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Accelerating the development and scaling up of environmentally, socially and economically sound technologies in the energy and transport sectors in developing countries

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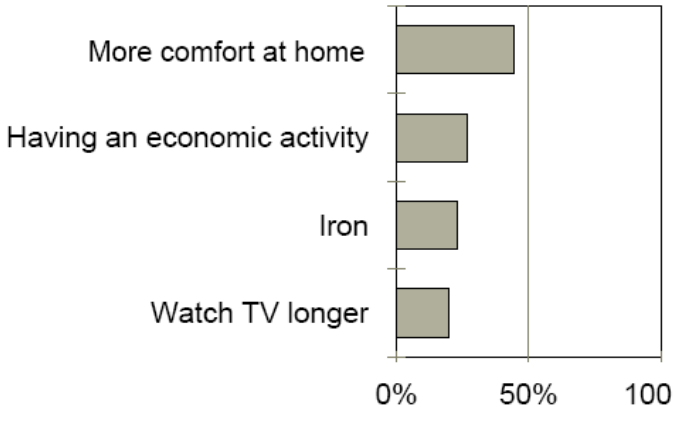
***Synopsis**: The accelerating of the development and scaling up of environmentally, socially and economically sound technologies in the energy and transport sectors may help to reduce Greenhouse Gas (GHG) Emissions. But as this document will show, it is not a simple and straightforward issue, given the multitude of relevant concerns at different levels, requirements for use and dangers of shifting problems. Instead of giving policy prescriptions, this document outlines relevant issues for consideration in decision-making. It is a think piece for making better choices by decision makers at different levels by drawing attention to tradeoffs and temporal issues.*

1. About half of all people in developing countries are dependent for fuel on traditional biomass (wood, dung and crop residue). Three quarters of these live in China, India and Sub-Saharan Africa. The use of traditional biomass is forecast to decrease in many countries by the International Energy Agency (IEA) but overall the IEA forecasts that by 2030 the total number of people reliant on biomass will not have changed significantly (UK Parliamentary Office of Science and Technology, 2002).
2. Poverty and the related use of traditional biomass are factors in deforestation and degradation of forests. Shifting to modern energy sources, such as electricity and petroleum-based fuels, may help to deal with those problems and may decrease GHG emissions. Burning wood is energy inefficient and contributes more GHG per energy service. But access to modern energy sources which is so desirable from a development point of view may stimulate GHG emissions in a longer-time frame through increased energy use.
3. Shifting to modern energy sources is no easy matter. For solar home system projects, challenges are to demonstrate sustainable and replicable business models, develop regulatory models of energy-service concessions, and integrate rural electrification policy with solar home system delivery (Marinot et al, 2001). Green electricity faces competition

from not so green electricity. Simply having access to the technology will not guarantee that people in need will receive the energy services.

4. In general, no energy source and energy technology are pristine. They all involve tradeoffs. Some of the tradeoffs are immediate, such as the tradeoff between capital costs and maintenance costs; other tradeoffs are more long-term. One possible tradeoff is between GHG protection and poverty alleviation. There is a risk that the climate protection agenda of developed countries conflicts with the agenda for poverty alleviation of developing countries. This calls for an assessment of tradeoffs and research into possible mechanisms for containing negative effects. At the moment we lack a good understanding of such tradeoffs and how these can be managed.
5. The notion of sustainable development helps to consider various effects and tradeoffs by giving attention to environmental and social side-effects of economic development. Fossil fuel technologies are generally viewed as non-sustainable because they rely on depletable resources (gas, oil, coal) whose combustion produces greenhouse gases as well as other emissions. For stationary sources, however, carbon emissions can be captured and stored for re-use at a later time. Fossil fuels can thus be made more sustainable. Renewable energy technologies on the other hand are frequently referred to as *sustainable* energy technologies. Yet wind turbines kill birds and energy crops are grown in non-environmentally benign ways. Even photovoltaic electricity, arguably the most pristine source of electric power, is not completely free of effects on the environment. As with any consumer product, the raw materials for PV systems must be shipped to factories, and completed products must be shipped from factories to consumers. There is also an issue of safe disposal at the end of its lifetime. From this, it follows that sustainable development should not be viewed as a technological project but as a project of reflexive modernization aimed at anticipating negative impacts and dealing with them (preferably in a proactive manner but this is not always possible). To do so requires a host of control policies and institutional mechanisms for learning about system-wide effects and ways to limit harmful effects (Kemp, 2008).
6. Renewable energy technologies (RET) are often advocated for developing countries because they are viewed as more sustainable. But many RET have fallen into disuse and have not been able to meet user demand.

Unmet Needs for Electricity for Solar Home Systems in Sri Lanka



Source: The International Bank for reconstruction and Development/World Bank, 2003

The optimal choice of technology will be specific to each location and depends on a number of factors: including resource availability, affordability, ease of access and local capacity to absorb, use and maintain the technology. It will also depend on the services and uses desired in each locality, as not all technologies are adaptable and cost-effective for particular end uses (UK Parliamentary Office of Science and Technology, 2002).

7. Stopping deforestation and desertification is desirable both from an economic and environmental point of view and is to be pursued actively through separate policies and joined-up policies. Desertification may be fought through irrigation policies but deserts may also be used for electricity production. From a climate protection point of view, a very interesting option is to redevelop deserts for energy use. It has been calculated that covering just 0.5% of the world's hot deserts with a technology called concentrated solar power (CSP) would provide the world's entire electricity needs, with the technology also providing desalinated water to desert regions as a valuable byproduct, as well as air conditioning for nearby cities. The costs of the production of CSP are now around $50 per barrel of oil equivalent to the cost of building a plant. That cost is likely to fall sharply, to about $20, as the production of the mirrors reaches industrial levels. It is about half the equivalent cost of using the photovoltaic cells that people have on their roofs (Trieb and Knies, 2004; Guardian, 2006). Cost reductions may come from research but also depend on deployment and scale economies, so a deployment policy is called for achieving cost reductions. As with any option, there are also sustainability to be considered both in design choices and the management of CSP systems. But the risks appear far lower and better manageable than, for example, the risks of using biomass for energy. Further research however is needed here.
8. Impacts are co-produced by various actors (Rip and Kemp, 1998). They are coproduced by actors through technology choices in a market context, with individual and collective choices being shaped by framing conditions and the social and political context. Impacts are not caused by technology in a simple way. There may be knock-on effects. Choices now may affect choices for the future through designs and organizational arrangements that become the basis for development (path dependencies). The task for policy is to create sustainable configurations. This is an ongoing task for multiple decision makers that requires a multitude of policies. Benefits at the global level should not be achieved at the expense of disadvantages

at the local level. This calls for proper assessment of various configurations and for creating institutional arrangements to deal with negative effects.

9. From a sustainable development point of view, relevant criteria for energy systems can be said to be:
   - Produce energy in the right form at relatively low cost and modest investments;
   - Lead to an increase in income for the poor people;
   - Use technologies which are appropriate or adaptable to local circumstances and can still be improved;
   - Form the basis for new SME;
   - Improve the currency position of a country;
   - Be amply available;
   - Have proven to satisfy at other places;
   - Diminish the environmental burden;
   - Improve the position of women;
   - Links up with the other WEHAB topics (Water, Energy, Health, Agriculture, and Biodiversity).

   Source: Daey Ouwens (2006)
10. Innovation for sustainable development puts paradoxical demands on policy. On the one hand, there is a need to stimulate innovations with sustainability benefits given the many barriers to innovations whose benefits are undervalued in the marketplace, which have to compete with well-developed options that have benefited from dynamic scale and learning effects, system economics and institutional adaptation. At the same time, policy has to deal with risks associated with the new technologies and make sure that they are sustainable as much as possible. There is a need for support and control at the same time. A possible solution is to balance both: to make support conditional and to create institutions for containing side effects (Kemp, 2008).

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