

SYNTHESIS OF ENERGY-RELATED ISSUES HIGHLIGHTED IN NATIONAL REPORTS OF RIO+20



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UN-Energy



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1. Executive Summary

Building on the results of the 1992 Rio Earth Summit, world leaders and thousands of stakeholder participants came together in June of 2012 at Rio+20, the United Nations Conference on Sustainable Development, to chart a path and build focused commitment to “The Future We Want” – to reduce poverty, advance social equity, and ensure environmental protection for our planet. In preparation for the conference, 72 countries conducted participatory consultations to review progress, challenges and gaps in efforts related to Rio+20 themes. More than 60 countries prepared National Reports reflecting those proceedings and highlighting relevant policies and programmes in key areas.

This report is a synthesis of the energy issues discussed in the national reports, intended to help strengthen implementation of the Rio+20 directions and commitments. It identifies lessons and best practices across all regions, underscoring the nexus of energy-related concerns with other sustainable development factors. It addresses in particular the issues relating most directly to the three focal areas of the UN Secretary General’s Sustainable Energy for All initiative: access to energy services, improving energy efficiency, and increasing the use of renewable energy sources.

The opportunities and challenges facing each country are different, as are the paths they choose to follow to meet them. Yet within that diversity there is a great deal of commonality. Countries are grappling with how to plan in an informed and integrated manner, recognizing that sectoral models are no longer sufficient. They realize that energy is not simply about resources; it is about services that drive, and are driven by, social, political, economic and environmental well-being.

As they strengthen their integrated sustainable development planning processes, countries are becoming increasingly aware of the need to develop enabling environments through policy and other initiatives to shape energy supply and demand, leading in the direction of efficiency, access and environmental protection. They are using a range of approaches, from opening up their electricity production sectors to independent power generators, to raising funds for environmental needs through taxes linked directly to resource use, to establishing energy efficiency standards for energy-using equipment and devices. Many countries are focusing attention on creating conditions and positive incentives for market-driven or public-private partnership solutions. Further, countries share the intention to reduce expensive and unsustainable energy imports by developing indigenous resources,

improving efficiency of both production and consumption, and pursuing expanded use of renewable resources and technologies. They recognize that in doing so they will have the potential to create sustainable employment and achieve other important goals, such as improving the environment and enhancing human health.

Most countries also acknowledge that new decentralized renewable energy technologies can help bring modern energy services to their rural populations, usually the poorest of their citizens, and that providing access to basic modern energy services – particularly electricity for lighting and improved cooking methods to replace unhealthy and inefficient burning of traditional biomass – can spark dramatic breakthroughs in rural economies, health status, and gender equity.

There are many barriers to success. Chief among them are the need for better human capacity to plan and implement, better access to information, and more financial resources to invest in new infrastructure, technology, and programming. However, the reports provide many rich examples of innovative and effective work being done to meet these challenges. They point to the possibility of real progress toward a future in which countries power their economies efficiently and sustainably, providing clean, affordable modern energy services for all.

Synthesis of Energy-Related Issues Highlighted in National Reports of Rio+20

*Energy is the golden thread that connects
economic growth, increased social equity,
and an environment that allows the world to thrive.*

-- UN Secretary-General Ban Ki-moon¹

2. Introduction

2.1 Energy and Sustainable Development

In discussions of sustainable development, energy is often listed as one of the important priority sectors or areas of concern. But in reality, energy is much more than a “sector.” For better or for worse, it plays a central role in all factors related to sustainable development. In many cases, energy is key to the success or failure of sustainable development policies and initiatives. This conceptual framework includes but extends well beyond the familiar “nexus” understanding of the relationship between energy, water and food. For example:

- The provision of reliable and efficient energy services, particularly electricity, is an essential ingredient in the recipe for successful economic development, enabling trade, manufacturing, distribution and transport of commodities and finished products.
- Reducing reliance on costly fossil fuels for electrical generation, industry, and transportation cannot only forestall environmental damage and reduce greenhouse gas emissions; it can also free up much needed resources and reduce short and long-term uncertainties due to the volatility inherent in pricing and supply availability.

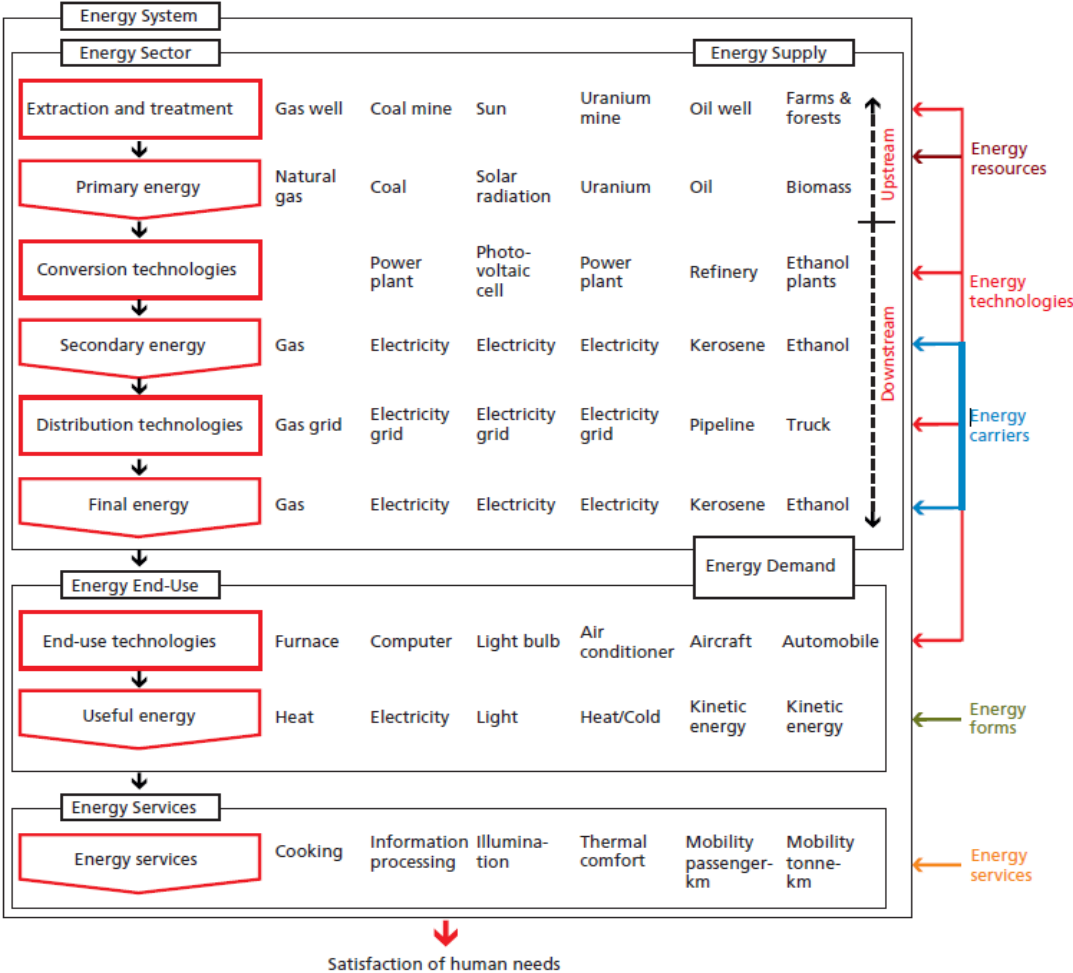
If in developed countries, the problem is intensive consumption of non-renewable energy sources; in developing countries the question has different facets. In addition to the sustainability of sources, the problem is also about access. For Haiti, this issue holds capital importance and is one of the priorities for government action. The already serious problem has been exacerbated with the earthquake of January 12 (2010), and today it is difficult to consider any public policy question without taking into account the issue of energy.

-- **Haiti Country Report**

¹ Remarks of UN Secretary-General Ban Ki-moon, as prepared for delivery, at the Center for Global Development event on “Delivering Sustainable Energy for All: Opportunities at Rio+20”, 20 April, 2013 Washington, D.C. <http://www.un.org/News/Press/docs/2012/sgsm14242.doc.htm>, accessed 30 September 2013.

- New and increasingly cost-effective technologies now allow affordable energy services to reach isolated rural communities, which are usually made up of the poorest members of the society. This small change can spark major transformations in health, economic development, and environmental conditions. For many households, reliance on traditional solid biomass, burned in traditional ways, for cooking and heating, is a major health hazard, particularly women and children. Nearly 4 million people – mostly women and children – die each year from indoor air pollution resulting from traditional solid biomass cooking and heating.
- Many actions required for adaptation to climate change necessarily involve enhancement to energy systems, and this work in turn serves as a stimulus for job creation and economic development.

Figure 1: Schematic Diagram of the Energy System



Source: *Global Energy Assessment - Toward a Sustainable Future*, Technical Summary Document, Cambridge University Press, Cambridge, UK and New York, NY, USA and the International Institute for Applied Systems Analysis, Laxenburg, Austria, p. 43.

While in the past energy has often been treated principally as a component of economic development, it is clear that an important conceptual threshold has been crossed, and energy is now being recognized globally as a key nexus in the complex system of interrelated factors related to achievement of sustainable development objectives.

Momentum continues to build for concerted actions at the local, national, regional and global levels that recognize essential nexus between energy and other key components of the sustainable development agenda. Going even further, some countries have asserted, as noted in the country report of Paraguay, that “States should guarantee the human right to water, education, health, communication, transportation, energy and sanitation.”

2.2 Rio+20 and Beyond

While the Millennium Development Goals (MDGs) adopted in the year 2000 did not specifically address energy, energy has been increasingly recognized as a pre-requisite to their achievement, as emphasized by numerous international debates including the World Summit on Sustainable Development (WSSD), and the MDG+10 Summit.²

Energy use has consequences on the surrounding society, irrespective of whether it is dealt with from economic, social, political or environmental perspective. The energy policy recognizes also the need to address economic, cultural and social barriers on the local capacity to design, develop, manufacture, market, distribute renewable energy technologies and provide after-sales services. One of the concerns in the energy policy is the due regard to gender issues.

-- Tanzania Country Report

This recognition was made explicit and brought to the forefront in the outcome document of the Rio+20 Conference, “The Future We Want”, which highlighted “the critical role that energy plays in the development process, as access to sustainable modern energy services contributes to poverty eradication, saves lives, improves health and helps provide for basic human needs.”³ A wide range of multifaceted efforts are now taking place at all levels, with a multitude of stakeholders, to realize the vision of “The Future We Want” and deliver on its promise.

2.3 Sustainable Energy For All

In 2011, the Secretary-General of the United Nations launched the “Sustainable Energy for All” initiative to identify and mobilize action by all stakeholders in support of a major global transformation of energy systems. The initiative has the goal of achieving sustainable energy for all by the year 2030 through the achievement of three major

² Report of the Secretary-General, 2014-2024 United Nations Decade of Sustainable Energy for All, A/68/100. p.4

³ A/RES/66/288. The Future We Want – Outcome Document of the Rio+20 Conference.

objectives: (1) ensuring universal access to modern energy services; (2) doubling the rate of improvement in energy efficiency; and (3) doubling the share of renewable energy in the global energy mix.⁴ This multi-stakeholder effort aims to mobilize governments, the private sector and civil society to make transformational changes in the world's energy system. The Global Action Agenda for the initiative charts a way forward and provides tangible entry points for all stakeholders interested in taking action in specific areas of interest. Sustainable Energy for All is focusing currently on 11 targeted Action Areas, with a particular emphasis on a set of High-Impact Opportunities based on their significance and ability to make an immediate impact towards reaching Sustainable Energy for All's three objectives.⁵

To support this initiative and to underscore the importance of energy issues in the post-2015 sustainable development framework, the UN General Assembly has declared the period from 2014 to 2024 as the United Nations Decade of Sustainable Energy for All.⁶

2.4 Energy in the Post-2015 Framework

In the two years following the launch of The Secretary General's initiative, and gaining momentum in the follow-up to Rio+20, a new and intensive process has begun as the international community prepares for the formulation and adoption of a new framework of Sustainable Development Goals (SDGs). From its inception, this work has recognized and acknowledged the fact that energy is a key ingredient in the recipe for sustainable development.

The availability of a reliable system of energy supply that is efficient, affordable and environmentally sound is crucial for progress in all three dimensions of sustainable development and a condition for transition to a green economy. Energy powers industrial processes, commerce and agriculture and supports the provision of resources in the health, education and water and sanitation sectors.

-- **Gambia Country Report**

The report on the "Initial Input of the Secretary-General to the Open Working Group on Sustainable Development Goals" in December 2012 presents a summary of the responses from 63 Member States to a questionnaire asking them to identify priority areas for the

⁴ United Nations, *Sustainable Energy for All: A Vision Statement by Ban Ki-moon Secretary-General of the United Nations*, New York, November 2011.

⁵ <http://www.sustainableenergyforall.org/actions-commitments>

⁶ <http://www.un.org/News/Press/docs/2012/ga11333.doc.htm>

definition of the SDGs⁷. Energy was ranked among the three main priorities. The results of this exercise reflect the high level of importance that Member States place on energy.⁸

The High-Level Panel on the Post 2015 development agenda has also recognized the importance of energy in the post 2015 agenda, and energy has been identified as one of the Thematic Clusters of the Open Working Group on the development of SDGs.⁹ These multi-stakeholder thematic consultations call for sustainable energy for all as a potential global goal as well as the creation of a global network on sustainable energy for all to help continue dialogues with a wide array of stakeholders on energy issues.¹⁰

2.5 Scope and Methodology of This Report

Rio+20, and the processes leading up to it, generated a tremendous amount of knowledge and learning, and it is important that the knowledge and lessons learned be available to feed into future work on energy and sustainable development. This report is intended to assist country level policymakers, practitioners, and other stakeholders in doing so.

In preparation for the conference, with support from UNDP and UN-DESA, 72 countries conducted participatory consultations to review progress, challenges and gaps in efforts related to the Rio+20 themes. More than 60 countries prepared National Reports reflecting those proceedings and providing summaries of policies and programmes in key areas.¹¹ In 2012, a Synthesis Report was prepared focusing on the priorities most closely related to the Rio+20 outcomes.¹² The Synthesis Report highlights Energy (along with Poverty and Food Security, Water, and Climate Change and Natural Hazards) as key Thematic Areas in its Framework for Action and Follow-Up.

From most Country's Reports, energy is highlighted as a central factor of attention and concern; for others it is discussed only tangentially or as one of many items in a list of

⁷ A67/634, UN GA, "Initial Inputs of the Secretary-General to the Open Working Group on Sustainable Development Goals" 17 Dec 2012, New York, USA

http://www.un.org/ga/search/view_doc.asp?symbol=A/67/634&Lang=E

⁸ Report of the Secretary-General, 2014-2024 United Nations Decade of Sustainable Energy for All, A/68/100. p.13

⁹ <http://sustainabledevelopment.un.org/index.php?menu=1565>

¹⁰ Report of the Secretary-General, 2014-2024 United Nations Decade of Sustainable Energy for All, A/68/100. p.14

¹¹ <http://www.uncsd2012.org/nationalpreparations.html#>.

¹² *Synthesis of National Reports for Rio +20*, United Nations Department of Economic and Social Affairs and the United Nations Development Programme, 2012.

http://www.undp.org/content/undp/en/home/librarypage/environment-energy/integrating_environmentintodevelopment/synthesis-of-national-reports-for-rio-20/.

concerns. Each country has a particular and specific story to tell, based on its individual identity, policy framework and circumstances. There are, however, recurring themes and issues reflecting both regional and global commonalities.

As noted in the main Synthesis Report, “Energy is one of the major thematic issues identified in most national reports; the main focus for these countries is to ensure reliable supplies of energy for economic growth and for urban populations thereby moving away from a dependence on fossil fuels to promote renewable energy both for its environmental benefits, especially on climate change, and the drain on foreign exchange reserves.”¹³



This report drills deeper, identifying and synthesizing the energy-related observations and findings, focusing on the key themes, messages and critical elements emerging from these reports to identify lessons and best practices of interest across all regions. It also highlights the nexus of energy-related concerns with other sustainable development factors, especially as they relate to the three focal areas of the Sustainable Energy for All initiative: universal access to modern energy services, improvements in energy efficiency, and advancement in the movement toward renewables.

¹³ *Synthesis of National Reports for Rio +20*, United Nations Department of Economic and Social Affairs and the United Nations Development Programme, 2012, page 18.

3. Descriptive Synthesis of Energy Issues in Country Reports

The Rio+20 national reports reflect the reality that different countries grapple with energy in very different ways, reflecting their different history and circumstances. In many cases, the way energy issues are approached by a country is driven by the relative scarcity or abundance of its fuels, as well as the existing demand patterns and political frameworks. This in turn gives rise to regional patterns and interactions.

The first “great divide” reflects the current reality that fossil fuels remain the predominant fuel used in generating energy services, and that the sourcing, availability, and cost of fossil fuels is a major driver of national economic realities. It also shapes thinking about the prioritization of resource allocation, the value of increased efficiency and the possibility of mobilizing a significant shift toward technologies using renewable sources of energy.

Discussions of energy in the country reports tend to be oriented sectorally around resource and supply issues, although there is some movement toward a model that considers energy as a means to accomplish policy goals, and considers energy services (rather than energy inputs or outputs) as key indicators.

3.1 *Institutional Frameworks: Policy and Planning*

Virtually all reporting countries cited weaknesses in national-level policy and planning for energy, and particularly the lack of integration of energy-related policies and plans with other sectors and ministries, as a barrier to effective implementation.

Countries vary widely in the ways energy is treated within governmental structures. In some cases the energy portfolio exists as a stand-alone Ministry or Department. In others, it is associated with Mining, Natural Resources, or Water. Some countries have cross-departmental coordinating units at different levels, and some have overarching national planning authorities. In many cases, these line ministries are only loosely connected with policy and planning units focused on sustainable development or environmental protection, which may operate outside of “normal” governmental structures.

There are also big differences between countries in the extent to which energy issues are seen as a core part of an integrated sustainable development framework, although most reporting countries express an intention to move in that direction.¹⁴ Some countries

¹⁴ It seems likely that a broader sampling of countries (as distinct from the group of countries submitting reports) would paint a somewhat different picture. To a certain extent, the countries reporting reflect a self-selecting group of countries that have made high-level commitment to the incorporation of sustainable development as a national priority, and are actively working on doing so.

express the need for a comprehensive refocusing of policy and planning. The Philippines, for example, cites the need that a “review of existing policies and plans must also specifically uncover those that are biased for the prevailing brown economy in any of the following ways:

- Those that are heavily skewed towards economic growth to the detriment of environmental integrity and equity concerns;
- Those that tacitly, if not explicitly, sanction unsustainable and inefficient resource extraction, maintain dependence on fossil fuel energy, high carbon production and consumption; and
- Those that simply reject the internalization of social and environmental costs.”

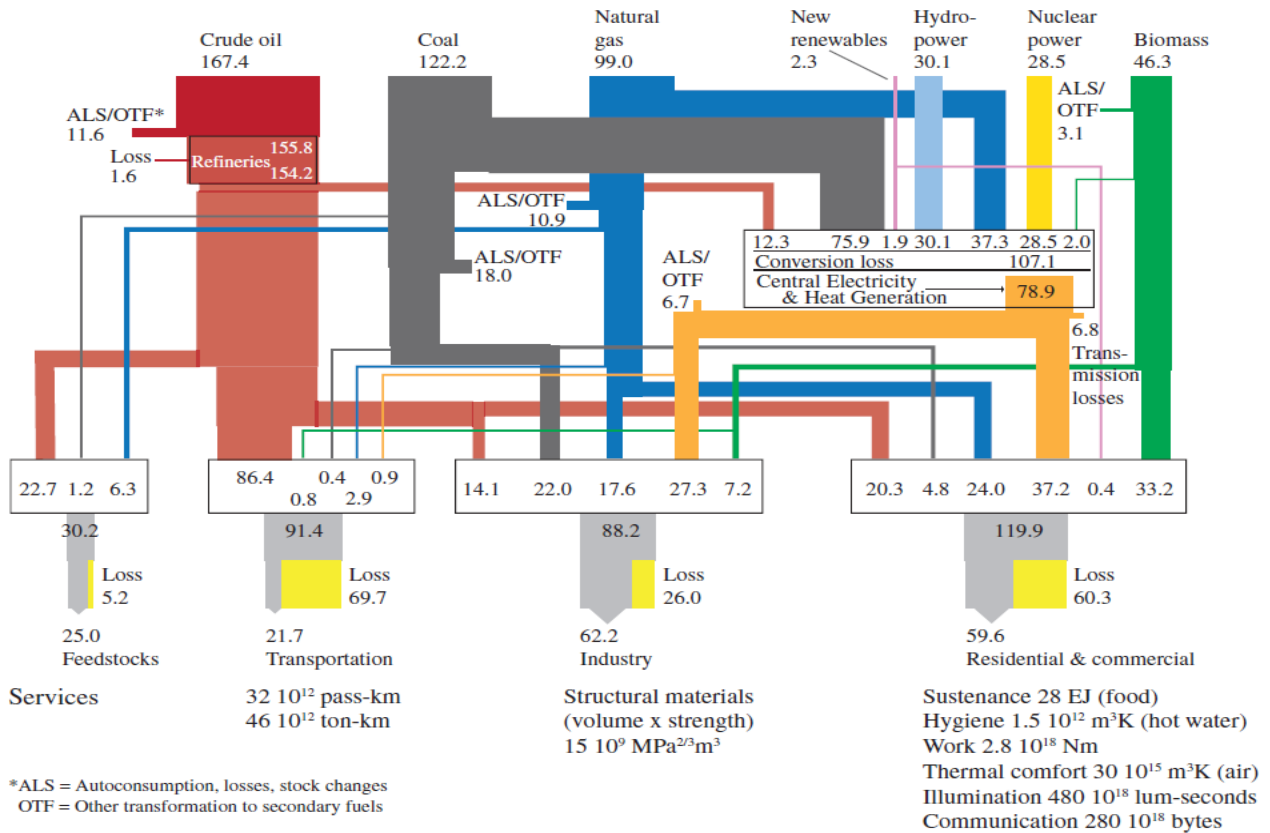
Finally, in addition to the lack of enabling structures and capacity, the country reports reveal limitations in the information and knowledge available to decision-makers. In part, this relates to weaknesses in centralized information-gathering, tracking and analysis of energy-related issues. In part it may also reflect the fact that many existing information systems have been developed to address specific sectoral needs, unrelated to an over-arching vision or connection to related issues. Many countries stress the need to build stronger capacity within government to gather, access and analyze relevant data and statistics using modern tools.



3.2 Energy Resources and Supply Technologies

The review of country reports suggests that as countries face planning for sustainable development within the context of the energy sector, they recognize that each of the pillars of sustainable development and many other sectors affect and are affected by their energy planning decisions and the way that energy development takes place. While a few countries address these issues within the context of energy services, most discussions are still elaborated within the framework of primary energy resource types.

Figure 2: Global Energy Flows from Primary to Useful Energy in 2005 (in EJ)



Source: *Global Energy Assessment - Toward a Sustainable Future*, Technical Summary Document, International Institute for Applied Systems Analysis (Cambridge University Press 2012), Laxenburg, p.45

Petroleum: The discussion of energy resources starts with petroleum because it is the fuel that all countries relate to. Most country economies have been developed around the easy access and use of petroleum, and in many if not most economies, subsidies, taxes, and other aspects of the financial system were set up to encourage its development and use. Petroleum is easy to transport, store and use. It is the primary fuel for transportation in most places and transportation systems are set up for that.

However, country reports of oil-importing countries overwhelmingly discuss the negative pressures that purchasing petroleum has on their economies. Wild price swings of a critical input to their economies leave economic stability vulnerable to factors outside their control. High prices for petroleum products drain valuable foreign exchange from their reserves. In short, countries report that the reliance on petroleum is destabilizing to their economic security. This is the case for both developed and developing economies that are petroleum-dependent. For oil-producing countries, the challenges are different but still very real.

From a global environmental perspective, all countries report the awareness that the use of petroleum products contributes to their CO₂ emissions. Nearly all of the countries reporting in this study have some program in place to attempt to limit or minimize CO₂ emissions. On the local environmental side, they are also aware that the use of petroleum products generates local pollution and particulates, especially transportation sector diesel fuel use.

Arguably, the main challenge facing the Republic of Equatorial Guinea to achieve true sustainable development is to achieve adequate diversification of its economy. As mentioned many times, the development of the oil industry has resulted in the country being focused more on improving that sector apart from others that are indispensable in the economic life of the country. Also, we must consider mechanisms to recognize greener sectors of the economy through subsidies, tax incentives or environmental surcharges, so that those companies that carry out their activities in a sustainable and less harmful way receive appropriate support.

-- Equatorial Guinea Country Report

Finally, on the social side of the equation, petroleum products also have negative impacts on human health. For example, the use of kerosene for primary cooking and lighting runs the risk of poisoning household members when improperly stored, and is also a source of explosions and household fires.

Coal: A primary economic consideration listed by all countries includes coal as beneficial in displacing imported petroleum for the production of electricity. This allows for greater economic stability and the desirable increased reliability of locally sourced energy resources. Some countries are considering developing and selling new coal resources (either directly or as coal-converted-to-electricity) to bring in additional revenue streams to their economies. In some cases this would allow them to reduce some of their imported oil expense. In addition, developing new resources would bring new jobs to the economy.

Environmental considerations linked to the use of coal mentioned by most countries include the relatively high contribution to climate change that accompanies coal's generation of CO₂ emissions which is primarily from burning coal to produce electricity. Coal use also contributes to acid rain and pollution from particulates.

On a more local level, coal is also found to have a strong negative impact on human health and indoor air quality when used as a primary domestic cooking or heating fuel. In addition, coal development affects water availability and quality. Water is used extensively in extracting, processing and using coal, especially in the generation of electricity. The Botswana Energy Policy Brief reported that as the country is considering developing its coal resource it does so with the full awareness that "... with acute water shortages Botswana is yet to face, exporting coal-generated electricity is in part, exporting water and the gains need to be assessed more critically." To a lesser extent, the full development and utilization of many other primary energy sources such as petroleum will also strongly

impact water quality and availability for other uses such as domestic use, agriculture, and biodiversity protection.

Natural Gas/LNG: Natural Gas is considered in a favorable light by many of the reporting countries. On the positive side, it is an indigenous resource for many countries. Developments and improvements in natural gas extraction technologies in other parts of the world have made its extraction in countries that have not yet developed their gas resources more feasible. Countries eyeing future gas development are anticipating the benefits it will bring to their economies, including improving their balance of payments. In addition, it will help stabilize the swings in total energy costs faced by economies more strongly dependent on imported oil. As with developing coal resources, developing new natural gas resources will also generate new jobs.

Positive climate impacts are also cited by country reports; natural gas combustion emits much less CO₂ than coal or even oil. Other negative air quality impacts such as the emission of particulates and sulfur oxides are also less when burning natural gas instead of coal or oil. In households, gas is widely considered a clean, efficient, modern cooking fuel.

As some point out, the ability to store gas allows for flexible timing of its use. Thus, using gas as a backup fuel could help encourage the use of more renewable energy sources that are time or weather dependent. Another benefit cited in particular by Albania, is the ability of gas to be stored in that it allows enhancing food security because it will be available when food needs to be processed.

However, countries are also mindful of challenges that can come with using natural gas. If executed badly, extracting natural gas can generate methane leaks, and methane is roughly 20 times more potent in its global warming potential than CO₂. Also, depending on extraction techniques, the development of natural gas resources could lead to groundwater pollution. There is also a serious agriculture sector nexus to be considered in the use of natural gas use as an energy source, given the competition between natural gas as a fuel and as a chemical feedstock for fertilizer in some countries, such as Bangladesh.

Traditional Biomass – Fuelwood: Worldwide, nearly three billion people rely on traditional biomass – typically collected fuelwood – for cooking and heating. This reality has enormous impacts on health, productivity and the prospects for sustainable development. Most critically, indoor air pollution made up of smoke from polluting and inefficient cooking, lighting, and heating devices, kills nearly 4 million people each year and causes a range of chronic illnesses and other health impacts (including burns).¹⁵

¹⁵ <http://www.unfoundation.org/what-we-do/issues/energy-and-climate/clean-energy-development.html>

Widespread burning of wood in traditional stoves is also a source of outdoor ambient air quality degradation through the generation of particulates.

Women and children are primarily responsible for collecting fuelwood in areas where it is the predominant domestic fuel. Each hour they spend collecting wood takes them away from more productive work or study. The poor dependent on wood for energy therefore have fewer opportunities to improve their economic condition than those who are able to afford modern cooking fuels and lighting sources. Food production suffers. Many countries indicate awareness of the challenging gender and economic issues involved in the unsustainable traditional use of fuelwood for cooking and heating – although data are incomplete and often unavailable to policymakers.

Unsustainable use of fuelwood threatens the integrity and health of forests in many places around the world. When forests are cut back due to unsustainable wood harvesting, biodiversity is negatively impacted. Other environmental pressures resulting from unsustainable traditional fuelwood use includes damaged watersheds and the ensuing negative impacts on water availability and quality. Countries with current or potential tourism economies also note the potential negative impact on tourism revenues resulting from loss of forests.



When sustainably gathered and used with modern cookstoves, fuelwood has the potential to be more carbon neutral than fossil fuels in many cases. Unfortunately, for many countries, this is not the case.

Other Biomass: Much less widely used than fuelwood are other forms of biomass. Burning some of these, such as bagasse, to generate electricity can have a positive impact on a country's carbon balance sheet. If executed successfully, combustion of crop wastes and other biomass can displace petroleum and other fossil fuels. For example, Uruguay listed several projects of this type in its report, funded in part by the Global Environment Facility (GEF).

Another potential use of biomass is its conversion to liquid fuels. Many country reports mentioned this possibility. Again, depending on the process, this has the potential to displace petroleum use and help stabilize energy prices and the country's economy. With the right technology, using non-traditional biomass to generate liquid fuels can also lead to reductions in net carbon emissions.

Setting up the system to produce liquid fuels from biomass would also improve a country economy by creating jobs. This would also impact the educational system due to the need to be able to train workers to install, operate, and maintain these new fuel systems. On a smaller scale, biogas on rural farms could be generated by the conversion of biomass and used in hybrid installations to even out the sporadic nature of solar photovoltaic (PV) production, as is proposed in the Botswana country report. However, if not done well, and if crops are grown to generate liquid fuels that compete with food-based agricultural activities, food prices could increase, sometimes dramatically.

Hydropower: Many reporting countries are developing significant levels of new large hydropower production facilities. They see hydropower as a very good, low-carbon emitting electricity generation resource. New hydropower generation plants can either replace petroleum-based electricity generation, or can provide power for areas that are currently facing an electricity deficit. Both of these are desired outcomes in the country reports.

In addition to the positive impacts that new hydropower can have on the economy and the environment, countries list the benefits that expanding access to power has for them, including improving health outcomes by providing power for air conditioning and hospitals, and enhancing the gender equity balance due to less time looking for fuelwood, and providing lights to enable nighttime farming activities.

However, the reports also mention the need to consider other nexus factors, including potential population dislocations, and the possibility of net carbon emissions resulting from new hydro reservoirs (mentioned in the Cambodia country report). Finally, the proper development of new hydropower would provide for the protection of watersheds to conserve biodiversity, provide adequate quantities and quality of water for domestic and agricultural use, prevent landslides and erosion, and have a neutral or positive impact on fisheries. If not executed well, the development of hydropower could put any of those other sectors at risk.

In addition to the factors listed above mainly for large-scale hydropower facilities, the Armenia country report mentions potential agricultural water resource depletion issues and safety issues involved with landslides accompanying inappropriate and unsustainable

small hydro development. The report warns of the dangers of developing small hydro too quickly before the human and budgetary capacity to adequately monitor safe development is in place, noting that “All the above mentioned problems can cause social and economic tensions.”

Nuclear: Several country reports address nuclear energy, from both sides of the equation. On one hand, some countries are assessing whether they will need to close down operating nuclear plants in light of the international financial and regulatory environment developing in the wake of the Fukushima accident. For example, Armenia’s country report highlighted the planning that country is doing to ensure energy independence if their nuclear plant is shut down.

On the other hand, some countries are planning to develop and install new nuclear power plants. Belarus, for example, reports a target of 2018 for startup of a new nuclear plant. From the perspective of countries like Belarus, nuclear power has the positive environmental attribute that it allows them to produce power with lower carbon dioxide emissions than those associated with fossil-fuel-powered electricity generation. Both of these are offsetting factors in the environmental equation, and every country is in a different position in their development, planning and consideration of these elements, so they come to different answers to the nuclear energy planning question.

Another environmental nexus factor countries consider when assessing nuclear power is the demand that nuclear plants would place on their country’s water resources.

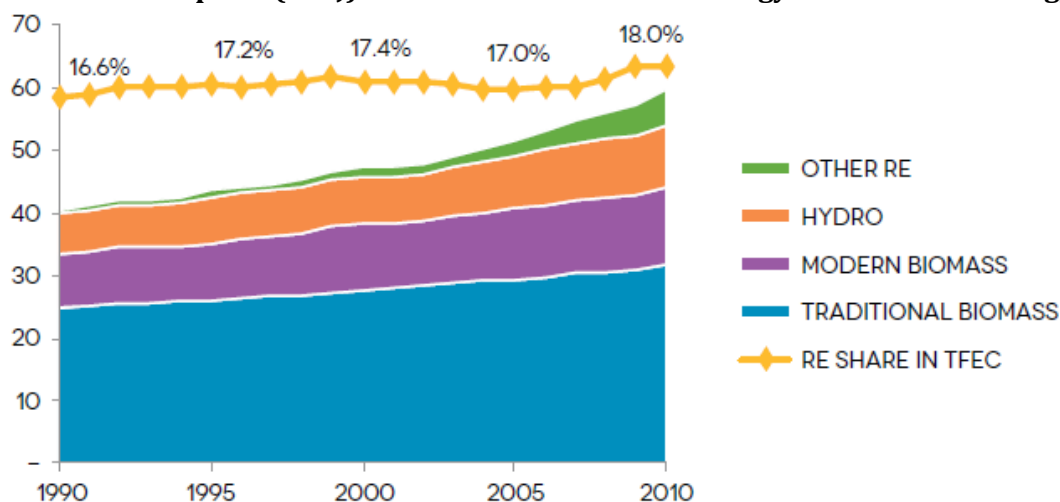
Assessing the economic aspects of nuclear power, countries appreciate that using nuclear fuel to generate power helps shelter their economies from the swings associated with dependence on petroleum. Developing a nuclear industry will also generate employment opportunities, but with that, will also require the capacity development in the country to adequately train the people who will be working in the industry.

From a social perspective, countries employing nuclear power will have to satisfy their constituencies that the plants will be designed and operated in a way that safeguards human health in the face of possible accidents resulting from natural disasters, sabotage, or operator error.

Renewable Energy Resources: All of the country reports cite some effort to encourage the development of their renewable energy resources, and they are at different stages in this process. Countries further along the path to renewable energy deployment have inventories of renewable resource potential and goals and strategies for its development. Other countries are in the early stages of the process and state that they need assistance

even quantifying the extent of their renewable resources. Wind and geothermal resources seem to be cited more than others in this category.

Figure 3: World Consumption (in EJ) and Share of Renewable Energy in Total Final Energy



Source: *Overview Global Tracking Framework Vol 2. SE4ALL*, (Washington DC 2013) World Bank, page 28

Renewable energy resources share the positive economic attribute of enabling a country to displace expensive, destabilizing petroleum from their fuel mix. An additional desirable economic factor is that installing and maintaining renewable energy technologies is seen as a way of encouraging “green sector” employment growth. A positive environmental quality is that renewables allow countries to add low-carbon emitting sources of electricity production to their portfolios. Along with avoiding CO₂ emissions, most of these technologies also avoid the emission of other major pollutants such as particulates and sulfur and nitrous oxides associated with the combustion of fossil fuels.

Countries anticipate that in addition to contributing to the enhancement of environmental health, using renewables (especially in rural areas) will contribute to the enhancement of human health by giving people cleaner options for satisfying the need for energy services for cooking, lighting and heating. This is especially true in areas where deploying renewables will help avoid the unsustainable and ambient air polluting use of fuelwood for cooking. Countries also cite anticipated improvements in gender equity resulting from rural women being able

To reduce emissions of greenhouse gas emissions in the country and reduce the high dependence on fuel imports, in particular for the production of energy, the government of Djibouti has launched in 2011 a combined project of wind power and seawater desalination. This project is funded by the European Union Europe at an estimated cost of € 80 million. The goal is to install a wind farm 20 MW connected to the national grid and install a seawater desalination plant of 45,000 m³ of drinking water per day.

-- Djibouti Country Report

to save the time and energy now spent gathering fuelwood through the use of renewable energy technologies to satisfy their domestic energy service needs.



3.3 *Intra-Regional and Trans-Regional Issues*

Typically, country energy planning is done within a regional context. In the modern world, countries are inextricably connected to, interact with, and rely upon their neighbors to serve as markets for excess capacity or as sources of resources where the country is deficient. This was noted as an important reality in all regions, with island nations being the exception where direct natural gas pipelines or electricity interties are not possible. Countries in all regions stressed the importance of regional networks, energy exchanges and South-South partnerships, highlighting current and planned projects and programmes. These activities facilitate least-cost development of sustainable energy resources by enabling countries to share the economic benefits of their own competitive advantages.

As they develop their energy resources, nations in **West Africa** are also strengthening the connections between them. Niger, which imports nearly 70% of its electricity from neighboring Nigeria, is an example. As Nigeria is working to capture and use the now mostly flared natural gas generated as a byproduct of its oil extraction industry, it has developed a natural gas pipeline that can ship natural gas as far west as Ghana. There have also been reports in the press regarding proposed sales of electricity from Ghana to Nigeria, and other power sales are contemplated among the group of 14 countries comprising the West African Power Pool.

North Africa is blessed with abundant solar energy resources. The Algeria country report suggests a plan for developing these and exporting them to Europe, stating that the National Energy Plan calls for the development of 22,000 MW of new renewable power production by 2030, and has plans to export 10,000 MW of that to Europe.

In **South Asia**, electric power is also transmitted between countries. Bangladesh in particular is dependent on imported power for satisfying its electricity demand. “Regional power sharing will be a key factor in solving Bangladesh’s acute power crisis. To meet the acute shortage of power, Bangladesh has signed an agreement with India to purchase 250 MW from one of their state-owned corporations and is in the process of purchasing another 250MW from private Indian power companies.... Bangladesh is also exploring import of power from Nepal and Bhutan and setting up of a tri or quadrilateral sub-regional cooperation structure for the power sector with win-win incentives for all the countries.”

South East Asia has extensive potential for intra-regional synergies, particularly as related to hydropower. Lao PDR is the principal electricity exporter. According to the Lao country report, “The Mekong River and its tributaries in Lao PDR provide rich water resources and ecosystems, with excellent potential for power generation, irrigation development and ecosystem conservation. Hydropower potential has been estimated at 18,000 MW; until now, however, only 25 percent of this potential has been used.” Much of the capacity that has been developed is available for export, at least during the rainy season. Lao PDR exports power to Thailand, and these exports influence the planning of neighboring countries, including Cambodia. According to the Cambodia country report, plans to increase their rural electrification rates “could include securing firm commitments for power imports from neighbouring countries, e.g. Lao PDR, as it is likely to have surplus power for some time.”

Island Nations, and particularly small island developing states (SIDS), have distinctive challenges and concerns. The primary theme of most island nations’ energy stories is the dependence on imported petroleum products, with the ensuing drain on the economy and vulnerability to oil price volatility and supply disruptions. In addition, island nations are on

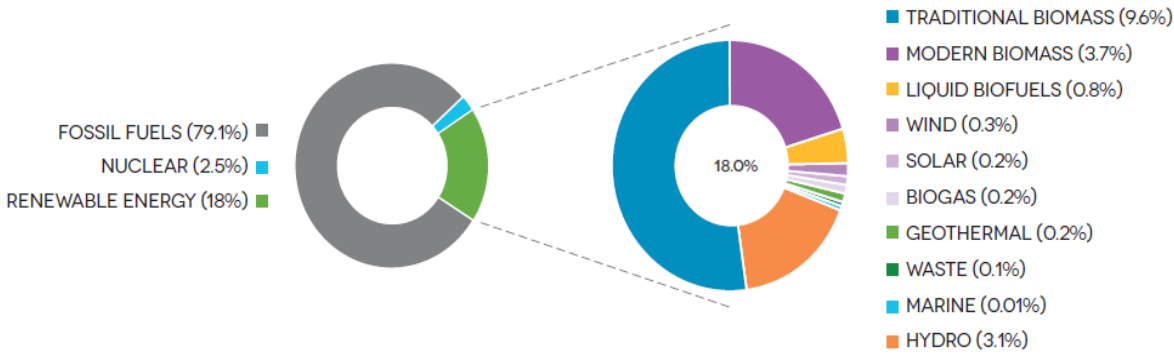
the leading edge of the world in having to adapt to climate change, with sea levels rising at unprecedented rates. And while many of them, like Antigua, have the desire and goals for charting “a coherent low-carbon way forward,” they don’t have many existing indigenous alternatives for doing so.

Larger, more developed countries like Jamaica have already started developing renewable resources. Jamaica’s report indicates that “...currently, 9% of the country’s energy supply mix comes from renewable sources such as wind, mini-hydro, solar and biomass (mainly fuelwood, ethanol from sugar cane used, and bagasse used in co-generation facilities).” But Antigua is more typical of smaller countries just getting started in their transition to a greener economy, and reports that while solar hot water technology is widely in use on the island, other forms of renewable energy are seen as too expensive to be widely accepted now. The Antigua report cites the need to gain access to financing for renewable energy “on equal terms” with diesel generation. This is also the case for many other island nations, as well as many oil-dependent developing countries.

3.4 Transition to Renewable Sources of Energy

One of the three principal objectives of The Sustainable Energy for All initiative is to double the percentage of energy from renewable sources in the global energy mix. Momentum in this direction is already building. The investment in renewables has more than doubled – to \$260 Billion, or more than 15% of total global energy – in the last five years. The Rio+20 Country reports indicate that adoption of renewables is a major priority, and in addition to sustainable biomass, countries are considering implementing a range of other renewable energy sources. The most prevalent of these include solar thermal and photovoltaics (PV), biofuels, wind, and geothermal, with other approaches. As with other energy technologies, upfront capital costs remain significant barriers to entry.

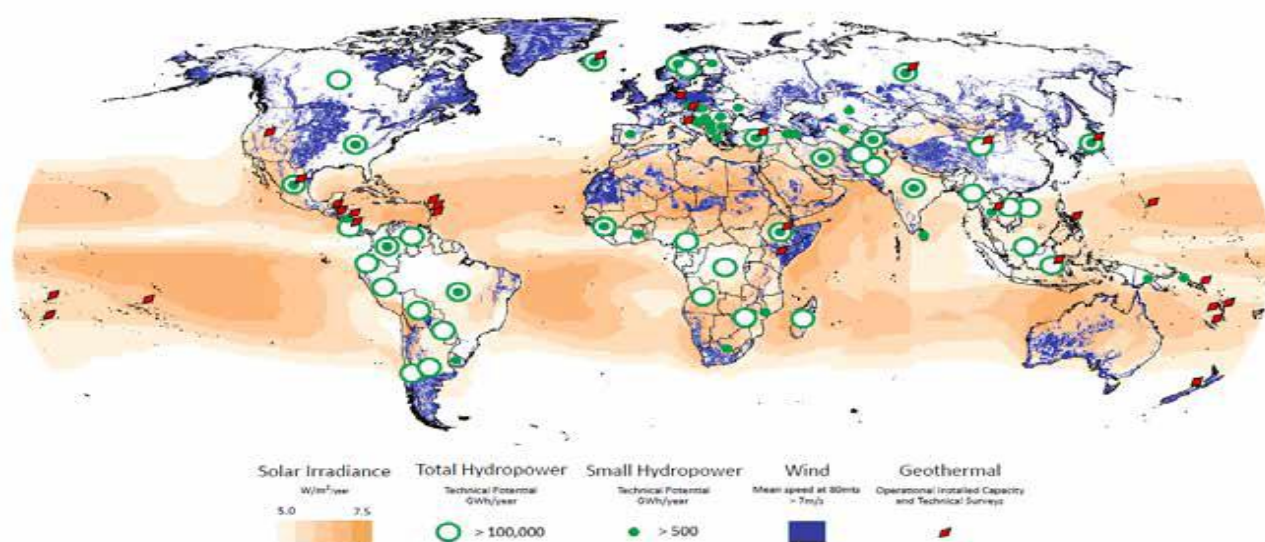
Figure 4: Share of Renewable Energy



Source: *Overview Global Tracking Framework. Vol 2. SE4ALL*, (Washington DC 2013) World Bank, page 29.

Solar is the most cited non-hydro or biomass renewable energy source in country reports. For many developing countries, solar energy has tremendous potential, particularly as a way of reaching off-grid rural and isolated populations. To date, solar energy is most often used at the small-scale, end user or community level. Many, but not all, reporting countries have programmes in place to facilitate installation of solar hot water devices at the household level. PV continues to be seen as expensive, although this is rapidly changing with the drop in PV panel costs and the emergence of new technologies and financing approaches.

Figure 5: Potential for Hydro, Solar, Wind, and Geothermal



Source: *Overview Global Tracking Framework Vol 3. SE4ALL*, (Washington DC 2013) World Bank, page 224.

Wind resources are available, abundant and reliable in many parts of the world. One of the specific challenges noted in country reports regarding the installation of wind energy technologies is the lack of good wind resource mapping for their countries. In addition, as with other technologies, the substantial up-front capital investment required and the need for a high-quality network of trained installation and maintenance personnel represent barriers for countries considering the implementation of larger-scale wind generation capacity.

Burkina Faso does not have a tradition of recycling and waste-to-energy. But waste management and recycling can create jobs and income for the poor, help clean the environment and improve quality of life. In this perspective and in the context of a green economy, political focus must first be placed on biomass waste that can be composted or be used for energy recovery followed by development and adoption of a national policy on solid waste. This policy must be the result of a dialogue between government, industry production, the actors in the management of waste, and the international community.

-- Burkina Faso Country Report

Waste-to-Energy technologies have the

potential to be win/win/win solutions for both developed and developing countries. Yet, while many countries mention problems with garbage and waste, only a few reports identify waste-to-energy as possible power sources, either through landfill gas recovery or combustion and generation. This is an example of a nexus opportunity that is underappreciated, and where the availability of more information for planners could be useful to present the opportunities to decision-makers at all levels dealing with waste disposal issues.

Geothermal opportunities are highly dependent on the particular geological attributes of the area, and some countries with known geothermal resources have taken great advantage of this. Many developing countries, however, including many with clear potential, lack an adequate mapping of the resources.

Challenges in Developing Renewable Energy Sources Common to All Renewables

As one report notes, “A number of market and regulatory conditions need to be put in place and large scale financial resources will have to be mobilized to achieve the transition to a green economy.” Some of the specific challenges to developing renewable energy sources in a green economy are mentioned in the country reports and can be placed in five basic categories.

- **Lack of Political Will:** As Antigua puts it, “fossil fuel interests in the economy are not won over yet.” Sometimes it takes education of both public and private groups about the importance of sustainable development and the potential win/win/win of the nexus approach to providing energy services for sufficient support to be gained to make the required changes in the economic planning system.
- **Lack of Capital to Invest in Higher Cost Green Technologies:** Although in the long run they can be lower cost, green technologies often have higher up-front costs. Many countries lack the capital and and/or the financing capacity to pay for them.
- **Lack of a Level Playing Field for Renewable Energy:** Several factors contribute to this. One is that the current system of subsidies and tariffs in many countries are set up to favor petroleum-using technologies. Also, the real and unavoidable costs of degrading the environment resulting from unsustainable technology use are often not factored into the prices that are paid for coal or petroleum use. Import tariffs on PV and other renewable energy devices are too high in some countries. Finally, embedded subsidies in grid-provided electricity and fossil-fuel pricing frequently make solar seem less attractive than it would otherwise be.

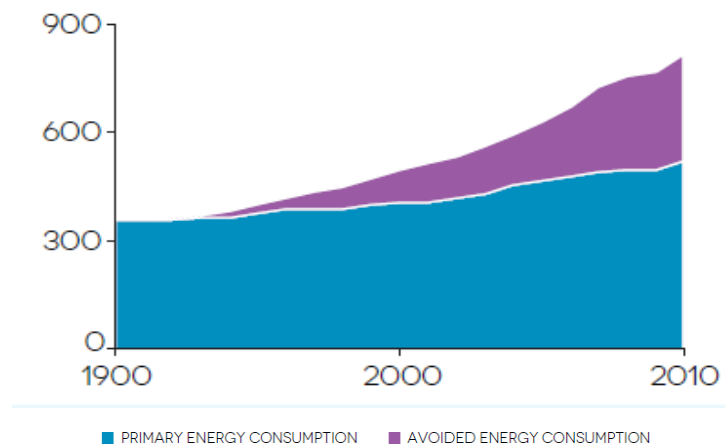
- **Lack of Knowledge about Renewable Energy Technologies and Renewable Energy Resource Potential:** There is a general perception that decision-makers in both the private and public sectors lack access to accurate and actionable information about renewable energy technology costs and performance characteristics. Also, in many countries renewable energy resource mapping has not been completed.
- **Lack of Skilled and Trained Green Equipment Installers and Operators:** Where renewable industries have not been established, training centers to produce adequate numbers of skilled artisans have also not been established.
- **Economic Downturn and Subsidies:** Global economic conditions and the recent worldwide recession have led some countries to subsidize oil in order to keep their economies afloat, and they are reluctant to dial back the subsidies too quickly. The G-20 and the Rio+20 conference have called for the phasing out of harmful and inefficient fossil fuel subsidies that encourage wasteful consumption and undermine sustainable development, noting also that this should be done carefully, and that the removal of the subsidies not negatively impact the poorest and most vulnerable members of society.

3.5 *Improving Energy Efficiency*

Improving energy efficiency, one of the three objectives of Sustainable Energy for All, is critical to meeting future energy demand and mitigating climate change. By reducing energy demand, efficiency also makes renewable energy more affordable – shrinking the size of the solar panel needed to power a lamp, for example. It also creates jobs, fosters economic growth and improves energy security.¹⁶ Improvements in efficiency can take place on the production or “supply” side – with upgrades to infrastructure and technology resulting in the availability of more useful energy given the same resource inputs. It can also be implemented on the consumption or “demand” side – both through incentives to reduce levels of consumption and use to sustainable levels and through adoption of more efficient end-user devices. Adopting cost-effective standards for a wider range of technologies could, by 2030, reduce global projected electricity consumption by buildings and industry by 14%, avoiding roughly 1,300 mid-size power plants. Between 1990 and 2006, increased energy efficiency in the manufacturing sectors of 21 member countries of the International Energy Agency resulted in a 21% reduction of energy use per unit of output.

¹⁶ <http://www.sustainableenergyforall.org/objectives/energy-efficiency>

Figure 6: Energy Savings from Realized Improvements in Energy Intensity (in EJ)



Source: *Overview Global Tracking Framework Vol 2. SE4ALL*, (Washington DC 2013) World Bank, page 28.

Decisions affecting energy efficiency are made at many levels, from the individual household to central economic planners. Energy efficiency improvement actions can be generated from both private and public sector actors and be done at the individual or group decision-making level. Examples of approaches cited in the Rio+20 country reports include:

- **Create an Energy Efficient Culture:** One place to start in approaching energy efficiency is to make sure that it becomes a filter through which all planning decisions are made. Belize states in its National Sustainable Development Report that it seeks to “Create an energy-efficiency and conservation culture; not just the uptake of appropriate energy-efficient technologies, but a whole mindset extending across the public and private continuum on the rational use of energy.”
- **Energy Use Standards and Efficiency Codes:** Many countries, including Armenia, Bangladesh and Cote d’Ivoire and others report implementing or planning to implement energy use standards at all levels of the economy. These include the household level (lighting and appliance efficiency standards), building level (minimum new building energy efficiency heating and cooling standards and lighting standards), transportation (automobile, mass transit and truck energy use standards), and industry (process and materials use standards).
- **Efficiency in Fossil Fuel Production:** Countries such as Nigeria are working to improve processes and eliminate wasteful (and harmful) practices such as natural gas flaring. Recapture of gas that is now flared can both improve efficiency and reduce methane and other greenhouse gas emissions.

- **Labeling Programmes to Provide Energy Use Information to Consumers:** These programmes require manufacturers to advertise the energy use profiles of their products so consumers can make educated investment decisions. Automobiles, lighting, and appliances are some of the products that could be covered by energy use labeling requirements.
- **Demonstration Projects (Distribution of Energy-efficient Devices):** One of Nigeria's first projects was to disseminate efficient lighting to encourage energy awareness. Distributing efficient devices accomplishes two purposes; education about the availability of more efficient alternatives, and demonstrating how they work to help overcome the social/habitual use barriers to adaptation of new devices.
- **Look for Conservation in All Sectors Including Electricity Generation and Distribution:** Jamaica reports that in addition to the buildings sector, it was able to achieve significant energy savings in its electricity generation and distribution system.
- **Include Transportation Considerations in Urban Planning to Support Mass Transit and Non-Motorized Transport Sector Approaches:** Through its participation in the UNDP project "Down to Earth: Territorial Approach to Climate Change (TACC)," Uruguay has developed a sophisticated regional land use and development planning approach. This approach involves stakeholders at all levels in planning decisions that impact sustainable urban development in all sectors, including transportation.¹⁷
- **Make Biking and Other Non-motorized Transportation Safer and More Desirable:** Botswana reports that its National Development Plan for 2010-2016 "targets decentralizing some transport functions to local authorities to allow for increased focus on such elements as non-motorized transport," finding that non-motorized transport is not feasible for distances over 10 km. The need to travel those distances can be created by uncontrolled urban sprawl.
- **Better Signage to Encourage Mass Transit:** Botswana also reports that they are hoping to increase ridership in shared passenger mass transportation by simply improving the way that signage is used to publicize the routes and locations of the stops.

¹⁷ The set of tools developed by the UNDP to facilitate this integrated planning is available at http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Climate%20Strategies/TACC_report.pdf

- **Increase Energy Efficiency in Public Housing Stock:** Countries with aging public housing stock report that replacing it with more efficient housing is a high value target for achieving large energy conservation gains. Belarus is one country where this has taken place.
- **Progressive Rate Structures:** Charging higher prices for higher levels of power use can encourage electricity conservation. For example, The Bhutan Electricity Authority has fixed a “slab pricing system” where the power tariff progressively increases with the increase in power consumption. According to their report, “This pricing system provides the first 100 units of electricity consumption at a significantly low price as a measure to make electricity affordable to the poor and low-income group. Concurrently, the progressive price increase is expected to deter wasteful consumption.”
- **District Heating/Combined Heat and Power (CHP):** Countries with significant heating demands can consider opportunities for implementing district heating in their cities. Often, this can be accomplished through combined heat and power units, as accomplished in Belarus.

Challenges

In most cases, the economic returns or paybacks resulting from actions to improve energy efficiency exceed those of almost any other way of providing new energy resources. Yet few reporting countries have thus far adopted a major emphasis, or made substantial progress, in energy efficiency. An important question is then, if these investments are so profitable, why aren't they all being done now? The answers are many and varied, and country reports that discuss the issue highlight the up-front costs of substantial supply-side efficiency improvements. On the demand-management/conservation side, factors include the reality that (1) users of energy are often not the ones who pay for it or determine the equipment that uses it, and (2) there is often little or no feedback (such as metered electricity service) to users on the amounts of energy they use and the consequences of actions they take to change the levels of energy that they consume.

- **Lack of Information on and Access to Best Energy Efficiency Approaches:** In many countries the people making decisions about installing new energy-using equipment do not have access to information about the most efficient way to provide the energy services they seek to provide. Even if they do know there is a better way to provide the energy service, systems may not be in place to allow them to gain access to or put into place the more efficient device or practice.

- **Lack of Capital:** Even though energy efficiency improvements have high returns, many energy service users simply do not have access to the up-front funds required to implement them.
- **Consumers of Energy Services Do Not Pay for Energy or the Equipment That Uses It:** For example, in many cases urban apartment dwellers do not see individual bills for the electricity or heating fuel allocable to their dwelling unit.
- **Lack of Price Signals on True Energy Costs:** Rate structures often are not set up to follow the true cost of providing the energy. For example, electricity produced in peak periods of use can cost much more than that produced during periods of average demand. These prices are often averaged out and not passed on to the consumer in a manner that gives them price feedback to empower them to change their use patterns if they wanted to. Also, in almost no arena do energy service prices include the total cost of dealing with the environmental impacts that follow their use.
- **Difficulty of Changing Ingrained Behaviors:** Unless there is a dramatic shift in the environment that forces change, people generally will continue to exercise learned habits of energy service consumption behaviors. Energy service use patterns often are based in culture, and changing them involves more than simply exchanging one device for another. For example, changing a cookstove can necessitate changes to the way that meals are prepared. Opting to take public transportation rather than driving a private automobile in the user's mind might signal something unwanted about socioeconomic status.
- **Industrial and Building Planning Decisions Can Lock In Inefficient Energy Use:** If planning for new buildings or industrial facilities is done without consideration for long term sustainability, relatively inefficient equipment or processes with long lifetimes can be locked in place in the economy, because they will be too expensive to change out until they are retired.
- **Urban and Transportation Planning Can Lock in Inefficient Energy Use:** Similarly, if plans for urbanization and urban growth and their associated transportation demands proceed without the benefit of the filter of sustainable development, patterns of energy use will be set in place with no regard for potentially lower-carbon alternative use patterns. This unfortunately could permanently shut out many opportunities for saving energy.

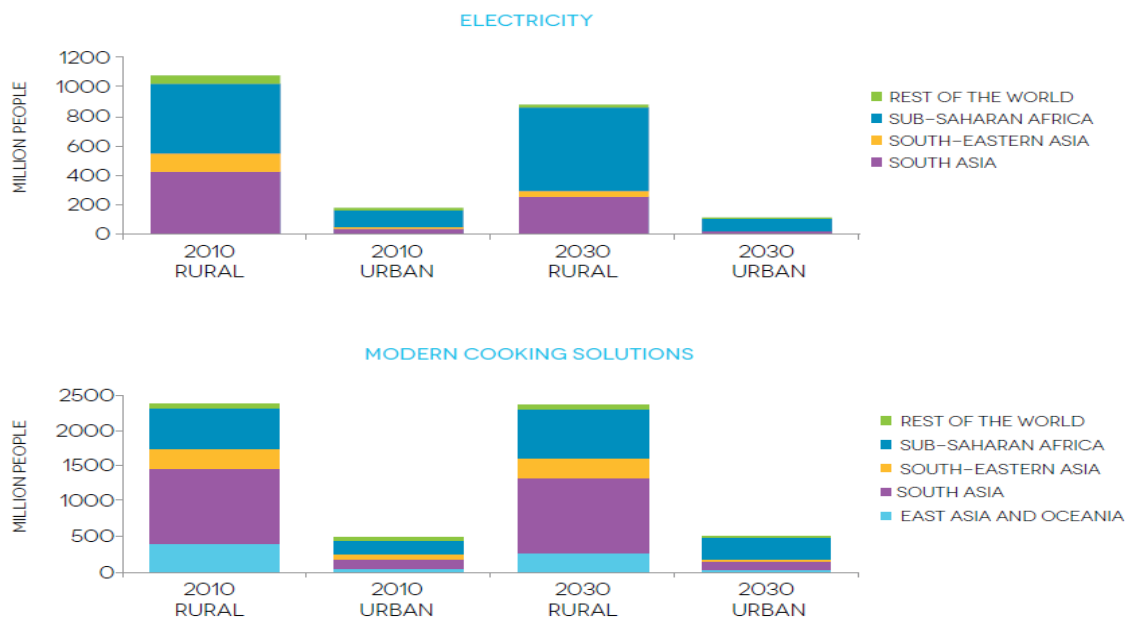
- **Lack of Data for Tracking Energy Use:** In many places, data on energy use is not available on a disaggregated basis. Planners and energy users therefore have no way of knowing how their changing actions are affecting ultimate energy use. This makes setting and meeting energy efficiency targets very difficult.

3.6 Access to Energy Services for Rural Areas

Of the more than 1.2 billion people who lack access to electricity, around 1 billion, or 85% live in rural areas. Rural areas present one of the major challenges at the nexus of energy and the achievement of sustainable development goals. Despite the growth of mega-cities, rural areas are home to many of the poorest, most vulnerable, and least represented people in the world. Furthermore, rural environments are frequently fragile and threatened by land degradation, scarcity of water resources, desertification, and loss of biodiversity. Yet, paradoxically, for most developing countries dependent on agriculture, rural areas are key to the nation’s viability.

Rural areas are often isolated, in many ways. Physically, distance and terrain make the provision of electricity from centralized sources impractical or unaffordable. Socially and politically, rural populations are often marginalized, lacking effective voice and capital in the corridors of national power and planning.

Figure 7: Number of People without Access in Rural and Urban Areas



Source: Overview Global Tracking Framework Vol 2. SE4ALL, (Washington DC 2013) World Bank, page 18.

The implementation plan for the Sustainable Energy for All initiative recognizes the importance of supporting rural isolated communities in their efforts to secure access to modern energy services. There is a growing recognition that newly affordable technologies such as low-cost standalone and “mini-grid” solar PV systems for households or communities, along with advanced cookstoves, can provide opportunities for breakthroughs in key sustainable development factors in rural areas.

This is an area ripe for major initiatives at the national and international levels, with major opportunities for public-private sector partnerships to provide outreach and establish cost-effective market-based marketing, distribution, and service networks. As noted below, access to capital financing is one of the key barriers that must be overcome to create viable avenues to reach the rural areas. Furthermore, since rural areas are generally poor areas with limited cash economies and income potential, few private companies have considered it worthwhile to invest in the development and distribution of products serving that market. Still, many countries report significant advances, and innovative implementation models and initiatives are noted throughout the Rio+20 country reports. These include:

- **Public/Private Partnership Companies to Provide Packages of Devices Appropriate for Rural Households – Bangladesh and Botswana:** Both Bangladesh and Botswana have developed free-standing companies to offer packages of energy systems appropriate for the rural communities in their countries. In Bangladesh, “Infrastructure Development Company Limited (IDCOL) has so far installed a total of 1.4 million solar home systems (SHS’s) ... and about 500 biogas plants are being set up by IDCOL every month.” In Botswana, Électricité de France and Botswana Power Corporation partnered in a private company with a franchise model to provide integrated packages of solar home systems and lights,

With more than 90% of Ugandans depending on wood fuel, forest cover has consistently declined over the years, with dire consequences for the general environment and mankind. In an effort to counteract this trend, a local NGO implemented a pilot project titled “Promoting Alternative Energy Sources and Sustainable Use of Energy in Schools”. The project was implemented in five schools with the objectives of increasing knowledge, awareness and capacity to use and manage alternative energy sources in Mukono District; and increasing the use of solar energy systems and improved stove technologies, and exploit their commercial and economic potential. The interventions in each school included (i) establishing a school woodlot; (ii) construction of a demo improved institutional energy saving stove; and (iii) installation of a solar energy system.

Through these interventions, significant savings were made by the schools in terms of expenditure on purchase of firewood. Other impacts resulting from these interventions include reduced degradation of natural forests in the neighbourhood as less firewood was required by the schools; improved school performance since students were able to do their night preps using solar lighting; improved kitchen hygiene and health of cooks since the improved stoves do not emit smoke; reduced theft of school property as the solar lighting improved security around the school; and schools acquired their own firewood sources from the planted woodlots.

The popular participation of all stakeholders and effective project implementation committees were pointed out by the beneficiaries as being largely responsible for the success of the project.

-- Uganda Country

efficient cookstoves, and heat retention cooking bags.

- **EcoVillages Senegal:** Working with funding from the Globe Environment Facility (GEF), Senegal has developed an EcoVillage concept, where 100 home micro-grid solar systems with batteries have been deployed, in conjunction with activities to plant biofuel feedstock crops and utilize agroforestry techniques. The project also involves the introduction and use of efficient cookstoves and biogas digesters.
- **“Pico” devices, Micro-Finance, and Pay-As-You-Go:** Faced with the challenge of marketing to consumers who lack the cash to make even modest up-front investments, countries have been exploring and implementing a range of models to reduce or remove that barrier. One widespread approach is to encourage the use of extremely inexpensive standalone PV-powered devices (such as solar lanterns) to meet lighting needs. There are also “rent-to-own” models, targeted micro-lending, and “pay-as-you-go” metered service and devices that can be activated via cell phone sim card technology.
- **Hybrid Solar Combined With Reliable Backup Systems:** The appreciation that solar energy can be developed most effectively in isolated rural areas when paired with a reliable back-up energy source is developing in all parts of the world. Back-up energy sources that are being analyzed for cost-effectiveness include batteries, biogas from animal waste or biomass, and Natural Gas or LNG.
- **Non-Fossil Irrigation:** In an answer to the challenge to provide reliable cost-effective energy to run irrigation systems, Bangladesh is experimenting with solar PV-based micro-grids for agricultural irrigation.
- **Rural Power Integrated With Waste Management:** In a project demonstrating the nexus between waste management and rural energy access, a hotel in Lobatse, Botswana is recycling food waste to generate biogas for cooking, while also powering water boilers. In less than 2 years, the investment is believed to have paid for itself through savings in LPG.
- **Growing Feedstock Crops for Biofuels:** In addition to the biofuel project mentioned previously in Senegal, Jamaica

The Institute for Applied Science and Research (IAST) has executed a project targeted at the production of biodiesel on a commercial basis. The aim is to foster the adaptation of biodiesel and feedstock technologies so that by 2020 the country would derive 65% of its diesel demand from agricultural feedstock, through:

1. Construction of pilot demonstration facilities for ethanol and biodiesel,
2. Development of standards and testing capabilities for controlling the quality of bio-fuels;
3. Promoting investment in bio-fuels; and
4. Provision of technical due diligence for proposals to develop bio-fuels.

-- Guyana Country Report

and Cambodia also report exploring the development of rural biofuel industries.

- **Agricultural Sources of Biomass for Power:** In efforts funded through the Clean Development Mechanism, Uruguay has developed several projects converting forest wastes and rice and sugar residues to electricity.

Challenges

Throughout the world, countries with significant rural populations report that they face similar challenges in bringing modern energy services to remote locations:

- **Lack Information on Alternative Technologies:** Planners in many countries are aware of the general existence of solar or wind technologies, but do not have access to good and up-to-date cost and performance information.
- **Need Capital and Low-Cost Funding Sources for More Expensive Renewables:** Renewable energy technology is regarded in many places as too expensive compared to the fossil fuel business-as-usual alternative. Countries report that they need access to capital and low-cost financing alternatives to be able to install renewables in their remote settings. This compounds the related challenge of attracting businesses interested in serving rural markets with perceived high-risks and low rewards.
- **Remote Locations Not Easily Accessible to Grid Due to Geography:** Geography can make it too difficult to connect widely-dispersed rural areas to a centralized electricity grid, even in countries with abundant renewable resources and large power facilities such as large-scale hydropower.
- **Reliable Energy Source for Irrigation:** Most rural areas are also agricultural areas. Countries report the need for reliable energy to power irrigation needs.
- **Need Cost-effective, Reliable Backup Energy Source to Balance the Intermittent Nature of Some Renewables:** The desire to provide a constant reliable source of electricity to rural areas was cited by many countries as a challenge in harnessing the power of intermittent renewable energy sources.
- **Lack of Trained Personnel and Skilled Labor to Install and Maintain Equipment:** One of the impediments some countries cite to installing solar or other renewable energy sources in rural areas is the lack of personnel trained to install and maintain the devices.

- **Lack of Devolved Ownership of Forest Resources:** One reported barrier to the sustainable management of fuelwood resources in forests was the fact that the users of the forest resource do not have ownership or management authority over the resource.
- **Need Good Information on Sustainable Forestry Practices:** In areas such as Botswana, where fuelwood is the main energy source for most people in rural areas, there is a need cited for the development and transmission of better information about optimum tree pruning and other sustainable forestry and agroforestry practices.
- **Need Information on Crops That Can Be Grown for a Biofuel Industry:** Countries with strong agricultural sectors and water resources are interested in getting information on the potential for growing biofuel feedstock crops.

3.7 *Taxation and Financing Approaches and Other Enabling Actions and Policies*

All aspects of an economy need to be scrutinized to discover opportunities to reverse longstanding barriers to the development of renewable energy and the cost-effective application of energy efficiency improvements. A toolbox of actions and policies that countries can apply to achieve that goal is developing. As the Rwanda report states, “Green economy policies include the internationalization of environmental externalities in prices, taxes and subsidies, public expenditures on green infrastructure and technology, renewable energy, energy and material efficiency improvements and sustainable buildings.”

- **Environmental Taxes and Other Approaches to Monetize “Environmental Externalities” and Raise Funds for Sustainable Development**

- **Environmental Insurance or Fines:** Belarus, among other countries, is considering imposing “environmental insurance” and/or fines to discourage wasteful behavior and raise funds to support sustainable development. Albania also states that it employs “market-based environmental taxes,” and that these are implemented in conjunction with tradable permits.
- **Carbon Tax:** Costa Rica is an example of a non-European country that has implemented a carbon tax. Theirs is set at 3.5 per cent of the market value of fossil fuels. The revenue raised

Global markets still do not fully recognize the value of ecosystem services that provide biodiversity and natural resources. Developing countries, in pursuit of new and better income opportunities, are forced to intensify their use, resulting in a progressive deterioration of the natural that is the basis of development and is essential for the sustainability of our countries.

-- Costa Rica Country Report

from this goes into a national forest fund.

- **National Environment Fund:** Benin has established a “National Environment Fund” that uses money generated through environmental taxes, donations and public funding to support environmental projects.
- **Link Taxes or Royalties to Protection:** In Bhutan, there is a system where there is a charge of 1% of royalties from hydropower sales that is used to protect watersheds.
- **Give Tax Benefits to Projects That Achieve Sustainable Economic Policy Goals:** Uruguay grants tax benefits to a select group of projects that are designed to support its sustainable development goals.
- **Revise Electricity Regulation to Allow for Independent Power Production from Desired Energy Sources:** In all parts of the world countries are opening up their power systems to allow independent power producers to connect to their grids. These regulations can be written to support renewable or other low-carbon energy sources.
- **Increase Tariffs for Power From Renewables:** Where they have opened up access to the power grid, countries can chose to pay more for power generated from renewable or other low-carbon energy sources.
- **Streamlining Permitting for Renewables:** As an example, Albania has streamlined its permitting process for new small hydropower installations.
- **Targeted Subsidies for Renewables (or Energy Conservation Investments):** Countries suggest that they could offer subsidies for renewable or energy conservation investments, much in the same way as fossil fuel investments receive (or received) subsidies.
- **Loan Packages and “Pay-As-You-Go”:** To help small companies or households implement desirable renewable energy technologies or energy efficiency improvement measures, countries can offer no or low interest loans. For example, Bangladesh offers no interest loans to households installing their Solar Home Systems that are paid back over 3 years. Other ways of lowering the initial capital cost required include sim-card based metering of electrical service on solar devices with prepaid service similar to cellular phone cards.
- **Solar Installation Before Electric Hookup:** To help stimulate the solar PV market and lead to improved economies of scale, Bangladesh requires new commercial buildings to

provide 3% of their electricity through solar PV before allowing new electric connections to be made.

- **Public/Private Partnerships Encouraged;** Uruguay developed its crop waste to energy projects using public/private partnerships. As mentioned before, Botswana and Bangladesh also both are promoting renewable rural energy technology diffusion through the use of companies formed in public/private partnerships.
- **Establishing Energy Efficiency Codes for Different End-Use Sectors:** It is worth mentioning again that establishing energy efficiency codes is a cost-effective way for governments to promote wide-spread adoption of energy efficiency improvements. These can be created in all end use sectors and address technologies including automobiles, buildings' heating and cooling, appliances, lighting, and industrial processes and materials use, among other things.

3.8 *Green Economy*

One of the sustainable development themes established during the lead-up to Rio+20 was the concept of “green economy”. A challenge noted by many countries in their deliberations was their difficulty defining what a “green economy” is and the best way to achieve it. Countries in general take issue with what they see as potential additional roadblocks on their paths of development and the prospect of new conditions being added to potential funding sources.

Where the concept of “green economy” was found to be most useful was in providing additional tools to a sustainable development toolbox or an additional lens to view sustainable development through, rather than serving as an overarching organizing principle for planning activities. As noted in Paraguay’s report, “The Green Economy is one more tool to achieve sustainable development.” Most countries that do find utility in the “green economy” concept have been using it to help them identify the most fruitful areas in which to be planning for new employment growth and in making plans for developing the educational and training resources that those new jobs will depend on.



As a good illustration of this attitude, the Ghana country report states, “The consensus with government officials is that Green Economy is not a substitute for SD, but rather a way of realizing it. In the past two years with the support of UNEP, the country has been discussing the transition to green economy in the areas of green budgeting; agriculture; energy; forests; water; transport and to a lesser extent, urban environmental management, roads, buildings, industrial installations, finance, manufacturing and tourism. Such a transition will require substantial resources, part of which must come from the international community... Ghana’s quest to engage in green projects stems from the fact that these projects are the engine for SD with the potential to create sustainable employment.”

4. Key Themes and Challenges

While each reporting country represents a unique mix of natural resources and economic, social, political and environmental realities, there is a remarkable consistency of themes and concerns expressed. These include:

- The need for **capacity development** in government, in civil society institutions, and among private sector stakeholders is widely cited. Countries indicate the need for trained and skilled planning personnel in government, and note that those responsible for planning “lack comprehensive policy and strategy to guide sustainable development.” Grappling with new and unfamiliar technologies is also challenging due to the lack of standards for efficiency and inter-operability of systems and devices, and the lack of national capacity to develop and enforce such standards. There is also limited technical and management expertise to implement technologies for production of renewable energy – particularly with regard to new and emerging technologies. This is true both at the leadership level and at the level of on-the-ground operations, where there is a need for education and training programmes to build a skilled operational workforce.
- There is a need for **better data and information** on which to base planning and policymaking. Data that do exist are often not readily accessible to those designing programmes or policies. This includes mapping of current and potential resources (both fossil and renewable – such as wind), as well as economic and social information. Countries specifically cited lack of good data on gender and fuel use. Rural isolated areas are particularly off the “information grid” and are therefore not well represented in decisions regarding allocation of limited resources. Countries that have engaged in comprehensive energy reviews are better equipped to make good decisions.
- Nearly every reporting country raises the issue of **integration in planning and implementation**. The question of “who is at the table” when resource decisions are made, and the segmentation or sectorization of responsibility for those decisions represent challenges in ensuring full consideration of multiple inter-related agendas. Examples include decisions about provision or extension of electrical service, allocation of water resources, and forest and range management. Civil society stakeholders have noted that the end users of land and resources, such as forests, frequently lack ownership or management control of those lands and resources.
- Similarly, while country reports generally recognize **the nexus of energy and other sustainable development factors** such as health, education, economic opportunities to fight poverty at the local level, and environmental protection, few indicate the presence

of energy-related decision-making structures and frameworks that take these factors fully into account.

- Those countries that rely heavily on **imported fossil fuels** universally recognize the desirability of decreasing that dependency, both because of the significant resource drain it entails, and because of the risks and volatility of price and supply availability.
- Some countries, though not all, also highlight the opportunity to **promote conservation and efficiency**, as well as to move toward renewables, as viable means of reducing imported fossil fuel dependency in the short to medium term.
- For many countries, the idea of sustainable development is still unfamiliar outside of those directly involved in promoting it. In the energy sector, and particularly in regard to resource extraction, there continues to be a **perceived conflict between economic development and environmental responsibility**. This is seen in some cases as part of the political interplay of entrenched interests (including particularly fossil fuel interests), along with a noted lack of voice for rural populations and women.
- Discussions relating to the idea of a **Green Economy** indicate that it can usefully point to synergies and opportunities for “win-win-win” directions, particularly related to job creation in support of sustainable development goals, notably including rural access to energy services and adaptation to climate change.
- At the same time, many countries express concern about the challenge of integrating new **externally-imposed models** and the inherent potential for new forms of conditionality.
- Even in cases where synergies are recognized, countries report that there is often inadequate **political will** to bring about substantive changes and transitions. Often, the economic and social advantages of shifts toward renewables and conservation are not seen as strong enough to get the process started in the face of other priorities and system inertia. Several countries report that civil society organizations could be doing much more to spread information that would help catalyze change.
- Another factor seen as limiting the move to renewables and new technologies is the presence of **existing subsidies and incentives**, particularly for the agricultural and energy sectors. Many of these subsidies were put in place to address the effects of the global economic recession, and there is concern that (in addition to the political ramifications) withdrawing those subsidies too quickly could destabilize the economy.

- Related to the above, there is recognition that in order for investments in efficiency and renewable to be able to compete for investment with traditional technologies, it is necessary to begin to ***assign monetary values to environmental externalities*** and future costs, and take those costs into account in current decision-making. Efforts to put a price on ecosystem services, such as the imposition of a carbon tax or other environmental taxes are in early stages of consideration by many countries. Only a few countries have actually implemented such programmes.
- Not surprisingly, there is a widely felt need for ***financing capacity*** on workable terms for new and renewable technologies that can compete with often-subsidized fossil fuels such as diesel for generation and kerosene for home use.
- Existing fuels and technologies are also advantaged by the presence of ***tariff and non-tariff barriers to entry*** for the importation and sale of advanced energy technologies.
- Many countries highlight the need for increased ***private sector involvement*** in the introduction, marketing, distribution, and servicing of renewable and more efficient energy solutions, including public/private partnerships. They note a particular need for more market-based incentives and the opportunity for companies to make a reasonable return on their investment commensurate with the risks involved. This involves both positive actions to create incentives as well as steps to remove existing disincentives. It is noted that the private sector has a particularly significant role to play in providing (off-grid) electricity services to rural isolated areas, but that the risks and challenges for companies entering these markets remains very high.
- Many countries indicate need for ***transfer of technology*** from developed countries, particularly in the areas of efficiency, conservation, fuel substitution, transportation, and off-grid/mini-grid solar PV systems. This includes, notably, development of biofuels for transport from local non-food plant species.

5. Conclusion: A Look Ahead

The central energy-related message in the Rio+20 Country Reports is that energy is increasingly recognized as a vital means to meeting critically important sustainable development ends. As countries assess present conditions and chart future directions, the future of energy is seen both as a major threat to environmental, economic, and social well-being, and as an arena of great opportunity for breakthroughs in each of those areas.

This is consistent with the observation in the overall Rio+20 Synthesis Report indicating that countries recognize that “fragmented approaches must give way to inclusive processes that bring together sectoral and central government agencies in the formulation of development plans and in their implementation.”¹⁸

While there is a clear and consistently high level of understanding and commitment to the integration of energy within a sustainable development framework, countries generally indicate that they have much further to go in realizing significant progress in doing so. The key challenges cited include lack of internal policy, planning and implementation capacity, lack of sufficient political will to make systemic changes, lack of technical knowledge and access to efficient and advanced technologies, and almost universally, lack of adequate financial resources to invest in new energy initiatives. Many countries recognize the need to enhance market incentives for innovation and investment, and to build effective public-private sector partnerships. There are some, but not all that many, “success stories” cited in this area.

To a certain extent, these country reports merely skim the surface of the energy picture. A few countries took the opportunity to do a more in-depth and focused analysis, while most provided headlines and highlights. In many cases, the reports reveal the need for a much deeper look at the energy challenges and opportunities, and their fundamental connections to the achievement of sustainable development goals. Underlying the expressed concerns about weak capacity to chart and carry forward effective policies and plans is a need for better information – data and analysis of current realities, resource mapping (especially water, geothermal, and wind resources), economic and demographic patterns, financial models, and technological advances.

The reports reveal the need for up-to-date comprehensive country-level assessment, using improved tools. For many if not most of the reporting countries, better information on energy, with its nexus with other key sectors, can reveal both needs and important opportunities. When paired with robust tools to assist in targeting and tracking results, this can lead to real measurable progress.

¹⁸ *Synthesis of National Reports for Rio +20*, United Nations Department of Economic and Social Affairs and the United Nations Development Programme, 2012.

ANNEX

I. Rio+20 Country Reports Reviewed for this Report

Albania	Kenya
Algeria	Lao PDR
Antigua & Barbuda	Lebanon
Armenia	Liberia
Bangladesh	Madagascar
Belarus	Malawi
Belize	Mali
Benin	Mauritania
Bhutan	Mauritius
Botswana	Moldova
Burkina Faso	Morocco
Burundi	Mozambique
Cambodia	Nepal
Cameroon	Niger
Cape Verde	Nigeria
Central African Republic	Paraguay
Comoros	Philippines
Congo	Rwanda
Brazzaville	Saint Lucia
Congo DR	Senegal
Costa Rica	Serbia
Cote d'Ivoire	Seychelles
Djibouti	Solomon Islands
Dominica	Sri Lanka
Ecuador	St Kitts and Nevis
El Salvador	Tajikistan
Equatorial Guinea	Tanzania
Ethiopia	Timor Leste
Fiji	Togo
Gambia	Uganda
Ghana	Uruguay
Grenada	Uzbekistan
Guinea Bissau	Viet Nam
Guyana	Yemen
Haiti	Zambia
Jamaica	Zimbabwe

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