

Sustainability Matters

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Authors: Dr. Regina Schwegler, Senior Analyst & Lead Author, Madeleine Guyer, Senior Analyst & Judith Reutimann, Senior Analyst



The end of the renaissance for nuclear energy – What are the ramifications for investors?

The catastrophic meltdown of the Japanese Fukushima Dai-ichi nuclear power station, owned and operated by Tepco, recently reminded the world of the incalculable risks of nuclear energy. It showed the dramatic effects it can have on people, the environment and, last but not least, the economy. All the signs point to an end to the renaissance of nuclear energy. In the future, the external costs of nuclear energy, which up to now have been borne by society, will increasingly need to be borne by the operators of nuclear power stations. Nuclear power will thereby become less competitive, whilst clean tech – renewable energies intended to replace nuclear power, plus energy-efficient products and processes – will profit from this trend.

Inrate has been rating nuclear energy as non-sustainable for many years – for ecological and social reasons, and lately for economic reasons as well. The structural change towards sustainable energy supply will ensure that investments in companies involved with nuclear energy will constitute risk-rich investments, whereas clean tech companies will offer more investment opportunities in the long-term.

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Fukushima – A residual risk became reality

A series of unlikely events at the Fukushima Dai-Ichi nuclear reactor led to a catastrophic meltdown in May 2011, with dramatic and incalculable ramifications for people, the economy and the environment. Future generations in particular will, as shown by the after-effects of the Chernobyl meltdown of 1986, be forced to deal with these consequences: the extended period during which the reactors will continue to give off radiation; radiation contamination of soil and water; an increased risk of cancer; and the changes to human genetic make-up that can result in birth defects in children. This illustrated once again the consequences that the so-called 'residual risk' of nuclear energy can have.

The risks of nuclear energy generation contain a fundamental incertitude. Although it is very unlikely that accidents, and the ensuing damage to health and the environment will occur but if they do they will cause very considerable harm. When using nuclear energy, it is not possible to identify all potential harmful incidents in advance, any more than it is possible to quantify precisely the likelihood of their occurrence or the harm they will cause. For this reason the risks of nuclear energy cannot be insured against completely by private insurers. The residual risk of nuclear energy is the portion of the risk that is neither eliminated nor covered by the safety systems in nuclear power stations. It exists because the risks of nuclear power are not (fully) known, but also because reducing the risks is seen as too costly: both the technical systems themselves and the users are prone to failure and to making mistakes, and State monitoring bodies do not always pay sufficient heed to their duty to supervise. The consequences of these residual risks end up being borne by society.

Even though the current focus is predominantly on the risks of generating nuclear energy, it is important to consider that the entire life cycle chain poses significant risks, including dismantling the plant and , transporting, conditioning and disposing of the nuclear material.

The end of the renaissance of nuclear energy

The events in Fukushima demonstrate that the risks of nuclear energy had been incorrectly calculated and that society (the population, investors, etc.) was not wholly aware of the residual risks. A fresh assessment of the risks will result in many societies worldwide becoming less prepared to accept these residual risks, with some give up on nuclear energy altogether and others accelerating the pace at which their nuclear power grid is decommissioned. The world population will be less prepared than ever to bear the external costs of nuclear energy technology: the uninsured costs of damage resulting from accidents, including the health costs resulting from the affected population, and the uncovered costs of final disposal which have been underestimated by the nuclear industry, to name only the most important ones. If these external costs start to be increasingly internalised, i.e. if the nuclear industry itself has to meet the costs it actually generates, nuclear energy will become increasingly expensive and unappealing.

A first step towards internalising external costs has already been completed, in that nuclear reactors and final disposal sites must meet stricter safety standards. A further step is increasing the limits of liability for nuclear power station operators for loss or damage in the event of an accident. The current limits of liability are relatively low in most countries and cover only a tiny portion of the costs incurred in the event of a meltdown or a catastrophic situation. For example, the damage from a catastrophic nuclear meltdown in Germany was quantified in a study by the Prognos Institute (Ewers/Rennings 1992:

Identifizierung und Internalisierung externer Kosten der Energieversorgung), commissioned by the German Federal Ministry for the Economy, at around 5 billion euros. As against this, the German Atomic Energy Law stipulates a compulsory cover of only 2.5 billion euros. Other European countries have even lower limits of liability: Switzerland's is approximately 1.4 billion euros; Spain's is approximately 700 million euros; Belgium's and Sweden's are around 333 million euros; the Netherlands' is 313 million; the UK's, Poland's and Slovenia's is 165; France's is 84; and Italy's is 5.5 million euros. Austria is the only European country to allow for unlimited liability in this scenario and to have banned the construction and operation of nuclear power stations by federal law.

If nuclear plant operators had to bear the full extent of their external costs, especially those resulting from nuclear accidents, their liability insurance premiums would skyrocket. This would result in price increases being passed on to electricity customers. The amount of any such price rise is however very uncertain. Estimations range from 0.1 cent per kWh to 270 cents per kWh, depending inter alia on the methods used and the assumptions made as to system limits. The German Aerospace Center (DLR et al. 2007: Externe Kosten der Stromerzeugung aus erneuerbaren Energien im Vergleich zur Stromerzeugung aus fossilen Energieträgern), for example, calculated an estimate of 7.9 cents per kWh, whereas Meyer/Küchler (2010: Staatliche Förderungen der Atomenergie, Studie vom Forum ökologisch-soziale Marktwirtschaft im Auftrag von Greenpeace) arrived at a figure of 270 cents per kWh. In any event, nuclear energy is set to become less economical than other energy sources as a result of the internalisation of external costs. The Tepco Company is expected to have to cover the health costs of the population affected, the economic ramifications for the region, the environmental costs from the contamination of the water and soil, etc. Last but not least, another significant (and often neglected) factor that can drive up nuclear energy prices is the fact that uranium is a finite resource. The uranium reserves accessible at economically viable prices will, at current consumption levels, be exhausted by 2030. Extraction costs are set to rise in a linear fashion up until that date.

The increase in the price of atomic energy will make clean tech (even) more attractive: electricity from renewable energies is becoming more competitive, and rising electricity prices are bolstering the desire for improved energy efficiency. At the same time, at least in the short term, electricity from coal, oil and gas will also benefit. However, these fuels also pose high risks (see our report from September 2010): in major developing countries, the political risks are high, not to mention hard to calculate, as the current recurrence of unrest in the Middle East shows. Even the ecological risks have up to now often been underestimated, as illustrated by the oil spill in the Gulf of Mexico caused by the explosion of the 'Deepwater Horizon' oil platform in April 2010. Fossil fuels also constitute economic risks: since they are finite in quantity, they will become scarcer and thus more expensive in the future. Added to this are the national and international efforts made to internalise the external costs brought about by climate change, as global climate change also involves enormous and incalculable risks. This results in the price of fossil fuels increasingly being contained in the cost of pollution taxes or emissions certificates. The risks of nuclear energy and fossil fuels must therefore not be played off against each other when society thinks about its future.

The post-nuclear age can be realised by 2050

Current developments are announcing a post-nuclear age that

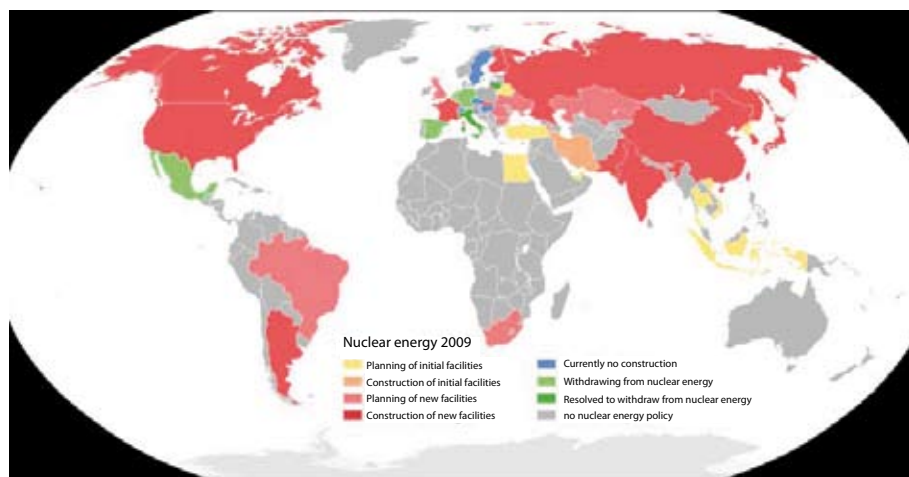
Figure 1: Nuclear energy policy around the world

Figure 1 In 2009, nuclear power stations were being planned in many countries. Only a few resolved to withdraw from nuclear energy or had already resolved to do so. Source: atw Rapid statistics for nuclear power stations 2009

will champion energy efficiency and renewable energies. However, the road ahead looks long and winding. There are still 212 nuclear power stations in 30 countries worldwide, with 442 reactor blocks and a total installed power rating of 374.682 megawatts devoted to generating commercial electricity (as at 2011, source: Power Reactor Information System, IAEA). Many countries resolved in 2009 to build additional nuclear plants, and only a few planned to discontinue their nuclear energy programme or had already planned to do so.

Nonetheless, it will still be possible to meet growing global demand for quality of life – e.g. for food in poorer countries, for living comfort and for mobility – by ensuring a reliable and stable energy supply. PricewaterhouseCoopers (2010: 100% renewable electricity) published a roadmap for energy supply in Europe and North America until 2050 that relies exclusively on renewable energy sources. The German Federal Government's scientific advisory board on global climate change (WBGU 2003: Welt im Wandel) believes that meeting all energy requirements from renewable sources at a global level within that same period is realistic. The "Special Report on Renew-

able Energy Sources" published by the Intergovernmental Panel on Climate Change in late April 2011 also shows the great potential offered by renewable energies. The "Energy Report" from the WWF and Ecofys (Jeffries 2010) describes – at least for the most part (95%) – how this can be achieved: not by adopting a laissez faire approach, but also without dramatic electricity price increases. The key is in saving energy and promoting the use of renewable energy on a large scale.

This energy scenario assumes a 15% drop in energy consumption, notwithstanding population and economic growth and increasing personal mobility and transport of goods. It is rendered possible by efficiency measures and substitution measures, based on technologies already in existence today or currently being developed. The economy will use materials more efficiently, making greater use of re-

cycled materials, optimising the energy consumption of buildings and providing more efficient mobility. Fixed and flowing energy sources are being increasingly replaced by electricity from renewable sources. 'Smart grids' can store and provide energy efficiently.

This comprehensive shift in the economy would save around 4 billion euros a year thanks to efficiency measures and the resulting savings on the cost of energy sources. On the other hand, however, high initial investment is required to develop electricity grids, production structures, means of and routes for transport and buildings. However, according to the WWF/Ecofys scenario, this investment is expected to pay for itself by 2040. This shift will not occur by itself. It needs political incentives, e.g. in the form of ecotaxes or certificates and feed-in tariffs for renewable energy. The economy and the financial sector need leading players that will contribute from the early stages to making the change happen. Last but not least, consumers will have to rethink their habits: what really provides quality of life? What can we give up without undue hardship?

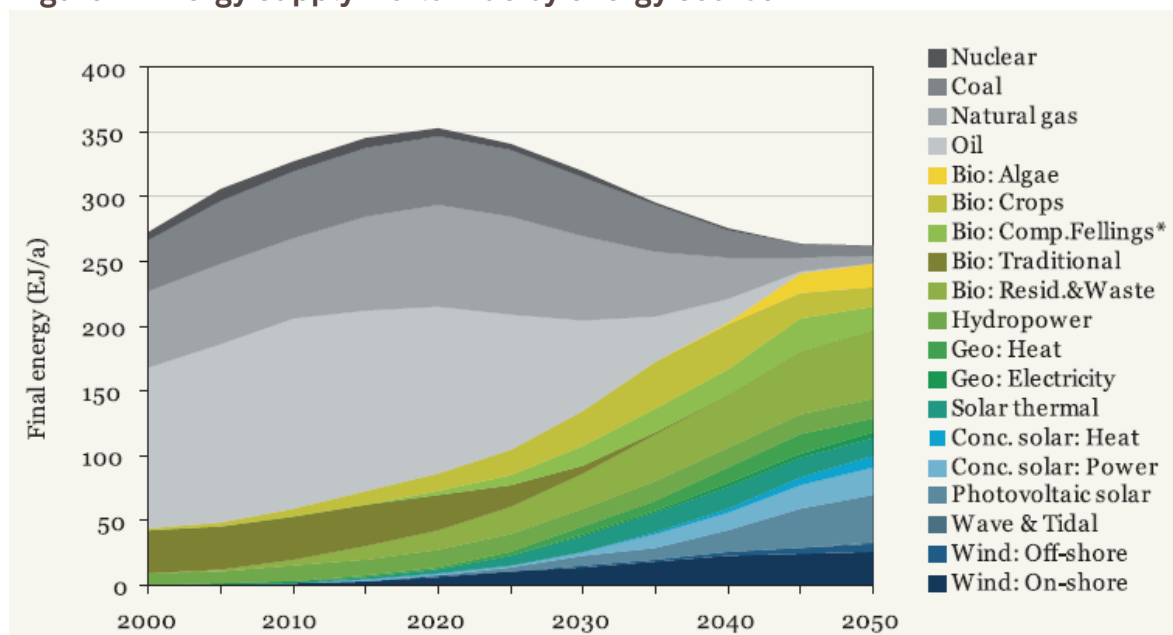
Figure 2: Energy supply worldwide by energy source

Figure 2 This graph shows how the breakdown of energy sources will change by 2050, if active measures are taken to increase energy efficiency and promote renewable energy sources. Source: The Ecofys Energy Scenario, December 2010.

The post-nuclear age offers opportunities and risks for investors

How are the economy and the financial world affected by this structural change towards a sustainable energy economy? What are the opportunities and risks involved? The existing megatrend towards clean tech, i.e. energy-efficient process and product technologies and companies that develop or produce renewable energies, is set to strengthen. Companies involved in converting electricity grids or developing and producing electricity storage media will also benefit. On the other hand, the nuclear energy sector will become less competitive, as it will be required to bear increasingly high costs. This will affect constructors, operators and suppliers of nuclear power stations and components, together with electricity suppliers that fail to switch to alternative energy sources in good time. Companies that are capable of demolishing nuclear power stations will initially profit from these withdrawal strategies, although over the long term their business opportunities will diminish.

Accordingly, investment in companies that anticipate this trend and know how to exploit it will offer good potential returns. These companies chiefly include manufacturers of energy-efficient products and production technologies, as well as companies whose overall production is energy-efficient. Companies whose product solutions make it possible to do

without energy-efficient products or activities altogether will also benefit. Such companies include manufacturers of passive houses or providers of telecommunications solutions that enable people to avoid having to travel.

Companies involved in nuclear power, however, represent investment risks. The most imported products are nuclear power products, since high investment in nuclear power plants represent 'sunk costs' that are not easy to disinvest. Many nuclear power stations continue to be run despite stricter safety standards, risks of liability and accruals for final disposal that make them run more cost-intensively and at lower profit margins, whereas others are no longer profitable at all and must be decommissioned. A range of major energy providers supply nuclear energy. The structural change will hit providers supplying a higher percentage of their energy from nuclear sources harder than those using a lower percentage. Other players in the production chain of the nuclear industry – companies that build nuclear power stations, suppliers of components and services – will also be affected, albeit less strongly than nuclear power producers, since they have a greater flexibility to shift to more sustainable energy technologies.

Figure 3: Largest european electricity producers: total electricity production and percentage from nuclear energy

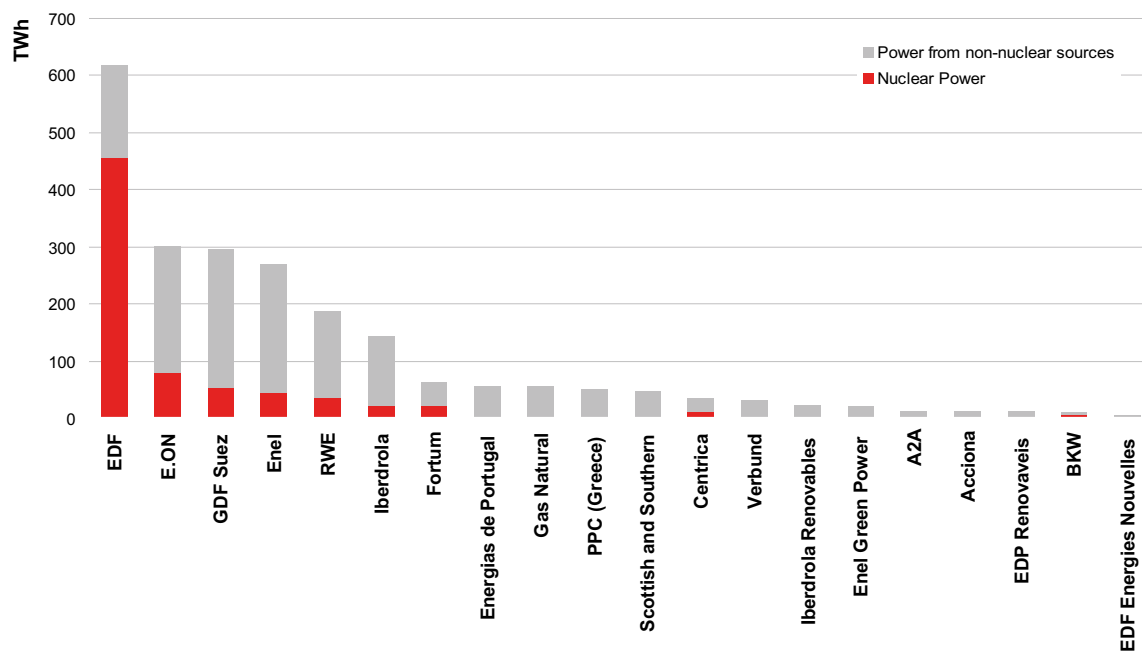


Figure 3 Electricity producers that currently produce large quantities of nuclear energy will be the most strongly affected by a structural change towards renewable energies. Source: Inrate 2011, estimation based on company data for the 2009 business year, including company participations



News on the investment theme of **climate protection**

Alternatives for future-facing energy supply

The recent events in Fukushima and the political unrest in various oil prospecting regions call Switzerland's and Europe's current energy policy into question. On the one hand, oil prospecting and nuclear energy both represent major, incalculable risks. Political discussions in the energy sector are thus currently shifting to a risk discussion as to whether accidents and the resulting consequences will still be bearable for current and future generations. On the other hand, the issue of reliance on foreign countries, particularly for oil supply, has been broached, as the political situation in numerous Middle Eastern countries is jeopardising the certainty of oil and natural gas supplies. Thus, many European countries are for the time being still faced with dramatic price fluctuations and uncertain delivery conditions, a situation expected to become even more pronounced in the future.

Sustainable and future-facing energy supply should thus be as free as possible from nuclear energy, guarantee a stable supply and also be low in CO₂. The immediate reaction in Switzerland to the Fukushima incident was to suspend the three framework approval procedures for replacing nuclear power stations. Furthermore, the Swiss Bundesrat gave the Federal Department for the Environment, Traffic, Energy and Communication (UVEK) the green light to modernise energy policy scenarios (energy perspectives). In parallel to this are the associated economical and domestic and foreign policy issues arising with regard to Switzerland's future energy supply (Swiss Federal Energy Bureau, 23/03/2011). Three electricity

supply scenarios are being analysed as part of this project:

1. Continuing the current electricity mixture (nuclear energy, hydroelectric power, conventional thermal power stations and unverifiable energy imports), and potentially replacing the three oldest nuclear power stations ahead of time in the interests of maximum safety;
2. Not replacing current nuclear power stations when they reach the end of their operating life; and
3. Withdrawing from nuclear energy ahead of time, by taking existing nuclear power stations off the grid before their safe operating lifetime has expired.

Talk of abandoning atomic energy is also taking centre stage in Germany. Federal Chancellor Merkel has taken the immediate measure of initially withdrawing the seven oldest nuclear power stations from the grid, ordering safety checks to be carried out on 17 other German nuclear power stations and imposing a three-month moratorium on the lifespan extension approved as recently as last November (Weltonline, 15/03/2011).

A rapid shift – away from nuclear energy – does pose the question, especially in Europe, of whether this would represent a threat to Europe's climate protection targets. It would represent a problem for climate protection policy if abandoning nuclear energy meant that new fossil fuel power stations releasing high levels of CO₂ had to be built in order to guarantee supply. Various studies show however that over the longer term, it is possible to avoid nuclear and fossil fuels (see opening paragraph). Massive development of renewable energies and the infrastructure required for this, exhausting the considerable potential for increased efficiency and revisiting non-sustainable lifestyles, particularly in industrial and developing countries, are all quintessential for this process.

One energy source for the future is solar energy, which offers a virtually boundless source of power. Compared with wind and hydroelectric, solar energy has the advantage of being available almost everywhere, even if not at the same intensity. The disadvantage of using solar energy, however, is the fact that, unlike other energy sources (such as those used in thermal power stations), it cannot be used around the clock, as the sun does not shine 24 hours a day. On the other hand, the electricity generated when the weather is nice can exceed demand. Therefore, technology for storing solar energy and suitable networks for feeding it into the grid from decentralised locations should be improved.

Figure 4: Competitive trends: energy costs for fossil, nuclear and solar energy

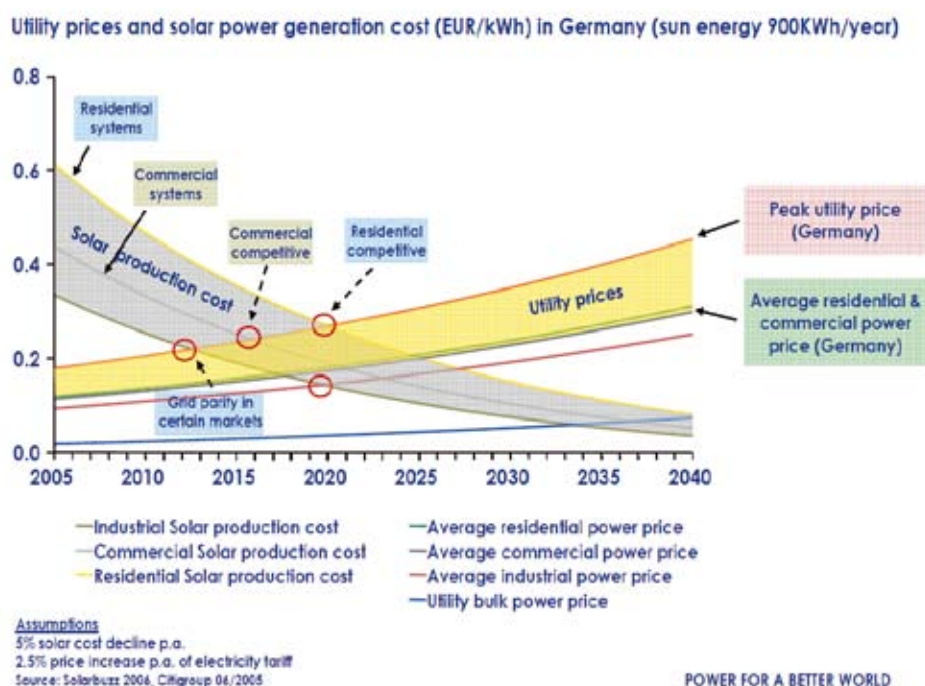


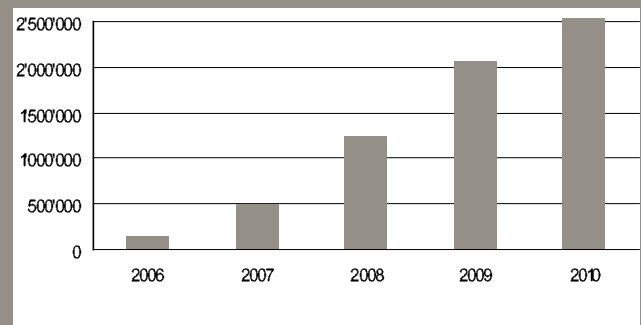
Figure 4 The costs for electricity from fossil and nuclear sources rise linearly, whereas the costs for solar energy gradually sink. A rather pessimistic estimation from 2005/6 predicted that solar energy would become competitive from 2020. Source: Solarbuzz 2006, Citigroup 06/2005.

proving and higher production volumes enable economies of scale, i.e. lower production costs thanks to increasing production quantities. The various research and development programmes to promote and produce renewable energy also contribute to reducing production costs. On the other hand, costs for nuclear and fossil fuels will rise, because these costs are linked to finite resources and the external costs they generate are being increasingly internalised (owing to more stringent safety requirements imposed on power stations, for example, and the rising pricing of CO₂). In this manner, solar energy will become competitive by 2020, according to an estimate from 2005/6. The catastrophe in Fukushima will however lead to costs for nuclear and fossil fuels rising even more sharply than predicted in 2005/6. We can therefore proceed on the basis that solar energy will become competitive at an even earlier date.

First Solar

The American company First Solar will benefit from this development. First Solar is the world's leading manufacturer of photovoltaic modules. The company offers sustainable solutions for today's energy requirements and thus provides an environmentally friendly alternative to fossil energy generation. As its net sales trend shows, First Solar has achieved considerable success during past years. The company plans to take on around 500 new employees in its new factory in Frankfurt an der Oder (Wissenmedia 02/04/2011: Solarindustrie steht vor goldenen Zeiten).

Net Sales trend for First Solar 2006-2009



Source: First Solar Annual Report 2010



News on the investment theme of **Smart Mobility**

Future visions of sustainable mobility

Transport is the foundation of our economy and society. Individual mobility is a prerequisite for economic growth and

for participating in society – and thus also for achieving well-being. The basis for this in the past was primarily the availability of large quantities of relatively cheap fossil fuels, thanks to which transport was able to expand at an exponential rate. Oil is however set to become ever-increasingly scarce in coming decades. Oil-importing countries will also have to contend with even more uncertain supply conditions and price fluctuations. The International Energy Agency (IEA) has come to the conclusion that the more oil prices rise, the less it will be possible to switch to non-fossil fuels. Dependence on oil imports has a knock-on effect on the economy. EU Oil imports in 2010 were around 210 bn EUR. If this dependence continues and the price of oil continues to rise, this could have dramatic consequences on the price stability, trade balance and competitiveness of the European economy as a whole (EU Commission 2011: White Paper, Roadmap to a Single European Transport Area). At the same time, the EU is at risk of not being able to meet its objective of reducing greenhouse gas emissions by 80-90% by 2050 (compared with 1990 levels). To achieve this objective, emissions in the transport sector would have to be reduced by around 60% (EU Commission 2011: White Paper, Roadmap to a Single European Transport Area). Looking into the past shows that this is an ambitious goal: between 1990 and 2008, greenhouse gas emissions from the transport sector, including international air and sea transport, rose by around 34% (Euro-

pean Environment Agency 2010: Annual European Community GHG inventory 1990-2008 and inventory report 2010).

The European Commission set itself these requirements and sketched out the roadmap to a European transport policy for the future in its white paper published in March 2011 (EU Commission 2011: White Paper, Roadmap to a Single European Transport Area). The transport sector is a major branch of the economy in the EU. It employs around ten million people and generates around 5% of gross domestic product. What are the lines of attack required in order to make sure that transport in the future is sustainable and competitive? The EU has resolved to guarantee transport growth and support mobility whilst simultaneously achieving its goal to reduce emissions by 60%. The focus here is on reducing dependence on oil without reducing transport efficiency. If this vision is to be achieved, innovations will first and foremost need to be made, in terms of both technology and individual behaviour.

With regard to technology, the EU is concentrating on vehicle efficiency, new propulsion technologies and making better use of transport networks. Using electric and hybrid technologies would not only reduce airborne pollutant emissions during journeys, but would also reduce noise pollution. It is precisely this electric mobility that has hit the headlines in light of recent events in Fukushima. Critics warn that a premature exit from nuclear energy and the resulting increased energy costs could hamper electric mobility. More optimistic pundits however claim that an accelerated exit from nuclear energy would not harm the introduction of electric mobility (Zeit Online

12/04/2011: Elektromobilität braucht keine AKW). In any event, Inrate is in no doubt that any electric mobility in the future will be possible only without nuclear energy, not only for ecological and social but also for economic reasons.

In addition to technological developments, changes to individual transport behaviour will also need to be made. This include switching from private means of transport to public transport and to environmentally friendly vehicles, as well as reducing traffic volumes, e.g. by using telecommunications solutions (such as video telephony) to prevent the need for journeys. To obtain such behavioural changes in the way transport is used, mobility planning in particular must be improved, for example by introducing land consolidation planning. This can lead to shorter journey distances and thus a reduction in traffic volumes. Furthermore, efficient public transport services and the construction of a new infrastructure for non-motorised transport must be organised. These measures are a prerequisite for the sustainable transition towards public transport.

Another major pillar is the improvement of transport networks for the multimodal transport (i.e. using two or more different transport media) of persons or goods, something that will be facilitated by shifting to rail transport in particular. Merely relying on the efforts being made in terms of resource-efficient vehicles and environmentally friendly fuels is not sufficient. There must be the option to choose between multiple modes of transport, and points for changing between modes and for transferring cargoes must be improved. Decisions taken today with regard to traffic planning and infrastructure construction will determine the transport landscape of years to come. However, these improvements to the infrastructure will involve considerable investment. It is estimated that around 1.5 bn euros will be required between 2010 and 2030 to cover rising demand. A further one billion will be necessary to ensure that vehicles, machines and charging infrastructures (charging stations for electric vehicles) meet lower emission thresholds (SEC 2011: EC calculations based on TENtec Information System and the Impact Assessment accompanying the White Paper).

Figure 5: Greenhouse gas emissions from the transport sector between 1990 and 2008

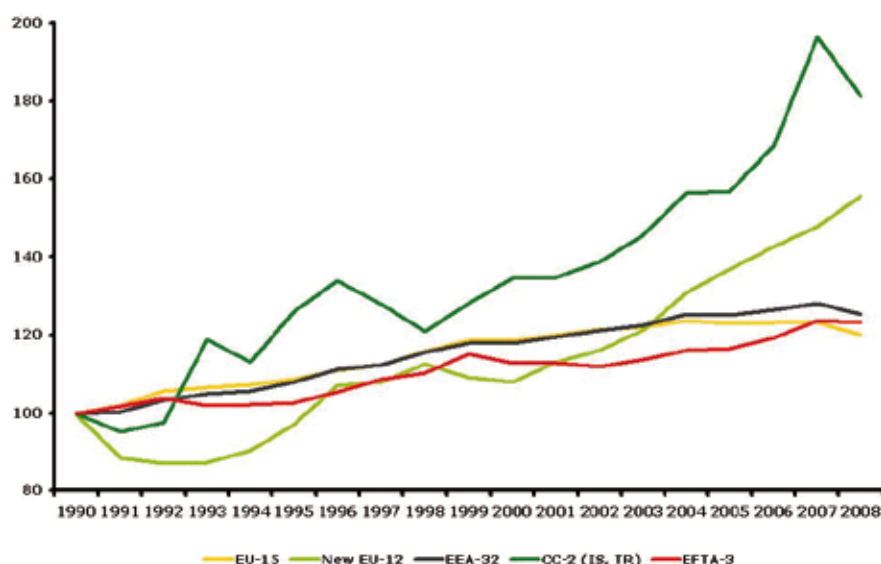
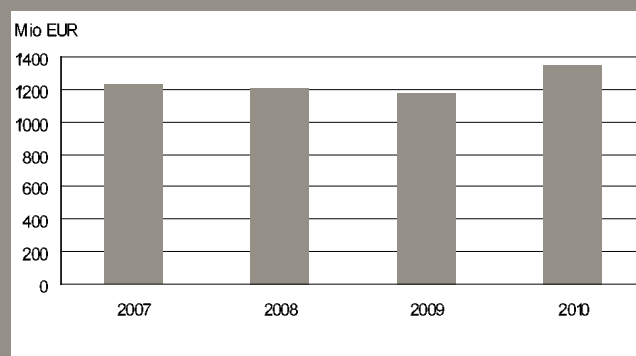


Figure 5 EU 15 (15 old EU Member States prior to May 2004), EFTA 3 (Liechtenstein, Norway, Switzerland), new EU 12 (new EU Member States since January 2007: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Malta, Poland, Romania, Slovakia and Slovenia), CC2 (Turkey and Iceland). Source: European Environment Agency 2010: Annual European Community greenhouse gas inventory 1990-2008 and inventory report 2010, Submission to the UNFCCC Secretariat, EEA Technical Report No 6/2010.

Vossloh

One company set to profit from the EU's focus on infrastructures is the German company Vossloh, which is active worldwide in the railway infrastructure and engineering sector. This company therefore makes a significant contribution to the economic and environmentally friendly nature of public transport, and rail transport in particular. Vossloh is also a leading name in special markets such as rail fastenings or points systems and in the manufacture of diesel locomotives and key electrical components for trams, metros and trolley-buses. The EU's focus on improving transport systems and infrastructures will enable Vossloh to continue to combine economic success with sustainable products.

Revenue trends for Vossloh 2007-2010



Source: Vossloh Annual Report 2010



News on the investment theme of **Sustainable Consumption**

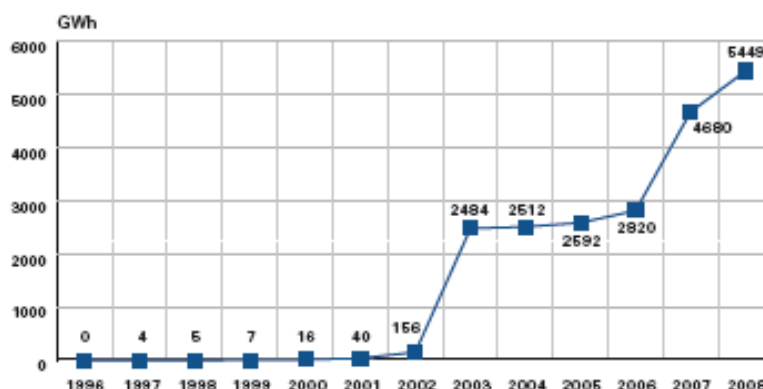
Energy efficiency and renewable energy are trending

The incident at the Fukushima nuclear power station and its consequences jolted the world's population and made them aware of the risks of nuclear energy. In many countries, people are taking to the streets to demand higher safety standards in nuclear power stations or even that their country renounce nuclear energy altogether. In the most recent elections in Switzerland and Germany, the 'green' parties gained ground.

Even consumer behaviour has changed. For many years, there has been a widespread trend towards electricity from renewable energy sources, as the figure below shows for the example of Switzerland. As early as a few days after the Fukushima incident in mid-March, there was not only a rethinking of nuclear energy but also an even clearer switch to green energy, as shown by many power plants in Switzerland, such as EWZ (the power station for the city of Zurich). In Germany, this reaction has been even stronger: considerably more than 50% of electricity customers are now deciding to switch from their conventional electricity supplier to a green provider. This electricity is generated not only without nuclear fuel but also in a CO₂-neutral manner (Martin Büchler, 2011). At Greenpeace Energy in Germany, a few days after the incident in Japan, comments submitted online reached over eight times their normal level. The green energy provider Lichtblick received up to three times as many online enquiries (www.strom-magazin.de, 16/03/2011).

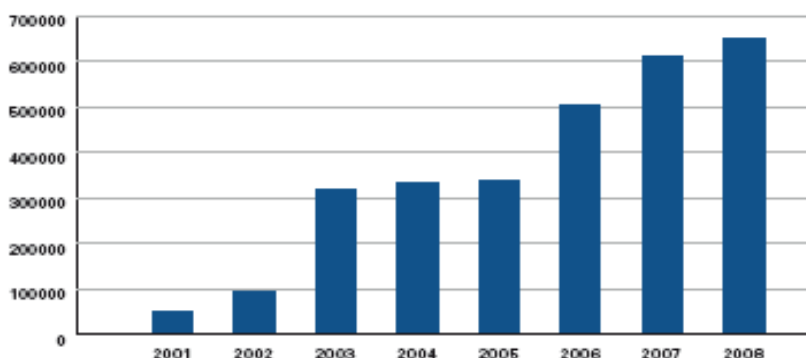
Over the medium term, switching off older nuclear power stations and the increasing internalisation of the external effects of electricity generation from nuclear and fossil fuels (see opening text) will lead to higher energy prices. This will stimulate demand for energy-efficient production processes and products. Consumers have already been switching to more energy-efficient devices for some time now. For example, revenues from high-efficiency refrigerators (A++) increased by a factor of five between 2005 and 2006, whereas the market share of energy-efficient fridges (A+ and A++) rose from 29% in 2004 to 50% in 2006 (Fachverband Elektroapparate für Haushalt und Gewerbe Schweiz 2007: market statistics for household electrical goods). This trend can also be seen worldwide: in Europe and North America, demand for energy-efficient devices has been rising noticeably for several years, and since then this trend for increased demand has also been measured in developing countries (GfK 2011).

Figure 6: Electricity produced from renewable sources sold in GWh



Source: Agency for Renewable Energy and Energy Efficiency 2009: Green energy in Switzerland

Figure 7: Demand for electricity products from renewable sources, number of subscriptions in Switzerland



Source: Agency for Renewable Energy and Energy Efficiency 2009: Green energy in Switzerland

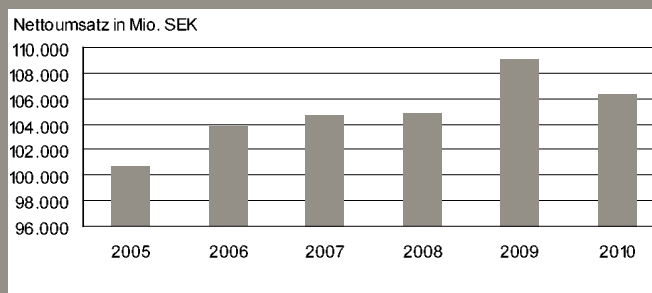
Electrolux

Companies that offer energy-efficient devices will have opportunities to boost their revenues worldwide. Electrolux is showing it can use this trend to its advantage. Thanks to analyses of its product life-cycles, it is reducing the environmental impact of its products during production, use and disposal. The focus on saving energy and water is centred on the usage phase, which offers the greatest potential for savings. Every branch of the company now offers at least one energy and water-efficient product and markets that product as not only environmentally friendly but also as cost-effective. Thanks to this strategy, 21% of the products sold by the company in 2009 were 'green', i.e. saved energy and water.

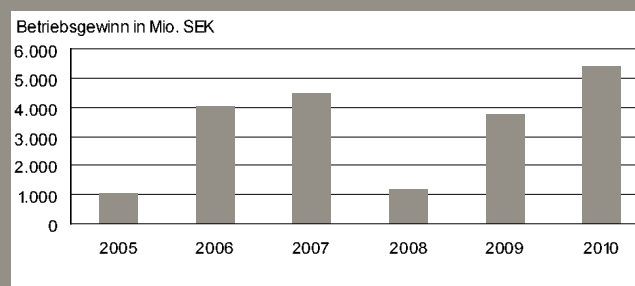
Electrolux also relies extensively on energy efficiency in its own processes. It is aiming, as part of its 'Green Spirit' programme implemented in all of its production sites, to ensure that its energy consumption falls by 15% between 2008 and 2012. Between 2005 and 2009, the company managed to reduce its energy consumption by 24% and thus avoid releasing 163.000 tonnes of CO₂. Business trips were reduced by 40% between 2008 and 2009, by carrying out more video and audioconferences. The company is thus protecting the environment and noticeably saving costs.

This strategy has allowed the company to have been successful for many years and to increase its net turnover by around 6% between 2005 and 2010. The drop in turnover between 2009 and 2010 was attributed to currency losses abroad; expressed in the national currencies of the countries in question, net turnover rose by 1.5%. Operating profits more than quintupled between 2005 and 2010, notwithstanding the drop in profits in 2008.

Net turnover for Electrolux between 2005 and 2010



Operating profits for Electrolux between 2005 and 2010



Source: Electrolux Annual Report 2010



News on the investment theme of **Water**

How should dirty water be dealt with?

Access to clean water is taken for granted by most of us. It is easy to forget that the world's water resources are limited and that clean water is increasingly becoming a rare commodity. Over the past 40 years, over half of the world's natural bodies of water have been destroyed (WWF Switzerland). Water pollution through human activity has a large part to play in this.

The current events at the Fukushima nuclear power plant will have uncontrollable consequences for the natural water table. Heavily radioactive contaminated water from the power plants is leaking from the damaged reactor directly into the sea. Although the concentrations of radiation are quickly dissipated by the ocean, the number of radioactive particles emitted will continue to rise until the problem is under control. The higher the overall level of emissions, the more negative the impact on the Pacific and its ecosystem. The radioactive isotope iodine-131's diminishes by half over around eight days; however, the radioactive isotopes caesium-134 and caesium-137, which were also emitted in large quantities, have long half-lives of two and 30 years respectively. Which means that it will take that long for half of its radioactivity to subside. The high levels

of contamination will therefore remain detectable for a long time. On the Pacific seabed near the power station, radiation levels 100 to 1000 times greater than normal have been measured (Asia Pacific News, 4 May 2011). The measures taken at the Fukushima power plant to attempt to prevent any further harmful consequences to the environment recall to some extent those taken in the wake of the "Deepwater Horizon" oil spill in the Gulf of Mexico in April 2010. The operator Tepco has erected barriers at Fukushima that are conventionally used to catch escaping oil. The plant operator's aim in doing this is to restrict the spread of the contamination (Spiegel, 4 April 2011). Tepco is furthermore planning to remove the radioactivity from contaminated seawater by pumping it through a metal container filled with zeolite, a mineral that absorbs radioactive material (Asia Pacific News, 4 May 2011).

It is not only the seawater that has been contaminated with radiation, however, but also the groundwater. The damaged reactors are emitting radioactive isotopes into the air that are contaminating the countryside over a wide area as a result of precipitation and deposits. Rainfall that flows off or drains away via the surface then transport the radioactivity into the groundwater. As a result, increased radiation levels have been demonstrated in the drinking water for the region around the Fukushima nuclear power plant. In mid-March 2011, the Japa-

nese Minister for Health announced that traces of radioactive iodine had been found in the tap water of all prefectures neighbouring Fukushima and in Greater Tokyo for the first time since 1900, and that radioactive caesium had also been found in two prefectures. The concentrations of radioactive iodine rose in numerous town in the prefecture of Fukushima and even further away in Tokyo, occasionally exceeding the limit for small children of 100 becquerels per litre. In light of this, the government warned against allowing small children and infants to drink tap water (IAEA Briefing on Fukushima Nuclear Emergency, 19 March 2011).

Figure 8: Contamination around the Fukushima reactor



Figure 8 The contaminated zone around the Fukushima reactor. The worst contamination was measured in Iitate (Source: Wikipedia, author: Mayhew).

recommended by the US Environmental Protection Agency (EPA). Ion exchangers displace more weakly binding ions like hydrogen ions with ions with a higher binding affinity – such as those of the radioactive element caesium-137 – and thus eliminate them from the water. Reverse osmosis involves a selective separation (enrichment) of dissolved substances from the contaminated water by forcing it through a semipermeable membrane under high pressure. When the pressure is removed, the filtrate flows back owing to the difference in concentration (osmosis). Reverse osmosis is used to separate salts, so this procedure is also used to extract salt from seawater. Such water treatment systems are already available on the market, as in addition to radioactive isotopes they can also remove other toxins such as heavy metals etc. from water.

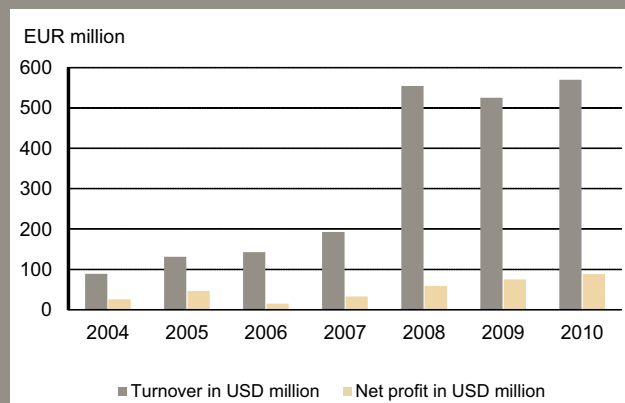
The population of Japan has since ceased drinking tap water in favour of bottled water. Over the longer term, however, the issue will arise of which technical solutions might be implemented to remove radiation from the water. Radiation, on the other hand, is a highly complex theme: account must be taken not only of the type of radioactive isotope but also of its solubility and behaviour in drinking water, together with the decay process and half-lives, when assessing the best possible solution for treating water.

Potential procedures for removing radionuclides are ion exchangers and reverse osmosis, as recommended by the US Environmental Protection Agency (EPA).

Hyflux

One company providing technical solutions for treating water is Hyflux. This company specialises in cost-efficient solutions for desalinating seawater, recycling water and processing waste water and drinking water. One such solution involves membrane technologies that can be used for a variety of purposes, including for reverse osmosis. Although the company does not specifically specialise in treating water contaminated with radiation, its innovative water treatment and waste water processing systems can help in general to ensure that the consequences and risks of water pollution are minimised worldwide. In particular, the mobile water treatment systems and drinking water processing plants developed by Hyflux that use “Kristal® ultrafiltration membranes” permit access to clean water in regions such as the Chinese province of Jiangsu, in which heavy contamination and a high salt content in the water are the general rule. In addition to China, Hyflux is also involved in facilities and projects in South-East Asia, India, the Middle East and North Africa. The corporate success of Hyflux comes as no surprise because water contamination is a key issue that is likely to grow in importance. A strengthened awareness of the potential consequences and the associated higher quality requirements for drinking water makes water treatment facilities and waste water processing plants invaluable in many areas. Hyflux posted a turnover of around 569 m USD and employed 2.000 people in 2011.

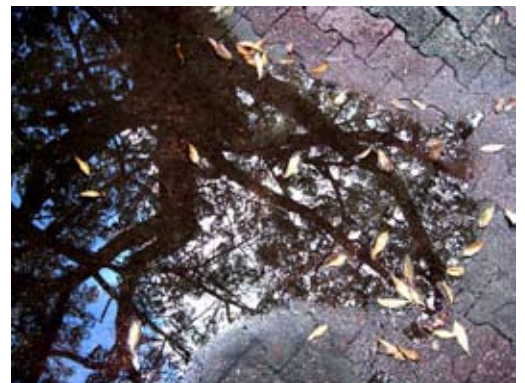
Company turnover and net profit for Hyflux



Source: Hyflux website

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Inrate AG

Rue de Romont 2
CH - 1700 Fribourg
+41 58 344 00 00

Binzstrasse 23
CH - 8045 Zürich
+41 58 344 00 20

www.inrate.com