



Defence Academy
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Climate Change and the Energy Crunch

Dr Mark A Smith, Dr Mohammed El-Katiri & Dr Steven J Main



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Key Findings

- If Intergovernmental Panel on Climate Change (IPCC) scenarios turn out to be correct, then climate change could inter-connect with both energy and food/water security to become a major security challenge in the next few decades. The post-2007 economic global downturn could make coping with these challenges all the more difficult.
- The possible food security challenge should be emphasised. The increased use of ethanol as a fuel source will place greater pressure on food supplies. Water security is also likely to become a significant security issue, which could result in conflict.
- These security challenges will place increased pressure on weak, failing and failed states, and increase the likelihood of intervention by developed powers to help mitigate problems caused by climate change or to contain and prevent conflict. The need for intervention in such cases may help promote great power cooperation; it could also become a source of geopolitical rivalry.
- These security challenges will also pose a challenge to the resilience capabilities of advanced states as demonstrated by Hurricane Katrina in 2005 in New Orleans.
- The problems of energy security may be complicated by the possible phenomenon of peak oil, which some analysts believe will occur between 2009 and 2030. The Middle East's importance as a source of oil will increase. This will result in increased great power interest in the region. The problem of resource nationalism is likely to become more acute. Insufficient energy supplies could cause major socio-economic dislocation in both developed and developing nations.
- Both climate change and energy security are intimately linked with the rise of Chinese power, and the extent to which China is willing to become a responsible stakeholder in the international system. China is now the world's biggest emitter of greenhouse gases, and her energy import needs over the next few decades could pose a challenge to western energy security.
- Over the long-term climate change and energy security will enhance the geo-political importance of the Arctic, and also possibly of the Antarctic.

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Climate Change as a New Security Challenge

Awareness of climate change as a new security challenge has come particularly to the fore in the last two to three years. It has been described by Rear Admiral Neil Morisetti, the UK's Climate and Energy Security Envoy as a threat multiplier, and was listed by US Under-Secretary for Defence Michele Flournoy in April 2009 as one of five major trends affecting the strategic environment; she warned that it is an "accelerant" of state failure, humanitarian crises and other problems which could result in conflict.¹

It received passing mention in the US National Defence Strategy of June 2008, but the UK National Security Strategy of March 2008 put greater emphasis on the problem, noting that:

Climate change is potentially the greatest challenge to global stability and security, and therefore to national security. Tackling its causes, mitigating its risks and preparing for and dealing with its consequences are critical to our future security, as well as protecting global prosperity and avoiding humanitarian disaster.²

It also received greater attention in the US National Intelligence Council's November 2008 study Global Trends 2025: A Transformed World, which considers climate change as part of a new transnational agenda.³

Barack Obama's Director of National Intelligence Dennis Blair, in his first Annual Threat Assessment, commented in February 2009 that:

Climate change, energy, global health, and environmental security . . . [are] critical issues . . . in a future where global warming and resource shortages will have destabilizing effects on many regions, threatening the vital interests of the United States.⁴

The 2010 National Security Strategy (NSS) of the USA devoted more attention to the issue of climate change than its predecessors of 2002 and 2006.⁵

¹ Cited by Rymn J. Parsons, Taking up the security challenge of climate change, Carlisle Paper, Strategic Studies Institute, US Army War College, August 2009, p.4.

<http://www.strategicstudiesinstitute.army.mil/pubs/display.cfm?pubid=932>. For a reference to Admiral Morisetti's use of this term, see <http://climatechange.foreignpolicyblogs.com/tag/neil-morisetti/>

² The National Security Strategy of the United Kingdom: Security in an interdependent world, Cm7291, London, HMSO, March 2008, p.18.

http://interactive.cabinetoffice.gov.uk/documents/security/national_security_strategy.pdf

³ Global Trends 2025: A Transformed World, National Intelligence Council NIC 2008-003, November 2008, p.viii, http://www.dni.gov/nic/NIC_2025_project.html

⁴ Parsons, *op cit*.

⁵ http://www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf ;

http://www.humansecuritygateway.com/documents/USGOV_NationalSecurityStrategy2010.pdf . The 2002 NSS has a 229 word section on the subject of climate change and the need to reduce greenhouse gas emissions. The word "climate" appeared once in the 2006 NSS, and had no section on the subject. The 2010 NSS has a 327 word section on the subject.

Rear Admiral Neil Morisetti warns that socio-economic and political impact of climate change could pose a threat to international security. On its own it is unlikely to pose a threat, but in combination with other problems such as food and water shortages, poor health care, weak government, then it has the potential to be the tipping point to cause conflict.⁶

In 2007, the UK, when it held the chairmanship of the UN Security Council raised the issue of climate change in the UNSC. The UNSC's first ever debate on the security implications of climate change was held in April 2007 as a British initiative.⁷ The then UK Foreign Secretary Margaret Beckett gave a speech on the security implications of climate change in the USA at that time in which she described the struggle for climate security as "the first great war of interdependence". She went on to say:

Like the Cold War, the soft power war for climate security will have to be fought simultaneously on the political, economic, developmental, scientific and cultural fronts.

And that direction is pretty clear. It means moving to a low-carbon, economy that uses energy far more efficiently than we do today. It is our good fortune that doing so makes sense from almost every angle. It will cut emissions and help to achieve climate security. And it will improve our energy security: making us less reliant on increasingly expensive hydrocarbons, and on a relatively small number of states, some of them in regions which are themselves already unstable.

By 2020 half of the world's oil production will be in countries currently considered at risk of internal instability. And already, today, two countries – Russia and Iran – account for over two-fifths of global gas reserves.⁸

The statement setting out the programme of the new UK coalition government echoes the concern of its predecessor regarding climate change. It considers climate change to be "one of the gravest threats we face, and that urgent action at home and abroad is required."⁹ Chris Huhne, the Secretary of State for Energy and Climate Change said in June 2010, that "the real challenge is to build a different kind of economy. One that cuts our carbon emissions to tackle climate change and which makes our energy secure in a volatile world."¹⁰

One of the most significant features of climate change is its interconnection with other new security challenges, such as the phenomenon of failed states, the problems of food security, water security, and energy security, which is relevant because of the problems of CO₂ emissions caused by the use of fossil fuels.

The Phenomenon of Global Warming

The Climate Research Unit (CRU) at the University of East Anglia became embroiled in scandal in November 2009, when a hacker apparently hacked into the CRU's computers and

⁶ <http://www.fco.gov.uk/en/global-issues/climate-change/priorities/global-security/> . See Neil Morisetti, 'Climate Change: threat to global security', New Security Beat, 17 March 2010.

⁷ <http://newsecuritybeat.blogspot.com/2010/03/guest-contributor-rear-admiral.html>

⁷ <http://www.un.org/News/Press/docs/2007/sc9000.doc.htm> ;

<http://climatechange.foreignpolicyblogs.com/tag/neil-morisetti/> ; For a discussion of the concept of climate security see Hiroshi Ohta The Interlinkage of Climate Security and Human Security: The Convergence on Policy Requirements Paper Prepared for Conference on "Climate/Security" At University of Copenhagen, Copenhagen, Denmark, 9 March 2009

<http://www.fasid.or.jp/daigakuin/sien/kaisetsu/gaiyo21/pdf/02-2.pdf>

⁸ http://www.fpa.org/calendar_url2420/calendar_url_show.htm?doc_id=472794

⁹ The Coalition: Our Programme for Government, Cabinet Office, London, May 2010, p.16.

¹⁰ http://www.decc.gov.uk/en/content/cms/news/Energy_Summit/Energy_Summit.aspx

released on the Internet emails by CRU scientists which appeared to indicate that some of the leading advocates of the theory of anthropogenic (man-made) global warming (AGW) had suppressed evidence that conflicted with their belief that global warming was caused by human activity.¹¹ This has reduced the credibility of the whole notion of AGW, and may conceivably weaken the case for reducing GHG emissions, and so complicate and undermine the entire climate change diplomatic process.

However, although there is still an element of doubt in some circles over the extent to which warming is caused by man-made CO₂ emissions, few doubt that warming has been occurring in the latter half of the twentieth century.¹² The Intergovernmental Panel on Climate Change (IPCC) report Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,¹³ which obviously does believe in AGW, lists some of the changes in climate it considers to have taken place:

- Eleven of the last twelve years (1995–2006) rank among the 12 warmest years in the instrumental record of global surface temperature (since 1850). The updated 100-year linear trend (1906 to 2005) of 0.74°C [0.56°C to 0.92°C] is therefore larger than the corresponding trend for 1901 to 2000 given in the Third Assessment Report (TAR) of 0.6°C [0.4°C to 0.8°C]. The linear warming trend over the last 50 years (0.13°C [0.10°C to 0.16°C] per decade) is nearly twice that for the last 100 years. The total temperature increase from 1850–1899 to 2001–2005 is 0.76°C [0.57°C to 0.95°C]. Urban heat island effects are real but local, and have a negligible influence (less than 0.006°C per decade over land and zero over the oceans) on these values.
- Global average sea level rose at an average rate of 1.8 [1.3 to 2.3] mm per year over 1961 to 2003. The rate was faster over 1993 to 2003: about 3.1 [2.4 to 3.8] mm per year. Whether the faster rate for 1993 to 2003 reflects decadal variability or an increase in the longer term trend is unclear. There is high confidence that the rate of

¹¹ There is a suggestion that the person who leaked the files may not have been a hacker, see Terry Hurlbut, 'Who leaked the Hadley CRU files and why', Essex County Conservative Examiner, 21 November 2009 <http://www.examiner.com/x-28973-Essex-County-Conservative-Examiner~y2009m11d21-Who-leaked-the-Hadley-CRU-files-and-why>. For further discussion of the Hadley CRU files see for example, Melanie Phillips, 'Green totalitarianism', <http://www.spectator.co.uk/melaniephillips/5565331/green-totalitarianism.shtml> ; Phillips, 'The Smoking Iceberg', <http://www.spectator.co.uk/melaniephillips/5559816/the-smoking-iceberg.shtml> ; See also David Rose, 'Climate change emails row deepens as Russians admit they DID come from their Siberian server', Mail on Sunday, 13 December 2009 <http://www.dailymail.co.uk/news/article-1235395/SPECIAL-INVESTIGATION-Climate-change-emails-row-deepens--Russians-admit-DID-send-them.html>

¹² See Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 30 August 2007. http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_SPM.pdf . See also the United Nations Development Programme Human Development Report 2007/2008 Fighting climate change: Human solidarity in a divided world New York, Macmillan, 2007 http://hdr.undp.org/en/media/HDR_20072008_EN_Complete.pdf. See also Climate change controversies. A simple guide, The Royal Society, London, 2007, http://web.mac.com/dannysatterfield/climatechange/Resources_files/Climate.pdf. For a dissenting view see US Senate Minority Report: U. S. Senate Minority Report: More Than 700 International Scientists Dissent Over Man-Made Global Warming Claims Scientists Continue to Debunk "Consensus" in 2008 & 2009, March 2009. http://epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=83947f5d-d84a-4a84-ad5d-6e2d71db52d9&CFID=24704133&CFTOKEN=86250417 .

¹³ Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 30 August 2007. http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_SPM.pdf . Note that the IPCC is now working on its fifth assessment report which is due in 2013.

observed sea level rise increased from the 19th to the 20th century. The total 20th-century rise is estimated to be 0.17 [0.12 to 0.22] metres.

- Average Arctic temperatures increased at almost twice the global average rate in the past 100 years. Arctic temperatures have high decadal variability, and a warm period was also observed from 1925 to 1945.
- Satellite data since 1978 show that annual average arctic sea ice extent has shrunk by 2.7 [2.1 to 3.3] per cent per decade, with larger decreases in summer of 7.4 [5.0 to 9.8] per cent per decade. These values are consistent with those reported in the TAR.
- Temperatures at the top of the permafrost layer have generally increased since the 1980s in the Arctic (by up to 3°C). The maximum area covered by seasonally frozen ground has decreased by about 7 per cent in the Northern Hemisphere since 1900, with a decrease in spring of up to 15 per cent.
- Long-term trends from 1900 to 2005 have been observed in precipitation amount over many large regions. Significantly increased precipitation has been observed in eastern parts of North and South America, northern Europe and northern and central Asia. Drying has been observed in the Sahel, the Mediterranean, southern Africa and parts of southern Asia. Precipitation is highly variable spatially and temporally, and data are limited in some regions.
- More intense and longer droughts have been observed over wider areas since the 1970s, particularly in the tropics and subtropics. Increased drying linked with higher temperatures and decreased precipitation has contributed to changes in drought. Changes in sea surface temperatures, wind patterns and decreased snowpack and snow cover have also been linked to droughts.

Climate Change – The Diplomatic Process

As noted above, this led to a belief that these changes could have extremely detrimental consequences for the environment and the world's population, which could therefore become a source of major instability. This has resulted in a diplomatic process to counter the effects of what is considered to be anthropogenic climate change. This process began at the United Nations Conference on Environment and Development held in Rio de Janeiro in June 1992.¹⁴ This conference produced the United Nations Framework Convention on Climate Change (UNFCCC)¹⁵, which aims to achieve the "stabilisation of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." The Kyoto Protocol signed in October 1997 is a protocol to this Convention. The Kyoto Protocol commits 37 industrialized countries to a reduction of four GHGs (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride) and two groups of gases (hydrofluorocarbons and perfluorocarbons) produced by them, and all member countries give general commitments. These 37 countries agreed to reduce their collective GHG emissions by 5.2 per cent reduction from the 1990 level.¹⁶ This process of reduction is to take place between 2008 and 2012. The targets for individual countries

¹⁴ http://en.wikipedia.org/wiki/Earth_Summit_%281992%29

¹⁵ http://en.wikipedia.org/wiki/Climate_Change_Convention

¹⁶ http://unfccc.int/kyoto_protocol/items/3145.php ; http://en.wikipedia.org/wiki/Kyoto_Protocol ; <http://www.carbonify.com/articles/kyoto-protocol.htm>

varied. Japan agreed to make a 6 per cent reduction, the USA 7 per cent, and the EU 8 per cent.¹⁷

Climate Change and Trade Wars

Trade wars are one aspect of the conflicts that might characterise the trade relationships among leading global economic players in the future as result of carbon related trade measures. The lack of a global consensus on mitigation and adaptation measures to tackle climate change has resulted in different countries taking individual initiatives. The approaches differ from one country to another. The main initiative introduced or proposed by developed countries is carbon taxes. Introducing cap-and-trade regulations to mitigate greenhouse emissions will clearly have a profound economic impact on producers in these countries. Such regulations will add more costs to the producers, and will affect the global competitiveness of energy-intensive industries. The decision makers are aware of how imposing taxes or any other financial burden are going to disadvantage their domestic industries vis-à-vis other producers in countries that have not taken any similar policies. Growing concerns about the competitiveness of national industries, brought by actions on climate change, are at the heart of the political discussion in industrialised countries. There are also fears that any asymmetrical adoption and implementation of green taxes will end up in more outsourcing and relocation of business from developed economies to less developed ones.¹⁸

To tackle such disadvantages, a trade mechanism has been proposed. Several national climate change draft proposals have included trade measures. The catalyst of such move is the Clean Energy and Security Act in the US. This Bill was passed by the US House of Representatives in June 2009, and is now awaiting Senate approval.¹⁹ The most controversial aspect of that Bill is the inclusion of punitive measures against imports that fail to meet the US greenhouse standards. Although the Bill states the trade measures will not take effect until 2025, it is more likely that if the law is endorsed one will see the interest groups and lobbyists using the law to pressure the government for actions to protect national industries.

The UK's Climate Change Act of November 2008 makes the UK the first country in the world to have a legally binding long-term framework to cut carbon emissions. It establishes the following:

- a UK-wide climate change risk assessment that must take place every five years;
- a national adaptation programme which must be put in place and reviewed every five years to address the most pressing climate change risks to England;
- the Government has the power to require 'bodies with functions of a public nature' and 'statutory undertakers' (companies like water and energy utilities) to report on how they have assessed the risks of climate change to their work, and what they are doing to address these risks;
- the Government is required to publish a strategy outlining how this new power will be used, and identifying the priority organisations that will be covered by it;
- the Government will provide Statutory Guidance on how to undertake a climate risk assessment and draw up an adaptation action plan; and

¹⁷ See Kyoto Protocol reference manual: On Counting of Emissions and Assigned Amount

http://unfccc.int/resource/docs/publications/08_unfccc_kp_ref_manual.pdf

¹⁸ "Carbon Leakage": A challenge for EU industry" 27 January 2009,

<http://www.euractiv.com/en/climate-change/carbon-leakage-challenge-eu-industry/article-176591>

¹⁹ Petroleum Intelligence Weekly, Vol. XLVIII, 25 May 2009, p.3. See also

<http://www.nrdc.org/globalwarming/legislation/senate.asp>

- the creation of an Adaptation Sub-Committee of the independent Committee on Climate Change in order to oversee progress on the Adapting to Climate Change Programme and advise on the risk assessment.²⁰

It has a target of ensuring that the net UK carbon account for the year 2050 is at least 80 per cent lower than the 1990 baseline.²¹

China and India have seen legislative developments by Western countries as a threat to their economic development, and to free trade. Chinese authorities commented in July 2009 that carbon tariffs would violate World Trade Organisation rules and incite trade wars.²² China and India have done little to reduce GHG emissions. There are a few initiatives that are more to tackle energy security with regards to energy prices than climate change. These initiatives seek fuel efficiency, and increase renewable energy use.

The supporters of carbon tariffs argue that their adoption will provide incentives for foreign firms to reduce their carbon emissions. If there is no such burden on exporting products to green economies, exporting companies in countries with no carbon tax would not change their practices. Aaron Cosbey of the International Institute for Sustainable Development argues that what these trade measures seek to achieve is a fair deal between producers in countries with costly decarbonising measures and other producers facing very few or none.²³ He calls such trade measures “Border Carbon Adjustment”.

The opposing side in the debate, led by China and India, believes that carbon tariffs constitute a threat to their economies and the multilateral trade system. Zhang Xiangchen, a Chinese representative at the World Trade Organisation (WTO) in Geneva believes that the endorsement and implementation of these unilateral actions is not going to be objective and non-discriminatory.²⁴ The adoption of such measures is against one of the fundamental Kyoto Protocol’s principles, which is that developed countries should bear a heavier emission mitigation burden than developing countries.²⁵

So far there is no international proposal at the WTO to deal with climate change and trade. Many countries are not enthusiastic about multilateralism, as they know from experience that WTO negotiations tend to be extremely protracted. There is a risk of trade retaliation measures that could be adopted by major developing economies such as China and India. With this in mind, one can easily argue that the threat of more contentious trade wars in the near future is quite possible.

The Road to Copenhagen

The next stage in the conference process was the United Nations Climate Change Conference that took place in Copenhagen in December 2009. The conference included the 15th Conference of the Parties to the United Nations Framework Convention on Climate

²⁰ Climate Change Act 2008. Department of Environment, Food and Rural Affairs (DEFRA), <http://www.defra.gov.uk/environment/climate/legislation/adaptation.htm>

²¹ DEFRA <http://www.defra.gov.uk/environment/climate/legislation/>; Climate Change Act 2008 Chapter 27 http://www.opsi.gov.uk/acts/acts2008/ukpga_20080027_en_1; For an independent review of the Climate Change Act, see Karla Hill, *The UK Climate Change Act 2008 – Lessons for national climate laws An independent review by ClientEarth*, November 2009

²² Chuin Wei-Yap, “China Again Objects to Tariffs on Nations Not Capping Emissions”, *The Wall Street Journal*, 6 July 2009. <http://online.wsj.com/article/SB124662442501992421.html>

²³ Aaron Cosbey “Border Carbon Adjustment” International Institute for Sustainable Development, August, 2008. http://www.iisd.org/pdf/2008/cph_trade_climate_border_carbon.pdf

²⁴ David Stanway and Wang Lan, ‘Carbon tariff proposals unworkable - China WTO rep 29 October 2009’, <http://www.alertnet.org/thenews/newsdesk/PEK8535.htm>

²⁵ “China, India lash out at talk of ‘Carbon Tariffs’” Bridges Weekly Trade News Digest, Volume 13, No.25, 8 July 2009.

Change and the 5th Meeting of the Parties to the Kyoto Protocol. It was intended that a framework for climate change mitigation beyond 2012 was to be agreed at Copenhagen.²⁶ It was intended at Copenhagen to reach agreement on a cut in global emissions, from the developed and developing world alike of 50 per cent below 1990 levels by 2050. There were huge differences between developing and the advanced industrialised nations over the extent to which emissions should be cut.²⁷ However there was some progress in the run-up to Copenhagen, as the Obama Administration announced at the end of November 2009 that it would offer to cut emissions by 17 percent from 2005 levels by 2020, deepening to 30 percent by 2025, 42 percent by 2030 and 83 percent by 2050. China said it would take voluntary steps to cut the intensity of its CO₂ emissions per unit of GDP by 40 to 45 percent by 2020 from 2005 level.²⁸

A controversial aspect of the Copenhagen summit was the demand by developing nations that advanced nations make a financial contribution to them in climate adaptation programmes. The then UNFCCC Executive Secretary Yvo de Boer stated in November that “the world is very much looking to the United States to come forward...and contribute financially to help developing countries.”²⁹ The draft Copenhagen treaty set out the requirement that developed countries pay their “adaptation debt” to developing countries. Clause 33 of the draft treaty for example said that by 2020 the scale of financial flows to support adaptation in developing countries must be at least \$US67 billion, or in the range of \$US70 billion to \$US140 billion a year.³⁰

The group of developing countries known as G77, including China and India, seemed to be in the process of consolidating their positions just before the start of climate negotiations in Copenhagen. Their aim was what they called an “equitable” deal at Copenhagen. Despite various differences in their economic structures and stage of development, these countries have many common interests and demands in the ongoing global negotiations on climate change. At the end of November 2009, the G77 met with the aim of producing a 10 page document draft functioning as a counter proposal to what the industrialised countries would probably release during the Copenhagen summit.³¹ Four of the global emerging economies (Brazil, China, India and South Africa) agreed to walk out if their demands were not taken seriously.³² Developing countries are reluctant to commit to any quantitative emission reductions. Industrialised nations seek to achieve a binding commitment by developing countries (or at least emerging economies) to implement appropriate mitigation actions at national levels, with the aim of stopping their carbon emissions from further rising.

France and Brazil made an interesting proposal during the visit of French President Nicolas Sarkozy to Brazil in November 2009. He and Brazilian President Lula called for the establishment of an international organisation for the environment and sustainable development.³³ If this organisation is set up, it would be a new multilateral organisation, on the same level of the Bretton Woods institutions. In order to meet this new paradigm of

²⁶ http://en.wikipedia.org/wiki/United_Nations_Climate_Change_Conference_2009

²⁷ John Vidal, ‘Climate talks end in acrimony as UN and EU accuse US of endangering deal’. *The Guardian*, 6 November 2009 <http://www.guardian.co.uk/environment/2009/nov/06/developing-nations-copenhagen-walkout>

²⁸ How key countries are cutting carbon emissions, *The Independent*, 27 November 2009 <http://www.independent.co.uk/environment/climate-change/how-key-countries-are-cutting-carbon-emissions-1828907.html>

²⁹ “Obama Taking Emission Goal to Summit”, *The Washington Times*, 26 November 2009.

³⁰ UN Framework Convention on Climate Change FCCC/AWGLCA/2009/INF.2, 15 September 2009 <http://wl.theaustralian.news.com.au/files/copenhagen.pdf>

³¹ Alan Wheatley “Big Developing Countries Form Climate Change Front” Reuters, 29 November 2009.

³² “Copenhagen Conference: India China Plan Joint Exit”, *The Times of India*, 28 November 2009.

³³ “Climat: Sarkozy et Lula adoptent une position commune”, *Radio France Internationale*, 14 November 2009. www.rfi.fr

international relations, this organisation should seek to take the shape of a multi-functional organisation in the style of the WTO, an organisation that provides finance, monitoring, a dispute resolution mechanism and capacity building, among other functions.

Copenhagen – The Outcome

The outcome of the December 2009 Copenhagen conference was by common consensus at best a disappointment and an anti-climax, and in some ways was a step backward from Kyoto. It also showed that little progress had been made since the December 2007 agreement on the Bali Road Map.³⁴ A non-binding political agreement was signed in which participants agreed to keep global warming to less than 2°C. Each participating country agreed to submit a quantified economy-wide emissions target by 31 January 2010, and the performance of each country will be reviewed. However the Copenhagen Accord does not set out firm numbers. China was felt to be the main culprit by many other participants and commentators. Beijing opposed a target of a 50 per cent reduction in global emissions by 2050. However, others blame Denmark (who chaired the conference) and major western powers for attempting to hijack the summit. Denmark organised a secret meeting of 26 heads of state, where a Danish text was presented for agreement. This text reflected mainly the position of developed countries, and disregarded many of the positions put forward by developing countries in the negotiations that had taken place since the Bali summit of December 2007. The proposal of the 26 nations would have meant that developing countries would have to cut their emissions overall by about 20 per cent in absolute terms and at least 60 per cent in per capita terms. By 2050, developed countries would still be allowed to have two to five times higher per capita emission levels than developing countries. The latter would have to severely curb not only their emissions but also their economic growth plans, as there are still commitments for financial and technology transfers to help them shift to a low-emissions development path.³⁵

In the post-Copenhagen study Hitting Reboot: Where next for climate after Copenhagen?, Alex Evans and David Steven comment that if all countries fulfil the low end of the 'offers' for 2020 they have made, then warming might be limited to 3°C. This would take the world around a third of the way the trajectory needed for stabilization at 450ppm CO₂. This is the target that might provide a 40-60 per cent chance of restraining warming to below 2°C. Even full implementation of the high end of all existing 'offers' would still leave the world only two-thirds of the way towards a 450ppm trajectory in 2020.

Both Evans and Steven are pessimistic about major progress being made by the time of the next major climate summit at Cancún in Mexico in December 2010. Before the Copenhagen summit, they argued that for Copenhagen to be successful, the following six criteria would have to be met:

- Rock solid agreement among countries about the eventual legal status of a deal;
- Strong mutual understanding between the US and China of what the other should contribute, in each case more or less in line with IPCC findings;
- Obvious bear traps – especially Monitoring, Reporting and Verification (MRV), governance and finance – to have been cleared away;

³⁴ Alex Evans and David Steven, Hitting Reboot : Where next for climate after Copenhagen?, Managing Global Insecurity, Brookings, December 2009 http://www.brookings.edu/~media/Files/rc/papers/2009/12_climate_evans_steven/12_climate_evans_steven.pdf . See also the assessment of Copenhagen by Bernice Lee, 'Beyond Doom and Gloom', World Today, August-September 2010, http://www.chathamhouse.org.uk/files/17008_wt081032.pdf . Lee's assessment is more positive than that of Evans and Steven. See also Michael Levi, 'Beyond Copenhagen: Why Less may be more in global climate talks', 2 February 2010 <http://www.foreignaffairs.com/articles/65985/michael-levi/beyond-copenhagen>

³⁵ Martin Khor, 'Blame Denmark, not China, for Copenhagen failure', The Guardian, 28 December 2009 <http://www.guardian.co.uk/commentisfree/cif-green/2009/dec/28/copenhagen-denmark-china>

- An agreed roadmap leading out of the summit;
- Clear outlines for a Senate bill; and
- Assurances on the US domestic roadmap that are based on more than wishful thinking.

They point out that none of the criteria have been met, and that there is a strong danger that the diplomatic process could simply drag on with no conclusive outcome. In the Lowy Institute Policy Brief of July 2010, Confronting the Crisis of International Climate Policy: Rethinking the Framework for Cutting Emissions, Fergus Green, Warwick McKibbin and Greg Picker note that “fundamental disagreements remain on nearly every element of the Bali Action Plan...from the long-term targets for developed country mitigation to the permissible role of offsets in domestic emissions accounting. While many hope that a comprehensive agreement will emerge by the time of the Mexico conference later this year, few observers seriously rate the prospects of reaching such an agreement in the near term.”³⁶ Green and his fellow authors argue that the divergent positions of different countries will not converge through “more vigorous bargaining, ‘higher ambition’ and ‘greater momentum’ from governments during the ongoing UN negotiations.” They contend that the possibilities for institutionalised international cooperation to mitigate climate change are “severely limited.” The Lowy Paper believes that four main factors undermine the prospects of achieving meaningful agreement through the UNFCCC process.³⁷ These are:

1. The UNFCCC’s comprehensive institutional scope. The emphasis on signing a single climate change treaty means that the negotiating agenda is now overloaded.
2. The requirement for universal consensus in the UNFCCC. As the UNFCCC currently consists of 193 parties, consensus can only be reached at the level of the lowest common denominator.
3. The UNFCCC process is heavily oriented towards targets and timetables. This means that negotiations are dominated by nations negotiating on the basis of “self-interested domestic and international political calculations.”
4. The distinction between developed and developing countries. This has resulted in an antagonistic relationship between these two groups in the UNFCCC process, which has eroded trust between them.

The Lowy Paper argues that “there is little confidence among many countries and observers that an agreement based on targets, timetable and global emissions trading would ever be implemented.”³⁸

Climate Change Scenarios

This process to secure wide-ranging agreement on mitigating the effects of climate change is because of the fear that if no action is taken to reduce CO₂ emissions, then the effects of global warming could be catastrophic. In November 2007, a joint study by the Centre for Strategic and International Studies and Centre for a New American Security, entitled The Age of Consequences: The Foreign Policy and National Security Implications of Global

³⁶Fergus Green, Warwick McKibbin and Greg Picker, Confronting the Crisis of International Climate Policy: Rethinking the Framework for Cutting Emissions, Lowy Institute Policy Brief, July 2010, p.3. <http://www.lowyinstitute.org/Publication.asp?pid=1329>

³⁷ Green, *ibid.*, p.3-4.

³⁸ Green, *ibid.*, p.4.

Climate Change, put forward three scenarios of climate change in the 21st century.³⁹ These were: expected; severe; catastrophic.

- **Expected** refers to an increase in temperature above the 1990 average of 1.3 degrees Celsius over the next 30 years, with sea levels rising by 0.23 metres. The effects of climate change in this scenario are based on the A1B GHG emissions scenario of the Fourth Assessment Report.
- **Severe** envisages a temperature increase above the 1990 average of 2.6 degrees Celsius over the next 30 years, with sea levels rising by 0.52 metres.
- **Catastrophic** assumes an increase above the 1990 average of 5.6 degrees Celsius over the next 100 years, with sea levels rising by 2.0 metres.

In their outline of expected climate change, John Podesta and Peter Ogden note that the first scenario “is a scenario in which people and nations are threatened by massive food and water shortages, devastating natural disasters, and deadly disease outbreaks. It is also inevitable.”⁴⁰

This scenario indicates that the most significant climate impacts will occur in the south-western USA, Central America, sub-Saharan Africa, the Mediterranean region, the mega deltas of South and East Asia, the tropical Andes, and small tropical islands in the Pacific and Indian oceans. The largest impacts of change in the expected scenario are reductions in water availability and increases in the intensity and frequency of extreme weather events. The scenario also states that the sub-Saharan Africa, the Mediterranean region and south-western USA will experience more frequent and longer-lasting drought and associated extreme heat events, in addition to forest loss from increased insect damage and wildfires.⁴¹

Obviously the second and third scenarios envisage harsher effects, which will pose greater challenges to food and water security, and greater threats to the safety of populations living in coastal areas.

The main possible effects of climate change that have security implications are as follows:

- Drought in some areas, leading to desertification, deforestation and loss of arable land for cultivation. This will obviously pose problems for food supply
- The melting of glaciers such as in the Himalayas, which will affect water supply.
- The erosion of coastlines. This may cause mass migration from affected areas.
- Severe weather situations, which could damage infrastructure, populated areas, also resulting in mass migration.

Whilst these problems may affect both industrialised and developing nations, they will obviously pose a greater challenge to developing nations, whose capacity and governance levels are lower than those of first world nations. A November 2007 study by International Alert listed 46 countries in which climate change could create a high risk of violent conflict. These countries have a combined population of 2.7 billion, which is roughly 40 per cent of the world’s population. This study also listed an additional 56 countries (combined population of 1.2 billion) where the challenges of climate change could cause instability, which raises

³⁹ Alexander T.J. Lennon et al, The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate Change, Centre for Strategic and International Studies, November 2007, pp.6-7. <http://csis.org/publication/age-consequences>

⁴⁰ ibid., p.55.

⁴¹ ibid., p.42.

the long-term risk of violent conflict.⁴² In other words around 3.9 billion or about 57 per cent of the world's population could face the risk of major instability and/or violent conflict as a result of climate change. The Indonesian government's weak response to the disaster caused by the tsunami in 2004 undermined its authority in various parts of the country. In a state as large and fragile as Indonesia, a failure to respond effectively to natural disasters, be they caused by climate change or not, could fuel extremism and separatism.⁴³

One of the most likely problems to emerge may be that of resource conflict. Desertification in certain regions could result in a struggle for agricultural land. Some consider climate change to be partially responsible for the conflict in Darfur. The desertification in Darfur aggravated tensions between herders and farmers, as there was less land for both groups, triggering conflict. Land disputes in Darfur have increased steadily since the 1970s.⁴⁴ Yousef Takana, a Darfur scholar, lists three traditional, resource-based conflicts between 1968 and 1976; five between 1976 and 1980; and 21 between 1980 and 1998.⁴⁵ In the mid-1980s, when a north-south civil war broke out in Sudan, the central government used Arab militias against the rebels in Darfur. The use of Arab militias thus introduced an ethnic element into the conflict which therefore made it more intractable. Some 2.7 million people fled from their homes, and total casualties are estimated to be around 300,000.⁴⁶ It might be argued that other countries in the Sahelian belt have suffered the impact of global warming, but conflict has only erupted in Sudan. This is true, but the case of Darfur demonstrates how global warming can aggravate a situation that resulted in armed conflict. If global warming intensifies then the potential for conflict elsewhere will increase. Displacement of people also exacerbates the problem. Camps for displaced people in Darfur result in increased deforestation, which in turn increases desertification.

Food Security

The threat to arable land posed by desertification poses a threat to food production, and raises the issue of food security. UN Secretary-General Ban Ki-Moon said in June 2008 that food production needs to rise by 50 per cent by the year 2030 to meet rising demand.⁴⁷ The World Bank report Global Economic Prospects 2009: Commodities at the Crossroads cited FAO estimates that global food demand will increase by about 1.5 per cent a year between now and 2030. Three-quarters of the additional global demand for food between now and 2030 will originate from developing countries.⁴⁸

The Global Trends 2025 study stated that experts currently consider 21 countries with a combined population of about 600 million to be either cropland or freshwater scarce. Owing to continuing population growth, 36 countries, with a population of about 1.4 billion are projected to fall into this category by 2025.

⁴² Dan Smith, Janani Vivekananda, A Climate of Conflict: The links between climate change, peace and war, International Alert, November 2007, p.3. For the list of these countries, see p.44. See also p.18-19. <http://www.international-alert.org/publications/pub.php?p=322>

⁴³ Joshua W. Busby Climate Change and National Security: An Agenda for Action, Council on Foreign Relations, November 2007, p.8. In this particular case, as Busby points out, the separatists decided to hand in their weapons. However the general point remains valid. Failure by governments in fragile states could exacerbate unrest and separatist tendencies. http://www.cfr.org/publication/14862/climate_change_and_national_security.html

⁴⁴ Dan Smith, Janani Vivekananda, A Climate of Conflict, p.12.

⁴⁵ Darfur Rising: Sudan's new crisis, International Crisis Group, 25 March 2004, p.5, fn.21 http://www.crisisgroup.org/library/documents/africa/horn_of_africa/076_darfur_sudan_new_crisis.pdf.

⁴⁶ <http://news.bbc.co.uk/1/hi/world/africa/3496731.stm>

⁴⁷ <http://www.un.org/News/Press/docs/2008/sgsm11612.doc.htm>

⁴⁸ Global Economic Prospects 2009: Commodities at the Crossroads, World Bank 2009. p.72 http://siteresources.worldbank.org/INTGEP2009/Resources/10363_WebPDF-w47.pdf

Global Economic Prospects 2009 states that global temperatures are expected to rise by 0.4 degrees Celsius between now and 2030. The report argues that this could lead “to an overall decline in agricultural productivity of between 1 and 10 per cent by 2030 (compared with a counterfactual where average global temperatures remained stable), India, sub-Saharan Africa and parts of Latin America being the most affected.” The report speculates that over the longer term, agricultural productivity in many developing regions, notably Africa, potentially declining by as much as 25 per cent as compared with a baseline of temperatures remaining stable at their 2030 levels.⁴⁹

The IPCC prediction of a temperature rise of 1-3 degrees Celsius in the next 50 years would mean crop yields falling in the mid to high altitude regions. The Climate of Conflict study argues that the regions most likely to be affected by decreasing crop yields are those which already suffer from food insecurity, such as Southern Africa, Central Asia and South Asia. Dan Smith and Janani Vivekananda draw attention to studies in India which note that production of rice and wheat has already declined as temperature increases.⁵⁰

However although food supply may become a problem in certain areas, global warming is unlikely to cause serious damage to food production in the period up to 2030. The World Bank is fairly sanguine about the food supply situation:

Fears of a food shortage over the long term are unwarranted, however, given the enormous potential for increasing agricultural output through cultivating unused land and increases in yields. Although much of the best agricultural land is already in use, significant opportunities for increasing output remain simply by increasing the amount of land under cultivation. About 12 percent of arable land worldwide that is not currently forested could be brought into agricultural production relatively easily.⁵¹

Furthermore, the slowdown in world population growth should reduce the demand for food. However, if the more drastic warming scenarios become reality, then these predictions could be excessively optimistic.⁵² Indeed it should be noted that in 2006 it was reported that the world grain harvest had failed to match consumption in six of the previous seven years, and that grain stocks were at low levels.⁵³ There is concern about the capability of the global agricultural system to meet demand. In August 2009, the US Agriculture Secretary Tom Vilsack warned about the link between food security and international security. He warned that countries needed to boost food output. He stated:

This is not just about food security, this is about national security, it is about environmental security...I can figure out there are only three things that could happen if people do not have food: people could riot, that they have done; people migrate to place where there is food, which creates additional challenges; or people die.⁵⁴

The current Russian leadership for example is seriously concerned about the capacity of Russian agriculture to ensure food security within the Russian Federation.⁵⁵ In September

⁴⁹ Global Economic Prospects 2009, p.84.

⁵⁰ Dan Smith, Janani Vivekananda, op cit., p.13.

⁵¹ Global Economic Prospects 2009, p.81.

⁵² See the discussion below.

⁵³ David Strahan, The Last Oil Shock: A Survival Guide to the Imminent Extinction of Petroleum Man, London, John Murray, 2007, p.99, fn.27.

⁵⁴ ‘An issue to digest’, The Herald, 11 August 2009. For general discussion of how the world may face increased food security problems over the next few decades, see Paul Roberts, The End of Food: The coming crisis in the world food industry, London, Bloomsbury, 2008; Evan D.G. Fraser Andrew Rimas, Empires of Food: Feast, Famine and the Rise and Fall of Civilizations, London, Random House, 2010. Julian Cribb, The Coming Famine: The Global Food Crisis and What We Can Do to Avoid It, Berkeley, University of California Press, 2010.

⁵⁵ See Dr Steven J Main , ‘Cockroaches, ‘X-Men’ and the “Black Day”’: Food Security

2010 Jiang Shusheng, vice chairman of the Standing Committee of China's National People's Congress (NPC) called for global collective efforts to enhance food security.⁵⁶ A study by the Chinese Ministry of Water Resources warned in July 2010 that soil erosion in China could result in a 40 per cent loss in food production over the next 50 years.⁵⁷

Water Security

This will also be affected by climate change. In 2007 it was stated that 430 million people worldwide currently suffer from water scarcity, and the IPCC predicts that this will increase over time.⁵⁸ Only three per cent of the water on the planet is fresh water, and only one per cent of this three per cent is easily accessible for human consumption. In the 20th century the world population tripled and the use of water grew by a factor of six.⁵⁹ Water security problems will grow in the 21st century. The World Bank report states that “already 15–35 percent of water withdrawals worldwide are not sustainable, in the sense that the amount being withdrawn from aquifers or rivers exceeds the rate at which the source is naturally re-supplied.”⁶⁰ About 85 per cent of water use in the developing world is used in agricultural production. Urbanisation means that city populations will increasingly compete with agriculture for water supplies. Already water supplies in the western USA are being diverted from agriculture to cities. This means that less water is available for irrigation, which will obviously affect agricultural productivity. The Ogallala Aquifer for example, is one of the main irrigation sources for the American breadbasket. It is likely to become unproductive in about 30 years.⁶¹ The UK introduced a water strategy for England in 2008 through to 2030. The then Secretary of State for the Environment, Food and Rural Affairs, Hilary Benn warned that “droughts are likely to be more common. By 2080, some long term climate projections forecast half as much rainfall in summer (nothing like fully offset by 30 per cent more rainfall in winter) in the South East.” The strategy stated that current daily per capita daily consumption in England was 150 litres. The strategy aims at reducing this to 130 litres by 2030.⁶² It should also be noted that it has been estimated that the “average person consumes over 3,400 litres every day, taking into account the water which has gone into making the products we consume, from the car we drive to the food on our plate. This includes water use along the supply chain both in the UK and overseas”.⁶³

The melting of glaciers in certain areas will create serious water supply problems. The IPCC Fourth Assessment Report projects that dry season rainfall will drop by 6 to 16 per cent, while wet season rains will increase by 10 to 31 per cent. Warmer temperatures appear to be contributing to melting the glaciers in the Himalayas. The Himalayan glaciers are an important source for the Indus, Ganges and Brahmaputra rivers. IPCC analyses estimate that India could suffer from outright water stress (this is the annual availability of less than

and the Russian Federation’, Research and Assessment Branch, UK Defence Academy, 09/15, 2009.

⁵⁶ Xinhua, ‘Senior Chinese legislator urges collective efforts to ensure food security’, *Global Times*, 4 September 2010 <http://china.globaltimes.cn/chinanews/2010-09/570193.html>

⁵⁷ Ding Jie, ‘Chinese soil experts warn of massive threat to food security’, *SciDevNet*, 5 August 2010 <http://www.scidev.net/en/news/chinese-soil-experts-warn-of-massive-threat-to-food-security.html>

⁵⁸ Dan Smith Janani Vivekananda *op cit.*, p.13.

⁵⁹ Uttam Kumar Sinha, ‘The Why and What of Water Security’, *Strategic Analysis*, 33, 4, July 2009, p.470.

⁶⁰ *Global Economic Prospects 2009*, p.85.

⁶¹ Dale Allen Pfeiffer, *Eating Fossil Fuels: Oil, food and the Coming Crisis in Agriculture*, Gabriola Island (Canada), New Society Publishers, 2004, p.17. It is worth noting that it takes 1,000 tons of water to grow 1 ton of grain. This is average, with rice being the thirstiest crop, and corn the least thirsty.

⁶² Future Water: the government’s water strategy for England, <http://www.defra.gov.uk/environment/quality/water/strategy/pdf/future-water.pdf>. Water policy in the UK is devolved. Scotland and Wales have their own separate water policies in accordance with EU directives.

⁶³ *Ibid.*

1,000 cubic metres per capita) by 2025, and gross water availability by 37 per cent by mid-century.⁶⁴

In 2005 the World Bank warned that India could face a severe water supply crisis. Per capita surface water availability fell from 2,309 m³ to 1,902 m³ in 2001, and could fall to 1,401 m³ in 2025 and 1,919 m³ in 2050. There is evidence that some rivers are discharging less water. NASA satellites show that groundwater is being depleted in Rajasthan, Punjab and Haryana, with 109 km³ of groundwater being lost over the period 2002-2008.⁶⁵ The dropping of ground water levels is largely due to unsustainable consumption of ground water for irrigation and other uses along with increased run off and evaporation, which climate change will make worse.

China may face major water security problems.⁶⁶ A 2009 World Bank report commented that "Northern China is already a water-scarce region, and China as a whole will soon join the group of water-stressed countries. The combined impact of the widening gap between water demand and limited supplies and the deteriorating water quality caused by widespread pollution suggests that a severe water scarcity crisis is emerging."⁶⁷ Over half of China's 660 cities face water shortages. The World Bank forecasts that by 2020 there could be up to 30 million environmental refugees in China due to water stress. Two-thirds of the country already faces water shortages. Its annual water shortage is 40 billion cubic metres and it uses 30 more cubic kilometres of water than is replaced by rain.

Furthermore, according to Summit Global Management, "75 per cent of China's drinking water is unsuitable for drinking and cooking, and 80 per cent of China's seven major river systems no longer support fish."⁶⁸ The vice-minister of China's Ministry of Water Resources, Jiao Yong, says that China's total water shortage is about 40 billion cubic metres, 7.1 per cent of its total 2005 water consumption. Two-thirds of China's 660 cities are facing water shortage problems. The Ministry of Water Resources states that 64 per cent of ground drinking water is severely polluted, and 54 per cent of China's seven major bodies of water

⁶⁴ David Michel, 'Introduction', in David Michel, Amit Pandya, eds. Indian Climate Policy: Changes and Challenges, Washington, Henry L. Stimson Centre, 2009, pp.3-4.

<http://www.stimson.org/pub.cfm?ID=899>. Peru provides another example of glacial melting. Peru provides another example of glacial melting. Glacial coverage has been reduced by 25% in the last three decades and all glaciers below 5,500 metres (i.e most of them) could disappear by 2015. This could have a serious effect on the national water supply. It will make the task of the management of water resources all the more difficult. Dan Smith, Janani Vivekananda *op cit.*, p.14. Note the IPCC in its Fourth Assessment Report overstated the rate of glacial melting in the Himalayas. See Alister Doyle, 'Himalayan glacier melt overstated', The Independent, 21 January 2010 <http://www.independent.co.uk/environment/climate-change/himalayan-glacier-melt-overstated-1874229.html>

⁶⁵ Chandan Mahanta, 'Climate Change Threats to India's Water Resources and emerging policy responses', in Michel, Pandya eds. *ibid.*, p.20.

⁶⁶ Peter H. Gleick et al. The World's Water 2008-2009: The Biennial Report on Freshwater Resources, Island Press, 2009. <http://www.worldwater.org/data.html> ; For the chapter on China see <http://www.worldwater.org/data20082009/ch05.pdf> ; See also Christina Larson, 'Growing Shortages of Water Threaten China's Development', Yale Environment 360, 26 July 2010, <http://e360.yale.edu/content/feature.msp?id=2298> ; See also the 2030 Water Resources Group, Charting Our Water Future: Economic Frameworks to Inform Decision-Making, The Barilla Group, 2009 http://www.mckinsey.com/App_Media/Reports/Water/Charting_Our_Water_Future_Full_Report_001.pdf

⁶⁷ Jian Xie, Addressing China's Water Scarcity: Recommendations for Selected Water Resource Management Issues, World Bank 2009, p.xix. http://www-wds.worldbank.org/external/default/main?pagePK=64193027&piPK=64187937&theSitePK=523679&menuPK=64187510&searchMenuPK=64187282&theSitePK=523679&entityID=000333037_20090114011126&searchMenuPK=64187282&theSitePK=523679

⁶⁸ <http://www.moneyweek.com/investment-advice/profit-from-combatting-the-worlds-fresh-water-shortage-14645.aspx>

are unsuitable for drinking.⁶⁹ The World Bank warned in 2004 that there could be "a fight between rural interests, urban interests and industrial interests on who gets water in China".⁷⁰ Water scarcity could thus threaten political stability and governance, particularly in countries whose capacity is already limited.⁷¹

There is concern that water scarcity could become a cause of conflict between states as well as within states. There is however debate about the likelihood of such a development. One study argued that there have only been seven cases of water-related, trans-boundary conflict, and of these seven, only four of them resulted in exchanges of fire (two of these four cases involved Israel and Syria).⁷² Indeed cooperation between states on water security is the norm, even between states who regard each other with hostility.⁷³ However if water shortages do become extremely acute in some regions, then it cannot be ruled out that they may become a source of conflict, particularly if migration alters the ethnic balance in areas suffering from water shortages. Water and food shortages may well result in migration from affected regions. Mexico suffers from water shortages, and this could result in increased migration to the USA. Similarly, Europe could also face increased migration from North Africa. As noted above, China faces serious water shortages, and this may cause to look northward to the rivers of Siberia.

Coastline Vulnerability

Rising sea-levels will make coastlines vulnerable. A 2007 study by the International Institute for Environment and Development reported that about 10 per cent of the total global population, 634 million people, live that lie between zero and ten metres above sea level.⁷⁴ Three-quarters of them live in Asia. Some countries, such as Bangladesh are especially vulnerable, as just under half of its population live in low-lying areas. This includes the capital, Dacca, with a population of 12.6 million.⁷⁵ The IPCC predicts that Bangladesh could lose 17 per cent of its land and 30 per cent of its food production by 2050. Rising sea levels and the effects of storms could require mass evacuation.⁷⁶ India has already built a 2,500 mile fence along its border with Bangladesh to counter economic refugees. It is estimated that major flooding in Bangladesh could result in the displacement of 125 million people by the end of the 21st century.⁷⁷

Small island states such as the Maldives could disappear altogether. Obviously many refugees in this situation may move to other countries, which could aggravate tensions. The Stern Report on the Economics of Climate Change of October 2006 estimates that the scale of migration caused by climate change could reach 200 million by 2050.⁷⁸ If global warming is the cause of increased storm and hurricane activity, then incidents such as the damage inflicted on New Orleans by Hurricane Katrina in 2005 could become more common. This particular incident also demonstrates that such disasters will also affect developed countries.

⁶⁹ <http://www.awsc.com.hk/index.php?thispage=business>

⁷⁰ Jonathan Watts, '100 Chinese cities face water crisis, says minister', The Guardian, 8 June 2005
<http://www.guardian.co.uk/world/2005/jun/08/china.jonathanwatts>

⁷¹ In Peru and some other Latin American countries the privatisation of water utilities has caused a decline in supply. In March 2004 there were mass protests in La Libertad (Peru) in response to the deterioration in water supply caused by privatisation. Dan Smith, Janani Vivekananda *op cit.*, p.14. See also the interview with Frederic Lasserre, 'Water scarcity, conflicts and global warming', May 2009
http://www.exploringgeopolitics.org/Interview_Lasserre_Frederic_Water_Scarcity_Conflicts_Wars_Transboundary_Resources_Hydropolitics_Global_Warming_Middle_East_Aral_Sea_China_Geopolitical_Briefing.html

⁷² Alexander T.J. Lennon, *op cit.*, p.16.

⁷³ Utam Kumar Sinha, *op cit.*, p.471-472.

⁷⁴ Joshua W. Busby, *op cit.*, p.8.

⁷⁵ *ibid.*, p.8.

⁷⁶ Brahma Chellaney, 'Climate Risks to Indian National Security', in Michel, Pandya, *op cit.*, p.27.

⁷⁷ Chandan Mahanta, *ibid.*, p.19.

⁷⁸ Nicholas Stern, Stern Review Report on the Economics of Climate Change. October 2006.
http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/stern_review_report.htm

Migration will also become a major problem for developed countries, as migrants will seek to move to more prosperous regions.

Rising sea levels may also cause serious problems for countries' military infrastructures. The study National Security and the Threat of Climate Change noted:

The British Indian Ocean Territory island of Diego Garcia, an atoll in the southern Indian Ocean, is a major logistics hub for US and British forces in the Middle East and is also only a few feet above sea level at its highest point. The consequences of the losing places like Diego Garcia would require advance military planning. The Kwajalein is a low-lying atoll, critical for space operations and missile tests. Guam is the US gateway to Asia and could be moderately or severely affected by rising sea levels. Loss of some forward bases would require the US Armed Forces to have longer range lift and strike capabilities and possibly increase the military's energy needs.

Military bases on the eastern coast of the US are vulnerable to hurricanes and other extreme weather events. In 1992, Hurricane Andrew virtually destroyed Homestead Air Force Base in Florida. In 2004 Hurricane Ivan knocked out Naval Air Station Pensacola for almost a year. Most US Navy and Coast Guard bases are located on the coast, as are most US Marine corps locations. The Army and Air Force also operate bases in low-lying or coastal areas. One meter of sea level rise would inundate much of Norfolk, Virginia, the major East Coast hub for the US Navy. As key installations are degraded, so is the readiness of military forces.⁷⁹

The diplomatic process described above has been hindered by the refusal of the USA to ratify the Kyoto Protocol. However since the advent of the Obama Administration, Washington's attitudes towards CO₂ emissions are changing. One of the most significant developments in 2009 has been the promotion of the American Clean Energy and Security Act (ACES) or the Waxman-Markey bill. This was passed by the US House of Representatives in June 2009. The bill is now waiting approval by the US Senate. The journey through the Senate will be difficult, since several opponents have raised criticism to the potential financial burden on businesses and consumers.⁸⁰ ACES calls for a 17 per cent reduction in carbon emissions from the 2005 level by 2020, and the targets will gradually increase to reach the 83 percent target by 2050.

The Kyoto protocol also suffers from the fact that China and India, who have ratified it, are not obliged to reduce GHG emissions as they are still classified as developing countries. China and India are determined to develop modern industrialised economies, and as a consequence are significant producers of GHGs. However it is of interest to note that there have been indications of a change in official Indian and Chinese attitudes on this issue. Furthermore, given the increasingly close cooperation of these two states with Russia and Brazil within the BRIC format, the attitudes of all four states will now be discussed.

China and Climate Change

China now exceeds the USA as the largest emitter of GHGs, although the USA remains the largest per capita emitter. Coal accounts for about two-thirds of Chinese energy consumption and is likely to continue to do so as the country has large coal reserves. Coal

⁷⁹ Gordon R. Sullivan et al, National Security and the Threat of Climate Change, CNA Corporation, 2007, p.48. <http://securityandclimate.cna.org/report/>

⁸⁰ Nicolas Loris and Ben Lieberman "The 2009 Energy Bill: Anti-Market and Anti-Consumer" Web Memo 2378, the Heritage Foundation, 6 April 2009. <http://www.heritage.org/research/energyandenvironment/wm2378.cfm>

use accounts for 80 per cent of China's carbon emissions, and car emissions account for 6 per cent. The latter will increase, as the size of China's vehicle fleet is likely to grow from the current level of 37 million to 370 million over the next 25 years.

China already suffers from desertification (the Gobi desert is expanding), and could face increased water shortages. In 2004 a UN report stated that most of China's major rivers had shrunk, and in 2006 it was found that the Yangtze River had sunk to an all time low because of climate change.

China has hitherto been reluctant to enter into international agreements to restrict emissions. However attitudes may be changing. In 2006 the Chinese government published its first report on climate change. The government has set national goals of reducing energy intensity by 20 per cent by 2010, and quadrupling GDP while only doubling energy growth by 2020.⁸¹

Chinese President Hu Jintao gave a speech to the UN General Assembly in September 2009, in which he outlined various steps that the Chinese government would make to mitigate the effects of climate change. He advocated four major measures:

- Efforts to conserve energy and improve energy efficiency will be intensified. The leadership will endeavour to cut carbon dioxide emissions per unit of GDP by a notable margin by 2020 from the 2005 level.
- Renewable energy and nuclear energy will be developed. The leadership will endeavour to increase the share of non-fossil fuels in primary energy consumption to around 15 per cent by 2020.
- Forest carbon sink will be increased. The leadership will endeavour to increase forest coverage by 40 million hectares and forest stock volume by 1.3 billion cubic meters by 2020 from the 2005 levels.
- The leadership will step up effort to develop green economy, low-carbon economy and circular economy, and enhance research, development and dissemination of climate-friendly technologies.⁸²

He also made clear that he saw international cooperation in this sphere as something of vital importance. This would appear to indicate a significant change in thinking by Beijing, and may reflect China's possible growing awareness that she should play the role of a responsible stake-holder in the international system. In the July 2009 Major Economies Forum on Energy and Climate in Italy, China stated with 15 other large emitting countries that it would seek to ensure a peak of global and national emissions "as soon as possible." In August 2009 a study by Chinese government think-tanks urged China to set firm targets to limit GHG emissions so they peak around 2030.⁸³ Another report also released in 2009 by the Chinese Academy of Sciences called for peaking between 2030 and 2040.⁸⁴ China is in fact accelerating its investment to become more 'green' in sectors such as transportation, industrial energy efficiency, wind, solar, geothermal, and urban design.⁸⁵ In August 2009

⁸¹ Alexander T.J. Lennon *op cit.*, p.62.

⁸² <http://www.china-un.org/eng/gdxw/t606111.htm>

⁸³ Chris Buckley, 'China study urges greenhouse gas caps, peak in 2030,' Reuters 17 August 2009. <http://www.reuters.com/article/latestCrisis/idUSSP434277> ; See also <http://climateprogress.org/2009/08/17/energy-and-global-warming-news-for-august-17th-china%E2%80%99s-top-climate-policy-advisers-push-for-2030-emissions-peak-australias-bureau-of-meteorology-australias-bureau-of-meteorology-droughtglobal/>

⁸⁴ Julian L. Wong, 'Peaking Duck Beijing's Growing Appetite for Climate Action', 20 August 2009 http://www.americanprogress.org/issues/2009/08/peaking_duck.html

⁸⁵ The Climate Group, *China's Clean Revolution II : Opportunities for a low carbon future*, August 2009 http://www.theclimategroup.org/assets/resources/Chinas_Clean_Revolution_II.PDF

China's State Council, led by Premier Wen Jiabao, said it would incorporate climate change considerations into "the medium and long-term development strategies and plans of government at every level." As noted above, the Chinese government announced in November 2009 that it will take voluntary steps to cut the intensity of its CO₂ emissions.⁸⁶

There may be considerable potential for US-Chinese collaboration in climate change mitigation programmes. The US and China made joint commitments at the July 2009 US–China Strategic and Economic Dialogue in the form of a "Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and the Environment," and during US Energy Secretary Steven Chu's trip to China in July 2009, when climate change was one of the main topics on the agenda.⁸⁷ There may also be potential for closer cooperation between China and the EU on both climate change and energy security.⁸⁸ Some US studies have also argued that there may be scope for US-Chinese military cooperation in various climate change adaptation programmes in various parts of the world. Rymn Parsons in his August 2009 study Taking up the security challenge of climate change suggests that there could be scope for US-Chinese military cooperation in clean water drinking projects in Africa.⁸⁹

However, China's stance at the Copenhagen summit indicates that it is still a long way from accepting significant limitations on its CO₂ emissions, although Beijing feels it can make legitimate criticisms of western approaches to the issue.

India and Climate Change

India had until recently taken a non-cooperative stance on climate change in relation to the major industrialised powers. It had sympathy with the line taken by the G77 nations, namely refusing to commit to any climate action unless developed countries committed to deep cuts in emissions (25 to 40 percent of 1990 levels by 2020) and agreed to provide enormous sums to developing countries, as well as technological and financial assistance, for mitigation and adaptation activities.⁹⁰

In October 2009 The Times of India reported that Indian Environment Minister Jairam Ramesh, had argued in a leaked letter to the Prime Minister Manmohan Singh that India should move away from the Kyoto Protocol, and delink itself from G77 (the 131-member bloc of developing nations) and take on GHG emission reduction commitments under a new deal without any counter-guarantee of finances and technology. He also called for India to permit strict external scrutiny of the mitigation measures it takes at its own cost. Ramesh argued that by doing so, India would align its position on climate change closer to US positions, and those of other members of the developed world.⁹¹ Other major powers in the G77 bloc, such

⁸⁶ See <http://www.independent.co.uk/environment/climate-change/how-key-countries-are-cutting-carbon-emissions-1828907.html>

⁸⁷ Orville Schell, Albert G. Chang et al., A Roadmap for US-China Collaboration on Carbon Capture and Sequestration, Centre for American Progress, November 2009, http://www.americanprogress.org/issues/2009/11/china_ccs.html

⁸⁸ Bernice Lee, Antony Froggatt et al, Changing Climates: Interdependencies on Energy and Climate Security for China and Europe, Royal Institute of International Affairs, November 2007 <http://www.chathamhouse.org.uk/publications/papers/view/-/id/580/>

⁸⁹ Parsons op cit, .p. 8.

⁹⁰ Andrew Light, Julian L. Wong, Sabina Dewan, 'The Changing Climate in India: India Brings New Hope to Global Climate Negotiations', 22 October 2009.

http://www.americanprogress.org/issues/2009/10/india_climate.html

⁹¹ Nitin Sethi, 'Jairam for major shift at climate talks', Times of India, 19 October 2009, <http://timesofindia.indiatimes.com/India/Jairam-for-major-shift-at-climate-talks/articleshow/5136979.cms> ; Andrew Light, Julian L. Wong, Sabina Dewan, op cit., http://www.americanprogress.org/issues/2009/10/india_climate.html

as Brazil, Argentina, and China have also indicated a greater willingness to be flexible over issues like emission reductions, Monitoring, Reporting and Verification (MRV), and Reduced Emissions on Degradation and Deforestation.⁹²

There are logical reasons for India to be concerned about climate change. India is now the fourth largest carbon emitter,⁹³ although this amounts to less than five per cent of GHG emissions.⁹⁴ A 2008 International Energy Agency (IEA) study saw India by 2030 more than quadrupling its GDP to \$12.5 trillion, with its CO₂ emissions reaching 3.4Gt. The melting of the Himalayan glaciers (discussed above) is a major problem, and India could possibly find itself in conflict with China, in view of Beijing's control over the Plateau of Tibet, which is the source of most of Asia's major rivers. China is engaged in major inter-basin and inter-river transfer projects on the Tibetan plateau which could threaten river flows into India. New Delhi has requested greater transparency from Beijing over hydrological data sharing and a commitment not to redirect rivers or reduce cross-border flows. There has been little positive response from China to these requests.⁹⁵

With a coast line of 4,660 miles, India is also particularly vulnerable to rising sea-levels. Salt-water is entering the Ganges, and the intrusion of salt-water into coastal areas is ruining agriculture. Rising temperatures are already affecting food production throughout the country. The rural population of India is 700 million, and these people depend upon sectors which are being heavily affected by climate change, namely agriculture, fishing and forestry. Heavy rainfall has already caused significant economic damage in Mumbai (2005), Bihar (2008), and Karnatka (2009).⁹⁶ India already spends 2.6 per cent of its GDP on climate change adaptation, and it has been estimated by the Indian military that the frequency of flooding has doubled in Asia in the last 30 years, leading to an economic loss of \$32 billion.⁹⁷

India has also undertaken several domestic initiatives, aiming at mitigating climate change:

- A National Solar mission, which sets targets of 20,000 Megawatts (MW) of solar capacity by 2020, 100,000 MW by 2030, and 200,000 MW by 2050.
- A new Renewable energy law that will stipulate mandatory procurements of prescribed minimal renewable energy in every state.
- To expand the size of forests, to enable India to sequester 15-20 per cent of India's total emissions by 2020.
- The National Missions for Enhanced Energy Efficiency which aims to save about 5 per cent of annual energy consumption and nearly 100 million tons of carbon dioxide equivalent annually.⁹⁸

India has argued that cutting emissions is primarily the responsibility of the developed world, which is why it has in the past often been perceived as uncooperative in the sphere of climate change. This is still the view of the Indian government, but it does appear to be slowly moving to a more cooperative stance vis-à-vis the developed nations, although there is still a considerable difference in outlook. In September 2009, Ramesh stated:

⁹² Udit Mathur and George C. Varughese, 'From "Obstructionist" to Leading Player. Transforming India's International Image', in Michel, Pandya eds, *op cit.*, p.46.

⁹³ Michel in *ibid.*, p.2.

⁹⁴ India's Climate Change Forecast, CFR Interview with Jairam Ramesh, Minister of State for Environment and Forests, India 22 September 2009, <http://www.cfr.org/publication/20248/>

⁹⁵ Brahma Chellaney in Michel, Pandya eds, *op cit.*, p.25-26.

⁹⁶ Malini Mehra, 'India's role in confronting Climate Change From Vulnerability to Opportunity', in Michel, Pandya, *ibid.*, p.37-38.

⁹⁷ *ibid.*, p.38

⁹⁸ Udit Mathur and George C. Varughese, in Michel, Pandya *op cit.*, p.45.

In the United States and the developed world, emissions are lifestyle emissions. For us, emissions are developmental emissions. If you take income class to income class, social strata to social strata, the carbon footprint of an Indian is far lower than the carbon footprint of an American or a European.⁹⁹

Russia and Climate Change¹⁰⁰

The Russian Federation is the third largest emitter of GHGs, after the USA and China. It accounts for six to seven per cent of GHG emissions. According to 2003 figures, the USA accounts for 24 per cent, and China for 13 per cent.¹⁰¹ The breakup of the USSR in 1991 and the substantial reduction in the size of the post-Soviet Russian economy meant that CO₂ emissions declined significantly. As of 2006, Russian CO emissions were 37 per cent lower than they had been in 1990.

The Russian Federation did not ratify the Kyoto Protocol until 2004. This enabled the Protocol to come into force in 2005. Annex B of the Protocol set limits to Russia's GHG emission at the end of the Protocol first commitment period (2008-2012) at the level of country's GHG emissions in 1990.

In June 2009, Dmitry Medvedev announced an emissions reduction plan that would actually increase emissions from the current level by 30 per cent more than the 2009 level. This would still be about 10-15 per cent less than the 1990 level. Medvedev said that the targets in his plan would amount to cumulative cuts of 30 billion tonnes of greenhouse gases from 1990 to 2020. This implies Russia will emit about 3 billion tonnes of greenhouse gas in 2020 compared with 2.2 billion tonnes in 2007.¹⁰²

In December 2009, Medvedev signed into law the climate doctrine of the Russian Federation.¹⁰³ At this time the Kremlin stated that by 2020 Russia would seek to cut the rise in its GHG by 25 per cent in relation to the 1990 level, cutting the level of emissions by over 30 billion tonnes by 2020.¹⁰⁴ However, presidential adviser Arkady Dvorkovich said Russia would not make changes to its policies on climate change if it damaged the economy.¹⁰⁵

The issue of climate change was discussed further by the Russian leadership at a meeting of the Security Council in March 2010. This meeting discussed legislation that is to be introduced to implement the climate doctrine by October 2010. He pointed out that the Russian Federation was "still quite a long way behind most developed countries in

⁹⁹ India's Climate Change forecast, [op cit](#).

¹⁰⁰ The possible implications for Russia of climate change are discussed in Boris Porfiriev, 'Climate Change and Economy: A Risk for or a Factor of Development?' *Russia in Global Affairs*, April-June 2010 http://eng.globalaffairs.ru/number/Climate_Change_and_Economy-14899

¹⁰¹ Renat Perelet, Serguey Pegov and Mikhail Yulkin, *Human Development Report 2007/2008 Fighting climate change: Human solidarity in a divided world* UN Human Development Report Office OCCASIONAL PAPER Climate Change. Russia Country Paper, p.9.

http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/perelet_renat_pegov_yulkin.pdf

¹⁰² Simon Shuster, 'Russia Offers Climate Plan with no real bite', Reuters 19 June 2009.

<http://www.reuters.com/article/idUSTRE55I3CP20090619?pageNumber=1&virtualBrandChannel=0>

¹⁰³ <http://archive.kremlin.ru/eng/text/docs/2009/12/223509.shtml> . For a discussion of the doctrine when it was at draft stage, see Anna Korppoo, *The Russian Debate on Climate Doctrine*, UPI Briefing Paper 33, Finnish Institute of International Affairs, 5 June 2009. <http://www.isn.ethz.ch/isn/Digital-Library/Publications/Detail/?ots591=cab359a3-9328-19cc-a1d2-8023e646b22c&lng=en&id=101547> See also the interview with the Minister of Natural Resources, Yury Trutnev in *Rossiyskaya Gazeta*, 11 January 2010. <http://www.mnr.gov.ru/part/?act=more&id=4613&pid=729>

¹⁰⁴ Interfax news agency, Moscow, 17 December 2009

¹⁰⁵ ITAR-TASS news agency, Moscow, 17 December 2009; Interfax news agency, Moscow, in Russian 0819 gmt 17 December 2009

monitoring and forecasting climate change.” He said that “we are still unable to carry out on-going meteorological studies of the Arctic region.”

He also commented:

We still lack a clear organizational system for managing climate research, both fundamental and applied. We need a single centre and single research plan that includes forecasting national security threats and offering effective recommendations for adapting to climate change at the national level and at the level of specific regions and industries.

Medvedev warned of the tendency of developed countries to engage in “carbon protectionism”, which could result in unilateral decisions which “could limit export opportunities for some of Russia’s commodities on international markets and serve as a pretext for increasing unfair competition against Russia.”¹⁰⁶

Some Russian analysts are quite sanguine about the possible impact of climate change. It has been argued that it could result in improved agricultural yields as agricultural land would become less frost vulnerable. The UNDP study of 2007 comments that “as a whole, health and quality of a life of Russians in connection with global warming should improve. Comfort of a climate and the area of a comfortable zone of residing will increase. The labour potential as a whole would increase, positive changes in working conditions and labour capacity in northern areas will be especially appreciable.”¹⁰⁷

This study also suggests that “housing, building and engineering construction, pipelines and their maintenance, as well as mining industries will require less heating and frost resisting equipment and therefore will become less energy-consuming, feature lower production costs and may become more competitive in world markets.”¹⁰⁸

However there are also possible negative consequences. Southern regions are likely to face increased droughts (Russia in 2010 suffered from a serious drought, and 23 regions were forced to declare a state of emergency). About 10 million hectares of crops have been destroyed. It is also feared that a warmer climate will increase the prevalence of insect-borne diseases.

Climate change has also had an adverse effect on some industries. In Archangelskaya region forestry has “suffered due to delayed winters since logging was practiced during the snowy season when it is easier to transport the timber from forests...Logging has markedly decreased over the last two years which affected sawmilling and pulp and paper production.”¹⁰⁹ There has been an increase in forest fires, and permafrost thawing has led to the formation of lakes with water dissolved methane dangerous to humans. Southern Russia now experiences water shortages due to increased droughts. Permafrost thawing will also require increased investment in underpinning infrastructure in northern regions, such as the Baikal-Amur railway and East Siberia Pacific oil pipeline. The entire cost of pipeline construction could increase. River flooding has increased in recent years. The river Lena has caused severe floods in the last nine years. Sixty-two towns and villages were badly affected by flooding in 2001 and the town of Lensk was completely inundated. The Bellona group said in 2009 that a century ago, Russia every year suffered 150 to 200 “dangerous natural phenomena,” such as flooding. Now the number of such events has risen to 300 to 400 annually.¹¹⁰

¹⁰⁶ http://archive.kremlin.ru/eng/speeches/2010/03/17/1931_type82913_224806.shtml

¹⁰⁷ Perelet et al *op cit.*, p.20.

¹⁰⁸ *Ibid.*, p.19.

¹⁰⁹ *Ibid.*, p.21.

¹¹⁰ Paul Goble, ‘Environmentalists Say New Climate Doctrine Focuses on Reacting to Change, Rather Than Preventing It’, Moscow Times, 14 May 2009.

Brazil and Climate Change

Brazil is not a significant emitter of GHGs. Brazilian per capita carbon emissions are less than half the world average, and will remain low, as her dependence on hydrocarbon energy sources will remain minimal. However, in view of her prominent role in the G20, her role as a champion of the developing world, and as custodian of the Amazon rain forests, Brazil's attitude towards climate change is important. The rate of deforestation in Brazil put her in fifth place in 2009 in the carbon emissions table.¹¹¹

Unlike most developed and many developing countries, Brazil's energy sector contributes little to the country's greenhouse gas emissions. Unsustainable land use and forestry contribute most.

In international negotiations, Brazil points out that climate change is driven more by the accumulation of GHGs in the atmosphere than by yearly emissions, primarily because CO₂ remains in the atmosphere for more than a century on average. Yearly emissions data therefore generally overestimate developing countries' contributions to climate change, and underestimate that of developed countries. Brazil therefore says that it will not limit its greenhouse gas emissions until the middle of the 21st century.

A National Climate Change Plan was introduced in December 2008. The two main challenges in achieving the objective of reducing greenhouse gas emissions are emissions from land use, land use change and forestry and to follow a low carbon path of development.

The plan focuses on seven areas:

1. Low carbon development
2. Renewable electricity
3. Biofuels
4. Deforestation
5. Forest cover
6. Vulnerability and adaption
7. Research and development

Brazil wants to keep a high share of renewable energy in the energy matrix. The aim is to encourage the development of the ethanol programme. Under the plan, deforestation is to be reduced by 70 per cent by 2018 (The goal is a 70 per cent reduction in deforestation by 2018 over the average between 1996 and 2006.), which would avoid 4.8 billion tons of greenhouse gas emissions. Brazil wants "to eliminate net loss of forest cover by 2015".

Goals include getting 7,000 MW of power from renewable energy between 2008 and 2010, increasing production of ethanol from 25.6bn litres in 2008 to 53.2bn litres by 2017, and preventing the release 570m tonnes of carbon dioxide between 2008 and 2017 by using biofuels.¹¹²

<http://www.themoscowtimes.com/columns//article/environmentalists-say-new-climate-doctrine-focuses-on-reacting-to-change-rather-than-preventing-it/377125.html>

¹¹¹ Michael McCarthy, 'Historic chance to halt the scourge of deforestation', *The Independent*, 26 October 2009 <http://www.independent.co.uk/environment/climate-change/historic-chance-to-halt-the-scourge-of-deforestation-1809418.html>

¹¹² GOVERNMENT OF BRAZIL Interministerial Committee on Climate Change Decree No. 6263 of November 21, 2007 EXECUTIVE SUMMARY NATIONAL PLAN ON CLIMATE CHANGE BRAZIL DECEMBER 2008. http://www.elaw.org/system/files/Brazil+Climate+Change_0.pdf

In December 2009, following the Copenhagen summit, President Lula signed into law requiring that Brazil cut greenhouse gas emissions by 39 per cent by 2020.¹¹³ Like India and China, Brazil is also wary of what she sees as a possible attempt by industrialised nations to avoid their historic responsibility for global warming, and she wishes to ensure that the resolution of the problem of climate change is not achieved at the expense of the economic progress of developing nations.¹¹⁴

Climate Change: Security Implications

As noted above, climate change can both create and exacerbate a shortage of resources, and pose an additional challenge to the existing problems of food and water security. These could lead to armed conflict. In addition migration from affected areas, including displaced persons and refugees from conflict zones will place a strain on the places to which persons flee. This could be another source of conflict both between and within states.

These problems could turn weak states into failed ones, and significantly weaken the capacity of even strong states. The lack of adequate governance capacity in developing countries could place a strain on resources that could lead to protest and conflict within these countries. This may result in intervention by major powers as peace-keeping or peace-making forces. Armed forces may also play a role in post-conflict stabilisation or even in engage in “pre-conflict” intervention in order to help promote conflict prevention mechanisms. There is obviously the danger that failing states in strategic regions may become the object of geopolitical competition or even conflict between major powers.

The Armed Forces may also be able to help in various climate change mitigation and adaptation projects in developing countries. Such projects, assuming they are successfully implemented, may help to reduce tensions within a community and avoid conflict. They will also promote cooperation between the Armed Forces of different states, and help contribute to global governance. Involvement in such operations is likely to become a regular feature of defence planning for western Armed Forces in the years to come. By law, climate change is now an essential consideration in US DoD planning and operations.¹¹⁵

Major instability that may be caused by freak weather incidents or an influx of refugees from affected areas will not only pose a security challenge to developing nations. They will also affect developed nations. Hurricane Katrina in New Orleans in 2005 constitutes a clear example of the challenge that could be posed to internal security and rescue services.¹¹⁶

¹¹³ Brazil's Lula signs law cutting CO₂ emissions, AFP 29 December 2009

<http://www.google.com/hostednews/afp/article/ALeqM5iez9sn2BkTTmjkMO-JxaGawmSrdw>

¹¹⁴ See President Lula's speech at the Copenhagen Conference, December 2009.

<http://climatechange.thinkaboutit.eu/think2/post/pre>

¹¹⁵ Parsons *op cit.*, p.9, fn. 121.

¹¹⁶ http://en.wikipedia.org/wiki/Criticism_of_government_response_to_Hurricane_Katrina

SPECIAL CASE STUDY **THE ARCTIC: ARENA FOR AN ICE WAR?**

Dr Steven J. Main

Whilst the warming of the Arctic is not a new phenomenon – indeed, it has been an observable scientific fact since the 1920s¹¹⁷ - there is now very little doubt that the overwhelming body of scientific evidence would clearly show that surface temperatures on Earth are warming up at a rate signalling a major shift both in terms of weather patterns and, subsequently, global climate. What makes this shift different from previous shifts in the world's climate is that earlier climate change was due to natural causes - variations in the earth's orbit, affecting the amount of sunlight reaching the Earth's surface, for instance. This episode is different, in as much as it would appear to stem directly from human activity on the planet, rather than some natural cycle of alternative cooling and warming of the Earth's surface temperature. As is already a matter of well-established scientific record, burning of hydrocarbon fuels - coal, oil, gas - has caused an increase in the levels of heat-trapping carbon dioxide in the atmosphere, causing mean global temperature to increase by 1 degree Fahrenheit over the past 30 years, or so. In short, unless carbon dioxide emissions are drastically cut, Earth will likely continue to heat up and, as has already been evidenced by various extreme weather events both here and abroad, the future long-term consequences for the planet could be so fundamental that they could well spell very drastic changes in human activity on the planet.¹¹⁸

In looking at one particular example - namely the effect of climate change on the Arctic and how this could impact on global energy security - it is hoped that this small section will simply highlight potentially one of the main areas of concern for future global and energy security, not only for the countries who have a direct interest in the Arctic region, but also for states elsewhere, far removed from the Arctic. Russia's interests in the region are both long-standing and significant and reveal that, both now and in the future, Russia will still play a key role, (if not *the* key role), in determining the long-term of, potentially at least, one of the world's major security hotspots of the 21st century.

With an Arctic border stretching some 12,430 miles, by this fact alone, if nothing else, Russia, in relation to the Arctic, is A major player in the region and, indeed, in the eyes of many Russians, it is THE major player:

“Russia is the most prominent Arctic power. In the consciousness of many generations of our people, the North was an indelible part of their understanding of the greatness of Russia. And...it is no accident that the great [Russian] Navy man and scientist, Admiral S Makarov, compared Russia to a building whose front faced the Northern Ice [Arctic] Ocean. For many decades, the Russian states has poured significant financial and material resources, knowledge, effort, as well as many human lives, into the study and taming of its northern territories and seas, containing great natural wealth. That is why the Arctic, for Russia, is and will be in the future, of exceptional significance.”¹¹⁹

Thus, whatever policies it adopts here – be they designed to exploit further the regions' rich deposits of oil, gas, coal, mineral ores; enhance its national security; strengthen the long-neglected civil infra-structure, etc. – these policies will have a knock-on effect on the policies of the other members of the 'Arctic Five' (the so-called "Arctic Five" are countries who have declared territorial claims on the Arctic and include not only Russia, but also USA, Canada,

¹¹⁷ See, for instance, the section in an early Soviet work on the Arctic, N N Zubov, “V Tsentr Arktiki”, (M.1940, 239 pp.,) entitled, “Potopleniye Arktiki” (“The warming of the Arctic”), 220-229.

¹¹⁸ B McKibben, 'Carbon's new math', *National Geographic*, vol.212, no.4, October 2007, 32-37.

¹¹⁹ Rear-Admiral A Rudomyotkin, Captain (1st class) A Nagorskiy, “Arktika kak vazhneyshee napravleniye Rossiyskoi morskoi deyatel'nosti”, *Morskoi sbornik*, 8, 2010, 64-69; 69.

Norway and Denmark. Thus, since four of the five states are NATO members, the Arctic is also of no small interest to NATO, this is another area where Russia and NATO could either compete, or co-operate).¹²⁰

Climate change, natural resources and the Arctic

The drastic climate changes in the Arctic, pronounced as "alarming" by the UN Secretary-General Ban Ki Moon, in September 2008, threaten not only to dramatically increase the world's sea-levels, as well as produce more extreme weather events, but also open the way to an intensified political struggle between the Arctic Five member-states, competing to control either much of the natural wealth of the Arctic, as well as the potentially very lucrative Northern Sea Route. One of Russia's leading military analysts on Arctic affairs recently stated that:

"the increased interest of a number of foreign states in the region is conditioned by a number of factors. Amongst the best known factors [behind this] is, first and foremost, global climate change which, probably, will not only give birth to physical changes in the natural world, but will strain inter-state relations in connection with energy supplies, maritime transport routes [Northern Sea Route], bio-resources, the drop in water and food resources."¹²¹

It has been estimated that since scientists began monitoring the level of sea ice in and around the Arctic in the late 1970s, one third of the Arctic's summer ice has vanished, reaching a record low in September 2007.¹²² If current trends continue, according to some experts, the Arctic could be ice free either by 2070, or even earlier - by 2040.¹²³ This, in turn, would mean more of the region's natural resources being open - quite literally, in some respects - to commercial exploitation, particularly in previously hitherto inaccessible regions of the Arctic, as well as increasing the commercial attractiveness of the Northern Sea Route to growing amounts of freight traffic, moving goods from the markets of Asia to Europe, and beyond. At 5,500 km in length, the Northern Sea Route could represent the shortest transport artery linking Europe and the Far East, if properly developed.¹²⁴ Furthermore, according to experts from the US Geological Survey, the Arctic could hold as much as 13 per cent of the world's undiscovered oil and 30 per cent of its undiscovered natural gas.¹²⁵ For his part, quoting figures produced by the Russian Oil and Gas Institute, Sosnin stated that, by 2030, Russia could be extracting upwards of 30m tonnes of oil and 130bn cubic metres of gas from the Arctic shelf.¹²⁶ Similarly, quoting other figures produced by Russia's Ministry of Natural Resources, Smolovskiy stated that Russia's Arctic zone could hold as much as 586bn barrels of oil, more than double the existing reserves of Saudi Arabia.¹²⁷

Although Russians do not dispute the overall figures, they also point out that, other than the huge reserves of hydrocarbons contained in the Arctic, the region also contains as much as 90 per cent of the world's reserves of nickel and cobalt, 60 per cent of the world's copper, 96 per cent of its platinum.¹²⁸ According to one of Russia's most prominent experts on the Arctic, Dr M Shestopalov:

¹²⁰ T Parfitt, 'Russia plans military force to protect Arctic, as 'cold rush' intensifies', *The Independent*, 28 March 2009; T Halpin, 'Russia warns of war within decade over hunt for oil and gas', *The Times*, 14 May 2009; T Coghlan, 'NATO chief warns of conflict in the Arctic', *The Times*, 3 October 2009.

¹²¹ Captain (1st class) A Smolovskiy, "Arktika-2010. Voенно-politicheskiye, transportnye i drugie arkticheskiye factory", *Morskoj sbornik*, 7, 2010, 38-44; 38.

¹²² R Howard, 'Cold War in the Arctic', *The Independent*, 4 September 2009.

¹²³ V Kuzar, 'Arktika: pole bitvy', *Krasnaya Zvezda*, 29 May 2008.

¹²⁴ Major-General V I Sosnin, "Arktika-slozhnyy uzel mezghosudarstvennykh voennykh protivorechiy", *Voennaya mys'*, 7, 2010, 3-9; 5.

¹²⁵ Howard, *ibid.*

¹²⁶ Sosnin, *ibid.*, 8.

¹²⁷ Smolovskiy, *ibid.*, 42.

¹²⁸ A Diyev, 'Arkticheskaya strategiya Rossii', *Krasnaya Zvezda*, 8 April 2009.

"according to a number of estimates, the total value of known reserves of the mineral wealth of the Arctic is between \$1.5-2 trillion."¹²⁹

Quite simply, Russia's Arctic zone "is the strategic resource base for the country" and is seen as vital for the country's future socio-economic development.¹³⁰

The future accessibility of much of what was previously inaccessible has also been far from lost on many Western experts and, as stated by some here, could well be the cause of further tension between all states directly involved in seeking to exploit the region's mineral and hydrocarbon wealth:

exploiting many of these resources would not currently be commercially viable...but the Arctic Five know that, over the coming decades, new engineering techniques could realise what can now only be dreamt of...Natural resources apart, neighbouring countries are also deeply aware that an ice-free Arctic Ocean would have all sorts of important, even alarming, strategic repercussions. Russia, deeply conscious of its national security, now faces the prospect of a new 'fourth' front line - a hostile power launching a naval attack over the North Pole against its naval bases and key oil and gas fields along its northern coast.¹³¹

Thus, it is not surprising that, with such potential wealth at stake, as well as resources guaranteed to ensure the economic well-being of the country for years to come, a number of Russian analysts, looking ahead, predict that the "resource grab" for the region could hot up quite quickly and not, necessarily, be resolved peacefully:

"everyone is more intensely pressing their legal case for this very rich region and, on top of that, it is vital to do this as quickly as possible, as the struggle for the Arctic's resources [intensifies]. No one hides the fact that the struggle will become sufficiently fierce – you see, in the not too distant future, this question may [simply] become an issue of survival."¹³²

Russia's threat perceptions in the North

One of the unforeseen consequences of the collapse of the USSR in 1991 was that the strategic importance of the Arctic would increase:

"as a result of the collapse of the USSR, the Russian Federation was deprived of significant access to the Baltic, Black and Caspian Seas. Objectively, this meant the quickest possible necessary development of the Arctic seas and coast."¹³³

As the overall strategic importance of the Arctic increased, so did the perception heighten of a possible military threat to Russia's hold of the region. In one particular analysis of the possible threat to the Northern Sea Route, published in the highly respected journal of the Military-Science Academy of Russia, the author outlined the following scenario:

"along the North Sea route, cargo is transported through the ports of Dikson, Dudinka, Khatanga and Pesina, wood is transported. There is a direct air link between Noril'sk and Moscow. In the local industrial complex in Noril'sk, there is a nuclear reactor. In the ports of Dikson and Dudinka, for the purpose of ensuring the navigability of the North Sea route, there are two nuclear-powered ice-breakers.

¹²⁹ M Shestopalov, 'Vektor ustremleniy - Arktika', *Vozdushno-kosmicheskaya oborona*, 6, 2008, 16-24, 18.

¹³⁰ Diyeu, *ibid.*

¹³¹ Howard, *ibid.*

¹³² Rudyomyotkin, *ibid.*, 65.

¹³³ *ibid.*, 64.

Grounds for occupying the region may be served by a myth about the violation of steps [designed] to forestall a terrorist attack on the atomic reactors on board the ships and/or in the scientific-research institute of the furnace-metallurgical complex. Such grounds could serve as a basis for taking under control the adjacent territory of the North Sea route.

The most likely way of seizing the airport will be by airborne assault. Subsequently, its units would take control of the railway line, the pipelines, the mineral deposits and other targets. The creation of the infrastructure for the occupation forces would be possible by means of supplies of equipment and other materials being shipped in through the ports of Dikson, Dudinka and Khatanga... To seize and subsequently secure the [occupation] regime, for example in Noril'sk, with a population of [only] 170,000, only one battalion would be required. To control other towns, other targets, one squad each.¹³⁴

Playing the Chinese card, so to speak, Korabel'nikov, is also quick to point out that China has long held ambitions in the "disputed territories" in the Russian Far East, strategically not that far away from the Russian North, and:

in the event of a crisis situation arising in bilateral relations between the two countries, the PRC [China] may send its Armed Forces to the Russian Federation on the pretext of defending the security and interests of the Chinese, living in the 'disputed' territories of the Far East and Siberia.¹³⁵

China aside, Russia is also extremely wary about US intentions towards the Arctic:

"the presence of the US military [in the Arctic] on a permanent basis is not unexpected... The [main] object of interest for the USA is not only... the oil and gas, but also the sea transport corridors which [have] become more and more suitable for active, year-round exploitation due to the melting of the Arctic ice as a result of climate warning."¹³⁶

Bearing this in mind, there is probably very little doubt that the Russians will not have been well-enamoured to have noted the comments made by the US Navy's Oceanographer, Rear-Admiral David Titley, earlier this, year, speculating on the need for the US to seriously think about "ice-hardening its ships and submarines" in order for the latter to be able to venture forth into the Arctic:

"the Bering Straits now is a strategic backwater. But if what we have been talking comes true with significant trade in the Arctic region in 30 to 40 years, and if the world is still one in which hydrocarbons play a significant role for power, heating, lighting, energy extraction may be coming southbound through the Bering Straits... So we need ice-hardened surface ships. If so, how many? To what degree do we need to have ships that can safely operate inside the ice-pack? If we're going to be operating in pack-ice, then you need to look at what hull

¹³⁴ Colonel A A Korabel'nikov, 'Ob ugrozakh na severe Rossii i vozmozhnosti adekvatno reagirovat' na nikh', *Vestnik Akademii Voennykh Nauk*, 4, 2007, 33-38, 37. Despite the enormous size of the Russian Arctic zone - calculated at 6 million square km, it has a population of slightly more than 1 million people, 136,000 of whom are the indigenous peoples of the North, (A Diyev, 'Arkticheskoye budushchee Rossii', *Krasnaya Zvezda*, 14 May 2009).

¹³⁵ Korabel'nikov, *ibid.*, 36. In this particular context, it is also worth noting, as some Russian commentators have done, that China has a nuclear-powered ice-breaker in its fleet, the "Snow Dragon", which "regularly sails to the Arctic Ocean. Clearly not to study the Northern Lights", (P Inozemtsev, 'NATO rvetsya k belym mishkam', *Izvestiya*, 2 February 2009). A few more reports of China's potential threat to Russia in the Arctic have also appeared recently: A Smirnov, "Arkticheskoye dykhaniye Kitaya", *Novye Izvestiya*, 3/3/2010; A Smirnov, "Zolotyie marshruty", *Novye Izvestiya*, 18/3/2010.

¹³⁶ Sosnin, *ibid.*, 8.

structure is needed. Ice-breaking ships have rounded hulls, but combat vessels are not built like that."¹³⁷

Concluding his interview, Titley affirmed that his studies on this whole issue would be completed by soon and a decision on whether to finance a new-look Navy for the Arctic taken "in time for the fiscal year 2013."¹³⁸

Thus, when Russians planted their flag at the depths of the Arctic Ocean in August 2007, it was an important symbolic gesture, designed not only to further solidify Russian territorial claims on the region, but also as a clear warning signal to all and sundry: this is Russian soil. Keep off!¹³⁹ They are very aware that, given the world's seemingly insatiable demand for hydrocarbons, at least for the foreseeable future, any source of "fresh" supplies of both oil and gas are going to attract a lot of interest on the geostrategic stage and, if the analysis by both US, Russian government experts and other interested parties are correct and the Arctic does contain the significant reserves of both oil and gas, as widely predicted, then pressure will be brought to bear to extract the reserves, just as soon as the technology becomes available and get the oil and gas to the customer as quickly as possible.¹⁴⁰

In order to further solidify Russian policy towards the protection and development of Russia's interests in the region, in September 2008, the Russian Security Council passed a decree, signed by the President, Dmitry Medvedev, simply entitled "the fundamental [basis] of the state policy of the Russian Federation in the Arctic up to and including the year 2020."¹⁴¹ On publication, the document produced a degree of alarm in the West, due to the Russian government's declared intent of creating a military force in order to protect the nation's interests in the Arctic. In the words of the document, Russia aims:

to create a group of general purpose troops of the Armed Forces of the Russian Federation, other troops, military formations and organs, in the first instance, organs of the border guards, in the Russian Federation's Arctic zone, able to maintain military security under varying military-political conditions.¹⁴²

In analysing the role of the general purpose forces in the Arctic, according to one Russian Rear-Admiral, the former have a very specific role in combating US and NATO influence in the region:

"negative outside factors have manifested themselves in the attempts by foreign states to internationalise the Northern Sea Route, exploit the natural resources of the Russian Arctic and conduct...research. To combat the growing US and NATO military-political influence in the Arctic, Russia is creating in the Arctic zone a group of general purpose forces of the Armed Forces of the RF and Coastal Defence of the FSB of the RF."¹⁴³

This was immediately seized on by various commentators in the West as further evidence that Russia was seeking to gain some early advantage in the future northern dash to exploit

¹³⁷ M Evans, "The new frontier: how retreating ice is putting the navy on climate watch", *The Times*, 7/7/2010.

¹³⁸ *Ibid.*

¹³⁹ Thus, even though there is some dispute about whether, or not, Russia did plant a flag at the depths of the Arctic Ocean in August 2007, nevertheless, the symbolic part of the gesture was what really mattered, both to the Russian political class and the domestic public audience, (M Elder, 'Russia should unilaterally seize Arctic territory, says Medvedev', *The Daily Telegraph*, 18 September 2008).

¹⁴⁰ R Anderson, C Hoyos, 'Talks aim to avert oil rush', *The Financial Times*, 28 May 2008.

¹⁴¹ <http://www.scrf.gov.ru/searchhl?url=news/352.html&mime=text/html&charset=utf...>; Diyeu, 'Arkticheskaya strategiya...', *ibid.*

¹⁴² Diyeu, *ibid.*

¹⁴³ Rear-Admiral, Professor A Yakovlev, G Lebedev, "Kto upravlyaet Severnym morskim putem?", *Morskoi sbornik*, 6, 2010, 34-43; 36.

the Arctic's natural wealth, rather neatly summed up in an editorial published not long after the Kremlin's announcement of its new Arctic strategy:

during the Cold War, Moscow's leverage depended on its military might. Today, vast reserves of oil and gas, lying between the hungry markets of Europe and Asia, have taken over that role. The importance that Russia attaches to hydrocarbons diplomacy was underlined yesterday by President Dmitry Medvedev's call for a formal demarcation of the territory that it claims under the Arctic Ocean. Its aggressive policy towards a region whose melting ice cap offers access to possibly huge energy and mineral deposits was dramatically illustrated last year by the planting of a Russian flag on the seabed at the North Pole...The front line of the confrontation between Russia and the West has shifted from the North German Plain to the fossil fuel deposits that lie beneath Siberia and the Arctic.¹⁴⁴

Conclusion

As in many other areas, the view from Russia of the Arctic is very different from that which exists in the West. Russia has interests in the Arctic, vital, as far as the security and well-being of its people are concerned, to the long-term future of the country, as a whole. As far as the government is concerned, steps have to be taken now, in order partly to make up for the degradation of the infrastructure which has taken place all over the Russian zone of the Arctic ever since the collapse of the USSR, as well as ensure that what, as far as Russia is concerned, is Russian remains under Russian control.¹⁴⁵

Like all other countries in the world, climate change, both in relation to the Arctic, as well as elsewhere in Russia, is going to have a major impact on the country's socio-economic development. In specific terms of the Arctic warming up, previously inaccessible reserves of oil, gas, coal, minerals, locked away for aeons in the Arctic ice, (with the necessary advances in engineering technology), will become accessible and should help to alleviate, partly and for a limited period of time, the hydrocarbon fuel demands of the world's advanced economies. However, even the Arctic's reserves are finite and can only offset the inevitable for a certain period of time. In the mean time, Russia has clearly signalled its intent not to be bullied, ignored, or "treated" out of what it considers its legitimate claims to a significant proportion of the Arctic's natural hydrocarbon and mineral wealth. With the increasing likelihood that warming of the Arctic ice will make the Northern Sea Route increasingly more navigable, (cutting down the journey time for transporting goods from Tokyo-Rotterdam by up to 40 per cent, for example¹⁴⁶), Russia faces the added possibility that this, in itself, could also become an area of tension between it and the West:

With the improvement in conditions for navigation...comes with it a number of not inconsiderable difficulties. The Northern Sea route will become part of the 'global agenda'. The trans-national corporations and, behind them, the financial circles, will combine to internationalise 'this corridor' right along the [full] length of Russia's Arctic coastline under the superficially benevolent pretext of modernising it and maintaining the security of passage [in order to achieve this] (they will find an excuse: old mines, pirates, dangers of the ice, etc)...¹⁴⁷

Thus, climate change in the Arctic would appear to have both a considerable plus side for Russia's socio-economic development, as well as potentially increasing the danger of further tension between itself and the other member-states of the Arctic Five, as well as those not all that far away, geographically speaking. Its decision to press ahead its claims even by arcane methods, as well as its proposals to improve both the local military and civilian

¹⁴⁴ 'Russia's Arctic designs', The Daily Telegraph, 18 September 2008.

¹⁴⁵ Diyev, 'Arkticheskaya strategiya...', ibid.

¹⁴⁶ Ibid.

¹⁴⁷ Ibid.

infrastructure, are as much for the benefit of the foreign, as well as the domestic audiences: Russia wants everyone to know that in this new "drive to the North", Russia will be at the forefront. It will not be left behind. In the words of one Western commentator of Russia's Arctic hopes and aspirations, however, the former expressed a degree of cautious optimism for the future:

"yet if there is one country that will shape the future of the Arctic, it is Russia. Its interests are substantial, grounded in history and geo-politics, and sharpened by climate change and resource hunger...Correctly understood, Russia's attitude towards the Arctic are not necessarily alarming. However, they require management and diplomacy on the part of other Arctic countries, and organisations such as NATO."¹⁴⁸

Not too much to ask for, is it?

The Energy Crunch

Energy security is a separate issue, although it is integrally linked with climate change.¹⁴⁹ The use of fossil fuels is a major contributor to CO₂ emissions, and so any reduction in their use and their replacement by renewable energy sources constitutes an important part of any climate change mitigation strategy. The EU is committed to its 20-20-20 plan by 2020. This aims at reducing its overall emissions to at least 20 per cent below 1990 levels by 2020, and is ready to scale up this reduction to as much as 30 per cent under a new global climate change agreement when other developed countries make comparable efforts. It has also set itself the target of increasing the share of renewables in energy use to 20 per cent by that year, and increasing energy efficiency by 20 per cent.

Peak Oil?

Energy security may also become a significant security challenge in the next few decades as it is possible that the demand for oil may soon exceed supply, and that oil reserves may not be as great as previously thought.¹⁵⁰ In December 2008, Fatih Birol, the chief economist of IEA warned that, "in terms of the global picture, assuming that OPEC will invest in a timely manner, global conventional oil can still continue, but we still expect that it will come around 2020 to a plateau as well, which is, of course, not good news from a global-oil-supply point of view." Birol says we need a "global energy revolution" to avoid an oil crunch. He comments

¹⁴⁸ C Emmerson, "Russia has reasons to turn up the heat in the Arctic", *The Financial Times*, 16/4/2010.

¹⁴⁹ Energy security is here defined as "reliable supplies at a reasonable price". This is taken from Florian Baumann, 'Energy Security as multidimensional concept', Centre for Applied Policy Research, Policy Analysis No.1, March 2008, p.4, fn.1 <http://www.cap.lmu.de/download/2008/CAP-Policy-Analysis-2008-01.pdf>. See also the discussion by A.F.Alhajji in *Middle East Economic Survey*, Vol. 50 nos. 39, 43, 45, and 52 (2007), and vol. 51, no. 2 (2008).

<http://www.mees.com/postedarticles/oped/v50n39-5OD01.htm> ;

<http://www.mees.com/postedarticles/oped/v50n43-5OD01.htm> ;

<http://www.mees.com/postedarticles/oped/v50n45-5OD01.htm> ;

<http://www.mees.com/postedarticles/oped/v50n52-5OD01.htm> ;

<http://www.mees.com/postedarticles/oped/v51n02-5OD01.htm>

Alhajji defines energy security as: The steady availability of energy supplies in a way that ensures economic growth in both producing and consuming countries with the lowest social cost and the lowest price volatility.

¹⁵⁰ Terry Macalister, 'Key oil figures were distorted by US pressure, says whistleblower', *The Guardian*, 9 November 2009 <http://www.guardian.co.uk/environment/2009/nov/09/peak-oil-international-energy-agency>

that, "I think time is not on our side here."¹⁵¹ Oil accounts for about 40 per cent of the world's energy needs, and about 57 per cent of this oil is used in the transport sector.

Global oil demand now averages 84.6 mb/d (million barrels per day) in 2009.¹⁵² This is equivalent to 30 billion barrels per year. In 2005 Kjell Aleklett stated that demand for oil was growing at the rate of 2 per cent annually.¹⁵³ The global oil supply rose by 310 kb/d in September 2009 to 84.9 mb/d.¹⁵⁴ The IEA in 2009 predicts demand in 2030 of 105 mb/d. The IEA has constantly revised its predictions for oil production downwards for several years. At the Oil and Money Conference held in London in October 2004, the IEA forecast that world oil production would reach 120 mb/d by 2030.¹⁵⁵ This was then reduced to 116 mb/d, and then 105 mb/d. Even this figure is considered to be excessively optimistic.

The consumption rate of oil currently exceeds the discovery rate. In December 2005 Kjell Aleklett in testimony to the US Congress stated that "Fifty years ago the world was consuming 4 billion barrels of oil per year and the average discovery rate (the rate of finding undiscovered oil fields) was around 30 billion barrels per year. Today we consume 30 billion barrels per year and the discovery rate is dropping toward 4 billion barrels per year." The last major discoveries of oil (i.e. of fields of 500 million barrels or more) were made in the early 1960s.¹⁵⁶ Aleklett noted that the IEA World Energy Outlook for 2005 projected that by 2030 global oil demand would be 115 mb/d. That will require increasing production by 31 mb/d between now and then, and 25 mb/d will have to come from fields yet to be discovered. Aleklett states that this means it will be necessary to find four petroleum systems the size of the North Sea (which had 60 million barrels).¹⁵⁷ It is highly unlikely that such discoveries will be made. The discovery rate for fields of at least 500 million barrels is declining. In 2000, there were 13 such discoveries, in 2001 six, in 2002 two and in 2003 none.¹⁵⁸ Furthermore, over 1,000 fields have been found in OPEC countries since 1980. Only 10 per cent were larger than 130 million barrels, and 50 per cent were smaller than 8 million barrels.

In addition to the decline in discovery, the production rate of existing oil fields is also declining. According to ExxonMobil in 2003 the average production decline rate for oil fields is between 4 and 6 per cent a year. In 2007 the IEA predicted a rate of decline in output from the world's existing oilfields of 3.7 per cent a year. In November 2008, the IEA put the rate of decline at 6.7 per cent.¹⁵⁹ Output from 54 of the 65 largest oil producing countries is also declining. In December 2005 Aleklett warned that by 2011 five more countries will peak, and only Saudi Arabia, Iraq, Kuwait, UAE, Kazkahstan and Bolivia can increase their oil production. He noted that by 2010 production from these countries and deepwater fields will have to offset the decline in 59 countries and increased demand.

¹⁵¹ George Monbiot, When will the oil run out? The Guardian, 15 December 2008

<http://www.guardian.co.uk/business/2008/dec/15/oil-peak-energy-iea>

¹⁵² It is interesting however to note how in the early 1970s some analysts were predicting that daily demand by 1985 would be at 100 mb/d. See Strategic Survey 1973, IISS, London, 1974, p.31.

¹⁵³ Kjell Aleklett, President of ASPO Testimony on Peak Oil to US House of Representatives the Committee on Energy and Commerce. 7 December 2005. <http://www.energybulletin.net/node/11621>

¹⁵⁴ <http://omrpublic.iea.org/>

¹⁵⁵ David Strahan, op cit., pp.59-60.

¹⁵⁶ David Strahan, op cit., p.60; <http://www.energybulletin.net/node/11621>

¹⁵⁷ The August 2009 study by the UK Energy Research Centre, (Global Oil Depletion: An assessment of the evidence for a near-term peak in global oil production) states (p.viii) that:

The average rate of decline from fields that are past their peak of production is at least 6.5%/year globally, while the corresponding rate of decline from all currently-producing fields is at least 4%/year. This implies that approximately 3 mb/d of new capacity must be added each year, simply to maintain production at current levels - equivalent to a new Saudi Arabia coming on stream every three years.

http://www.ukerc.ac.uk/support/tiki-download_file.php?fileId=283

¹⁵⁸ George Monbiot, 'Break out the bicycles', The Guardian, 8 June 2004.

<http://www.guardian.co.uk/politics/2004/jun/08/renewableenergy.oil>

¹⁵⁹ George Monbiot When will the oil run out? The Guardian, Monday 15 December 2008

<http://www.guardian.co.uk/business/2008/dec/15/oil-peak-energy-iea>

The August 2009 study by the UK Energy Research Centre, (Global Oil Depletion: An assessment of the evidence for a near-term peak in global oil production) notes:

Although there are around 70,000 oil fields in the world, approximately 25 fields account for one quarter of the global production of crude oil, 100 fields account for half of production and up to 500 fields account for two thirds of cumulative discoveries. Most of these 'giant' fields are relatively old, many are well past their peak of production, most of the rest will begin to decline within the next decade or so and few new giant fields are expected to be found. The remaining reserves at these fields, their future production profile and the potential for reserve growth are therefore of critical importance for future supply.¹⁶⁰

The decline in oil supplies will increase the importance of OPEC. David Strahan comments that "many serious forecasters predict that total oil production for the world *excluding* OPEC will peak and go into plateau from about 2010. So from that point onwards, everything depends on the cartel".¹⁶¹ OPEC countries have about 77 per cent of the world's known oil reserves and account for 40 per cent of production.¹⁶² The Middle East accounts for about 61 per cent of known reserves. The Russian Federation has 6.4 per cent of known reserves.¹⁶³ The two key areas for both oil and gas production will be the Middle East and the former Soviet Union.¹⁶⁴

It is often assumed that OPEC in general and Saudi Arabia in particular will be able to make up for shortfalls in production and ensure that supply meets demand. This may no longer be the case. The IEA World Energy Outlook 2006 assumed that OPEC will raise production by almost 70 per cent to 56 mb/d by 2030, with Saudi Arabia producing 17.6 mb/d.¹⁶⁵

The Saudis themselves are no longer as confident as they were that they can make up any shortfall in world oil supply. Oil production in March 2009 was 8.038 mb/d.¹⁶⁶ In 2007 Saudi Arabia was claiming that it would increase production from 11 mb/d to 12.5 mb/d in 2009. Many doubt that the Saudi oil industry has the capacity to maintain production above 12 mb/d for long. Investment banker Matthew Simmons, in his study of Saudi oil production Twilight in the Desert: the coming Saudi oil shock and the world economy, argues that many

¹⁶⁰ Global Oil Depletion, p.vii.

¹⁶¹ David Strahan, *op cit.*, p.153. The UK Energy Research Centre study Global Oil Depletion, believes that peaking is likely to occur between 2009 and 2031. See Global Oil Depletion, p.137, 170. Note that some opponents of Peak Oil put forward the concept of oil supplies plateauing instead of peaking. See the response to this by Jérôme Guillet, 'Peak oil: the last skeptics', European Tribune 15 November 2006 <http://www.energybulletin.net/node/22466>. Guillet notes that the plateau does in fact look rather "peaky".

¹⁶² Tamsin Carlisle, 'Saudi Production at 10 year low', The National, 21 June 2009

<http://www.thenational.ae/article/20090621/BUSINESS/706219954/-1/opinion>

¹⁶³ Commission of the European Communities Commission staff working document accompanying the Communication from the Commission to the European Parliament, the Council the European Economic and Social Committee and the Committee of the Regions Second Strategic Energy Review An EU Energy Security and Solidarity Action Plan Europe's current and future energy position Demand – resources – investments, Brussels, 13 November 2008 SEC(2008) 2871 VOLUME I, p.33 http://www.ipex.eu/ipex/cms/home/Documents/doc_SEC20082871FIN;jsessionid=B94206DDC5AE01DB2A99AA3ED327E89D

¹⁶⁴ See Aleklett <http://www.energybulletin.net/node/11621>. Russia, Saudi Arabia, Iran and the USA already account for 39% of global oil production. See Global Oil Depletion, p.31. Russia, Iran and Qatar account for about 58% of natural gas reserves.

41% of proved gas reserves are in the Middle East, and the former USSR accounts for more than 30% of the total. See Commission of the European Communities Second Strategic Energy Review, p.33-34.

¹⁶⁵ David Strahan, *op cit.*, p.158.

¹⁶⁶ Tamsin Carlisle, 'Saudi Production at 10 year low', The National, 21 June 2009

<http://www.thenational.ae/article/20090621/BUSINESS/706219954/-1/opinion>

Saudi oil fields are over produced and facing depletion, and could go into a rapid decline.¹⁶⁷ These claims were angrily rejected by Saudi officials in 2004-05, but they have now become less confident about their ability to meet global demand.

In 2005, the Financial Times reported that Saudi officials warned that OPEC could not meet the global demand projected by the IEA over the next 15-20 years. The IEA was assuming an OPEC production increase to 50 mb/d by 2020. The Financial Times stated:

Senior Saudi energy officials have privately warned US and European counterparts that OPEC would have an extremely difficult time meeting that demand. Saudi Arabia calculates there is a 4.5 mb/d gap between what the world needs and what the kingdom can provide...Saudi Arabia pumps 9.5 mb/d and has assured consumer countries that it could reach 12.5 mb/d in 2009 and probably 15 mb/d eventually. But a senior western energy official said: 'They said it would be extremely difficult to move above that figure.'¹⁶⁸

The economic development of China and India means that these countries' energy needs will grow, and they will need to import more oil. This will place increasing demand on the world oil supply. China was the world's second largest consumer of petroleum products in 2004, having surpassed Japan for the first time in 2003, with total demand of 6.5 mb/d. China's oil demand is projected by EIA to reach 14.2 mb/d by 2025, with net imports of 10.9 mb/d. As the source of around 40 per cent of world oil demand growth over the past four years, with year-on-year growth of 1.0 mb/d in 2004, Chinese oil demand is a key factor in world oil markets. Professor Pang Xiongqi at the China University of Petroleum has stated that Chinese oil production will plateau in 2009 and then start to decline. This will obviously make China more dependent on imports.¹⁶⁹ China is "expected to account for more than 40 per cent of the rise in world oil demand from 2007 to 2030."¹⁷⁰

India imports 70 percent of its oil, 11 percent of its coal, and 17 percent of its natural gas. Its total installed electrical generating capacity is less than 150 gigawatts (GW), leading to estimated shortages of nearly 10 percent in energy terms and almost 17 percent in peak demand. The Indian government's Integrated Energy Policy (IEP) formulated by the government's Planning Commission, would require India to go from 327 million tons of oil equivalent (Mtoe) in 2003-2004 to as high as 1858 Mtoe in 2031.

India's fossil fuel "path dependence," results in very high and growing imported fossil fuel dependence. The IEP projects that India's import dependency will rise from about 30 percent in 2003-2004 to 59 percent of commercial energy consumption in 2031-2032 (assuming an 8 percent growth rate during this period.) India's share of global supply of fossil fuels is projected to be between 3.7 and 10.9 percent by 2031-2032 in a range of scenarios.¹⁷¹ The bulk of oil required by India, China and other Asia Pacific countries will be coming from the Persian Gulf.

This discussion has so far focused on the challenge posed by the possibility of peak oil to energy security. There are arguments against peak oil, although it is interesting to note how the IEA's assessment of the world energy situation has moved closer to the views of those

¹⁶⁷ Matthew R. Simmons, Twilight in the Desert: the coming Saudi oil shock and the world economy, Hoboken NJ, John Wiley and Sons, 2005. See also Simmons' website: <http://www.simmonsco-intl.com/research.aspx?Type=msspeeches>. See also his interview of 10 November 2009 <http://www.energybulletin.net/node/50660>

¹⁶⁸ David Strahan, *op cit.*, p.170.

¹⁶⁹ See Aleklett <http://www.energybulletin.net/node/11621>

¹⁷⁰ Erica S. Downs, 'China's Energy Rise', in China's Rise in Historical Perspective, edited by Brantly Womack, New York, Rowman and Littlefield Publishers Inc., 2010, p.176.

¹⁷¹ David Michel, Amit Pandya eds, *op cit.*, p.7-8.

who believe that peaking may occur sometime before 2030.¹⁷² In addition it has been argued that insufficient investment in the oil sector may also cause a major supply crunch in the next decade.¹⁷³

Given the importance of oil and gas to modern economies, the energy security implications of inadequate supplies should be obvious. The security situation is potentially made worse as the Middle East and the former Soviet Union will be key suppliers of fossil fuels. Both regions are characterised by a high degree of instability and the potential for the emergence of anti-western regimes which may seek to withhold energy supplies as a weapon. In October 2002, the then Malaysian Prime Minister, Mahathir Mohamed stated that, "oil is the only thing Muslim nations have which is needed by the rest of the world. If they can cut back on supply, people will not be oppressive on them....It can be used as a weapon to protect the interests of Muslims."¹⁷⁴ It should be noted that the Islamic world owns about 75 per cent of the world's oil reserves.

The following two sections examine the energy security situations of the principle members of the Euro-Atlantic community, namely the EU and the USA. As Japan is the major pillar of the industrialised world in the Asia-Pacific region, her energy security is also examined.¹⁷⁵

EU Energy Security

The current EU energy profile is as follows.¹⁷⁶ In 2006, according to the latest official data, gross inland energy consumption in the EU-27 was 1,825 Mtoe, while total final energy consumption, which excludes deliveries to the energy conversion sector and to energy industries themselves, was 1,176 Mtoe.

Oil accounts for 37 per cent of total energy consumption, gas 24 per cent, nuclear power 14 per cent, solid fuels 18 per cent, and renewables 7 per cent. EU-27 is a net energy importer. In 2006 it depended on imported energy for 54 per cent of its energy needs. Oil makes up the bulk of EU energy imports (60 per cent), then gas (26 per cent) and solid fuels (13 per cent). Less than one per cent of renewable energy is imported.

The European Union in 2006 imported 608 Mtoe of oil. Most of the oil imports come from OPEC (38 per cent) and Russia (33 per cent), while Norway and Kazakhstan respectively provide 16 per cent and 5 per cent of oil imports to the European Union. The EU produces less than one fifth of its total oil consumption.

Domestic EU gas production (mostly taking place in the Netherlands and the United Kingdom) satisfies about two fifths of consumption needs. Gas is mainly imported from four big suppliers: Russia (42 per cent), Norway (24 per cent), Algeria (18 per cent) and Nigeria (5 per cent). The EU imported 53.8 per cent of the natural gas it consumed in 2006. By 2030, it could be importing about 60 per cent of its gas from Russia.

¹⁷² [Global Economic Prospects 2009](#) p.74-77. See also Michael Lynch, 'Peak Oil is a waste of energy', [New York Times](#), 24 August 2009 <http://www.nytimes.com/2009/08/25/opinion/25lynch.html>

¹⁷³ Paul Stephens, [The Coming Oil Supply Crunch](#), Royal Institute of International Affairs, May 2009 (originally published August 2008). <http://www.chathamhouse.org.uk/publications/papers/view/-/id/652/>

¹⁷⁴ Gal Luft, [Dependency on the Middle East energy and its impact on global security](#), 2 June 2008. http://www.analyst-network.com/article.php?art_id=2371

¹⁷⁵ See Appendix for a listing of the energy self-sufficiency of major energy consumers in 2005.

¹⁷⁶ Information on the EU energy profile comes from Commission of the European Communities [Second Strategic Energy Review](#) p.6-9. See also http://www.eoearth.org/article/Energy_profile_of_the_European_Union

With regard to coal, the largest suppliers are Russia (26 per cent) and South Africa (25 per cent), followed by Australia (13 per cent), Colombia (12 per cent), Indonesia (10 per cent) and the United States (8 per cent).

According to the European Commission's Second Energy Review (published in November 2008), import dependency for oil could reach 93 per cent in 2020 if current trends and policies continue. Even if the New Energy Policy - NEP (the 20-20-20) is implemented, oil dependency could still be as high as 92 per cent. Gas import dependency if current policies are followed would reach 77 per cent in 2020. Under the NEP, it could decline to 71-73 per cent in 2020. Solid fuel external dependency is currently just under 40 per cent, and if current policies continue, external dependency would stand at about 58 per cent in 2020. If the NEP is implemented, then import dependency would be about 49-50 per cent.¹⁷⁷

The Second Strategic Energy Review states:

Currently estimated at more than 54 per cent of needs, external dependency would stabilise around 56 per cent in 2020 assuming the implementation of the New Energy Policy and oil prices over 100 US\$/barrel in real terms. However, import dependency would be higher with moderate oil prices (59 per cent with 61 US\$/barrel) and considerably higher under a business-as-usual development (between 60 per cent and 64 per cent depending on the oil price assumption).¹⁷⁸

The gas crises between Russia and Ukraine in recent years, most notably January 2009 have raised concerns that the Russian leadership may in the future cut off gas supplies to EU countries in order to exert political pressure. The Russian leadership has denied that it has any intention of doing so, and draws attention to the fact that the USSR/Russian Federation has been a reliable supplier to Western Europe ever since Moscow started supplying gas in the late 1960s.

In one sense the EU should not be vulnerable to any possible future Russian pressure, as the EU-27 is dependent on Russian gas for only 6.5 per cent of its total energy needs.¹⁷⁹ However, this obscures the fact that some of the former communist states which are now members of the EU are heavily dependent on Russian gas supplies. All ten East European EU members rely on Russia for at least 50 per cent of their gas supply (with the exception of Romania). Six of these states depend on Russia for at least 80 per cent. These states could therefore be vulnerable, particularly as Gazprom derives only a small amount of its earnings from exports to these states.

The overall dependency of EU-15 on Russian gas is much lower.¹⁸⁰ Russian gas constitutes 20 per cent of EU-15's gas supply. Furthermore, the bulk of Gazprom's earnings from EU exports come from its exports to West European states. Roughly 40 per cent of Gazprom's profits come from exports to Italy and Germany. As West European states are less dependent on Russian gas, and are the main source of Gazprom's income, then there is a Russian dependency on Western Europe as a source of hard currency earnings. Overall, Gazprom receives 80 per cent of its export earnings from the EU market, so it has a strong incentive to maintain supplies to Europe.

However, the EU does face an energy challenge from Moscow. Pierre Noel notes:

The extreme variations throughout Europe in gas import volumes and dependence on Russia present the EU with a strategic challenge. In the absence of an integrated

¹⁷⁷ Second Strategic Energy Review, p.17-18.

¹⁷⁸ Ibid., p.20.

¹⁷⁹ Pierre Noel Beyond Dependence: How to deal with Russian gas, ECFR Policy Brief, November 2008, p.1. http://www.ecfr.eu/content/entry/russia_gas_policy_brief

¹⁸⁰ EU-15 refers to the EU prior to its expansion in 2004.

European market creating effective solidarity between gas consumers across national markets – especially between the big western importing countries and the smaller eastern European ones – Russia is able to exploit these variations to divide EU governments. Moscow extends privileged energy “co-operation” offers to its strategic partners – inviting the German companies involved in the building of the Nordstream pipeline to participate in gas field projects in Russia, for example - something European governments find very hard to refuse, even with the political strings that are always attached to such offers. Because Germany and Italy can effectively capture the economic benefits of their cosy political relationships with Moscow, they have a strong incentive to accommodate Russia politically at the expense of European unity.¹⁸¹

Noel sees the development of the Nord Stream (due to be completed in 2011) and South Stream pipeline (due to be completed in 2013) projects as an attempt to continue its policy of exploiting variations to divide EU governments. He comments:

The rationale for the Nordstream and Southstream projects, which bypass the Ukraine-Slovakia and Belarus-Poland corridors, is not to bring additional Russian gas to Europe but to preserve and consolidate the conditions of Gazprom’s differentiated gas export policy, which is inseparable from Russia’s differentiated foreign policy towards Europe.¹⁸²

It is for this reason that Noel argues that it is advisable for the EU to develop a single energy policy, in order to prevent Russian attempts to divide and rule. The EU has also expressed interest in the Nabucco pipeline project, which is intended to run from Erzurum in Turkey to Baumgarten an der March in Austria.¹⁸³ It is due to commence operations in 2015. The 2,050 miles long pipeline will run from Erzurum in Turkey via Bulgaria, Romania, and Hungary to Baumgarten an der March, a major natural gas hub in Austria. Near Erzurum, it will be connected with the Tabriz–Erzurum pipeline and with the South Caucasus Pipeline, connecting the Nabucco Pipeline with the planned Trans-Caspian Gas Pipeline. The pipeline will run from Turkey via Bulgaria, Romania, and Hungary to Austria. The Polish gas company PGNiG is studying the possibility of building a link from the Nabucco gas pipeline to Poland.

The main source of Nabucco's supply will be the second stage of the Shah Deniz gas field in Azerbaijan, coming on-stream in 2013. Turkmenistan, Kazakhstan, Iraq and Egypt may also supply gas. Iran has also expressed an interest in supplying gas for Nabucco, but this has so far been resisted by the USA and EU.

Moscow, unsurprisingly, has been unenthusiastic about the Nabucco project, seeing it as a competitor, and has argued that it will not be viable. However the Russo-Ukrainian energy disputes and the Russo-Georgian conflict of August 2008 have convinced EU members of the merits of diversifying supply. The EU is also seeking to increase its gas imports from North Africa, as a further means of reducing dependency on Russia.¹⁸⁴

¹⁸¹ Pierre Noel *Beyond Dependence: How to deal with Russian gas*, p.9.

http://www.ecfr.eu/content/entry/russia_gas_policy_brief

¹⁸² *ibid.*, p.9, fn.25. However it makes sense for Russia to build pipelines bypassing Ukraine and Belarus, in order to ensure that the flow of gas to Europe is not interrupted.

¹⁸³ http://en.wikipedia.org/wiki/Nabucco_pipeline ; <http://www.nabucco-pipeline.com/project/project-description-pipeline-route/project-description.html>

¹⁸⁴ Some prominent figures in Germany and various Middle East countries are proposing to develop solar power in North Africa in order to export it as electricity to the EU. If this project were to prove successful it would also reduce dependence on Russian gas supplies. See *Clean Power from Deserts: The Desertec Concept for Energy, Water and Climate Security*, 4th edition, Bonn, Protex Verlag February 2009 <http://www.desertec.org/> Rear Admiral Neil Morisetti is apparently supportive of this initiative. <http://climatechange.foreignpolicyblogs.com/tag/desertec/>

Russia wishes to increase its customer base. It is aware of the dangers to itself of monopsony. Moscow is seeking to become a more significant supplier of oil and gas to her eastern neighbours, China in particular. The agreements on energy cooperation made during the visits of Vladimir Putin to China in March 2006 and October 2009, and deputy prime minister Igor Sechin in July 2008 are all indicative of Moscow's desire to develop a very close energy partnership with China. Gazprom and oil companies such as Rosneft and Lukoil are also interested in expanding their presence further afield, as their activities in Libya, Algeria, Iraq, Iran, Nigeria, Venezuela and Brazil and other countries demonstrate.

The Russian energy sector may also face the problem of not being able to expand production sufficiently to meet demand in the coming decade. Gazprom is dependent on purchasing gas from Central Asia to meet its export targets.¹⁸⁵ Production at Russian gas fields is declining, and Gazprom is dependent on Western technology to improve production.¹⁸⁶ A similar situation exists in the oil sector. In October 2008, Deputy Prime Minister and Finance Minister Aleksey Kudrin warned that that Russian oil and gas production may have peaked in 2008. He stated that, "most likely, in the year 2008 the oil and gas production will peak in our country. There will be no more revenues like these. In this sense we are crossing a historical boundary".¹⁸⁷

Russia therefore faces problems as an energy supplier, which to a certain extent undermines the potency of any energy weapon she feels she may possess. As a consumer of energy, Russia enjoys an extremely high degree of security, as she is totally self-sufficient in hydrocarbons, and will remain so for decades.¹⁸⁸ As an exporter, then failure to improve production efficiency could have security implications in view of the importance of hydrocarbon exports for the Russian economy. The energy sector accounts for about 20.5 per cent of GDP, and according to IMF and World Bank estimates, the oil and gas sector generated more than 60 per cent of Russia's export revenues (64 per cent in 2007), and accounted for 30 per cent of all foreign direct investment.¹⁸⁹ If the shale gas revolution and development of gas to liquid technology which is being pursued by both the USA and China succeeds in reducing the role of Russia as an energy supplier, then she could face a significant loss of revenue, and a threat to her economic and national security.¹⁹⁰

US Energy Security

The USA is the largest energy consumer in terms of total use, using 101.9 quadrillion British thermal units (Btu) in 2007. The US ranks seventh in energy consumption per-capita after Canada and a number of small countries. The majority of this energy is derived from fossil fuels: in 2005, it was estimated that 40 per cent of the nation's energy came from petroleum,

¹⁸⁵ Roman Kupchinsky, 'Russia: Gas Export Plans Dependent On Central Asia,' RFE/RL 28 March 2006, . <http://www.rferl.org/content/article/1067172.html>

¹⁸⁶ Roman Kupchinsky, 'Russia: Gazprom -- A Troubled Giant', RFE/RL 5 January 2006, <http://www.rferl.org/content/article/1064448.html>

¹⁸⁷ Ekho Moskvyy news agency, Moscow, 7 October 2008. See also http://en.wikipedia.org/wiki/Oil_reserves_in_Russia . See also Robert E. Ebel, The Geopolitics of Russian Energy: Looking Back, Looking Forward, Centre for Strategic and International Studies, July 2009.

¹⁸⁸ For an overview of the Russian energy sector, see Vasily Astrov, Current State and Prospects of the Russian Energy Sector, Vienna Institute for International Economic Studies, Research Report June 2010 (No. 363). <http://publications.wiwi.ac.at/>

¹⁸⁹ US Energy Information Administration Country Analysis Brief Russia May 2008. <http://www.eia.doe.gov/cabs/Russia/Background.html>

¹⁹⁰ See Paul Stephens, 'Cheap Gas Coming', World Today, August-September 2010 http://www.chathamhouse.org.uk/files/17010_wt081038.pdf . However, as Stephens points out, the circumstances which favoured a shale gas revolution in the USA are absent in Europe.

23 per cent from coal, and 23 per cent from natural gas. Nuclear power supplied 8.4 per cent and renewable energy supplied 7.3 per cent, which was mainly from hydroelectric dams although other renewables are included such as wind power, geothermal and solar energy.¹⁹¹

US Oil Supply

Oil supply has traditionally been a major concern for successive US leaderships, particularly as US dependence on imported oil has grown steadily since the late 1940s. In the 1950s, foreign oil accounted for 10 per cent of US consumption; in the 1960s, about 18 per cent; and in the 1970s, about 36 per cent.¹⁹² In 2007, the US imported about 58 per cent of the oil it consumed. The US consumed 20.7 mb/d in 2007 making the US the world's largest petroleum consumer. The US was third in crude oil production at 5.1 mb/d. The US imported 13.5 mb/d imported crude oil and petroleum products to meet domestic demand. Overall the US produces 10 per cent of the world's oil and consumes 24 per cent.¹⁹³

Most of the USA's imported oil comes from Canada, Mexico and Venezuela. The Middle East only accounts for about 16 per cent of the US oil supply, the bulk of that coming from Saudi Arabia.

During 2007, the USA's five biggest suppliers of crude oil and petroleum products were:

- Canada (18.2 per cent)
- Mexico (11.4 per cent)
- Saudi Arabia (11.0 per cent)
- Venezuela (10.1 per cent)
- Nigeria (8.4 per cent)

The USA has sought to increase its energy independence since the Nixon Administration in the early 1970s. In the wake of the Arab oil embargo following the Yom Kippur war between Israel, Egypt and Syria in October 1973, US President Richard Nixon announced a programme to make the USA self-sufficient in oil by 1979.¹⁹⁴ The Ford Administration proposed in January 1975 a 10 year plan to build 200 nuclear power plants, 250 major coal mines, 150 major coal fired power plants, 30 major oil refineries, and 20 major synthetic fuel plants.¹⁹⁵ However these projects never saw the light of day. The Carter Administration introduced an energy programme in April 1977.¹⁹⁶ This failed to reduce the USA's growing dependence on imported oil. In May 2001, Vice-President Dick Cheney released a report

¹⁹¹ http://en.wikipedia.org/wiki/Energy_in_the_United_States

¹⁹² Michael T. Klare, *Blood and Oil, The Dangers and Consequences of America's Growing Dependency on imported petroleum*, New York, Metropolitan Books, 2004, p.10. In 1994, the USA for the first time imported more oil than it could produce domestically. Paul Roberts, *The End of Oil: On the edge of a perilous new world*, New York, Houghton Mifflin, 2004, p.220.

¹⁹³ http://tonto.eia.doe.gov/energy_in_brief/foreign_oil_dependence.cfm

¹⁹⁴ Dilip Hiro, *Blood of the Earth: The Battle for the World's vanishing oil resources*, New York, Nation Books, 2007 p.111. His successor Gerald Ford then said the USA would become self-sufficient in 1985, and Jimmy Carter stated in 1979 that the USA would become self-sufficient by 1990. See Hiro, *ibid.*, p.314. See also Daniel Yergin, 'Energy Independence', *Wall Street Journal*, 23 January 2007. <http://www.cera.com/aspx/cda/public1/news/articles/newsArticleDetails.aspx?CID=8560> for his comments on Nixon's Project Independence.

¹⁹⁵ Daniel Yergin, *The Prize: The Epic Quest for oil money and power*, New York, Pocket Books, p.660

¹⁹⁶ *ibid.*, p.662-664.

entitled National Energy Policy.¹⁹⁷ This however did nothing to reduce US dependence on foreign oil. It actually saw US dependence increasing and discussed measures to ensure the security of foreign supplies. In his state of the union address in 2006, George W. Bush was complaining that the USA was still “addicted to oil.”

However, the picture may have now changed for the better. The Energy Information Administration (EIA) projects US crude oil and petroleum products imports will decline from 12.1 mb/d in 2007 to 8.3 mb/d in 2030. Growth in total US petroleum consumption is expected to remain relatively flat out to 2030. The Department of Energy argues in 2009 that the increase in US crude oil production in the Gulf of Mexico and elsewhere, combined with increasing biofuel and coal-to-liquids (CTL) production, is expected to reduce the need for imports over the longer term. US petroleum import dependence is projected to fall from 58 per cent in 2007 to 41 per cent by 2030.¹⁹⁸ This is in marked contrast to the Department of Energy’s assessment in its Annual Energy Outlook 2006, where it was projected that US imports will grow from 58.4 percent of the 20.74 mb/d oil consumption in 2004 to 62.3 percent of the 27.7 mb/d oil consumption in 2030.

The Energy Independence and Security Act 2007

The Energy Independence and Security Act which was signed into law in December 2007 promotes several measures to promote energy efficiency.¹⁹⁹ Its key provisions are:

- Increased CAFE standards. Automakers are required to boost fleetwide gas mileage to 35 mpg (14.8 km/l) by 2020. This applies to all passenger automobiles, including light trucks.
- Required vehicle technology and transportation electrification. Incentives for the development of plug-in hybrids.
- New conservation requirements for federal vehicle fleets.
- Taxpayer funding for increased production of biofuels. The total amount of biofuels added to gasoline is required to increase to 36 billion gallons by 2022, from 4.7 billion gallons in 2007. The Energy Act further specifies that 21 billion gallons of the 2022 total must be derived from non-cornstarch products (e.g. sugar or cellulose).

The US may also become less dependent on imported natural gas. In 2007, the USA imported 16 per cent of its supply in 2007. According to the Annual Energy Outlook 2009, this is projected to drop to 3 per cent in 2030. From 2007 to 2030, domestic production of natural gas increases by 4.3 trillion feet (22 percent), while net imports fall by 3.1 trillion cubic feet (83 per cent). The production of shale gas in the USA is a major factor in reducing US dependence on imports.²⁰⁰

If the projections of the US Department of Energy’s Annual Energy Outlook 2009 turn out to be accurate, then US vulnerability to interruptions in supply from foreign suppliers may be

¹⁹⁷ National Energy Policy: Report of the National Energy Policy Development Group May 2001, Washington, USGPO, 2001 <http://www.wtrg.com/EnergyReport/National-Energy-Policy.pdf>

¹⁹⁸ http://tonto.eia.doe.gov/energy_in_brief/foreign_oil_dependence.cfm

¹⁹⁹ http://en.wikipedia.org/wiki/Energy_Independence_and_Security_Act_of_2007

²⁰⁰ For a pessimistic view of the US gas situation, see Frank Clemente, What Price, Natural Gas? Long-term Question Will be Cost, Testimony of EIA at Senate hearings on natural gas, 28 October 2009 http://www.elp.com/index/display/article-display/1556733182/articles/electric-light-power/volume-88/issue-1/sections/what-price_natural.html ; See also Dave Cohen Betting the House on shale gas 28 March 2010 <http://www.declineoftheempire.com/2010/03/betting-the-house-on-shale-gas.html> ; Shale Gas Shenanigans, 29 March 2010 <http://www.declineoftheempire.com/2010/03/shale-gas-shenanigans.html>

significantly reduced and consequently her energy security correspondingly enhanced. Obviously the failure of previous administrations to reduce US energy dependency should induce a degree of caution in predicting that current and future presidential administrations will be more successful in dealing with this problem than their predecessors.

From the standpoint of the Euro-Atlantic community, Europe faces more significant energy security concerns than the USA. The bulk of its oil and gas comes from regions (i.e. the former USSR and the Middle East) which are prone to instability and the possibility of regimes engaging in resource nationalism. Even if energy efficiency and the increased reliance on LNG reduces dependence on these regions, Europe is likely to be dependent on them to a significant extent for the foreseeable future.

Japanese Energy Security

Like the USA and China, Japan is a major consumer of energy.²⁰¹ Japan is the third largest oil consumer in the world behind the USA and China, and the second largest net importer of oil, and the largest net importer of LNG in the world. Japan is only 16 per cent energy self-sufficient.²⁰² Due to her lack of hydrocarbon resources, Japan actively pursues up-stream oil and gas activities abroad, and has a well-developed energy efficiency programme. In order to reduce dependence on hydrocarbons, Japan makes increasing use of nuclear energy. In 2005, oil accounted for 49 per cent of total Japanese energy consumption, gas 14 per cent, coal 20 per cent, nuclear power 13 per cent. In 2007, Japan was dependent on the Middle East for about 82 per cent the oil she imported. Her dependence on Middle East oil naturally increases her interest in importing energy from the Russian Far East, and other parts of the former Soviet Union. The growth of Chinese energy consumption has forced Japan to devote increased attention to energy security since 1993, when China began to import oil.

In 2006 a New National Energy Strategy was announced, intended to reduce dependence on oil. Oil as a percentage of total primary energy demand has fallen from roughly 80 per cent of the energy mix in the 1970s to roughly 50 per cent. By 2030, the goal is to reduce this share to 40 per cent. The aim is to achieve an overall conservation of energy of 30 per cent by 2030. Japan has probably the most impressive record of industrialised states in improving her energy efficiency. However, the rise of China will continue to pose a significant challenge, particularly in view of Beijing's declared strategic interest in the South China Sea, which could bring China into conflict with both Japan and the USA.²⁰³

Reducing Vulnerability

²⁰¹ For information on Japan's energy profile, see US Energy Information Administration Country Analysis Brief Japan September 2008. <http://www.eia.doe.gov/cabs/Japan/Background.html> ; See also <http://www.rice.edu/energy/publications/japaneseenergysecurity.html> ; See Peter C. Evans, Brookings Foreign Policy Studies Energy Security Series Japan December 2006 <http://www.brookings.edu/fp/research/energy/2006japan.pdf> ; *Energy In Japan 2008*, Agency for Natural Resources and Energy, Ministry of Economy Trade and Industry, 2008. <http://www.enecho.meti.go.jp/topics/energy-in-japan/english2008.pdf>

²⁰² 19 per cent if nuclear power is included.

²⁰³ See Michael T. Klare, *Resource Wars: The new landscape of global conflict*, New York, Metropolitan-Owl Book, 2001, pp.131-137. See also US Department of Energy, Energy Information Administration Background on South China Sea http://www.eia.doe.gov/emeu/cabs/South_China_Sea/Background.html and East China Sea http://www.eia.doe.gov/emeu/cabs/East_China_Sea/Background.html

It has been said that oil security consists of three factors; guaranteeing the security of producer governments, maintaining cooperative relationships with them and ensuring the security of the means of delivery from producer to consumer. This is also true of gas security.

The first two factors explain why both the USA and European states have avoided harsh criticisms of Saudi internal policy. It also explains the unwillingness of many European states to criticise Russian domestic policy, and the reluctance of these states to support a hardline US policy towards Iran.

Major powers are also likely to consider means of trying to ensure that producer nations remain stable, and to encourage antagonistic producer regimes to soften their attitudes. Ensuring the stability of Saudi Arabia and other Persian Gulf producers is and will remain a major concern of consumer countries. The avoidance of confrontation or even harsh criticism of producer regimes will be a key part of the diplomatic strategy of many consumer states towards most producer regimes.

In addition to reducing dependence on fossil fuels by promoting energy efficiency and the use of renewables, which obviously also interrelates with the need to reduce GHG emissions, other measures taken by western states include:

The Building up of Reserves

An IEA agreement of March 2001 requires all members of that organisation to hold a 90 day oil reserve. As an oil producer, the UK is permitted a derogation, and is only currently required to have a 67.5 day reserve. As UK crude oil production declines, the derogation will be phased out and the obligation will gradually increase to 90 days. This will probably commence in 2014.²⁰⁴ Germany has reserves of 130 days. The USA is reported to only have 60 days worth of strategic reserves at 703 million barrels. According to the 2005 Energy Act this can be increased to 1 billion.²⁰⁵

Consumer-Producer Agreements

The European Energy Charter signed in 1994 has sought to bind together consumers and producers. However the Russian Federation refuses to ratify it, and without Moscow's participation, the Charter is virtually meaningless. The former Dutch Premier Kozius van Aartsen proposed in 2007 a treaty system that would embrace Europe, Central Asia, the Middle East and North Africa. A system of agreements always assumes that both consumers and producers always win from cooperation, and that producers have too much to lose by cutting off supply. It is certainly true that sustained embargoes by energy producers have been relatively rare, but these moves obviously cannot be ruled out. Regimes may emerge which may be willing to forego revenues in the hope of gaining some geopolitical advantage.²⁰⁶

Ensuring the Security of Energy Transportation Routes

²⁰⁴ UK Emergency Oil Stocks: A guide to the measures the UK adopts to meet its international obligations to maintain emergency oil stocks Department of Energy and Climate Change, May 2009 <http://www.berr.gov.uk/files/file37711.pdf>

²⁰⁵ George Joffe, Samir Allal, Houda Ben Jannet Allal, Energy and Global Economic Crisis: The Chances for Progress, EU Institute for Security Studies, European Institute of the Mediterranean, October 2009, p.35.

²⁰⁶ ibid., p.36.

The protection of pipelines is almost impossible. Sea transport routes can be and are easily protected. The US Fifth Fleet protects routes from the Persian Gulf, and the US Sixth Fleet and various European navies are able to protect tankers in the Mediterranean. There are seven significant shipping chokepoints.²⁰⁷ The Suez Canal is one chokepoint which was closed in 1956 and again from 1967 until 1973. If these are ever closed by a hostile regime, then it is unlikely that military force can be used to ensure that they remain permanently open. Diplomacy will be more important than military force in these situations.

Improving energy efficiency

Industrialised states did improve their energy efficiency as a response to the 1973 and 1979 oil shocks. Over the period 1977-1985, oil demand in the USA dropped by more than 16 per cent, even though the economy grew by 27 per cent over that period of time. US energy intensity, namely, the amount of energy required per dollar of economic productivity fell by more than 3.5 per cent every year.²⁰⁸ By 1985, the USA was 25 per cent more energy efficient and 32 per cent more energy efficient when compared with 1973. This was a saving of 13 million barrels of oil. Over the same period, Japan became 31 per cent more energy efficient and 51 per cent more oil efficient. Over the period 1979-1983, oil consumption in the non-communist world fell from 51.6 mb/d, to 45.7 mb/d.²⁰⁹

However these savings are small in scale when one bears in mind that current global daily consumption is 84.6 mb/d. Other measures such as the increased use of battery powered vehicles and use of biofuels and renewables will obviously have some impact, but it is extremely difficult to see how oil and gas consumption can be significantly reduced without it having a major impact on the economies and lifestyles in the industrialised states.²¹⁰ The possibility of having to accept a less affluent lifestyle may pose a serious threat to political and social cohesion, and hence become an internal security challenge.

Conclusions

Both climate change and energy security are inter-related. There are two major interconnections. Firstly, the imperative to reduce CO₂ emissions can enhance energy security, as it creates an obvious need to reduce usage of fossil fuels, although dependence on hydrocarbons will remain heavy. Secondly, both could become a cause of resource conflict and great power intervention in unstable regions. The interventions may be for different reasons. As noted above, resource conflict caused by desertification may result in the need for peace-keeping/peace making operations, and also in the deployment of both military and civilian specialists to help build capacity and improve resilience. Military intervention may also occur to counter instability caused by mass-migration from desertification and flooding etc. UK Climate Change envoy Rear Admiral Neil Morisetti commented in March 2010,

It is the job of any responsible military to plan not just for the national security challenges that face us currently, but for those that might appear on our horizon in the

²⁰⁷ http://www.eia.doe.gov/cabs/World_Oil_Transit_Chokepoints/Background.html About 50% of daily oil production is moved by tankers.

²⁰⁸ Paul Roberts *op cit.*, p.218-219.

²⁰⁹ Daniel Yergin, *op cit.*, p.718.

²¹⁰ If all the world's maize were used for biofuel, it would meet just 8 per cent of global energy demand. *Global Economic Prospects 2009*, p.7. If the entire US grain harvest were given over to ethanol production, it would satisfy only 18 per cent of US automotive fuel needs. Lester R. Brown, 'Why Ethanol Production Will Drive World Food Prices Even Higher in 2008,' 24 January 2008 http://www.earth-policy.org/index.php?plan_b_updates/2008/update69

future...our militaries must proactively anticipate the environmental changes that will impact our national security in the coming years. Current military operations will, rightly, always be our highest priority, but we must also find time to address future threats, including climate change.²¹¹

Acute competition for energy supplies could also prompt military intervention in key oil producing regions and possibly lead to great power conflict. This could easily be the case with the Middle East. Although consumer nations will naturally seek to diversify their sources of supply, the Middle East is likely to increase in importance as an energy supplier over the next few decades. Dependency on this region is already heavy. In 2006, the Middle East supplied 22 per cent of US imports, 36 per cent of OECD Europe's, 40 per cent of China's, and 80 per cent of Japan's and South Korea's. According to the IEA, oil consumption is likely to increase by 60 per cent between 2007 and 2030. Most of this will probably come from the Middle East. China's dependency on the Middle East as a source of oil will increase, and by 2030 it is estimated that Asia will import 80 per cent of its oil needs, and 80 per cent of this will come from the Persian Gulf.²¹²

Failure to reduce dependency on Middle East oil may increase the likelihood of great power rivalry in this region, quite possibly between the USA and China. The potential instability of regimes in this region could well draw in major powers in an attempt to stabilise the region, which could easily develop into a conflict of interests between these powers.

It should also be noted that there is also a close inter-relationship between climate change, energy and food security, which is also likely to become a major security challenge in the 21st century. If climate change occurs on a more dramatic scale than expected, then desertification and deforestation will aggravate the food supply situation, and the World Bank's confidence about food supply as expressed in its report Global Economic Prospects 2009: Commodities at the Crossroads may be misplaced.

Over the past three decades, the amount of arable land worldwide has stagnated at about 1.5 billion hectares (3.7 billion acres). Droughts in 2009 have already caused significant global losses in food production.²¹³ The rise in food prices after 2005 caused shortages in many developing countries. Although prices have eased in 2009, prices for consumers remain high, and the food supply situation in many countries remains precarious.²¹⁴ Riots over food prices occurred in several countries in 2007-2008, and such events could become a serious threat to political instability.

The increased use of corn for biofuels (20 per cent of the US corn crop in 2008 was used for ethanol production), puts pressure on the food supply and causes food prices to increase.²¹⁵ The production of biofuels in Brazil, the United States, and the European Union (which together account for more than 90 per cent of global output) has increased by 18 per cent a year since 2000. Biofuels now use 16 per cent of global sugarcane production, 9 per cent of global vegetable oils production, and 13 per cent of global maize production.²¹⁶

²¹¹ <http://newsecuritybeat.blogspot.com/2010/03/guest-contributor-rear-admiral.html>

²¹² Gal Luft *op cit.*,

²¹³ Eric de Carbonnel 'Catastrophic Fall in 2009 Global Food Production', Global Research, 10 February 2009 <http://www.globalresearch.ca/index.php?context=va&aid=12252>

²¹⁴ The State of Food Insecurity in the World Economic crises – impacts and lessons learned, Rome, FAO, 2009, p.4. <http://docustore.wfp.org/stellent/groups/public/documents/newsroom/wfp209430.pdf>

²¹⁵ Joseph Dancy, 'Experts: Global Food Shortages Could 'Continue for Decades'', 22 February 2008, <http://www.marketoracle.co.uk/Article3782.html> ;

http://en.wikipedia.org/wiki/2007%E2%80%932008_world_food_price_crisis

²¹⁶ Global Economic Prospects 2009, p.72

If the world oil supplies do peak in the relatively near future, then this will obviously create more demand for biofuels, which will obviously pose an even greater threat to food security. Oil and gas shortages, should they come about will also pose a threat to the viability of agricultural systems, as they are heavily dependent on fossil fuel fertilisers. Food security also depends on the availability of fuel for the transportation of food to shops. The food supply chain in many industrialised countries operates on the Just in Time (JIT) principle, where deliveries are made to supermarkets.²¹⁷ The fuel shortages caused by the blockade of oil refineries and fuel terminals by lorry drivers in the UK in September 2000 affected deliveries of food to supermarkets and resulted in panic buying and rationing in some parts of the country.²¹⁸ In 2004 it was reported that the British army would be used to maintain fuel supplies if there was a repetition of the September 2000 events.²¹⁹ The possibility of energy and food shortages will pose a strong challenge to the resilience capabilities of advanced as well as developing states.

As already discussed, the importance of the Middle East as a source of hydrocarbons could lead to great power competition in a region already burdened by the Israeli-Palestinian dispute, the need to stabilise Iraq, the perceived Iranian challenge to her neighbours, the potential development by Tehran of a nuclear weapons capability, not to mention the possibility of regimes in this region facing major social upheaval.

The need for oil and gas could mean that other regions will also become arenas of geopolitical competition. In addition to the Middle East, mention has already been made of the South China Sea, which could become a point of competition between China, the USA and her allies. The growth of Chinese power is prompted by the need to secure natural resources in order to ensure the continued expansion of the country's economy. Andrew Erickson writes that "China now imports half of its crude oil, with 4.6 mbpd in imports as of July 2009. Seaborne imports, which even ambitious overland pipeline projects lack the capacity to reduce, constitute more than 80 percent of this total. At present, therefore, 40 percent of China's oil comes by sea".²²⁰

Robert Kaplan writes that "simply by securing its economic needs, China is shifting the balance of power in the Eastern Hemisphere, and that must mightily concern the United States." Kaplan notes the growth of Chinese naval power in the South China Sea, in particular the construction of a naval base in Hainan, and comments:

The current security situation at the edges of Eurasia is fundamentally more complicated than it was in the first years after World War II. As American hegemony ebbs and the size of the U.S. Navy declines or plateaus, while China's economy and military grow, multipolarity will increasingly define power relationships in Asia. The United States is providing Taiwan with Patriot air defense missiles and dozens of advanced military communications systems. China is building underground submarine pens on Hainan Island and developing antiship missiles. Japan and South Korea are continuing to modernize their fleets. India is building a great navy. Each of these states is seeking to adjust the balance of power in its favor.

²¹⁷ DEFRA, *UK Food Security Assessment: Detailed analysis*, DEFRA August 2009, p.83
<http://www.defra.gov.uk/foodfarm/food/security/assessment.htm>

²¹⁸ Impact of September 2000 Fuel Price Protests on UK Critical Infrastructure Public Safety and Emergency Preparedness Canada (PSEPC): Incident Analysis: IA05-001 25 January 2005
<http://www.iwar.org.uk/cip/resources/PSEPC/fuel-price-protests.htm>

²¹⁹ Mark Townsend and Martin Bright, 'Army guard on food if fuel crisis flares', *The Observer* 6 June 2004 <http://www.energybulletin.net/node/525>

²²⁰ See also Andrew S. Erickson, 'Chinese Sea Power in Action: The counterpiracy mission in the Gulf of Aden and Beyond,' in Roy Kamphausen, David Lai, Andrew Scobell eds., *The PLA at Home and Abroad: Assessing the Operational Capabilities of China's Military*, US Army War College, Strategic Studies Institute, July 2010, p.297.
<http://www.strategicstudiesinstitute.army.mil/pubs/display.cfm?pubID=995>

This is why U.S. Secretary of State Hillary Clinton's rejection of balance-of-power politics as a relic of the past is either disingenuous or misguided. There is an arms race going on in Asia, and the United States will have to face this reality when it substantially reduces its forces in Afghanistan and Iraq. Although no Asian state has any incentive to go to war, the risk of miscalculations about the balance of power will increase with time and with the buildup of air and naval forces in the region (if only by China and India). Tensions on land may reinforce tensions at sea: the power vacuums that China is now filling will in due course bring it into uneasy contact with, at a minimum, India and Russia. Once-empty spaces are becoming crowded with people, roads, pipelines, ships--and missiles. The Yale political scientist Paul Bracken warned in 1999 that Asia was becoming a closed geography and faced a crisis of "room." That process has only continued since.

...the very fact of China's rising economic and military power will exacerbate U.S.-Chinese tensions in the years ahead. To paraphrase Mearsheimer, the United States, the hegemon of the Western Hemisphere, will try to prevent China from becoming the hegemon of much of the Eastern Hemisphere. This could be the signal drama of the age.²²¹

As global warming makes the natural resources of the Arctic more accessible, then great power interest in this region will grow.²²² It has in the post-Cold War era been an arena of cooperation rather than competition between the Arctic powers, and it seems likely that this trend will continue for the foreseeable future. However the Russian Federation, the USA, Canada, Denmark and Norway are all now paying greater attention to the Arctic region in the formulation of their security policies and will increase their military capabilities there.²²³ Although not an Arctic power, China is also becoming increasingly interested in the region, and is developing an Arctic agenda.²²⁴ In March 2010, Chinese Rear Admiral Yin Zhuo commented that "the Arctic belongs to all the people around the world as no nation has sovereignty over it...China must play an indispensable role in Arctic exploration as we have one-fifth of the world's population."²²⁵

Global warming could also result in increased interest in the mineral resources of Antarctica, and possibly make this a region of geopolitical competition in the future.²²⁶ The US Energy Information Agency estimates that there may be 50 billion barrels of oil in the Weddell and Ross Seas.²²⁷ The 1991 Madrid Protocol to the Antarctic Treaty (which came into force in 1998) forbids mining and drilling for oil for a minimum of 50 years. However, both the

²²¹ Robert Kaplan, 'The Geography of Chinese Power. How far will China reach at land and on sea?' *Foreign Affairs*, 89, 3 (2010), pp.22-41.

http://www.cerium.ca/IMG/pdf/Kaplan_How_far_can_Beijing_reach_on_land_and_at_sea.pdf ; See also his discussion of Chinese naval power <http://www.foreignaffairs.com/discussions/interviews/qa-with-robert-kaplan-on-china> .

²²² See the discussion by Steven Main above.

²²³ See Charles Emmerson, *The Future History of the Arctic*, London, The Bodley Head, 2010, pp.136-143

²²⁴ See Linda Jakobson, 'China Prepares for an ice-free Arctic', *SIPRI Insights on Peace and Security* 2/2010, March 2010 <http://books.sipri.org/files/insight/SIPRIInsight1002.pdf> ; Joseph Spears, 'China and the Arctic: The Awakening Snow Dragon', *China Brief* Volume: 9 Issue: 6, March 18, 2009 [http://www.jamestown.org/programs/chinabrief/single/?tx_ttnews\[tt_news\]=34725&tx_ttnews\[backPid\]=25&cHash=1c22119d7c](http://www.jamestown.org/programs/chinabrief/single/?tx_ttnews[tt_news]=34725&tx_ttnews[backPid]=25&cHash=1c22119d7c)

²²⁵ Gordon G. Chang, 'China's Arctic Play', *The Diplomat*, 9 March 2010 <http://the-diplomat.com/2010/03/09/china%E2%80%99s-arctic-play/> Yin Zhuo is described as CPPCC (Chinese People's Political Consultative Conference) National Committee member of the Expert Committee, director of Naval Information. <http://www.comhaha.com/blog/465893-yin-zhuo-admiral-pla-transparency-can-not-be-done-in-accordance-with-western-demands/>

²²⁶ http://climatelab.org/Climate_Change_Security

²²⁷ <http://www.eia.doe.gov/emeu/cabs/antarctica.html#oil>

Antarctic and the South Atlantic are now seen as being of increased strategic significance, and global warming may raise questions over the future governance of the Antarctic.

The possibility that there may be oil in the territorial waters surrounding the Falkland Islands has created fresh tension between Britain and Argentina, and is creating a new area of strategic interest for London. In early March 2010, the Liberal Democrat MP Bob Russell asked in the House of Commons that:

Is it not time that Britain looked at the whole south Atlantic as a single strategically important part of the world?²²⁸

This question was met with approval by the then Minister for Europe Chris Bryant, and as such highlights the growing importance of the South Atlantic. Britain's Antarctic claims are rejected by both Argentina and Chile, and so the southern polar region could become an area of dispute later in the 21st century. It was reported in July 2008 that Argentine President Cristina Fernández de Kirchner was considering stationing troops in Antarctica. She stated: "This world is no longer a world divided by ideology...It is more complex, and it is necessary to defend our natural resources, our Antarctica, our water."²²⁹ Brazil has also embarked on an ambitious programme to expand her navy in order to be able to protect her Exclusive Economic Zone of 3.6 million square kilometres. Salvador Raza, a professor at the Brazilian National Defense University warns that "where there is oil, there are conflicts, and we must be prepared".²³⁰

Climate change, energy and food security will constitute major challenges to interdependence, global and national governance, state and societal cohesion in both the developing and developed worlds in the next few decades of the 21st century. These challenges will exist alongside the more traditional challenges of geopolitical rivalry, and the "clash of civilizations", and they are likely to be "game-changers", affecting the whole nature of global governance and international security management.

²²⁸ <http://www.publications.parliament.uk/pa/cm200910/cmhansrd/cm100302/debtext/100302-0003.htm> . The full exchange reads: **Bob Russell (Colchester) (LD)**: The Falkland Islands, in the south Atlantic, are very important to Britain's interests. May I draw the Minister's attention to the fact that without Ascension Island the Falklands could not be sustained, and that without the people of St. Helena living on the Falklands and Ascension Island the Falklands could not be sustained? Is it not time that Britain looked at the whole south Atlantic as a single strategically important part of the world? **Chris Bryant**: The hon. Gentleman makes a very good point, and I have had many conversations with the Ministry of Defence about ensuring that it recognises the financial requirements on Ascension. We also have a duty to stand by St. Helena. House of Commons 2 March 2010.

²²⁹ Graeme Baker, 'Argentina's military threat raises fears over Falklands', *Daily Telegraph*, <http://www.telegraph.co.uk/news/worldnews/southamerica/falklandislands/2271140/Argentinas-military-threat-raises-fears-over-Falklands.html>

²³⁰ by Raul Zibechi, Brazil as a Key Player, February 2010 http://www.meatradenewsdaily.co.uk/news/260210/brazil_a_leading_world_power_today.aspx

APPENDIX

Energy Self-Sufficiency for G8 plus China and India 2005

Russian Federation	100 per cent
Canada	100 per cent
China	95 per cent
UK	87 per cent
India	70 per cent
USA	70 per cent
France	50 per cent
Germany	39 per cent
Japan	19 per cent
Italy	15 per cent

Source: Energy in Japan 2008, Agency for Natural Resources and Energy, Japanese Ministry of Economy Trade and Industry, 2008., p.11.

<http://www.enecho.meti.go.jp/english/toprunner/6.7english2008.pdf>

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