DOHA 2012
UN CLIMATE CHANGE CONFERENCE
COP18·CMP8

inside:

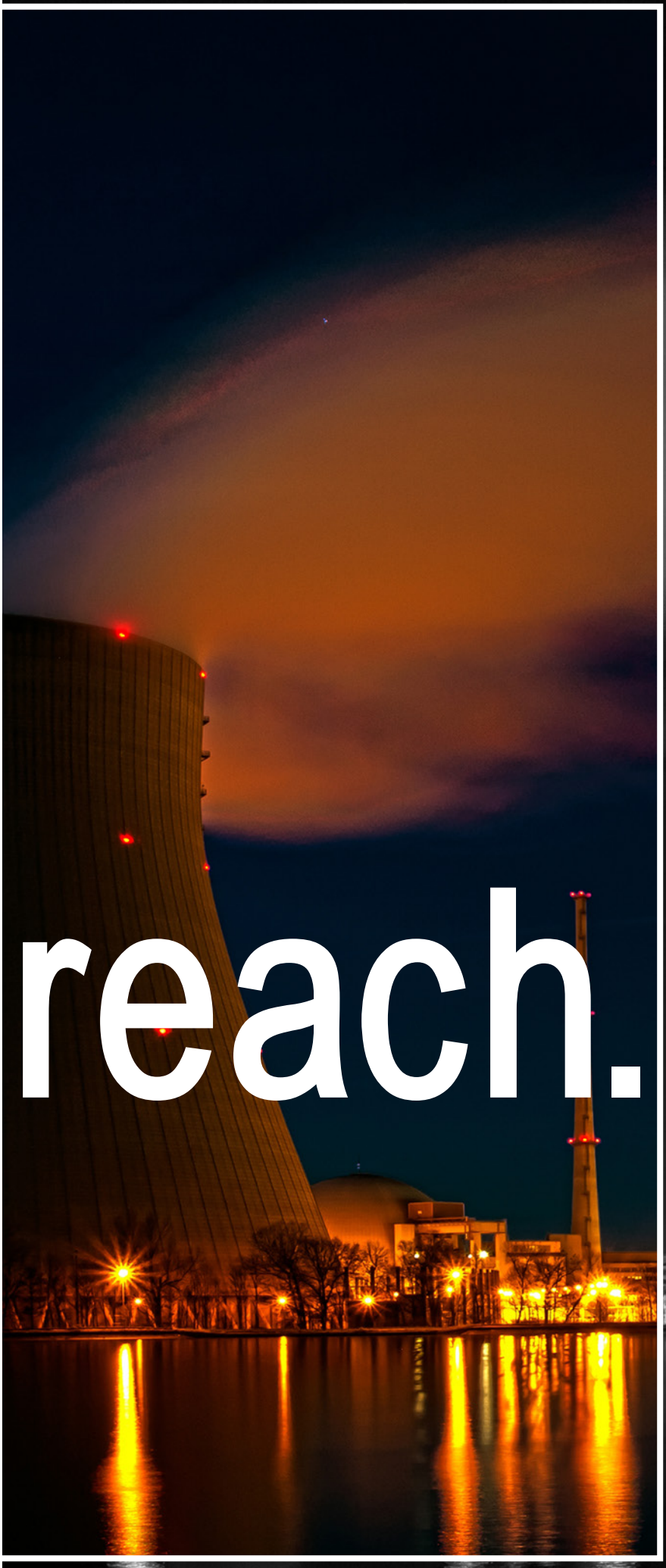
More energy for the negotiations

Sustainable energy technology in a changing climate: An alternative for developing countries

a daily multi-stakeholder magazine on climate change and sustainable development

outreach.

28 November 2012



pic: Bjoern Schwarz

Be PaperSmart: Read Outreach online
www.stakeholderforum.org/sf/outreach

contents.

pic: Isabell Schulz

OUTREACH IS PUBLISHED BY:

STAKEHOLDER FORUM

Stakeholder Forum is an international organisation working to advance sustainable development and promote democracy at a global level. Our work aims to enhance open, accountable and participatory international decision-making on sustainable development and climate change through enhancing the involvement of stakeholders in intergovernmental processes. For more information, visit: www.stakeholderforum.org

Outreach is a multi-stakeholder publication on climate change and sustainable development. It is the longest continually produced stakeholder magazine in the sustainable development arena, published at various international meetings on the environment; including the UNCSD meetings (since 1997), UNEP Governing Council, UNFCCC Conference of the Parties (COP) and World Water Week. Published as a daily edition, in both print and web form, Outreach provides a vehicle for critical analysis on key thematic topics in the sustainability and climate change arenas, giving a voice to individuals and organisations from all stakeholder groups. To fully ensure a multi-stakeholder perspective, we aim to engage a wide range of stakeholders for article contributions and project funding.

If you are interested in contributing to Outreach, please contact the team (acutter@stakeholderforum.org or jcornforth@stakeholderforum.org)
You can also follow us on Twitter: @stakeholders

OUTREACH EDITORIAL TEAM

Editor	Amy Cutter	*Stakeholder Forum*
Editorial Assistant	Jack Cornforth	*Stakeholder Forum*
Editorial Advisor	Farooq Ullah	*Stakeholder Forum*
Print Designer	Faye Arrowsmith	*www.floga-design.co.uk*
Web Designer	Matthew Reading-Smith	*Stakeholder Forum*

CONTRIBUTING WRITERS

Prianka Ball	*British Council Climate Champion*
Isobel Braithwaite	*Healthy Planet UK*
Stuart Bruce	*Lawyer*
Polly Higgins	*Eradicating Ecocide*
Sylvia I. Karlsson-Vinkhuyzen	*Wageningen University*
Jan Ole Kiso	*Department of Energy and Climate Change, UK*
Dr. Rafael Leal-Arcas	*Queen Mary University of London and World Trade Institute*
Magdalena A. K. Muir	*Climate, Coastal and Marine Union*
David M. Mwayafu	*Uganda Coalition for Sustainable Development*
Maria Neira	*World Health Organisation*
Alexander Ochs	*Worldwatch Institute*
Jonathan D. Quartey	*Kwame Nkrumah University of Science and Technology, Ghana*
Jamie Seah	*ECO Singapore*
Pujarini Sen	*Adopt a Negotiator Fellow*

More energy for the negotiations

Alexander Ochs
Worldwatch Institute

More than half of all human-caused greenhouse gas emissions result from the burning of fossil fuels for energy supply. Even excluding traditional biomass, fossil fuel combustion accounts for 90% of carbon dioxide (CO_2) emissions.

Against this background, it is surprising how much of a limited role energy is playing in the ongoing climate negotiations. And yet this discussion could be instrumental in refocusing the debate about what is necessary and what is possible in both the areas of climate mitigation and adaptation – bringing it back down from the current inscrutable spheres of negotiation tracks, subsidiary bodies, parallel sessions, ad-hoc working groups, and special meetings (which, let's be frank, nobody outside the negotiators understands anymore).

First, a focus on energy shows how far we are from solving the climate crisis. Energy-related CO_2 emissions grew 3.2% in 2011 to more than 31 gigatons – despite the economic crisis. We know that if we do not want to lose track of the 2°C threshold of maximum warming that would hopefully avoid major disasters, energy emissions must decline by at least one third to 20 gigatons in 2035, despite expectations that energy demand might double in the same time frame.

So the challenge is enormous. But – and this is where the good news starts – clean energy solutions are at hand, ready to be implemented. The costs for wind, solar, sustainable hydro, biomass and waste energy technologies all continue to fall rapidly, and, in many markets, they are becoming price competitive with fossil fuels – even if externalities and fossil fuel subsidies are not internalised. If they are, the cost that our societies pay for our continued reliance on fossil fuels becomes truly outrageous: Coal, responsible for 71% of global energy-related CO_2 emissions, causes more than US$100 billion in local pollution and health care costs annually in the United States alone, in addition to the personal hardships of those suffering from these impacts. Add the costs for climate change, and it becomes incomprehensible why our societies continue down the fossil fuel path despite the availability of alternatives.

Many countries and regions, including China, India, Japan, South Korea, and most parts of Europe, are running out of fossil fuels rapidly. In 2011, for the first time, investments in renewable energy sources were higher than those in conventional energy. The results are impressive. As a result of its Energiewende ("energy transition"), Germany now supplies 27% of its electricity from renewables. Costa Rica has pledged to be carbon-neutral by 2021, covering 100% of its electricity supply from renewable sources. Municipalities, provinces, and countries around the world show similar ambitions.


pic: Fiona Shields

At home, that is. Neither the technological progress of the recent past nor the potential for future advances seems to be reflected in the United Nations climate negotiations, which still follow a paradigm of climate mitigation equaling economic loss. For 20 years, they have only resembled one logic, that of "how can I possibly commit to less than you do?" Research has shown that energy emissions can be halved by 2030 if efforts at efficiency and renewables are integrated in an ambitious strategy. What is technically possible would have enormous environmental, social, and economic benefits.

At this point, continued global warming is already inevitable. Our need to adapt to future changes in our environment, including extreme weather events, is becoming more urgent by the day. And again, renewables hold enormous advantages over fossil fuels. As distributed power solutions, many renewable technologies are less vulnerable to storms and floods, and most of them rely on less water to operate.

What countries know that they can do – and must do – at home, finally needs to be reflected at this COP and beyond. Energy ought to bring new power to the negotiations ■

ABOUT THE AUTHOR

Alexander Ochs is Director of Climate and Energy at the Worldwatch Institute.

Powering global health

Maria Neira
World Health Organisation

When considering priorities for energy initiatives, the health sector may not be the first to spring to mind. However, health constitutes a large and growing share of the global economy, with annual expenditures totalling over $US 5 trillion or approximately 10% of global Gross Domestic Product.

Modern facilities and procedures are also highly energy-intensive – in the use of water, lighting, heating, cooling and ventilation, as well as through waste disposal. It is estimated that the health sector contributes 3-7% of global carbon emissions – probably a larger contributor than air travel. Health deserves a central place in any energy policy.

Access to clean, safe and sustainable energy for all is one of the main global development challenges today. The UN Secretary General's initiative, Sustainable Energy for All (SE4ALL), calls for universal access to modern energy services, and doubling the efficiency of energy use and the energy share of renewables by 2030. Reaching these targets would greatly support sustainable development, the economy, environment and general health.

Energy access is essential for the health sector. A stable and reliable power supply is indispensable for health facilities to run refrigerators, operate and maintain diagnostic equipment, and provide light. This cannot be taken for granted. Recent analysis by the World Health Organisation (WHO) shows that lack of access to electricity, in the context of health care, is a significant problem. Nationally representative surveys, conducted in six countries, revealed that up to 58% of the population in sub-Saharan Africa lacked any electricity at all. Other surveys in developing countries showed that intermittent power supply was the single most common cause of failure of medical devices, accounting for almost a third of total cases. Sustainable development, including human well being, cannot be achieved if women are required to deliver babies in the dark, without basic medical equipment, or procedures are interrupted due to an intermittent or unstable power supply. Guaranteeing energy access for medical facilities should be one of the most basic criteria for sustainable development.

However, the amount of energy, and the source, is important. There is an increasing body of evidence that suggests that even in developing countries, and particularly in remote settings, more climate friendly and energy efficient provision of health care services brings many benefits. These include improved equity of health care access, service, safety, and resilience to emergencies – including the extreme weather events that are expected to become more frequent and severe under climate change. Promoting renewable energy and energy efficiency for developing country health facilities is therefore a perfect case study of integrated sustainable development – enhancing human wellbeing, climate change adaptation, and mitigation.

As economies grow, and demand for medical services increase, there are even more gains to be had from wise use of energy in the health sector. Hospital and health care settings around the world are "greening" their facilities and improving their energy performance, saving money, and yielding benefits to the health system. In the richest, and highest energy consuming countries, the potential for energy savings is considerable - estimated to range from 8 to over 40% in European countries. Greening the health sector is not a luxury – surveys of patients show strong support for initiatives to enhance sustainability and reduce waste, including wasted energy. Energy savings from more efficient heat and power, as well as energy efficient buildings, can significantly assist with resilience to a diminished energy supply, through extreme weather or grid failures, both in developed and developing countries.

Universal access to health care is dependent on access to energy, and the future needs of treating non-communicable diseases. In energy poor settings more energy efficient buildings, devices and power systems can also help prevent power overload and failure, create more comfortable patient environments, and ensure that available power may be channelled to the health operations and procedures that need it most.

The role of energy in protecting our health is fundamental, and no sector has more to gain from guaranteeing access to clean, safe and sustainable energy for all, than the health sector. WHO, and its partners in the health community, are committed to playing their part in supporting this aim ■

ABOUT THE AUTHOR

Maria Neira is Director of the Public Health and Environment Department at the World Health Organisation

pic: Shaun Dunphy

Climate change and rural energy issues in the Lake Victoria Basin in East Africa

David M. Mwayafu
Uganda Coalition for Sustainable Development

East Africa is vulnerable to climate change because of its low adaptive capacities. This is compounded by weak institutional capacities, the lack of skills on climate change adaptation and disaster management, limited financial resources, poor planning, and above all, economies that are entirely dependent on natural resource exploitation. The region has already experienced an increase in the frequency and intensity of extreme weather events, some causing serious socio-economic consequences.

The climate system is East Africa's most valuable natural resource as it determines other the behaviour of other natural resources – including water, land, plants and animals – which the region's economic and social development depends on. Adverse effects of climate change threaten to undo decades of development efforts and frustrate poverty reduction programmes.

Energy is a major driver of the region's economic development. The local communities' basic rural energy sources are climate-based and include hydroelectric, biomass and solar power.

When climate changes adversely, communities' access to energy is affected. The Lake Victoria Basin (LVB) is one of the most populated areas in East Africa.

Rural energy situation and potential in the LVB
Currently, the energy sector of the partner states relies wholly on the importation of petroleum. However, this trend will likely change considering the discovery of oil in Northern Kenya and Western Uganda, and natural gas in Tanzania. Electricity generation is predominately hydro, supplemented by geothermal and thermal sources. Apart from wood fuel – used by over 90% of the local population and therefore over-exploited – other renewable energy resources have not been optimally exploited.

Major challenges facing the energy sector include improving the quantity, quality and reliability of energy supply; initial capital outlay and long lead times from feasibility studies to development of energy infrastructure; mobilising adequate financial resources to undertake massive investment in the power sector, high cost of energy, low per capita incomes, and low industrialisation levels across all partner states.

Rural energy issues in the LVB can be summarised into six categories:

- **Non-availability of Energy** – no form of energy at all in some localities.
- **Available but not enough** – the available wood or energy cannot satisfy the demand.
- **Efficiency of use** – wood and energy are available but used inefficiently and may soon get exhausted.
- **No accessibility to energy** – energy resources are available but communities cannot access them.
- **Cost inaccessibility** – energy is available but unaffordable by communities because of high cost.
- **Energy effectiveness attitudes** – energy innovations are provided but communities resent these solutions and instead seek scarcer forms of energy, which they are used to (e.g. biogas).

COP18 needs to stress the importance of access by developing countries to environmentally sound technologies, knowledge, know-how, expertise, and further ensure cooperative action on technology innovation, research and development.

There is an urgent need to fully operationalise the technology mechanism in 2012 and take into account the need to resolve outstanding issues, such as the removal of barriers that prevent access to climate-related technologies and appropriate treatment of intellectual property rights, including the removal of patents on climate-related technologies for non-Annex I parties.

There is a need to provide new, scaled-up and additional financial resources to enable developing countries – particularly African countries – to mitigate and adapt to climate change without depleting the scarce resources required for poverty eradication and other sustainable development objectives.

Direct access to financial resources should be ensured for developing countries through a transparent process, providing equitable allocation, taking into account geographical and needs-based criteria, a balance between adaptation and mitigation, and grant-based funding for adaptation activities.

In order for Africa to develop sustainably, public finance should be the main source of funding to ensure predictability and adequacy of funding, bearing in mind that private and market finance can be complementary ■

MORE INFO

This article is based on the Lake Victoria Climate Change Readiness Brief, produced by the East African Sustainability Watch Network: http://www.easuswatch.org/phocadownload/resources/UCSD%20-%20e-mail.pdf

Linking energy and climate change

Dr. Rafael Leal-Arcas
Queen Mary University of London and World Trade Institute

The nexus between energy and climate change
Starting from the premise that climate change mitigation is a global public good, there is a nexus between energy and climate change, which encompasses a range of issues such as clean energy subsidies, carbon taxes, and border adjustment for carbon emissions. In the absence of a global climate agreement, this last point of border carbon adjustment may be a way forward in tackling climate change post COP18 in Doha, by helping to level the playing field in international trade while internalising the costs of climate damage into prices of goods and services. As climate change is one of the most important public policy issues facing countries around the world, countries are adopting various policies in order to address these concerns. Of these, limiting anthropogenic (man-made) greenhouse gas (GHG) emissions is a significant mitigation measure.

In the view of Dieter Helm:

> "since 1900, the global population has more than tripled and the consumption of energy (largely fossil fuels) has increased more than tenfold. Climate change has been caused by the way resources have been consumed, and climate change policy necessitates a substantial change in the allocation of resources."

Moreover, according to A.M. Kleymeyer:

> "the energy sector, including energy use and production, accounts for over 50% of global GHGs."

Given rapidly rising industrialisation in the developing world, and the fact that low-cost energy options are likely to be heavily fossil fuel based for some time to come, GHG emissions are projected to increase and climate change mitigation will remain an urgent issue. Furthermore, when dealing with biofuels, it is necessary to find a balance between climate change and energy security concerns, as well as understand their impact on other factors such as food security.

Beyond fossil fuels: Investing in renewable energy
Since the use of fossil fuel is one of the major sources of anthropogenic GHG emissions, it is important to promote climate-sensitive energy policies that will help countries increase non-fossil fuel sources in their energy mix. Various alternative energies, in which nuclear and renewable sources play key roles, are being explored and developed by countries as part of their diversification efforts. Major investments in the new and renewable energy sector will be required in order to increase non-fossil energy usage.
The increased competition for energy resources, climate change and GHG emissions controls, technological advances and limitations have all contributed to a contradictory, fragmented regulatory web. These include: the exploration of new sources of energy, the transition to greener resources and intelligent grids, the challenges to the security of supply networks, affordability and its links with development and the contested consumption paradigms, the nature and size of energy companies, and the cross-jurisdictional terrain on which they compete.

The nexus between energy and trade
The presumption is that trade liberalisation will increase economic activity and therefore energy consumption. All countries require energy resources, but few possess these, and thus trade in energy (primarily oil) is crucial to fulfil global energy needs. Internationally, there is more trade in oil than in anything else. Yet, the General Agreement on Tariffs and Trade (GATT), now replaced by the Word Trade Organisation (WTO), has historically not preoccupied itself with energy trade. Very few energy-rich countries saw a need to join the GATT/WTO club, given that the reduction of import restrictions - one of the main goals of the multilateral trading system - is not an issue when it comes to energy. For instance, Saudi Arabia, the main energy-producing country in the world, only joined the WTO in 2005 and many energy-producing countries are still not WTO Members ■

MORE INFO

Dr. Rafael Leal-Arcas is a Senior Lecturer in Law, Queen Mary University of London, UK; and Marie Curie Senior Research Fellow, World Trade Institute (University of Bern)
r.leal-arcas@qmul.ac.uk

pic: Arnold Paul | Wikimedia Commons

Energy and climate change: Towards sustainable energy for all?

Stuart Bruce
Lawyer

Decarbonisation imperative
The remaining carbon emissions budget to stay below a 2°C global temperature increase is 565 gigatonnes. Global emissions locked into forecasted fossil fuel combustion up until 2050 exceed this allowance fivefold. Accordingly, the International Energy Agency has declared that 'the door to staying below 2°C is closing', while the World Bank says we are on track to a 4°C warmer world by the end of this century.

Energy must decarbonise. Clean energy is a vital if we are to avert catastrophic climate change. Yet energy barely features in the text of the climate change regime and meaningful international regulations are scarce. One elephant in the negotiating room is energy production and consumption. The IPCC has highlighted the important role of renewable energy through a special report. This article argues for a global energy decarbonisation revolution, underpinned by international legal regulation.

Sustainable Energy for All requires global cooperation
While a sizeable proportion of the world is addicted to fossil-fuels that exacerbate climate change, over 1.3 billion people currently have no access to electricity – disproportionately the poor in developing countries. In an attempt to catalyse change in domestic energy generation and use, the UN Secretary-General Ban Ki-moon established the Sustainable Energy for All initiative (SE4ALL).

One of its strengths, according to a new Accenture report on SE4ALL business opportunities, is its clear global vision and ambitious objectives to be achieved by 2030:

1. Ensuring universal access to modern energy services;
2. Doubling the rate of improvement in energy efficiency; and
3. Doubling the share of renewable energy in the global energy mix.

These objectives interlink and self-reinforce. Distributed and off-grid renewable energy is a sound option to advance access to energy, reduce emissions and increase economic growth and energy security.

Achieving the SE4ALL objectives necessitates unprecedented cooperation at the international, regional and national levels, by government, business and civil society. Finance and technology assistance for developing states will be needed. How then, can international cooperation be galvanised? More specifically, what is the role, if any, of the climate change regime and international law in facilitating SE4ALL?

Climate change regime should include energy regulation
By establishing the UNFCCC, the deleterious consequences of energy generation and consumption were recognised by the international community. Yet the Convention and Kyoto Protocol do not create any binding obligations


pic: Eric Schmuttenmaer

related to energy generation or mix. Rather, the climate regime seeks to regulate the consequence of energy generation: greenhouse gas emissions.

By becoming party to the Convention, and especially the Protocol, developed states agree to reduce their national greenhouse gas emission levels according to quantified targets, but have complete discretion about how to do it. Moreover, developing states, many with increasing emissions trajectories, do not have the same obligations. While theses treaties do make reference to energy efficiency and renewable energy, for the most part the text merely invites consideration of energy policy suggestions. Obligations to use energy efficiency and renewable energy remain scant and considered "supplementary" means to increase ambition in the Durban Platform.

In practice, renewable energy constitutes a large proportion of the Clean Development Mechanism projects, driven primarily by financial and economic considerations. But the Protocol only covers 10–15% of global emissions. The scale of renewable energy projects remains inadequate to achieve either SE4ALL or the Convention's ultimate objective – prevention of dangerous anthropogenic interference with the climate system – despite record investments in renewable energy. As suggested by UNFCCC Executive Secretary Christiana Figures, 'sustainable development without sustainable, renewable energy is impossible'. An energy revolution supported by law is needed.

Beyond the climate change regime, the International Renewable Energy Agency (IRENA) was established in 2009 to promote widespread adoption and sustainable use of all forms of renewable energy. It's a great step, but IRENA's competence is limited, without power to mandate renewable energy generation or energy efficiency uptake. IRENA has a role to play, but it, and the climate regime, could do more for climate change and SE4ALL. Only through international cooperation, facilitated through international law, perhaps with timetables and targets, can the required clean energy revolution be achieved. However this is manifested – by independent treaty or Protocol – it will be thwarted unless the energy elephant is addressed. The barrier to change is political will. The clock to 2°C is ticking ■

The missing energy negotiations

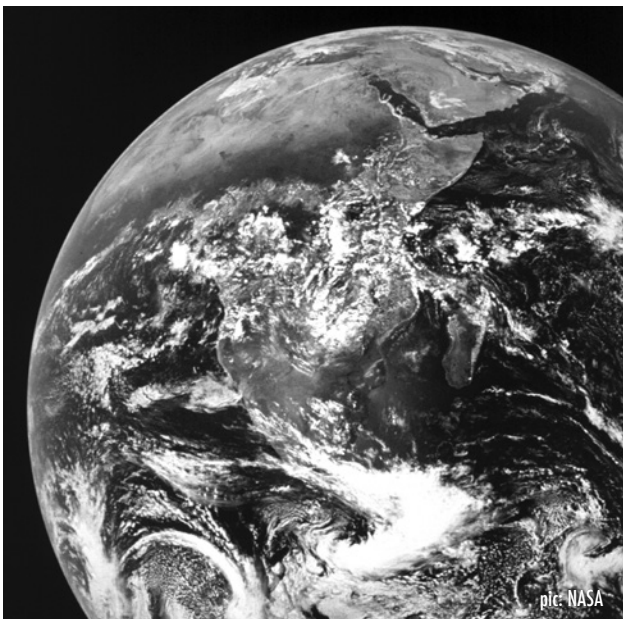
Sylvia I. Karlsson-Vinkhuyzen
Wageningen University

Few in Doha would question the need for universal multilateral agreements on climate change mitigation and adaptation. Underlying this unity of purpose - despite the lack of unity in agreements - is the notion that a stable climate system is a global public good (GPG).

Public goods are resources that are non-rival and non-excludable. This means that there can be no exclusion of those who refuse to pay for the good or service to enjoy the benefits, and that its use by one person does not impact on another's use. Because of their character, public goods – and particularly GPGs – risk being under-provided, as is all too clearly illustrated by the climate negotiations here.

One of the reasons for countries' reluctance to contribute their share to its provision is that the possibilities for multilateral win-win cooperation around energy have been neglected for decades. An illustration of this is the fragmented and ad hoc approach to develop both norms and action around energy for sustainable development, especially within the UN System. For example, the Rio+20 Outcome Document has five paragraphs dedicated to energy using the most general and non-committal language, including: "We...recognise the importance of promoting incentives in favour of, and removing disincentives to, energy efficiency and the diversification of the energy mix, including promoting research and development in all countries, including developing countries." (para 128). This language is even weaker than the soft goal of the 2002 World Summit on Sustainable Development where countries agreed with "a sense of urgency, [to] substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply..." (para 20).

In a recently published paper in '*Ecological Economics*' my co-authors and I argue that that there are good reasons, both normative and analytical, to view the sustainability of the global energy system as a GPG. For the individual consumer, energy is of course both excludable and rival. We can therefore only argue this if we take a global systems perspective. We can find a parallel in the stability of the global financial system. Once financial stability has been achieved, everyone benefits from it and no one can be excluded. The same goes for a global energy system that is efficient and has low or no carbon intensity. Once it is established it would be a GPG for at least two reasons. Firstly, it would give the non-excludable and non-rival benefits of a less dangerous degree of climate change and reduced air pollution. Secondly, such an energy system would mean that more people would have access to modern energy services in the future, when current energy


pic: NASA

sources become scarcer and more expensive. Access to modern energy services is a pre-requisite for economic and social development.

It is society's choice to change the mind-set from looking at energy as – for example, a national security issue where countries consider each other as competitors – to looking at the sustainability of the global energy system as a GPG. If we did so, then the issue of global collaboration on energy would become less sensitive and more open to discussion about the type of global collaboration on sustainable energy that would make sense. In our paper we suggest that global provisioning of a sustainable energy system becomes desirable when it is effective and necessary. For example, this can be achieved by strengthening the capacity and motivation of countries to take action, addressing barriers in the international system and targetting the GPG properties of global sustainable energy collaboration, including knowledge creation and diffusion, and international standards and targets.

Perhaps the establishment of the International Renewable Energy Agency (IRENA) was a positive sign that the mind-sets of governments around opportunities and benefits of international collaboration on sustainable energy is changing. If that is the case it should also be reflected in these negotiations by the willingness of countries to adopt bold positions and show real leadership for climate mitigation here in Doha ■

MORE INFO

Karlsson-Vinkhuyzen, S.I., Jollands, N., Staudt, L., 2012. Global governance for sustainable energy: The contribution of a global public goods approach. *Ecological Economics* 83, pp.11-18.

Sustainable energy technology in a changing climate: An alternative for developing countries

Jonathan D. Quartey
Kwame Nkrumah University of Science and Technology, Ghana

The energy sector stands out as one of the major areas of intervention for climate change mitigation in developing countries. It is expected that COP will pay particular attention to issues of new energy technology diffusion, which is a major area of promise towards climate change mitigation in these countries.

Learning curves suggest that the extremely high initial cost of creating new energy technology in developing economies may be temporary. New energy technology diffusion is imperative for developing economies between now and 2050, if they have to conform to international efficiency standards by replacing obsolete technology and also achieve low carbon development. While developed economies use only 30% of wood produced for energy, developing economies use 80% for the same purpose, showing an urgent need for new energy technology diffusion to these nations. Thus the interaction between cost reduction and the diffusion of new energy technologies will have far reaching implications for the assessment of future costs of sustainable energy development, the abatement of carbon emissions, and sustainable welfare in developing economies.

Technological change that occurs through learning-by-doing presupposes that experience can enhance product quality, improve production efficiency, reduce material and labour inputs and hence reduce average production costs. However, for developing economies, new technologies have often brought both positive and negative outcomes for natural resources which appear to be their most important form of capital. For instance, pollution from the use of fossil-fuel based technologies and metals in extraction, production and consumption have further deteriorated the productive capacities of developing economies' ecosystems and lowered sustainable welfare. Thus, increasing technology diffusion might be seen as just another driver of further reductions in sustainable welfare through ecosystems.

To prevent this, practical steps need to be adopted to develop new renewable energy technologies, since most developing countries have a comparative advantage in these. Currently, renewable energy technologies are not cost competitive compared with other energy sources in application in developing countries. To make matters worse, the inadequacy of financing schemes for renewable energy technology and little public awareness of the benefits of renewable energy technologies, coupled with uncoordinated research within the energy sector, seem to have rendered the diffusion of these technologies almost impossible.

These bottlenecks have survived many UNFCCC Conferences. However, it should be possible to charge developing countries to practically ensure that whatever they are capable of doing to facilitate the diffusion of renewable energy technologies is done – subject to admission into subsequent negotiations – as a matter of principle. Some of these bottlenecks are not beyond the abilities of these countries to solve if they will harness available human capital from all local stakeholders. The current rate of progress only serves to worsen the plight of the vulnerable. Serious negotiations require every party to show enough commitment to the cause, not only seek to be at the receiving end of the benefits. It is also worth noting that the approaches applied so far have, to a large extent, been engineering approaches, which, though commendable, are a solution to only a third of the problems. A holistic approach is recommended for all parties, particularly in terms of energy behaviours of the people for whom the energy is produced. Technology that does not convey an economic and social appeal is doomed for failure at the expense of the already vulnerable people living in developing economies. COP18 must champion the course of a sustainable energy future for all ■

pic: Green Prophet

Making 2050 add-up: Mapping a sustainable, energy-secure and low-cost future with the 2050 Pathways Calculator

Jan Ole Kiso
Department of Energy and Climate Change, UK

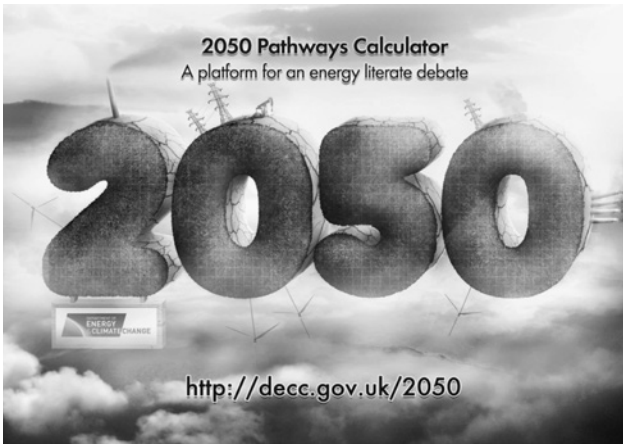
In minutes, the 2050 Calculator can outline months of work from technical experts. It allows you to answer the fundamental questions about how far you can reduce emissions and meet energy needs.

With three different levels of detail it can be used to engage technicians, policy makers and the public on how a country's energy system and emissions could change over time. It brings energy and emissions data alive and shows the benefits, costs and trade-offs of different versions of the future. By developing your own 2050 Calculator for your country, you can openly challenge long-held beliefs on what is possible.

Focusing on the engineering and science options of each demand and supply sector, the 2050 Calculator allows you to investigate the possibilities of all high-level options. Your sector choices translate into impacts on the country's greenhouse gas (GHG) emissions, land-use, energy security situation, costs etc. As such, the Calculator becomes a platform for an energy literate debate – within government and between external experts, as well as the general public.

The UK Government has used the 2050 Pathways analysis to promote an energy literate debate and inform policy. The UK 2050 Pathways Calculator informed the UK Government's 'Carbon Plan' of December 2011 which outlined pathways which would achieve an 80% emissions reduction in 2050. More than 100,000 people have looked at the publically available analysis to gain insight into the UK's energy and emissions challenge. More than 20,000 people, including large organisations, have submitted their 2050 Pathways to Government to provide critical feedback. Many experts poked holes in the analysis during a call for evidence and, as such, have made the Calculator better and more broadly accepted. Taking advantage of the open-source nature, many experts also made alterations to the 2050 Calculator, developing their own additions, further advancing its scope.

Publishing the 2050 Calculator analysis as open-source, ensures that other countries are able to utilise its know-how and further adapt it. Belgium, South Korea and China have now developed their own versions of the tool and the work is proving similarly informative within these countries. A prominent example is the 2050 China Calculator, published in September 2012 by the Chinese Energy Research Institute of the National Development and



Reform Commission. At the first 'International Conference on 2050 Pathways' in Beijing, the China Calculator was presented to representatives from over 10 different countries, including the US, India, Brazil and South Africa.

The UK Department of Energy and Climate Change (DECC) aims to further strengthen the international outreach of the 2050 Calculator approach. DECC's Secretary of State, Ed Davey, stated that "The 2050 Calculator is a ground-breaking tool to help countries better plan their future energy strategy, in a transparent and evidence-based way." By focusing the challenge of a low-carbon future on practical engineering and life-style options we gain an understanding of what needs to happen, on the ground, to achieve our targets. The Calculator allows for a shift towards aspirational and practical goals for policy-makers and the general public to focus on ■

"This excellent pathway model provides critical data on what is possible and what it may cost. Importantly it allows people to explore their own pathway to a low carbon economy."
Friends of the Earth

MORE INFO

How many wind turbines need to be constructed to decarbonise the grid? How many cars need to be converted to low-carbon? If you would like to know the answers to these, and other, questions, go to:
www.decc.gov.uk/2050 – for the UK
china-en.2050calculator.net – for the People's Republic of China
www.wbc2050.be/ – for Belgium

You can find out more about the 2050 International Calculators at a side-event on Friday, 30th November 2012, 18.30- 20.00, in the Doha Climate Change Conference Centre. Join the debate!

Using renewable energy and desalination for climate mitigation and adaptation in Small Island Developing States and coasts of arid regions

Magdalena A. K. Muir
Climate, Coastal and Marine Union

The UN Secretary-General, Ban Ki-moon has launched the Sustainable Energy for All (SE4ALL) initiative, and 2012 is the designated International Year of Sustainable Energy for All. The SE4ALL initiative has three interlinked objectives for 2030: ensuring universal access to modern energy services; doubling the rate of improvement in energy efficiency; and doubling the share of renewable energy in the global energy mix.

Renewable energy can help address water security and scarcity by integrating energy and water systems, and combining renewable energy with desalination. The Small Island Developing States (SIDS) – as well as coastal arid regions such as northern Africa and the Middle East – need to incorporate energy with water for sustainable energy development, economic development and poverty alleviation in order to mitigate and adapt to climate change. Although SIDS have geothermal, ocean, solar, and wind resources, they mainly rely on hydrocarbons to generate electricity. Both SIDS and arid regions share similar issues relating to energy and water security, which renewable energy, desalination, and aquifer management can address.

SIDS and coasts of arid regions are highly exposed to the impacts of climate change and adaptation, including responding to higher temperatures, changing seasonal and annual precipitation, depletion of aquifers and groundwater, saline intrusion of coastal and island aquifers, increased water quality issues and incidences of waterborne illnesses. Both regions have rich customary, local and traditional knowledge and technologies to manage energy and water needs (e.g. water harvesting, traditional architecture), which can augment and complement the generation of renewable energy and desalination rates.

Sustainable energy development and water linkages were recognised at the UN Conference on Sustainable Development, Rio+20. International policy developments are also underway, such as the Global Dry Land Alliance, initially proposed by Qatar at the 66th Session of UN General Assembly in 2011, and scheduled for launch at COP18 in Doha. The Global Dry Land Alliance could boost food security in arid regions through joint research and the adoption of energy and water systems and technologies by Member States.

Likewise, the Renewable Energy-Desalination-Water Treatment Pilot Project for Small Islands and Coasts in the Americas is currently being implemented by academic institutions, civil society, and international agencies. The project intends to confirm an island or coastal location, identify a suitable commercial or government client, develop a project plan, and obtain the mandatory approvals and finance to construct a renewable energy, desalination and water treatment facility. This facility will displace the imported hydrocarbons, provide energy and address water scarcity, allowing for local mitigation and adaptation to climate change.

The Munipality of Los Cabos, Baha State, Mexico, is a potential location, which is part of the feasibility assessment for the project. The municipality is located on the arid coast of the Baha peninsula and shares numerous characteristics with islands, being beset by high seasonal temperatures, limited precipitation and declining aquifers. Though solar and wind resources are available, the municipality mostly uses diesel generators to provide electricity. If water scarcity and high energy costs are not addressed, they could limit the tourism sector, which supports the local economy. Additionally, renewable energy and desalination could improve sustainability and thereby attract more tourists to the Los Cabos Municipality.


pic: Vlad Litvinov

The energy, environmental and economic feasibility of renewable energy and desalination approaches and projects is being explored by the Municipality of Los Cabos in collaboration with the Sustainable Cities International (SCI) Energy Lab (2013-2016). Working initially with ten cities, the SCI Energy Lab supports innovation in the development of local energy solutions and furthers the understanding of how cities can address the barriers that prevent larger scale uptake of sustainable energy technologies by providing a multidisciplinary forum for collaborative problem-solving and idea generation around all aspects of the design, implementation and regulation of urban renewable and local energy systems ■

ABOUT THE AUTHOR

Dr. Magdalena A. K. Muir is an Associate Professor, Aarhus School of Business and Social Sciences and NCoE NORD-STAR, Aarhus University; Adjunct Professor, Ms. Energy Policy and Climate, Zanyl Krieger School of Arts and Sciences, John Hopkins University; Research Associate, Arctic Institute of North America, Universities of Calgary and Alaska Fairbanks and Advisory Board Member, Climate, Coastal and Marine Union (EUCC), Netherlands.

Closing the door to dangerous industrial activity

Polly Higgins
Eradicating Ecocide

On 15 March 2012 the Organisation for Economic Co-operation and Development (OECD) issued a stark warning: CO_2 emissions from energy use are expected to grow by 70% in the next 38 years because of our fossil fuel dependence. As a result, by 2100 the global average temperature will have increased by between 3-6°C. The risk of harm to human and non-human life is real and immediate. Humanity is faced with a difficult choice: continue with business as usual or confront the urgent need to adapt.

Business as usual is not an option. A disruptor to our current trajectory is urgently required, one significant enough to turn existing legislation into a framework that sets in place an intervention powerful enough to stop our current business regime. Only when we do that can we build a green economy.

To be mandatory, policy needs law. To be global, law needs to be international. To be a disruptor that stabilises greenhouse gas emissions and our economies, that law needs to be enforced at the top level.

A law that prohibits extensive damage to, loss or destruction of ecosystems closes the door on the industries that cause extensive CO_2 emissions. Acting as a disruptor, the law of Ecocide creates a new wave of innovation, and new solutions that are non-destructive to ecosystems and do not cause extensive emissions. There is also potential for cities and countries throughout the world to benefit from wealth generated as the world invests trillions of dollars into new jobs.

In April 2010, I proposed to the UN Law Commission an amendment to the Rome Statute to include a law of Ecocide. A Concept Paper expanding on that proposal was submitted to all governments in March 2012. It sets out a summary route-map for implementing a law of Ecocide by 2020 and explains why existing policies are unable to disrupt our current trajectory.

Carbon emissions are just one of the adverse impacts of dangerous industrial activity. There are many more: soil erosion, pollution and decreasing biodiversity are all at the brink of triggering mass crisis. International law can impose a new system that changes the rules for us all. A law of Ecocide will lock the door on our destructive past and present, enabling us to take steps toward a safer and truly prosperous future for people and planet.

pic: Climate and Ecosystems Change Adaptation Research University Network

Implementation of the law of Ecocide will halt the flow of destruction at the source and create a pre-emptive duty on corporate activity to prohibit damage and destruction to ecosystems from the outset. CEO's, Heads of State and heads of financial institutions will have direct responsibility to ensure their decisions do not support or finance mass damage and destruction.

There are three compelling reasons for supporting a law of Ecocide:

1. to put in place the legislative framework that prioritises a green economy
2. to create jobs and build a new business platform that is premised on 'do no harm'
3. to gain first market advantage

Ecocide is a law to stem the flow of destruction from the outset. It is an upstream solution; far more cost effective to implement preventative measures than to pay fines and restoration costs after the damage has been caused. By creating a crime premised on strict liability, years of unnecessary litigation and costs will be a thing of the past. Moreover, it is a law that will create a level playing field for business across the world.

There is increasing recognition that current and projected rates of fossil fuel consumption reflect a criminal disregard for our environment. Catastrophic climate change is a threat we have to face in order to change our course of action. Once we accept that we can no longer continue business as usual, we can create the legislative framework to ensure a rapid and smooth transition. Not one single State can justify putting humanity at risk when the whole of civilisation stands on the brink of disaster ■

MORE INFO

You can read more about the law of Ecocide at www.eradicatingecocide.com and in Polly Higgins' two books, *Eradicating Ecocide: laws and governance to prevent the destruction of our planet* and *Earth is our Business: changing the rules of the game.*

Shedding light on shale gas and alternative energies

Jamie Seah
ECO Singapore

What are the standard solutions to rising ambient temperatures and to ameliorate further climate change? Cut greenhouse gas (GHG) emissions, via domestic climate policy, or something along the lines of the European Union Emissions Trading Scheme (EU ETS). Better yet, embrace Carbon Capture and Storage (CCS), a mitigation technology deemed instrumental in enabling nations to keep to 2050 emissions reductions targets.

Pre-industrial revolution, there were 275 parts per million (ppm) of CO_2 in the atmosphere; current figures stand at 392 ppm. There is a general consensus that we – as a global entity – need to act fast. The issue of energy is closely tied to that of climate change, given that as we embark on a long, arduous process to reduce reliance on conventional fossil fuels, we naturally look towards other alternatives with great potential.

Gas, an unconventional fossil fuel

Gas produces half of the carbon emissions than coal does when burnt, leading some industry lobbyists to rebrand it as a 'clean' fuel. However, its effect on climate is less obvious than a direct comparison with traditional fuels would suggest. In May 2012, the International Energy Agency (IEA) published a report titled "Golden Rules for a Golden Age of Gas", which outlined the future of shale gas extracted through hydraulic "fracking" and hailed it as a resource "poised for the golden age". Yet, it is not a panacea to tackling climate change if implemented piecemeal.

The production of shale gas is extremely intensive, with the potential for air pollution and contamination of surface and groundwater; there are insufficient wells for current extraction, and thus more resources need to be pumped into their construction if the scale of production is to expand. But perhaps most importantly, fugitive methane emissions are estimated at 4% of total gas captured, when some sources have calculated emissions of between 3-9% to be equivalent to the emissions from burning coal in power stations.

Use of shale gas can also displace emissions instead of globally reducing them. For example, in some parts of the US, nominal carbon emissions fell when gas-fired power stations replaced coal-fired power. Yet in 2011, European coal consumption rose by 6% as a result of an excess of cheap coal on the market due to reduced US consumption, while the price on carbon emissions under the EU ETS – intended to discourage coal – was too low to be effective.

With other policies in place, shale gas can act as a transitional fuel consistent with required emissions cuts. While a coal-gas switch in the short term would be pragmatic for countries like China, it would not be as appropriate for the EU where support for climate policy is strong – gas should be slowly phased out and CCS more widely utilised instead of countries gearing up for long-term reliance on shale gas.

Renewable energy, a viable alternative

Renewable energy comprises many forms of clean energy; in general, its production does not release significant carbon emissions – an advantage over traditional fuels – and is sustainable. However, its intermittency (solar, wind), substantial cost of production and catastrophic risk (nuclear) mean that more research needs to be done to improve its reliability.

Take onshore wind energy in the UK for example – in 2010, it generated 7TWh, estimated to be enough to save 6 million tonnes of CO_2; by 2020 this figure is expected to rise to 30TWh and play a crucial role in ensuring the UK meets its legally-binding carbon targets. Wind remains one of the most affordable forms of renewable energy, with each kWh costing $0.04-0.06, a fraction of the cost of generating electricity from solar panels. However, the intermittency of wind energy leads to fossil-fuel-based power supply being employed as 'backup' when wind strength is insufficient for the operation of turbines. Wind energy is also criticised for its visual impact and disruption of animals' habitats and careful site selection needs to be implemented to reduce its environmental costs.

In view of the economic and environmental trade-offs and uncertainty in terms of the best form of renewable energy, there needs to be a mix of different technologies in countries' energy plans. Nonetheless, renewables will be crucial to achieving national emissions reductions targets and maintaining a sustainable energy supply ■


pic: Jeremy Buckingham

Health risks of nuclear widely overstated

Isobel Braithwaite
Healthy Planet UK

The biggest problem we face now is how to cut carbon as fast as possible. That will require massive scaling up of renewables and scaling down of fossil fuel usage.

As PricewaterhouseCoopers (PwC) recently reported, without unprecedented carbon intensity reductions, we are probably heading for a 6°C rise by 2100. That will be much harder to avoid if we seek to end nuclear power. It is extremely low carbon, much cheaper than renewables, and the risks to health are much smaller than most people think. It could give us the time we need to improve the efficiency and economic viability of renewables – and, crucially, to develop adequate energy storage technologies for renewables. As James Lovelock, one of the world's most highly respected climate scientists, explains:

"opposition … is based on irrational fear fed by Hollywood-style fiction, the green lobbies and the media."

The prominent and well-respected environmentalists Mark Lynas and George Monbiot have also publicly explained their pro-nuclear positions, and the reasons make sense. So I was quite disconcerted earlier this year when talking to German young people overjoyed at their anti-nuclear movement's political success in the wake of Fukushima. The result will probably be a doubling of the coal-fired power stations Germany will build over the next ten years: not the sort of change we can afford to be making now. The people I met had acted in good faith – but it is a shame if their idealism is ill-informed when we so urgently need to be pragmatic.

Nuclear has by far the lowest number of deaths per unit of energy generated, from accidents or air pollution, compared to any fossil fuel or biomass. Chernobyl caused 28 deaths from acute radiation sickness, and the WHO's Expert Group's Report concluded that over the long term the statistics suggest 4,000 additional cancer deaths among the 626,000 people in the three highest exposed groups, less than 1/20th the baseline cancer rate. Fukushima has been predicted to contribute to approximately 100 early deaths from cancer in the long term. Both are tragic – of course we must avoid future Chernobyls – but other much bigger health risks receive only a fraction of the attention. 19,205 life-years were lost per million in China due to air pollution from electricity production, in 2010 alone.

What about waste?

A 2007 article on electricity generation and health concludes that nuclear power "has one of the lowest levels of greenhouse gas emissions per unit of power production and one of the smallest levels of direct health effects…it would add a substantial further barrier to the achievement of urgent reductions in greenhouse gases if the current 17% of world electricity generation from nuclear power were allowed to decline."

CO_2 tends not to be thought of as hazardous waste, but it certainly poses a severe threat to the health of future generations. Even renewables like solar have their problems, and a push for more biomass could spell ecological (and climate) disaster.

With nuclear, as with climate, 'doing the math' is key: a typical background level of exposure is 2-3 milliSieverts/year, of which approx. 0.4mSv naturally occurs in food such as bananas. Regulations limit extra exposure from man-made radiation (other than medicine) to 1 mSv/y for members of the public and most are exposed to far less. Good governance and well-chosen sites are both essential and possible; fear should not prevent us from using nuclear as a bridging technology.

George Monbiot summarises the unavoidable trade-off around renewables: "we could meet all our electricity needs through renewables. But it would take longer and cost more". The trouble with climate change is precisely that: we're fast running out of time. Work by the Committee on Climate Change shows that the maximum likely contribution to UK electricity from renewables by 2030 is 45%; the maximum from carbon capture and storage is 15% – and the gap must be made up. Nuclear seems a far better way than fossil fuels to fill that gap, for climate and for health ■

MORE INFO

www.healthyplanetuk.org

pic: Bjoern Schwarz

COP18 side event calendar

DATE	TIME	VENUE	TITLE	ORGANISERS
WEDNESDAY 28th NOVEMBER	11:30–13:00	Side Event Room 7	Brazilian indigenous peoples present elements for a indigenous plan to adapt to Climate change	Amazon Environmental Research Institute (IPAM)
	13:15–14:45	Side Event Room 4	Climate change and disaster risk management	WMO/UNEP Intergovernmental Panel on Climate Change (IPCC)
	13:15–14:45	Side Event Room 7	Supporting climate policies through social media - opportunities and limits	Responding to Climate Change (RTCC)
	15:00–16:30	Side Event Room 6	Strengthening Institutional Capacities for Climate Change Research and Training: Lessons-Learned	Environnement et Developpement du Tiers-Monde (ENDA-TM)
	16:45–18:15	Side Event Room 7	Overcoming barriers to start pro-poor carbon projects in Africa	Institute Research for the Upliftment and Prevention of Poverty (Nova Institute)
	18:30–20:00	Side Event Room 6	Green economy and global climate change risks: Challenges and Opportunities	China Association for Science and Technology (CAST)
	18:30–20:00	Side Event Room 5	Contribution of mining and metals to a low carbon economy	International Council for Mining and Metals (ICMM)
	20:15-21:45	Side Event Room 7	What National Forest Monitoring Systems can do? – Development of NFMS and MRV system for REDD+	Forestry and Forest Products Research Institute (FFPRI)
	20:15-21:45	Side Event Room 10	Agriculture in the Climate Talks and the Food Security Imperative: Which Way to Just Solutions?	IATP, CIDSE and EAA
	20:15-21:45	Side Event Room 5	The Green Climate Fund – maximizing public and private sector capital to drive low carbon investment	UNEP - Finance Initiative (UNEP FI)
THURDAY 29th NOVEMBER	11:30–13:00	Side Event Room 7	Poverty and Climate Change Mitigation	University of Cape Town (UCT) and The Energy and Resources Institute (TERI)
	13:15-14:45	Side Event Room 4	Integrated Spatial Data for Climate Adaptation Planning	United Nations Population Fund (UNFPA)
	13:15-14:45	Side Event Room 7	Engaging and empowering children and young people for resilience and green development	Earth Child Institute (ECI) and British Council
	16:45–18:15	Side Event Room 8	Pacific Islands and Climate Change - Our Century's Challenge, Our Pacific Res	Secretariat of the Pacific Regional Environment Programme (SPREP)
	18:30–20:00	Side Event Room 1	Innovating Climate Mitigation Technologies Post-2012: Integrating Engineering, Science and Policy	Imperial College London and Bellona Foundation
	18:30–20:00	Side Event Room 4	Achieving Scale in Agricultural Innovation for Climate Change	International Food Policy Research Institute (IFPRI)
	18:30–20:00	Side Event Room 6	The tourism sector response to climate change: mitigation and adaptation initiatives and strategies	World Tourism Organization (UNWTO)
	20:15-21:45	Side Event Room 6	Climate Change & Ensuring Sustainable, Humane, Equitable Food Systems: Views from the North & South	Brighter Green Inc., HSI and WSPA
	20:15-21:45	Side Event Room 7	Addressing Climate Change through South-South Sci-tech Cooperation	China Science and Technology Exchange Center (CSTEC)
	20:15-21:45	Side Event Room 6	Climate Change & Ensuring Sustainable, Humane, Equitable Food Systems: Views from the North & South	Brighter Green, HSI and WSPA

Reflections from COP18, Tuesday 27 November

Pujarini Sen
Adopt a Negotiator Fellow

On day two of COP18 in Doha, things speeded up a little bit from day one. I was at the Qatar National Convention Center by 8:30am with the rest of my Adopt a Negotiator team (you'll find us on the green couches near the spider around this time every morning), suitably sleep deprived and in need of a caffeine shot.

Today marked the first sessions of several of the seven tracks that are part of this negotiation process. The LCA (Long-Term Cooperative Action) session was of particular interest. Cracks started showing right from the word go.

There was talk about closing the track, as is scheduled in Doha, as well as calls to continue in fast track for at least the next two years. Historical responsibility and equity were discussed.

But the most heart wrenching part for me was when the Philippines said:

> "Unfortunately, we do not have good news to share. Last year alone we lost 3000 people. We are surviving. Just surviving. And we are doing it completely on our own resources. The drowning needs to stop Mr.Chairman."

They, like many others, called for strong financial action, and the filling of the Green Climate Fund, something the developing world – especially the most vulnerable countries in the developing world – desperately need.

Today was also Gender Day. It opened with a discussion with Christiana Figueres, UNFCCC's Executive Secretary, Mary Robinson and Alcinda Abreu. Ms.Abreu reinforced that:

> "There is no sustainable development without incorporating gender into our plans."

Meanwhile, the Fossil of the Day went to Turkey, the fourth largest investor in coal, with the second prize going to EU, who do not want to reduce their emissions for the next eight years until 2020, now that they have already met their pledged goals!

For more, see: www.youtube.com/watch?v=EaVsIAT4LnU&feature=youtu.be

Tomorrow is Energy day, looking forward to more stories and fossils, and hopefully some progress!
http://adoptanegotiator.org/

Prianka Ball
British Council Climate Champion

After my first day at COP, I was looking forward to what lies next for me. Day two came with its own bowl of activities, expectations and excitements. It started with the regular schedule of the YOUNGO meeting where we had a discussion about minors not being able to attend COP and the steps we can do to alter the UN constituency. The barrier of age is very disappointing considering the passion that each of these young people holds and the work they have been doing in their own countries to forge a better future, free from the impact of climate change.

COP certainly does not lack work or activities. Being a young person working at grassroots level, I would say it is the prime ground of learning and interaction that can help enable better climate-related interventions in the place I come from. COP seems to hold everything for everyone.

Today was Gender Day and it was hard to choose one event over another for a subject which is very close to my heart. It was the first time Gender Day was being observed at COP. It was a very good initiative but how effective can a Gender Day be when gender issues are not even in the agenda this time. Coming from a developing country that is prone to disasters, I have seen women be the direct victims of the effects of climate change. Women are farmers without ownership of lands; women have to walk distances just to have proper drinking water for their family. If gender issues are not an agenda here in COP then how can degradation of women can be solved at the grassroots level?

The best moment of the day was when I was in one of the gender-related side events listening to Farah Kabir, Liane Schalatek and other inspiring women. I heard of the concerns and the expectations women have for the COP ■

Outreach is made possible by the support of

UN WOMEN
United Nations Entity for Gender Equality and the Empowerment of Women

WSPA World Society for the Protection of Animals

World Health Organization

Comhshaol, Pobal agus Rialtas Áitiúil
Environment, Community and Local Government

SciDev Net