ENERGY EFFICIENCY, ENERGY SECURITY, RENEWABLE ENERGY: TAKING FORWARD THE GLENEAGLES DIALOGUE AND THE G8 ST PETERSBURG CONCLUSIONS

Roger Williamson

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1 Overview of International Initiatives

The Russian emphasis on energy security at the G8 meeting in St Petersburg underlined that energy issues are now at the heart of the international political agenda. With oil at over US$70 per barrel, conflict in the Middle East and high temperatures and dramatic climatic events occurring with increasing regularity, it is understandable that greater attention is being paid to climate change, renewable energy and energy efficiency issues.

The UK's Presidency of the G8 in 2005 had given impetus to these concerns. The Gleneagles plan of action on 'Climate Change, Clean Energy and Sustainable Development' focused on such issues as transforming the way we use energy, financing the transition to cleaner energy and managing the impact of climate change. Non–oil producing developing countries, with limited access to modern energy sources, also face the additional problems of increasing import dependency through the high oil price. Many of the countries supplying oil are either in politically volatile regions or themselves unstable. There is an increasing scientific consensus that we can no longer assure energy security at the cost of the environment. At the same time, however, it must be recognised that for many countries, economic development for poverty eradication is the top policy goal. The Millennium Development Goals cannot be achieved without access to energy. Poverty also has serious health consequences. The World Health Organisation estimates that 2.5 million deaths each year are due to indoor pollution, primarily respiratory diseases caused by burning wood.

As former US Vice-President Al Gore has stressed, there is no one 'silver bullet' which can solve all of these problems. What we are looking for instead is 'silver buckshot'. Many approaches are needed. While there is general agreement that a move to a low carbon economy is required, the policy instruments are still being developed to achieve this. The EU's Emissions Trading Scheme is helping to push climate change up the agenda. Carbon Trading is a market-based mechanism which can help to favour energy sources with less damaging environmental impact. Energy efficiency is still a neglected aspect of energy policy but has massive potential, both in developed and developing countries.

The energy issues are not only a concern of government. The International Energy Agency (IEA) is anticipating that as much as US$16 trillion could be invested in energy infrastructure in the period up to 2030. Two-thirds of this will be in electricity generation. The bulk of these resources will have to come from the private sector.

If countries such as India, China, South Africa, Nigeria and Brazil are developing fast, it is essential that the development path also uses cleaner energy. The Gleneagles Dialogue has therefore widened the circle to engage such countries in active policy discussion on energy futures.

The St Petersburg G8 conference has continued the emphasis from Gleneagles and discussed such issues as improving the investment climate in the energy sector, enhancing energy efficiency and saving energy, ensuring physical security for critical

energy infrastructure, reducing energy poverty and addressing climate change and sustainable development.

The IEA is playing a critical role in providing expert analyses so that the Japanese G8 presidency in 2008 can bring the Gleneagles Dialogue to a culmination.

The next stage in this process is the Mexico Ministerial.[1] The preparatory meeting of the Mexico City Dialogue of 7-9th June 2006 focused on technology development and transfer, policies frameworks and market mechanisms and adaptation.

Underlying the work on technology development, deployment and transfer is the analytical expertise of the IEA. This work focuses on identifying long-term emissions reduction potential, the costs of achieving sustainable scenarios and technology cost scenarios on a medium and long-term basis. To enable technology transfer to occur, issues such as intellectual property rights need to be addressed to provide incentives for the participation of the private sector. This could well require creation of an international common fund to foster research and support technology transfer to the poorest countries.

In the field of policies, frameworks and market mechanisms, action is needed both at national and regional level to promote enabling environments, enhance capacity building and to share technical assistance. A sectoral approach, for example, addressing the transport sector needs further elaboration. It is also clear that national energy policy must take account of the different nature of policies on information, regulation, taxation and market based approaches and also the different levels of response, including the national, local and urban levels. Research and development has shown a declining trend in many countries. Carbon finance plays a critical part for investment decisions and reinforces the other investment considerations. The use and functioning of existing tools including the Clean Development Mechanism, needs to be enhanced. The international financial institutions are working on an energy investment framework in support of the Gleneagles plan of action. Developing countries stress that the adaptation agenda is very complex and must be based on detailed assessment of the impacts, needs, vulnerabilities and variations in capacity within and between regions and countries. Exchange of information on best practice is also essential.

Increasingly, it is understood that these issues are not only considerations for energy and environment ministries, but it is essential to get the finance ministries on board because of the cost implications. The British government has done this through the 2003 Energy White Paper,[2] which has been followed up through the Stern Review which analysed the economics of climate change and energy security.[3] The Government has also recently published an energy review on 'The Energy

[1] http://www.defra.gov.uk/ENVIRONMENT/climatechange/internat/g8.htm

[2] http://www.defra.gov.uk/environment/energy/review/

[3] http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm

Challenge' in July 2006.[4] This seeks to take a long-term approach and stresses that it is not possible to make all the policy decisions today which will be needed for energy policy through to 2050. It does, however, seek to take a comprehensive approach about these issues. It also sets the context for decision- making firmly within the policy goal of cutting the UK's carbon dioxide emissions by 60% by 2050.

The Moscow G8 meeting also outlined the key principles on which energy policy must develop.[5] It stressed economic growth and market access, as well as investment. In addition, it has put considerable emphasis on stable and effective legal and regulatory frameworks, including the obligation to uphold contracts. Diversification of energy supply and demand, environmentally sound development and use of energy, technology transfer and safeguarding infrastructure were all regarded as key aspects. The climate change considerations in the Report stressed the centrality of the Clean Development Mechanism and Joint Implementation Mechanism.

The forthcoming report of the Inter-Governmental Panel on Climate Change (IPCC), due to be published in 2007, was also emphasised.[6] Anticipating the Ministerial Meeting in Mexico in October 2006, the G8 report stressed as agenda items: energy security and sustainable development through the development of cleaner, more efficient and low carbon energy technologies; finance and market mechanisms including the Clean Development Mechanism; Joint Implementation; emissions trading and adaptation. Under the heading of 'reducing energy poverty', the role of the international financial institutions, the UN Commission on Sustainable Development, and the World Bank's Clean Energy Investment Framework were all mentioned.

Among other initiatives and networks stressed in the report included:

- The Joint Oil Data Initiative (JODI);
- The Extractive Industries Transparency Initiative (EITI);
- The Global Environment Facility;
- The Carbon Sequestration Leadership Forum (CSLF);
- The International Partnership for the Hydrogen Economy; and
- The Renewable Energy and Energy Efficiency Partnership, the renewable energy policy for the 21st century (REN21), the Global Village Energy Partnership (GVEP).

[4] http://www.dti.gov.uk/energy/review/page31995.html

[5] http://en.g8russia.ru/docs/11.html

[6] http://www.ipcc.ch/

2 The Size and Complexity of the Challenges, Energy Technology Perspectives and Energy Efficiency: IEA Analysis.

At the Gleneagles summit, it was agreed that:

'The IEA will advise on alternative energy scenarios and strategies aimed at a clean, clever and competitive energy future'.

In fulfilment of this mandate, the IEA has produced a report on '*Energy Technology Perspectives 2006: Scenarios and Strategies to 2050'*.[7] This provided a groundbreaking review of technologies across all sectors and assesses how together they can make a difference. The report looks at key energy sectors such as power generation, transport, buildings and appliances and industry as a whole. It develops global scenarios to illustrate the potential for different technologies and the strategies needed to help key technologies to make a difference. The main findings of the study were as follows:

- Current policies will not lead to a sustainable energy future;
- However, a more sustainable energy future is possible with a portfolio of clean and efficient technology;
- Technologies which have an additional cost of less then $25 per tonne of carbon dioxide avoided provides a more promising perspective. Global carbon dioxide emissions can be returned to today's level by 2050 and expected growth in both oil and electricity demand can be halved;
- This would require urgent action to promote, develop and deploy a full mix of energy technology; and
- Co-operation between developing and developed nations will be essential.

According to the study, most energy will still come from fossil fuels in 2050. However, carbon dioxide emissions can be returned to today's level by 2050. Growth in oil and electricity demand can be halved and power generation could be substantially de-carbonised by 2050. De-carbonising transport will take longer but must be achieved in the second half of the 21st century. Improving energy efficiency is thus top priority. Carbon capture and storage (particularly if coal is likely to be used in significant quantities for power generation) is essential for a sustainable energy future. Other technologies will play an important role including renewables (including biofuels), nuclear power in countries where it is socially and politically acceptable and efficient use of natural gas.

By 2050 most emissions will be from developing countries. The more promising scenario recorded above assumes a 2% increase in improvement in energy efficiency per annum. This compares with a 2.3% increase in OECD countries from 1973 to 1990 in response to the oil crisis. Significantly to reduce greenhouse gas emissions will need development of carbon capture and storage (CCS) as oil from

[7] http://195.200.115.136/dbtw-wpd/Textbase/press/pressdetail.asp?PRESS_REL_ID=180 ; http://www.iea.org/w/bookshop/add.aspx?id=255

coal and gas is developed. Huge reductions in emissions are possible in power generation.

The report is centred around the analysis of three scenarios;

- the baseline scenario or “business as usual”;
- the accelerated technology scenarios (ACT), and an even more far-reaching approach;
- the TECH Plus scenario.

The ACT scenarios vary according to the assumptions built in. For example: renewables can be developed at a faster or slower rate; nuclear power will have higher or lower public acceptance; carbon capture and storage either will or will not be developed significantly. Each of these scenarios makes a difference to the final outcome.

The TECH Plus scenario enhances what can be achieved, but depends on stronger cost reductions for renewable energy; stronger cost reductions and technological improvements for nuclear power; a breakthrough in the development of hydrogen fuel cells and advances in biofuels.

In the baseline scenario, carbon dioxide emissions increase between 2003 and 2050 by 137%.

Huge reductions are possible under the ACT scenarios, largely through the possibilities in the power generation sector. Improved energy efficiency is the most important contributor to reduced emissions, saving the equivalent of 60% of current emissions.

The ACT scenarios all have an important role for carbon capture and storage for electricity generation by coal and a strong growth in nuclear power and renewables. The report gives an example of the possibility of a 50% reduction in carbon dioxide intensity for coal-fired power generation in China from 2003 to 2050 due to improved generation efficiency, as well as carbon capture and storage. In the ACT scenarios, two-thirds of the carbon dioxide emissions reduction is from improved fuel efficiency and one-third from biofuels.

In the transport sector, the key issue is to reduce growth and oil demand. The expected growth in transport oil demand of almost 50% could be met by increasing the share of biofuels by 13% and increases in energy efficiency of vehicles in 2050 (almost 50% more efficient than today). If hydrogen and fuel cells could reduce oil demand in the transport sector and carbon dioxide emissions even further, this would be crucial for long-term sustainability. Under the most optimistic ACT scenario 43 million barrels of oil per day could be saved (compared with the ‘business as usual projections’). Transport would account for 62% of this saving.

The economic growth assumptions are relatively high, with average GDP growth to 2050 (per annum) of 3.9% in developing and 1.8% in OECD countries. The picture with regard to carbon dioxide emissions is particularly revealing. On the baseline

(business as usual) scenario OECD countries would increase their emissions by 70% and developing countries by 250% by 2050. On the ACT map scenario, emissions in OECD countries would be –32% and in developing countries +65%.

In time, and assuming technological breakthroughs, hydrogen and fuel cells will be essential enabling significant improvement in the transport sector. In terms of cost a '$25 per tonne' carbon dioxide incentive is necessary for encouraging the application of the technologies needed. There will be significant transitional costs and progress in efficiency and carbon capture and storage will be required.

While challenging, the research is encouraging since it suggests that a more sustainable energy future is possible with the known technology and the costs are not out of reach. However, energy technologies must be introduced, research and development enhanced, the demonstration and deployment of new technologies must be speeded up and clear and predictable incentives must be provided. Co-operation between the developed and developing countries is essential. These scenarios are not about restricting demand for energy services, but increasing energy efficiency and deployment of current technologies. The costs are manageable or within reach, but very substantial. However, the economic and social costs of inaction will be considerably higher.

3 Energy Efficiency – IEA Findings

Further work by the International Energy Agency estimates that $16 trillion could be invested in energy in the period 2001 to 2030. At least 60% of this will be in electricity generation. Comparing the reference scenario with an alternative, CO^2 emissions could be 16% less, saving 6 gigatonnes (Gt) of carbon dioxide. Improvements in end use efficiency contribute more than half the decrease in emissions, and use of renewables approximately 20%. In this same period to 2030, the IEA estimates that efficiency measures costing $700 billion on the demand side could contribute to avoided supply side investment in generation, transmission and distribution of $1.4 trillion. The IEA, in its report *Cool Appliances*, has shown how residential electricity consumption could be reduced in IEA countries (between 1990 and 2030) by 35%.[8] This reduction in residential electricity demand would require the use of the most efficient appliances. The recent study *'Light's Labour's Lost*' shows similarly significant reductions in consumption, primarily through using good quality, compact fluorescent light bulbs.

Given the possibility of such savings, it is necessary to examine the reasons why the necessary policies are not implemented. Factors include:

- Missing or partial information regarding the energy performance of energy using systems;
- Lack of awareness on cost-effective energy-savings potentials;
- Energy efficiency is a secondary factor in capital acquisitions and there are split incentives. The last point is often referred to as the landlord-tenant factor.

[8] http://library.iea.org/Textbase/press/pressdetail.asp?PRESS_REL_ID=90

The decisions about energy efficiency investment are often not the final users who have to pay the energy bill.

Policies to improve performance in lights include setting limits for the maximum power density for lighting. These should be incorporated into building codes. The reduction of unnecessary power use through intelligent controls would also assist. Standards and labelling for lighting appliances and controlling the quality of compact fluorescent lamp bulbs and provision of incentives to replace incandescent lamps could also help.

Currently, over fifty countries covering about 80% of the world's population have standards of labelling.

Policies which can deliver energy savings include:

- Standardised energy performance metrics and energy information (for example, labelling and certification of buildings, equipment and vehicles);
- Mandatory efficiency standards for buildings, equipment and vehicles;
- Preferential procurement (bulk/technology);
- Fiscal incentives and financial support for investment in efficient products and processes;
- Third-party financing (for example, support for energy service companies, which finance improvements and are repaid from future savings;
- Getting the energy price right, by removing subsidies and internalising externalities (for example, there are insufficient incentives in Russia to introduce energy efficiency programmes with the gas price so low);
- Public utilities should be required to introduce energy efficiency; industrial and service sector audits (green reporting, etc.) could be combined with incentives;
- Promotion of energy consumption feedback system;
- Carbon finance, joint implementation and Clean Development Mechanism finance for efficient appliance, industry, transport and building programmes in developing countries.

The actual development of energy demand since 1973 indicates that energy use would have been 50% higher by 1998 had energy efficiency savings not been forthcoming. With more concerted policies, more can be achieved. Energy efficiency improvements offer large-scale abatement at a net benefit to the economy. However, policies must be implemented to address the market failures and imperfections. Careful study of each sector is required as are the different requirements of each end use, power for transport, light, industrial processes, etc. To achieve these goals, leadership by government and heads of industry is needed.

4 Energy Efficiency in Industry

Motor driven systems use more than 70% of global manufacturing electricity. While some gains can be achieved through attention to individual components of a system, the big savings in energy (between 20% and 50%) can be achieved between optimisation of the efficiency of a system. To achieve such savings, a thorough

review of an entire system is necessary to check inefficient uses and practices. Even where a motor is very efficient, overall system efficiency is often reduced through cumulative losses within a system through, for example, pumps, valves. As an example, a UNIDO project in Jiangsu and Shanghai provinces trained twenty-two engineers in systems optimisation techniques.[9] Within two years they had conducted surveys on 38 industrial plants and identified nearly 40 million kwh in energy savings. Typical energy savings from system improvements can often pay for themselves within two years.

The question must then be asked if such large energy savings are completely possible, why industrial firms do not take advantage of them. The main reasons are that industrial markets focus on components not systems; energy efficiency is not the core mission for most industries and their supporting systems. There is also a variant of the "landlord-tenant" disconnect, namely the budgetary disconnect between capital projects (equipment purchases) and operating expenses (energy and maintenance). Even if a company has achieved system optimisation, the essential knowledge resides with the individuals who have been trained - it is not institutionalised. These individuals may well leave or transfer and take the knowledge with them. Processes also change over time and can reoccur. The typical motivations for industry to become more energy efficient are if they have to (e.g. through taxes, fines or damage to the public perception of the company) or if they want to, because there is a competitive advantage to be gained. The International Organisation for Standardisation (ISO) provides frameworks for organisations to improve the quality of their operations and production (ISO 9000) or to demonstrate their environmental management (ISO 14001).[10] More than 670,000 companies in 154 countries were participating in ISO 9000 and more than 90,000 companies in 127 countries were participating in ISO 14001 in 2004. To achieve and retain these certificates, companies have to both implement and show that they have implemented continuous improvement. The standards are regularly audited. Governments can improve the situation by issuing broad-based standards for industrial energy management which are written in ISO-compatible language. There are other measures which they can take such as provision of tools, information and training on implementation of the standards and awards for companies which make outstanding efforts to improve the operation of their motor systems. Standards for motor driven systems can also be provided.

In addition, steps such as the creation of an Industrial Systems Optimisation Library can provide documentation. Training and regular audits are also important. International teams of experts can train a highly skilled core of national system optimisation experts and supportive public policies can be introduced. The approach seems complex but carries with it the promise of considerable savings in energy use.

[9] http://www.unido.org/doc/51262

[10] http://www.iso.org/iso/en/ISOOnline.frontpage

5 Energy Efficiency in Buildings

The use of insulation material (such as mineral wool) helps to fulfil major social and environmental goals of e.g. saving energy, minimising pollution, combating noise, reducing the risk of fire and job creation. Key firms are organised in the European Insulation Manufacturers Association (EURIMA).[11] 40% of the energy used on buildings could be saved on adequate insulation. This would represent a saving of 460 million tonnes of CO^2 emissions. This in turn is the equivalent of saving 3.3 million barrels of oil per year. The potential cost saving would be €270 billion.

EURIMA works together with ECOFYS to quantify the potential benefits of energy efficiency in buildings through climate protection, regulation, competitiveness and EU enlargement.[12] Only 10% of the potential for buildings is currently covered by the EU Energy Performance of Buildings Directive.[13] The gap between the potential and what is covered by current EU regulations could be addressed by standards for new buildings and existing large buildings, followed by addressing all small buildings. Recommendations from the insulation sector include provision of a strong signal that energy and efficiency in buildings must be a priority. This should be given by the G8, it is argued. At the level of the European Union, the buildings directive should be extended so that no component of a house can be renovated without an energy efficiency upgrade taking place. At a national level, national energy efficiency plans should be undertaken. These should have a clean analysis of barriers to improvement. At local level, additional support should also be provided.

6 Transitions to New Technologies and Energy Sufficiency: National and Regional Approaches

Access to modern forms of energy is a pre-requisite for meeting the Millennium Development Goals (MDGs).[14] Worldwide, there is a growing demand for energy services. Two billion of the world's population are in 'permanent blackout' and two billion face regular 'brownout' of intermittent or unreliable energy supply. At the same time, the need to reduce greenhouse gas emissions dramatically is recognised. Even 'energy maps' of the world as far ahead as 2070 suggest low use of modern energy sources in most countries of sub-Saharan Africa. A radical approach to dramatically reducing green house gas emissions, a 'decarbonisation strategy' is needed. This requires improvements in energy efficiency and end use, introduction of zero carbon technologies, decarbonisation of hydrocarbon sources, and carbon capture and storage.

This chapter continues with a review of policies at regional and national levels to show what initiatives have been taken and are planned.

[11] http://www.eurima.org/index_en.cfm

[12] http://www.ecofys.co.uk/

[13] http://www.managenergy.net/products/R210.htm

[14] http://www.un.org/millenniumgoals/

USA

In his State of the Union Address for 2006, President Bush stated: *"Keeping America competitive requires affordable energy. And here we have a serious problem: America is addicted to oil, which is often imported from unstable parts of the world. The best way to break this addiction is through technology … and we are on the threshold of incredible advances …"*

He continued that the USA would "push for breakthroughs in two vital areas in order to *"change how we power our homes and offices" and to "change how we power our automobiles".*

He announced the Advanced Energy Initiative with incentives totalling $3.4 billion over 10 years committed through the Advanced Energy Initiative to encourage wind, solar, biomass and geothermal fuel. The programme represents a 22% increase in funding for clean-energy research. Clean coal research is aimed at developing the first zero-emission coal plant integrated with sequestration. A second element of the approach is expanding nuclear power generation, recycling nuclear fuel, reducing nuclear waste and enhancing non-proliferation agreements. $250 million is committed to these elements of the programme for Fiscal Year 2007.

The Solar America Initiative has funding increased from $65 million to $148 million, with the aim of making photovoltaics cost competitive by 2015. The wind Energy Initiative sees an immediate increase in funding form $5 million to $44 million, with the eventual aim of supplying 20% of US electricity needs from wind power.

The President's biofuels initiative aims to replace 75% of oil imports from the Middle East by 2025. By 2012, enhanced production of ethanol to make it competitive within six years is the aim. The "Billion Ton" study [15] has provided the research basis to suggest that more than 30% of current US petroleum consumption could be replaced by biomass of various types (producing ethanol from corn, agricultural crops and residues, woody plants and grasses).

The additional commitments are on top of the $1.2 billion in research funding designed to ensure that America leads the world in the development of hydrogen powered cars, as announced in the 2003 State of the Union address. The USA is also central to the International Partnership for a Hydrogen Economy.

In addition, attention is also paid to energy efficiency through the "whole buildings" approach of addressing energy and lighting management, system optimisation, building security and health issues. There is a move towards "zero-energy" buildings – with the aim of producing efficiencies of 50-70% coupled with use of on-site or purchased green power (30-50%). There are already a considerable number of building prototypes which meet this goal.

[15] http://www1.eere.energy.gov/biomass/pdfs/final_billionton_vision_report2.pdf

Other research goals which have been set by the USA include:

- For vehicle technology - to improve energy efficiency for passenger vehicles to 45% by 2010 and for commercial vehicles by 55% by 2013;
- Solar technology - developing next-generation photovoltaic technology such as 'thin film', PV cells and 'leapfrog' technologies such as polymers and nanostructures. If these goals are met PV capacity could reach 30,000 megawatts in the United States by 2020 (currently 100-150 mw);
- Bio refineries - By 2008 complete construction of at least one industrial site project for a near-term pathway such as agricultural residues or oil seeds with validation in 2009. In 2009 complete preliminary design for at least two additional bio refineries;
- Hydrogen and fuel cell technologies – Achievement of an industry decision by 2015 to commercialise hydrogen-powered fuel cell vehicles;
- Solid state lighting - The capture at least of 50% electricity peak demand reduction in commercial building's lighting load;
- Zero Energy Buildings - Enable the design and construction of net-Zero Energy Buildings by 2020;
- Distributed energy resources - Develop by 2015 a diverse array of integrated distributed generation and thermal energy technologies;
- Wind technology - Accelerate off-shore wind and low wind speed technology.

Japan

Japan's approach follows the findings of the IEA's Energy Technology Perspectives that the most cost effective and simple measure which will have significant impact is improving energy efficiency. This, however, needs to be broken down sector by sector. Sectoral approaches need to be fine tuned to achieve the best results. Japan has two programmes, the Top Runner Programme for appliances and the land transport sector, and the Nippon Keidanren Voluntary Action Plan which covers the entire industrial sector.

Responding to new challenges, the Japanese government has established a New National Energy Strategy, approved in May 2006. This has three objectives:

- Establishment of reliable energy section measures;
- A commitment to assist Asian and other nations in addressing energy problems;
- Establishment of a foundation for sustainable development, which will address energy and environmental issues together.

The comprehensive plan also addresses issues such as energy conservation, the development of nuclear power, an Asian Energy and Environment Cooperation Strategy and enhancing emergency response, and also looks at the sub-national level of cities and regions.

Japan has also committed itself to co-operate with other Asian countries, in particular with China and India where energy demand is increasing very rapidly. This includes

joint work on energy efficiency, clean coal technology and nuclear power. More than $12.5 billion has already been invested in upstream projects in over thirty countries.

The ambitious plan centres on improving energy efficiency by sector and the development of appropriate energy technology. The sectoral method will be applied to Asia through cooperation with other countries, and it is Japan's intention to establish a world-wide sectoral approach by 2008 when the G8 Summit is held in Japan.

European Union

The EU has been the leader in the field of energy efficiency and issues directives or EU laws promoting energy efficiency in e.g. building, energy services, environmental design and labelling. Member States will implement a series of EU energy-saving measure. These will promote energy efficiency in buildings, lighting systems, appliances and office equipment. There will also be savings as a result of new incentive-based tax policies. Other measures include efforts designed to reduce energy waste such as increasing fuel efficiency in automobiles and transport systems, reducing air traffic congestion through better airport management, reducing automobile usage in crowded urban centres, promoting public transport, reducing 'phantom' energy consumption in appliances, etc. EU Directives cover a wide range of issues including promotion of biofuels, energy-efficient public procurement, and such specific issues as labelling of electric ovens, air-conditioning units and refrigerators.

At the level of the European Union, the second half of 2006 has been a decisive period for policy formation. Efforts are underway to develop a 'European strategy for sustainable, competitive and secure energy'. A key phase in the development of this policy was the publication of the Green Paper in March. In November 2006, the Energy Council discussed key aspects of the policy, and the EU-Russia Summit on energy issues and WTO accession took place.

In December, the Commission tabled an energy package including conclusions from the enquiry into the gas and electricity sector, a proposal to revise the EU Biofuels directive, an update of the Commissions strategy to reduce carbon dioxide emissions from cars and a communication on clean coal focusing on carbon capture and storage technology. In January 2007, the Strategic Energy Review focusing on both the internal and external aspects of EU policy will be published. In March 2007, EU heads of state and governments should adopt an Action Plan on a common European energy policy. The Green Paper published in March 2006, is a consultation document which identifies six key areas:

- Development of internal electricity and gas markets in Europe;
- Security of supply and solidarity between Member States in the event of a crisis;
- The energy mix – each Member State can choose its energy mix, but it is clear that decisions in one country have an impact on energy security for its neighbours and the European Community as a whole;

- Climate change, where the emphasis is on energy efficiency as the most cost effective way to contribute to sustainable development and increases in renewable energy (including the recommendation to double the share of renewable energy in energy consumption from 6% to 12% by 2010);
- Technology – Europe needs a strategic energy technology plan;
- External policy.

The key elements of EU external policy focus on issues including:

- Improving transparency and governance in the energy sector;
- Creating open, transparent, non-discriminatory stable legal conditions for energy investment and trade;
- Non-discriminatory transit and third-party access to export pipeline infrastructure;
- Improving production and transport capacity in producer countries and upgrading energy transport infrastructure in producer and transit countries;
- Encouraging energy efficiency and diversification of energy sources including low emission sources;
- Promoting strategic reserve stocks including joint holding with partner countries.

In terms of specific policies, the dialogue with Russia is key - with a view to negotiating a comprehensive agreement covering all aspects of energy. It should also be noted that Algeria currently supplies 10% of EU gas. If this were to be doubled Algeria's role in energy supply to Europe would be similar to that of Russia. Turkey could also become a major energy transit hub. Gas projects with North Africa, Middle East, the Caspian Region, Russia and Norway are of great significance.

The EU 15 is committed to making a collective 8% cut in emissions by 2008 to 2012 under the Kyoto protocol. Active consideration for commitments beyond 2012 is essential. The ten new Member States are not formally covered under the EU target, but in most cases have their own reduction targets of 6% to 8%. They are also involved in the EU Emissions Trading Scheme (ETS). The ETS allows companies to use credits for the Joint Implementation (JI) and Clean Development Mechanism (CDM) to help them comply with their obligations under the Kyoto scheme. It also provides incentives for businesses to invest in emission-reduction projects, for example in Russia and developing countries. During the first trading period (2005 to 2007), the ETS only covers carbon dioxide emissions from the large emitters in the power and heat generators industry and selected energy-intensive industrial sectors. Each country has to provide a national allocation plan to reflect the Member State's Kyoto target as well as actual projected progress towards meeting the target. These plans are assessed by the European Commission. It has the power to require changes or even reject them if they are found to be inadequate.

Apart from the obvious challenges of co-ordinating energy with twenty-five Member States, a number of other key considerations need to be emphasised. The extent and the urgency of the problem has been stressed by José Manuel Barroso, President of the European Commission, who has said:

'The EU is already the largest importer and second largest consumer of energy in the world. We depend on external sources for 50% of our energy needs [and] this could rise to 70% by 2030. We have to do something about this and we have to do it now …….. The year 2030 may seem a long time away, but it is the day after tomorrow in energy terms.'

The infrastructure decisions taken now will determine energy production patterns for decades to come. It is arguable that the energy infrastructure needs, whilst the sums involved look huge, are less a financing problem and more a feasibility problem. Currently, one-third of EU electricity is generated in nuclear power plants and the sector is likely to remain an important part of Europe's energy mix for years to come as the EU seeks to reduce fossil fuel dependency. However, in a number of European countries, there is likely to be a lively debate on the desirability of a new generation of nuclear power stations. Nor is this the only technology to which there is some measure of public resistance. Wind power seems to face particular difficulties. The siting of large wind farms on land often generates resistance. The alternative of off-shore location increases the price. The complexity of progress at the European level is also underlined by the determination of national governments to keep the right to fix their own energy mix nationally.

Getting the price of carbon right is also difficult. However, there has been criticism of the EU ETS in the wake of the collapse of the carbon price in July 2005. It now seems clear that the collapse in the price of tradable carbon permits was the result of over-generosity in allocation of permits to industries such as car makers and power generators. Unless policies are put in place to enable feed-in tariffs to promote e.g. wind energy, the ETS will not have the desired effect of stimulating investment in renewable energy. It also seems that the deregulation of energy production has often led to higher rather than lower energy prices. In addition, there has been a failure so far to address one of the most polluting sectors, namely transport, in particular air transport.

The basic approach of the Emissions Trading Scheme is that companies will receive a lower level of allowances than they need against "business as usual" scenarios.[16] The power sector accounts for 60% of all emissions in the ETS and will reduce emissions via fuel switching. Given existing capacity, fuel switching is likely only to occur in Germany, the UK and Spain. In Germany, this could be switching from lignite to coal (with a carbon price of €25-30 per ton). In the UK and Spain it would be from coal to gas, at a carbon price of over €40 per ton. The price of carbon dioxide emissions is set by the interaction of supply and demand. On the supply side, the key driver for carbon dioxide abatement options is the price differential between different fossil fuels. On the demand side, the key drivers are economic growth and weather conditions.

The cap for the whole of the European Union for Phase 1 of the ETS was 6.57 billion tons in the period 2005-2007. The market assumption was that this was about 3%

[16] http://ec.europa.eu/environment/climat/emission_plans.htm; http://www.defra.gov.uk/environment/climatechange/trading/eu/

below business as usual needs. As a result of high gas prices and low rainfall, there was a sharp rise in carbon prices in 2005 and early 2006. This created a sharp rise in power prices across the EU until the carbon price collapsed in early 2006.

The collapse in the carbon dioxide price was also due to leaks of 2005 emissions data from the Netherlands, France and the Czech Republic. In a three-week period up to mid-May 2006, the price of carbon dioxide fell from over €30 per tonne to €9.75 per tonne. The main assumption has been that there was an over-allocation of permits. Germany, in particular, has admitted this.

The next phase is essential. National allocation plans for Phase 2 (2008 to 2012) have to be finalised by the end of 2006. The Commission will be much sharper in its evaluation of National Allocation Plans than previously. The Commission has also stated that it will use all political and legal measures to ensure that there is a deficit of permits, rather than the previous over-allocation in Phase 1.

France

Jacques Chirac, President of the French Republic, said at the G8 meeting at St Petersburg: *'We will not solve this problem simply by means of voluntary or sector-based initiatives. This global challenge calls for a global response'.*

In the 1970's, France provided only 25% of its own energy; it is now 50% self-reliant for its energy needs. 75% of all French electricity is generated by nuclear power. The last coal mine in France closed in 2004, and the country has very little oil or gas. France is now the leading European producer of renewable energies and has considerable potential in wind power and biomass. The French Energy Policy Act, which was agreed by the French Parliament in June 2005 and published on the 13th July 2005, sets four goals for French energy policy:

- To guarantee energy self-reliance and supply security. This involves a range of measures including guaranteeing strategic stocks of approximately 100 days of domestic consumption;
- To safeguard human health, protect the environment and step up the fight against global warming;
- To ensure competitive energy prices for households and industry;
- To guarantee social and territorial cohesion by ensuring access to energy for all.

Three lines of action are emphasised to achieve these goals. These measures include:

- Progressive reduction of energy intensity and 3% per annum reductions in greenhouse gas emissions in order to achieve a 75% overall reduction in greenhouse gas emissions by 2050;
- Diversification of the energy mix on the supply side by increasing the share of renewable energy and maintaining nuclear power options;
- Substantially increasing both public and private research in all new energy technologies. Key areas include biofuels, fuel cells, clean cars, solar power,

positive energy buildings, carbon capture and storage and generation for nuclear reactors.

France intends to keep the nuclear power option with the construction of the European Pressurised Water Reactor to enable the launch of a new generation of power stations between 2015 and 2020 and significantly to increase renewable energies, with a goal of producing 21% of France's electricity from renewable energy by 2010.

In order to encourage wind power and biomass production, France will be prepared to use compulsory purchase orders for land.

Tax incentives will also be used to encourage purchase of clean vehicles. Tax credits have also been increased through 25% for energy savings and 40% for renewable energy.

The United Kingdom

The UK Energy Review was published in July 2006. It outlines the approach proposed for covering energy needs for the next 30-40 years. This is set within the context of a goal of a 60% reduction in carbon dioxide emissions by 2050. Energy efficiency and reduction of carbon intensity through low energy sources including renewables are at the heart of the programme. The EU Emissions Trading Scheme covers 11,000 high intensity users of energy and the Climate Change Levy is also being used to encourage businesses, including power stations and steel works, to save energy and cut emissions. The Government is proposing to set incentives to an additional 5000 large businesses and public services in the UK which are currently not covered to increase their energy efficiency.

In November 2005, the Government announced the Renewable Transport Fuel Obligation, whereby 5% of all fuels must be from renewable sources by 2010. The Energy Review proposes extending this beyond 2010. The Government is also seeking to increase power from micro-generation and combined heat and power schemes. The latter currently provide 7% of power. Currently, 90% of the UK's energy needs are met from fossil fuels. The Energy Review makes proposals to increase the total for renewables to 20%. Coal fired generation meets about one-third of electricity demand. Carbon capture and storage could cut emissions by 80%-90%. The UK is co-operating with Norway on this for the North Sea. In addition, the maximisation of exploitation of oil and gas reserves from the UK continental shelf is seen as essential. The government has also announced that *'new nuclear power stations could make a significant contribution to meeting our energy policy goals'*. Unless a new generation of nuclear power stations is built, the proportion of electricity from nuclear will fall from 20% today to 6% by 2020. The Secretary of State for Trade and Industry, Alistair Darling, stated in Parliament: *'It will be for the private sector, fund, construct and operate new nuclear plants and cover the cost of decommissioning and their full-share of waste management costs'.*[17] The package of measures proposed could result in an additional reduction in carbon emissions of 19-

[17] Energy Review Statement, House of Commons, 11th July 2006

25 million tonnes of carbon. This is roughly equivalent to the annual emissions of Austria or Greece. Overall, the package is designed to help diversify sources of energy supply and contribute to the move towards a low carbon economy.

Russia

Given the huge oil and gas reserves of Russia, it is unsurprising that renewable energy and alternatives have struggled to find a significant place in the energy mix. While Russia sees energy security both in terms of supply and demand, i.e. in terms of its guaranteed markets for oil and gas, many of its neighbours have been shaken by the dispute between Russia and Ukraine in January 2006 which led to a brief suspension of supplies. The EU-Russia dialogue will be of considerable importance. Russia has the world's largest proven natural gas reserves and significant oil reserves.

After a twenty-year break, as a result of the Chernobyl disaster, Russia has major plans for new nuclear power stations. These could result in the increase of nuclear power from 16% to 25% with the construction of forty new reactors by 2030.[18] Against this background, it is hardly surprising that renewable energy has yet to make its mark in Russia. On 4th July, President Putin had a meeting with NGOs at which the environment and energy alternatives (renewables) were discussed.

The difficulty with the energy policy elite is to get acceptance for the idea that alternatives are needed. With the domestic gas price so low, there is very little incentive to embrace energy efficiency. Energy efficiency in Russian industry and buildings is very low compared with European standards.

However, there is growing recognition that internal oil and gas prices should be raised. The G8 in St Petersburg could yet prove to have been a milestone in official attitudes. The domestic energy industry in Russia is facing gas shortages as there is not enough gas for supplies within Russia, exports and the current levels of ineffective use and wastage. Renewables are therefore set to become more of an element in official energy policies. In 1996 a renewables law was drafted but eventually rejected by the President. Energy efficiency regulation is still weak. In the longer term, however, it is recognised that energy efficiency and renewables are important elements of policy. Pilot projects for a wind farm have already begun.

China

China is already the world's second largest carbon dioxide emitter and is projected to catch up with US emissions by 2020. However, China's reforms of the 1980's show that energy use and growth in GDP can be de-coupled. GDP has risen significantly faster than energy use. This trend has continued since 2001. However, the rate of investment in energy efficiency has been declining; this trend needs to be reversed. China's goal of reducing energy intensity by 20% by 2010 means that the average growth rate in energy use would have to be below 3% for the period 2005-2010. This compares with the average growth rate in energy use between 2000 and 2005 of

[18] source: BBC

11.3%. In short, significant energy efficiency savings have to be made. Efficient appliances, for example in lighting, refrigeration, air conditioning and washing machines could save 12% of residential electricity needs by 2020. This would be the equivalent of 34 large (1000 megawatt) coal fired plants.

The huge size of China and its varied climate mean that different priorities have to apply to building codes. The southern coast has hot summers and warm winters, whereas the north of the country has conditions of extreme cold.

China's ambition is to implement energy efficiency in the most carbon intensive industrial sectors. This requires equipment standards for motors, pumps and fans. There are already examples of energy efficiency agreements in industry, for example with the Shandong Steel Enterprises and the Top 1000 Enterprises Programme. The latter programme aims to save 100 million tons of coal and reduce carbon emissions by 242 million tonnes by 2010.

According to the renewable energy law, renewables are to be 15% of all electricity generation by 2020. China is also embarking on an ambitious programme of wind power. The bulk purchase of equipment will drive down the costs and speed commercialisation. Currently, 1000 megawatts are generated by wind power – this is projected to increase to 3570 megawatts by 2010.

By 2020 China will import 80% of its oil. A recent cover of Newsweek reported on 'China's car craze' as the cover story. By 2030 China's vehicle population could reach US levels. Under these circumstances, the development of commercial vehicle standards is essential. It is predicted that such measures could save the import of 960 million barrels of oil by 2030.

In addition, many Chinese cities are planning dedicated bus lanes for public transport. At least fifteen cities are in the advanced planning stage. China has also developed a new NGO, the 'China Sustainable Transportation Centre'.

In rural areas, small hydro-electric generation plants plays an important role in electricity generation. The cumulative capacity of small hydropower installations in China is equivalent to two Three Gorges projects. 660,000 people are employed in small hydropower, primarily in rural areas. 98% of renewable energy in China is from small hydropower. One quarter of the population, approximately 300 million people, rely on small hydropower.

Small hydropower has developed quickly through support by government, a decentralised approach and through indigenous manufacturing. The self-reliance is an important dimension of the approach, but through the international network on small hydropower, the expertise developed is shared through extensive contacts, primarily in the third world.

The reliance on small hydropower also has important environmental dimensions. It is planned to provide electricity for 28 million families (104 million people) for cooking and heating between 2003 to 2020, by replacing firewood through electricity. The remaining villages with 28 million people (over 16,000 villages) should also be provided with electricity. They live primarily in remote outlying areas.

India

India with its population of 1.1 billion people and a high growth rate which is expected to be 7%-8% per annum during this decade is already the 6th largest greenhouse gas emitter in the world. After China, it is the fastest growing emitter. It has both a large middle class and a very large poor population (over 200 million in extreme poverty). It suffers from a number of bottlenecks to its growth. In infrastructure, the power, port, airport, road, public transport and urban and rural infrastructures generally need further development. In many rural areas there is virtually no basic infrastructure. The country also suffers from a high fiscal deficit (over 6% of GDP), misdirected subsidies, unviable public enterprises, red tape and corruption and inequality.

Nonetheless, emissions are still low per capita at one-tenth of the worlds average. This means that if action can be taken now huge savings in greenhouse gas emissions over the coming decades can be achieved. Per capita consumption of energy remains low - barely 15% of the world average. In the economy as a whole, the fuel mix is 59% coal, 11% gas, 25% hydro, 2.5% nuclear, 1.7% wind and 1.1% diesel. There is currently a gap between energy generation and peak demand of perhaps 8%. India is also not achieving the decreases in energy intensity which other countries are registering. The State Electricity Boards, because of the inefficient way in which they are being run, are absorbing twice the level of the investment in education and half that of investment in health. In order to achieve its target of power for all by 2012, another 100,000 megawatts of generating capacity would be required. This ambitious programme has targets of electrification of all villages by 2007 and electricity access for all households by 2012. This will require significant expansion of the national grid, strengthening the distribution system, a rural electrification programme and energy conservation.

Energy efficiency is essential for maintaining a high level of growth. For environmental reasons, India faces restrictions on the possibility of expanding its network of large hydro projects. Energy efficiency has considerable advantages. It is cheaper than increasing generating capacity; it provides maximum system-wide benefits; it reduces the need for imports and use of scarce resources; it also mitigates risks from supplier vulnerability. Energy efficiency will also play a role in reducing the impact of rising energy prices. Over time, it is estimated that energy efficiency could reduce by 90% the electricity shortage. Estimates for different industrial, agricultural and residential sectors suggest that energy efficiency could save between 10% and 30% of energy use in many of these sectors. Approaches which have to be actively developed include codes and standards, labelling, market transformation, information and demonstration, research and development and use of taxes and tariffs. In the business sector, information and training, demonstration and pilots, financing, energy conservation in government buildings, aggregation of projects and standard contracts are key.

Public policy-based mechanisms can help to increase energy system efficiency, reduce shortages, promote economic development, reduce fiscal deficits and reduce environmental damage. On the business side, approaches can increase profitability and customer retention and satisfaction.

Legislation has been passed in these areas, including the Energy Conservation Act of 2001, which established the Bureau of Energy Efficiency in 2002. This has a wide range of initiatives including certification and accreditation, work in key industry sectors, standards and labelling. USAID has identified the need for a state energy efficiency fund as customers are, by and large, unwilling to invest their own funds in what is considered to be a non-core activity. Energy service organisations are inadequately funded. There are problems with funding such approaches from the public purse and this could well be an area requiring finance from financial organisations.

If energy efficiency strategies are to be fully successful in India they will have to be a combination of market 'push' and market 'pull' factors requiring a regulatory framework and standards as well as innovative financing, performance contracts and use of energy service companies.

Utilities are also being actively encouraged to exercise demand-side management. Energy efficiency and capping peak demand play a role here. Under the Electricity Act of 2003, electricity boards are being restructured. Open access to distribution is being phased in and subsidies are gradually being phased out. The vision for the longer term is to move towards a more de-centralised or distributed energy generation system.

There is a considerable role for energy service companies (ESCOs). These are projects which should pay for themselves through energy savings, often with a payback time of around two years. Big industries should be able to implement their own energy efficiency projects but small and medium enterprises (SMEs) are a good fit for ESCO or energy efficiency projects. Buildings such as hotels, hospitals and office blocks also are a viable market.

The draft report of the Integrated Energy Policy 2005 stressed the following:

- Coal will remain the primary energy source;
- There is a need for power sector reforms;
- Fuel prices must be rationalised;
- Both energy efficiency and demandside management have a key role to play;
- Energy conservation could result in 15% savings of energy by 2012;
- Electricity should be provided to all households in the next five years;
- There will be a shift to more efficient fuels for cooking in households within the next ten to fifteen years.

Energy efficiency contributes to energy security and the reduction of the fiscal deficit. There is a need to move energy efficiency to the state level. State level action plans must be developed. Demand-side management in agriculture is a priority with a particular emphasis on the management of water. The energy efficiency successes achieved in industry need to be replicated elsewhere. Innovative financing and private public partnerships are necessary.

Renewable energy is also growing significantly in India. The rationale is to supplement existing conventional sources of energy and also to meet the needs of

rural India. The Ministry of Non Conventional Energy Sources was created in 1992. This is to promote alternative sources of energy and awareness of its advantages. Efforts have mainly been through subsidies. Considerable attention has been paid to the necessary legislative and tariff policy frameworks to encourage renewables. The role of renewables was reasserted in the Electricity Policy of 2005, and environmental considerations were also highlighted.

South Africa

The issue of energy security for South Africa can be approached from two different perspectives. One kind of answer is generated if the issue is understood as 'national' energy security; a quite different answer is given if energy security is approached from the perspective of energy security, particularly for the poorer sections of the population. 50% of South Africans live off less than Euro 2.30 per day. 60% of this group live in rural areas. Domestic cooking and space heating needs are met only to the extent of 50% by electricity with 26% biomass and 18% kerosene. 80% of the population have access to electricity but for many it is too expensive to be the energy medium of choice. The main policy challenge for the South African government is how to develop an energy policy framework to ensure that all its citizens have access to affordable, safer and cleaner energy?

Since the election of a democratic, non-racial government in South African in 1994 the mandate of specialist energy agencies within South Africa has changed. CEF was initially established under apartheid to protect South Africa's energy security whilst sanctions were in place.[19] Under apartheid, SASOL was established; it is a petro-chemical company which perfected the industrial application of the Fischer Tropps process of converting coal and gas to liquids.[20]

40% of South Africa's crude oil is imported; 38% is produced using coal to oil technology and 8% from gas to liquids. Of South Africa's energy generation capacity, 89% of electricity production comes from dirty coal fired power stations (this is Grade D-Brown-coal). South Africa is responsible for 44% of Africa's greenhouse gas emissions. To set this figure in perspective, Africa produces only 3.6% of the global total.

The strains in the electricity generation system are beginning to show; recently, the nuclear power station in Cape Town had to be closed down resulting in prolonged rolling blackouts in the region. In this situation, the Department of Minerals and Energy is looking at the best way of implementing a long-term renewable energy finance mechanism. The current approach is to suggest that a direct support scheme, based on production using a top up feed-in tariff will be the best approach. This will apply only to the national grid.

It is thus clear that the South African government faces difficult choices if it is going to be able to assist the poorer sectors of the community in achieving access to clean and modern energy sources and that renewables will have an increased role.

[19] http://www.cef.org.za/

[20] http://institutions.africadatabase.org/data/i125362.html

Brazil

From an environmental perspective, the issue of energy security can be phrased thus: 'No energy security without climate security'.

In 2005 the drought in the Amazon was the worst in the last sixty years, if not this century. According to some models, 30% to 60% of the Amazon forest could become savannah as a result of a 2-3°C global warming. This would have significant impact on biodiversity and the global climate. Applying the precautionary principle, as, for example, the EU is seeking to do, and remaining below a 2°C increase in global temperature probably requires a 50% reduction by 2050 on Brazilian greenhouse gas emissions (compared with the 1990 level). Brazil faces major power sector challenges. Under a "business as usual" scenario Brazil requires huge investments in power generation, transmission and distribution (according to some estimates US$140 billion). This will increase dependence on natural gas imports and hydropower which is vulnerable to climate change. The World Wildlife Fund has constructed a scenario avoiding 40% of the projected 2020 level of energy use. This would avoid the need to flood 70,000 sq. kilometres of Amazon rainforest, which would generate over 400 million tonnes of carbon dioxide emissions in the 2004 to 2020 period. Such savings would require two-thirds to come from end use efficiency and one-third from supply side efficiencies. The scenario looks carefully at all appliances, both in the industrial and residential sectors. It would also involve use of technologies such as solar water heaters, but these would need to overcome architectural and credit barriers.

The scenario would also require increases in bio energy and wind power, at costs reduced by 15% to 20% on today's prices. It is estimated that such a 'powerSwitch' scenario could avoid US$15 billion of investment in power generation, create 8 million new jobs in the power sector, stabilise greenhouse gas emissions and significantly reduce the amount of land to be flooded.

For a fast developing country such as Brazil, energy efficiency in industry and the domestic sector are thus very important. As well as public opinion, government has to introduce minimum efficiency standards, energy efficiency standards for public procurement, standards for power supply and transmission and feed in laws for renewable energy. The financial and regulatory incentives for distributive generation systems must also be developed. Research and development for renewables and energy efficiency must be increased and subsidies for fossil fuels and nuclear power decreased.

7 Business Perspectives

Increasingly, companies see climate change and energy policy as being of importance. Some companies are looking ahead 15 or 20 years, but the carbon price and carbon markets are not central to the decisions about using technologies such as renewable energy that could play an important role - certainly towards the end of that time period. National energy policies, both for climate change and for energy security, and the incentive frameworks and subsidies for clean energy technologies are seen as the key drivers for low carbon investment.

There is a difference of approach between 'early movers' in carbon and renewable energy and multinationals. Multinationals are much more likely to take a long-term strategic approach than smaller firms. The largest companies are much less sensitive to short-term policies such as national allocation plans. There is already a sense that decisions need to be taken for the period beyond 2012. Some companies are looking for governments of EU countries to make a commitment as soon as possible that the Emissions Trading Scheme will continue. Many companies, and indeed others, stress that it is important that Kyoto survives beyond 2012 as a signal that governments are serious about the issue of climate change. There is a range of views on investment in the Clean Development Mechanism, with a general perception that the functioning of the system needs to be streamlined and simplified.

8 Perspectives from Major Oil Companies

Fossil fuels currently provide 79% of all primary energy and this is unlikely to change significantly in the next twenty to thirty years. Innovation to reduce CO^2 emissions from the use of fossil fuels will be a major contributor to mitigating climate change. This can involve increased use of biofuels in transport, of gas in power and heat generation and improved efficiency in all sectors. Decarbonisation and sequestration will contribute to decreasing the impact of use of fossil fuels. Unlike some of the US-based oil companies, BP has clearly indicated that it accepts the evidence for humanly-induced climate change and welcomes policies aimed at addressing it. The impact of fossil fuels can be improved primarily in two ways, through reduction in carbon intensity and through technology-enabled breakthroughs.[21]

Drawing on the work of Socolow and Pacala at Princeton University, the concept of the stabilisation triangle has been developed, i.e. the gap between "business as usual" projections into the future and the level of emissions which cannot be exceeded if stabilisation is to occur. The challenge can be summarised as finding, over the next 45 years, seven one gigatonne 'wedges' which would enable the projected doubling of carbon dioxide emissions to be avoided.[22] To give an idea of the scale of the challenge, each gigatonne wedge could be, for example:

[21] http://www.bp.com/home.do?categoryId=1
[22] http://www.stabilisation2005.com/Robert_Socolow.pdf

- 700 one-gigawatt nuclear power stations;
- holding emissions from equipment in buildings flat;
- a fifty-fold increase in wind;
- 2500 DF1 hydrogen power with carbon storage;
- a seven hundred-fold increase in photovoltaic solar;
- re-powering 1400 gigawatts of coal-fired power with gas or stopping deforestation and doubling reforestation.

Major investors are looking for policies such as the following;

- emissions cap and trade scheme;
- traditional incentives to encourage commercial deployment of 'near-to-market' technology such as renewables and carbon capture and storage;
- investment criteria to ensure that all new energy infrastructures are competitive against cost and emission benchmarks;
- increasing public awareness;
- regulation and tax and trade consistency.

In looking for major investment opportunities, in alternative energy, BP is looking at solar power, hydrogen power, wind power and gas generation. Its aspiration is to become the world's leading low carbon power business; planning to invest $8 billion over the next ten years in renewables, to deliver an annual revenue of $6.5 billion by 2015 and to cut its own greenhouse gas emissions by 24 million tonnes a year by 2015. One of the major innovations is a new BP biofuels business. The BP-DuPont collaboration is aimed a developing advanced biofuels, the first example of which, biobutanol, an advanced generation biofuel in the UK by 2007.

The approach of Shell is conceptualised as the search for cheap, clean and convenient energy. Different energy options will be chosen according to which two of the three factors are emphasised. Shell emphasises technology for enhanced oil recovery, exploration technologies, recovery of oil from oil sands and in-situ conversion. It is also concentrating on low sulphur fuels, high performance fuels, biofuels and GTL/CTL. Furthermore, renewables are an increasing element of its business. It is probably the largest marketer of biofuels, selling more than 2 billion litres a year (primarily ethanol and bio-diesel). In four years, it has also become one of the largest wind power developers. Shell is also actively seeking to develop the hydrogen economy. It has ventures and projects in Europe, North America, Japan and China. Carbon capture and storage is actively being pursued in the mid-Norway project.[23]

[23] http://www.shell.com/home/Framework?siteId=rw-br

9 The European Bank for Reconstruction and Development (EBRD): Improving Industrial Energy Efficiency

The EBRD is an investment bank with public shareholders, with AAA rating, founded in 1981. Its mandate is to facilitate the transition of twenty-eight central and Eastern European countries and the CIS and Mongolia to market economies. The capital base is €20 billion and it has a portfolio of €15 billion. It is the largest single private investor in the region but can also finance public sector projects. It operates with a wide range of financing instruments including loans, equity and guarantees in a direct approach, and in an indirect approach loans for small and medium enterprises, equity funds, micro or small business programmes, credit lines, trade facilitation programmes and co-financing. In seeking to support industrial energy efficiency, the EBRD is addressing these and other issues:

- Reluctance to prioritise investment in energy efficiency;
- Lack of awareness and adequate information;
- Lack of project implementation capacity;
- The legacy of the central planning economy;
- A banking system which lacks interest or skills in this field;
- Limited availability of financial resources;
- Subsidised energy prices (especially in the CIS);
- Inappropriate tariff structures;
- Lack of legal and regulatory framework for ESCOs;
- Lack of adequate metrics to assess benefits;
- Technology inefficiency gap.

Energy efficiency for industry is a top priority of the EBRD, with a target of €1 billion to invest in demand-side energy efficiency and renewable energy in the period 2006 to 2010.[24] The EBRD is currently preparing the new initiative as a contribution to the IFI Climate Change 'Investment Framework' called for by the G8 at Gleneagles. The EBRD's contribution was recognised at the recent St Petersburg Summit. The EBRD is also systematically promoting energy efficiency opportunities in industrial projects. It is making the energy supply systems more efficient and reaching out to small projects through its financing instruments. It also promotes carbon finance as a co-financing source. It is systematically screening all projects for their energy efficiency potential, it tracks energy efficiency investments of the EBRD and also has an energy audits programme. In the near future, it will seek to benchmark industrial projects in less energy intensive sectors.

The EBRD provides free energy audits funded by donors; its main focus is on the energy intensive sectors such as steel, pulp and paper, cement and chemicals. It also will provide assistance in identifying carbon credits opportunities. Often it provides add-on to direct debt or equity financing. The EBRD is also engaging in project financing based on carbon credit sales. This will help to develop the market. The Netherlands Carbon Fund has a budget of €50 million and the multilateral

[24] http://www.ebrd.com/country/sector/energyef/index.htm

Carbon Credits Fund has a target budget of €150 million (EBRD and the European Investment Bank). This will purchase credits from Joint Implementation, Clean Development Mechanism and the Emissions Trading Scheme (but only for EBRD and/or EIB funded projects).

10 Asian Development Bank and Clean Energy

The Asian Development Bank (ADB) is seeking to develop clean energy finance in Asia and the Pacific.[25] It has two new initiatives for clean energy financing, an energy efficiency initiative which includes renewable energy and carbon market initiative. In 2000 the ADB had an energy policy review which aligned energy sector investments with the ADB's Poverty Reduction Strategy. It increased the emphasis on energy sector reform and adopted a more pro-active role on environmental and clean energy investment. It also looked at cross-border energy transactions and addresses regional and global environmental impacts. The ADB is increasing its clean energy loans substantially.

In the area of policy dialogue, it is systematically studying barriers across countries and focusing interventions primarily on developing and an enabling environment for clean energy. It also seeks to enhance awareness of clean energy through country-based capacity building initiatives. The Clean Energy Programme is a loan programme which also supports capacity building, institutional development and project development initiatives. It has established a clean development mechanism to support clean energy, carbon sequestration and adaptation projects. The Energy Efficiency Initiative begins from the insight that Asia's current energy development path is environmentally and economically unsustainable. The increased carbon dioxide emissions are causing global warming and high demand is increasing the international fuel prices for all countries, including Asian countries. The highest priority is to improve energy efficiency, followed by the expansion of renewable energy.

To date, the ADB has focused on larger infrastructure projects (between $100 and 400 million). Clean energy projects are typically much smaller than this and new and faster funding initiatives need to be developed.

The investment strategy seeks to achieve a lending target of $1 billion. It will also establish an Asia-Pacific Clean Energy Fund. In addition, there will be an Asia-Pacific Fund for Energy Efficiency. The target fund size is $500 million and the ADB will invest $25 million or 12.5% of the capitalisation. It also provides guarantees and associated funding lines to energy efficiency finance partners. The Carbon Market Initiative recognises that a number of Kyoto Protocol signatories are well behind in terms of their greenhouse gas reduction commitment targets and that there is a shortage of good projects with good carbon credits. There is also a financing gap and projects are heavily skewed towards countries and sectors which are favourable for foreign direct investment. This should help to generate promising projects.

[25] http://www.asiandevbank.org/

11 The Clean Development Mechanism – Case Study: Nigeria

The Clean Development Mechanism (CDM)[26] under the Kyoto Protocol is designed to assist sustainable development in non Annex 1 countries and help Annex 1 countries comply with their emissions reduction commitments.[27] If a developing country can achieve a Certified Emission Reduction, it is potentially eligible for project sponsoring under the CDM. This can therefore, at least in principle, attract capital for projects which assist in the shift to a less carbon intensive economy. It encourages the participation of both the private and public sectors. It also provides a tool for technology transfer of new environmentally sustainable industries.

In the Nigerian case, serious efforts have been made to establish a detailed emissions inventory. The energy sector consistently contributes over 50% of total emissions of greenhouse gas in Nigeria, with land use change and forestry being other significant sectors. Given that Nigeria is a rapidly industrialising country with a growing middle class, carbon emissions are likely to increase. This is both as a result of increases in population, changes in lifestyle and also changes in energy use and industrial production. It is calculated that emissions by 2025 could be four times as high as 1990.

In particular, one of the issues which Nigeria has sought to address through the CDM is gas flaring. Rather than the associated natural gas from oil fields being used as a fuel, it has simply been burnt. Flaring has been a major environmental hazard in Nigeria. However, the flare fraction has decreased from a maximum of 89% in 1990 to 48% in 2000. Flaring contributed 36% to the carbon dioxide emissions of 1990 and 24% in 2000. The Nigerian government wants to phase out gas flaring in Nigeria by 2008. Instead, the intention is to use the natural gas for industrial and domestic fuel and central electricity generation. It can also be used to generate foreign exchange earnings.

The CDM seems particularly well fitted to projects which can contribute to the ending of gas flaring. Such projects could be:

- Power generation schemes, expanded liquid natural gas programmes for export;
- Introduction of gas liquids programmes, etc.

One of the advantages of the CDM is that it generates additional funding streams for projects and can help to make marginal projects viable.

The CDM has, so far, been concentrated in a few countries such as India, Brazil and China. It is not only Nigeria which is seeking to get into CDM funding. There is a need to increase the number of countries which are actively benefiting and to increase the number of projects involved.

[26] http://cdm.unfccc.int/

[27] The Annex 1 countries are those which have accepted legally binding targets for reduction of greenhouse gas emissions. http://www.defra.gov.uk/environment/climatechange/internat/un-kyoto.htm

12 Regulatory Frameworks and Market Mechanisms: Limitations and Possibilities – An African Example

Per capita energy consumption in sub-Saharan Africa today is less than the average person in England consumed in 1875. Development by the 'old path' will require huge injections of investment and energy. Sub-Saharan African is characterised by low energy productivity and high energy intensity. The energy sector of most African countries is based on indigenous energy resources including biomass and coal. In some sub-Saharan Africa biomass makes up 95% of the energy use. In Ghana the figure is 67%. Such indigenous energy sources are difficult to regulate.

Setting up energy regulatory institutions in Africa is new and must be seen as part of the broader energy sector reform process. The objectives of the reform are to improve performance of national economies, to address major developmental changes and to attract private sector investment in infrastructure. Independent utility regulators are to set a level playing field for investors and pave the way for sustainable energy development at the national and regional level.

There is a low level of awareness of energy efficiency technologies and practices in most developing countries, including those in sub-Saharan Africa. There is also a lack of financial, technological and regulatory incentives to promote efficient and productive use of energy resources. However, demand for energy is high and growing.

In a country like Ghana, residential or household electricity is roughly 50% of the national total. Refrigeration accounts for 47% of residential electricity use. The average refrigerator in Ghana operates at only half of the average efficiency of the European standard. Lighting accounts for 38% of residential activity. Use of compact fluorescent light bulbs (CFL's) would generate a potential saving of 44%. There are also considerable saving to be had in the industrial sector. Making energy efficiency a reality in a country like Ghana requires capacity-building, a provision of technical support, removal of market imperfections and establishment of appropriate financing mechanisms.

The use and increased availability of energy efficient technologies such as electric motors, lighting systems, boilers and furnaces is also essential. Such technologies must also be demonstrated. In addition, other technologies, such as solar water heaters for hotels, mini-hydro for local grids, biomass powered plants, etc, could also be used.

As well as attending to the regulatory functions and legislation, the government of Ghana has established an Energy Foundation and a private public institution to promote energy efficiency. Measures which can be taken have included the removal of import duty and VAT on compact fluorescent lamps. Another approach that has been taken has been to address energy efficiency standards and labelling on air-conditioning, which is a luxury item. Standards are being addressed for refrigerators and deep freezers. The approach taken was to focus on the luxury item first (i.e. air conditioning) and to follow up with the necessity, i.e. refrigeration technology.

13 The International Finance Corporation: Case Study - Russia

The International Finance Corporation is the private arm of the World Bank with a mandate to 'promote sustainable private sector development' through investment and technical assistance. 175 countries are shareholders and Russia has been a member since 1993. $1.3 billion has been invested in Russia to date. The IFC's investments in emerging markets are only in private sector ventures. It shares the same risks as other investors and does not accept government guarantees.

In Russia, the Global Environment Facility, the Ministry of Environment of Denmark, the Minister of Trade and Industry in Finland and Finland's Ministry of Foreign Affairs are funding the Russian Sustainable Energy Finance Programme (RSEFP).[28]

Russia has major issues in terms of the energy intensity of the Russian economy, end user inefficiency and rising energy tariffs. Energy consumption by Russian industry is $18 billion per annum. 48% of production assets were installed over twenty years ago.

The barriers which have been identified for energy efficiency are lack of long term liquidity, the high perceived risks and lack of experience in this issue. Results for the RSEFP to date include four partner finance institutions and five banks in negotiation; over twenty education events conducted, six energy efficiency projects financed exceeding $4 million in size and 67 deals 'in the pipeline' totalling over $90 million. These include making oil from sunflower seed husks where financing of $1.1 million would have a one-year payback.

In terms of policy, the IFC is also recommending tariffs, taxes and administrative approaches. Tax incentives, for example, can be invested in energy saving equipment.

14 Networks and Initiatives

There is an increasing range of international networks in the fields of renewable energy, energy efficiency and alternatives. These share information and best practice. Some also provide finance for innovative projects.

The Renewable Energy and Energy Efficiency Partnership (REEEP)[29]

The work of REEEP was again acknowledged by the G8 meeting in St Petersburg. REEEP is a network which focuses on being a 'partnership of delivery'. It addresses energy system transformation on the demand and supply sides; aims to reduce market barriers and financial obstacles for renewables and energy efficiency systems, and to improve access to energy for the poor. It emphasises action on the

[28] http://www.ifc.org/ifcext/eca.nsf/Content/russia_energy_efficiency

[29] http://www.reeep.org/

ground via project activities targeted to policy improvements for innovative finance mechanisms. There are currently 185 partners, of which 34 are governments and REEEP has trebled its number of partners in the last two years. The activities are driven by regional demand through a network of regional offices. In the G8 meetings at Gleneagles and St Petersburg, REEEP has been recognised as the leading energy partnership with the following tasks:

- Promotion of energy efficiency in buildings and outreach to developing countries;
- Promotion of continued development and commercialisation of renewable energy;
- Improved access to energy for the poor.

REEEP is working closely with other partnerships to generate synergies and avoid overlapping. The method of working is to emphasize the programme, services and management. In the programme area, the added value of REEEP is to show what is done in regulatory and policy issues and innovative finance in other parts of the world. In terms of services, REEEP has expert databases, training toolkits, an information gateway (REEGLE) and emphasises communication. The management is to service the network, provide finance lobbying and ensure that partners co-operate. 60% of REEEP funded projects concentrate on emerging markets. There are currently 50 such projects in 40 countries. The portfolio is fairly evenly split between energy efficiency and renewable energy, with a determination to concentrate on energy efficiency. Many of the challenges to address energy efficiency are currently non-technical. There has to be a turnaround in institutional focus and capacity, increased ownership through frontrunner programmes, innovative marketing of projects and energy efficiency has to become a 'growth issue'. Energy efficiency measures need to be compared and the best applied internationally (primarily through South to South co-operation). New business models are needed for the finance and utility sectors and innovative educational programmes are necessary to drive behavioural change. In the field of renewables, the integration of renewables into the national resource and energy planning strategy is essential. It must be stressed there is no one best practice for policy and regulation for South to South solutions. The regional and municipality (or city) levels offer good opportunities for implementation. Bundling of projects is vital to generate scale for local partners, as is the promotion of risk mitigation measures. Enhanced awareness is essential in the finance and banking sectors. Currently €3.3 million are allocated to projects and this shows that small contributions can make a significant difference. Assessment of energy saving potential in residential areas has been pioneered in Armenia, Bulgaria, Latvia, Poland and Ukraine. The Municipal Network for Energy Efficiency (MUNEE) is acting as a partner in this work.[30] The provision of insulated ceilings, solar water heaters and energy efficient lighting in the Kuyasa district of Cape Town for 1900 houses has reduced costs by €150,000 per year. A project of this kind could be replicated in any sub-Saharan Africa and would be eligible for use as a Clean Development Mechanism project. REEEP projects have also helped finance energy efficient street lighting in five municipalities in Madhya Pradesh. Again, this could be eligible for Clean Development Mechanism status.

[30] http://www.munee.org/

The information gateway, REEGLE, provides a one-stop shop for renewable energy and energy efficiency information. [31]

The Alliance to Save Energy[32]

One of the initiatives associated with REEEP is the Alliance to Save Energy. It is an international NGO coalition of prominent business, government, environmental and consumer leaders to promote efficient and clean use of energy. It has the support of over 100 businesses, not-for-profit organisations, national laboratories, trade associations and environmental organisations. It is always chaired by a politician and a senior business leader, with bi-partisan support in the US Congress. It also has the support of over 110 different businesses and other organisations.

One paradigm which ASE uses is the 'watergy' concept. The basic insight is that every litre of water that is passed through a system has significant energy cost and also represents an investment of money to purify it. Between a third and a half of all water in developing countries is lost. The 'watergy' approach has a rapid payback with savings ranging from immediate impact to two years and at least 20% is saved from energy costs. The South African projects are funded by USAID, the Coca Cola company and the Coca Cola Africa Foundation, South African National and Municipal Funding, REEEP, The International Finance Corporation and the Inter-American Development Bank. The work concentrates both on the water supply and waste-water treatment. The approach is to help cities in South Africa bring down the cost of providing ample quantities of water to all residents, including a free basic daily quantity of water as required by the South African Constitution. The work is done in partnership with municipalities in South Africa to take advantage of the tremendous energy efficiency opportunities in municipal water supply and waste-water treatment facilities.

There are many obstacles to overcome, including the mistrust of water utilities by customers, the lack of capital for application, lack of awareness of the benefits of water and energy efficiency and poor enforcement of existing codes.

Three case studies which can be briefly assessed have common factors; leak reduction, awareness building and water auditing are elements of all three examples in Soweto, Emfulini and Munsieville. The Soweto project focuses on pre-payment and metering, Emfulini is focused on pressure management and Munsieville on private property system replacement. In Soweto, reducing the leaks is important for obvious reasons. Most water pumped to households is lost in delivery. There is a legacy of arbitrary billing not linked to use. There is no culture of ownership to help people feel responsible for saving water. Operation Save Water in the Johannesburg area is a public awareness campaign while, at the same time, residents' plumbing is

[31] It also uses the best pre-selected databases such as the IEA, the World Bank, the EIA, the WEC, REEEP, and REN21.

[32] http://www.ase.org/

being fixed for free and water meters are installed (with a guaranteed free minimum usage and pre-payment cards are distributed).

The acceptance of pre-payment on this basis has been 96%. Water pumped per household has dropped to 15% of previous levels and Johannesburg water has saved $7 million by March 2006. The estimated savings once all phases of the project is complete are US$45 million.

In Emfulini 80% of water flowing to homes and Sobokeng/Evaton was lost through leaking plumbing fixtures and 80% of the water supplied at night entered the waste water system. High bulk pressure was making leaks worse and causing premature failure of plumbing fixtures. The technical solution was pressure management with advanced pressure management valves on each supply line. The $800,000 installation was commissioned in September 2005. The financial solution was performance contracting through an ESCO on a build-operate-train-transfer model to the municipality after five years. The firm got 20% of the savings. The payback period was three months. The savings in Emfulini were 800 cubic metres per hour which meant saving the equivalent of an Olympic swimming pool of water every two hours. The annual saving of 700 million cubic metres is equivalent to a medium sized dam or reservoir each year. In Munsieville, over 1300 properties were selected and audited and new toilets, cisterns, taps and components and water pipes were provided as necessary. Before the project began, each household used over 1000 litres of water per day. On completion, household water use averaged less than 800 litres per day.

Together with REEEP, financial models for the urban waste sector have been developed. This is built on initial USAID and Coca Cola watergy projects. Many municipalities have found that the approach developed can overcome anticipated resistance and produce much more efficient approaches. There have been rapid and sustained energy savings with considerable benefits in terms of greenhouse gas emissions, job creation and health benefits.

Global Village Energy Partnership

This network was launched at the World Summit on Sustainable Development in Johannesburg in August 2002.[33] Its purpose is to promote social and economic development in rural and peri-urban areas of developing countries for increasing access to appropriate modern energy services. GVEP has 1500 partners, mainly from the least developed countries, almost half of which are outside the formal energy sector.

[33] http://www.gvep.org/ In March 2006, GVEP International was established as a UK based charity. It will be managed by trustees drawn from the GVEP Partnership Board which includes bodies such as The Shell Foundation, The World Bank, UNDP, USAID, Energia, Selco, IRG, WRC, The Brazilian Government, etc. The headquarters is now in London.

The key principles for GVEP are:

- It is technology neutral;
- Multi-application (i.e. electricity, heating, cooking, lighting, cooling, transport – not just power);
- Multi-use emphasis on productive use and livelihoods;
- Multi-stakeholder private, public NGO;
- Multi-sector energy, agriculture, water, health, education, small and medium enterprises;
- Market principles and gender focusing on empowering women through energy system management.

The diversity of GVEP gives the network the opportunity to have a strong advocacy position in the development community, making it able to ensure that small voices are heard and can have an impact.

From roots in the 1990s of discussions at community level with village level advocates, sixty countries attending village power conferences, GVEP was created in 2002. From 2006 onwards the focus will be to set up in-country funds to support local supply chains, productive use and income generating activities. The partnership is being strengthened through the mobilisation of new partners, through new products and services, and through capitalisation of knowledge and skills.

Since 2002, GVEP has provided technical assistance and funding from donor partners to enable developing countries to undertake the development of action plans and studies and project activities. In countries such as Cameroon, Ghana, Brazil and Guatemala, the energy needs of key sectors have been identified in national poverty reduction strategies.

In Cameroon, support was given to the development of the National Energy Action Plan. In Ghana, an action plan has been developed for Energy for Poverty Reduction. At a regional level, a white paper on Energy for Poverty Reduction has been agreed by the energy ministers of the Economic Community of West African States (ECOWAS). In East Africa, country action plans are being developed.

There is a need to build further on the relationships in East and West Africa. Outreach to the village level is essential and feedback through the network is also a key element of the plans.

In Brazil, links have been made between the Light for All Programme, the National Poverty and Hunger Reduction Strategy and a number of national initiatives. In Guatemala an action plan has been produced and GVEP and REEEP are co-ordinating on the next phase.

The immediate development plans for GVEP include:

- An energy gateway;
- Development activity mapping;
- Appropriate technologies;

- Finance facilitation;
- Capacity building;
- Monitoring and evaluation.

This will lead to establishing regional organisations with local offices, and insistence that actions are measurable, scalable and sustainable. There will also be a focus on the productive use of energy for income generation and poverty reduction.

The availability of small grants and loans, i.e. micro-finance from $100 to $50,000 to viable small-scale enterprises is essential. There will be three $15 million regional funds and plans, by 2012 to have assisted 7000 small enterprises and have 4.5 million direct and indirect beneficiaries at village level.

The plan to set up three regional funds of US$10-15 million each and leverage matching funds to bring these up to the $20-30 million level. This will involve both traditional funders and also new funders who are being approached. The Russian commitment from the G8 will allow the first two $15 million funds to be set up in sub-Saharan Africa. There is also the beginning of private sector funding involvement. EDF Energy has made a commitment of $100,000 to GVEP's India fund.

The Renewable Energy Network: Voluntary Commitments and the International Action Programme

International Action Programme, hosted by Renewable Energy Network (REN21) [34]takes up several important features of the major Bonn Renewables 2004 conference. In particular, REN21 is a multi-stakeholder and multi-sectoral. At the Bonn meeting, 197 concrete specific actions and commitments were made. The REN21 Secretariat is responsible for co-ordinating responses on a self-reporting basis. The IAP follow-up, which began in March 2006 had, by July 2006, generated a 64% response rate, i.e. on 125 actions. Research and development projects had a particularly high response rate (28 out of 33 reports received). Most reports (78%) show that the commitments have been, or are being, implemented. Very few have been abandoned.

A number of countries including Egypt, Uganda, France, UK, Czech Republic, Turkey, Iran, Pakistan, China, Japan, Australia, New Zealand and some Pacific islands are implementing quantitative renewable energy targets.

The early experience from this network indicates that voluntary commitments do work and that self-reporting provides an excellent basis for information sharing and discussion of best practice.

In a situation where binding commitments prove hard to achieve, voluntary commitments help to continue momentum.

[34] http://www.ren21.net/

The World Association for Decentralised Energy – Generating Energy Close to Point of Use

Decentralised energy, i.e. the generation of electricity at the point of use, can be large or small based on a wide range of fuels, on-grid or off-grid. It includes, for example, high efficiency co-generation (combined heat and power), on site renewable energy or industrial energy recycling. The World Association for Decentralised Energy is a network created in 2002 which is engaged in not-for-profit research and promotion of these energy solution.[35] The Danish Energy Generation pattern is an example of what can be achieved. It has decentralised very significantly since the 1980's. There are many different types of decentralised energy solution, both on-grid and off-grid, village scale renewable energy, small scale industrial combined heat and power, small wind, solar photovoltaics, fuel cells, micro hydro, etc. Different applications require different types of solution. A 2003 study by the International Energy Agency has commented favourably on decentralised energy as requiring lower investment and producing lower carbon dioxide emissions.

Decentralised energy investment does not only depend on the technology. Policy drivers which make a difference include targets set by government, feed-in tariffs, renewable portfolio standards, disclosure labelling on power bills, public benefits charges and carbon taxes.

There are also financial drivers which can assist such as guaranteed financing or favourable loans for decentralised energy. In the context of the Gleneagles Dialogue, decentralised energy has advantages in terms of economic development, climate change, energy security and poverty eradication.

18 Bringing It All Together: Energy Access, Energy Security and Climate Change

There are increasing concerns that the world is approaching the limits in terms of resources and environmental impacts. Demand today for oil is 84 million barrels and is estimated to rise to 120 million barrels a day by 2030. There are serious questions where the 50% extra is going to come from.

It is increasingly being recognised in a development context, that development aims must be related to energy policy, not least in the context in the achievement of the Millennium Development Goals. 1.6 billion people have no access to electricity. Over 2.4 billion are dependent on traditional fuels for cooking. Energy-linked poverty and drudgery for women and children go hand in hand. At the same time, commercial energy use is growing at about 1.7% per annum in industrialised countries and 3.8% in developing countries. Energy prices are volatile and increasingly high. 80% of total energy comes from fossil fuels which generate greenhouse gases.

On a "business as usual" scenario, it is estimated that $8.4 trillion would need to be invested in developing countries to meet the energy demand. World electricity demand will double by 2030, with most of the growth in developing countries. The

[35] http://www.localpower.org/

demand in coal use will be most dramatic in India and China, and nuclear energy production is likely to rise as well. It is predicted that China could have as many as 130 million cars by 2030, up from 30 million today. China has plans to become more energy efficient and less energy intensive. China's continued economic growth will require it to treble its electricity generation capacity. In contrast, in sub-Saharan Africa today 77% of the population have no access to electricity. The figure rises to 90% if South Africa is excluded. This represents over 500 million people. In India, there are almost 600 million without access to electricity.

If one takes seriously the idea of energy access for all by 2030, this would require huge efforts in the area of household electrification, on and off the grid; new electricity generation; clean cooking, heating and lighting fuels, energy services to public services including schools and hospitals and lighting packages for non-electrified households such as solar photovoltaics.

Energy security has a different meaning in different places. However, the oil price increase from $25 per barrel to three times that level in just four years has had its greatest impact on poor oil importing countries. Security of supply is challenged by vulnerability and instability. Developing countries are increasingly exposed as they are more dependent on imported oil (with some exceptions such as Angola which produces oil). They also use twice as much oil per unit of economic output than the OECD countries. Sub-Saharan African countries pay a very high price relatively for their fuel imports. The policy responses in the Third World include the following; improving energy efficiency, but also looking for opportunities to build efficient energy futures into industry, urban development and transport programmes. They also have to diversify their supplies and use indigenous natural resources, both renewable and conventional.

The British government's new White Paper on development issues presented to parliament in July 2006 presents the following policy emphases:

- The increase of the development budget to 0.7% of UK GNI by 2013;
- A commitment to achieve the Millennium Development Goals;
- Focus on governance, peace and security;
- Promotion of economic growth including through improved infrastructure;
- Education and health;
- A recognition that climate change is the most serious threat to development and the prospects for achieving the Millennium Development Goals.

As a result, there is to be more research on impacts and adaptation, a focus on disaster risk reduction and support for the development of national strategies for reducing the impacts of climate change and adapting to the effects, e.g. through water resource management. The support is also to be given to the World Bank's Energy Investment Framework.

It is clear that all need secure and affordable energy supplies. Economic growth will drive energy demand, particularly in developing countries. Access to energy must be improved if growth and poverty reduction are to be achieved, but this is increasingly difficult in a world which could number 10 billion people compared with 6 billion

today. Can the supply of fuel and infrastructure investment keep pace with the rising energy demand in a growing and urbanising world and can the impacts on the global environment be managed to avoid catastrophic effects?

19 Conclusions

The complexity of the challenges in the field of energy security and the urgency of the development needs of the “energy poor” world provide a seemingly intractable set of problems. Key players are still not signed up to the Kyoto protocol, including the USA, the major emitter from the developing world and the biggest emerging powers from the developing world (China and India). Many significant initiatives in the areas of renewable energy and energy efficiency are cited here – and these are only some of those which could be mentioned.

It is clear that technology alone will not solve the development and energy needs of the world in coming decades. Political will and the more equitable distribution of access to the means of development are required. The technological possibilities are impressive – and cleaner energy will be part of the equation.