House of Commons
All Party Parliamentary Group on Peak Oil

and

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Renewable Energy • Shelter • Environment Training

The Impact of Peak Oil on International Development

July 2008

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The All Party Parliamentary Group on Peak Oil (APPGOPO)

The All Party Parliamentary Group on Peak Oil was set up in July 2007 to review estimates of future oil production and consider the consequences of declining world oil production for the UK and world economy.

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RESET (Renewable Energy Shelter Environment Training) is a training and consultancy charity set up in 2007 to increase awareness of peak oil, climate change and practical technology and design solutions.

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Contents

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- Depletion Scotland

Foreword

The limits to growth in global oil production are becoming increasingly evident. Gordon Brown and George Bush can persist with their efforts to pressure Saudi Arabia to increase production, but sooner or later they will have to square up to reality and accept that oil is a finite resource, and that production of all finite resources must decline.

Of course we all know that oil is finite, but years of relatively cheap oil have lulled us into a false sense of security. The price of oil has steadily increased since 2002. As I write this, oil has hit an all-time high of $140 a barrel. Investment bank Goldman Sachs is predicting $200 oil within two years.

Warnings about peak oil - the point at which global oil production reaches its maximum and begins to decline - have been sounded for many years, and many such warnings have in fact proved premature. Now though there is real cause for concern that we are approaching that historic peak. The International Energy Agency (IEA) have warned in their Medium Term Oil Market Report of July 2007 of an oil 'supply crunch' by 2012, and an increasingly large body of geologists, oil industry figures and analysts are forecasting that global peak oil production will occur at some point between 2008-2012. Recent rises in food and energy prices are consistent with these forecasts.

The implications of global peak oil are profound. Declining oil production is likely to cause major economic and social disruption as the world's economies face supply constrictions and booming prices. This year my constituents in Birmingham have been struggling with the soaring price of petrol. For those in the developing world however, the struggle with energy costs has been desperate for much longer. In the West we rely on oil primarily for transport. Across the developing world oil is also widely used to generate electricity and so many Third World countries are acutely vulnerable to shortage and price rises.

In light of this I was keen to invite experts in international development to address the All Party Parliamentary Group on Peak Oil (APPGOPO). In March of this year RESET, Practical Action and Global Witness made clear to the group that big changes will be required in the international development community if it is to cope with the emerging energy crisis. RESET and Practical Action with whom this report has been produced, spelt out how training in truly sustainable, non-fossil fuel dependent energy generation, construction and farming methods will be essential if communities are to become resilient to energy price rises.

In a warming world, disaster relief is likely to be more necessary than ever, as the frequency of drought, famine and severe weather conditions increases. The ability to respond to disasters will be seriously affected by rising energy costs. Governments and the international disaster relief community must consider how their operations will be affected by peak oil if they are to effectively tackle disasters in the future.

There are many unprecedented challenges ahead, and work to address them must be initiated now.

John Hemming

John Hemming MP
Chairman of the All Party Parliamentary Group on Peak Oil (APPGOPO)

1 Executive Summary

The world is on the brink of an energy crisis that has drastic implications for people in the developing world. As almost every aspect of modern life is sustained by cheap energy, the impacts of rising oil prices will be profound.

Energy security has become a political priority for governments world-wide, a priority which needs to be reflected in the field of international development. Principal donors of overseas aid and senior policy advisors are encouraged to consider that:

- **Vulnerability to energy and commodity price rises must be addressed at all levels – from humanitarian aid to bilateral development;**
- **Business as usual is not an option: future project funding should include criteria for reducing energy vulnerability - especially in post-disaster recovery and reconstruction settings;**
- **Food production should be de-linked from petro-chemicals; proven alternatives should be promoted.**

Transport, diesel-generated electricity, refrigeration, plastics and medicines are all susceptible to increasing energy costs. Availability of all these items is not in question – the question is whether people will be able to afford them as energy becomes scarcer.

This paper urges the British Government and its DFID to invest in research and disaster mitigation strategies in light of the Peak Oil scenarios. Specifically, it recommends that:

- **An inter-agency working group on *energy security and international development* is set up**
- **Contingency planning for energy vulnerability become an immediate priority**
- **Training and research aiming to build capacity in local food and energy security is funded and disseminated across the humanitarian and development sector.**

Many cities[1], and some nations[2], realise that global Peak Oil is not only inevitable, but imminent. This paper argues that contingency planning now – and subsequent mobilisation of training and adaptation of programme design – must be seen as a high priority.

This paper looks initially at Peak Oil and the likely political and economic impacts. Next it presents a series of proposals for practical strategies to build resilience in a time of sharply rising energy prices. Viable alternatives are offered in food production, human settlement design and local energy security.

Global oil production is reaching its peak, critical decisions are needed to prepare communities everywhere for the dramatic and irreversible changes ahead. Carrying on with 'business as usual' is no longer an option.

We are capable of predicting the outcomes of irreversible energy depletion. Proven and effective strategies that build resilience and reduce energy vulnerability exist. Donors and agencies of international development need to learn and adopt these strategies.

[1] Portland, Oregon is among several US cities to adopt Peak Oil strategies. See: http://globalpublicmedia.com/news/706

[2] Sweden aims to be fossil fuel free by 2020 (Swedish Commission to End Oil Dependency); France believes the peak will come in 2013. (French Government Report : "The Oil Industry 2004", Direction des Ressources Energétiques et Minérales de la DGEMP, 2004).

2 Peak Oil

Peak Oil occurs when global oil production reaches a maximum point after which it enters irreversible decline. If demand remains constant, prices will inevitably rise as demand outstrips supply.

The price for crude oil has doubled within the last 12 months[3]. Global oil production has peaked at around 86 million barrels per day since 2005. For every barrel of oil we discover, we consume three. Output is already falling in over 60 of the world's 98 oil producing countries[4]. These statistics seem to indicate that we are on the verge of global Peak Oil.

There is little dispute that access to fossil-derived energy has shaped human civilisation over the past two centuries[5]. Within the 20th century alone, our population soared on a strikingly similar trajectory to our extraction of fossil fuels from the ground.

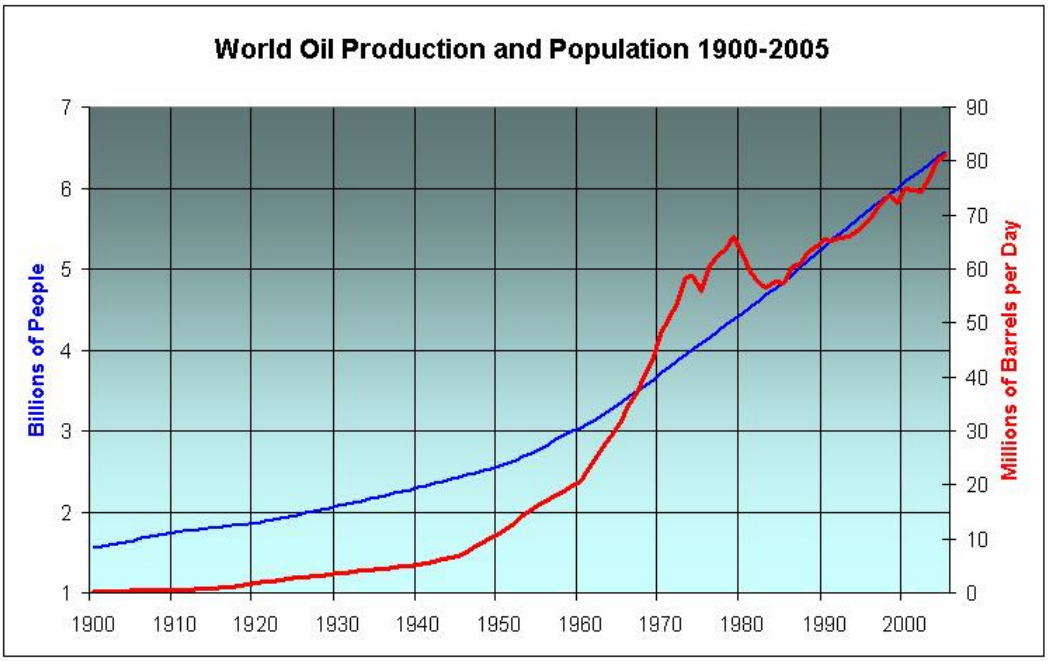

Fig. 1: World Population and Oil Production
(Source: Chefurka, P. *World Energy and Population Trends to 2100*)

Oil and gas are uniquely valuable resources. Energy-dense and easily transported, it is important to recognise that they cannot be directly replaced with modern alternatives, such as biofuels, hydrogen or tar-sands.

[3] In May 2007 oil was priced at about $65 a barrel (http://news.bbc.co.uk/1/hi/business/7414093.stm) and a maximum of $138.83 was reached on June 6, 2008 (http://www.cnbc.com/id/24993747)
[4] Strahan, D., 2008, *Gordon Brown doesn't get the oil crisis*, Daily Telegraph, 29th May 2008
[5] Heinberg, R., 2007, *Peak Everything: waking up to the century of decline in Earth's resources*, Clairview

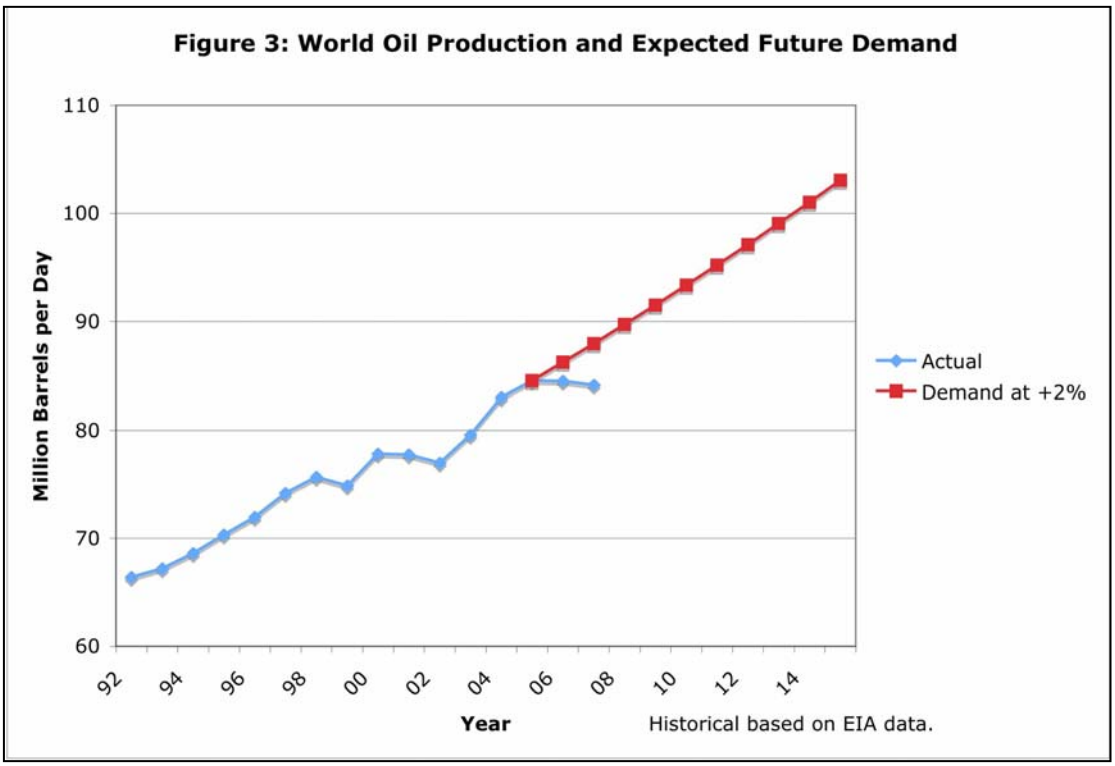

Fig. 2: World Oil Production and Expected Future Demand
(Source: The Oildrum, based on US Energy Information Association data, 2005)

The exact date of Peak Oil remains difficult to identify, but falls in production are more easily pinpointed. North Sea oil is recognised to be in steep decline; 2007 output was 60% lower than in 1999[6] when it peaked at 2.9 million barrels per day (bpd), now having fallen by almost 60% is around 1.2 million bpd[7].

Both the OECD's International Energy Agency (IEA) and the US Energy Information Administration (EIA) figures show that global liquids production has been on a plateau since 2005.[8] Since then oil prices have soared like never before, in a manner that was unforeseen by energy experts of the World Bank and the IEA[9]. Our inability to forecast the availability and price of oil accurately casts doubt on assurances of secured future supply.

In January 2008, the EU Energy Commissioner, Andris Piebalgs, questioned whether oil supply could keep up with demand. He stated that "the gap between supply and demand could widen by 4% annually leading to a 20% gap within 5 years"[10].

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[6] International Herald Tribune, 28th April 2008
[7] Oil Depletion Analysis Centre (ODAC) http://www.odac-info.org/node/2559; Williamson, M, Williamson, M, 2007, Alarm bells ring about North Sea output, The Glasgow Herald, 5th October, 2007,
[8] The Oil Drum - http://europe.theoildrum.com/node/3087
[9] A report by The World Bank Group's Energy Unit, published in 2007, predicted the most expensive / worst case scenario price of oil in 2010 and 2015 to be $56 and $61 respectively. It uses the IEA World Energy Outlook, 2005 as reference for this forecast
[10] EurActiv, 2008, EU energy chief warns about 'peak oil', 16 January 2008: http://www.euractiv.com/en/energy/eu-energy-chief-warns-peak-oil/article-169582

Increased demand in producer countries

There is growing evidence that the main producer nations (Middle East countries and Russia) are also those with the fastest growing demand.[11] As global supply starts to decline, it is likely that exports will be cut – to meet domestic demand and avoid internal disturbances. This will reduce the amount of oil available for export and increase costs as the supply and demand gap widens.

As the implications of increasing oil prices are profound and fundamental to almost every aspect of modern society, the potential impact on international development should be analysed in depth.

Impacts of Peak Oil

The critical question is not whether we have reached Peak Oil, but whether prices will continue to rise. And it is the impact of these rises that should be of most concern to the development sector.

Assuming global Peak Oil is a possible scenario over the next 5 years, governments and aid donors need to focus attention, resources and creativity to ask - and attempt to answer - some essential questions:

- What impacts will be less abundant and more expensive fossil fuels have on development?
- What can be done to reduce dependency on fossil fuels and to build communities resilient to fossil fuel depletion?
- What scenario planning is in place and how will these plans be put into effect?

Peak Oil

- **Modern society owes its growth to energy derived from fossil fuels, and is almost entirely dependent on it.**
- **Global oil production has remained level since 2005, despite significant investment and rising prices.**
- **Peak Oil is likely to occur in the near future: our challenge is to mitigate its impacts and enable communities to develop resilience and self-reliance.**

[11] Heinberg, R., 2007 Peak Everything: Waking up to the century of decline in Earth's resources. Clairview, 2007

3 The political and economic impacts of Peak Oil

When oil passed $130 per barrel in May 2008, it sent shockwaves through the global economic system. As prices have risen, protests at the economic impact have been organised. Hauliers across Britain, France, the Netherlands and Bulgaria, as well as European fishermen, have shown their desperation.

However, the impacts are hitting hardest in the developing world, where fuel price rises make the difference between poverty and extreme vulnerability.

After Indonesia withdrew subsidies in June, leading to a 30% fuel price jump, daily protests have erupted[12]. In the Lebanon, reports were received of five people killed and forty injured, as police attempted to quell civil unrest as a result of protests against rising fuel costs.[13]

Potential impacts of a global recession

In 2006, Dr Robert Wescott, former chief economic advisor to the US President, stated that "if oil increased to $120 a barrel and stayed there for a year…it would almost certainly precipitate a global recession"[14]. Goldman Sachs and OPEC representatives indicated the possibility of a $200 barrel by the end of 2008[15] meaning that despite efforts to stem economic downturn in the short term, a global recession is now likely.

The impacts of global recession on the international development sector would be profound. For agencies working in the field, the outcomes are likely to be stark: higher operational costs together with contracted donor aid budgets.

Furthermore, as oil prices rise and commodities become less affordable, social unrest and conflict is inevitable[16] – food and energy riots reported already during 2008 are testament to this.

Economic Impacts on Developing Nations

In 2007, a High-Level Task Force based at Oxford University, warned that high energy prices would "wipe out Millennium Development Goal progress"[17]. Meanwhile, the International Energy Agency found that each $10 per barrel increase costs sub-Saharan Africa 3% of GDP[18]. In the year 2000, it was estimated that countries in sub-Saharan Africa spent 14% of their GDP on fuel imports[19]. Oil is now $100 a barrel more expensive than in the year 2000.

What actions are required?

Far from making poverty history, the deepening energy crisis has the potential to make poverty a permanent state for a growing number of people, undoing the development efforts of a generation. Communities across the globe are more vulnerable than ever, living in an unsustainable present and facing an uncertain future.

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[12] The Malaysia Sun, 31st May 2008
[13] BBC News, 27th May 2008
[14] Wescott, R., 2006, *What would a $120 oil mean for the Global Economy?* Securing America's Future Energy, Washington DC
[15] Blas, J. and Flood, C., 2008, *"Analyst warns of Oil at $200 a barrel"*, Financial Times, May 6 2008, London
[16] The link between international security, Climate Change and resource depletion is explored in: *An Uncertain Future: Law enforcement, National Security and Climate Change*, Abbot, C. (2007) Oxford Research Group
[17] Oxford, 2007, *Energy, Politics and Poverty: A strategy for energy security, climate change and development assistance*, University of Oxford, June 2007
[18] IEA, 2004, available online at http://www.iea.org/textbase/npsum/high_oil04sum.pdf
[19] Oxford, 2007, *Energy, Politics and Poverty: A strategy for energy security, climate change and development assistance*, University of Oxford, June 2007

This situation is clearly unsustainable and needs to be addressed. Where possible, development assistance should promote energy security through local, renewable energy generation that minimises dependency on fossil fuels. This is in line with EU energy policy[20].

The political and economic impacts of energy scarcity

- **High energy prices reverse MDG progress**
- **Current oil prices are likely to cause global economic recession**
- **Peak Oil will impact the most vulnerable in developing countries, at a time when the twin injustice of climate change is already hitting hard**
- **Reduced energy demand and alternative energy sources are essential for economic and political security**

[20] "Europe must lead the world into a new, or maybe one should say post-industrial revolution - the development of a low-carbon economy." Jose Manuel Barroso, Chief of the European Commission (2007).

4 The impact of energy scarcity on humanitarian affairs

Today, the relief sector can respond swiftly to humanitarian emergencies anywhere. The system, however, relies heavily on fossil fuels for distribution of emergency supplies and personnel, diesel-fed electricity for every aspect of relief coordination, oil-based plastics, medicines and other products.

In the event of a deepening energy crisis, the aid sector may have to reconsider how it delivers humanitarian assistance. It will become increasingly dangerous to run energy intensive operations in areas where people have little or no access to fossil fuels. Agencies will also have less overall funding for projects as donor nations' economies contract.

Other impacts of rising oil & energy prices worth noting are:

- **Food Aid:** the current food crisis is set to deepen as prices rise for oil and gas-based agricultural inputs, such as fertiliser, pesticides and transport fuel. As the most recent oil price rises filter through the system, food costs are likely to increase further.
- **Humanitarian operations:** as local fuel prices soar, agencies will need to implement low carbon strategies, to make relief programs themselves more resilient.
- **Electricity generation:** aid coordination, government operations, hospitals and other social infrastructure conventionally are entirely dependent on diesel-powered generators; investment in renewable energy technologies for electricity generation will increase the resilience of these vital functions.

The UN Development Programme has pointed out that energy is central to all aspects of human welfare – facilitating food production, access to water, health care and education. Reaching all of the eight Millennium Development Goals hinges on access to basic energy services[21].

Just as modern society has integrated oil derivatives fundamentally into our lives - from food to transport to medicines to buildings - so international development has also become vulnerable, in its reliance on hydrocarbons.

Impact of energy scarcity on humanitarian relief

- **The current aid model is energy hungry and vulnerable to energy scarcity**
- **Capacity to provide assistance is dwindling as the world economy is hit by soaring oil prices**
- **The food crisis is set to deepen if modern agriculture remains reliant on fossil fuels**
- **As we strive to "make poverty history" the twin crises of climate change and energy scarcity threaten to make it permanent**

[21] UNDP (August, 2005) Energising the Millennium Development Goals

5 Possible Solutions: Building resilience

What kind of projects can build resilience against energy scarcity? Do we have any models of best practice? Can these be integrated into existing humanitarian and development programmes?

The remaining part of this document addresses these questions.

The aid community is distributed throughout the world's most vulnerable locations. In each case, opportunities exist to reduce community vulnerability to future food and energy crises; to pursue the 'business as usual' model would reinforce a community's dependency on fossil fuels and deepen their vulnerability to price rises. Donors should insist that funded projects incorporate and promote sustainable energy systems where possible.

Post-disaster recovery and reconstruction settings offer ideal opportunities to integrate sustainable food, energy and building strategies. For example, reconstructed communities could be designed to:

- **reduce energy demand using 'passive design' principles relevant to the local climate**
- **ensure sewerage systems are rebuilt as energy sources (e.g. through biogas digesters, producing gas for cooking and heating and fertiliser inputs for soil recovery)**
- **incorporate renewable energy systems, where economically competitive to the fossil fuel alternative**

In each case, local solutions exist. Local people would have an opportunity to see first hand how such alternative energy systems work – drawing their own conclusions regarding their applicability and economic value.

This requires a huge training commitment that begins with local awareness-raising to build an understanding of the contemporary threats. Training should be provided in local food production and composting. The ultimate result should be a mobilised community ready to tackle the immense energy, food and construction challenges on their doorstep.

Contingency planning to assess the likely impacts and possible scenarios on each phase of international development should be launched. The purpose of this should be to:

- Identify proactive and viable strategies to moderate the more serious implications
- Initiate training and knowledge transfer with national partners
- Mobilise the necessary resources in advance.

6 Alternative Energy Systems

It is important to remember - amidst all the discussions of the impact of Peak Oil and Climate Change on our energy usage - that around a third of the world's population today still has no access to electricity[22] and almost a half of the world's population still cooks over open fires[23]. Energy poverty is a feature of life in the developing world. Ending energy poverty means providing sufficient access to improved energy sources, to cover:

- **Elemental needs – providing basic energy needs in the home**
- **Basic services that make a big impact on quality of life: energised pumping to bring water closer to the home, refrigeration for vaccines, lighting in health posts to extend opening hours, lighting and basic equipment in schools to improve teaching facilities, and better facilities in schools and clinics to attract better doctors and teachers to work in rural areas.**

There is a direct correlation between energy consumption figures and countries' levels of development, as shown by the graph below charting Human Development Index (HDI) scores against per capita energy usage. HDI seems to reach a plateau when the average nation's people consume about 4000 kWh (kilowatt hours) per capita of electricity annually.

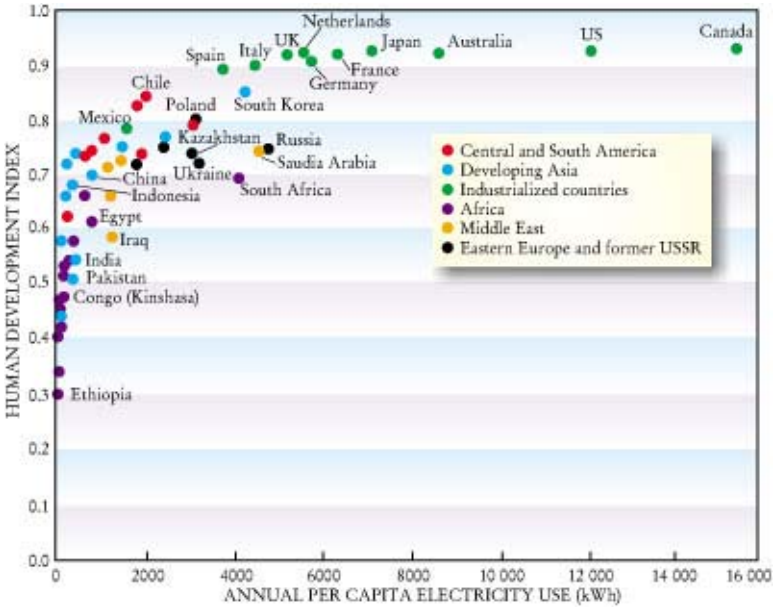

Figure 3. Paternak, Global Energy Futures and Human Development: A Framework for Analysis, Lawrence Livermore National Laboratory rep no: UCRL - ID- 140773, October 2000. *Provided by:* Practical Action

The EU recognises that to avoid energy vulnerability we "cannot hang on to old, fossil energy systems"[24]. An equally compelling argument has been made for overseas development in a UN Development Programme analysis that *"today's situation…entrenches poverty, constrains the delivery of social services, limits opportunities for women and erodes environmental sustainability at the local, national and global levels."*[25]

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[22] Third UN Conference on LDCs, 13th Meeting, May 2001
[23] WHO World Health Report, 2002
[24] Comments made by the EU energy chief, Andris Piebalgs, in January, 2008.
[25] Comments made by Mats Karlsson, UN-Energy Chair, in The UNDP report "The Energy Challenge for Achieving the Millennium Development Goals", 2005, UNDP.

Energy security and development

In relation to energy security, it is useful to identify where communities in the developing world may be most vulnerable to energy price rises. Risk areas include cooking, electricity, light, heating and cooling.

From this point, it is possible to see how renewable energy systems, or in some cases increased efficiency, could play a useful role to reduce vulnerability, offer better economic value and strengthen resilience. The economic comparison between renewable energy systems and fossil fuel improves every time the price of oil rises. The graph below showing solar power costs compared to a diesel generator in Malaysia exemplifies this.

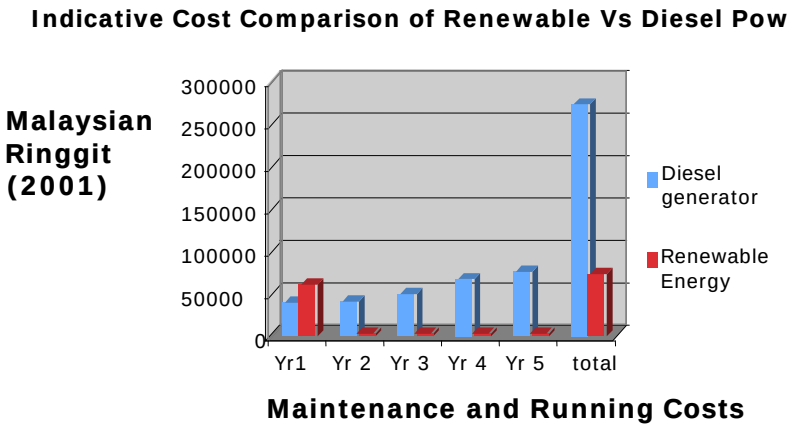

Fig. 4: Indicative Cost Comparison of Renewable versus Diesel Power Generation
Source: http://www.mered.org.uk/Hornbill/Md_Amin.htm

Sufficient field studies show the technical viability and economic advantages of renewable energy technologies. In light of rising oil and fuel costs, there can be little argument over the strategy of increased application of renewable energy systems at all stages of the relief to recovery transition.

To tackle energy poverty in a world of rising oil prices and the threats from climate change the following actions are required:

- Urgent government action to reduce the unit cost of renewable technologies, including solar photovoltaics, and to increase efficiency (e.g. through feed-in tariffs).
- Greater emphasis on renewables as the first choice option wherever feasible and additional grant funding to cover increased capital costs where this is not the lowest cost option.
- More investment in decentralised energy production to enable the rural poor to gain access to energy where extensions of national grids are unlikely in the medium term.
- Grant financing to enable developing countries to access new technology to improve efficiency and reduce carbon emissions where fossil fuel use is currently inevitable.
- Recognition that, if energy poverty is to be dealt with, the developing world's use of carbon will have to increase in the short to medium term and that the developed world's absolute and relative share of consumption of fossil fuels will have to fall sufficiently to accommodate this and concerns over reducing global carbon emissions.

7 Food Production

"The status quo is no longer an option. We must develop agriculture that is less dependent on fossil fuels, favours the use of locally available resources and explores the use of natural processes such as crop rotation and use of organic fertilisers".
UNESCO, 2008 [26]

Current approaches to food production

The recent Green Revolution was made possible through the application of cheap fossil fuels to agriculture. It increased food production in absolute terms but did so through huge inputs of energy and resources, and has led in many cases to disastrous ecological consequences.

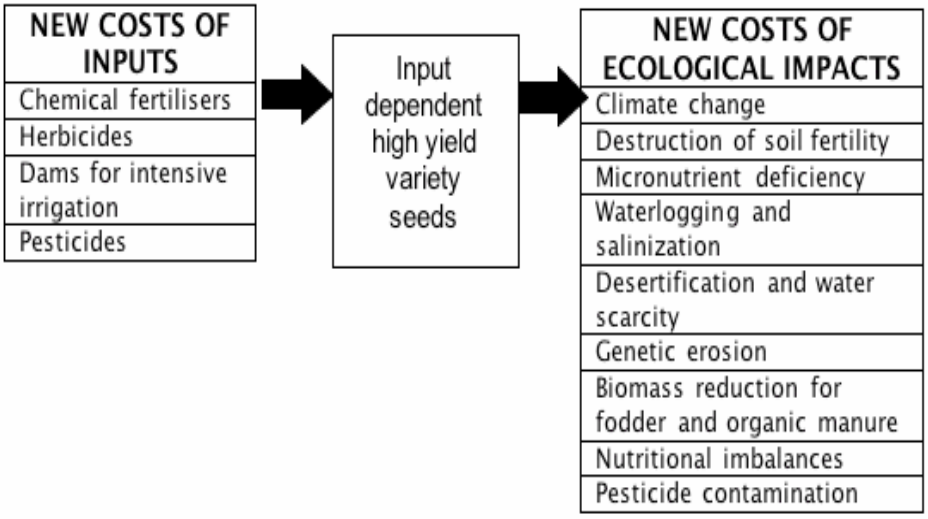

Fig. 5: External Input Agriculture
(Source: Adapted from Shiva and Pandey, 2006)

A recent report from the International Assessment of Agricultural Science and Technology for Development (IAASTD) stated that continuing such an approach is not an option[27]. The IAASTD found that a fundamental change in farming practice is needed to counteract soaring food prices, hunger, social inequities and environmental disasters.

They also state that genetically modified (GM) crops will not play a substantial role. Instead, small-scale farmers and agro-ecological methods are the way forward; with indigenous and local knowledge playing as important a role as formal science.

[26] Guilhem Calvo, UNESCO adviser, ecological and earth sciences division, a sponsor of the IAASTD report (April 15th 2008) http://news.bbc.co.uk/1/hi/world/europe/7348728.stm
[27] IAASTD (2008) *Global Summary for Decision Makers* http://www.agassessment.org/docs/Global_SDM_050508_FINAL.pdf. This project is a major global initiative, developed out of a consultative process involving 900 participants and 110 countries from all regions of the world. The IAASTD was launched as an intergovernmental process, with a multi-stakeholder Bureau, under the co-sponsorship of the FAO, GEF, UNDP, UNEP, UNESCO, the World Bank and WHO.

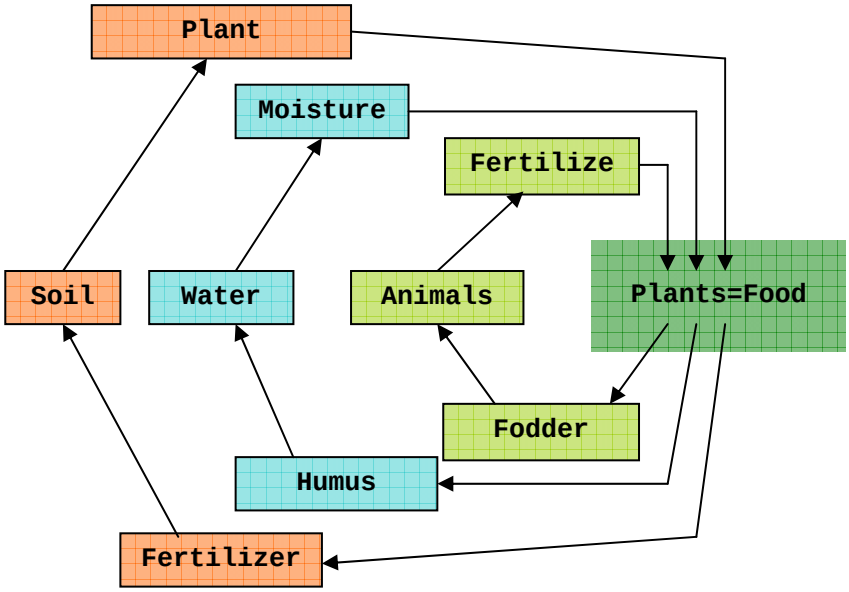

Fig. 6: Internal Input Agriculture
(Source: Adapted from Shiva and Pandey, 2006)

Resilient food production

Key to adapting to Peak Oil and Climate Change is the design of resilient and flexible systems that ultimately return control over food production and supply to local people. This creates independence from external suppliers of seeds, fertiliser, pesticides and water, and so builds resilience and stronger local economies, health and wellbeing.

When viewed in terms of resource use efficiency, 'External Input' agricultural models of Green Revolution and genetic engineering technologies fare poorly compared with 'Internal Input' ecological agriculture, where productivity is based upon biodiversity and full and efficient utilisation of biological resources (Figs. 5 and 6)[28]. Such agro-ecosystems more closely resemble natural systems, use polycultures with smaller or no external energy input while delivering higher combined yield of all farm products than a single monoculture crop. They are better at supporting ecosystem functions and are more resilient to Climate Change.

A recent report from the Institute of Science in Society (ISIS), gives extensive evidence from peer reviewed research and case studies to show how organic, sustainable and fossil fuel free agricultural systems can meet needs, and actually increase yields over conventional systems (Fig. 7)[29].

By increasing soil organic matter and using landscaping and agroforestry techniques, it is possible to greatly increase the passive harvesting, infiltration and retention of rainwater in agricultural landscapes. This provides a buffer against floods and droughts, reduces erosion and the need for irrigation, and builds fertile topsoil.

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[28] Adapted from Shiva and Pandey, (2006): *Biodiversity Based Organic Farming: A new paradigm for food security and food safety*. Navdanya, New Delhi
[29] ISIS (2008) *Food Futures Now*. ISIS-TWN Sustainable World (2nd report). http://www.i-sis.org.uk/foodFutures.php

The Permaculture Research Institute (PRI) has been successfully trialling such organic systems for several years. In Jordan's Dead Sea region, PRI rehabilitated a salinated desert area, with minimal rainfall and summer temperatures of over 50°C. Results included regenerated fertility and topsoil, rapid food production and an agroforestry system[30].

We have the ability to produce food with minimal external energy inputs. There are many successful permaculture projects globally that demonstrate how to achieve productivity and resilience.[31] Permaculture also contains a holistic and practical training and extension methodology to bridge the gap between scientific and indigenous knowledge. It is well suited to training illiterate people and for scaling up from demonstration and teaching centres.

Now that external input agriculture is failing from cost and reduced availability of inputs (particularly petrochemical based inputs) and ecological collapse, it is vital that permaculture models of agriculture be targeted for more research and development funding, and introduced as a key part of development programmes.

***Food Futures Now:* Findings of ISIS study**

- Composting gives 30 percent more crop yields than chemical fertilisers
- Organic out-yields conventional agriculture by a factor of 1.8, and green manure alone could provide all nitrogen needs
- Sahel farmers defied predictions of scientists and policy-makers by greening the desert and creating a haven of trees
- Anaerobic digestion of farm and food wastes could boost total energy savings to 49.7% and greenhouse gas savings to 54%
- Organic agriculture and localised food systems mitigate 30% of the world's greenhouse gas emissions and save one-sixth of energy consumption
- Helps to regenerate local economies, revitalise local, indigenous knowledge, and create social wealth

Fig. 7: Highlights of findings of the ISIS Study, "*Food Futures Now*"
(Source: Institute of Science in Society, 2008)

[30] Permaculture Research Institute: www.permaculture.org.au/2005/02/01/use-of-permaculture-under-salinity-and-drought-conditions
[31] The permaculture Association of GB administers a global network of local permaculture organisations, and is able to provide case studies for a variety of different climates. Weblink: www.permaculture.org.uk

8 Resilient Community Design

Architecture and human settlement design offer aid donors and practitioners enormous opportunities to reduce vulnerability to the combined threats of Peak Oil and Climate Change.

From post-disaster reconstruction to slum rehabilitation and new town planning, new projects can draw upon a wide range of options to reduce energy demand, while incorporating local food and energy resilience.

Where these approaches can be applied together, the potential to create resilient communities is increased. Four key elements to resilient shelter and community design are:

- Energy Efficient Buildings
- Renewable Energy Generation
- Local Food Production
- Integrated Water and Sanitation

1 Resilient Buildings

- Climate responsive design which provides thermal comfort and security
- Energy efficient design for minimum energy demand
- Building materials and practices that support local, transferable skills development
- Durable design that supports health and well being
- Design for minimum environmental impact, by using local and renewable materials
- Design for low cost and maintenance
- Skills training in appropriate, low energy building design

Fig. 8: Resilient earth building technology**,** Sahel **-** no-wood build, reducing deforestation, better thermal performance at 10% of normal construction cost. (Source: La Voûte Nubienne. http://www.lavoutenubienne.org/)

Fig. 9: SECMOL training Centre – Ladakh, showing passive design for minimum energy demand. (Source: SECMOL. http://www.secmol.org/solarenergy/)

2 Renewable Energy Generation

- Capture and use of local energy sources (solar, wind, micro-hydro, bio-gas)
- Design for local/community level energy storage and supply
- Energy systems which support local, transferable skills development
- Design for minimum cost and maintenance
- Skills training for maintenance and replication

Fig. 11: Shidhulai Swanirvar Sangstha, Bangladesh. Solar powered boats bring education and sustainable energy to remote areas. (Source: Ashden Awards, 2007)

Fig. 10: BIOTECH Biogas, India. Biogas provides a source of renewable energy for cooking and hot water. (Source: Ashden Awards, 2007)

3 Local Food Production

- Zoning for food production spaces
- Planning for allotments and orchards around buildings
- Consideration of design appropriate to arid, temperate or humid climates
- Minimise external inputs, maximise internal, organic inputs
- Community supported agriculture, including possibilities for urban agriculture[32]
- Skills training for local food production

Fig. 12: Greenhand Field School, Aceh. Permaculture demonstration and training centre for tsunami survivors. (Source: IDEP foundation, 2008)

Fig. 13: Home gardens, Aceh. Tsunami survivors implement permaculture training in new homes. (Source: http://www.idepfoundation.org 2008)

[32] During the "Special Period" from 1991 to 1995 when Cuba was cut off from foreign oil imports, the country mobilized a drive for self sufficiency. Within a few years, 85% of food consumed in Havana was grown within the city itself. Source: The Power of Community – How Cuba Survived Peak Oil. The Community Project

4 Integrated Water & Sanitation

- Implementing rainwater capture, storage and supply strategies
- Micro-irrigation for local agriculture
- ‘Grey-water’ retention, filtration and use
- Energy capture and use from sewerage and organic waste (compost, vermiculture, biogas)

Fig. 14: Rainwater harvesting at school, Kolkata, India.
(Source: Asia-Pacific Water Forum)

Fig. 15: Biogas for cooking plus fertiliser from slurry.
SKG Sangha project, Siradhanahalli village, near Bangalore. (Source: Ashden Awards 2007)

9 Conclusions and Recommendations

It is clear that the current level of global energy consumption is unsustainable, from both environmental and geological points of view. The implications of global Peak Oil within the next five years demand attention. Failure to adequately address this threat would be a serious abrogation of duty in light of available information and recent market fluctuations.

This paper advocates urgent risk assessment in energy scarcity, international development and cooperation. Viable strategies need to be identified that can mitigate further hardship and disaster through community based projects. These strategies need to be included in donor funding criteria.

More specifically, the following recommendations are made:

- Support and fund a Working Group on energy security and international development to undertake contingency planning on the impact of Peak Oil in developing countries, and humanitarian response capacity
- Make local energy security a donor funding criteria to encourage organisations to adopt appropriate technologies and designs
- Initiate wider dialogue and action planning within the UN and other leading donors on questions of energy security
- Fund research and training that builds capacity in local food and energy security that is independent from fossil fuel imports - disseminated across the humanitarian and development sector.

Many proactive strategies exist to manage this transition to sustainable, low carbon communities. They should be integrated into humanitarian and development funding priorities and criteria.

A shift from an industrialised agriculture system to one based on ecologically sound principles and free from petro-chemical inputs is essential. Similarly, energy efficient dwellings that have minimal environmental impact are necessary.

Donors and humanitarian and development agencies are encouraged to assess their position regarding energy and food security and how they may engage in the transition to a low carbon future.

We live in an era of supreme comfort and technology – on an unmatched pinnacle of energy consumption and resource use. Looking forward, we can either plan an orderly energy descent strategy or we can refuse to accept that the era of cheap energy is drawing to a close and continue business as usual. Either way, energy policies and funding choices made now will have lasting consequences for future generations.