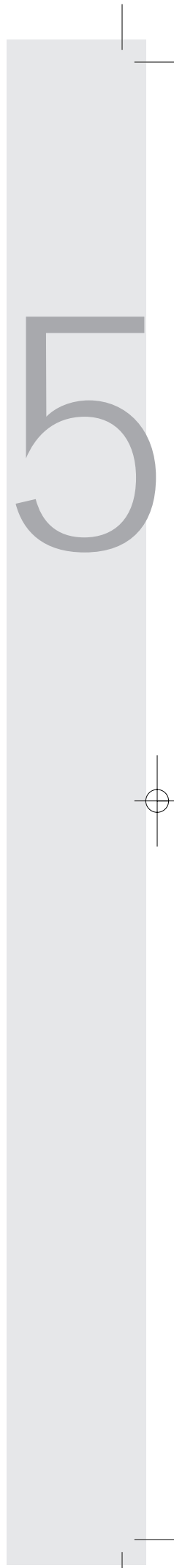
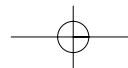


2005

Annual Report





Fraunhofer Institute for Systems and Innovation Research ISI Annual Report 2005

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 58 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 over one billion euros. Of this sum, more than 900 million 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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"Only he who does not seek does not err"

Albert Einstein

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Internal and external views: the FhG headquarters moved into new premises in Munich in 2003



Foreword by the Heads of the Institute



Hariolf Grupp and
Stefan Kuhlmann (right)

Dear readers,

Worldwide competition for creative people, innovations and successful technological concepts, as well as their application for a sustainable development characterises this decade. Anyone who wants to pursue promising paths in research, technologies and innovation needs outstanding scientific-technical competences, but today a good understanding of the social and economic preconditions and consequences of technology development is also required. Which knowledge and innovation potentials does an economy or a sector possess? What may users expect from innovations and how can they influence the developments? Which innovations are necessary to operate old, large technical infrastructures such as energy or water supply along sustainable and also competitive lines in the future? What leeway do policy-makers have if they want to promote innovations and which are the most appropriate instruments? For years, ISI has been conducting "socio-economic" research and consulting in a "systemic perspective" in order to answer such questions.

In 2005, about 145 persons worked on 250 research and consultancy projects in ISI, to the value of approx. € 9 million. 260 scientific publications also resulted. In the press, radio and television ISI's work was referred to more than 500 times. This success is only possible on a solid basis, both methodological and content-wise.

Thorough knowledge of innovation fields

The systemically oriented innovation research in ISI demands on the one hand a thorough knowledge of the specialised fields being dealt with. Among others, the socio-economic potentials of new technologies (for instance, bio-, nano- and information technologies, as well as their convergence fields), innovative and sustainable infrastructures (such as the hydrogen economy and renewable energies, waste water systems, communication systems, technological aspects of health care systems), innovative production systems (like 'customisation' of production, new business models, international sourcing), leading-edge institutions in knowledge production and utilisation (for example, the organisational framework conditions for creative research, the European Research Area, regional specialisation patterns, demand-oriented innovation policy), as well as favourable conditions for lead markets (such as regulation and market entry conditions, user expectations, innovation-oriented financing).

ISI's unique research and consulting portfolio results from the combination of this expert knowledge with special conceptual and methodological competences: in this category belong system heuristics, comprehensive data access and datasets, the use of differentiated indicators, finely honed analytical concepts (such as extrapolations and model-based simulations), as well as procedures to apply such information to advise policy-makers and industry (in the form of programme evaluations or foresight exercises, for example).

Expanding innovation indicators

In the year reported on, several important steps were taken in the continual further development of ISI's conceptual, methodological and content portfolio: innovation indicators attained an outstanding position in the institute's research spectrum. As innovation processes are hardly measurable, indicators are utilised instead. The construction, collection, selection and assessment of indicators are crucial factors for the quality of ISI's work as a whole. The mastery of quantitative approaches is of special importance, as these approaches are attracting increasing attention in the political arena. The co-ordination of this new cross-departmental task has been entrusted to Reader Ulrich Schmoch (see also the contribution on p. 11).

For a long time ISI has conducted foresight exercises, hence investigating future scientific-technical developments and innovations as well as their preconditions and implications. In order to bundle own competences better in this area, in 2005 the institute carried out a comprehensive internal stocktaking process of all the concepts, indicators, data sources and analytical methods utilised in-house which could contribute to qualitatively top-notch foresight processes. In a series of expert colloquia it became apparent how broad the existing competence spectrum is, but also which synergy potentials could still be exploited.

ISI has begun to investigate innovations in transportation systems. Investments in traffic infrastructure mean long-term commitments, which is why the needs of today's and future generations must be weighed as regards technology development, investment decisions and political regulation. Since 2005 an interdisciplinary team has been working on an analysis of future transportation concepts with the goal of a sustainable development. Main focuses lie on the integrated evaluation of national or EU-wide traffic policies in their interplay with the socio-economic environment, for example in the model ASTRA, the analysis of pricing policy like the truck toll (see also the contribution on p. 29 on this subject), the elaboration of long-term scenarios, the drafting of new policy instruments such as certificates in traffic and the strategic planning of investments for new building or maintenance of transportation infrastructures.

ISI branch in Berlin

ISI has dropped an institutional anchor in the German capital city: since spring 2006 a branch of ISI is being created in Berlin in cooperation with the Technical University there. The nucleus of the Berlin representation – which will bring ISI closer to clients in politics and administration as well as in industrial associations – is formed by a new chair for Innovation Economics at the TU Berlin. The holder of the chair, Professor Knut Blind, will simultaneously head the new ISI research team "Regulation and New Markets", which examines the complex interrelationship between innovation, regulatory framework conditions, demand and market dynamics, in order to derive policy and strategic perspectives for action (see the contribution on p. 10).



Foreword by the Heads of the Institute

ISI sees itself as an institute for European and international innovation research. In the past year, the long-term international interconnections were consistently deepened and expanded. From the large number of cooperations, just a few are picked out for special mention: the Laboratoire Européen Associé (LEA) opened its doors. It is funded by the Bureau d'économie théorique et appliquée (BETA) in Strasbourg, ISI and the Max Planck Institute for the research of economic systems. LEA offers a platform for research work in the field "Knowledge, Science and Innovation". ISI performs important functions in the European Network of Excellence PRIME (Policies for Research and Innovation in the Move towards the European Research Area) and is now also active in the thematically related Network of Excellence DIME (Dynamics of Institutions and Markets in Europe). ISI is also one of the most active members of the research and advisory network ETEPS (European Techno-economic Policy Support Network) which has been promoted by the EU Commission since 2005. In the Global Research Alliance of large international contract research institutions ISI coordinates the research work on the topic innovative water infrastructures.

Lively relationships with universities

Besides these and other associations, ISI's existing cooperations with international universities (University of Utrecht, Copernicus Institute for Sustainable Development and Innovation; ETH Zurich, Centre for Energy Policy and Economics) as well as the collaboration with the Karlsruhe University (above all with the Institute for Economic Policy Research) proceed very lively.

Dear readers, this annual report for 2005 can present only a small selection of examples from the Institute's widely diversified research spectrum. We would like here to thank all the staff members mentioned and not mentioned in this report for their output, the quality and professionalism of their hard work, and also their commitment.

Our thanks include our partners and clients from the public sector and industry, at home and abroad. Without the lively interest in our research, the continuing discussion with our partners and a lively cooperation network, ISI's interdisciplinary work would be less effective.

We hope you enjoy reading the report and look forward to further collaboration in the future.

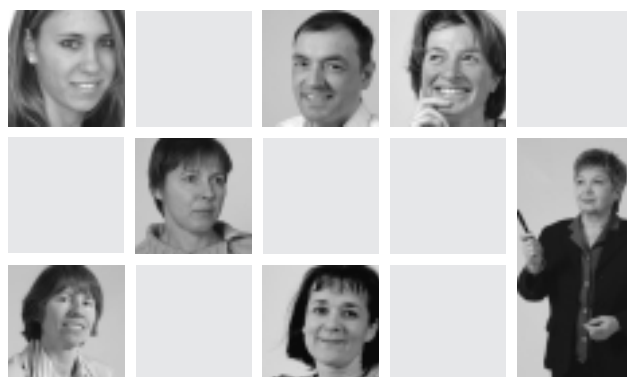
Best regards from Karlsruhe



Hariolf Grupp



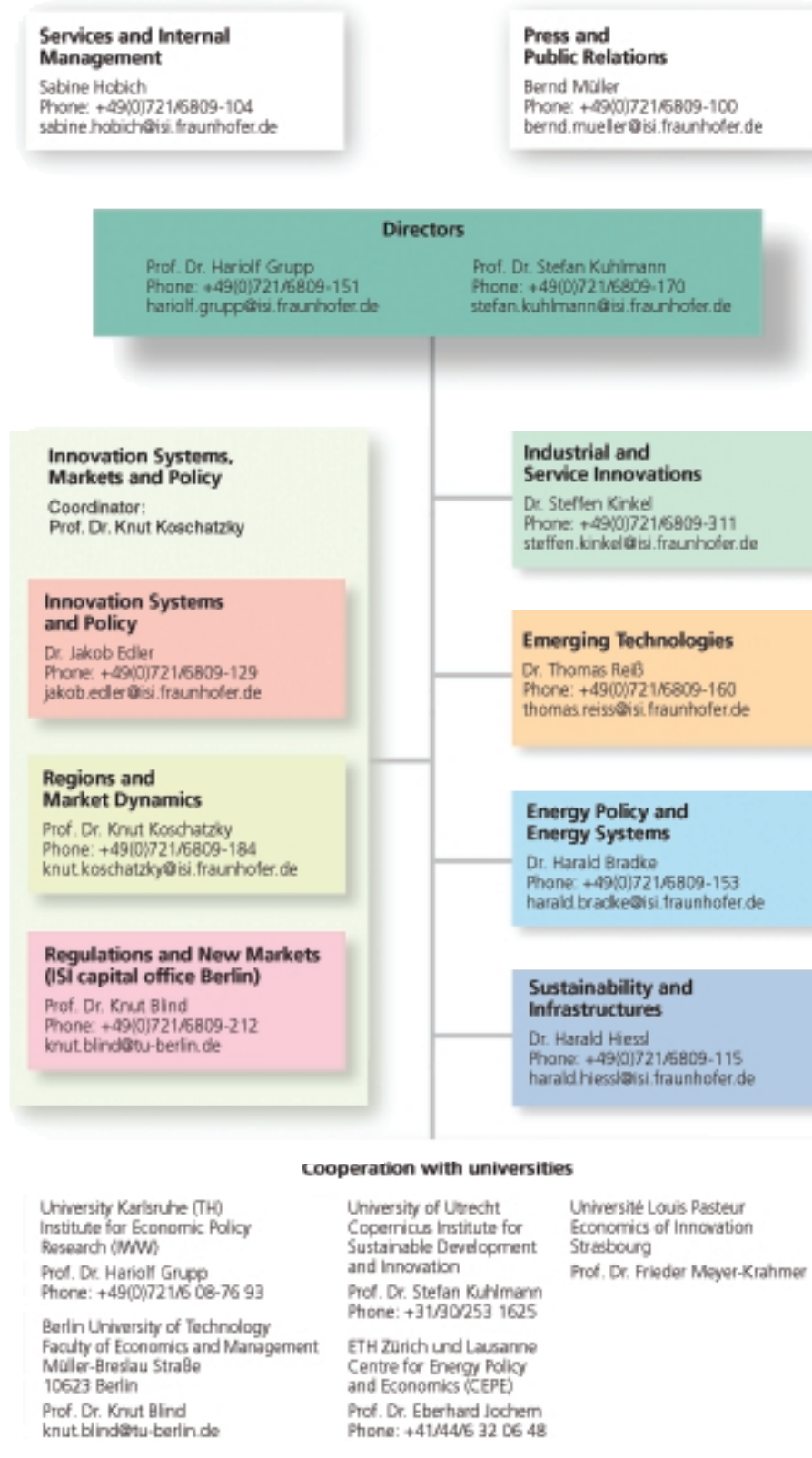
Stefan Kuhlmann



The staff of ISI's directorate (from left)

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

Organizational Chart



Message from the Board of Trustees



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

In the office windows of a well-known architect's and media agency in the city centre of Lausanne, I saw a notice which read: "Non à une métropole suisse – oui à un réseau de ville". Passers-by continually stop and nod their agreement. The concern expressed here about urban expansion is not only shared by architects and town planners but also by wider circles of society. Urban sprawl is increasingly becoming a topic of general public interest. However, in the case mentioned, the reflex of wanting to encounter an unwanted development using a network seems typical: a cartel of the core cities against the formation of an agglomeration. The debate about the spatial distribution of first-class medicine is just as characterised by this attitude as the portfolio debates in university bodies or cultural and educational policy.

Forming networks

The assumption that this undesired trend can be stopped, channelled or even turned around by an institutionalised cooperation of the urban centres under threat is only achievable under very specific macroeconomic and policy-organisational conditions. In many countries such as Germany and Switzerland this results in a specific challenge. How can favourable conditions for regional and urban development be created in a period of weak economic growth and financial bottlenecks? Here, the attempt is being made to increase institutional efficiency by federal reform – from financial equalization through vertical allocation of responsibilities up to territorial organisation. But will this approach be enough and what supporting macroeconomic measures have to be taken? Will infrastructure and competition policy play along? In such an atmosphere, it doesn't take much for policy blockers to gain the upper hand. The well intentioned network idea is then reduced to the smallest common denominator and regional policy comes to a standstill. *Quieta non movere.*

Necessary control

So what are the pros and cons of networks? It is certainly in their favour that existing structures (for example the national divisions into states or cantons, the subdivisions of a university and corporate structures) can be retained and that economies of scale still emerge if the exercise is well designed. However, the associated overlapping of structures and processes is simultaneously their most significant drawback. Above all, communication and decision-making become more cumbersome and complicated. Many conservative network supporters are ranged against this demanding instrument like communards: they believe that only good will is important – the rest will then fall into place. But this fails to address the insight from organisation theory and control technology that networks have to be designed as systems and only function properly with a distinct controller.

At present, the network idea is especially widespread in research policy and innovation promotion. Ministries, rectorates and management boards all hope to motivate scientists in this way to cooperate better and to increase transfer efficiency. Oiling the wheels of such top-down cooperations, platforms and initiatives devours considerable private and even

more public funds. I myself belong to those who regard all this with scepticism and who plead for moderation primarily for regulatory policy reasons. My main reason for doing so is my doubt about their effectiveness. This is as valid on a European level as on a regional one. I interpret the current international competition among universities and the phenomenon of insourcing such that fewer and fewer interfaces should be necessary – that, in a Darwinian sense, excellent researchers will find excellent users. In such an environment, the most important thing is to allow bottom-up initiatives room to develop and to design transfer vessels in an extremely market-economic and cost-effective way. On the other hand, I believe that promoting the quality of teaching and research which is the core business of universities and colleges should be given top priority. In practice, this means a better basic funding of universities in order to bundle programme research (as is taking place in Germany in the Helmholtz institutes) and greater planning security at all levels of the science establishment. In this way, scientific cooperation can and should be driven by interests and take place in competition.

Strengths of the Fraunhofer system

If, however, we decide in favour of networks for specific reasons in specific areas – from system biology to orientalism – then these should be guided and controlled by a firm hand. The international strengths of the Fraunhofer system are the associations which are capable of meeting this requirement and which are held together by a realistic allocation of competences.

Experience and system analyses show that in such ordered constructions, initiatives are also promoted by deliberately leaving room to manoeuvre which is then exploited by versatile forces. The "transversal abilities" of ISI show to particular advantage within the framework of the FhG and the role of a general contractor, as outlined in the audit report of 2004, could also offer additional opportunities. The very good result for 2005, for which I warmly congratulate the directors and staff of ISI, is another favourable prerequisite for this.

Dr. Stephan Bieri
Chairman of the Board of Trustees

Members of ISI's Board of Trustees

Science

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Director Technopolis Ltd., Brighton

Dr. Stephan Bieri (chairman)
next consulting group ag, Aarau

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Faculty of Economic Science,
Technical University of Freiberg

Dr. Wilhelm Krull
Secretary General of the Volkswagen
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Prof. Dr. Patrick Llerena
Bureau d'Économie Théorique et
Appliquée (BETA)
Université Louis Pasteur, Strasbourg

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Institute for Economic Policy
Research, University of Karlsruhe

Industry

Dr. Karin Benz-Overhage,
German Metalworkers' Union,
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Prof. Dr. Hans Günter Danielmeyer,
Stuttgart

Dr. Manfred Eggersdorfer
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Dr. Carsten Kreklau,
Federation of German Industries
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Manfred Wittenstein
Chairman of the board of manage-
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Federal Office for Vocational Training
and Technology, Bern

Dr. Heribert Knorr,
Ministry of Science, Research and Art
in Baden-Württemberg, Stuttgart

Monika Mundkowsky-Bek
Ministry for Economic Affairs Baden-
Württemberg, Stuttgart

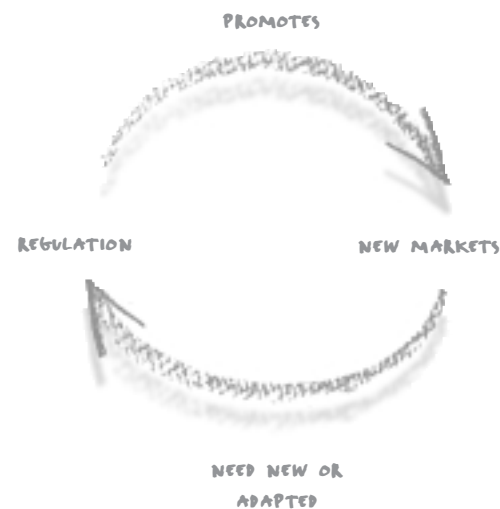
Department "Regulation and New Markets"



Professor Knut Blind, head of the ISI department "Regulation and New Markets"

Deputy head of department:
Dr. Simone Kimpeler

The regulation of markets has a bad reputation: it prevents innovation, it is said, although reliable legal framework conditions are a crucial precondition for technical progress and the development of new markets. Fraunhofer ISI takes their increasing significance into account and is intensifying its activities in this field, with its new department "Regulation and New Markets" with headquarters in the Technical University Berlin. The institute is focusing on the entire innovation process and all components of the innovation system, both of which are often obscured by the many questions of detail. On the one hand, the department examines the influence of regulative framework conditions on research, innovation and the development of new markets. In the context of regulation, innovative regulatory forms are also examined, for example the trend towards self-regulation by the actors in the innovation system. A special focus is brought to bear on standardisation as a particular form of self-coordination. On the other hand, the impacts of changes in science, technology, the economy and society on the regulatory framework conditions are analysed. They present great challenges to existing regulative framework conditions and will possibly even require a



new legal framework, for example for intellectual property rights. Many new markets have emerged partly as a result of changes in regulative framework conditions such as the liberalisation of former state monopolies. New markets can however also originate as a result of shifts in the demand side. Examples of this – besides new modes of utilising information and communication technology – are demographic developments and the demand impulses emanating from the so-called "catching-up" countries. The department's methodological competence should be developed in the area of regulation indicators, regulatory impact assessments and regulatory foresight, on the one hand. On the other hand, indicators and methods must be developed to analyse new markets, which take both the demand and the supply side into account. The department's research pursues two main conceptual paths:

Regulation

- connections between regulation and innovation
- standardisation
- intellectual property rights

An example in this field is the project "NO-REST" which investigated the impacts of standards on behalf of the EU Commission (see p. 18).

New Markets

- supply-side factors for the development of new markets
- role of the consumer and customer in the development of new markets
- emergence of digital products and services and their diffusion
- internationalisation of services

An example for this area is the FAZIT project which examines the development of technologies and markets in information and communication technologies (see p. 21).

Taskforce "Innovation Indicators"

Fraunhofer ISI investigates various aspects of innovation processes, frequently utilising quantitative methods of data collection and analysis thereby. As innovation processes are not directly measurable as a rule, indicators are used instead. The construction, collection, selection and analysis of indicators are therefore crucial factors for the good quality of the institute's work as a whole. The mastery of quantitative approaches is so important because quantitative approaches are receiving increasing attention in policy-making.

However, studies are often based on an inadequate methodological basis, whose evidence is accordingly disputed. Therefore the high quality of relevant research is crucial for the credibility of the entire field. Fraunhofer ISI, as one of the leading institutes in innovation research, has a particular responsibility in this field. In the present situation all research departments in Fraunhofer ISI have competences in the areas of innovation indicators and the required quantitative methods. They are frequently limited to the direct requirements of the individual project, however, so that thematic questions can also only be handled within a restricted spectrum. In individual cases this problem is solved by cooperation between different research departments. The existing potential can however be better exploited and further developed. Stock-taking revealed that many and diverse experiences in this context already exist in the institute. Now the task is to improve the co-ordination of these existing competences. They include:

- knowledge of indicators which are suitable to describe a certain question. Besides the usual innovation indicators such as expenditures on research and development, foreign trade with technology-intensive goods, patent applications etc., indicators to analyse specific fields such as traffic, energy, the environment or industrial production are applied.
- knowledge of data sources for indicators, for example where certain basic data are available in the latest and most com-

plete form. Beside works of reference, databases in particular belong in this category and the ability to extract the appropriate data from them.

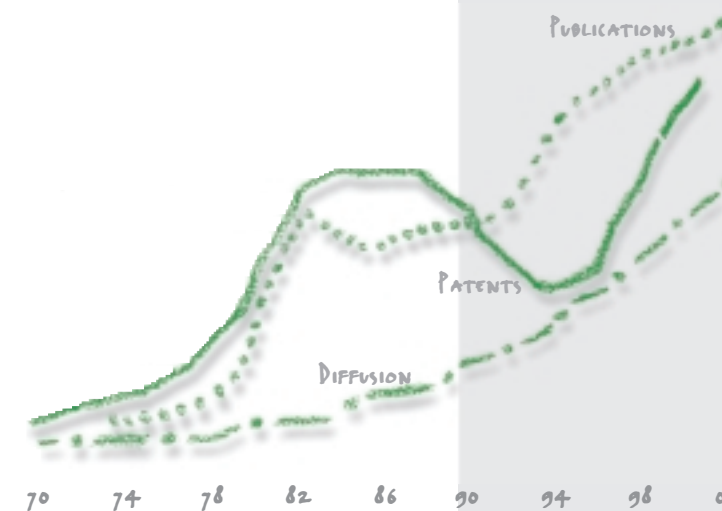
- selection of suitable indicators to describe the facts of the case. Often many indicators are utilised to analyse a situation without examining their suitability in detail, which can lead to errors in an evaluation with statistical methods. The quality of the analyses can be clearly improved by pre-selecting and examining appropriate indicators.
- design of indicators which are adapted to the problem in hand. In many cases the usual innovation indicators are not appropriate to analyse specific situations, so that it becomes necessary to design new indicators, based on databases, for instance.

· analysis with modern statistical methods. A suitable analysis requires mastery of advanced multivariate procedures with attention to data quality.

- advanced prognostic procedures. Indicator analyses are frequently utilised to prognosticate technical developments and the resulting impacts on the economy and society. Besides various forms of estimation, the solidity of the data basis is decisive. The planned taskforce will bundle the competences presently distributed over several work fields and thus strengthen the competitiveness of the institute.



PD Dr. Ulrich Schmoch, head of the ISI Taskforce "Innovation Indicators"



Innovations for sustainable Infrastructure Systems



Dr. Harald Hiessl,
head of the department
"Sustainability and Infra-
structures"

Infrastructure systems are the lifelines of our settlements and are absolutely vital for our societies. This is true for water supply and sewage disposal, for energy supply with electricity, gas or district heat and for roads and rail transport. Their core is formed by grid based and traditionally centralised systems. Especially in the water and energy sector, complex networks of pipes and transmission lines are used to transport supplies from centralised plants (e. g. potable water treatment, sewage treatment plants, power stations, gas production) to the consumers in a service area.

These infrastructure systems have a long technical lifespan and were never actually planned as total systems but have simply grown over the course of decades along with the settlements and the demands of the economy and households. Long-term demand forecasts for water, energy and transport were and still are an essential element of the extension of infrastructure systems. As revealed by a look at the past these forecasts are full of uncertainties. For example, uncertainties result from the constant technological progress or from changes in the basic institutional, especially legal, conditions.

The combination of high costs and the subadditivity of costs associated with the construction and extension of the grids result in monopolistic bottlenecks, which cannot be liberalised like other sectors open to competition, but must be regulated in one form or the other. Especially in the water sector, the lack of competition results in relatively high prices for the utility services. In the energy sector, there has recently been an even greater concentration of electricity suppliers and, in addition, there are difficulties for independent power producers to access the grid. The lack of competition and the enormous amounts of capital tied up in the infrastructure networks hardly offer suppliers, planners, equippers, authorities or R&D institutions incentives to develop and implement efficiency improvements by means of innovative technologies and services, let alone radically different alternati-

ves that do not conform with the existing network. As a consequence, innovations in such a context are incremental rather than radical or disruptive. Alongside the regulation of the economic sector, environmental regulations are also important.

The longer such infrastructure systems exist and evolve, the harder it becomes to part with the once chosen technological and institutional-organisational approach for the provision of the utility services. The main reason are the high investments made in the past (sunk costs). This is one aspect of path dependency and the lock-in-effect to which infrastructures are subject. Centralised, grid-based infrastructure systems have a series of characteristic problems:

Lifespan of infrastructure systems

1. Compared with the economic and technical lifespan of the water and/or energy using plants and devices of industrial and private consumers or of the corresponding in-house distribution grids, the "outdoor" part of the infrastructure grid under the utilities' responsibility has a considerably longer lifespan. The (water/energy) efficiency of the end-users' devices is continuously improving due to technical progress and due to the shorter reinvestment cycles; increasingly efficient devices are rapidly being applied leading to an increasing gap between the supply capacities of the grids and the quantities demanded by the users. Consequently, difficulties and disturbances in the operation of the grids may occur and technical incompatibilities between the inhouse and the outdoor parts are increasing.

2. Compared to the overall costs, the fixed costs (without depreciation) of grid-based infrastructure systems are very high (approx. 75 percent for water and sewage, approx. 90 percent for electricity and gas and approx. 85 percent for district heat). This reduces the capability of the utilities to respond quickly to changes in demand. A reduction in consumption (compared to the design capacity) thus requires an increase of the end consumer prices in order to cover fixed costs. Increasing con-

sumption results in a system overload and supply bottlenecks.

3. In order to maintain their effectiveness and operability, grid-based infrastructure systems have to be adapted to changing needs, demands and external conditions. The demand for the service may change with respect to the number of customers, the quantity, quality and time patterns of the demand. Other important drivers for change are climate change, economic development or behavioural changes of the customers. One example are the excess capacities of the water supply networks, sewage disposal systems or district heating systems in specific regions in East Germany resulting from the drop in resident population. This leads to technical and economic problems in the operation of the grids which can only be overcome by active deconstruction of the grids.

4. Due to their high investments and operating costs, centralised concepts are not suitable for developing countries. This is especially valid for developing countries with shortage of water and in rural areas. Here, decentralised systems can be employed advantageously at much lower specific costs.

5. As a consequence of changed regulative conditions (e.g. privatisation, deregulation, competition), there are hardly any incentives at present to invest in the maintenance and expansion of electricity networks. Either legal changes rewarding the modernisation of the grids, or a strategic shift towards more decentralised energy supply systems which reduce the dependence on regional grids are needed.

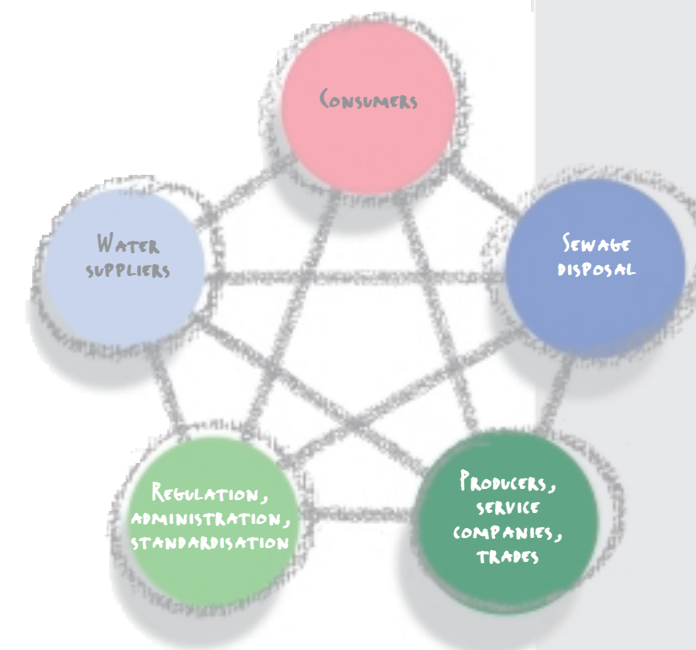
6. Technically centralised infrastructure systems rely on grids and are therefore highly vulnerable to natural disasters and terrorist attacks. Examples for such vulnerabilities include the disruption to the water supply and sewage disposal during the flood on the river Elbe in Germany in 2002 or the destruction of oil and gas pipelines and high-voltage lines by natural disasters or terrorist attacks.

New, highly efficient and cost effective technologies allowing for more decentrali-

sed concepts of the infrastructure service and reducing the need for extended grids offer an alternative to the conventional, centralised infrastructures. Special efforts are necessary to manage the transition from the existing to new system concepts. One such novel concept is the so-called "virtual power station". In this concept, mini and micro-scale combined heat and power systems are installed at the customers' premises and linked to the local grid. Operation and maintenance are provided in a centralised way by a utility.

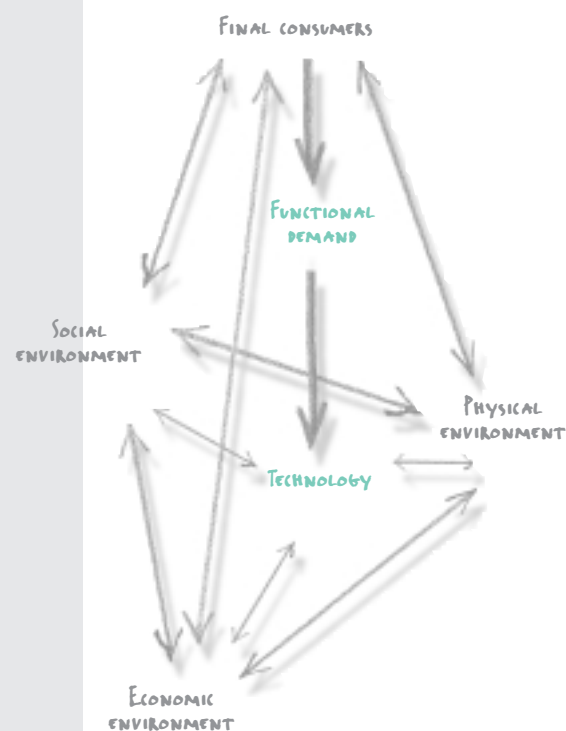
More challenges

Many more challenges have to be mastered before our infrastructure systems become more sustainable. For example, faced by the limits of natural deposits of phosphate ore, the recycling of phosphorous (as well as of other nutrients) contained in residential wastewater becomes an issue. Also the synergies between the infrastructure sectors (e. g. heat recovery from waste water, use of biogas from the waste water treatment) have cost-cutting potentials that need to be realised. This not only requires innovative technologies but also organisational-institutional innovations to a greater extent, ranging from new business models through economic and environmental regulations which promote innovations right up to supporting policy measures. Finally, the



implementation of the Millennium Development Goals gives the development of new markets in regions of growth such as China, India or Brazil additional significance. Consequently, many research questions arise owing to these challenges. The Fraunhofer ISI is contributing answers to these questions:

- ISI is analysing factors of influence and innovation processes in infrastructure. It links the special features of innovation dynamics in the field of sustainability with the specific sectoral, regional, technical, institutional and economic attributes of infrastructure systems. A very promising approach here is extending the heuristics of innovation systems to "sustainable infrastructure innovation systems".
- In the sense of a demand-oriented innovation policy, the transition from the existing to a new (for example more decentralised) system concept demands strategic niche and transition management which promotes learning effects. Market segments have to be identified which create the conditions necessary for the further development of technologies and of orga-



nisational concepts in the market and, at the same time, guarantee a variety of possible solutions without resulting in unacceptably high funding costs.

- New instruments and policy innovations are currently being introduced in both economic regulation and sustainable policy – from new forms of regulating grid access to environmental certificates. The interaction of different new policy instruments and forms of regulation with innovation processes has to be structured and evaluated and innovation-supporting measures have to be elaborated.
- Time plays a special role in answering the questions as to when it is most effective to introduce regulatory instruments are introduced most effectively and how long their use needs to be maintained in order to ensure effectiveness of the instruments on the one hand and not to waste resources on the other.
- Using scenario analyses, the ISI is analysing the direction, extent and pace of the long-term and complex transitional processes. Such analyses will increasingly be model based and take into account the behaviour of the stakeholders involved.
- Assessing the sustainability of such transitions will remain a key issue in the future. Alongside ecological evaluation, it will – in the sense of a comprehensive impact assessment – also have to take greater account of economic and social aspects. With their interdisciplinary competence in sustainability and innovation research as well as their sector-specific know-how, ISI's departments of Sustainability and Infrastructures and Energy Policy and Energy Systems are well prepared to tackle these issues. Developing models for comprehensive impact assessment and applying the innovation system approach to sustainability problems in infrastructure systems, they have the necessary methodological prerequisites to deal with the quantitative and qualitative issues involved. In this sense, the work on specific innovation processes in infrastructure systems is not only a distinct contribution to the basic topic of "Innovation" at ISI, but also an important contribution to applied research at the interface of policy, society, economy and science.

ISI closes Health Care Research Gap

There is a gap in health care services: on the one hand new technologies are constantly being developed, while on the other hand physicians and patients place an increasing demand for new therapies. Nonetheless, innovative treatment methods again and again fail to meet these demands.

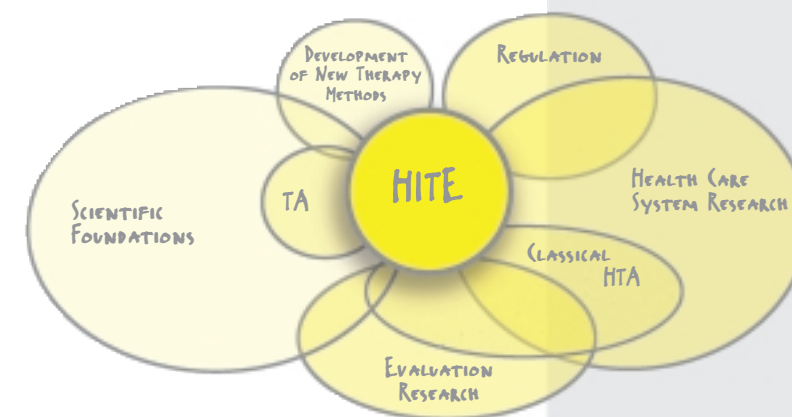
Research in health care provision concentrates on scientific and sociological foundations as well as pre-clinical and clinical research. A second area is health care system research, which investigates the health care system and the interaction of its component parts, including the basic regulatory prerequisites which are of great importance to the health care system. However, when viewed separately, the two research areas provide no insights into the potential future value of new technologies. The "innovation" component has thus been absent from health care research in the past.

This is the point of departure for HITE. The "Health Innovation TEchnology Assessment" combines the two aspects of health care research and constitutes a new approach, putting the Fraunhofer ISI at the forefront of national and international health care research. New research groups and expert conferences, primarily in foreign countries, attest to demand. In light of these needs, the European Union requested proposals for a project aimed at developing methods for evaluation of innovative technologies in health care services. In Germany as well, an increasing number of health care experts are demanding an assessment of how new treatment methods can be implemented in the most efficient manner. This is in particular in the context of major societal afflictions such as obesity, where conventional prevention measures have reached their limits. There is an enormous potential in national economy terms: Expenditures of approximately 225 billion euros in the German health care system are equivalent to around half of the federal budget.

The HITE idea is in good hands at ISI. In past years there have been a number of projects, including projects on new technologies such as stem cells and tissue engineering and on the standard of medical technology in Switzerland. Projects on systematic consideration have been focused e.g. on Germany as a pharmaceuticals innovation site and the efficiency of innovation policy in medical technology. As a part of strategic planning of research activities, this expertise is now being consolidated in HITE. This entails more comprehensive coverage of the innovation system "health" through appropriate methods and indicators. The HITE strategy provides for five steps:

1. Modification of the general innovation system approach to fit the health care system
2. Comparison with classic health technology assessment (HTA) approaches
3. Formulation of evaluation criteria and indicators
4. Testing of the indicators in case studies
5. Refinement of the evaluation criteria and their use

Later, Fraunhofer ISI plans an international workshop on the HITE approach and improved use of research. In the future the institute will be approaching potential customers, including manufacturers of medical technology, hospitals and ministries. Health insurers have already shown interest in the concept. Instead of short-term cost cutting, HITE is to shift the focus to aspects of comprehensive and innovation-oriented quality evaluation for new therapeutic strategies.



Dr. Bernhard Bührlen, head of the HITE project

The Future of the European Manufacturing Industry



Dr. Heidi Armbruster,
head of ManVis-project

Europe has set the goal of being the most competitive economy in the world by the year 2010. One of the strongest European economic sectors is the manufacturing industry, generating a total of 27 million jobs and realising value-added of more than 1300 billion euros. In order to develop strategies for maintaining and improving the competitive strength of the manufacturing industries in Europe, both industry and politics need a convincing vision of the future for the European manufacturing sector.

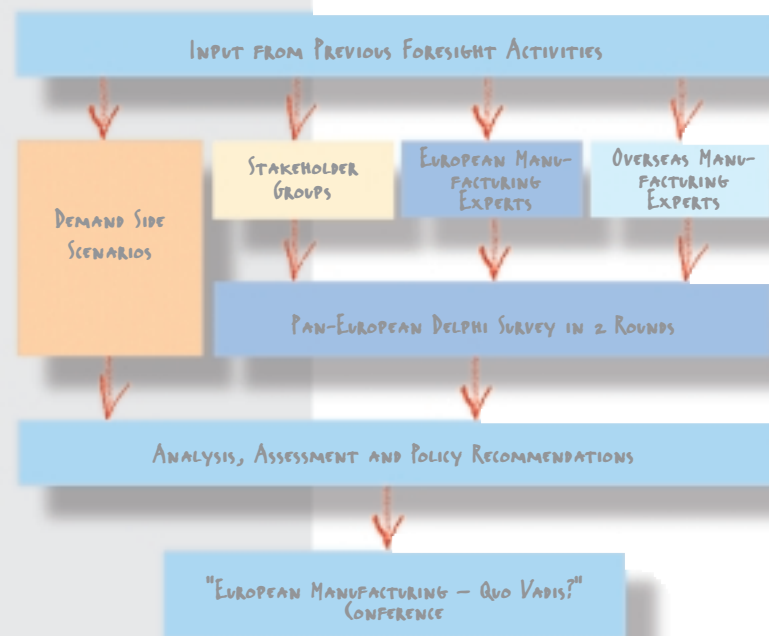
Manufacturing visions

This is the background for the "Manufacturing Visions" project (short: ManVis), coordinated by Fraunhofer ISI and financed by the European Commission's Directorate General for Research. The goal of the project was to develop innovative and creative visions for the European manufacturing industry for the upcoming decades. The ManVis consortium consisted of scientists from 31 research institutes in 22 European countries (Austria, Belgium, Bulgaria, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, the Netherlands, Norway, Poland, Romania,

Slovakia, Slovenia, Spain, Sweden, Turkey, the United Kingdom). In order to develop this vision of the future, workshops were held throughout Europe in all 22 partner countries with a total of over 300 manufacturing experts from industry, research and academia. The objective of these workshops was to generate statements about the future manufacturing sector which were then integrated in a widely deployed Delphi survey. The statements on the future of manufacturing covered all relevant areas of the manufacturing sector: manufacturing technologies, strategy, organisation and management, product features and concepts, logistics and supply chain, as well as working conditions. In addition, specific statements were developed for selected industry sectors and countries with the objective of capturing and analysing sector- and country specificities.

3,000 experts surveyed

In addition to European experts, additional stakeholders such as international manufacturing experts, consumers and users were included in the discussion process so that the most comprehensive and widely varied statements could be developed. Over 3,000 manufacturing experts from companies, political institutions and research facilities in 22 European countries participated in the subsequent Delphi surveys. The international project completion conference "European Manufacturing – Quo Vadis?", was held on October 24 and 25, 2005 in Bled, Slovenia, to present and discuss the results of the ManVis project. The conference's primary objective was to reflect on the formulated development trends and visions with manufacturing experts of different national and career backgrounds in a joint session. Discussions covered results and visions as well as paths towards the long-term security of the manufacturing industry in Europe. The results of the project will be integrated in the Seventh Framework Programme as well as in the ManuFuture initiative, the technology platform of the European manufacturing industry. A total of approximately 180 representatives from



industry and academia as well as from European and national political institutions involved in the manufacturing industry participated in the conference.

The manufacturing experts saw a major chance to increase the competitive strength of the European manufacturing sector in the use of demanding and highly developed manufacturing technologies. This will require the systematic enhancement and wide-scale practical application of modern manufacturing techniques such as the implementation of micro systems technologies, of intelligent materials and of nano- and biotechnologies. In the opinion of the experts, however, this vision of European market leadership in the use of highly developed manufacturing technologies will not lead to the creation of new jobs. The loss of jobs due to manufacturing relocation to non-European countries may grow into the largest risk for the future of the European manufacturing sector, according to the experts. Relocation of manufacturing locations has up to now taken place primarily in Europe, but in the foreseeable future the eastern European countries will no longer be able to withstand international price pressure either, the experts say.

Search for global solutions

According to the manufacturing experts, the competitive advantages for the European manufacturing sector are no longer to be found exclusively in the quality of manufacturing, but rather in the use of new manufacturing technologies which increase productivity, in the expansion of sustainable products, materials and business models and in an expanded range of product-related services. If it is possible to successfully follow this path to global solutions for the customer which are innovative and at the same time efficiently realised, qualified industrial activities could remain anchored in Europe and could even be extended in certain areas.

Holistic approach

In contrast to previous national and international studies on the manufacturing industry, based mostly on individual aspects

of the manufacturing sector such as technology development or materials research, ManVis aimed to develop holistic visions of the future of manufacturing. The declared objective was not to limit considerations of the future of manufacturing to individual topics, but rather to examine the widest possible spectrum of content from various research perspectives and from different interest representatives. It was possible to address and successfully complete the tasks posed in ManVis thanks to the interdisciplinary orientation of ISI. Ultimately ISI was able to draw on long years of experience in foresight analysis and a tight network of contacts with research facilities in the area of manufacturing research throughout Europe, and together with its consortium was chosen for the project over other competitors.

Valuable contacts

In the ManVis project, ISI established valuable contacts with manufacturing experts throughout Europe. Although ISI already had excellent relationships with European research institutes, in the course of ManVis this group was expanded to include manufacturing experts from industry as well as political decision makers at national and international levels. In particular, relationships with representatives of industry, politicians and scientists from eastern European countries were established and expanded. Through the European project ManVis, ISI also achieved increased awareness among international agents as a research institute with comprehensive competence in the areas of international manufacturing innovation studies and foresight studies. The European Delphi data as well as the individual Delphi data from the participating countries will be used in support of project acquisition at both the national and international levels. ManVis was a large and demanding project, but was also highly multifaceted and well worth the effort which was of value in promoting ISI's internationalisation strategy.

Innovation Systems and Policy



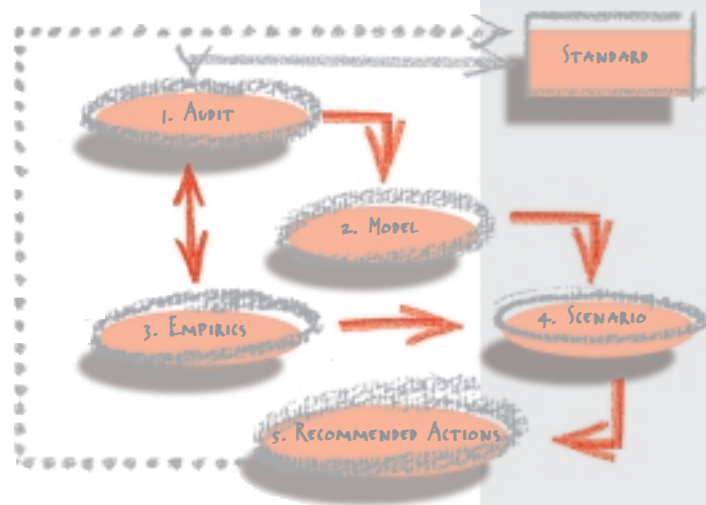
What standards achieve

Why does a screw fit into a nut and why can a music CD be played in every CD player? Answer: because there are standards which regulate the interplay of technologies, today even across continents. Enterprises save costs as a result, in the case of international standards because of the lower expense of adapting a product to different national markets. But standards have even more far-reaching consequences. The project "Networking Organisations – Research into Standards and Standardisation" (NO-REST) for the EU Commission, which deals in particular with standards in information technologies, should clarify what these consequences are. Three European research institutions,

three universities and the standardisation organisation ETSI (European Telecommunications Standards Institute) are participating in NO-REST. Fraunhofer ISI's task was to determine the impacts of standards. In a first step, a general concept was developed together with the partners (see figure), which besides stocktaking the state-of-the-art contains future-oriented elements like scenarios. As up to now only little methodological findings on measuring the impacts of standards exist, several methods were applied in order to measure the influence of standards most comprehensively. Among others, surveys were conducted among the members of various standardisation institutions, as well as a Delphi survey which aimed to plumb the future need for standards.

The survey took also into account that in the IT sector standards established by industrial consortia compete with official standards drawn up by the standardisation organisations. Further, there are also proprietary standards of individual enterprises. These have little positive influence on the development of markets according to the survey participants, the ISI experts found. The survey results reveal that standards are necessary to prevent frictional losses in a globalised economy. They structure markets and lead to new relationships and actors in the added value chain. This is no longer restricted to industrial production, but expands to the whole added value chain, from research and development via design up to sales and marketing.

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Understanding scientific creativity

Where and under which conditions do the most creative scientists carry out research in the fields of nanotechnology and human genetics? Researchers at Fraunhofer ISI conducted a written survey among several hundred scientists, industrial researchers, journal editors and programme managers in Europe and the USA. At present they are interviewing in depth numerous scientists at selected research institutes. The CREA Study (Creative Capabilities and the Promotion of Highly Innovative Research), funded by the NEST Programme (New Emerging Science and Technology) of the EU Commission, is designed to compare USA and Europe and should clarify which organisational and institutional framework conditions lead to creative research performance. In contrast to earlier investigations, this study does not examine so much the creativity of individual persons, but concentrates for example on interdisciplinarity, research management or financing modes.

The experts from Fraunhofer ISI, the Technology Policy and Assessment Center at the Georgia Institute of Technology, USA, and the Science and Technology Policy Research Unit at the University of Sussex in the United Kingdom want to derive recommendations from this study on how to promote creative and innovative research and how research institutions can be best organised. They are also hoping for explanations about the differences in the promotion of and rewards for creativity in the American and European research systems.

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Standard for research performance

How does one measure the quality of research? More and more scientific organisations are asking themselves this question, as they want to deploy their funds where most returns for their money can be expected. The most popular evaluation criteria are the amount of third party funding or the number of publications. But that is too short-sighted, as Fraunhofer ISI discovered in a project on behalf of the Deutsche Forschungsgemeinschaft. If research performance is to be judged fairly, then more indicators are needed – the institute has found about 30, among them the frequency of cooperations, foreign scholarships and many more.

The most important result is that the importance of indicators varies according to the subject field. ISI examined the fields of microeconomics, astrophysics and nanotechnology as examples and determined that criteria such as third party funding or size of the working groups differ greatly from field to field. The connections between input and output appeared different in every case. ISI therefore recommends to differentiate according to subject fields and to measure the performance of a working group only against the reference data for the same field. From the analyses it also appears that third party funding can be applied as a performance indicator only to a limited extent. ISI would like to extend the data sets in future so that all German universities and scientific organisations are able to evaluate their research performance in all fields.

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International research and research policy

The internationalisation of research and science is proceeding. Multinational firms conduct research in foreign markets or global pockets of excellence. Simultaneously, publicly funded research is becoming international, both on an individual and on an institutional level. Both developments impinge upon research and innovation policy.

Two current projects deal with these questions. In a workshop project within the PRIME Network of Excellency, conceptual and empirical studies were discussed, with the main focus on the impacts on policy. The results of this workshop will appear shortly in a special edition of the Journal of Technology Transfer.

The aim of a study on behalf of the Federal German Ministry for Education and Research (BMBF) launched in October 2005 is to analyse and assess goals, measures, successes and obstacles as regards the internationalisation of the German research landscape. This includes international activities of individual researchers and institutes, of large scientific organisations, of brokering and sponsoring organisations, as well as policy-making itself. The study will not only analyse individual strategies, but also their deliberate or unintentional interplay. Finally, recommendations for action for German research policy will be derived from the results.

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"Software Patents"
 by Knut Blind, Jakob Edler and Michael Friedewald, published by Edward Elgar



For further projects, see p. 32

Regions and Market Dynamics

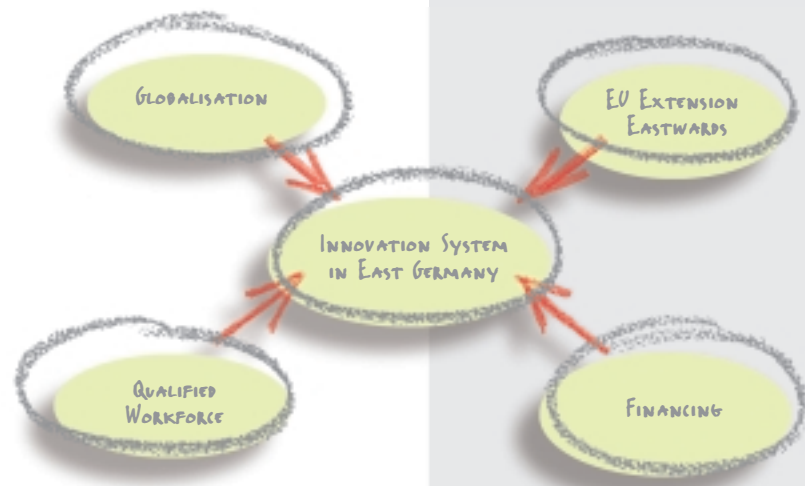


Innovation policy in the new federal states

Since the unification of Germany, many billion Euros have been spent in strengthening the innovative capability of East Germany – apparently without decisive success. On behalf of the Federal German Ministry for Traffic, Construction and Town Planning, which is responsible for the future development of East Germany, Fraunhofer ISI investigated what progress innovation policy has made in the new Länder and where there is still catching to do. With this end in view, stock was taken of the promotional measures utilised till now and their impacts. The result gives cause for optimism. Even although the "jungle" of promotional programmes offered by federal government and Länder ministries and other sponsors is almost impenetrable to lay persons, the

individual measures are judged positively by the beneficiaries, on the whole. The programmes thus have the desired effect. However, innovation activity up till now has been borne for too long by the state. Half of the R&D expenditures in East Germany are from public funds – in the west, the state contributes less than a third towards R&D financing, the enterprises here are responsible for more than two thirds. At the same time, 85 percent of all East German enterprises which conduct research and development receive money from the state, while in the west only one third of enterprises receive support. Programmes promoting innovation networks have proved their worth. But the networks are not always as productive as they might be.

In the opinion of the ISI experts, innovation efficiency in the new federal states is not what it could be, that is the transfer of innovations into concrete products and their marketing. Smaller companies are at a disadvantage here anyway – a problem which can hardly be solved by innovation policy. ISI therefore proposes to examine the subject marketing closely in further studies and develop strategies for more efficiency, for instance by means of improved coordination of innovation policy at the government and federal state level. Publicity-catching competitions often serve here as a detonator. On the whole, however, it is apparent that innovation policy cannot work fast miracles: promotional measures are most efficient where they can dock onto existing potentials. Long time horizons are necessary for sustainable structural change. Contact: Prof. Knut Koschatzky (-184, knut.koschatzky@isi.fraunhofer.de)



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Modest founders

Company spin-offs from universities or research organisations such as the Fraunhofer or Max Planck Societies are regarded as particularly innovative and can supposedly transform knowledge and technology directly into products and services for the market. They are accordingly intensely promoted. A focal study by Fraunhofer ISI contained in the annual report of the BMBF on Germany's technological performance arrives at a different result: in 20 case studies of academic spin-offs – ten in East and ten in West Germany – the ISI experts found many successful start-ups, but only a few which are capable of making a substantial contribution to the rapid modernisation of the industrial structure in Germany. In interviews with founders, investors, business consultants or with representatives of the scientific organisations, the ISI researchers looked for criteria for the success and failure of such spin-offs. Strikingly, the founders themselves often have demanding technological goals, but usually very modest financial ones. They are striving for manageable entrepreneurial

units with slow but robust growth, and often attempt to get by without venture capital or bank loans. The company founders – as a rule top-notch scientists or engineers – also have little know-how in business administration and marketing and frequently develop realistic business and market strategies only at a very much later stage. The technology and knowledge transfer via academic spin-offs is therefore not nearly as effective as policy-makers had hoped. Often the scientists start off without a concrete product idea or with a product not nearly mature enough for the market, or which is not accepted by the market. Some founders operate their company as if it were an extension of their previous scientific environment. Promotional policy should take the mentality and the goals of the German scientific founders more into consideration in future, the ISI experts find. Instead of always expecting rapidly growing start-ups, cautious but sustainable enterprise strategies should also be supported. However, other financing and promotional concepts are required to achieve this.

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Promotion pays

Since June 2004, Fraunhofer ISI has been examining the impact of the programme Innovation Competence of SMEs (PRO INNO) which aims to strengthen the innovative capabilities of small and medium-sized enterprises. An evaluation should now show how sustained the effect of the innovation project was. In order to find out, ISI evaluated 613 project final reports and conducted a written survey which resulted in an outstandingly high response rate of 66 percent and data from 1,283 programme beneficiaries. The results are positive: the supported firms maintained their activities in research and development at a constant level and further improved their technological lead. Innovation management was improved, cooperations ran more smoothly. On average 4.5 jobs were secured or newly created per project, of which 1.1 were in the R&D area. Every promotional euro generated 6.70 euro turnover, whereby the larger SMEs profited more than the smallest firms. Marketing competences could still be improved. Contact: Dr. Marianne Kulicke (-137, marianne.kulicke@isi.fraunhofer.de)

New markets for Baden-Württemberg

Information and communication technology is a driving force for innovations and new markets in Baden-Württemberg. The research project FAZIT investigates the future development of technology and applications and which markets will emerge and will be affected. Fraunhofer ISI is responsible for the foresight process within the project and will demonstrate future trends up to the year 2020, based on Delphi studies, a scenario analysis and a roadmap. Project partners are the MFG Foundation Baden-Württemberg (main contractor) and the Centre for European Economic Research (ZEW) in Mannheim. In October 2005 Fraunhofer ISI organised a conference on the subject "Best Ager in the Information Society", during which experts discussed exciting questions on the internet acceptance by and its user-friendliness for senior citizens. From 2006 in-depth studies on future topics will be drawn up. E-business, social software in marketing and IT-aided health services, for example, are among these topics. Contact: Dr. Simone Kimpeler (-318, simone.kimpeler@isi.fraunhofer.de)



„Den Wandel gestalten“, Untersuchung der Wirksamkeit von PRO INNO® und „Innovationspolitik in den neuen Ländern“ – all published in the ISI series „Innovationspotenziale“



Industrial and Service Innovations



New business models for mechanical engineering

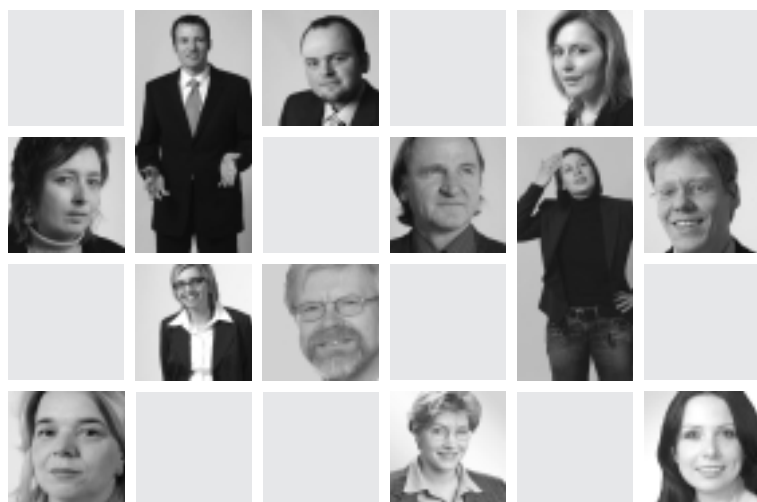
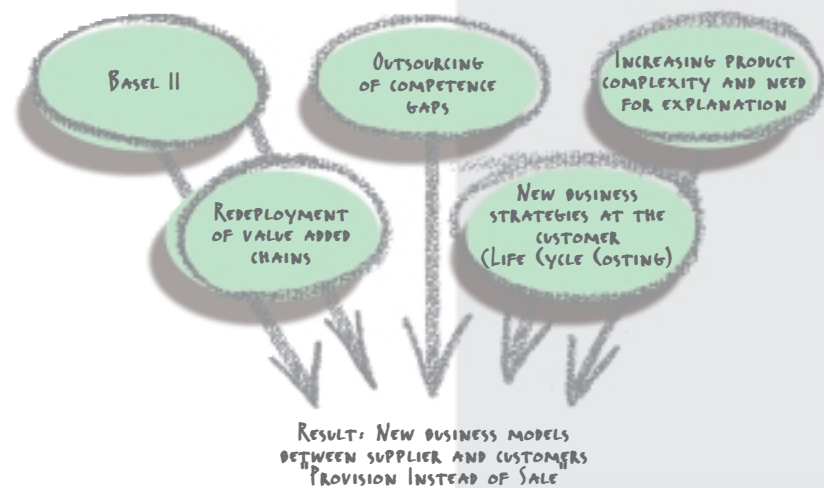
In mechanical engineering, product-related services are developing into independent business segments at an increasing rate. The most advanced state occurs with business models in which mechanical engineering companies operate their products for the customer under their own authority – so-called build-operate-own models. Demand for this business concept is particularly high in the automotive industry, being primarily interested in shifting risks. It is thus not surprising that mechanical engineering firms tend to be hesitant about build-operate-own model strategies, a position which may however result in missed competitive opportunities. In 2005 Fraunhofer ISI initiated several projects aimed at finding out where and how mechanical engineering companies

could implement a build-operate-own model:
NEXT Supported by the EU, research institutes from a number of countries are working together with the European Machine Tool Builders' Association on concepts for the machine tool of the future. ISI's role is to develop new business models and to investigate these models' feasibility.
DEXINPRO Here Fraunhofer ISI has joined forces with three German companies and, with the support of the German Federal Ministry of Education and Research, is developing business models facilitating the export of product-associated services, even as far as the build-operate-own model. This will help to improve the foreign trade balance in the service sector.

SMErobot This EU project is aimed at promoting the use of robots in small and medium-sized enterprises (SMEs) by developing cost-efficient, modular and interactive robot concepts. SMEs are less likely to use robots because the complexity involved is too great. The ISI investigation will answer the question of whether new business models could change this, for example when the robot manufacturers operate their robots at small and medium-sized customers.

LOMO Supported by the German Federal Ministry of Education and Research, in this project ISI is working together with three assembly system manufacturers, two of their customers and an engineering firm to investigate assembly system concepts suitable for build-operate-own models. Optimisation of lifecycle costs plays an important role, entailing reductions in consumption and improving reusability of components. This will also have a positive impact on the level of sustainability.

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 Not in photograph: Monika Mühlberg, Christoph Zanker

How innovative is your company?

When faced with the task of evaluating their ability to innovate, small and medium-sized enterprises in particular are dependent on assumptions. Banks would also like to know just how innovative a business is before approving a loan. A measurement technique for evaluating the ability of SMEs to innovate is the goal of the project InnoKMU (Procedures for Evaluating and Increasing the Ability of Small and Medium-Sized Manufacturers to Innovate), sponsored by the German Federal Ministry of Education and Research. Here Fraunhofer ISI has joined the Fraunhofer IAO in taking over scientific supervision. Plans include an Internet page with a self-test that companies can use to evaluate and rate themselves amongst similar enterprises. Based on the results, the participants receive

recommendations for targeted increases in innovation strength. Besides product, process and service innovations, organisational innovations play a role.

In the EU project PORCH Fraunhofer ISI is already working on the key question of how to measure and evaluate such changes. Practical realisation of modernisation concepts is the focus of the German Federal Ministry of Education and Research project IMPROVE. Small and medium-sized companies in particular often tamper with their organisational weak points, pursuing isolated solutions such as groupwork or Total Quality Management. Integrated concepts of the sort found in larger companies are too difficult for them. Fraunhofer ISI and its partners are formulating pilot projects and instruments to support companies in the analysis and realisation of organisational modernisation.
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"Arbeit in neuen Unternehmensstrukturen", published in the ISI series "Innovationspotenziale"

Time consumers slowing innovation

Innovation takes time – sometimes so much time that the opportunity to successfully launch a product in the market is missed. On behalf of the Fraunhofer Society, eight Fraunhofer Institutes have investigated where in the innovation process time traps may hide and how the Fraunhofer Society can help its customers avoid these traps and accelerate innovation. Fraunhofer ISI surveyed companies in the metal and electronics industries regarding their innovation processes, with the intent of identifying recurring time consumers. The most frequently cited hurdles were problems in innovation management. Above all, unclear objectives at project start and unclear product specifications led to market launch delays. Reports of difficulties with project partners were relatively rare, but when such friction occurred it had a particularly negative effect. An average of around 40 percent of development time could be saved here, according to ISI expert estimates.

It also became evident that innovation dynamics have not increased over recent years, despite frequent reports of shortened product cycles. Thus, just as before, small companies need an average of 12 months from the start of a development project until market launch, with a typically higher degree of complexity resulting in times of up to 20 months for large companies.
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Offshoring with a return ticket

Why are companies shifting parts of their production abroad? The usual reply points to lower wage costs. In a study on behalf of the German Federal Ministry of Finance, the Fraunhofer ISI was able to show that other motives such as active market acquisition or proximity to key customers are also important factors in the decision to shift production abroad. The question of repatriation of production activities was also evaluated by using data from the study "Innovation in Production". The result: One out of every four to five companies shifting production abroad returns activities to the home country within two years. Furthermore it was shown that relocations motivated by cost concerns fail more often than shifts which are driven by market factors. Not only are market-driven relocations more successful, they also do not result in loss of jobs at the German home site. In recent years the topic of production relocation has been expanded at the Fraunhofer ISI into an entire project family. The latest addition is a project for the Hans Böckler Foundation in which the ISI is developing an assessment tool specifically for automobile component suppliers, making it possible to estimate the opportunities and risks of relocation activities. The tool will be made available to corporate management and employee representatives in mid-2006.

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For further projects, see p. 33

Emerging Technologies

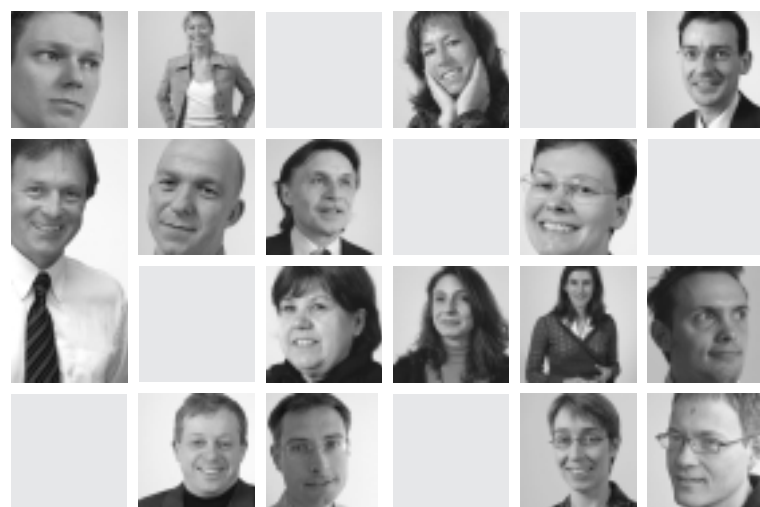
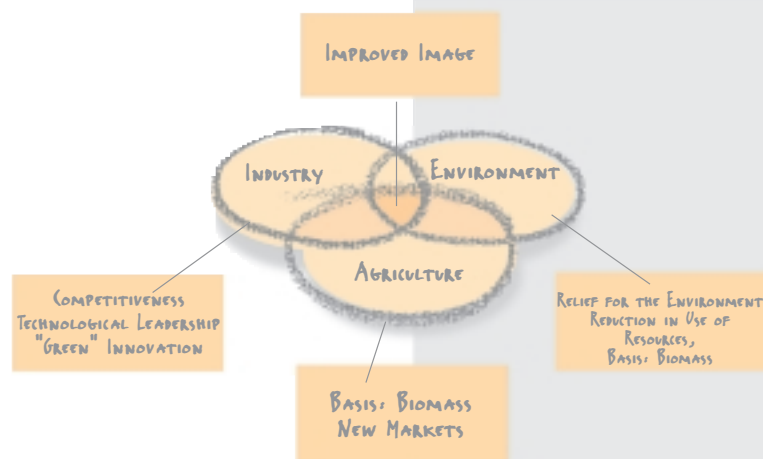


Nature as a chemical plant

Every day we hear about topics like pollution, climate change and dwindling natural resources and the resulting burdens being passed on to future generations. The sustainable deployment of industrial processes takes on particular importance in light of rising oil prices and increasingly stringent environmental regulations. Many chemicals can also be produced in biological processes using optimised enzymes or microorganisms. Reductions in use of resources also make it possible to cut costs for material, water and energy while reducing negative impacts on the environment. Renewable resources can be transla-

ted into bioenergy and biofuels, as well as producing new synthetic materials, medications and cosmetics. New developments and applications of industrial White Biotechnology therefore generate an enormous economic and ecological potential in the form of new and improved products, processes and services. This creates new jobs and helps to secure existing jobs. Seven Fraunhofer Institutes, led by the Fraunhofer ISI, are exploring the actual extent of the innovation, growth and employment potentials of this so-called industrial White Biotechnology. The German Federal Ministry of Education and Research is awaiting results from the study "Analysis of White Biotechnology Potentials" which will direct the future orientation of research activities in this field. The final report is expected in Autumn 2006. The systems innovation approach is to illustrate whether or not these potentials can be exploited: Location advantages and obstacles to innovation in Germany such as lack of expert staff, regulatory hurdles and scarce risk capital are being investigated. ISI researchers are using written surveys, interviews with experts from research, industry and political sectors as well as database analyses to investigate the potentials of White Biotechnology. The issue of whether biotechnology can develop new processes, products and services or will simply replace existing technologies will be the deciding factor in generating new jobs.

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Support for virtual companies

Small companies often need to rely on partnerships when tackling major projects. Communication via the Internet continues to gain in importance for the success of these collaborating companies. The VirtUSO project, sponsored by the German Federal Ministry of Education and Research (BMBF), is investigating the effects of so-called soft factors such as honesty and trust, different cultures and conflict resolution can have on virtual corporate organisations. Based on the project, Fraunhofer ISI and its partners have formulated a functional specification for a web-based communication platform which takes these soft factors into account. The open source software is currently being realised together with the partners and provides conventional functions such as contact lists, calendars and e-mail, as well as tools for time recording, knowledge management and e-learning which were previously not available in this combination and degree of complexity.

A further VirtUSO objective is to introduce the advantages of virtual corporate complexes, especially to the small businesses that are dependent on cooperation partners. For this purpose Fraunhofer ISI is working together with the University of Hohenheim and other partners to develop consulting modules for information and qualification workshops for small start-up companies. Information: www.virtuso.de
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Small is beautiful

Nanotechnology is regarded as a key technology of the future. The Austrian Federal Ministry of Transportation, Innovation and Technology (Bundesministerium für Verkehr, Innovation und Technologie) wanted to know whether a small country such as Austria would be able to hold its own against major competitors and asked Fraunhofer ISI to investigate the local national status and perspectives of nanoresearch. In terms of absolute numbers, the research sector in Austria is small, but includes several institutions and researchers of international renown, in particular in the fields of semi-conductor electronics. In nano-life sciences Austria lacks the major corporate entities found in Switzerland or Germany. It is noteworthy that nanoresearch is strong at the universities, but that these activities are only rarely integrated with industry and in particular with medium-sized business. In international comparison, the relatively small num-

ber of Austrian patents is also remarkable. Many Austrian companies complain that they have no chance in competition for patents abroad against multinational concerns. ISI therefore recommends a focus on support for research towards the goal of reinforcing the strengths of Austrian nanotechnology and acquiring new fields working jointly with all involved parties. Promotion will be necessary especially for young companies and for raising the interest of medium-sized business in nanotechnology.
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Four in one

Nanotechnology, biology, information technology and cognitive sciences – in the past, these were separate disciplines. But these technologies appear to be drawing closer to one another, even converging. On behalf of the EU Commission, Fraunhofer ISI is investigating how far along this convergence is and where deficiencies can be seen. Partners in the project "Converging Technologies and Their Impact on Social Sciences and Humanities" include the ITAS at the research centre Forschungszentrum Karlsruhe as well as the École normale supérieure in Paris and Oxford University.

The convergence of the disciplines mentioned is expected to result in progress in various application fields, for example in visualisation of thought, the man-machine interface, and for the "Cyber Soldier". The trend originated in the USA, where the discussion is driven by an unbowed faith in progress. Europe, on the other hand, is more oriented towards the cooperative development of technology and society. The goal of the project is therefore to find a European path through the "Converging Technologies". The partners are to formulate suggestions regarding which research questions are relevant and what contribution can be made by the humanities and social sciences. The objective is to propose a European research agenda in support of these developments. Plans for the two-year project include events at which representatives of the natural sciences and engineering, humanities and social sciences meet to look beyond the horizons of their own respective fields. This is a part of the EU strategy for reinforcing the humanities and social sciences in the upcoming seventh Framework Programme for research.
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New publications in the ISI book series (above). Below: "Changing Innovation in the Pharmaceutical Industry" (Springer), "The Future of the German Cable Television Network" ("Die Zukunft des deutschen Kabelfernsehnetzes") (Physica)



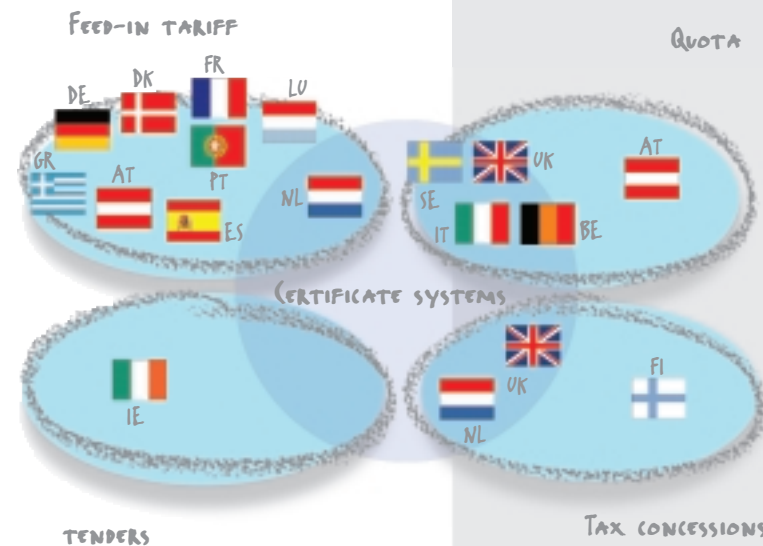
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Energy Policy and Energy Systems



The right way to promote renewable energies

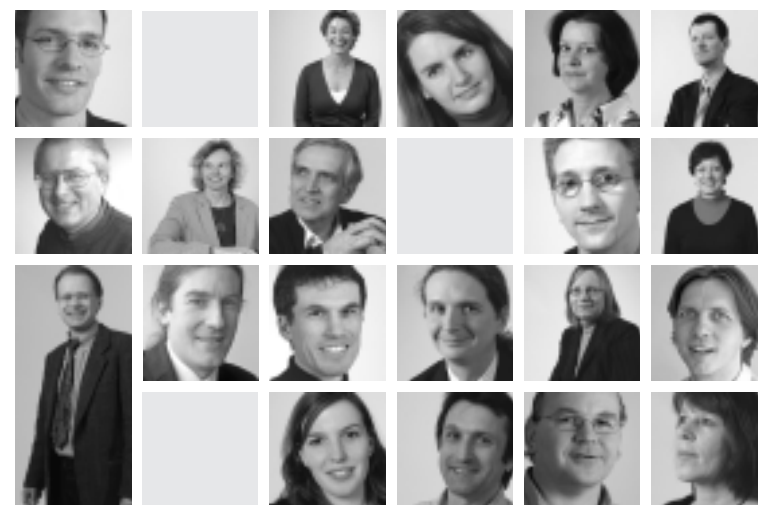
Renewable energies should be increased in the electricity sector – up to 21 per cent by 2010. This is the target set by the European Union. It is up to the Member States to select the instruments to achieve this which is why a wide range of national support measures exist in Europe. The dominant measures to develop renewable energies for electricity generation are fixed feed-in payments for power from renewable energy sources on the one hand and quota models based on tradable green certificates on the other. These two support systems have principal differences



in their effectiveness, economic efficiency, long-term innovation effects as well as with regard to the possibilities of cross-national harmonization and coordination. On behalf of the European Commission, the Fraunhofer ISI analysed the success achieved to date of the various support instruments in the Member States of the EU. It became clear that the most effective measures are frequently also the most cost-efficient. Countries like Spain, Germany and Denmark have managed to achieve high growth rates in wind energy at comparatively moderate funding by guaranteeing investors long-term security through fixed-feed in payments. At the same time, the policy pursued in these countries is the main driving force for technological innovation and falling costs. The results of the study were incorporated in the communication of the EU Commission and make it clear that the market growth of renewable electricity is not solely determined by the level of payments. Other factors are also influential such as the stability of the promotion instrument, the risk for investors and non-economic barriers.

Guaranteed feed-in payments have proven to be a successful instrument for promoting renewable energy sources in the electricity sector, especially with regard to economic efficiency. Quota systems, in contrast, still have to prove their feasibility in practice.

Before support systems are harmonized on the EU level, the opportunities and risks of individual policies should be analysed using real market experience in order to ensure the growth of the still young sector of renewable energies in the long term. Contact: Dr. Mario Ragwitz (-157, mario.ragwitz@isi.fraunhofer.de)



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Energy research quo vadis?

When short of funds, the public sector tends to ask whether and how the efficiency of research can be increased. The Federal Ministry of Economics commissioned the Fraunhofer ISI to have a closer look at the funding of energy research in Germany using the most recent methods of innovation research. Instead of taking only technical feasibility and energy-economic significance as assessment criteria, the ISI is to enlist other well-founded indices which minimize risks and improve the decision basis and efficiency. The project, called EduaR&D (Energy Data with Analysis R&D), was initiated in 2005. The Institute looked at four energy technologies and assessed each one's stage of innovation and who the active players are in the respective fields of research and market diffusion.

While industrial furnaces have to sell themselves on international markets and use new improvements to do so, fuel cells are still waiting for their breakthrough

Transparent electricity market

The frame conditions of the German electricity market have changed dramatically due to the liberalisation of the markets, the European CO₂ emissions trading system and the promotion of renewable energy sources. The question for policy is how to improve the interaction of power markets and policy instruments. Agent-based simulation opens up new possibilities to depict the complex interaction of the different players on a computer. In a project sponsored by the Volkswagen-Foundation, the Fraunhofer ISI together with the University of Karlsruhe developed a computer model of the German electricity market, which spotlighted the European CO₂ emissions trading system and the promotion of renewable energy sources in particular. The ISI concentrated on the price development on the end customer market and the integration of fluctuating supply from renewable energy sources in the power markets. The aim is to examine how a more efficient integration of renewables can be achieved by modifying market mechanisms and promotion regulations. Price increases on the consumer market can also be explained in this way.

Contact: Dr. Mario Ragwitz (-157, mario.ragwitz@isi.fraunhofer.de)

due to technical and cost reasons. Ranked in-between these are carbon dioxide capture and separation in fossil-fuelled power stations and energy-saving passive houses. The former is being pushed internationally and depends on future energy and climate policy decisions, the latter is only popular in a few European countries, including Germany, and represents more regional innovation markets.

An international workshop took place in February 2006 where initial results were presented and discussed. Whether the efficiency of energy research can really be improved is still unclear. However, it is apparent that the ISI's new approach permits statements to be made about which kind of support is appropriate for which phase of technology development. In this way, errors can be avoided such as, for example, the promotion of low temperature fuel cells to market introduction a few years ago when fundamental technical questions of the membranes were still unresolved.

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New rules for emissions trading

Around 1200 companies in Germany with a total of 1849 installations have been taking part in the EU emissions trading scheme since January 2005. The total amount of allowances and the rules for allocating these to existing and new installations are laid down in a so-called national allocation plan. The Fraunhofer ISI already acted as an advisor to the Federal Ministry for the Environment in setting up the plan for the ongoing trading period (2005 to 2007). For the second trading period (2008 to 2012), ISI researchers are currently working on concepts which allocate some of the allowances via an auction process. The allocation of allowances based on set emission values, so called benchmarks, is also being examined.

In a study for the Büro für Technikfolgen-Abschätzung beim Deutschen Bundestag (TAB) (Office of Technology Assessment at the German Parliament), the ISI showed to what extent the concrete rules can have an impact on the demand for innovative technologies, especially for production-related innovations. Comparing the allocation regulations in the EU Member States shows that some – but not all – of the German Allocation Plan's regulations for the first trading period are among the more innovation friendly ones.

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"Analyses of the EU renewable energy sources' evolution up to 2020" by Mario Ragwitz and Joachim Schleich



For further projects, see p. 34

Sustainability and Infrastructures

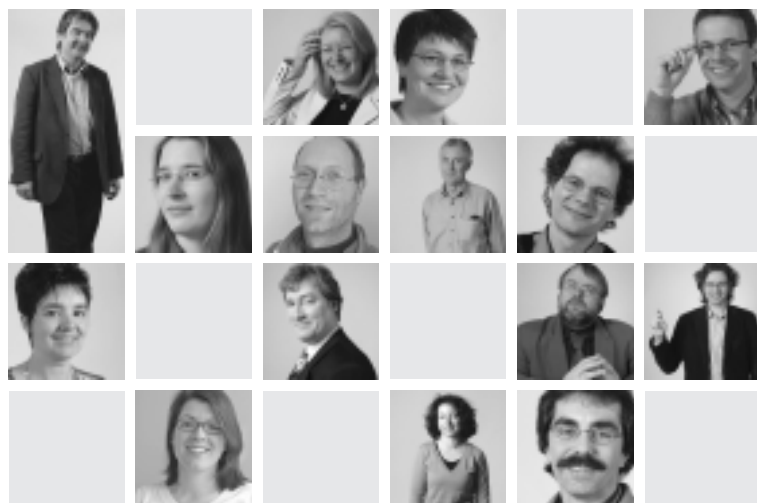
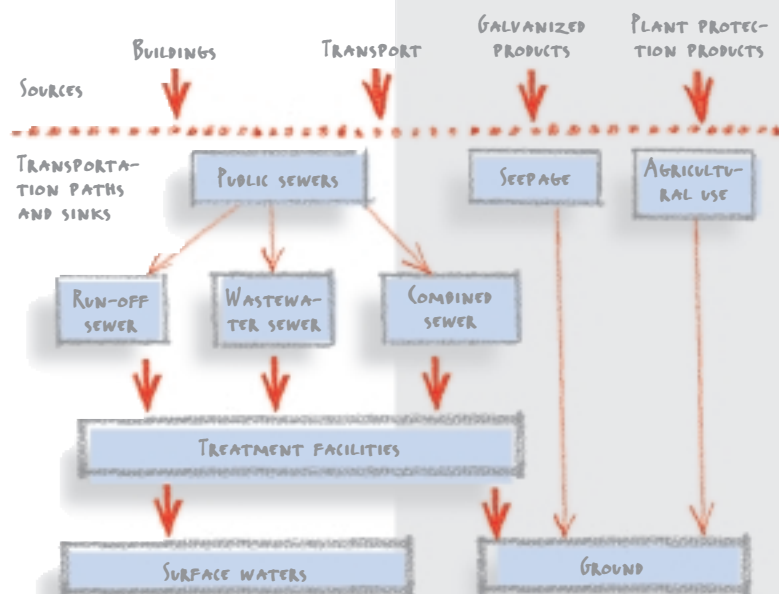


Heavy metals from buildings and traffic

German rivers and lakes are cleaner than before; the discharges of numerous pollutants have been clearly reduced. However, one notable exception is the contamination due to the heavy metals copper, zinc and lead which has not been able to be cut in the past few years. The targets for copper and zinc are being exceeded at more than 50 per cent of the measuring points. These heavy metals can damage sensitive plants and animals in water. The Federal Environmental Agency charged the Fraunhofer ISI with discover-

ing the causes for this high pollutant load and what steps can be taken against this. An important share of the emissions of heavy metals to water stems from the construction industry – 480 tonnes of zinc and 59 tonnes of copper are emitted here each year. Today, architects and building owners are using more and more copper guttering and facades and covering roofs with metal plates made of galvanized steel – partly for optical design reasons. Based on the results of the study, the Federal Environmental Agency has published a guideline to generate awareness among architects and building owners about using more environmentally-friendly materials. As well as promoting doing without large metal areas in roofs and guttering, the guideline also cites alternatives to reduce the emissions of heavy metals. For example, tin-plated sheet copper, aluminium sheets or stainless steel can now be used for numerous applications or filters can be incorporated into downpipes. Whereas the problem of heavy metals in buildings has been known for a while, the ISI study also highlighted road traffic for the first time. Every year 932 tonnes of copper, 2078 tonnes of zinc and 80 tonnes of lead are emitted here to the environment. The use of lead balancing weights in tyres is now no longer permitted. However, there is greater environmental pollution from brake pads. They contain copper which is discharged as a result of abrasion during braking. Brake pads without heavy metals are already being used in the replacement parts market but have not yet managed to become accepted as part of the original equipment of new vehicles.

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Kyoto in practice

Allowances for companies participating in the EU wide emissions trading, which started operation in January 2005, currently cost between 20 and 30 Euro per tonne of carbon dioxide. The price on the market for emission allowances is higher than expected and has made a significant contribution to the latest price increases on the electricity market. In this way, emissions trading has had a strong influence right from the start on the business strategies of the 1200 companies in Germany which operate installations with particularly high CO₂ emissions. To help companies deal with the new climate protection instruments, the ISI compiled a manual "Flexible Instruments in Climate Protection" for Baden-Württemberg's Ministry for the Environment. It describes

EU emissions trading as well as the so-called flexible mechanisms of the Kyoto Protocol. These include, for instance, CO₂ saving measures conducted by German companies in other countries. The emissions thus saved can be credited to these companies and then used in the EU emissions trading scheme for example.

The new edition of the manual has been comprehensively extended and updated, mainly with regard to EU emissions trading, but it also deals in more depth with new topics such as afforestation activities. The manual now contains detailed practical examples of monitoring in emission trading, the Clean Development Mechanism and Joint Implementation as well as a comprehensive glossary.

Information: www.isi.fraunhofer.de/n/klimapolitik.html
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The manual "Flexible Elements in Climate Protection" is available as a book and a CD-ROM



What to do with the billions from the German road-toll system?

The German toll collection system for Heavy Goods Vehicles flushes around three billion Euro each year into the government's coffers. How to put this money to best use remains unclear however – should it be used for tax cuts, for investments in the transport sector or to fill holes in the budget? In the Revenue project, 17 European partners are investigating this question by developing theoretical concepts and looking at case examples.

In the consortium, the Fraunhofer ISI is contributing a case study to the German HGV road toll. The ISI experts conclude that it would be more cost-effective to use the revenue to lower taxes in the short term – which is unlikely to happen however in view of the enormous budget deficits. In the long term, the ISI model clearly supports leaving the funds in the transport sector since this has positive impulses for productivity in almost all economic sectors. Slight economic advantages resulted for investments in road construction, but in the long term, however, the only sensible option is a balanced distribution of funds among all the transport services. In any case, the ISI recommends giving priority to preservation measures. New infrastructure would only create an additional mountain of preservation investments in the future.

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Impetus for fuel cells

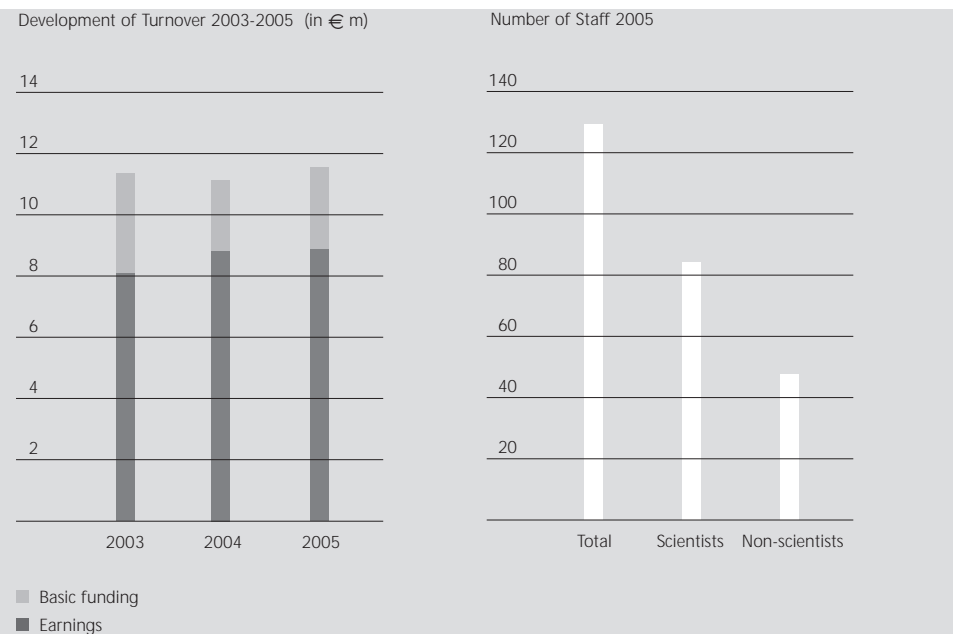
Fuel cells are a potentially promising, clean and resource efficient way to produce energy. But they have not yet managed to become widely accepted – which is also true for other technologies such as bio fuels or highly energy-efficient houses. The EU would like to promote environmentally-friendly technologies in transport, agriculture, energy and industry and is searching for suitable policy instruments to do so. Companies in six countries were questioned about eight technologies. The ISI looked at stationary fuel cells which are intended to stand alone in private houses and companies and supply dwellings and industrial processes with electricity and heat. Germany is a pioneer in this field: half of all the stationary fuel cells installed in Europe are in Germany. The ISI conducted a survey and a workshop with stakeholders such as manufacturers and users of fuel cells. The most important recommendations for policy can be summarised as follows:

- first of all, reinforce R&D-support until fundamental technical problems have been resolved,
 - adapt standards and legal regulations to the new technology,
 - support demand for a limited period by fixed payments for power from fuel cells,
 - allow independent power producers free access to the market by regulating grid use.
- Information: www.popa-ctda.net,
Contact: Dr. Dr. Christian Sartorius (-118, christian.sartorius@isi.fraunhofer.de)

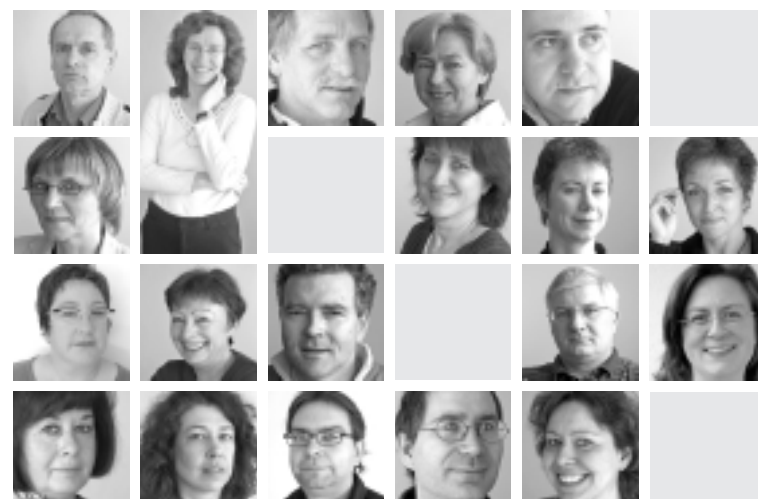


"AKWA 2100" published in the ISI series "Innovationspotenziale" (Innovation potentials)

Fraunhofer ISI in Figures



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Dissertations

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 · Arbeit in neuen Unternehmensstrukturen. Eine empirische Untersuchung zu Arbeit in Kooperationen produzierender Unternehmen unter besonderer Berücksichtigung von „boundary spanners“
- Heinze, Thomas**
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- Stahlecker, Thomas**
 · Regionale Bindungen im Gründungs- und Entwicklungsprozess wissensintensiver Dienstleistungsunternehmen, dargestellt am Beispiel der Region Bremen und Stuttgart
- Ossenkopf, Birgit**
 · Einflussfaktoren des Wachstums junger Technologieunternehmen in ihren frühen Lebensphasen, dargestellt am Beispiel ostdeutscher Unternehmen

Academic Teaching

- Bradke, Harald**
 · Energiewirtschaftliche Aspekte der Energietechnik
 Fachbereich Elektrotechnik, Universität Kassel
- Cremer, Clemens**
 · Carbon Capture and Storage
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- Dreher, Carsten**
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 · Vorlesung „Strategic Innovation Management“ (Innovation 2) Syddansk Universitet Mads Clausen Institut, Sønderborg, Denmark
- Edler, Jakob**
 · Gastvorlesung: Knowledge Management
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- Friedewald, Michael**
 · Seminar: Das viktorianische Internet: Vom optischen Telegraphen zum Rundfunk – Nachrichtentechnik im langen 19. Jahrhundert
 Universität Stuttgart
- Grupp, Hariolf**
 · Vorlesung mit Übung „Innovation und Technischer Wandel I und II“ im Wechsel
 Wirtschaftswissenschaftliche Fakultät der Universität Karlsruhe
 Doktoranden- und Diplomandenseminar
 Wirtschaftswissenschaftliche Fakultät der Universität Karlsruhe
 Seminar Innovationssysteme
 Wirtschaftswissenschaftliche Fakultät der Universität Karlsruhe
 Vorlesung mit STATA-Übungen im CIP-Rechner-Pool „Anwendungen der Industrieökonomik“
 Wirtschaftswissenschaftliche Fakultät der Universität Karlsruhe
- Seminar Innovationspolitik**
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 · Unternehmensführung
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 · „Unternehmenshandeln in noch nicht regulierten Feldern am Beispiel ethisch umstrittener Innovationen in der Biotechnologie“ im Rahmen des Seminars „Wirtschaftsstrafrecht und Wirtschaftsethik“
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 · Energiewirtschaftliches Kolloquium
 ETH Zürich
 Economics of Technology Diffusion – Applied to New Energy Technologies
 ETH Zürich
 Energiewirtschaft
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 Energiewirtschaftliches Doktoranden-Seminar
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 · Seminar „Fragestellungen und methodische Ansätze der regionalen Innovationsforschung – Beispiele aus der Projektarbeit des Fraunhofer ISI“
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 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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 Seminar „Technik und Gesellschaft“
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 Seminar Angewandte Wirtschaftsgeographie:
 Fragestellungen und methodische Ansätze der regionalen Innovationsforschung
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Innovation Systems and Policy

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STARMAP
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Nachfrageorientierte Innovationspolitik (Politik-Benchmarking)
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Integrating Research and Standardisation
PD Dr. Knut Blind

Genderspekte in der Forschung
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Networked Organisations – Research into Standards
PD Dr. Knut Blind

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Prof. Dr. Stefan Kuhlmann

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Prof. Dr. Stefan Kuhlmann

Forschungsbedarf des industriellen Mittelstandes
Dr. Kerstin Cuhls

Wissenschaftliche Begleitung des FUTUR-Prozesses. Konzeption, Monitoring und Analyse des FUTUR-Prozesses
Dr. Kerstin Cuhls

Beitrag zum Indikatorensystem zur Technologischen Leistungsfähigkeit Deutschlands
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FWF
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Prof. Dr. Stefan Kuhlmann

CREA - Creativity capabilities and the promotion of highly innovative Research in Europe and the United States
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Erfolgsfaktoren nachhaltiger Innovationspolitik – Erfahrungen aus dem Ausland
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Observatory of the European University (OEU)
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European Network of Indicators Producers (ENIP)
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Identification and Assessment of Promising Emerging Technological Fields in Europe
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Erhebung zur Beschreibung des Innovationsverhaltens im Produzierenden Gewerbe und im Dienstleistungssektor in Deutschland für den Zeitraum 2005-2008
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ERAWATCH
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Innovationsindikatoren Schweiz
PD Dr. Ulrich Schmoch

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

Zur technologischen Leistungsfähigkeit der deutschen Umweltwirtschaft im internationalen Vergleich
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Fora of Strategic Intelligence for Research and Innovation – preparation of research and experimental forum
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Globalisation of Industrial R&D: The policy dimension
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DIN – Verbundvorhaben: IS Dienstleistungsstandards in erfolgreichen Internationalisierungsstrategien; Teilvorhaben: Rolle von Standards in ausgewählten Dienstleistungsbranchen
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NEST-Promoting Research on Optimal Methodology and Impacts Supported by Experience
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European Techno-Economic Policy support Network (ETEPS)
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Support to Foresight practice: assess, validate and complement the structuring of an Online Foresight Guide
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Studie zur Internationalisierung der deutschen Forschungs- und Wissenschaftslandschaft
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Zusammenhang von technischen Innovationen und Kultur im Spiegel von Indikatoren
PD Dr. Ulrich Schmoch

Regions and Market Dynamics

Projects and person to contact

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

Resisting Inequality through Science and Technology
Dr. Vivien Lo

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
Dr. Simone Kimpeler

Zielgruppenorientiertes eLearning im Rahmen des Vorhabens „Monitoring eLearning“ des TAB
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Regionales Lernen in multinationalen Unternehmen
Prof. Dr. Knut Koschatzky

Interim-Evaluierung von protec2002+ – Das Programm zur Förderung des Technologietransfers
Dr. Vivien Lo

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

Erstellung von Patent- und Publikationsdaten
Prof. Dr. Knut Koschatzky

Mitarbeit bei der Entwicklung eines Systems von Indikatoren zur Nachhaltigkeitsbewertung von Stromerzeugungstechnologien
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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

Strategiefonds: Flankieren der Arbeiten zum NoE-PRIME Projekt „ERA-SPACES“
Prof. Dr. Knut Koschatzky

Unpacking Geographical Spaces in Research and Innovation in Europe (ERA-Spaces)
Prof. Dr. Knut Koschatzky

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

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

Erfolgsfaktoren für Unternehmensausgründungen aus der Wissenschaft
Joachim Hemer

Regionale Vorausschau und Innovationsentwicklung in ostdeutschen Grenzregionen
Prof. Dr. Knut Koschatzky, Dr. Vivien Lo

Enlarging the European Research Area: identifying priorities for regional focusing on Research and Technological Development in the Candidate Countries / Regional Innovation Systems & Strategies in European Candidate Countries (RISSECCO)
Prof. Dr. Emmanuel Muller

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

Verbesserung der Innovationsförderung in den neuen Ländern
Prof. Dr. Knut Koschatzky, Dr. Vivien Lo

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

Erbringung von wissenschaftlichen Beiträgen im Rahmen des Monitoring-Vorhabens „eLearning“
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Unterstützung der Kooperation Universität Louis Pasteur/Beta und FhG-ISI als Laboratoire Associé (LEA), FhG-Programm: PROFIL-Marketingaktionen Europa
Prof. Dr. Knut Koschatzky

Zukunftsreport: Arbeiten in der Zukunft
Dr. Simone Kimpeler

Dienstleistungsdiversifikation als Beschäftigungs- und Wertschöpfungspotenzial – Analyse des Exports/Imports und der Internationalisierung von Dienstleistungen für Deutschland und wichtige Wettbewerber
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Arbeitsschwerpunkte der wissenschaftlichen Begleitung zu EXIST – Existenzgründungen aus Hochschulen (Zweite EXIST-Phase)
Dr. Marianne Kulicke

TRANSFER of successful supporting schemes for technology-based start-ups to innovative ACTIONS in Associated Countries
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Industrial and Service Innovations

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Dr. Steffen Kinkel

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

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
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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 1999 bis 2004
Dr. Steffen Kinkel

Mitarbeit im Innovationsbüro zur Unterstützung der Innovationsinitiative der Bundesregierung und der Partner für Innovation
Dr. Steffen Kinkel

Verfahren zur Bewertung und Steuerung der Innovationsfähigkeit produzierender KMU
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Fraunhofer European Manufacturing Survey
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Beitrag des Fraunhofer ISI zum Präsidialprojekt „Fraunhofer – die Innovationsbeschleuniger“
Dr. Eva Kirner

Antriebstechnik 2015 – Roadmaps als Instrument einer vorausschauenden Forschungsförderung
Elna Schirmmeister

Verbundprojekt: Unternehmensverbund des Jahres – Ermittlung von Typologien und Benchmarks zur Erfassung und Bewertung der Performance von Netzwerken
Dr. Eva Kirner

Servicepartner Industrie (SPIN) – Strategie, Controlling, Qualifizierung, Technik, Organisation und Qualitätssicherung für produktbegleitende Dienstleistungen
Dr. Gunter Lay

Bilanzierung betrieblicher Kompetenzen und ihre Fundierung in individuellen Kompetenzen der Mitarbeiter – eine Pilotstudie auf Basis der Erhebung Innovationen in der Produktion
Dr. Heidi Armbruster

Produktionsverlagerungen ins Ausland und Rückverlagerungen
Dr. Steffen Kinkel

Emerging Technologies

Projects and person to contact

Consequences, opportunities and challenges of modern biotechnology for Europe
Dr. Thomas Reiß

FuE-Pipeline in den Life Sciences
Dr. Thomas Reiß

Life-Science-Standort Wien im Vergleich
Dr. Sybille Hinze, Dr. Sibylle Gaisser

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

Konvergenz von Nano-, Bio-, IuK-Technologie und Kognitionswissenschaft
Dr. Bernd Beckert

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

Hirnforschung und Converging Technologies (Teil 1) und Überblick über Förderprogramme zur Hirnforschung national und international (Teil 2)
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Impact Assessment of Neuroimaging
Dr. Bärbel Hüsing

Nanobiotechnology in the medical sector – Drivers for development and possible impacts
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Nanowissenschaften und Nanotechnologien in Österreich – Eine Fakten- und Potenzialanalyse im internationalen Vergleich
Dr. Michael Friedewald

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

Sustainable Introduction of GMOs into European Agriculture (SIGMEA)
Dr. Bernhard Bühlren

New case studies on the co-existence of GM and non-GM crops in European agriculture
Dr. Thomas Reiß

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

Seaweed antioxidants as novel ingredients for better health and food quality (SEAHEALTH)
Dr. Bernhard Bühlren

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

Medium- and long-term opportunities and risks of the biotechnological production of bulk chemicals from renewable resources (BREW)
Dr. Barbel Hüsing

Potenzialanalyse der industriellen, weißen Biotechnologie
Dr. Michael Nusser

Modellierung von Szenarien
Dr. Bernd Beckert

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

Technologische und ökonomische Langfristperspektiven der Telekommunikation
Dr. Bernd Beckert

Forschungs-Informationen-System Verkehr, Städtebau, Raumordnung, Wohnungswesen und Aufbau Ost
Peter Zoche M.A.

Mobilität 21 – Kompetenznetzwerk für innovative Verkehrslösungen
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FAZIT-Forschung: Szenarien für den IT- und Medienstandort Baden-Württemberg
Dr. Bernd Beckert, Dr. Simone Kimpeler

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

Health Innovation Technology Assessment (HITE)
Dr. Bernhard Bühlren

Zukunftstrendsreport „Individuelle Medizin und Gesundheitssystem“
Dr. Barbel Hüsing

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

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

Stärkung des Pharma-Innovationsstandortes Deutschland
Dr. Sibylle Gaisser

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, Dr. Thomas Reiß

Pharmacogenetics and Pharmacogenomics: State-of-the-art and social and economic impacts
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Brain exchange – Brain drain? Internationale und intersektorale Mobilität von Wissenschaftlern
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Regenerative Medicine – Support Networks in Tissue Engineering Innovation Systems (REMEDY)
Dr. Thomas Reiß

The Take-off of European Systems Biology (EUSYSBIO)
Dr. Thomas Reiß

Benchmarking of public biotechnology policy
Dr. Thomas Reiß

Koordination der ISI-Beteiligung am Büro für Technikfolgen-Abschätzung beim Deutschen Bundestag
Peter Zoche M.A.

Deutschland innovativ
Dr. Thomas Reiß

Strategische Forschung in Baden-Württemberg
Dr. Sybille Hinze

Energy Policy and Energy Systems

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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
Dr. Mario Ragwitz

Investing in Renewable Energy Sources & Rational Use of Energy Technologies: Models for Saving Public Money (INVERT)
Dr. Mario Ragwitz

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

Forum für Energiemodelle und Energiewirtschaftliche Systemanalysen in Deutschland – Modellexperiment V
Dr. Clemens Cremer

Sustainability Impact Assessment of Strategies Integrating Transport Technology and Energy Scenarios / TRIAS Management
PD Dr. Martin Wietschel

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

Scientific Reference System for New Energy Technologies and Energy End-Use Efficiency
Dr. Mario Ragwitz

Entwicklung eines Konzepts für die Schwerpunktsetzung in der Energieforschungsförderung auf der Basis der Erkenntnisse der Innovations- und Diffusionsforschung
Prof. Eberhard Jochem

Early market Introduction of New Energy Technologies in Liason with Science and Industry
Dr. Wolfgang Eichhammer

Innovationsinitiative – wissenschaftliche Begleitung des Impulskreises Energie
Dr. Harald Bradke

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

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

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

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

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

Side Effects of Tradable Renewable Energy Certificates (TREC) on the Development of Renewable Energy (RE) Production (SETREC)
PD Dr. Martin Wietschel

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

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

Extend Accredited Renewables Training for Heating
Edelgard Gruber

Guiding a least cost grid integration of RES-E in the EU27
Marian Klobasa

Integration von Windenergie in ein zukünftiges Energiesystem unterstützt durch Lastmanagement
Dr. Mario Ragwitz

Economic Analysis of Reaching a 20% Share of Renewable Energy Sources in 2020
Dr. Mario Ragwitz

Wissenschaftliche Begleitung der Feed-in Cooperation
Dr. Mario Ragwitz

Ökologische Steuerreform: Energieintensive Prozesse / Energieaudit
Dr. Harald Bradke

Statistisch-methodische Fragen im Zusammenhang mit dem Richtlinienvorschlag der EU-KOM zu Endenergieeffizienz und zu Energiedienstleistungen
Dr. Wolfgang Eichhammer

Technische und rechtliche Anwendungsmöglichkeiten einer verpflichtenden Kennzeichnung des Leerlaufverbrauchs strombetriebener Haushalts- und Bürogeräte
Barbara Schlomann

Internationaler Vergleich von Energiestandards im Baubereich einschließlich Teilmodul „Export von Minergie“
Dr. Wolfgang Eichhammer

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

Promotion of Efficient Electric Motor Systems
Dr. Peter Radgen

Dissemination, Extension and Application of the Motor Challenge Program
Dr. Peter Radgen

Vorarbeiten zum Start der Kampagne Druckluft effizient Schweiz und begleitende Arbeiten zum Aufbau eines Druckluft-Kompetenzzentrums
Dr. Peter Radgen

Umsetzung eines mehrsprachigen internetgestützten Benchmarkings von Druckluftanlagen als Baustein einer Kampagne Druckluft Schweiz
Dr. Peter Radgen

Energieeffizienz-Initiative Modell Hohenlohe, Phase III
Prof. Eberhard Jochem

Energieeffizienz-Initiative Ulm
Prof. Eberhard Jochem

Studie zur Konzeption eines Programms für die Steigerung der Materialeffizienz in mittelständischen Unternehmen
Prof. Eberhard Jochem

Methodologies for the Implementation of the Kyoto Flexible Mechanisms-Clean Development Mechanism (CDM-Synergy)
Dr. Wolfgang Eichhammer

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

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

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

The European Hydrogen (Based) Society
PD Dr. Martin Wietschel

The Development and Detailed Evaluation of a Harmonised „European Hydrogen Energy Roadmap“
PD Dr. Martin Wietschel

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

Bewertung von Verfahren zur CO₂-Abscheidung und -Deponierung
Dr. Peter Radgen

Sustainability and Infrastructures Projects and person to contact

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

Wissenschaftliche Begleitung des Projektes Klimafolgen für Baden-Württemberg
Dr. Harald Hiessl

Handelbare Flächenausweisungskontingente zur Begrenzung des Flächenverbrauchs – Ansätze für Baden-Württemberg
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Verbundvorhaben: Wirkungen des globalen Wandels auf den Wasserkreislauf im Elbegebiet – 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 21
Dr. Harald Hiessl

AKWA Dahler Feld: Konzeptentwicklung und Genehmigungsplanung, bauliche Umsetzung und wissenschaftliche Begleitung und Evaluation des innovativen Abwasserentsorgungskonzeptes
Dr. Harald Hiessl

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

Expertenberatung im NAGUS AA7 „Treibhaus-gase“
Karoline Rogge, Dr. Regina Betz

Technical Assistance to Armenia, Azerbaijan, Georgia and Moldova with respect to their Global Climate Change Commitments EuropeAid
Dr. Wolfgang Eichhammer

Emissionsminderung für prioritäre gefährliche Stoffe der Wasserrahmenrichtlinie
Thomas Hillenbrand

Aktuelle Politikberatung zum Projekt „Strategie zur Reduzierung der Flächeninanspruchnahme – Gestaltung eines Modells handelbarer Flächenausweisungsrechte unter Berücksichtigung ökologischer, rechtlicher und sozialer Aspekte“
PD Dr. Rainer Walz

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

Innovative Urban Water and Sanitation Programs – India
Dr. Harald Hiessl

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

Aktualisierung und Optimierung der Metadatenbank der Messnetze
Frank Broecker

The impact of REACH in the European member states
Dr. Gerhard Angerer

Weiterentwicklung der urbanen Wasserinfrastruktur in Hamburg
Dr. Harald Hiessl

The Impact of REACH on the chemical supply chain
Dr. Dr. Christian Sartorius

Überarbeitung und Ergänzung des Leitfadens „Flexible Instrumente im Klimaschutz“
Dr. Joachim Schleich

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

Beschäftigung im Umweltschutz
PD Dr. Rainer Walz

INANU – Innovation durch Nanotechnologie in der Umwelttechnik als Schlüssel zur Nachhaltigkeit
Dr. Gerhard Angerer

Emissions Trading als Instrument der globalen Klimavorsorge
Karoline Rogge

The Use of Transport Pricing Revenues
Dr. Claus Doll

Insure: Flexible framework for indicators
Dr. Wolfgang Schade

Regional Infrastructure Foresight (RIF)
Dr. Harald Hiessl

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

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

Direkt-Ethanol-Brennstoffzelle
Dr. Frank Marscheider-Weidemann

MATISSE: Methods and Tools for Integrated Sustainability Assessment
Dr. Wolfgang Schade

Flexible framework for indicators for sustainability in regions using systems
Dr. Wolfgang Schade

Foresight and assessment for environmental technologies (FORASSET)
Dr. Dr. Christian Sartorius

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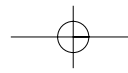
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