with regard to integrity and transparency.

All staff are familiar with the contents of the TNO Code and act accordingly. In the most recent staff engagement survey, 79% of respondents agree that their immediate working environment meets all integrity requirements. We shall continue to monitor the situation and pursue improvement. From 2016 onwards, integrity will be one of the Key Performance Indicators.

The organization may be seen to respond adequately and proportionately to any report of suspected irregularities, whether made by staff or external parties. In all cases, the Integrity Officer is asked to advise so that undesirable situations can be resolved through the management line as quickly as possible.

[Click here for further information on this topic.](#)



GOOD RESEARCH

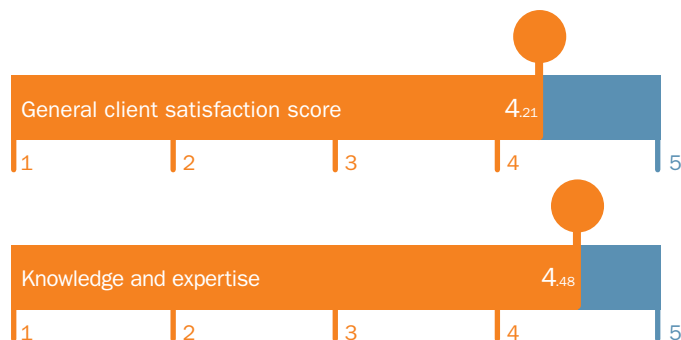
CLIENT SATISFACTION

Ambition

We strive to earn our clients' respect and appreciation for the added value of our work, in both process and result. We also consider transparency to be extremely important and will therefore attempt to respond to all requests made further to the Government Information (Public Access) Act (*Wet openbaarheid van bestuur*; Wob) in a timely manner. This will ensure that the organization is not exposed to any financial penalties and, more importantly, will serve the interests of public accountability. At the same time, we will respect the confidentiality of our clients and staff.

Approach

Client satisfaction is measured by an external consultancy using random sample surveys for each theme. The resultant information is shared with the individual project manager and his or her immediate superior. Aggregate information is collected at the organizational level. There is also a formal [complaints procedure](#), full details of which are available online at TNO.nl.



This site also includes an online contact form. Requests under the Government Information (Public Access) Act must be submitted in writing. The relevant procedure is also described at [TNO.nl](#).

Results

- The overall client satisfaction score for projects conducted in 2015 was 4.21 (on a scale of 1 to 5). This is virtually unchanged since 2014 (4.22). The rating for knowledge and expertise was 4.48 (2014: 4.49) out of five.
- Two letters which made reference to the complaints procedure were received in 2015. One announced that a complaint was about to be made against a TNO legal consultant. This complaint did not materialize. The other letter alleged unprofessional or inappropriate conduct on the part of a staff member. This complaint was later withdrawn.
- A total of 35 new requests under the Government Information (Public Access) Act were received in 2015. Of these, thirteen related to matters within TNO's direct sphere of influence, while nineteen related to the policy or process of other administrative bodies. In addition, three objections to earlier decisions made by TNO in relation to information requests were received.
- An information request which had been received and denied in 2011 became the subject of judicial proceedings in which the court found in favour of the applicant. TNO has lodged an appeal with the Council of State. The case is expected to be heard in 2016.
- Further professionalization of the procedure for dealing with information requests ensured that the organization was not exposed to financial penalties in 2015.

[Click here for further information on this topic.](#)

GOOD RESEARCH

KNOWLEDGE POSITION

Ambition

TNO wishes to achieve and maintain an excellent knowledge position in order to maximize impact.

Approach

Each knowledge domain is subject to assessment by an external audit committee at four-yearly intervals. The committee discusses its recommendations with the Board of Management, whereupon an action plan for the coming period is produced.

Results

- A total of 58 Knowledge Position Audits (KPAs) were conducted during the 2011-2014 strategy period.
- The average score is 7.5 (on a scale of 1 to 9), which indicates a 'research group of international significance'.
- 29 research groups were adjudged to have 'a position of international leadership'.
- The ICT cluster has been subject to one mid-term KPA, the results of which were used in the regrouping of ICT areas of expertise.
- The KPA methodology itself was reviewed in 2015 and a number of modifications made for the 2015-2018 strategy period.

[Click here for further information on this topic.](#)



GOOD RESEARCH

ANIMAL TESTING

Ambition

TNO is keen to minimize the use of laboratory animals and the resultant suffering or distress. TNO champions the ethical use of animal testing throughout the research chain.

Approach

- In all its [research programmes](#), TNO will strive to replace, reduce and refine the use of animal testing, devoting attention to the development, acceptance and implementation of viable alternatives.
- Dedicated and competent staff will ensure the ethical and responsible use of animal testing insofar as it remains absolutely necessary.
- TNO will provide complete transparency with regard to its use of animal testing.

Results

- TNO is part of an international consortium working on the development of 'organs on a chip'. In 2015, the initial steps were made towards a situation in which new drugs can be screened using microchips that mimic the complicated mechanical and biochemical behaviours of human organs.
- Implementation of the amended animal testing policy and legislation, which provides for the establishment of the [Institute for Animal Welfare](#) (IvD).
- An annual report containing concrete information about animal testing conducted under the responsibility of TNO is submitted to the Minister of Economic Affairs. The information is then published online at [TNO.nl](#).

HEALTHY EMPLOYEES

ENGAGEMENT AND LOYALTY

Ambition

All TNO staff should feel a strong sense of engagement with their work, their colleagues and the organization.

Approach

- Strengthening engagement relies on a cyclical process of assessment (the staff satisfaction survey), production of improvement plans, implementation of those plans, adjustment as necessary, and re-assessment.
- In late 2014, an external consultancy conducted the staff satisfaction survey, the results of which were reported at the departmental level. Improvement plans were then developed and implemented at both the departmental and the organizational level.
- In 2015, a follow-up survey examining a smaller number of selected aspects was conducted.

Result

- The average score for employee engagement was 6.7 (out of 10) in both 2014 and 2015.
- The 2015 survey showed improved scores for 'Confidence in the future of TNO' and 'Confidence in the TNO management'.
- Senior management therefore conclude that staff feel a strong need for a clear course, mutual support and leadership.
- A number of local improvement measures have been implemented. In addition, senior management has taken steps to inform all personnel about the organization's strategic course. There have been a number of interactive meetings and communication via social media has been stepped up.

[Click here for further information on this topic.](#)

HEALTHY EMPLOYEES

VITALITY

Ambition

TNO wishes all staff to remain healthy and vital.

Approach

A Vitality workgroup has been established in association with the Health & Safety consultancy ArboUnie. It will work to:

- reduce work-related stress among new employees
- reduce absenteeism through illness (sick leave)
- establish a firm foundation for the relevant activities (for example, all line managers must be aware of the organization's absenteeism policy, and must apply it in a consistent manner).

Results

- Overall, the number of employees reporting work-related stress has fallen from 21.6% to 16.6%. However, there remain a number of departments in which this aspect demands attention.
- The absenteeism rate in 2015 was 3.41% (2014: 2.9%) with a reporting frequency of 1.3 (unchanged). The figure is in keeping with the downwards trend which began in 2012 when specific attention was devoted to vitality and work-related stress. The figure for 2014 was unexpectedly low and would appear to be an outlier or 'blip'.
- The majority of line managers have now attended the workshop on absenteeism and recognizing work-related stress.

[Click here for further information.](#)





HEALTHY EMPLOYEES



DIVERSITY

Ambition

TNO wishes to have a workforce that reflects the diversity of society at large. All employees should feel comfortable and 'be themselves' within a safe working environment, in which all the strengths of diversity are exploited to the full.

Approach

- An annual Diversity plan is produced which sets out strategy, management agreements, instruments, interventions and communication in pursuit of diversity.
- TNO is committed to the 'Talent to the Top' charter, aiming for at least thirty per cent of senior management positions being held by women by the end of 2018.
- The long-term personnel development programme devotes specific attention to increasing international diversity.

Results

- The updated, expanded diversity policy now enjoys greater support and attention from management.
- The importance of diversity is more widely recognized throughout the organization.
- Due to the restructuring of middle management positions and responsibilities, results for 2015 are not directly comparable with those of previous years.
- In terms of gender diversity, there has been a slight increase in the number of women in management positions or the career development schemes for 'high potentials'. Nevertheless, this aspect continues to demand attention.
- Monitoring of international diversity was implemented in 2015.

[Click here for further information about this topic.](#)



HEALTHY EMPLOYEES



TRAINING AND DEVELOPMENT

Ambition

TNO wishes to create a positive working and learning environment. We therefore offer training and development opportunities which enable individuals and teams to enhance effectiveness, achieve professional excellence and maximize the societal impact of their work.

Approach

- At least once a year, employees discuss training requirements with their line managers. The objective is to maximize each employee's contribution to the organization's results and long-term strategy.
- Employees can take advantage of a wide range of in-house training opportunities, which include courses, workshops, coaching, mentoring and peer supervision schemes.
- Training opportunities are structured according to the various (career) development lines. Programmes are developed and offered at all levels.

Results

- Training and development opportunities are seen as good, scoring an average of 8 in the staff survey (8.1 for satisfaction and 7.9 for practical relevance).
- Several new programmes were developed and introduced in 2015.
- Particular attention was devoted to the commercial development line ('Selling Innovation') in 2015, with modules focusing on specific aspects such as Negotiation and Entrepreneurship.

[Click here for further information on this topic.](#)



ENERGY EFFICIENCY



CARBON FOOTPRINT

Ambition

TNO wishes to achieve an ongoing reduction in its relative CO₂ footprint. For mobility-related emissions, the target is a 20% reduction on the 2013 baseline level to be achieved by 2018.

Approach

- Our CO₂ footprint is calculated and published annually.
- The most significant reduction in CO₂ emissions will be achieved in two areas: business accommodation and mobility.
- TNO is actively working to improve the sustainability of its real estate holdings. Older, obsolescent locations are vacated and sold, while other buildings are retrofitted with appropriate energy-efficiency measures.
- Measures addressing mobility include encouraging the use of public transport, increasing the energy efficiency of vehicles used for business purposes, and making greater use of teleconferencing, for which appropriate equipment has been installed. In 2014, our efforts were acknowledged by the Lean and Green Personal Mobility Award.
- In 2015, measures were taken to improve the accuracy with which we calculate our CO₂ footprint, which will in turn improve the accuracy with which the effects of interventions can be monitored.

Results

- In 2015, TNO recorded a 7% year-on-year reduction in its overall CO₂ footprint.
- The reduction in the relative CO₂ footprint was far smaller since turnover had also decreased.
- The new policy for lease vehicles includes an upper limit for CO₂ emissions which applies to both diesel- and petrol-driven vehicles. Since 2015, it has also been possible to opt for an electric vehicle.
- The CO₂ emissions from transport and mobility showed a further 2.3% decrease compared to the 2014 level.
- During the reporting year, six obsolescent locations which no longer met our energy-efficiency requirements were closed and activities transferred to two modern, well-insulated office buildings. Both have the additional benefit of being close to a major railway station (Leiden and Den Haag CS respectively).
- The intention is that the newbuild location in Ypenburg will be entirely energy-neutral.
- A new mobility policy is to be developed and will be implemented in late 2016. It will devote particular attention to flexible, sustainable transport and will support the attainment of our 'Lean and Green' ambitions.

The [key figures](#) for environmental performance show the results of efforts to reduce the CO₂ footprint.

[Click here for further information about this topic.](#)



SAFETY



SAFETY IN THE WORKPLACE

Ambition

All TNO staff must have a safe and healthy working environment.

Approach

- Line managers, prevention advisors and other key staff are given training in various aspects of health and safety.
- The Risk Inventory and Evaluation (RI&E) procedure for the existing organization and projects is subject to ongoing improvement, with particular attention paid to the material safety data sheets for CMR (carcinogenic, mutagenic, toxic) substances.
- All pending improvement plans have now been implemented.

Results

- The basic risk inventory for all locations was completed in 2015.
- Good progress has been made in improving the procedures for project risk inventories.
- Safety officers, accident prevention advisors, chemical administrators and storeroom staff have all received relevant training.
- The facilities audit noted fewer nonconformities than in previous years.

[Click here for further information on this topic.](#)



SAFETY



INCIDENTS

Ambition

TNO must learn lessons from any safety or environmental incident.

Approach

- All safety and environmental incidents are reported so that the organization can gain a better understanding of the causes and the measures necessary to preclude recurrence.
- One of the new Key Performance Indicator (KPIs) to be introduced in 2016 relates to the registration and follow-up of incidents.

Results

- The number of reported incidents has risen. The total LTI (Lost Time Injury) for 2015 was 2.06 (2014: 1.40). This increase is thought to be due to the extra attention devoted to the topic and the improvement of the reporting procedures.
- The requirements for a fully effective incident reports procedure have been established, the intention being to implement a better system in practice.
- This aspect forms part of the new Key Performance Indicators. The number of incident reports will be monitored from 2016 onwards.

[Click here for further information about this topic.](#)





SOCIAL ENGAGEMENT



INNOVATION FOR DEVELOPMENT

Ambition

- TNO strives to sustainably improve the health, wellbeing and income of disadvantaged people in the developing countries and emerging economies.
- We inspire and mobilize Dutch companies and aid organizations to co-develop and apply inclusive innovations.

Approach

- We define innovative projects to be undertaken alongside (international) public and private partners, and we assist in acquiring the necessary funding.
- We perform the project to achieve the desired impact.
- We oversee the upscaling of successful innovations.
- We communicate with internal and external parties about our ambitions and activities.

Results

- In 2015, we achieved notable impact in eleven ongoing projects:
 - 600 children in Sudan learned basic arithmetic by playing our game
 - 400 pregnant women in Ghana and Suriname received better healthcare
 - 300 people in Tanzania gained access to clean drinking water
 - 50 farmers in Kenya and Uganda bred crickets, providing both income and a healthy source of nutrition.
- In 2015, we successfully launched fourteen new projects with a total value of 16 million euros, of which 2.2 million euros is TNO revenue.
- We have increased our investment of 200,000 euros by a factor of ten.
- We are working on these projects alongside fifteen private sector companies and six NGOs.

[Click here for further information about this topic.](#)



SOCIAL ENGAGEMENT



SOCIAL RETURN

Ambition

TNO wishes to create opportunities for people whose access to the employment market is restricted.

Approach

- There is ongoing cooperation between HR, CSR and various TNO experts.
- Contacts have been made with relevant external organizations, such as local authorities, social security and welfare departments, the UWV (Employee Insurance Agency), the Ministry of Economic Affairs, and the AWWN employers' federation.
- Specialist recruitment advisers have been retained.

Results

- The TNO Board of Management has formally undertaken to employ five persons with restricted access to the labour market.
- TNO actively supports three specialist organizations in the field of work and disability: Stichting Studeren en Werken op Maat, De Normaalste Zaak, and Werkgeversgaaninclusief.
- Preparations are in hand for the forthcoming UWV inclusivity analysis.
- As yet, no employees have been engaged under the Social Return policy. This is due to the recent reorganization in which approximately one hundred jobs were shed.

[Click here for further information about this topic.](#)



APPENDIX

KEY FIGURES: PERSONNEL AND ABSENTEEISM

	2012		2013		2014		2015	
	Number	%	Number	%	Number	%	Number	%
Total on payroll	3,409		3,276		3,009		2,926	
Permanent	3,051	89.5	2,978	90.9	2,776	92.3	2,691	92.0
Fixed-term	358	11.8	298	9.1	233	7.7	235	8.0
Part-time (< 100)	978	28.7	946	28.9	918	30.5	949	32.4
Part-time (< 90)	704	20.7	673	20.5	653	21.7	654	22.4
Absenteeism through illness		4.1		3.9		2.9		3.4
Reporting frequency						1.3		1.3

GRI INDEX



This report is structured according to the G4 guidelines for Sustainability Reporting, part of the Global Reporting Initiative (GRI). We have chosen to apply the 'Core' option.

GRI Indicator	Description	Notes or location in report	Reason for omission or partial reporting
Strategy and analysis			
G4-1	CEO's statement	Foreword Report of the TNO Board of Management	
G4-3	Name of organization	TNO stands for <i>Nederlandse Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek</i> . The standard English translation used in all communications is Netherlands Organization for Applied Scientific Research.	
G4-4	Brands, products and/or services	Innovation for Life	
G4-5	Location of headquarters	The registered seat of TNO is in Delft, the Netherlands. The head office building is in The Hague, the Netherlands.	
G4-6	Number of countries in which the organization is active	TNO is registered in the Netherlands and holds a participating interest in various companies, the registered locations of which are given as part of the company information in this report. A full list can be found at www.tno.nl .	
G4-7	Ownership structure and legal form	Profile, mission and impact Corporate Governance	
G4-8	Sales markets	Profile, mission and impact Innovation landscape Europe Notes to the consolidated income statement; the distribution of activities across the various stakeholders is evident from the financial statements.	
G4-9	Size of organization	Financial Key Figures Personnel and environment key figures	
G4-10	Profile of staffing establishment	Personnel and environment key figures Staffing establishment at 31 December 2015	
G4-11	Employees subject to Collective Labour Agreement	Agreements regarding terms and conditions of employment are made with the co-determination body (Works Council) on an annual basis. See also www.tno.nl .	
G4-12	Description of the organization's supply chain	Value Creation Model Profile, mission and impact	
G4-13	Significant organizational changes during report period	Foreword Profile, mission and impact (Preparations for 2015-2018 strategic period) Report of the Board of Management	
G4-14	Use of precautionary principle	In control statement	
G4-15	External initiatives endorsed by the organization	<ul style="list-style-type: none"> – Transparency benchmark – Sustainable mobility: Lean & Green personal mobility – Talent to the Top charter – Various Social Return initiatives 	

GRI Indicator	Description	Notes or location in report	Reason for omission or partial reporting
G4-16	Membership of associations, federations, etc.	TNO is an active member of numerous federations, associations and networks. At the strategic international level, we are affiliated with EARTO (European Association of Research and Technology Organizations), and at the national level we are a member of the T02 federation.	
Material aspects and boundaries			
G4-17	Operational structure of the organization	TNO organizational chart Corporate Governance	
G4-18	Process for determining contents of report	Sustainable operations (approach) Five pillars of CSR The structure of this report has been determined in consultation with the Executive Board.	
G4-19	Material aspects relevant to compilation of report	Sustainable operations (approach) Five pillars of CSR	
G4-20	Scope	This Annual Report draws a distinction between the TNO (research) Organization and the operating companies in which it holds a participating interest. The calculation of the CO ₂ footprint excludes locations with fewer than twelve employees. See also Carbon footprint .	
G4-21	Restrictions re scope and applicability	Responsible Business Most topics have a link to further information elsewhere.	
G4-22	Restatements	Not applicable.	
G4-23	Changes to reporting procedures	Not applicable.	
Stakeholder engagement			
G4-24	List of relevant stakeholder groups	Stakeholders Profile, mission and impact	
G4-25	Basis for selection of stakeholders	Corporate Governance Client satisfaction Staff engagement	
G4-26	Contact with stakeholders	Corporate Governance Client satisfaction Staff engagement	
G4-27	Organization's response to matters raised by stakeholders	Corporate Governance Client satisfaction Staff engagement	
Report parameters			
G4-28	Reporting period	Consolidated financial statements The reporting period is the calendar year, viz. 1 January 2015 to 31 January 2015 inclusive.	
G4-29	Date of previous report	The Annual Report 2014 was published in March 2015.	
G4-30	Reporting cycle	Annual	
G4-31	Contact information	Acknowledgements and contact information	

GRI Indicator	Description	Notes or location in report	Reason for omission or partial reporting
G4-32	GRI reference table	GRI Index	
G4-33	External validation	The financial statements are only subject to external validation by the independent accountant (auditor).	
Governance			
G4-34	Governance structure of the organization	Corporate Governance TNO organizational chart	
Ethics and integrity			
G4-56	Values, principles and standards of conduct	TNO Code CSR policy statement Responsible Business: integrity	
Tangible topics			
Economic performance			
G4-DMA		Report of the Board of Management	
G4-EC1	Direct economic value generated and distributed	Financial statements	
Social impact			
G4-DMA		Value creation Responsible Business Development of strategy for 2015-2018 Social impact	
G4-EC8	Indirect economic impact	Project descriptions providing concrete examples of indirect economic impact are given for each theme .	
Good research			
G4-DMA		Responsible Business: approach	
	Integrity	Responsible Business: integrity	
G4-PR5	Client satisfaction	Responsible Business: client satisfaction (see also the further information which can be accessed using the link)	
G4-S011	Number of formal complaints	Responsible Business: client satisfaction	
Healthy employees			
G4-DMA	Social	Responsible Business: diversity (see also the further information which can be accessed using the link)	
G4-LA12	Diversity and equal pay	Responsible Business: diversity (see also the further information which can be accessed using the link)	The report does not include a breakdown by age or ethnicity because these aspects play no part in the remuneration policy.
G4-LA10	Training and development	Responsible Business: training and development Responsible Business: safety (see also the further information which can be accessed using the link)	

GRI Indicator	Description	Notes or location in report	Reason for omission or partial reporting
Reduction of energy impact			
G4-DMA	Environment	Personnel and environment key figures Responsible Business: reduction of energy impact Reduction of energy impact	
G4-EN3	Energy consumption within the organization	Personnel and environment key figures Responsible Business: reduction of energy impact Reduction of energy impact	
G4-EN15	Direct emissions of greenhouse gases (scope 1)	Personnel and environment key figures Responsible Business: reduction of energy impact Reduction of energy impact	
G4-EN16	Indirect emissions of greenhouse gases (scope 2)	Personnel and environment key figures Responsible Business: reduction of energy impact Reduction of energy impact	
G4-EN17	Indirect emissions of greenhouse gases (scope 3)	Personnel and environment key figures Responsible Business: reduction of energy impact Reduction of energy impact	
Safety			
G4-DMA		There are two key aspects to safety: the prevention of incidents and learning from those incidents which nevertheless occur. Responsible Business: safety (see also the further information that can be accessed using the link)	
	Learning from incidents	Responsible Business: safety (see also the further information that can be accessed using the link)	
Social engagement			
DMA		Responsible Business: safety (see also the further information that can be accessed using the link)	
G4-EC8	Indirect economic impact	We interpret this as an economic improvement for people whose access to the employment market is restricted. Responsible Business: Social Return (see also the further information that can be accessed using the link)	



2015

FINANCIAL STATEMENTS 2015

TNO innovation
for life

TNO ANNUAL REPORT 2015

64	Consolidated financial statements 2015
64	Consolidated balance sheet per 31 December 2015
65	Consolidated income statement 2015
66	Consolidated cash flow statement and statement of overall result 2015
67	Notes to the consolidated financial statements 2015
73	Notes to the consolidated balance sheet per 31 December 2015
82	Notes to the consolidated income statement 2015
87	Financial statements of the TNO Organization 2015
87	Balance sheet of the TNO Organization per 31 December 2015
88	Income statement of the TNO Organization 2015
89	Cash flow statement of the TNO Organization 2015
90	Accounting policies
91	Notes to the financial statements of the TNO Organization 2015
91	Notes to the balance sheet of the TNO Organization per 31 December 2015
95	Notes to the income statement of the TNO Organization 2015
96	Compliance statement: standards for Remuneration Act (WNT)
101	Participating interests
104	Other Information
105	Members of the Supervisory Board
106	Members of the TNO Council for Defence Research
107	Acknowledgements and contact information

CONSOLIDATED BALANCE SHEET PER 31 DECEMBER 2015

(in EUR x 1,000)

After allocation of profits

			31-12-2015	31-12-2014
Fixed assets				
Intangible assets	1	6,560	4,809	
Property, plant and equipment	2	181,823	185,966	
Financial assets	3	9,288	8,164	
			197,671	198,939
Current assets				
Inventories		780	534	
Receivables	4	72,899	65,553	
Cash and cash equivalents	5	134,895	113,287	
			208,574	179,374
Total			406,245	378,313
EQUITY				
General reserve	6	93,099	89,067	
Statutory reserve	7	12,007	10,471	
Appropriated reserves	8	72,061	75,043	
			177,167	174,581
Non-controlling interests			1,399	696
Investment grant equalization account	9		28,011	26,900
Provisions	10		19,392	11,843
Long-term liabilities	11		5,618	14,227
Current liabilities	12		174,658	150,066
Total			406,245	378,313

CONSOLIDATED INCOME STATEMENT 2015

(in EUR x 1,000)

			2015	2014
Revenue	13	518,381	526,408	
Other operating income	14	16,337	14,145	
Operating income			534,718	540,553
Direct project costs	15	-63,276	-66,336	
Personnel expenses	16	-333,981	-335,771	
Amortization		-3,750	-3,240	
Depreciation	17	-23,026	-24,712	
Impairment of property, plant and equipment	18	-3,000	-	
Other operating expenses	19	-103,063	-103,525	
Operating expenses			-530,096	-533,584
Operating profit			4,622	6,969
Interest income	20		-2,122	-13
Result from ordinary activities before tax			2,500	6,956
Tax paid			-468	-385
Result of participating interests	21		511	2,351
Result from ordinary activities after tax			2,543	8,922
Non-controlling interests			4	-161
Net result			2,547	8,761
Allocation of profits				
Net result			2,547	8,761
Additions to:				
- appropriated reserve for civil operating risks		-	-3,600	
- appropriated reserve for defence operating risks		-	-	
- statutory reserve		-1,536	-1,222	
- appropriated reserve for defence buildings		-3,044	-3,271	
			-4,580	-8,093
Withdrawals from:				
- appropriated reserve for civil operating risks		-	3,600	
- appropriated reserve for defence operating risks		-	-	
- statutory reserve		-	-	
- appropriated reserve for defence buildings		6,026	7,091	
			6,026	10,691
Result after movements in appropriated reserves			3,993	11,359
Movement in general reserve			-3,993	-11,359
			-	-

CONSOLIDATED CASH FLOW STATEMENT AND STATEMENT OF OVERALL RESULT 2015

(in EUR x 1,000)

CONSOLIDATED CASH FLOW STATEMENT

		2015	2014
Group result	4,622	6,969	
Amortization and depreciations	26,776	27,952	
Extraordinary impairments	3,000	-	
Results on disposals of fixed assets	-1,811	85	
Movement in provisions	7,549	-9,118	
Movement in working capital excl. cash and cash equivalents	6,436	-3,164	
Cash flow from operating activities	46,572	22,724	
Interest received	697	1,050	
Interest paid	-1,037	-1,222	
Dividends received	377	190	
Tax paid	-468	-385	
Cash flow from operational activities		46,141	22,357
Investments in intangible assets	-5,504	-3,540	
Investments in property, plant and equipment	-28,114	-29,241	
Investments in financial assets	-1,393	-362	
Disinvestments in intangible assets	3	260	
Disinvestments in property, plant and equipment	3,852	1,929	
Movement in non-controlling interests	703	-	
Sale of participating interests and repayments received	1,315	6,304	
Cash flow from investment activities		-29,138	-24,650
Investment grants received	5,301	516	
Repayment of borrowings	-345	-1,339	
Cash flow from financing activities		4,956	-823
Cash flow for financial year		21,959	-3,116
Cash and cash equivalents at 1 January		113,287	118,677
Cash flow for financial year		21,959	-3,116
Deconsolidation		-869	-2,433
Exchange gains and losses		518	159
Cash and cash equivalents at 31 December		134,895	113,287

STATEMENT OF OVERALL RESULT

	2015	2014
Consolidated net result after tax	2,547	8,761
Translation differences reserve	39	-124
Overall result	2,586	8,637

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS 2015

ACCOUNTING POLICIES

1.1 GENERAL

TNO connects people and knowledge to create innovations which will strengthen the competitive ability of industry and promote the sustainable well-being of society.

TNO has registered offices in Delft, the Netherlands.

Reporting period

The financial statements relate to a reporting period of one calendar year, 1 January 2015 to 31 December 2015 inclusive.

Applicable standards

The financial statements and accompanying information have been produced in accordance with the TNO Guidelines for Financial Reporting, as issued by the Minister of Education, Culture and Science (OCW). These guidelines implement the statutory provisions of Part 9, Book 2 of the Netherlands Civil Code. A supplementary order issued by the Minister exempts TNO from the provisions of Dutch Accounting Standard no. 271, which relates to employee remuneration and benefits.

The accounting policies applied are based on the historical costs convention.

The Standards for Remuneration Act (*Wet Normering Topinkomens* 2013; WNT) restricts the remuneration payable to

the directors and other senior officials of (semi-) governmental organizations. To ensure compliance, TNO applies the WNT Policy Regulations, which provide the reference framework for the relevant sections of the financial statements.

Comparative figures

Where necessary and appropriate, the figures for 2014 have been restated to facilitate comparison with those for 2015.

The financial statements have been prepared according to the continuity ('going concern') principle.

1.2 ACCOUNTING POLICIES

Except where stated otherwise, assets and liabilities are recognized at face value.

An asset is included on the balance sheet if and insofar as it is likely to represent an economic benefit to the organization at some future date, and the value of such benefit can be assessed with a reasonable degree of accuracy. A liability is included in the balance sheet if and insofar as its settlement will result in an outflow of resources, again where the amount concerned can be assessed with a reasonable degree of accuracy.

Where any transaction has the effect of transferring all or the greater part of future economic advantage or risks represented by an asset or liability to a third party, the asset or liability concerned is not included in the balance sheet. Assets and liabilities

are also excluded from the balance sheet if the condition of probable future economic effect is no longer met or if the value of that effect can no longer be quantified with a reasonable degree of accuracy.

Income is recognized in the balance sheet if and insofar as there has been an increase in economic potential further to the increase in value of an asset, or the decrease in value of a liability, whereby the effect can be quantified with a reasonable degree of accuracy. Expenses are included if and insofar as there has been a decrease in economic potential, further to the fall in value of an asset or an increase in the value of a liability, again where the effect can be quantified with a reasonable degree of accuracy.

Costs are entered against the period in which they are incurred.

All financial statements are presented in euros, being the functional currency of the organization; figures are rounded off to the nearest one thousand euros.

1.3 ACCOUNTING POLICIES FOR CONSOLIDATION

The consolidated financial statements present the financial information of the TNO Organization as a whole, including its group companies and other legal entities over which it exercises control or central management. Group companies are participating interests in which the

organization holds a majority interest or can otherwise exercise significant influence. To determine whether there is indeed 'significant influence', the existence of financial instruments which include potential voting rights is taken into consideration. Participating interests which are currently held with a view to short-term disposal are not consolidated if on acquisition there is already the intention to dispose of the interest, disposal within one year is likely and other relevant indicators are met. They are included under current assets, under securities (only held with a view to disposal). Newly acquired interests are included in the consolidation from the date on which significant influence can first be exercised.

The consolidated financial statements are produced in accordance with the uniform accounting principles of valuation and result calculation applied by the group.

Disposed interests are included in the consolidation until the date on which significant influence can no longer be exercised.

Inter-company liabilities, receivables and transactions are excluded from the consolidated financial statements. Group companies are fully consolidated, whereby non-controlling interests are disclosed separately.

Where losses incurred by a company in which TNO has a non-controlling interest

would exceed the value of the minority holding in the equity of the consolidated enterprise, the difference and any further losses are recognized in the statements of the majority shareholder only. A third-party share in results is shown separately as the final entry on the consolidated income statement, being a deduction against the group result.

A list of the consolidated group companies and non-consolidate participating interests is included in the notes to the relevant financial statements.

1.4 FOREIGN CURRENCY TRANSLATION

Transactions in foreign currencies

Transactions in foreign currencies are translated (converted) into the functional currency of the relevant group company at the exchange rate applicable on the transaction date. Monetary assets and liabilities denominated in foreign currencies are translated into the functional currency at the exchange rate applicable on the balance sheet date. Exchange rate differences which arise further to the conversion are included in the income statement.

Operations in countries other than the Netherlands

Assets and liabilities which relate to operations in countries other than the Netherlands, including goodwill and any material value corrections upon consolidation, are translated into euros

at the exchange rate applicable on the reporting date. The income and expenses which arise from operations in other countries are translated into euros at the average exchange rate for the entire reporting period, which generally provides a close approximation of translation at the exchange rate on the date of transaction.

Exchange rate differences are recognized by means of the translation reserve. When an overseas activity is wholly or partly divested, the relevant amount is transferred from this reserve to the income statement.

1.5 FINANCIAL INSTRUMENTS

Financial instruments comprise receivables, funds, loans and other financing obligations, trade debts and other payables. Financial instruments further include contracts with closed derivatives that are separated by the company from the basic contract and accounted separately: if the economic benefits and risks of the basic contract and its closed derivative are not closely related; if a separate instrument with the same conditions as the contract would meet the standard definition of a derivative, and if the combined instrument is not valued at the actual current value when processing value changes in the income statement.

Financial instruments, including those derivatives which are separated from the underlying contracts, are at actual value upon the first entry, whereupon the premium or discount and directly

attributable transaction costs are incorporated. If in a subsequent valuation the instruments are not valued at actual value, with value differences processed within the income statement, directly attributable transaction costs are included in the initial valuation.

Closed financial instruments which are not separated from the underlying contract are processed in accordance with the requirements stated in that contract.

Following the first entry, financial instruments are valued in the manner described below.

Loans, other receivables, borrowings and other payables

Loans, (other) receivables, as well as borrowings and other liabilities are valued at the amortized cost price, based on the effective interest method. The effect of discounting short-term receivables and liabilities which are not subject to interest will generally be insignificant and are therefore entered at face value. In the case of loans extended and (other) receivables, the valuation is adjusted as necessary to reflect any extraordinary depreciation losses.

Derivative financial instruments

Derivatives are at cost price or current market value, whichever is the lower, except where the cost hedge model is applied. TNO makes only limited use of forward exchange transactions in order to

hedge exchange rate risks further to either sales or purchase transactions. Where currency contracts are indeed entered into to protect monetary assets and liabilities, the hedge accounting method is applied to ensure that the results upon translation are not adversely affected by exchange rate fluctuations on the reporting date itself. The difference between the 'spot' exchange rate on the closing date of the forward exchange contract and the forward rate itself is amortized over the entire term of the forward contract.

One TNO group company uses interest rate swaps to hedge interest rate risks on long-term loans. Here too, the cost hedge accounting method is applied to ensure that the net interest costs on the income statement are not subject to exchange rate fluctuations. The stated interest costs therefore represent the amount of interest paid to financiers, adjusted by the amount of gains or losses which accrue on the rent swaps.

Where cost hedge accounting is applied, the initial valuation is based on the 'fair' value. No adjustment is made provided the derivative concerned is intended solely to hedge the risk of a future transaction which is expected to take place at some time in the future. When that transaction is to be included in the income statement, the loss or gain associated with the derivative instrument becomes accountable. Where the hedged position of a forecast transaction results in the

entry on the balance sheet of a non-financial asset, the cost price of that asset is adjusted by the value of the hedging results which have not yet been included in the income statement.

A percentage loss greater than the amount which is hedged by the derivative instrument is entered at cost price or current market value, whichever is the lower. Hedging arrangements terminate immediately upon expiry or sale of the derivative instrument. Any cumulative gains or losses which have not yet been entered onto the balance sheet will be entered as an accrual or prepayment until the transactions concerned are concluded. If it appears unlikely that the transactions will take place at all, the cumulative gains or losses are transferred to the income statement.

TNO monitors all hedging arrangements using a dedicated registration system, and regularly reassesses their effectiveness by ensuring that there is no over-hedging.

1.6 INTANGIBLE ASSETS

Goodwill is defined and calculated as the difference between the acquisition price of a participating interest and TNO's share of the net fair value of the identifiable assets and liabilities of the entity concerned, less cumulative amortization and impairment. Goodwill is amortized over the expected economic life term of the participating interest, which in principle is limited to five years.

Other intangible assets relate to past development costs and are capitalized if and when the resultant product is deemed commercially viable. The asset can be fulfilled if it is technically feasible to complete development, if the company concerned has the intention of doing so and then exploiting the product (for which there must be adequate financial, technical and other resources), the company has the ability to do so, the product will generate adequate economic returns, and expenditure during the development process can be assessed with a reasonable degree of accuracy. Development costs are valued at the manufacturing price less accumulated depreciation and extraordinary value depreciation. The primary costs are the salaries of the research and development staff and any external expertise, together with licensing rights and software. At the culmination of the development phase, the capitalized costs are amortized over the duration of the expected usage period of the product, which in principle will not exceed five years. Depreciation is linear. Capitalization will only occur if there is a reasonable likelihood that the costs will be covered by future income. A statutory reserve is formed in respect of the activated development costs which have yet to be amortized.

1.7 PROPERTY, PLANT AND EQUIPMENT

Tangible fixed assets comprise property, plant and equipment and are valued at the cost price of acquisition, or if produced by

the organization itself, at the cost of manufacture, less accumulated depreciations based on expected economic life and any extraordinary depreciation or impairment.

Depreciation is calculated as a percentage of cost using the linear method over the entire economic life term of the asset in question. Land, buildings under construction and prepayments on buildings, plant or equipment are not subject to amortization.

The depreciation period begins when the asset concerned becomes available for its intended purpose and ends upon discontinuation of use or on divestment, whichever is the earlier.

1.8 FINANCIAL ASSETS

Participating interests in which TNO can exert significant influence over the commercial and financial strategy are valued according to the equity method, based on net asset value as determined using the accounting policies of the TNO Organization. Participating interests with negative equity are valued at zero. Where TNO acts as guarantor for the liabilities of the interest, a separate provision is made. Amounts receivable from the interest are initially charged against this provision and thereafter against provisions to an amount equivalent to TNO's share of the losses incurred by the interest, or to the payments which TNO expects to make on its behalf.

Participating interests in which TNO is not able to exert significant interest are valued at acquisition price or at current market value, whichever is the lower. Loans made to non-consolidated participations are entered at amortized cost price, calculated using the effective interest method, less any impairment.

Dividends are booked against the period in which they become payable. Interest income is recognized in the period to which it relates, based on the effective interest rate. Gains or losses are entered under financial income and expenses.

1.9 IMPAIRMENT

Non-current assets with a longer life term are tested for impairment if there is any indication that the asset's carrying amount will not be recovered. The recoverability of current (in use) assets is assessed by comparing the carrying amount (book value) against the estimated cash value of the new cash flows which the asset will generate.

If the carrying amount of an asset is higher than the cash value of the cash flows it will generate. Impairment is applied to the amount of the difference between carrying amount and recoverable value.

1.10 INVENTORIES

Raw materials and consumables are valued at cost price or net realizable resale value, whichever is the lower.

The valuation takes account of any depreciation at the reporting date.

1.11 WORK IN PROGRESS

Work in progress refers to contract research projects which have yet to be completed, where their value is calculated on the basis of direct project costs (such as staff salaries and the costs of raw materials), overheads, and other costs which can be charged to the client under the terms of the contract. Project costs which relate to work undertaken after the reporting date are recognized as assets if it is likely that they will generate revenue at some later date. Where necessary, a provision is formed against which project losses can be charged. The value of work in progress is reduced by the cumulative amounts already invoiced to clients.

1.12 RECEIVABLES

The accounting policies which apply to receivables are given in the section on financial instruments above.

1.13 CASH AND CASH EQUIVALENTS

Cash equivalents are recognized at face value. Adjustment is made where the cash equivalent is not immediately available. Cash equivalents in a foreign currency are translated into the functional currency at the exchange rate applicable on the transaction date, as described in the section on foreign currency translation.

1.14 EQUITY

Financial instruments considered in terms of economic reality to be equity instruments are presented under Equity. Financial instruments considered in terms of economic reality to be a financial liability are presented under Payables. Gains and losses on these financial instruments are recognized as income or expenditure on the income statement.

Statutory reserve

The statutory reserve relates to intangible assets and non-distributable profits of participating interests in group companies, which are recognized at their intrinsic value.

Appropriated reserves

Further to Article 22 of the TNO Act and Articles 4 and 5 of the Financial Reporting Guidelines for TNO, appropriated reserves may be formed to allow for future expenditure or costs, or to cover economic or technical risks. Withdrawals may only be made in accordance with the designated purpose of the reserve.

The appropriated reserve for 'Civil operating risks' is intended to cover both economic and technical risks. When allocating the result each year, the TNO Board of Management designates a percentage of both government funding and market research revenue to the reserve, the maximum amount of which has been set by the government at 9.1 million euros.

The appropriated reserve for 'Defence operating risks' is based on specific agreements with the Ministry of Defence and is intended to cover risks further to the performance of defence-related assignments. The TNO Board of Management consults with the TNO Council for Defence Research to determine the amount to be added to the reserve each year when appropriating the result of the Defence, Safety and Security theme. Additions may be made annually until the maximum reserve of 2.5 million euros, as agreed with the Ministry of Defence, has been reached.

The appropriated reserve for Defence buildings has been formed to cover future investments in construction and/or renovation projects in support of defence-related activities. Additions to the reserve are made annually when allocating the result, subject to specific agreements with the Ministry of Defence.

1.15 NON-CONTROLLING INTERESTS

Non-controlling interests are recognized in the financial statements as the proportional value of third party holdings in the net asset value, determined in accordance with the TNO accounting policies.

1.16 INVESTMENT GRANT EQUALIZATION ACCOUNT

Funding provided by government or third parties in respect of TNO's investment in an asset are recognized as a liability and are transferred to the income statement in

instalments over the life period of that asset.

1.17 PROVISIONS

A provision is included on the balance sheet where:

- there is a current constructive or legal obligation created by some past event
- of which a reliable estimate of value can be made, and:
- an outflow of funds is likely to be required in settlement of that obligation.

Provisions are valued at the face value of the expected expenditure necessary to discharge the obligation and any accompanying losses, or the current value of the expenditure.

The provision for social obligations relates to current benefits and agreed future benefits payable to current and former employees of the TNO Organization further to the contractual terms and conditions of their employment. The component of the provision relating to current pension entitlements is valued according to actuarial calculations with a discount rate of four per cent (4%).

The claims provision relates to potential liabilities arising from legal proceedings. The restructuring provision relates to costs which accrue further to current and planned reorganization processes.

The redundancy (severance) provision relates to the expected costs further to

the termination of current contracts of employment, other than in the context of a reorganization process.

The provision for major maintenance is intended to spread the costs relating to the upkeep of buildings which are in the ownership of the TNO Organization and its group companies, based on a long-term maintenance plan.

Other provisions may be formed to cover vacancy costs. The main estimated entries are those of the restructuring provision, the redundancy (severance) provision and the miscellaneous provisions.

1.18 EMPLOYEE REMUNERATION AND PENSIONS

TNO has a number of pension schemes, of which the most significant is a defined-benefit plan administered by Stichting Pensioenfonds TNO. An order issued by the Minister of Education, Culture and Science stipulates that Dutch Accounting Standard RJ271 ('Employee benefits') does not apply to the TNO Organization, where liabilities in respect of pension contributions are recognized as an expense to be shown on the income statement in the period in which they fall due. A liability is formed insofar as the pension obligations at the reporting date have not been discharged in full. If the contributions paid prior to the reporting date exceed the amount of the obligation, a prepayment entry is made to the value of the amount which is to be refunded by the pension fund or offset

against future obligations. A provision is formed at the reporting date for any existing additional obligations to the fund or to employees if an outflow of funds is expected to be required to discharge those obligations and the amount concerned can be ascertained with reasonable accuracy. The possible existence of additional obligations is determined on the basis of the administration agreement with the pension fund, the pension agreements with employees and any other express or implicit agreements with employees. The provision is valued at the best estimate of the current value of the amount needed to discharge the obligations at the reporting date.

Any surplus in the pension fund at the reporting date is recognized as a receivable if that surplus may be expected to accrue to the organization as disposable assets, and the value of the surplus can be ascertained with a reasonable degree of accuracy.

1.19 CURRENT (SHORT-TERM) LIABILITIES

The valuation method for current (short-term) liabilities is given in the section on financial instruments above.

1.20 REVENUE RECOGNITION

For the purposes of the financial statements, revenue is defined as the total of:

- market revenue (further to contract research assignments)
- government funding.

Market revenue is made up of the invoiced amounts for activities conducted on behalf of clients, excluding Value Added Tax where applicable, and the movement in the value of work in progress. Because there is a regular flow of projects throughout the year, and most are completed within a year, profits derived from work in progress is recognized upon the completion of the project.

The government provides direct funding to support the demand-led 'programme' research for the benefit of the Top Sectors and in the societal transition themes. The resources are accounted as revenue pro rata the activities conducted. The direct project costs entry relates to material costs (including those of outsourced or subcontracted work) which are incurred in the performance of the project activities.

1.21 GOVERNMENT GRANTS AND SUBSIDIES

Government grants and subsidies are initially recognized on the balance sheet as revenue received in advance once there is a reasonable assurance that the grant or subsidy will be made and that the TNO Organization will be able to fulfil the conditions which attach to its payment. Grants made to reimburse or offset costs incurred by the TNO Organization are recognized on the income statement during the period in which the costs are actually incurred. The accounting policies which apply to grants on capital expenditure are explained in Section 1.5 (Financial Instruments) above.

1.22 SHARE IN THE RESULT OF PARTICIPATING INTERESTS

The entry 'share in the result of participating interests' relates solely to the TNO Organization's share in the profit or loss made by a company, stated in proportion to the organization's holding in that company. Results on transactions which involve a transfer of assets or liabilities between the TNO Organization and non-consolidated companies, or between two or more non-consolidated companies, are excluded from the statement unless and until they are deemed to have been realized. The results of participating interests which are acquired during the reporting period are included in the result of the TNO Organization from the date of acquisition, and those which are divested during the reporting period are excluded from the result from the date of divestment.

1.23 FINANCIAL INCOME AND EXPENDITURE

Interest income is entered against the period in which it is payable and may be adjusted in accordance with the effective interest rate on the transaction date. Interest expenses and similar outgoings are booked against the period in which they are incurred.

1.24 TAXATION

New taxation arrangements for semi-public commercial organizations become effective on 1 January 2016. Until that date, TNO and TNO Bedrijven B.V. are exempt from corporation tax liability

further to Article 2.7 of the *Wet op de Vennootschapsbelasting* (Corporation Tax Act 1969).

TNO Bedrijven B.V. has a 99% participating interest in TNO Deelnemingen B.V., which together with all subsidiaries registered in the Netherlands is indeed subject to Corporation Tax. Subsidiaries registered in other tax jurisdictions are subject to the relevant taxation regime.

The taxation amounts shown in the financial statements relate to taxes on profits and deferred taxes which are payable or recoverable during the reporting period. Tax is recognized on the income statement except where it relates to items which can be recognized directly through equity, in which case the amount concerned is booked to or charged against equity.

Tax due or recoverable during the reporting period is calculated according to the rates applicable at the reporting date, whereby adjustment is made for any underpayments or overpayments in previous periods.

If there is any temporary difference between the current book value of assets or liabilities for reporting purposes and their fiscal value, a provision for deferred

tax liability is made. Where the temporary differences will result in reduced tax liability, forward loss compensation is applied and a provision for a deferred tax claim is made, insofar as it may be assumed that there will be future taxable profits against which the adjustment can be made.

1.25 CASH FLOW STATEMENT

The Cash Flow Statement is prepared using the indirect method. Cash flows in foreign currencies are translated into euros at the average exchange rate over the entire reporting period.

1.26 FAIR VALUE

Various accounting policies and notes to the financial statements require an assessment of the 'fair' value of assets and liabilities, both financial and non-financial, to be made. The methods used to arrive at the fair value are as follows.

Receivables

The fair value of trade and other receivables is estimated according to the current value of the future cash flows.

Derivatives

The fair value of currency forward contracts and interest rate swaps is based on listed market prices, where available. In the

absence of listed market prices, fair value is exterminated by discounting expected cash flows to their present value using current interest rates to which a risk premium is applied.

Non-derivative financial liabilities

The fair value of non-derivative financial liabilities (borrowings) is determined for information purposes only, and is calculated using the present value of future repayments, including interest discounted at the market interest rate at the reporting date.

Further information about the criteria on which fair value is assessed is given in the notes to the specific asset or liability concerned, where applicable.

1.27 ESTIMATES

The production of the annual financial statements requires management to apply judgement and to arrive at estimates and assumptions which may influence the precise application of the accounting policies, thus affecting the reported value of assets and liabilities as well as income and expenses. The actual results may differ from these estimates. The estimates and their underlying assumptions are subject to ongoing review. Any revision of the estimates is applied to the period in

which that revision takes place, as well as the subsequent periods in which the effects of the revision are relevant.

1.28 RELATED PARTIES

Transactions with related parties occur if there is a relationship with the entity concerned, its participating interests and/or their directors and senior executives. In the course of its normal operations, TNO provides and receives services to and from various related parties in which TNO has an interest of 50% or less. These transactions are generally conducted 'at arm's length', i.e. under terms and conditions comparable to those applying to third parties with whom no relationship exists.

NOTES TO THE CONSOLIDATED BALANCE SHEET PER 31 DECEMBER 2015

(in EUR x 1,000)

1 INTANGIBLE ASSETS

Movements in intangible assets in 2015:

	Goodwill	Software	Total
Balance at 31-12-2014			
Cost	636	12,026	12,662
Cumulative amortization and impairment	-424	-7,429	-7,853
Carrying amount	212	4,597	4,809
Movement in carrying amount			
Investments	-	5,504	5,504
Disinvestments	-3	-	-3
Amortization	-44	-3,706	-3,750
	-47	1,798	1,751
Balance at 31-12-2015			
Cost	453	17,514	17,967
Cumulative amortization and impairment	-288	-11,119	-11,407
Carrying amount	165	6,395	6,560

2 PROPERTY, PLANT AND EQUIPMENT

Movements in property, plant and equipment in 2015:

	Land and buildings	Technical plant	Technical equipment	Inventories	Total
Balance at 31-12-2014					
Cost	206,251	152,063	174,203	12,125	544,642
Cumulative amortization and impairment	-124,881	-105,317	-131,149	-7,695	-369,042
Assets under construction or development	-	9,522	844	-	10,366
Carrying amount	81,370	56,268	43,898	4,430	185,966
Movement in carrying amount					
Investments	39	15,050	13,451	1,530	30,070
Disinvestments	-1,044	-17	-801	-179	-2,041
Reclassification	-	-	-	-	-
Extraordinary impairment	-	-	-3,000	-	-3,000
Depreciation	-3,927	-8,686	-13,493	-1,110	-27,216
Assets under construction or development activated during report period	-	-14,858	-764	-	-15,622
Assets under construction or development new in 2015	1,925	10,345	1,396	-	13,666
	-3,007	1,834	-3,211	241	-4,143
Balance at 31-12-2015					
Cost	204,799	161,592	172,484	12,637	551,512
Cumulative amortization and impairment	-128,361	-108,499	-133,273	-7,966	-378,099
Assets under construction or development	1,925	5,009	1,476	-	8,410
Carrying amount	78,363	58,102	40,687	4,671	181,823

The depreciation charge shown on the income statement includes the release of funds from the investment grant equalization account. The carrying amount for fixed assets at 31 December 2015 includes land, buildings and technical plant with a total value of 31.7 million euros (2013: 25.3 million) of which TNO is sole beneficial owner.

Depreciation rates per year (%)

	2015	2014
Land	nil	nil
Buildings	40	40
Technical plant	15	15
Renovations	4-15	4-15
Computer equipment	3-5	3-5
Technical equipment	5	5
Inventory, fixtures and fittings	10	10

3 FINANCIAL ASSETS

	Non-consolidated participating interests		Other loans	Total
	Share in equity	Loans		
Balance at 31-12-14	8,009	-	155	8,164
Movements:				
Investments and extended loans	127	1,038	228	1,393
Disinvestments and repayments	-	-171	-	-171
Changes in value	-	-867	-	-867
Result of participating interests	1,146	-	-	1,146
Dividend	-377	-	-	-377
Balance at 31-12-15	8,905	-	383	9,288

Participating interests are those companies in which TNO and/or TNO Bedrijven B.V has a shareholding. A list of all direct and indirect participations is included in the notes to the non-consolidated financial statements.

4 RECEIVABLES

	31-12-2015	31-12-2014
Receivables from projects	58,841	48,774
Receivables from participations	1,144	243
Other receivables	7,930	11,795
Prepayments and accrued income	4,984	4,741
Total	72,899	65,553

Receivables totalling 2.0 million euros fall due in more than one year (2013: 1.3 million). All others have a period of less than one year.

5 CASH AND CASH EQUIVALENTS

The value of cash and cash equivalents at year-end 2015 exceeded that of the appropriated reserves in respect of operating risks, defence and defence buildings (see paragraph 8). Cash and cash equivalents to a value of 133.7 million euros are freely available with no withdrawal restrictions.

6 GENERAL RESERVE

	2015	2014
Balance at 1 January	89,067	77,832
Translation differences reserve	39	-124
Result allocation	3,993	11,359
Balance at 31 December	93,099	89,067

7 STATUTORY RESERVE

	2015	2014
Balance at 1 January	10,471	9,249
Movement	1,536	1,222
Balance at 31 December	12,007	10,471

The statutory reserve relates to the intangible assets and non-apportionable profits of group companies.

8 APPROPRIATED RESERVES

	Balance at 31-12-2014	Withdrawals in 2015	Additions in 2015	Balance at 31-12-2015
Civil operating risks	9,075	-	-	9,075
Defence operating risks		-	-	2,500
Defence buildings	63,468	6,026	3,044	60,486
Total		6,026	3,044	72,061

9 INVESTMENT GRANT EQUALIZATION ACCOUNT

	2015	2014
Balance at 1 January 2015	26,900	31,009
Net funds granted in respect of property, plant and equipment	5,301	516
	32,201	31,525
Released to result	-4,190	-4,625
Balance at 31 December	28,011	26,900

10 PROVISIONS

	Balance at 31-12-2014	Withdrawals in 2015	Additions in 2015	Released in 2015	Balance at 31-12-2015
Social commitments	866	175	-	-	691
Claims	800	-	-	-	800
Restructuring	4,502	3,709	10,683	1,638	9,838
Redundancy	445	518	3,022	179	2,770
Loans to participating Interests	177	-	-	9	168
Major maintenance	1,107	2,820	2,119	-	406
Other	3,946	2,352	3,942	817	4,719
Total	11,843	9,574	19,766	2,643	19,392

Provisions to a total value of approximately 6.4 million euros are long-term in nature (2014: 3.4 million euros).

Further information about the provisions can be found in the accounting policies section.

11 LONG-TERM LIABILITIES

	31-12-2015	31-12-2014
Borrowings		
Loans from credit institutions	4,329	13,925
Medium-term bank credit	954	70
Other borrowings	335	232
Total	5,618	14,227

Of the long-term liabilities, 2.8 million euros are of a term greater than one year but shorter than five years. The remainder (1.8 million euros) have a term longer than five years.

During the reporting period, the Netherlands Enterprise Agency awarded an Innovation Credit loan to LDI Systems B.V. in respect of the Laser Direct Imaging for PCB Manufacturing project. This will offset 45% of the project costs incurred during the period from 28 October 2014 to 31 December 2015, to a maximum amount of EUR 1,364,903. Provided certain conditions are met, the loan can be converted into a non-repayable grant. LDI Systems B.V. has provided surety in the form of a first lien on the equipment and intangible assets purchased using the loan amount, while the shareholders act as guarantors. If repayment is required, there are to be six quarterly repayments commencing on 1 January 2018, with cumulative interest payable from 1 July 2019. The annual interest rate is 7%. The full amount of the loan, EUR 954,399, is recognized as a long-term liability at the balance sheet date.

Holland Metrology N.V. holds a twenty-year linear mortgage loan (from ABN AMRO Bank) with an original principal sum of 13 million euros, taken out to finance the construction and conversion project in Delft. Repayments totalling 7.7 million euros were made during the period 2005-2015. The amount recognized as a long-term liability at the balance sheet date of 31 December 2015 is 4.6 million euros. A further 0.7 million euros is included on the balance sheet under current (short-term) liabilities. The interest rate is 4.08% – 5.2% (swap rate plus surcharge).

The bank has stipulated that Holland Metrology N.V. may not allocate profits for any purpose other than the payment of dividends and repayment of loans extended by TNO and/or TNO Deelnemingen B.V. (which are subordinated to the bank), unless certain conditions are met. Those conditions include a solvency rate of no less than 35% and satisfactory debt/EBITDA ratios). The loan provided by TNO is included in the liability capital.

In addition to these requirements, security on the loan is required in the form of:

- A first mortgage charge on property in Delft (Thijssseweg 11), Dordrecht and Rotterdam (Vondelingenplaat)
- A lien on intellectual property rights, office equipment and contents, inventories (except that of VSL B.V.), stocks and receivables
- Joint and several liability to the bank on the part of NMI Certin B.V., VSL B.V. and EuroLoop B.V.

In 2015, Ducares B.V. entered into a leasing agreement with ING Lease Nederland B.V. to finance the purchase of laboratory equipment. The principal sum is EUR 160,000 and the interest rate is equivalent to 2.83%. Repayments are to be made in 36 equal monthly instalments of 4,641 euros (including interest and annuity), commencing in March 2015. Of the total amount, 63,839 euros is recognized as a long-term liability on the balance sheet date of 31 December 2015, and 53,069 euros as a current (short-term) liability.

In 2010, Vitens N.V. extended an annuity loan of 461,796 euros with a period of ten years to Ducares B.V. to finance the construction and fitting-out of laboratories. The interest rate is equivalent to 6%. During the period from 2010 to 2015, Ducares B.V. made repayments totalling 231,674 euros, whereupon the amount outstanding at 31 December 2015 was 230,122. This amount is to be repaid in full in 2016 and is therefore presented on the balance sheet under current liabilities.

12 CURRENT LIABILITIES

	31-12-2015	31-12-2014
Bank loans	9,983	1,719
Creditors	14,599	13,736
Taxes and social security contributions	18,522	16,890
Pensions	40	18
Holiday pay	9,292	9,388
Outstanding leave entitlement	13,511	14,731
Other liabilities	39,592	40,615
Accruals and deferred income	33,284	43,997
Work in progress	35,835	8,972
Total	174,658	150,066

Holland Metrology N.V. holds a linear mortgage loan (from ABN AMRO Bank) with an original principal sum of 12 million euros, taken out to finance the construction of the EuroLoop building in Rotterdam. Interest is payable at 6.77% (swap rate plus surcharge). Repayments totalling 3.0 million euros were made during the 2011-2015 period. The formal due date of the loan is 1 January 2016 (at which time the outstanding amount is 9 million). Holland Metrology N.V. has entered into talks with ABN AMRO Bank to negotiate terms and conditions for an extension of the loan.

The entry 'other current liabilities' relates predominantly to costs and liabilities incurred in 2015 for which payment falls due in 2016. These short-term debts do not bear interest.

The accruals and deferred income entry relates predominately to advance payments made in respect of specific research projects, as well as accrued government funding. Of the total, 7.5 million euros has a due period of greater than one year.

Work in progress	31-12-2015	31-12-2014
Cumulative costs less provisions for losses and risks	319,538	324,993
Less: amounts invoiced	-355,373	-333,965
Total work in progress	-35,835	-8,972
Net work in progress > 0	82,371	76,705
Net work in progress < 0	-118,206	-85,677
Total work in progress	-35,835	-8,972

FINANCIAL INSTRUMENTS

General

In the course of its regular business operations, TNO uses a wide range of financial instruments which expose the organization to market and/or credit risks. The financial instruments are recognized in the balance sheet, together with currency forward contracts and interest rate swaps to protect future transactions, cash flows and interest rate risks. TNO does not trade in these financial derivatives. It applies procedures and guidelines intended to restrict the credit risks of each market or individual party. Should any counterparty default on payments which are due to TNO, the losses thus sustained are limited to the market value of the instruments concerned. The contract value or notional principal sum of the financial instruments is no more than an indication of the degree to which they are used, rather than the actual amount of the credit or market risk.

Interest rate risk

The interest rate risk is limited to any fluctuations in the market value of loans receivable or borrowings. It is preferable for all loans to have a fixed interest rate throughout their term. Where this is not the case, the policy of TNO is to use derivative financial instruments to manage (interim) interest rate fluctuations. Loans are held until maturity.

Credit risk

TNO is exposed to credit risks further to certain transactions where losses could occur if a counterparty were to default on payment. The level of risk is limited due to the sheer number and diversity of debtors. There is only a concentration of credit risk in terms of geographic distribution, since most clients and contracting parties are registered and active in the Netherlands.

Market value

The market value of most financial instruments recognized on the balance sheet, including extended loans, receivables, cash and cash equivalents and short-term liabilities, is broadly equivalent to the carrying amount (book value). The market value of other financial instruments recognized on the balance sheet can be represented as follows:

It is not possible to determine the market value of amounts owed by participating interests with a reasonable degree of accuracy (see Section 3). Long-term liabilities are entered at face value. The fair and current value of loans may differ from the face value, but again it is not possible to determine the difference with a reasonable degree of accuracy.

Outstanding forward contracts in US dollars (USD) have a market value of 9.1 million euros and a contract value of 8.9 million euros. The outstanding forward contracts in pounds sterling (GBP) have a market value of 0.4 million euros and a contract value of 0.4 million euros.

To cover the interest rate risk further to the long-term mortgage loan of 14.3 million euros, Holland Metrology N.V. has entered into interest rate swaps totalling the same amount and with terms ranging from 1 December 2018 (two contracts totalling 5.3 million euros) to 1 July 2025 (9.0 million euros). The former contracts have a fixed coupon rate of 3.73% – 4.85% while the latter has a fixed coupon rate of 4.37%, all at three-month Euribor. At 31 December 2015, the market value of the three contracts was -2.9 million euros (2014: – 3.5 million euros).

Assets and liabilities not included on the balance sheet

At 31 December 2015, the total of 'operational lease' liabilities over the period from 2016 to 2020 (inclusive) was approximately 5.7 million euros (2014: 6.5 million euros), of which approximately 2.4 million euros falls due in 2016 (2014: 3.0 million euro) and 3.3 million euros within a period exceeding one year but less than five years (2014: 3.5 million euros).

Rental liabilities totalled 95.5 million euros at year end (2014: 108.3 million euros), of which 13.3 million euros (2014: 15.2 million euros) falls due within one year, 46.7 million euros (2014: 50.3 million euros) in between one and five years, and 35.5 million euros (2014: 42.9 million euros) in five or more years.

On 31 December 2015, investment liabilities with regard to property, plant and equipment totalled 2.2 million euros (2014: 2.6 million euros).

Bank guarantees issued totalled 5.4 million euros (2014: 7.1 million euros). The total of credit facilities was 15.4 million euros (2013: 15.1 million euros) and that of bank guarantee facilities was 11.0 million euros (2011: 11.0 million euros).

Other securities and stipulations for the credit facilities are:

- negative pledge/pari passu and cross default statement
- positive/negative mortgage statement on property held in Eindhoven
- joint and several liability agreement (CJMO), security type RC plus one party.

The total in sureties at year-end 2015 was 2.4 million euros (2014: 2.8 million euros). TNO is currently a litigant in various legal proceedings in connection with its regular business activities. The liabilities arising from these proceedings are not expected to be of material significance to the organization's financial position. Provisions have been formed for all disputes and proceedings based on the face value of expenditure likely to arise in settlement of liabilities and losses in a 'worst case scenario'.

NOTES TO THE CONSOLIDATED INCOME STATEMENT 2015

(in EUR x 1,000)

13 REVENUE

	2015	2014
Revenue from contract research	350,447	355,236
Government funding	167,934	171,172
Total	518,381	526,408

The stated revenue includes the movement in work in progress of -26.9 million euros (2014: -10.3 million euros).

CONTRACTS

Revenue from contract research by category:

	2015	2014
Domestic		
Government	85,832	86,883
Industry	102,742	116,946
Total domestic	188,574	203,829
International		
International organizations	35,949	37,300
Other	125,924	114,107
Total international	161,873	151,407
Total	350,447	355,236

14 OTHER OPERATING INCOME

	2015	2014
Result from disposals of property, plant and equipment	1,811	-85
Other income	14,526	14,230
Total	16,337	14,145

The stated 'other income' includes that from licences and patents, non-project-related income and costs charged on to external parties.

15 DIRECT PROJECT COSTS

	2015	2014
Accommodation and energy	168	596
Materials	14,327	13,895
Use of technical assets	3,870	2,298
General administrative expenses	8,020	10,455
Subcontracted work	31,831	33,930
Other expenses	5,060	5,162
Total	63,276	66,336

16 PERSONNEL COSTS

	2015	2014
Wages and salaries	227,968	232,258
Pension expenses	26,090	27,052
Other social security expenses	30,145	33,757
Other personnel costs	43,563	49,073
Movement in liability re unclaimed leave entitlement	-1,203	-254
Use of provisions:		
- social commitments	-175	-382
- redundancy	-697	-1,097
- restructuring	-5,346	-9,971
- pensions	-69	-6
	320,276	330,430
Additions to provisions:		
- social commitments	-	-1
- restructuring	10,683	5,104
- redundancy	3,022	238
- pensions	-	-
Total	333,981	335,771

The average effective number of employees (full time equivalent) over the reporting year was 3,438 (2014: 3,599, of whom 55.9 were deployed outside the Netherlands (unchanged). Remuneration paid to the TNO Board of Management (including pension premiums) totalled 0.8 million euros (2014: 0.8 million euros, unchanged). Remuneration paid to the members of the TNO Supervisory Board totalled 0.1 million euros (2014: 0.1 million euros, unchanged).

At 31 December 2014, the funding ratio ('cover rate') of Stichting Pensioenfonds TNO (being the market value of investments expressed as a percentage of the provision for future pension obligations calculated according to the principles of DNB) was 111.7%, subject to confirmation. This figure is calculated in accordance with the amended definition of the funding ratio which makes allowances for the direct risk to the beneficiary. New legislation has been drafted in consultation with the social partners and will come into effect on 1 January 2016; it provides for variable premiums based on expected yield, with a fixed recovery surcharge of 0.3%. Application of the new calculation method gives a premium rate of 18.3%.

17 DEPRECIATION

	2015	2014
Depreciation of:		
- buildings	3,927	3,681
- technical plant	8,686	9,877
- technical equipment	13,493	14,731
- inventory, fixtures and fittings	1,110	1,048
	27,216	29,337
Release from:		
- investment grant equalization account	-4,190	-4,625
Total	23,026	24,712

18 EXTRAORDINARY IMPAIRMENT OF PROPERTY, PLANT AND EQUIPMENT

The extraordinary impairment of 3.0 million euros is further to the write-down of property, plant and equipment pertaining to one of the TNO participating interests.

19 OTHER OPERATING EXPENSES

	2015	2014
Accommodation	40,974	44,469
Materials	4,207	3,446
Use of technical assets	13,865	13,162
General administrative expenses	27,098	27,069
Subcontracted work	9,228	9,978
Movements in provisions	835	-1,366
Other expenses	5,613	5,849
Contributions	1,243	918
Total	103,063	103,525

20 FINANCIAL INCOME AND EXPENDITURE

	2015	2014
Interest gains	697	1,050
Interest expenses	-1,037	-1,222
Value adjustment re (instruments on) loans	-2,300	-
Exchange rate differences	518	159
Total	-2,122	-13

The value adjustment of 2.3 million euros is further to the negative market value of an interest swap at the balance sheet date.

21 RESULT OF PARTICIPATING INTERESTS

	2015	2014
Participating interests:		
- Non-consolidated participations	239	825
- Loans and other investments	-	-
- Disposal of interests TB	272	1,526
Total	511	2,351

22 AUDITOR'S FEES

The fees paid to KPMG Accountants N.V. are charged against the TNO Organization, its subsidiaries and other consolidated companies further to the provisions of Section 2:382a of the Netherlands Civil Code.

	2015	2014
Audit of the financial statements	442	452
Other auditing activities	425	390
Consultancy	-	-
Total	867	842

BALANCE SHEET OF THE TNO ORGANIZATION PER 31 DECEMBER 2015

(in EUR x 1,000)

After allocation of profit

			31-12-2015	31-12-2014
Non-current assets				
Property, plant and equipment	1	144,036	144,097	
Financial assets	2	44,374	46,522	
			188,410	190,619
Current assets				
Inventories		653	422	
Receivables	3	57,411	52,597	
Cash and cash equivalents		115,416	94,147	
			173,480	147,166
Total			361,890	337,785
Equity				
General reserve		93,099	89,067	
Statutory reserve		12,007	10,471	
Appropriated reserves		72,061	75,043	
			177,167	174,581
Investment grant equalization account			28,011	26,900
Provisions	4		18,496	10,368
Current liabilities	5		138,216	125,936
Total			361,890	337,785

INCOME STATEMENT OF THE TNO ORGANIZATION 2015

(in EUR x 1,000)

			2015		2014
Revenue contract research (domestic and international)		176,333		182,505	
Revenue government contracts		71,863		70,515	
Market revenue			248,196		253,020
Government funding			167,934		171,172
Revenue	6		416,130		424,192
Other operating income			24,813		22,827
Operating income			440,943		447,019
Direct project costs		-56,382		-61,667	
Personnel expenses	7	-278,768		-276,321	
Depreciation and impairment		-17,017		-18,038	
Other operating expenses		-85,446		-86,273	
Operating expenses			-437,613		-442,299
Operating result			3,330		4,720
Financial gains and expenses	8		703		989
Result from ordinary operations before tax			4,033		5,709
Tax paid			-		-
Result from participating interests			-1,486		3,052
Net result			2,547		8,761

CASH FLOW STATEMENT OF THE TNO ORGANIZATION 2015

(in EUR x 1,000)

CASH FLOW STATEMENT OF THE TNO ORGANIZATION

		2015	2014
Operating result	3,330		4,720
Depreciation	17,017		18,038
Movement in provisions	8,128		-8,413
Movement in working capital (excl. cash and cash equivalents)	7,235		-416
Cash flow from operations	35,710		13,929
Interest received	727		1,025
Interest paid	-11		-30
Cash flow from operational activities		36,426	14,924
Investments in property, plant and equipment	-23,057		-22,838
Investments in financial assets	-228		-1,781
Disinvestments in property, plant and equipment	1,910		1,840
Disposal of participating interests and repayments received	929		4,390
Cash flow from investment activities		-20,446	-18,389
Investment grants received	5,302		516
Cash flow from financing activities		5,302	516
Cash flow for reporting year		21,282	-2,949
Cash and cash equivalents at 1 January		94,147	97,102
Cash flow for reporting year		21,282	-2,949
Exchange rate differences		-13	-6
Cash and cash equivalents at 31 December		115,416	94,147

ACCOUNTING POLICIES

General

Accounting policies which are not listed separately below are given in the notes to the consolidated financial statements.

NOTES TO THE BALANCE SHEET OF THE TNO ORGANIZATION PER 31 DECEMBER 2015

(in EUR x 1,000)

1 PROPERTY, PLANT AND EQUIPMENT

Movements in property, plant and equipment in 2015:

	Land and buildings	Technical plant	Technical equipment	Inventories	Total
Balance at 31-12-2014					
Cost	182,346	151,467	84,637	9,627	428,077
Cumulative depreciation and impairment	-117,296	-104,830	-64,677	-6,392	-293,195
Assets under construction or development	-	8,371	844	-	9,215
Carrying amount	65,050	55,008	20,804	3,235	144,097
Movement in carrying amount					
Investments	-	15,050	9,163	1,452	25,665
Disinvestments	-1,044	-17	-726	-123	-1,910
Reclassification	-	-	-	-	-
Reclassification cumulative	-	-	-	-	-
Extraordinary impairments	-	-	-	-	-
Depreciation	-3,274	-8,666	-8,392	-876	-21,208
Assets under construction or development activated during financial year	-	-14,756	-764	-	-15,520
Assets under construction or development new in 2015	1,925	9,591	1,396	-	12,912
	-2,393	1,202	677	453	-61
Balance at 31-12-2015					
Cost	180,855	160,996	81,209	10,370	433,430
Cumulative depreciation and impairments	-120,123	-107,992	-61,204	-6,682	-296,001
Assets under construction or development	1,925	3,206	1,476	-	6,607
Carrying value	62,657	56,210	21,481	3,688	144,036

The income statement entry 'depreciation of Property, plant and equipment' includes the release from the investment grant equalization account. The carrying value of Property, plant and equipment at 31 December 2014 includes assets to a value of 31.7 million euros (2014: 25.3 million euros) of which TNO has sole beneficial ownership.

2 FINANCIAL ASSETS

	Group companies	Participating interests	Loans	Total
	Share of equity	Share of equity		
Balance at 31-12-2014	40,229	-	6,293	46,522
Movements:				
Investments and loans extended	-	-	228	228
Disinvestments and repayments received	-	-	-929	-929
Result from participating interests	-1,486	-	-	-1,486
Translation differences reserve	39	-	-	39
Balance at 31-12-2015	38,782	-	5,592	44,374

Group companies include the wholly-owned participating interest in TNO Bedrijven B.V. (100%)
Loans totalling 4.5 million euros have a remaining term greater than one year. (2014: 4.9 million euros).

3 RECEIVABLES

	31-12-2015	31-12-2014
Receivables from contract research	43,507	37,858
Amounts owed by group companies	5,565	7,746
Amounts owed by participating interests	1,144	243
Other receivables	2,211	1,789
Prepayments and accrued income	4,984	4,961
Total	57,411	52,597

Receivables totalling 2.0 million euros have a term of one year or greater (2014: 1,3 million). All amounts included under 'prepayments and accrued income' have a term of less than one year.

NOTES TO THE BALANCE SHEET OF THE
TNO ORGANIZATION PER 31 DECEMBER 2015

4 PROVISIONS

	Balance at 31-12-2014	Withdrawals in 2015	Additions in 2015	Release in 2015	Balance at 31-12-2015
Social commitments	866	175	-	-	691
Claims	800	-	-	-	800
Restructuring	4,219	3,449	10,597	1,638	9,729
Redundancy	445	518	3,022	179	2,770
Major maintenance	1,107	2,820	2,119	-	406
Other	2,931	2,352	3,930	409	4,100
Total	10,368	9,314	19,668	2,226	18,496

Approximately 5.7 million euros of the provision amounts are long-term in nature (2014: 2.3 million euros).

5 CURRENT LIABILITIES

	31-12-2015	31-12-2014
Creditors	12,029	10,993
Amounts owed to group companies	2,399	2,781
Taxes and social security premiums	14,892	13,877
Holiday pay	6,959	7,021
Unclaimed leave entitlement	13,511	14,731
Other liabilities	23,303	26,244
Accruals and deferred income	33,284	44,399
Work in progress	31,839	5,890
Total	138,216	125,936

The accruals and deferred income entry relates predominantly to prepayments made in respect of specific research projects and to accrued government grants and subsidies. Of the total, 7.5 million euros falls due in over one year.

WORK IN PROGRESS

	31-12-2015		31-12-2014
Cumulative costs less provisions for losses and risks	291,534		284,856
Less: cumulative amounts invoiced	-323,373		-290,746
Total work in progress	-31,839		-5,890
Net work in progress > 0	76,406		71,067
Net work in progress < 0	-108,245		-76,957
Total work in progress	-31,839		-5,890

The TNO Organization has extended a credit facility of 9.0 million euros to TNO Bedrijven B.V., which has free access to this amount subject to the conditions stated in the credit agreement. TNO Bedrijven B.V. pays interest on any outstanding amount owed at an annual rate equivalent to three-month Euribor plus a surcharge of 6.25%, with a lower threshold of 6% (below which the interest rate cannot fall). If TNO Bedrijven B.V. has made use of the credit facility, repayment falls due in 2016.

NOTES TO THE INCOME STATEMENT OF THE TNO ORGANIZATION 2015

(in EUR x 1,000)

6 REVENUE

		2015		2014
Domestic private sector		79,865		92,516
International organizations	33,312		31,958	
Other international	63,156		58,031	
		96,468		89,989
Government		71,863		70,515
Market revenue		248,196		253,020
Government funding		167,934		171,172
Total		416,130		424,192

7 PERSONNEL EXPENSES

		2015		2014
Wages and salaries		184,653		187,256
Pension expenses		21,463		22,242
Other social costs		23,971		27,217
Other personnel expenses		42,225		45,406
Movement in unclaimed leave entitlement		-1,204		-254
Movements in provisions		7,660		-5,546
Total		278,768		276,321

The average effective number of employees in 2015 was 2,689, of whom 7 outside the Netherlands (2014: 2,819 of whom 4 in other countries).

8 FINANCIAL GAINS AND EXPENSES

		2015		2014
Interest rate gains		727		1,025
Interest rate expenses		-11		-30
Exchange rate differences		-13		-6
Total		703		989

COMPLIANCE STATEMENT: STANDARDS FOR REMUNERATION ACT (WNT)

The Standards for Remuneration Act (*Wet Normering Topinkomens*; WNT) came into effect on 1 January 2013. It limits the remuneration payable to governance officers (executive and non-executive directors) of all public and semi-public organizations. This compliance statement has been prepared in accordance with the requirements of the Act insofar as they are applicable to the Netherlands Organization for Applied Scientific Research, TNO.

According to the published remuneration schedule which took effect on 1 January 2015, the maximum amount payable to any

officer of the TNO Organization during the reporting year was €178,000. The salaries and emoluments payable to each individual are to be calculated pro rata according to the contracted hours committed to the organization (and in the case of senior officers, the duration of contract) whereby an appointment can never exceed 1.0 FTE (full time equivalent). In the case of the members of a Supervisory Board, the amount payable to the chairman in the form of a retainer is not to exceed 15% of the schedule maximum while those paid to the other members must not exceed 10% of the schedule maximum.

REMUNERATION OF SENIOR EXECUTIVE OFFICERS Senior officials in managerial positions

Amounts in euros	P de Krom	J.W. Kelder	Prof. J.T.F. Keurentjes	F. Marring	W. Nagtegaal
Position	Member, Board of Management (Chair from 1-3-2015)	Member, Board of Management (Chair to 1-3-2015)	Member, Board of Management	Member, Board of Management	Member, Board of Management
Term of office in 2015	15/1 - 31/12	1/1 - 1/3	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12
Commitment (FTE)	1.0	1.0	1.0	1.0	1.0
Former officer (no longer active)?	No	No	No	No	No
Employment relationship?	Yes	Yes	Yes	Yes	Yes
If not, active for more than six months within the past 18 months?					
Remuneration					
Salary	159,904.52	35,284.84	199,680.31	198,480.31	112,967.01
Taxable expenses allowance	0.00	0.00	13,186.20	10,976.28	0.00
Deferred payments and benefits	9,964.88	0.00	10,357.20	10,357.20	10,357.20
Total remuneration	169,869.39	35,284.84	223,223.71	219,813.79	123,324.21
Applicable schedule maximum	170,684.93	29,666.67	178,000.00	178,000.00	178,000.00
Reason for payment in excess of schedule maximum		1	2	2	

1. Transition arrangements per Art. 7.3 in conjunction with Art. 7.3a WNT; appointed prior to 1 January 2013 whereupon schedule maximums will apply from 1 January 2017.
2. Transition arrangements per Art. 7.3 in conjunction with Art. 7.3a WNT; appointed prior to 1 January 2015 whereupon schedule maximums are to be phased in over a period of four years after coming into force of the WNT on 1 January 2015, i.e. by 1 January 2019.

COMPLIANCE STATEMENT: STANDARDS FOR REMUNERATION ACT (WNT)

	Dr. C.M. Hooymans
Position(s)	Former member, Board of Management
Commitment (FTE)	1.0
Employment relationship?	
Payments made in 2015 further to termination of contract	362,639.00
Year in which contract was terminated	2014

Total of payments awarded further to termination of contract

Applicable schedule maximum	75,000.00
Reason for payment in excess of schedule maximum	1

1. Transition arrangements per Art 7.3. in conjunction with Art. 7.3a WNT.

Remuneration of non-executive (supervisory) officers of the TNO organization

Amounts in euros	Dr C.A. Linse	Prof. J.M. Bensing	I.G.C. Faber MBA	I.H.J. Vanden Berghe	J.D. Lamse- Minderhoud RA	Prof. PRC.C. Verbeek	H.W. Broeders
Appointment(s)	Member, Supervisory Board (Chair)	Member, Supervisory Board	Member, Supervisory Board	Member, Supervisory Board	Member, Supervisory Board	Member, Supervisory Board	Member, Supervisory Board
Term of office in 2015	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12

Remuneration

Emoluments	24,996.00	15,792.00	15,792.00	18,000.00	15,792.00	18,000.00	18,000.00
Taxable expenses allowance	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Deferred benefits	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Total remuneration	24,996.00	15,792.00	15,792.00	18,000.00	15,792.00	18,000.00	18,000.00
---------------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------

Applicable maximum per WNT	26,700.00	17,800.00	17,800.00	17,800.00	17,800.00	17,800.00	17,800.00
Reason for payment exceeding maximum (where applicable: see notes)				1		1	1

1. Transition arrangements per Art. 7.3 in conjunction with Art. 7.3a WNT.

COMPLIANCE STATEMENT: STANDARDS FOR REMUNERATION ACT (WNT)

REMUNERATION OR SEVERANCE PAYMENTS EXCEEDING WNT MAXIMUM PAID TO NON-SENIOR PERSONNEL (1)

The WNT maximums do not apply to personnel in these grades. The Act does however require the publication of the above information.

Amounts in euros	Director	Theme employee	Director	Administrative staff	Theme employee	Theme employee	Director
Service in 2015	-	1/1 - 31/3	1/1 - 30/4	1/1 - 31/7	1/1 - 31/8	1/1 - 30/6	1/1 - 30/6
FTE	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Remuneration

Salary	0.00	32,946.54	64,086.24	43,222.02	74,799.20	61,149.37	109,391.00
Taxable expenses allowance	0.00	1,431.30	2561.40	0.00	2,512.96	1,199.34	-172.93
Deferred benefits	0.00	2,589.30	3,452.40	4,670.96	6,529.20	5,178.60	5,178.60

Total remuneration	0.00	36,967.14	70,100.04	47,892.98	83,841.36	67,527.31	114,396.67
---------------------------	-------------	------------------	------------------	------------------	------------------	------------------	-------------------

Applicable maximum per WNT

Reason for payment exceeding maximum	a	a	a	a	a	a	a
--------------------------------------	---	---	---	---	---	---	---

a. The WNT maximums do not apply to personnel in these grades. The Act does however require the publication of the above information.

PAYMENTS MADE IN 2015 FURTHER TO TERMINATION OF EMPLOYMENT

Total	475,719.00	324,049.63	275,000.00	293,000.00	236,000.00	200,000.00	88,000.00
-------	------------	------------	------------	------------	------------	------------	-----------

Applicable maximum per WNT

Reasons for excess payment

REQUIRED INFORMATION 2014

Function	Director	Theme employee	Director	Administrative staff	Theme employee	Theme employee	Director
Service in 2014	1/1 - 30/11	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12
FTE	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Remuneration

Salary	225,176.00	116,578.72	141,523.54	73,296.60	98,677.68	140,187.78	159,891.72
Taxable expenses allowance	10,496.00	5,725.20	8,625.19	0.00	3,769.44	6,400.20	2,048.28
Deferred benefits	15,582.00	11,472.84	12,740.52	7,941.72	9,700.92	11,292.44	13,979.61

Total remuneration	251,254.00	133,776.76	162,889.25	81,238.32	112,148.04	157,880.42	175,919.61
---------------------------	-------------------	-------------------	-------------------	------------------	-------------------	-------------------	-------------------

COMPLIANCE STATEMENT: STANDARDS FOR REMUNERATION ACT (WNT)

REMUNERATION OR SEVERANCE PAYMENTS EXCEEDING WNT MAXIMUM PAID TO NON-SENIOR PERSONNEL (2)

The WNT maximums do not apply to personnel in these grades. The Act does however require the publication of the above information.

Amounts in euros	Director	Director	Director	Director	Director	Director	Director
Service in 2015	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12
FTE	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Remuneration

Salary	186,451.07	182,652.58	179,969.36	182,179.79	186,380.99	183,929.22	172,187.42
Taxable expenses allowance	9,659.16	10,796.04	11,482.56	9,334.96	3,916.43	6,046.56	10,019.88
Deferred benefits	10,357.20	10,357.20	10,357.20	10,357.20	10,357.20	10,357.20	10,357.20

Total remuneration	206,467.43	203,805.82	201,809.12	201,871.95	200,654.62	200,332.98	192,564.50
---------------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------

Applicable WNT maximum							
Reason for payment exceeding maximum	a	a	a	a	a	a	a

a. The WNT maximums do not apply to personnel in these grades. The Act does however require the publication of the above information.

PAYMENTS MADE IN 2015 FURTHER TO TERMINATION OF EMPLOYMENT

Total							
Applicable maximum per WNT							
Reasons for excess payment							

REQUIRED INFORMATION 2014

Function	Director	Director	Director	Director	Director	Director	Director
Service in 2014	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12
FTE	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Remuneration

Salary	193,282.94	179,158.24	173,832.85	178,528.90	191,518.58	178,608.56	166,508.64
Taxable expenses allowance	11,418.38	13,196.04	13,882.56	12,655.56	12,549.24	7,962.88	12,419.88
Deferred benefits	15,734.04	15,255.72	14,902.44	15,225.60	15,695.32	15,338.52	14,574.96

Total remuneration	220,435.36	207,610.00	202,617.85	206,410.06	219,763.14	201,909.96	193,503.48
---------------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------

REMUNERATION OR SEVERANCE PAYMENTS EXCEEDING WNT MAXIMUM PAID TO NON-SENIOR PERSONNEL (3)

The WNT maximums do not apply to personnel in these grades. The Act does however require the publication of the above information.

Amounts in euros	Director	Director	Director	Director	Administrative staff
Service in 2015	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 30/6	1/1 - 31/12
FTE	1.0	1.0	1.0	1.0	0.3

Remuneration

Salary	168,291.24	174,886.31	162,957.83	99,542.61	61,244.32
Taxable expenses allowance	7,140.24	4,567.92	7,572.12	1,531.25	9,307.64
Deferred benefits	10,357.20	10,357.20	10,357.20	5,178.60	3,107.16

Total remuneration	185,788.68	189,811.43	180,887.15	106,252.46	73,659.12
---------------------------	-------------------	-------------------	-------------------	-------------------	------------------

Applicable WNT maximum					
Reason for payment exceeding maximum	a	a	a	a	a

a. The WNT maximums do not apply to personnel in these grades. The Act does however require the publication of the above information.

PAYMENTS MADE IN 2015 FURTHER TO TERMINATION OF EMPLOYMENT

Total					
WNT maximum based on previous position					
Reason for exceeding maximum					

REQUIRED INFORMATION 2014

Position	Director	Director	Director	Director	Administrative staff
Service in 2014	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/1 - 31/12	1/12 - 31/12
FTE	1.0		1.0	1.0	0.3

Remuneration

Salary	163,937.69	162,904.98	153,404.43	151,448.40	4,654.71
Taxable expenses allowance	9,540.24	5,839.92	7,572.12	9,992.40	954.20
Deferred benefits	14,099.64	13,849.56	12,995.88	13,522.20	413.88

Total remuneration	187,577.57	182,594.46	173,972.43	174,963.00	6,022.79
---------------------------	-------------------	-------------------	-------------------	-------------------	-----------------

› PARTICIPATING INTERESTS

AT 31 DECEMBER 2015, TNO HELD A DIRECT OR INDIRECT PARTICIPATING INTEREST IN THE FOLLOWING ENTITIES:

Name	Statutory seat/ principal location	%
TNO Bedrijven BV	Delft	100%
– TNO Deelnemingen BV	Delft	99%
– TNO Technostarters BV	Delft	100%
Dutcheer BV (vh TPSS)	Delft	100%
TASS International BV	Delft	100%
– TASS International Software and Services BV	Delft	100%
– TASS International Software BV	Delft	100%
– TASS International Inc	Livonia, USA	100%
– TASS International K.K.	Yokohama, Japan	100%
– TASS International GmbH	Stuttgart, Germany	100%
– TASS International Co. Ltd	Shanghai, China	100%
– TASS International Co. Ltd	Seoul, South Korea	100%
– TASS International Homologations BV	Helmond	100%
– TASS International Powertrain Center BV	Helmond	100%
– TASS International Mobility Center BV	Helmond	100%
– TASS International Safety Center BV	Helmond	100%
TNO Heimolen BV	Bergen op Zoom	100%
TNO International Agencies BV (TIA)	Delft	100%
Den Haag Centrum voor Strategische Studies BV	The Hague	80%
Holland Metrology NV	Delft	100%
– Verispect BV	Delft	100%
– NMI Certin BV	Delft	100%
– NMI Italia SRL	Padua, Italy	85%
– VSL BV (voorheen NMI Van Swinden Lab.)	Delft	100%
– Euroloop BV	Rotterdam	100%
TNO Diana BV	Delft	70%
– TNO Diana NA Inc.	Delaware, USA	100%
DUCARES BV	Zeist	100%
SU Biomedicine BV	Zeist	70%
TNO Triskelion BV	Zeist	100%
ProQares BV	Rijswijk	100%
– Proquares USA Inc.	Washington, USA	100%
CelSian Glass & Solar BV	Eindhoven	100%
Endures BV	Delft	100%
Prime Data BV	Delft	100%
LDI Systems	Delft	70%

› PARTICIPATING INTERESTS

THE FOLLOWING ENTITIES ARE NOT CONSOLIDATED:

Name	Statutory seat/ principal location	%
Automotive Facilities Brainport Holding NV	Helmond	24%
MEST Corp. Inc.	Lake Oswego, USA	6%
Beyond Genomics Medicine Inc.	Waltham, USA	0%
Transport & Mobility Leuven NV	Leuven	50%
Prime Vision BV	Delft	40%
Scapeye BV	Delft	50%
GnTel BV	Groningen	33%
Noord Tech Venture CV	Groningen	3%
Dyadic International, Inc.	Jupiter, USA	0%
NMi UK	Bangor, UK	51%
Noria Fibre Technologies BV	Delft	14%
Innoser Laboratories BV	Leiden	50%
Dariuz BV	Eindhoven	30%
Efectis Holding SAS	Saint-Aubin, France	50%
– Efectis France SAS	Saint-Aubin, France	100%
– Efectis Investment NL BV	Rijswijk	100%
– Efectis Nederland BV	Delft	100%
– Efectis Ibérica S.L.	Madrid, Spain	27%
– Efectis Real Estate Company (EREC) BV	Rijswijk	100%
– Efectis Eurasia	Istanbul, Turkey	100%
– Efectis Era Avrasya	Istanbul, Turkey	66%
SoLayTec BV	Eindhoven	27%
BATAVIA Bioservices BV	Leiden	25%
– BATAVIA Holdings Inc	Dover, USA	100%
– BATAVIA Bioservices Inc	Woburn, USA	100%
Trinomics BV	Rotterdam	25%
YES!Delft BV	Delft	20%
BIODENTIFY BV	Hilversum	44%
Cosanta BV	Amstelveen	46%
Dutch DNA Biotech BV	Zeist	33%
APP Beheer BV	Bergen op Zoom	30%
– Aerospace Propulsion Products BV (APP)	Hoogerheide	100%
– APP Onroerend Goed BV	Klundert	100%

› PARTICIPATING INTERESTS

DIVESTED OR DISCONTINUED IN 2015:

Name	Statutory seat/ principal location	%
Delbia BV	Beverwijk	24%
CBO BV	Apeldoorn	100%
Femsys Ltd.	Leicester, UK	100%
Value2Share BV	Amsterdam	85%
Consumersvoice BV	Groningen	90%
Kestrel Displays Ltd.	Portsmouth, UK	20%
Soliqz BV	Delft	100%
Delft Patents BV (divested 07-10-2015)	Delft	80%
GnTel BV	Groningen	1%
LDI Systems BV	Delft	30%
Biodentify BV	Zeist	51%
GluGreen BV	Helmond	20%
TNO Management Consultants BV (TMC) (Divested 30 September 2015)	Apeldoorn	100%

At year-end, TNO also had branch offices in Singapore, Qatar and Aruba.

Delft, 22 March 2016

**STATEMENT OF THE TNO BOARD OF
MANAGEMENT**

The consolidated and company balance sheet as at 31 December 2015 and the consolidated and company profit and loss account for the year then ended have been derived from the financial statements of TNO for the year 2015.

Our auditors issued an unqualified opinion on these financial statements in their auditor's report, dated March 22, 2016. This auditor's report, as a part of the Dutch Annual Audit, Can be obtained from TNO.

MEMBERS OF THE SUPERVISORY BOARD

Dr C.A. Linse

Chair since 1 March 2011

- Chairman, Supervisory Board of MN Services N.V.
- Supervisory director of AKZO Nobel Nederland B.V.
- Supervisory director of MRC Global Inc. Houston
- Member of the governing board of Technology Foundation STW
- Chairman of Netherlands Commission for Environmental Assessment

I.H.J. Vanden Berghe

Since 1 February 2011

- Administrator General of the National Geographic Institute
- President of Eurogeographics
- Principle Belgian delegate to EuroSDR–OEEPE
- (Founding) Director of EuroSDR
- Member of the Council of Administrators General of the Parastatal Institutions
- Chairman of the Interparastatal Internship Committee
- Visiting professor at the University of Leuven
- Member of the board of the Flemish Institute for Technological Research (VITO)

Prof. J.M. Bensing

Since 1 September 2008

- Honorary Research Fellow, Netherlands Institute for Health Services Research (NIVEL)
- Professor of Health Psychology at Utrecht University
- Member of the Royal Netherlands Academy of Arts and Sciences (KNAW)

Various executive and non-executive appointments including:

- Supervisory director, Dutch Consumer Association
- Supervisory director, Flevoziekenhuis (hospital)
- Supervisory director, Medisch Spectrum Twente
- Supervisory director, De Hoogstraat Revalidation Centre
- Member, NWO Vici assessment committee.

I.G.C. Faber MBA

Since 1 October 2009

- Chief Executive Officer, FHG

Various executive and non-executive appointments, including:

- Supervisory director, Jaarbeurs Conference and Exhibition Centre, Utrecht
- Supervisory director, Rova Zwolle (waste processing)
- Board member, National Register of Supervisory Directors
- Supervisory director, Probos (sustainable forestry)

H.W. Broeders

Since 1 July 2006

Various executive and non-executive appointments, including:

- Non executive director, Forrester Research
- President of the Executive Board, Jaarbeurs Conference and Exhibition Centre, Utrecht
- Supervisory director, Triple-P N.V. (information technology)
- Chairman of the Trustees of the Hilversum Museum Foundation
- President, Netherlands International Chamber of Commerce Nederland
- Trustee, International Liszt Piano Competition Foundation
- Chair, Economic Board Utrecht

J.D. Lamse-Minderhoud RA

Since 1 November 2014

- Director and Assurance Partner, PricewaterhouseCoopers Nederland (PwC), COO with responsibility for Human Capital (No other appointments)

C. van Dijkhuizen

1 November 2009 to 31 October 2014

- Director, ABN AMRO Bank N.V.

Various executive and non-executive appointments, including:

- Supervisory director, Meermanno Museum of Literature and Illustration, The Hague
- President of the National Commission on Export, Import and Investment Guarantees
- President of the Supervisory Board of NVB
- Member of the Capital Markets Committee, Authority Financial Markets
- Governor, Duisenberg School of Finance

Prof. P.P.C.C. Verbeek

Since 1 May 2012

- Professor of Philosophy of Man and Technology, University of Twente
- Chair of the department of Philosophy, University of Twente
- President of the Society for Philosophy and Technology
- Member of the Netherlands Council for the Humanities
- Member of the editorial boards of Tijdschrift voor Filosofie, SATS, the Journal for Northern Philosophy and Philosophy & Technology.

Dr E.I.V. van den Hengel

1 August 2012 to 15 October 2014

- Secretary

J. Hoegee

Since 15 October 2014

- Secretary

MEMBERS OF THE TNO COUNCIL FOR DEFENCE RESEARCH

- Vice Admiral (ret'd) W. (Wim) Nagtegaal, chair
- M. (Marc) Gazenbeek, deputy chair
- H.G. (Henk) Geveke
- Rear Admiral R.P. (Rob) Bauer
- Dr S.J.G. (Sebastian) Reyn
- Dr M.PI. (Maarten) Manders, secretary

› ACKNOWLEDGEMENTS AND CONTACT INFORMATION

› For further information about TNO, or if you have any questions or suggestions further to this report, please contact infodesk@tno.nl.

EDITING AND PRODUCTION:
TNO Marketing & Communications

TEXT:
TNO, Dik Binnendijk, Ruud van der Ros

DESIGN:
C&F Report, Amsterdam

PHOTOS:
NFP Photography, Pieter Magielsen

©TNO, May 2016

› **TNO.NL**



TNO innovation
for life

ANNUAL REPORT 2015