UN/DESA Policy Brief No. 43

Achieving sustainable development: the energy investment challenge

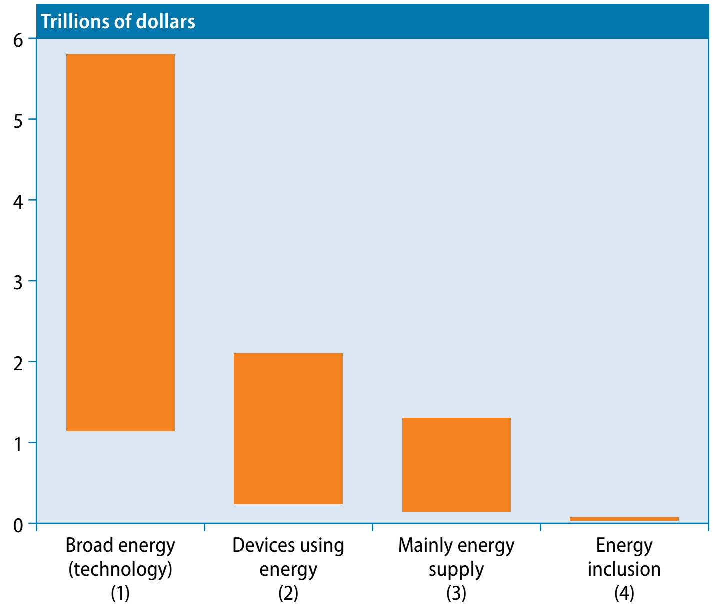
There is an emerging consensus holding that sustainable development requires a radical transformation of the world's energy system. For its part, WESS (2009,2011, and 2013) have argued that only through a significant transformation of the way we produce and use energy the world can converge towards high living standards and ensure that human activity remains within Earth's carrying capacity. Transforming the world energy system calls for strong leadership, carefully designed policies, behavioural changes, and large investments, both in developed and developing countries. Estimates of the additional energy investments required to build a sustainable system are around 0.7 trillion dollars per year between 2011 and 2030.[1]

Estimates of additional energy investments needed to prevent an increase in world's temperature larger than 2 ºC vary significantly. A useful reference is the US$ 0.7 trillion a year of additional investments proposed by the compilation of the Green Economy Investment Report (2013). However, estimates of additional investments in energy to achieve sustainability vary significantly. For example, the Global Energy Assessment (2012) proposes a range from US$0.14 trillion to over US$4 trillion per year (figure 1). Such large variations in the estimates depend on the policies and technologies assumed to be in place between now and the medium and long term, the costs of related investments that will be required to make use of alternative energy sources, and on the foreseen cost of technology development, among others (see, for example, UNDESA 2014).

Following the Global Energy Assessment (GEA), needed investments in energy supply tally 0.6 trillion a year (figure 1, column 3); but if we account for the cost of additional investments necessary to adapt devices to the new sources of energy such as those required to adapt car engines, boilers for heating systems, compressors, etc. for the newly emerging energy system, required investments will almost double (figure 1, column 2). Furthermore, if we also account for broad energy investments such as the cost of fostering innovation, market creation for alternative energy sources and technology diffusion, the investment requirements will multiply by a factor of five (figure 1, column 1).

The above estimates suggest that the additional investment effort needed to transform the energy system towards environmental sustainability represents a significant challenge. In comparison, achieving energy inclusion requires relatively modest investments. Outlays to provide universal access to clean fuel cooking and electricity can range between US$0.03 trillion and US$0.04 trillion per year (GEA 2012, IEA 2012) and, even if the expansion of energy would be done from traditional sources, the greenhouse gas emissions generated would be negligible (figure 1 column 4). Thus, achieving energy inclusion is not only affordable but also compatible with the aim of controlling the rise of world's temperature below the target of 2 ºC.[2]

Figure 1
Range of additional annual energy investments to achieve sustainability



The interplay of policies and technologies

The GEA study is particularly useful to probe into the effects of needed additional investments arising from different combinations of policies and technologies. The GEA looks at 60 scenarios defined through a combination of policies dealing with energy, transportation and technology. First, the study defines three demand and supply energy paths: the supply path considers policies concentrated on meeting the world's increasing demand for energy; the efficiency path consists of policies aiming to make efficient use of energy; and the mix path, a combination of the two alternatives. Second the study considers two transport modes: continued reliance on traditional technologies and fuels (mainly liquid) and the adoption of advanced technologies and fuels for transportation (mainly hydrogen and electricity). Third, the study considers ten technology portfolios defined by access to technologies: full access to all technologies; partial access to renewables and bioenergy; and the exclusion or phasing out of controversial technologies such as nuclear, carbon sinks, carbon sequestration, and bioenergy carbon sequestration. On the other hand, the definition of sustainability in the GEA study goes beyond keeping the increase in temperature within safe limits. A path is deemed sustainable if it meets all of the four

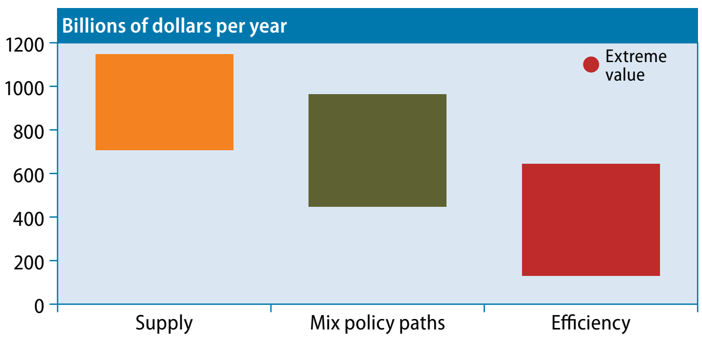
1 See, for example, Green Growth Action Alliance (2013).

2 See Rogelj et al 2013 and UN 2012.

following criteria: a) it provides universal access to modern energy; b) it ensures good air quality to the majority of the world's population; c) it contains the rise in global average temperature below 2 °C; and d) it limits energy trade and heightens the diversity and resilience of energy supply. Of the 60 scenarios considered, 41 meet GEA's sustainability test.

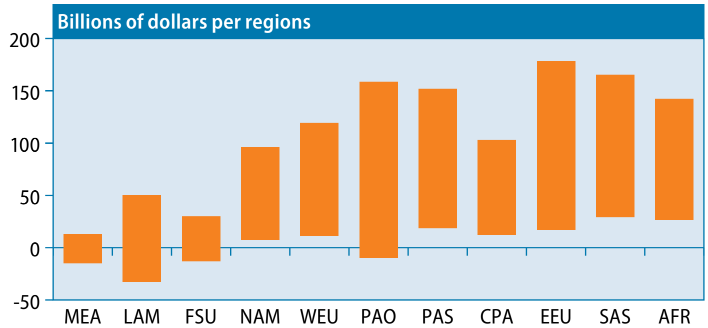
The GEA analysis of alternative paths for the transformation of the energy system towards sustainability serves to make a very important point: sustainable energy strategies should give high priority to policies to promote efficient use of energy. This intuitive finding confirms the idea that policies emphasising efficiency can greatly contribute to sustainability and reduce the amount of resources needed to achieve it. While all efficiency paths succeed in meeting the sustainability goals, only eight of the 20 supply path scenarios do so and, equally important, the investment ticket increases. All supply paths require higher annual investment amounts to reach sustainability than any of the efficiency paths, except for one extreme case (figure 2).

Figure 2
Range of additional annual investments in sustainable pathways, by supply, mix and efficiency policies



Source: WESS 2013 p. 139.

Figure 3
Range of additional annual investments in sustainable pathways by region



Source: WESS 2013 p. 139.

The volume of investments required varies widely across regions. While in some regions local conditions, and existent policies and technologies result in actual savings when compared with business as usual, in other regions additional investment can be as high as 170 billion. Needed investments tend to be higher for low income regions and lower for regions with high income per capita. For example, the additional investment needed to arrive to a sustainable path in South Asia and Sub-Saharan Africa is larger than in Western Europe or the United States (figure 3). The challenge of generating and deploying such additional investments will be, of course, more daunting in low income countries given the size and resources available to these economies.

Increasing energy investment to set the world on a sustainable path poses difficult challenges. Early adoption of policies aiming to increase energy efficiency, promote the use of renewables, and deepen social inclusion can significantly reduce the investment effort needed to place the world on a sustainable path (United Nations Environment Programme, *The Emissions Gap Report 2012*). Given the importance of identifying and adopting the most appropriate policies, there is an urgent need to broaden the evidence and start building national capacities to identify and adopt the best policies. In addition to financial resources, setting the world on a sustainable path also requires intensive technological innovation and faster transfer of technologies to developing countries. Technological innovation in developing countries will require strong systems of innovation to undertake research, development and diffusion of renewable energy technologies in a way that responds to the needs and the particular characteristics of countries. Thus, the economics of a timely transformation of the energy system involves questions that go far beyond the amount of resources needed to generate clean energy. Countries will need to manage large and complex investment projects and implement policies to support the transformation of the energy systems. The timely design of coherent policies covering a wide-range of economic, social and environmental areas will become increasingly critical.

REFERENCES

Green Growth Action Alliance (2013). The Green Investment Report The ways and means to unlock private finance for green growth. World Economic Forum, Geneva, Switzerland.

Johansson, Thomas B. and Nebojsa Nakicenovic, Anand Patwardhan, Luis Gomez-Echeverri, Global Energy Assessment Toward a Sustainable Future, International Institute for Applied Systems Analysis, Cambridge University Press, 2012.

Rogelj, Joeri, David L. McCollum and Keywan Riahi (2013b). The UN's 'Sustainable Energy for All' initiative is compatible with a warming limit of 2°C. Nature PUBLISHED ONLINE: 24 FEBRUARY 2013, DOI:10.1038/NCLIMATE1806.

United Nations (2012b). Sustainable Energy for All. New York. http://www.un.org/en/events/sustainableenergyforall/background.shtml.

UNEP (2012). The Emissions Gap Report 2012, A UNEP Synthesis Report.

United Nations Task Team, Working Group on Sustainable Development Financing (2014), "Financing for sustainable development: Review of global investment requirement estimates, UNDESA, New York.

Prepared by Eduardo Zepeda and Diana Alarcon
UNDESA, DPAD. The opinions expressed here do not necessarily represent the views of the United Nations.
For further information please contact the author at: tel: +1 917 367-5498; e-mail: alarcond@un.org
http://www.un.org/en/development/desa/policy/index.shtml ♦ Follow us on **Facebook, LinkedIn and Twitter**