Evolution and the Green Economy in the Age of the Anthropocene
Achim Steiner

Electromagnetic Pulses: The Problem from Hell
R. James Woolsey

Norway's Environmental Policy and the Impact on the Energy Sector
Tine Sundtoft

Creating the Urban Revolutions
Andrew Streer

Energy Security and the Sustainability of SIDS
Elizabeth Thompson
Editor’s Note

Towards a Low-Carbon Century

The year 2014 stands out as a pivotal year for many good reasons along with some continued concerns. The success of the Climate Summit at the UN, G20’s focus on energy issues, the US-China climate change agreement, EU’s new plan for increased energy efficiency, and a push for Power Africa have catalyzed efforts for sustainable development and reaching a meaningful universal climate agreement next year in Paris.

In this end-of-the-year, expanded issue, Achim Steiner highlights the imperativeness for green economy in the age of Anthropocene; Andrew Steer stresses the need for building a sustainable urban revolution to meet the challenges of a growing population and climate change; and Elizabeth Thompson finds a great hope in SEA4All for the SIDS. Insights on the trend and future of investment in sustainable energy projects, decentralized energy access, and global governance for sustainable development are also featured herein.

Unconventional topics, like energy ethics, the climate change-security nexus, and Electro-Magnetic Pulses have added a great value and variety both to the sustainable energy and climate change discourse. The world section offers an interesting mix of perspectives on Norway, Scotland, and Dubai’s energy and environmental priorities. Importance of cleaner cookstoves and green architecture for a healthy planet are covered in the technology sections. An interview with Shari Berenbach sheds light on how Power Africa is leveraging partnerships for Africa’s energy challenges.

With energy’s imminent inclusion as one of the Sustainable Development Goals, there is now a global recognition that the energy sector is the driver for sustainable growth. And as the momentum for a meaningful universal Climate Agreement at COP 21 intensifies, hopefully next year we will come one step closer to making the 21st century a low-carbon century.

Dinesh Kumar, Ph.D.
## Contents

### Insights

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-5</td>
<td>Evolution and the Green Economy in the Age of the Anthropocene</td>
<td>Achim Steiner</td>
</tr>
<tr>
<td>6-7</td>
<td>Creating the Sustainable Urban Revolution</td>
<td>Andrew Steer</td>
</tr>
<tr>
<td>8-9</td>
<td>Energy Security and the Sustainability of SIDS</td>
<td>Elizabeth Thompson</td>
</tr>
<tr>
<td>10-11</td>
<td>Climate Change: Send in the Marines?</td>
<td>Stephen Cheney</td>
</tr>
<tr>
<td>12-13</td>
<td>Bridging the Financing Gap for Renewable Energy</td>
<td>Anita Marangoly George</td>
</tr>
<tr>
<td>14-15</td>
<td>Global Governance Catalyzing Sustainable Development</td>
<td>Raghavan Seetharaman</td>
</tr>
<tr>
<td>16-17</td>
<td>The New Paradigm of Energy Ethics</td>
<td>Erin Lothes</td>
</tr>
<tr>
<td>18-19</td>
<td>Power Africa: Leveraging Partnerships for Africa’s Energy</td>
<td>Interview with Shari Berenbach</td>
</tr>
<tr>
<td>20-21</td>
<td>Effective Leapfrogging to Decentralized Energy Access</td>
<td>Harish Hande and Surabhi Rajagopal</td>
</tr>
</tbody>
</table>

### World

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26-27</td>
<td>Norway: Environmental Policy and the Impact on the Energy Sector</td>
<td>Tine Sundtoft</td>
</tr>
<tr>
<td>28-29</td>
<td>Scotland: Current Renewable Energy Issues</td>
<td>David Torrance</td>
</tr>
<tr>
<td>30-31</td>
<td>Dubai: Harvesting Green Economy</td>
<td>Waleed Salman</td>
</tr>
</tbody>
</table>

### Technology and Architecture

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>32-33</td>
<td>Cleaner Cookstoves and Fuels: Ingredients for a Healthy Planet</td>
<td>Radha Muthiah</td>
</tr>
<tr>
<td>34-35</td>
<td>Energy in Architecture</td>
<td>Sheila Sriprakash</td>
</tr>
</tbody>
</table>

### Featured Event of the Year

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>36-37</td>
<td>World Climate Summit 2014</td>
<td>Siqi Zhou</td>
</tr>
</tbody>
</table>

### Briefs

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>38-39</td>
<td>World Energy Headlines</td>
<td>Bessie Weisman</td>
</tr>
</tbody>
</table>

### Essay

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Author(s)</th>
</tr>
</thead>
</table>

---

**Global Energy Affairs**

*Vol. 2, No. 4 DECEMBER 2014*

**Editor and Publisher**

Dinesh Kumar, Ph.D.

**Editorial Board**

Carolyn Kissane, Ph.D.
Mourad Belguedj, Ph.D.
Andrew J. Yager, Ph.D.
Satbir S. Kadian, Ph.D.

**Coordinating Editors**

Bessie Weisman
Daryna Tabatska

**Production Editor**

Richard Stein

---

**Researchers**

Yixin Li
Anastasia Figueroa
Sam Zantzienger
Siqi Zhou

---

Send your comments to:

gea@globalenergyinitiative.org

866 United Nations Plaza, STE 471
New York, NY 10017

United States of America

PH: 212.574.8138   FAX: 646.476.2495

www.globalenergyinitiative.org
Evolution and the Green Economy in the Age of the Anthropocene

Achim Steiner

Never in Earth’s history has one species changed the planet so dramatically and so quickly as man, leading a growing number of scientists to define the current geological era as the ‘Anthropocene’ – the Age of Humans.

The most dramatic and pervasive example of how we have come to dominate our planet is climate change, which the Intergovernmental Panel on Climate Change (IPCC) has unequivocally linked to CO₂ and greenhouse gas emissions from human activities. In its latest report, the IPCC warns that failure to reduce emissions could exacerbate food insecurity and result in the flooding of major cities and entire island nations. This could cause further refugee crises, mass extinction of plants and animals, and a drastically altered climate that might change life as we know it today for hundreds of millions of people.

All of these impacts are being propelled, to a large extent, by our current linear economic system: we extract, produce, consume, and discard. This has provided some with an opulent lifestyle, but continues to exact a great environmental toll on the planet. Further, the conventional thinking in the 20th century was that our fossil-fuel-dependent energy system would dominate well past the 21st century and underpin development in the world’s poorest countries. We need to change, and we need to start by evolving our economic paradigm in terms of a transition to a green economy.

By this I mean an economy that improves human well-being and social equity while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy is low-carbon, resource-efficient, and socially inclusive.

Practically speaking, a green economy is one in which growth in income and employment is driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and the ecosystem services of clean air, clean water, and healthy soils.

Clean energy is not just a desirable element of the green economy, it is essential.

The development and deployment of clean energy technologies in the past decade has been nothing short of astounding. No one, for example, imagined that between 2004 and 2011, 70 percent of new power capacity added in Europe would come from renewable energy sources.

At its core, the evolution of clean energy is a logical
consequence based on quickly evolving technologies that are redefining the DNA of our energy systems – from the simple viral extraction and combustion of fossil fuels to the double helix of energy efficiency and renewable energy.

The concept of clean energy has now spread to every corner of the globe, replacing the traditional thinking that said our economic future needs fossil fuels, particularly for developing economies. From dirty to clean, and from limited to renewable – we now know it is no longer necessary and increasingly unprofitable to support technologies that damage the atmosphere and biosphere when so many cost-effective and cleaner solutions exist today.

The facts are powerful and often surprising:

In 2013, the electricity sector added more new renewable capacity than fossil-fueled and nuclear capacity combined. By 2030, new renewable capacity, including large-scale hydro, could exceed new thermal capacity by seven times, without even counting cogeneration.

One of the most surprising trends is the growth of micropower – sources of electricity that are relatively small, modular, mass-producible, quick to deploy, and rapidly scalable. Their capital cost, deployment times, and carbon footprint are the opposite of large-scale fossil-fueled power plants that often cost billions of dollars and can take up to a decade to license and build.

Micropower includes renewable energy technologies, other than big hydroelectric dams, and cogeneration of electricity together with useful heat in factories or buildings (also known as combined heat and power, or CHP).

The startling fact is that micropower now produces about one-fourth of the world’s total electricity. In its 2014 Solar Roadmap publication, the International Energy Agency (IEA) notes that micropower based on off-grid solar systems is now “the most suitable solution for minimum electrification” in sparsely populated rural areas. With proper financing to manage high initial costs, the IEA report says that by 2030, around 500 million people of the current 1.3 billion people with no access to electricity could enjoy the equivalent of 200W of solar PV capacity.

This would be equivalent to 100GW of solar generation, not far short of the total solar PV deployment to date, and would be entirely in mini-grid and off-grid situations.

Another important trend is better energy storage. Citigroup estimates a 240GW global market for energy storage worth more than $400 billion by 2030. Its report, *Energy Darwinism II*, notes that the global energy mix is shifting more rapidly than is widely appreciated, and this has major implications for power generators, utilities and consumers, as well as for exporters of fossil fuels. Combined with electric vehicles, for example, new energy storage options integrated into smart grids could eliminate the need for peaking power plants.

The transition to a clean energy economy is under way. But sooner is not just better; it will also be cheaper, particularly in terms of global warming and climate change.

“At its core, the evolution of clean energy is a natural selection based on quickly evolving technologies that are redefining the DNA of human energy systems.”

In UNEP’s recent publication *The Clean Energy Voyage*, many examples already indicate that the ‘destination’ of a clean energy economy is already being realized at the local, regional, state and national levels. Examples from China, Morocco, Brazil, Kenya, Nicaragua, and South Africa demonstrate the capacity and pace with which developing economies are seizing the opportunity of renewables. And from Denmark and Iceland to Tuvalu, San Francisco and 60 cities and regions in Germany, a growing ‘Club 100’ demonstrates how it is possible to move to an economy based on 100 percent sustainable energy now.

One of the most significant actions governments can take is to simply remove or redirect subsidies for mature and profitable fossil fuels – a figure estimated to be $600 billion annually, according to the IEA. Combined with a new climate agreement in 2015, the transition to a green economy can be realized more quickly than most imagine today, but only if we direct the estimated $37 trillion that will be invested in energy infrastructure and projects over the coming two decades into accelerating and scaling up clean energy technologies.

As Victor Hugo observed, nothing is as powerful as an idea whose time has come. A green economy based on renewable energy and energy efficiency is just such an idea, and its arrival could very well determine whether the ‘Anthropocene’ will be an age in which human ingenuity and responsibility will allow 10 billion people to have access to electricity without compromising the vital life support systems of our planet.

Achim Steiner is the United Nations Under Secretary General and Executive Director, United Nations Environmental Programme.
Creating the Sustainable Urban Revolution

Andrew Steer

A population wave is heading for the world’s cities, and we need to be ready. More than 2 billion people are expected to stream into urban areas by 2050. Making sure these growing cities are economically vibrant and environmentally sustainable is going to require a new kind of development.

But cities around the globe are likely to spend $3 trillion more than they need on infrastructure over the next 15 years simply by building 21st century communities as if they were 20th century communities. This encompasses lots of superhighways for lots of personal vehicles to drive to lots of distant energy-inefficient suburbs, resulting in less productivity, more air pollution and higher greenhouse gas emissions.

There is a better way, and it’s already happening, as smart city leaders realize the old ways of urban development do not work for business, for citizens, or for the environment. Rather than building sprawling, car-dependent cities, these leaders recognize the benefits of creating compact, connected communities with public transport as an essential component.

The need is urgent. By mid-century, two-thirds of the global population will live in cities, and 90 percent of that urban growth will be in developing countries. That means there will be 2.5 billion more people living in urban areas than there are now. China alone is expected to see 70 percent of its population – one billion people – living in cities by 2030.

This extraordinary urban growth is taking place against a backdrop of economic transformation. The global economy is expected to grow by more than half over the next 15 years, and rapid technological advances are likely to continue to change businesses and lives. Approximately $90 trillion is expected to be invested in three sectors: urbanization, land use, and energy infrastructure. This is one of the main findings of a new report, The New Climate Economy, which is the flagship product of the Global Commission on the Economy and Climate. (World Resources Institute was one of eight research institutions that contributed to the report’s findings.) These infrastructure investments will shape growth patterns for the 21st century and beyond.

“Cities must be part of the solution to the climate problem.”

Over the same 15-year period, the need to dramatically reduce global greenhouse gas emissions will be critical. If climate-warming emissions continue on their present trajectory, the world will lock in a global temperature rise of more than 2°C (3.6°F) above pre-industrial levels by
Even sprawling mega-cities have the potential to shift to a more sustainable model. In car-dependent Houston, the argument for change is simple: city leaders found that companies have struggled to attract the most talented workers because prospective employees want to live in a place with an attractive urban core and strong multi-mode transport networks. As Houston Mayor Annise Parker has said, “At some point, it’s not enough to keep grabbing the suburbs and roping them in. You’ve got to make the system as a whole function, and you do things that bring people back to the inner core.”

“Cities have the potential to reduce annual emissions by eight gigatons by 2050 – equivalent to half the annual emissions from worldwide coal use.”

Momentum for better cities is building. A global Compact of Mayors, launched at the UN Climate Summit in September, highlights the central role cities can play in cutting greenhouse gas emissions. Already, cities with voluntary targets are on track to reduce emissions by 454 megatons by 2020. Cities have the potential to reduce annual emissions by eight gigatons by 2050 – equivalent to half the annual emissions from worldwide coal use.

To encourage this trend, we need to put the right policies in place and increase finance for sustainable, compact cities that have people, not cars, at their cores. By doing so, we can make urban areas more productive, make streets safer and improve the quality of the air people breathe. Such bedrock benefits should create the political will to make these changes a reality.

With the vision to plan for more compact and well-designed cities, urban leaders can ensure that their growing populations are able to get where they need to go and enjoy the advantages of a thriving urban center, while setting a course for sustainable economic development. A new wave of sustainable development for cities is building – be part of it!

Andrew Steer, Ph.D. is the President and CEO of the World Resources Institute.
Energy Security and the Sustainability of SIDS

Elizabeth Thompson

Energy security is the access by countries and consumers to an affordable and continuous supply of energy. Some 90 percent of economic and social activity in Small Island Developing States (SIDS) is powered by imported fossil fuels. Lack of energy security adds to the numerous vulnerabilities characterising SIDS. The current global energy “trilemma,” of “energy equity, energy security and environmental sustainability,” to which the World Energy Council speaks, is manifested in SIDS. The islands are on “the front line” of climate change impacts by which their societies, economies and ecosystems are severely threatened. Many suffer water stress and scarcity, desertification, warming marine habitats, and other adverse impacts. The Maldives is literally sinking. SIDS are witnessing more frequent and extreme weather events such as the Category 5 storm, Hurricane Ivan, which in a few hours wiped out 90 percent of Grenada’s housing stock and 200 percent of its GDP. Energy security in SIDS is inseparable from mitigating climate change impacts and achieving development prospects.

SIDS are located far from the centres of fossil fuel extraction and production and have high freighting costs. Their small sizes and population bases also act as barriers against competitive volume pricing and the creation of economies of scale; this also makes profit generation for power producers and distributors difficult. Island states are highly vulnerable to oil price fluctuations and particularly hard hit by price spikes. Many islands are legally locked into monopoly relationships with utility companies that are diesel-using generators and militate against the exploration of off-grid and shared power from renewable energy sources. As a consequence of these combined factors, the energy prices in SIDS are amongst the highest in the world.

International oil prices reached the historical high of US $147 per barrel in July 2008. However, according to UNDP, in 2007 with oil prices at US $75 per barrel, SIDS were already collectively spending US $67 million per day. At that time, the average oil import bill “in the Caribbean region, was 21 percent of GDP; in the Pacific SIDS it was 18 percent of GDP.” Higher oil prices make energy more unaffordable for SIDS, further undermining their viability. Ranking amongst the world’s most tourism-dependent economies, islands in the Caribbean, Indian Ocean and Pacific are significantly impacted by seasonality and volatility. This is compounded by the fact that four SIDS are amongst the world’s most heavily indebted nations: St Kitts and Nevis, Jamaica, Singapore and Barbados.

If SIDS are to wean themselves off of fossil fuels and transition to sustainable energy, they now need to develop clear action plans and roadmaps, translate energy policy statements into an action agenda, develop relevant incentive
and disincentive schemes to ensure universal island access, promote renewable energy and energy efficiency and attract private investment for building out the necessary energy infrastructure in the power sector. SIDS would also need a suitable instrument to support their energy and strategic development agendas.

The urgency to lower energy costs, reduce economic expenditure and minimise climate change impacts, has forced SIDS to develop national energy policies centred on energy efficiency, renewables, and sustainable energy. Despite this important initial step, few island states have developed roadmaps or the appropriate enabling environments with corollary policy, strategy, fiscal, capacity, and institutional and governance frameworks to take their policies beyond conceptual framework to implementation, or to transition into sustainable energy sectors. The dearth of enabling frameworks, strategic approaches, and roadmaps have resulted in the inability of SIDS to attract and mobilise the financial resources and suitably scaled technologies needed to give full actualisation to the goals of universal energy access, renewable energy and energy efficiency. While there is now far greater availability of financing to support renewable energy development than in 1994, accessing that capital has presented SIDS with major challenges. This is where SE4All can be particularly useful as an enabler, bringing together countries, development agencies, and capital.

“The islands are on ‘the frontline’ of climate change impacts by which their societies, economies and ecosystems are severely threatened.”

SIDS have long recognised and sought to treat to the energy, development, and security nexus. It is noteworthy that 20 years after the United Nation’s First International Conference on Small Island Developing States in Barbados in 1994, the global community is now seeking to include energy as a sustainable development goal (SDG), and a critical component of the post-2015 development agenda. Framing energy as “the golden thread that connects economic growth, increased social equity, and an environment that allows the world to thrive,” in 2011, United Nations Secretary General Ban Ki-Moon launched his energy initiative, Sustainable Energy for All (SE4All) with three core principles and objectives; by 2030 to:

• Ensure universal access to modern energy services
• Double the rate of improvement in energy efficiency
• Double the share of renewable energy in the global mix

There are four “enabling” action areas with “high impact opportunities” which are of relevance to SIDS: “energy planning and policies, business model and technology innovation, finance and risk management, and capacity building and knowledge sharing.” SE4All also includes an “action agenda” around which its objectives can be realized with policy, programs and projects in the areas of “modern cooking appliances and fuels, distributed electricity solutions, grid infrastructure and supply efficiency, large-scale renewable power, industrial and agricultural processes, transportation, and buildings and appliances.”

“SE4ALL can be the backbone on which SIDS energy policy and programming can be built.”

SIDS regard SE4All as converging with their own strategic development and security priorities. In May 2012, the highest political representatives of SIDS agreed to the Barbados Declaration, expressing the view that “the increasing cost of imported fossil fuels represents a major impediment to the achievement of sustainable development and poverty eradication in SIDS.” They consequently embraced the three core objectives of SE4All as capable of addressing energy cost, demand and supply, as well as wider social, economic and environmental concerns, particularly climate change. The most recent expression of the intention of SIDS to pursue sustainable energy and the SE4All objectives have found expression in the “S.A.M.O.A Pathway,” the Outcome Document of the recently concluded Third International SIDS Conference.

The small size of the islands means that it is possible to effect transition to sustainable energy, make development gains, and eradicate poverty. SIDS have an abundance of renewable energy resources, which if properly used can reduce fossil fuel expenditures, create jobs, and strengthen their economies. Their shortage is in appropriate technologies at scale, adequate financial resources and a suitable “backbone” on which energy policy and programming can be built. SE4All can be that backbone since its objectives span the gamut of the three pillars of development and help to circumvent the continued use of fossil fuels that cause climate change and enhance both energy and national security.

Elizabeth Thompson is a Senior Advisor to Sustainable Energy for All and former Minister for Energy and Environment of Barbados.
Climate Change: Send in the Marines?

Stephen Cheney and Andrew Holland

In November, the United Nations Intergovernmental Panel on Climate Change released the final, synthesis report of their fifth assessment report on the science of climate change. As you wade through the science and statistics, it becomes clear that the report gives a dire warning of “severe, widespread and irreversible” effects from climate change. As this was just another in a litany of scientific warnings, it had no effect on the midterm elections, and little effect on leaders around the world.

The report makes clear that the world is on track, under a “business as usual” track, of global warming of at least 4 degrees Celsius, and perhaps up to 6 degrees or more by the end of this century. It made clear that, even with rapid, concerted action by governments around the world to reduce emissions, the limit of 2 degrees of warming – deemed “safe” by governments in international treaties – is drifting out of reach.

At first glance, a rise of two degrees Celsius in average temperature does not appear to be intrinsically harmful. That is the difference between the average temperature of New York and of Boston. A four degree Celsius rise – which some have determined to be impossible to simply adapt to – is still only the difference between Boston and Washington’s average annual temperature. Even a six degree Celsius rise – widely seen as a harbinger of global disaster – is still only the difference between Boston and Atlanta.

It is not clear that the climate of Georgia is any more dangerous than the climate of Massachusetts – so one could ask why the U.S. Department of Defense and militaries around the world care about climate change? When we talk about the national security challenges of climate change, we are not simply talking about temperature rises.

In today’s world, problems like economic growth, disease, hunger, and fresh water availability are a greater challenge to human security than simply a rise in temperature of 2 or 4 degrees in average temperature. Terrorism, nuclear proliferation, and resource wars would seem to pose a greater threat to global security than just a difference of even 6 degrees in average temperature.

Climate change presents security threats, not because a rise in temperatures will be intrinsically harmful, but because of how it will affect things like extreme weather, agricultural production, and sea levels. In turn, how those effects of climate change will interact with where people live and already existing unstable situations.

It is the implication that the effects of climate change will
have on the water, food, and energy systems that humans need to survive that could create societal instability. This then relates to how that instability will impact conflicts. We can never say that any war was caused by climate change because of the long chain of causes that lead to war, but we can say that climate change has multiplied the existing threats. It is impossible to separate climate change from the other problems. It is “the impacts of the impacts of climate change” that pose security threats.

The Department of Defense has called climate change a threat multiplier and the National Intelligence Community has called it an accelerant of instability. That means that the effects of climate change will have an impact on all of the other threats that we face in the 21st century. A warming of only 2 degrees Celsius will have a significant impact on water, food, and energy security. It will change disease vectors. It will drive migration. These changes, in turn, will influence state stability and harm global security.

A few examples could serve to show how the effects of climate change will harm regional security.

Sea level rise is a problem on coasts around the world, but there are some areas where people and food production are concentrated in low-lying river deltas that are particularly vulnerable. In the Mekong River in Southern Vietnam, salt water inundation and rising water levels could displace millions and destroy the local rice crops. Millions in Egypt’s Nile Delta region will lose their homes – and wheat crops – to rising sea levels. Even the major cities in China on the Pearl and Yangtze River deltas, like Shanghai and Guangzhou, are in danger because rising seas will make them more vulnerable to extreme coastal storms. This will multiply risks across Asian and Middle Eastern societies as people become homeless and migrate, and regional agricultural production collapses.

“If we do not effectively address climate change, then it is clear that we will not be able to address the other challenges of the 21st century.”

The result was that more than 7,000 people died around Tacloban, making this the deadliest typhoon in Philippine history. Filipinos are accustomed to typhoons as they make landfall nearly every year; their governmental institutions and culture are prepared to weather the storms. Haiyan simply overwhelmed their ability to cope; this typhoon was of a strength unprecedented in human history – how could they have prepared for this? The American security response, in which over 13,000 soldiers, sailors, airmen, and marines were engaged in the mission, certainly saved lives. Even weeks after the typhoon, doctors – transported to remote areas by U.S. Navy and Marine helicopters – were treating patients injured in the storm.

Moreover, they provided more than simply food, fresh water, and supplies; they prevented a downfall into lawlessness. In the days immediately after the storm, there were reports of radical Filipino insurgents hijacking aid supplies from Filipino government convoys. Once the Marines arrived, this was no longer a problem. Their presence helped to quell such violence before it became common – it stopped a humanitarian crisis from becoming a security crisis.

Left unchecked, it is not an exaggeration to say that climate change could make solving the other problems the world faces impossible. If we do not effectively address climate change, then it is clear that we will not be able to address the other challenges of the 21st century – and there are many. The Marines (and the entire U.S. Department of Defense) can help in solving the problems presented by climate change, but only the world’s governments, acting together, can work to actually solve the underlying problems of climate change. It is time to get to work.

The effects of climate change on extreme weather systems are complicated and the science is still uncertain, but more warming could increase both the frequency and intensity of extreme events. Last year, Super-Typhoon Haiyan made landfall in the Philippines with maximum sustained winds estimated at 195 mph – the highest in recorded history anywhere in the world. Bryan Norcross, the Senior Hurricane Specialist from the Weather Channel called it “the most perfect storm he has ever seen.”

“It is the implication that the effects of climate change will have on the water, food, and energy systems that humans need to survive that could create societal instability.”

The result was that more than 7,000 people died around Tacloban, making this the deadliest typhoon in Philippine history. Filipinos are accustomed to typhoons as they make landfall nearly every year; their governmental institutions and culture are prepared to weather the storms. Haiyan simply overwhelmed their ability to cope; this typhoon was of a strength unprecedented in human history – how could they have prepared for this? The American security response, in which over 13,000 soldiers, sailors, airmen, and marines were engaged in the mission, certainly saved lives. Even weeks after the typhoon, doctors – transported to remote areas by U.S. Navy and Marine helicopters – were treating patients injured in the storm.

Moreover, they provided more than simply food, fresh water, and supplies; they prevented a downfall into lawlessness. In the days immediately after the storm, there were reports of radical Filipino insurgents hijacking aid supplies from Filipino government convoys. Once the Marines arrived, this was no longer a problem. Their presence helped to quell such violence before it became common – it stopped a humanitarian crisis from becoming a security crisis.

Left unchecked, it is not an exaggeration to say that climate change could make solving the other problems the world faces impossible. If we do not effectively address climate change, then it is clear that we will not be able to address the other challenges of the 21st century – and there are many. The Marines (and the entire U.S. Department of Defense) can help in solving the problems presented by climate change, but only the world’s governments, acting together, can work to actually solve the underlying problems of climate change. It is time to get to work.

The effects of climate change on extreme weather systems are complicated and the science is still uncertain, but more warming could increase both the frequency and intensity of extreme events. Last year, Super-Typhoon Haiyan made landfall in the Philippines with maximum sustained winds estimated at 195 mph – the highest in recorded history anywhere in the world. Bryan Norcross, the Senior Hurricane Specialist from the Weather Channel called it “the most perfect storm he has ever seen.”

“BGen Stephen Cheney is the CEO of the American Security Project and Andrew Holland is Senior Fellow for Energy and Climate.”

INSIGHTS
Bridging the Financial Gap for Renewable Energy

Anita Marangoly George

These are exciting times for those of us who closely watch trends in renewable energy supply and demand – especially seeing its uptake in developing regions where millions of people still live without access to modern energy.

Over the last 25 years, renewable energy technologies have matured and are now strongly established in the global energy supply. We now have an array of commercially viable renewable energy technologies and their costs continue to come down. With growing energy demand, higher fossil fuel prices, and the continually diminishing costs of key technologies like wind and solar, opportunities are growing by the day for renewables to provide affordable and sustainable options for electricity, heat, and transport.

Despite this exponential growth, the overall share of renewable energy in the global energy mix has barely moved from 16.4 percent in 1990 to 18.0 percent in 2010. This is because global energy consumption continues to rise steeply, and a large share of that consumption continues to be met from fossil fuels. Wind, solar, and geothermal energy account for only 1 percent of all renewable energy and hydro makes up a further 3 percent. The rest comes from the burning of biomass and other traditional fuels.

As a key partner of the Sustainable Energy for All initiative (SE4All) which World Bank Group President Jim Yong Kim co-chairs with UN Secretary General Ban Ki-moon, the Bank Group is keenly focused on the goal of doubling the share of renewable energy in the global energy mix by 2030. We see this as vital to tackling the climate change threat while also strengthening the future energy security of developing countries and addressing air quality concerns.

But to double the share of renewable energy in the mix, we have estimated that annual investments of $320 billion a year are needed – particularly in the deployment of solar, hydro and wind technologies. Currently, renewable energy investment is at around $154 billion a year – that’s an investment gap of $166 billion annually. It’s clear that we need to accelerate investments significantly in renewable energy technologies. But how?

The financing gap was the focus of considerable attention at the recent UN Climate Summit (September 23, 2014) in New York. Over several months running up to the Summit, Bank of America, Merrill Lynch, the Brazilian Development Bank (BNDES), and the World Bank worked together to identify innovative financial structures with the potential to be incubated or accelerated. We explored a range of de-risking structures and products in the public and private sectors, reviewed the current investor base, and identified...
potential sources of new funds required for the transition to achieve the goals of SE4All.

We concluded that to drive fresh capital into new sustainable energy investments, it’s critical to scale up the issuance of Green Bonds, which are tax efficient bonds directed toward sustainable projects. We also need to develop tailored lending structures that allow the private sector to co-lend with multilateral development banks (MDBs) and development finance institutions (DFIs) in emerging markets, as well as help to refinance existing sustainable energy loan portfolios of official lenders by attracting new investors.

At the same time, we must encourage new construction stage lending, supported by MDB/DFI subordinated debt credit enhancement instruments to improve the credit quality of projects, and enable institutional investor flows. Last but not least, there remains a need to develop aggregation structures by bundling projects for project developers, including those doing replicable small-scale projects in emerging markets for renewable energy and energy efficiency.

“To double the share of renewable energy in the mix, we have estimated that annual investments of $320 billion a year are needed.”

Besides working to support and develop new financing structures, the World Bank Group is also playing an important role in supporting countries in their efforts to move away from fossil fuel-based energy and towards cleaner, renewable technologies. World Bank Green Bonds raise funds from fixed income investors to support our lending for projects that aim to mitigate climate change or help affected people adapt to it. Fiscal year 2014 was a record year for World Bank Green Bond issuances, raising a total of almost $3 billion.

Also over the past fiscal year, we provided a record $3.6 billion in financing for renewable energy projects and demand, especially from low-income countries, which continues to grow. Much of the increase on our 2013 renewable energy lending was due to approval of a number of large-scale hydropower projects. It also represented strong continuing investment in solar, wind, and geothermal energy, especially from the International Finance Corporation (IFC), the Bank Group’s private sector arm. Included in our total lending, IFC’s renewable and energy efficiency lending went from $1 billion in 2013 to over $1.4 billion in 2014 – with a record 25 percent of this going to wind energy projects.

A considerable proportion of World Bank Group renewable energy financing also went towards building the policies and institutions that countries need to manage a sustainable electricity supply as well as the smart transmission and distribution systems that connect people and industry to energy.

A key aspect of our energy lending is that it brings in other financing sources. Last year, we mobilized a record amount of over $1 billion of private sector finance through guarantees that help to mitigate the risk for potential investors. The IFC and the Multilateral Investment Guarantee Agency each mobilized a further U.S. $1 billion from third party sources to complement their own investments.

But overall, developing countries themselves are driving the demand for greater investment. Many countries are setting targets for renewable energy, which help focus attention and attract private financing. For example:

China is expected to account for 40 percent of new capacity in renewables in the next five years.

The Philippines has set a target to double renewable energy from 4,500MW to 9,000 MW between 2010 and 2030 and offers renewable energy incentives like tax holidays, accelerated depreciation and net metering to allow consumers generating power to sell back to the grid.

Morocco aims to have 42 percent of its total electrical capacity in renewable energy – a mix of solar, wind and hydro power. Its renewable energy investment soared to $1.8 billion in 2013 from just under $300 million in 2012, due in part to reduced energy subsidies.

And Mexico, which has a target of 35 percent renewable energy and carbon tax, is starting to allow retail electricity consumers to connect their renewable facilities to the national grid for billing credit. Mexico’s policies have prompted Walmart, Coca-Cola and Grupo Bimbo to invest in renewable energy self-generation.

As the trend towards greater renewable investments continues and we work together with our partners – both public and private – to drive new sources of financing for clean energy development, the opportunities just grow and grow. These are exciting times indeed.

Anita Marangoly George is Senior Director of the World Bank Group’s Global Practice on Energy and Extractive Industries.
The concept of sustainable development has achieved importance at the global level. Economies need to integrate the principles of sustainable development into their policies and programs and reverse the loss of environmental resources. United Nations Framework Convention on Climate Change (UNFCCC) led deliberations on fighting global warming has already reached at crucial stage. The ongoing 20th Session of the Conference of the Parties (COP 20) in Peru is an essential step to reach a meaningful agreement in Paris, in 2015.

Global Governance through G20 will work together to adopt successfully a protocol or an agreed outcome with legal force under the UNFCCC that is applicable to all parties at the COP 21. The United Nations has also defined the future global development framework through creation of Post 2015 development agenda, which will succeed UN Millennium Development Goals (MDGs). In November 2014 the U.S. and China made an announcement of their respective post-2020 actions on climate change. Such actions are giving a decisive momentum to the global climate negotiations and inspire other countries to join in coming forward with ambitious actions.

At the G20 meeting in November 2014, the United States made a commitment of $3 billion towards Green Climate Fund and Japan pledged it would contribute $US1.5 billion to the climate fund. G20 agreed to a plan to reduce the gap between men and women in the workforce by 25 percent over the next 10 years. This has the potential to bring 100 million women into the global workforce. G20 supported the initiatives to prevent, detect, report early and respond rapidly to infectious diseases like Ebola and make sure basic public health system prevails, which allow for early warning when outbreaks of infectious disease occur. The G20 Food Security and Nutrition Framework will strengthen growth by lifting investment in food systems, raising productivity to expand food supply, and increasing incomes and quality jobs. G20 will support efforts in the United Nations to agree an ambitious post-2015 development agenda. These measures of Global Governance has indeed provided momentum to sustainable development.

Renewable Energy Investment and Beyond

Renewable energy sources such as solar and wind could supply up to 80 percent of the world’s energy needs by 2050 and will play a significant role in fighting global warming. According to Global Trends in Renewable Energy
Investment 2014 – produced by the Frankfurt School-UNEP Collaborating Centre for Climate & Sustainable Energy Finance, the United Nations Environment Programme (UNEP) and Bloomberg New Energy Finance – total renewable energy investments fell in 2013 by 14 percent to $214 billion worldwide, partly due to the falling cost of solar photovoltaic systems and the impact of policy uncertainty. Investment in wind energy was $80 billion, while that in solar was $114 billion. Biofuels was $5 billion, while biomass and waste-to-energy was $8 billion, small hydroelectric was $5 billion and Geothermal was $2.5 billion. The major investors in 2013 were China: $56 billion, Europe: $48 billion, US: $36 billion, Middle East & Africa: $9 billion, India: $6 billion and Brazil: $3 billion. The major sources of renewable energy in Gulf Cooperation Council (GCC) countries are solar and wind. If the GCC countries allocate 0.5 percent of their 2.5 million square kilometers area for the generation of solar power, and assuming their equipment has an efficiency of 20 percent, they can generate enough power for the year. In case of wind energy, the average wind velocity in the Gulf region is around 7 meters/sec at 80 meters high, which is very suitable to operate windmills economically.

Green Banking for Sustainable Development

The banking environment operates within the global standards of lending or investing. Such standards have been revised after the global financial crisis both in terms of liquidity and capital adequacy. The going–concern and gone–concern capital has been redefined and suitable buffers have also been developed taking into consideration the liquidity and systematic issues. In addition to above, banks, as socially responsible institution, have a role to play in protecting the environment and contribute to sustainable development. Hence every bank should earmark a minimum 10 percent of Tier 1 capital subject to a cap of 10 percent of risk weighted capital towards green banking or clean development mechanism or any sustainable development projects taking into consideration the carbon emissions prevailing in the economy in which the bank operates. The initiatives may be in the form of lending or investing.

This forms the basis for green banking and brings prudence into the capital framework. The Clean Development Mechanism (CDM) allows developed countries, or companies within those countries, to invest in projects that either reduce greenhouse gas emissions or sequester carbon in forests in developing countries. Some of the CDM projects includes renewable energy: wind farms, hydroelectric power, reducing emissions in industrial and manufacturing processes and sequestering carbon through afforestation and reforestation.

“Every bank should earmark a minimum 10 percent of Tier 1 capital subject to a cap of 10 percent of risk weighted capital towards green banking or clean development mechanism or any sustainable development projects taking into consideration the carbon emissions prevailing in the economy in which the bank operates.”

There are various green banking initiatives brought at the global forum which includes Equator Principles, UN Principles for Responsible Investment (UNPRI), UN Environment Programme (UNEP) Finance Initiative Statements and UN Global Compact (UNGC). Equator Principles define the set of voluntary standards that commit signatory banks to take social and environmental risks into account when providing project finance. UNPRI was developed by institutional investors that recognize the increasing relevance of environmental, social, and corporate governance issues that apply to asset management. UNEP Finance Initiative Statements recognize the role of financial service sector in making global economies sustainable. This promotes investment in clean and renewable energy by financial institutions and other investors. UNGC are a set of voluntary principles under which signatories promise to avoid complicity to human rights violations, adhere to labor standards, and protect the environment.

As a forward-thinking and socially responsible institution, Doha Bank has embraced sustainable business practices and promote solid environmental stewardship. Doha Bank advocates and practices Green Banking, which is one of the core business philosophies. The Bank has worked on “ECO-Schools Programme,” conducted Green Quiz and seminars, hosted Green fun run and support tree planting activities to generate awareness of environmental preservation and protecting the natural environment.

Since investment in renewable sector is one of the crucial factors in tackling the issues of climate change, actions of socially and environmentally conscious financial institutions are creating a good platform to the global climate negotiations and inspiring a new era of global governance that would support the sustainable development.

Raghavan Seetharaman, Ph.D. is the Chief Executive Officer of Doha Bank.
The New Paradigm of Energy Ethics

Erin Lothes

Since 1981, when the US Catholic Bishops published a letter on energy and ethical principles, the ecological, economic, and technological landscape for assessing renewable energy has undergone shifts of seismic proportion. The IPCC’s Fifth Assessment Report states that society’s dependence on fossil fuels is driving severe disruption of ecological systems worldwide and accelerating socio-political disruption. While the realities and possibilities of renewable energy remain hotly debated, the ethical imperative to eliminate the impacts of fossil fuels is clear.

In April 2014, Bishop Mario Toso of the Vatican’s Pontifical Council for Justice and Peace, stressed that “in view of the realization of peace... it is necessary that energy be thought of, produced, distributed, and used, according to a new paradigm.” This new paradigm is the necessity of assessing social cost in tandem with economic cost.

Climate change poses an ethical challenge to global society because it is a life issue. Catholic social teaching upholds the values of human dignity, human health, socio-economic stability, respect for ecosystem integrity, and sustainable development. Access to affordable energy for lower-income households and developing nations is critical, as poorer communities suffer most from climate change, and are least able to adapt or mitigate its effects. The rights of informed participation in energy choices and the personal and societal freedom to change current lifestyles are also key principles. These values complement national goals to create affordable, clean, and secure domestic energy for a competitive economy.

Affordable Renewable Energy “Revolutions”

Why start the discussion with renewable energy? Simply put, renewable energy is needed at an enormous scale. A recent study that examined multiple models of global energy systems concludes that the global energy supply must use 50 to 75 percent renewable energy by 2100 – in order to have a 70 percent chance of remaining below the two degrees Celsius temperature increase. But in the United States, renewable energy currently provides only about 10 percent of total energy produced in April 2014. Thus, haste in moving toward renewable energy is essential.

Ethical energy policies should support low-income households through efficiency measures that reduce household costs and greenhouse gas emissions. One proposed initiative offers vouchers and guaranteed loans for the purchase of efficient cars, appliances, and home renovations. Such initiatives can reduce energy bills by more than 20 percent. Zero-emission buildings also represent opportunities for sustainable development and job creation, as does infrastructure that supports walkable communities.
Industrial Capacity

Ensuring global income equity and meeting a 450 ppm emission target require greatly reducing the carbon intensity of global economic output. A report by the British Sustainability Council quantifies the reduction from 68 gCO₂/$ in 2007 to 14 gCO₂/$ in 2050. Creating such a shift to a low-carbon macroeconomics is a big challenge.

However, constructing a straw man argument for a 100 percent renewable energy baseload, and then concluding intermittencies make this impossible; this evades the opportunity to engage the present options for renewable energy supply. Maximum shifts to renewable energy for transport, heating, and electricity can be achieved, limiting fossil fuel use to its most necessary applications, and using the smart grids that are increasingly cost-effective.

A 2011 study concludes that “wind, water and solar (WWS) energy can be supplied reliably and economically to all energy-use sectors,” and that the barriers “to 100 percent WWS power worldwide are socio-political, not technoeconomic.” Overcoming such socio-political barriers requires the political will and ethical resolve to insist upon the necessary R&D- the same resolve that created the Model T and the Manhattan Project.

Investing at the Necessary Scale

McCollum et al. calculate that creating sufficient renewable energy to remain below a two degree temperature increase requires investments of $1.1 trillion annually. Current annual investments into renewable energy amount to $200-250 billion globally. “In other words, a substantial ‘clean-energy investment gap’ of some $800 billion/yr exists. Unless the gap is filled rather quickly, the two degrees Celsius target could potentially become out of reach.”

Notably global fossil fuel investments in 2010 amounted to $500 billion for extraction, fossil electricity generation, pipelines, refineries, and liquefied natural gas terminals and $523 billion are spent on present-day subsidies for fossil energy and electricity worldwide, six times the subsidies for renewables. Redirecting these funds to meet the $800 billion clean-energy investment gap is an economic, political, and ethical choice.

The costs of shifting to renewable energy are estimated at two to 6 percent of GDP. The Apollo Project cost 4 percent of GDP; digging London’s sewers after deadly cholera outbreaks took two percent of GDP. Investing in a sustainable planet is at least as valid. And according to economist and IPCC co-chair Ottmar Edenhofer, “If we lose another decade, it becomes extremely costly to achieve climate stabilization.”

“Climate change poses an ethical challenge to global society because it is a life issue.”

Given that global society must act now, some solutions may not be fast enough. The 50 percent climate advantage of natural gas over coal is unlikely to be achieved over the next few critical decades. Natural gas, which appears to be a “bridge” forward, may instead lay down a “gangplank” to a warm future. Nor is carbon capture and sequestration (CCS) immediately deployable within a plan to reduce emissions by 2030. The current development of CCS risks perpetuating fossil fuel use if its research and development is restricted to coal plants or enhanced oil recovery, instead of clean technologies like air capture and fiber development.

Energy choices and investments must be assessed with the aim of creating an economically stable, equitable, peaceful, ecologically vibrant global society. Social cost must be included in honest energy calculations to protect human health and wellbeing. Participatory decision-making requires disclosure of subsidies and externality pricing, which is essential to register the impact of climate change upon those most vulnerable.

Because the energy infrastructure of the developed world is largely fully built-out, phase-out programs must be accelerated. But investments into transitional or “backup” technologies must be carefully evaluated lest they become permanent technologies. Given the long lifespan of energy infrastructure, the immediate investment can become the de facto energy system of the future.

Investments can be assessed using the just war principle of “violence as a last resort.” Translated to energy ethics, this suggests that all non-fossil fuel options must be exhausted before justifying fossil fuels. If “one of the biggest hurdles to overcome on the path to energy system transformation and the [two degrees Celsius] target will be to mobilize the necessary investment flows” – then society must view creating the necessary investments in renewable energy as a major ethical imperative.

(Visit our website for the references to this article)

Erin Lothes, Ph.D. is assistant professor of Theology at the College of St. Elizabeth (USA).
Interview with Shari Berenbach, President of the US-African Development Foundation

President Barack Obama’s Power Africa initiative, driven by the private sector and supported by host country governments and multilateral and bilateral donors, has created new momentum and hope for the African continent. Instead of being recipients, African countries today see themselves increasingly as partners in bringing light to hundreds of millions of people in sub-Saharan Africa, and thus further spurring growth in the continent. In an interview with Global Energy Initiative, the President and CEO of the U.S. African Development Foundation, Shari Berenbach, shares her thoughts on this important initiative and its catalytic effect on growth in the region.

GEI: Please briefly share with us the story and rationale behind Power Africa.

Shari Berenbach: The United States recognizes that energy is a significant constraint for Africa and it can have a catalytic effect on Africa. When we look at the tremendous economic growth that is taking place in Africa currently, one cannot help but be excited at recent trends, which offer a great opportunity for the continent. The U.S. government initiative, Power Africa, was created to help spur this catalytic effect by: 1) providing electricity for more manufacturing and more economic growth and 2) extending the delivery of power to more parts of Africa so that more segments of the African population can benefit from and participate in the economic growth trajectory.

We believe that Power Africa is good for Africa, and also good for U.S. business, including the export of major infrastructure equipment. Undoubtedly, from a development standpoint, it was an absolutely compelling reason to focus on Africa’s energy constraints, which are choking Africa’s economic and human potential in the short and the long-term.

GEI: How different is the Power Africa model from past models of development assistance. With the Power Africa experience, are we entering into a new era of public-private partnership as the cutting-edge of development policy?

Shari Berenbach: To me, what is really exciting about Power Africa is the realization that what Africa needs today is foreign direct investment and commercial and private capital flows, not just overseas development assistance. It is very heartening to know that private capital flows are beginning to dwarf the overseas development assistance in Africa. So one of the important things about Power Africa is that it has enabled the unleashing of private capital into Africa. You would agree with me, that, today, private enterprise has emerged as an integrated element of economic growth in Africa.

With regard to the public-private partnership, I wanted to make two main points:

One of the most significant sessions at the African Leaders Summit in Washington, DC, 4-5 August 2014, was the U.S. African Business Forum, where we saw tremendous interest among leaders to participate in the Forum. There is a clear recognition on our as well as other stakeholders’ part that for Power Africa to be successful, it has to be a joint effort of public and private sectors.

Another important feature of Power Africa is its focus on policy reform that will create a level playing field and a more conducive environment for the private sector. In this context, the role of transaction advisors in Power Africa’s target countries is important. This innovative approach of development, I think, in some ways, is a bigger break from past practices in development assistance.

Once again, this same spirit was seen at the African Leaders Summit where the overall tone was all about how the U.S. and African nations can work together to address Africa’s developmental goals. It is not “we are the benefactors and you are the recipients;” it is, “how can we partner together in a much more dynamic, impactful way?” I think that Power Africa is an important legacy that President Obama will be leaving.

GEI: What kind of coordination mechanism does Power Africa have with other major international energy initiatives, like the UN’s Sustainable Energy for All?

Shari Berenbach: There is a very active coordination through the Office of Special Envoy and Coordinator for
International Energy Affairs in the State Department. The coordinator of this office has been an active participant at the UN’s initiative Sustainable Energy for All (SE4All). I do think that there is a tendency among UN-related institutions to focus more on governments and/or NGOs as the implementing vehicles and institutions as opposed to our approach, which is focused more on economic activities and private sector investment.

While there is a slight difference in orientation, there certainly is a lot of overlap. I think the UN recognizes that private companies have an important role to play, just as we recognize the need of household-based solutions for lighting clinics and schools. These consumer-based solutions are very important in addition to providing energy for productive purposes. Power Africa might be considered a next-door neighbor for the UN’s SE4All.

We have also worked very closely with the World Bank. In terms of collaboration with the European Union, Power Africa has begun discussions on how to collaborate.

I would also like to emphasize that Power Africa is a comprehensive U.S. government effort in which USAID plays a very prominent and coordinating role vis-à-vis the Departments of State and Energy, OPIC, the Export-Import Bank and others. Throughout, there have been coordinating meetings across all the different agencies, and I think that all of us who are working on this challenge are very excited at the potential to overcome the lack of electrification in Africa. It is right before our hands. It is doable over the next 20-30 years.

GEI: Please share with us more about the Power Africa Off-Grid Energy Challenge – an important component of Power Africa.

Shari Berenbach: The initial focus of Power Africa’s transactions was on large power plants near urban centers and industries. However, the U.S. African Development Foundation is mandated to support grassroots economic development. We target the very poorest of Africa and those people primarily live in the rural areas. I quickly recognized that it is great that we are expanding the grid via power plants, but we need to think about off-grid energy solutions to meet the needs of rural communities.

I would like to believe that Africa will not repeat the U.S.’s approach of having a focus on a national grid that connects one place to the next. For Africa, being such a large landmass, my sense is that you will have grids that are in urban areas, major metropolises, etc., but that there will be another generation of what I call off-grid energy solutions that might be micro grids or mini-grids, or even household level solutions like solar-land lighting.

This interest in off-grid solutions led us to launch the Off-Grid Energy Challenge. The Challenge asks: how does an entrepreneur really create a viable business that is generating and distributing energy in these rural areas? We have been doing this in partnership with GE Africa and this was first launched in 2013 with a total of six awards in Kenya and Nigeria. And, by mandate, the U.S. African Development Foundation provides support to only 100 percent Africa-owned and managed companies.

This year, twenty-two African companies/organizations won the Power Africa Off-Grid Energy Challenge with each receiving a grant of $100,000. Their projects all focus on how renewable energy resources can be deployed to power productive activities within communities in Africa. These winning projects include 14 solar developments, six biogas generation projects, one wind turbine system and a small hydroelectricity power plant. We believe these innovative solutions to meet the energy needs of undeserved communities will provide a solid base to scale and grow.

GEI: Indeed off-grid solutions play an important role in meeting Africa’s energy challenges and with Power Africa in the lead, the continent seems to entering into a new phase of light and progress. Thank you for sharing your thoughts for Global Energy Affairs.

Shari Berenbach: Absolutely, and it is an exciting time with a lot of innovation, new approaches, and new ways to bring energy to Africa and change the developmental scene of the continent. Power Africa has already initiated this beginning, and as said earlier, it will be an important legacy of President Obama. Thank you.
Effective Leapfrogging to Decentralized Energy Access

Harish Hande and Surabhi Rajagopal

The world has approximately 1.3 billion people that have never experienced the benefits of electricity in their homes, and 2.8 billion who still use solid fuels for cooking and heating\(^4,5\). Then there are several other households that, despite being connected to the grid, often find themselves starved of power supply. Combine this with estimates\(^6\) from a country like India where expenditure on fuel and light by the urban and rural poor is the third highest expenditure after food and health, with poorer households spending up to 20 percent of their incomes on energy\(^7,8\). What this reveals is an opportunity for plugging the energy gap by leapfrogging to decentralized, renewable sources of energy, and facilitating improvements in basic quality of life as well as productivity at the household and village level\(^9\). These alternative solutions allow for local generation and use, overcoming problems around the demand on central grid, increasing costs of traditional fuels, transmission losses and so on.

In recent times, there have been a good number of enterprises taking on this challenge. Energy enterprises with holistic solutions (customized technology with affordable financing and maintenance mechanisms) have shown that they can play an integral role in bridging the gap in the provision of basic energy services. Having recognized the case for these alternatives, many governments have also introduced schemes to support a dissemination of market based decentralized renewable energy (DRE) solutions. However, they are often restricted to measures such as subsidies and tax incentives. What is overlooked in the process is the creation of more conducive conditions for these newer enterprises and the development of a supportive ecosystem including technological innovations, human resource development, and financing options for end users. The important steps to building this ecosystem are outlined below:

**Human Resource Development**

There is often skepticism around the longevity and durability of decentralized renewable solutions—a fear that they will not last. This fear stems from the lack of a skilled human resource base for this sector that would work as a service mechanism to ensure maintenance. While the sector is still nascent, it is critical to address the human resource needs at all levels—operations, sales and marketing, finance, servicing, research and development, and community involvement. There is immense potential for entrepreneurship and job creation. Today, this time and resource intensive need is being met directly by the entrepreneurs who are already stretched for resources. Individual organizations are forced to invest in
the most basic skill training even while the initiative would better the sector as a whole.

To reduce the cost of training and skill development incurred by individual entrepreneurs, there must be a thrust on creating curriculum and teaching modules for training of DRE technicians, operators, and micro-entrepreneurs. Existing vocational training and self-employment training institutions or apprenticeship programs should be utilized to disseminate these courses at the local level and build manpower on the ground.

Financing for Entrepreneurs

An important prerequisite for entrepreneurs to actively engage in this sector is the access to right forms of capital, i.e., the right mix of social investments and low cost working capital. For entrepreneurs at the grassroots, this is not merely a challenge but it is a prohibitive factor. Approaching private impact investors or private banking institutions is virtually impossible for individuals with a lack of both fluency in English language and skills to make PowerPoint presentations or excel sheets.

There is an opportunity here for various bilateral and multilateral organizations, keen on providing an impetus to this sector to facilitate the access to such debt financing. Organizations can create mechanisms for existing banks and financial institutions to lend to entrepreneurs. It would be ideal to structure working capital debt allowing for lower rates of interest and a reasonable moratorium period.

The other challenge of attracting investment capital requires a change in mindsets within the impact investment community. While there are impact investors who recognize the significance of ‘patient capital,’ there are just as many solely focused on exit strategies and higher rates of return. Often individuals undertaking due diligence from the investor’s standpoint do not have the practical experience to fully understand the entrepreneur’s perspective. These expectations seriously affect the real social impact being created on the ground. The impact investment community must seriously introspect and take measures to counter this trend.

Consumer Financing for Energy Solutions

The financial linkage is a critical piece in energy access provision. The use and adoption of innovative financing mechanisms that reduce the risk of bankers and increase access to loans are essential in bolstering this linkage. Where the basic financing model is unviable due to high risk, where customers have a low ability to pay and communities are migrant or “illegal” or lack land titles and collateral, similar to the case of entrepreneurs, increasing the financial institution’s confidence can be achieved by facilitating loan guarantees and interest subsidies using soft funds.

There is an opportunity for plugging the energy gap by leapfrogging to decentralized, renewable sources of energy, and facilitating improvements in basic quality of life as well as productivity at the household and village level.

The off-grid component within India’s National Solar Mission is a good example of a government program that has taken the first step to facilitate this linkage. However, this has to be supported with a significant amount of capacity building among banking and lending institutions to discuss risk mitigation techniques, financing newer, productive use technologies, innovative mechanisms and so on.

Once the linkage is created, there is also an opportunity to extend financing for other off-grid appliances through the same institutions. Beyond household appliances such as fans or televisions, access to credit should be facilitated for productive utilizations such as irrigation pump sets, sewing machines, milk weighing and testing machines in dairy cooperatives, laptop and internet centers, energy efficient equipment for garage shops, powerlooms and other MSMEs.

Technology and Energy Efficiency

The constraints with technology are currently on a few different fronts: 1) Energy efficiency of existing appliances
Electromagnetic Pulses: The Problem from Hell

R. James Woolsey

Energy issues suffuse all aspects of our lives, and concerns about the security of the nation’s electricity grid are rapidly moving front and center in the U.S. energy debate.

Since a massive solar electric storm – caused by a “coronal mass ejection” – knocked out most of the world’s telegraphs in 1859, scientists and engineers who follow such developments have worried that another such massive solar generated storm might occur. A huge geomagnetic storm of this sort, known as a “Carrington Event” could have a devastating effect on the Earth’s electric grids. One such solar event in 1989 (not large enough for the “Carrington” label), seriously damaged and blacked-out the eastern half of Canada’s grid. If it had been located slightly differently and had been focused on Washington, D.C. instead of Quebec, a study by Lloyd’s of London estimates 20 million Americans might have been blacked-out for a protracted period.

Until the early 1960s, there was no particular focus, however, on there being any danger to the electric grid from electromagnetic pulses (EMP) caused by humans, rather than by solar events. Both the American and Soviet military establishments were paying attention in 1962 to the effects of the final above-ground nuclear tests. The Limited Test Ban Treaty of 1963 was about to come into force, so nuclear tests in the atmosphere, outer space, and under water would soon end. Both noticed that the detonation of nuclear weapons in orbits tens to hundreds of miles above the Earth destroyed electronics in far away portions of the robust but primitive vacuum tube technology of that time.

In the half century that has passed since then, the U.S. has undertaken some steps to harden those of its military electronic components that are vital to nuclear deterrence, but little else has been done.

The U.S. government regarded human-caused EMPs – especially those that would be generated by the detonation of a nuclear weapon in orbit – as just one aspect of a possible future nuclear war that might occur if deterrence failed. A few strategic missiles, aircraft and weapons, and their communications, were electronically hardened against EMP, but that was about it.

In the meantime, however, civilian energy issues were beginning to enter the EMP picture for two reasons.

First, in recent years we have come to be, in William Davidow’s phrase “over-connected” and we have also come to live in the midst of an “internet of things.” It is not only our telephones that are connected, but everything else as well. We have 18 critical infrastructures in the U.S., including
electricity – for example, food, water, telecommunications, finance, etc. All 17 of the others depend on electricity in order to function.

If the electric grid goes down for a period longer than emergency backup power is available – as was the case e.g., for some electricity consumers during Hurricane Sandy two years ago – affected electricity consumers aren’t just transported back into the mid-80s, pre-internet. They are, rather, transported back into the 1880s, pre-electricity. Very few of us have enough wells, hand pumps, plow horses, and seed stocks to live in an 1880s world.

The problem is not just that some things wouldn’t work. Nothing would work. Not water purification. Not food storage. Not medical care. Not transportation. Nothing. Estimates from the Congressional chartered EMP Commission indicate that those killed by such effects could total, within a year, somewhere between two thirds and 90 percent of the U.S. population.

The second major source of vulnerability to EMP is that modern micro-electronics that are the heart of our interconnections are over a million times more capable than were electronics in the early 1960s, but they are also over a million times more vulnerable.

Because of these developments, the detonation of a small nuclear device in low-earth orbit (tens to hundreds of miles above the earth) in a small satellite would mean that it is not only the lights that would go out.

For example, reflect for a moment on what you own. Apart from real estate, your property and savings are normally not anything that you can store, protect, and observe – they are rather a particular record of ones and zeros in a computer somewhere. If the pattern of ones and zeros is obliterated by EMP, what do you own? Even if you kept a hand-written record, how do you prove its validity?

Further, an EMP is easier to bring about than one would hope.

The most destructive EMP generated by a nuclear detonation is caused by the gamma rays that come from the detonation, not by the explosive blast. So a small, simple weapon, of say, a few kilotons could produce an EMP that, depending on the altitude in which it was detonated, could destroy a major part, or essentially all, of the nation’s electric grid. The reason that it can be so effective is that the short wavelength highly energetic electromagnetic shockwave can destroy small and large electronics of all kinds, inflicting deep damage on the critical infrastructures.

An EMP can also travel for thousands of miles on the grid’s transmission lines, destroying transformers, control systems and other critical equipment as it goes. Transformers are the heart of the grid. If they are destroyed, replacement of the large, Extra-High Voltage (EHV) transformers can take years. The EHV transformers are not made in the U.S. and

Continued on page 24
are so large and heavy that they are very difficult to move. They are also designed for a specific function in a specific part of the grid. The EHV transformers are thus, generally, not fungible.

Ballistic missile defenses (BMD) of the sort that we are half-heartedly pursuing are largely ineffective against an EMP caused by a simple nuclear weapon in a small satellite launched into low-Earth orbit.

One reason for BMD’s lack of effectiveness is that our defensive systems face north and the Russians have admitted to us that they have not only developed, but have passed on to North Koreans, the approach towards launching satellites or missiles called a “fractional orbit bombardment system.” This is simply launching a satellite to the south into orbit instead of on an arcing ballistic trajectory over the North Pole, so the satellite’s first approach comes at the U.S. from the south, and would hit us with a surprise EMP attack from our blindside. The United States has no Ballistic Missile Early Warning Radars or missile interceptors facing south.

Whether it is a ballistic missile targeted on the U.S. and designed to proceed immediately toward a target on land, or is the first orbit of a satellite carrying a weapon able to be detonated whenever the launcher wants, our defensive systems are not focused on such a southern-hemisphere bound launch. Even if they were, how could we tell if a North Korean launch of a small satellite contained a harmless communications package or a small nuclear weapon that could be exploded at any time over the years to come?

This last threat described above is not merely theoretical, but may already be real. North Korea is orbiting its KSM-3 satellite over the United States, regularly passing over the U.S. from our southern blindside, at the optimum trajectory and altitude to place an EMP field over the 48 contiguous United States – if KSM-3 is a small nuclear warhead disguised as a satellite.

It would not help with this problem if we were to move toward a BMD approach – boost-phase intercept – which a number of us have advocated over the years. We can’t see inside a launched missile or satellite.

It should be stressed that the deterrence as we utilized it during the Cold War depended upon our adversaries, such as the USSR, knowing that they could not successfully attack us anonymously. They knew that any nuclear attack by them on us would be met by a devastating response.

But deterrence will not work in a world of existential threats that can be delivered anonymously. And with respect to EMP today, if the lights go out, it may be a solar magnetic storm, or it may be North Korea. We may not know.

“An EMP can also travel for thousands of miles on the grid’s transmission lines, destroying transformers, control systems and other critical equipment as it goes.”

There has been substantial delay in dealing with EMP caused by the finger pointing of different organizations as corporations and government agencies seek to avoid responsibility and the cost of paying for solutions. The funding and management of the U.S. electricity grid is extremely complex and there are many federal, state, local, and corporate entities involved. The most aggravating aspect of the EMP problem is that key steps that would substantially improve the grid’s resilience are, according to the EMP Commission’s estimates, not extremely expensive. The Commission estimates that the national electric grid could be protected for about US $2.0 billion – approximately what we give Pakistan in military aid annually.

We should move immediately to take the technical steps to improve grid resilience that are authorized by the SHIELD Act, now before the House, or the GRID Act, now before the Senate.

Above all, we need to confront those agencies, trade associations, corporations, lobbyist, and White House officials, who are fighting against spending even the modest funds that could move us towards grid resilience. They should be asked to respond publicly whether because of their delays and inaction, they really want to run the risk of being responsible, essentially, for the death of our civilization.

R. James Woolsey is a national security and energy specialist and former Director of Central Intelligence Agency
such as televisions, motors, etc., which make decentralized renewable energy more expensive 2) Quality assurance of products meant for this sector itself which lack standards for comparison to determine the working under field conditions.

To address this, in addition to existing lighting solutions, field-testing of other off-grid appliances for faster implementation in rural and urban poor communities is critical. Research and development funds should be allocated to developing sustainable models through field-based testing and pilot programs in specific contexts. Efficiency of appliances for productive use and livelihoods should also be highlighted as an important area of work for manufacturers.

**Practitioner-Driven Policies**

To bring all of the above-mentioned aspects together and accelerate the impact, an interest from policymakers is essential. There is a need to work on policies that consider the needs on the ground while also capitalizing on synergies with other developmental concerns. Energy access interventions can be used as means to address the critical energy gaps that exist in the development-oriented programs of ministries such as Rural Development, Women and Child Welfare and, Human Resource Development. For example, energy interventions can support improvements in agriculture, dairy farming, and small businesses as well as help with inclusion of information communication technologies in schools. This convergence needs to be noted to prevent duplication of efforts.

To support practitioners to tackle these common ecosystem challenges, there is a need for representation of enterprises operating in this space, relevant research organizations, think tanks, and donors. A practitioner-centric alliance of this nature is being set up in India – one that could provide a platform to bring forth many of these concerns while also being a go-to point to provide examples of successful models.

All the possible ways of creating this ecosystem listed above are meaningless without that one important first step – a willingness to view these DRE solutions not as stop gap measures for the grid but rather as ideal complements to the grid depending on resources and context. There are a host of successful models using solutions that range from waste products like rice husk, grid interactive and standalone PV systems, pico-hydro and so on, to satisfy needs such as cooking, lighting, and productive utilizations. They serve the needs of communities that have not managed to access basic energy services for decades while the rest of the world moves towards a systematic dependence on electricity for every new appliance. Many of the DRE models can be replicated with customizations for specific energy needs, culture, financial behaviour, consumer interests, etc. Once there is a willingness to view these as sustainable solutions, the next step must be to create the right eco-system.

> “.../View these DRE solutions not as stop gap measures for the grid but rather as ideal complements to the grid depending on resources and context.”

The declaration of this as the decade of ‘Sustainable Energy for All’ by the UN General assembly provides an opportunity to master a holistic approach to energy. This approach would take cognizance of development needs of the poor and facilitate energy access using renewable energy sources at the local level while also promoting sustainable entrepreneurship on the ground.

**Footnotes**

3. Level and Pattern of consumption expenditure, 2009-10, NSSO 66th round

---

Harish Hande, Ph.D. co-founder of SELCO India and Surabhi Rajagopal is a Principal Analyst at the SELCO Foundation.
Today we face global warming, higher fuel costs and pollution of the soil, air and water that we humans so desperately depend upon. This is leading to a growing need for clean and renewable energy. The Norwegian energy sector, being unique in several ways, is of particular interest.

The abundance of hydro power has made our power system almost 100 percent renewable. It has also made us a large exporter of energy intensive products produced in an environmentally friendly manner. The deployment of large amounts of variable wind and solar production in Northern Europe increases the demand for flexible hydro power production. My government has recently granted license to two new power cables to Germany and UK. These will each be on 1400 MW and are planned to be finished in 2018 and 2020. Increasingly, Norway is becoming Europe’s green battery.

Norway also has a large potential for further development of renewable energy. Due to EUs renewable energy Directive, Norway and Sweden have a common electricity certificate market that was established in 2012. The two countries’ common goal is to increase the renewable electricity production by a total of 26.4 TWh by 2020. This corresponds to the power consumption of more than half of all Norwegian households. The increased production is expected to come mostly from wind, hydro and bio energy. A recent study of the Nordic Energy system from IEA shows that renewable power production in the Nordics may increase substantially by 2050, resulting in a net electricity export to Continental Europe of around 80 TWh in a two degree scenario.

Balancing Nature And Climate

When renewable energy projects are developed conflicts may arise between companies, authorities and environmental interests. A comprehensive regulatory framework and policy guidelines are established to ensure sustainable tradeoffs between power generation and environmental values. Every license to build a renewable energy project is granted on the foundation that the social benefits shall exceed the disadvantages. This includes making assessments on the negative impacts on biodiversity, such as vulnerable and endangered species, ecological systems, and landscapes.

Since the 1970s, the Norwegian parliament has protected approximately 390 waterways from development of hydropower. This means that we have refrained from utilizing approximately 46 TWh, equal to about 1/3 of Norway’s average power production of approximately 130 TWh. Outside of these protected waterways, we seek to develop sustainable projects with valuable renewable energy production with minimal and thus acceptable impacts on
environment. This includes requiring mitigating measures in licenses in order to limit the environmental impact.

One third of the Norwegian salmon rivers are affected by river regulations. The actual impact however, depends on the extent of each project, and to what extent the implementation of measures can reduce the damage. Many of the measures do not necessarily require major investments. Mitigating measures to create a better environment for salmon may include sufficient water flow, physical adaptations of habitats such as restoring side channels, and other fish stabilization measures. At the same time, wind farms impact bird populations negatively in some areas. However, by making use of ecological knowledge one can reduce the risk of collisions and disturbance by carefully positioning each wind turbine in the landscape.

Reducing domestic emissions

Despite the decarbonized electricity supply, Norway has slightly higher greenhouse gas emissions per capita (10 million tons CO₂-eqv.) than other industrialized countries in Europe and Asia. According to the IPCC must average emissions in a two degree scenario be 1.5-3.1 tons CO₂-eqv. per capita in 2050. Norway is part of the Kyoto Protocol and will by 2020 reduce the global greenhouse gas emissions equal to 30 percent of Norway’s 1990 emissions. Norway also has a goal to be carbon neutral by 2050.

“Approximately 80 percent of the Norwegian greenhouse gas emissions are subject to a carbon price.”

One reason for the relatively high emissions is that Norway is a major producer of oil and gas. Norway supplies about 20 percent of the European demand for natural gas, which in the medium term is important in reducing Europe’s emissions. Norway is also a country far north and has a dispersed settlement. This gives a large need for heating and transport services. Due to the large access to hydro power, Norway also has a large and emission intensive process industry.

Norway is working on a broad scale to reduce domestic emissions, and this is affecting the energy sector both directly and indirectly. At the basis of Norway’s climate policy are general means like CO₂ tax and participation in the EU Emission Trading System (ETS). Approximately 80 percent of the Norwegian greenhouse gas emissions are subject to a carbon price. Another major tool in the energy and climate policy is Enova, a public enterprise working on driving forward the changeover to more environmentally friendly consumption and generation of energy. In 2013, Enova awarded support to new energy projects corresponding to 1.4 TWh, with a total of 214 million Euros. Enova also supports new energy and climate technology, to harness experience that will contribute to expertise development, innovation and diffusion of the technology both nationally and internationally.

The phase-out of oil heating in buildings and industry sectors is leading to increased consumption of power and district heating. In addition to carbon pricing and strong environmental restrictions, companies in the petroleum sector must investigate electrification on large projects offshore. This is leading to lower emissions and increased consumption of renewable electricity offshore. Norway also has the highest share of electric cars in the world. Thirteen percent of all new cars sold in Norway so far in 2014 have been full electric cars. If the electric cars continue to have high market share, this will increase the power consumption over time. At the same time environmental policy is causing energy efficiency improvement across all sectors, releasing energy for other purposes. In sum, therefore, it may be hard to foresee the precise effect on the total energy consumption.

Responsibility to cooperate

Evaluations show that the Norwegian environmental policy is working. It is expected that emissions in 2020 will be 17-20 million tons CO₂-eqv. lower than without CO₂ pricing and other measures. This is telling us that the climate policy is working. Still, the absolute level of emissions in Norway has not been declining as expected, mostly due to other factors such as population and economic growth.

To reach the two degree target we need tough emission reductions in all countries in the coming decades. This will have a huge impact on the energy sector and demand tough balancing of the need to increase renewable power production with other environmental goals such as preserving livable habitats for endangered species.

What we urgently need is international cooperation. All countries have a responsibility to participate in a cooperative manner in the forming of a global climate agreement in Paris next year. The world needs to agree on emission reductions adequate to keep global warming within two degrees. This demands action in all countries, both rich and poor.

*Tine Sundtoft is the Minister of Environment and Climate Change of Norway.*
Scotland: Current Renewable Energy Issues

David Torrance

Scotland is well on its way towards becoming a world leader in renewable energy. Rich in natural resources, Scotland enjoys a plethora of potential sources of renewable energy, from wave and tidal to wind, solar, geothermal, hydropower and biofuels. Not only do we possess the largest offshore renewable energy resources in the EU, with a quarter of Europe’s tidal and offshore wind potential, we are also at the forefront of developing breakthrough innovations in renewable energy technology. In this article I focus on marine (wave and tidal) power, which I view as one of the most promising sources of renewable energy in Scotland.

Whilst we remain at an early stage in terms of technological development, there is vast potential for Scotland to harness its marine power further. This will require targeted investment in innovation, research and development, in addition to more practical aspects such as improvements to grid access; however, the benefits that Scotland can gain in relation to jobs, the economy, meeting our climate change targets and achieving energy security constitute major incentives for doing so.

The development of marine power technology in Scotland has come a long way in a relatively short space of time. The Saltire Prize initiative recognises technological advances in this sector. Launched in 2008 by Scotland’s First Minister Alex Salmond, the Saltire Prize currently has five competitors vying for the £10 million reward, the largest of its kind in the world. One of the participants, Aquamarine Power Limited, developed the revolutionary Oyster technology that converts energy from nearshore waves into clean sustainable electricity via an onshore hydroelectric turbine. It brings me great pride to know that Aquamarine Power’s Oyster 800 wave energy device was manufactured within my constituency at Fife Energy Park in Methil by local contractor Burntisland Fabrications (BiFab). Another competitor for the Saltire Prize, Pelamis Wave Power, has a facility just across the Firth of Forth in Leith, Edinburgh, where assembly of its Pelamis structures takes place. Both are examples of cutting-edge renewable energy technology being developed on Scottish shores.

Based on the popularity of the Saltire Prize, the Junior Saltire Prize was launched in 2011, sponsored by Skills Development Scotland and backed by the Scottish Government. Open to school pupils across Scotland, the Junior Saltire Prize aims to inspire a new generation of innovators in marine energy. It is a means of encouraging interest and engagement in the renewable energy industry amongst young Scots, those who will take forward the pioneering of new technology into the future. This is vitally important if renewable energy is to become a sustainable and integral part of Scotland’s economy in the years to come.
Despite the vast potential of Scotland’s marine power and renewable energy industry more generally, there are a number of challenges to overcome before its value can be fully realised. One of the major issues is the cost of developing new technologies and encouraging the continued advancement of renewables whilst keeping down the costs of supplying energy to the consumer. The financial gain of increasing our reliance on renewable energy is significant long-term, with an estimated £30 billion of investment in the Scottish economy. However, there is no denying that investing in the industry in the early stages is expensive, and already many consumers are facing fuel poverty as a result of recent high price increases by the major energy suppliers. One way of tackling this problem was proposed by the Scottish Government in its plans for energy policy in an independent Scotland which involved transferring the cost of energy efficiency measures, such as the Energy Company Obligation (ECO) and Warm Homes Discount, from energy companies to the central government, meeting these costs through central resources.

“In the long-term we can assure our energy security in Scotland by aiming to become entirely self-sufficient in our own energy supply.”

A further problem is the lack of grid access in many areas, particularly in terms of offshore infrastructure. The existing electricity transmission network in Scotland and across the UK is outdated and in need of major upgrading. Significant investment is therefore required to connect and deliver Scotland’s vast renewable resources to consumers. For this reason, the Scottish Government has been working with its partners in Ireland, Northern Ireland, and across the North Sea to improve offshore grid connections. The EU has recognised these connections as priority infrastructure projects, and we must continue to work with all interested parties in the EU to ensure rapid deployment over the coming years.

It is also important for Scotland to promote continued and increased innovation and research and development in the renewables sector. Whilst much has been achieved thus far, including the technological innovations recognised by the Saltire Prize, we must ensure that Scotland continues to capitalise upon its strong track record in R&D by working with industry partners and academia from our leading Scottish universities in order to direct funding towards the most appropriate research areas.

Whilst there are a number of challenges to face in expanding the renewable energy industry in Scotland, there are also some fantastic opportunities to be gained from doing so. The potential for employment is extensive, with the prospect of up to 40,000 jobs to be created in this modern and innovative sector by 2020. The contribution that Scotland’s renewable energy industry will make to our economy in financial terms is also significant. It has been estimated that capturing just a third of our offshore renewable energy potential could generate the equivalent, in terms of electricity sales, of £14 billion net by 2050.

Furthermore, increasing our focus on renewable energy will allow Scotland to work towards decarbonisation of its energy mix and the achievement of its ambitious climate change targets. With the world’s fast-depleting supplies of fossil fuels, it is becoming increasingly important for countries, particularly those heavily dependent on oil and gas, to turn to more sustainable sources of energy. Countries that depend less on energy importation also have a much higher level of energy security. In Scotland we have the most ambitious renewable energy target in the EU; by aiming to meet 100 percent of our electricity consumption from renewables by 2020, alongside 11 percent renewable heat and 10 percent renewable transport targets, Scotland’s overall share of renewable energy is expected to be 30 percent by 2020. Not only does this exceed the EU-wide target of 20 percent, it eclipses the UK’s target of 15 percent. In the long-term we can assure our energy security in Scotland by aiming to become entirely self-sufficient in our own energy supply.

It is clear that Scotland has enormous potential to harness its renewable energy, particularly in terms of marine power. Although there will undoubtedly be obstacles to overcome along the way, there are innumerable benefits to be gained by our people, our economy and our environment. By encouraging continued innovation through positive initiatives like the Saltire Prize and continued investment in research and development we can go further in delivering, for ourselves and the wider world, modern and sustainable sources of energy to take us into an increasingly decarbonised future. I am extremely proud of what Scotland has achieved in this sector thus far and I look with anticipation towards what is certain to be a bright and enterprising future for renewable energy in Scotland.

David Torrance is Scottish National Party member of the Scottish Parliament for the Kirkcaldy constituency.
Dubai: Harvesting Green Economy

Waleed Salman

Dubai rumbles on enroute its ambitions to become the Green Capital of the world, as Dubai Carbon Center of Excellence ramps up plans after a successful 2014, with a forum and knowledge product on Green Economy, measurement and verification of Greenhouse Gas Emissions for 2014.

Dubai has made rapid strides in “green economy innovation”. I refer to it as an innovation because of the shift in thinking the emirate is going through. 2014 was a successful year, because UAE is moving towards a low carbon economy and the Dubai Carbon Center of Excellence is actively involved by facilitating the transition.

Green Economic Development Taking up Pace

The ‘State of Green Economy Report’ released a few months ago, contains scores of valuable data, for the various projects undertaken by the Emirate of Dubai. Dubai Carbon created the platform on behalf of the World Green Economy Summit committee and invited several thought-leaders and industry experts to discourse on the focus areas when greening economies. While the Report was a crucial pivot point to orchestrate the movement, it goes above and beyond enlisting Dubai’s green credentials. The Report is an active guide to every country’s economy around the world on how to successfully implement various measures to lower carbon footprint in their own backyard.

Then, the thrust towards green initiatives serves as the vantage point for Dubai’s ambitions to become the capital of green economy, in line with the global trend, of countries developing strategies and initiatives adhering to the United Nations Environment Programme’s (UNEP) ‘Green Economy Coalition’. As many as 65 countries are participating with deployment plans expected in a few years.

Dubai holds an edge owing to its early planning. Being one of the world’s newer cities, all government and semi-government bodies have been extremely proactive in enforcing strong environmental laws, then may it be for the real-estate sector, transport or energy production and conservation. Hence, Dubai will witness quick turnaround times, reaping the fruits of its efforts earlier than forecasted.

Clean Energy Scaling Up

To put things in perspective, let’s consider the world figures. By the end of 2013, global renewable power capacity exceeded 1,560 GW, equaling an 8.3 percent increase over 2012. Hydropower rose by 4 percent to approximately 1,000 GW, accounting for about one-third of renewable
power capacity added during the year. Other renewables collectively grew nearly 17 percent to an estimated 560 GW. For the first time, more solar PV than wind power capacity was added worldwide. Overall renewables accounted for more than 56 percent of net additions.

Dubai is undertaking efforts to lead the charge across the region: the emirate has hosted two dedicated conferences on green economy in 2014, one of them being the World Green Economy Summit 2014 (WGES). As the most notable outcome of the summit, the Dubai Declaration, pledges a commitment to establish WGES as a long-term development platform, with the aim of establishing Dubai as “The Capital of the Green Economy”. The commitments made through this Declaration will be followed-up over the course of the coming year and serve as a point of departure for WGES 2015. A few of the commitments are: to sustain the engagements of stakeholders in preparation for WGES 2015, support the development of an innovative financing mechanism for green projects and investments, develop and showcase cutting-edge green innovation, and engage the youth in green economy activities.

A Data-Based Roadmap

Dubai Carbon has been commissioned, for the second consecutive year, to compile a Greenhouse Gas Inventory, on a national level by the Ministry of Energy (MoENR) and for the third consecutive year for the Emirate of Dubai by the Supreme Council of Energy (with data from 2011, 2012 & 2013). During its first endeavor in 2009, the centre developed the process to annually calculate the Grid Emission Factors for electricity. It was soon evident that the re-occurring data streams were vital to derive trends and optimize the operational and business practice. Dubai Carbon has been running a Monitoring Reporting and Verification (MRV) platform for the Emirate of Dubai and the UAE as a whole, compiling annually the UAE Greenhouse Gas (GHG) Inventory since 2012 (based on 2011 data) for Dubai, respectively 2013 (based on 2012 data) for the UAE. As a result, Dubai Carbon applied its environmental economics skills to derive both intelligence and economic trends out of the data consolidated.

The Ministry of Energy made the contribution of each sector to the GHG emissions of the UAE available in the UAE State of Energy Report 2015 this October with contributions from electricity and water of 35 percent, road and transport sector of 19 percent, oil and gas of 15 percent, Industrial sector aluminium of 8 percent and cement of 8 percent, waste of 6 percent agriculture of 1 percent and miscellaneous adding up to 8 percent. The Dubai Supreme Council of Energy has used the data and developed a road map through its working group: the ‘Carbon Abatement Committee’.

The Dubai ‘Carbon Abatement Committee

The Carbon Abatement Committee reviews the objectives and mechanisms, and provides strategic direction and recommendations in terms of carbon reduction, with the support of the Technical Committee and a working group of stakeholders, experts and decision makers. The Committee comprises key public organisations in the Emirate of Dubai and focuses on achieving its goals for energy, the city, roads and transportation, and aviation, as well as the gradual empowerment strategy to promote innovation in reducing carbon emissions.

Headed by His Highness Sheikh Ahmed Bin Saeed Al Maktoum, Chairman of the Dubai Supreme Council of Energy and its Vice-Chair, His Excellency Saeed Al Tayer, the committee reviewed and endorsed the carbon reduction strategy for Dubai to reduce carbon emissions by 16 percent, by the year 2021. The executive plan was presented by the Dubai Carbon Centre of Excellence (DCCE) this October.

A strategy of this nature is the first of its kind in the region. It supports the UAE Vision 2021, which aims to transform the UAE to be one of the best countries in the world by 2021. It also supports the national long-term Green Economy for Sustainable Development initiative by HH Sheikh Mohammed Bin Rashid Al Maktoum, UAE Vice President, Prime Minister and Ruler of Dubai to enhance competitiveness and economic sustainability of the UAE, and make it a global role model in sustainability and green initiatives. By complementing the Dubai Strategic Plan 2021, it assists to maintain Dubai’s leading position at the regional level and its competitiveness at the global level, as well as Dubai Integrated Energy Strategy to reduce energy consumption by 30 percent by 2030.

Today, transition to green economies is set in motion, irreversibly. We need to move fast to scale up and strengthen this momentum not only to make the Sustainable Energy for All a reality, but also to fulfill the legitimate needs and aspirations of humanity.

Waleed Salman, Ph.D. is Chairman of Dubai Carbon Centre of Excellence.
Cleaner Cookstoves and Fuels: Ingredients for a Healthy Planet

Radha Muthiah

Cooking is a daily ritual we all do. To many, it is a chore. But for nearly three billion people – about half of the world’s population – it is something much more. Like many women in the developing world, Sarah Roba and her family in Kenya cook over an open flame or use inefficient cookstoves that threaten their lives and damage the environment. “The smoke from cooking affects us,” Sarah says. “They make this world black. They also make us black inside.” Sarah’s mother died when she was ten, and her sister lost her battle with lung cancer.

To put it bluntly, this type of cooking kills. Prolonged exposure to harmful smoke and fumes contributes to illness and the premature deaths of an estimated 4 million people each year. Crude cooking stoves produce toxic emissions that poison the air, both inside the household and outdoors, and consume precious natural resources. The damage to the ecosystem cannot be understated.

According to the UN’s Sustainable Energy for All initiative, access to clean energy will foster economic growth, increase social equity, reduce pollution and alleviate climate change.

Burning solid fuels like wood, agriculture waste and animal excrement releases carbon dioxide, methane, carbon monoxide and black carbon, all major contributors to global climate change. According to the Climate and Clean Air Coalition, an international group of national and NGO partners mobilizing to reduce emissions of short-lived climate pollutants, approximately 21 percent of black carbon emissions come from the use of inefficient cookstoves and fuels. The adoption of clean cookstoves and fuels represents an ideal mitigation measure for addressing climate change and will have an important role to play at the 20th UN Conference of Parties in Lima, Peru later this year.

Warming from black carbon, or soot, contributes to the accelerated melting of glaciers and alpine snow and changes precipitation patterns impacting drinking water supplies and crop irrigation. The inefficient use of fuel for cookstoves contributes to deforestation and degradation as forests are cut to make charcoal to meet urban cooking needs. Researchers estimate that the burning of household cooking fuels is a major contributor to air pollution in cities, and causes between 25-30 percent of damaging air pollution in India.

The Global Alliance for Clean Cookstoves, a public-private partnership led by the United Nations Foundation and comprised of 1,000 partner organizations, is working
on viable, cost-effective solutions for more efficient and cleaner cooking. But we need far greater public awareness of the issue and its implications.

In the salt producing region of Gujarat in western India, I met with workers who understand the benefits of efficient cookstoves in an area where trees are scarce. One woman named Sharadaben told me she spent at least four hours a day collecting wood for her traditional cookstove, the chulha. Its smoke hurt her eyes and deterred her ability to carry out other economic and education pursuits.

Sharadaben is a member of the Self Employed Women’s Association (SEWA), an Indian non-profit organization of more than two million women that is working to distribute clean cookstoves and fuels in Gujarat and other states. SEWA estimates that fuel-efficient stoves would cut in half the average need for wood.

“We know efficient cooking makes a difference.”

Most of the people I spoke with in Gujarat are willing to invest in fuel-efficient stoves, but there is a lack of quality stoves and little financing for this type of investment. That is why the Alliance and our partners have been taking a market-based approach to solving the cookstove problem. We are helping groups like SEWA with technical assistance, consumer financing, and connections to manufacturers of clean and efficient cookstoves and fuels.

Our public and private effort is making great strides. In just four years, the Alliance has helped drive more than $50 million in investment into the sector and raised $50 million in grant funding. Every dollar of grant funding has generated one dollar of investment. The manufacturing, marketing and distribution expertise of the private sector is ensuring cleaner and more efficient stoves are products consumers will buy and use. And we have just started.

Our latest figures show that more than 20 million clean cookstoves have been manufactured and distributed around the world helping to save tens of thousands of lives, protecting millions of trees, and creating hundreds of thousands of jobs. We are well under way, but much more work needs to be done to meet our adoption goal of 100 million clean and efficient cookstoves by 2020.

More efficient cookstoves can reduce fuel use by 30 to 60 percent and produce fewer greenhouse gases and black carbon emissions. If more people use cleaner burning cookstoves it will help mitigate climate change and improve air quality.

But there is no one-size-fits-all solution to the problem. Viable clean cooking alternatives depend on the fuels and technologies available, whether they are affordable and they meet the households’ needs.

That is why the Alliance and its partners, including the U.S. Environmental Protection Agency and the United Kingdom’s Department for International Development, are supporting our research to maximize the value of cleaner cooking and ensure rapid delivery of results. Some of the projects include: mapping hotspots for environmental degradation to identify where clean cookstoves and fuels can have the greatest impact, determining how much black carbon is reduced when old cookstoves are replaced, and better understanding the relationship between cookstove emissions and public health.

“Health and environmental impacts of air pollution and climate expand beyond the borders of any one country,” said EPA Administrator Gina McCarthy. “This research funding seeks to provide new tools to reduce health risks for the nearly three billion people around the world who are exposed to household air pollution from crude stoves.”

We know efficient cooking makes a difference. In Kenya, Sarah Roba now uses a cleaner cookstove that she says produces less smoke and consumes less fuel. The amount of firewood she would use in a week now lasts for a month, meaning less time searching for fuel and more time to do other things. “We can help our children in school, visit the elders, and help the sick. I even set up a shop to improve myself,” says Sarah.

Adoption of cleaner cookstoves and fuels may seem like a small act to improve health and the environment. But when you consider the ripple effect of hundreds of millions of people having access to cleaner cookstove technologies, the impact is enormous. It is an economic boon for local communities. Women who spend hours each day collecting wood or other fuel to cook now have time to earn a livelihood for their families and educate their children. People can live healthier, more productive lives. And we have a chance to reverse deforestation and better control climate change. The opportunity to provide people with healthier choices, while at the same time ensuring a healthier planet, is one we cannot afford to miss.

**Radha Muthiah is Executive Director of Global Alliance for Clean Cookstoves.**
Energy in Architecture

Sheila Sriprakash

Energy is omnipresent and has been venerated since Vedic times. It is impossible to ignore its powerful dominance. This cultural linkage is ingrained in me since I was a child. Energy forms and shapes life, and possessing energy awareness leads to its judicious use. Architecture stimulates development through optimum use of all energies.

The revolutionary way in which paperless offices work today, and the use of the Internet has drastically reduced consumption required for movement and communication. Automobile companies are aware that it is their responsibility to create models that consume less. Despite these significant achievements, it is imperative to work towards reduction and elimination of irresponsible and thoughtless consumption that throws nature out of balance. The vicious backlash alters weather patterns resulting in devastating climate change.

South Asian Architecture responds to the climate through its characteristic verandahs and courtyards. The inclusion of naturally lit landscaped pockets embellishes the ambience and enlivens design. These “nature punctures” articulate the rigorously built forms. They not only reduce consumption of energy by lighting the space, but also naturally energize the environment. Landscaped courtyards and light shafts have been traditionally used to enhance the livability of buildings. These building elements offer magical design options besides creating passive architectural responses to the climate. Design is about the amalgamation of numerous detailed solutions that are individually energy efficient, that cumulatively reduce consumption while enhancing overall performance.

Converting raw materials into building components requires energy. The structures so built consume energy over their lifetimes. Recycling and reuse of materials conserve the use of materials and the energy required in buildings. Both cement and steel guzzle energy for their manufacture, but it is hard to replace them both. However, they provide exceptional strength and are versatile materials of construction. Discovering materials of construction that provide both high performance and strength while consuming lesser resources using lesser energy to manufacture is the key to conservation.

The first step in designing energy efficient buildings is to orient and position buildings so as to minimize the sun’s thermal absorption. Even a 50 percent reduction in power requirements for air conditioning and heating can be achieved through right building orientation. The emphasis in countries close to the tropics would be to reduce the heat gained from sunlight and protect the residents from glare. Conversely buildings beyond the tropics would do well to absorb the heat of the sun, and harness as much solar energy as possible. Maximizing the use of natural light reduces the dependency on artificial lighting thereby conserving power. Buildings can be designed to optimize glare free daylight. North facing windows provide glare free light, whereas...
southern openings in a building brings in the sun’s heat and glare. Openings that permit light from the east and west will require shading devices to obstruct the direct ingress of heat and glare into the interiors of buildings in the tropics. Passive architectural design elements provide a special aesthetic appeal to the exterior of the building by creating a rhythmic play of light and shade. This provides a unique grammar to architectural design based on location.

Technology provides options to prioritize and choose that which maintain a subtle architectural balance, and reciprocate with the macro setting of which we are a part. The use of local materials invariably results in considerable savings. Using locally available building materials makes the construction practices efficient and responsive to the immediate environment. Sensitive use of natural resources ensures sustainability. Designing with locally available material and talent challenges the designer to create unique detailing that responds to a specific place and its people.

A major consumption of energy by the building industry is by the way we cool or heat our buildings. The set temperature and air movement within a building determines comfort. Savings in capital expenses and in running costs can be optimized. Societal norms have a profound impact on energy consumption. Japanese are shifting towards higher set temperatures inside offices by simply doing away with suits and ties as formal business attire. Technological advancements have ensured that our HVAC systems are more efficient. The use of thermal storage techniques and VRV systems are examples of this. Building orientation and passive architectural detailing reduce the load required to run heating and cooling systems. Use of LED lights has resulted in substantial savings of energy. Rating of equipment has ensured efficiency in the running of machines.

By ancient Hindu texts, the “Pancha Boothas” or the five elements – air, water, fire, earth and space – maintain the balance of life. They manifest into myriad forms of energy, and their balance ensures harmony in this world. Green house gas emissions are pushing carbon dioxide levels in the environment perilously close to calamitous levels. The melting of the Arctic and receding fresh water glaciers pose threats that cannot be comprehended. Humanity would be wise to acknowledge the role of the elements of energy, and realize that its balance is crucial for survival. Disruption to this subtle balance is the cause of concern and calamities.

The philosophy that rules my design thinking is “Reciprocity.” The ability to understand and acknowledge the unique parameters and compulsions of a place and their people, to evolve inclusive solutions to problems, and to pointedly address concerns while maintaining the environment in a sustainable manner are the fundamentals of Reciprocity in Design. Reciprocity as a philosophy of design respects the subtle balance of nature to ensure sustaining harmony.

Sheila Sriprakash, an architect and urban designer, is the founder of Shilpa Architects (India).
Siqi Zhou

The Climate Summit at the United Nations on September 23, 2014 was an “unprecedented and important gathering” of more than 120 Heads of States and Government, and business and civil society leaders. During the Summit, leaders at the highest level united to advance climate action on five fronts: cutting emissions, mobilizing money and markets, pricing carbon, strengthening resilience, and creating new coalitions. Global leaders from diverse sectors came together to announce bold commitments in eight action areas: agriculture, cities, energy, financing, forests, industry, resilience and transportation. The Summit also aimed to strengthening political will for a meaningful universal climate agreement at the Paris COP-21 in 2015.

A very exciting grassroots action to curb climate change occurred in New York City two days before the Summit. It is estimated that over 300,000 people participated in the People’s Climate March on September 21. “Our citizens keep marching,” Obama said in his address at the Summit, “We cannot pretend we do not hear them. We have to answer the call.”

The one-day Summit focused on tangible climate actions. U.S. President Barack Obama promised to announce more aggressive targets on emissions reductions next year and the European Union committed to cut greenhouse gas emissions 80-95 percent by 2050 compared to 1990 levels and pledged about $22 billion to the Green Climate Fund to aid developing nations. Later in the program, during a Private Sector Forum luncheon many companies announced their support for carbon regulatory policies, like carbon taxing and cap-and-trade programs. Six global energy firms signed onto the “Climate and Clean Air Coalition Oil and Gas Partnership” to reduce methane emissions.

Promoting collaboration, local leaders pledged towards major carbon cuts in their cities. Compact of Mayors announced a plan to reduce their greenhouse gas emissions by 454 megatons by 2020. In addition, the World Bank and other initiatives, like the City Creditworthiness Partnership, will help the world’s cities to improve their financial management and strengthen their creditworthiness to attract investors.

The protection of forestlands was another major focus of the Summit. A public-private partnership pledged to cut deforestation to half by 2020 and end it by 2030. In support of the New York Declaration on Forests, a political agreement
that calls for the restoration of forests and croplands, 20
global food companies, including Dunkin Donuts and
Krispy Kreme, announced their pledges to deforestation-
free sourcing policies of palm oil. The Consumer Goods
Forum, a coalition of 400 companies, called on governments
to pass a legally binding climate deal in Paris in 2015 that
would include large-scale payments to countries that reduce
deforestation.

With respect to energy, two initiatives were publicized to
boost low-carbon, renewable energy in Africa’s small island
developing states. The Africa Clean Energy Corridor aims to
expand the portion of renewable energy used by the Eastern
and Southern Africa Power Pool and the Small Island
Developing States Lighthouse Initiative will strengthen
international cooperation and speed the development of
low-carbon renewable energy resources.

Investment Mobilization

Various action plans announced at the Summit mobilized
more than $200 billion to finance clean energy projects
and support resilience among vulnerable nations. Obama
promised the United States would lead a global effort to
forge an international agreement next year that would
require all countries to set emission targets by 2020 and
provide upwards of $100 billion annually to help the poorest
countries shift away from fossil fuels and adapt to warming
temperature. France will commit $1 billion in the next few
years to the Green Climate Fund. Forty companies, among
them Kellogg, L’Oréal and Nestlé, signed a declaration to
help cut tropical deforestation. Apple, Google and Facebook
have made strong commitments to power their huge,
electricity-hungry data centers with renewable power.

“Our citizens keep marching; we cannot pretend
we do not hear them. We have to answer the call.”
-Barack Obama

World Bank Group President Jim Yong Kim praised the
unexpected partnerships that have come out of the summit.
The green bond market has reached over $25 billion and will
surpass the goal of $10 billion that he had set in January
2014.

Although the Summit is not part of the United Nations
Framework Convention on Climate Change (UNFCCC)
negotiations, it has added a new energy to the formal
negotiation process. The Summit provided a valuable
platform for world leaders to submit their Intended
Nationally Determined Contributions (INDCs) for the new

agreement in the first quarter of 2015. It also expanded the
efforts to help poor countries adopt clean energy, which
will contribute to the collaboration of the international
community and ultimately help facilitate the negotiations
surrounding a new climate strategy in Paris next year.

“The Summit has catalyzed the momentum for addressing
climate change issues decisively and mobilized leaders
across sectors to take action.”

Notwithstanding the momentum Climate Summit has
created, the absence of many prominent heads of state and
government, including China’s President Xi Jinping, Indian
Prime Minister Narendra Modi, Russian President Putin,
and German Chancellor Angela Merkel, was a reflection of
the hurdles that the international community has to yet to
overcome on its way to the climate agreement at COP-21 in
Paris 2015. As the world’s largest and third-largest carbon
emitters respectively, China and India play critical roles in
determining the fate of the global climate negotiations and
their leaders’ absence reinforced the “North-South Divide”
on the climate issue. India even expressed its dissatisfaction
of starting a parallel negotiating platform beyond the
UNFCCC.

Unquestionably, the Summit has provided a platform for
new coalitions and has brought together both leaders and
industries across the globe to not only recognize climate
risks, but to work collaboratively toward a shared goal. It
has catalyzed the momentum for addressing climate change
issues decisively and mobilized leaders across sectors to
take action. Despite the positive contribution of the Summit,
it will be a big challenge to channel this momentum into
action at all levels. The real test of this Summit will be on
how much progress the COP-20 negotiation in Lima will
make, and also if the international community will be able
to sign for a meaningful global climate agreement at Paris
during COP-21 in Paris in 2015.

Sigi Zhou is Program Coordinator at Global
Energy Initiative.
World Energy Headlines

Bessie Weisman

The International Energy Agency predicted that renewable energy will make up almost half of sub-Saharan Africa’s power generation growth by 2040. Solar energy will lead the growth in renewables, and geothermal will become the second-largest source of power supply in East Africa.

A study from the Union of Concerned Scientists (USC) found that America can nearly quadruple its renewable electricity in the next 15 years, reaching 23 percent by 2030. Though the Environmental Protection Agency has set the goal of 12 percent by 2030, seven states already exceed the goal and another 17 have existing laws that require more renewable electricity than what the EPA requires.

The Indian government plans to hold the first global renewable energy investors summit next year. The summit would be an important step towards Prime Minister Narendra Modi’s target to improve the cumulative installed the renewable energy capacity to 100 GW over the next five years.

Industrial Technology Research Institute, Taiwan’s largest high-tech applied research institution, introduces High Efficiency Calcium Looping Technology (HECLOT). Using a cycling of calcination and carbonation method, the technology claims to capture up to 90 percent of CO₂ and cost 40 times less than existing CO₂ capture technology.

Morocco’s first solar energy plant will start operating in 2015. Aiming to raise renewable energy production to 42 percent of its total power supply mix by 2020, Morocco expects to build five new solar plants by the end of the decade with a combined production capacity of 2,000MW and at an estimated cost of $9 billion.

To cater the needs of modernizing United Kingdom’s infrastructure, China is set to invest over $67.25 billion in the UK’s energy sector in the next 10 years, according to Pinsent Masons and the Centre of Economic and Business Research. This will be a significant boost to the UK economy.

Warburg Pincus LLC announced on October 27 that it raised $4 billion for its first energy-focused private equity fund, with a focus on energy exploration and production investment in North America and around the world.

South Africa has signed an intergovernmental nuclear energy co-operation agreement with France, as part of its long-term plan to secure a sustainable energy mix. With only one nuclear power station currently, South Africa plans to build more nuclear power plants with a total capacity of 9.6GW by 2030 as part of its Nuclear New Build program.

Four Nigerian companies- Giphed Nigeria Limited, Quintas Renewable Energy Solutions, Sky Resources, and Topstep Nigeria – won the Power Africa Off-Grid Energy Challenge sponsored by General Electric (GE) and the United States-Africa Development Foundation (USADF) with each of the four companies receiving a grant of $100,000.

Iranian Energy Minister Hamid Chitchian and his Armenian counterpart Yervand Zakharian announced that they agreed to launch the third energy transfer line between Iran and Armenia and construction of two hydro-electric power plants on both sides of the Aras River.

Iran aims to produce 5,000 MW of electricity with renewable energy sources in the next five years. The increasing investment in the renewable energy sector stimulated by the government’s incentives, which enjoys geographical and geological advantages to push forward the development of the energy sector.

GE has signed a contract with leading Turkish utility company ENKA to supply power generation equipment for a new 750MW combined-cycle plant that is under construction by Qaiwan Group in Iraq. GE’s turbines support more than 90 percent of the electricity generated...
in the Kurdistan region and this will be the fourth power project that GE is supporting in the region.

**China and Russia** agreed to start building the west route of the China-Russia natural gas pipeline, which will provide 30 billion cubic meters of natural gas a year to China. Additionally, China National Petroleum Corp purchased a 10 percent share of Vankorneft, the upstream subsidiary of Russian oil giant Rosneft and operator of the lucrative Vankor oilfield.

India’s minister for coal, power, and renewable energy, Piyush Goyal, announced a $100 billion investment in the renewable energy sector over the next few years. He also said that the government has increased the solar power capacity addition target to 100GW by 2019 compared to the previous 22GW installed capacity target by 2022.

Global energy has become a central issue at G20 Summit for the first time, and leaders agreed that the long-term stability of energy markets is critical in order to accomplish goals set by the G20 as well as economic growth.

Nanotechnology could dramatically improve energy storage for electronics, cars, and buildings, according to University of Maryland researchers. These nanosize batteries are 80,000 times thinner than a human hair, and can be fully charged in 12 minutes and recharged thousands of times.

The International Energy Agency calls for greater integration and cooperation of the European Union to shift to renewable energy and ensure energy security throughout Europe. A potential Energy Union across Europe is needed and transformative steps may include pan-continental agreement on reforming the EU Emissions Trading Scheme and better investment in clean energy.

China’s Energy Development Strategy Action Plan has set up ambitious goals for the period 2014 to 2020; 1) cap the energy usage annual growth at 3.5 percent or less, 3) increase the percentage of the total energy mix supplied by clean energy to 15 percent and 3) produce 85 percent of total energy used by 2020.

Considering new carbon reduction targets to be announced by the climate conference in Paris next year, Australian Prime Minister Tony Abbott says he has “no theological objection” to nuclear energy. Nuclear energy operation is allowed in Australia, but will not receive government subsidies.

Competition is heating among world’s top energy companies, including BP, Total, CNOOC, Statoil, Petrobras, Shell, and Exxon Mobile, for oil and gas exploration after Tanzania’s new-found oil and gas reserves, 53.2 trillion cubic feet (tcf) of recoverable natural gas resources.

Despite falling international crude oil prices and weak domestic energy demand, the Chinese government has called for construction of oil and gas infrastructure, such as pipelines and storage facilities, to be accelerated, and investment in shale gas to be increased.

Amid its existing shortage of fuel and fighting with Russian-backed rebels in the east, a nuclear accident at Zaporizhzhya, Europe’s largest nuclear power plant, on November 28, has added to Ukraine’s energy vows. Though this incident was much less dangerous than the Chernobyl disaster, the fragility of Ukraine’s energy security is further exposed.

Bank of America/Merrill Lynch reduced its rating on the energy sector in the wake of OPEC’s decision not to cut oil production. OPEC’s decision came last week amid the continued decline of oil prices, along with energy stocks.

India refused to announce a timeline to cap its emissions at COP-20 in Lima. It is noteworthy that China has committed to a 2030 deadline in a surprise deal with the US recently.

Blaming European opposition to the South Stream Project, Russian President Vladimir Putin has announced that the gas pipeline to Europe will not be built. He said Russia would instead look at creating a gas hub on the Turkish-Greek border.

To diversify its energy sources, China is pushing hard to expand its nuclear power capacity, which is estimated to triple by 2020. While change certainly has the political will and resources to succeed, safety of nuclear power plants still remains a big concern.
My Vision for the Decade of Sustainable Energy for All (2014–2024)

Ward Snoek

It is a great privilege for an energy engineer and member of the Model United Nations Society Belgium to address the UN about the matter that is closest to my heart. The future of our energy system and its implications on climate change and sustainable development is one of the most important and pressing matters at hand. The problem’s specific nature calls for a global solution. Therefore, this is exactly the crisis for which the UN has been established. UN efforts to take responsibility are admirable but not yet sufficient.

On the matter of energy policy, the international community is at a crossroad. Declaring 2014-2024 as ‘the decade of sustainable energy for all’ in the General Assembly is this crossroad’s signpost to the right path. Although passionately spreading the idea of energy and environmental sustainability, these words unfortunately remain empty if they cause no action. Governments, the private sector and civil society not only need to be shown the way but they also need to be strongly incentivized to follow it. An ambitious, effective, and globally enforced climate treaty is crucial if we want to avoid an environmental catastrophe. Indeed, there is a great deal of good work to do in the UNFCCC.

The Importance of a Global Climate Treaty

The first main focus of the 2014-2024 energy transition program should be to succeed where we failed in Copenhagen, Cancun, Durban and Doha: enforcing a globally ratified climate treaty.

In a world where every country would have its own individual emissions abatement program, emission reductions would be limited to only compensate the self-inflicted damage. This situation emerges as a Nash equilibrium. If a country would decide on greater efforts, while not backed by a treaty, its neighbors will act as free riders. In the end the country will reduce its efforts again until an equilibrium is reached. In other words, even when consequences of climate change become tangible within our societies, countries will keep polluting each other and the necessary reduction targets will never be attained. However, if an international treaty is enforced, neighbors will agree not to pollute each other
anymore and the marginal benefit of emission abatement rises. Equaling marginal benefit with marginal cost gives a new economic equilibrium which entices a much greater, global reduction effort. The figure below shows the economics behind this reasoning.

Reduction efforts ($ spent on abatement)

- No Treaty \( \rightarrow \) country abatement* \( \times \) #countries \( \times \) x
- International Treaty \( \rightarrow \) country abatement * (y \( \times \) #countriestreaty + x \( \times \) #countriesnot_in_treaty)
- Global Treaty \( \rightarrow \) country abatement* \#countries \( \times \) z

What should the ‘International Climate Treaty contain?

- A clear timeframe on emissions reduction and where to find reductions.
- Recommendation of a global emission trading scheme or carbon taxation.
- Region specific guidance for the transition into renewable energy sources.
- Countering the increase of fossil fuel resource base (shale gas).
- Discussion of the place for nuclear energy in the energy transition.
- Promotion of end use efficiency and the electrification of life.
- A comprehensive plan to protect the vulnerable and empowering the poor during the energy transition.

A Timeframe for Carbon Emission Reduction

Once CO\(_2\) is emitted, it remains in the atmosphere for a century. Earth’s temperature rise depends on the concentration of CO\(_2\) in the atmosphere. This means that even if we manage to stabilize emissions, temperature will keep rising. It is therefore crucial to strongly decrease emissions. Our world leaders must decide by how much, based on the following questions: ‘What is the optimal reduction level, leading to both an acceptable burden on global, national and local economies, and an ‘acceptable’ amount of climate change effects?’ For instance: from which point on does the rising amount of climate refugees, the increasing damage from natural disasters and the disappearance of small island states counterweigh the economic potential of burning fossil fuels? It is hereby very important not to make U-turn decisions, but to prepare a sustainable transition. For instance: immediately quitting oil would mean economic disaster, with all the subsequent effects and potential political instability.

The IEA has provided a reduction timeframe that can serve as a valuable example of what we need to do to limit Earth’s temperature rise to the intentionally agreed 2°C or the equivalent CO\(_2\) concentration of 450 ppm. This is the scenario to follow if we want to stick to the Copenhagen intentions. We conclude from this graph that 2014-2024 is the time to start acting.

The IEA also suggests, at a global level, how to achieve the reductions needed by 2030. The biggest chunk of emissions reduction should be found in energy efficiency, followed by renewables, biofuels, nuclear energy and carbon capture/storage. Of course, these measures are to be determined on a national level. The potential for renewable energy sources or nuclear energy is very country-specific.

A Global Emission Trading Scheme & Carbon Taxation

It does not matter where CO\(_2\) is emitted, but it does matter where emissions are reduced. For countries with a very efficient industry, it is more expensive to reduce emissions than it is in countries where one is still inefficiently burning coal. Reduction efforts therefore must be allocated to industries where it is most cost efficient. Efficient countries can make reduction investments in inefficient countries. Buying clean air does make sense, if the money is used for emissions reduction at the seller’s side.

Actually, a spot market of CO\(_2\) emission rights has the same effect. A legal cap on emission quantity is enforced. Emitters need to decide to reduce emission or buy extra emission certificates. As a consequence, the companies that can reduce most cost effectively will do so, while the others will prefer to buy emission rights at spot market prices. The system has proven to work in the EU. However, the economic crisis made the spot price of emission rights crash because
of a recession-driven reduction in emissions, instead of the intended efficiency-driven reduction in emissions. CO\textsubscript{2} taxes are not that much dependent on economic volatility.

CO\textsubscript{2} taxes or emission trading schemes have the same economic effect; an increase of producers surplus of low carbon energy generation technologies like renewables or nuclear energy. They encourage investments in renewables and nuclear, and discourage coal and gas. The following graph illustrates this principle for liberalized energy markets.

Transition to Renewable Energy Sources & Limiting the Fossil Fuel Resource Base

With the right economic and regulatory frameworks, we can produce more renewable energy. Eventually, renewable energy sources (RES) are the only true sustainable forms of energy production. By 2024, it is realistic to achieve a substantial growth in RES, but it would be foolish to expect it will be enough to tackle climate problems. The obstructing factors of RES are mainly of the techno-economical kind:

- High investment cost: RES still have high investment costs. Therefore energy prices need to be high enough in order to achieve reasonable payback times. This conflicts with the expected problems in ‘energy poverty’.

- Intermittency: RES do not always run. They’re often dependent on external conditions. In order to have 100 percent RES coverage, much more than the 100 percent of capacity must be installed. How will we react to sudden energy overproduction and shortages?

- Technologies are region specific: it makes more sense to put photovoltaic in Spain than in Denmark, where offshore wind farms have more potential.

- Grid equipment: To deal with the intermittency problems, we need an electricity grid that can act to the imminent needs of the energy market. This includes large amounts of data exchange, energy storage, increased levels of security and interconnections between countries and areas. This is what we call a smart grid.

For the previous reasons, it is absolutely crucial that the transition to RES is accompanied by the development of smart grids. Reaching the high percentages of energy supply with RES will be impossible without the development of the supporting technologies.

A threat to renewable energy sources as a backstop for fossil fuel technologies is the increase in resource base of fossil fuels. The shale gas issue has led to a supply increase in fossil fuels, forcing coal prices to historically low levels, which is one of the biggest drivers of global warming.

The Necessity and Acceptability of Nuclear Energy

Dogmatically renouncing nuclear energy as a part of the energy transition is a mistake. After the Fukushima disaster, nuclear energy has globally been criminalized by popular media. Political leaders have found electoral ground for nuclear phase outs, a U-turn decision based on incomplete or wrong information. It is unwise to write nuclear energy off before experts (e.g. UNSCEAR or WHO) got the chance to communicate the results of their investigations. Therefore, after publication of UNSCEAR’s findings about the Fukushima disaster, nuclear energy should be re-included in the debate on how to produce large amounts of energy at almost zero carbon emission and at low cost for the consumer.

Of course, the risks of nuclear proliferation remain imminent and that is why we need to further empower the IAEA with the means to manage and monitor nuclear installations all over the world. Also the NPT and the NTBT need to be promoted, respected and protected.

Protecting the Weak, Empowering the Poor

To conclude, climate change is not the only pressing issue when it comes to energy. Energy poverty is a matter at hand. Access to energy in developing countries is one of the main necessities to facilitate economic growth and bring welfare to a country. It is therefore crucial that these matters get a prominent place in the UN’s plan for sustainable energy for all.

Ward Snoeck was a finalist in the annual Global Energy Essay Contest 2013.
GLOBAL ENERGY ESSAY CONTEST

Prizes

• First Global Winner: $2,000
• Second Global Winner: $1,000
• Five Regional Winners: $500 each
• Global Winners will receive awards at GEI’s Conference at the UN in 2015. Airfare and accommodation will be provided
• Publication of Essays in Global Energy Affairs

Deadline: February 28, 2015

TOPIC
The Road to Paris 2015
Vision, Reality, and Solutions for a Climate Agreement

GlobalEnergyInitiative.org/EssayContest
SAVE THE DATE

AFRICA FUTURE ENERGY FORUM
18 - 19 March 2015, Nairobi, Kenya

Unlocking Africa’s Energy Potential

Program Highlights:

- Africa’s Changing Energy Landscape
- Global Push for Powering Africa and its Impact
- Dilemma of Growing Fossil Fuel Industry in Africa
- Preparing Africa for Renewable Energy Revolution
- Financing Energy Systems of Africa
- Fostering Corporate Social Responsibility in the African Energy Sector

www.africafutureenergyforum.org