Öko-Institut standpoint

Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

Resources Fever

A situational analysis

A cool head for sustainable solutions

Imprint

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Öko-Institut

❞ Öko-Institut, the independent Institute for Applied Ecology, which was founded in 1977, has concerned itself for thirty years with key environmental issues, and it advises policy-makers, environmental organizations and industry on the practical implementation of sustainable development. ❞

Global demand for natural resources is increasing. Not only industrialized countries, but also newly industrializing countries such as Brazil, China, India, Mexico and South Africa increase the pressure on energy sources, metal ores, water and foodstuffs. Record prices on commodity markets and intensified competition for access to raw materials are the result; the fear of dependence and scarcity is growing: The world is in resources fever.

Parallel to the fever curve for resource demand, adverse effects on the environment and climate as well as – a direct result – social and political tensions are sharply increasing. It is therefore time to grasp the new "resources debate" as an opportunity for more sustainable use of resources.

In "Resources Fever" Öko-Institut states its view on the new debate on resources, defines key challenges and develops – supported by examples from its own activities – strategies for sustainable resource efficiency.

Scarcity – cause or symptom?

__Natural resources__ are elements of nature that yield a profit for man: renewable and non-renewable raw materials, fossil energy sources, genetic resources, solar energy, wind, water and soil.

__Raw materials__ are unprocessed and untreated primary materials that flow into the production process

Resources fever has stricken not only Europe and North America. The topic enjoys a high priority in other OECD countries as well as with new global players. China, for instance, pursues an aggressive policy in Africa to secure supplies of important raw materials and, as a result, triggers off fears of shortages in industrialized countries. Are raw materials actually becoming scarce? Do we really have to fear that important resources will soon no longer be available, or is it merely momentary media hysteria? A differentiated analysis is essential. Scarcity can be a result of political decisions, pricing, speculation and capacity restrictions; it can also be of a physical nature. Here, cause and effect are often confused.

"Without a guaranteed supply of raw materials the wheels of German industry will grind to a halt"
Federation of German Industries (BDI), 2006

"The consumption of raw materials by the present generation only supposedly deprives future generations of something"
RWI Essen, 2006

Öko-Institut standpoint

Scarcity is a symptom and not the actual problem. The real scarcity debate must address sustainability as the key to the solution.

Physical scarcity

Physical shortages of raw materials – at least of most bulk metals – need not be feared even in the long term. Economic "schools" categorically rule out shortages of metals and mineral raw materials with the argument that these cannot be "used up" and are always recyclable.
This argument does not always hold true, however. In the case of platinum, for example, a metal that plays a key role in modern technology, Öko-Institut has identified large widespread losses. The same also applies to other precious metals, which occur naturally only in low concentrations and are mined worldwide in small quantities. If they are not to be permanently lost for reuse, new forms of international co-operation will have to be established.

Page 14: International co-operation – Example: precious metals

Were worldwide per capita demand for raw materials to reach the level of industrialized countries, global demand for certain metals, such as copper, could no longer be met, even with 100 % recovery. Yale University computations (by Gordon and Gredel) show that the global stock of metal then required would be too large. In this case, therefore, there is a real threat of physical scarcity.
A further, as yet hardly noticed example is uranium ore. With the tripling of global nuclear energy capacity, as forecast in some energy scenarios, reserves would be exhausted within 20 to 30 years.

Page 16: Scarcity – Example: uranium

Politically induced scarcity

Politically induced scarcity is a nightmare for industrialized countries lacking in raw materials. Supposed or actual dependence on a few producer countries severely threatens their economic power. Politically induced scarcity has nothing to do with physical scarcity, but it can provoke international crises and even the threat of war. The oil-price crises of the 1970s and 1980s are still a painful memory. With a number of raw materials there are regional or economic concentrations and thus the danger of growing dependence. Niobium, for example, a special-steel additive, is produced almost entirely in just three countries.

Raw materials with the highest regional concentrations
Source: Federation of German Industries (BDI) 2006

	Share of world production of the three most important producing countries	Producing countries in order of share of production
Niobium	98.7 %	Brazil > Canada > Australia
Tungsten	97.6 %	China > Russia > Austria
Platinum	95.0 %	South Africa > Russia > Canada
Palladium	88.3 %	South Africa > Russia > USA
Tin	82.9 %	China > Indonesia > Peru
Chrome	78.3 %	South Africa > Kazakhstan > India

Our diagnosis: resources fever

	1985	1995	2005
Copper *(Ore production in million t/a)*			
	8.54	10.1	15.1
Aluminium *(Primary production in million t/a)*			
	16.6	19.9	31.6
Iron *(Ore production in million t/a iron content)*			
	502	554	642
Zinc *(Ore production in million t/a zinc content)*			
	6.63	7.13	9.39
Platinum *(Mining production in t/a platinum content)*			
	112	145	214

All data: worldwide, Fe 2003 instead of 2005, Zn, Pt 2004 instead of 2005
Source: RWI/BGR, FhG-ISI 2007

In recent years, natural resources have become the focus of interest in political debate and at top-level industrial forums. The "mainstream" debate on resources is characterized by the fear of scarcity, of sharply increasing raw material prices, of dependence on politically unstable countries and resultant international tension. The media, which – with the exception of oil – has devoted very little attention to the topic over the years, is stoking up discussions. Resources fever prevails. The question of the ecological compatibility of the use of resources mostly plays only a minor role.

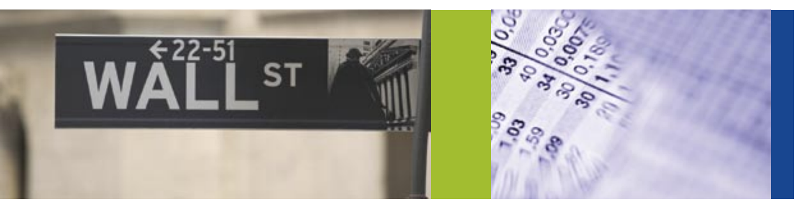
The diagram shows increases in ore mining of selected metals and primary metal production, respectively, in the last two decades. The list could be extended to include a number of other raw materials.

Öko-Institut standpoint

❞ The big challenge of resources fever is to establish economic, ecological and social justice: justice between industrialized, newly industrializing and developing countries, but also between our generation and future generations. ❞

A multi-dimensional challenge

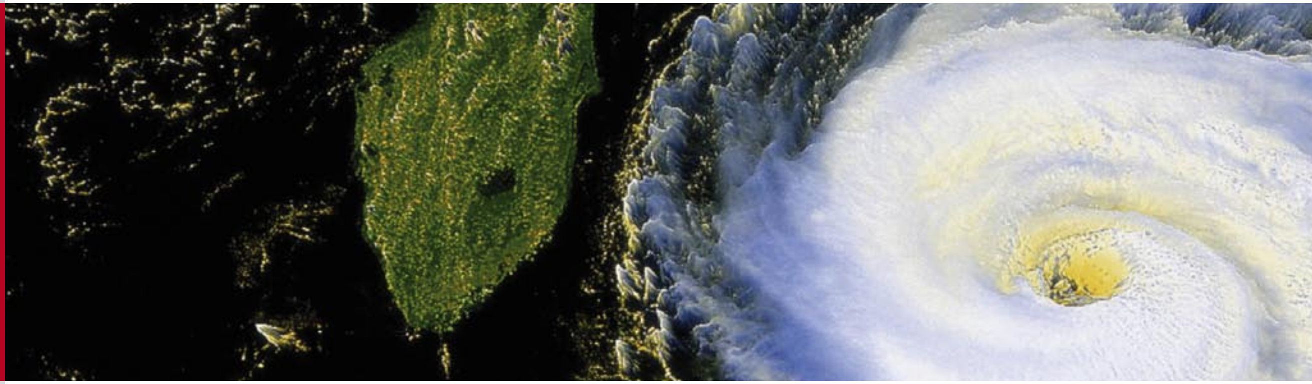
Adverse effects on the environment of the worldwide extraction, processing, use and recovery of resources are serious. Interference in ecosystems endangers biodiversity, great quantities of, in part, hazardous wastes arise and high energy input accelerates climate warming. The problem is aggravated by increasing growth rates in the consumption of resources.
Relative pressures on the environment can be reduced at all processing stages through the use of modern technology. In absolute terms, however, such pressures will still increase if high prices for raw materials once more make the energy-intensive mining of low concentrations of ore – or, for example, the extraction of oil from oil sand – attractive. With a maintained high level of demand and high prices, regions under particular protection, such as national parks, could be sacrificed, whether in a legal or illegal manner. This could have serious consequences not only for the ecology of these areas but also for local indigenous peoples.
Resources fever is therefore an economic, ecological and social challenge.



Rio 92: A question of justice

The connection between the ecological and the social dimension of resources fever is varied and not free of contradiction. On the one hand, justice within a generation requires the creation of fair living conditions for all people and thus a certain need for resources. Newly industrializing countries rightly react sensitively to appeals for sacrifices from industrialized countries. On the other hand, the destruction of natural bases of life can have massive social implications, including the complete loss of health, housing and jobs. Moreover, the opportunities of coming generations are greatly restricted. Besides intragenerational justice, Intergenerational justice is a keystone of resolutions passed at the Earth Summit in Rio in 1992.

The strategy: sustainable resource efficiency



The just use of natural resources with an extensive reduction in adverse effects on the environment requires a policy of sustainable resource efficiency, which pursues, at one and the same time, ecological, social and economic targets. Environmental research is particularly called upon to point out the connections between the use of resources and social and economic implications.

The attainment of globally sustainable resource efficiency necessitates the following political processes:

Operationalization of the sustainable strategy

In Germany, the government's national sustainability strategy sets important specific targets. For instance, there should be a doubling of raw material productivity between 1994 and 2020 as well as of energy productivity between 1990 and 2020. These targets can only be achieved if they are tangible for individual industries, areas of need and key stakeholders in business, policy making and society. For this purpose, possible contributions of individual industries have to be determined, communicated and expressed by means of specific measures. As defined in EU resources strategy, specific steps have to be formulated in individual Member States – comparable to the strategy for the reduction of greenhouse gases.

Öko-Institut standpoint

Sustainable resource efficiency
| precludes dependence
| lessens local and global environmental impacts
| supports just distribution and
| provides the impetus for strategic innovations and developments.

Development of the secondary raw materials economy

Global crude steel production greatly influences worldwide demand for important raw materials such as iron ore, alloying metals and coke. Crude steel production in Germany alone gives rise to annual emissions of around 60 million tonnes of greenhouse gases. Through more efficient processes and the increased use of steel scrap in electric steel production, around 10 to 15 million tonnes of greenhouse gas emissions and many million tonnes of primary raw materials could be saved annually by 2030. The secondary raw material path is, however, not only ecologically but also socially and economically advantageous. It creates jobs over a wide area, promotes small- and medium-sized business structures and reduces dependence on primary raw materials.

Promotion of sustainable consumption

Private consumption directly influences both the quality and the quantity of production. With the **EcoTopTen Project** for important product groups, Öko-Institut demonstrates the considerable contribution to sustainable resource efficiency that private consumers can make through intelligent purchasing decisions.

www.ecotopten.de

Benefit of demographic developments

In industrialized countries, **demography** offers a particular **opportunity**: Specific gains in efficiency enable reductions in the utilization of resources not only in relative but also in absolute terms, when the total population grows only moderately, or stagnates.

Page 18: Demography as opportunity – Example: housing

Fair production of raw materials

Öko-Institut will press strongly in the coming years for an internationally binding system, which provides access to world markets only to those raw materials whose production is fair and environmentally sound – e. g., **"fair ores"**, in the case of metals. Such a process corresponds in its dimension to the Kyoto process, and It can only be established under the roof of the United Nations. Here, the EU fulfils a catalytic function within the framework of its resources strategy.

Page 14: International co-operation – Example: Precious metals

The strategy: sustainable resource efficiency

Renewable raw materials

Renewable raw materials can make a significant contribution to worldwide resource efficiency. However, **competing uses** arise when raw materials can be utilized as energy sources, chemical feedstock or as food and fibre. In this contentious area, **sustainable potentials** have to be investigated and used.

Page 12: Potentials and competing uses – Example: Renewable raw materials

New technologies

The potentials of new technologies go beyond increases in efficiency in existing manufacturing processes and improvements in recycling. Besides **new opportunities** for the purposes of sustainable resource efficiency they also involve **new risks**, which have to be investigated at an early stage and precluded where possible.

Page 22: New opportunities, new risks – Example: Nanotechnologies

Co-operation with newly industrializing countries

A reduction in the use of resources in established industrialized countries is tremendously important. Without the exploitation of relief potentials in newly industrializing countries, however, a reduction in absolute terms is not possible. Positive experiences on the part of OECD countries with regard to environmentally beneficial raw material production, efficient production and sustainable consumption must therefore be made available to newly industrializing as well as developing countries in an accelerated **exchange of experience** and through **technological co-operation**.

*Page 20: Newly industrializing countries –
Example: Exchange of experience and technological co-operation*

http://www.oeko.de

„Further information on the methodical and political challenges of sustainable resource efficiency, as well as on our activities, can be found at www.oeko.de"

From research to action

Öko-Institut concerns itself, together with research partners as well as policy-makers, industrial decision-makers and NGOs, with varied aspects of sustainable resource efficiency. In the following pages we highlight six such projects:

Potentials and competing use

The example of renewable raw materials demonstrates the huge worldwide potentials with concomitant competition through varied usage.

International co-operation

The production and handling of precious metals demonstrate exemplarily the necessity of increased international co-operation.

Scarcity

Uranium – previously little discussed – is an example of a very scarce resource.

Demography as opportunity

Demographic developments open up, together with new strategies in house building, the opportunity to utilize resources that are going to waste.

Exchange of experience and technological co-operation

Global sustainable resource management can only be realized by way of intensive technological co-operation with newly industrializing countries.

New opportunities – new risks

The opportunities for resource efficiency that are offered by the use of nanotechnologies – taking account of and minimizing risks – are illustrated by the final project.

Example
Renewable raw materials

Renewable raw materials serve as food, animal feed and fibre, as energy sources and as feedstock for the chemicals industry. Since arable land is limited, competing use arises. The issue of food security is currently the subject of discussion. Sustainable cultivation includes short-rotation coppices, such as poplars and willows, as well as perennial grasses, such as Miscanthus and switch, which demonstrate high yields with little fertilizer. Double-cropping systems, with the sequential cultivation of different plants within one year that hardly require pesticides, are a further example.

Résumé: *Renewable raw materials are regenerative; their sustainable potential is limited, however, by the availability of land and its yield. Sustainability standards and the use of non-food plants can help avoid conflicts from competing use.*

Renewable raw materials in Germany and the EU

In Germany, the sustainable potential for bioenergy, excluding imports, is 15 per cent of primary energy demand, providing that, parallel to this, materials recycling increases and 30 per cent of our food come from organic agriculture. Biogas from plants and liquid manure is mainly used for the production of electricity, and wood for the production of heat. In the case of fuel, biodiesel from rapeseed and ethanol from grain play an important role. Renewable raw materials are utilized in building materials, as feedstock for chemicals, paper/cardboard and textiles. And we eat them – also indirectly as animal feed.

In the EU, the sustainable potential is 20 per cent. As a result of agricultural policy, developments in yields and demand trends, a decline in land devoted to the cultivation of foodstuffs is to be expected, even with an increase in extensive and organic agriculture.

In the EU, with increasing demand and high oil prices, imports of biomass from Eastern Europe and Latin America as well as South-East Asia and Africa are becoming attractive. Palm oil from Indonesia is one example.

Öko-Institut standpoint

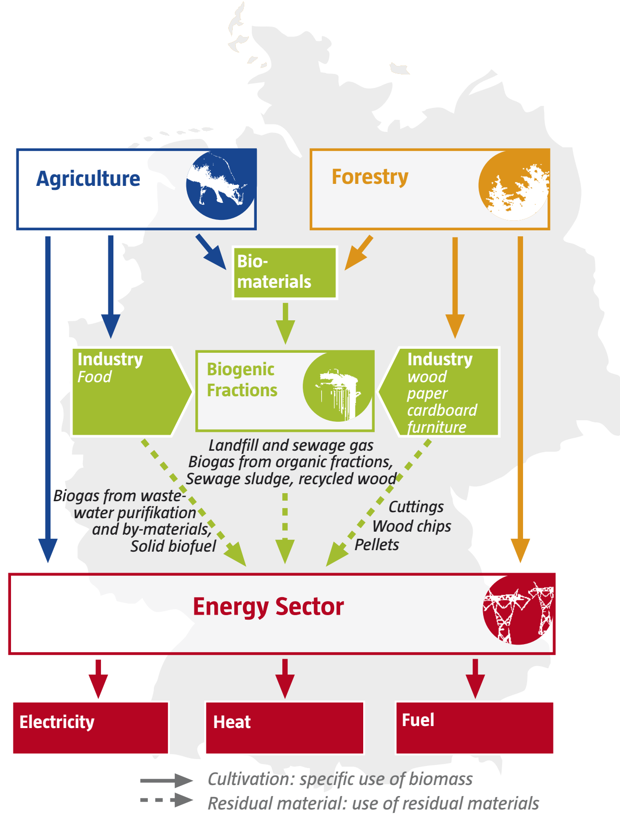
„ With internationally binding sustainability standards for the provision of renewable raw materials and the increased cultivation of non-food plants, negative ecological, economic and social effects can be avoided. “

Food or chemical feedstock?

Sufficient land is available globally to avoid direct competition between animal feed and food on the one hand and non-food products on the other. The cultivation of renewable raw materials leads indirectly, through price effects, to competition. When an agricultural product is marketable as food, chemical feedstock and energy source, the highest price determines attractiveness on all markets. If the use of biodiesel results in a higher price for rapeseed, prices for palm oil and soybeans also increase indirectly, even when these are not processed for fuel. Farmers then earn more, there is an increase in employment and bio-companies pay taxes. However, increasing food prices can have fatal consequences for those people who do not profit from greater prosperity.

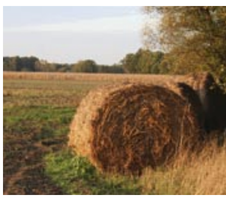
The key: non-food plants

Social aspects have therefore to be considered in the marketing of renewable raw materials. In the long term, however, non-food plants, such as fast-growing trees and energy grasses, have to be cultivated as raw materials in order to decouple markets.
From the point of view of research, considerable efforts are necessary to improve sustainable production of renewable raw materials. Up to now, plant cultivation has concentrated on components such as oil and starch of just a few types of plant and on purely economical optimization. In terms of sustainability, however, whole-plant yields with minimal input of additional resources are the target. Robust conversion technology allows the use of a broad spectrum of plant types. Finally, the development of biorefineries for the long-term replacement of fossil hydrocarbons is a global challenge.



Biogenic residues and wastes as a resource

The potentials of biogenic residues are often overlooked. Through cascade use in waste management, renewable resources that have already been used as materials can be “reused” energetically and thus additionally defuse competitive relationships.

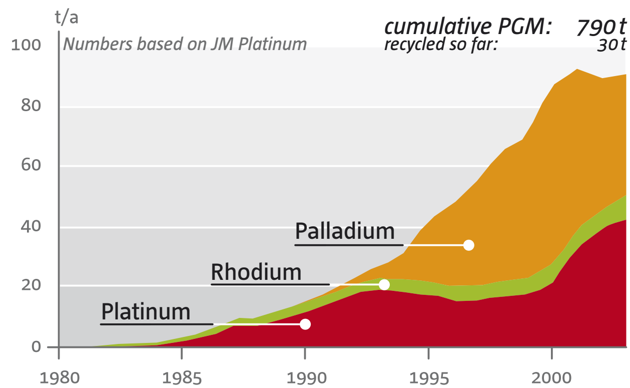


Example
Precious metals

Platinum group metals (PGMs) in catalysts increase the efficiency of industrial processes, reduce car exhaust emissions and play an important role in the manufacture of many products. Their primary production is restricted to just a few countries, above all Russia and South Africa. The recycling of platinum, palladium and rhodium is ecologically 10 to 100 times more favourable compared to primary production.

In Germany, recycling quotas for precious metals in some areas of application are in excess of 90 per cent. With cars and electrical appliances, however, more than 60 per cent of PGMs put into them are lost, despite EU-wide waste-related regulations. The reason for this is large export flows, which for old cars in Germany lies at around 80 per cent.

Automotive catalysts:
gross demand Pt, Pd, Rh in Europe

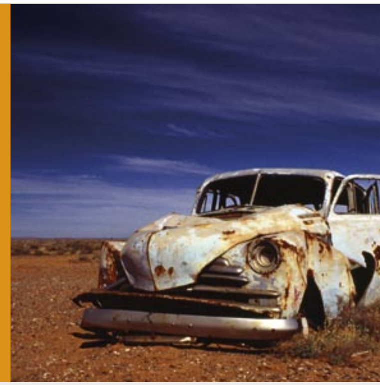


Öko-Institut standpoint

Only when we obtain more transparency in export flows and gain the support of stakeholders at home and abroad for an internationally upgraded closed-cycle materials economy can we recover the bulk of valuable platinum group metals. This approach offers economic opportunities for all participants.

Widespread losses in newly industrializing and developing countries

The further use of old cars and electrical appliances in importing regions, such as West Africa, involves heavy PGM losses. Due to a lack of exhaust controls and bad road conditions, ceramic catalysts in cars are gradually destroyed. Important precious metals are irretrievably lost. In many regions there is also a lack of even rudimentary logistical and technological structures for efficient closed-cycle materials management.



Initial steps towards international co-operation

On behalf of the Federal Environmental Agency, and with the support of Umicore Precious Metals Refining, Öko-Institut investigated export flows of used cars and electrical appliances, based on the example of the port of Hamburg. The objective of research was the improvement of existing information on export quantities, destinations, participating institutions and stakeholders.

Up to 130,000 cars are exported to West Africa over Hamburg alone. These cars are typically 12 to 16 years old and around 20 per cent have a damaged engine or gear unit. According to shipowners surveyed, return flows of secondary raw materials occur only occasionally. The second most important destinations are the Near and Middle East.

The recovery of valuable secondary raw materials can only be ensured through co-operation between industrialized, newly industrializing and developing countries. That is why potential partners, such as shipping companies and agents, have been identified and sensitized for future co-operation in an internationally operating and optimized closed-cycle materials economy.

Used goods or scrap?

It became clear at a conference of the United Nations Environment Programme (UNEP) in Nairobi at the end of 2006 that exports of electronic scrap from industrialized countries pose an environmental problem of global significance. In many newly industrializing and developing countries the recovery of valuable metals takes place with the most primitive techniques, such as open-air incineration, and with the use of cyanide and mercury, leading to intolerable risks to human health and the environment as well as high overall losses of secondary metals.

Clear criteria on the demarcation of used goods and wastes are important for the prevention of exports of electronic scrap. For this purpose, "Correspondents' Guidelines No 1 – Subject: Shipment of Waste Electrical and Electronic Equipment" were adopted at the EU level in December 2006. These support port and environment authorities in the EU through the provision of practical criteria for distinguishing used goods and wastes.

Example Uranium

Annual waste arising from the production and leaching of uranium ore of varied quality to cover German annual demand for 4,800 tonnes of natural uranium:

Soon exhausted:
Ore containing 4 % uranium
119,650 t/a of waste

Waste from uranium ore production with a uranium content of 0.1 %
4.8 million t/a

Waste from uranium ore production with a uranium content of 0,01 %
48 million t/a

300 m

36 m *

4.0 %

122 m *

0.1 %

263 m *

0.01 %

Résumé: *Technically and economically exploitable uranium reserves are finite, and ways to eke out reserves are questionable on technical, economic and ecological grounds. The adverse environmental effects of uranium mining are immense even under present conditions, and the exploitation of inferior ore will markedly aggravate them. Therefore nuclear energy cannot substitute fossil energy sources.*

Though uranium is found in large quantities in the earth's crust, it is rarely enriched in large concentrations (in percentage terms). Once these deposits have been exhausted (with comparatively low extraction costs of less than 40 US dollars per kilogram of extracted uranium), less economical ore will increasingly have to be exploited. Reasonably assured resources (RAR) of natural uranium in the price category up to 130 US dollars per kilogram amount, according to the Nuclear Energy Agency of the OECD, to around 3.3 million tonnes. At the current level of consumption of about 65,000 t/a, this would be sufficient for 50 years. Were one to add to this resources in known but as yet unexplored deposits, at the same level of consumption, uranium deposits would last for a further 20 years.

Global energy scenarios frequently discuss assigning nuclear energy a more important role in the future, in order to replace fossil energy sources. One proposal is for a tripling of the present 3.5 per cent worldwide share of nuclear energy in final energy production. The consequence would be an even earlier transition to low-concentrated uranium deposits and more rapid exhaustion of reserves after around 20 to 30 years.

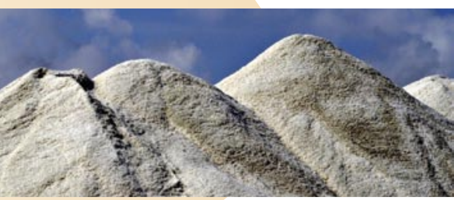
** Waste-cone height with a 1:1 gradient*

Öko-Institut standpoint

The scarce resource uranium cannot replace fossil energy sources.

Uranium – hoping for the best

A number of strategies are being discussed for a way out of finiteness. Some speculate, with increasing uranium prices, on greater efforts in the search for and discovery of new deposits. They overlook that this extensive search already took place in many countries at the time of the Cold War, or during the period of high uranium prices in the 1960s. Others see a solution in the exploitation of ore with ever-lower uranium content. This has its limits, however, for the technical costs of production and production-related energy consumption will greatly increase, and the share of natural uranium in the cost of electricity production, which is currently negligible, will be significant.
Then there are those who hope that technical, ecological, political and economic technologies that failed in the past – such as the use of plutonium (reprocessing, fast breeders) – will enjoy a renaissance. This, however, would frustrate international efforts on the non-proliferation of nuclear weapons and towards stability in many regions of the world. There are neither technically operable nor economically feasible methods that justify speculative hopes for the extraction of uranium from oceans.



Protest against a new uranium mine in Namibia | Photo: NSHR

Uranium and environmental standards

The exploitation of uranium deposits in ever-lower concentrations will make the mountains of radioactive sludge from the processing and production of uranium even larger. With them, not only will the burden of radioactive radon, contaminated dust and polluted groundwater grow, but also difficulties with long-term aftercare.
In situ leaching (ISL) of uranium is often suggested as a technical solution for this problem. Here, a chemical solution is injected below the water table to mobilize uranium minerals. The uranium then dissolves into the leach solution, and this solution is then brought to the surface for processing. The process is only applicable, however, under particular geological conditions. At the conclusion of uranium mining, moreover, groundwater remains chemically and radioactively contaminated.
Costs for compliance with environmental standards during operations and over the very long period of active aftercare can exceed proceeds from sales of uranium. Only in the rarest of cases, however, are funds available at the conclusion of mining operations to properly carry out required remediation.
An additional factor is that for some poor countries uranium mining represents such a hugely important source of foreign currency that there is hardly a chance for the consistent realization of environmental and health standards. If a country is economically dependent on the success of mining companies, effective and independent control is not guaranteed.

Example
Housing

Résumé: *As a result of demographic changes, the housing stock in many countries will acquire increased significance as a valuable store of secondary raw materials. Accelerated recycling of these millions of tonnes of materials could substantially reduce the pressure on primary raw materials.*

Due to the trend in their population figures many industrialized countries can reduce their need of primary raw materials not only in relative, but even in absolute terms. In Germany, since the immediate post-war period substantial housing stocks have been built for a growing number of households. In the meantime, the total population remains stagnant and, as a consequence, also the number of households. Already today, many flats are unoccupied, and, just like unused office and industrial buildings, they represent a huge store of raw materials for the future.

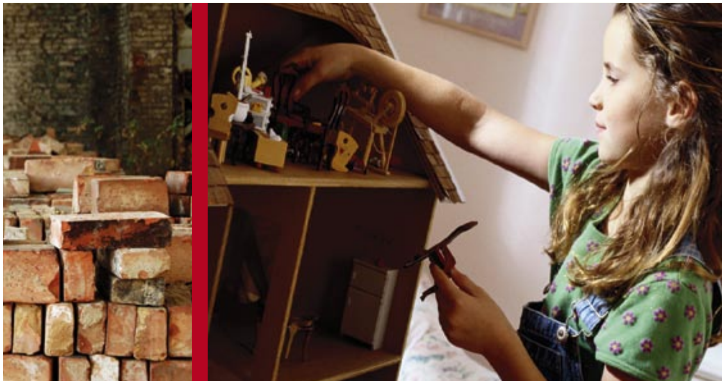
Urban Mining – "Mines" in cities

In the "old" German Länder (formerly West Germany) – the number of unoccupied flats increased to 1.8 million between 1993 und 1998, which represents a doubling from three to six per cent within five years. Since then, the annual number of newly built flats has decreased, but there nevertheless remains a positive balance for housing stock. Regions with dynamic population development form a contrast to those countries that suffer from migration and an ageing population. In the "new" German Länder (formerly East Germany) a total of 1.1 million flats are presently unoccupied.

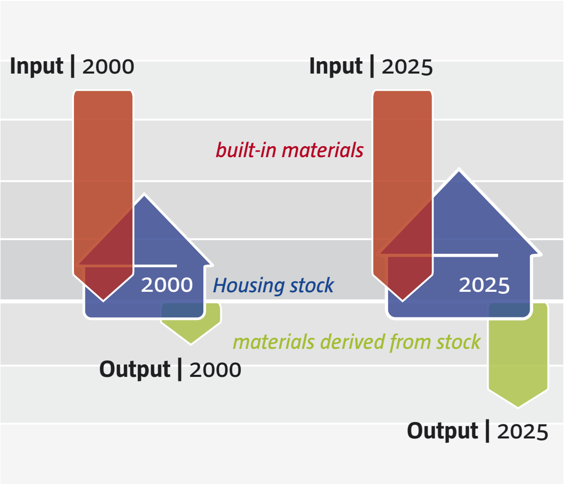
Öko-Institut standpoint

❞ Stores of materials in the housing stock must be more resolutely utilized, either through an extension of the lifespan and continued use of buildings or through the demolition of unoccupied buildings and the recovery of secondary raw materials. ❞

Future potentials for the protection of resources are to be found, above all, in very large stores of materials in the housing stock. These amounted in Germany in the year 2000 to around 10.5 billion tonnes, of which 9.6 billion tonnes were mineral building materials, such as concrete, bricks etc., 220 million tonnes were wood and almost 100 million tonnes were metal. Experts already talk about "urban mining", the extensive recovery of numerous secondary raw materials from old buildings. According to Öko-Institut scenario computations with the BASiS-2 model, the store of materials in the housing stock will further grow in the period to 2025, namely by more than 19 per cent to 12.6 billion tonnes. Through an increase in demolitions, however, the ratio of materials input to materials output in German housing stock will decrease from 5:1 in the year 2000 to 2:1 in 2025.



Materials input/output ratio in the housing stock
Comparison of the years 2000 and 2025



How will the treasure be raised?

Numerous regulations stand in the way of efficient "urban mining". In Germany, capital investment in new greenfield housing developments, for instance, enjoys "tax advantages" that are not available for the development and use of plots of land with derelict buildings. As a result, there is the danger of unchanged, unoccupied housing stock for decades to come, with all imaginable negative social and economic effects. Only when general policy conditions are in future consistently optimized for the purposes of sustainable resource efficiency can the treasure be raised that many towns and villages contain.

Example
Newly industrializing countries

Öko-Institut provides backup research in the area of resource-efficient product and process innovation, and advises companies and government organizations on the effects of sustainability. Here, particular attention is focused on the examination of global production chains and the identification of political and economic latitude for the solution of global problems.

In 2003, a report from an American investment bank caused quite a stir: In "Dreaming with BRICs: the Path to 2050" the bank forecast continued high economic growth for Brazil, Russia, India and China, with the effect that within just a few decades these countries will head the list of the most important national economies.

Even if the forecasts do not stand up to the test of reality, the fact is that the rapid economic upturn of India and China as well as the growing importance of countries exporting raw materials changes the familiar view of a world divided into industrialized and developing countries. In the last two decades, a significant share of manufacturing industry was transferred to newly industrializing countries, which happily resulted in increased prosperity, but also – less-happily – in increased consumption of resources.

Economic and social opportunities – ecological risks

While India has successfully established itself on the global market in the area of IT services, China has taken on the role of "global workbench". Though wage levels of newly industrializing countries still lie well below those of industrialized countries, the economic upsurge has ensured an increasing standard of living and greater demand for consumer goods.

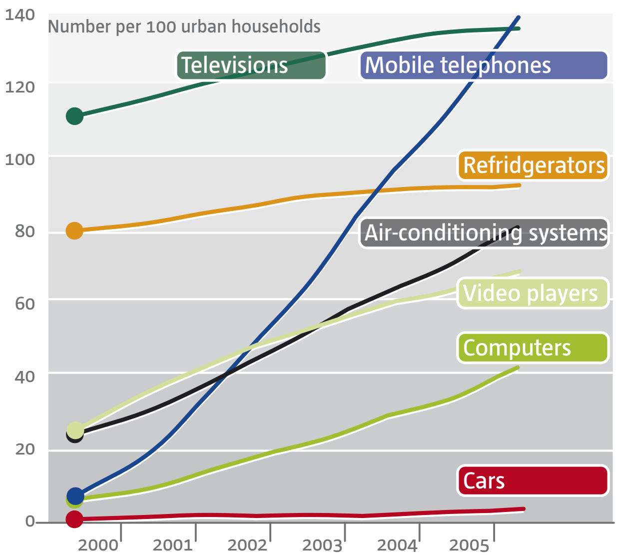
Öko-Institut standpoint

Globally sustainable resource management can only be achieved in close co-operation with newly industrializing and developing countries. It is a matter of creating appropriate conditions for the global diffusion of resource-efficient technologies as well as of specifically promoting pathbreaking innovation.

It is obvious that this development gives rise not only to social and economic opportunities, but also to ecological risks. While in 1990, Brazil, India, China and South Africa gave rise to around 13 per cent of global CO_2 emissions, in 2004 the figure was almost 25 per cent. Moreover, the development of newly industrializing countries additionally fuels demand for resources. China alone today consumes 26 per cent of the worldwide production of iron ore, 37 per cent of globally produced cotton and 47 per cent of cement.

Equipment of urban households with resource-intensive consumer goods in China

Source: National Bureau of Statistics of China



Influence is possible

A large part of resources required by newly industrializing countries is processed into consumer goods and exported. Europe, as one of the most important markets, can influence the use of resources through control of its own consumption. Examples from the area of electronics show that European product policy has significant spillover effects on other countries and influences production patterns worldwide.

A further approach is the transfer of resource-efficient technology. Many products and industries of newly industrializing countries have modest resource efficiency. For example, the technological standards of air-conditioning systems used in newly industrializing countries lag far behind those that are technically feasible.

In the area of infrastructure, there are a number of departure points for the coming years. All newly industrializing countries have considerable backlog demand for transport, housing and energy infrastructure; areas in which European countries have substantial know-how at their disposal.

An increase in technical standards and processes will no doubt slow down future claims on resources; it cannot, however, counteract the general trend of growing consumption, for which strategic innovations in resource-intensive sectors are needed as well as joint efforts in the development of efficient technologies. In a current project, Öko-Institut is investigating the main areas, opportunities and challenges for co-operation on sustainability between industrialized, newly industrializing and developing countries.

The living standard is improving and the demand for resource-intensive consumer goods increasing in newly industrializing countries

Example
Nanotechnologies

Most nanoparticles presently in use have a size of between 20 and 50 billionths of a meter. Compared to that of a football, there size is the same as that of a football compared to the planet earth.

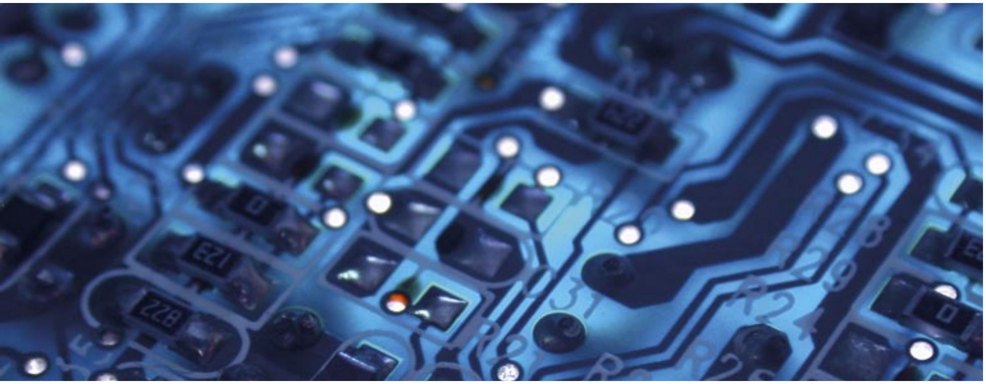
New technologies arouse hopes. They offer the chance of new products and markets as well as the protection of resources and the environment. At the same time, they can also involve risks for human health and the environment. A topical example is nanotechnology, which already has an early effect, as an "enabling technology", in the production chain. With the production of structures that measure less than 100 nanometers completely new functionalities and properties are created – particularly in the case of materials and intermediate products – and specifically used for the development of new products and applications. The supply of products with nanoscale components ranges from scratch-resistant varnish to bactericidal textiles and sunscreen products.

Resource-savings as an opportunity

Nanotechnologies offer opportunities for the environment: They contribute to more durable products and enable more efficient production processes as well as savings in the use of materials and energy. Catalysts optimized with nanotechnology, for instance, reduce the use of resources in the chemicals industry. Innovations in fuel-cell, photovoltaic and filter technologies promise even greater ecological relief. Research into energy- and resource-savings through nanotechnology and its application in products and processes is, however, in its infancy. Present imprecise communication of potential ecological benefits requires concretization and systematic realization.

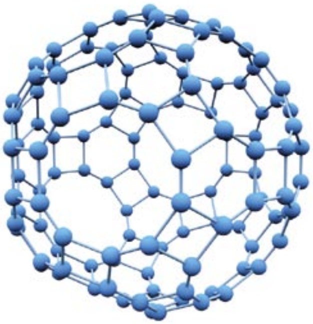
Öko-Institut standpoint

"Opportunities for sustainable products have to be systematically identified and realized, and risks must be recognized and minimized at an early stage in the development process. Due to the considerable inhomogeneity of nanomaterials, case-specific analysis is absolutely essential."



Successful concepts for the sustainable use of nanotechnologies

Experience with the development of other risky technologies shows that early investigation, assessment and control of risks, as well as their communication, are important for acceptance of technology. Öko-Institut has many years of experience in the inter-disciplinary assessment of the opportunities and risks of new technologies. We accompany the development process of nano products, in open dialogue with companies, with the aim of early identification and minimization of risks ("design for safety") throughout the life of a product, and of establishing potentials for resource protection and environmental relief.



Avoidance of risks pays off

At present, the behaviour of nanomaterials in the environment is largely unknown. Due to their high reactivity they can, however, give rise to risks to human health and the environment; for instance they can mobilize pollutants in soil, which then accumulate in drinking water or the food chain. According to the few presently available toxicity studies, nanoparticles, fullerenes and new carbon nanotubes are particularly risky. Nevertheless, the development of nanotechnological applications may not be generally impeded. On the contrary, a regulatory framework for nanomaterials should be created, which enables solutions in specific cases.

Perspectives
for research and action

	China	Germany
Inhabitants *(in millions)*	1,308	82
Living space per inhabitant *(in m²)*	28.69	40.80
Cars *(per 1,000 inhabitants)*	14	562
Televisions *(per 1,000 inhabitants)*	313	437

Source: National Bureau of Statistics of China (2006): China Statistical Yearbook 2006. Beijing.

Federal Statistics Office, Federal Motor Transport Authority (KBA)

Much has been achieved in the area of sustainable resource efficiency since the founding of Öko-Institut in 1977. The use of renewable raw materials nowadays plays a more important role than thirty years ago, and closed-cycle materials management in Europe has been improved.

The key task in the next three decades has a global dimension. The race for resources is in full swing, fuelled by the strong economies of densely populated, newly industrializing countries. This race forces up demand for raw materials and threatens to obscure all gains in efficiency.

Not an uncurbed run on resources, but only common action on the part of industrialized and newly industrializing countries can secure resources for all in the long term.
Numerous existing efficiency potentials in industrialized countries must be resolutely exploited, for industrialized countries still lay claim to a large share of worldwide resources, not only per capita but also in absolute terms. The concept of sustainable consumption has to be further developed and implemented in practice. This is the prerequisite for the acceptance of corresponding concepts by people in newly industrializing countries.

Newly industrializing countries can accelerate the "learning curve" with regard to resource efficiency if **technological co-operation between industrialized and newly industrializing countries** is strengthened and if, as a consequence, newly industrializing countries speed up the introduction of efficient production processes and infrastructure systems. Here, Europe can proactively support the exchange of know-how and innovative technologies.

Öko-Institut

Öko-Institut is one of Europe's leading independent research and consultancy organizations for a sustainable future. It has more than 100 staff, including 70 researchers, in offices in Freiburg, Darmstadt and Berlin.

Fields of research

Rapid action is required to get resources fever under control. Doing things for the sake of doing things is, however, counterproductive. Sustainable resource efficiency rather requires increased research and the scientific accompaniment of economic and political processes.

Important fields of research, in the view of Öko-Institut, are:

- Quality standards for renewable products and the broad-based market introduction of **non-food plants**.
- Global environmental and social standards for the fair production of non-renewable raw materials, such as **"fair ores"**.
- An **international** closed-cycle materials economy.
- **Potentials, opportunities** and **risks** of new technologies.
- **Co-operation** with newly industrializing countries on sustainable consumption, sustainable mobility and sustainable urban planning.

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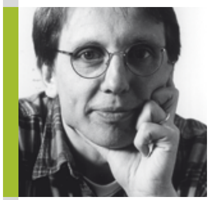

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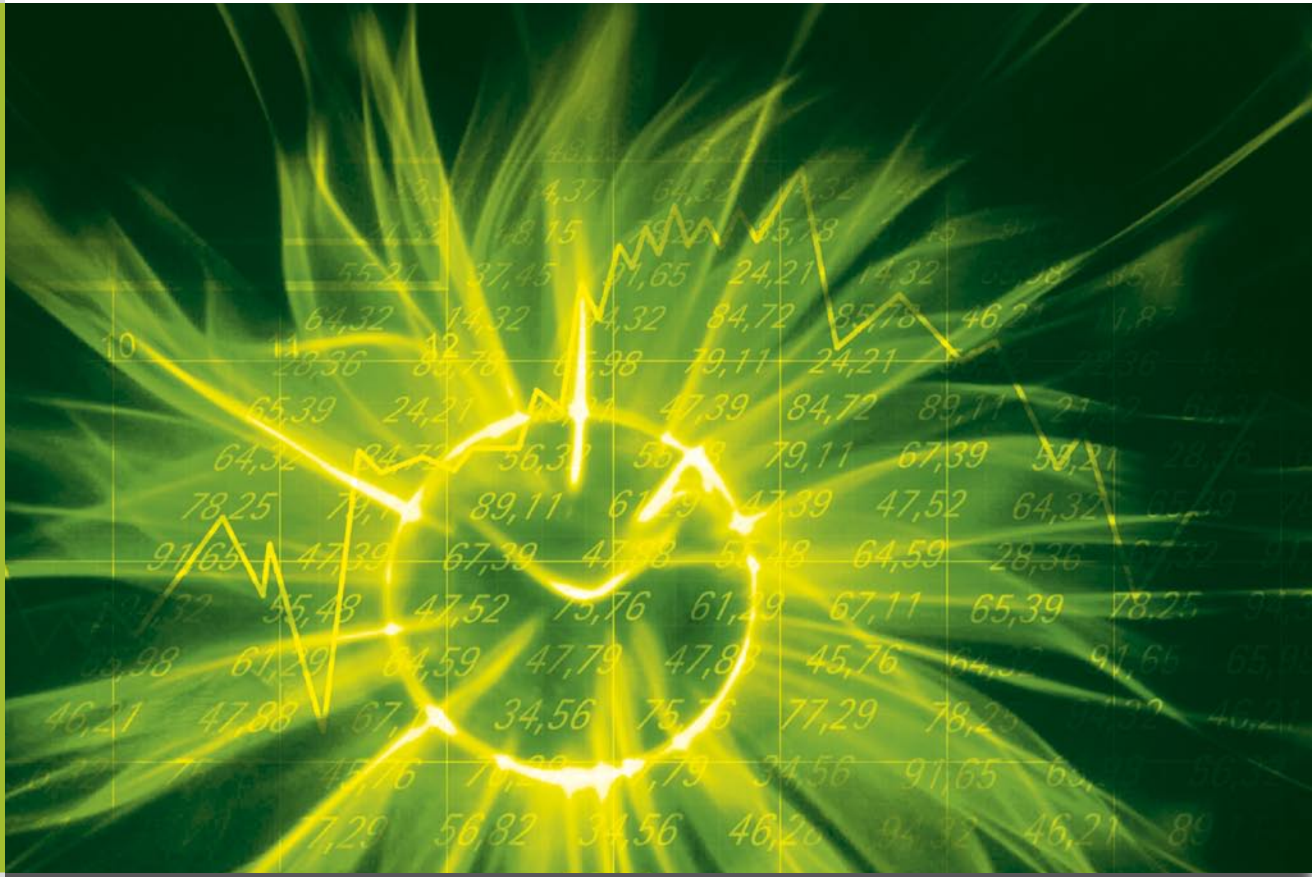

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