

2006

Annual Report

Fraunhofer Institute for Systems and Innovation Research ISI Annual Report 2006



Internal and external views: the FHG headquarters in Munich

The Fraunhofer-Gesellschaft

The Fraunhofer-Gesellschaft (Fraunhofer Society) undertakes applied research of direct utility to private and public enterprise and of wide benefit to society. Its services are solicited by customers and contractual partners in industry, the service sector and public administration. The organisation also accepts commissions and funding from German federal and Länder ministries and government departments to participate in future-oriented research projects with the aim of finding innovative solutions to issues concerning the industrial economy and society in general.

At present, the Fraunhofer-Gesellschaft maintains some 80 research units, including 56 Fraunhofer Institutes, at over 40 different locations in Germany. The majority of the roughly 12,500 staff are qualified scientists and engineers, who work with an annual research budget of 1.2 billion euros. Of this sum, more than one billion euros are generated through contract research. Roughly two thirds of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. The remaining one third is contributed by the German federal and Länder governments, partly as a means of enabling the institutes to pursue more fundamental research in areas that are likely to become relevant to industry and society in five or ten years' time.

Affiliated research centres and representative offices in Europe, the USA and Asia provide contact with the regions of greatest importance to present and future scientific progress and economic development.

The organisation takes its name from Joseph von Fraunhofer (1787-1826), the illustrious Munich researcher, inventor and entrepreneur.



The Fraunhofer ISI

The Fraunhofer Institute for Systems and Innovation Research ISI in Karlsruhe analyses the scientific, social and political origins and market potentials of innovative technological developments and their impacts on economy, state and society. To this end the institute applies interdisciplinary analytical, evaluation and prognosis methods, such as Delphi surveys, in-depth interviews or techno-economic indicators. The Institute's interdisciplinary research teams focus mainly on emerging technologies, industrial and service innovations, energy policy and renewable energy sources as well as the dynamics of regional markets and innovation policy.

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“The best way to predict
the future is to invent it”

Alan Kay
(Computer Pioneer)

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Preface by the Heads of the Institute



Prof. Dr. Hariolf Grupp
and Dr. Thomas Reiss

Dear readers,

ISI looks back on a very successful and eventful year. A great demand for our research and consulting services, high visibility of and recognition for ISI's research and studies, as well as a more intensive internal and external networking are characteristic for the year 2006.

For the third year in succession we observed a growing demand for our research and consulting services. In 2006, about 140 staff members worked on 240 projects amounting to 9.5 million euros. We also experienced increasing internationalisation: approx. one third of the project volume stems in the meantime from non-domestic clients. As a result of the excellent demand situation, we were unable to meet all requests for our services in one case or another. In these cases we would like to apologise to our partners and clients.

All these research projects cannot be adequately reflected in an annual report. In the following pages we will present some of the highlights from the work of the ISI scientific departments. All projects are summarised in the project list at the end of the report. The contact persons named therein will be happy to provide you with detailed information.

ISI in the innovation offensive

The high recognition and visibility of ISI's work can be demonstrated in individual projects, but also in personal awards. For instance, ISI studies are included in the "Innovation Offensive" launched by the Federal Ministry for the Environment in 2006. Numerous findings of ISI studies are also to be found in the federal government's high-technology strategy. ISI plays a central role in a preparatory project dealing with the revision of the European Commission's biotechnology strategy. ISI studies such as, for example, an investigation on the future of the manufacturing industry, have significantly influenced the planning of the European Commission's 7th Framework Programme.

ISI scientists were appointed to serve in important expert committees of the federal government (Expert Council for Research and Innovation, Innovation Advisory Board of the Federal Ministry for the Environment) or of the European Commission (Sectoral Innovation Panel). Also within the Fraunhofer Society itself, ISI scientists were honoured and were selected to participate in the excellence programme or in the Profx² programme, for example.

Appointment to a famous chair

Excellent ISI staff members are highly regarded, not only at home but also by our national and international cooperation partners. This in itself very pleasant development however can also lead to colleagues switching to partner institutions. In 2006, Stefan Kuhlmann, who together with Hariolf Grupp was acting head of ISI, received a call to the renowned professorship (Chair of Foundations of Science, Technology and Society) of Professor Emeritus Arie Rip at the University of Twente (The Netherlands). We understand this call not only as a high honour for Stefan Kuhlmann's personal scientific excellence, but also as recognition of ISI's work and we are very proud of this. The gap in the ISI

leadership occasioned by his departure was closed by Thomas Reiss, till then Head of the Department New Technologies, who was appointed acting deputy to Hariolf Grupp.

In spring 2006 the Board of the Fraunhofer Society began the process of appointing a successor for Frieder Meyer-Krahmer, the Director of our institute for many years up until 2004 who will remain as State Secretary in the Federal Ministry for Education and Research (BMBF) serving the grand coalition government. The appointment committee has accomplished its task in the meantime. The appointment process was however not finalised at the time of going to press.

The ISI board of trustees has also undergone changes. We welcome Professor Jutta Allmendinger, Edeltraut Glänzer, Krista Sager and Reinhard Wiek as new trustees.

ISI cooperates with the Karlsruhe Institute of Technology

Numerous ISI studies have shown that innovation is a joint process in which networking among the innovating actors forms a central driving force of the innovation process. This insight into the innovation system is also significant for ISI itself. Networking with other actors in the innovation system therefore plays a crucial role for the ability of the institute to master the future. The outstanding event in this context was ISI's participation in the successful application of the University of Karlsruhe and the Research Centre Karlsruhe in the federal government's Initiative of Excellence. ISI will play an essential role in implementing the thematic field "Impact on Society" in the context of establishing the "Karlsruhe Institute of Technology (KIT)".

But ISI's networking within the Fraunhofer Society itself is also proceeding apace. The institute is in charge of founding the FhG research association "Water". For some time now we have cooperated successfully with the FhG research association "Energy", and a comprehensive analysis of potentials was carried out for industrial white biotechnology in collaboration with eight other Fraunhofer institutes.

Research department in Berlin

The joint research department with the Berlin University of Technology announced in the last annual report commenced operations on 1 April 2006. This is linked to a Chair in Innovation Economics, which is held by our colleague and department head Knut Blind. Besides opening up new scientific perspectives, this research department enables ISI to be permanently present in the capital Berlin, the seat of government.

The international networking of ISI has also progressed in the area of policy consulting. Thus ISI (Thomas Reiss) is a member of the Scientific Steering Committee of the European Techno-Economic Policy Support Network (ETEPS network) since January 2007. Equally, ISI participates in a framework contract for research and consulting for the committee Industry, Foreign Trade, Research and Energy (ITRE) of the European Parliament. But the institute is not only intensifying its networking activities with external partners. By means of strategic inter-departmental activities, synergy potentials are being increasingly mobilised among the various work areas in ISI.

Decisive for the very positive development of the institute are the members of staff. With expert competence, great motivation and extraordinary commitment, the scientists and

Preface by the Heads of the Institute

also all other staff members from the areas of project assistance, services and infrastructure have performed outstandingly in this eventful year. For this we offer them grateful thanks.

We would like also to thank our partners and clients from industry and the public sector, at home and abroad. Through your interest in our research and consulting outputs, you have contributed towards making 2006 a successful year for ISI and that the institute's work is ultimately effective.

We hope you will find reading the report stimulating and look forward to further fruitful collaboration in the future.

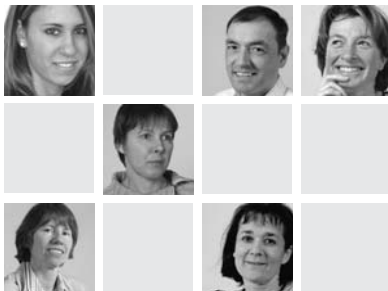
Best regards from Karlsruhe,



Hariolf Grupp



Thomas Reiß



The directors' staff members (from left to right)

Elke Bauer, Bernd Müller, Barbara Breitschopf
Brigitte Mastel,
Monika Silbereis, Ulrike Glutsch

Organisational Chart

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Prof. Dr. Frieder Meyer-Krahmer

Karlsruhe Institute
of Technology (KIT)

Message from the Board of Trustees



Dr. Stephan Bieri,
Chairman of the
Board of Trustees of
the Fraunhofer ISI

The ISI is making good progress: 2006 showed an excellent result, both scientifically and financially. The Board of Trustees is pleased and impressed. Congratulations to all those responsible for this outcome – the Institute's leaders and the scientific researchers with their teams of supportive co-workers without whom this progress would not have been possible. Success is and remains a matter of teamwork.

The dilemma of excellent institutions

It is good farming tradition to think about sowing the next crop at the moment of harvesting and to keep future generations' concerns in mind while doing so. Regrettably, short-term planning is becoming widespread today throughout the economy and politics which does not stop at the stock exchange or the consumer goods sector. Even scientific institutions are having to defend themselves against the application of superficial, short-lived performance indicators.

Excellent universities and research institutes are facing a double-edged dilemma:

- How to assure the quality (scientific approaches, resources, culture or overheads) which achieved success in the past?
- How to further develop a good portfolio and especially how to change a successful one?

I know well-established, high-performance institutions which are reacting quite differently to these questions. Some of them are primarily concerned with tending to what they already have and trying to eliminate weak spots. Others want to anticipate future trends and tend to deliberately relinquish proven elements and push the use of new, riskier subjects and methods. Each of these approaches has its pros and cons and its own specific stumbling blocks. The first tends to be too phlegmatic and faces the danger of collecting weak freeriders; the second tends to over-exaggerate a top-down culture. Of course, if funds are scarce or competition strong, then more adventurous steps like those in the second approach become unavoidable.

The ISI is not affected in this way at present, but there are plenty of national and international factors which could bring about a rapid change in the situation.

Equilibrium issues

The term "crowding-out" has its origins in monetary theory, but can also be used to describe a science policy phenomenon that I continue to come up against in practice. Successful, scientific institutions become so weighed down with external research and service contracts one day that they are hard put to manage their scientific core business really autonomously. Sooner or later their scientific publication activity suffers and the flow of income from funds promoting real research is affected. Often, it can be observed that pre-research is blocked or there are difficulties in attracting new staff, for instance in the form of postgraduates.

The ISI's directors tackled several of these aspects in a presentation to the Board of Trustees and submitted a first careful appraisal of the situation. The question was also addressed of whether the ISI should continue to grow. I do not believe there is any urgent need for action at present based on the ISI's current performance – we may unreservedly celebrate the success of 2006.

There is no doubt that scientific services require efficient organization and effective quality control. On the other hand, it is also necessary to remind ourselves again and again how new knowledge is formed – by which paths and circuitous routes knowledge

gain actually happens. Donald T. Campbell, one of the great Anglo-Saxon organizational scientists and behavioural researchers, described scientific activity in 1981 in this very colourful way:

"... the inevitable wastefulness of scientific exploration, the chancy indirectness of discovery and the further chanciness of recognition".

It is vital for scientific institutions to enhance their profiles both for their own internal orientation and in order to assert themselves externally. Quite a few people, however, fall back on platitudes in doing so, talk about "innovative regions", a "concentration of funds" or of "structures which facilitate transdisciplinarity". These may be true. But my experience is that you cannot answer questions about profiles without inside knowledge of the subjects involved and without independent, bold assessments. In other words: specialist, scientific dynamics cannot be brought about in universities or research institutions without reference to the subject matter. Form follows function and similar metaphors rightly express that structures and processes have to be designed to match the given contents. A fixed commitment to certain topics and statements about the relevance of a certain portfolio are always uncertain and risky. Changed framework conditions as well as new knowledge and technologies can alter the assessment of disciplines, schools of thought and portfolio positions in the short term. 'The What' is always of top priority – the performance catalogue of research, services and science with the respective methods.

Critical mass and main focus

If one looks at the rapid progress made in the fields of nanotechnology, advanced materials and structural biology, questions inevitably arise about critical mass and concentration. Competent industrial and policy consultation is only possible here based upon a shared division of labour with specialized partners, for instance within a Fraunhofer Network.

The portfolio problems of the ISI have been well highlighted by the audit conducted in 2004 and the strategy development pursued since then. Different measures, for example the recently corrected departmental structure or the creation of the joint venture in Berlin, have reweighted its fields of activity. I believe these adjustments to be appropriate. Additional steps are planned, above all ones with an international focus. Other options should be kept open for the future. Portfolio adjustments may force themselves in the wake of staff changes, due to the dynamics on location in Karlsruhe and due to specific priorities of the Fraunhofer group.

Dr. Stephan Bieri

Members of the ISI Board of Trustees

Science

Prof. **Jutta Allmendinger**
Director of the Institute for Labor Market and Employment Research

Dr. **Erik Arnold**
Director Technopolis Ltd., Brighton

Dr. **Stephan Bieri** (chairman)
next consulting group AG, Bern

Prof. Dr. **Michael Fritsch**,
Chair of Business Dynamics, Innovation and Economic Change at the Friedrich-Schiller-University, Jena

Dr. **Wilhelm Krull**
Secretary General of the Volkswagen Foundation, Hannover

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Prof. Dr. **Werner Rothengatter**,
Institute for Economic Policy Research, University of Karlsruhe

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Ministry for Economic Affairs Baden-Württemberg, Stuttgart

Krista Sager
Member of the German Bundestag, parliamentary party Bündnis 90/Die Grünen

Innovation Systems in Flux – Challenges for Innovation Policy



Dr. Thomas Reiss, Deputy
Head of the Fraunhofer ISI

Innovations sometimes do originate in the proverbial Silicon Valley garage, but they do not usually come from individual inventors. Today innovations are much more the result of collaboration among a wide variety of actors. Research facilities, universities, small and medium-sized companies, multinational corporate groups, public and private investors, government authorities, customers and others exchange knowledge, technologies and goods which they modify and recombine to generate innovation. Here the collaboration between innovators and institutions accompanying and supporting innovation plays a central role, as does the integration of the innovation user. Innovation is thus a system process.

In recent years, Fraunhofer ISI has analysed several aspects of innovation systems. Investigations have centred for example on innovation systems in particular sectors (pharmaceuticals, optical technologies, medical technologies, environmental technologies, energy technologies, mechanical engineering), on the regional manifestations of innovation systems or on the influence of regulatory framework conditions and standards on the innovation process. Innovation systems are not static bodies, but rather are subject to constant

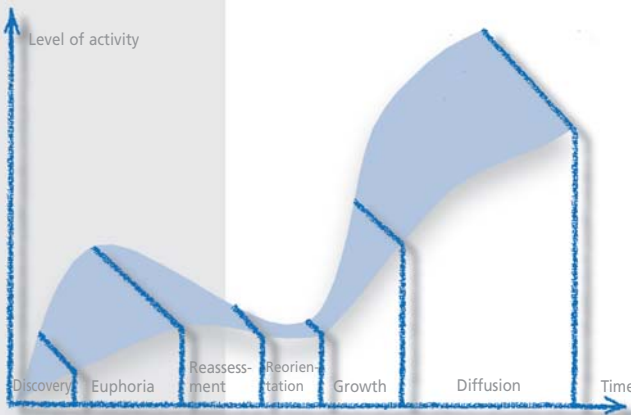
change. The following trends are evident in this context:

An increasing number of innovations arise at the interfaces between areas of science or fields of technology, as can be demonstrated using information on patent applications. Fraunhofer ISI investigations have for example shown that hybrid power train technologies, developed at the interface between classic drive technologies, electrical engineering and energy storage technologies, display a much more substantial dynamic than their corresponding parent disciplines. Another example from the life sciences indicates that this interface effect already appears in the very early phases of the innovation process. At present, systems biology is developing a far larger dynamic at the interface between bio-sciences, information technologies and system sciences than is the case in any one of the respective contributing sectors.

Reciprocal push and pull

An almost classic question in innovation research concerns the role of science/technology push and demand pull in the innovation process. When innovation processes are observed over a long period of time (15 to 25 years), it becomes evident that the influence of both factors changes depending on the innovation stage. Investigations by Fraunhofer ISI have shown that in particular knowledge-intensive and complex innovations follow a so-called double boom pattern, resulting from the interaction of both push and pull factors.

Shortly after the discovery of a new phenomenon, an euphoric phase is often seen in the sciences. A diverse range of application potentials which can be realised rapidly are described as immediately attainable – a typical manifestation of science/technology push. However, the problems involved in realisation are usually greater than expected and the solution contributions of innovative development can not be immediately realised. A reorientation phase follows in which market contingencies play an increased role. This in turn results in a



second dynamic development phase, a second boom, which is driven to a great extent by demand-pull factors and ultimately opens the way to prosperity and employment with the market launch of an innovation.

Virtual companies

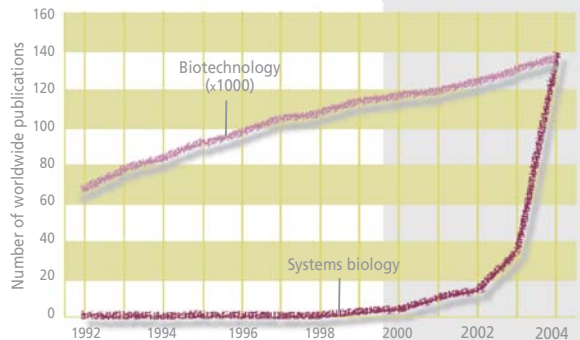
The use of information and communication technologies makes new organisational forms possible for innovation actors. One example here is the so-called virtual company, a new concept in which companies, institutions or individual persons cooperate based on a shared business understanding and acting as a unified company towards third parties. In principle, this strategy allows the participating actors more flexibility. However, especially for small and medium-sized companies, the question arises as to how virtual corporate networks can best be generated and cultivated. Working together with several partners from research and industry, Fraunhofer ISI analyzed success factors for virtual companies. Based on this research, ISI has developed a consulting spectrum particularly focused on small and medium-sized companies.

The meaning of the term innovation is itself subject to constant change. Although it is classically associated primarily with technology-driven innovations, the importance of the role played by non-technical innovations will continue to increase, especially in the knowledge-driven society of the future. Here a distinction can be made between organisational innovations and service innovations. Organisational innovations play a decisive role in understanding the significance of innovations for the competitive strength of companies and national economies. Organisational innovations often establish the initial prerequisites for the development of technological innovations by implementing corresponding organisational changes at the corporate level. In spite of the growing interest in organisational innovations, the knowledge basis remains too small. As part of a European project, Fraunhofer ISI contributed to

filling this gap by developing methods and concepts to analyse organisational innovations in various industry sectors.

In order for Germany to remain a competitive business location, industrial companies will in the future have to concentrate more on offering complete problem solutions, consisting of products and product-related services. Among the most frequently offered product-associated services are consulting, training, maintenance and initial implementation of systems. In this context, Fraunhofer ISI has scientifically monitored a number of industrial partners from various sectors over several years in the development and realisation of innovative product-related services and supported the necessary development process both methodically and content-wise.

Not only is the orientation of production and marketing of goods becoming increasingly international. Research and development are also subject to a growing globalisation process. Here Fraunhofer ISI investigations have shown that the globalisation of industrial R&D need not necessarily be regarded as a location disadvantage. Instead, this globalisation simplifies access to global markets and makes internationally generated knowledge available. Both factors contribute to increasing the competitive strength of industry in Germany. But



not only industrial research and development has an increasingly international dimension; public sector research is also increasingly present in international scientific competition. In this context the Fraunhofer ISI analyses the extent to which the German research landscape is internationally oriented.

Lead markets for innovation

The knowledge and technology basis of a country is not the only essential factor in the success of innovations. The respective market conditions are also of crucial importance. Thus, for example, the success story of mobile communication devices in Europe shows how the demand situation in the Nordic countries generated the decisive competitive advantage for European companies. Scandinavia was the lead market for these technologies: lead markets are regional and national markets in which innovations are introduced and further developed and from which they later go on to international success. Such markets are characterised for example by high per-capita income, high-quality demand, high readiness to innovate, high levels of technology acceptance, good framework conditions for rapid learning processes, bold approval standards, cultural factors (such as the writing systems in Asia which made the introduction of a fax system highly feasible) or an open and innovation-friendly regulatory situation. ISI is currently investigating how the lead market potentials of new technologies can best be quantitatively identified. In this context a set of indicators was developed for the description of lead markets which is currently being tested in a variety of application fields.

The outlined flux in innovation systems presents innovation policies with new challenges:

Innovation is a system process requiring the efficient interaction of widely diverse actors, functions and interests. Innovation policy must therefore be deployed as system policy involving all policy functions

which are relevant for innovation processes, together with their respective dependencies.

Innovation processes are created on a long-term basis and are characterised by a variable mutual interaction between science/technology push and demand pull factors, driven by differing innovation actors. Innovation policy therefore requires patience and must flexibly realise policy designs tailored to the respective needs of the actors.

Cooperation between highly diverse actors is a central element of the innovation process. Creating incentive systems for cooperation is therefore a fundamental priority for modern innovation policy.

Innovation potentials at interfaces between "classic" areas of science and technology must be identified at an early stage. Inadequacies and friction losses in innovation systems as motive for policy intervention should be promptly recognised. Innovation policy requires support from strategic intelligence in order to properly meet these requirements.

Regulatory framework conditions and lead markets are essential drivers for innovation. Innovation policy faces the challenge of engaging these elements as the integral components of an overall concept. Change in innovation systems and the resulting challenges for innovation policy are ultimately reflected in the high-tech strategy for Germany presented by the German federal government in the summer of 2006.

Economic Opportunities of Environmental Innovations

Environmental innovations are system processes in which interactions among the different players from science, industry, the services, administrations and media through to end users and final consumers are assigned a central role. These interactions are played out according to certain rules which are strongly influenced by public policies.

Innovation processes take place at varying levels of complexity. There have been considerable shifts in the focus of environmental protection strategies over time: in the end-of-pipe measures (e. g. filters for large power stations), which held centre stage at the beginning of environmental protection, innovations happen in the immediate environment of the user, but have little effect on the actual production processes involved. In production-integrated environmental protection (e. g. use of more efficient processes in primary industries), there may be more complex process adaptations in the actual manufacturing process involved. If new product concepts are developed within product-based environmental protection concepts, alongside extensive in-house adaptations, the entire value added chain is affected by the innovation, from the supply of the inputs through to the acceptance by the customers and users.

Future of the environmental market

The future of this market is tending towards system innovation in which entire technological systems are being redesigned in the direction of sustainability. Typical examples for this strategy are infrastructures such as sustainable energy systems or sustainable water management distinguished by a greater degree of decentralization. They are not only characterized by a greater significance of renewable energy sources or a much more efficient use of water, but also require far-reaching changes with regard to technological paradigms, the actors involved and the associated forms of organisation.

The four strategies illustrated in the diagram clearly show that environmental concepts and innovation are becoming increasingly interconnected. On the one hand, the complexity of the innovations is increasing: this is signalled by the inclusion of all company functions and value added chains, new actor constellations and the very long time horizon needed for the co-evolution of technological and socio-economic systems. On the other hand, these environmental strategies offer – in addition to the desired positive environmental effects – also manifold economic opportunities:

- The use of new environmentally-friendly technologies can bring about productivity increases which boost competitiveness and the quality of production in the long term.
- New products lead to new markets, rising sales potentials and improved satisfaction of demand through the supply of private and public goods.
- The growing demand for infrastructure expansion and the increasing relevance of global environmental problems result in a considerable international diffusion of these strategies. Those economies which are the first to master these developments and are able to establish lead markets can expect great success in international competition.

Modern environmental strategies thus offer the economic opportunities which are typical for important economic innovations. Indeed, they are even sometimes assigned the character of a future lead industry, similar to the automobile industry today. Be that as it may, there is no doubt that environmental strategies, which so far are predominantly ecological in nature, show a considerable potential to modernize our national economies – strategies for environmental innovations evolve from environmental protection strategies, so that environmental policy is actually innovation policy at the same time.

Policy efforts to promote environmental innovations are necessary in different areas. There are several prominent aspects to environmental innovations: the long-



Reader Dr. Rainer Walz,
Deputy Head of the
Department Sustainability
and Infrastructures

lived investments and the complexity of the innovation processes result in a long lifetime and a high path dependency. This is reinforced by the fact that the technologies are often incorporated into complex infrastructures in energy, water and transport. Overcoming these path dependencies requires specific support from policy. Finally, reference should be made to the special kind of transformation involved in turning social needs into purchasing power. Since the external costs of environmental pollution are not (fully) reflected in the prices, policy has to organize the shaping of demand. Demand-oriented innovation policy and the interactions of regulation and innovation thus become key variables.

ISI's contribution to policy design

The ISI can contribute to meeting these challenges by providing knowledge about strategic policy design and can apply its broad portfolio of methods to do so:

- The ISI can contribute its comprehensive foresight competence to setting up a technology 'radar' for early recognition of environmental innovation potentials.

- The indicators of innovation developed at the ISI and the approaches used to identify pioneering market potentials make it possible to analyse the specific strengths and weaknesses of individual countries in environmental innovations and identify the most promising subsectors for them.

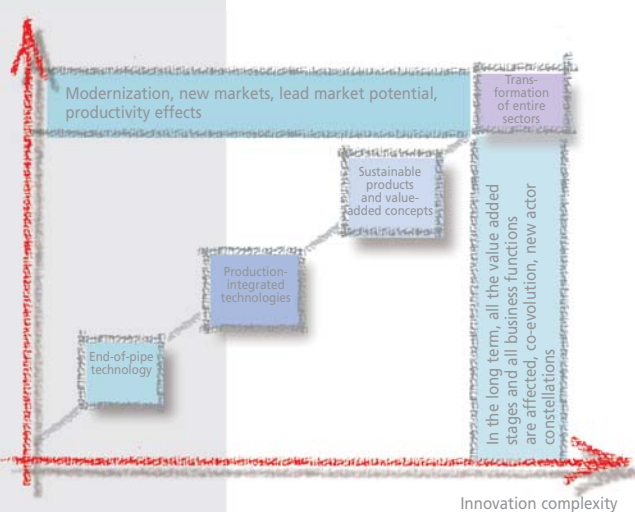
- A long-term and at the same time flexible, customized policy design for the individual environmental innovation processes is required which cannot be developed or implemented without understanding the motives and actions of the players involved set against the background of how the innovation system functions and inter-relates.

- The system models constructed to analyse infrastructures allow resilient, quantitative scenario treatments of the future diffusion processes of innovations.

- The varied, meso- and macroeconomic analysis instruments, which have been greatly developed in the past few years, can be used to evaluate the economic impacts

After almost 35 years of observing and analysing innovation including very early experience in dealing with questions concerning environmental protection and environmental technology, the ISI is well equipped to competently tackle the new challenges arising from the development towards sustainability and ecological compatibility in the future.

Innovation effect



Laboratoire Européen Associé "Knowledge, Science and Innovation"

The Laboratoire Européen Associé (LEA) is an instrument of the French national research organisation, Centre National de la Recherche Scientifique (CNRS), which promotes scientific cooperation with foreign research institutions. No new institutes are created in this context, rather existing institutions should bundle their research activities in a special thematic field in a jointly operated "virtual" platform to develop the chosen topic further.

CNRS approves LEAs for four years, whereby the period can be extended for four years, twice. The cooperation is regulated by an "agreement" between the participating research organisations, in which resources, thematic focuses and the organisational structure are fixed. At present, approximately 50 LEAs exist, in all areas of science. The essential characteristic of CNRS promotional policy is that only the French institutes receive a small sum in basic funding to finance travel, publications and the organisation of workshops, but not the partners abroad. Research projects must be brought along or newly acquired, there is no corresponding financing from CNRS. Despite these framework conditions, the LEAs are an interesting platform for establishing and further developing cross-border research cooperations.

Initiative of the Former ISI Director

In response to the initiative of ISI's former Director, Professor Frieder Meyer-Krahmer, in spring 2004 the CNRS, the University Louis Pasteur, Strasbourg and the Fraunhofer Society signed a cooperation agreement on behalf of their institutes BETA (Bureau d'économie théorique et appliquée) in Strasbourg and ISI in Karlsruhe. This agreement was extended in summer 2006 to include the Max Planck Institute for Economics in Jena. The main goals of the LEA are to conduct joint research in the topic "Knowledge, Science and Innovation". Three fundamental lines of research are being pursued at present:

1. Theoretical and methodological aspects of the knowledge economy

2. Empirical studies of technology diffusion and knowledge generation
3. Regional innovation systems.

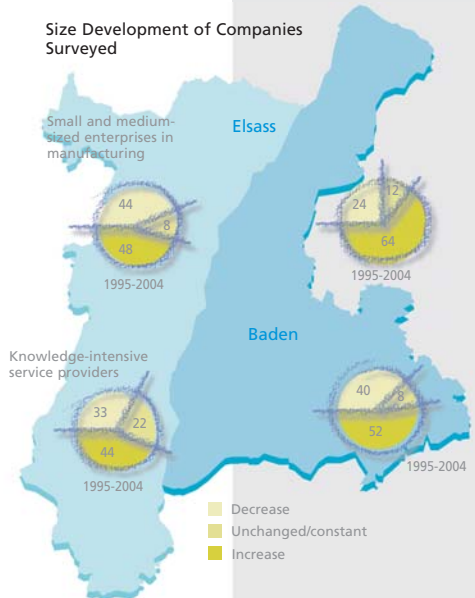
In the first research focus, Fraunhofer ISI is represented in the thematic field "market dynamics" with studies on emission trading, which was provided by the ISI Department of Energy Policy and Energy Systems. Otherwise the emphasis lies in the area of evolutionary economics, above all in theoretical work on knowledge-based enterprise start-ups and in quantitative analyses of the growth paths of companies. The MPI in Jena and BETA Strasbourg collaborate mainly in this theme.

The second focus is on cooperation projects between ISI and BETA. These are the surveys of French enterprises in the framework of the European Manufacturing Innovation Survey conducted by the Department Industrial and Service Innovations, and the research carried out in the integrated EU project HYWAYS by the Department Energy Policy and Energy Systems, which examines questions pertaining to the socio-economic effects of hydrogen technologies.

In the third focus various aspects of regional innovation dynamics take centre stage. Thus BETA and the Department Regions and Market Dynamics are jointly working on questions of the multi-dimensionality of political governance with regard to regional science, technology and innovation policy. This research forms an integral part of a project conducted by BETA, ISI, PREST Manchester and other partners in the framework of the PRIME Network of Excellence. Further studies are being conducted to examine



Prof. Knut Koschatzky,
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Regions and Market
Dynamics



the situation of small and medium-sized enterprises in Baden and Alsace. One crucial result of Andrea Zenker's doctoral dissertation which was written within the LEA framework about enterprises' perception of the spatial environment is that on both banks of the Rhine enterprises today judge the availability of employees and the quality of the research infrastructure more positively than even in the mid 1990s. The innovation climate has however improved to a clearly greater extent in Baden than in Alsace. This can be explained by the fact (among others) that economic policy in Alsace backed the traditional strengths of the region for too long during the last years: large concerns and foreign capital long guaranteed above-average growth rates. There are now other locations which are attractive for enterprises in the enlarged Europe.

Highlight of the year 2006 was a policy workshop organised by BETA, which took place on 24 May in Alsace. Participants were representatives of the three institutes and the University of Strasbourg, above all also representatives of the French and German research ministries and further institutions. The goal was to spark off an exchange of opinions between science and policy-makers, based on scientific lectures, and to discuss topics of mutual interest. On the basis of an empirical study of property rights in public research in France, for instance, the policy approaches and measures in Germany and France were discussed, how to increase the creativity and invention potentials of HEI researchers in both countries, and which framework conditions and incentive systems are necessary so that the inventions can also be commercially exploited. From this starting point, the discussion moved on to transfer models and the question of how the science system and its sub-organisations can be even better integrated in knowledge exchange processes with industry. One insight was that up to now too few transfer activities take place between the single

research organisations and that this constitutes a great reservoir of untapped potential.

With a view to achieving the Lisbon goal, according to which all European Union Member States should spend three per cent of their gross national product on research and development by 2010, considerable efforts are still required of the entire European research system to intensify the mobility within and among research institutions, not only at the national level, but throughout Europe.

Successful workshop

The workshop format, which foresees plenty of time to discuss various topics, was praised by all participants. The event form of policy consulting and political exchange should be anchored as an essential element of the LEA. The workshop ended with Professor Meyer-Krahmer being awarded the Ordre National du Mérite for his many and varied activities to promote German-French cooperation.

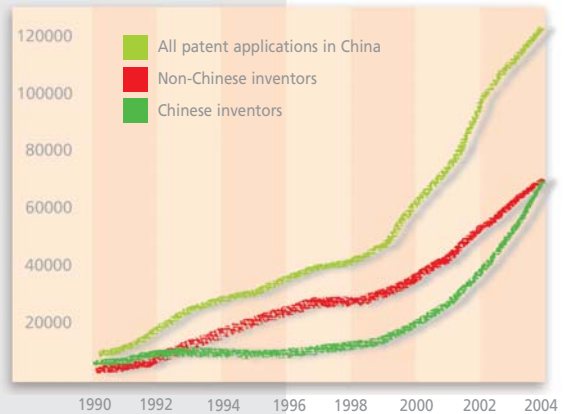
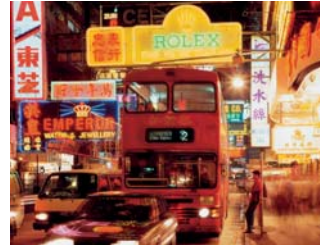
With the inclusion of the Max Planck Institute for Economics, the LEA Knowledge, Science and Innovation forms a bridge, transferring scientific findings between the basic research conducted by BETA and the MPI and the applied research of ISI. The bridge connecting both these worlds should be built, besides the collaboration in joint projects, above all of scientific exchange in the annual workshops, as well as seminars for doctoral candidates or the exchange of scientific personnel.

China's innovation system under the magnifying glass

How efficient is China's innovation system compared to that of other countries? Fraunhofer ISI investigated this question as a member of an OECD research team. The institute paid particular attention to the statistics for patent applications and publications in specialist journals in this context. The project is supported by the Federal Ministry for Education and Research, which is hoping for better cooperation between German and Chinese science and industry as a result. The patent statistics reflect the enormous growth (rate) of Chinese industry, although the main patent applicants such as the universities and academies of science are starting from a relatively low level. In the field which the Chinese call "invention patents" – patents for technically demanding innovations – foreign actors are still the leaders: they apply for 60% of these patents in China. Conversely, China has not yet succeeded in placing patents of technically high quality abroad to a broad extent. Obviously, China is thus not yet able to produce crucial innovations by its own efforts. The situation is quite different for utility and design patents: China's position here has improved. Other industrialised countries, however, see this as the proof that China is pirating ideas on a grand scale, for instance by very slightly adapting well-known patents. The ISI experts cannot confirm this in this form. Copying and imitating others in order to learn is normal for a country intent on catching up. Criticism of the Chinese innovation system stems above all from the Chinese scientists themselves. They complain that an innova-

tion strategy is lacking, respectively that strategy is oriented towards short-term profits. Chinese scientists visiting Fraunhofer ISI have examined the innovation system of the past 30 years and come to the conclusion that the government has recently recognised this lack and is increasingly attempting to implement long-term strategies.

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"National Systems of Innovation" co-edited by Ulrich Schmoch, published in Springer-Verlag



"Die Kopplung von Wissenschaft und Wirtschaft" by Thomas Heinze, published in Campus-Verlag

How scientific creativity prospers

Scientific progress is fuelled by original and path-breaking findings. Fraunhofer ISI, in collaboration with partners in the USA and England, identified twenty highly creative research groups in the fields of nanotechnology and human genetics and investigated their work environments. In contrast to earlier studies, the CREA Study (Creative Capabilities and the Promotion of Highly Innovative Research) does not deal with the creativity of individual scientists, but with the framework conditions which influence the scientific work, for example, organisational structures, external cooperation relationships, funding models and leadership qualities. Some of the results:

- Creative research takes place in small groups, which are embedded in both competitive and collaborative relationships with numerous other groups. In small teams, the relationship between senior and junior scientists is closer. In contrast, large groups often turn

into creativity traps, because the group leader is too involved in management and representational tasks.

- Research teams are creative if their working environment offers opportunities for contact to groups with complementary thematic focus or instrumentation.

The traditional disciplinary diversity and research infrastructure of universities are advantageous in this context. Surprising is the finding that basic research labs in industry are successful in effectively organising scientific diversity.

- Creative groups need scientific freedom. In this they are supported by funding models which are tailored to research, for example, substantial prize monies spread over several years, institutional basic funding or a broad range of third party grants. Firmly cemented faculty structures and exclusively disciplinarily oriented third party funding are barriers to creative research: both can hinder the flow of ideas and prevent the change to new research fields.

Information: www.crea-server.de

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Researchers are mobilising

Research is increasingly internationally interlinked – this observation is empirically backed up by ISI, together with ZEW and Technopolis, in a study commissioned by the BMBF (Federal Ministry for Education and Research). According to the study, the number of cooperations undertaken by German research institutes with institutions abroad has risen considerably – on average, international partners participate in 40% of the projects. German researchers find most of their partners in the EU and the USA. Two thirds of German researchers have experience working abroad; natural scientists go abroad most frequently, engineers and economists least.

ISI examined the reasons for the increasing internationalisation. In the ever faster and more specialised world of science, research projects can hardly be managed alone, without cooperations. The most important personal motive for cooperations with colleagues abroad is the positive significance for one's own scientific career. In order that Germany does not lose out in the competition for research talents in the long term, the science location as a whole must become more attractive, says ISI, improved immigration regulations alone do not suffice.

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Women are not "little men"

Are the special needs of women taken sufficiently into account in developing new technologies, products and services? No, says Fraunhofer ISI. Simple things are often not heeded, for example that women have different body measurements or react differently to noises. Thus women are treated merely as "little men" when cars are designed or dosages of medicine calculated. And this despite the fact that gender differences harbour great innovation and market potentials.

Fraunhofer ISI, together with the headquarters of the Fraunhofer Society, developed 16 key questions in the course of the project "Gender Aspects in Research", with which researchers can detect gender-specific aspects in their products and services. The ISI experts examined some examples themselves, for instance, as far apart as food with health-promoting properties, new technologies in water supply and waste water disposal and even trading in emission rights for climate protection. The ISI experts found differences in every case between the demands of men and women, which makes a differentiated approach in the research and development process appear meaningful.

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On the trail of the need for standardisation

Standards contribute to the competitiveness of German industry in important markets at home and abroad. For this reason, firms participate in the standardisation processes which directly affect their markets. The situation is different for standards in significant new research fields such as nanotechnology, which are now gradually beginning to develop further from basic research into applied research. Enterprises do not yet have a specific vested interest in the standardisation of terminology and measuring and testing aspects in this field, because of its public good character. Even researchers have only a limited individual interest in contributing actively to standardisation activities. These standards can however drive new technology fields forward and thus create a good starting position for one's own industry in the long term exploitation of new markets.

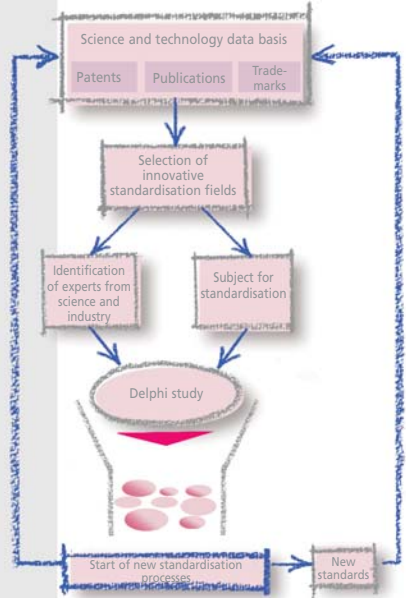
In the project "Identification of Future Standardisation Fields" within the programme "Innovation with Norms and Standards" on behalf of the German Institute for Standardisation (DIN), ISI, together with its office located at the Chair for Innovation Economics at the Berlin University of Technology, examines which research areas will have great need for standardisation in the future. In order to identify new standardisation fields, ISI develops and utilises an combination of methods of technology indicators and Delphi surveys.

The project INTEREST (Integrating Research and Standardisation) in the 6th EU Research Framework Programme had a similar target, which was to identify and break down barriers at the interface between research and standardisation. More than 3000 scientists whose research projects were promoted by the EU in the 5th Framework Programme were questioned in this project.

According to the answers of more than 500 respondents, standardisation activities become more important the closer the scientists are to the market. The standardisation goals also change: basic researchers are more interested in terminology standards which define a new common language for a new research field – such as nanotechnology. In the development of technologies – the field where the Fraunhofer Society is predominantly active – measuring and testing standards are more called for. If a technology has made it to market maturity in the form of products or services, then quality standards finally take effect.

The questionees also expressed their views on obstacles to standardisation. The high costs and the inflexible and protracted processes were named in first place. They also complained that standardisation activities do not reflect on the scientists' reputation. The experts in the INTEREST project therefore recommend that standardisation activities be positively credited when scientists' performance is evaluated. In addition, the study shows that research teams who are actively engaged in standardisation cooperate more frequently with colleagues and have better links to networks.

The INTEREST results were summarised in two manuals which have already aroused great interest. One is intended for research organisations, to provide guidance in developing standardisation strategies, while the second one is devoted to the organisation of standardisation processes in standard-setting organisations. Information: www.isi.tu-berlin.de
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"Strengthening the Integration of Innovation and Standardisation" published in the "Partners for Innovation" initiative

Regions and Market Dynamics



Strategic symbiosis

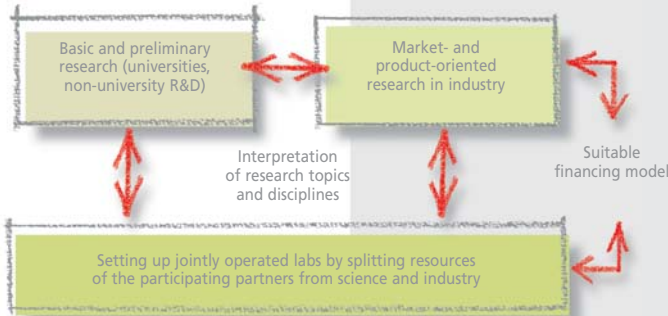
There are approximately 550 so-called "An-Institutes" in Germany – legally independent institutes which are however associated with a university, for example by a cooperation contract or in personal union via a professorship, and which offer application-oriented research, consulting and training for external clients. A comprehensive overview does not exist of how many institutes there actually are, which clients they work for, how the association with the university is structured or what new forms of cooperation develop. Fraunhofer ISI's study on behalf of the Federal Ministry for Education and Research illuminates this darkness. About 280 An-Institutes

and other university-oriented institutions provided information about their legal status, their clients and their economic development in a written survey. Some of these institutes were further questioned in interviews, in some cases also the cooperating companies.

The ISI study shows that the once so immutable pillars of the German science system are increasingly breaking up. Besides the An-Institutes, new strategic partnerships have recently evolved between universities and industry. The borders between the ivory tower and industry are becoming more open, which is advantageous for both sides. Industry has access to the latest scientific findings and highly qualified academics, without long-term commitment, the An-Institutes and their universities receive additional financing and more market proximity.

An example of a successful new cooperation is the T-Lab at the Technical University (TU) Berlin. Four professors will work on projects for the Deutsche Telekom AG, which finances the lab, but can also utilise part of their time for free research. The study falls on fertile soil in the BMBF, because the Ministry aims to strengthen strategic cooperations between research and industry. ISI identified good practices which should contribute to the development of fruitful public-private partnerships for both sides. The call for new strategic partnerships between science and industry is also found in the federal government's high-tech strategy.

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More spirit of entrepreneurship in universities

How to think and act like an entrepreneur – the requisite know-how is being taught with increasing frequency in the course of an academic education. EXIST, a federal government programme which since its launch in 1998 has been promoting spin-offs from universities, initially in five regions and subsequently in a further ten, contributed greatly towards the new spirit of entrepreneurship. Fraunhofer ISI which evaluated the impact of EXIST for the 1998 – 2005 period, now draws a predominantly positive balance. One strength of EXIST is that, unlike other programmes, it does not principally support individual enterprises, but starts much earlier, with the potential business founders. Scientific staff and university graduates often do not possess the know-how and motivation to risk the first step towards entrepreneurship. EXIST has accomplished much in this regard: "entrepre-

Research promotion in eastern Germany

The Federal Ministry of Economics and Technology spends around 90 million euros annually on the promotional programme INNO-WATT to support research and development in small and medium-sized firms in the new federal states. Fraunhofer ISI's evaluation gives the programme a good report card. It promotes the innovation capability and eases financial bottlenecks. The rapid processing of applications and the continuous monitoring of success by the project executing organisation Euronorm is praised. However, the economic effects of the promoted projects often do not fulfil expectations and there are potentials for improvement. The firms frequently lack the money to transfer good results from research and development to a broader market commercialisation. ISI therefore proposed some alterations to INNO-WATT, which have meanwhile been implemented. For instance, when applications are screened, attention should be paid to better commercialisation concepts in future. The minimum rate of R&D intensity has been significantly lowered, with this end in view. There is no longer a minimum age requirement for firms, i.e. start-ups will also qualify for promotional support. In addition, the Ministry has included a promotional component in the programme, which supports the so-called non-profit-making external research institutions, so that they can fund necessary initial research and increase innovation capability. Contact: Prof. Knut Koschatzky (-184, knut.koschatzky@isi.fraunhofer.de)

neurship" is now integrated in many courses of study. Start-up management is taught, there are management simulations, business plan competitions, and the students can hone their "soft skills", such as the ability to communicate or leadership skills. The attitude towards self-employment as a professional option was greatly improved. Fraunhofer ISI's scientific monitoring also brought definite potential for improvement to light: for instance, awareness of entrepreneurship is not yet satisfactory in the technical and natural science disciplines – among students and staff members equally. In addition, founders (both male and female) must be more effectively sensitised to implement the research results gained at the university or non-university research institution into growth-oriented business models. The new orientation of the EXIST III programme aims to build on and further develop what has already been achieved.

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Innovative regions for Europe

In 2010, Europe should be the worldwide leading area for innovations and technology development – so the ambitious goal of the European Commission. This goal is only within reach if innovative regions in the individual countries press forward with knowledge and technology development. Whereas the EU Commission already has a comprehensive reporting system in place recording the efforts of the Member States to spend three per cent of their gross national product (GNP) on research, such a reporting system is missing so far for the European regions. Together with Technopolis in Brussels, ISI's task is to gather information on the innovative strengths of all European regions and place them at the EU Commission's disposal in a database. The database is the foundation for comprehensive analyses of the structure and development of regional distribution of educational levels, qualifications characteristics, research and development and scientific excellence in the regions of the European Union. These results document the advances made in the creation of a European Research Area and are presented to a broad public in the "Regional Key Figures". Contact: Prof. Knut Koschatzky, Dr. Thomas Stahlecker (-173, thomas.stahlecker@isi.fraunhofer.de)



Department publications appearing in the ISI series "Innovation Potentials" by Fraunhofer-IRB-Verlag

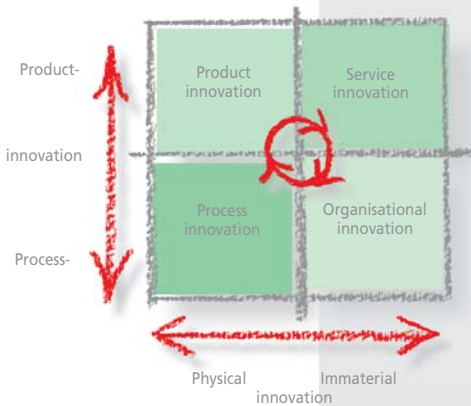


Industrial and Service Innovations



Innovation benchmarking for small and medium-sized companies

Small and medium-sized companies find it difficult to systematically evaluate their ability to innovate and to optimise innovation processes in a focused manner. Nevertheless, this is an important prerequisite for long-term market success. The German Federal Ministry of Education and Research has recognised this requirement and has commissioned the development of an integrated evaluation instrument to help small and medium-sized companies better understand their ability to innovate and to improve this ability when possible. A comprehensive evaluation of the innovative ability includes not only tangibly measurable innovation indicators in various operative innovation fields, but also



management-related success factors providing information on the deployment of innovation processes within the company. This broad approach of the InnoKMU project is also reflected by the range of participating partners: In addition to the research partners Fraunhofer IAO and Fraunhofer ISI, the project consortium also includes several highly innovative companies, the industry associations VDMA and ZVEI, the IKB Deutsche Industriebank, the German standardisation institute Deutsche Institut für Normung (DIN) as well as Prof. Dr. Schneck Rating GmbH. The project is supported by the German Federal Ministry of Education and Research and is supervised by the research centre Forschungszentrum Karlsruhe.

The result of the project is an online benchmarking instrument with which companies can evaluate their own innovation ability in comparison with other similar companies. The companies receive the evaluation results as an analysis report in the form of a PDF file containing detailed benchmarking results on the requested innovation indicators and success factors for innovation processes.

However, the evaluation goes even further: If deficiencies become apparent, recommendations for action to eliminate these deficiencies are given. Selected best practice examples from innovative companies complement the analysis. The written evaluation can also be used together with a self-assessment for communication with customers or banks. The self-evaluation instrument is available in the Internet at: www.innoscore.de and www.innokmu.de
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There's no place like home

When automobile component suppliers shift parts of their production abroad, it can be for one of two reasons: Either the automobile manufacturers are pressuring the supplier to follow their own production abroad, or the component suppliers themselves are hoping for tangible cost savings. The second strategy is risky, as the Fraunhofer ISI demonstrated in its study "Innovation in Production" and in 12 case studies at automobile component suppliers. The lower wage cost share in foreign countries often enables savings of no more than 15 percent of total expenses, while expectations for greater savings do not take frequently underestimated start-up difficulties and support costs into account. On the other hand, systematic optimisation of production systems makes it possible to save up to 30 percent of production costs by remaining at the domestic location – especially when production and process innovation continue to boost one another. On behalf of the Hans Boeckler Foundation, the ISI is currently developing a software product which lets companies identify and soundly assess the real poten-

tials and costs associated with various location alternatives. The tool is expected to be available from the Institute in spring 2007.

In the IMPROVE project the ISI is also developing tangible aids aimed especially at small and medium-sized companies on behalf of the German Federal Ministry of Education and Research. Small and medium-sized companies often have to face that various elements of their evolved production systems often do not fit well together. Thus for example quality may suffer for the sake of faster throughput times, or continuing education measures for teamwork may not work as desired because the compensation system is solely oriented towards short-term productivity. The objective here is to identify such tensions between various measures and to develop paths towards integrated modernisation concepts. The method set, planned for completion at the beginning of 2008, contains among other things a cockpit based on a balanced scorecard linking the various dimensions and showing how they influence one another and how they can be optimised for the benefit of the company.

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"Globale Produktionsstrategien in der Automobilzulieferindustrie", published by Springer-Verlag, Heidelberg

New business models for practical use

In the EU project NEXT, partners from science and industry are developing the machine tools of the future. New business models play an important role. Machine tool manufacturers are taking on an increasing amount of value-added activities from their customers and are not only selling, but also operating their own machines, frequently under pressure from customers suffering under highly vacillating demand. Instead of selling machines which the customer can not fully utilise, the manufacturer can operate his own machine himself, charging only for batch lots, or can provide mobile systems to cover peak periods.

There are numerous variations on this type of new business model. The ISI is therefore working in several projects towards creating decision-making tools for manufacturers using various initial scenarios (robots, export markets) – the objective is creation of specific checklists – to make it possible to better evaluate relating requirements and to be able to combine different options in a reasonable way. The institute is also developing ideas for the practical realisation of such new business models, for example through the development of models for the calculation of lifecycle costs.

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Drive for the future

Where are the technical challenges in drive technologies? The Fraunhofer ISI addressed this question on behalf of the Research Association for Power Transmission Engineering (FVA). In the future, the FVA intends to orient itself towards project results when assigning research projects. The ISI has drafted roadmaps for this purpose covering four technology areas: Electric drives and mechatronic systems, manufacturing technologies and materials, tribology and nanotechnology, and simulation and calculation.

In expert workshops the ISI identified future-oriented topics which were then evaluated by 485 experts in an online survey according to importance and time perspectives. Results show that both aspects must be linked, since greater emphasis on importance tends to favour short-term topics and strategic research topics are thus neglected. The concluding integrity workshops synchronised the qualitative results from the workshop with the quantitative results from the survey.

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Emerging Technologies



Biotech on the move

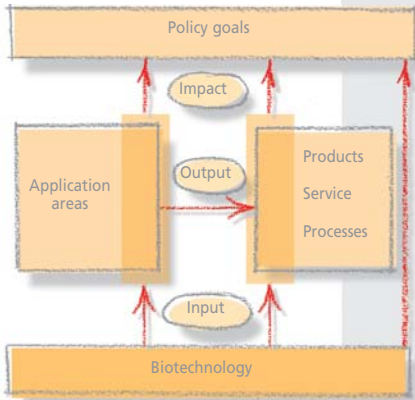
What are the benefits of biotechnology for the economy, society and environment, and what are the challenges of the future? In 2004 the EU Parliament posed this question to the EU Commission. The Commission is thus currently conducting the most comprehensive study on biotechnology the world has ever seen. The study is the responsibility of the European Commission's Joint Research Centre (JRC), the Institute for Prospective Technological Studies (IPTS) in Seville, with the Fraunhofer ISI coordinating the eight project partners of the ETEPS network. The "Biotechnology for Europe (Bio4EU)" study will be completed in spring 2007. In a first step the ETEPS team, under the leadership of the

ISI, generated an overview of biotechnological products and processes and formulated indicators for measuring the impact of biotechnology on the technical and economic processes in various industry and service sectors as well as on environment and society. In the second step the project partners assembled available data on the worldwide use of biotechnology in medicine, agriculture/foodstuffs processing and industry,

beginning with the research landscape and ranging as far as revenue and job market statistics.

For that purpose, statistics and reports were evaluated, interviews were held with stakeholders and written surveys were conducted in selected industry sectors such as seed production and animal husbandry. There were also 29 case studies on typical applications such as the biotechnological production of human insulin as compared to traditional insulin from animals. Several trends have become evident even before the final evaluation. The original hypothesis according to which large amounts are invested in biotechnology with a relatively muted impact on business is no longer tenable. An example from agriculture: Discussions about genetic engineering of agricultural crops are always heated, even though there are many other biotechnological methods without which modern agriculture and animal husbandry would be unthinkable today. Biotechnology applications in the area of health care continue to be dominated by the USA, although advantages for Europe are emerging in certain subsegments, such as vaccines. In general, biotechnology has gained considerable influence in a number of application areas over the last ten years. Many new products and procedures have overtaken the market. Here some applications such as the new breeding methods mentioned are hardly visible to the general public, while others, e.g. enzymes in detergents or "bio-stone-washed" jeans have become integral components in everyday products. Contact: Dr. Thomas Reiss

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A controversial look at the brain

Modern diagnostic procedures such as computer tomography or magnetoencephalography provide fascinating images of how we speak, think and feel. On behalf of the Centre for Technology Assessment at the Swiss Science and Technology Council, the ISI has evaluated the risks and benefits of such procedures for the first time. According to results, brain images offer great potential in connection with the diagnosis of illness and in investigating the fundamental processes of the brain. The significance of brain images is however greatly overestimated in some cases. For example, these instruments are used in market research to measure the reaction to advertising messages, and neuropsychological panaceas promise to turn learning into child's play. Allegedly objective neuro-imaging is said to be clearly superior to cognitive psychology, a claim which is not supported by present research. In this context, concerns that imaging processes might make it possible to read minds or invade personalities remain unfounded.

In order to properly exploit the potentials of this technology, the study recommends among other things better access for scientists to devices typically costing many millions, compliance with strict quality standards in measurements made on patients and test subjects and in the interpretation of the corresponding results. Contact: Dr. Bärbel Hüsing, (-210, baerbel.huesing@isi.fraunhofer.de)

Biotech brings employment potentials

Biotechnology offers enormous potentials, including the possibility of creating and preserving jobs. The magnitude of the employment effects has up to now only been investigated for small biotechnology companies and their equipment manufacturers. In particular in the downstream application industries and the upstream supplier sectors there has been as yet no complete study of employments figures. The Fraunhofer ISI has eliminated this research gap, investigating the employment outlook until the year 2020 using the input-output model ISIS, which the Institute developed itself.

The model indicates that the direct effects on employment will increase in the downstream application sectors (pharmaceuticals, chemical and foodstuffs industry as well as agriculture and environmental biotechnology) by 2020 to approximately 272,000 in

case of slow biotechnology market penetration and to 483,000 in case of rapid diffusion. Furthermore the ISI experts came to the conclusion that biotechnology employment potentials will be greater in upstream supplier industries than in direct application in 2004 just as in 2020.

The ISI also evaluated Germany as a corporate location for biotechnology. It found strengths in highly qualified personnel, a highly differentiated research environment, the competitive industrial basis as well as the large domestic market and good access to export markets. But there are also risks here: Personnel bottlenecks may occur in the future, and German industry and government sectors invest too little in future-oriented education, research and development. Contact: Dr. Michael Nusser (-336, michael.nusser@isi.fraunhofer.de)

Erosion of privacy

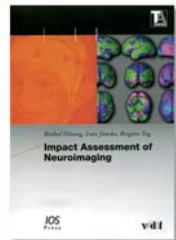
Ambient intelligence is the next revolution in the area of computer technology. But ambient intelligence will only be able to survive if the apprehensions of the users are properly addressed, in particular concerning data protection. On behalf of the European Commission, the ISI has joined four international institutes to investigate safeguards in a world with ambient intelligence.

In order to identify the social, economic, legal and technical hurdles, the Institute evaluated existing projects and studies. The researchers developed so-called "dark scenarios" intended to realistically portray the dangers and risks that are to be expected in connection with everyday use of ambient intelligence. For example, the what-if scenarios evaluated the consequences of hacker attacks on traffic control systems and the possible impact of theft of customer data from a company. In addition to technical risks, in all scenarios data protection played a decisive role in the success or failure of ambient intelligence. Networking invisible and ever-present computers makes it easier to collect data and then link it to personal profiles, which could lead to the erosion of personal privacy. The project partners have formulated corresponding recommendations for action for politics, science and business. The ISI recommends politics to refrain from regulating the young market for the time being, instead only taking action with new legislation once the need actually arises.

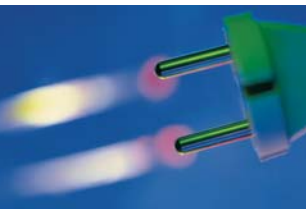
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"Assessment of the European Community System of Pharmacovigilance", a publication of the ISI Series "Innovationspotenziale"



"Impact Assessment of Neuroimaging", published by IOS Press, Amsterdam

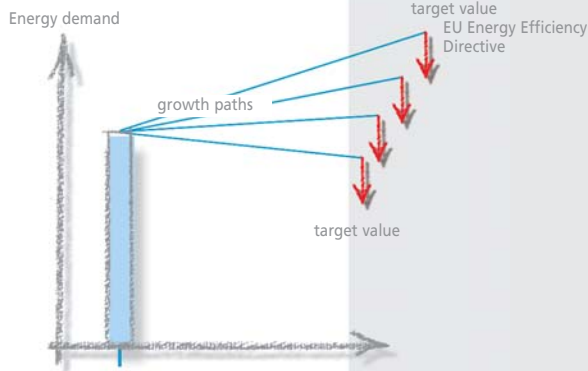


EU wants to reduce energy consumption

The European Union wants to lower its final energy consumption by nine per cent between 2008 and 2016. Around 80 per cent of final energy users will be affected by the Directive "Energy End-Use Efficiency and Energy Services" which was passed in May 2006. Only the operators of power stations or large industrial installations which are already subject to the Emissions Trading Scheme are not covered by this. All the EU Member States have to submit National Energy Efficiency Action Plans by June 2007 which describe the measures the country intends to implement in order to meet its target. Two other plans are to follow which then assess what has actually been achieved. The Fraunhofer ISI has advised the EU Commission's Directorate

General for Energy and Transport on the design of the Directive and is also represented in the expert committee "Monitoring and Verification" which is concerned with the issue of how to measure and evaluate savings. Among other things, it is being considered how to evaluate the lifetime of saving measures. Building insulation, for instance, could make a positive difference in the savings balance for 25 years. It must also be clarified how so-called free rider effects can be excluded, i. e. energy saving which would have taken place even without the effects of the EU Directive. Furthermore, it is planned to reward saving measures undertaken prior to 2008. In Germany's case this means that 40 per cent of the reduction target would already have been achieved before 2008 due to the effects of such "early actions". The EU Energy End-Use Efficiency Directive is not binding, but will probably still exert a strong moral pressure on governments similar to the Directive of the EU on renewable energies. This is certainly necessary since calculations of the ISI have shown that the efforts made to save energy will have to be doubled compared to those made in the 90s if the Directive's targets are to be met.

The Fraunhofer ISI will continue to work on the Energy End-Use Efficiency Directive for the next few years. At present, the Institute is compiling the Energy Efficiency Action Plan for Luxembourg. In a new project for the EU Commission, the ISI is also developing models to independently assess the national action plans of all the EU countries. The ISI has already completed a study on the Efficiency Directive for the German Federal Ministry of Economics. Contact: Dr. Wolfgang Eichhammer (-158, wolfgang.eichhammer@isi.fraunhofer.de).



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Harald Bradke, Clemens Cremer, Joachim Schleich, Philipp Seydel, Barbara Schломann, Mario Ragwitz
Anne Held, Wolfgang Eichhammer, Martin Wietschel, Bärbel Katz

More drive with less energy

70 per cent of the electricity consumed by industry is used in pumps, compressed air, cooling, fans and other electric motor applications. The annual consumption of 160 TWh in Germany alone could be reduced by 20 to 30 per cent by the application of economic measures. The ISI has been tackling the issue of how energy efficiency can be increased in electric motor systems for more than ten years. Recently, the ISI has concentrated on the analysis of innovation obstacles, designing measures to overcome these and putting them into practice in projects conducted with various partners. For example, in the campaign "Druckluft effizient" (Efficient compressed air), companies were provided with information, training and supported in tapping saving potentials. This successful concept has since been transferred to Switzerland and forms part of the SwissEnergy Programme there.

At EU level, the Institute is the national contact point of the Motor Challenge Programme of the EU Commission, in which 20 countries are promoting the implementation of efficiency measures in electric motor driven systems. The EU is also intending to set minimum energy and environmental efficiency requirements for energy-using products via implementing measures in the EuP Directive which will also affect electric motors and electric motor driven systems. The ISI is supporting the Commission by defining the appropriate values for fans. To do so, ISI experts are evaluating trade statistics and material use and analysing the effect of legal regulations.

The Institute also has a representative on the Programme Committee of the 5th International Conference on Energy Efficiency in Motor Driven Systems due to be held in Peking in June 2007 at which the ISI will present the results of the motor system work it has carried out.

Contact: Dr. Peter Radgen

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Detailed forecasts of the electricity market

Almost all the large energy supply companies in Europe are now clients of the Fraunhofer ISI. The energy supply companies are particularly interested in demand forecasts for electricity, heat and gas, not only in their home markets, but also in the EU as a whole as well as in Eastern Europe. In several eastern European countries, the electricity demand is likely to double or even triple according to the ISI's models.

The Institute has also developed its own, very reliable analysis instruments to predict the prices for CO₂ emission allowances. In this way, the ISI was able to recognize very early on that too many allowances had been allotted to industry throughout Europe in the first commitment period 2005 to 2006 and that this would lead to a dramatic drop in prices. Thanks to this prediction, energy suppliers were able to optimize their trading with emission allowances and sell surplus allowances in time. In 2007, the ISI is also working on similar follow-up projects concerning emissions trading.

Contact: Reader Dr. Martin Wietschel

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Innovations for efficient energy use

An energy supply which is secure, economic and environmentally compatible is a basic prerequisite for every modern national economy. The challenges which energy supply and use will face in the future stem from the continuous growth in energy demand world-wide, the increasing concentration of the remaining oil and gas reserves in only a few countries and the rising CO₂ concentration in the atmosphere. To tackle these challenges, outstanding innovativeness is necessary to considerably accelerate the more efficient conversion and use of energy and the consistent development of technologies using renewable energies. This innovativeness is required in both a wide range of technologies and in the form of entrepreneurial and social changes.

The Department is applying different instruments and methods from innovation research to support innovations in practice:

- Literature and patent evaluations identify new technologies; simulation calculations examine their energy-economic significance.
- The most efficient support strategies are determined by studying which innovation phase a technology is in and analysing the respective actor arenas; suitable strategies for market introduction are determined using roadmaps and scenarios.
- Initiating and accompanying actor networks increase the chances of implementation and the accompanying evaluation observes the success of the implementation measures and allows controlled intervention. Through the networking with sister institutes, practical applications can also be offered to industrial customers under one umbrella.

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"Endogenous Technological Change and CO₂-Emissions" by Joachim Schleich (published in the ISI book series on innovation potentials)



"Die Energie der Zukunft (Energy of the Future)" by Harald Bradke – final report of the German government "Partners for Innovation" initiative

Incentives for environmental protection in emerging markets

Environmental protection has a global dimension today, and that not just since the public have become aware of the issue of climate change. Nevertheless, it still remains up to the individual nations to put environmental protection measures into practice. Especially emerging markets experiencing strong economic growth such as China or India may find it difficult to do this. The incentives for these

countries to implement sustainability strategies might be not strong enough, or they do not possess the necessary technologies. In order to support political initiatives led by the BMBF to foster the exchange of sustainability strategies between the BRICS + G countries (Brazil, Russia, India, China, South Africa and Germany), the German Council for Sustainable Development has commissioned the Fraunhofer ISI to examine the technological starting points.

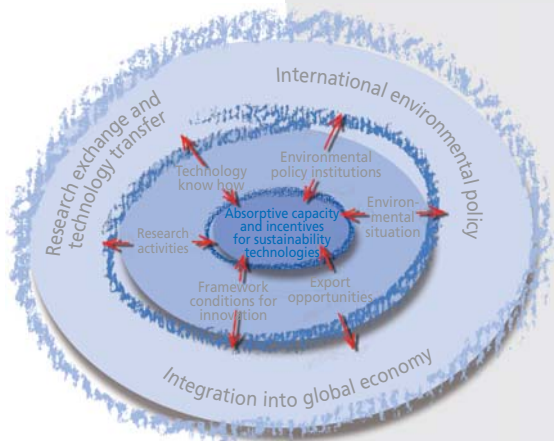
For these strategies to take effect, it is necessary to know the technological competences of the environmental technologies in the respective countries. The Council has defined 5 subject areas in which the ISI is to evaluate the technological competences using patents, foreign trade figures, research results and other indicators and to compare these with the figures for Germany. In addition to this, the ISI is conducting interviews with relevant stakeholders and companies.

The five subject areas are:

- renewable energies and CO₂ free fossil energy sources,
- buildings and building efficiency,
- water supply and wastewater disposal systems,
- material efficiency and
- mobility and logistics.

The study will be completed in May 2007. Initial results show that several of the countries studied have already made some progress on the sustainability front. The results and recommendations of the ISI will be incorporated into the political discourse which is due to begin in autumn 2007.

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- Harald Hiessl, Melanie Jünemann, Katrin Ostertag, Gerhard Angerer, Christian Sartorius, Karoline Rogge, Dominik Toussaint, Nele Glienke, Rainer Walz, Claudia Hertweck-Maurer, Claus Doll, Frank Marscheider-Weidemann, Wolfgang Schade, Nicki Helfrich, Christiane Klobasa, Sonja Mohr, Thomas Hillenbrand

The value of transport

A well functioning transport sector with reasonable transport costs forms the backbone of every industrial nation. In the COMPETE project for the EU Commission, the Fraunhofer ISI together with other partners compared the infrastructures in the EU with those in the US. One result is that pure kilometre costs do not say anything about the transport sector's performance. For example, a train ton-kilometre in the EU costs 11 Cent but only 1 Cent in the US. On the other hand, HGV-carriers in Europe pay only 14 cent per ton-kilometre, but their American colleagues 20 cent. The total costs depend on the distances involved which are greater in the US. Therefore the share of transport expenditures on the GDP in the US amounts to 24 per cent and to 19 per cent in the EU. Both economic powers have recognized the importance of the transport sector and are trying to use it to promote innovations and growth. The ISI study comes to the conclusion that the EU is currently more successful here due to its more balanced transport mix. On top of this, transport productivity in Europe grew strongly in the 90s.
Contact: Dr. Wolfgang Schade
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Gap in raw material research

Raw materials account for 40 per cent of the production costs of industry. If supply problems were to occur, industry would bear a high cost risk. This makes it all the more astonishing that the availability, economic efficiency and utilisation efficiency have only been closely studied for those raw materials used to generate energy such as coal, oil or gas. There are hardly any reliable data on metallic or mineral resources. This knowledge gap is now being narrowed by the Fraunhofer ISI together with the RWI in Essen in a study for the Federal Ministry of Economics and Technology. The institutes are examining essential metals and industrial minerals including copper, tantalum, palladium, platinum and fluorspan.
To do so, Fraunhofer ISI is employing a new research approach analogous to the familiar energy demand forecasts which, for the first time, evaluates the specific demand for raw materials and decouples this from speculative economic growth. The results turned out to vary widely: While current technology trends, mainly in electronics, are pushing the demand for tantalum, the effects which increase and decrease the demand for copper are more or less balanced. There will probably be a clear drop in the demand for fluorspan. If German industry were to exploit all the available efficiency potentials, it could save 120 billion Euro each

year, equivalent to 20 per cent of the costs of the raw materials. In acknowledgment of this, Germany is now increasingly focusing on recycling, lightweight construction, nanotechnology, miniaturisation and new production processes. 56 per cent of the copper consumed in Germany is already produced from copper scrap; globally, this figure is only 13 per cent. Despite this, raw material research should be improved because its results help to improve the sustainability of resource use and open up effective economisation potentials to industry.
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Sewage treatment plants for the backyard

Since it would have been too costly to connect the 25 houses of the Dahler Feld, a small residential area outside the core settlement of the city of Selm, to the municipal sewer system, on-site septic tanks are used for wastewater treatment. The existing septic tanks no longer meet the regulatory requirements and need to be replaced. Usually, each household would opt for lowest price standard micro treatment plant which fulfils the present regulatory requirements. Innovative high performance micro treatment plants would be passed due to their higher cost.

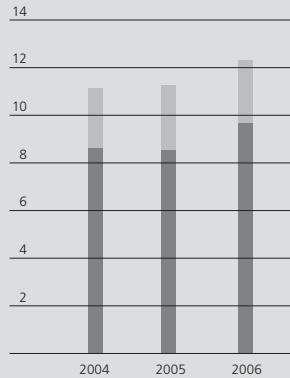
With the financial support of the WestLB Foundation, the ISI together with project partners developed and assessed various technical and organisational options for a sustainable wastewater management concept. The winning concept applies most advanced membrane bio-reactor (MBR) micro treatment plants. Substantial cost reductions as compared to individual procurement of the households were realized by introducing a contracting scheme. The Lippe-Verband (LV), responsible for the wastewater management in the region, stepped with a contractor business model. Based on 10 years service contracts with the homeowners the LV purchased, installed and operates the treatment plants. The homeowners just pay a monthly service fee. The system has been operational since 2006. Within an ongoing 2 years monitoring and evaluation phase, the project is evaluated in terms of technical and economic performance as well as in terms of customer satisfaction. So far, the technical performance of system is very good and the customers are highly satisfied. This business model supports the practical application of innovative and high performance MBR-technology and contributes to cost reduction of this technology. The contracting concept is suitable for decentralized wastewater in industrialized countries as well as in developing countries.
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"Handelbare Flächenverweiskontingente zur Begrenzung des Flächenverbrauchs" (ISI book series on innovation potentials)

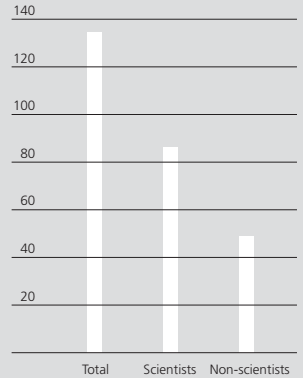
Fraunhofer ISI in Figures

Development of Turnover 2004-2006 (in Mio. Euro)



■ Basic funding
■ Earnings

Number of Staff 2006



Clients

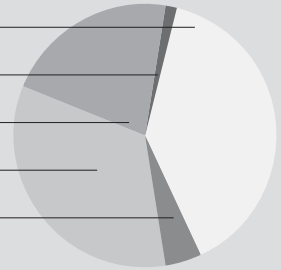
Public sector (national) 37.1%

Public sector (international) 1.1%

Industry 20.4%

EU 31.5%

Research promotion (DFG etc.) 4.3%



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Not in photograph: Viola Schielenski

Academic Teaching

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Energiewirtschaftliche Aspekte der Energietechnik, Fachbereich Elektrotechnik
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Cremer, Clemens

Carbon Capture and Storage
ETH Zürich

Grupp, Hariolf

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Doktoranden- und Diplomandenseminar
Seminar Innovationssysteme
Vorlesung mit STATA-Übungen im CIP-Rechner-Pool „Anwendungen der Industrieökonomik“
Seminar Innovationspolitik
alle: Wirtschaftswissenschaftliche Fakultät der Universität Karlsruhe

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Jochem, Eberhard

Energiewirtschaftliches Kolloquium
Economics of Technology Diffusion – Applied to New Energy Technologies
Energiewirtschaft
Energiewirtschaftliches Doktoranden-Seminar
Energiewirtschaftliches Kolloquium
Material Efficiency
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Seminar „Einführung in die Kommunikationswissenschaft“
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„Neue Märkte durch den Einsatz von IT? Die Auswirkungen von IT-Innovationen auf unterschiedliche Sektoren“
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Seminar „Nationale und regionale Innovationssysteme im internationalen Vergleich: Strukturen, Herausforderungen, Politik“
Seminar „Das deutsche Innovationssystem im internationalen Vergleich: Strukturen, Herausforderungen, Politik“
Seminar „Partizipative Ansätze zur Stimulierung regionaler Innovationsdynamik – Regionale Vorausschau- und Zukunftsinitiativen in Deutschland und Europa“
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Energieeffizienz bei Querschnittstechnologien in Industrie und Dienstleistungssektoren
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Carbon Capture and Storage
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Vorlesung Quantitative Modelle zum Abbilden des technologischen Wandels am Beispiel der Energieanwendung
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Projects and person to contact

European Science and Technology Observatory
Prof. Dr. Stefan Kuhlmann

Policies For Research and Innovation in the Move towards the European Research Area
Prof. Dr. Stefan Kuhlmann

European Techno-Economic Policy support Network
Prof. Dr. Stefan Kuhlmann, Dr. Thomas Reiß

6 CP-Netzwerk
Prof. Dr. Stefan Kuhlmann, Dr. Steffen Kinkel

Creativity capabilities and the promotion of highly innovative research in Europe and the United States
Dr. Thomas Heinze

Governance der Kooperation heterogener Partner im Forschungs- und Innovationssystem
Prof. Dr. Stefan Kuhlmann, Dr. Thomas Heinze

INTEREST – Integrating Research and Standardisation
Prof. Dr. Knut Blind

Mitarbeit im Innovationsbüro zur Unterstützung der Innovationsinitiative der Bundesregierung und der Partner für Innovation (Deutschland innovativ Phase 3)
Prof. Dr. Knut Blind

STEPPIN – Promoting Innovation via Standards in Public Procurement
Prof. Dr. Knut Blind

INS (Identifikation neuer Standardisierungsfelder) – Förderung der Innovation und Marktfähigkeit durch Normung und Standardisierung
Prof. Dr. Knut Blind

NO-REST: Networked Organisations – Research into Standards
Prof. Dr. Knut Blind

STANDARD: IS
Prof. Dr. Knut Blind

DIN – Verbundvorhaben: IS Dienstleistungsstandards in erfolgreichen Internationalisierungsstrategien; Teilvorhaben: Rolle von Standards in ausgewählten Dienstleistungsbranchen
Prof. Dr. Knut Blind

Erawatch baseload inventory
Dr. Jakob Edler

Network-ERAWATCH
Dr. Jakob Edler

Fora of Strategic Intelligence for Research and Innovation – preparation of research and experimental forum
Dr. Jakob Edler

Studie zur Internationalisierung der deutschen Forschungs- und Wissenschaftslandschaft
Dr. Jakob Edler

ERA-Dynamics
Dr. Jakob Edler

ERA-CONFIG
Dr. Jakob Edler

Konzeptentwicklung für Sekundäranalyse von Politikinstrumenten

Dr. Jakob Edler, Dr. Vivien Lo

Evaluation des Verbundprojektes Netzwerk RNA-Technologien Berlin
Dr. Sybille Hinze

Resisting Inequality through Science and Technology
PD Dr. Ulrich Schmoch

Forschung und Entwicklung in der Wissenschaftslandschaft der Türkei und Nordafrikas
PD Dr. Ulrich Schmoch

Identification and Assessment of Promising Emerging Technological Fields in Europe
PD Dr. Ulrich Schmoch

Mathematical Modelling of Innovation Dynamics
PD Dr. Ulrich Schmoch

Developing Universities – The Evolving Role of Academic Institutions in Economic Growth
PD Dr. Ulrich Schmoch

Performanzindikatoren für Forschungseinrichtungen, insbesondere für Forschungsgruppen
PD Dr. Ulrich Schmoch

Erstellung des Berichts zur Technologischen Leistungsfähigkeit Deutschlands 2007
PD Dr. Ulrich Schmoch

Zusammenhang von technischen Innovationen und Kultur im Spiegel von Indikatoren
PD Dr. Ulrich Schmoch

Taskforce Innovationsindikatoren
PD Dr. Ulrich Schmoch

Beitrag zum Indikatorensystem zur „Technologischen Leistungsfähigkeit Deutschlands“
Dipl.-Soz. Rainer Frietsch

Abgrenzung der Wissenswirtschaft für die Berichterstattung zur technologischen Leistungsfähigkeit Deutschlands
Dipl.-Soz. Rainer Frietsch

Zur technologischen Leistungsfähigkeit der deutschen Umweltwirtschaft im internationalen Vergleich
Dipl.-Soz. Rainer Frietsch

Toyota – Domestic Researcher Identification
Dipl.-Soz. Rainer Frietsch

OECD-Projekt Co-Operative Work on Chinas National Innovation System and Innovation Policy
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ERAWATCH: Feasibility study on R&D specialisation
Dipl.-Soz. Rainer Frietsch

ERAWATCH: Monitoring the Globalisation of R&D
Dipl.-Soz. Rainer Frietsch

Beitrag des Fraunhofer ISI zur Erarbeitung einer Europa-Strategie der Fraunhofer-Gesellschaft
Dipl.-Soz. Rainer Frietsch

Erhebung zur Beschreibung des Innovationsverhaltens im Produzierenden Gewerbe und im Dienstleistungssektor in Deutschland für den Zeitraum 2005-2008
Dr. Bernd Ebersberger

Production and Analysis of R&D policy Indicators
Dr. Sybille Hinze

Meeting promises: Public policies and firm strategies in nanotechnologies
Dr. Thomas Heinze

NEST – Promoting Research on Optimal Methodology and Impacts
Dr. Thomas Heinze, Dr. Sybille Hinze

EFMN: Monitoring foresight activities in Europe and fostering their European dimension
Dr. Kerstin Cuhls

ETEPS: FTA Seville Seminar
Dr. Kerstin Cuhls

Überblick über nationale Technikvorausschau-Prozesse
Dr. Kerstin Cuhls

Zukunftsinitiative Rheinland-Pfalz
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Landkarte Hochschulmedizin
Dr. Susanne Bührer

Genderaspekte in der Forschung
Dr. Susanne Bührer

Regions and Market Dynamics

Projects and person to contact

Specific Analysis on the Regional Dimension of Investment in Research
Prof. Dr. Knut Koschatzky

Support to Mutual Learning and Co-ordination in Research Policy Making
Prof. Dr. Knut Koschatzky

Characterising Spaces for Research and Innovation Policy
Prof. Dr. Knut Koschatzky

Méthodologie pour l'Anticipation des Transformations Industrielles
Prof. Dr. Knut Koschatzky

IKT Standort Wien im Vergleich
Elisabeth Baier

Regionales Lernen in multinationalen Unternehmen
Prof. Dr. Knut Koschatzky

Towards Knowledge-based Societies. ICT for Growth and Cohesion in a Global Knowledge-based Economy: Lessons from East Asian Growth Areas – Workpackages 3 to 9
Dr. Thomas Stahlecker

Wissens- und Technologietransfer in der Materialforschung. Charakteristika und Bedingungen für erfolgreiche Produktinnovation – InnoMat
Joachim Hemer

Regional Key Figures of the European Research Area
Prof. Dr. Knut Koschatzky

Zwischenevaluierung des Impulsprogramms FHplus
Dr. Thomas Stahlecker

Schwerpunktstudien zur technologischen Leistungsfähigkeit Deutschlands: „Die Bedeutung der An-Institute im wirtschaftlichen Innovationsprozess“
Prof. Dr. Knut Koschatzky

Study on the Trends in European Public and Private Investments in ICT R&D and on the Globalisation of R&D and the Competitiveness of the European Innovation System in ICT
Dr. Thomas Stahlecker

Towards Knowledge-based Societies. ICT for Growth and Cohesion in a Global Knowledge-based Economy: Lessons from East Asian Growth Areas – Workpackages 1 and 2
Dr. Thomas Stahlecker

Evaluation des BMWA-Programms „Förderung von Forschung und Entwicklung bei Wachstumsträgern in benachteiligten Regionen“ (INNO-WATT)
Dr. Vivien Lo, Björn Wolf

Analyse des Ausgründungsgeschehens aus öffentlichen Forschungseinrichtungen von Erfolgs- bzw. Hemmnisfaktoren speziell in den ostdeutschen Regionen
Joachim Hemer

Strategiefonds: Strukturen und Kausalitäten in regionalen Innovationssystemen (SK-RIS)
Prof. Dr. Knut Koschatzky

Durchführung des Sonderprogramms zum Aufbau der Informationsgesellschaft in Sachsen-Anhalt
Joachim Hemer

Untersuchung der Wirksamkeit des Förderprogramms PROgramm INNOvationskompetenz mittelständischer Unternehmen“ (PRO INNO)
Dr. Marianne Kulicke

Evaluation der innoWi in den Jahren 2004 + 2005
Prof. Dr. Knut Koschatzky

Wissenschaftliche Begleitung zu EXIST – Existenzgründungen aus Hochschulen (Zweite EXIST-Phase)
Dr. Marianne Kulicke

Neue Märkte im Kontext von Innovation und Regulierung
Dr. Simone Kimpeler

Zielgruppenorientiertes eLearning
Dr. Simone Kimpeler

Zielgruppenorientiertes eLearning im Rahmen des Vorhabens "Monitoring eLearning" des TAB
Dr. Simone Kimpeler

FAZIT – Forschungsprojekt für aktuelle und zukunftsorientierte IT- und Medientechnologien und deren Nutzung in Baden-Württemberg
Dr. Simone Kimpeler

Industrial and Service Innovations

Projects and person to contact

Begleitvorhaben zum Themenfeld Werkzeugmaschine 2010 - Szenariengestützte Instrumente zur Strategieentwicklung, Transferbündelung und begleitende Wirkungsanalyse
Dr. Steffen Kinkel

Manufacturing Visions – Integrating Diverse Perspectives into Pan-European Foresight
Dr. Heidi Armbruster

Integrierte Modernisierungsprozesse für kleine und mittlere Unternehmen des Verarbeitenden Gewerbes (IMPROVE)
Dr. Gunter Lay

Next Generation Machine Tools
Dr. Gunter Lay

The European Robot Initiative for Strengthening the Competitiveness of SMEs in Manufacturing
Dr. Steffen Kinkel, Dr. Heidi Armbruster

Patterns of organisational change in European industry: ways to strengthen the empirical basis of research and policy
Dr. Heidi Armbruster

Neue Methoden für strategisch-fundierte Standortentscheidungen – Instrumente zur Unterstützung der Betriebsratsarbeit bei Automobilzulieferern
Dr. Steffen Kinkel

Dienstleistungsexport mit Industrieprodukten (DEXINPRO) – Entwicklung organisatorischer Modelle zur Steigerung der Exportfähigkeit industrieller Betreibermodelle
Dr. Gunter Lay

Chancen und Risiken von Betreibermodellen für die Investitionsgüterindustrie am Standort Deutschland
Dr. Gunter Lay

Lebenszyklusoptimierte Montagesysteme für den Hochleistungsstandort Deutschland
Dr. Marcus Schröter

Ex-post Evaluation des Forschungsprogramms „Forschung für die Produktion von morgen“ für die Jahre 1999 bis 2004
Dr. Steffen Kinkel

Mitarbeit im Innovationsbüro zur Unterstützung der Innovationsinitiative der Bundesregierung und der Partner für Innovation: Impuls-kreis Wirtschaft-Wissenschaft-Staat
Dr. Steffen Kinkel

Verfahren zur Bewertung und Steuerung der Innovationsfähigkeit produzierender KMU
Dr. Eva Kirner

Fraunhofer European Manufacturing Survey
Dr. Heidi Armbruster

Beitrag des Fraunhofer ISI zum Präsidialprojekt „Fraunhofer – als Innovationsbeschleuniger“
Dr. Eva Kirner

Antriebstechnik 2015 – Roadmaps als Instrument einer vorausschauenden Forschungsförderung
Elna Schirrmeyer

Service Chain Management in industriellen Wertschöpfungsketten
Elna Schirrmeyer

Emerging Technologies

Projects and person to contact

Staatliche Förderstrategien für die Neurowissenschaften. Programme und Projekte im internationalen Vergleich
Dr. Bernd Beckert

Modellierung von Szenarien
Dr. Bernd Beckert

Technologische und ökonomische Langfristperspektiven der Telekommunikation
Dr. Bernd Beckert

FAZIT-Forschung: Szenarien für den IT- und Medienstandort Baden-Württemberg
Dr. Bernd Beckert, Dr. Simone Kimpeler

Brain exchange – Brain drain? Internationale und intersektorale Mobilität von Wissenschaftlern
Dr. Bernd Beckert, Dr. Ralf Lindner

Converging Technologies and their impact on the social sciences and humanities (CONTECS)
Dr. Bernd Beckert, Dr. Michael Friedewald

Sustainable Introduction of GMOs into European Agriculture (SIGMEA)
Dr. Bernhard Bührlen, Dr. Thomas Reiß

Health Innovation Technology Assessment (HITE)
Dr. Bernhard Bührlen

Assessment of the European Community System of Pharmacovigilance
Dr. Bernhard Bührlen

Safeguards in a World of Ambient Intelligence (SWAMI)
Dr. Michael Friedewald

European Perspectives on the Creative Content Sector (EPIS06)
Dr. Michael Friedewald

Exploration of a thematic extension of the ERAWATCH Base-load Research Inventory
Dr. Michael Friedewald

Interdisziplinäre Fortbildungsveranstaltungen zur Gendiagnostik für Lehrerinnen und Lehrer
Dr. Sibylle Gaisser, Dr. Bärbel Hüsing

Evaluation des Verbundprojektes Netzwerk RNA-Technologien Berlin
Dr. Sybille Hinze

Impact Assessment of Neuroimaging
Dr. Bärbel Hüsing

Nanobiotechnology in the medical sector – Drivers for development and possible impacts
Dr. Bärbel Hüsing

Genetisch veränderte Pflanzen für die Produktion von Pharmaka und funktionellen Inhaltsstoffen für Functional Food
Dr. Bärbel Hüsing

Zukunftsreport „Individuelle Medizin und Gesundheitssystem“
Dr. Bärbel Hüsing

Wissenschaftliche Evaluierung und Begleitung des Modellversuchs „Öffentliche Petition“
Dr. Ralf Lindner

Potenzialanalyse der industriellen, weißen Biotechnologie
Dr. Michael Nusser

Innovative Pharmaindustrie als Chance für den Wirtschaftsstandort Deutschland
Dr. Michael Nusser

Handlungsoptionen zur Stärkung der internationalen Wettbewerbsfähigkeit forschungs- und wissensintensiver Branchen in Deutschland am Beispiel der pharmazeutischen Industrie
Dr. Michael Nusser

Wettbewerbsfähigkeit und Beschäftigungspotenziale der Biotechnologie in Deutschland
Dr. Michael Nusser

Makroökonomische Effekte des Anbaus und der Nutzung von nachwachsenden Rohstoffen
Dr. Michael Nusser, Dr. Thomas Reiß

FuE-Pipeline in den Life Sciences: Eine Analyse neu aufkommender Themenfelder
Dr. Thomas Reiß

Inventory and analysis of national public policies that stimulate research in life sciences and biotechnology, its exploitation and commercialisation by industry in Europe (BIOPOLIS)
Dr. Thomas Reiß, Dr. Ralf Lindner

Consequences, opportunities and challenges of modern biotechnology for Europe (Bio4EU)
Dr. Thomas Reiß, Dr. Sibylle Gaisser

Virtuelle Unternehmen (im Spannungsfeld) zwischen Struktur und Offenheit
Peter Zoche, M.A.

Forschungs-Informations-System Mobilität, Verkehr und Stadtentwicklung
Peter Zoche, M.A.

Mobilität 21 – Kompetenznetzwerk für innovative Verkehrslösungen
Peter Zoche, M.A.

Zukunftsreport: Ubiquitous Computing
Peter Zoche, M.A., Dr. Michael Friedewald

Energy Policy and Energy Systems

Projects and person to contact

Sustainability Impact Assessment of Strategies Integrating Transport, Technology and Energy Scenarios (TRIAS)
PD Dr. Martin Wietschel

Methodologies and Technologies for Industrial Strength Systems Engineering (MATISSE)
PD Dr. Martin Wietschel

The Development and Detailed Evaluation of a Harmonised European Hydrogen Energy Roadmap (Hyways)
PD Dr. Martin Wietschel

Auswirkungen des CO₂-Zertifikatehandels und des verstärkten Einsatzes erneuerbarer Energieträger auf den liberalisierten Strommarkt
Dr. Mario Ragwitz

Einrichtung eines thematischen Netzwerks zur Optimierung des Einsatzes dezentraler Energieversorgungssysteme durch Einbindung moderner Kommunikationstechniken
Dipl.-Ing. Marian Klobasa

Ökologische Steuerreform: energieintensive Prozesse/Energiemanagement
Dr. Harald Bradke

Assessment and Optimisation of Renewable Energy Support Schemes in the European Electricity Market (OPTRES)
Dr. Mario Ragwitz

Dissemination, Extension and Application of the Motor Challenge Program (DEXA-MCP)
Dr. Peter Radgen

Extend Accredited Renewables Training for Heating (EARTH)
Dipl.-Soz. Edelgard Gruber

Monitoring energy efficiency in Europe (ODYSSEE-MURE)
Dr. Wolfgang Eichhammer

Guiding a least cost grid integration of RES-E in the EU27 (GreenNet-EU27)
Dipl.-Ing. Marian Klobasa

Leveraging the new Green Building Program (GBP) to Promote Energy-efficiency and Renewables in Non-residential Buildings (Green-building)
Dr. Peter Radgen

Scientific Reference System for New Energy Technologies and Energy End-Use Efficiency (SRS Net&EE)
Dr. Mario Ragwitz

Energy Corridor Optimisation for the European Markets of Gas, Electricity and Hydrogen (ENCOURAGED)
PD Dr. Martin Wietschel

Modellvorhaben Energieeffizienz-Initiative Region Hohenlohe zur Reduzierung der CO₂-Emissionen 2002 – 2006
Prof. Dr. Eberhard Jochem

Developing an assessment framework to improve the efficiency of R&D and the market diffusion of energy technologies (Eduar&D)
Prof. Dr. Eberhard Jochem

Multidimensionale Analyse von Techniken zur Strom- und Wärmeerzeugung
Dr. Peter Radgen

Towards hydrogen and electricity production with carbon dioxide capture and storage (DYNAMIS)
Dr. Clemens Cremer

Early Market Introduction of New Energy Technologies in Liaison with Science and Industry (EMINENT RTD)
Dr. Wolfgang Eichhammer

Adaptation and Mitigation Strategies (ADAM)
Prof. Dr. Eberhard Jochem

Monitoring Electricity Consumption in the Tertiary (EL-TERTIARY)
Dipl.-Soz. Edelgard Gruber

Analysis of Industrial Energy-related Greenhouse Gas Emissions and of Electricity Demand in EU-25 with Respect to EU Emissions Trading
Dr. Wolfgang Eichhammer

Residential Monitoring to Decrease Energy Use and Carbon Emission in Europe (REMODOECE)
Diplom-Volkswirtin Barbara Schlomann

Basic Research and Innovative Science for Energy (BRISE)
Dr. Mario Ragwitz

Eckpunkte für die Entwicklung und Einführung budgetunabhängiger Instrumente zur Marktdurchdringung erneuerbarer Energien im Wärmemarkt
Dr. Mario Ragwitz

Kampagne effiziente Druckluft im Rahmen des Programms Energie Schweiz
Dr. Peter Radgen

Entwicklung und Erstellung eines nationalen Allokationsplans gemäß der EU-Richtlinienentwürfe für einen EU-weiten Emissionshandel
Prof. Dr. Joachim Schleich

EnBW Netzwerk Energieeffizienz Ravensburg und Mitteldeutschland
Prof. Dr. Eberhard Jochem

Energieeffizienz-Initiative Ulm
Prof. Dr. Eberhard Jochem

Energieverbrauch des Sektors Gewerbe, Handel und Dienstleistungen (GHD) für die Jahre 2004 bis 2006
Dipl.-Volkswirtin Barbara Schlomann

Externe Kosten der Stromerzeugung aus erneuerbaren Energien im Vergleich zur Stromerzeugung aus fossilen Energieträgern
Dipl.-Volkswirtin Barbara Schlomann

Innovationsinitiative – wissenschaftliche Begleitung des Impulskreises Energie (BK-Innovation Phase III)
Dr. Harald Bradke

Twining-Project: Integrated Pollution and Prevention Control (IPPC) (Slovenien)
Dr. Peter Radgen

Fortentwicklung des Erneuerbaren-Energie-Gesetzes (EEG) zur Marktdurchdringung Erneuerbarer Energien im deutschen und europäischen Strommarkt
Dr. Mario Ragwitz

Wissenschaftliche Begleitung des Feed-In Cooperation (Feed-In Coop)
Dr. Mario Ragwitz

Erneuerbare Energienstrategie für Luxemburg
Dr. Mario Ragwitz

Assessment of the World Bank / GEF Solar Thermal Market Development Strategy
Dr. Wolfgang Eichhammer

Evaluation and Monitoring for the EU Directive on Energy end-use Efficiency and Energy Services (EMEEES)
Dr. Wolfgang Eichhammer

Post-2012 Climate Policy – Enhancing International Technology Cooperation to Create Incentives for Regime Participation
Dr. Wolfgang Eichhammer

Potenziale der Informations- und Kommunikations-Technologien zur Optimierung der Energieversorgung und des Energieverbrauchs (eEnergy)
Dr. Clemens Cremer

World Energy Council (WEC) Study – Audits for Energy Efficiency
Dr. Wolfgang Eichhammer

ESD Potentials: Study on the Energy Savings Potentials in EU Member States, Candidate Countries and EEA Countries
Dr. Wolfgang Eichhammer

Gaspotenzial im Sektor Gewerbe, Handel, Dienstleistung
Dipl.-Soz. Edelgard Gruber

Politikszenerarien für den Klimaschutz
Dr. Wolfgang Eichhammer

Analysis of the achievement of 2010 national and Community targets under Directive 2001/77/EC (PROGRESS)
Dr. Mario Ragwitz

Szenarien für die dezentrale Stromproduktion 2030
Dr. Harald Bradke

REN-Botschafter-Initiative für KMU
Dipl.-Soz. Edelgard Gruber

Erarbeitung einer Energiestrategie für Luxemburg sowie zur Umsetzung der Richtlinie über Endenergieeffizienz und Energiedienstleistungen
Dr. Wolfgang Eichhammer

Sozioökonomische Begleitforschung zur gesellschaftlichen Akzeptanz von Carbon Capture and Storage (CSS) auf nationaler und internationaler Ebene
Dr. Peter Radgen

Deriving a future European Policy for Renewable Electricity (FUTURES-E)
Dr. Mario Ragwitz

Prognose der CO₂-Emissionen der Industrie
PD Dr. Martin Wietschel

Stromprognose für Gewerbe, Handel, Dienstleistung
Dipl.-Soz. Edelgard Gruber

Simulationsmodell für die CO₂-Gesamtemissionen und Minderungsbeiträge der relevanten, unter den EU-Emissionshandel fallenden, Industrie-sektoren in der EU-25
PD Dr. Martin Wietschel

Dienstleistungsexport mit Industrieprodukten
Dr. Peter Radgen

Chancen und Risiken von Betreibermodellen für die Investitionsgüterindustrie in Deutschland
Dr. Peter Radgen

Increasing the Ambition of EU Emissions Trading. An Assessment of the Draft Second Allocation Plans and Verified Emission Reports of Germany, the United Kingdom and the Netherlands
Prof. Dr. Joachim Schleich

An Early Assessment of the Draft Second Allocation Plan for Spain
Prof. Dr. Joachim Schleich

Konzeptionelle Beiträge für das Network of Excellence DIME
Prof. Dr. Joachim Schleich

Modellierung von Kraftwerksbetrieb und Regelenergiebedarf bei verstärkter Einspeisung von Windenergie in verschiedene Energiesysteme unter Berücksichtigung des Lastmanagements
Dipl.-Ing. Marian Klobasa

Guiding a least cost grid integration of RES-E in the EU27 (GreenNet-EU27)
Dipl.-Ing. Marian Klobasa

Monitoring und Fortentwicklung nationaler europäischer Instrumente zur Marktdurchdringung erneuerbarer Energiequellen im Strommarkt
Dr. Mario Ragwitz

Sustainability and Infrastructures Projects and person to contact

Verbundvorhaben: Wirkungen des globalen Wandels auf den Wasserkreislauf im Elbe-Gebiet – Risiken und Optionen (GLOWA-ELBE II); Teilvorhaben 3.3: Vorausschau und Diffusion von wasserrelevanter Technologie sowie Analyse der Folgewirkungen.
PD Dr. Rainer Walz

Dezentrales Urbanes Infrastruktursystem DEUS
Dr. Harald Hiessl

AKWA 2100 Dahler Feld – Konzeptentwicklung und Genehmigungsplanung
Dr. Harald Hiessl

Policy pathways to promote the development and adoption of cleaner technologies
Dr. Dr. Christian Sartorius

Emissionsminderung für prioritäre gefährliche Stoffe der Wasserrahmenrichtlinie
Thomas Hillenbrand

Diffusion of innovations in energy efficiency and in climate change mitigation in the Public and private sector
Dr. Katrin Ostertag

Emission Trading als Instrument der globalen Klimavorsorge
Karoline Rogge

Innovative Urban Water and Sanitation Programmes in India (INUWASAPI)
Dr. Harald Hiessl

Bereitstellung von Emissionsdaten industrieller Direktleiter und Bergbaualllasten für Schwermetalle sowie Analyse der Datenlage und Zusammenstellung von Emissionsfaktoren für weitere prioritäre Stoffe
Thomas Hillenbrand

BDI-Umweltpreiswettbewerb 2005/2006 in Verbindung mit dem Europäischen Umweltschutzwettbewerb
Dr. Gerhard Angerer

Beschäftigung im Umweltschutz - Wirtschaftsfaktor Umweltschutz
PD Dr. Rainer Walz

INANU – Innovation durch Nanotechnologie in der Umwetttechnik als Schlüssel zur Nachhaltigkeit – Anwendung und Methoden
Dr. Gerhard Angerer

Flexible framework for indicators for sustainability in regions using system dynamics modeling
Dr. Wolfgang Schade

Phosphorrecycling – Ökologische und wirtschaftliche Bewertung verschiedener Verfahren und Entwicklung eines strategischen Verwertungskonzeptes für Deutschland
Dr. Dr. Christian Sartorius

Regional Infrastructure Foresight (RIF)
Dr. Harald Hiessl

Improved Decision-Aid Methods and Tools to support Evaluation of Investments for Transport and Energy Networks in Europe
Dr. Claus Doll

Foresight and Assessment for Environmental Technologies
Dr. Dr. Christian Sartorius

Beiträge deutscher Forschungs- und Wissenschaftskompetenz zur Realisierung des Leitbilds einer nachhaltigen Entwicklung mit Blick auf bestehende Innovationspotenziale in den BRICS Staaten
PD Dr. Rainer Walz

Trends der Angebots- und Nachfragesituation bei mineralischen Rohstoffen
Dr. Gerhard Angerer

Sustainability Impact Assessment of Strategies Integrating Transport, Technology and Energy Scenarios
Dr. Wolfgang Schade

Analysis of the contribution of transport policies to the competitiveness of the EU economy and comparison with the United States
Dr. Wolfgang Schade

Direkt-Ethanol-Brennstoffzelle (DEFC)
Dr. Frank Marscheider-Weidemann

Methods and Tools for Integrated Sustainability Assessment
Dr. Wolfgang Schade

Wasser 2050: Nachhaltige wasserwirtschaftliche Systemlösungen – künftige Chancen für die deutsche Wasserwirtschaft
Dr. Harald Hiessl

AKWA 2100 Dahler Feld – Teilprojekt 3 Wissenschaftliche Begleitung und Evaluation des innovativen Abwasserentsorgungskonzeptes
Dr. Harald Hiessl

Potenziale zur Minderung von CO₂ in den luxemburgischen Unternehmen des ET-Sektors als Grundlage für die Erstellung des zweiten Nationalen Zuteilungsplanes Luxemburg
Karoline Rogge

Adaptation and Mitigation Strategies: Supporting European climate policy
Dr. Wolfgang Schade

Verbundvorhaben: Integration von Sustainability Innovationen in Catching up Prozesse; Teilvorhaben: Anforderungen, sektorale Innovationsbedingungen und Maßnahmen
PD Dr. Rainer Walz

A study for the impact assessment of the report on the application of Council Regulation 1407/2002 on state aid for the coal industry, foreseen by article 11 of the Regulation
Dr. Claus Doll

Integration von Sustainability-Innovationen in Catching-up-Prozesse
PD Dr. Rainer Walz

Prioritäre Stoffe der Wasserrahmenrichtlinie – europäische Regelung und nationales Maßnahmenprogramm
Thomas Hillenbrand

Beratung zu Einzelfragen der Mikroplanung des zweiten Nationalen Zuteilungsplanes Luxemburg
Karoline Rogge

Innovative Umweltpolitik in wichtigen Handlungsfeldern
PD Dr. Rainer Walz

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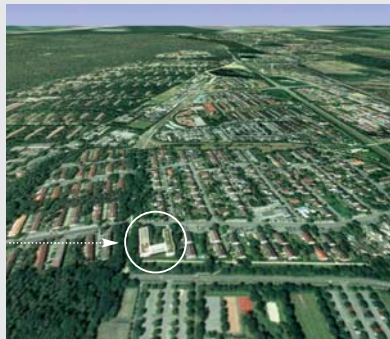
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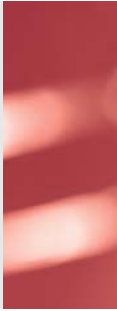


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By train to Karlsruhe main station, tram No. 4, direction Waldstadt to Glogauer Straße (approx. 25 minutes).

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Annual Report



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