



## Bridging the Divide Between Poverty Reduction and Climate Change Through Sustainable and Innovative Energy Technologies

**SCALING UP SUSTAINABLE ENERGY INNOVATIONS THAT CAN ADDRESS CLIMATE CHANGE CONCERNS AND POVERTY REDUCTION NEEDS**

December 2009

**Expert Paper**

Cover photographs: World Bank/Dominic Sansoni, 2002; Practical Action/Zul, 2004

Design and layout: Kimberly Koserowski

Printing: Phoenix Design Aid

This desk study is written independently by the author. It is financially supported by the Environment and Energy Group of UNDP. The author is an independent consultant who has worked on a range of sustainable development issues for UNDP, UNDESA and the World Bank-Global Environment Facility, UNFCCC, and other non-profit organisations, including the MacArthur and Rockefeller Foundations. The views expressed in this publication are those of the author and do not necessarily represent those of the United Nations, including UNDP, or their Member States.

# **Bridging the Divide Between Poverty Reduction and Climate Change through Sustainable and Innovative Energy Technologies**

Scaling Up Sustainable Energy Innovations That Can Address Climate Change Concerns and Poverty Reduction Needs

*Expert Paper*

Prepared by Dr. Anilla Cherian  
December 2009

# Foreword

World leaders who gathered in September 2009 in the context of the UN General Assembly, and also in various fora all over the globe, have called for a comprehensive and forward-looking international climate change agreement at the 15th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change in Copenhagen, 7–18 December 2009. The process leading to Copenhagen was launched in Bali, December 2007, when all Parties agreed on the Bali Action Plan—a 2-year process leading to an agreed outcome on climate change in Copenhagen. Although it now appears that a comprehensive agreement will not be reached at Copenhagen, negotiations are sure to continue in 2010.

Building on this 2-year process of global meetings and media attention calling on world leaders and intergovernmental negotiators to ‘seal the deal’ in Copenhagen and beyond, much remains to be done to achieve an ambitious and equitable climate change agreement. With the clock ticking fast, one key question that remains largely unanswered is: How will the climate change agreement of Copenhagen and beyond Copenhagen impact the lives of millions of poor and vulnerable communities and countries around the world?

There is a broad global consensus that the severity of the climate change problem will have profound and lasting impacts on human well-being and economic development, particularly amongst those countries and communities that have contributed the least to the problem, and have the least capacities to adapt to the adverse impacts of climate change. Despite global agreement that poverty reduction is central to achieving

sustainable development goals, and the growing consensus on the gravity of the climate change crisis, global, regional, and national actions and discussions focused on these two challenges have unfortunately remained distinct. Within the rubric of the international climate change framework, there have been insufficient concrete policy and programmatic inputs to ensure closer linkages between the poverty reduction and global climate change policy agendas.

UNDP, as a member of the UN Development Group and manager of the Resident Coordinator system, recognises that its continued support of nationally driven poverty eradication objectives at the country and local levels is directly impacted and influenced by the gravity of the climate change crisis. UNDP recognises that embracing a new development paradigm that links poverty reduction efforts with climate change goals necessitates that climate change considerations be fully integrated with national plans to achieve the Millennium Development Goals (MDGs); and that national climate change adaptation and mitigation strategies and projects be directly linked with poverty reduction goals. It also necessitates that investment and development decisions have a consistent climate change focus built in at every step from project idea to design, implementation, and monitoring.

Increasing and improving access to cost-effective, innovative, and sustainable energy technologies for the poor is critical for addressing both climate change and poverty reduction concerns in many developing countries. Any post-2012 climate consensus needs to focus on concrete mechanisms and frameworks that

can support energy innovations that directly improve the well-being of poor communities and countries that are most vulnerable to the adverse impacts of global climate change.

In the framework of global action to address climate change, the development community as a whole has a unique opportunity to integrate climate change and development concerns/goals by putting the needs of the poor and vulnerable at the front and centre of any future global climate change agreement. Focusing on ways and means that can

enable the research, design, development, and implementation of innovative energy technologies that address climate change needs and the needs of the poor is a very important element in any future, equitable global climate change deal.

It is my hope that this report will contribute to the current discussions on the issues raised above, and help bridge the divide between poverty reduction and climate change through sustainable technological innovations.

A handwritten signature in black ink, appearing to read 'Vandeweerd', with a stylized flourish at the end.

Veerle Vandeweerd  
Director, Environment and Energy Group  
Bureau for Development Policy  
UNDP

## Acknowledgements

I am very grateful for all the valuable support and inputs provided by Veerle Vandeweerd and Minoru Takada of UNDP, as well as the inputs of members of UNDP's recently convened Poverty and Climate Change Network who reside all over the world. The comments provided by Leena Srivastava of TERI are thought-provoking, and

merit a follow-up report focused on providing evidence and analyses of the institutional and regulatory frameworks/mechanisms that facilitate energy technology innovations. Last, but never least, I am particularly grateful to my family— my husband, our sons Rohan and Arman, and my parents—for all their support and encouragement.

# Table of Contents

Foreword	i
Acknowledgements	iii
Executive Summary	1
1. Introduction: Context for Action	5
2. Separate and Isolated Is Not Effective and Equitable: The Case for Integrating Climate Change Action with Poverty Reduction and Improved Energy Access for the Poor	9
3. Bridging the Divide between Climate Change and Poverty Reduction through Sustainable Energy Innovations: Moving from Isolation to Integration	22
4. Powering Up Unserved Communities: Overview of Select Innovations that Can/Are Transforming the Lives of the Poor	25
5. Tinkering ‘Out of the Box’ For a Brighter, Sustainable Future: Ideas Always Matter But They Also Need Support	29
6. Findings and Conclusions: ‘Seal An Equitable Deal’ and Not Just Any Deal in Copenhagen and Beyond	45

# Executive Summary

*Efforts to eradicate poverty and to tackle climate change cannot be separated. The experiences of the poor families across the Asia and Pacific region who will wake up this morning in shelters, without homes, or having lost their means of making a living, remind us that the poorest people—those who are least equipped to cope with natural disasters—are most likely to suffer the most severe impacts of climate change. A person living in a developing country is 79 times more likely to suffer from a climate-related disaster than someone living in a developed country... When they meet on climate change in Copenhagen this December, the negotiators could do a deal which is positive for our climate and for poverty reduction and development.*

—Helen Clark, Administrator, UNDP

There is a broad global consensus that the severity of the climate change problem will have profound and lasting impacts on human well-being and economic development, particularly amongst those countries and communities that have contributed the least to the problem, and have the least capacities to adapt to the adverse impacts of climate change. Clearly, failure or delay to secure an effective and equitable consensus for climate change action is not a viable option. The tragic reality is that for millions of poor and vulnerable living in diverse areas of the globe, climate change deals remain too far removed and often completely separated from poverty reduction efforts.

As the push toward securing a new global climate change consensus at the upcoming Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen (December 2009) gathers momentum, it is important to highlight the concern (as referenced above) that the quest for an equitable global climate change framework is

inextricably linked to the broader global quest for sustainable development for all; and that efforts to address global climate change need to more effectively linked with poverty reduction efforts at all levels. Toward this end, it is imperative that any post-2012 climate consensus focus on concrete elements such as increasing access to low-cost, sustainable energy technologies and systems that can directly improve the well-being of millions of poor and vulnerable people that live in areas estimated to be the most adversely impacted by the effects of global climate change.

Given the centrality of energy issues in the overall climate change debate, the role of energy technologies, particularly low-cost, pro-poor, sustainable energy technologies should arguably be one of the crucial components impacting future action related to global climate change. Increasing access to cost-effective, environmentally beneficial energy technologies and systems has also long been seen as critical in the global struggle against poverty. Although energy access is not one of the



eight globally agreed Millennium Development Goals (MDGs), energy access is seen as a key cross-cutting issue that directly impacts achievement of the MDGs. But as this study demonstrates, inadequate attention has been paid to the conceptual and concrete policy and programmatic linkages between climate change concerns, energy access, and poverty reduction at the global level, which in turn impacts capacity development, financing, and research and development in innovative energy technologies at all levels—global, national, and local.

This study argues that, despite the existing global climate change consensus and global agreements recognising that poverty reduction is central for achieving sustainable development goals, global negotiations related to these two critical challenges have not been consistently linked at the thematic and programmatic level. At the level of global negotiations, rather than being viewed as intersecting development concerns, these two global challenges tend largely to be viewed as distinct issues, with few, sustained attempts at policy coordination and synergy. In the ‘heated’ global debate as to the scope and nature of developing countries’ involvement in future climate change mitigation and adaptation efforts, what is markedly absent are global efforts to design, finance, and implement programmatic and policy initiatives that link needs-based and context-specific mitigation and adaptation efforts in developing countries with broader development goals, including poverty reduction. Consequently, within the rubric of the international climate change framework, there has been a marked absence of concrete frameworks and inputs related to access to sustainable energy for the poor that would ensure closer linkages between the poverty reduction and global climate change policy agendas.

Providing sufficient financing for mitigation,

adaptation, technology transfer, and capacity development in developing countries is one of the most important and challenging components of the post-2012 regime. But, equally important is the need to recognise that insufficient attention has been paid to the issue of sustainable energy for the poor in terms of financing, technology, capacity building, policy, and regulatory mechanisms and frameworks. As the study argues, at the global level (conceptually and programmatically), the issue of developing energy technologies that meet the needs of the poor has not been addressed adequately or consistently within the context of both the global climate change negotiations and the global agreements related to poverty reduction.

Within the immediate context of the global climate change negotiations, there is also a surprising lack of forums and mechanisms focused on the development of vibrant, creative partnerships between civil society actors, including the private sector and research and academic institutions, that are aimed at addressing the linkages between climate change and increasing access to sustainable energy as a means to reduce poverty. From the perspective of this study, the inability to bridge the divide between poverty reduction, climate change, and energy access has severe and lasting implications for the future well-being of millions of poor and vulnerable communities around the world.

### **Objectives of this Study**

The need to enable and promote access to innovative energy technologies that address both poverty reduction and climate change needs is both urgent and timely. Cognizant that there are no ‘one solution fits all’ technological options, and that institutional, regulatory, and capacity frameworks and constraints play a critical role in research and development of sustainable energy

innovations, the study seeks to:

- i) Make the case for addressing the divide between two of the most pressing global challenges—poverty reduction and climate change—which tend largely to be viewed as distinct global issues, with few, sustained attempts at policy coordination and programmatic synergy
- ii) Highlight the urgent need for systematic linkages between poverty reduction and future global efforts related to mitigation and adaptation. In particular, the timely and pressing need for coordination and synergy between increasing access to sustainable energy services for the poor and climate change concerns, through research, development, and implementation of new pro-poor sustainable energy services (technologies, applications, and systems)
- iii) Identify some innovative sustainable energy services that have the potential to transform broader, ongoing developing country efforts toward reducing poverty and responding to climate change.

The aim is **not** to provide a comprehensive listing of all available/existing energy technologies and options that can address poverty reduction and climate change concerns, nor to provide an overview of applicable regulatory, policy, and institutional frameworks and mechanisms that can encourage the development of appropriate innovative energy technologies. Rather, the study focuses on select examples and applications with the potential for broad applicability in varied settings.<sup>1</sup> It is worth pointing out that a nuanced study of sustainable energy innovations needs to

go beyond the identification of selected energy innovations to analyse the institutional and regulatory environment that may have supported successful examples. However, analyses of the institutional, regulatory, and policy frameworks/ environments that are conducive to the development of successful innovations are beyond the purview of this study.

## Findings and Conclusions

The key findings of the study are that:

- An effective and equitable post-2012 global climate change consensus that engages all stakeholders clearly requires that poverty reduction efforts not be seen as distinct and separate from climate change action, and merits from a shift toward implementing innovative, clean energy technologies that address the dual concerns of climate change and poverty reduction.
- Despite the existence of National Adaptation Programmes of Action (NAPAs) for Least Developed Countries (LDCs) that are Parties to the UNFCCC, at the broader global conceptual and practical level, climate change-related mitigation and adaptation projects, programmes, and mechanisms lack a consistent and explicit focus on the socio-economic needs and poverty reduction concerns of developing countries. In particular, enabling and promoting developing country actions related to climate change mitigation and adaptation are hampered by the lack of clear thematic and programmatic linkages at the global and regional levels, between contextually specific poverty needs

---

<sup>1</sup> This report does not provide a detailed review of the existing and anticipated regulatory and institutional frameworks or capacity development or financing mechanisms that can contribute toward the development and diffusion of innovative energy technologies, although it recognises that analyses of these frameworks and mechanisms are crucial for a fuller understanding on how to better enable and develop low-cost, sustainable energy innovations.

and climate change concerns.

- Embracing a new development paradigm that links climate change, poverty reduction, and energy access necessitates that climate change considerations are fully integrated with national plans to achieve the MDGs, and that national climate change adaptation and mitigation strategies/projects are directly linked with poverty reduction and sustainable development goals. It also necessitates that investment and development decisions have a consistent climate change focus built in every step, from project idea to design, implementation, and monitoring.
- Funding for innovative research and development that will enable the next generation of sustainable, pro-poor energy technologies is currently inadequate to meet the sheer scale and scope of the challenge of increasing access to sustainable energy whilst also addressing climate change concerns.
- Financing and capacity development that is directly linked to research, development, and implementation of innovative, pro-poor, sustainable energy technologies should be contextually specific, needs based, and developed so as to encourage creative, cooperative partnerships between local and community-based organisations, regional and national academic and research institutions, and private-sector partners.
- The role of grant/seed money dedicated specifically for research and development of

creative and innovative energy services/systems that can address both climate change and poverty reduction should be emphasized. There is a specific need to focus on frameworks for action and partnership that can promote collaboration and scaling up of innovations amongst young entrepreneurs, researchers, and civil society actors within the developing-country context. Toward this end, the World Bank's Development Marketplace Grant mechanism is an excellent example of an innovative funding mechanism where creative ideas/technologies/services that matter for development are given global recognition and seed funding so that they may grow and replicate.

Given the sheer volume of negotiating text and the divisions in negotiating stances between developed and developing countries, Parties to the December 2009 Copenhagen talks, held under the auspices of the United Nations Framework Convention on Climate Change, will in all likelihood need to continue discussions into 2010. In the event that negotiators at Copenhagen are unable to reach a comprehensive agreement, the onus is to reach consensus on key principles that will govern the creation of a climate change regime in the upcoming decade that includes consistent and comprehensive linkages between poverty reduction, climate change, and access to sustainable energy innovations. The call to action is not just to 'seal any deal' at Copenhagen and beyond, but to '*seal an equitable deal*' that links poverty reduction and energy access needs with global climate change concerns.

# 1 Introduction: Context for Action

*It is clear that climate change brings ethical dilemmas to the fore. Whatever the origins of pre-existing inequalities and injustices around the world, they are clearly compounded in new ways because of climate change. And in responding to climate change, there are winners and losers- and the losers as always are poor people.*

—Andrew Hewitt, *The Ethics of Climate Change*

The UN Secretary General has described climate change as a ‘defining issue of our era’ and called special attention to the impacts of climate change and the need for swift action, stating that, ‘Action is possible now and it makes economic sense. The cost of inaction will far outweigh the cost of early action.’<sup>2</sup>

The physical science evidence for climate change garnered global prominence as a consequence of the 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). The report’s Summary for Policy Makers (SPM) noted:

Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.<sup>3</sup>

Global climate change-associated temperature increases anticipated to occur by the end of the century are widely expected to have devastating climatic consequences for poor and vulnerable communities that are already prone to the adverse impacts of climate change.

2009 is being hailed as a crucial year in the international effort to address climate change, culminating in the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP) in Copenhagen, 7–18 December 2009. The ongoing search for a post-2012 global climate change consensus that could effectively respond to the adverse effects of climate change in face of poverty, disease, and increasing vulnerability is arguably one of the most essential challenges facing the global community.

<sup>2</sup> Chair’s Summary: High Level Event on Climate Change, Sept 24, 2007. The text of the Chair’s summary is available at <http://www.un.org/climatechange/2007highlevel/summary.shtml>

IPCC Working Group I, Climate Change 2007: The Physical Science Basis-Summary for Policy Makers, Feb 2007, page

<sup>3</sup> For additional information, the entire report can be obtained at <http://www.ipcc.ch/SPM2feb07.pdf>

The conclusions and policy formulations of the 4th Assessment Report which took six years to complete and have been put together by a panel of 2,500 reviewers from 130 countries are relatively well-known: higher sea levels, rise in global mean temperatures, loss of valuable and irreplaceable biodiversity, including coastal and marine resources and ecosystems, and an increase in desertification.

**A critical question is whether the anticipated global consensus on climate change action achieved in Copenhagen will address the needs of millions of poor communities and countries most vulnerable to the adverse impacts of climate change?**

In order to establish the context for this question, it is important to first recognise the significance and scope of the climate change and poverty challenge. Based on the global scientific consensus of the 2007 IPCC Reports, it is now possible to conclude that climate change threatens to impact every aspect of human development. There is broad consensus that the adverse impacts of global climate change will have profound and lasting consequences, and fall disproportionately upon poorer and more vulnerable countries and communities, which have contributed the least to the problem and have the least capacities to adapt to the adverse impacts of climate change. In its discussion on the impacts of climate change on development, the Stern Review (2006) makes the linkage between climate change impacts and poverty more explicit by cautioning that, 'Climate change poses a real threat to the developing world. Unchecked it will become a major obstacle to continued poverty reduction.'<sup>4</sup>

The *Human Development Report* (HDR) 2007–2008 goes even further in calling attention to this linkage by stating that:

International cooperation on adaptation can be thought of as an insurance mechanism for the world's poor...For governments concerned with achieving

progress toward the MDGs over the next decade and building on that progress afterwards, adaptation is the only option for limiting the damage caused by existing climate change.<sup>5</sup>

The HDR warns of five 'drivers' through which climate change could stall and reverse human development: reduced agricultural productivity and increased food insecurity; heightened water stress and insecurity; rising sea levels and increased exposure to climate disasters; loss of ecosystems and biodiversity; and amplified health risks, with the greatest health impacts felt in developing countries. According to the HDR, failure to address climate change will consign and trap the poorest 40 percent of the world's population, some 2.6 billion people, in downward spirals of deprivation.

A joint UNDP and World Bank report entitled, *Energy Services for the Millennium Development Goals*, notes that while there is no MDG on energy, access to energy services, especially by poor people and communities, is essential to reaching all of the MDGs. Consequently, the report argues, '...more and better energy services are needed to end poverty, hunger, educational disparity between boys and girls, the marginalisations of women, major disease and health service deficits, as well as environmental degradation'.<sup>6</sup>

The chapter dealing with strategies and technology options for meeting energy targets includes only a brief reference on the issue of 'energy technology options and the environment' and advocates the adoption of increasingly cleaner technologies with economic growth rather than

<sup>4</sup> Stern Review, *The Economics of Climate Change- Part II: Impacts of Climate Change on Growth and Development*. 2006: page 92. Online at: [http://www.hm-treasury.gov.uk/media/0/6/Chapter\\_4\\_Implications\\_of\\_climate\\_change\\_for\\_development\\_final\\_version\\_on\\_web\\_P1-71.pdf](http://www.hm-treasury.gov.uk/media/0/6/Chapter_4_Implications_of_climate_change_for_development_final_version_on_web_P1-71.pdf)

<sup>5</sup> UNDP, *Human Development Report 2007/2008- Fighting climate change: Human solidarity in a divided world*. UNDP: 2008, page 186.

<sup>6</sup> IBRD/World Bank and UNDP, *Energy Services for the Millennium Development Goals*, New York: 2005, page 73.



expensive solutions that leapfrog to cleanest technologies possible.<sup>7</sup>

It is also worth noting that of the eight Millennium Development Goals (MDGs), only MDG-7, *Achieve environmental sustainability*, has an explicit environmental focus. MDG-7 contains three diverse global targets and eight global indicators, of which three specifically address energy: energy use per \$1 GDP; carbon dioxide emissions (per capita), and proportion of population using solid fuels. A UNDP review of progress made by 158 countries toward MDG-7 targets and indicators finds that while all countries report on at least one environmental indicator, reporting on the MDG-7 indicators has been weak overall, with only eight countries reporting on all eight indicators. The review finds that indicators relating to water and forests have the highest rates of reporting—138 and 133 countries respectively—but reporting on energy and solid fuels remains low. The review notes that, ‘A total of 23 countries—including 16 developing countries and 7 donors (sic)—have set country-specific targets to reduce emissions of CO<sub>2</sub>, which are typically aligned with Kyoto Protocol obligations.’<sup>8</sup>

The operating premise of this study is that an effective and equitable post-2012 global climate change consensus will clearly require a *shift toward implementing innovative, clean energy technologies* that address the dual concerns of climate change and poverty reduction. The need to enable and promote access to innovative energy technologies that address both poverty reduction and climate change needs is therefore both urgent and timely.

**Cognizant that are no ‘one solution fits all’ technological options, and that institutional, regulatory, and capacity frameworks and constraints play a critical role in research and development of sustainable energy innovations, the study seeks to:**

- i) Make the case for addressing the divide between two of the most pressing global challenge—poverty reduction and climate change—which tend largely to be viewed as distinct global issues, with few, sustained attempts at policy coordination and programmatic synergy**
- ii) Highlight the urgent need for linkages between increasing access to sustainable energy services for the poor and climate change concerns, through research, development and implementation of new pro-poor sustainable energy services (technologies, applications, and systems)**
- iii) Identify some innovative sustainable energy services that have the potential to transform broader, ongoing developing country efforts toward reducing poverty and responding to climate change.**

It is worth pointing out that a nuanced study of sustainable energy innovations needs to go beyond the identification of selected energy innovations to analyse the institutional and regulatory environments that may have supported successful examples. Analyses of the relevant frameworks/mechanisms that are conducive to the development of successful

<sup>7</sup> Op. cit., 2005: page 63.

<sup>8</sup> The 23 countries include: Bulgaria, Chile, China, Colombia, Denmark, European Commission, Germany, Kazakhstan, Lao PDR, Latvia, Lithuania, Myanmar, the Netherlands, Norway, Peru, Romania, Russia, Slovakia, Sweden, Ukraine, United Kingdom, and Vietnam.

innovations are necessary and to be encouraged, but are unfortunately beyond the purview of this study. Accordingly, the report does not provide a detailed review of the existing and anticipated regulatory and institutional frameworks, capacity development, or financing mechanisms that can contribute to the development and diffusion of innovative energy technologies, although it recognises that analyses of these frameworks and mechanisms are crucial for a fuller understanding of how to better enable and develop low-cost, sustainable energy innovations.<sup>9</sup>

**It should be noted at the outset that the aim is not to provide a comprehensive listing of all available/existing energy technologies and options that can address poverty reduction and climate change concerns, nor to provide an overview of applicable regulatory, policy, and institutional frameworks and mechanisms which can encourage the development of appropriate innovative energy technologies, but rather to focus on select examples and applications that have the potential for broad applicability in varied settings.**

.....  
<sup>9</sup>This paper does not provide a detailed review of the existing and anticipated UNDP poverty reduction and climate change-related projects.

## 2 Separate and Isolated is Not Effective and Equitable: The Case for Integrating Climate Change Action with Poverty Reduction and Improved Energy Access for the Poor

This section of the study seeks to demonstrate that, despite the broad global climate change consensus and the global agreements recognising that poverty reduction is central for achieving sustainable development goals, global negotiations focused on these two critical challenges have not been consistently linked at the thematic, programmatic, and institutional levels. At the conceptual and programmatic level of global negotiations, rather than being viewed as intersecting challenges, these two global challenges tend largely to be viewed as distinct issues, with few, sustained attempts at policy coordination and synergy. Additionally, concrete global action on ways and means to accelerate deployment, diffusion, and transfer of affordable environmentally sound technologies and cooperation on new and innovative technologies has been minimal. With negotiations bogged down in the lead-up to Copenhagen, it remains to be seen how much progress will be made in advancing the lofty goals of enhanced action on technology development and transfer related to mitigation and adaptation. Nevertheless, such action is critical from the perspective of developing countries.

### Climate Change Mitigation

At the global level, conceptual and programmatic analyses focused on climate change mitigation have either a minimal or non-existent focus on poverty reduction, and inadequate linkages to the

sustainable development concerns that are crucial to developing countries. This lack of a focus on poverty and development concerns can be traced to the fact that mitigation efforts have been driven by principles enshrined in the UNFCCC, such as ‘common but differentiated responsibilities’ and the historical responsibility for greenhouse gas emissions, which all accrue to developed/ industrialised or Annex I Parties. However, a lack of focus on issues such as sustainable energy and poverty within the context of more recent analytical reports focused on mitigation and adaptation in the lead-up to Copenhagen may be seen as reflective of an inability to engage with the existing socio-economic needs and poverty-related concerns of developing countries.

Two key OECD reports on mitigation—*The Economic of Climate Change Mitigation: Policies for the Future* and *Climate Change Mitigation: What Do We Do?*<sup>10</sup>—contain no references to the phrases ‘poverty reduction’ or ‘sustainable energy’.<sup>10</sup> Similarly, the executive summary of a very recently released OECD working paper, ‘The Economics of Climate Change Mitigation: Policies and Options for Global Action Beyond 2012’—which includes chapters focusing specifically on technology and R&D as well as regional incentives for global action—also contains no references to ‘poverty reduction’ or ‘sustainable energy’. In a section on ‘Enhancing Participation Incentives through Financial Transfers’, the OECD report states that

<sup>10</sup> Jean-Marc Burniaux, Jean Chateau, Romain Duval, and Stéphanie Jamet, ‘The Economics of Climate Change Mitigation: Policies and Options for the Future’, Economics Department Working Paper No. 658. ECO/WKP(2008)66. OECD: Paris. Available also at [http://www.oilis.oecd.org/olis/2008doc.nsf/LinkTo/NT00007AA2/\\$FILE/JT03257661.PDF](http://www.oilis.oecd.org/olis/2008doc.nsf/LinkTo/NT00007AA2/$FILE/JT03257661.PDF). OECD, *Climate Change Mitigation: What do we do?*, OECD: Paris. 2008. Also available at <http://www.oecd.org/dataoecd/31/55/41751042.pdf>



Achieving the UNFCCC's ultimate objective, i.e. stabilising GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system will require ambitious emissions cuts in both developed and developing countries.... [H]owever, the large coalitions of countries needed to achieve sufficient emission reductions will be difficult to establish immediately. One condition for enhancing mitigation action in developing countries will be the establishment of implicit and/or explicit international financial transfer to support their action.<sup>11</sup>

What is interesting to note here is that mitigation action is viewed in the context of the report as completely distinct and abstract from the broader socio-economic and poverty reduction needs and concerns of developing countries. The assumption is that somehow implicit or explicit financial transfer to support mitigation action that is not defined as contextually specific and based on development needs can work at the abstract global level.

### **Adaptation to Climate Change**

The UNFCCC commits countries to facilitate adaptation to climate change (Article 4.1). All Parties are required to take the actions necessary related to funding, insurance, and the transfer of technology to meet the specific needs and concerns of developing countries arising from the adverse effects of climate change (Article 4.8) and to take full account of the specific needs and special situations of the least developed countries in their actions with regard to funding and transfer

of technology (Article 4.9). In addition, developed countries are required to assist developing countries in meeting costs of adaptation to the adverse effects of climate change (Article 4.4).

Adaptation is viewed as a critical component in global and national efforts to address the climate change concerns of developing countries, especially those countries that are most vulnerable to the adverse impacts of climate change. Article 4.9 of the UNFCCC recognises the special situation of the LDCs, stating that Parties shall take 'full account of the specific needs and special situations of the least developed countries in their actions with regard to funding and transfer of technology.'<sup>12</sup>

In order to address the urgent adaptation needs of LDCs, Decision 28/CP.7 provided a set of guidelines for National Adaptation Programmes of Action (NAPAs) as a country-driven means/process for LDCs to identify priority adaptation activities that respond to urgent and immediate needs—those for which further delay could increase vulnerability or lead to increased costs at a later stage. The rationale for NAPAs rests on the limited ability of LDCs to adapt to the adverse effects of climate change. NAPAs are designed to use existing information and provide an opportunity to engage community- and grassroots-level action.

The Global Environment Facility (GEF) has been entrusted to operate the LDC fund for financing for NAPAs through Decision 27/CP.7.<sup>13</sup> In a report submitted to the UNFCCC, UNDP notes that it is supporting 31 NAPA projects and NAPA follow-up projects in 27 countries; while UNEP notes that it has supported NAPAs for 15 countries

<sup>11</sup> OECD, *The Economics of Climate Change Mitigation: Policies and Options for Global Action Beyond 2012*. OECD: Paris, 2009: page 202.

<sup>12</sup> The UN identifies 49 countries as belonging to the group of least developed countries (LDCs), of which 33 countries are in Africa, 10 in Asia, 1 in the Caribbean, and 5 in the Pacific. At present, 48 of 49 LDCs are Parties to the UNFCCC.

<sup>13</sup> The development of a NAPA also includes short profiles of projects and/or activities intended to address urgent and immediate adaptation needs of LDC Parties. Upon completion, the NAPA is submitted to the UNFCCC secretariat, where it is posted on the website, and the LDC Party becomes eligible to apply for funding for implementation of the NAPA under the LDC Fund.

and NAPA follow-up projects in 8 countries.<sup>14</sup> As of 26 May 2009, 19 contributing participants had pledged contributions to the LDCF. The total amount pledged to date is US\$ 176.5 million.<sup>15</sup>

While NAPAs are a crucial first step in identifying priority adaptation actions in LDCs, comprehensive financing, capacity building, and cooperation related to technology transfer, diffusion, and development for implementing context- and needs-based adaptation in LDCs and vulnerable communities and countries remains to be done. By design, the formulation of the NAPA priority projects based on national poverty reduction goals ensures that, at least at the conceptual and policy levels, adaptation will be a national policy priority. What remains unanswered is the effective and full implementation of local and country-specific adaptation activities based on the above. Another relevant question concerns what is to be done in vulnerable communities and countries, such as the Small Island Developing States (SIDS), which are not categorised as LDCs, but are in the front line, facing adverse climatic impacts.

A recent note prepared by the UNFCCC Secretariat, *Synthesis Report on Approaches to and Experiences in Integrating and Expanding Adaptation Planning and Action, and Lessons Learned, Good Practices, Gaps, Needs, and Barriers and Constraints to Adaptation*, includes a total of six references to 'poverty reduction', with the majority of these discussing the integration of disaster risk reduction into poverty reduction and adaptation strategies.<sup>16</sup> From the perspective of the current study, it is useful to highlight a few comments contained in this report.

On the issue of 'good practices', the report finds that, '[E]xamples of good practices in integrating and expanding adaptation planning span all levels of government, from international to community level, and many different approaches and kinds of integration.' While this is laudable, in the absence of specific information, the question remains as to whether this statement captures the practical experiences of developing countries.

The report goes on to state:

Furthermore, general good practices involve the recognition of co-benefits between adaptation to climate change, development and environment protection and of the importance of taking a no regrets approach. Many Parties are already taking this approach.<sup>17</sup>

Since the only footnoted reference is to another Secretariat report, it is not clear which Parties have benefited from these good practices, nor is it clear how many of these are developing countries in general, and LDCs and SIDS in particular.

Interestingly, the report also points out:

The needs relating to integration in the national communications highlight the general lack of capacity in non-Annex I Parties to mainstream climate change into national development and sectoral plans, and into efforts to achieve the Millennium Development Goals.<sup>18</sup>

This lack of capacity amongst LDCs and SIDS to implement country-driven adaptation activities that are fully integrated with national and sectoral

<sup>14</sup> UNFCCC/SBI, 'Implementation of national adaptation programmes of action including on accessing funds from the Least Developed Countries Fund', 17 November 2008: pages 7 and 10. Available at <http://unfccc.int/resource/docs/2008/sbi/eng/misc08.pdf>

<sup>15</sup> UNFCCC, Least Developed Countries under the UNFCCC, 2009, page 16. Available at [http://unfccc.int/resource/docs/publications/ldc\\_brochure2009.pdf](http://unfccc.int/resource/docs/publications/ldc_brochure2009.pdf)

<sup>16</sup> UNFCCC, *Synthesis Report on Approaches to and Experiences in Integrating and Expanding Adaptation Planning and Action, and Lessons Learned, Good Practices, Gaps, Needs, and Barriers and Constraints to Adaptation*. FCCC/SBSTA/2009/6 27 October 2009. Available at <http://unfccc.int/resource/docs/2009/sbsta/eng/06.pdf>

<sup>17</sup> Op. cit., 2009: page 12.

<sup>18</sup> Op. cit., 2009: page 14

policies and local development needs is critical. A fundamental concern for developing countries in designing and developing adaptation is that it is both context specific and continually evolving in response to broader development needs. Capacity development associated with adaptation planning in the developing-country context by definition needs to be flexible and responsive.

With regard to the issue of food security, which is closely identified with adaptation concerns in developing countries, much remains to be done. A recent analysis of climate risks for crops in 12 food-insecure regions, conducted by researchers at Stanford University with a view to identifying relevant adaptation priorities, recognises the importance of adaptation in shaping the future severity of climate change impacts on food production.<sup>19</sup> Focusing on food security impacts by 2030,<sup>20</sup> the study notes that investments aimed at improving agricultural adaptation to climate change inevitably favor some crops and regions over others. The researchers identify South Asia and Southern Africa as two regions that, without sufficient adaptation measures, will likely suffer negative impacts on several crops that are important to large food-insecure human populations.<sup>21</sup>

Recognising the need for a global dialogue on how to mainstream and integrate adaptation into poverty reduction efforts, a range of UN, multi-lateral, and bilateral donor agencies, published a report entitled, *Poverty and Climate Change: Reducing the Vulnerability of the Poor through Adaptation*. The report states that 'climate change

will compound existing poverty' and lists a series of issues where climate change compounds existing risks and vulnerabilities, including ecosystem goods and services, water, agriculture and food security, health, involuntary displacement, migration and conflicts, and economy-wide effects; however, it does not mention access to energy.<sup>22</sup> The energy-related implications of poverty-climate change linkage are also absent in the concluding section of the report, focused on identifying the way forward, which includes references to mainstreaming adaptation into sustainable development programmes and policies of donors, development agencies, and developing countries and calls for increased engagement with the UNFCCC process and external funding.<sup>23</sup>

Non-profit groups have also recently begun to see the relevance of working on adaptation issues in developing countries. Two years ago, the Rockefeller Foundation announced the creation of a \$70 million program to promote 'climate resilience' in the developing world. Last year, the John D. and Catherine T. MacArthur Foundation announced that it was committing \$50 million to conservation groups to help them preserve biodiversity in eight ecologically rich 'hotspots' as the world warms. But as Bruce Stutz writes, citing Stanford University climatologist Stephen Schneider, adaptation strategies are only beginning to be developed, mainly because there is precious little science on adaptation and few working models: 'Everyone is now talking about adaptation, but for all the talk there's little actually being done.'<sup>24</sup>

<sup>19</sup> The Program on Food Security and Environment of Stanford University examines a range of potential effects of climate change on regional and global food security. Cited below is a publication that is part of ongoing research conducted by the program.

<sup>20</sup> D. Lobell, M. Burke, C. Tebaldi, M. Mastrandrea, et al. 'Prioritizing climate change adaptation needs for food security in 2030'. *Science*. 1 February 2008, vol. 319, pages 607-610. The study notes that this is a time period most relevant to large agricultural investments, which typically take 15 to 30 years to realise full returns.

<sup>21</sup> Op cit. page 607.

<sup>22</sup> AfDB, ADB, DFID, et al., *Poverty and Climate Change: Reducing the Vulnerability of the Poor through Adaptation*. 2004. Pages 7-10.

<sup>23</sup> Op. cit., pages 29-33.

<sup>24</sup> Bruce Stutz, 'Adaptation Emerges As Key Part Of Any Climate Change Plan' in *Environment* 360, May 26, 2009. Available at <http://e360.yale.edu/content/feature.msp?id=2156>

**Despite the existence of a range of analytical linkages between food security, poverty and malnutrition, and climate change, inter-governmental financing for adaptation is currently not seen as part of the broader global financing effort for poverty reduction in general, or for improving food security or increasing access to energy services in particular.**

### Global Green New Deal

In the face of growing global financial insecurity, a 2009 research paper commissioned by the United Nations Environment Programme called on developed and developing nations to forge a 'Global Green New Deal' that puts the environment, climate change, and poverty reduction at the heart of efforts to reboot the world economy. Arguing that the multiple crises—food, fuel, and financial—threatening the world economy today demand a global initiative akin to the 1930s New Deal in the United States, the paper calls for a Global Green New Deal (GGND), whose objectives would be to:

- Revive the world economy, create employment opportunities and protect vulnerable groups
- Reduce carbon dependency, ecosystem degradation and water scarcity
- Further the Millennium Development Goal of ending extreme poverty by 2025.<sup>25</sup>

In order to achieve these objectives, the paper's specific proposals for the GGND include the following:

- High-income OECD economies should spend at least 1 percent of their GDP over the next 2 years on national actions for reducing carbon dependency

- Other high- and middle-income economies of the Group of 20 should aim 'as far as possible' to do likewise
- Developing countries should also implement over the next 2 years the national actions proposed for reducing carbon dependency.
- Developing economies should spend at least 1 percent of their GDP on national actions proposed for improving clean water and sanitation for the poor, and 'should also develop urgently comprehensive well-targeted safety net programs and maintain if not expand, educational and health services for the poor.'<sup>26</sup>

Unfortunately, the GGND does not provide any specific inputs/recommendations as to how exactly developing economies, in particular the least developed countries (LDCs), are to finance and implement the aforementioned national actions, especially when these countries are, according to the GGND paper, 'likely to see an increase' in numbers of poor people as a consequence of the current global economic recession.

While referencing the need to reduce carbon dependency, the GGND paper does not provide any specific analytical or programmatic linkages between responding to climate change and reducing poverty, even though it focuses on the link between reducing ecological scarcity and improving the livelihoods of the poor. In a section entitled, 'Reducing Ecological Scarcity and Poverty', the paper states

Most developing economies and the majority of their populations depend directly on exploiting natural resources. For the foreseeable future, primary product exports will remain the main source of

<sup>25</sup> Edward Barbier, *A Global Green New Deal: Executive Summary*, UNEP: February 2009: page 6. The full report is available at <http://www.unep.org/greeneconomy>

<sup>26</sup> Op.cit, page 15.



export earnings and savings that will facilitate the foreign direct investment, domestic private and public investment and international borrowing necessary for financing economic development.<sup>27</sup>

Setting aside the issue of grouping a wide array of developing countries with differing economic pathways and contexts, arguably, the reference above necessitates at least a mention of climatic impacts on natural resources, but there is no mention here of adverse impacts of climate change on land and marine resources that developing countries on the whole are seen to depend so heavily on.

**Where and how are poor and vulnerable communities and countries going to find resources (financial, human, and infrastructure) to implement the GGND?**

**What, if any, are the delivery and implementation modalities of GGND, that will allow new and innovative energy technologies and systems to make ‘the biggest impact’ in terms of exacerbating both poverty and climate change?**

A recent 2009 publication of International Energy Agency (IEA) is explicit about the linkages between climate change, energy, and sustainable development:

The link between climate change and energy is part of the larger challenge of sustainable development. The socio-economic and technological characteristics of development paths will strongly affect emissions, the rate and magnitude of climate change, climate change impacts,

the capability to adapt and the capacity to mitigate the emissions themselves.<sup>28</sup>

From a developing-country perspective, several key points referenced directly from the IEA 2009 report are worth highlighting:

- CO<sub>2</sub> from energy accounts for about 80 percent of anthropogenic greenhouse gas emissions from Annex I countries, and about 60 percent of global emissions.
- Asian CO<sub>2</sub> emissions will soon rival those of Annex II Parties to the UNFCCC. Between 1990 and 2007, CO<sub>2</sub> emission rose by 108 percent for non-Annex I countries as a whole and more than doubled for Asia.
- In 2007, five so-called BRICS countries (Brazil, the Russian Federation, India, China and South Africa) represented 30 percent of global energy use and 33 percent of CO<sub>2</sub> emissions from fuel combustion, and these shares are likely to rise further in coming years based on individual countries’ economic performances.<sup>29</sup>

But, the same report contains only one reference to the linkage between poverty reduction and energy which follows directly after a reference that power generation and transport related emissions from developing countries have been ‘particularly pronounced for developing countries’. The sole reference states that, ‘Access to modern energy services is crucial to eradicating poverty and for economic development of these countries and the challenge will be to help developing countries use energy in a rational way.’<sup>30</sup>

Highlighting the impacts of climate change on Africa, a report by a regional workshop on adaptation in Africa (mandated by the COP Decision 1/CP.10, paragraph 8) states that:

<sup>27</sup> Op. cit., page 10.

<sup>28</sup> IEA, CO<sub>2</sub> Emissions from Fuel Consumption: 2009 Highlights. OECD/IEA: Paris, 2009; page 9 Available at <http://www.iea.org/co2highlights/CO2highlights.pdf>

<sup>29</sup> Op cit. 2009, pages 10 and 16.

<sup>30</sup> Op cit. 2009. Page 16.

The continent is already under pressure from climate stresses which will be exacerbated by future climate change. ...Furthermore, climate change in the region is anticipated to have far-reaching adverse effects on Africa's efforts to foster sustainable development and attain the United Nations Millennium Development Goals (MDGs). Climate change may jeopardize in particular the achievement of goal 1 (eradicate extreme poverty and hunger), goal 6 (combat HIV/AIDS, malaria and other diseases) and goal 7 (ensure environmental sustainability).

However, the report of the workshop includes only two references to poverty reduction—one in connection to mainstreaming adaptation with national poverty reduction strategies, and the other stating that poverty reduction efforts needed to be coordinated with efforts at combating land degradation and reducing loss of biological diversity and ecosystem services as well as enhancing adaptive capacity.<sup>31</sup>

### **Ad Hoc Working Groups**

It is important to note that global negotiations on longer-term action to address climate change are currently occurring under the aegis of the *Ad Hoc Working Group on Long term Cooperative Action under the Convention (AWG-LCA)* and the *Ad Hoc Working Group on Further Commitments for Annex I Parties under the Protocol (AWG-KP)*. The COP, by its Decision 1/CP.11, resolved to engage in a dialogue,

...without prejudice to any future negotiations, commitments, process, framework or mandate under the Convention, to exchange experiences and analyse strategic approaches for long-term cooperative action to address climate change that includes, inter alia, the following areas:

- (a) Advancing development goals in a sustainable way;
- (b) Addressing action on adaptation;
- (c) Realizing the full potential of technology;
- (d) Realizing the full potential of market-based opportunities.<sup>32</sup>

The two AWGs are scheduled to conclude their work by the fifteenth session of the Conference of the Parties (COP 15) to be held in Copenhagen, Denmark, in December 2009. The AWG-KP is currently undertaking discussion on future commitments for Annex I Parties to the Kyoto Protocol and as such it covers future commitments of industrialised and developed countries. The AWG-LCA is expected to focus its work on a negotiating text which has implications for the future involvement of developing country Parties.

A search of the AWG-KP documentation and reports leading up to the current and penultimate session that has just started in Bangkok (28 September–9 October 2009) not surprisingly reveals no references to the phrase 'poverty reduction' but also reveals no references to the phrases 'energy technologies' or 'sustainable energy'.<sup>33</sup> This may not

<sup>31</sup> UNFCCC, *Report on the African regional workshop on adaptation*, FCCC/SBI/2007/2. 2007: Pages 6 and 13. Available at <http://unfccc.int/resource/docs/2007/sbi/eng/02.pdf>

<sup>32</sup> UNFCCC, *Provisional agenda and annotations*, FCCC/CP/2007/1; 7 Sept 2007. Available on the internet at <http://unfccc.int/resource/docs/2007/cop13/eng/01.pdf>

be that surprising since the AWG-KP is seen as a body dealing with future commitments related to developed or Annex I countries.

It is the voluminous AWG-LCA revised negotiating text which encompasses the key aspects of the Bali Action Plan—namely a shared vision for long-term cooperative action, mitigation, adaptation, finance, and technology—with that have significant implications for future action by developing countries. A search of the current revised negotiating text of the AWG-LCA reveals only **seven** references to the phrase ‘poverty reduction’, with several of the references included as bracketed text, and one reference with the phrase itself bracketed. Additionally, a search of the same 199-page negotiating text reveals no references to the phrases ‘energy technologies’ or ‘sustainable energy’.<sup>34</sup>

A search of the newly revised (reordered and consolidated) 181-page negotiating text under consideration by the penultimate session of the AWG-LCA (Bangkok, October 2009), for the phrase ‘poverty reduction’ now includes only **six** references, while there remain no references to the phrases ‘energy technologies’ and ‘sustainable energy’.<sup>35</sup> It should be also be noted that two Addendums (87 pages and 17 pages in length) to

the Reordered and Consolidated Negotiating Text document have also been prepared. These Addendums are intended respectively to serve as a guide to those elements, indicating the sources of the revised text and providing information on the approach to the reordering and consolidation, and as additional information background material prepared by facilitators. A search of these documents reveals that neither Addendum contains any references to the three phrases listed above.<sup>36</sup>

### **Transfer, Diffusion, and Development of Technologies**

With regard to the transfer, diffusion, and development of technologies, Article 4.5 of the UNFCCC, calls on developed country Parties and other developed Parties included in Annex II to promote, facilitate, and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing countries, to enable them to implement the provisions of the Convention. This commitment is echoed in the provisions of Article 10c of the Kyoto Protocol. A number of decisions have taken to promote the development and transfer of environmentally

<sup>33</sup> UNFCCC, Documentation to facilitate negotiations among Parties prepared within the context of the AWG-KP include, FCCC/KP/AWG/2009/10/Rev.1, 28 August 2009. Available at <http://unfccc.int/resource/docs/2009/awg9/eng/10r01.pdf> FCCC/KP/AWG/2009/10/Add.1/Rev.1, 28 August 2009. Available at <http://unfccc.int/resource/docs/2009/awg9/eng/10r01.pdf> FCCC/KP/AWG/2009/10/Add.2, 1 July 2009. Available at <http://unfccc.int/resource/docs/2009/awg9/eng/10a02.pdf> FCCC/KP/AWG/2009/10/Add.3/Rev.1, 28 August 2009. Available at <http://unfccc.int/resource/docs/2009/awg9/eng/10a03r01.pdf>

<sup>34</sup> UNFCCC, Enabling the full, effective and sustained implementation of the Convention through long-term cooperative action now, up to and beyond 2012: Revised Negotiating Text, FCCC/AWGLCA/2009/INF.1 22 June 2009. Available at <http://unfccc.int/resource/docs/2009/awglca6/eng/inf01.pdf> The seven references to the phrase ‘poverty reduction’ contained in the entire 199 page document are found on pages 9, 25, 36, 41, 44, 48, and 56.

<sup>35</sup> UNFCCC, Reordering and consolidation of text in the revised negotiating text, FCCC/AWGLCA/2009/INF.2. 17 September 2009. This revised document contains reordered and/or consolidated sections of the revised negotiating text (FCCC/AWGLCA/2009/INF.1) prepared by facilitators during and after the informal meeting of the AWG-LCA held in Bonn, Germany, on 10–14 August 2009. It is available at <http://unfccc.int/resource/docs/2009/awglca7/eng/inf02.pdf>

<sup>36</sup> UNFCCC, Reordering and consolidation of text in the revised negotiating text: Addendum , FCCC/AWGLCA/2009/INF.2/Add.1, 17 September 2009 and FCCC/AWGLCA/2009/INF.2/Add.2 22 September 2009. Available at <http://unfccc.int/resource/docs/2009/awglca7/eng/inf02a01.pdf> and <http://unfccc.int/resource/docs/2009/awglca7/eng/inf02a02.pdf>

sound technologies by various COPs, but the key question is whether these decisions have resulted in practical action that can result in transfer, diffusion, and development of energy technologies that directly focus on shared poverty reduction and climate change policy agendas at the relevant local, national, and regional levels.

**In other words, in the lead-up to Copenhagen and beyond, what are the specific mechanisms, modalities, and actions related to the transfer, diffusion, and development of technologies that can enable the global community to meet the dual and intersecting objectives of addressing climate change and reducing poverty?**

A review of the global climate change negotiations related to the transfer, diffusion, and development of technologies indicates that, as a result of the Marrakesh Accords at COP 7, Parties were able to reach an agreement to work together on a set of technology transfer activities, grouped under a framework for meaningful and effective actions to enhance the implementation of Article 4.5 of the Convention. This framework, contained in the annex to Decision 4/CP.7 has five main themes:

- Technology needs and needs assessments
- Technology information
- Enabling environments
- Capacity building
- Mechanisms for technology transfer

At COP-13, Parties adopted a set of actions for enhancing the implementation of the technology transfer framework and agreed that these activities would complement the actions in the technology transfer framework. Funding to implement the framework complemented by the set of actions is to be provided through the GEF.

A key feature of the global climate change negotiations leading up to Copenhagen has been the sheer volume of documents, particularly related to the AWG-LCA in the form of revised negotiating texts, non-papers, and guidelines. Within the context of the intergovernmental climate change negotiations, it is very clear that there are no shortages of proposals and suggestions for mechanisms, frameworks, committees, and action plans related to technology transfer and development.

It is important to note that all these options are under negotiations in the lead-up to Copenhagen and the vast array of ‘proposed new institutional arrangements’ in the form of committees, funds, frameworks, and mechanisms have been put forward within the context of the existing intergovernmental negotiations. A comprehensive list of these proposed new institutional arrangements is contained in a recent non-paper prepared by the AWG-LCA Chair.<sup>37</sup> From the perspective of the current study, the question that is raised is whether this plethora of proposals for new mechanisms, frameworks, committees, and action plans will result in sustained and focused efforts at the transfer, diffusion, and development of technologies related to sustainable energy for the poor.

Within the context of the AWG-LCA discussions in the lead-up to Copenhagen, it is useful to reference a brief summary of potential and proposed mechanisms and bodies related to transfer of technologies, as excerpted from a non-paper (Non-Paper # 29) prepared by the Co-Chairs of the Contact Group on Enhanced Action on Development and Transfer of Technology for the AWG-LCA deliberations. The non-paper does not contain any references to the phrases ‘poverty reduction’, ‘sustainable energy’, or ‘energy access’, but does contain four references to the phrase ‘renewable energy’. In order to

<sup>37</sup> AWG/LCA, *Further updated list of proposed new institutional arrangements : Non Paper by Chair*, September 10, 2009. Available at [http://unfccc.int/files/kyoto\\_protocol/application/pdf/instarrangfurtherupdated091009.pdf](http://unfccc.int/files/kyoto_protocol/application/pdf/instarrangfurtherupdated091009.pdf)



support and further the objective of enhancing action on the development and transfer of technology, four different options, each with its

own set of relevant funds, actions, panels, committees, windows, and other modalities, have been proposed and are referenced below<sup>38</sup>

**Option 1: A technology mechanism** comprising:

- (a) An Executive Body on Technology comprised of and supported by a strategic planning committee, technical panels, a verification group and a secretariat, with a technology action plan as a starting point of its work to enable implementation of enhanced action on technology development and transfer;
- (b) A Multilateral Climate Change Fund operating under the COP to support a list of activities and cost eligible for support agreed by the COP.

**Option 2: An enhanced framework for technology** to strengthen the implementation of technology-related commitments under the Convention and elaborated in the Bali Action Plan, and the implementation of national mitigation programmes and national planning related to adaptation consisting of:

- (a) Key actions including low-emission development strategies, enabling environments, capacity-building, voluntary agreements and partnerships, technology information;
- (b) A set of short-, medium- and long-term national and international cooperative actions shall be developed to support global research, development, diffusion and transfer of technologies for adaptation and mitigation.
- (c) Institutional arrangements to help guide, support, verify and monitor the activities and commitments related to technology within the Convention;
- (d) Scaled-up public finance to support developing country Parties, efforts on the key actions mentioned above and to leverage private-sector investment.

**Option 3: A technology action framework** to promote low-emission growth, particularly in developing countries, and enhance the resilience of communities, particularly in least developed countries, through support for concrete actions on development and wide diffusion of mitigation and adaptation technologies, including:

- (a) Actions on development and transfer of both new and existing technologies for mitigation and adaptation;
- (b) A Technology Executive Committee and Technology Panel to advise the COP on technology-related issues;
- (c) A technology window established in the new financial mechanism under the guidance of the COP, to support implementation of concrete and practical technology activities.

**Option 4: A financial and technology mechanism** to ensure full, effective and sustained implementation of the Convention and which is comprised of an adaptation and mitigation pillar. Each pillar contains an executive body accountable to the COP and supported by technical panels to perform the functions including organizing, coordinating, monitoring and evaluating the implementation of the comprehensive framework for mitigation and adaptation and governing and disbursing funds to support action on mitigation and adaptation.

<sup>38</sup> AWG/LCA, *Contact Group on Enhanced Action on Development and Transfer of Technology: Non Paper by Co-Chairs*, Non-Paper No. 29. September 10, 2009. Available at [http://unfccc.int/files/kyoto\\_protocol/application/pdf/technology29091009v03.pdf](http://unfccc.int/files/kyoto_protocol/application/pdf/technology29091009v03.pdf)

The non-paper also specifically references that developing country Parties 'shall be provided with the necessary financial and capacity building support to conduct national technology action plans'. Capacity building, which is globally recognised as critical for technology transfer and development, is also specifically referenced in that

Capacity-building activities should be implemented to contribute to the establishment and strengthening of enabling environments and accelerated technology development, deployment and diffusion in developing countries.

And that,

A programme for capacity-building for accelerated technology development, deployment and diffusion in developing countries shall be developed....

From the immediate perspective of the study, the proposals contained in the non-paper that relate to 'cooperative actions on and support for research and development' for technology are critical and are excerpted below. (It should be noted that the table contains bracketed text signifying that the text is the subject of ongoing negotiations in the lead-up to Copenhagen, and as such is not agreed text.)

### **Cooperative Actions on and Support for Research and Development<sup>39</sup>**

[Developed country Parties [and other developed country Parties included in Annex II to the Convention]], in accordance with national capabilities, [shall][should] provide appropriate support to developing country Parties through, inter alia:

- (a) Enhancing cooperation between developing country Parties, such as South-South cooperation, and between developed and developing country Parties, including North-South and triangular cooperation, including city to city twinning arrangements, with the following aims:
  - (i) Promoting the development of technologies, including adaptive research and development, endogenous technologies and technologies for adaptation;
  - (ii) Prioritizing technologies for mitigation and adaptation that might have high costs but also high potential for greenhouse gas mitigation and/or increasing resilience to the adverse impacts of climate change;
  - (iii) Bringing down costs and increasing the potential for greenhouse gas mitigation and/or resilience to the negative adverse impacts of climate change.
- (b) Providing opportunities for participation by [developing country Parties] [all Parties] in joint research and development programmes including through technology innovation centres, as appropriate, for specific technologies and joint ventures to accelerate deployment, diffusion and effective transfer of technologies [from developed country Parties and other developed country Parties included in Annex II to the Convention to developing country Parties] [from developed to developing country Parties], particularly technologies for adaptation [for SIDS,] [small island developing countries, least developed countries and Africa] [for low lying and other small island countries, countries with low-lying coastal, arid and semi-arid areas or areas liable to floods, drought and desertification, and developing countries with fragile mountainous ecosystems are particularly vulnerable to the adverse effects of climate change,] [consistent with the Decision 1/CP.13 and the Convention], in the absence of win-win solutions and market intervention.

Analytical work related to equity and climate change posits equity considerations as somehow distinct from the real-world policy and policy challenges of addressing poverty concerns.<sup>40</sup> Although the concept of equity is at the heart of a proposal entitled, 'South-North Dialogue on Equity in the Greenhouse: A proposal for an adequate and equitable global climate agreement', the reality is that the phrase 'poverty reduction' is not referenced once in the report, although the term 'poverty' surfaces in five references throughout the report, including two references which are footnotes themselves referencing UNCTAD and UNDP reports. An excerpt of the report, given below contains two of the five references to 'poverty':

The required global resolve will only materialize, however, if an equitable framework is offered that acknowledges the disparity among nations in historic and continuing emissions. It would also recognize that the world's majority lives in poverty, and relief from poverty entails an increase in energy services and an unavoidable near-term rise in carbon emissions. This is another challenge for the North – to foster low-carbon technology in the Southern hemisphere in order to leapfrog the fossil fuel intensive stage of economic development.<sup>41</sup>

Disregarding, for a moment, the challenges of groupings such as North and South, the key question is: How can low-carbon technologies be promoted and implemented in developing countries, if lack of access to sustainable energy by poor communities and countries is not seen as an integral part of the global climate change dialogue? How can developing countries 'leapfrog' out of intensive fossil fuel into sustainable energy sources, if poverty reduction, national development needs and climate change objectives are not clearly integrated at all levels?

More recently, however the linkage between responding to climate change and poverty reduction was explicitly mentioned in the recent 'Declaration of the Leaders' of the Major Economies Forum on Energy and Climate (July 9, 2009) which clearly states that:

Climate change is one of the greatest challenges of our time.... The peaking of global and national emissions should take place as soon as possible, recognizing that the timeframe for peaking will be longer in developing countries, bearing in mind that social and economic development and poverty eradication are the first and overriding priorities in developing countries and that low-carbon development is indispensable to sustainable development.<sup>42</sup>

<sup>40</sup> See also C. Okereke and H. Schroeder, 'How can justice, development and climate change mitigation be reconciled for developing countries in a post-Kyoto settlement?' *Climate and Development*, Vol. 1: 2009, pages 10-15.

<sup>41</sup> GTZ et al, 'South-North Dialogue on Equity in the Greenhouse: A proposal for an adequate and equitable global climate agreement', May 2004, page 16. Available at <http://www.erc.uct.ac.za/Research/publications/04Ott-et-al-SouthNorthDiaLogue.pdf>

<sup>42</sup> The White House: Office of the Press Secretary, 'Declaration of the Leaders: Major Economies Forum on Energy and Climate Change', July 9, 2009. Available at [http://www.whitehouse.gov/the\\_press\\_office/Declaration-of-the-Leaders-the-Major-Economies-Forum-on-Energy-and-Climate/](http://www.whitehouse.gov/the_press_office/Declaration-of-the-Leaders-the-Major-Economies-Forum-on-Energy-and-Climate/)

President Barack Obama announced the launch of the Major Economies Forum (MEF) on Energy and Climate on March 28, 2009. The Forum is intended to facilitate a candid dialogue among major developed and developing economies, help generate the political leadership necessary to achieve a successful outcome at the December UN climate change conference in Copenhagen, and advance the exploration of concrete initiatives and joint ventures that increase the supply of clean energy while cutting greenhouse gas emissions. The 17 countries participating in the MEF are: Australia, Brazil, Canada, China, the European Union, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, Russia, South Africa, the United Kingdom, and the United States. Denmark, in its capacity as the President of the December 2009 Conference of the Parties to the UN Framework Convention on Climate Change, and the United Nations have also been invited to participate in this dialogue.

The Declaration of the MEF goes on to call for the ‘establishment of a Global Partnership to drive transformational low-carbon, climate-friendly technologies’ and increased, coordinated public-sector investments in the research, development, and demonstration of these technologies, with ‘a view to doubling such investments by 2015, while recognizing the importance of private investment, public-private partnerships and international cooperation, including regional innovation centers’.<sup>43</sup>

**This idea of a development paradigm shift that can be jumpstarted by the research, development, and implementation of innovative, low-cost, low-carbon, climate-friendly energy technologies that enable poverty reduction and sponsor development is critical.**

### 3 Bridging the Divide between Climate Change and Poverty Reduction through Sustainable Energy Innovations: Moving from Isolation to Integration

*It's not the technology, it's the mindset. The 21st century is now stockpiling great technologies but it's going to take, I'm afraid, a long time before people at the top...understand that we got to change the way we do things to get to 4 billion people.... We're sitting here swatting at flies when we are going to get trampled by the elephants. Why don't we use our technology to make the biggest impact?'*

—Dean Kamen, Inventor

The gravity of the poverty-climate change nexus, and the surprising absence of coordinated global efforts that directly link poverty reduction actions with access to sustainable energy technologies and innovations do bring to mind Kamen's analogy of 'swatting of flies' in the face of 'being trampled by elephants'. What is important is that synergistic action between global climate change and poverty reduction is urgently needed. Such action clearly presents unprecedented challenges and opportunities for all development stakeholders as they strive to 'do development differently'. Embracing this new development paradigm necessitates that climate change considerations are fully integrated with national plans to achieve the MDGs, and that national climate change adaptation and mitigation strategies/projects are directly linked with poverty reduction and sustainable development goals. It also necessitates that investment and development decisions have a consistent climate change focus built in every step, from project idea to design, implementation and monitoring.

It is not that renewable energy has not been adequately focused on within the context of

global negotiations, or that renewable energy resources should somehow be exclusively focused toward addressing poverty reduction. What is relevant is that the broader issue of increasing access to energy services has not been highlighted adequately within the context of climate change and poverty reduction. So, for instance, global conferences such as Renewable 2004 have sought to focus attention on the need for modern renewable energy technologies that can expand the energy choices available to millions living without access to electricity. While the energy-poverty policy and programmatic nexus has harnessed a considerable amount of focus from bilateral, non-governmental, and UN agencies, what is largely missing from the equation is the factoring in of climate change considerations from the perspective of poor and vulnerable communities and countries.

A salient global finding of a UNDP review, *Energizing Poverty Reduction: a Review of the Energy-Poverty Nexus in Poverty Reduction Strategy Papers*, pertaining to linkages between energy and environmental sustainability in PRSPs is that:

Energy related environmental issues are strongly cited in 67 percent of PRSPs... However, fewer reports directly mention the energy-climate change nexus. While 60 percent of reports from Latin America and Eastern Europe and the CIS region discuss the topic, it is much less frequently mentioned in the PRSPs of African and Asian countries.<sup>44</sup>

With regard to linkages between the energy service needs of the poor and the PRSPs, the UNDP review states that, the 'extent to which energy needs of the poor are prioritized in the PRSPs is more implicit than explicit'. Based on tabular evidence, the review notes that energy strategies detailed in the PRSPs are 'skewed heavily in favor of electricity provision, not heating and cooking fuels' and that 'little emphasis is placed on mechanical power for productive applications and traditional biomass management'.<sup>45</sup>

A study funded by the Poverty Environment Partnership examined the integration of environment into the PRSPs of four countries—Ghana, Honduras, Uganda, and Viet Nam. It argues that, where environmental concerns have been integrated into PRSPs, the emphasis has been on technical solutions, and political aspects of environmental management have been ignored. The resulting solutions, while they often meet the basic criteria of 'environmental' sustainability, do not contribute to poverty alleviation, livelihood development, and the resolution of ingrained power inequalities that will inevitably augment poverty and environmental degradation in the long term.

The development community has a unique opportunity to integrate climate change and development concerns/goals by focusing on specific mechanisms and modalities that can facilitate

**If PRSPs—by definition, the principal national poverty reduction policy strategies—do not show an explicit focus on prioritising the energy needs of the poor, then how exactly can the real energy-related development needs of the poor be met?**

access to low-cost, sustainable, community-driven energy services and systems for poor and vulnerable communities and countries. For the vast majority of developing countries, it is precisely the policy nexus between increasing access to energy services, improving energy efficiency, and the achievement of sustainable development objectives where climate change action is most relevant and meaningful. The integration of environmental considerations, such as adverse impacts of climate change, into 'second generation' poverty reduction strategies or national development strategies is essential both for addressing poverty reduction and improving access to sustainable energy.

Enabling countries and communities that are particularly vulnerable to the adverse effects of climate change to respond more effectively to climate change impacts is a necessity for human development. Ignoring this reality will seriously undermine national efforts to reach the MDGs by 2015. Toward this end, it is imperative that any post-2012 climate consensus focus on concrete and practical actions that can directly improve the well-being of millions of poor and vulnerable people that live in areas estimated to be the most adversely impacted by global climate change.

Key issues related to meeting the dual challenges of responding to global climate change and promoting increased access to sustainable energy services for poor and vulnerable communities and countries include *inter alia*:

<sup>44</sup> UNDP, *Energizing Poverty Reduction: A Review of the Energy-Poverty Nexus in Poverty Reduction Strategy Papers*, UNDP: New York, March 2007, p. 10.

<sup>45</sup> Op. cit., p. 10.



- ***Embracing a new development paradigm—a pro-poor global climate change agenda—at the requisite global and national levels.*** This will require that climate change considerations are fully integrated with national plans to achieve the MDGs; and that national climate change adaptation and mitigation strategies and projects are directly linked with poverty reduction and sustainable development goals. It also necessitates that investment and development decisions have a consistent climate change focus built in every step, from project idea to design, implementation, and monitoring. The focus should be on the development of a pro-poor global climate change policy agenda, to ensure that access to sustainable, low-cost, innovative, efficient energy services is fully integrated with climate change response strategies, including the impacts of climate change on poverty reduction strategies. For example, it is critically important that PRSPs focus on both centralised and decentralised energy production and supply, and that poverty reduction strategies have clear, consistent linkages between national climate change and poverty reduction objectives.
- ***Increasing and targeting development assistance and public-private partnerships.*** This would enable financing and implementation for sustainable energy options and services that are directly linked to the identifiable needs of poor and vulnerable communities. This entails a clear focus on the role of microfinance and innovative service delivery mechanisms for increasing access to sustainable energy. It also entails making sure that existing and anticipated financing

mechanisms related to climate change concerns—such as bilateral and multilateral funding sources, including the GEF, the CDM, and the Adaptation Fund—have an explicit focus on making sustainable, decentralised energy options accessible and affordable to the poor. Given that the upfront cost of new energy technologies are prohibitively expensive for poor and vulnerable communities, targeted financing and incentives offer low-income communities, households, and entrepreneurs the ability to invest in new energy technologies. Expanding the role of civil society and private-sector actors in developing countries, through effective national compacts that include all partners, could be useful. Enhancing the role of public-private partnerships related to energy access that were heralded in the context of the World Summit on Sustainable Development could be invigorated to include explicit linkage between climate change responses and sustainable energy technologies that combat poverty.

- ***Building capacities (institutional, financial, and programmatic) at the local and national levels.*** This is crucial for integrating local and national pro-poor energy needs with local and national climate change responses. Accordingly, any existing or future global climate change framework agreement and its attendant financing and implementation mechanisms and agencies needs to support the development of vibrant, effective partnerships and programmes that build capacities to implement climate-neutral, pro-poor energy services and systems at all implementation/service delivery levels.

## 4 Powering Up Unserved Communities: Overview of Select Innovations that Can/Are Transforming the Lives of the Poor

Addressing the trio of issues—poverty reduction, climate change, and increasing access to sustainable energy—is not just about introducing technological innovations. Capacity and financing constraints need to be addressed and overcome. It is critical to recognise that demands for increased energy access in poor households and communities can be better served through innovations in a wide variety of areas, including information technologies, wireless networks, microfinance, capacity development, and resource networks.

### Barefoot College

The role of new innovations in digital communication and information sharing as well as new services for finance (microfinance), health, and education have the potential to transform the lives of rural and urban poor. Innovative approaches to educating poor communities include the Barefoot College, which trains poor, rural, jobless, and unemployable youth to be ‘barefoot’ doctors, teachers, engineers, architects, designers, metal workers, IT specialists, and communicators. The innovation lies in the simple, informal method of confidence building and a hands-on approach.

To date, barefoot technologists have solar-electrified several thousand houses in eight Indian states and installed hand pumps in the Himalayas, a task which urban engineers had declared technically impossible. Barefoot water engineers

have planned and implemented piped drinking water in their communities. Barefoot educators have been trained as pre-primary and night-school teachers, instructing some 3,000 boys and girls who attend the 150 Barefoot-run night schools. The Barefoot campus itself is a testament to the quality of its training programmes as Barefoot-educated architects and masons constructed the 30,000-square-foot facility out of low-cost materials. It is the only fully solar-electrified college in India.<sup>46</sup>

### E-Choupals

Wireless communication for use in mobile telephones has spread throughout the developing world and offers exciting, new avenues for information sharing in a range of areas relevant to the needs of poor communities. In an article, ‘Digital Development: Innovations Push Rural Electrification’, Nancy Wimmer notes:

Greater things lie ahead because innovation is about much more than technology and products. It is about applications, business models and entirely new markets - far different from those in the industrialized urban world. The combined force of these innovations can speed-up rural ‘evolution’ and help meet the untapped energy needs of two billion rural customers.<sup>47</sup>

<sup>46</sup> Information excerpted from the Schwab Social Entrepreneurs Profile of Roy Sanjit (Bunker), founder of the Barefoot College at <http://schwabfound.weforum.org/sf/SocialEntrepreneurs/Profiles/index.htm?sname=129161&organization=0&area=0&sector=0&stype=0>

<sup>47</sup> Nancy Wimmer, ‘Digital Development: Innovations Push Rural Electrification’, 2007. Available at <http://www.renewableenergyworld.com/rea/news/article/2007/01/digital-development-innovations-push-rural-electrification-51563>



In writing about how information technology is taking root in rural areas and enabling entirely new applications, which will grow as they meet the needs of rural customers, Wimmer highlights the 'e-Choupal' phenomenon in India, where millions of farmers gather not at their village meeting place (a Choupal in Hindi), but at places where a PC is linked to the Internet. Wimmer points out that, for instance, small-scale soya farmers can visit their village e-Choupal, check the website of the Chicago Board of Trade and local markets on prices for their crop, weather forecasts, and tips on increasing their yields—all in the local language. If they so choose, they can sell their crops online and even buy seeds and fertiliser. In only 6 years, 6,000 e-Choupals have been installed, covering 36,000 villages and serving 3.5 million farmers.<sup>48</sup>

**A brief review of key innovations in the areas of information and communication technology and microfinance is useful, because these innovations offer promise for improving the lives of poor households and communities in diverse parts of the world. These innovations, when combined with new ideas and applications in sustainable energy services, need to be promoted and highlighted.**

Several exciting innovations and changes in the areas of information and communication technology have had dramatic impacts on the lives of many poor communities and households worldwide. Despite limitations in Internet and electricity access,

most developing countries have some degree of mobile phone coverage. According to the U.N. Foundation, about 80 percent of the world's population lives in a region with mobile phone coverage and about 64 percent of all mobile phone users live in the developing world. Innovative mobile technologies, including open source technologies and potential adaptations of mobile phones, could help to fundamentally transform health care in many developing countries.<sup>49</sup>

In July 2009, the Rockefeller Foundation announced a \$100 million initiative to strengthen health systems in Africa and Asia by building capacity, supporting policy interventions, and promoting health IT applications. As part of its health IT strategy, the foundation intends to leverage mobile phone-based technologies to improve health care access, quality, and efficiency.

Officially established as an electronic data collection standard by the World Health Organization, EpiSurveyor, created by Dr. J Selanikio, is now the most widely adopted open-source mobile health software in the world. EpiSurveyor, a free, open-source software program that enables public health workers to easily create handheld data entry forms, collect data on mobile devices, and transfer the information back to a desktop or laptop for analysis.<sup>50</sup>

Scientists at the University of California have noted that light microscopy provides a simple, cost-effective method for the diagnosis and screening of haematologic and infectious diseases; however, in many regions of the world, the required equipment is unavailable or insufficiently portable. These same regions are often well served by mobile phone

<sup>48</sup> Op. cit. 2007. E-choupals were launched in 2000 by the Indian agricultural trading company, ITC Limited (ITC), as an e-commerce platform to capture more of the soybean crop and to lower transaction costs. E-choupals were an immediate success, because they solved a mutual problem. Previously, farmers sold to village traders, settling for whatever price was offered. ITC then had to buy from the traders, with little quality control and high transaction costs. E-Choupals allow ITC to buy directly from farmers, and let farmers check prices to decide whether they want to sell—all of which increases farmer incomes, reduces transaction costs, and excludes the proverbial middle man.

<sup>49</sup> Paula Fortner, 'Mobile Phones Drive Health IT Innovation in Developing Countries', Aug 10, 2009.

<http://www.ihealthbeat.org/Features/2009/Mobile-Phones-Driving-Health-IT-Innovation-in-Developing-Countries.aspx>

<sup>50</sup> Open source mobile technology software reinventing health care in developing countries, April 28, 2009. Available at <http://www.physorg.com/news160128864.html>

networks, suggesting the possibility of leveraging portable, camera-enabled mobile phones for diagnostic imaging and telemedicine. To this end, scientists have built a mobile phone-mounted light microscope and demonstrated its potential as a low-cost medical microscope for the developing world, with built-in image analysis. The report highlighting the findings states:

We expect such a telemedicine system for global healthcare via mobile phone – offering inexpensive bright field and fluorescence microscopy integrated with automated image analysis – to provide an important tool for disease diagnosis and screening, particularly in the developing world and rural areas where laboratory facilities are scarce but mobile phone infrastructure is extensive.<sup>51</sup>

The system uses a standard, low-cost microscope eyepiece and objective lenses in conjunction with the phone's camera. In all cases, resolution exceeded that necessary to detect blood cell and microorganism morphology. Prototypes have allowed the diagnosis of malaria, sickle cell disease, and tuberculosis.<sup>52</sup>

### **One Laptop Per Child**

The groundbreaking One Laptop Per Child (OLPC) initiative, spearheaded by Nicholas Negroponte of the Massachusetts Institute of Technology (MIT) Media Lab, is another innovative example of using modern, low-cost communication technologies to benefit unserved communities. The vision of the OLPC is to 'create

educational opportunities for the world's poorest children by providing each child with a rugged, low-cost, low-power, connected laptop with content and software designed for collaborative, joyful, self-empowered learning'.<sup>53</sup>

The idea is that millions of children in poor countries will receive inexpensive laptop computers in the next several years. This US\$100 laptop is designed specifically for young students living in harsh environments and features advanced technologies, such as wireless communication, sunlight readability, open-source software, and a user interface adapted to local languages. The question is whether the low-cost laptops are just a trend, or the beginning of a true technological revolution in developing nations.<sup>54</sup>

Since 2007, OLPC has produced 825,000 laptops, including 200,000 through a give-one, get-one program, with an additional 700,000 on order. They have shipped laptops to 24 countries all over the world, with the largest shipments going to Peru and Uruguay. Currently OLPC is working on a large rollout to Rwanda with a new learning centre in Kigali, Rwanda. Writing in *Wired*, C. Lawton notes that initially, the buzz was about the prospect of a \$100 laptop; however, the real point of the OLPC is the creation of:

an ecosystem whereby kids can learn through doing and sharing. They have organized a group of talented hardware and software developers and challenged them to invent something new. They have created a philanthropic organisations to achieve their goal of production and distribution. The

<sup>51</sup> David N. Breslauer, Robi N. Maamari, Neil A. Switz, Wilbur A. Lam, Daniel A. Fletcher, 'Mobile Phone Based Clinical Microscopy for Global Health Applications' July 22, 2009. Available at <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0006320>

<sup>52</sup> Steve Bush, 'Mobile phone becomes low-cost medical microscope', *Electronics Weekly*, July 23, 2009. Available at <http://www.electronicweekly.com/Articles/2009/07/28/46581/mobile-phone-becomes-low-cost-medical-microscope.htm>

<sup>53</sup> This and other additional information on the OLPC is available at the OLPC website at <http://www.laptop.org/en/vision/index.shtml>

<sup>54</sup> Jessica Ravitz, 'Laptops bring lessons, maybe even peace', *CNN*, March 5, 2009. Available at [http://www.cnn.com/2009/TECH/03/05/one.laptop.per.child/index.html?eref=rss\\_topstories](http://www.cnn.com/2009/TECH/03/05/one.laptop.per.child/index.html?eref=rss_topstories)

cost is only one part of the equation - a barrier that must be broken in order to make that ecosystem accessible. And it's that ecosystem - their vision - that deserves more credit than many of the tech blogs are willing to discuss.<sup>55</sup>

OLPC has had its fair share of funding problems and is feeling the impacts of the global recession. In January 2009, the company laid off half of its work force and shifted its goals. While listing the 'Generation 2.0' laptop as a priority, Negroponte also announced an 'exciting new direction' for OLPC, which includes 'a no-cost connectivity program, a million digital books, and passing on the development of the Sugar Operating System to the community.'<sup>56</sup>

**From the immediate perspective of this review, the question is: What will power computers in areas where few people have reliable access to energy? Car batteries, diesel, or solar- or biofuel- powered generators?**

## Microfinance

Microfinance is another major area where innovations have occurred that are central to the issue of increasing access to sustainable energy services. Microfinance—the extension of very small-scale loans, mainly to women and households with little or no access to more traditional finance—was pioneered and popularised in the developing world by Dr. Muhammad Yunus and the Grameen Bank. Founded in 1983, the Grameen Bank model has been replicated by lenders, NGOs, and advocacy groups in dozens of countries.

Microfinance has unshackled the livelihoods of poor communities, subverting more conventional banking concepts about the creditworthiness of poor borrowers by giving uncollateralised loans. It has been seen as responsible for creating and sustaining new income-generating activities amongst poor households and communities heavily dependent on subsistence-level farming and animal husbandry.

More important, the overwhelming majority of borrowers in the developing world have been women, who have previously been excluded from participating in economic enterprises. The advent of microfinance has afforded women an opportunity to run micro-enterprises. Over the last three decades, the popularity of microfinance has increased exponentially. Organisations such as ACCION International, FINCA, and Trickle Up finance millions of micro-entrepreneurs in dozens of countries.

R. Calkins identifies some of the best micro-finance innovations in 2008<sup>57</sup>:

- Direct corporate support for microfinance
- Microfinance tapped into social networking
- Spread of mobile banking through phones
- User-generated content on microfinance sites (Kiva just introduced an 'application development interface' or API at [build.kiva.org](http://build.kiva.org). An API is a place where independent software developers can build neat new gizmos that, hopefully, will enhance the user's experience on Kiva.org)
- Extension of Grameen model
- Lending in local currency

<sup>55</sup> Chuck Lawton, 'The XO Laptop Two Years Later: Part 1 - The Vision' *Wired*, June 19, 2009. Available at <http://www.wired.com/geekdad/2009/06/the-xo-laptop-two-years-later-part-1-the-vision/>

<sup>56</sup> Chuck Lawton, 'A Look Back at the OLPC XO-1 and a Peek at the Road Ahead' *Wired*: July 2, 2009. <http://www.wired.com/geekdad/2009/07/a-look-back-at-the-olpc-xo-1-and-a-peek-at-the-road-ahead/>

<sup>57</sup> Ryan Calkins, 'Best Microfinance Innovations in 2008'. Available online at <http://www.seattlemicrofinance.org/best-microfinance-innovations-in-2008/2009/02/08>

## 5 Tinkering ‘Out of the Box’ for a Brighter, Sustainable Future: Ideas Always Matter, but They Need Support

‘Energy poverty’—which, for the purpose of this study, may be defined as a lack of access to modern, cost-effective and sustainable energy services, systems, and technologies)—is widely recognised as a major impediment to human development in many areas of the world, with negative impacts on education, health, and gender. Above the cacophony of voices clamouring for action on climate change, poor communities across the globe continue to have very limited choices when it comes to sustainable, low-cost, and efficient energy services.

A joint World Bank/UNDP report (2005) notes that the largest concentrations of the ‘energy poor’ (that is, those people who are both poor and lack access to modern forms of energy) are currently in sub-Saharan Africa and South Asia. The report also finds that the direct use of solid biomass—including charcoal, fuel wood, stalks and other crop waste, and dung—is widespread in the poorest parts of the world. In other words, the lack of access to improved cooking fuels is most extreme in sub-Saharan Africa, followed by South Asia.

The report indicates that, ‘One measure of energy poverty at the level of the poorest is the inability to cook with modern cooking fuels and the lack of a bare minimum of electric lighting to read, or for other household and productive activities after sunset.’<sup>58</sup>

The health consequences of using biomass in an unsustainable way are staggering. According to the World Health Organization, exposure to

**An often repeated statistic is that about 1.6 billion people have no access to electricity, and more than two billion have to use inefficient and unhealthy forms of biomass.**

**What is not often recognised is that:**

- **About half a billion ‘energy poor’ will be added over the next two decades at current growth rates.**
- **To meet minimum future energy needs, over 100 million people per year would have to be connected, more than doubling the current rate.**

indoor air pollution is responsible for nearly two million premature deaths, primarily women and children, from cancer, respiratory infections, and lung diseases annually and for 4 percent of the global burden of disease. In relative terms, deaths related to biomass pollution kill more people than malaria (1.2 million) and tuberculosis (1.6 million) each year around the world.<sup>59</sup>

Despite advances in areas such as rural electrification, the number of people lacking access to energy services has remained relatively constant due to increases in population. The total number of people without electricity has fallen by fewer than 500 million since 1990. Without modern energy services, millions of women and children face debilitating illness or premature death; basic social goods like health care and education are more costly in both real and human terms; and economic development is harder to

<sup>58</sup> IBRD/World Bank and UNDP, *Energy Services for the Millennium Development Goals*. New York: 2005, page 9.

<sup>59</sup> Information available at <http://www.rice.edu/energy/research/poverty&energy/index.html>



perpetuate. The services that energy enables can create conditions for improved living standards, especially in areas of public health, education, and family life. Without the implementation of new innovations, by 2030, 1.4 billion people still will not have access to electricity under a business-as-usual scenario, while the number reliant upon biomass should increase from 2.5 billion in 2006 to 2.7 billion by 2030 (IEA 2006).

## Renewable Energy

Clearly, 'business as usual' and 'more of the same' will not suffice. There is an urgent need to identify innovative sustainable energy technologies and options that can enhance the policy nexus between poverty reduction and climate change in developing countries.<sup>60</sup> Key concerns and lessons learnt about renewable energy from a policy and programmatic level have been well documented, and range from the importance of micro-finance and enabling regulatory frameworks to financing and capacity constraints. For example, in an article prepared for the 2004 International Conference for Renewable Energies,<sup>61</sup> Jamal Saghir, Director of Energy and Water of the World Bank, identifies the main components of successful renewable energy programmes in developing countries:

- Demand side development
- Supply side development
- Policy, legal, and regulatory frameworks that are appropriate and enabling
- Appropriate institutional framework
- Incentive schemes

Renewable energy is the world's fastest growing energy technology and has a major role to play in reducing poverty while protecting the environment, according to the World Bank. In its report, *Improving Lives: World Bank Progress on Renewable Energy and Energy Efficiency in Fiscal Year 2006*, the bank said its annual commitments for renewable energy and energy efficiency projects totaled \$668 million—nearly double the 2005 level. Renewable energy can be used in on- and off-grid applications to produce electricity, with off-grid being a flexible and easy-to-use solution for electrification of rural and remote areas. The technologies used to power off-grid applications—such as solar home systems, wind turbines, biogas digesters, and gasifiers, along with micro-hydro power plants and hybrid systems, etc.—are often affordable, decentralised, and environmentally sound.

With adequate financial and political support, renewable energy technologies like wind and photovoltaics could supply 40 percent of the world's electricity by 2050, according to findings published by the International Scientific Congress Conference.<sup>62</sup> However, if such technologies are marginalised, the share is likely to hover below 15 percent. Previous projections put renewables' share at only 12 percent by 2030.

Given the overwhelming dependence on biomass energy in poor communities and countries, the research conducted by Jeanette Whitaker of the Centre for Ecology and Hydrology in Lancaster, UK found that second-generation biofuels, such as ethanol from woody crops/straw, had substantially lower energy requirements and greenhouse gas emissions than first-generation biofuels, such as

<sup>60</sup> There is a need to emphasise links between poverty, climate change, and energy by networks and organisations such as the Alliance for Rural Electrification, which was created in response to the need for access to sustainable electricity in the developing world, and to facilitate the involvement of ARE members in emerging rural energy markets.

<sup>61</sup> Jamal Saghir, 'Market Development and Financing Instruments in Renewable Energy in Developing Countries', published in *Words into Action: International Conference for Renewable Energies* (June 2004), Bonn: 2004, page 15-16.

<sup>62</sup> The International Scientific Congress on *Climate Change: Global Risks, Challenges and Decisions* was held in Copenhagen on March 10-12, 2009. It was attended by more than 2,500 delegates from nearly 80 countries with approximately '1,600 scientific contributions from researchers from more than 70 countries.' The conference conclusions will be published as a synthesis report in June 2009.[1]

ethanol made from foodstuffs, such as corn and sugar beet. These findings have been seen as important and relevant, because the current debate over the efficacy of biofuels has revolved around the issue of competing needs between cultivating crops for food and crops for fuel.<sup>63</sup>

By combining energy generation with storage mechanisms, off-grid communities can run a range of equipment using renewable energy sources. A wide variety of services and innovative products are currently offered by the private sector for off-grid applications, including plant design, production and supply of system components, operation and maintenance, commissioning, turnkey project realisation, village electrification, training activities, and so on. As a result, wind, solar, and hydro power systems have been successfully installed in different developing areas, such as China, Ecuador, Mexico, Morocco,

Senegal, and many more. Likewise, hybrid village electrification systems have also been implemented in countries ranging from China and India to Ghana, South Africa, and Tanzania.

The section below describes several key, innovative energy technologies that are either small scale/pilot, new and cost-effective innovations that have the potential to transform broader, ongoing efforts toward reducing poverty and adapting to climate change. As noted previously, the aim is not to provide a comprehensive listing of all available and anticipated technologies, but merely to provide a brief overview of select examples that have broad applicability and potential. The applications/innovations are grouped under broad categories listed below.

## Solar Energy

*We must avoid the 'ghetto-ification' of renewable energy. Solar should never be seen as second class power. In South Africa, we need to take into account our vulnerability to climate change, and focus on where we can make the biggest impact. It is not the poor who are polluting with their energy use - it's middle and upper income households.*

—Peter Lukey, Department of Environmental Affairs and Tourism, Republic of South Africa

We must avoid the 'ghetto-ification' of renewable energy. Solar should never be seen as second class power. In South Africa, we need to take into account our vulnerability to climate change, and focus on where we can make the biggest impact. It is not the poor who are polluting with their energy use - it's middle and upper income households.

—Peter Lukey, Department of Environmental Affairs and Tourism, Republic of South Africa

There are two ways of generating power from the sun: collect its heat (solar-thermal) or convert its light (photovoltaic). Although both approaches have been around for a long time, they have penetrated only a small share of the market in

<sup>63</sup> International Scientific Congress on Climate Change, 'New renewables to power 40 per cent of global electricity demand by 2050.' 11 March 2009. Media release available at [http://climatecongress.ku.dk/newsroom/renewable\\_energy/](http://climatecongress.ku.dk/newsroom/renewable_energy/)

most countries. This lack of market share is attributable to a variety of reasons, including the ready availability of carbon-based energy supplies at relatively low cost. Once technology and intellectual property barriers are addressed, there is no reason to believe that an aggressive push toward solar energy innovations cannot be used to increase access to energy services in developing countries.

Photovoltaic technology (PV) came into commercial production in 1953. Over time the price has declined and the energy efficiency has improved. However, the cost remains a barrier to the widespread uptake of PV technology. Almost all existing systems use silicon as the base material. Essentially, it is the cost of silicon and associated manufacturing processes that account for the relatively high cost of PV panels.<sup>64</sup>

**The key question is: How can solar energy power and fuel the needs of unserved communities in the future? What are some of the experiences with solar energy that have been successful and what lessons can be learnt from past failures?**

The section below draws on a wide range of sources, including innovative grants funded by the World Bank-sponsored Development Marketplace competitive grant program.<sup>65</sup> Programs such as this, which fund research, development, and implementation of innovative

sustainable energy services, urgently need to be scaled up for broader regional and sub-regional participation and application in under-served communities and countries.

Poor households and communities across worldwide, particularly in Africa and South Asia, struggle daily with the effects of black carbon or soot emitted from inefficient cookstoves fueled by wood, charcoal, and animal and crop wastes. Black carbon has recently been deemed to be a major environmental polluter. Its role was not, however, mentioned as a potential global warming source in the IPCC's 2007 summary report, and could be the subject of political wrangling, when seen in terms of per capita GHG emissions attributable to poor communities and countries.

Cutting back on black carbon is one of a number of relatively simple climate solutions using available, innovative technologies that can be replicated in a number of different community settings. A concerted global push toward switching to new cooking stoves, especially solar-powered cooking stoves that ameliorate the impacts of airborne pollution and reduce soot and smoke. A recent article notes that:

Decreasing black carbon emissions would be a relatively cheap way to significantly rein in global warming — especially in the short term... Replacing primitive cooking stoves with modern versions that emit far less soot could provide a much-needed

<sup>64</sup> The National Renewable Energy Laboratory (NREL) categorises PV technologies into three generations: first generation (silicon wafers); second generation (thin films); and third generation (mostly at the basic research stage). At present, these PV technologies are beyond the reach of poor communities and countries, but these are concepts that could be low cost or very high efficiency (three or four times that of current state-of-the-art silicon wafer cells). Other concepts include: hot-carrier solar cells (which capture and convert electrons in excited states before they return to stable energy levels); cells that can convert a photon into two or more electron-hole pairs to carry the current (in contrast to conventional cells, in which a photon produces one electron-hole pair); and quantum-dot solar cells (in which nano-sized dots of semiconductor material are tuned to capture and convert specific wavelengths of the solar spectrum).

<sup>65</sup> Development Marketplace (DM) is a competitive grant program administered by the World Bank and supported by various partners that identifies and funds innovative, early-stage projects with high potential for development impact. DM competitions—held at the global, regional, and country levels—attract ideas from a range of innovators, including civil society groups, social entrepreneurs, academia, and businesses. DM has awarded more than \$54 million in grants, supporting projects through their proof-of-concept phase. Using DM funding as a launching pad, projects often go on to scale up or replicate elsewhere, winning prestigious awards within the sphere of social entrepreneurship.

stopgap, while nations struggle with the more difficult task of enacting programs and developing technologies to curb carbon dioxide emissions from fossil fuels.<sup>66</sup>

The potential for solar energy to improve the lives of the poor and assist in the diversification of energy sources at the regional, national and local levels has been well documented. Recent studies, such as the one conducted by Agoormorty and Hsu, provide quantitative data on the benefits of

solar photovoltaic lanterns for the livelihoods of village communities and the sustainable use of the environment in the semiarid regions of Western India.<sup>67</sup> But, the two decades of development experience with solar cookers have not produced the kind of stellar results that were promised. Although solar cookers have long been viewed as a panacea for poor households' dependence on fuel wood and dung, the actual use of solar cookers has not been without resistance.

**A report by GTZ identifies the following key concerns:<sup>68</sup>**

- Solar cookers have only been able to take a firm hold where there are virtually no alternative fuels available (e.g., Tibet and the Altiplano in South America) and where they also fit in with customary cooking methods.
- Sophisticated, energy-efficient solar cookers, especially parabolic cookers, have proved to be too expensive for many communities, and it has not been possible to set up independent local production in Africa, given the need to import parts. The simple and inexpensive but less efficient box cookers are usually incapable of competing with traditional stoves.
- Almost all commercial approaches are no longer aimed at the poor or at rural areas, but at the numerically much smaller middle class in towns and cities. Although these people are able to afford solar cookers, they do not have to rely on them and therefore often use them only sporadically.
- A possible alternative to solar cookers is a new generation of improved stoves designed according to the principle of the Rocket Stove. Such stoves have an L-shaped, insulated combustion chamber in which the wood burns at a high temperature, producing very little smoke.

**Solar water heaters** (SWHs) offer people the chance to save money, increase the security of the local and national energy supply, and cut down on greenhouse gas emissions. Yet, roofs throughout Africa and South Asia are far from awash in SWHs. SWH technology has been available at least since the 1950s. The key problems associated with SWH are high installation costs and the lack of incentives offered. SWHs are relatively expensive to install,

costing between about US\$500 and US\$2,100. They do however require little maintenance and are durable (approximately 25 years), which enables end-users to recover installation costs through future electricity savings.

In the case of SWHs in South Africa, for instance, the focus has been on middle-income and wealthy households. Where low-cost developments have benefited from solar water heating, it has been

<sup>66</sup> Elizabeth Rosenthal, 'Less smoky stoves crucial to climate change fight', New York Times, 21 April 2009.

<sup>67</sup> Govindasamy Agoramorthy and Minna J. Hsu, 'Lighting the Lives of the Impoverished in India's Rural and Tribal Drylands'. Human Ecology, Vol.37: No.4, Aug 2009. Pages 513-517

<sup>68</sup> GTZ, *Here Comes the Sun Options for Using Solar Cookers in Developing Countries, 2007*: Introduction. Available at <http://cedesol.org/archives/english/gtz-en-here-comes-the-sun-2007.pdf>



largely under pilot projects designed to assist local authorities in reaching renewable energy targets, or because environmental impact assessments have stipulated energy-efficient developments. According to research published in 2008 by Sustainable Energy Africa, a non-governmental organisation based in Cape Town, South Africa, less than 1 percent of households have SWHs, even though South Africa is bathed in sunshine. Under a 2005 proposed by-law, the first of its kind in South Africa, Cape Town's 2005 Energy and Climate Change Strategy has set a target of 10 percent for the number of city households using solar water heating by 2010. (Official estimates put Cape Town's population at 3.23 million.) Most new buildings (and those undergoing renovations) with a value of more than about \$70,000 will be required to meet at least 60 percent of their water heating needs with solar heaters.

Currently, organisations like **SELCO** (India) are revolutionising the use of solar PV modules to provide electricity for lighting (indoor and outdoor home lighting and solar headlamps), solar water heaters, solar inverter systems (for use in communications and computing), and small business appliances. SELCO was established in 1995 to provide solar energy solutions to underserved households and businesses in India on the basis of three tenets:<sup>69</sup>

- i. Poor people can afford sustainable technologies
- ii. Poor people can maintain sustainable technologies
- iii. Social ventures can be run as commercial entities

Three factors make SELCO different from other organisations and entities focused on solar energy applications: it offers 'door-step servicing in

combination with door-step financing; its philosophy is that it is not just a technology supplier but an energy service provider; and its products are designed for end-user needs.

In Karnataka and Gujarat, where Selco works, lives have transformed by solar power. From helping midwives in Gujarat to deliver children with the aid of solar lighting kits to giving rose-pickers outside Bangalore solar-powered headlamps so that they can work in the pre-dawn darkness with their hands free, innovation has been the key to success. 'Design has to be customised to fit the needs of the customer. The one-size-fits-all approach that's usually used when the user is from a financially weak background invariably fails,' says Hande of SELCO. A two-time winner of the Ashden Award (the 'Green Oscar'), SELCO has also tied up with the Self Employed Women's Association (SEWA) bank in Gujarat, where it plans to sell a range of energy services, including energy-efficient stoves, to the bank's 300,000 low-income female customers.

In addition to meeting people's lighting and small electrical needs, SELCO, through its extensive fieldwork presence in remote rural villages, understood the urgency of providing improved household cooking technologies. This led SELCO to introduce improved cookstove technologies, such as the improved biomass cookstove, into its product portfolio in late 2008.

The **improved biomass cookstove** designed by Prakti Design Lab is approximately 40 percent more fuel efficient than traditional cookstoves, emits 70–80 percent less smoke, and is designed to meet the cooking requirements of rural households.<sup>70</sup> SELCO also sells the charcoal-based Sarai cooker designed by Appropriate Rural Technology Institute of Pune, India. SELCO's

<sup>69</sup> For additional information on SELCO India, see [http://www.selco-india.com/images/innovations\\_brochure.pdf](http://www.selco-india.com/images/innovations_brochure.pdf)

<sup>70</sup> Prakti Design Lab is currently designing new products, including stoves with new features (a dosai-cooking stove, bread ovens, double skirt and door to improve efficiency) as well as new energy-saving products such as LED lights, incinerators, and water filters. See also <http://www.praktidesign.com/>

cookstove program is determined to reduce indoor air pollution and increase the quality of life of rural people by providing efficient cooking technologies.

The Mighty Light, a **solar-powered lantern** that costs around US\$45 and lasts up to 30 years, was dubbed 'the new electric lamp' by *Time* magazine in 2006. The Mighty Light is a product of the U.S.-India joint venture, Cosmos Ignite Innovations. It has replaced polluting, dangerous kerosene lamps for thousands of people in Afghanistan, Guatemala, India, Pakistan, and Rwanda. The key component is a solid-state light emitting diode (LED), the most efficient lighting technology on the market. Cosmos Ignite focuses on poor, needy areas and communities, with both direct sales and grant-funded distribution.

In Bangladesh, **Grameen Shakti**<sup>71</sup> has been actively promoting rural electrification through the use of solar home systems (SHSs), including small SHSs aimed at reaching low-income rural households. These small systems are highly decentralised and particularly suitable for remote, inaccessible areas. Grameen Shakti started business in 1996 as the first rural energy service company (RESCO) in Bangladesh. By 2007, Grameen Shakti will have installed 100,000 solar home systems to power lights, motors, pumps, televisions, mobile phones, and computers.<sup>72</sup>

Grameen Shakti's solar program targets mainly those areas without access to conventional electricity, and little chance of being connected to the grid within the next 5–10 years. It has introduced a micro-utility model in order to reach poorer households which cannot afford an SHS. It is one of the largest and fastest-growing rural renewable energy companies in the world, and has

a specific research program with the following distinct areas:

- Exploration and development of appropriate technologies and their uses
- Developing way to popularise and make renewable energy systems easily accessible to greater number of households and institutions
- Local development and fabrication of solar accessories (including charge controllers, AC-DC converters, DC ballasts for fluorescent lights, and mobile phone chargers) to reduce total system cost

**The role of grant/seed money dedicated specifically for research and development of creative and innovative energy services/systems that can address both climate change and poverty reduction needs should be emphasised. There is a specific need to focus on frameworks for action and partnership that can promote collaboration and scaling up of innovations amongst young entrepreneurs, researchers, and civil-society actors within the developing-country context.**

**Some of the most innovative work in new, low-cost sustainable energy applications has been done by students and young entrepreneurs in partnership with NGOs. Toward this end, the World Bank's Development Marketplace Grant mechanism is an excellent example of an innovative funding mechanism where creative ideas/technologies/services that matter for development are given global recognition and seed funding, so that they may grow and replicate.**

<sup>71</sup> <http://www.gshakti.org/solar.html>

<sup>72</sup> Wimmer 2007, op. cit.

As noted, above several key innovations have won the World Bank Development Marketplace grants. Based on a review of the DM grant

portfolio, the following section summarises some of the innovative grants in the area of energy that were awarded DM grants from 2005 to 2008.<sup>73</sup>

**Solar ‘Tuki’ Lamps:** Nepal (DM Grant 2005)<sup>74</sup>

**Objective:** To improve household lighting and family health in rural Nepal by replacing kerosene lamps with solar-powered lighting sold through an affordable microfinance arrangement.

**Rationale:** Over 2 million households in Nepal lack access to electricity and use kerosene-based wick lamps (known as tuki in the local language) for household lighting. These tukis pose a fire hazard, and the fumes harm people’s eyes and lungs and contribute to global warming. The kerosene used by the lamps must be imported and is expensive or unavailable in rural areas. In addition, each kerosene tuki emits about 250 kg of carbon dioxide annually.

**Innovation:** This project proposes to sell the solar tuki, an innovative portable solar lamp unit with white LED bulbs, to low-income, rural Nepalese households. The LED bulbs offer significant advantages over traditional tukis: it emits a brighter light, requires less maintenance, and lasts longer. Since Nepal enjoys an average of 300 days of sunshine per year, there is a ready supply of energy without incurring continuous refueling costs (unlike kerosene tukis). One of the greatest benefits, however, is the elimination of fumes and smoke, which will both improve the health of families and reduce greenhouse gas emissions. The project team also plans to set up a microfinance mechanism to enable poor households to buy the solar tukis. This project expects to reach 800 households within 24 months and 2.4 million households by the year 2015.

<sup>73</sup> Information on DM grants contained in this section and any additional information of DM grants from 2000 (year of inception) is available at <http://web.worldbank.org/WBSITE/EXTERNAL/OPPORTUNITIES/GRANTS/DEVMARKETPLACE/0,,menuPK:4103637~pagePK:64750782~piPK:64750915~theSitePK:205098,00.html>

<sup>74</sup> Related links include [www.ecca.org.np](http://www.ecca.org.np); [www.eccanepal.phanfare.com](http://www.eccanepal.phanfare.com); and [www.globalgiving.com/1268](http://www.globalgiving.com/1268)

**Micro solar generator:** Lesotho (DM Grant 2006)<sup>75</sup>

**Objective:** To improve the lives of Basotho people in rural communities by: 1) using an innovative solar micro-generator technology to provide an affordable and renewable source of electricity and hot water, and 2) building local capacity to encourage regional manufacture and dissemination of the technology.

**Rationale:** In Lesotho less than 10 percent of the population is connected to the electricity grid. Extensions of the grid to rural villages are estimated to cost more than \$1,000 per household, in a nation with a per capita GDP of \$3,300. Economic productivity has been severely handicapped by the absence of energy infrastructure. In addition, unsustainable harvesting of biomass fuel has contributed to massive land degradation, which affects much of Lesotho, undermining its agricultural productivity and perpetuating poverty and lack of opportunity.

**Innovation:** This project promotes a pioneering version of a proven renewable energy technology (i.e., concentrated solar thermal power) that can be manufactured locally. The technology combines solar thermal power with a unique micro-scale generator adapted and scaled to suit the needs of underserved communities in Lesotho. The system, known as an organic Rankine cycle (ORC), works by concentrating solar thermal energy to heat a fluid refrigerant. The typical ORC is a massive affair, but in the MIT micro-version, the system's vapour is expanded through a rotary vane turbine (an automobile power-steering pump) that makes mechanical energy to spin a generator (an automobile alternator).

It is rugged and simple to construct, uses inexpensive, ubiquitous automotive parts for components, operates via mechanical principles understood by any local mechanic or repairman, and can provide sustainable, cost-effective electricity, water heating, and refrigeration off the grid. The systems will be disseminated with a market-based approach, mobilising local entrepreneurship using micro-credit lending. Three pilot communities will initially benefit from the technology: a village in the high plateaus, a rural school, and a clinic.

Following on from this project, the MIT students hope to use their micro-solar generator system to create a viable business, under the name Promethean Power. Their business plan for Promethan Power won a \$10,000 prize in MIT's annual entrepreneurship competition. The goal is to produce inexpensive solar energy systems in developing countries. India will be Promethean Power's first beachhead, because the country has a well-established microlending system.<sup>76</sup>

<sup>75</sup> Two MIT engineering graduate students (Mathew Orosz and Amy Mueller) won this 2006 DM grant. The pioneering MIT technology combines solar thermal power with a microscale generator that is built and repaired with ordinary auto parts. The MIT team's goal is to provide not only energy but also support for the local economy through manufacturing the generator in Lesotho. See also Sarah H. Wright, 'Students win grant for Lesotho solar generator', MIT News Office, June 5, 2006. Available at <http://web.mit.edu/newsoffice/2006/lesotho.html>

Related links also include: [www.stginternational.org](http://www.stginternational.org).

<sup>76</sup> H. Bray, 'Solar firm's focus: Power to the people-Inexpensive system targets poor nations needing electricity', Boston Globe, June 18, 2007. Available at

[http://www.boston.com/business/technology/articles/2007/06/18/solar\\_firms\\_focus\\_power\\_to\\_the\\_people/](http://www.boston.com/business/technology/articles/2007/06/18/solar_firms_focus_power_to_the_people/)

## Bioenergy/Biofuels

Bioenergy (i.e., energy derived from sustainable agricultural practices) and energy from sustainable biofuels is seen as a vital component in the global efforts to increase options of available sustainable energy sources. However, as Daniel Ugarte notes, the size of bioenergy's ultimate contribution depends on a variety of factors, including: the use of sustainable agricultural practices; land use consistent with food and agricultural needs of local, national, regional, and global populations; and the technically and economically efficient distribution and conversion of feedstock into energy. Accordingly, bioenergy cannot be viewed as the replacement or substitute for fossil fuels, but rather as one element in the broader portfolio of renewable energy sources.<sup>77</sup> Because demand for energy in the developing world is predicted to further expand in coming decades, more advancements, investments, and policies facilitating biofuel technology are needed, according to a report from the Washington-based International Food Policy Research Institute (IFPRI).

A number of existing bioenergy-related applications, such as densified biomass and small-scale biogas digesters, are currently in use. Biodiesel has generated widespread concern, due to the potential for conflicts, now and in the future, between cultivating crops for food and cultivating crops for energy. According to Sivan

and Leach, several emerging technologies could be used in rural and poor communities:

- Microturbines have been powered primarily by natural gas or diesel fuel, but research is underway that is expected to produce microturbines that could run on typical biomass-derived thermal gas or digester gas. It is expected that these might eventually be competitive with diesel engines for village-scale power applications, with relatively low maintenance costs, high reliability, long lifetime, and low capital costs.
- Stirling engines have attracted interest because they can potentially tolerate a wide range of fuel sources, with little fuel processing. Recent technical advances in 'free-piston' Stirling designs may eventually yield commercial models with high reliability and engine efficiency, making them a particularly interesting power generating option at very small scales (1–3 kW).
- Fuel cells might ultimately prove able to generate power at village scales from gasified biomass, at efficiencies more than twice as high as the gasifier/diesel engine systems that are now being commercialised.

However many obstacles and concerns need to be addressed before these technologies can be deployed.<sup>78</sup>

<sup>77</sup> Daniel Ugarte, 'Positive Dynamics' in Our Planet.

<sup>78</sup> Sivan Kartha and Gerald Leach, *Using Modern Bioenergy to Reduce Rural Poverty*. Stockholm Environmental Institute.



**From Harmful Aquatic Plants to New Cooking Fuel: Senegal(DM Grant 2006)<sup>79</sup>**

**Objective:** To remove proliferating invasive aquatic plants from the surface waters of northern Senegal and transform them into combustible pellets that can be used for cooking.

**Rationale:** The waters of the Senegal River region are being invaded by harmful aquatic plants. The plants' proliferation is causing an increase in waterborne diseases, and is specifically affecting the water quality of Gier Lake, which provides potable water to Dakar. The invasive aquatic plants are also threatening the region's biodiversity, reducing the navigability of the river, and creating problems for fishermen (i.e., plants jam in their nets) and farmers (i.e., draining of their lands and reducing access to water for livestock).

**Innovation:** Past attempts to control the plant's proliferation have failed, proving too costly or unproductive. Initiated by the Senegalese diaspora, this project endeavours to succeed by using a simple and proven technology: a floating grapple with cable which can drag plants out from watercourses. Instead of rotting, plants will be transformed into fuel pellets for cooking, replacing wood and charcoal and thus contributing to the fight against desertification. The new energy product will create an ongoing source of revenue for the local populace. Based on capacity production of the compaction machine (4,000 kg/week) and a local price of US\$ 0.28/kg, this could generate income of about US\$ 1,120/week. Twenty local workers will be hired and trained to manage the process, while many more local fishermen and farmers will be recruited as plant removers. The broader environmental health benefits are expected to be reaped by the 600,000 people living in the low valley of the Senegal River.

### **Producing Biofuel from Indigenous Non-Edible Nuts:** Tanzania (DM Grant 2008)<sup>80</sup>

**Objective:** To replace up to 10 percent of Tanzania's oil requirements by 2018 through the production and sale of an affordable, straight vegetable oil (SVO) as biodiesel. This 'green' biodiesel, which complies with United Nations carbon emission reduction protocols, will provide a new, sustainable cash crop for smallholder farmers, increasing their incomes by US \$500 to US\$ 3,000 over the current average level of less than US\$ 350 per year. The project will also eliminate unfair labour practices and use of children in heavy agricultural labour by offering a fair wage to adults, particularly women.

**Rationale:** Energy supply issues contribute to poverty in Tanzania through: i) chronic shortage of affordable fuel and inadequate energy supply in off-grid, rural areas; ii) profound reliance on imported crude oil derivatives; iii) high retail pricing due to transportation and production costs, import taxes, and theft in the supply chain; iv) lack of new markets and income for small farmers; and v) inadequate supply of affordable energy to power entrepreneurship. Currently, fossil diesel at the pump costs \$10.60 per gallon in western Tanzania. The government is providing leadership in privatising biofuel as a way to produce new sources of power and fuel and has invested time and resources in Africa Biofuel and Emission Reduction (ABF). ABF expects to supply biodiesel at a fair-market price that is 40 percent lower than current prices at the pump. This reduced price for fuel is expected to significantly increase purchasing power for over 35,000 local farmers in the region by 2018.

**Innovation:** The project will be the first to cultivate an indigenous, non-edible oilseed for biofuel, using *Croton megalocarpus*, a tree that permits intercropping. ABF expects to be the first African company to provide Tanzania with a sustainable, locally sourced fuel for rural development by 2010. The project will also develop micro-propagation protocols for *Croton megalocarpus* to secure optimal yield and hardiness of the *Croton* tree. ABF is also unique in its public-private partnership with the government of Tanzania and its equity-based and employee-and investor-owned business model.

<sup>80</sup> Related links include [www.africabiofuel.com](http://www.africabiofuel.com)

## Other Novel Ideas

*I love working with passionate people who want to help address climate change and poverty by thinking and experimenting outside the square.*

—Nicole Kuepper, Inventor

### Energy from Dirt<sup>81</sup>

A small company based in Cambridge, Massachusetts is working to develop fuel cells made from the bacteria that occur in soil or waste. The name of the company is Lebônê Solutions (Lebônê means 'light stick' in the Sotho language) and the company plans to develop a battery (microbial fuel cell) that makes a small amount of energy out of everyday materials commonly available to African households, such as manure, soil, and graphite cloth. The group hopes that each household will be able to build a battery for about \$15 as the technology improves.

In a microbial fuel cell, the bacteria breaks down organic waste, producing electrons. Once released from the fuel cell, the electrons stick to an electrode, like a piece of graphite, which produces a small charge of energy that could power something like a mobile phone or a lamp.

It is interesting to note that the founders of Lebônê were classmates at Harvard and were looking at sustainable lighting technologies for Africa as a class project. Their project won a grant of almost US\$ 200,000 in the 'Development Marketplace' competition, for which results were announced at 'Lighting Africa 2008' (May 2008 Accra, Ghana).

Lebônê Solutions, Inc., is a self-described social enterprise, working in off-grid energy delivery and lighting technology. The mission of Lebônê is to help end the energy and lighting crisis in Africa by identifying and harnessing emerging technologies, developing and adapting them for the African market, and delivering them to rural villages in an innovative, accessible manner. Recently, Lebônê took its technology to a village in Tanzania to see how the batteries work in households. For 3 hours each night, six families used batteries made of manure, graphite cloth, and buckets, along with a copper wire to conduct the current to a circuit board. The group is expanding the refined prototypes into Namibia, where, over the next 2 years, it will examine how more easily available materials, like chicken wire, will create electricity. Eventually, Lebônê wants to create a new business model for energy distribution in Africa, helping to funnel fuel cells and other technologies tested in Africa to distributors there, rather than reducing developed technologies to meet African needs.

Microbial fuel cells, based on the energy produced by soil microbes, are amongst the new technologies that offer a lot of promise, because they could provide much needed off-grid electricity, and are easy to make and maintain.<sup>82</sup>

<sup>81</sup> Cate Doty, 'For Africa, energy from dirt', New York Times, October 11, 2008. Available at [http://www.nytimes.com/2008/11/11/news/11iht-11africa.17707543.html?\\_r=1&scp=1&sq=energy%20from%20dirt&st=cse](http://www.nytimes.com/2008/11/11/news/11iht-11africa.17707543.html?_r=1&scp=1&sq=energy%20from%20dirt&st=cse)

<sup>82</sup> See also 'Q&A: 'Literally, This Is Energy From Dirt'. Interview with Lebônê founder Hugo Van Vuuren in IPS, May 10, 2008. Available at <http://www.ipsnews.net/news.asp?idnews=42320>

### **Thinking Outside the Square Finds Light in the Oven: Producing Solar Cells in a Pizza Oven**<sup>83</sup>

A 23 year-old Ph.D. student, Nicole Kuepper has developed a simple, inexpensive way of producing solar cells in a pizza oven. Her research into developing cutting-edge photovoltaic (solar) technology using a low-cost inkjet printing process has won the Eureka Prize for Young Leaders in Environmental Issues and Climate Change.<sup>84</sup>

Currently, production techniques for photovoltaic cells makes them expensive and out of reach for most people in developing countries. The iJET solar cell represents a breakthrough: a simple, affordable solar device that can be made without high-tech environments or high-cost inputs. Using Inkjet printing, aluminum spray, and a low-temperature pizza oven, Ms Kuepper created the metal contacts necessary for a solar cell to generate electricity. Her iJET solar cell could potentially bring not only affordable but also sustainable and clean energy to the poorest people in the world.

While photovoltaics is the world's most rapidly growing energy source, the production of solar cells currently requires sophisticated and expensive manufacturing facilities and highly trained personnel. These conditions are not easily available in developing countries. Nicole Kuepper's low-cost, low-tech solar cells could offer a way to remove the dependence of developing countries on greenhouse gas-producing energy sources.

### **Biofuel from the Sewage Plant**<sup>85</sup>

Researchers throughout the world are working to produce biofuel from algae, but some are using a novel energy source with the potential to reap multiple benefits by using an abundant and freely available source—human waste—to make the fuel of the future while also treating sewage.

Roger Ruan, a professor at the University of Minnesota, is using wastewater from Minneapolis' largest sewage treatment plant to grow single-celled algae and produce a diesel-like biofuel. He is one of many researchers around the world working to make biofuel from algae at a price that is competitive with gasoline and diesel fuel. But Ruan's project, along with several other sewage-to-fuel experiments, has a distinct advantage over competing algae-to-fuel efforts: His nutrient-rich feedstock is free and available at a nearly constant rate all year long. An additional benefit of producing algae from wastewater is the cleanup of the wastewater, which results in cost savings. A single acre of algae, even in an inefficient open pond, can produce 5,000 gallons of biodiesel per year—100 times as much as soybeans. University of Minnesota researchers hope their research yields a demonstration algae-to-fuel plant within a year.

<sup>83</sup> Deborah Smith, 'Thinking outside the square finds light in the oven,' Canberra Times, August 20, 2008. Available at <http://search.yahoo.com/search?p=kuepper+light+in+oven&toggle=1&cop=mss&ei=UTF-8&fr=fp-yie8-701>

<sup>84</sup> Australian Museum, 'Global Warming - Ink Jet to the Rescue', Winner 2008- Young Leaders in Environmental Issues and Climate Change: Nicole Kuepper. Available at <http://eureka.australianmuseum.net.au/index.cfm?objectid=A4D69CF1-9890-B67D-2409EF3BFCD8F038&DISPLAYENTRY=true>

<sup>85</sup> Greg Breining, 'From the Sewage Plant- The Promise of Biofuel,' Jul 1 2009.

### **Cooker, Fridge and Generator in One- It's a SCORE<sup>86</sup>**

It's a cooker, a fridge, and a generator in one—and it could have a huge impact on the lives of people in the world's poorest communities. The 2m pound SCORE (Stove for Cooking, Refrigeration and Electricity) project brings together experts from across the world to develop a wood-powered generator capable of both cooking and cooling food.

By developing an affordable, versatile domestic appliance, SCORE aims to address the energy needs of rural communities in Africa and Asia, where access to power is extremely limited. Led by the School of Electrical and Electronic Engineering at The University of Nottingham, the project team uses thermoacoustic technology for the first time to convert biomass fuels into energy, powering the stove, fridge, and generator.

Thermoacoustics refers to the generation of sound waves through the non-uniform heating of gas, illustrated by the 'singing' of hot glass vessels heard during the glass-blowing process. This phenomena has been known for centuries, but could offer new possibilities in the energy conversion process. Using thermoacoustic technology is a more efficient way of using wood as a fuel than using an open fire to cook. It produces less pollutants. The device will also have few moving parts making in more reliable.

The concept of the proposed device is based on proven thermoacoustic engines and refrigerators developed for applications such as combustion-fired natural gas liquefaction and radioisotope-fuelled electric power generation. Los Alamos Laboratories, in collaboration with several industrial partners, has played a lead role in the development of thermoacoustic technology. Researchers from Los Alamos Laboratories are also supporting the project, along with Practical Action, a charity which promotes the development of sustainable technology to tackle poverty in developing countries. The SCORE consortium is funded by grants from the Engineering and Physical Sciences Research Council as part of its initiative on energy and international development.

---

<sup>86</sup> Staff Writers, 'Powered By Sound-Revolutionary Stove Could Help Reduce Poverty', Nottingham, May 16, 2007  
Available at [http://www.energy-daily.com/reports/Powered\\_By\\_Sound\\_Revolutionary\\_Stove\\_Could\\_Help\\_Reduce\\_Poverty\\_999.html](http://www.energy-daily.com/reports/Powered_By_Sound_Revolutionary_Stove_Could_Help_Reduce_Poverty_999.html)



### **Clean and Reliable LED lighting for Tribal Homes:** India (DM Grant 2006)<sup>88</sup>

**Objective:** To provide clean and reliable lighting to 10,000 tribal households using LED units and a community-based maintenance plan organised by THRIVE (an NGO).

**Rationale:** Kondh tribes residing in the hill and forest tracts of southern Orissa in India do not have access to grid power and use kerosene for lighting. Kerosene rations are supplied through distantly-located government outlets and must be heavily subsidised. The light produced by kerosene lamps is neither bright nor clean and does not adequately support reading and working.

**Innovation:** This project would deploy the latest technology in LED lighting with the participation of a grassroots NGO to ensure sustained acceptance by the community. The team will provide light units at a cost of US\$12 each to 10,000 Kondh homes in roughly 200 villages. The batteries will be charged once every 2 weeks by the village entrepreneur, using grid power available in the nearby headquarters. Each home will pay 50 cents a month in user fees, which is shared between the entrepreneur and the light replacement fund. These lighting systems will improve the education, health, and productivity of the villagers and enhance their safety. Nearly 200 youth entrepreneurs will also increase their incomes. The systems' upfront capital cost is far less than any other available method and daily energy consumption is also low. This model has strong potential to be scaled up, as there are nearly 100,000 villages in India without access to electricity and LED technology continues to improve.

**A further footnote is** that as a consequence of Thrive's LED lamp initiative, villagers are trained as entrepreneurs to sell, change, and repair the lanterns, offering local people a way to make extra income. About 100 village entrepreneurs have been trained in selling lamps. Maintenance is simple, and LED lanterns require a biweekly recharge from a nearby grid or one of THRIVE's three solar-powered charging stations, at a cost of US\$ 0.02. And the repairman is often a neighbour or a resident of a nearby village. As the project grows in India, development groups in other regions are becoming interested in LED lights. THRIVE is now collaborating with similar initiatives in Afghanistan, Cambodia, and Kenya. The LED lamp developed by THRIVE has been illuminating about 4,000 homes in the provinces of Kabul and Maidan Wardak in Afghanistan since November 2006.<sup>88</sup>

<sup>87</sup> Ranganayakulu Bodavala, or Ranga, a 1999-2000 Takemi Fellow at Harvard School of Public Health founded an organisation called THRIVE (jumbled acronym for Volunteers for Rural Health, Education, and Information Technology), to provide the Kondh tribal group and others with alternative light sources. See also Harvard School of Public Health article 'Former Takemi Fellow Wins World Bank Award for Bringing Light Sources to Rural India', August 4, 2006. Available at <http://www.hsph.harvard.edu/now/20060804/ranga.html> . For more information, visit <http://www.thrive.in>

<sup>88</sup> S. Ramu, 'Lights from India now illuminate homes in Afghanistan', The Hindu, July 6, 2007. Available at <http://www.hindu.com/2007/07/06/stories/2007070652532200.htm>

## 6 Findings and Conclusion: ‘Seal an Equitable Deal’ and Not Just Any Deal in Copenhagen and Beyond

Within the rubric of the international climate change negotiations framework, there has been a marked absence of concrete policy and programmatic inputs that would ensure closer linkages between the poverty reduction and global climate change policy agendas. Current global discussions on climate change have not focused adequate attention on jumpstarting the development and implementation of innovative energy technologies that are sustainable and cost effective, and improve the lives of poor and vulnerable communities and countries. Synergistic action between global climate change and poverty reduction presents unprecedented challenges and opportunities for all development stakeholders as they strive to ‘do development differently’.

In the ‘heated’ global debate as to the scope and nature of developing countries’ involvement in future climate change mitigation and adaptation efforts, what is markedly absent are global efforts to design, finance, and implement programmatic and policy initiatives that link needs-based and context-specific mitigation and adaptation efforts in developing countries with broader development goals, including poverty reduction. It is this absence of a global framework for linked action between climate change and poverty reduction needs that arguably has contributed to the lack of coordinated policies and programmes available for implementation and use in the context of developing countries.

### Key Findings

The key findings of this study are as follows.

- An effective and equitable post-2012 global climate change consensus that engages all

stakeholders clearly requires that poverty reduction efforts not be seen as distinct and separate from climate change action, and merits a shift toward implementing innovative, clean energy technologies that address the dual concerns of climate change and poverty reduction.

- Despite the existence of National Adaptation Programmes of Action (NAPAs) for least developed countries (LDCs) that are Parties to the UNFCCC, at the broader global conceptual and practical level, climate change-related mitigation and adaptation projects, programmes, and mechanisms lack a consistent and explicit focus on the socio-economic needs and poverty reduction concerns of developing countries. In particular, enabling and promoting developing-country actions related to climate change mitigation and adaptation are hampered by a lack of clear thematic and programmatic linkages at the global and regional levels, between contextually specific poverty needs and climate change concerns.
- Embracing a new development paradigm that links climate change, poverty reduction, and energy access necessitates that climate change considerations are fully integrated with national plans to achieve the MDGs, and that national climate change adaptation and mitigation strategies/projects are directly linked with poverty reduction and sustainable development goals. It also necessitates that investment and development decisions have a consistent climate change focus built in every step, from project idea to design, implementation, and monitoring.
- Funding for innovative research and develop-

ment that will enable the next generation of sustainable, pro-poor energy technologies is currently inadequate to meet the sheer scale and scope of the challenge of increasing access to sustainable energy whilst also addressing climate change concerns.

- Financing and capacity development that is directly linked to research, development, and implementation of innovative, pro-poor, sustainable energy technologies should be contextually specific, needs-based, and developed so as to encourage creative, cooperative partnerships between local and community-based organisations, regional and national academic and research institutions, and private-sector partners.
- The role of grant/seed money dedicated specifically for research and development of creative and innovative energy services/systems that can address both climate change and poverty reduction needs should be emphasised. There is a specific need to focus on frameworks for action and partnership that can promote collaboration and scaling up of innovations amongst young entrepreneurs, researchers, and civil society actors within the developing-country context. Toward this end, the World Bank's Development Marketplace Grant mechanism is an excellent example of an innovative funding mechanism, where creative ideas/technologies/services that matter for development are given global recognition and seed funding so that they may grow and replicate.

## **Conclusion and Way Forward**

The development community has a unique opportunity to integrate climate change and development concerns/goals by putting the needs of the poor and vulnerable at the front and centre of any Copenhagen global climate change agreement, but it cannot do so without taking stock of the need to increase access to improved,

low-cost, sustainable energy for the poor. There is a considerable amount of information related to the range of policy and programmatic challenges associated with development and implementation of energy and poverty issues and the development and implementation of renewable energy services and technologies. What is largely missing from discussions on energy and climate change is a framework at the global and national levels that allows for the identification of innovative technologies that offer promise for addressing the triumvirate of climate change-poverty-energy concerns faced by poor communities and countries.

With the attention of the world focused on achieving a global consensus for action on climate change, the policy and programmatic linkages that will enable the creation and development of innovative, pro-poor sustainable energy services cannot and should not be ignored. It is both surprising and disappointing to see a lack of funding and R&D fora sponsored in partnership with governments, international organisations, private sector, and NGOs, which would allow the best and brightest pro-poor, sustainable energy-related ideas and concepts to come to the fore.

Clearly, this will require not only access to new ideas but also access to new finance and capital flows. This will also necessitate enterprise development through decentralising energy generation so that poor people can be active agents of their own development without depending on centralised energy systems, particularly in rural and remote areas, which are unlikely to be reached by electricity grids.

What is needed is an effective infusion of targeted and well-designed funds, along with institutional and capacity development tools, that can jump-start research, design, and development of innovative and sustainable energy technologies that address the needs of the poor. Surely, the global community can design and implement

creative programmes and projects that focus on new ways of maximising the contribution of the private sector and civil society so as to mainstream low-carbon energy technologies that can completely transform the lives of the poor.

Given the sheer volume of negotiating text and the divisions in negotiating stances between developed and developing countries, Parties to the December 2009 Copenhagen talks, held under the auspices of the United Nations Framework Convention on Climate Change, will in all likelihood need to

continue discussions into 2010. In the event that negotiators at Copenhagen are unable to reach a comprehensive agreement, the onus is to reach consensus on key principles that will govern the creation of a climate change regime in the upcoming decade that includes consistent and comprehensive linkages between poverty reduction, climate change, and access to sustainable energy innovations. The call to action is not just to 'seal any deal' at Copenhagen and beyond, but to 'seal an equitable deal' that links poverty reduction and energy access needs with global climate change concerns.

