A global programme to tackle energy access and climate change

Tariq Banuri and Niclas Hällström

Energy access is one of the most urgent challenges confronting the world today. It is essential for promoting sustainable development and tackling poverty and global injustices, and it holds a key to a successful and equitable solution to climate change.

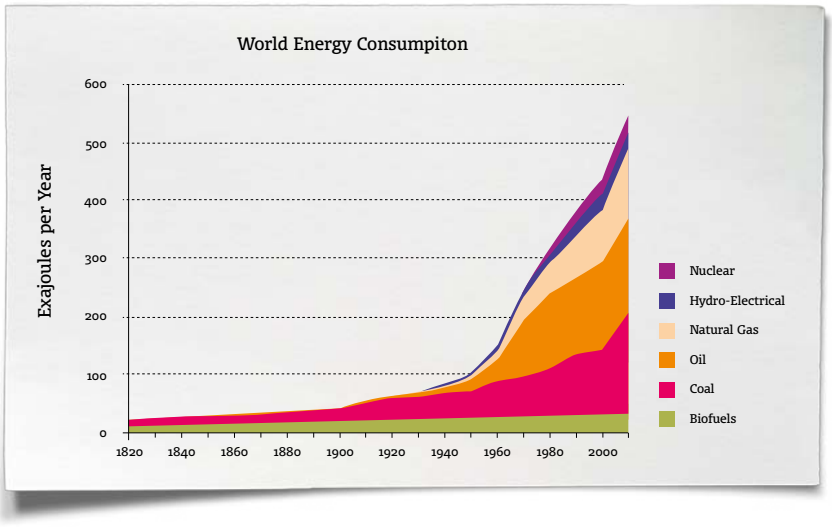

Figure 1: Until the late 18th century, 'muscle and firewood' constituted the main sources of energy. After that, there was a sudden explosion in access to energy – first coal, and later oil and electricity (Tverberg, 2012).

Worldwide energy use multiplied 30 times between the years 1800 and 2000; over the same period, GDP multiplied by a factor of 100. Mobility, as measured by the number of kilometres per person and day, has increased 1,000 times over the last 200 years.

However, 250 years after the technologies with which to access fossil energy sources were first discovered, access to energy remains extremely unequal. Whatever notions or ideals of 'development' one may have, to successfully address many development challenges will depend on the continued expansion of energy services in developing countries.

This article builds on prior work by the authors, including seminars and interventions organised through the Swedish Society for Nature Conservation (SSNC) in the lead-up to the Copenhagen summit and beyond (SSNC, 2009; SSNC, 2010; SSNC, 2011).

The fundamental importance of energy access

Access to energy is extremely unequally distributed, and it is highly correlated (up to a point) with human wellbeing. Measured in kilowatt hours (kWh) per person per day, the global average consumption of primary energy of the richest countries is even more unequally distributed than per capita income. For example, the total primary energy consumption of the United States (250 kWh per capita per day) is almost 50 times that of Bangladesh (5 kWh per capita per day).

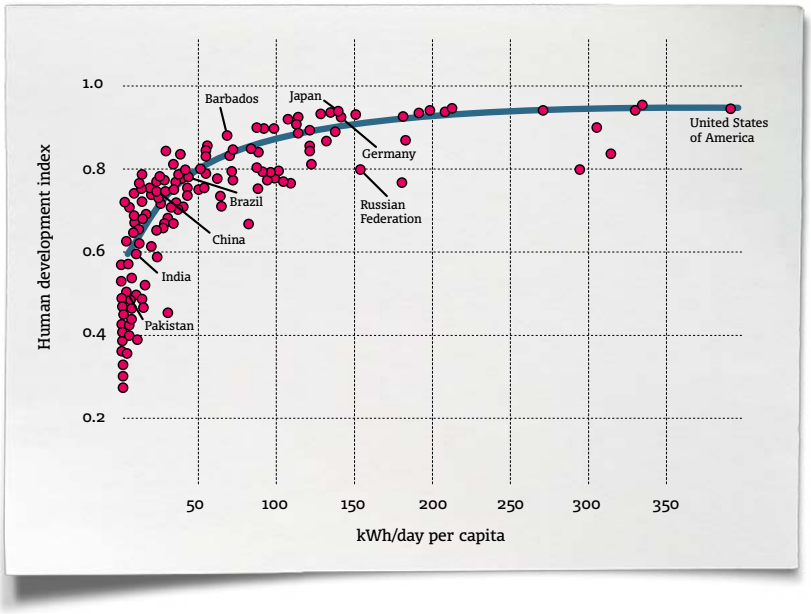

Figure 2. The correlation between energy use and human well-being (using the Human Development Index as a proxy).

A distinction can be made between low-, medium- and high-energy consumption countries. In low-consuming countries, where total primary energy use is below 35 kWh per capita per day, the level of human development (as measured by the Human Development Index or HDI) is also low, ranging between 0.3 and 0.7. However, the improvement curve describing the relationship between energy use and human development is initially very steep, so there are major developmental benefits to be had from increasing energy use in these countries.

In the middle category, where energy use is between 35 and 100 kWh per person per day, the HDI ranges between 0.7 and 0.9, and while the energy-development relationship is a great deal flatter – indicating that increased energy use, while beneficial, has less proportional impacts on human development – it still has a positive contribution. Finally, the energy-welfare relation is essentially a flat line in high-energy nations (or strata of societies), those consuming more than 120 kWh per capita per day – a category that includes high-income developed countries as well

as some resource-rich developing countries (with often grossly unequal distribution). In this light, it might therefore be argued that much of the energy being used in United States, Sweden and other wealthy countries is redundant, in that it does not contribute to human development.

Three other features of the energy distribution landscape deserve to be mentioned here. First, the figures on total primary energy consumption mask even greater disparities in the consumption of electricity. No country has ever been able to reach a high score (0.9) on the Human Development Index without universal access to electricity. For instance, electricity consumption (in kWh per capita per day) in the United States is nearly 100 times that of Bangladesh, and over 200 times that of Tanzania.

Country	Final	Electricity
US	167.07	39.01
Germany	98.09	20.39
Sweden	122.77	45.67
Korea	95.71	21.12
China	29.19	4.61
India	10.87	1.61
Brazil	30.39	6.41
Ghana	10.23	0.79
Tanzania	13.21	0.19
Bangladesh	4.11	0.42

Figure 3: Overall energy use and electricity use per capita, kWh per day. A Swedish citizen consumes on average 200 times more electricity per day than a citizen of Tanzania (UN-DESA 2009).

Second, there are critical differences between rich and poor nations in regard to the allocation of modern energy services to different uses. Consider, for example, two statistics on energy consumption for public health in the United States. In 2005, 65.6 billion kWh of electricity, equivalent to 0.6 kWh per capita per day, were used for water purification and distribution and wastewater treatment, far higher than the total electricity consumption of a citizen of Bangladesh or Tanzania. Similarly, in 2003, the 3,040 large hospitals in the US consumed a total of 134.2 billion kWh of energy, including 56.9 billion kWh of electricity, numbers that on a per capita basis (1.2 and 0.5 kWh per person per day) are way beyond the reach of most developing countries.

The scarcity of modern energy services in developing and middle-income countries forces them to make difficult decisions between al-

location for human welfare (household consumption and public health) and economic development and industrialisation. Data from the International Energy Agency suggests that in very poor countries, almost all of the energy (mainly traditional biomass) is consumed by households. Middle-income, emerging economies tend to allocate a disproportionately large share to industry; for example, in China that share is 40-plus per cent, which is much higher than the figure of 20-25 per cent in Western Europe and the United States.

The need for additional energy

Recognising this striking inequality in energy access is crucial. From the previous figures it is abundantly clear that there is a need for additional energy in developing countries, while rich countries can and must scale down their energy use significantly. This translates into reducing the vast disparity in incomes and welfare between poor and rich countries.

But of which kind will this additional energy for developing countries be? The answer is simple: it will be the kind that people are able to afford – and the kind of energy that is accessible as a result of appropriate ownership arrangement and local distribution arrangements, including off-grid/local mini-grid solutions.

Let us first examine the affordability question. While detailed comparable data on energy prices are difficult to come by, the broad patterns are not unknown. The price of energy ranges between 10 and 30 cents (US) per kWh in developed countries[1], at the lower end of this range (about 10 cents) in emerging economies, and even lower, around 4-5 cents in developing countries. The reasons have less to do with supply costs than with affordability and competitiveness.

What people can afford depends, naturally, on their incomes. For instance, in countries with per capita income of under US$1,000 per annum (say India), which translates as a little more than the proverbial US$2 per day, an expenditure of 10 per cent of personal income on energy would mean a total of 20 cents for all energy services, electricity, transport, and other fuel for cooking or heating. At 20 cents per kWh, no more than 1 kWh per person per day would be affordable.

In other words, there is a triangular relationship between national income, energy price and energy affordability. Poor countries have no option but to seek the cheapest forms of energy, regardless of environ-

1 This is a crude aggregation of the final cost of electricity, petroleum, and natural gas. There are wide divergences, of course.

The only strategy that can command the allegiance of both rich and poor countries is one that can rapidly lower the costs of renewable energy. We need to use environmental public investments as a driver.

mental costs. Countries, such as China and India, which have abundant coal and hydropower resources, have invested heavily in them, primarily because they can yield affordable electricity of 3 cents per kWh. Shifting to higher-cost alternatives, such as modern renewables or nuclear energy, which may cost upwards of 15-20 cents per kWh, would imply excluding significant parts of the population from access to electricity.

The strategies that developing countries use to solve the affordability problem are well known. First, in many countries large segments of the population are simply excluded from access to energy. Approximately 2 billion people, half of the population of the developing world, have no access to modern energy. Although from a health and environmental perspective biomass is anything but cheap, the default option for many households as well as countries is to continue to rely primarily on burning firewood instead of electricity or modern fuels.

A second strategy is to lower the quality of the services provided: cheaper buses, inefficient but cheap appliances and technologies.

Finally, the most important strategy that developing countries use is targeted subsidies. In developed countries, industry pays less for electricity than households; but in developing countries, low-income households pay even less than industry. Similarly, the prices of diesel and kerosene are kept below those of petrol in order to subsidise public transport as well as the cooking needs of poor households. Notwithstanding the World Bank's ideological opposition to the use of subsidies in developing countries, an excellent World Bank sponsored study (Komives et al., 2005) showed that such 'targeted' subsidies are in fact highly efficient (more so than 'generalised' subsidies that are more prevalent in the water sector).

The climate dimension

These realities of global energy use and its inequitable distribution are key factors when confronting the double challenge: to drastically cut energy-related emissions while ensuring greater energy access for the developing countries.

Energy use is responsible for some 75 per cent of total emissions of greenhouse gases and, what is more, energy emissions are rising much faster than aggregate emissions, especially in developing countries, where growth in energy use outruns energy efficiency. The stark reality leaves us with no choice: the world as a whole needs to relinquish its dependence on fossil fuels and urgently move into a 100 per cent renewable energy future.

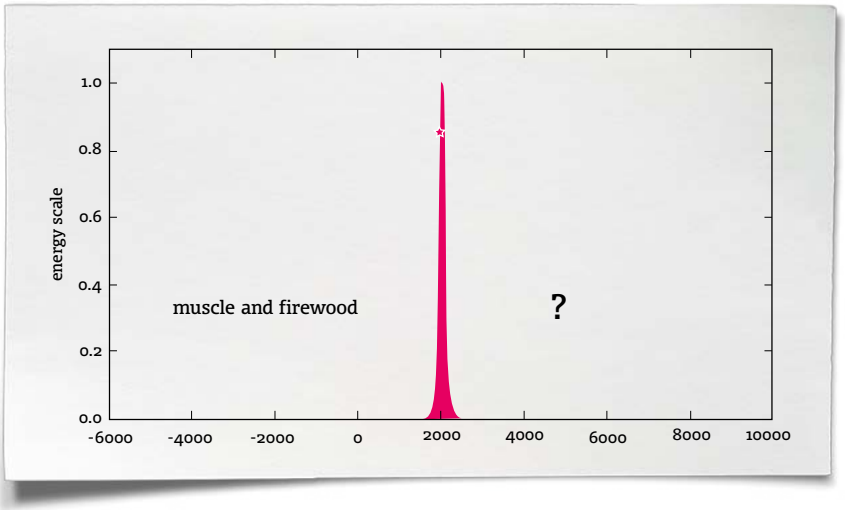

Figure 4: The era of fossil fuels – a parenthesis in world history.

There is thus growing pressure also on developing countries to mitigate. If the global concentration of greenhouse gases in the atmosphere is to be stabilised at a reasonably safe level, be it 2° or 1.5°C, total emissions need to decrease drastically over the next few decades – even when the Annex 1 countries assume their long overdue, fair responsibility and quickly move to zero emissions.

The only way to reconcile this need to cut emissions with the need to enhance energy access in the developing countries is to quickly move to renewable energy.

The main strategy with which renewable energy sources within the developed countries has been promoted, has generally been to *raise* the price of conventional, carbon-intensive energy – for example, by the use of carbon taxes or cap-and-trade schemes. A universal carbon tax is perhaps the most popular policy recommendation of the Northern climate community. This sharply contrasts with the only successful strategy carried out in the developing countries: to seek to *lower* the cost of energy by way of targeted subsidies, cheaper technological options (especially coal and hydro), development assistance, and a nudging of global policy towards supportive directions.

The only strategy that can command the allegiance of both rich and poor countries is one that can rapidly lower the costs of renewable energy, so that renewables become the natural choice for both groups of countries. Fortunately, there is a way to achieve this objective: to use environmental public investments as a driver.

From zero-sum to positive-sum

The concept of 'development' has emerged only recently in human history. Perhaps more than anything else, its mainstream connotation signifies what economists call a 'positive-sum game': the promise of increased income and well-being for all, which in turn is assumed to provide a basis for greater cooperation within society. Where 'development' gains have been distributed equitably, it has led not only to greater prosperity, but to improved stability, resilience and social solidarity as well.

Climate policy, on the other hand, is usually construed as a 'zero-sum game' where one actor benefits only if another actor loses. Focusing solely on national emissions budgets forces countries to view the process as one in which they can gain only by browbeating or hoodwinking others into accepting a loss. This traditional approach has produced its inevitable outcome – an inability to cooperate or take effective action. An exclusive focus on the fixed nature of the carbon budget will invariably lead to conflict over its allocation.

This is not an argument for refusing to cut greenhouse gas emissions. Rather, it is an argument for examining the tacit assumption behind this approach, that energy technologies are fixed independently of policy choices. It is true that if nothing is done to change the energy infrastructure, the fixed carbon budget will translate into a fixed energy budget, which will in turn translate into a fixed ceiling on both economic growth and welfare. It is also true that in such a case, every country has the incentive to dig in its heels and fight over every gram of the carbon budget.

But there is an alternative. If, instead of focusing on the emissions budget directly, countries were asked to focus on what would be needed to bring the energy infrastructure in line with the dictates of climate *as well* as development, it would provide an incentive to identify areas of cooperation through investment and development. *An investment approach* is fundamentally different from the traditional climate budget approach: it asks how it might be possible to expand the energy budget through investment while cutting the carbon budget. In other words, it converts a zero-sum problem into a positive-sum one.

Investment is also most conducive to a 'joint' commitment on the part of countries – where they agree to undertake activities together – instead

of the conventional partiality for unilateral or conditional commitments[2]. The decisive factor is to identify areas for investment that meet climate objectives as well as the national goals of different groups of countries – for example, full employment and energy security in the North, and economic growth and energy access in the South. Within this domain, four criteria can help focus the discussion on appropriate areas for investment further: is there consensus (broad agreement on what needs to be done), momentum (building on steps that are already being taken), transparency (making it possible to assess the effects of policy), and the possibility to work within time limits (setting a deadline for the achievement of the target and the conclusion of the joint action)?

Focusing on the energy sector makes eminent sense, it offers enormous scope for international cooperation.

Energy is a sector in which there is tremendous momentum, consensus and transparency (although one must of course recognise vested and powerful interests such as the fossil industry). In contrast to a purely price-led approach (that is, putting a price on carbon), which caters only to the focus of developed countries on competitiveness (of climate-friendly alternatives), the investment-led approach also accommodates the concerns of developing countries about affordability (of all relevant technologies). It seeks to promote strategic public-sector interventions to pull in private investment. In addition, it argues strongly that investments should be front-loaded in order to avoid the dangers of further 'lock-in' of carbon-intensive technologies, and also in order to take advantage of economies of scale and learning in these emerging renewable-energy sectors. International transfers of finance and technology must be focused in a very targeted manner on achieving this 'big push' for low-carbon technologies.

Focusing on the energy sector therefore makes eminent sense. Investment in renewable energies can allow developing countries to leapfrog to clean technologies; it would stimulate public as well as private sectors in both North and South; it would build upon a range of actions and strategies already in place in several countries; it is most conducive to simple measurement and observation; it comes with a clear target and timetable; and most importantly, it offers enormous scope for international cooperation.

This approach also provides a refreshing contrast to the current climate negotiations, where there is stalemate – and no consensus, momentum

2 Unilateral commitments (for example, on emissions cuts) would achieve the desired result if the overall level of ambition were equal to the sum of those commitments. Conditional commitments refer to actions that are undertaken only if an external condition is satisfied, such as, in the case of developing countries, the provision of financing and technology transfer from developed countries. Obviously, most of what has been seen in climate negotiations falls into these two categories.

or transparency. Most negotiators still view climate and development as separate or even contrasting agendas; this is a false dichotomy and reveals only the inability to forge a consensus. After two decades of negotiation, the only outcome is the reneging of countries even on past commitments. Finally, as is revealed in the desultory obsession with measurement, verification and monitoring, the relationships between inputs and outputs in the mechanisms being proposed are vague, undefined, and subject to manipulation. Developed countries fear that their financial contributions would disappear into a 'black hole' of development cooperation budgets with unknown end results; while developing countries fear that the ancillary conditions on funding would mean the abandonment of their developmental aspirations.

Finally, as currently constituted, climate action is completely open-ended. There is no end in sight for any commitments made under the negotiations. When will developed countries be able to conclude financial obligations under the treaty? When will solving the climate issues become a self-sustaining process without the need for external support in both developing and developed countries? No one can say.

What is necessary is a time-bound strategy that creates consensus, builds momentum and is consistent with the demands for transparency. This indeed is the main goal of the work that one of us has been involved with in the UN – and through joint work in other fora (see, for example, Banuri and Opschoor, 2007; UN-DESA, 2009a; UN-DESA, 2009b; UN-DESA, 2009c; SSNC, 2010, SSNC, 2011a; SSNC, 2011b; Atkisson, 2011). Below we set out the key features of such a strategy.

First step – The renewable energy cost target

A reasonable starting point is the formation of a global partnership for agreeing on a shared international target price for renewable energy, say US$1 per watt of investment or, equivalently, 4 cents per kWh of the cost of delivered energy. These numbers are much lower than current levels, but are well within reach. While renewable energy is, on average (see Figure 4), more expensive than non-renewable alternatives, it is already competitive in some settings.

More importantly, costs have been declining steadily over time. Nowhere is this decline as marked as for wind and solar energy. The main driver of cost reduction thus far is the installed capacity. As the installed capacity has increased, it has enabled producers to benefit from scale economies, standardisation of production, learning by doing, and shift to low-cost locations.

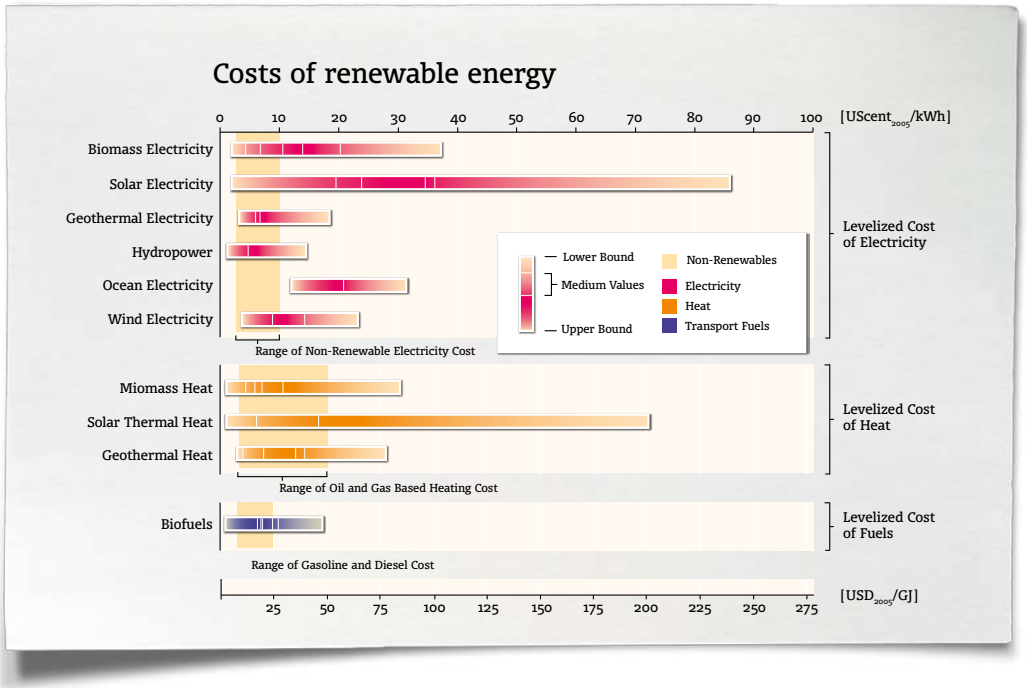

Figure 5: Although renewable energy is already competitive in some settings, costs are still generally higher than current energy prices. (IPCC, 2012)

Moreover, given that the suggested target costs are at parity with the lowest investment costs of coal-based electricity (in China), the achievement of this target would make renewable energy competitive with the cheapest alternative at the same time as making it affordable by the poorest consumer. The achievement of cost competitiveness is a tipping-point, after which the technology will become the default option for future investments without the need for continued subsidies and protection.

Elements of a 'big push' strategy – the feed-in-tariff approach

Once a target is agreed upon, the next step is to ask how it can be reached. As mentioned, the main driver of the declining cost of renewable energy is the installed capacity. This has increased in recent years but has yet to reach the scale where it becomes both competitive and affordable. Our calculations (see UN-DESA, 2009b) suggest that this tipping-point requires an additional 1,000 GW of renewable energy. From the point of view of costs, it may be immaterial whether this capacity is installed in developed or developing countries. But from the point of view of social needs as well as the requirements of efficient deployment of resources, it makes sense to privilege developing countries, especially least developed countries.

The question then is how governments of the world can unite to expand renewables' installed capacity by 1,000 GW. Recent history suggests that the optimum strategy is a globally funded programme to support national feed-in tariff (FIT) systems.

Feed-in tariff programmes have been used in some 50 countries around the world, including Germany and Spain, with extremely favourable results. For example, the recent IPCC special report on renewable energy concludes (IPCC, 2012: 906):

> In summary, a number of historical studies, including those carried out for the European Commission, have concluded that well-designed and well-implemented FITs are the most efficient (defined as comparison of total support received and generation cost) and effective (ability to deliver increase in the share of RE [renewable energy] electricity consumed) support policies for promoting RE electricity[3]

The policy itself is very simple. It is a public guarantee to purchase electricity from new (renewable) energy projects at pre-announced prices. The prevailing form is one where the electricity is fed into the national grid. However, the concept can be adapted to off-grid situations as well. In developed countries, the higher costs of the feed in tariff programmes are passed on to the consumers. In developing countries, this is not possible because of the low incomes of the populace.

The way in which such a programme would work in a developing country is the following: An investor (a public entity, cooperative or private company) is willing to set up a new solar power plant provided it can earn at least 12 cents per kWh. However, consumers cannot pay more than 4 cents per kWh. The government then steps in and offers to purchase the electricity at 12 cents and sell it to the consumers at 4 cents, paying the remaining 8 cents from the budget. In general, given the fiscal crunch faced by developing country governments, they generally choose to limit their exposure by instituting a strict approval regime, thus restricting the scope of the policy to a few plants each year. Thus, the capacity of developing countries for implementing wide-reaching feed-in tariff systems is constrained by the degree of financing that states can afford.

3 See the report (IPCC 2012:906) for numerous citations.

A globally funded programme for national feed-in tariffs for renewable energy

The only way to expand the scale of feed-in tariff programme is through international supplementation of the national subsidies. The justification for the global support is thus straightforward. The programme would provide global benefits in terms of emissions reductions, reduced costs of cutting future emissions, and support for energy access in poor countries. The reduction in the unit cost of energy helps the North as well as the South, because green alternatives for replacing obsolete power plants in developed countries will also be cheaper. By investing in renewable energy for the peoples of the South, in accordance with historical responsibility and common but differentiated responsibilities (CBDR), countries of the North are also making their own transition to a 100 per cent renewable energy future more affordable. In addition, particularly during the early phases of the programme, these investments will also spur employment in green jobs in the North.

When we put together the Word Economic and Social Survey report at the UN Department of Economic and Social Affairs (UN-DESA) to present this scheme in 2009, we aimed to make the analysis as conservative as possible. That is, we tried to find the maximum subsidy cost of making renewables competitive. The figure we came up with was a total cost of between 1,000 and 1,400 billion dollars. This works out to an average of US$100 billion per year over 10 to 14 years.

Is this a lot of money or a little? To put it into perspective, the combined tax base of the Annex 1 countries in 2009 was US$12.7 trillion. The US$100 billion needed annually for this programme is less than 0.8 per cent of the money raised by these countries every year, and less than 0.2 per cent of their combined GDP. Used in this way, this sum could effectively help 1.5 billion people gain access to energy, while taking decisive steps towards a renewable energy future in time to prevent all our societies from suffering from climate catastrophe.

The global feed-in tariff subsidy will only pay incremental costs, above what is paid for by consumers plus the subsidy provided by the national government. The higher the level of a country's income, the higher would be the level of affordability as well as what the national government would provide from its own resources. The remainder, inversely related to the national income of the country, would be provided through the global subsidy. In other words, global equity is written into the very structure of the programme.

Another advantage of this approach is its transparency. It is a system based on so-called output-based funding. This is not about simply disbursing money

to developing country governments (with the sometimes accompanying fear of corruption); it is about enabling the funding of concrete projects. And if the project is unsuccessful, so that the energy is not forthcoming, there will be no financial compensation. What a feed-in tariff rewards is actual results on the ground.

Third, this is a time-bound commitment. As the production costs of renewable energy come down, while, at the same time, the incomes of developing countries rise (in part because of increasing access to affordable energy), the need for supplementary financing will continue to dwindle from below as well as above. Depending on how rapidly scales are ramped up, within a span of 10 to 20 years the subsidy will disappear altogether. The question is how quickly we wish to make this transformation happen.

In the context of developing countries and the overriding challenge of energy access, the system of feed-in tariffs provides opportunity to support poor consumers and low-carbon technologies alike. For example, the same principle of guaranteed subsidies and commitment to cover the 'gap' between costs for the installation and selling price to (poor) consumers can be applied to solutions off the national grids. In fact, for large parts of the developing world, this would be the most important aspect of the scheme: the possibility for communities, municipalities and small businesses to invest in renewable energy locally, set up local mini-grids and connect households, public services and small-scale industries with electricity: a 'bottom-up energy revolution'. Furthermore, variations of the feed-in tariff schemes could even support (off-grid) investments that are not even connected to mini-grids, such as new cooking stoves. This capacity of feed-in tariffs to support a rapid energy transformation at both large and small, local scales is one of its many striking benefits, something which is also duly noted in the recent IPCC report on renewable energy (IPCC, 2012: 906).

> FITs tend to favour ease of entry, local ownership and control of renewable energy systems…and thus can result in wider public support for renewable energy… Such ease of entry has also proved a powerful means for unleashing capital towards the deployment of renewable energy projects.[4]

How should the global support system for feed-in tariffs in developing countries be set up? There are a number of possibilities but one prerequisite would be a UN-based global fund with a dedicated renewable energy window (this could either be the new Green Climate Fund or a new special fund) that each developing country willing to take part in the scheme can link to after signing up to a set of mutually agreed principles and rules.

4 See report (IPCC, 2012: 906) for citations.

A revolution in the making

'The only way forward is to create an enabling framework that allows the North to reduce emissions while at the same time the South also makes the transition. I believe feed-in tariffs will be an integral part of that framework.

The issue really is affordability. No one in India is opposed to solar; no one is saying that this transition is undesirable. We know that there are tremendous opportunities, that there are large parts of the country that are not connected to the grid and thus have the potential of leapfrogging the fossil trajectory altogether. No one should be preaching to us about solar energy.

Yet, we need to actually make it work… There are constraints to how much energy supply a country can afford. I come from a nation where 60 per cent of the population have no energy access. Energy supply is a major challenge; and if you want to increase access, you simply cannot have unaffordable solutions that by their cost limit access even further.

The bottom line is that our capacity is limited unless there is a global fair deal in which the North agrees to pay, through a global feed-in tariff, for the transition of the South.'

Sunita Narain, Center for Science and Environment, Delhi (SSNC, 2010:51)

'My colleagues at the Centre for Science and Environment have proposed off-grid but interactive systems for rural electrification. In this system, like the German roof-top energy revolution, government would provide feed-in tariff incentives for entrepreneurs to set up local solar energy systems. This energy would be fed through mini grids to users – poor and rich would pay costs. It is important to remember that solar energy costs are decreasing – the latest bids for projects put the price at Rs 7 per unit. This is still more than the price of coal- or gas- based power. But while costs of coal and gas will only go up, solar can and will come down.

Energy supply could be decentralised because demand is also decentralised. There could be a revolution in the making. But only if we see the light in the tunnel.'

Sunita Narain in Down to Earth, *15 September 2012 (Narain, 2012)*

This is an example of the 'joint commitment' strategy whereby the Annex 1 countries provide the funds (according to their capacities and the principle of CBDR) and the non-Annex 1 countries enter stringent commitments to set up national feed-in systems – with mutual benefits in the end. Financing for the fund can be provided in many ways, among them, assessed public contributions from Annex 1 countries, international financial transaction taxes, and use of IMF special drawing rights. What a programme of globally funded feed-in tariffs does is provide concreteness to the debates on climate finance. It speaks to why and how much climate finance is needed for a particular purpose, and shows how funds can be disbursed and made use of in beneficial and accountable ways.

In conclusion: front-loaded investment with strong public support is necessary in order to tackle the dual challenge of global warming and increased and equitable energy access. The fact is that contributions of US$100 billion in public funds annually over the next 10–15 year period, channelled through national systems of feed-in tariffs with funding based on output, will likely be sufficient to bring about the transition to low-carbon societies and to lower the costs of renewables to the point where subsidies are no longer needed.

However, this scheme must be accompanied by other important elements, including improving energy efficiency, removing perverse subsidies, transferring knowledge, building new national institutions appropriate for implementing the relevant policies, and ensuring the active involvement of civil society and local communities. The endemic risks of diversions and take-over by powerful interests must be taken into consideration at the early design stages. Finally, in order to ensure energy access as broadly as possible and to the communities most in need, decentralised, local solutions must be favoured in the way the feed-in tariff systems are set up. If done well, they can provide inspiring examples of how to successfully connect the local level with the global.

Our message is thus: On the targets for emissions reductions, let the debate continue. But here is a concrete programme addressing issues where basically everyone can agree and where the goals are shared. Let us then find a way of making it happen; let us bring about the transition to clean energy that is in everybody's ultimate interest. If we can expand the scale of renewable energy and lower the costs, we will have solved a considerable part of the problem; and we will have done so regardless of whether or not we agree on national targets.

References

Atkisson, Alan (2011), 'A Global Plan for Accelerating the Renewable Energy Transformation', *Solutions*, Vol. 2, No. 4, 21 July.

Banuri, Tariq and Hans Opschoor (2007), *Climate Change and Sustainable Development*, DESA Working Paper No. 56, ST/ESA/2007/DWP/56.

Bogataj, Lucka Kjfez,(2008), 'IPCC Fourth Assessment – Climate Change is Here and Real!', Pre-COP IPCC Workshop, Warsaw, 2 www. http://www.ipcc.ch/pdf/presentations/pre-cop-warsaw-2-10-2008/pres-warsaw-climate%20-botagaj-1.pdf.

Burger, Oskar, John P. DeLong, and Marcus J. Hamilton (2011), 'Industrial energy use and the human life history', *Nature, Sci. Rep. 1*, No. 56; DOI:10.1038/srep00056.

Ellman, Michael (1990), 'Grigorii Alexandrovic Feldman', in J. Eatwell, M. Milgate, and P. Newman (eds), *Problems of the Planned Economy*, New York: Norton.

EIA (Energy Information Agency) (2007), 'Miscellaneous Services in the Energy Sector', http://www.eia.gov/oiaf/aeo/otheranalysis/mesbs.html

FoE-EWNI (Friends of the Earth, England, Wales, and Nothern Ireland) (2011), Reclaiming *power – and energy model for people and the planet*. http://www.foe.co.uk/resource/briefings/gfits_briefing.pdf

IPCC (2012), *Renewable Energy Sources and Climate Change Mitigation Special Report of the Intergovernmental Panel on Climate Change*, Cambridge: Cambridge University Press. http://srren.ipcc-wg3.de/report/IPCC_SRREN_Full_Report.pdf

Komives, Kristin, Vivien Foster, Jonathan Halpern and Quentin Wodon (with support from Roohi Abdullah) (2005), *Water, Electricity, and the Poor: Who Benefits from Utility Subsidies?* Washington DC: World Bank, 2005.

Polanyi, Karl (1944), *The Great Transformation*, New York: Rinehart.

Smil, Vaclav (2010), 'Science, energy, ethics, and civilization', in R.Y. Chiao, M. L. Cohen, A. J. Leggett, W. D. Phillips and C. L. Harper, Jr. (eds), *Visions of Discovery: New Light on Physics, Cosmology, and Consciousness*, Cambridge University Press.

SSNC (Swedish Society for Nature Conservation) (2010), *A Green Energy Revolution for Climate and Development – Visions and arguments: A compilation of material.* http://www.naturskyddsforeningen.se/upload/Foreningsdokument/Klimat/Knackfragor/GER_feed-in-tariff_compilation.pdf

SSNC (Swedish Society for Nature Conservation) (2011a), *A public investment programme to drive transformation to 100% renewable energy while ensuring universal access to affordable, renewable energy*, Submission to UN on views on the establishment of one or more non-market-based mechanisms, 21 February. http://unfccc.int/resource/docs/2011/smsn/ngo/239.pdf

SSNC (Swedish Society for Nature Conservation) (2011b), *Submission to input document for the zero draft of outcome document for the UN Conference on Sustainable Development (Rio '+20).* http://www.uncsd2012.org/index.php?page=view&type=510&nr=668&menu=20

Tverberg, Gail (2012), *World Energy Consumption Since 1820 in Charts*, blogpost, posted on 12 March. http://ourfiniteworld.com/2012/03/12/world-energy-consumption-since-1820-in-charts/.

UN-DESA (2009a), *World Economic and Social Survey 2009: Promoting Development, Saving the Planet*, New York. http://www.un.org/en/development/desa/policy/wess/wess_archive/2009wess.pdf

UN-DESA (2009b), *A Global Green New Deal for Climate, Energy, and Development Technical Notre.* http://www.un.org/esa/dsd/resources/res_pdfs/publications/sdt_cc/cc_global_green_new_deal.pdf

UN-DESA (2009c) *A Global Green New Deal for Sustainable Development*, Policy Brief No. 12, March 2009.

UNEP (2012), *Feed-in tariffs as a policy instrument for promoting renewable energies and green economies in developing countries*, Nairobi: UNEP.