

Investing in the Future

Advancing Energy

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01/05

sam insight 01/05

Dear Reader

One thing has become very clear in recent months: our entire socio-economic system is heavily dependent on the available energy resources of our planet. It is hardly surprising, therefore, that a heated public debate is currently underway in political and economic circles about the best way to assure a secure and sustainable energy supply in the future. The debate centres on three issues:

1. Restrictions on energy imports, which continue to grow at an alarming rate
2. Minimising economic exposure to high and volatile energy prices
3. Reducing the environmental pollution caused by using mainly fossil fuels.

The International Energy Agency (IEA) estimates that as much as USD 16 billion will have to be invested up to 2030 in order to meet the long-term energy demands of the world's population. Investments are therefore likely to be concentrated in the areas of energy generation and transport, as well as up and down stream along the value chain for oil and gas supply. But it's also important not to overlook end-user efficiency. Energy consumption would have risen by another 49% in the period between the oil price shock of 1973 and 1998, were it not for massive improvements in efficiency. This impressive figure shows that improving consumer efficiency will continue to be an important factor in the energy sector's innovation drive in future.

Another stumbling block is the reliability of the energy supply, which has immediate consequences for market growth. In an interview with "SAM Insight", Peter Hughes, Vice Chairman of BG Group, points out this link: "We expect to be able to maximise

market growth by striving for security of supply." Peter Hughes, who is responsible for group strategy at BG Group, is also confident that the "Age of Gas" will stretch well into the middle part of the century (see pages 6 to 9). But the industry is also increasingly looking to substitute traditional energy resources with innovations such as clean coal technology. You can find out which process in this generation of new technologies has the best chances of succeeding in the article by SAM analyst Charles Vaslet on page 9. Solar energy is also expected to continue to enjoy attractive growth rates (see article on page 10).

Last but not least, our "SAM Insight" provides an overview of the different energy sources – oil, natural gas, coal, nuclear power and renewable energies – and their prospects for the next 20 to 30 years. In his article "Getting the Fuel Mix Right", SAM analyst Björn Tore Urdal describes different strategies for optimising the energy portfolio, increasing the use of clean technologies and improving end-user efficiency. The key question for investors is: do investments in energy stocks pay off? A look at the 35 oil and gas companies analysed by SAM shows a clearly positive correlation between their sustainability rating and the return on equity. The conclusion therefore comes as no surprise: a selective exposure to the energy sector can prove to be a worthwhile investment in the long term.

I hope this brief summary encourages you to explore our publication in more depth, and hope that you find it a stimulating and rewarding read. May I also take this opportunity to remind you that the SAM Smart Energy Fund is a very attractive vehicle for investing in the constantly changing energy sector.

Reto Ringger, CEO SAM Group



Strong fundamentals are the salient features for the energy sector

Energy-Boost for the Portfolio

Bjørn Tore Urdal, Analyst, SAM Research

Industries that are more exposed to sustainability risks are more likely to integrate sustainability criteria into their business strategy ahead of companies that have a lower exposure to these risks. This finding, which is not entirely unexpected, also applies to companies that are active in the exploration, production and marketing of energy and natural resources.

With these companies, special attention has to be paid to the problem of how they can maintain competitiveness in a world with tougher CO₂ restrictions and how they deal with long-standing environmental and social problems they may have inherited. It is therefore hardly surprising to find that the sustainability analysis of around 1,000 companies carried out by SAM in 2004 showed that all branches associated with oil and gas – energy, commodities and energy utilities – have been the best performers in their sector (Fig. 1).

The more a sector is exposed to sustainability risks, the easier it is for companies to differentiate themselves from the competition by responding to and accommodating sustainability risks and opportunities in their business strategy. This also applies to energy companies that identify and make allowances for sustainability risks and exploit available sustainability opportunities, thereby improving their long-term competitive position. An investment strategy designed to selectively invest in sustainability pioneers in the energy sector should therefore reap rewards for long-term investors. This assumption is borne out by a sector comparison which identified a close correlation for the energy sector between sustainability performance and shareholder value creation.

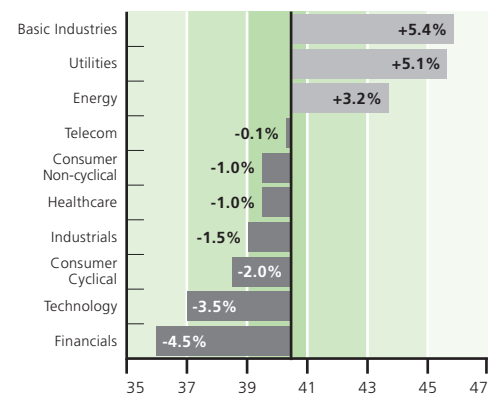
The most critical aspect for energy companies is the concentration of risks that could

be detrimental to their business activities, finances and reputation. The same applies for the potential consequences of the future development of companies, since in their battle to gain access to dwindling resources they often have to overstep environmentally and socially sensitive limits and venture into regions that are not only unstable in a geopolitical sense, but also have a very underdeveloped infrastructure. In addition, the aim is to ensure sustainable energy production and consumption, as well as guaranteeing a sustainable energy supply. This interdependence will be a key driver of the energy market and in some cases will also determine the competitiveness of companies shows a clearly positive correlation between the sustainability positioning in SAM's ratings and the return on equity (Fig. 2). The correlation is more pronounced for the energy industry than for other sectors.

Even if energy stocks do not at first sight seem to have a place in a sustainability portfolio, we do not think the inclusion of these investments is at all paradoxical. The salient features of the sector are strong fundamental data and a widening value creation spread over market rivals. Given our positive outlook for commodity prices, we therefore expect that a selective exposure to the energy sector will prove to be a healthy investment in the long term.

Figure 1. Sectors with a high sustainability risk perform better

Source: SAM Research

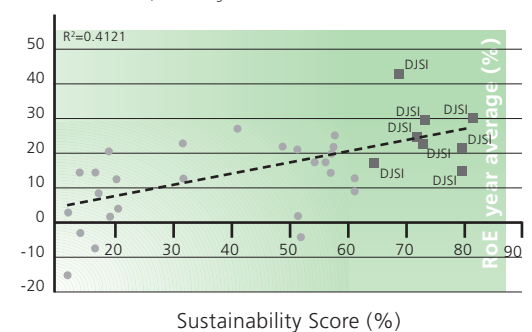


Sustainability Sector Ranking:

This study is based on the performance of the Dow Jones Sustainability Index (DJSI) 2004. A total of 978 global companies were compared, including 48 energy companies, using 18 industry-specific sustainability criteria.

Figure 2. Sustainability vs. Shareholder Value Creation

Source: SAM Research, Bloomberg



Sustainability vs. RoE:

Our regression analysis of the eight oil stocks contained in the DJSI 2004 compared with the 5-year return on equity (RoE) is based on the 35 oil and gas company stocks analysed. This 5-year average RoE is based on Bloomberg data. It is calculated as the net profit divided by the book value.



Author: Bjørn Tore Urdal, Analyst, SAM Research

Bjørn Tore Urdal is an analyst in SAM's research team covering the energy sector including oil and natural gas, oil field service, energy shipping, and the renewable energy and energy technology sectors. Additionally, he is the responsible analyst of the SAM Smart Energy Fund. Bjørn Tore, who has a Masters of Science degree in Environmental and Resource Economics, joined SAM from Handelsbanken Capital Markets.

Strategies for evaluating attractive energy-investments

Getting the Fuel Mix Right

Bjørn Tore Urdal, Analyst, SAM Research

In the last couple of weeks US President George W. Bush has given numerous speeches on the nations urgent need for increased energy security, mentioning virtually every alternative energy technology one can think of. In pursuit of a sustainable energy mix, security and the environment are interlinked creating new investment opportunities.

The solar industry is still dependent on state subsidy programs.

However, by 2010 the price level should reach 2 USD/Wp so that the cost will become competitive during peak output without subvention.



After a successful year in 2004 for energy investments, we continue to remain positive for this sector, in particular with alternative and renewable energy. This is our conclusion after having examined the megatrends shaping the global energy sector yet to be. The global mega trends accentuating the dynamics of the energy sector are:

1. Continuing mammoth growth in energy demand in emerging economies, China in particular
2. Increasing focus on energy security
3. Environmental acceptability

4. A carbon-constrained world
5. Continuing liberalization of natural gas and electricity markets

The current provision and use of energy is associated with two interdependent and fundamental concerns; namely how to ensure a sustainable supply of energy regarding accessibility, availability and reliability whilst simultaneously ensuring the environmental and social sustainability of that energy supply. The sum of these trends equates to an unprecedented challenge: the materializing need for a sustainable energy system.

4



Natural gas: High growth rates are forecast for the natural gas market up to the middle of this century.

Coal: "Clean coal" technology could ensure the survival of coal, which is a controversial and highly polluting source of energy.

The investor's challenge is to seize the right opportunities in this gigantic growth sector. SAM has assessed a range of energy clusters that will profit from these trends and identified investment opportunities along the entire energy value chain.

Sustainability-gear strategy – the key to success

The aforementioned trends create both threats and opportunities, and consequently dictate the dynamism of the energy industries and markets by emphasizing the challenges energy corporations face when competing for longevity and profitability. Corporate strategies geared towards co-dependent sustainability concept will gain competitive advantage and profitability in the medium- to long-term. To ensure long-term competitiveness, a company's strategy must thus be aligned to the ability to foresee these trends, and adapt accordingly. Tomorrow's winners will be those companies that respond to the new market requirements as opportunities, helping to define the new parameters and thereby achieving an early competitive edge.

An energy company can capitalize on the opportunities arising from the need for a sustainable supply of energy by acknowledging the need for sustainability of that energy source. Sustainability along two interdependent paths creates openings for a new kind of small, innovative niche company, as well as for mature major players to see themselves no longer as oil companies, but rather as energy providers.

Identifying attractive investment clusters

To identify attractive investment clusters, SAM has attempted to address the absolute sustainability of the different energy sources. In Figure 1 (top right), the Supply Sustainability of energy is based upon the broad parameters

of accessibility, availability and reliability (physical, geographical, geopolitical, continuity, price, cost, etc.). The Environmental Sustainability of the energy source is based on parameters such as GHG emissions, environmental impact from production and consumption, public perceptions, regulatory risks, improvement potential for clean technologies, etc. The size of the boxes indicates relative sustainability strength, i.e. the absolute sustainability of the energy source.

Based on the five mega trends and the relative sustainability strength of each energy source, SAM has developed a "Sustainability Road Map" representing three target areas for a sustainable energy system. These areas are; fuel portfolio, energy utilization and efficiency. Based on these three focus areas, SAM has singled out three strategies for assessing investment opportunities. Firstly, to re-align fuel portfolios towards more sustainable sources (e.g. shift from oil to natural gas). Secondly, to increase utilization (cut losses) and increase cleanliness (reduce emissions) of energy production (e.g. clean coal technologies in electricity generation). Thirdly, to raise end-user efficiency (reduce energy consumption e.g. through hybrid technologies in mobility). In Figure 2 we illustrate appropriate strategies for each of the energy sources.

The analysis of the five trends and the relative sustainability strength of each energy source provides a basis for SAM's five investment clusters. These clusters, depicted in Figure 3, are Renewable Energy, Natural Gas, Clean Fossil Technologies, Conversion & Distribution technologies, and End-use Efficiency Technologies. Within these investment clusters, SAM identifies investment opportunities arising in companies that are exposed to the interlinked sustainability concept and actively incorporate sustainability into their corporate strategies.

Figure 1. Energy sustainability

Source: SAM

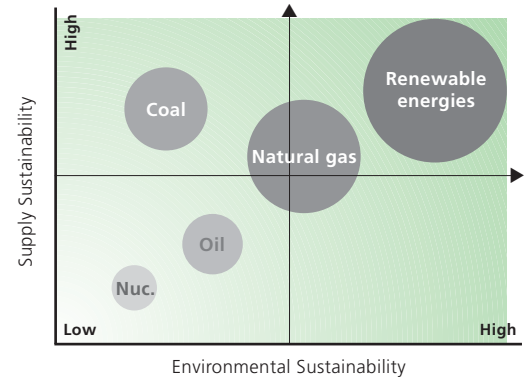


Figure 2. Sustainability roadmap for energy sources

Source: SAM

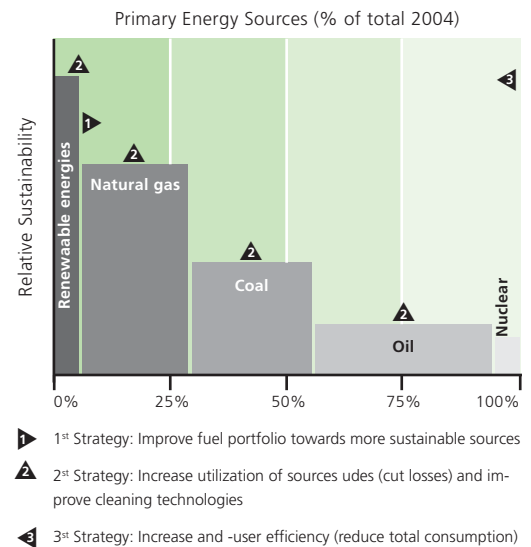


Figure 3. Investment clusters in the energy sector

<p>Renewable Energy</p> <ul style="list-style-type: none"> Wind power Photovoltaic Biomass Geothermal Hydro power 	<p>Clean Fossil Technologies</p> <ul style="list-style-type: none"> Clean Coal Technologies Coal Gasification Carbon Sequestration
<p>Natural Gas</p> <ul style="list-style-type: none"> E&P companies Natural gas distribution Oil field services LNG value chain GTL 	<p>Conversion & Distribution</p> <ul style="list-style-type: none"> Fuel Cells CCGT Power Electronics Power Management Energy Storage
<p>End-use efficiency tech.</p> <ul style="list-style-type: none"> Mobility 	



Nuclear: Until the problem of long-term storage of spent nuclear fuel rods is resolved, nuclear power does not offer a viable alternative to fossil fuels.

Oil: At the moment crude oil satisfies around 40% of global energy demand. This figure will change dramatically over the course of this century.

The “Age of Gas” will stretch well into the middle part of the century

“Gas is the Bridge to a Sustainable Future”

Interview with **Peter Hughes**, Vice President BG Group

In addition to the challenges facing the oil and gas industry of how to improve sustainability of energy production and consumption, the increasingly important challenge for the industry is to ensure a sustainable supply of energy, i.e. the challenge of energy security, in particular accessibility and availability of resources.



“Accessibility and availability of reserves are becoming greater challenges for a range of technical, institutional and geo-political reasons.”



This interview was held by Bjørn Tore Urdal, Analyst, SAM Research

In your strategic thinking, do you see these two sustainability issues as interdependent, and if so, are these issues complementary or contradictory for designing successful corporate strategies for the future of your company?

The two are interlinked rather than interdependent. As a company, naturally we aim to add to our reserves with a view to serving reliably the markets we have identified. And it is a fact that issues of accessibility and availability of gas resources are becoming greater challenges.

However, the reality is that there is no shortage of gas to meet demand. Therefore, producer countries and private companies like ours clearly have a shared interest in working together to meet the security of supply concerns of consumer countries. We need to remember that there are alternatives to gas, albeit alternatives that incur both economic and environmental penalties, so it is in both of our interests to instill in our customers a real feeling of confidence that gas can provide security of energy supply. In that way, we can maximise the growth of the global gas market. While that market will undoubtedly grow in coming years, it will not reach its full potential if consumers do not have faith in its ability to meet demand reliably. From a company perspective, we at BG Group see our ability to offer diverse – as well as reliable – sources of gas supply to major consumer nations such as the US and the UK as one of our strengths.

How do these two trends impact your strategic thinking both on sustainability and corporate strategy levels?

The overlap between energy policy and environmental policy is a central consideration to BG Group. We frequently make the case that gas has the lowest carbon emissions of any hydrocarbon fuel. We also support economic instruments that reflect carbon content – such as emissions trading – and we see gas as the bridge to a sustainable future. However, we would stress that, in our view, that “sustainable future” is several decades away at best and we expect “the Age of Gas” to stretch well into the middle part of the century at least.

Our “licence to operate” in many parts of the world is dependent on our ability to operate in a responsible and sustainable way. As we argue above, we would also suggest that, by striving to meet security of supply challenges, we can strengthen confidence in gas and maximise its market growth – and this will tend to have an environmentally beneficial impact, particularly where coal is the most viable alternative to gas. So both trends are central to our thinking and planning at a corporate level.

Is the energy security issue of more concern on a national level than on a company level?

Any company seeking to prosper will acknowledge consumer countries’ supply security needs and work with them to try to help them meet the challenge for the reasons we have outlined above – namely, with a view to maximizing the size of the gas market. It is true that accessibility and availability of reserves are

“The reality is that there is no shortage of gas to meet demand.”

becoming greater challenges for a range of technical, institutional and geo-political reasons, so the complexion of that aspect of the business has changed in recent years and is likely to continue to change.

Another matter where the emphasis is shifting lies in the area in which energy policy and environmental policy overlap. And here a potential contradiction in emphasis is becoming sharper. Energy policy tends increasingly to focus on security of supply, which – for example in the US – could push policy-makers in the direction of indigenous coal (which is abundant but environmentally unfriendly) ahead of any major breakthrough in clean coal and carbon sequestration technology. Environmental policy, in contrast, has tended to favour gas, while renewable alternatives are being developed.

There is a risk that this contradiction could deepen and cloud policy-makers’ thinking as they plan for the future. We believe that it is over-

optimistic to think that there will soon be carbon capture and sequestration technologies that can make “clean coal” a realistic, early option from an economically competitive point of view. It is therefore more “sustainable” to pursue the route of maximizing gas’s share of the energy market.

BG Group is targeting most of the natural gas value chain with operational exposure in the natural gas hot-spots in the world. Do you believe BG has a competitive advantage vs. peers in capitalizing on a pursuit to a more sustainable energy mix?

We believe that BG Group has a number of clear competitive advantages. Our focus is on gas and we are able to side-step the vertical segmentation and the inter-business rivalries that can at times hamper the smooth operation of companies that have to juggle upstream and downstream oil issues, as well as gas. Our market-based approach and our clarity of strategy mean that our team can focus rigorously on opportunities that fit our strategy. We have a heritage of skills in the gas industry that stretches back over 100 years and the size of our company is in itself a source of competitive advantage – we are big enough to invest in major projects, yet we remain small enough to be agile. The scale of our company means that we can grow fast. It also is un-intimidating and makes us attractive partners to other companies and to host governments.

Are E&P operations and capex spending targeting increased natural gas exposure via higher natural gas proportion of total reserves and production vs. oil, and LNG operations, an important means for E&P companies to ensure competitiveness and value creation going forward?

The balance of our portfolio is roughly 70% gas to 30% oil. Historically the traditional supermajors have favoured oil, though gas as a share of their portfolios has been increasing markedly recently. Since BG Group in its current form was established in 2000, the pursuit of natural gas has always been our aim so there hasn’t been any change for us. We believe that this distinctiveness of approach – in focusing on gas without the segmentation and different business priorities implicit in oil and gas companies – means that we are well placed for what



Social dimension: BG Group has defined new, stringent standards for suppliers, designed to ensure a sustainable procurement chain. Furthermore, BG’s health and safety rules are some of the best in the industry.

Environmental dimension: Here BG Group stands out with its clear strategy to reduce greenhouse gas emissions.

we expect to be “the Age of Gas”, during a period in which gas growth is expected to be higher than that of all major competing fuels.

On behalf of the industry, if you could weigh the importance of carbon constraints and accessibility/security, what is the most important driver for an E&P company strongly targeting natural gas?

Accessibility is the most important driver at this stage in the cycle. The pursuit of reserves is becoming more challenging, the competition is greater and, increasingly, companies need to demonstrate why they should be partners of choice on the basis of a strong record of project delivery across the gas-chain. Because of the integrated nature of the gas business, it is important to acknowledge that the ability to deliver right along the gas-chain is of critical importance – in a way that is not the case in the oil market.

In the recent year, the financial markets increasingly want to see organic reserve growth and E&P capex spending. The financial markets are worried that E&P companies will fail to deliver on reserve replacement growth. What are the largest challenges facing the industry in terms of securing reserve replacement of oil and gas reserves – physical and technical challenges or getting access to exploration acres in high risk regions etc.?

While there are always technical challenges and extraction becomes trickier as provinces mature, the toughest challenge at present relates to accessing exploration acreage. But, as we highlighted earlier, the central factor here lies in the reciprocity of interests and the strategic alignment required between producer nations and private companies. In some circumstances, private companies can offer technological solutions that will facilitate extraction but companies such as BG Group are also able to offer guaranteed markets to producers. Once we appreciate the reciprocity of interests and the need to ensure gas growth potential is not restricted, the importance of strategic alignments becomes clear.

Thank you for this discussion.

“More Upstream and Profitable Downstream”

Interview with **Lex Holst**, Vice President Group Sustainable Development and Health Safety and Environment, Royal Dutch/Shell Group of Companies

The International Energy Agency (IEA) expects the world to be using nearly 60% more energy than today by 2030. What is Shell’s strategy in meeting this strongly growing energy demand?

Our strategy over the next five years is clear: “More upstream, profitable downstream”. More upstream means improving our performance in finding and producing oil and, especially, natural gas and increasing the upstream share of our portfolio.

Profitable downstream means increasing returns in our Oil Products and Chemicals businesses by running our facilities better, investing in fast growing markets like China and other parts of Asia, and selling off activities with lower returns or limited growth potential. As the energy mix continues to evolve, we will continue to invest in alternative energy.

What sources of renewable energies do you prefer and what do you expect from these investments?

Supplies from biomass, wind, solar, geothermal or small-scale hydro could grow strongly, but are beginning from a small base today. They currently supply about 1% of global energy demand. Our new scenarios see these sources growing by about 10% a year with strong government support. This would be many times faster than growth in coal, oil or even natural gas. We are the largest blender of transport biofuels.

In 2004, Iogen (partly Shell owned) produced the first commercially available biofuel from straw (“eco-ethanol”) with carbon emissions at least 85% lower than for conventional petrol. Furthermore we have invested around USD 700 million since 2000 to build commercial businesses in wind, solar power and hydrogen and have become one of the largest wind power developers within four years. We are also investing in thin film solar technology and reducing costs of today’s silicon based panels. At the same time we continue to invest in hydrogen technology.

In an interview with “SAM insight”, BG Group sees gas as the bridge to a sustainable future. What role does gas play in your energy portfolio?

Gas will play a key role in meeting our future energy needs. Growth in Liquefied Natural Gas (LNG) will drive the development of a bigger, more dynamic and more complex gas market. Combined with coal gasification, the technology could in due course provide a cleaner and more efficient way of using coal.

We have over 40 years experience producing and shipping LNG from Australia, Brunei, Malaysia, Nigeria and Oman, to Asia, Europe and North America, where natural gas demand is growing fast. Through our share in joint ventures we produce enough LNG to supply more than 10 million homes with power – more than any other private company. We aim to double production by 2009, with Sakhalin Energy in Russia the biggest contributor. LNG production will likely double over the next decade to ensure a diverse choice of natural gas suppliers. We are investing heavily to maintain our position as the largest private supplier of LNG.

This interview was held by **Bjorn Tore Urdal**, Analyst, SAM Research



Clean Coal – can this new generation of technology finally make it?

Coal – Energy Source with a Clean Future

Charles Vaslet, Analyst, SAM Private Equity

Some say that coal is king. But as the old monarch ages, will cleaner coal technology succeed or will the dominance of coal fade?

I remember, having just graduated as an electrical engineer, attending in 1988 a seminar organised by Foster Wheeler and the Institute of Electrical Engineers in the UK. It was there where I first heard the array of clean coal technology acronyms, CFB, PFBC, IGCC etc.. Up to that point I and my utility employer only referred to PC. Looking back now, it is clear that neither I, my employer, nor the coal industry recognised the significance of two other acronyms, those of CCGT and IPP, that came to dominant new power plant capacities in the 1990s.

Yet in spite of this considerable “dash for gas” investment, coal generation in the US still dominates with a 52% market share. And perhaps of greater significance, in a world increasingly concerned with security of supply, not only is the US self-sufficient but it has some 50% of the globe’s coal reserves. Compare this with its use of 33% of the globe’s oil and indigenous reserves of only 6% and it becomes clear why, in the post 9/11 era, the US President has outlined a plan towards greater energy independence, swinging some USD 1.2 billion into clean coal technology over a period of ten years.

If that weren’t enough, there are at least three other compelling arguments used to push forward clean coal technology. Firstly, that 25% of the US coal power plant fleet is over 50 years old, and 70% is over 30 years. This fact reduces the likelihood of pollution control retrofit investment of SCR and FGD, even if the permit conditions for these “grand-

fathered” plants were to be relaxed. Secondly, coal is still cheap and, in spite of the recent doubling in coal prices, those states that primarily use coal maintain a considerable energy cost advantage over those with natural gas (now trading some 3.5 times for the same energy content). Thirdly, the US needs to reduce emissions, both in response to local and global pressures.

It is somehow difficult to see renewable energy or energy conservation replacing this coal capacity, and whilst the US Government is preserving the nuclear option and of course more natural gas CCGTs will be built, timing for nuclear and the start of the decline in US gas production forecast in 2007, could limit further substitution.

Emissions is a key consideration in the US and with coal power plants currently producing some 66% of all US SO₂, 33% of all CO₂ and 25% of NO_x, the performance of clean coal technology will be a key determinant of its adoption. There is of course more than one solution and it is not clear which clean coal technology will emerge first; it could be either the supercritical steam condition boiler, that requires post-combustion treatment, or IGCC with its pre-combustion treatment. The desire for security of fuel supply and the resulting natural gas price volatility over a 30 year operating life will favour some deployment of Clean Coal, although the extent to which and the technology deployed is more difficult to determine.



Winners of the Clean Coal Technology

Who would benefit from the expansion in clean coal? Foremost the coal mining industry, companies such as Peabody Energy Corp., Consol Energy Inc., Massey Energy Co. and Arch Coal Inc. Then there are the energy companies that own the technology (e.g. ConocoPhillips, Dow Chemicals, Foster Wheeler, GE Energy, Lurgi, Shell and Siemens Westinghouse) as well as the US engineering and construction companies that have already built clean coal plants (Bechtel, Black & Veatch and Fluor Corp.). Finally, for IGCC there is a considerable investment in air separation equipment that would provide a new market for the gas companies such as Air Liquide, Air Products, BOC Gases, Linde and Praxair.

CCGT Combined Cycle Gas Turbine
CFB Circulating Fluidized Bed Boiler
IGCC Integrated Gasification Combined Cycle
IPP Independent Power Producer
PC Pulverised Coal
CFB Pressurised Fluid Bed Combustion boiler



Author: **Charles Vaslet**, Analyst, SAM Private Equity

Charles Vaslet is an Analyst at SAM's private equity division responsible for renewable and energy conversion technologies. In this function he is involved in the due diligence process including assessment of technologies, manufacturing processes and market opportunities. The electrical engineer worked before for the technology company ABB and the UK utility Innogy.

For how long will the solar industry be able to sustain its record growth rates?

Neverending Growth?

Markus Moor, Investment Director, SAM Private Equity

Another jump of 62% in installed photovoltaic modules in 2004 followed a period of more than 10 years with an average growth rate above 30%. The industry has increased its production capacity by a factor of almost ten in the last ten years.



I was 11 when the second oil crisis hit the front pages of news papers in the early eighties. It was at the same time when I summed up my limited savings and bought a small photovoltaic panel to learn more about the technology that was supposed to bring relieve to this disordered energy situation. More than twenty years later, I realise that my still existing small panel was probably within one of the first megawatt of photovoltaic panels produced. The same industry has skyrocketed since and reached a cumulative installed capacity of above 3,000 MW and a turnover volume of approximately USD 6.5 bn last year. In the last five years, the production of photovoltaic cells has increased steadily by an average of 40% per year.

The question arises for how long this record growth rate may be sustained. On the one hand the power produced based on photo-

voltaic modules is still not price competitive when competing against other large power generation technologies and requires support programs. On the other hand the demand for silicon at the required purity could face serious shortages on the supply side in the next few years. The weather forecast for the solar industry may however remain relatively sunny.

Even in the leading countries of PV installation the capacity of solar power installed per inhabitant is miles away from any saturation point. Luxemburg (55 W/capita) is leading this statistic with a capacity roughly ten times higher than the closest followers Japan and Germany. Most other OECD countries are a factor of five to ten behind Japan and Germany. While realising that this is by far still not a sufficient argument to forecast remaining good weather for the industry, the projected

targets for 2010 and beyond by the main markets Europe and Japan sound encouraging.

The European Commission target of cumulative 3,000 MWp for the end of the year 2010 asks for the installation of 2 GW over the next five years or twice the capacity installed in the past 25 years. In the meantime, not only the front-runner Germany (+152% in 2994), but also Spain, Italy and some other European countries have now set up favourable support schemes that will help to reach this target. Japan on the other hand plans for an installed capacity of 4.8 GWp by 2010, an ambitious target requiring an annual growth rate of 30%.

Beside the support programs that help to bridge the competitive gap in some markets, the industry has been and still is working hard to lower module cost. The last ten years saw a decrease in module prices in the range of 40-50%. Until 2010 manufacturers expect to cut module prices by another 30% to reach a price level of 2 USD/Wp. At this price level sound installations in favourable countries such as Spain produce power below USD 0.20/kWh and start to be competitive with peak power rates without the need for subsidies.

Last but not least, several players of the photovoltaic industry have started to produce "solar grade silicon" to overcome the dependence of the solar industry on the semiconductor industry as a raw material supplier. Even though still at a small production level, it will help to avoid larger shortages of silicon in the medium to long term.

MW Megawatt, **PV** Photovoltaik, **MWp** Megawatt Peak, **GWp** Gigawatt Peak, **Wp** Watt Peak, **kWh** Kilowatt hour
1 GW = 1000 MW



Author: **Markus Moor**, Investment Director, SAM Private Equity

Markus Moor is an analyst for investments within SAM Private Equity in the fields of emerging energy technologies. He has a particular focus on renewable energy, distributed generation and portable power. Markus Moor's main contributions include due diligence of technologies manufacturing process and market opportunities. He holds a BS in Mechanical Engineering and a MS in Economics and Technology.

News and Agenda

Agenda

21 September 2005

Launch of the Dow Jones Sustainability Index (DJSI) Nordamerika and the Dow Jones Sustainability Index (DJSI) USA

22 - 23 September 2005

SAM Private Equity Investoren Forum
Venue: Grindelwald

Publications

June 2005

SAM-contribution to the book "Responsible Investing", published by Insight Investment and Greenleaf Publishing

7 September 2005

Announcement of the members of the Dow Jones Sustainability Index (DJSI)

Autumn 2005

SAM-study about the energy sector and its challenges regarding a sustainable energy supply

Transparency Issues with the ACEA Agreement

SAM and the World Resources Institute (WRI) have jointly published the results of an analysis of the risks and costs that are associated with the European automotive industry's voluntary commitment to substantially reduce CO₂ emission rates of vehicles sold in the European Union. The company-specific obligations from this commitment – known as the ACEA Agreement – have not been disclosed. This report analyses the possible financial and competitive impacts of the ACEA Agreement on the world's largest automotive companies.

Four LIPPER-Awards for the SAM Sustainable Water Fund

In the "LIPPER Fund Awards 2005", SAM Sustainable Water Fund was voted the best fund over three years in the category "Global Equity Funds Non-cyclical Goods and Services". This important industry accolade was awarded not just for Switzerland, but also for Germany, Austria and Europe.

Two new funds, SAM Sustainable Global Equity Fund and SAM Sustainable European Equity Fund, also received sales licences for Switzerland, Germany, Austria and Luxembourg.

Several Milestones for SAM's Index Business

The first months of 2005 have brought along several milestones for SAM's index business. Four asset managers signed up as new licensees of the Dow Jones Sustainability Indexes (DJSI) and thereby increased the number of outstanding DJSI licenses to 55. Assets under management in DJSI-based portfolios crossed the important threshold of three billion EUR.

Shortly thereafter, SAM announced that it will add a set of North American and United States benchmarks to the DJSI family. The DJSI North America and DJSI United States will be launched on September 21. Following the establishment of the DJSI World in 1999 and the DJSI STOXX as well as DJSI EURO STOXX in 2001 these new indexes will constitute a significant expansion of SAM's range of sustainability benchmarks. Similarly, the Australian SAM Sustainability Index (AuSSI) represents another important addition to SAM's index offering. This dedicated sustainability benchmark for the Australian market went live in mid-February with the support of the Environment Protection Authority of Victoria.

SAM invests EUR 3 million in EnOcean

EnOcean, a leading international supplier of batteryless wireless technology, receives 13 million USD for expansion of its business in the USA, and to support further miniaturization and integration of its unique technology in ASICs and Micro-Electro-Mechanical Systems (MEMS). In addition to the new lead investor SAM Private Equity, the former investors Wellington Partners, 3i, Siemens Venture Capital and BayTech Venture are participating in this financing round for the Siemens spin-off that set up in 2001.



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Contact

SAM Group
Seefeldstrasse 215
CH-8008 Zurich
Switzerland
Tel. +41 44 397 10 10
Fax +41 44 397 10 80
insight@sam-group.com
www.sam-group.com

SAM Group was founded in 1995 as an independent asset management company specializing in sustainability investments. Today SAM ranks among the world's leading institutions in this sector. Its clients include banks, asset managers, insurances, companies, pension funds, trusts as well as private investors. SAM Sustainable Asset Management offers its institutional clients a wide range of customized mandates and standardized products. Furthermore, SAM is active in the Private Equity field, focused on venture capital in the cleantech sectors, namely, energy, materials, water, and agricultural technologies.

Through systematic analysis, SAM seeks to identify companies with sustainable success criteria. SAM's expertise stems from its own research as well as an active, worldwide sustainability network. In cooperation with Dow Jones and STOXX, SAM launched the world's first family of sustainability indices, tracking the performance of companies that lead their industry in terms of sustainability. For SAM this means evaluating more than 1,000 companies each year.

SAM Group is headquartered in Zurich (Switzerland), with branches and representative offices in Barcelona (Spain), Milan (Italy), Melbourne (Australia), Montreal (Canada), Sonoma (California, USA) and Stockholm (Sweden).

