



Federal Ministry for the
Environment, Nature Conservation
and Nuclear Safety



Environment and Innovation

ECOLOGICAL INDUSTRIAL POLICY

**SUSTAINABLE POLICY FOR INNOVATION,
GROWTH AND EMPLOYMENT**



IMPRINT

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DEAR READER,

Three years ago, the Federal Environment Ministry published a memorandum setting out first thoughts about an ecological industrial policy. The basic philosophy was: we need to give an economic answer to the ecological question, and we need to find an ecological solution to the economic challenges. This is because climate change, loss of biodiversity, global

environmental pollution and the way we use our natural resources are worldwide challenges that have not only ecological, but also major economic implications.

Many regions around the world are experiencing a veritable surge of industrialisation. There are more and more people living on this Earth. As a result, the worldwide hunger for energy and raw materials is growing all the time. But resources are scarce, and there are limits to what our ecosystems can stand. To satisfy rising demand, we need to break the link between economic growth and resource consumption. We have to make more from much less. And to do so, we need to restructure our industrial society. We need innovative environmental technologies in the production of our goods and a genuine efficiency revolution in manufacturing. In future, our consumer products and mass-produced goods will be much more strongly influenced by environmental technologies than they are today. This also means that there will be growing worldwide demand for good environmental and efficiency technologies. In the past, Germany has already enjoyed an excellent position in the environmental industry. If environmental and efficiency technologies develop from niche markets into lead markets of the future, this is good for Germany as the world champion exporter of environmental technology.

The ecological industrial policy seeks to combine both aspects: the modernisation and environmentally sound structuring of Germany as an industrial location in the interests of sustainability, and a policy that sets out to exploit economic opportunities. This is only possible with an intelligent policy mix that combines a wide range of different measures.

Politics can support the necessary restructuring of our industrial society. It cannot ordain it on a top-down basis. We therefore need a broad debate in society about practical goals and about the means we want to use to achieve these goals. We call upon everyone to take part in this debate and make their contribution: industry, academia and society. Disagreements will be unavoidable. But only broad and heated debates can produce the societal consensus that is necessary to overcome the massive problems we face.

The Federal Environment Ministry has prepared the following strategic paper to give this debate a fresh boost. The paper describes instruments and measures that can and should make a contribution to modernising our economy. In summer 2008 we sent a first draft of this text to a number of environmental and consumer associations, trade associations and trade unions, and asked them to tell us what they thought of our proposals. We ourselves were surprised by the response. Above all, we were delighted to find that almost everyone agreed with our initial premise that economics and ecology were not mutually exclusive, but merely two sides of the same coin. This is a good basis for the necessary discussion.

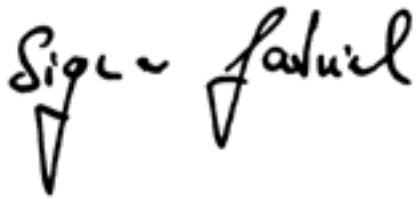
But something else which became clear – and this is hardly surprising – was that our proposals are far too ambitious for some people, while for others they do not go far enough. And in cases where everyone accepts the goals we envisage, there is sometimes considerable disagreement about the means.

We have revised our text in the light of these comments. We have taken up some suggestions and added them as new measures. We have modified others because we found the criticism convincing. Where things could be misunderstood, we have tried to explain them better. And we have made it clearer than in our first version that a good environment needs “good jobs”. Innovations in industry and society depend on highly motivated and capable employees. This is not merely a question of training, but also of working conditions.

The text published here will still draw criticism and it will also continue to leave unsatisfied some of the wishes and expectations of associations and other actors in society. It is not a question of pleasing everyone. The debate about concrete measures for restructuring our industrial society has only just begun. It has to continue. Those who find our suggestions wrong are invited to make better ones. Those who find our path too long should show us a shorter path.

Those who find it too difficult should tell us how to make it easier. Only one thing is not permitted: claiming that everything can stay as it is, or falling back into the “environment versus economy” debate of the last century.

The text you will read here is, in the best sense of the word, a presentation of ideas, not a government programme. Some of these ideas and measures are currently being set in motion by the Federal Environment Ministry – for example as part of the integrated energy and climate package. Others still sound a long way off. Realising them will call for a great deal of persuasion, vigorous fellow campaigners, and operational creativity in the implementation process. This does not argue against the ideas set out here. It does, however, underline the need for contributions to a constructive debate, which is why everyone is invited to take part in a competitive search for innovative, target-oriented and practical ideas. After all, these are what we need. And we need them today rather than tomorrow.

A handwritten signature in black ink, reading "Sigmar Gabriel". The signature is written in a cursive style with a small flourish at the end of the name.

Sigmar Gabriel
Federal Minister for the Environment,
Nature Conservation and Nuclear Safety

INTRODUCTION: DESIGNING THE FUTURE. RESTRUCTURING AND MODERNISING THE INDUSTRIAL SOCIETY

The ecological industrial policy is the Federal Environment Ministry's answer to the major economic and environmental challenges of our time. The spectrum of voices from those who have already made a close scrutiny of this concept is broad. They range from the Federation of German Industries (*Bundesverband der Deutschen Industrie – BDI*), through the trade unions, to the environmental associations and the German Advisory Council on the Environment (*Sachverständigenrat für Umweltfragen*). There has been considerable praise for this, but also criticism.¹ In this publication, the Federal Environment Ministry sets out to give new momentum to this debate by presenting specific instruments and priority measures that will have an important contribution to make to a sustainable national economy.

At the same time, the instruments of ecological industrial policy which it presents outline an agenda for a restructuring of our industrial society. A restructuring that does not mean demolition, but which – on the contrary – will lay the foundations for ensuring that our modern society has a future: from both an economic and an ecological point of view. There is no alternative to this restructuring, and it has already begun with the measures decided under the integrated energy and climate package. Now is the time to speed it up and to steer a clear course: in the direction of more growth and employment.

One of the formative negative events of the last century was the world economic crisis in the late 1920s. Some years later Franklin D. Roosevelt with his “New Deal” succeeded in containing serious dislocations and at the same time laying the foundations for fresh growth and new prosperity – in the USA, and also worldwide. But he was still unable to prevent the world economic crisis leaving a serious mark on the century. Nearly a century later, the world is once again experiencing a variety of crisis processes, not only as a result of crushing blows to the international financial system. We are threatened with a global climate and energy crisis. In our own country, despite all the favourable developments in recent years, we have still not really succeeded in overcoming existing structural weaknesses. Many parts of the world are facing the threat of development crises, some because phases of industrialisation have given rise to ecological and social upheavals, others because they are effectively seeing a stagnation of their social and economic development. Today we need

to do everything in our power to master these challenges and to prevent these processes gaining momentum – whether towards a world climate crisis or a world economic crisis. We need a “New Deal” for environment, economy and employment. At both national and international level.

Here in Germany, our ecological industrial policy sets out to pave the way for this, not by giving an ideological answer to the challenges of our time, but by creating a policy mix which does not seek its salvation either in radicalisation of the market economy or in mere “statism”, but points a pragmatic, targeted way ahead. Thus the ecological industrial policy is also a plea to at last break down old ideological fronts. Economics and politics, science and society – they all need to take account of the changed relationship between economics and the environment and to join forces to restructure our industrial society and move ahead on a course of sustainable growth leading to a new design for prosperity. We are convinced that this is possible and that the instruments outlined here can – and must – contribute to achieving it.

This means that the economy, society and politics must make a united effort to implement, develop and improve the proposed set of measures. It is clear that this will not happen without social debate – whether about social embodiment, international integration, implementation timescale, or supplementary activities in an intelligent policy mix. With this publication the Federal Environment Ministry is seeking to foster this discussion process and campaign for legitimacy and acceptance, because the debate about practical steps and instruments for sustainable restructuring and modernisation of our industrial society cannot be put off any longer. We must tackle it today – we cannot afford to delay.

1 Cf. for example BDI, Industriepolitik in der Marktwirtschaft. Discussion paper, 23 August 2007, http://www.bdi-online.de/download/Diskussionspapier_Industriepolitik.pdf; Martin Rocholl, Ökologische Industriepolitik. Die Herausforderung in Europa, Deutscher Naturschutzring (DNR)/EU-Koordination, Berlin 2007, http://www.eu-koordination.de/PDF/Rocholl_OekologischeIndustriepolitik.pdf. SRU, Umweltgutachten 2008. Umweltschutz im Zeichen des Klimawandels, Berlin 2008

PART 1:

ECOLOGY IS THE ECONOMICS OF THE 21ST CENTURY

Demand for energy and raw materials has grown enormously in the past and will continue to grow in the future. Over the next four decades the world's population will rise from over six to around nine billion people. During the same period, the number living in industrialised societies will treble to around four billion people. This also means there will be a massive increase in demand for industrially manufactured consumer products. Estimates indicate that the next three years will see a doubling of the affluent and high-spending middle classes in Brazil, Russia, India and China alone.

But our planet's raw materials are limited, as is the amount of land available for building and farming purposes. Air and water are valuable resources, and we are dependent on their quality. What's more, energy is not available in unlimited quantities, at least not energy obtained from conventional sources – and today that still means the greater part. Rising prices for petrol and food, steel and gas give us an idea of the great challenges that are already facing humanity. The rising price of oil is already driving the existing inflationary tendencies – with all the risks they entail for growth and employment.

But it is not only scarce resources and rising prices that are becoming a social issue: the ecological results of the present phase of global industrialisation and growth and their financial consequences are becoming a never-ending political issue. Nicholas Stern, former chief economist at the World Bank, estimates the economic costs of climate change at up to 20 percent of global GDP. At the request of the EU and the Federal Environment Ministry, Pavan Sukhdev, head of the "Global Markets" department of the Deutsche Bank in London, recently calculated the potential total cost of our continued over-exploitation of biological diversity: the economic losses worldwide could come to 6.3 percent of world GNP by the year 2050.² And it is above all the people in the developing and newly industrialising countries that will have to bear the main burden of these costs.

Nobody can be interested in climate change or in over-exploitation of our natural environment. But neither can we deny a growing world population and future generations their right to prosperity and to economic development. And even here in Germany we cannot place excessive burdens on people. Even today, many people find their disposable household income is significantly restricted by the cost of energy and raw materials. Material uncertainty, which is

making itself felt these days right into the midst of our society, is a poor basis for restraint-oriented lifestyle debates. In a nutshell: the energy and resources issue has become a key economic, environmental and social issue, both nationally and globally. And so it is not surprising that "climate wars", a "world prosperity war", "increase in environmental refugees" and "ecological justice" have become central concepts in climate and resources policy. This all makes it clear that economic and ecological challenges have long since become two sides of the same coin, and are not things that should be played off against each other.

A few months ago, when an Indian car manufacturer presented the world's cheapest car, this provided yet another very clear illustration of the connection between economic and ecological challenges and the dilemma facing a rapidly changing world: at 2,500 dollars, the new "People's Car" costs only half as much as the previous cheapest small car. This makes individual mobility affordable for many people who were previously excluded, and the company expects annual demand to reach about a million cars in the medium term.

What is socially and economically desirable, because it means prosperity for more people, could turn out to be a disaster from a climate and environment point of view. But the answer to this dilemma cannot be to sacrifice either mobility or prosperity. The alternative has to be an environmentally sound "People's Car" that is embedded in new, intelligent transport concepts designed for sustainable mobility.

We need a policy that takes account of the changes in interactions between environment and industry. A policy that has economic reasons for taking up environmental issues and seriously getting to grips with the idea of sustainability. Social cohesion, economic development and conservation of the natural basis for life must go hand in hand. Instead of cultivating catastrophism, we should be seizing economic opportunities. For there is another point that the example mentioned above makes clear: growing needs create growing markets – markets that need to be characterised by a common feature: the fact that environmental and efficiency technologies have to play a central role in them. The markets of the future are green.

² http://www.bmu.de/naturschutz_biologische_vielfalt/un-konferenz_2008/dokumente/doc/41607.php

Not only management consultants, but also far-sighted financial actors are forecasting that environmental technology is well on the way to developing from a niche market into a growth market. A glance at the world's largest industrial trade fair in Hanover in 2008 makes it clear that this realisation is gaining ground. An eloquent impression of this was also provided by the latest International Motor Show (IAA) in Frankfurt, which went into the annals of the show's history as a "green week".

Green markets have enormous growth potential, and the environmental industry has become an important economic factor in Germany. According to latest estimates, some 1.8 million people, or as much as 4.3 percent of the gainfully employed population, are currently working in the field of environmental protection.³ The fact that this development has gathered fresh momentum in recent years is due not only to the growing importance of renewable energy sources, but also to exports of environmental goods, which have become a driving force on the employment front. There are many reasons why Germany leads the world in exports of potential environmental goods: a great tradition in mechanical engineering, well trained skilled workers, and innovative engineers. However, some of the credit is also due to an environmental policy which has set ambitious standards and which, as a result, has often played a pioneering role at international level.

In many cases, German environmental technology companies are world market and technology leaders. This is illustrated by the fact that for some years now Germany has headed the list for world trade in potential environmental protection goods. In 2006 Germany's share was 16 percent, corresponding to an export volume of 56 billion. It was followed by the USA with 15 percent of world trade, and Japan with 9 percent.⁴ Thus the new green markets hold promise of vast opportunities for the German economy: energy generation, energy efficiency, sustainable water management, materials efficiency, recycling technology and sustainable mobility. Anyone who becomes established or gains a reputation as technological leader on these important lead markets of the future can be sure of growth, added value and employment. The Federal Environment Ministry has had an investigation made of the dynamic growth of these lead markets.⁵ The business consultants at Roland Berger estimate that in 2005 the green markets already had a world market volume of around 1,000 billion. Forecasts indicate that by 2020 this figure will have more than doubled to over 2,000 billion. Because Germany is already so well placed in these fields, the consultants see environmental technology as a new lead industry emerging in Germany. They predict that its sales will overtake

those of the car and machine tool sectors, and its share of industrial production will rise from the present 4 percent to around 16 percent by 2030. But it is also clear that the competition is not idle. Whether Japan, USA or Australia – these countries too are recognising the signs of the times and making substantial investments in the technologies of the future.

The ecological industrial policy seeks to develop business profiles for these markets. And it also seeks to decouple economic growth from resource consumption, because this is the only way of satisfying the needs of a growing world population without causing irreparable damage to nature or allowing conflicts over resource distribution to become the characteristic feature of the 21st century. Overcoming environmental supply problems calls for investment in new environmentally sound technologies. If this also results in establishing the expectation that the change-over to sustainable production methods in Germany will succeed, this in itself can slow down inflation and have positive effects on growth and employment in the short term.

In the 21st century, ecology is becoming economics. Ecological industrial policy takes this seriously. It gives an answer to the challenges outlined above and also sees the task of overcoming them as an opportunity for a new economic dynamism. It links an economic and ecological modernisation strategy for more sustainability with an ecological and economic specialisation strategy for Germany. The ecological industrial policy thus has several aims in view:

- **It aims to protect the climate, conserve nature and save finite resources – both in Germany and on a global scale.**
- **It aims to foster growth that is sustainable and create new jobs.** Every euro invested in modernising our industrial society instead of importing coal, oil, gas and increasingly expensive raw materials reduces the burden on Germany's trade balance and balance of payments, and makes for greater demand for domestic products and services. The German government's climate protection

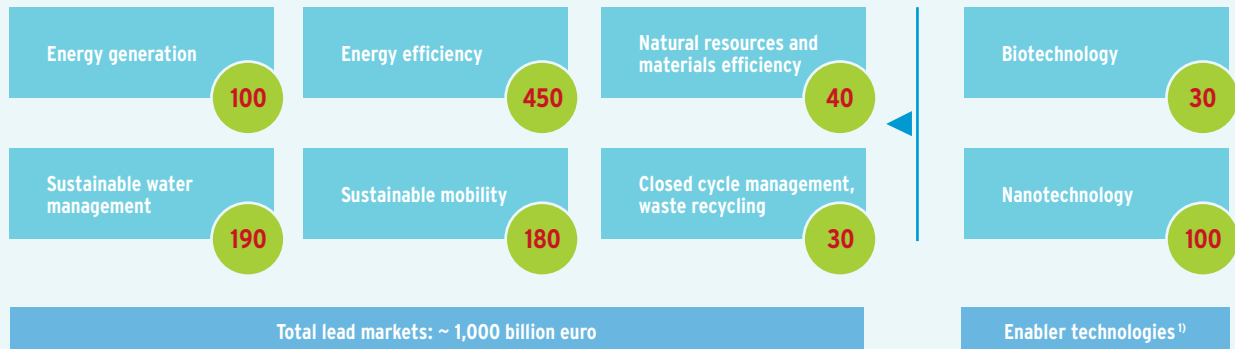
3 Cf: BMU, Umweltwirtschaftsbericht (Environment Industry Report) (in preparation); also UBA, background paper "Beschäftigung im Umweltschutz 2006" (Employment in the Environmental Sector), June 2008.

4 In this connection cf. BMU, Umweltwirtschaftsbericht (Environmental Industry Report), in preparation

5 BMU/UBA, Umweltpolitische Innovations- und Wachstumsmärkte aus Sicht der Unternehmen (Environmental Innovation and Growth Markets from the Business Point of View), research project conducted by Roland Berger Strategy Consultants, October 2007.

Green lead markets: Volume has already reached 1,000 billion euro

World market volume 2005 in billion euro



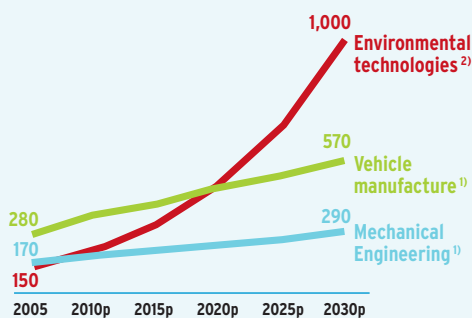
Source: Roland Berger Marktstudien (analysis of approx. 230 market studies, specialist articles, expert interviews)

1) Technologies that make a substantial contribution to the development of environmental technologies.

Environmental technology becomes lead industry

Sales forecast: Environmental technologies in Germany (billion euro)

1) Sales (excluding merchandise), real figures, base year 2000
2) Moderate estimate of growth rate and base figure 2005

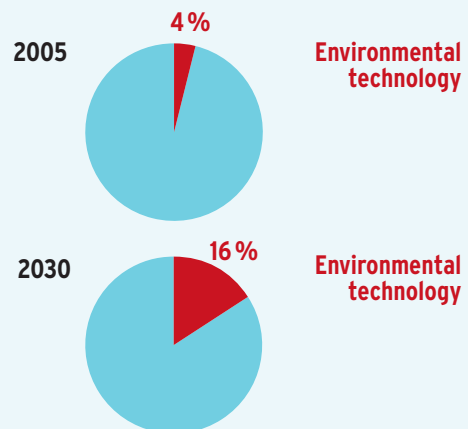


CAGR 8%

CAGR 3%

CAGR 2%

Share of sales by all industrial sectors



The Compound Annual Growth Rate (CAGR) represents average annual growth and is a major key indicator for observing market developments.

programme alone will raise net investment to over 30 billion per annum. Investments in the restructuring of our industrial society are more sustainable than promises of exaggerated yields by short-lived financial markets.

– It aims to internalise external costs at last.

This is the only way of making markets work efficiently and ensuring optimum allocation of scarce resources. At the same time it establishes a fundamental principle for sustainable management which reconciles economic, ecological and social interests.

– It aims to prepare and adjust industrial production structures to cope with the problem of

scarce and – above all – increasingly expensive resources (both energy and materials) and to reduce dependence on imported energy and raw materials. In concrete terms, this means stepping up energy efficiency and generating power from fossil fuels more efficiently. It means expanding renewable energy sources and replacing finite resources with renewable raw materials.

– It aims to help industries and services gear themselves to the lead markets of the future, and to ensure that the process of structural change takes place in a future-oriented and socially acceptable manner. To this end there is also a need for pioneer markets that stimulate eco-innovations and ensure that sustainable

products achieve rapid market acceptance. This makes an important contribution to the competitive strength of German industry and to safe-guarding value added within Germany.

– **It aims to initiate technological leaps in environmental and efficiency technologies and create the necessary framework conditions.** Particularly in the core industrial sectors of energy and use of materials, we need know-how and technological advances – the sooner the better, and the more the better. In view of the challenges of climate change, there is a need for really revolutionary technological leaps (especially in the field of integrated technologies) and not merely incremental technological evolution.

– **It aims to assume international responsibility and not merely confine itself to the domestic economy.** What is needed in the developing and newly industrialising countries is not “catching up the development backlog” or repeating old “industrialisation sins”, but “sustainable industrialisation” and industrialisation leaps at a high technological and resource-efficient level. In practical terms, this means a fair system of burden sharing that permits global prosperity and development, and also active forms of technology transfer and solidarity-based cooperation.

PART 2: PRINCIPLES OF AN ECOLOGICAL INDUSTRIAL POLICY

Although the market is increasingly reacting to the changing realities, it has so far failed to anticipate adequately the challenges arising and the resulting opportunities. It is not all that long ago that a price of 100 dollars for a barrel of crude oil seemed a prospect for the distant future. Today we have already got used to a level that is well in excess of this once magical mark. But this has not brought about any significant changes in the way we use this valuable resource. Despite higher petrol prices, annual mileage is increasing every year. And increases in raw materials prices have not resulted in our making fundamental changes in our production processes and consumer habits. Although industry and households are groaning under the additional burdens that are reducing profit margins or cutting disposable household income, essentially we are still using energy and raw materials as if nothing had happened. Despite all the market signals, the motto in many places is still “business as usual”.

In view of the seriousness of the problem that objectively exists, it is doubtful whether we can continue to afford this kind of “lethargy” and put our trust in the market and its price signals.

Our view is: we need to use the market, maybe even more than in the past. But learning and adjustment processes that are solely market driven are something we cannot afford, whether as regards ecological costs or from a structural policy point of view. Politics must make a contribution.

The tasks of policy makers have always included anticipating future opportunities and risks, organising the balance of interests, and shaping necessary restructuring processes so that they are sustainable and both socially and environmentally acceptable. What is called for here is not megalomaniac statist fantasies, but a state that sets ambitious targets and creates the right framework conditions, a state that points the way as a pioneer but is also – if the need arises – prepared to take the lead.

Of course the “ordoliberal” are right: the state should not claim to possess any knowledge that it does not have. But equally, it must not entrust the future of our planet entirely to “competition as a process of discovery” (Hayek). For even if the state cannot know everything, there is one thing we know very well: we cannot carry on as we have done in the past. And we do not have much time to change direction. Scientists give us another 15 years

to prevent the worst impacts of climate change and to keep the cost within limits.⁶ That is not very long. Which is why politics must stimulate the search and innovation potential of industry and society, producers and consumers – more than in the past. Against this background there is little point in disputes between orthodox views on economic policy. The question is not whether we in Germany need an industrial policy. The question is how we can make it better than in the past. Of course policy makers are constantly setting industrial policy signals – but it is unfortunate that in the past these have often been the wrong ones. Today, anyone who stands in the way of an active and ecological industrial policy for regulatory policy reasons is acting – maybe unconsciously but certainly in practice – as a custodian of (industrial) policy practices that will be unable to cope with the challenge of the future.

Take the example of subsidies: if we have to put new technologies on the market and want to promote not only their innovation, but also their distribution, there are important cases where this will not be possible without financial assistance. According to the German government’s 21st Report on Subsidies, financial assistance and tax concessions totalling some 4.3 billion benefit the environment either directly or indirectly – as a rule, subsidies with harmful effects on the environment are many times higher. This means that what is needed is not arguments about regulatory approaches, but targeted and future-oriented action. The justified risk of failure on the part of the state must not be used as a cheap argument for doing nothing, because market failure will also cost us dearly. This was the most important message from Lord Nicholas Stern and his survey on the economic costs of climate change.⁷

Picking a pragmatic way through the battlefield of market failure and government failure is becoming the hallmark of a wise environmental and innovation policy. To this end the state must use and coordinate the various political and economic instruments in a way that initiates innovation, puts eco-efficient technologies into practice, fosters energy-efficient and resource-efficient restructuring of industry and society, and at the same time stimulates growth and

6 Cf. IPCC/Working Group III, Report “Mitigation of Climate Change” <http://www.ipcc.ch/ipccreports/ar4-wg3.htm>

7 Stern puts the cost at 5–20 percent of global GNP.

employment. What this calls for is not theoretical modelling and simple answers, but an intelligent policy mix:

- **Prices must tell the truth – at least more than at present.** Prices are an important measure of scarcity that must not be allowed to obscure the ecological truth. Functioning markets and internalisation of external costs are important central issues of any ecological industrial policy. But being honest also means admitting that there are limits to monetarisation of “true costs”: because of global markets and the actual international competition situation, because costs frequently only arise in the future or cannot be calculated, or because of political opportunism. A realistic policy has to take these limits into account and must not rely entirely on price mechanisms.
- **Supply-oriented and demand-driven instruments must be combined wisely, not played off against each other.** Many people still act as if supply-oriented and demand-oriented policies were irreconcilable opposites. Innovation researchers have long been aware that interaction between good framework conditions on the supply side and activated demand is the best basis for helping innovative technologies to make a real breakthrough and putting them on the market. We must not content ourselves with allowing environmentally friendly products to languish in niche markets. Ecological innovations must be transported into the mass markets. This only works if both supply and demand are the points of attack for policy makers. And this also means activating the public sector as an innovation-driving demand factor.
- **Ensure calculable framework conditions and benchmarks.** Businesses must know where they stand. This means that politicians must not act arbitrarily and respond to every topical change of mood. At the same time, however, the justified call for a sure basis for planning must not result in businesses resting on their laurels or refusing to respond to the “challenge of the future”. Ambitious benchmarks that are announced and calculable on a long-term basis are an important component of a policy that establishes a reasonable relationship between plannability and dynamism. Another example is the “top runner” approach, which is not based on externally dictated standards, but on the state of the art at any given time. This guarantees that what businesses are called upon to do is not only what is theoretically desirable, but also what is viable and capable of practical implementation – and to constantly do it afresh.
- **Promote progress on a target basis not committed to a particular technology, and light beacons.** Nobody today can say which technological solutions will prove superior tomorrow. Policy must therefore take a basically open approach to technologies and must not put all its eggs in one basket. The risk would be too great. A “technology forcing” policy therefore sets ambitious targets, but does not dictate specific technological solution strategies. On the other hand there are specific lines of technology that the market would not develop on its own, but which appear to have great problem-solving potential. Governmental research and technology policy must take account of this aspect as well and at the same time initiate pilot projects and beacons.
- **Horizontal approaches and sectoral policies must complement each other.** The framework conditions must be designed so as to set our entire economy on an ecological innovation course. This is not only a question of environmental regulation, but also of competitive, fiscal and economic design. It is also a matter of an efficient, modern and environmentally sound infrastructure and well qualified employees. This horizontal dimension is important. But there will always be areas where structural change needs to be intensified on a targeted sectoral basis and where key technologies and industries need to be given precisely targeted assistance. This may be because there is no other way of breaking up rigid and strongly hierarchical market structures, or because leaps in technological development cannot be achieved solely by steering the framework conditions, or because long-term strategic interests also have a part to play in international competition, especially in sectors of the future such as GreenTech and resources policy.
- **Mobilise all actors: consumers and producers, industry, society and state.** Resource-oriented restructuring of the industrial society needs more than just innovative entrepreneurs and a state as a pioneer. It also needs employees who do a good job and who have good jobs. Only people who are motivated and have good working conditions can make a contribution to innovation in business and society. If we are seeking to achieve resource-efficient optimisation of production processes, this is not just a question of management, but also depends on involving the workforce, as they are closest to these processes. Employees are the “natural experts” in matters concerning resources. Hence a policy that demands and fosters “good work” is not merely a policy for employees, but is also in the legitimate interests of our national economy. And good jobs that provide a reasonable living are also a sound basis for people as consumers to make

wise use of their market power, demand ecologically innovative products and thereby drive innovation. One important aspect of an ecological industrial policy is to put consumers in a position to perform this task consciously – because price alone frequently fails to provide adequate information about products. Transparent markets and labelling systems are therefore an important precondition for a resource-efficient and energy-efficient economy. Such an economy draws its strength from the fact that researchers, producers and consumers are engaged in a joint dialogue with policy makers.

Ecological industrial policy relies on a state as the pioneer that coordinates its instruments and measures intelligently in the knowledge of such ambivalences. This is not without consequences for environmental policy, which has to re-invent itself from an innovation policy point of view.

If, by dint of coordinating the many and various instruments of ecological industrial policy, we succeed in shaping our domestic markets in such a way that future global standards are effectively developed here through an innovative supply and demand structure, then this is the best basis for innovative businesses, the emergence of “lead markets” and international market leadership.

Only through interaction of these instruments and content-based interrelationship of numerous measures will we succeed in putting our economy on a sustainable footing.

PART 3: ECOLOGICAL INDUSTRIAL POLICY – GROWTH POLICY FOR A SUSTAINABLE FUTURE

By 2020 we have to make a 40-percent reduction in our greenhouse gas emissions. We have ambitious targets that will contribute to this. We need to increase the share of renewable energies in the heating sector to 14 percent and modify the power mix so that 24 percent of our electricity comes from combined heat-and-power generation and 25–30 percent from renewable energy sources. And, also by 2020, we must double our energy productivity compared with the base year 1990 and our raw materials productivity compared with 1994.⁸

In order to achieve these targets, the ecological industrial policy relies on a number of priority measures. In doing so, it also lays the foundations for a growth policy for a sustainable future. The age of the virtual economy is over. The crisis on the financial markets makes it clear that growth which is tied to the growth of financial instruments and derivatives is anything but sustainable. Forward transactions on the future are not a business with a future. There is therefore a need to forge closer links between

1. Strengthening economic instruments

Although classic regulatory legislation with its prohibitions, requirements and limit values frequently brings about a singular surge in innovation, it does not create any incentives to place technological renewal on a permanent basis: once the limit value is reached, there is no longer any reason for further modernisation. Such legislation is not a good basis for minimising economic costs and making optimum use of comparative cost benefits. In recent years, therefore, there has been a rise in the importance of economic instruments as a significant additional resource for steering environmental policy. Market-based instruments mostly use the price mechanism as their incentive and lever. Taxes and public charges, for example, can be used to achieve important control effects and to influence demand for resources.

From a regulatory point of view, economic instruments actually have a key role to play, because the price of a good conveys relevant information. However, one precondition for optimum functioning of market allocation mechanisms is that prices must be “correct” and must not suppress important information. Unfortunately the latter is often the case, especially with regard to ecological and social costs,

economic growth and the real economy. In this sense, ecological industrial policy is practical politics, since it is concerned not with the sphere of virtual transactions, but with the foundations of our industrial society. It is concerned in the true sense with the material basis of our prosperity: with the way we use energy and raw materials, with innovation and “good jobs” that add value. According to a recent study for the Federal Environment Ministry, the German government’s climate and energy package is already proving to be a veritable economic boost programme, and by 2020 the net result of all its effects on the national economy will add up to 500,000 additional jobs. By 2030 it could be as many as 800,000 jobs.⁹ If we want to strengthen the real economy, we have to ensure that people have employment and enjoy a decent level of collectively agreed pay. And we have to invest in education and in social institutions. The instruments and measures of ecological industrial policy that we propose here are intended to contribute to this.

where prices fail to take account of so-called “external effects”.

Ecological charges and taxes correct this and “monetarise” such costs, in other words they help prices to tell the ecological truth, or at least get closer to this ideal situation. There are however limits to such monetarisation. Not all (external) costs can be monetarised, and international competition between locations restricts political freedom of choice. It does not help anyone if production and jobs migrate to other countries which allow even more ruthless exploitation of nature. How effective economic instruments are is also a question of the form taken by

8 Cf. inter alia the Federal Government’s Integrated Energy and Climate Package and the National Sustainability Strategy: http://www.bmu.de/files/pdfs/allgemein/application/pdf/hintergrund_meseberg.pdf; Nachhaltige Entwicklung in Deutschland. Indikatorenbericht 2006, Statistisches Bundesamt 2007.

9 Cf. Federal Environment Ministry (Ed.), *Investitionen für ein klimafreundliches Deutschland*. Study commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. Interim report, Potsdam/Karlsruhe, May 2008.

Quantities and prices – market-based instruments for resource conservation

The “ecological tax” is levied on heating fuels and automotive fuels. It provides a successful illustration of the steering effect of market-based instruments: since the tax was introduced in 1999, motor fuel consumption, after rising steadily for decades, has fallen by 3 percentage points every year. Although total annual mileage is increasing, Germany’s fuel consumption today is about 17 percent less than before the tax reform. But that’s not all. The additional income of about 18 billion generated by the tax has benefited the economy as a whole, because pension contributions are 1.7 points lower than they would have been without the ecological tax. This has not only saved jobs, but also created new ones. Up to 250,000 people owe their job at least in part to the ecological tax. Public charges like the “water penny”, for example, not only have a steering effect in that they create incentives to make economical use of a resource, they also create financial revenue that can be used to promote innovation. The wastewater levy, for example, is used to finance wastewater treatment projects, and this has resulted in investment and technological advances in both municipal and industrial wastewater purification.

The saving in the first trading period of the emissions trading scheme came to 2 million tonnes CO₂. In the second trading period currently in progress, the figure is already as high as 57 million tonnes. Ten percent of the allowances in this round have been sold, putting some 400 million at the disposal of the Federal Environment Ministry for climate protection purposes. When the quantity auctioned reaches 100 percent, this will generate additional financial room for manoeuvre of 5–10 billion, depending on the price of the allowances at the time.

international framework conditions and the competitive environment.

Another economic instrument is (emissions) trading. This uses the principle of scarcity to control environmental targets. But unlike the case of taxes and charges, it is not the price that is the direct lever, but the quantity. The available quantity of “pollution rights”, for example, is fixed, thereby creating a market. The price forms as a result of supply and demand (“cap and trade”). The great advantage over other instruments: it minimises the cost of preventing damage and creates incentives for ongoing further development of technologies, because every saving in CO₂ emissions brings financial rewards for the business. Such trading also benefits the state, however, because the sale of emission rights generates additional income. Emissions trading will bring the federal budget an estimated 900 million this year. Money which will to a large extent be at the disposal of the Federal Environment Ministry for specific climate

protection projects, which means it is ploughed back for the direct and indirect benefit of consumers and businesses.

Public charges and taxes also generate income. However, the ecological industrial policy is not concerned with “new money”, but with further developing the ecological financial reform, promoting “goods” and taxing “bads” and making them more expensive – as in the forthcoming reform of vehicle road tax: if the tax is based on CO₂ emissions rather than engine size, driving habits that are harmful to the climate will become more expensive and low-emission vehicles will become cheaper to run – regardless of their size, providing a genuine stimulus for car manufacturers’ development departments. Wherever possible, taxes should – while keeping revenue constant – be redesigned so that those who behave in an environmentally friendly way enjoy an advantage, not only over those who are blind to ecological sins, but also compared with the old system.

Reducing subsidies that are harmful to the environment

Subsidies distort prices. Sometimes this is necessary, especially if it is the only way of bringing about socially desirable developments or if the markets alone do not perform the desired allocation function. Often, however, subsidies do not set markets in motion, but reinforce vested rights. The result is not a dynamic situation, but a static one. Subsidies are particularly annoying where they result in over-exploitation of our natural resources. Not all subsidies can or should be directly abolished, but many make little ecological or economic sense. The abolition of the owner-occupied homes allowance, for

example, did away with a subsidy of dubious ecological merit. Especially in the energy and transport sectors there are many concessions that need close scrutiny. One example: the exemption of kerosene from the energy tax costs the taxpayer nearly 7 billion a year.

In future, systematic examination of the impact on environmental assets such as climate, air, water, soil, biodiversity and landscape and on health and resources must play a greater role in the design of financial assistance, tax concessions and other direct and indirect subsidies.

A sustainable financial policy does not set out to reduce subsidies across the board, but takes a close look at aims and purposes and adverse side-effects on the environment and the economy. **For this reason, it will be necessary in the medium term to examine public sector income and expenditure and arrangements between various levels in the public-sector hierarchy (e.g. in the form of burden sharing) to determine whether they can offer greater incentives to conserve resources, climate and environment. Ecologically counterproductive tax concessions must be abolished or redesigned.**

Continued resource-oriented development of tax incentives and fiscal depreciation arrangements

Why do the depreciation regulations treat a facility that wastes energy exactly the same as one that uses it efficiently? A policy that seeks to achieve ecological optimisation of product design and to make products long-lasting and recyclable has to make the same demands on production processes and installations. To this end, the fiscal depreciation regulations should be designed so that it is worthwhile for businesses to opt for resource-saving products and installations and to invest in environmentally innovative goods. Private households too should benefit from buying the latest energy-efficient appliances instead of cheap power-guzzling ones – specifically because the initial cost is somewhat higher and such investments take a long time to show a return.

In many OECD countries there are various opportunities for special depreciation on environmental investments. Until the early 1990s a special depreciation facility for environmental investments existed in Germany as well. Effectively, however, this applied only to environmental technologies in the narrow sense (so-called “end of pipe” technologies). Any new system needs to take account of the fact that today the focus is on production-integrated environmental protection. **Those who make use of the best available technology, thereby saving energy and raw materials, should in future be able to enjoy the benefit of depreciation that can be taken over shorter periods and offers more flexibility with regard to amounts.**

Businesses should be allowed to take **40 percent special depreciation in the year of acquisition, if they can show that the energy and material costs over a life cycle of at least 5 years are at least 20 percent below the status quo.** Alternatively 40 percent of the planned cost of acquisition or manufacture of future investments should be deductible from taxable income as “savings depreciation” in the form of a tax-free reserve ahead of the actual investment. Here also, proof is required of the savings in energy and material costs over the life cycle (at least 20 percent over at least 5 years).

Moreover, the European Commission’s recommendations of 30 May 2001 on the “recognition, measurement and disclosure of environmental issues in the annual accounts and annual reports of companies” should be transposed into German law.

Private households should be allowed **special expenses of €400 per annum for the purchase of household appliances, if they can show that the appliance saves at least 20 percent of the energy and material costs over a life cycle of at least 5 years compared with the previous appliance.** A possible alternative might be to tie this special allowance to the condition that the new appliance belongs to the highest energy-efficiency category. This in turn requires a dynamic classification system for energy efficiency.

To step up the rate of refurbishment of existing buildings, we need not only a loans programme, but also **effective and unbureaucratic tax incentives**. This is a field where experience shows that tax incentives are much more effective than reduced interest rates, for example.

Promoting tax-deductible employee savings schemes and energy-saving savings schemes

Most employees in Germany benefit from tax-deductible employee savings schemes. Such payments by the employer, which are laid down by collective agreement or individual contracts of employment and to which the employees themselves also make a contribution in many cases, are subsidised by an employee savings premium from the state. On the lines of the Fifth Capital Formation Act, **there could be an employee energy-saving allowance of 15 percent up to a maximum of €500 per annum for expenditure by the employee on the purchase of energy-saving appliances**, if the appliance is shown to save at least 20 percent of the energy and material costs over a life cycle of at least 5 years compared with the previous appliance. In future **the tax-deductible employee savings payments** should be designed so that **purchases which produce a significant reduction in energy costs count towards the total**. **In parallel with housing subsidies in the form of housing bonuses and building society savings schemes, “energy-saving savings plans” should also be promoted by tax concessions and bonuses.**

Ecological differentiation of value-added tax rates

A large proportion of state revenue is due to value-added tax. The VAT rate in Germany was raised three percent in 2006, and now stands at 19 percent. At present the additional revenue is being used to consolidate public-sector finances at national and regional level. This is right and good. But once this tour de force has succeeded, the extra revenue must be used **to provide incentives for people to buy environmentally friendly consumer goods and services by making more systematic use than in the past of differentiated VAT rates**. Today a number of important everyday products are already subject to VAT at a reduced rate of 7 percent.

Over the years, however, we have repeatedly seen the introduction of reductions that have long since lost their economic justification. Whether it be cut flowers, collectors’ items, participation in animal performance tests, or artificial insemination of animals – all these are currently taxed at the reduced rate. And it is hard to explain to anyone why take-away meals are subject to the reduced tax rate, while meals consumed on the premises are taxed at the full rate. **It is time to make a systematic review of the different VAT rates that exist at present and to revise them in the light of social and ecological considerations without affecting total revenue.**

Climate-friendly regulations for company cars

More than half of all new cars are registered by businesses. Some 60 percent of company cars are used wholly or partly for private purposes. In view of the way these cars are treated for tax purposes, purchase decisions have so far failed to take adequate account of efficiency criteria. At the same time, as a result of their share of new registrations, their mileage and their importance for the second-hand car market, company cars have a considerable influence on the efficiency of the total cars on the road in Germany, and are thus of great significance for environmental policy.

We intend to set the incentives so that it pays to buy low-consumption cars, and so that it is worthwhile for companies and motorists to minimise their fuel consumption. At present, business expenses for company cars are fully tax-deductible. Taxation of private use of company cars is very low, at 1 percent per month of the list price of the new car, and this is also a blanket rate. **Both “adjusting screws” – the tax concessions for purchase and operating costs, and the all-in rate for private use – need to be modified to provide both motorists and companies with incentives to buy economical cars**

with low CO₂ emission levels. This encourages modernisation in the car industry. In the United Kingdom this has been practised with great success since April 2002.

Introduction of tax on heating fuel

Until its reactors are shut down, the nuclear power industry enjoys a number of special conditions. And that's not all: whereas conventional power plants have to bear the burden of emissions trading, nuclear technology, which is anything but a technology of the future, remains unaffected by these additional burdens. On the contrary: nuclear power plant operators derive considerable benefits from higher electricity prices. Cheap nuclear power does not result in a reduction in electricity prices, but merely in extra profits, because on the electricity market it is only the production costs of the "marginal supplier" that determine the price and not the actual economic costs. There is nothing to justify these extra profits. Among other things they are the outcome of a long-standing subsidisation policy, the result of which is that the nuclear power plants have long been fully depreciated and that there is no need to internalise external costs like the final storage of nuclear waste.

If electricity prices rise, this should not lead to extra profits, but should be used to help reorganise our energy infrastructure and increase energy-efficient power supplies. **The introduction of a tax on nuclear fuels of around 1 cent per kWh would make it possible to skim off unjustified extra profits and generate income for the necessary sustainable restructuring of our industrial society.** And because NPPs, as base load power plants, never determine the price on the exchange, the introduction of a tax on nuclear fuel would not affect the price of electricity and would not place any additional burdens on the consumer.

Auctioning emission allowances, extending emissions trading to air and sea transport

Starting in 2013, all emission rights in the power sector are to be auctioned. The Commission of the European Communities envisages this in its proposal of 23 January 2008 for an amendment to the Emissions Trading Directive 2008/013 (COD). This favours new power plants compared with existing plants, as the former are more efficient. Thus the emissions trading scheme not only reduces climate-relevant greenhouse gases, it also promotes renewal of Germany's power plants. There is also a need for further expansion of emissions trading. It is therefore right that the European Commission's proposed directive requires new industrial activities and greenhouse gases to be included in the emissions trading scheme from 2013 onwards. But this market-based climate protection instrument has to be expanded as soon as possible to take in other areas. During 2008 the institutions of the European Communities reached agreement that **from 2012 onwards the scheme is also to include air transport, i.e. all flights within the EU and all flights that take off or land in the EU.** This is an important step. **Looking ahead, marine transport will also have to be included.** At the same time, emissions trading generates income which we are using to finance a number of specific measures of the ecological industrial policy.

Differentiating the HGV toll system and increasing its steering effect

Goods traffic is growing fast. And in a globalised economy it will continue to grow. The ecological industrial policy does not set out to limit the growth of road transport as such, but to avoid unnecessary trips, shift shipments to rail and waterways, and help achieve a breakthrough for intelligent and integrated mobility concepts. Above all, the aim is to reduce CO₂ emissions by road traffic. A refined HGV toll system will have to make a substantial contribution to this. To improve its steering effects, the **toll rates will have to be more widely differentiated on the basis of emission classes, and external costs will have to be internalised.** This favours low-emission vehicles and penalises high-emission ones. **Furthermore, differentiating toll charges on the basis of time and place will make it possible to ensure intelligent control of traffic flows, prevent traffic jams and reduce environmental pollution.** This not only stimulates innovative development of intelligent traffic control systems, but amounts to a veritable modernisation programme for transport fleets and creates and secures jobs.

Reorganisation of agricultural subsidies

The agricultural sector in Germany has a 6.3 percent share of the contribution to climate change, and it continues to be one of the main factors responsible for loss of biological diversity. At the same time, European taxpayers pay farmers subsidies totalling more than 40 billion a year, despite rising world market prices for agricultural produce. In Germany, the European Union's last medium-term financial plan actually produced a drastic shift in the ratio of unspecific subsidies ("first pillar") to targeted promotion of environmentally sound and nature-friendly farming, at the expense of the second pillar. **This unfortunate development must be corrected at the forthcoming "health check" on the European subsidies for agriculture. We need a radical reallocation of these funds.** In the agricultural sector too, targeted subsidies should be paid only where they can be expected to have positive effects on nature and the environment.

2. Encouraging investment

The international competitive strength of a highly developed economic system depends in particular – in addition to ambitious research and development efforts – on investment at regular intervals in the renewal of installations, buildings etc. This is the only way to ensure that the goods and services produced in the country can in fact be produced by modern and efficient means. The greater the extent to which energy and innovative technical know-how are used as major production factors in international competition, the more important this aspect becomes. Although the net investment ratio – in other words the money spent on new acquisitions above and beyond mere renewal of existing installations and buildings – is undoubtedly an important growth factor for an economic system, this figure

has been falling in Germany for decades. On an international comparison, Germany's net investment ratio is very low.

The ecological industrial policy sets out to expand renewable energies and replace scarce fossil resources with renewable raw materials, and to increase energy and raw materials efficiency. This is not only a question of technological progress, but above all of investment in more efficient buildings, plants, processes and equipment and of better organisation, servicing and maintenance of existing assets. Instead of spending euros on importing fossil fuels and scarce raw materials, domestic investment benefits growth and employment by buying goods and services that are largely produced within Germany.

Net investment ratio in Germany on the decline

A large proportion of German industry's capital assets will have to be replaced over the next 10–15 years. Of the roughly 7 trillion of existing capital assets, about half is due to residential buildings, another 2.5 trillion to non-residential buildings, 10 percent to machinery and less than 5 percent to vehicles. Capital assets are renewed by annual gross investment, and a positive difference between gross investment and depreciation reflects an increase in capital assets, i.e. net investment. In 2005 net investment, at 69 billion, stood at only about 17 percent of gross investment. There was a marked trend towards a service economy, with the industrial, energy and farming sectors actually displaying disinvestment. Net investment as a share of gross domestic product has been falling in Germany for decades, from 10 to 15 percent in the 1960s to less than 5 percent since 2003. Today – as an international comparison shows – it continues to be lower than in many other countries. In a remarkable parallel with the falling net investment ratio, Germany's economic growth rate has displayed a downward trend in recent decades. The fall in the net investment ratio has gone hand in hand with increasing obsolescence of Germany's capital assets (Figure 2–4). This means we now have the opportunity to build up a new, resource-conserving stock of capital assets.

Cf: Investitionen für ein klimafreundliches Deutschland. Study commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, June 2008.

Systematic implementation of the “Meseberg” package

Scientists, in particular from the Potsdam Institute for Climate Impact Research and the Fraunhofer Institute for Systems and Innovation Research, have calculated that the integrated energy and climate programme (the “Meseberg” package) means an investment volume of over 400 billion for the period 2008 to 2020. This will raise existing net investment in Germany by about one third. Their analysis for the national economy reveals that the additional investment and the resulting savings in energy costs will give rise to around 500,000 jobs in Germany by the year 2020, and by 2030 the figure could be as high as 800,000. Assuming implementation of a reduction in greenhouse gas emissions in Germany, the annual gross domestic product for the period to 2030 averages at least 50 billion more than the situation without climate change mitigation. **Not only for climate policy reasons, we must persist with the climate protection package and ensure systematic implementation of the measures agreed.**

Introduction of investment allowance for energy-efficient technologies

Investment allowances for investments in environmental protection (Investment Allowance Act, Section 4a) existed until the mid 1980s. Handled under the income and corporation tax system in a way that was very efficient from an administrative point of view, these had considerable multiplier effects, especially in times of slack economic activity. We need an intelligent reissue of this programme for environmental investments.

3. Simplifying finance

Small and medium enterprises are characteristic of the environmental industry and the innovation process. At the same time, small and medium enterprises are responsible for the employment miracle that can be seen in the environmental industry. Especially in the field of renewable energy, many of today’s world market leaders began on a very minor scale only a few years ago. In many cases the fact that they succeeded in progressing from this small-scale launch to factory production and onto the market was a question of finance.

To promote the development of environmental technology and facilitate further growth of the industry, it is important to ensure finance for environmental investments and business start-ups. Liquidity exists on the market in Germany, but it does not always flow to the right places. As a result, ecological investments often fail for lack of capital or lack of readiness to take risks, or incorrect risk assessments by banks and financial intermediaries.

A glance at the USA reveals the importance of the role played by financial aspects. The USA’s relative

competitive position in the environmental technology sector is improving all the time. The environmental technology industry there – unlike in Germany – has a “magical” attraction for venture capital. In the USA, CleanTech already holds third place in the venture capital rankings after information technology and biotechnology, and in China green venture capital has more than doubled in recent years with 19 percent of total investment.

In its capacity as a development and SME bank in Germany, the KfW already does a great deal to facilitate business start-ups and support environmental investments. But this can only alleviate existing weaknesses, not offset them entirely. We cannot afford to dismiss ideas that may be absolutely essential not only for our economic future, but also for human life on Earth, and to sacrifice the implementation of such innovations on the altar of petty thinking or risk-averse yield expectations. On the contrary, we must do everything in our power to facilitate business start-ups and promote investments – especially in times when banks and other financial players are keeping a tight rein on their lending.

Creation of a "Climate Protection Innovation Fund"

Environmental technologies are a lucrative market with a future. In the field of product and process innovation, however, a potential investor has great uncertainties to contend with. Especially from the seed phase of a business (less than 1 year) until the product is ready for the market, only vague answers are possible to the question of whether a technology will become established on the market and thereby make the investment profitable. In view of this great uncertainty, the number of investments in seed companies in Germany tends to be small. What is more, innovations in the field of climate protection technologies usually involve comparatively large investments. This is one of the reasons why the high-tech start-up fund and other existing funds do not adequately cover the demand for investment in innovative environmental technologies. At the same time, however, there is a great need for innovation in this segment in particular, and the financial industry has a great interest in investing.

A special innovation fund for climate protection should therefore make venture capital available on a broad and comprehensive basis, especially in the form of equity capital for innovative climate protection technologies. This fund should take account of the relevant special requirements and facilitate investment in innovative enterprises particularly (but not only) during the seed phase. Such a fund should if possible be designed as a public-private partnership, so that the fund can draw on both private and public capital. Important investment criteria should include: degree of innovation and strategic competitive advantage of the technology, growth potential of the market, barriers to market entry for competitors (patents), and the opportunity/risk profile.

Leasing models for energy efficiency measures

In many cases the implementation of economic investment in climate protection fails because the necessary capital is not available. New leasing models might be a solution here. **We will investigate whether and in what cases leasing can help to overcome finance problems and to make available made-to-measure offers for energy efficiency measures in an attractive form.** This will also involve examining what legal barriers exist and which of them may need to be removed. Local authorities in particular could profit from this form of finance. Since climate protection measures in buildings are relatively labour-intensive and have to be carried out within our country, this would also contribute to safeguarding or creating jobs in Germany. Leasing models might also make it possible to step up the export activities of German companies.

GreenTech Dax

Share indices are useful barometers for testing the mood of national economies or individual sectors: they are seismographs for measuring economic development trends – and, as crisis situations show, the financial markets need guidance. In view of the increased importance of environmental technology and the good growth forecasts, a **GreenTech Dax should reflect the development of the German market. This GreenTech Dax should be made up of companies from a wide variety of GreenTech sectors (resource conservation, waste management, sustainable water management, sustainable mobility, and climate-friendly power plant technology and renewable energy sources).**

It would not only be an indicator of market trends in the field of environmental technology, but would also facilitate comparisons with other technology sectors: an important requirement, particularly for many small shareholders who specifically want to invest their money in a leading-edge industry. In 2007 the Eco Dax, which comprises ten shares exclusively from the renewable energy sector, took a first step in this direction. But it still does not adequately reflect the breadth of environmental technology and the growing importance of integrated environmental protection.

4. Making use of regulatory law

Regulatory law is the classic instrument of environmental protection policy. It is clearly targeted and applies equally to all. By means of prohibitions and specific requirements, and also numerous limit values, it has contributed not only to great environmental successes in the past, but also to the fact that “GreenTech made in Germany” enjoys a good reputation today and many of its manufacturers are among the world market leaders. High environmental standards here in Germany have given a boost to technological development. More than a quarter of a century ago, Harvard economist Michael Porter made an empirical investigation of the relationship between environmental regulation, innovative activity and competitiveness. He developed the theory that a strict environmental policy prompts companies to improve quality, increase efficiency and make innovations that can result in medium- and long-term competitive advantages not only for the regulating country, but also for the regulated companies themselves.¹⁰ And a glance at the history of German environmental legislation confirms this theory: whether it be the Waste Disposal Act of 1972 or the ban on landfill of untreated waste of 2005,

the Federal Immission Control Act of 1974, the ban on leaded petrol in the Lead in Petrol Act, the revision of the Detergents and Cleaners Act or the Ordinance banning CFCs and halons: policy has driven technological development and helped to integrate environmental protection in product development.

And regulatory law has not outlived its usefulness, not even in the age of globalisation. Today, however, it is characterised more than ever by a political multitier system: If international agreement can be reached, multilateral environmental conventions can have a great impact. The “Montreal Protocol on substances that deplete the ozone layer”, which entered into force in 1989, made a major contribution to the rapid success of efforts to reduce and ultimately abolish emissions of chlorinated and brominated chemicals that destroy stratospheric ozone. The industries of the signatory states took a remarkably short time to adapt their production processes.

¹⁰ Porter, M.E./Linde, C. van der: Green and Competitive: Breaking the Stalemate. Harvard Business Review, Sept./Oct. 1995, p. 120–134.

Regulatory law as a driving force of technology and innovation

In the transport sector, Germany’s regulations with their exhaust gas emission limits have repeatedly given a boost to technological advances: be it three-way catalytic converters, low-sulphur diesel fuel or unleaded petrol – without regulatory law, none of these would today be an integral part of our (auto-) mobility. And in retrospect we find that a capable car industry regularly manages to comply with the deadlines for legal requirements that major lobby groups initially dismissed as technologically over-ambitious and economically unreasonable.

The fields of pollution protection, waste management and water management also provide important examples of a regulatory law that benefits the environment and the economy: in 1990 the Ordinance limiting emissions from waste incineration plants (17th Ordinance on the Implementation of the Federal Immission Control Act) laid down the strictest emission limits worldwide for dioxins and furans. Despite the need to develop new emission reduction technologies for this purpose, all waste incineration plants in Germany were equipped with such technology after only five years. Emissions of dioxins/furans were reduced by 99 percent. Since then, German flue-gas purification systems have been among the best in the world and have become a real export hit. Waste regulations have contributed to the development of an efficient waste management industry in Germany. In the global market for automatic systems for sorting and separation of substances, which estimates expect to grow by around 15 percent in the next few years, companies from Germany clearly lead the market with a share of two thirds. Sustainable water management in Germany has also profited from the fact that the Annexes to the Wastewater Ordinance prescribe a high degree of purity and have driven technical advances. German companies are well placed technologically to serve a vast global market. In Germany alone, municipal water and wastewater utilities invest about 8 billion every year in the expansion and renewal of their facilities and systems.

In many cases, however, rapid successes are prevented or diluted in the course of negotiations in Brussels or in international bargaining processes. International environmental law is characterised not by great successes and ambitious regulations, but by solutions at the level of the lowest common denominator.

However, whereas in the 1990s a certain euphoria with regard to softer forms of governance and of societal self-regulation determined the political agenda, this has given way to disillusionment following the failure of many national and international voluntary undertakings. Regulatory law is on the brink of a renaissance. Nevertheless, it should assign a stronger role to innovation policy aspects and should be of dynamic design. The Renewable Energies Heat Act recently set in motion is a good example of this. The regulatory duty to use renewable energy for heating new buildings not only helps to raise the share of renewable energy in the heating market from 6 percent today to 14 percent in 2020, and

thereby reduce greenhouse gas emissions. The new Act also gives a boost to ecological industrial policy by facilitating the technology scaling effect that is needed in the field of renewable energy for heat to make it economic in the foreseeable future.

Not until renewable energy sources become competitive on the heating market can their potential for climate protection measures be fully realised, above and beyond the 14 percent share already targeted. At the same time this helps to consolidate German industry's technological lead on the global market for renewable energy. And the use of national energy sources also generates more added value in Germany, including in local craft trades. The following seven measures are of high priority for an ecological industrial policy, in order to ensure sustainable design of our transport systems, promote energy-efficient technologies and make more economical use of raw materials:

Set ambitious and predictable CO₂ limit values for cars

One fifth of Germany's greenhouse gas emissions are due to the transport sector. In the past, ambitious limit values have contributed to a marked reduction in traffic-induced pollutant emissions in the car sector. Between 1990 and 2003, for example, carbon monoxide was reduced by 71.5 percent, oxides of nitrogen by 86 percent, hydrocarbons by 36 percent and diesel particles by 36 percent. And climate-relevant CO₂ has also been reduced in recent years, though not nearly enough to give the all-clear.

Today the greater part of greenhouse gases in the transport sector are due to car traffic. So it is important that European provisions are to be introduced soon: under the Commission's CO₂ strategy, average CO₂ emissions by new cars in the EU are to be **reduced to 120 g CO₂ per km by 2012**, having regard for the competitive situation and diversity of the European car industry. **However, this can only be an intermediate step: 95 g CO₂/km by 2020 and 70 g CO₂/km by 2030 should trigger major innovation by car makers.**

Put second-generation biofuels on the market faster

Unlike conventional biofuels which only convert part of the plant, e.g. an "oil seed", into motor fuel, second-generation biofuels use the entire plant. It is also possible to convert organic waste into valuable motor fuel. For this reason their energy balance is substantially better than for conventional "oil mills". This considerably alleviates the problem of competing uses that has been much debated recently, especially with regard to food production, as long as hitherto unused residual substances are used to produce second-generation biofuels. Another advantage of BTL fuels: they can be "designed" and optimised to meet specific engine requirements. **In order to get second-generation bio-fuels onto the market faster, the Federal Immission Control Act needs to be modified to cater for the better greenhouse gas balance of these fuels and make it attractive for the petroleum industry to supply such fuels.** But it is also clear that the biomass for the new fuels will have to be grown on a sustainable basis, to ensure that valuable ecosystems such as tropical forests are not endangered and that the bottom line is a net improvement in the climate situation. **EU directives to this effect are due to be passed shortly. Among other things, they will ensure that imported fuels also satisfy this sustainability criterion.**

Prescribe smart metering with intelligent counting and measuring systems

The technology currently still in use in Germany for measuring electricity and gas consumption has long been behind the times. Intelligent metering systems (“smart metering”) make it possible to measure energy consumption accurately for a specific period and invoice it correspondingly at short intervals. This has advantages for customers: they no longer have to wait a whole year to find out from their annual statement how much electricity and gas they have used in the last 12 months, but can see at a glance the amount of energy consumed by a specific appliance at any given time: valuable information for optimising demand for electricity and avoiding unnecessary idle times and standby losses. Experience in other countries (Italy, Sweden) indicates that merely installing smart metering systems and visualising consumption results in savings of 4–5 percent of electricity consumption.

But the supplier profits as well: the labour-intensive task of reading meters becomes superfluous, and differentiated user profiles make it possible to achieve a better balance between supply and demand, thereby reducing peak load periods. At the same time the use of “smart meters” is also a basic precondition for the “intelligent networks” of the future, in other words for a new infrastructure based on an innovative combination of information technology and energy technology, an infrastructure that permits not only optimised load management, but also energy-efficient and cost-efficient automatic control of “intelligent” household appliances. **To exploit this potential and make Germany a pioneer of this technology of the future, smart metering systems for electricity and gas consumption should be required by law – by 2010 for industrial customers, by 2012 for commercial customers, and by 2015 for households.**

No energy tax reduction without energy management system

Considerable potential for saving energy exists in the industrial and commercial sector. Estimates indicate that between 20 and 40 percent of industrial energy consumption could be saved by 2020 on economically reasonable terms.¹¹ The use of electronic speed controls could reduce consumption by 15 percent – that is more than 4,000 megawatts, or the output of three to four major power plants. Many potential minor adjustments do not even require substantial investments, and can be made without great effort and at no capital cost. An in-plant energy management system helps to visualise energy-saving potential. It also identifies hitherto neglected cost factors and makes it possible to calculate them for future investment and reorganisation decisions.

German industry enjoys special energy tax concessions. For companies in the manufacturing sector, for example, the tax rates for electricity and heating fuels are reduced to 60 percent of the standard rates. They are also entitled to the “Spitzenausgleich”, in other words a refund of the amount by which the burden of ecological taxes exceeds relief through reduction of state pension contributions. Certain energy-intensive processes are even completely exempted from the energy tax (e.g. in the glass, ceramics, cement, lime, building materials, fertiliser and metal-working industries). It would be absurd if these tax exemptions encouraged wasteful use of energy, and if the existing potential for increasing energy efficiency were not exploited. **Any tax exemption beyond 2012 must therefore be legally tied to the introduction of in-plant energy management systems.** Gradual introduction from 2009 onwards will give companies time for adjustment and learning processes.

11 Cf. also Federal Environment Ministry. Energieeffizienz – Die intelligente Energiequelle. Tipps für Industrie und Gewerbe. Berlin, September 2006.

Improve the legal basis for energy contracting

In the case of contracting, energy modernisation is not undertaken by the landlord himself, but by a third party (contractor) at his request. This enables the landlord to replace an old heating system with an efficient modern system without investing his own resources and without sacrificing liquidity. The reduced consumption results in lower energy costs in the long term, which gives the landlord a competi-

tive advantage for the homes he is offering. The contractor also provides the landlord with expert maintenance of the heating system by specialists. The cost of this contracting service is allocated to the tenants as part of the running costs.

However, innovative contracting models run into legal problems in the rented homes sector because allocation to running costs requires the consent of every single tenant. Energy-saving measures should not fail because of this legal uncertainty. There is thus a need to search for a solution that exploits the potential and enables tenants to benefit from modernisation measures, e.g. through lower running costs for their homes.

Waste legislation: increase the recycling rate for waste

The recycling rate has remained virtually unchanged since 2000, and stood at 66 percent in 2005. Of the total of 332 million tonnes of waste, 210 million tonnes were recycled, including 160 million tonnes of construction and demolition waste. The uses for construction waste included road and path construction, backfill of open-cast and subsurface mine sites, noise abatement and landfill construction measures. Some 10.4 million tonnes of waste were incinerated. In view of the scarcity of raw materials it will become increasingly important in future to optimise waste utilisation and improve recycling rates. Rising raw material prices are helping to ensure that it will increasingly pay to treat our waste and recycle it for economic reasons. In the interests of the environment, we must take advantage of this and step up recycling rates.

Make better use of biowaste

We are still not making optimum use of our biowaste. For one thing, there is still too much biowaste landing in the “wrong” bin. If all Länder and regions made the bio bin compulsory, it would be possible to collect an additional 3 million tonnes of biowaste. This is an opportunity we should not ignore, especially for the sake of the climate. Above all, however, we should make better use of waste ourselves, not only by composting, but also by fermenting it. The revision of the Renewable Energy Sources Act provides an important basis for this. To make better use of the potential of biowaste in terms of materials and energy, further steps will have to follow.

5. Making benchmarks transparent, establishing labels and top runners

The ecological industrial policy and its instruments address both the supply side and the demand side. Government, businesses, trade associations and consumers are all called upon to get our economy heading for sustainability and to stimulate innovation.

Consumers have great demand power. In order to deliberately stimulate modernisation, consumers must be free to take their own decisions. Frequently it is only the price that provides information about a product, and in many cases this information is not exactly informative from an environmental point of view. Marks and labels provide important additional information, bring transparency to the market and help identify the top runners in the relevant product group. This enables consumers to give important signals. It is only on the basis of such information that purchase decisions become genuine decisions. Labels

and marks are thus an important basis for strategic consumption and for innovation-driving demand. Without demanding purchasers, innovative pioneer markets cannot exist.

This “demand-oriented” approach of identifying the top runners and leading-edge products and promoting their distribution contrasts with an innovative approach taken in Japan which works on the supply side and is based on regulatory law. The Japanese are demonstrating how it is possible to establish high standards – not against the market, but with it – and really give product innovation a clear boost. The “top runner approach” elevates the best technology currently available on the market to the status of a standard within a foreseeable and clearly defined period (e.g. five years). Since the benchmarks are produced by the market itself, companies are only being required

to do what the state of the art actually permits. This, however, is emphatically backed up by the regulatory support: those who fail to satisfy the new minimum technological standards within the required period have to remove their products from the market.

Both approaches – voluntary marks and labels and innovative regulatory law – are instruments that we should use and develop here in Germany in order to promote the spread of leading-edge and top runner products.

A revolving innovation system: the Japanese top runner programme

The programme was initiated in Japan in 1998/1999 by the Ministry of International Trade and Industry (MITI) with the aim of reducing Japan's primary energy consumption to 1996 levels by 2010. The idea was as follows: the best product on the market in terms of consumption figures determines the standard that the other products within this product group have to reach within a specified period. Products that fail to do so may no longer be put on the market after this period has expired. The results are impressive: in the computer sector, the target for 2005 was to reduce power consumption in this way by 83 percent compared with the base year 1997. In fact, this target was achieved by 2001. In the case of CD systems, the standard based on the top runner of 1997 promised a reduction of 78 percent in 2005. This target was also reached by 2001.

Power consumption by video recorders was to be reduced by 59 percent by 2003, but in fact the saving achieved was 74 percent. Air conditioners, refrigerators, copiers and TV systems are further examples where the targets were either over-achieved or reached earlier than planned. The advances made are then taken as the basis for a second top runner round which again raises the best benchmarks to the level of standards: a permanent dynamic, market-driven innovation system.

Eco-label, Blue Angel

The Blue Angel is the world's oldest and best-known eco-label. Since 1978 it has been setting standards for environmentally sound products and services. It is awarded by an independent jury in accordance with defined criteria. The Blue Angel rewards companies for their commitment to environmental protection. They can use it for serious advertising of their environmentally sound products on the market. The Blue Angel is an ecological beacon which shows consumers the way to ecologically better products and encourages environmentally aware consumer behaviour. The principles for awarding the eco-label include the stipulation that the award criteria be chosen such that only the top third of the product group can satisfy the requirements. At present some 10,000 product and services in 80 product categories from about 950 licensees bear the Blue Angel.

A survey by the Federal Environment Agency shows that the Blue Angel has the best awareness rating of all eco-labels in Germany. Eighty percent of the population know it, and 38 percent say that they pay attention to it when shopping.

Continued dynamic development of energy labels

Energy and raw materials prices are rising higher and higher. They are a burden on private households and have a direct impact on disposable household income. Against this background there is long overdue need for a meaningful mark which provides information about the resource and energy consumption of household appliances, and which places this information in the context of the current state of the art. Existing consumption information of the kind we know from refrigerators and washing machines has long since ceased to be as informative as it should be. **This labelling must therefore be developed further and regularly updated to stay in line with technological advances. We need a clear, easily understood and general label.** After all, transparency also means ensuring that this is not obscured by competition and by a bewildering maze of competing national and international labels.

Public database for environmental and efficiency technologies

In the course of the Federal Environment Ministry's activities to improve resource efficiency it has repeatedly become apparent that there is a lack of easily understood information on technologies for improving resource efficiency. **In the context of the Resource Efficiency Network, the intention is to establish a public "best practice" database on efficiency technologies in close cooperation with representatives of industry.** It will integrate and supplement existing environmental technology portals of the Federal Environment Ministry and will present them in a more user-friendly fashion.

This project is also concerned with conveying knowledge about analysing production processes to identify genuine potential for saving energy and materials along the value added chain, and with preparing a statement of materials and resources costs. It has to be assumed that technologies can only be used efficiently if there is clarity about the stage in an individual production process at which specific resources can be saved. The structure of the database should be such that it can be searched not only by substances and materials, but also by industries, for the best available technologies and processes and for beacons for improving resource efficiency.

Transparency for the public sector: CO₂ footprint and avoidance potential

The German government has set ambitious targets for Germany in the field of climate protection. Greenhouse gas emissions are to be reduced by 20 percent by 2020 (or 30 percent if major non-EU states follow suit). The federal, regional and local authorities must themselves conform to these targets. To this end there is a need for valid information. **The Federal Environment Ministry aims to contribute to this by preparing the public sector's CO₂ footprint. This will make it possible to identify avoidance levers for action by the public sector, formulate goals, and design and implement reduction strategies** that create a relationship between goals and avoidance levers.

Continue developing the Eco-design Directive

A genuine top runner approach following the Japanese model would really only be enforceable at European level, as individual countries can no longer decide on their own which products are to be allowed on their domestic markets. The policy's frame of reference must therefore be the Single European Market. A first point of attack is offered by the **"Eco-design Directive"** adopted in July 2005. In the context of the implementation regulation for this directive, the Federal Environment Ministry is working to **establish a top runner approach for each of the targeted product groups. Unlike the Japanese model, however, this should not be confined to energy efficiency, but should also be extended to cover other forms of resource consumption (e.g. water in the case of "white goods").**

Dynamising European regulatory law

But this is not enough. We need to establish the basic philosophy of the approach as a **regulatory cross-sectional idea at European level, and also generalise it for the product groups set out in the Eco-design Directive.** In future we must not be content with ecological minimum standards, but must go for dynamic benchmarks wherever we can take advantage of technological competition on the market – not merely in the household appliances sector and not confined to energy consumption. Materials efficiency and consumption of other resources such as water are further important aspects that can be optimised by means of a system based on the best technology available at the time.

Using competitions, encouraging innovation

There is a need for innovative concepts and ideas to solve current problems such as climate change or the increasing scarcity of resources. **Nothing promotes innovation and creativity more than an**

intelligent competition. Although there are already a large number of competitions on a wide variety of topics, there are not many **with concrete technical target specifications** that address the problems of the future. And this although concrete specifications in particular would trigger solution-oriented innovations. The target group should be broad and should mobilise all creative brains – from school-children and students to businesspeople. One possibility might be a solar power competition aimed at answering the question: How much electricity is it possible to produce with the aid of one square metre of solar module or exactly one gram of silicon?

6. Using and developing market launch programmes

On ideal markets there is transparency and perfect competition. In practice, markets do not always function so smoothly, especially when they display an oligopolistic structure or a strong hierarchy. High barriers to market entry prevent potential suppliers and their products from entering into competition. Sometimes the suppliers are there, but the demand is not, because the products are still too expensive or there is a lack of information.

Market launch programmes are one way of creating new markets or bringing new movement to old markets. Market incentive programmes stimulate competition for technological solutions and transport innovations into the competition environment. Market launch programmes promote demand and product development, and they also favour scaling effects, i.e. economies of scale: Increased demand makes for increased production, which reduces average costs and makes it possible to reduce product selling prices. This in turn promotes their distribution.

Market launch programmes have to be designed so that they create a reliable and attractive framework

for market players, but do not lead to permanent subsidies. The Renewable Energy Sources Act has made a major contribution to the success of renewable energy, because it has created dependable investment conditions. The revised version of the Act reduces the fee rates. This forces companies to cut their costs. Another form of market launch is involved in the market incentive programme for renewable energy sources. Like the CO₂ building modernisation programme, it works with government grants and it supports investment in buildings. Every euro invested sets several euros of investment in motion. With the Renewable Energies Heat Act, the German government is now following on from the success of the Renewable Energy Sources Act and waking the “slumbering giant” in the heating market. However, to ensure that we are equipped to tackle the markets of the future, we should be even more energetic in this field and make use of the potential and advantages of market launch programmes.

The market incentive programme for renewable energy has triggered investments worth billions

The market incentive programme has given a great boost to the market development of biomass plants and solar collectors. It is helping to make these technologies increasingly economically viable and to bring about a great leap in demand for them. Ambitious environmental requirements in the assistance programme speed up the pace of technological development. However, the market incentive programme does not merely support employment in research and manufacture, but also safeguards and creates jobs in the craft trades sector: solar collectors and biomass incinerators have to be installed and connected.

In 2005 some 131 million of funding triggered investments totalling over 1.2 billion. Two years later the figure had already reached 1.7 billion prompted by funding of 142 million. This year more than twice as much is available: 350 million. It will be interesting to see what level of investment this ultimately gives rise to.

Stepping up the market incentive programme

The heating market offers great potential for reducing climate-relevant greenhouse gases. Biomass, solar thermal energy and geothermal energy offer a climate-friendly alternative to the use of gas or oil. To promote the introduction of these innovative technologies in private households and in trade and industry, the market incentive programme has already supported investment on a considerable scale in the past. Today, in 2008, there is already a sum of up to 350 million available for the market incentive programme, substantially more than in preceding years. To exploit the potential of renewable energy for the heating market to the full, the funding framework has been expanded in the past and a bonus system introduced to reward particularly energy-efficient use of technology.

Starting in 2009, the raising of the market incentive programme to more than €400 million a year (by 2013) is intended to help greater penetration of the heating market by climate-friendly technology. The Renewable Energies Heat Act introduces a compulsory requirement for new buildings to use renewable energy sources for heating. The market incentive programme puts “promoting” alongside “challenging”, and is intended to support energy modernisation of existing buildings in particular. Through its success, the programme also makes a considerable contribution to the fact that Germany is developing into a lead market in the field of renewable heating technologies.

The investment assistance makes it possible to utilise scaling effects and induce cost-reduction potential and technology development. By tying funding to ambitious standards, the programme minimises free-rider effects. The market incentive programme creates and safeguards jobs – not only in manufacturing companies, but also in the craft trade sector.

Market launch programme for ultra-efficient appliances

To promote energy efficiency, it is not sufficient merely to rely on regulations and limit values – we need an instrument that is as successful as the Renewable Energy Sources Act in the field of renewable energy. Its success was rooted in the combination of three elements: the feed-in fees, the duty to input renewable energy into the grid, and an apportionment system. We should also use this approach to make progress on efficiency technology: **the manufacturer/importer of an ultra-efficient electrical appliance would be entitled to include in the package an electricity credit note that was redeemable through the power supply company.** The standard demanded is always at least 10 to 20 percent above the best appliance (A++) currently available on the market. Following purchase of the appliance, the electricity credit note is credited to the purchaser’s electricity account. The amount credited is based on the power consumption avoided, the environmental benefits, and the economic incentive necessary to put the ultra-efficient technology into practice in this product category.

The purpose of the instrument is not so much to ensure that consumers on the market opt for a more efficient appliance, but to pave the way for technological innovations to actually reach the market. Much of what is technologically possible is never implemented because there is too much uncertainty about demand and saleability. The new instrument gives producers of such appliances greater certainty about planning and investing in their more expensive technology.

Electromobility

If they are powered by renewable energy, electric vehicle drive systems offer great potential for reducing CO₂ emissions and our dependence on imports of oil. Electric drive systems are highly efficient and make it possible to use the entire spectrum of renewable energy sources in the transport sector, especially in urban traffic.

The key to the introduction of electric vehicles on a broad front is sufficiently powerful batteries. Great advances have been made in this field in recent years as a result of the great demand for notebooks and mobile phones. Unfortunately, however, the batteries used in these applications cannot simply be

scaled up to traction batteries, since these are subject to different requirements with regard to both safety and costs. For this reason the German government has initiated various pro-programmes for further development of lithium-ion technology.

To support the targeted development of batteries and other components of electric vehicle drive systems and their interaction, the German government is due to start a multi-year field test with “plug-in hybrid vehicles” before the end of 2008. Such vehicles can cover distances of up to about 50 km with the electric motor, after which the combustion engine comes into action. This means that the benefits of electric drive systems can be used for a large percentage of annual mileage, without suffering any restrictions with regard to range. For some time now, experts have been agreed: the drive of the future is electric. In order to give both industry and consumers adequate certainty for planning in the many-faceted field of electromobility, the German government will draw up the **“National Electromobility Development Plan”** by the end of 2008.

Climate protection booster programme for commercial refrigeration systems

Roughly 15 percent of electricity in Germany is consumed by refrigeration and air-conditioning systems – and the trend is upward. In some cases the energy-saving potential is enormous. In one reference installation (meat products factory) a saving of some 60 percent was achieved. Investment grants are money well spent if they serve to exploit this massive potential and promote efficient refrigeration technology.

If the energy consumption in existing systems is at least 150,000 kWh or the energy costs are at least 15,000 per annum, and if an energy saving of at least 35 percent is achieved, **it is possible to apply for an investment grant of 15 percent for energy modernisation, or 25 percent where natural refrigerants are used.** To avoid the construction of installations that need modernisation from the outset and to support the use of highly efficient innovative solutions, grants are also possible for new systems. Expenditure by the programme is approximately 12 per tonne of CO₂ avoided.

Refrigeration systems consist of a number of components. In the interests of product development, we will also run an efficiency competition. The aim is to support the development of highly efficient and at the same time economical products with climate-friendly refrigerants.

Climate protection booster programme for mini CHP plants

Considerable savings of primary energy are possible by combined generation of power and heat or cold. In areas without district heating supplies, it is logical to install distributed CHP plants. The aim is to use investment grants differentiated by plant size to ensure that when there is a need for refurbishment or a new plant, a CHP plant is built instead of a traditional heating system (e.g. boiler system). Expenditure by the programme is approximately 20 per tonne of CO₂ avoided. Especially for the detached and semi-detached houses common in Germany, suitable micro CHP plants are still at the development stage or being prepared for the market. The same applies to innovative technologies such as stationary fuel cells. The programme is also designed to accelerate the market launch of these technologies.

Partnership for climate protection, energy efficiency and innovation

In many companies, especially small and medium enterprises, considerable potential exists for climate protection measures and greater energy efficiency. And although measures that would exploit this potential are often economic, or in some cases even well above the profitability threshold, not enough is done to get them off the ground. The Federal Environment Ministry’s climate protection initiative is therefore based on an approach of cooperation with industry, with a view to improving its self-organisation in this field, promoting measures and mobilising companies in the interests of climate protection and energy efficiency.

Together with the Federal Economics Ministry and the German Chamber of Commerce (DIHK), we have established a “Partnership for Climate Protection, Energy Efficiency and Innovation”. The aim of this partnership is to exploit the climate-protection and energy-efficiency potential that exists in industry, speed up the necessary use of innovative technologies in practical operation, and thereby make a contribution to achieving our ambitious climate protection and energy-efficiency targets in an economically sound manner. To this end the partnership gives financial assistance to specific, limited-term projects that have an innovative kick-off character aimed at more climate protection and energy efficiency in industry.

7. Focusing strength with a procurement pact

With an annual demand of at least 260 billion for products and services, the federal, regional and local authorities have considerable market power. In the past, this market power has not been harnessed sufficiently for innovation purposes: In public-sector purchases and investment projects, the focus is usually on purchase price alone, and purchase decisions frequently ignore both life-cycle costs and external costs. Procurement of more energy-efficient and environmentally sound products not only reduces maintenance costs, but also makes the public sector a driving force for the market launch of “GreenTech”. The local authorities, which account for some 50 percent of public-sector procurement, have a special role to play here.

Even today, purchasers and users can take advantage of existing leeway. But this often fails because the necessary information is not available. Here the model tenders prepared by the Federal Environment Agency (UBA) for various product groups can help to establish legal certainty. By means of a Procurement Law Modernisation Act, the German government intends to modernise procurement law and implement European requirements in the process. This will facilitate forward-looking, environmentally sound procurement in the future and promote the purchasing of energy-efficient products. But this is only a first step. If we are really to exploit the modernisation potential of public procurement to the full, we need nothing short of an investment and procurement pact.

Potential benefits for the environment

The European Commission has co-financed a project with the title “Relief” to make a scientific assessment of the environmental benefits that could potentially result from comprehensive EU-wide introduction of an environment-oriented procurement approach. This came to the following conclusions:

- If all government agencies in the EU were to convert to green electricity, this would save 60 million tonnes of CO₂, which corresponds to 18 percent of the commitment entered into by the EU under the Kyoto Protocol on the reduction of greenhouse gas emissions. Roughly the same savings could be achieved if all governmental agencies decided in favour of buildings of high environmental quality.
- If all governmental agencies throughout the EU were to demand more energy-efficient computers – thereby setting in motion a market trend – this would result in a saving of 830,000 tonnes of CO₂.
- If all governmental agencies in Europe installed economical toilets and taps in their buildings, this would reduce water consumption by 200 million tonnes (or 0.6 percent of total household consumption in the EU).

From: European Commission, Environment-oriented Procurement! A Guide to Green Public Procurement, EC 2005, p. 5.

Making a procurement pact between federal, regional and local authorities

Systematic exploitation of the scope and opportunities in procurement continues to fail because of a lack of will or awareness on the part of many actors. We therefore suggest an investment and procurement pact in which purchasers in local, regional and federal authorities join forces and take a joint approach to selected product groups (vehicles, office equipment and lighting). The aim is to send out signals to industry for a targeted modernisation initiative.

By means of a procurement pact between federal, regional and local authorities we want to focus and use this market power for innovation and the environment in Germany. For at least 25 percent of their procurement volume, the authorities at all three levels agree to procure only goods and services that satisfy strict, agreed environmental and social criteria. Green, innovation-oriented public procurement has a positive economic benefit: Firstly, it eases the burden on the environment in many fields. Secondly, the market potential of the public sector stimulates innovations which then become established on the markets as environmentally sound goods, methods and services and which may also have a positive impact on employment. Thirdly, reduced consumption of energy and resources saves costs – and in view of steadily rising energy and raw materials prices this is of great importance for the public sector in particular. Thus green public procurement has a neutral impact on costs and may even save costs in some cases.

We aim to take targeted steps to break down barriers in the fields of knowledge/information and incentives/sanctions. Financial support can be provided by contracting, “intracting” or energy-saving fund models.

8. Improving education and training

As a resource-poor country, Germany has always had to rely on making particularly efficient use of the production factor “knowledge” and optimising its use of human capital. The strength of German industry is based on engineers and well trained skilled workers. Innovation and technological progress centre round qualifications, and hence people. Investment in education and training is the basis for successful innovation, research and technology.

This is a fundamental principle, but it is particularly true of the future-oriented sector of environmental technology. Just as this sector has created new jobs and provides a living for engineers and skilled workers in particular, its growth and economic success depend on the availability of well trained employees.

Today, engineers and skilled workers have become a rare species. According to the iwd (Institut der deutschen Wirtschaft), some 165,000 vacancies for highly qualified individuals (engineers, technicians) could not be filled in 2006. Overtime and order cancellations are nothing unusual in booming industries. The Institute calculated that in 2006 German industry lost 18.5 billion in added value (0.8 percent of GDP)

merely as a result of the shortage of skilled employees. In view of the demographic trend, this problem will become more acute not only among engineers and skilled workers, but also in the field of training. It is already possible to predict considerable gaps. In 2015 about 43,000 engineers will retire, but only about 40,000 new graduates will come onto the labour market. So we need to take timely countermeasures.

The requirements that employees in the environmental sector have to meet are changing, and new professions are emerging. To take a simple example: the internationalisation of the wind energy sector means that language skills for service technicians are becoming an important requirement for providing operating and maintenance services abroad following the initial installation of wind energy systems.

And because environmental technology is a highly integrated technology, environmental technicians too have to become all-rounders. Equally, we need further training and upgrading courses for employees in those sectors that are increasingly working with environmental and efficiency technologies.

Educational initiative “Environment creates perspectives”

In August 2006, against the background of the emerging “educational gap”, companies and associations in the field of environmental technologies/ renewable energy got together with the Federal Environment Ministry at the initiative of Federal Environment Minister Sigmar Gabriel to launch the educational initiative “Environment creates perspectives”. Today over 40 companies and associations are taking part in the initiative and have promised more than 6,000 additional apprenticeships by 2009. The initiative seeks to safeguard Germany’s technological lead in the long term by means of an educational lead.

The initiative, which intensifies the dialogue between the actors, is particularly concerned with questions relating to the profiles of apprenticeship trades, the skills and competencies required by the environmental sector, the material taught at school and in industrial training, and the image problems of parts of the industry. Other bodies participating in the initiative are the Federal Ministry of Education and Research (BMBF), the Federal Institute for Vocational Training (BIBB) and the German Chamber of Commerce (DIHK). The initiative sets out to network and bundle actors and programmes (e.g. JOBSTARTER programme).

Developing a resource-efficiency oriented continuation training concept for employees

Companies and their employees are central actors when it comes to improving resource efficiency. This project is intended to systematically address and reach them for the first time. The aim is to support the development of practice-oriented further training material and events. Concrete plans include the development of upgrading modules on resource efficiency improvement for works council members and other employees. These will be tested and optimised in pilot training courses. Close cooperation with the German Trade Unions Federation (DGB) is planned.

The project is designed to reach employees (works councils etc.) on trade union training courses and raise their awareness of the need to improve resource efficiency in everyday operation and production, and also to communicate practical and technical knowledge that puts them in a position to stimulate and, where appropriate, implement change processes for improving resource efficiency at work. The project gives the Federal Environment Ministry the opportunity to address the topic of resource efficiency and ways and means of implementing it, taking it right into companies and factories with a very practical approach.

In addition, **funds from the European Social Fund (ESF) can be used in an ESF programme run jointly by the Federal Ministry of Labour and Social Affairs and the Federal Environment Ministry to support innovative environmental measures in the further vocational training of employees** and at the same time to help ensure stronger links and synergies between environment and employment in European policy as well.

New professional requirements, new jobs, new qualification offensive

Many new job profiles in the environmental sector have emerged without this being reflected adequately in university curricula or in apprenticeship courses. And in many traditional occupations, from the craft trades to the engineering sciences, materials and energy efficiency issues and environmental technology aspects are coming to play an increasingly important role, which is not yet catered for adequately by training courses.

We need to bring the curricula up to date. This is also a basis for better measures to counteract the shortage of skilled employees that threatens a number of sectors. The recently published status report “Training and Jobs for Renewable Energy” provides important pointers for this work which we intend to put into practice jointly with the BIBB and the Federal Labour Agency.

9. Focusing research funding, creating beacons

The market does a lot to stimulate innovation. But in view of the ecological and economic challenges, we need an active innovation and technology policy.

It is a question of two things: continuing incremental technological development in all sectors on the one hand, and great innovations – veritable technological quantum leaps – on the other. Only in this way can we succeed in decoupling growth from energy and resource consumption.

The state has an important role to play here. It cannot prescribe technological development on a top-down basis, but it can establish framework conditions

that encourage companies to intensify their research efforts. And, via financial support and pilot projects, it can help to promote major advances in efficiency and technology.

“Beacons” are important landmarks in uncertain terrain. They send out signals of feasibility and provide guidance. They also help to mobilise social forces, create social acceptance, and foster self-understanding in a society.

More than ever before, resource efficiency and energy intelligence must be at the focus of government research and technology policy.

Environmental technology master plan

The Federal Environment Ministry and the Federal Research Ministry have jointly established the environmental technology master plan. The master plan seeks to foster the development and dissemination of environmental technologies. To this end, other ministries will be involved in a second phase.

The two ministries have therefore agreed to bundle their commitments, coordinate measures better and take joint initiatives. At the same time the master plan is intended to provide industry with guidance, e.g. by bringing together existing knowledge about the newly emerging lead markets with a view to creating opportunities for influencing innovation policy and promoting strategic cooperation with science and industry.

Further development of the master plan will take place in four strategic “umbrella” processes. It will pay particular attention to developing innovation-promoting framework conditions and to enlarging our knowledge about future technological development, e.g. through foresight processes.

Intensifying energy research

As well as further technological development of renewable energy technologies, research and development must also have a special focus on issues relating to energy infrastructure: even if many questions are still open and it would be fatal to put all our money on a single horse where technology is concerned, it is possible to identify central areas that we need to develop without delay. This, for example, applies to the many and various challenges of improving energy supply systems to take account of the growing share of renewable energy. Electricity generation from wind and sun is subject to considerable fluctuations. We therefore need **intelligent power networks** (smart grids), for example, that permit more flexible coordination of generation and consumption. **Virtual power plants** allow power generation systems, consumers and storage facilities to communicate with each other, thereby facilitating system optimisation.

Efficient electricity storage technologies or the integration of electric vehicles can also make a contribution. But **power transmission technology** itself offers points of departure. To transport electricity to the south of Germany from onshore and offshore wind farms in the north, we need an efficient infrastructure. **So we need to intensify research efforts in all these fields. The Federal Environment Ministry therefore intends to step up its activities on this front.** For example, the Federal Environment Ministry will provide a total of up to 20 million funding for two projects in the context of the

“e-energy” competition initiated by the Federal Economics Ministry. Another beacon project will push ahead with the use of electric vehicles as a contribution to integrating renewable energy sources.

Beacon: “Green biorefinery”

Biorefinery concepts increase the added value derived from the resource “biomass”. This is because this kind of production optimises utilisation of these renewable raw materials: It links food production with the production of platform chemicals. Another conceivable option would be alternative production of motor fuels, electricity or heat, for example.

Biorefineries not only utilise all biomass components efficiently and optimise their application, they also make more efficient use of non-raw material resources (energy, water, etc.) and minimise waste. Biorefineries not only save fossil resources, they also convert the biomass as resource-efficiently as possible. **There are plans for a refinery at Selbelang (Brandenburg), which will use renewable raw materials to produce animal feeds and basic chemicals suitable for further processing to bioplastics. The aim is to develop a fundamentally new, highly innovative basic technology. The project is supported and co-financed by SMEs as part of the climate protection initiative.**

Beacon: “Urban mining”

The existing homes in cities and municipalities represent a vast source of secondary raw materials, making them the “materials store of tomorrow” (urban mining). Above all, demographic changes and internal migration within Germany will have an impact on the quantity and composition of construction and demolition waste. Even if a large proportion of construction and demolition waste today is already recycled, there is still considerable waste recycling potential that remains unexploited. And those items that are already recycled today are used largely in the highway and civil engineering sectors. To date there is hardly any recycling of high-quality materials or re-use in building construction.

The Federal Environment Ministry plans to extend research in the field of urban mining to cover high-quality re-use of mineral construction waste. There will also be a pilot project on better recycling of demolished prefabricated apartment blocks.

Beacon: “Electromobility”

The future is electromobile. This must be reflected in research: although very great advances have already been made in **battery technology**, a key element for the broad introduction of electric vehicles, further improvements with regard to costs, capacity, safety and reliability are still necessary for their use as traction batteries. From an economic point of view the establishment of an efficient battery industry and relevant research and training facilities is of crucial importance to ensure that the automobile industry, which is so important to Germany, does not become dependent on Asian battery manufacturers.

Another key area must focus on **drive technology**, because integrating the electric drive system in a vehicle, whether on its own or in combination with a combustion engine, presents not only new challenges, but also fresh creative opportunities for development engineers and designers.

The third key area addresses the **integration of electromobility in the future energy system**. On the one hand it is a question of energy supply: this is because electromobility cannot fully exploit its great potential for reducing CO₂ emissions and dependence on imported oil unless the electricity used originates from renewable energy sources. However, the renewable energy required must not be siphoned off from other sectors: instead there is a need to exploit new potential, such as distant offshore wind farms or solar energy from the Mediterranean region. Further research is also needed into the

interactions between electromobility and the power grid, as this field offers great potential for improving grid stability against the background of a rising share of fluctuating renewable energy sources.

In order to define the necessary guidelines in these areas for the next 10 years, the German government will present its national development plan for electromobility by the end of 2008.

10. Intensifying export initiatives and foreign trade

Even if the domestic market is of great importance for businesses in Germany, exports of environmental and efficiency technologies still need targeted support. "GreenTech made in Germany" offers solutions that are sought and needed in many places. At the same time the dynamic employment trend in the field of environmental technology is partly driven by exports.

Particularly for small and medium enterprises in the environmental industry, it is often difficult to maintain a presence abroad for themselves and their portfolio, and to assert themselves in the face of their competitors, which increasingly means competitors from Asia. Especially where it is a matter of supplying system solutions, small innovative companies run the risk of being left behind by major system suppliers. That is why it is important to overcome coordination problems and pool competencies and services. Export initiatives are a tried-and-tested means of bringing together supply and international demand.

Another point of attack for ecological industrial policy is to promote international demand by exporting successful policies. Policy export solves ecological problems and creates markets that German companies can also profit from: environmental dialogues contribute to creating the framework conditions that favour demand for environmental goods and services.

The Federal Environment Ministry's targeted activities help to establish Germany's global position as a supplier of environmental goods and services: this not only safeguards and creates growth and employment here in Germany, but also helps to overcome ecological problems by using good technology. The foreign trade component of the ecological industrial policy ensures further dissemination of the model of sustainable development.

Policy export: The feed-in fees as a worldwide model

Germany exports not only its technologies with great success, but also successful legislation. Within a short space of time, for example, the Renewable Energy Sources Act has become an international model and a trailblazer when it comes to promoting renewable power generation. Of the 49 countries around the world that had set themselves expansion targets for renewable energy by the end of 2005, some 32 countries use funding instruments with electricity feed legislation.

The principle of fixed feed-in fees is currently applied in 18 EU countries. As a rule, the scales of fees in these countries are also graduated on the basis of generation method and plant size; and some have declining scales that take account of price trends and technological advances. The system of feed-in fees based on the example of the Renewable Energy Sources Act is spreading fast. India and China already have comparable support instruments in place. What is more, China plans to use this means to expand renewable energy to 16 percent of primary energy requirements by 2020.

Unlike feed-in fees, the quota model is not used in many countries. In these countries the producers of renewable power have to negotiate the sale of their electricity to the grid operators themselves. Their revenue is usually based on wholesale prices. In addition, a coordinating authority issues them with certificates for every kilowatt-hour of electricity generated from renewable sources. They can then trade in or sell these certificates. Demand for them is artificially created by the state laying down a specific quota for renewable energy for the market.

Launching export initiatives and supporting the German export industry

Environmental technology “made in Germany” enjoys a good reputation the world over. To provide better political support for environmental technology exports and create synergies jointly with actors in industry, the Federal Environment Ministry has launched a number of initiatives:

- **Establishment of the German Water Partnership.** The German Water Partnership is a platform that coordinates actors in the water sector, promotes innovation and bundles information. It is the central point of contact for all foreign inquiries to the German water management sector. As a network within Germany, the platform embraces all export-oriented companies, research institutions, universities and partner trade associations, plus regional (state) initiatives and the relevant ministries.
- **Launch of the Export Initiative Recycling and Efficiency Technologies.** Among other things, this initiative aims at practical technology exports. By linking and fostering communication between the partners (ministries, regional and other authorities, trade associations, universities, foreign chambers of commerce etc.) it sets out to improve the efficiency of the technology export process – for the benefit of German companies in the recycling and waste management industries, components suppliers, service providers, local authorities and decision makers abroad.
- **Establishment of the Federal Environment Ministry Service Unit “Environmental Technology Export and CDM Projects”** as a point of contact for problems in specific individual cases. The aim is to provide companies with a central point of contact with a “pilot” function, to ensure targeted forwarding of their concerns through good networking with all actors in the foreign trade promotion sector, and to accompany the companies until their problem is solved.

International propagation of best practice in environmental policy

Frequently it is not only a lack of money and know-how that prevents efficient solutions to ecological problems; there is also a lack of administrative and organisational structures and effective policy concepts. In addition to practical project funding and technology exports, policy export and the propagation of good practices is an important and necessary form of assistance for the developing and newly industrialising countries to help them overcome the environmental problems they face and master the global ecological challenge.

For this reason the Federal Environment Ministry has numerous **strategic environmental partnerships**, especially with developing and newly industrialising countries, to support the development of a viable framework of environmental law and appropriate implementing structures in the partner countries. The bilateral and international dialogue on successful policy instruments and technological solutions in the field of energy and resource conservation benefits from Germany’s experience with ambitious environmental legislation. Conversely, Germany also profits from experience in other countries. As part of the climate protection initiative, the Federal Environment Ministry now intends to provide more assistance for **specific projects** that influence the shaping of political framework conditions in the target countries in ways that put their energy systems on a climate-friendly and sustainable course. Another aim is to facilitate adaptation to climate change and to conserve natural habitats. **Assistance is to be provided specifically for consultation and capacity building projects.**

OUTLOOK: SETTING SIGNALS FOR A NEW GROWTH SURGE

With its proposed mix of political measures and its plea for the ecological industrial policy, the Federal Environment Ministry is offering a concrete answer to the great economic and ecological challenges of our time. Climate change and population growth, the finite nature of fossil fuels, the global hunger for energy, industrialisation processes in the newly industrialising countries, price explosions on the raw materials markets, and loss of biodiversity – all these developments affect our ecosystems. But it is also becoming increasingly clear that they have significant impacts on our economic system as well. Today, ecological problems are economic problems; and economic challenges are also environmental challenges.

Ecology is becoming the economics of the 21st century, and the ecological industrial policy draws the necessary conclusions. It gives an economic answer to the ecological question. The ecological industrial policy is a strategy for modernising industry and society in the direction of more sustainable production and development. It aims to restructure the energy and materials base of our economy by replacing finite with renewable raw materials and by expanding the use of renewable energy. This not only helps to influence economic activity here in Germany in a direction that is more acceptable from an environmental and social point of view, but also makes a contribution to a new global development model that is capable of generalisation.

In view of a new international division of labour and globalised markets, however, ecological industrial policy is also a specialisation strategy that will make our economy fit for the future. Environmental technology is a growth market, and Germany is in a good position to profit from these economic opportunities and establish a profile as a global provider of environmental technologies and services for the 21st century.

The strategy of ecological industrial policy thus combines two things that have hitherto been thought of separately rather than together: it seeks to modernise and modify our industrial society, and at the same time it seeks to pave the way for a new growth surge. This is an opportunity we should seize – for the sake of our environment, but also to keep our economy competitive, safeguard growth and employment, and create “good jobs”.

The debate about concrete steps and instruments for restructuring our industrial society cannot be delayed any longer. It is a debate that we have to conduct today, as we may have to pay dearly – in both ecological and economic terms – for any hesitation. The ecological industrial policy and the policy mix on which it is based is also a plea to at last break down the old ideological fronts. Rather than holding forth on the great challenges facing us, we need to advance the debate about concrete measures. What we need is not just competition between sophisticated theoretical models, but also real competition to find the most innovative and the most practical ideas. Industry and politics, science and society – they all need to adjust to take account of the changed relationship between environment and industry, and they need to join forces to speed up the restructuring of our industrial society with the goal of a sustainable society – a new constellation of prosperity.

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